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April 12, 2019

VIA: ELECTRONIC FILING

Mr. Adam J. Teitzman
Commission Clerk
Florida Public Service Commission
2540 Shumard Oak Boulevard
Tallahassee, Florida 32399-0850

RE: FPSC Docket Nos. 20190015-EG, 20190016-EG, 20190017-EG, 20190018-EG, 20190019-EG, 20190020, 20190021-EG – Commission Review of Numeric Conservation Goals

Dear Mr. Teitzman:

Attached for filing in the above dockets is the testimony and exhibits of Mr. Jim Herndon, Vice President, Strategy and Planning Practice, Utility Services, Nexant. Mr. Herndon is appearing as a witness on behalf of each of the Florida Energy Efficiency and Conservation Act (FEECA) utilities: Florida Power & Light Company; Gulf Power Company; Florida Public Utilities Company; Duke Energy Florida, LLC; Orlando Utilities Commission; JEA; and Tampa Electric Company. Accordingly, Mr. Herndon's testimony and exhibits should be filed as part of the record in each of the dockets indicated above in support of each utility's petition.

Thank you for your assistance in this matter.

Sincerely,

Susan F. Clark

Susan F. Clark

SFC:plk
Attachment

CERTIFICATE OF SERVICE

I HEREBY CERTIFY that a true and correct copy of the foregoing Testimony of Jim Herndon on behalf of the FEECA utilities has been furnished by electronic mail on this 12th day of April 2019 to the following:

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/s/ Susan F. Clark
Attorney

BEFORE THE FLORIDA PUBLIC SERVICE COMMISSION

IN RE: COMMISSION REVIEW OF NUMERIC CONSERVATION GOALS

DOCKET NO. 20190015-EG (Florida Power & Light Company)

DOCKET NO. 20190016-EG (Gulf Power Company)

DOCKET NO. 20190017-EG (Florida Public Utilities Company)

DOCKET NO. 20190018-EG (Duke Energy Florida, LLC)

DOCKET NO. 20190019-EG (Orlando Utilities Commission)

DOCKET NO. 20190020-EG (JEA)

DOCKET NO. 20190021-EG (Tampa Electric Company)

DIRECT TESTIMONY OF JIM HERNDON

Q. Please state your name, position of employment, and business address.

A. My name is Jim Herndon. I am Vice President in the Strategy and Planning Practice within the Utility Services business unit of Nexant, Inc. (Nexant). My business address is 1255 Crescent Green Drive, Suite 460, Cary, North Carolina 27518. A statement of my background and qualifications is attached as Exhibit JH-1.

Q. Please discuss your areas of responsibility.

A. I am responsible for providing consulting services for Nexant clients in the field of Demand-Side Management (DSM) initiatives. In this capacity, I primarily focus on DSM planning, including analysis of DSM market impacts, and assisting utilities in the identification of DSM opportunities and the development and design of DSM program initiatives. This includes the development of market baseline and potential studies, cost-benefit analyses, and design of comprehensive DSM programs and portfolios.

Q. Please describe Nexant including its history, organization, and services provided.

A. Nexant, founded in 2000, is a globally recognized software, consulting, and services firm that provides innovative solutions to utilities, energy enterprises, chemical companies, and government entities worldwide. Nexant's Utility Services business unit provides DSM engineering and consulting services to government agencies and utilities, and helps commercial, institutional and industrial facility owners manage energy consumption and reduce costs in their facilities. Nexant also conducts development and implementation services of DSM programs for public and investor-owned utilities, governments, and end-use customers. Our range of experience in the field of energy efficiency includes, but is not limited to:

- Market Potential Studies;
- Program design;
- Program implementation;
- Marketing;
- Vendor outreach, education, and training;
- Incentive processing and fulfillment;
- Turnkey customer service;
- Online program tracking and reporting; and
- Evaluation, measurement and verification (EM&V).

Q. What specific projects or studies has Nexant done to assess DSM potential?

A. Nexant has conducted over 25 Market Potential Studies (MPS) to identify opportunities for DSM in the United States and Canada. Examples of recent clients include Georgia Power Company, Duke Energy, CPS Energy, Los Angeles Department of Water and Power, Pennsylvania Public Utilities Commission, the Independent Electricity System Operator (IESO) of Ontario, Canada, NorthWestern Energy, Platte River Power Authority, Nicor Gas, Cascade Gas, and Sacramento Municipal Utility District.

Q. What is the purpose of your testimony in this proceeding?

A. The purpose of my testimony is to introduce and summarize the methodology and findings of the MPS we conducted for each of the seven utilities subject to the requirements of the Florida Energy Efficiency and Conservation Act (FEECA), collectively the FEECA Utilities.

Q. What exhibits are you sponsoring?

A. Exhibit JH-1 – Herndon Background and Qualifications
Exhibit JH-2 – MPS for Florida Power & Light
Exhibit JH-3 – MPS for Tampa Electric Company
Exhibit JH-4 – MPS for Duke Energy Florida
Exhibit JH-5 – MPS for Gulf Power Company
Exhibit JH-6 – MPS for Florida Public Utilities Company
Exhibit JH-7 – MPS for Orlando Utilities Commission
Exhibit JH-8 – MPS for JEA

Exhibit JH-9 – 2019 Measure Lists

Exhibit JH-10 – Comparison of 2014 Measure List to 2019 Measure List

Q. What was the scope of work for which Nexant was retained?

A. As described in Section 2 of Nexant's MPS report for each utility, Nexant was retained by the FEECA Utilities to independently analyze the Technical Potential (TP) for energy efficiency (EE), demand response (DR) and demand-side renewable energy (DSRE) across their residential, commercial and industrial retail customer classes. In addition, Nexant was retained by five of the seven utilities to estimate the Economic Potential (EP) and Achievable Potential (AP) for their respective service territories.

More specifically, the scope of work included disaggregation of the current utility load forecasts into their constituent customer-class and end-use components, development of a comprehensive set of DSM measures and quantification of the measures' impacts, and calculation of potential energy and demand savings at the technology, end-use, customer class, and system levels.

Q. How, if at all, did the work performed by Nexant differ across the seven FEECA Utilities?

A. The assessment of TP, including the utility forecast disaggregation and customer segmentation, and development of a DSM measure list, was the same for all seven FEECA Utilities. The subsequent assessment of EP and AP varied in the work conducted by Nexant for individual FEECA Utilities, as follows:

- Florida Power & Light (FPL) and Tampa Electric Company (Tampa Electric) conducted their own EP and AP analyses.
- Duke Energy Florida (DEF) and Gulf Power Company (Gulf Power) conducted EP and AP measure screening and provided Nexant with the screening results. Nexant then performed the EP and AP analyses.
- For JEA, Orlando Utilities Commission (OUC), and Florida Public Utilities Company (FPUC), Nexant conducted the economic screening for the economic and achievable scenarios and analyzed the EP and AP based on the passing measures.

Q. What reports have been produced in the scope of Nexant's work?

A. Nexant has produced seven separate MPS reports, one for each FEECA Utility under this scope of work. As described above, for two utilities, FPL and Tampa Electric, the studies included TP only. For the other five utilities, the studies included analysis of TP, EP and AP.

Q. What were the major steps in the analytical work Nexant performed?

A. As summarized in Section 2 of each utility's MPS report, and illustrated in Figure 2-1 of each report, the major steps in assessing the DSM market potential consist of the following:

Step 1: Load Forecast Disaggregation. To disaggregate the load forecast, Nexant collected utility load forecast data, relevant customer segmentation and end-use consumption data, and supplemented this with existing secondary data to create a disaggregated utility load forecast broken out by customer sector and segment, as well as by end-use and equipment type. This disaggregated forecast, which is calibrated to the overall utility forecast, forms the basis for the development of market potential.

Step 2: Measure Development. Nexant worked collaboratively with the FEECA Utilities to develop a comprehensive list of DSM technologies currently commercially available in Florida. For all measures included in the study, Nexant developed estimates of energy and demand savings, useful life, and incremental cost.

Step 3: TP Analysis. Using the disaggregated utility load forecast and the DSM measure impacts, Nexant analyzed the TP for the application of all measures to each utility's retail customers.

Step 4: EP Analysis. For a subset of the FEECA Utilities, Nexant conducted an economic screening based on the parameters described in Section 6.1.2 of each MPS report to determine which measures and technologies were preliminarily cost-effective under a Rate Impact Measure (RIM) test scenario or the Total Resource Cost (TRC) test scenario. Nexant then analyzed the EP for the application of all preliminarily cost-effective measures to each utility's retail customers. Nexant also performed this analysis using a set of economic sensitivities.

Step 5: AP Analysis. For a subset of the FEECA Utilities, Nexant incorporated utility program costs and then conducted an economic screening for the AP analysis under both the RIM and TRC scenarios. Nexant then applied adoption curves to the measures that remained passing based on the incentives determined in Step 4 and as modified by the first part of Step 5. This produced the estimated levels of customer adoption over the 2020-2029 study period to estimate the AP of the cost-effective measures for each utility's retail customers.

MEASURES IDENTIFICATION AND SELECTION

Q. Please explain the process by which DSM measures were identified.

A. The starting point for measure identification was the list of measures included in the 2014 Florida TP Studies. Using this set of measures, the FEECA Utilities initially reviewed and added proposed measures, and provided the combined list to Nexant. Nexant reviewed the preliminary list against Nexant's DSM measure library, compiled from similar MPS conducted in recent years, as well as from other utility DSM programs that Nexant has designed, implemented or evaluated. Through discussion with the FEECA Utilities, the parameters for measures to be considered were established, and included the following: measures were limited to those that are currently commercially available in Florida; behavioral measures without accompanying physical changes or utility-provided products and tools were excluded; and fuel-switching measures, other than in the context of DSRE measures, were excluded.

Through an iterative process with the FEECA Utilities, a proposed measure list was developed for the study at the appropriate granularity to apply to the disaggregated utility load forecasts. Additionally, the proposed list was shared with an external party, the Southern Alliance for Clean Energy (SACE), whose input the FEECA Utilities considered. The process to identify DSM measures is more fully described in Section 4 of each MPS report.

Q. Was the process of measure identification and selection appropriate for the objectives of the study?

A. Yes. The measure identification process was robust, comprehensive and appropriate for the objectives of the study. The final measure list was developed to account for DSM measures that have been considered in prior Florida studies, and was based on current Florida Building Code and federal equipment standards, current program offerings by FEECA Utilities, and incorporation of DSM measures considered in other MPS reports and other utility DSM program offerings around the country.

Q. Did it allow for the assessment of the full TP for FEECA Utilities?

A. Yes. The thorough process for developing the list resulted in a comprehensive set of 278 unique EE, DR, and DSRE measures that fully addressed DSM opportunities across all electric energy-consuming end-uses at residential, commercial, and industrial facilities in the FEECA Utilities' service territories. The final measure list is provided in Exhibit JH-9.

Q. How does the final DSM measure list compare with the measures included in the 2014 TP Study?

A. Exhibit JH-10 compares the measure list for 2019 to the measure list for the 2014 Goals Dockets (Docket Nos. 20130199-EI – 20130205-EI). Compared to the 2014 TP, the 2019 TP update added 107 unique measures and eliminated 12 unique measures.

Q. Once measures were selected, what was the next step in Nexant's analysis?

A. Once measures were selected, the next step in Nexant's analysis was to develop individual impacts for each measure. These impacts included quantifying demand (kW) and energy (kWh) savings, equipment useful life, and incremental costs of the measure. The measure impacts were subsequently applied to the disaggregated utility load forecasts to estimate TP in each utility service territory.

TECHNICAL POTENTIAL

Q. Please define Technical Potential.

A. FEECA requires the Commission to "…evaluate the full technical potential of all available demand-side and supply-side conservation and efficiency measures, including demand-side renewable energy systems." (Section 366.82(3), F.S.) Therefore, a TP analysis is the first in a series of steps in the DSM Goals development process. Its purpose is to identify the theoretical limit to reducing summer and winter electric peak demand and energy. The TP assumes every identified potential end-use measure is installed everywhere it is "technically" feasible to do so from an engineering standpoint regardless of cost, customer acceptance, or any other real-world constraints (such as product availability, contractor/vendor capacity, cost-effectiveness, normal equipment replacement rates, or customer preferences). Therefore, the TP does not reflect the MW and GWh savings that are achievable through real-world voluntary utility programs, but rather it establishes the theoretical upper bound for DSM potential.

Q. Do Nexant's MPS reports provide a detailed description of Nexant's methodology, data, and assumptions for estimating TP?

A. Yes. As stated earlier, Nexant developed individual MPS reports for each of the seven FEECA Utilities. The reports describe Nexant's overall methodology, data, and assumptions for disaggregating each utility's baseline load forecast, development of DSM measures, and determination of TP.

Q. Do these MPS reports identify the full TP for the FEECA Utilities?

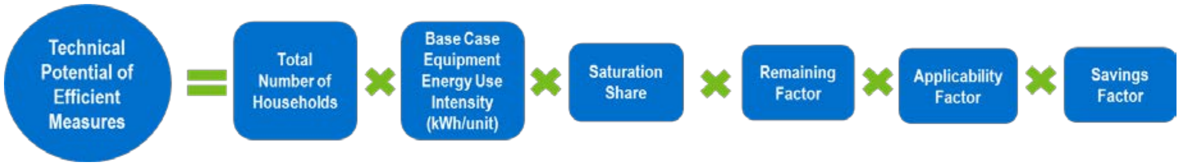
A. Yes. Each utility report identifies the full TP for the DSM measures analyzed against the utility's baseline load forecast.

Q. Please summarize the methodology, source of data, and assumptions used to develop the TP for EE measures for the FEECA Utilities.

A. As stated above, TP ignores all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt energy efficiency. Nexant's methodology for estimating EE TP begins with the disaggregated utility load forecast. For the current analysis, Nexant used the 2020 load forecast from each FEECA Utility, which, for all except FPUC, is based on the most recent Ten-Year Site Plan available at the time the MPS was initiated, which were the 2017 Ten-Year Site Plans.

Next, all technically feasible measures are assigned to the appropriate customer segments and end-uses. The measure kW and kWh impact data collected during

DSM measure development is then applied to the baseline forecast as illustrated in the following equation for the residential sector:



The savings factor, or percentage reduction in electricity consumption resulting from the application of the efficient technology, is applied to the baseline energy use intensity to determine the per-home impact, and the other factors listed in the equation above inform the total number of households where the measure is applicable, technically feasible, and has not already been installed. The result of this equation is the total TP for an EE measure or technology.

The final component of estimating overall TP is to account for the interaction between measures. In some situations, measures compete with each other, such as a T-8 lamp and a linear light emitting diode (LED) lamp. The saturation share factor in the equation above accounts for this competition between measures. The other interaction is measure overlap, where the impacts of one measure may affect the savings for a subsequent measure. To account for overlapping impacts, Nexant's model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For TP, interactive measures are ranked based on total end-use energy savings percentage with the measures having a greater savings being ranked first.

Q. Please summarize the methodology, source of data, and assumptions used to develop TP for DR measures for the FEECA Utilities.

A. TP for DR is effectively the total of customer loads that could be curtailed during conditions when utilities need capacity reductions. Therefore, Nexant's approach to estimating DR TP focuses on the curtailable load available within the time period of interest. In particular, the analysis is focused on the end-uses available for curtailment during peak periods and the magnitude of load within each of these end-uses that is beyond existing DR enrollment for each utility.

Similar to the estimation of EE TP, the DR analysis begins with a disaggregation of the utility load forecast. Nexant's approach for load disaggregation to identify DR opportunities is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8,760 hours of the year. This was needed because the customer loads available at times when utility system needs arise can vary substantially. For this study, curtailable load opportunities coincident with both the summer system peak and winter system peak were analyzed. Additionally, instead of producing disaggregated loads for the average customer, the study produced loads for several customer segments. Nexant examined three residential segments based on customer housing type, four different small commercial and industrial (C&I) segments and four different large C&I customer segments, for a total of 11 different customer segments.

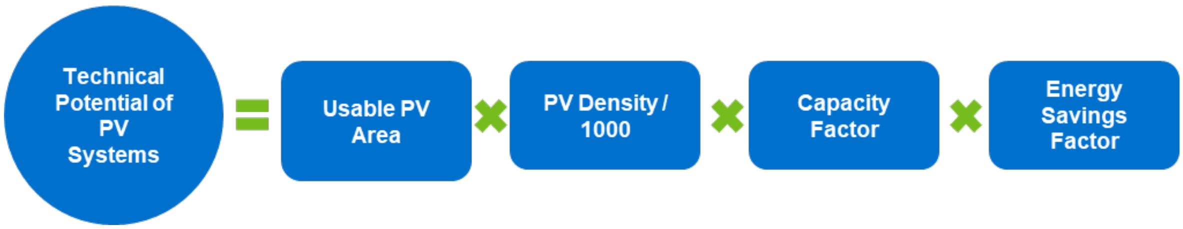
Next, Nexant identified the available load for the appropriate end-uses that can be curtailed. Nexant's approach assumed that large C&I customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers, TP for DR is limited by the loads that can be controlled remotely at scale. For this study, it was assumed that summer DR capacity for residential customers was comprised of air conditioning (A/C), pool pumps and water heaters. For small C&I customers, summer capacity was based on A/C load. For winter capacity, residential DR capacity was based on electric heating loads, pool pumps, and water heaters. For small C&I customers, winter capacity was based on heating load. For eligible loads within these end-uses, the TP was defined as the amount that was coincident with system peak hours for each season. System peak hours were identified using 2016 system load data. For DR TP, no measure breakout was necessary because all measures targeted the end-uses estimated for TP.

Finally, Nexant accounted for existing DR by assuming that all customers currently enrolled in a DR program did not have any additional load that could be curtailed. As a result, all currently-enrolled DR customers were excluded from the analysis.

Q. Please summarize the methodology, source of data, and assumptions used to develop TP for DSRE measures for the FEECA Utilities.

A. TP for DSRE measures was developed using three separate models for each category of DSRE: rooftop photovoltaic (PV); battery storage systems charged from PV systems; and combined heat and power (CHP).

For PV systems, Nexant's approach estimated the square footage of residential and commercial rooftops in the FEECA Utilities' service territories that are suitable for hosting PV technology, and applied the following formula to estimate overall TP:



To determine usable PV area, the first step was to use utility forecast and customer segmentation data, supplemented with U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS) and Commercial Building Energy Consumption Survey (CBECS) data, as well as U.S. Census data for the South region, to characterize the existing building stock in each utility's service territory. Based on the estimated total square footage, and other typical facility characteristics, such as average number of floors per segment, estimated mix of pitched and flat roofs, and usable area due to other rooftop equipment, the total available roof area feasible for installing PV systems was calculated.

Next, PV density, system capacity factors, and energy savings factors were estimated based on an average PV module, and the U.S. Department of Energy National Renewal Energy Laboratory's solar estimation calculator, PVWatts©, along with secondary research and utility-specific EM&V data from FEECA Utilities.

For battery storage systems, the TP analysis considered the fact that battery systems on their own do not generate power or create efficiency improvements, they simply store energy for use at different times. Therefore, battery systems that are energized directly from the grid do not produce additional energy savings, but may be used to shift or curtail load from one period for use in another. Because the DR potential analysis focused on curtailable load opportunities, Nexant concluded that no additional TP should be claimed. Similarly, battery systems connected to rooftop PV systems do not produce additional energy savings; however, they do create the opportunity to store excess PV-generated energy during hours where the PV system is generating more than the home or business is consuming and use the stored power during peak periods. Therefore, to determine additional peak demand reduction available from PV-connected battery storage systems, Nexant used the following methodology: first, 8,760 hourly annual load shapes for a PV system were developed. The load shapes were compared with annual load shapes for residential and commercial facilities to determine the hours that the full solar energy is used, and the hours where excess solar power is generated. Finally, Nexant developed a battery charge/discharge 8,760 hourly load profile to identify available stored load during summer and winter peak periods, which produced the estimate of the battery storage TP.

TP for CHP systems was based on identifying non-residential customer segments with thermal load profiles that allow for the application of CHP where the waste heat generated can be fully utilized. First, minimum size thresholds were determined for each non-residential segment using a segment-specific thermal factor that considered the power-to-heat ratio of a typical facility in each segment. Next, utility customers were segmented into industry classifications and screened against the size thresholds. Premises with annual kWh consumption that met or exceeded the thresholds were retained in the analysis. Finally, the facilities that were of sufficient size were matched with the appropriately-sized CHP technology. Nexant assigned CHP technologies to customers in a top-down fashion, starting with the largest CHP generators, which yielded the estimated quantity of CHP TP in each utility's service territory.

Q. Did your TP analysis account for interaction among EE, DR, and DSRE technologies?

A. Yes. While TP was estimated using separate models for EE, DR, and DSRE, Nexant did recognize that there is interaction among the TP for each, similar to the interaction between EE measures applied to the same end-use. For example, the installation of a more efficient A/C would reduce the peak consumption available for DR curtailment. Therefore, to account for this interaction, Nexant incorporated the following assumptions and adjustments to the identified TP:

- EE TP was assumed to be implemented first, and therefore was not adjusted for interaction with DR and DSRE.
- DR TP was applied next, and to account for the impact of EE TP, the baseline load forecast for applicable end-uses was adjusted by the EE TP, reducing the available load for curtailment.
- DSRE technologies were applied last and incorporated EE TP and DR TP. For PV systems, the EE potential and DR potential did not impact the amount of PV TP. However, for PV-connected battery systems, the reduced baseline due to EE TP resulted in more PV-generated power available from storage and usable during peak periods. The impact of DR events during the assumed curtailment

hours was incorporated into the modeling of available battery storage and loads available to be served by batteries. For CHP systems, the reduced baseline, as a result of EE resulted in a reduction in the number of facilities that met the annual energy threshold for CHP. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on the energy consumption and thermal parameters at the facility.

Q. Once TP estimates were developed, what was the next step in your analysis?

A. Upon completion of the TP estimates, the next analysis step for a subset of the utilities was to apply the measure economics (incremental cost) and utility system economics (avoided supply cost, utility electric revenues, and customer bill impacts) in order to conduct the economic screenings for the EP analysis.

ECONOMIC POTENTIAL

Q. For which FEECA Utilities did Nexant assess EP?

A. Nexant worked collaboratively with DEF, Gulf Power, OUC, JEA, and FPUC on EP, as follows:

JEA, FPUC, and OUC provided Nexant with utility-specific economic forecast data, including avoided supply costs and retail rate forecasts. Nexant incorporated this data into the economic screening module of Nexant's Technical, Economic, and Achievable Potential (TEA-POT) model to analyze the cost-effectiveness for individual measures under the cost-effectiveness tests required by the Order Consolidating Dockets and Establishing Procedure (Order No. PSC-2019-0062-

PCO-EI). Nexant then analyzed the measures passing the economic screening in the TEA-POT model to determine the EP.

Gulf Power and DEF used the measure impacts developed by Nexant to run the cost-effectiveness screening in each utility's model. Both utilities then provided Nexant with the list of RIM and TRC passing measures for Nexant to estimate EP demand and energy savings using Nexant's TEA-POT model.

Q. How was EP defined and estimated for this study?

A. EP is a subset of TP, which assumes every identified potential end-use measure is installed everywhere it is "economically" feasible to do so, regardless of customer acceptance, or any other real-world constraints (such as product availability, contractor/vendor capacity, normal equipment replacement rates, or customer preferences). Therefore, the EP does not reflect the MW and GWh savings that are achievable through real-world voluntary utility programs but establishes a theoretical upper bound for DSM potential that has passed the EP cost-effectiveness screening.

For this study, EP was estimated for two Base Case scenarios: the RIM scenario and TRC scenario. In both scenarios, all measures that achieved a cost-effectiveness ratio of 1.0 or higher were considered cost-effective from that test's perspective.

For Nexant's cost-effectiveness screening for JEA, OUC, and FPUC, additional considerations were:

- Individual measures did not include any utility program costs (program administrative or incentive costs), and therefore were evaluated on the basis of measure cost-effectiveness without any utility intervention.
- Both scenarios also required the measures to pass the Participant Cost Test (PCT), which analyzes the measure from the participating customer's perspective. Similar to the TRC and RIM perspectives, the PCT screening was done without any utility's incentive costs applied to the measure.
- Consistent with prior DSM analyses in Florida, free ridership was reflected by applying the two-year payback screening criterion which eliminated measures having a simple payback of less than two years.

Q. What was the next step in the development of EP?

A. Once the list of passing measures was identified for EP under each Base Case scenario, the measures were re-analyzed in Nexant's TEA-POT model to estimate EP demand and energy savings for each utility. The updated modeling included updated measure rankings to account for changes in measure interaction and overlap. For EP, the ranking was based on the applicable test perspective in each scenario (RIM ratio or TRC ratio) with the measures with a higher ratio being ranked first.

Q. Were any additional sensitivities considered for EP?

A. Yes. As specified in the Order Consolidating Dockets and Establishing Procedure (Order No. PSC-2019-0062-PCO-EI) in this docket, the following four sensitivities, in addition to the Base Case scenarios, were required: 1) higher fuel prices; 2) lower fuel prices; 3) shorter free ridership exclusion period (one year); and 4) longer free ridership exclusion period (three years). Additionally, for both DEF and OUC, Nexant performed an additional sensitivity that reflected costs associated with carbon dioxide emissions.

The methodology for each sensitivity was consistent with the analysis of the Base Case scenarios for EP. JEA, OUC, and FPUC provided Nexant with avoided supply cost forecasts for the higher and lower fuel price scenarios. DEF and Gulf Power conducted their own sensitivity screenings and provided Nexant with the list of measures passing each sensitivity.

Nexant then analyzed each sensitivity scenario in the TEA-POT model to estimate associated EP demand and energy savings for each utility.

Q. After these additional screenings were performed, what was the next major activity?

A. After the EP was estimated for the Base Case scenarios and the sensitivities for each utility, the next step in the study was to estimate AP for a subset of the utilities.

ACHIEVABLE POTENTIAL

Q. Were any additional economic screening criteria applied for estimating AP?

A. Yes. For the AP analysis, the associated program costs, including program administrative costs and customer incentives, were included in the economic analysis. All EP measures were re-screened for both the RIM and TRC scenarios with the inclusion of these program costs.

Q. How were measure incentives determined for this study?

A. Measure incentives were developed for both the RIM and TRC scenarios. Under each of these scenarios, the maximum incentive that could be applied while remaining cost-effective was calculated for each measure.

- For the RIM scenario, the RIM net benefit for each measure was calculated based on total RIM benefits minus total RIM costs. Next, the amount required to drive the simple payback down to two years for each measure was calculated. The maximum incentive was based on the lower of these two values.
- For the TRC scenario, since the TRC test does not include utility incentives as a cost or benefit, the maximum incentive was based on the amount required to drive the simple payback down to two years for each measure.

Q. Please explain the methodology used by Nexant to develop AP estimates for the cost-effective EE measures.

A. Nexant's methodology for estimating AP consists of applying estimates of market adoption based on utility-sponsored program incentives for all cost-effective EE measures in each Base Case scenario. Nexant's market adoption estimates are based on the Bass Diffusion Model, which is a mathematical description of how the rate of new product diffusion changes over time. Nexant's TEA-POT model includes a collection of typical DSM market adoption curves that apply to a range of end-uses and program offerings, developed from primary and secondary research on utility DSM accomplishments. For this study, these adoption curves were applied to the appropriate cost-effective EE measures. For measures currently offered, the adoption rates were calibrated based on past FEECA Utility programs' performance. For new measures, applicable secondary sources were used to calibrate adoption rates to the Florida market.

To account for the influence of incentives on market adoption, Nexant also incorporated an elasticity function based on a regression analysis performed on the EIA's Annual Electric Power Industry Report, also known as Form EIA-861. The regression analysis compared utility-reported savings and incentive rates to estimate the relative changes in savings based on differing incentive rates. The regression result was then incorporated into the overall market adoption rates. Nexant's TEA-POT model then calculated AP demand and energy savings by applying all cost-effective measures at the estimated market adoption rates to the baseline load forecast.

Q. Please explain the methodology used by Nexant to develop AP estimates for the cost-effective DR measures.

A. Similar to EE measures, Nexant's methodology for DR AP included calculating market adoption as a function of the incentives offered to each customer group. For DR measures that are currently offered by each utility, Nexant used the current incentive level offered to estimate market adoption. For measures not currently offered by a utility, Nexant used the net RIM benefits as the incentive level to estimate market adoption. The utility-specific incentive rates for each DR measure, along with historic participation rates for the DR programs offered by DEF and Gulf Power, were used to calibrate Nexant's collection of DR market adoption curves for each technology and customer segment. The calibrated adoption rates were applied to the baseline load forecast to estimate the AP for cost-effective DR technologies.

Q. Please explain the methodology used by Nexant to develop AP estimates for the cost-effective DSRE measures.

A. Nexant did not produce estimates of AP for DSRE measures because none of the measures passed the cost-effectiveness screening for either the RIM or TRC scenarios.

Q. Are the methodology and models Nexant employed to develop AP estimates for the FEECA Utilities analytically sound?

A. Yes. Nexant's approach is aligned with industry-standard methods and has been applied and externally reviewed in numerous regulated jurisdictions. Nexant's TEA-POT modeling tool has been specifically developed to accommodate and calibrate to individual utility load forecast data, and enables the application of individual DSM measures and analysis of market potential at a high resolution – by segment, end-use, equipment type, measure, vintage, and year, for each scenario analyzed.

Q. Have these methodologies and models been relied upon by other commissions or governmental agencies?

A. Yes. Nexant's MPS methodology and TEA-POT modeling tool has been used in numerous MPS in the United States and Canada. Nexant's tools and results have undergone extensive regulatory review and have been used for the establishment of utility DSM targets in multiple jurisdictions including North Carolina, Georgia, California, Pennsylvania, Texas, and Ontario.

REASONABLENESS OF NEXANT'S ANALYSES

Q. Are the estimates of the TP developed by Nexant analytically sound and reasonable?

A. Yes. The TP was performed under my direction and resulted in a thorough and wide-ranging analysis of DSM opportunities technically feasible in the FEECA Utilities' service territories. The TP process is in line with industry standards and included a greater level of analytic detail than that of comparable models and methodologies. The process included extensive iterative analytical work and continuous collaboration with the FEECA Utilities to ensure that it was comprehensive and aligned with the characteristics of their service territory and forecasted load.

Q. Are the estimates of the EP developed by Nexant analytically sound and reasonable?

A Yes. The EP was based on applying defined economic screening metrics to each TP measure to determine cost-effectiveness. The analysis included utility-provided economic forecasts to ensure alignment with other aspects of utility resource planning and to determine a reasonable estimate of EP for each utility.

Q. Are these estimates of AP a reasonable and appropriate basis for FEECA Utilities to propose DSM Goals?

A. Yes. Nexant's estimate of AP identifies cost-effective DSM opportunities for FEECA Utilities based on the test perspectives included in each scenario analyzed. This AP represents a reasonable estimate of the cost-effective savings that can be attained at the incentive levels and program delivery costs specified in the study. Along with other resource planning considerations, these estimates are an appropriate basis for FEECA Utilities to develop DSM goals.

Q. Does this conclude your testimony?

A. Yes.

BACKGROUND AND QUALIFICATIONS OF JIM HERNDON

Present Position:

Vice President, Strategy and Planning Practice within the Utility Services business unit of Nexant

Education:

MS, Engineering Management, Duke University, NC
BS, Civil Engineering, Duke University, NC

Professional Experience:

Nexant – Cary, NC
Vice President (2018-Present)
Principal (2014-2018)
Senior Project Manager (2009-2014)

Nexant – Atlanta, GA
Project Manager (2007-2009)
Senior Project Engineer (2005-2007)
Project Engineer (2003-2005)

Nexant – San Francisco, CA
Project Engineer (2002-2003)

IT Corporation – Andover, MA
Project Engineer (1998-2001)

Areas of Expertise:

Resource Planning Support: Providing technical analysis, regulatory support, and expert witness testimony for DSM program development and integrated resource planning (IRP) activities to electric and natural gas utilities.

Energy Analysis and Market Characterization: Evaluating the technical and economic applicability of DSM measures for program development; and determining energy savings estimates and market potential for measures and program offerings in a particular region or service territory.

Portfolio Planning and Program Design: Conducting cost-effectiveness analysis and providing strategic insights to assist in the planning, design, and implementation of DSM programs.

Program Management: Ensuring compliance with energy program rules; coordinating staff workload and budgets; working directly with service providers and customers on projects; and advising contractors on savings estimates.

Representative Project Experience:

Georgia Power Company – DSM Program Analysis and IRP Support (2005–Present)
Duke Energy – Market Potential Studies (2015–2018)
Duke Energy – Program Evaluations (2014–Present)
Columbia Gas of Virginia (CVA) – DSM Program Design and Implementation (2010–Present)
Virginia Natural Gas – DSM Program Design and Regulatory Support (2014–Present)
Elizabethtown Gas – DSM Program Design and Regulatory Support (2016–Present)
Dominion Virginia Power – Program Development and Regulatory Support (2014–2016)
Santee Cooper – DSM Program Design and Implementation (2009–Present)
Los Angeles Department of Water and Power (LADWP) – Energy Efficiency Potential Study (2013–2015)
CPS Energy – Market Potential Study, DSM Program Design, and Measurement and Verification (2008–2014)
Danville Utilities – Residential Program Design and Implementation (2011–2013)

REPORT

Market Potential Study of Demand-Side Management in Florida Power & Light's Service Territory

Submitted to Florida Power & Light

April, 2019

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objective of the study was:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.

This report provides the detailed methodology and results for the technical potential analysis of Florida Power & Light's (FPL) service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, and technical feasibility. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in FPL's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large C&I customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning (HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential.

The assessment further accounted for existing DR programs for FPL when calculating the total DR potential. .

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customers' PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for residential, commercial, and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Technical potential for EE, DR, DSRE are as follows:

1.2.1 EE Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	3,922	2,562	16,893
Non-Residential[1]	2,401	1,490	9,854
Total	6,323	4,052	26,747

1.2.2 DR Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

[1] Non-Residential results include all commercial and industrial customer segments

The estimated technical potential results are summarized in Table 1-2.

Table 1-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	4,546	5,237
Non-Residential	5,429	2,753
Total	9,975	7,989

1.2.3 DSRE Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems charged from PV, and CHP technologies based on the customer characteristics of each FEECA utility's customer base.

Table 1-3: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	3,278	714	14,391
Non-Residential	7,718	1,682	33,884
Total	10,996	2,396	48,274
Battery Storage charged from PV Systems			
Residential	-	1,524	-
Non-Residential	262	-	-
Total	262	1,524	-
CHP Systems			
Total	2,198	569	9,557

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objective of the study was:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.

This report provides the detailed methodology and results for the technical potential analysis of Florida Power & Light's (FPL) service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- Technical potential demand and energy savings
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant only estimated technical potential for FPL, and FPL conducted its own economic and achievable potential analyses.

Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.
- Economic Potential is the amount of energy and capacity that could be reduced by DSM measures that are considered cost-effective. Nexant did not perform this analysis for FPL.

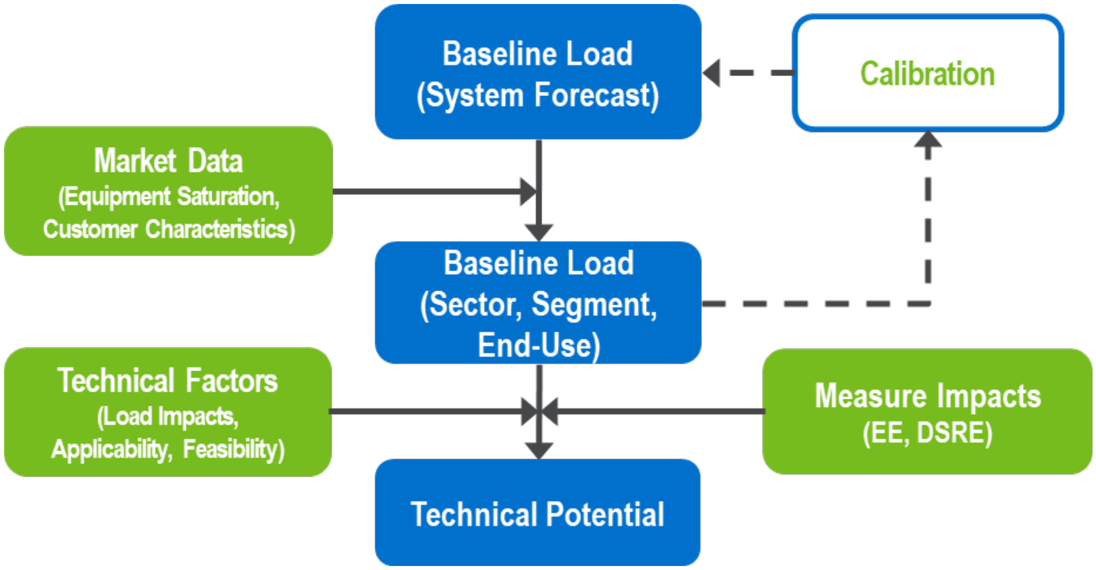
- Achievable Potential is the DSM savings feasible when considering how a utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant did not perform this analysis for FPL.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy savings, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to FPL's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, and measure impacts.

Figure 2-1 provides an illustration of the technical potential modeling process conducted for FPL, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, and technical feasibility. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Technical Potential Modeling



Nexant estimated DSM savings potential based on a combination of market research, analysis, and a review of FPL's existing DSM programs, all in coordination with FPL. Nexant examined the technical potential for EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions and projected customer response to DR measures. Customer demand was determined by looking at interval data for a sample of each customer segment. For each segment, Nexant determined the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures was developed based on the performance of existing FPL DR measures and other DR offerings in the U.S.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from PV, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a “bottom-up” modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The FPL base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of FPL's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	Other
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be

willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from FPL. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the FPL electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed the forecast for the year 2020, and based it on data provided by FPL, primarily their 2017 Ten-Year Site Plan, which was the most recent plan available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized FPL’s summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with FPL’s estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers’ baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA’s recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for

each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on FPL rate class load shares and intensities.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - FPL rate class load share is based on average per customer.
  - Nexant made conversions to usage estimates generated by applying utility-provided residential appliance saturation surveys (RASS) and EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on FPL rate class load shares, intensities, and EIA CBECS data.
- Segment data from EIA and FPL.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA CBECS and end-use forecasts from FPL.

Industrial sector:

- The disaggregation was based on rate class load shares, intensities, and EIA MECS data.
- Segment data from EIA and FPL.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA MECS and end-use forecasts from FPL.

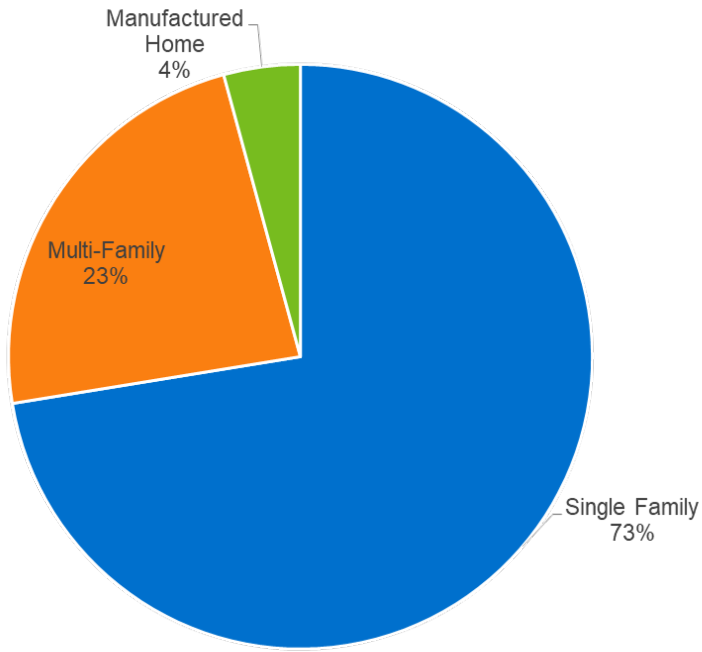
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. FPL provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential accounts, but the overall logic was consistent with the concept of expressing the accounts in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I accounts using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2 and Figure 3-3.

Figure 3-2: Commercial Customer Segmentation

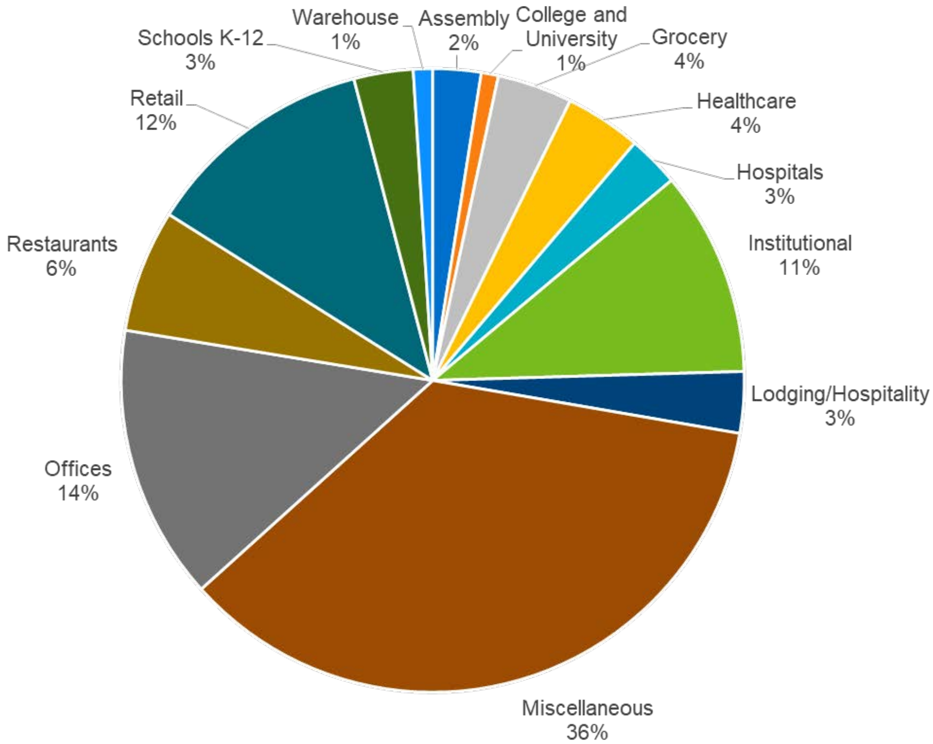
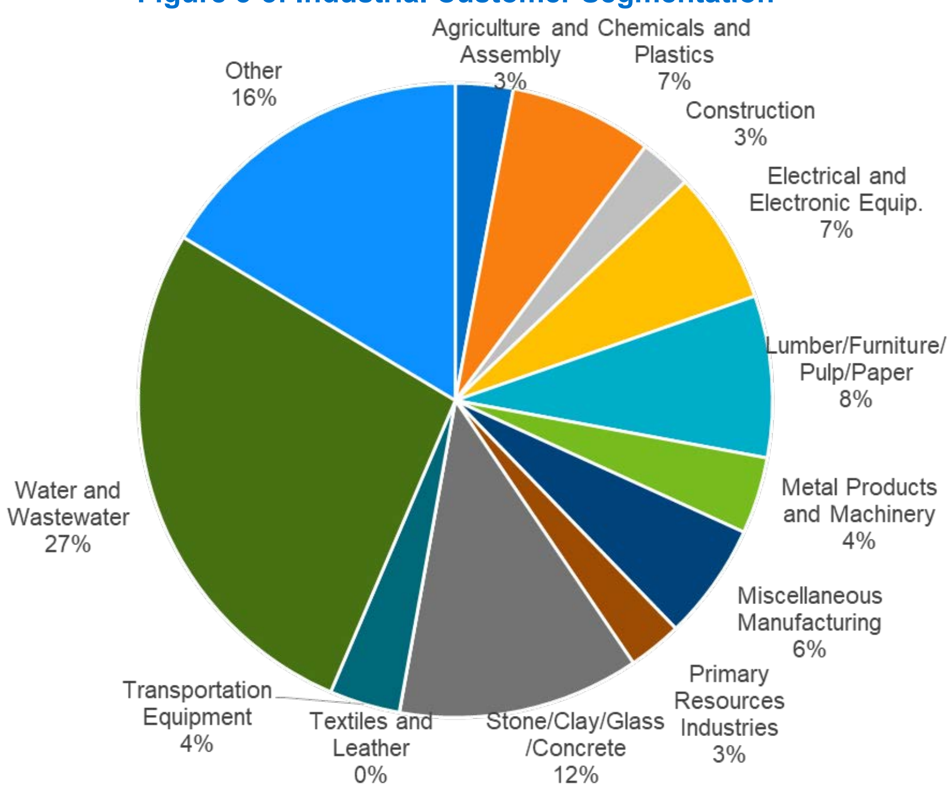


Figure 3-3: Industrial Customer Segmentation



3.2.3 Commercial and Industrial Accounts (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD) tariff or on the General Service Large Demand (GSLD) tariff[3]. Nexant further segmented these two groups based on customer size. For small C&I, segmentation was determined using annual customer consumption and for large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by FPL.

Table 3-3 shows the account breakout between small C&I and large C&I.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Annual kWh	Number of Accounts
Small C&I	0-15,000 kWh	229,020
	15,001-25,000 kWh	55,606
	25,001-50,000 kWh	53,792
	50,001 kWh +	100,971
	Total	**439,389**
Large C&I	0-50 kW	62,826
	51-300 kW	37,398
	301-500 kW	3,427
	501 kW +	4,535
	Total	**108,186**

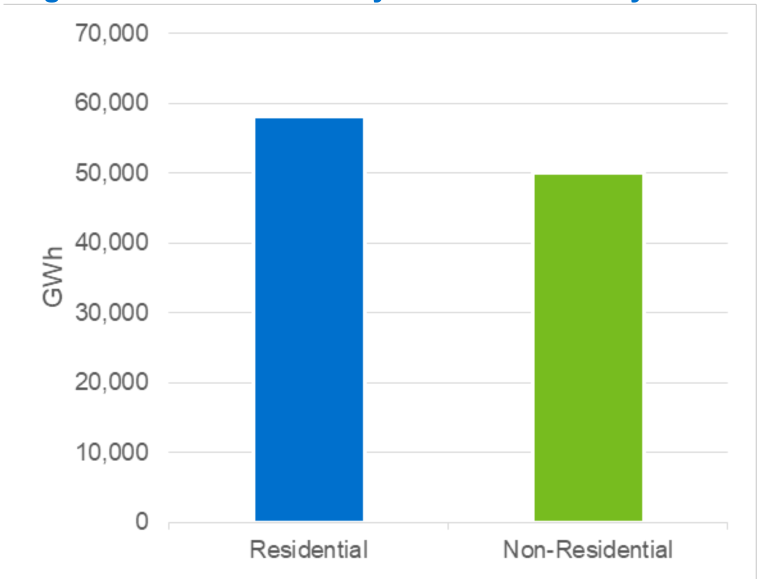
3.3 Analysis of System Load

3.3.1 System Energy Sales

Technical potential is based on FPL's load forecast for the year 2020 from their 2017 Ten Year Site Plan, which is illustrated in Figure 3-4.

[3] To be eligible, customers must have demand in excess of 20 kW.

Figure 3-4: 2020 Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine the technical potential for DR, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when maximum DR impact was the historical system load for FPL. The data provided contained the system loads for all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For the FEECA Utilities the summer peaking conditions were defined as August from 4:00-5:00 PM and the winter peaking conditions were defined as January from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are summarized in Figure 3-5, Figure 3-6 and Figure 3-7.

Figure 3-5: Residential Baseline (2020) Energy Sales by End-Use

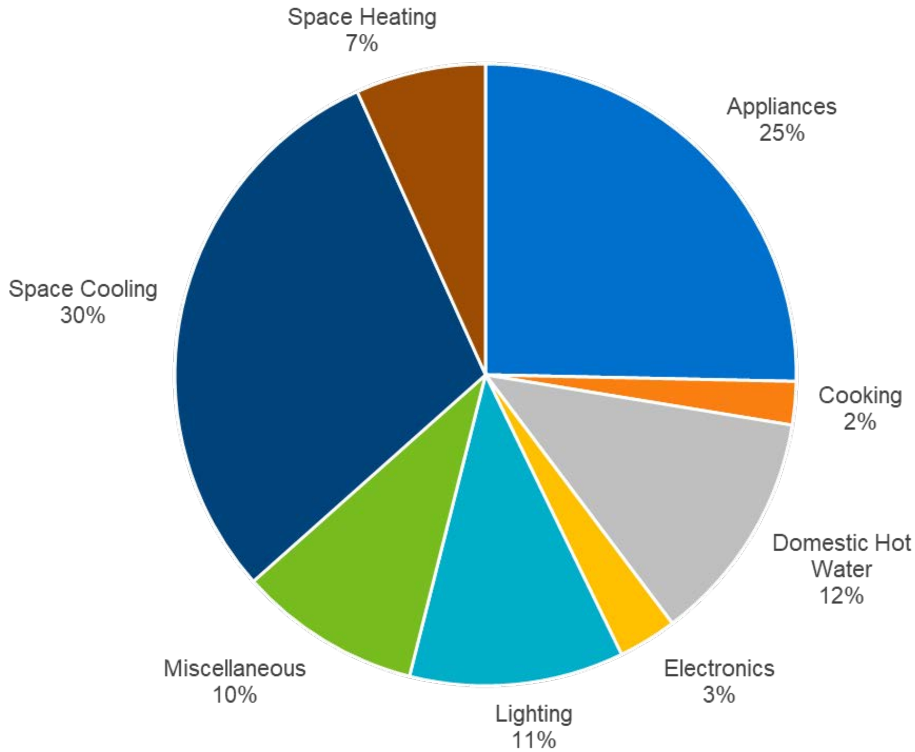


Figure 3-6: Commercial Baseline (2020) Energy Sales by End-Use

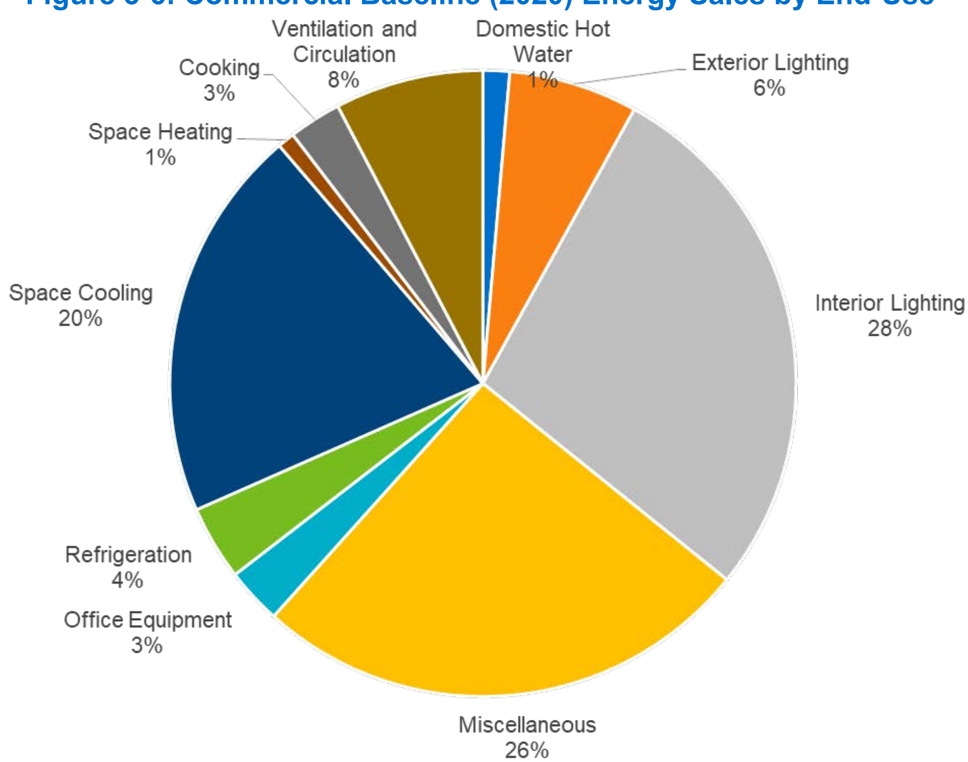
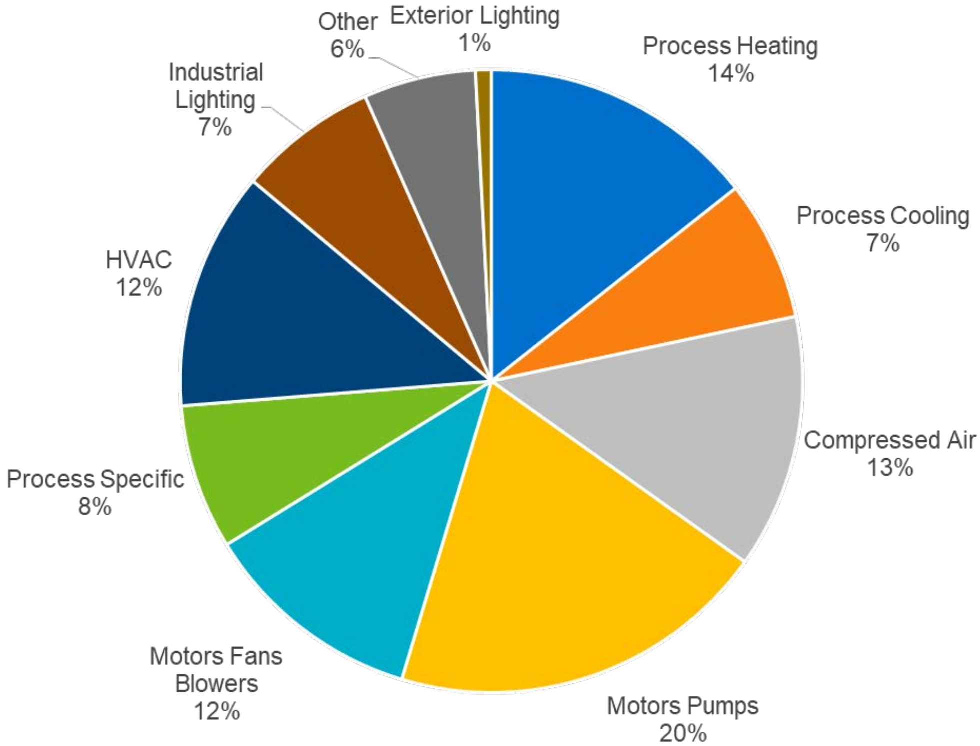


Figure 3-7: Industrial Baseline (2020) Energy Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the EE, DR, and DSRE measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar market potential studies conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to the residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[4]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations

[4] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.
- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used primarily derived from data in current regional and national databases, as well as FPL's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,186 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[5]	30	342

[5] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix A.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) with Technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.,* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or a rate discount for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end-uses estimated for technical potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[6].

[6] This study did not include ground-mounted or utility-scale solar PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged from PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover technologies used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of the commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as single numerical values for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

$$\text{Technical Potential of Efficient Measures} = \text{Total Number of Households} \times \text{Baseline Equipment Energy Use Intensity (kWh/unit)} \times \text{Equipment Saturation Share} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

$$\text{Technical Potential of Efficient Measures} = \text{Total Stock Sq. Footage by Segment} \times \text{Baseline Equipment Energy Use Intensity (kWh/unit)} \times \text{Equipment Saturation Share} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with FPL's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity, the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I accounts generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. When done properly, end-use disaggregation not only provides insights into which loads are on and off when specific grid services are needed, it also provides insight concerning how key loads and end-uses, such as air conditioning use, vary across customers. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8,760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For FPL, Nexant examined three residential segments based on customer housing type, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 11 different customer segments.

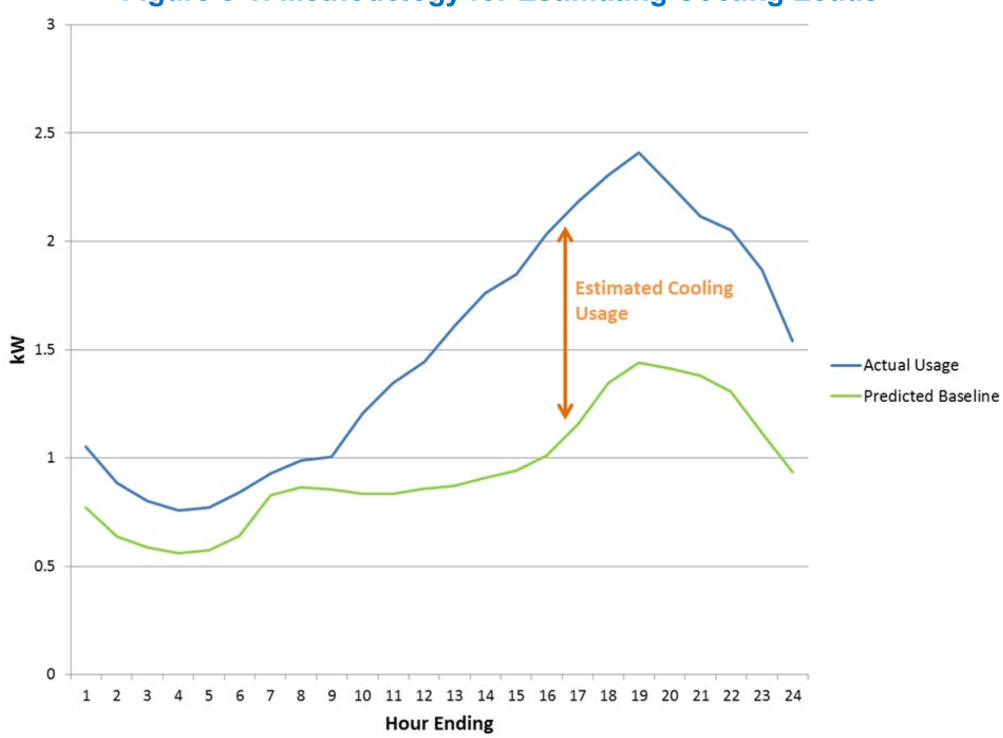
Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

AC and heating load profiles were generated for residential and small C&I customers using a sample customer interval data provided by FPL. This sample included a customer breakout based on housing type for residential customers and size for small C&I customers. Nexant then used the interval data from these customers to create an average load profile for each customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the seven different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR program.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are August from 4:00-5:00 PM for summer, and January from 7:00-8:00 AM for winter. As mentioned in Section 4, for technical potential there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads.

In order to account for existing FPL DR programs, all customers currently enrolled in a DR offering were excluded from FPL's technical potential. This methodology was consistent across all three sectors.

5.1.3 DSRE Technical Potential

5.1.3.1 PV Systems

To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[7], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

[7] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Equation 5-3: Core Equation for Solar Technical Potential

Technical Potential of PV Systems = Usable PV Area × PV Density / 1000 × Capacity Factor × Energy Savings Factor

Where:

Usable PV Area for Residential: (Total Floor Area[8] / Average No. of Stories[9]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[10] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PVWatts. Energy Savings Factor = Alternating System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems Charged from PV Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery

[8] Utility-provided data and US Census, South Region

[9] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[10] Floor space = based on utility data. Average floors by building type = Commercial Building Energy Consumption Survey (CBECS), South Atlantic Region

systems do create the opportunity to store energy during period when the PV system is generating more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for “solar plus storage” systems, our methodology consisted of the following steps:

- Develop an 8,760 hourly annual load shape for a PV system based on estimated annual hours of available sunlight.
- Compare the PV generation with a total home or total business 8,760 hourly annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.
- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers’ thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore, the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore, results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis, this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
- For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

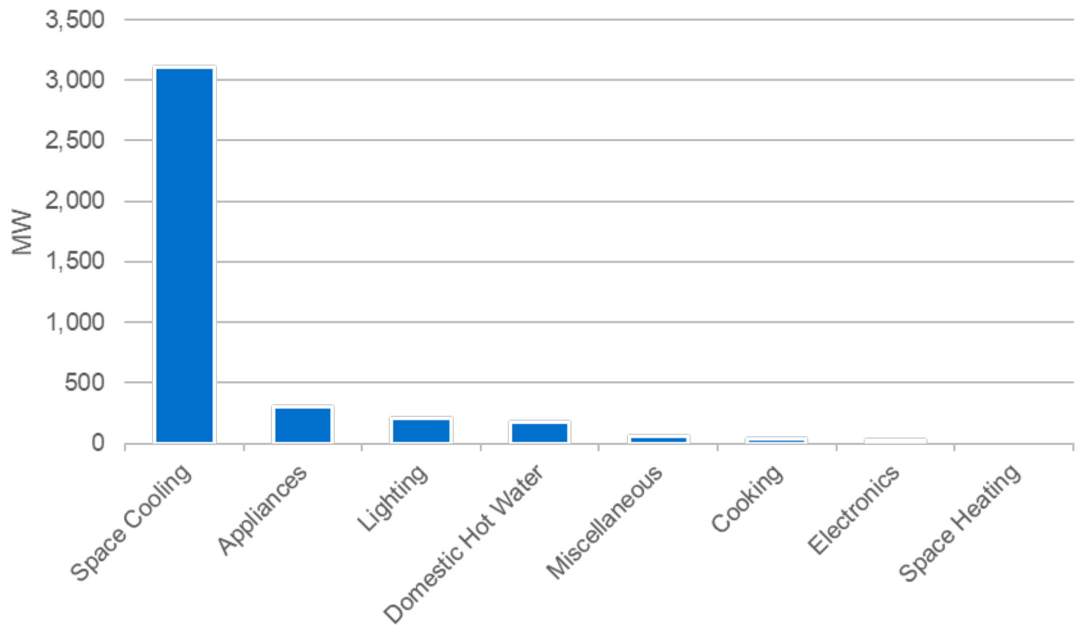
Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	3,922	2,562	16,893
Non-Residential[11]	2,401	1,490	9,854
Total	6,323	4,052	26,747

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 summarize the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Summer Peak Savings)



[11] Non-Residential results include all commercial and industrial customer segments

Figure 5-3: Residential EE Technical Potential by End-Use (Winter Peak Savings)

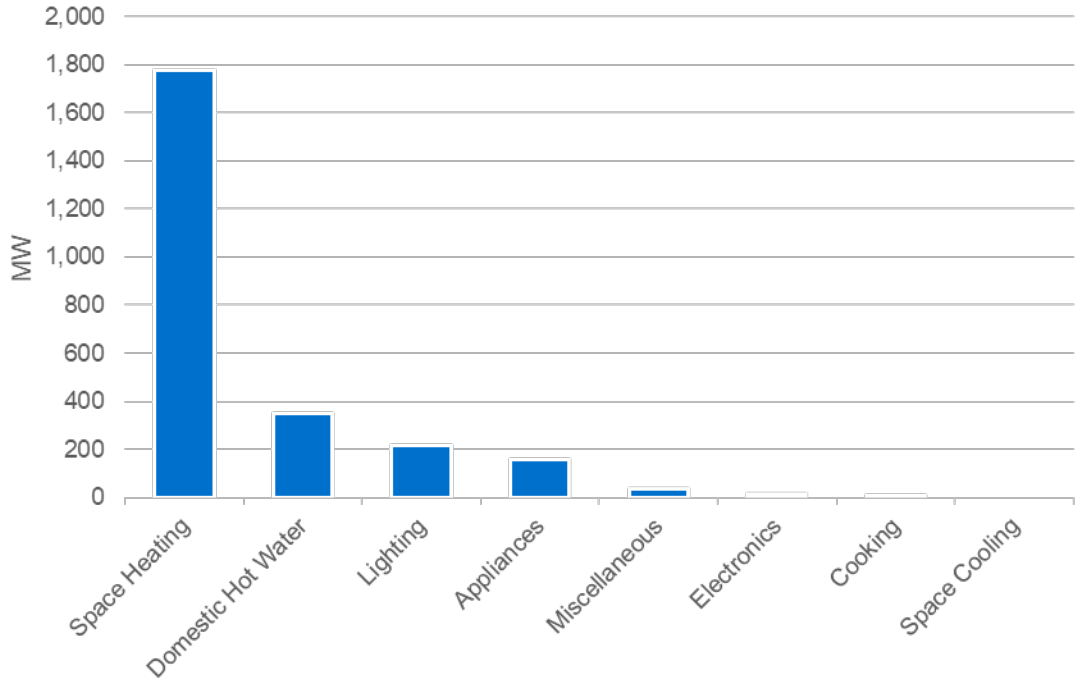
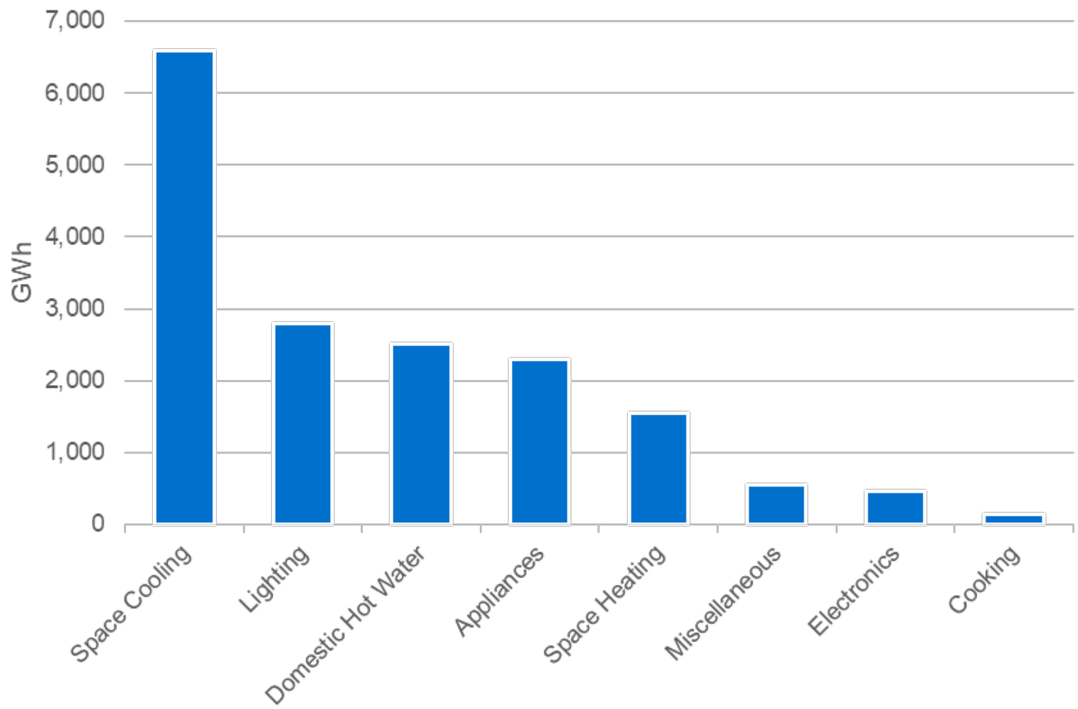


Figure 5-4: Residential EE Technical Potential by End-Use (Energy Savings)



5.2.3 Non-Residential

5.2.3.1 Commercial Segments

Figure 5-5, Figure 5-6, and Figure 5-7 summarize the commercial sector EE technical potential by end-use.

Figure 5-5: Commercial EE Technical Potential by End-Use (Summer Peak Savings)

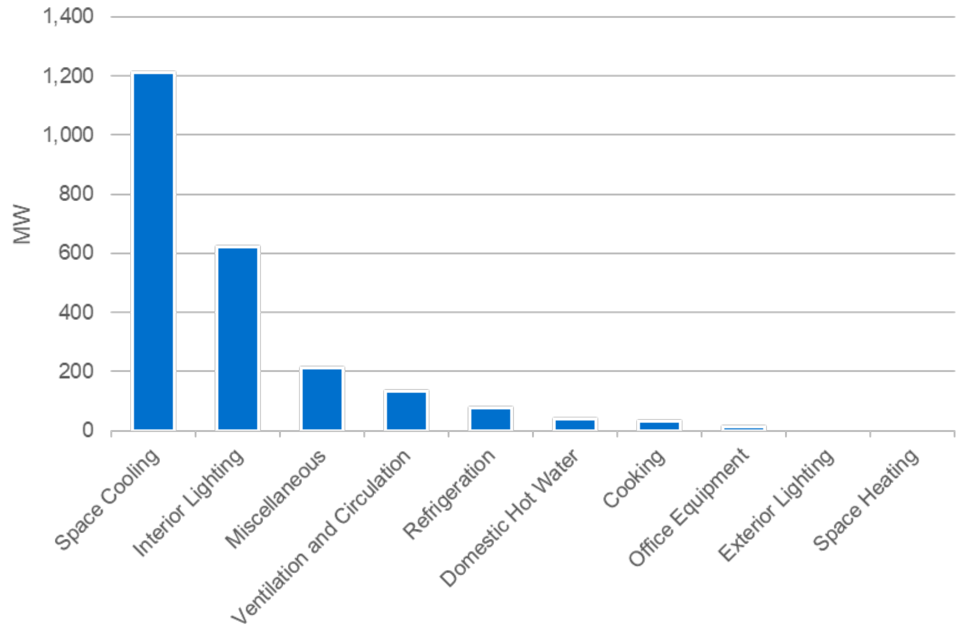


Figure 5-6: Commercial EE Technical Potential by End-Use (Winter Peak Savings)

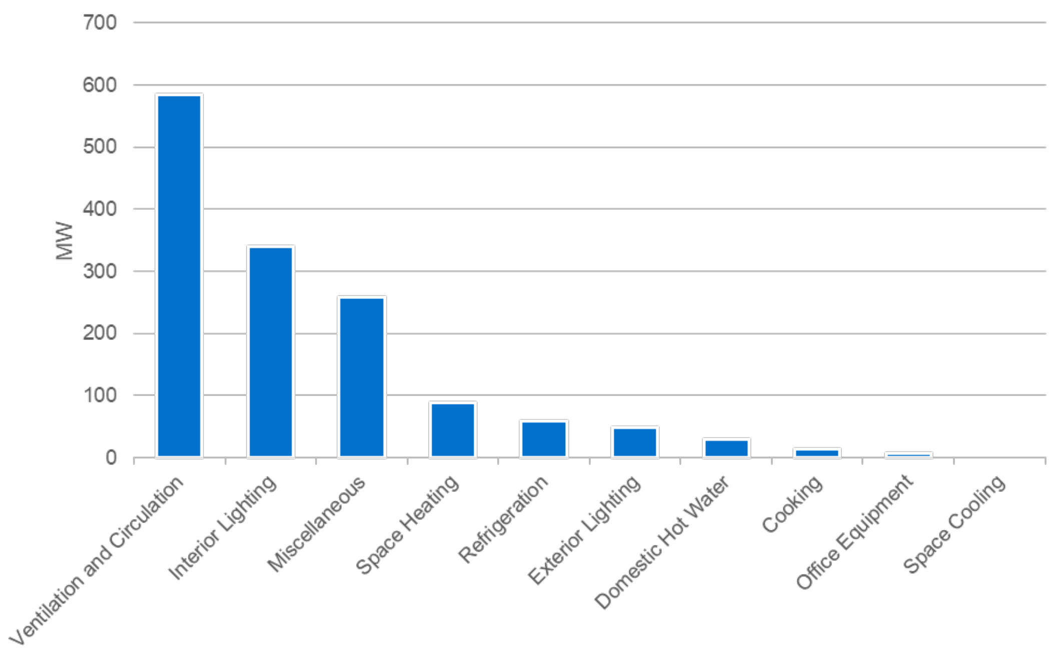
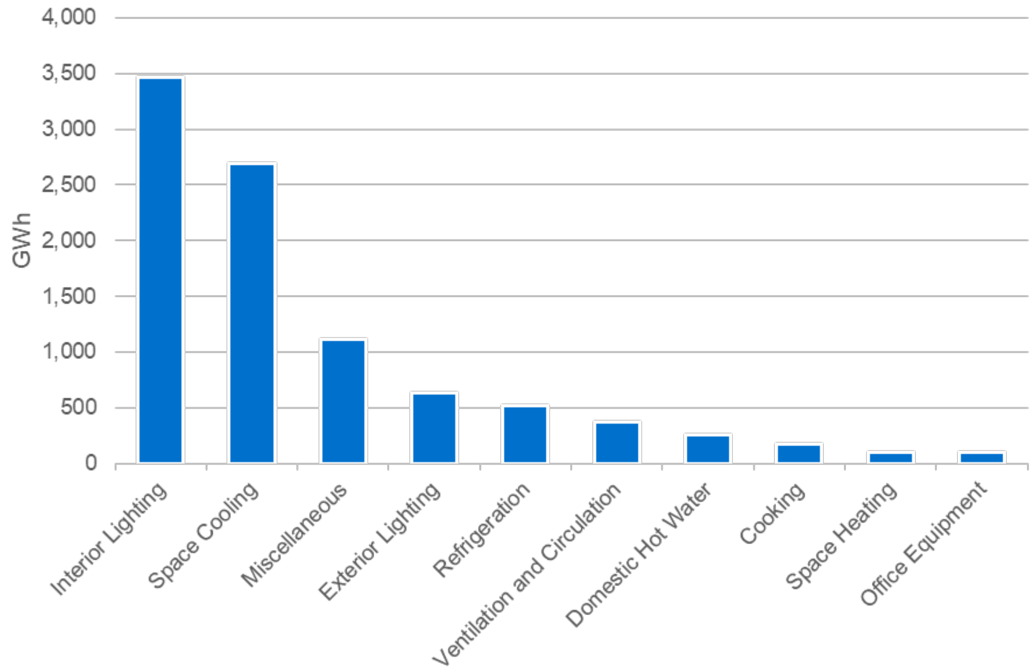


Figure 5-7: Commercial EE Technical Potential by End-Use (Energy Savings)



5.2.3.2 Industrial Segments

Figure 5-8, Figure 5-9, and Figure 5-10 summarize the industrial sector EE technical potential by end-use.

Figure 5-8: Industrial EE Technical Potential by End-Use (Summer Peak Savings)

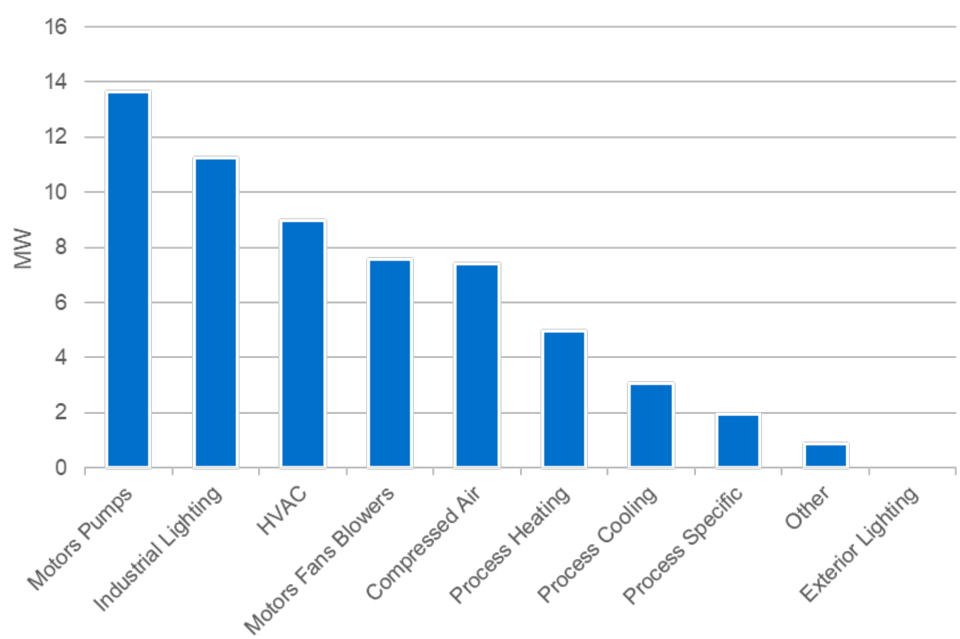


Figure 5-9: Industrial EE Technical Potential by End-Use (Winter Peak Savings)

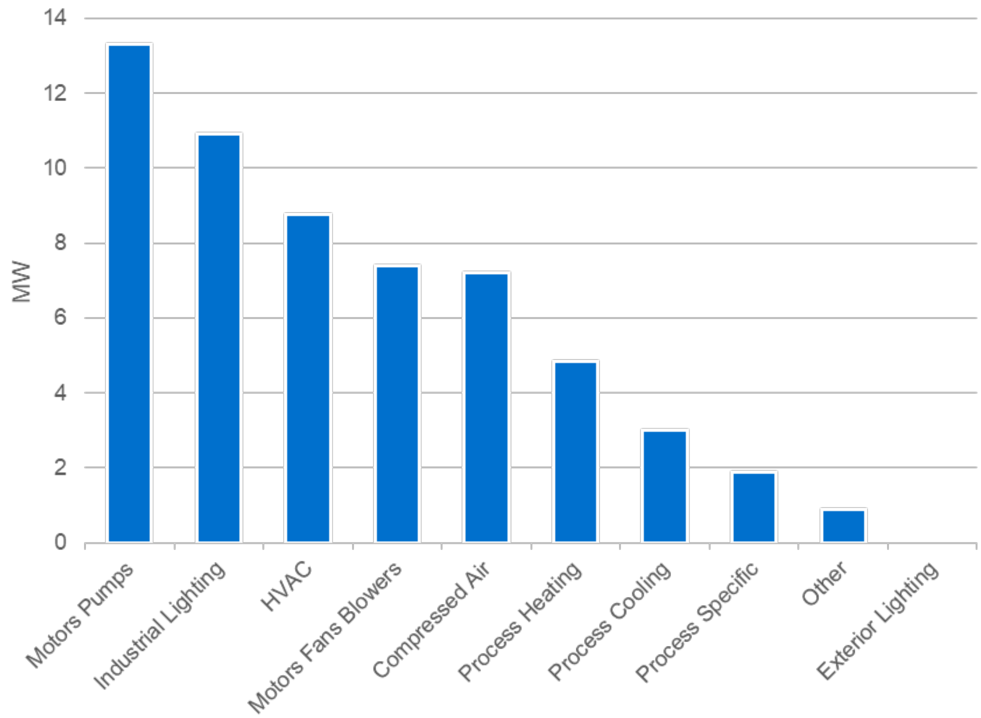
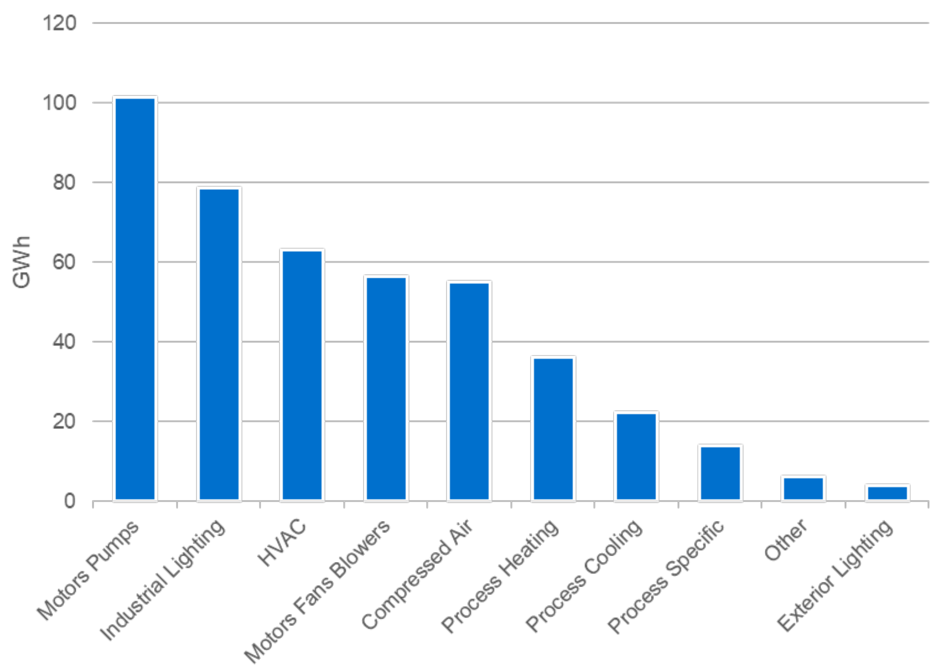


Figure 5-10: Industrial EE Technical Potential by End-Use (Energy Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in FPL's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

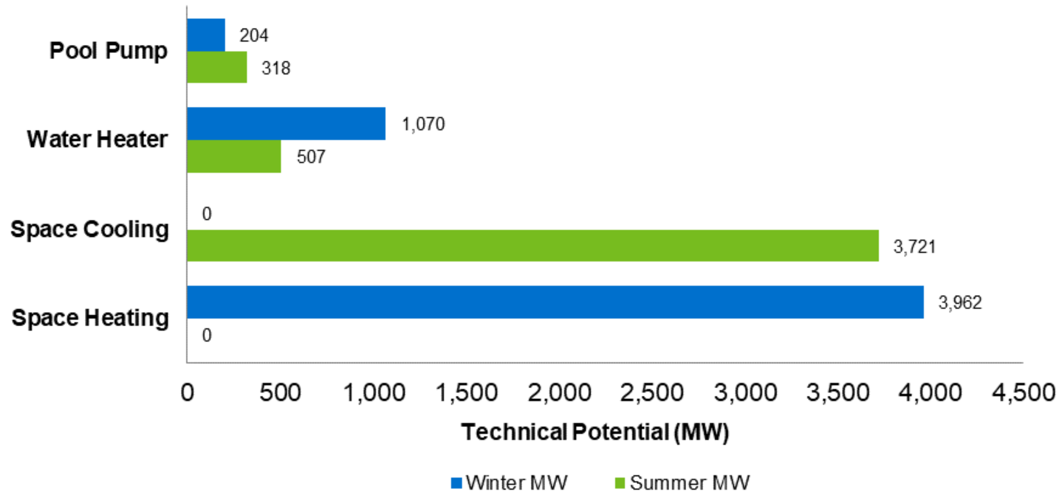
Table 5-2: DR Technical Potential by Sector

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	4,546	5,237
Non-Residential	5,429	2,753
Total	9,975	7,989

5.3.1 Residential

Residential technical potential is summarized in Figure 5-11.

Figure 5-11: Residential DR Technical Potential by End-Use (Incremental to Existing)[12]

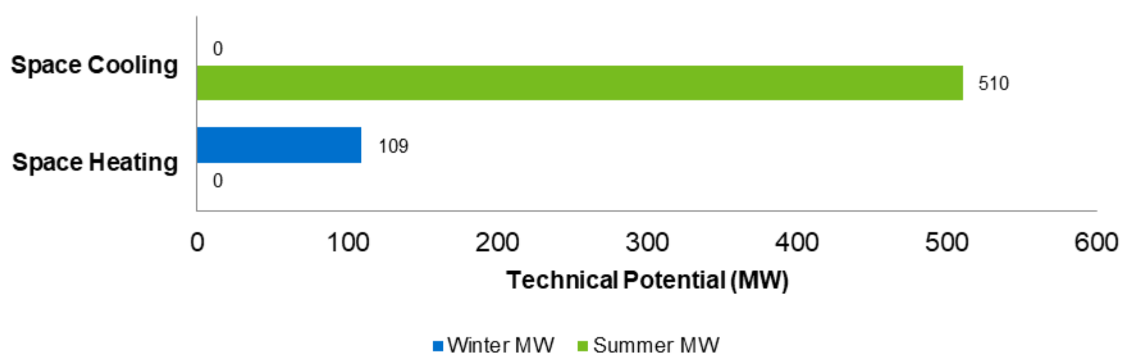


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential, Nexant looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-12.

Figure 5-12: Small C&I DR Technical Potential by End-Use (Incremental to Existing)[13]



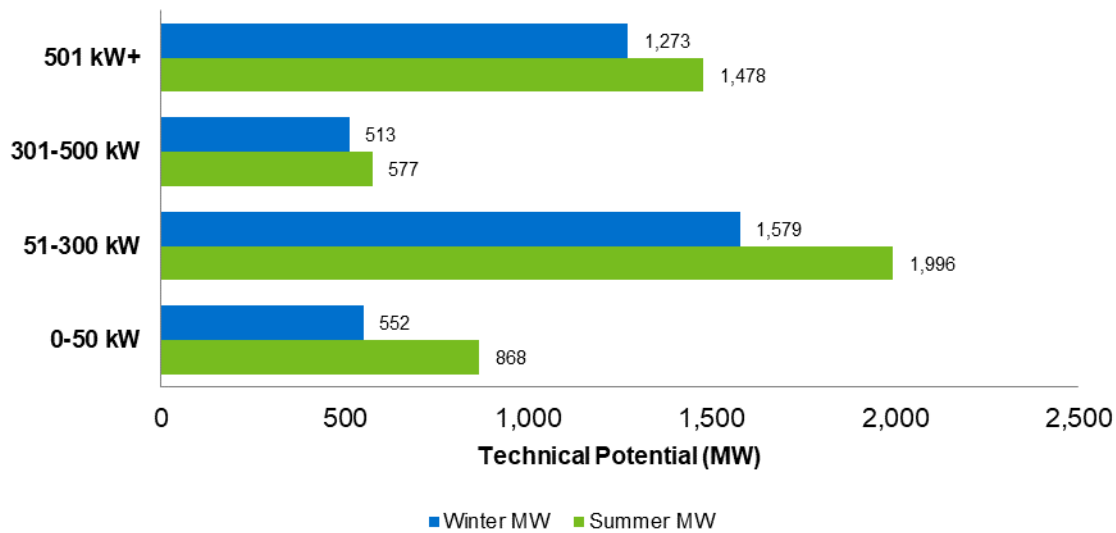
[12] All currently enrolled DR customers are excluded

[13] All currently enrolled DR customers are excluded

5.3.2.2 Large C&I Customers

Figure 5-13 provides the technical potential for large C&I customers, broken down by customer size.

Figure 5-13: Large C&I DR Technical Potential by Segment (Incremental to Existing)[14]



[14] All currently enrolled DR customers are excluded

DSRE Technical Potential

Table 5-3 section the results of the DSRE technical potential for each customer segment.

Table 5-3: DSRE Technical Potential[15]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	3,278	714	14,391
Non-Residential	7,718	1,682	33,884
Total	10,996	2,396	48,274
Battery Storage charged from PV Systems			
Residential	-	1,524	-
Non-Residential	262	-	-
Total	262	1,524	-
CHP Systems			
Total	2,198	569	9,557

[15] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system. Therefore results for each DSRE system should not be combined for overall DSRE potential.

6 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements

Measure	End-Use	Description	Baseline
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations

Measure	End-Use	Description	Baseline
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average pump equipment
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and small C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

The cooling load shapes on the summer peak weekday and average weekdays were generated from hourly interval data from a sample of customers in FPL territory for 2016. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2016
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer peaking conditions (August 4:00-5:00 PM). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same from hourly interval data from a sample of customers in FPL territory for 2016, and the peak day was defined as the day with system peak load during winter period (January 7:00-8:00 AM). The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

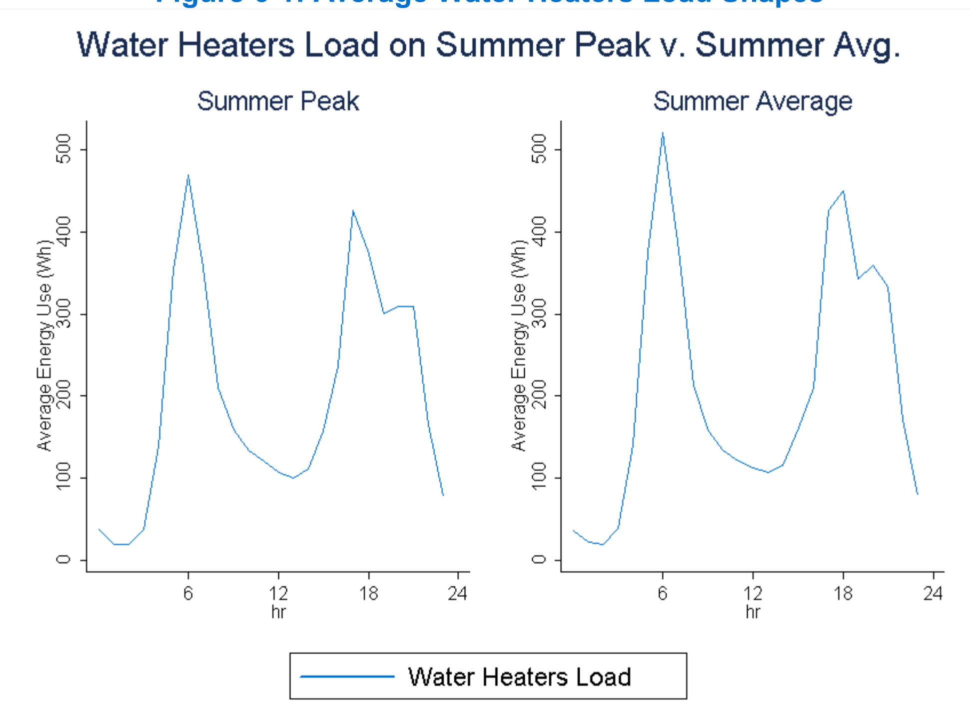
Where:

t	Hours in each day in year 2013 and 2014
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in FPL territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in FPL territory.

Figure 6-1: Average Water Heaters Load Shapes

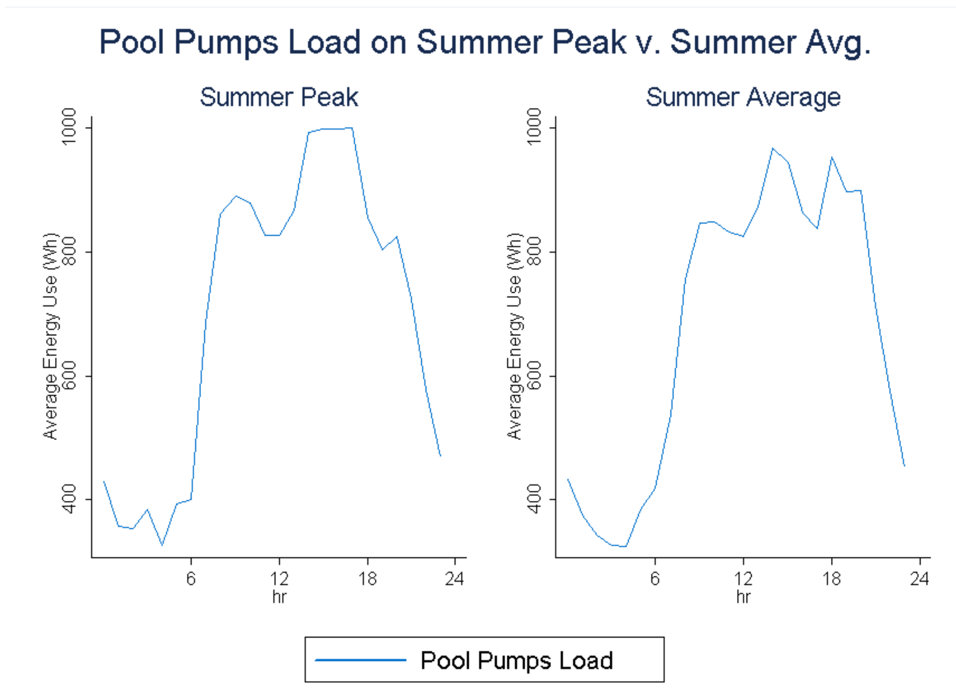


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads have low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 am – 7:00 am and 5:00 pm – 8:00 pm.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in the FEECA Utilities' jurisdictions.

Figure 6-2: Average Pool Pumps Load Shapes



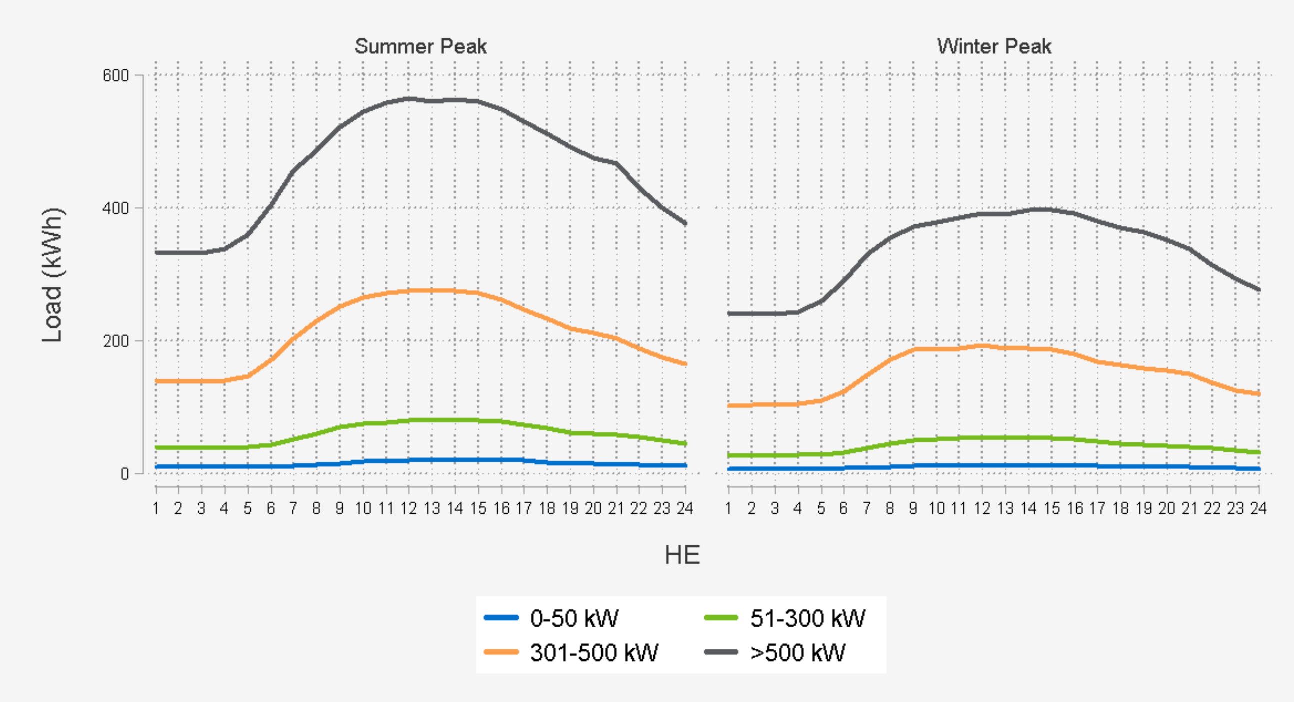
According to the Figure 8-4, the peak hours for pool pumps are 3:00 pm to 6:00 pm, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2016) for a sample of customers in the GSD and GSLD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential as well as examine the weather-sensitivity of each segment by comparing peak usage to the average usage in each season.

Figure 6-3: Aggregate Load Shapes for FPL Large C&I Customers



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REPORT

Market Potential Study of Demand-Side Management in Tampa Electric Company's Service Territory

Submitted to Tampa Electric Company

April, 2019

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing the technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.

This report provides the detailed methodology and results for the technical potential analysis of Tampa Electric Company's (TECO) service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, and technical feasibility. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in TECO's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large commercial and industrial customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning (HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential. The assessment further accounted for existing DR programs for TECO when calculating the total DR potential.

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customer's PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for residential, commercial, and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Technical potential for EE, DR, DSRE are as follows:

1.2.1 EE Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	755	388	2,791
Non-Residential[1]	383	195	1,691
Total	1,138	583	4,483

1.2.2 DR Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

The estimated technical potential results are summarized in Table 1-2.

[1] Non-Residential results include all commercial and industrial customer segments

Table 1-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	1,208	1,645
Non-Residential	1,191	673
Total	2,398	2,318

1.2.3 DSRE Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems charged from PV, and CHP technologies based on the customer characteristics of each FEECA utility's customer base.

Table 1-3: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	509	19	3,461
Non-Residential	835	31	5,679
Total	1,344	50	9,140
Battery Storage charged from PV Systems			
Residential	214	211	-
Non-Residential	1	-	-
Total	216	211	-
CHP Systems			
Total	656	358	3,126

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.

This report provides the detailed methodology and results for technical potential analysis of Tampa Electric Company's (TECO) service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- Technical potential demand and energy savings
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant only estimated technical potential for TECO, and TECO conducted their economic and achievable potential analyses.

Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.
- Economic Potential is the amount of energy and capacity that could be reduced by DSM measures that are considered cost-effective. Nexant did not perform this analysis for TECO.

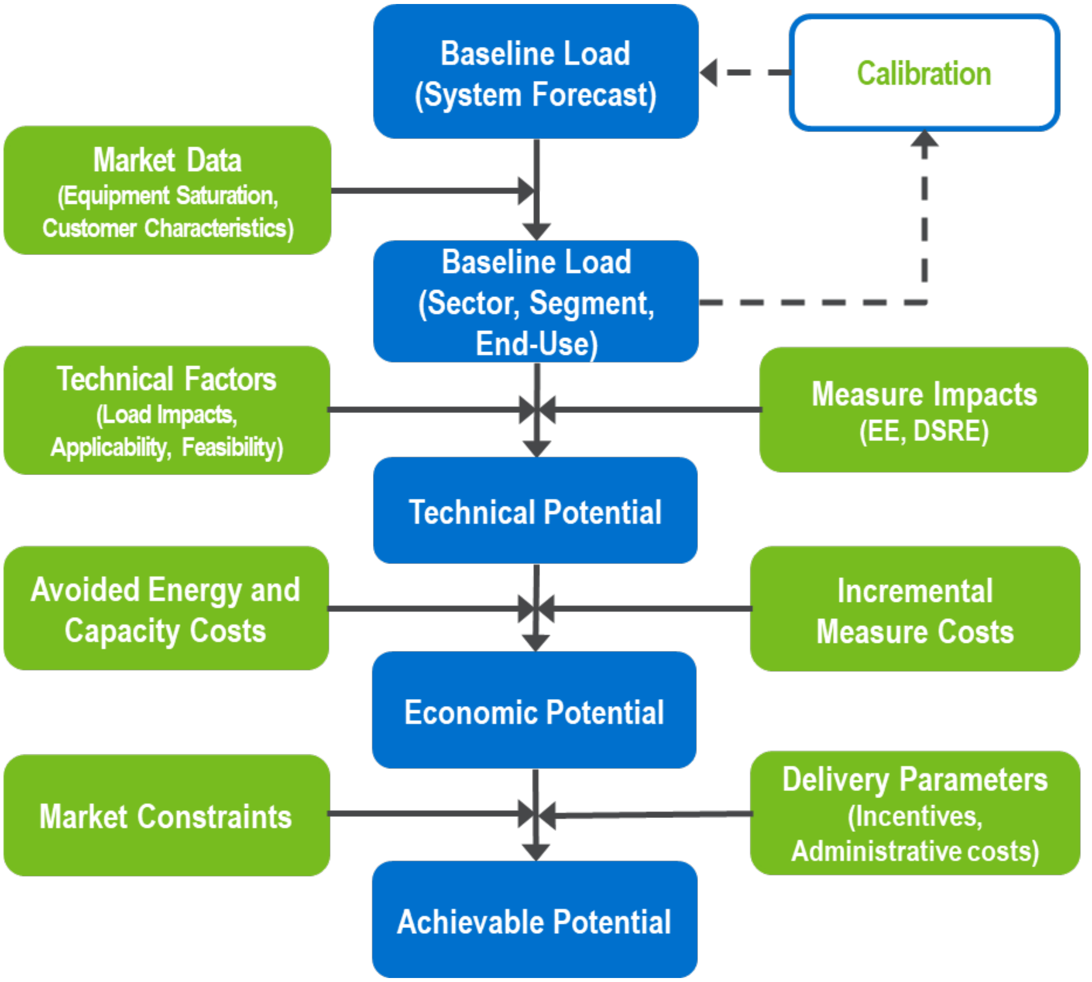
- Achievable Potential is the DSM savings feasible when considering how utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant did not perform this analysis for TECO.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to TECO's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, measure impacts, and costs.

Figure 2-1 provides an illustration of the MPS process, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, and technical feasibility. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Market Potential Modeling



Nexant estimated DSM savings based on a combination of market research, analysis, and a review of TECO's existing DSM programs, all in coordination with TECO. Nexant examined the technical potential for EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions and projected customer response to DR measures. Customer demand was determined by looking at interval data for a sample of each customer segment. For each segment, Nexant determined the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures was developed based on the performance of existing Florida DR programs. If a DR strategy did not currently exist in Florida, other programs in the United States were used as a proxy to estimate the performance of the program if it were implemented in Florida.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The TECO base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of TECO's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from TECO. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the TECO electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020-2029, and based it on data provided by TECO, primarily their 2017 Ten-Year Site Plan, which was the most recent plan available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized TECO's summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with TECO's estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers' baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA's recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for

each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on TECO rate class load shares and intensities.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - TECO rate class load share is based on average per customer.
    - Nexant made conversions to usage estimates generated by applying utility-provided residential appliance saturation surveys (RASS) and EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on TECO rate class load shares, intensities, and EIA CBECS data.
- Segment data from EIA and TECO.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA CBECS and end-use forecasts from TECO.

Industrial sector:

- The disaggregation was based on rate class load shares, intensities, and EIA MECS data.
- Segment data from EIA and TECO.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA MECS and end-use forecasts from TECO.

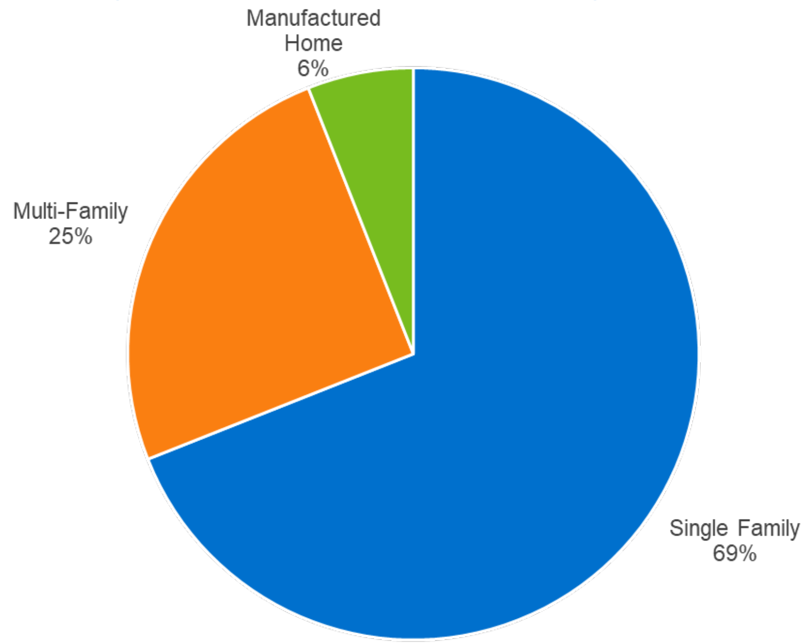
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. TECO provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential customers, but the overall logic was consistent with the concept of expressing the customers in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I customers using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2 and Figure 3-3.

Figure 3-2: Commercial Customer Segmentation

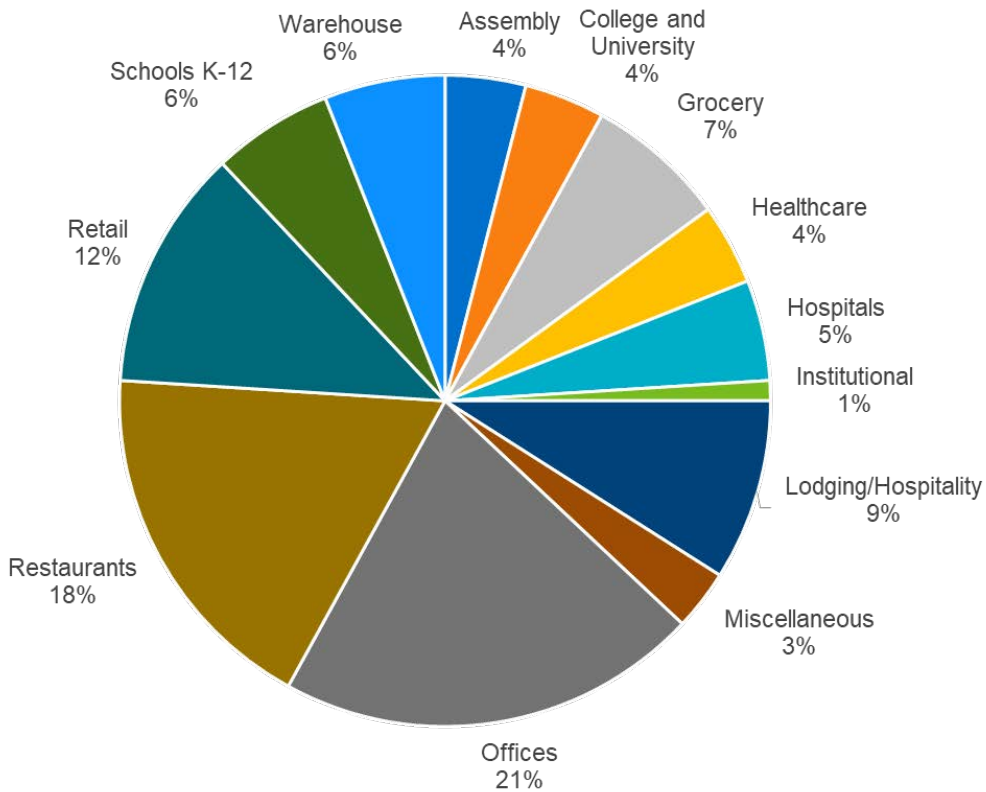
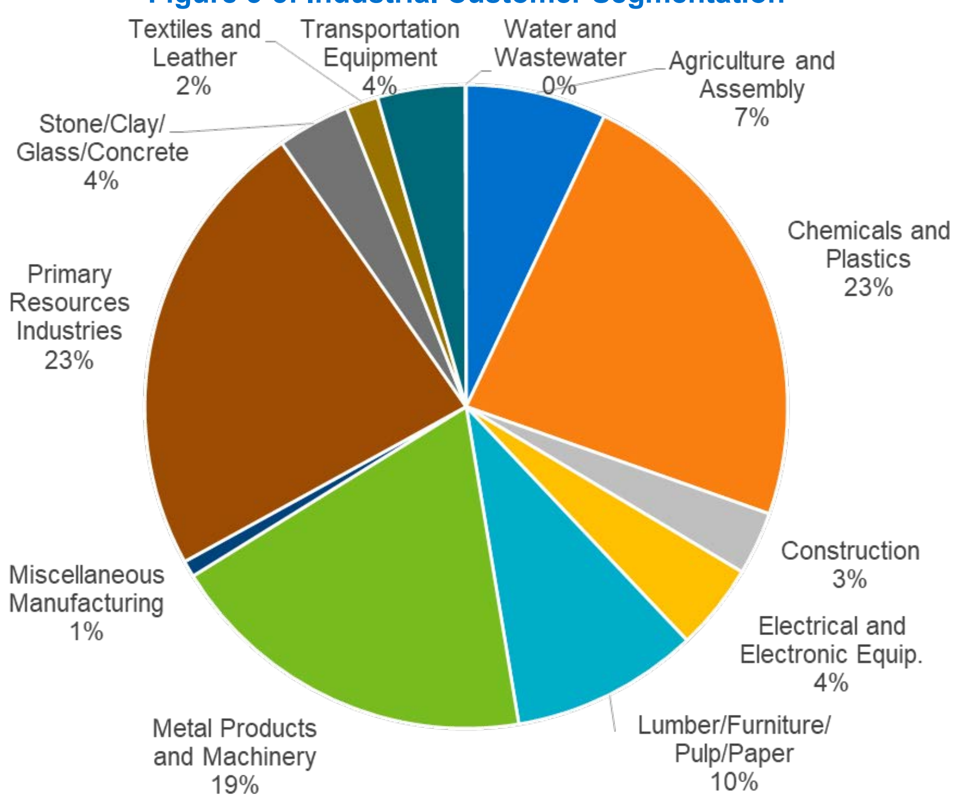


Figure 3-3: Industrial Customer Segmentation



3.2.3 Commercial and Industrial Customers (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD) tariff[3]. Nexant further segmented these two groups based on customer size. For small C&I segmentation was determined using annual customer consumption and for Large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by TECO.

Table 3-3 shows the account breakout between small C&I and large C&I.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Annual kWh	Number of Accounts
Small C&I	0-15,000 kWh	43,096
	15,001-25,000 kWh	9,401
	25,001-50,000 kWh	9,062
	50,001 kWh +	3,289
	Total	64,848
Large C&I	0-50 kW	8,294
	51-300 kW	6,173
	301-500 kW	702
	501 kW +	702
	Total	15,841

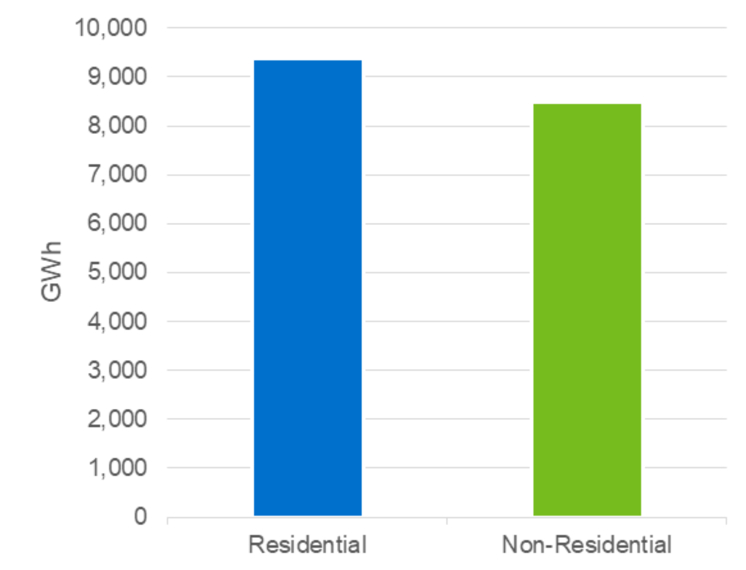
3.3 Analysis of System Load

3.3.1 System Energy Sales

Technical potential is based on TECO's load forecast for the year 2020 from their 2017 Ten Year Site Plan, which is illustrated in Figure 3-4.

[3] To be eligible, customers cannot have annual usage less than 9,000 kWh.

Figure 3-4: 2020 Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine the technical potential for DR, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when maximum DR impact was the historical system load for TECO. The data provided contained the system loads all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For TECO the summer peaking conditions were defined as July and August from 5:00-6:00 PM and the winter peaking conditions were defined as January and February from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are summarized in Figure 3-5, Figure 3-6 and Figure 3-7.

Figure 3-5: Residential Baseline (2020) Energy Sales by End-Use

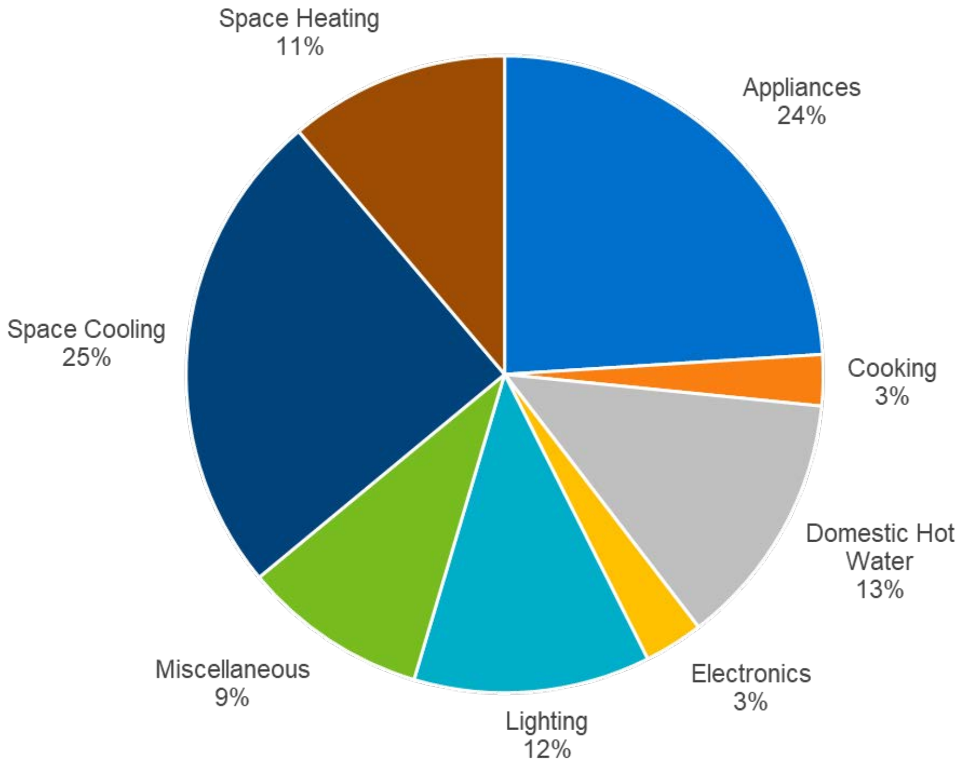


Figure 3-6: Commercial Baseline (2020) Energy Sales by End-Use

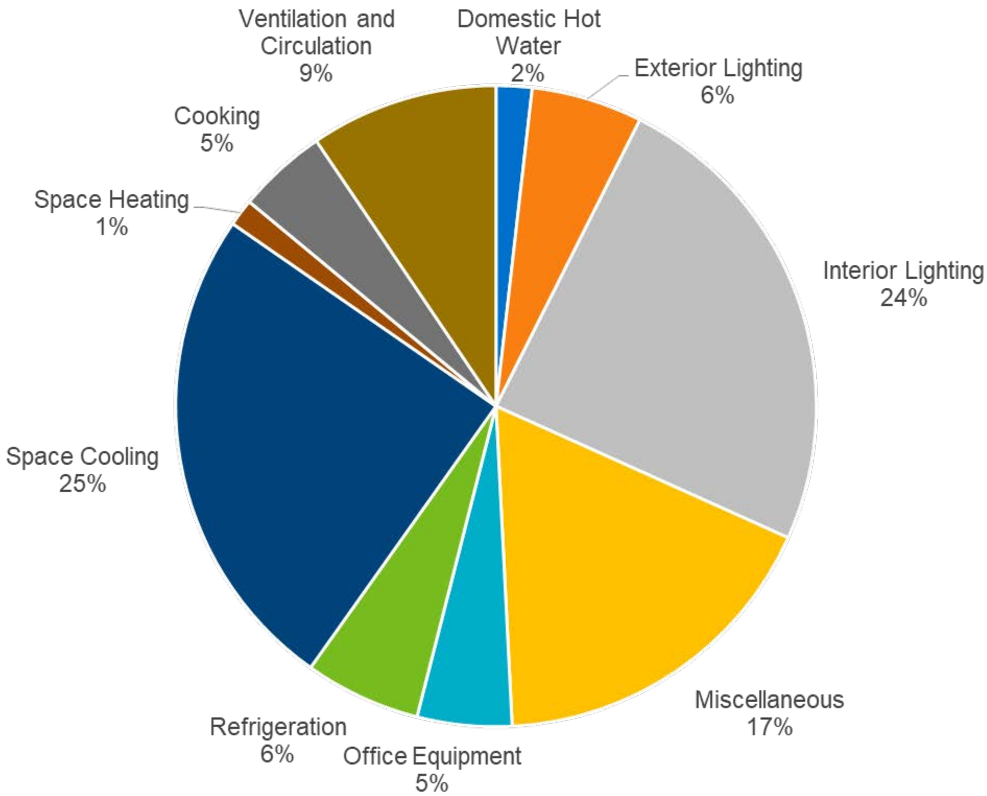
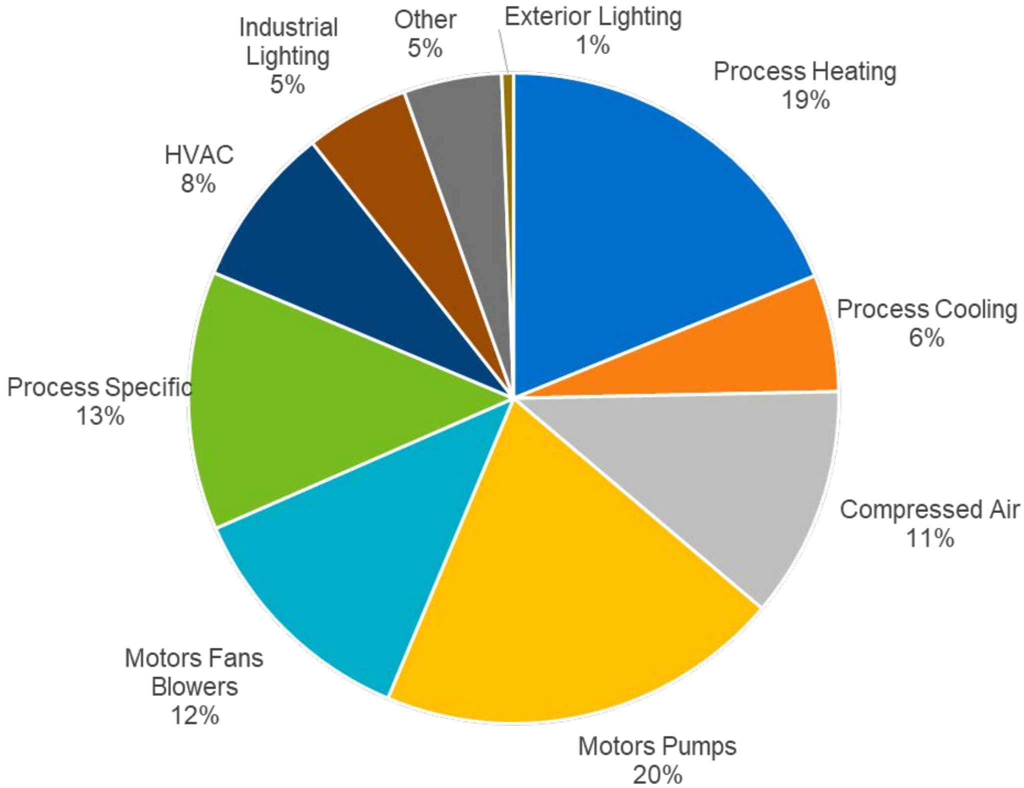


Figure 3-7: Industrial Baseline (2020) Energy Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the EE, DR, and DSRE measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar market potential studies conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to the residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[1]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations

[1] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.
- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used primarily derived from data in current regional and national databases, as well as TECO's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,164 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[2]	30	320

[2] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix A.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) with Technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or a rate discount for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end uses estimated for technical potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[3].

[3] This study did not include ground-mounted or utility-scale solar PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged from PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover technologies used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as single numerical values for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Number of Households × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Stock Sq. Footage by Segment × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with TECO's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity, the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I customers generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. When done properly, end-use disaggregation not only provides insights into which loads are on and off when specific grid services are needed, it also provides insight concerning how key loads and end-uses, such as air conditioning use, vary across customers. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For TECO, Nexant examined three residential segments based on customer housing type, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 11 different customer segments.

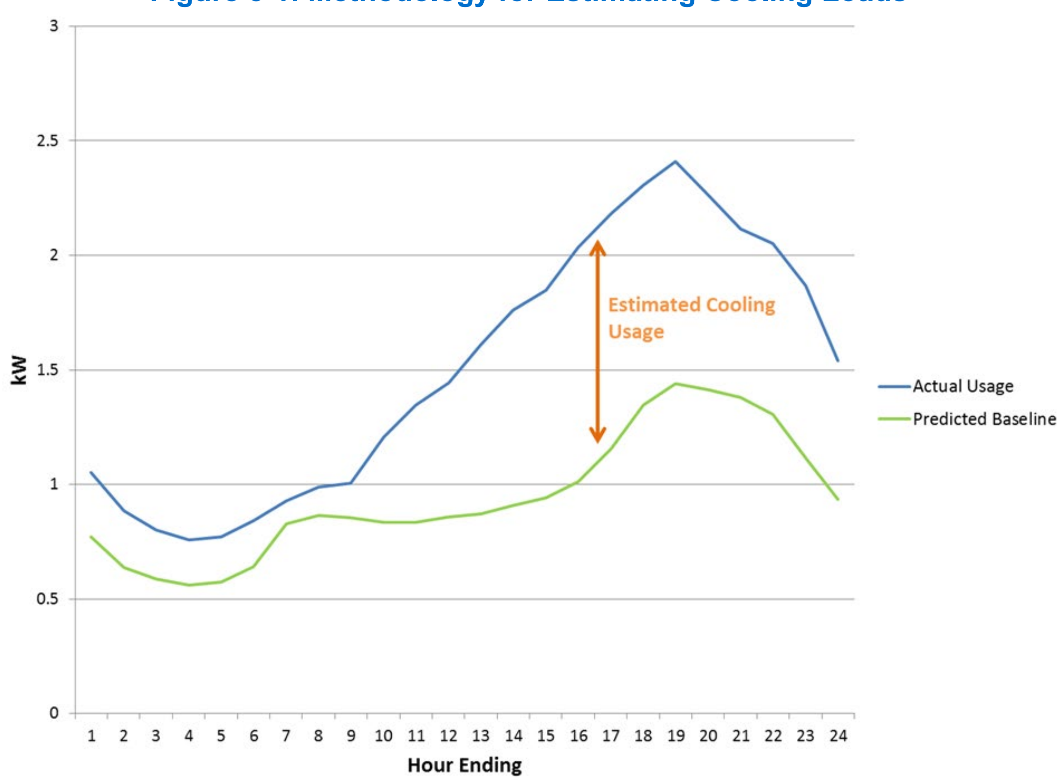
Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

AC and heating load profiles were generated for residential and small C&I customers using interval data from a sample of customers provided by TECO. This sample included a customer breakout based on size and housing type for each rate class. Nexant then used the interval data from these customers to create an average load profile for each customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the seven different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR program.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are July and August from 5:00-6:00 PM for summer, and January and February from 7:00-8:00 AM for winter.

As mentioned in Section 4, for technical potential there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads.

In order to account for existing utility DR programs, all customers currently enrolled in a DR offering were excluded from the technical potential. This methodology was consistent across all three sectors.

5.1.3 DSRE Technical Potential

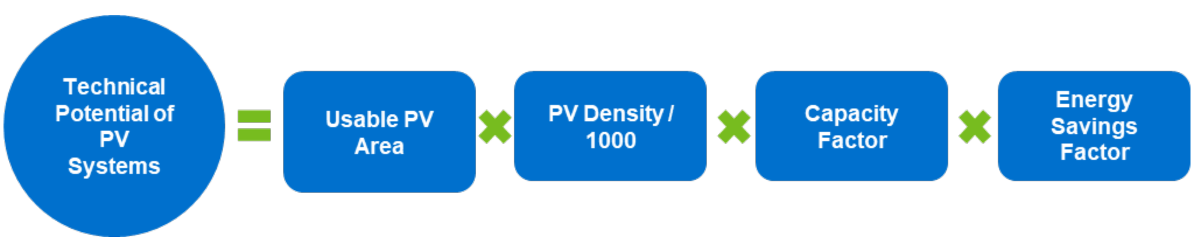
5.1.3.1 PV Systems

To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[7], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

Equation 5-3: Core Equation for Solar Technical Potential



[7] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Where:

Usable PV Area for Residential: (Total Floor Area[8] / Average No. of Stories[9]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[10] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PV Watts. Energy Savings Factor = Alternating Current System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery systems do create the opportunity to store energy during period when the PV system is generating more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for "solar plus storage" systems, our methodology consisted of the following steps:

- Develop an 8,760 hour annual load shape for a PV system based on estimated annual hours of available sunlight.

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[8] Utility-provided data and US Census, South Region

[9] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[10] Floor space = based on utility data. Average floors by building type = Commercial Building Energy Consumption Survey (CBECS), South Atlantic Region

- Compare the PV generation with a total home or total business 8,760 hour annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.
- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers' thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore, the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore, results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage coupled with PV, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
    - For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

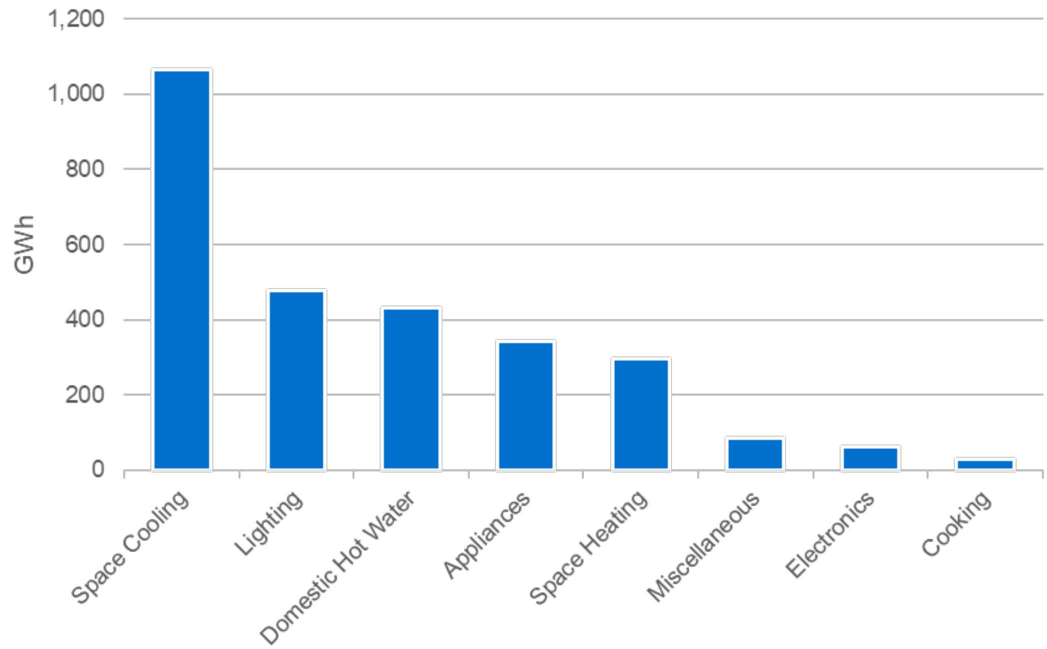
Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	755	388	2,791
Non-Residential[11]	383	195	1,691
Total	1,138	583	4,483

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 summarize the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Energy Savings)



[11] Non-Residential results include all commercial and industrial customer segments

Figure 5-3: Residential EE Technical Potential by End-Use (Summer Peak Savings)

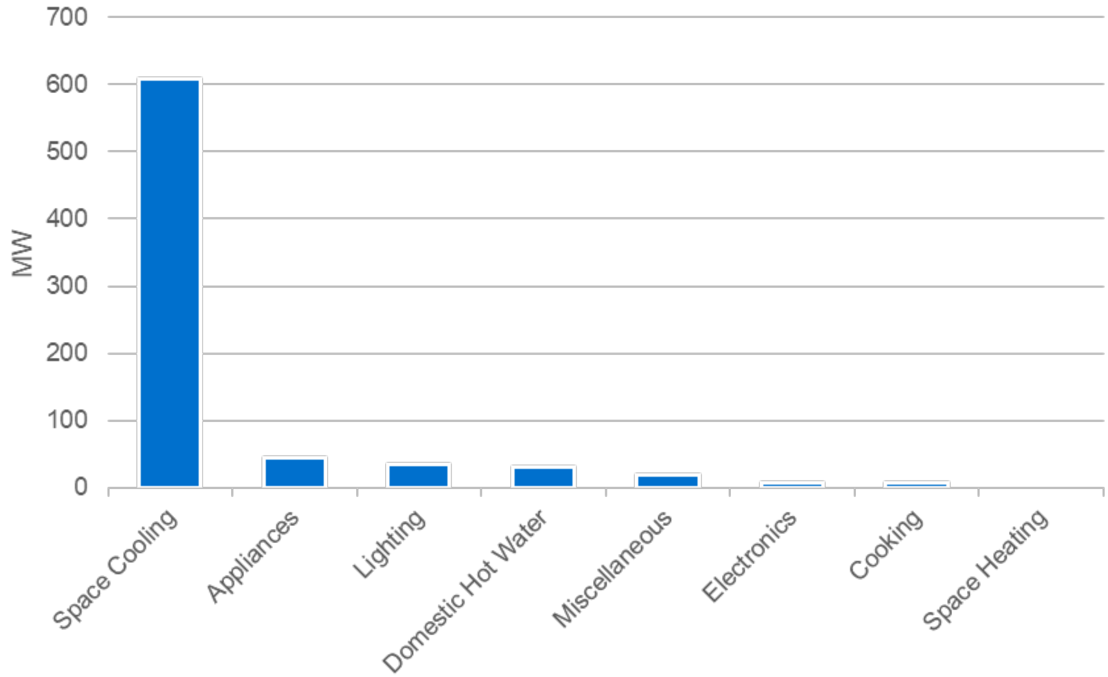
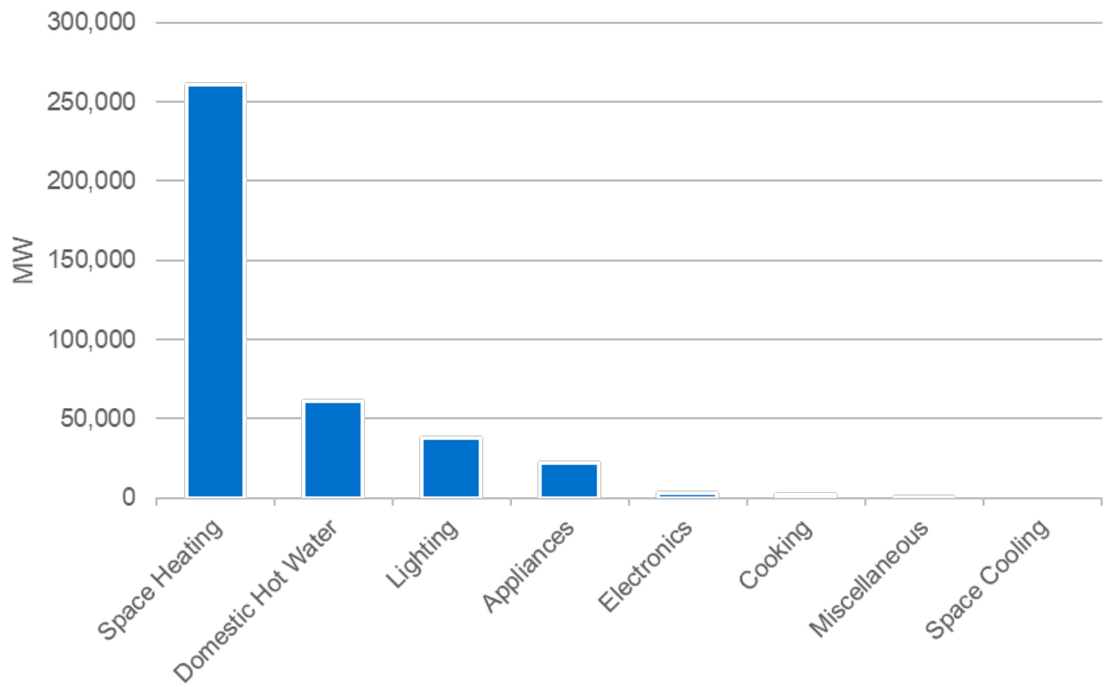


Figure 5-4: Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3 Non-Residential

5.2.3.1 Commercial Segments

Figure 5-5, Figure 5-6, and Figure 5-7 summarize the commercial EE technical potential by end-use.

Figure 5-5: Commercial EE Technical Potential by End-Use (Energy Savings)

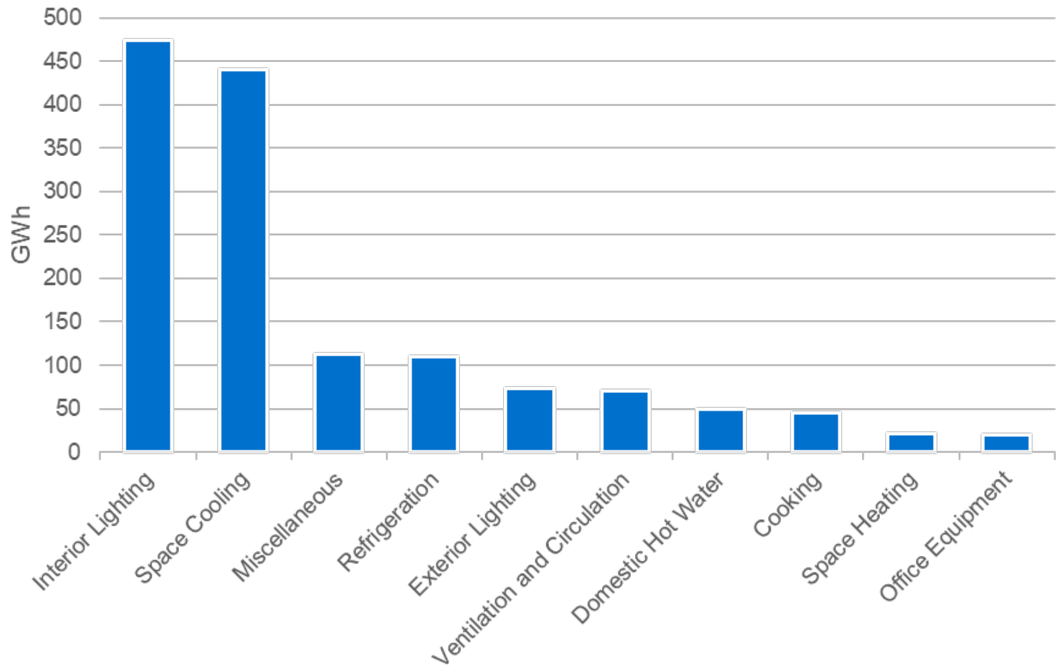


Figure 5-6: Commercial EE Technical Potential by End-Use (Summer Peak Savings)

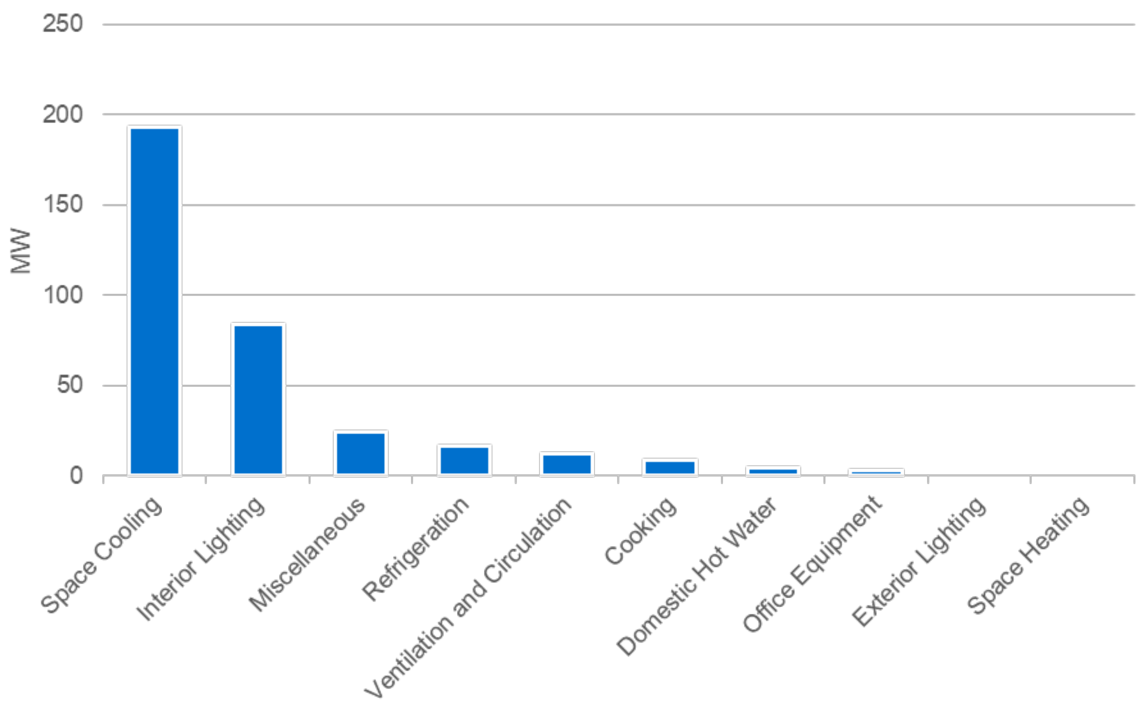
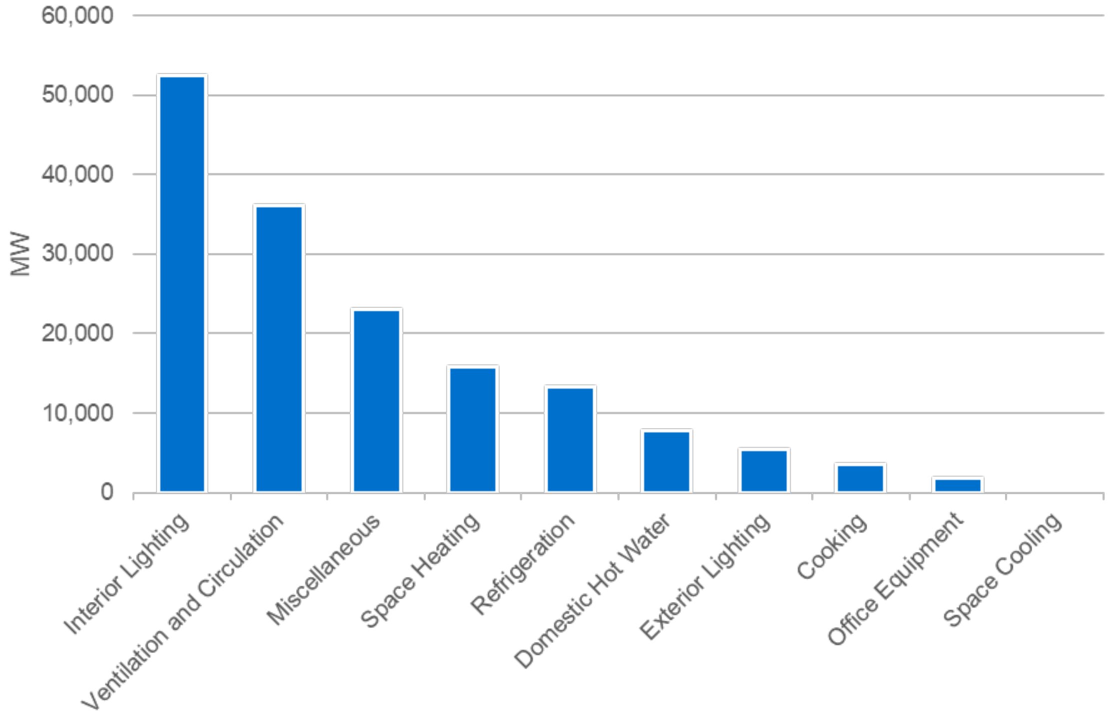


Figure 5-7: Commercial EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3.2 Industrial Segments

Figure 5-8, Figure 5-9, and Figure 5-10 summarize the industrial EE technical potential by end-use.

Figure 5-8: Industrial EE Technical Potential by End-Use (Energy Savings)

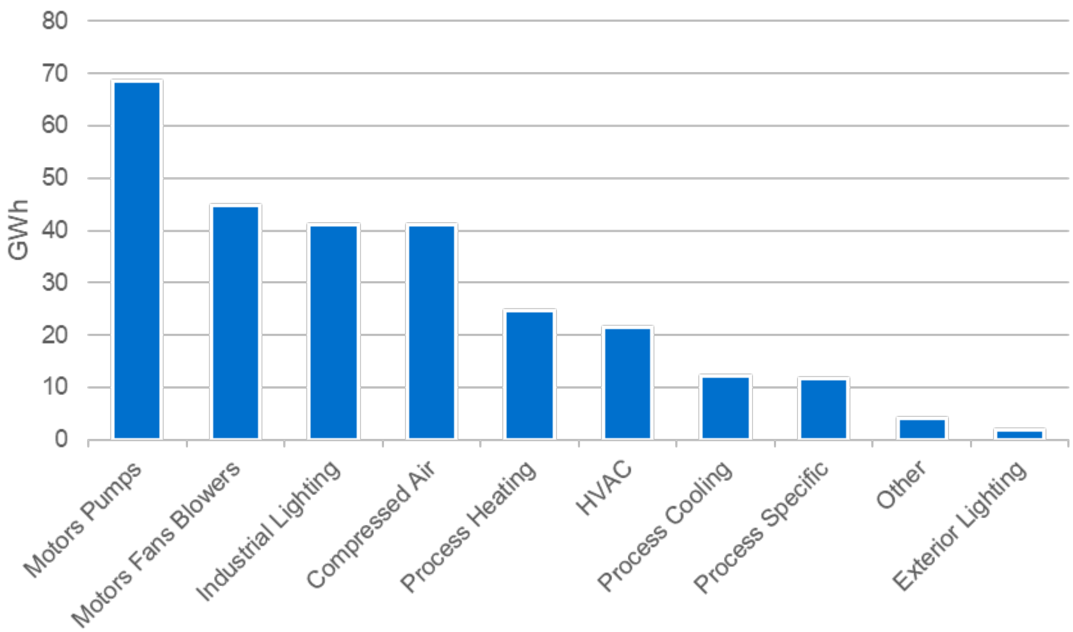


Figure 5-9: Industrial EE Technical Potential by End-Use (Summer Peak Savings)

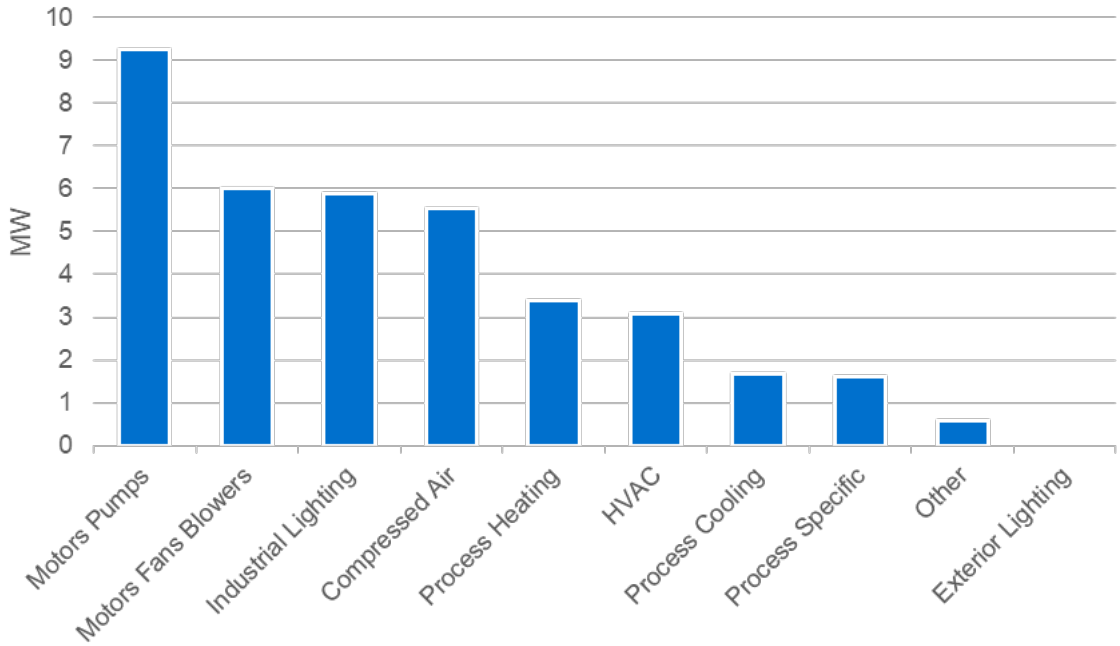
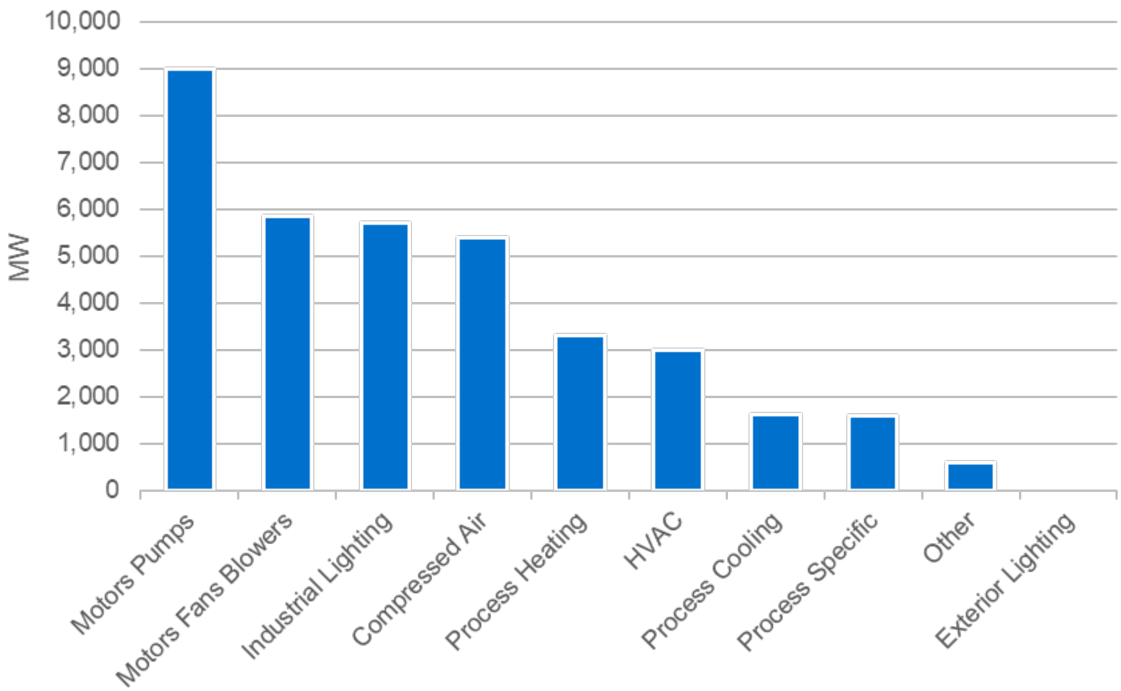


Figure 5-10: Industrial EE Technical Potential by End-Use (Winter Peak Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in TECO's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

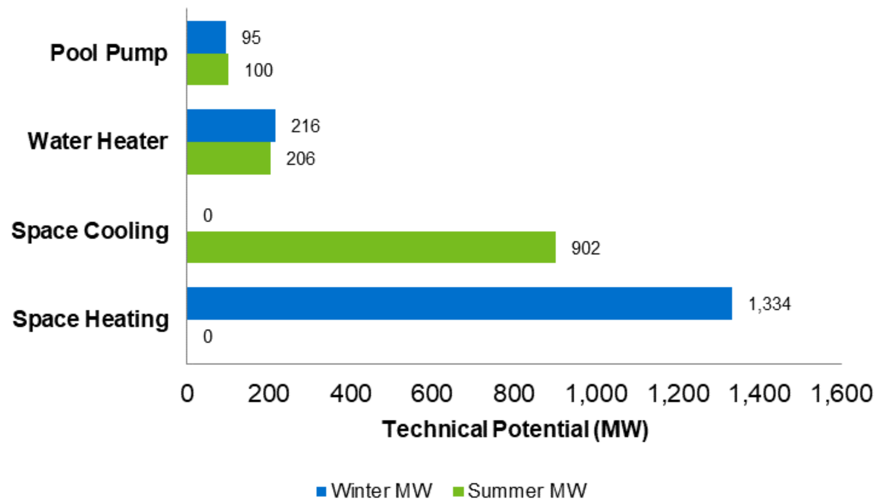
Table 5-2: DR Technical Potential by Sector

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	1,208	1,645
Non-Residential	1,191	673
Total	2,398	2,318

5.3.1 Residential

Residential technical potential is summarized in Figure 5-11.

Figure 5-11: Residential DR Technical Potential by End-Use (Incremental to Existing)[12]

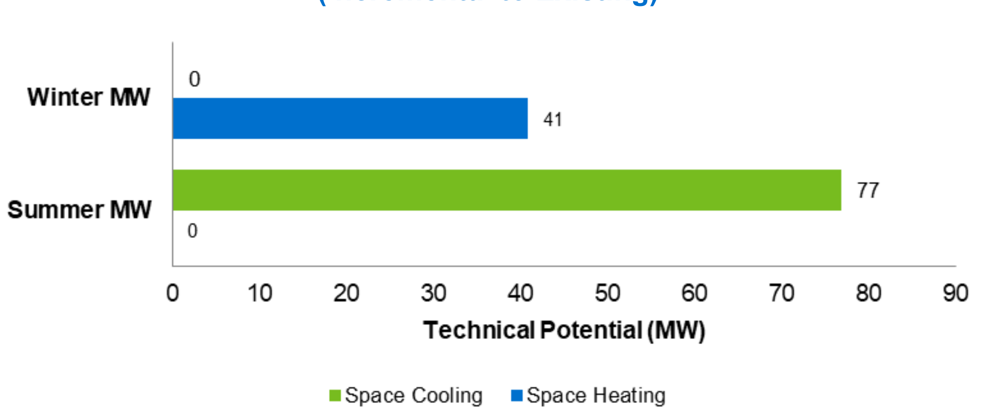


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-12.

Figure 5-12: Small C&I DR Technical Potential by End-Use (Incremental to Existing)[13]



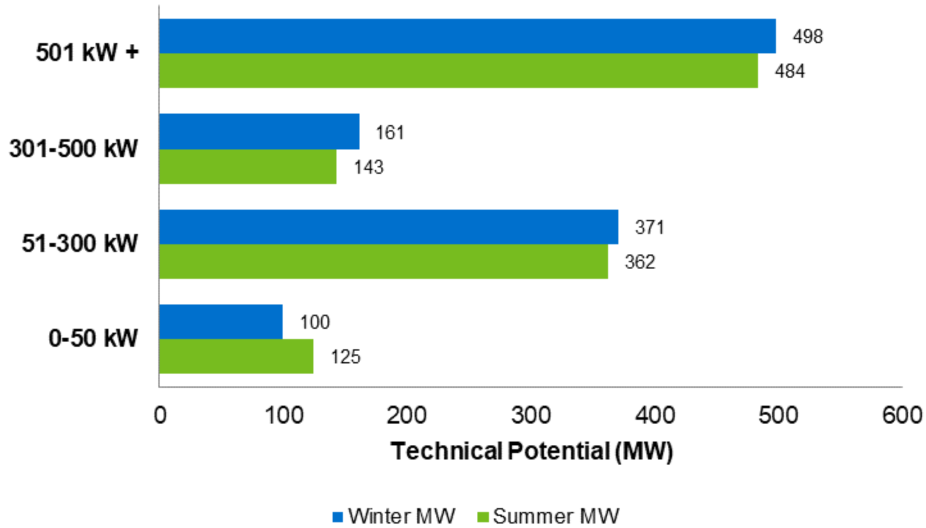
[12] All currently enrolled DR customers are excluded

[13] All currently enrolled DR customers are excluded

5.3.2.2 Large C&I Customers

Figure 5-13 provides the technical potential for large C&I customers, broken down by customer size.

Figure 5-13: Large C&I DR Technical Potential by Segment (Incremental to Existing)[14]



[14] All currently enrolled DR customers are excluded

5.4 DSRE Technical Potential

Table 5-3 provides the detailed results of the DSRE technical potential.

Table 5-3: DSRE Technical Potential[15]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	509	19	3,461
Non-Residential	835	31	5,679
Total	1,344	50	9,140
Battery Storage charged from PV Systems			
Residential	214	211	-
Non-Residential	1	-	-
Total	216	211	-
CHP Systems			
Total	656	358	3,126

[15] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

6 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements

Measure	End-Use	Description	Baseline
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations

Measure	End-Use	Description	Baseline
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average pump equipment
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and small C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

The cooling load shapes on the summer peak weekday and average weekdays were generated from interval data from a sample of customers in TECO territory for 2016. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2016
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (July and August from 5-6 pm). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, interval data from a sample of customers in TECO territory for 2016, and the peak day was defined as the day with system peak load during winter period (January and February from 7-8 am). The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

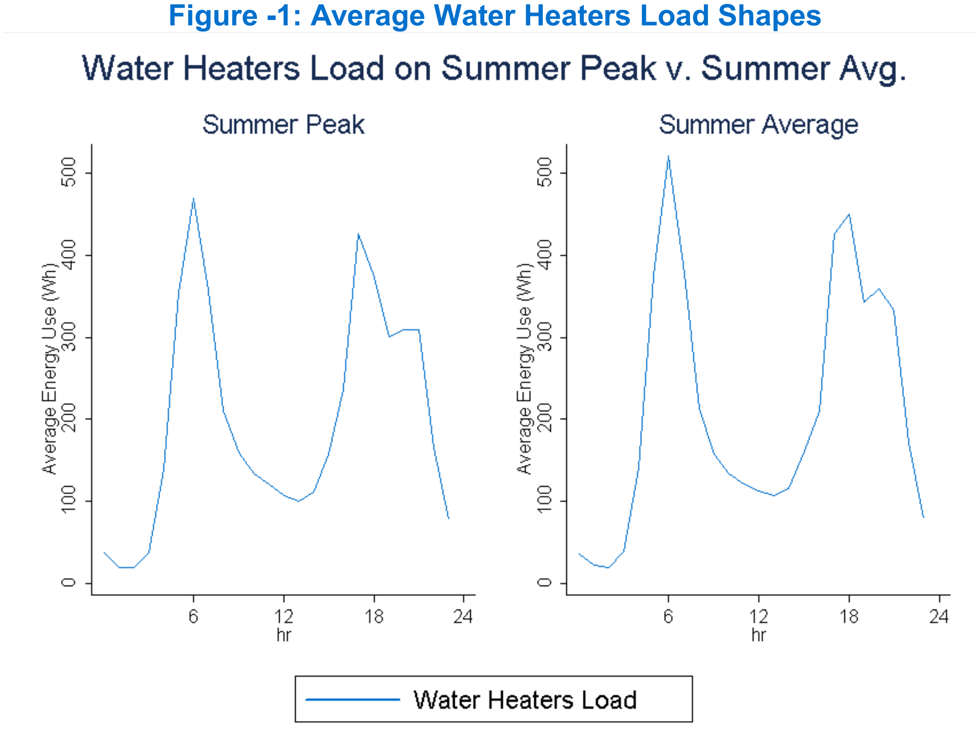
Where:

t	Hours in each day in year 2013 and 2014
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in TECO territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in TECO's jurisdiction.

Figure -1: Average Water Heaters Load Shapes

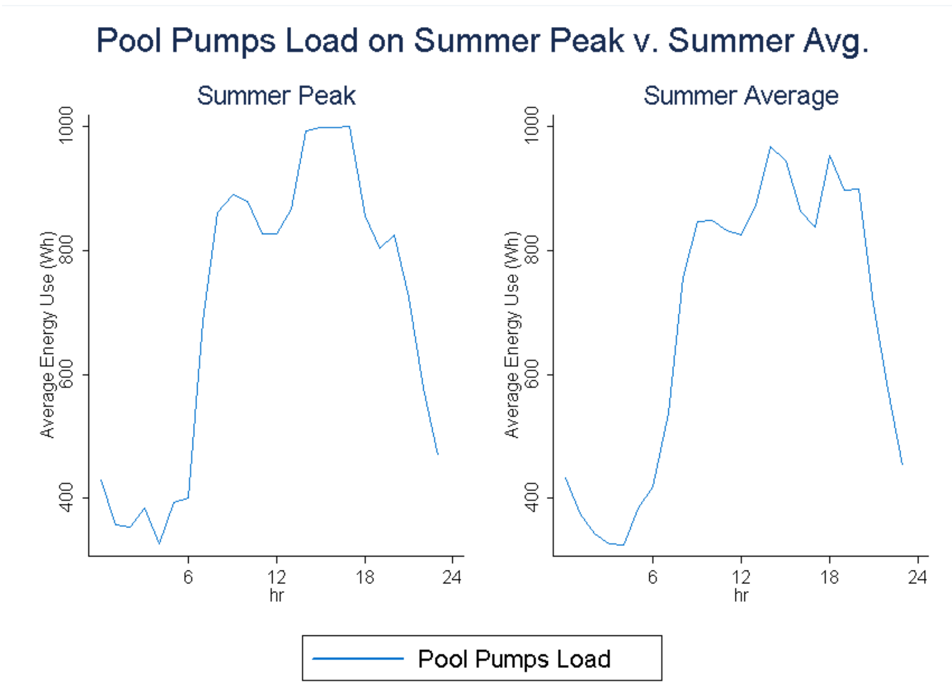


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads has low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 am – 7:00 am and 5:00 pm – 8:00 pm.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in the FEECA Utilities' jurisdictions.

Figure 6-2: Average Pool Pumps Load Shapes



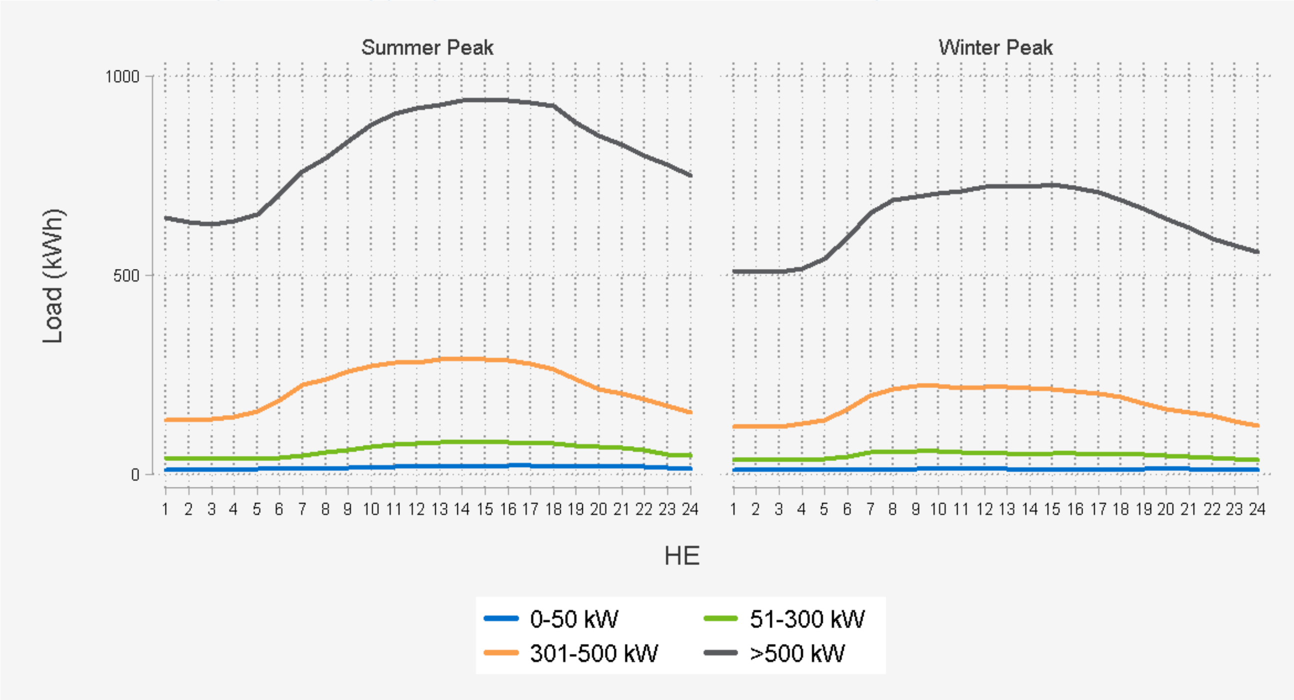
According to the Figure 8-4, the peak hours for pool pumps are 3:00 pm to 6:00 pm, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2016) for all customers in the GSD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential as well as examine the weather-sensitivity of each segment by comparing peak usage to the average usage in each season.

Figure 6-3: Aggregate Load Shapes for TECO Large C&I Customers



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REPORT

Reimagine tomorrow.

Market Potential Study of Demand-Side Management in Duke Energy Florida's Service Territory

Submitted to Duke Energy Florida

April, 2019

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Contents

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Duke Energy Florida's (DEF) service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in DEF's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large commercial and industrial customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning (HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential. The assessment further accounted for existing DR programs for DEF when calculating the total DR potential. The large C&I programs assessment used publicly available data on mature DR programs and current Florida large C&I DR programs to derive estimates of price responsiveness to program incentives and marketing techniques. Using these estimates, the maximum incentive and enrollment scenario was calculated to estimate the potential.

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customer's PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for residential, commercial and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Nexant estimated DSM savings potential according to three standard scenarios: technical, economic, and achievable potential. Each scenario is defined using slightly different criteria, which are described in the subsequent sections.

1.2.1 EE Potential

Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	2,236	1,519	6,294
Non-Residential[1]	719	361	3,137
Total	2,954	1,879	9,431

[1] Non-Residential results include all commercial and industrial customer segments

Economic Potential

EE economic potential applies a cost-effectiveness screening to all technically feasible measures and includes full implementation of all measures that pass this screening. Measure permutations were screened individually and the economic potential represents the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

Economic potential was determined for two scenarios: a Rate Impact Measure (RIM) scenario and Total Resource Cost (TRC) scenario. Additional screening criteria for both scenarios included the Participant Cost Test (PCT) perspective, and two-year payback criterion. Additional sensitivities were also analyzed, which are described in Section 6.1.3 and results presented in Appendix E.

The estimated economic potential results are summarized in Table 1-2.

Table 1-2: EE Economic Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	931	522	1,608
Non-Residential	104	42	290
Total	1,035	565	1,898
TRC SCENARIO			
Residential	970	550	2,138
Non-Residential	222	94	980
Total	1,192	644	3,117

Achievable Potential

Achievable potential estimates the demand and energy savings feasible with utility-sponsored programs, while considering market barriers and customer adoption rates for DSM technologies. Similar to the economic potential analysis, measures were screened to determine which are cost-effective from both the RIM and TRC perspectives. The achievable potential includes estimated program costs and incentives, whereas the economic potential scenario does not.

Table 1-3 summarizes the results for the estimated EE achievable potential, representing the cumulative savings over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

Table 1-3: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	66	39	115
Non-Residential	16	20	51
Total	82	59	166
TRC SCENARIO			
Residential	80	50	194
Non-Residential	53	30	238
Total	133	80	432

1.2.2 DR Potential

Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

The estimated technical potential results are summarized in Table 1-4.

Table 1-4: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	1,434	2,627
Non-Residential	1,857	1,446
Total	3,292	4,073

Economic Potential

DR economic potential incorporates the economic screening criteria described above for EE potential. Because of the costs and benefits associated with DR, all DR measures passed and DR EP is the same as DR TP for DEF. The results are summarized in Table 1-5.

Table 1-5: DR Economic Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	1,434	2,627
Non-Residential	1,857	1,446
Total	3,292	4,073

Achievable Potential

DR achievable potential incorporates the economic screening criteria described above for EE potential, and the results are summarized in Table 1-6.

Table 1-6: DR Achievable Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	42	39
Non-Residential	119	101
Total	161	140

1.2.3 DSRE Potential

Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems charged from PV, and CHP technologies based on the customer characteristics of each FEECA utility's customer base.

Table 1-7: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	1,108	87	7,907
Non-Residential	1,953	154	13,783
Total	3,061	242	21,690
Battery Storage charged from PV Systems			
Residential	439	243	-
Non-Residential	84	-	-
Total	523	243	-
CHP Systems			
Total	891	614	4,126

Economic Potential

DSRE economic potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective potential attainable for DEF for PV systems, battery storage systems, or CHP systems.

Achievable Potential

DSRE achievable potential incorporates the achievable screening criteria described above for EE potential. Nexant found there to be no cost-effective potential attainable for DEF for PV systems, battery storage systems, or CHP systems.

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and DSRE systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Duke Energy Florida's (DEF) service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- List of cost-effective EE, DR, and DSRE measures
- Potential demand and energy savings for technical, economic and achievable potential scenarios
- Estimated utility costs to acquire the achievable potential
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.

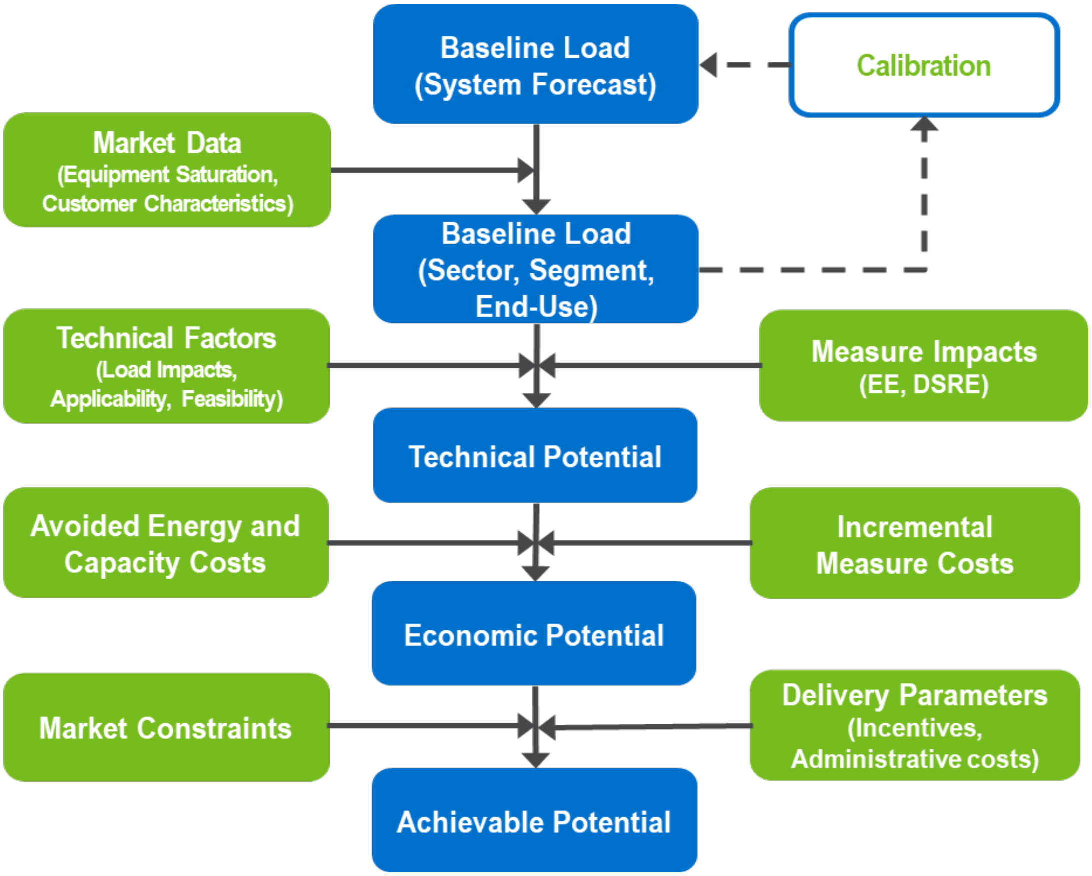
- Economic Potential is the amount of energy and capacity that could be reduced by DSM measures that are considered cost-effective. This study used the Ratepayer Impact Measure (RIM) test perspective and Total Resource Cost (TRC) test perspective, which were both coupled with the Participant Cost Test (PCT) and a two-year payback to determine cost-effectiveness.
- Achievable Potential is the DSM savings feasible when considering how utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant's achievable potential applied the same cost-effectiveness screening as the economic potential analysis, with the addition of utility program costs and incentives.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to DEF's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, measure impacts, and costs.

Figure 2-1 provides an illustration of the MPS process, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Market Potential Modeling



Nexant estimated DSM savings potential based on a combination of market research, analysis, and a review of DEF's existing DSM programs, all in coordination with DEF. Nexant examined EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions, projected customer response to DR measures, the marginal benefit and cost of recruiting a customer for DR, and customer enrollment. Customer demand was determined by looking at interval data for a sample of each customer segment and determining the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures

was developed based on the performance of existing Florida DR programs and other DR programs in the US. Cost-effectiveness was estimated based on demand reductions, how well reductions coincide with system peaking conditions, the benefits of reducing demand during peaking conditions, and cost information. Enrollment rates were determined as a function of the incentive paid to a customer as well as the level of marketing for each DR measure.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The DEF base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of DEF's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis. The goal of this further segmentation for DR was to understand which customer groups were most cost-effective to recruit and allow for more targeted marketing of DR programs.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be

willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from DEF. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the DEF electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020-2029, and based it on data provided by DEF, primarily their 2017 Ten-Year Site Plan, which was the most recent plan available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized DEF’s summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with DEF’s estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers’ baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA’s recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for

each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on DEF rate class load shares and intensities.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - DEF rate class load share is based on average per customer.
  - Nexant made conversions to usage estimates generated by applying utility-provided residential appliance saturation surveys (RASS) and EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on DEF rate class load shares, intensities, and EIA CBECS data.
- Segment data from EIA and DEF.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA CBECS and end-use forecasts from DEF.

Industrial sector:

- The disaggregation was based on rate class load shares, intensities, and EIA MECS data.
- Segment data from EIA and DEF.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA MECS and end-use forecasts from DEF.

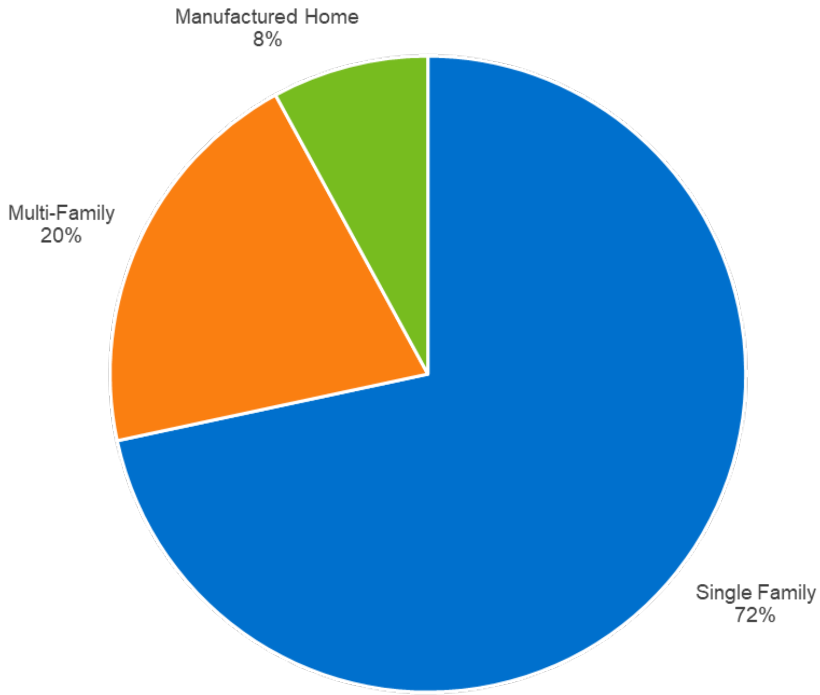
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. DEF provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential customers, but the overall logic was consistent with the concept of expressing the customers in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I customers using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2 and Figure 3-3.

Figure 3-2: Commercial Customer Segmentation

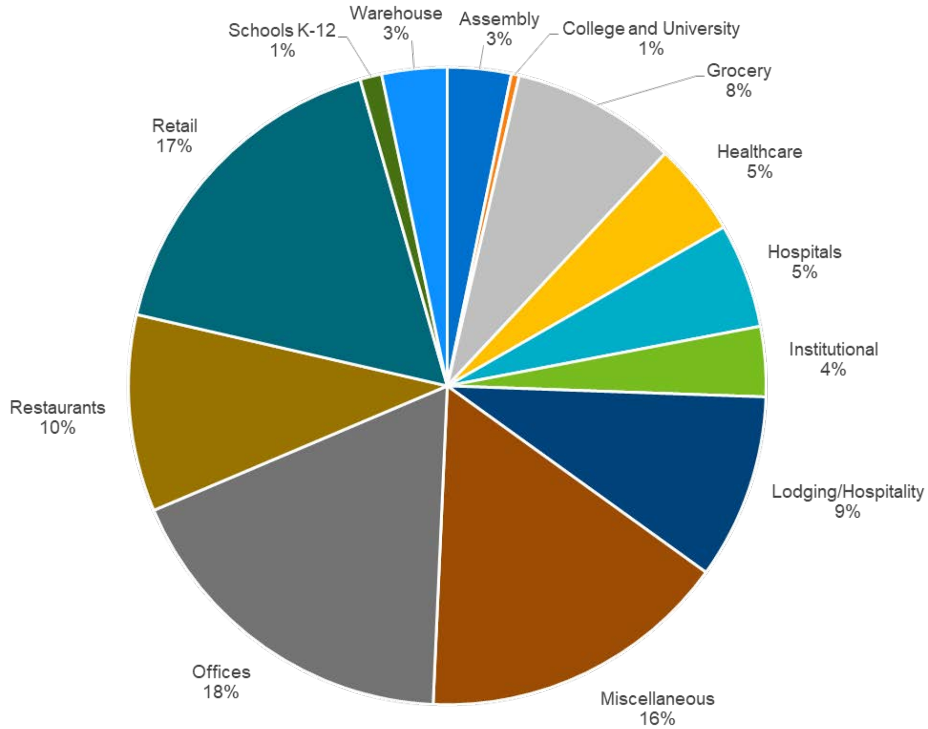
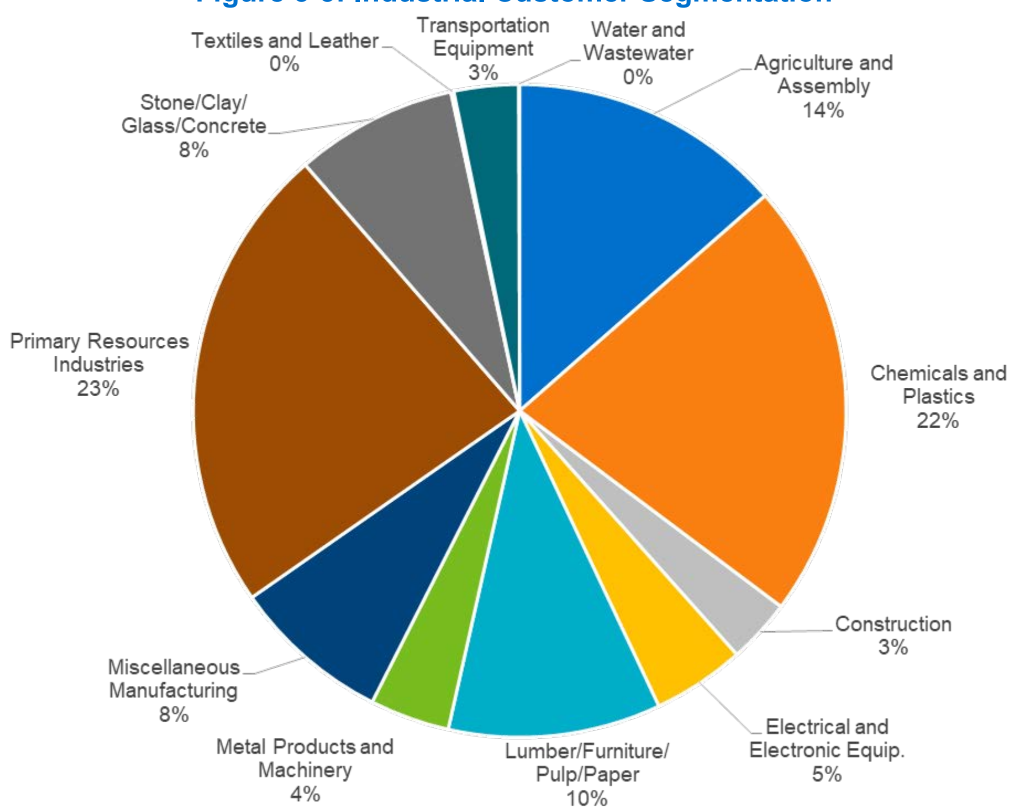


Figure 3-3: Industrial Customer Segmentation



3.2.3 Commercial and Industrial Customers (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD) tariff[3]. Nexant further segmented these two groups based on customer size. For small C&I segmentation was determined using annual customer consumption and for large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by DEF.

Table 3-3 shows the account breakout between small C&I and large C&I.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Customer Size	Number of Accounts
Small C&I	0-15,000 kWh	124,529
	15,001-25,000 kWh	14,816
	25,001-50,000 kWh	7,474
	50,001 kWh +	3,032
	Total	149,851
Large C&I	0-50 kW	44,938
	51-300 kW	10,922
	301-500 kW	1,067
	501 kW +	1,160
	Total	58,087

3.3 Analysis of System Load

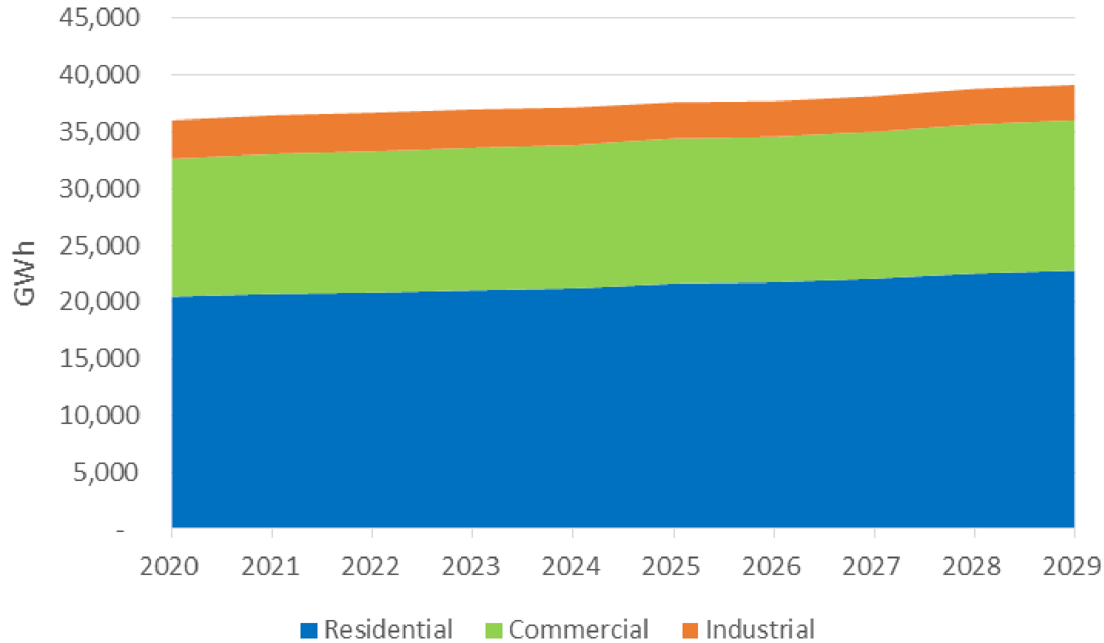
3.3.1 System Energy Sales

While the technical and economic potential are based on the year 2020's system load forecast[4], achievable potential is applied over the entire 10-year study period (2020-2029). Figure 3-7 summarizes the electric sales forecast by sector over the study period.

[3] To be eligible, customers cannot have an annual consumption less than 24,000 kWh.

[4] From DEF's 2017 Ten Year Site Plan

Figure 3-4: Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine when DR would be cost-effective to implement, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when DR resources will be needed was the historical system load for DEF. The data provided contained the system loads all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For the FEECA Utilities the summer peaking conditions were defined as August from 4:00-5:00 PM and the winter peaking conditions were defined as January from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are illustrated in Figure 3-4, Figure 3-5 and Figure 3-6.

Figure 3-5: Residential Baseline (2020) Energy Sales by End-Use

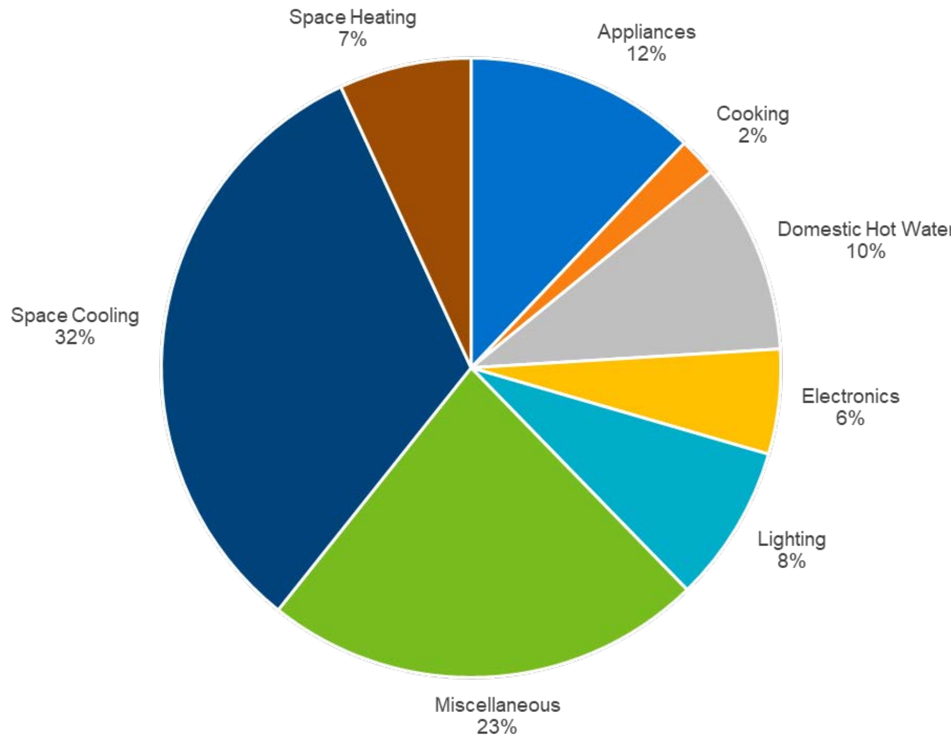


Figure 3-6: Commercial Baseline (2020) Energy Sales by End-Use

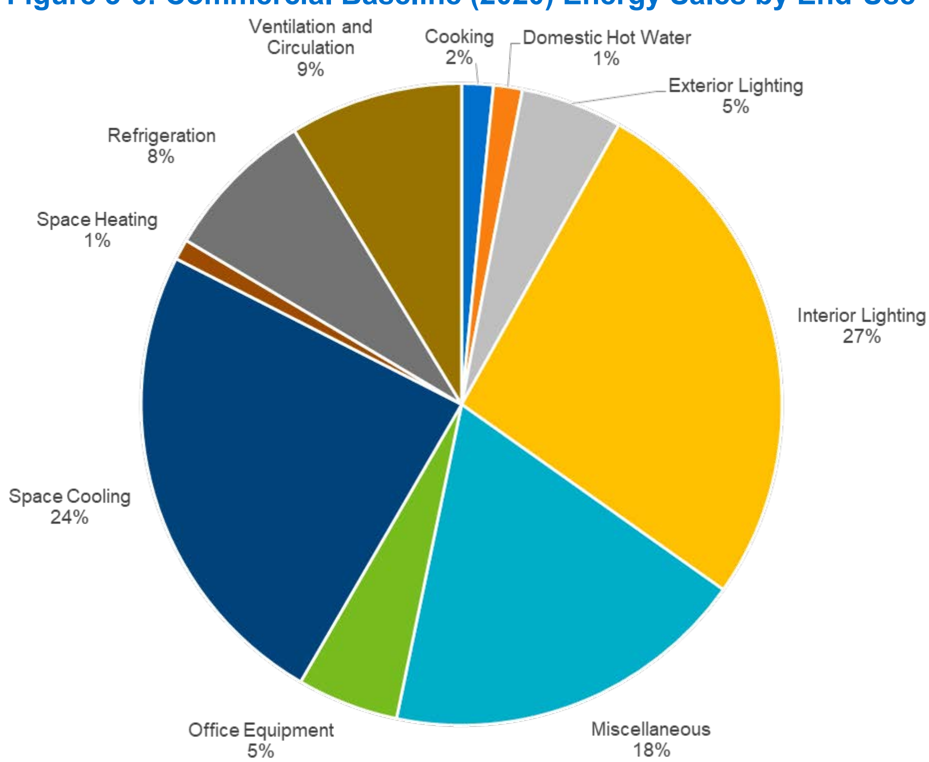
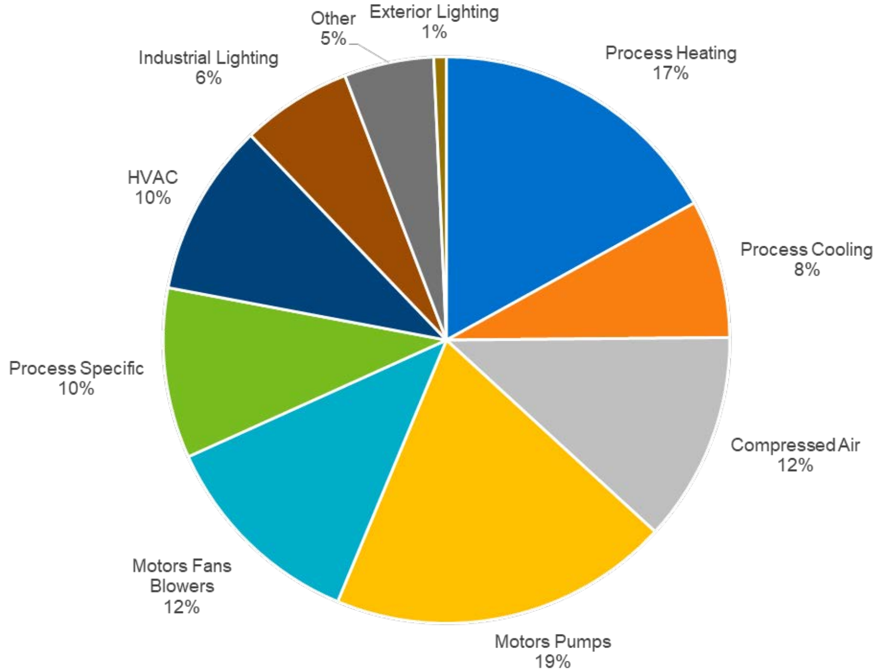


Figure 3-7: Industrial Baseline (2020) Energy Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar market potential studies conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to the residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[1]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations

[1] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.
- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used was primarily derived from data in current regional and national databases, as well as DEF's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,164 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[2]	30	320

[2] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix C.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) with Technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or a rate discount for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed.

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end uses estimated for technical potential. Individual measures were only considered for economic and achievable potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[3].

[3] This study did not include ground-mounted or utility-scale solar PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged From PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover technologies used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of the commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as a single numerical value for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Number of Households × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Stock Sq. Footage by Segment × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with DEF's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity, the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I customers generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For DEF, Nexant examined three residential segments based on customer housing type, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 11 different customer segments.

Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the

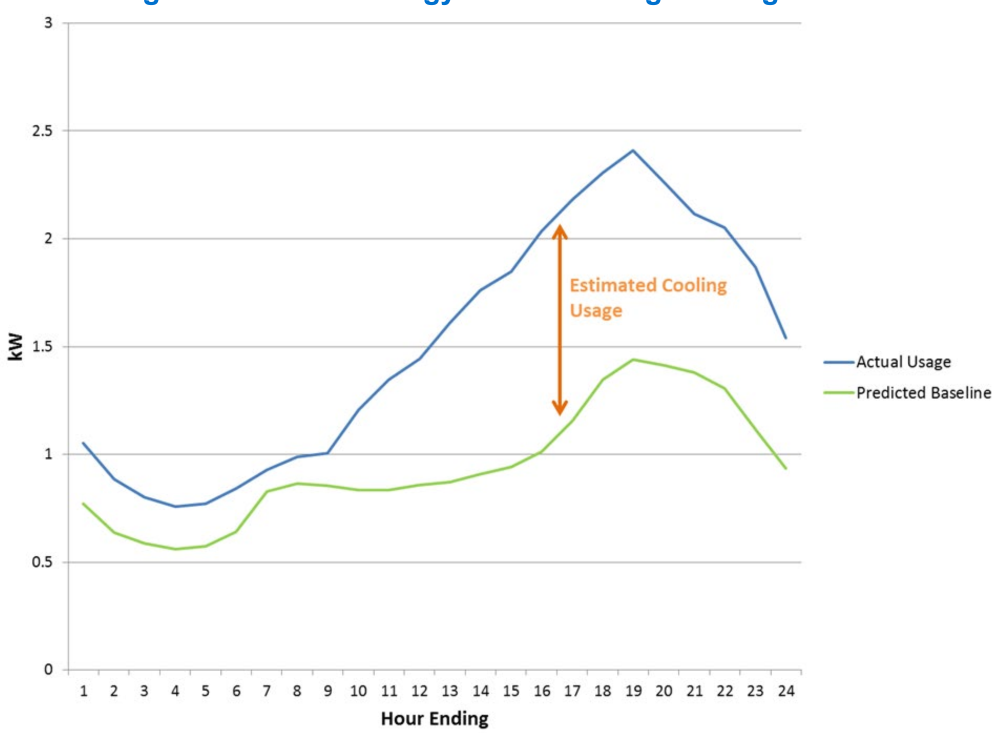
summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

AC and heating load profiles were generated for residential and small C&I customers using a sample of customers provided by DEF. This sample included a customer breakout based on size and housing type for each rate class. Nexant then used the interval data from these customers to create an average load profile for each customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the seven different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR program and the results from the Navigant DR End-Use Study performed for DEF.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are August from 4:00-5:00 PM for summer, and January from 7:00-8:00 AM for winter.

For technical potential, there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads. Individual measures are only considered for economic and achievable potential.

In order to account for existing DEF DR programs, all customers currently enrolled in a DR offering were excluded from DEF's technical potential. This methodology was consistent across all three sectors.

5.1.3 DSRE Technical Potential

5.1.3.1 PV Systems

To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[8], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

[8] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Equation 5-3: Core Equation for Solar Technical Potential

$$\text{Technical Potential of PV Systems} = \text{Usable PV Area} \times \text{PV Density} / 1000 \times \text{Capacity Factor} \times \text{Energy Savings Factor}$$

Where:

Usable PV Area for Residential: (Total Floor Area[9] / Average No. of Stories[10]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[11] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PV Watts. Energy Savings Factor = Alternating Current System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery systems do create the opportunity to store energy during period when the PV system is generating

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[9] Utility-provided data and US Census, South Region

[10] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[11] Floor space = based on utility data. Average floors by building type = CBECS, South Atlantic Region

more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for "solar plus storage" systems, our methodology consisted of the following steps:

- Develop an 8,760 hour annual load shape for a PV system based on estimated annual hours of available sunlight.
- Compare the PV generation with a total home or total business 8,760 hour annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.
- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers' thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore, the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore, results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
    - For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

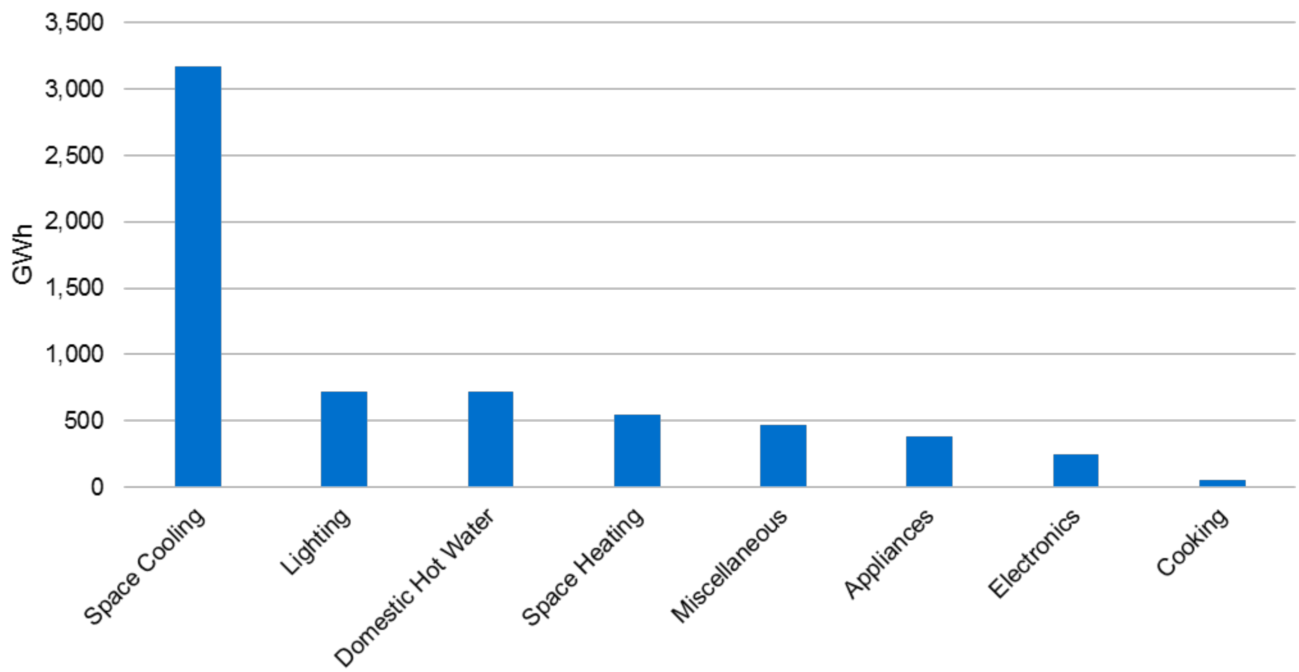
Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	2,236	1,519	6,294
Non-Residential[12]	719	361	3,137
Total	2,954	1,879	9,431

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 illustrate the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Energy Savings)



[12] Non-Residential results include all commercial and industrial customer segments

Figure 5-3: Residential EE Technical Potential by End-Use (Summer Peak Savings)

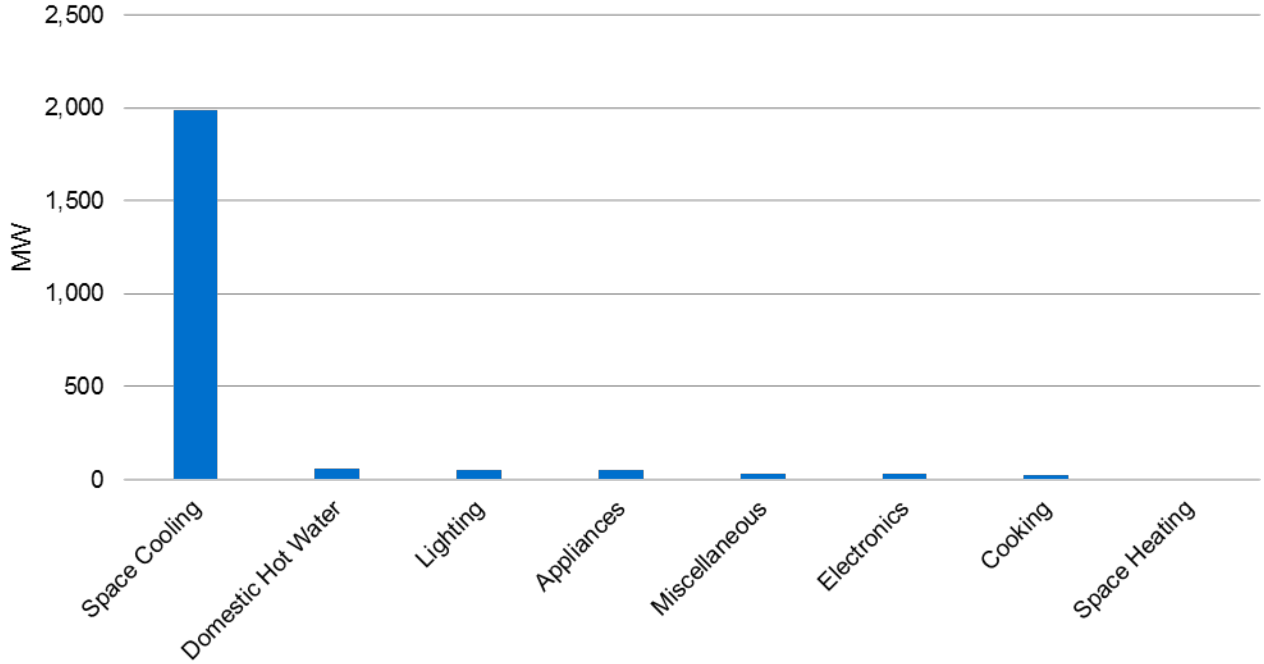
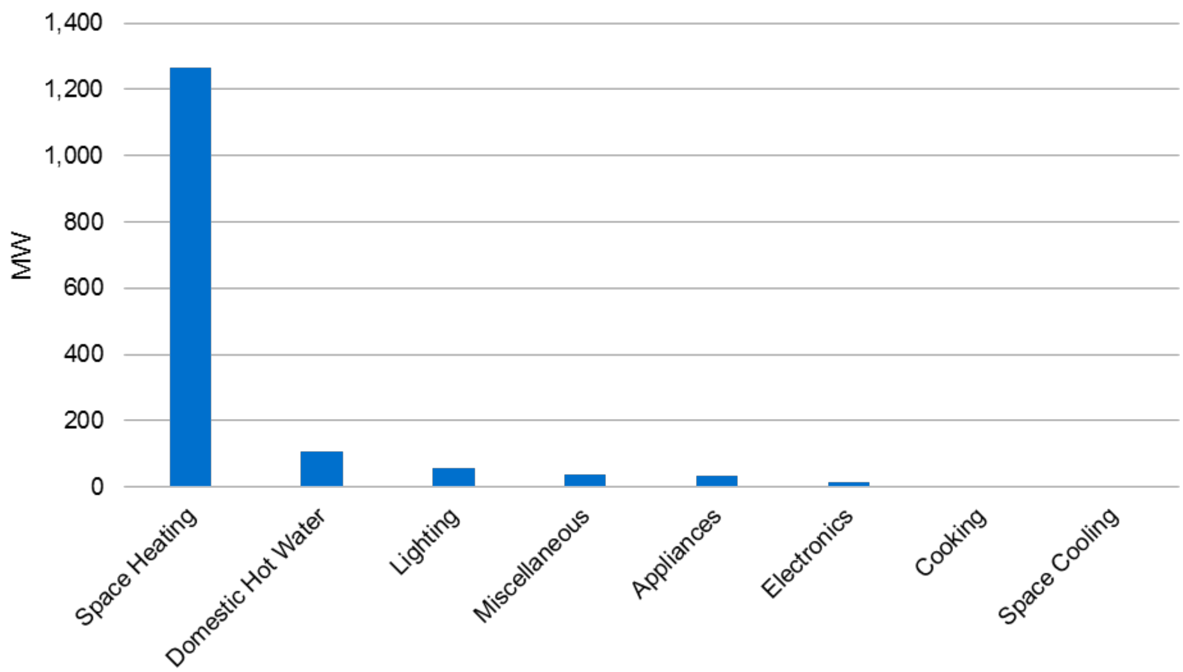


Figure 5-4: Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3 Non-Residential

5.2.3.1 Commercial Segments

Figure 5-5, Figure 5-6, and Figure 5-7 illustrate the commercial sector EE technical potential by end-use.

Figure 5-5: Commercial EE Technical Potential by End-Use (Energy Savings)

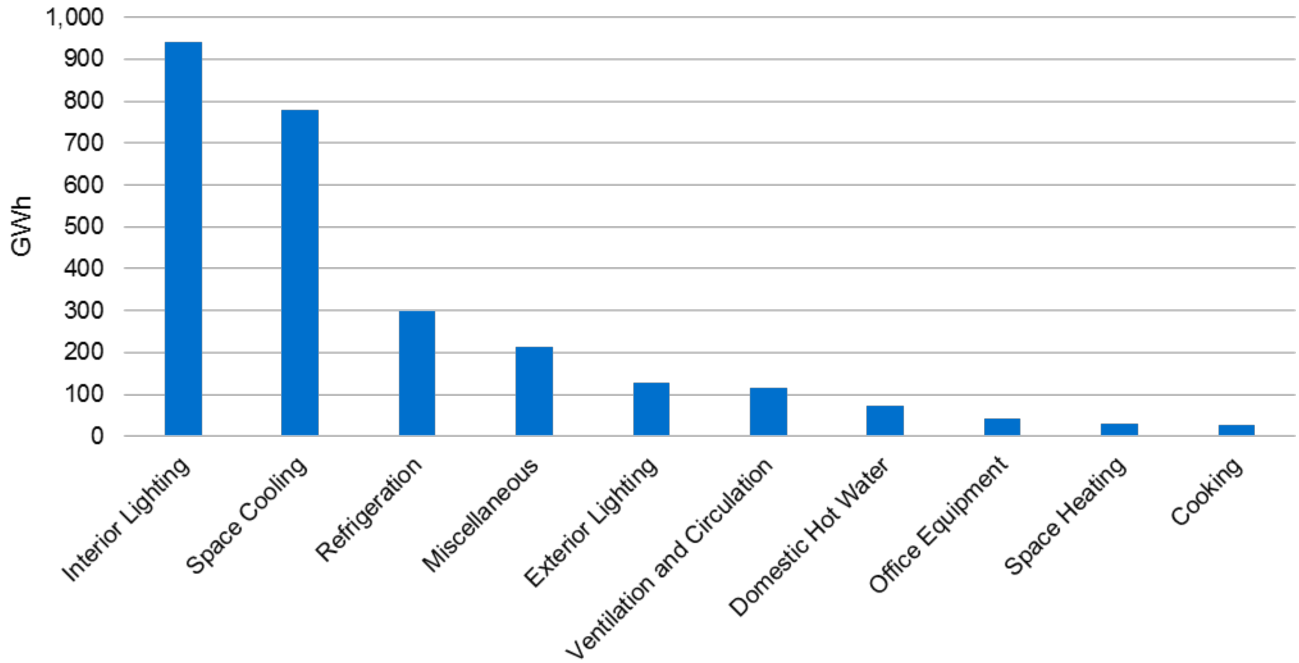


Figure 5-6: Commercial EE Technical Potential by End-Use (Summer Peak Savings)

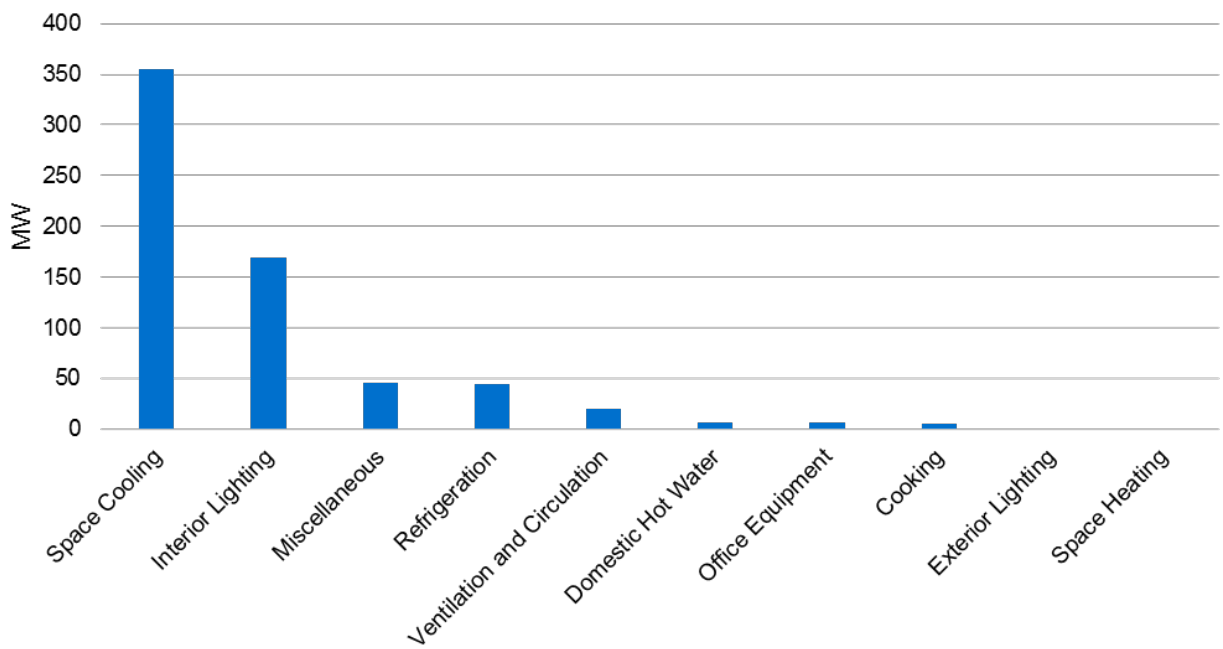
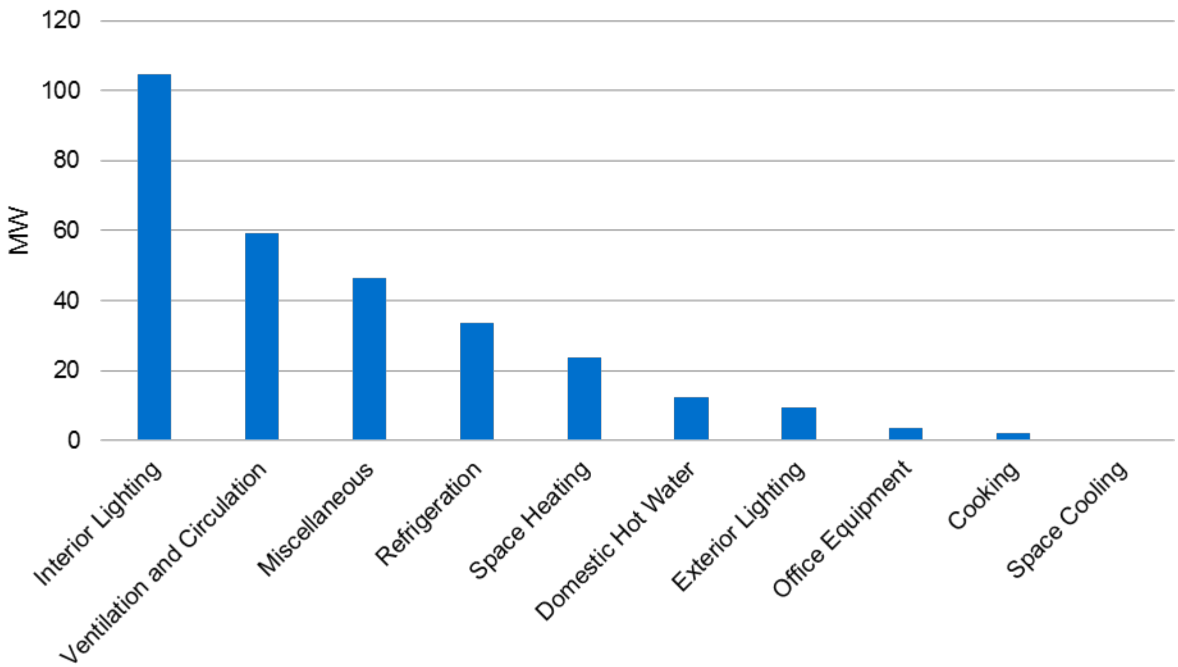


Figure 5-7: Commercial EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3.2 Industrial Segments

Figure 5-8, Figure 5-9, and Figure 5-10 illustrate the industrial sector EE technical potential by end-use.

Figure 5-8: Industrial EE Technical Potential by End-Use (Energy Savings)

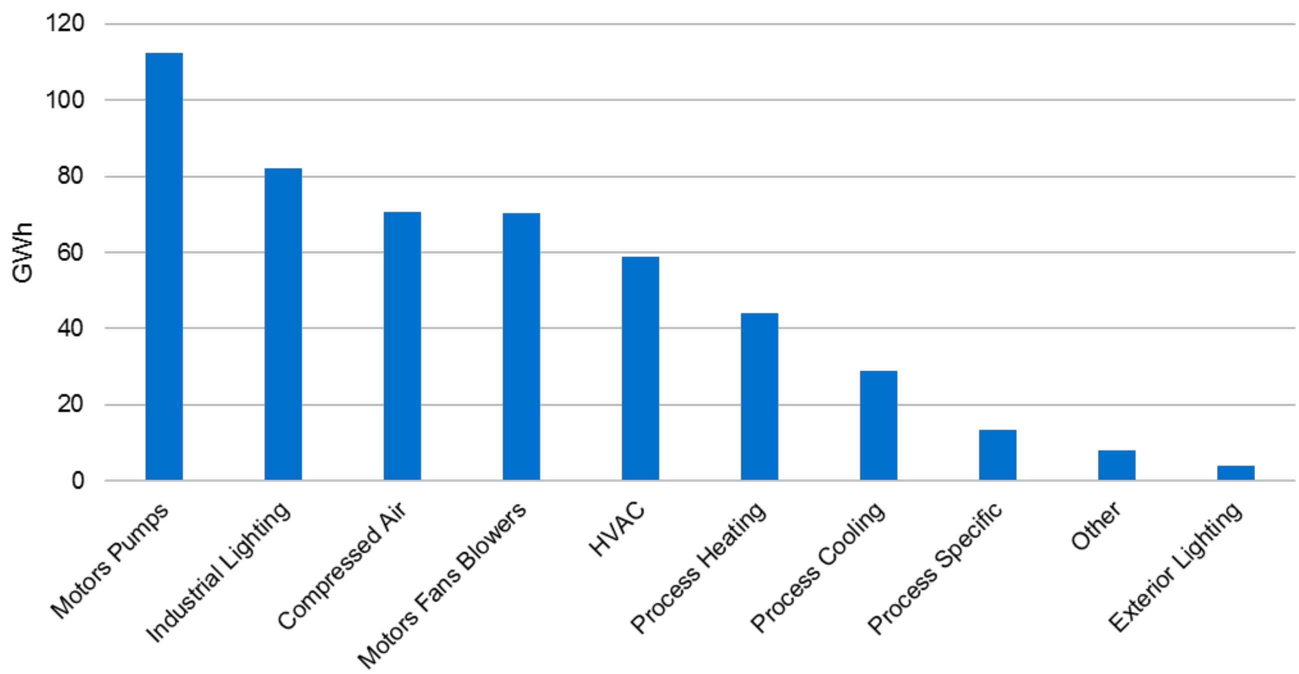


Figure 5-9: Industrial EE Technical Potential by End-Use (Summer Peak Savings)

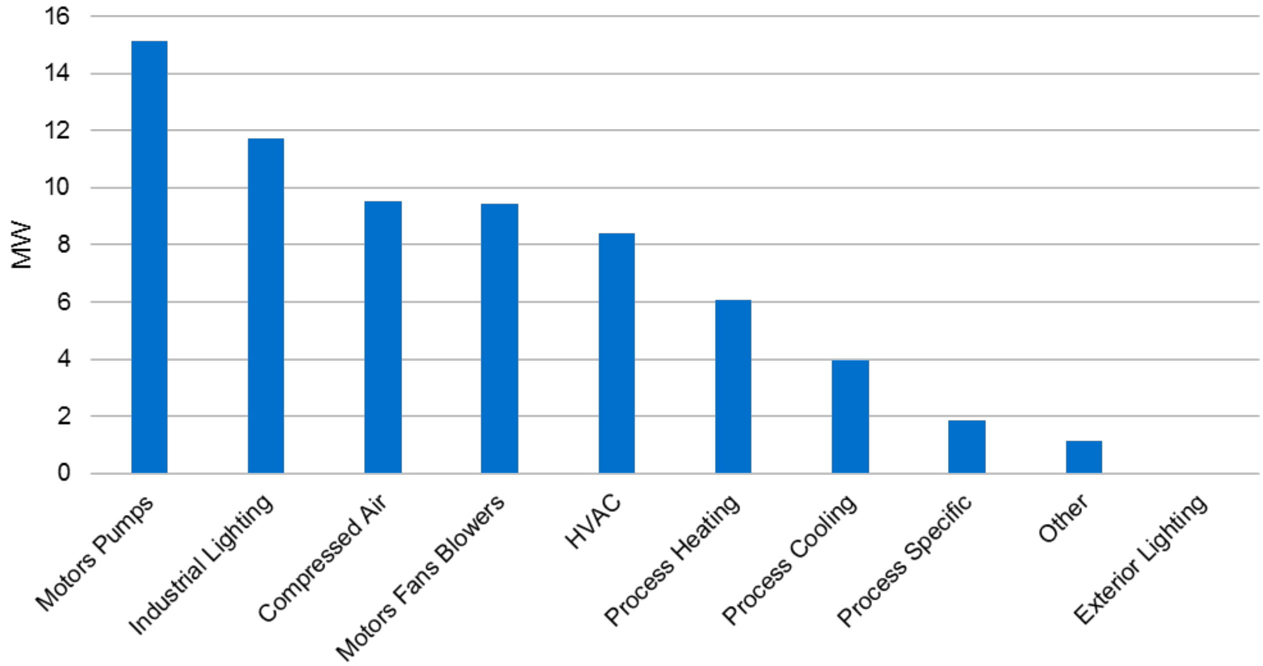
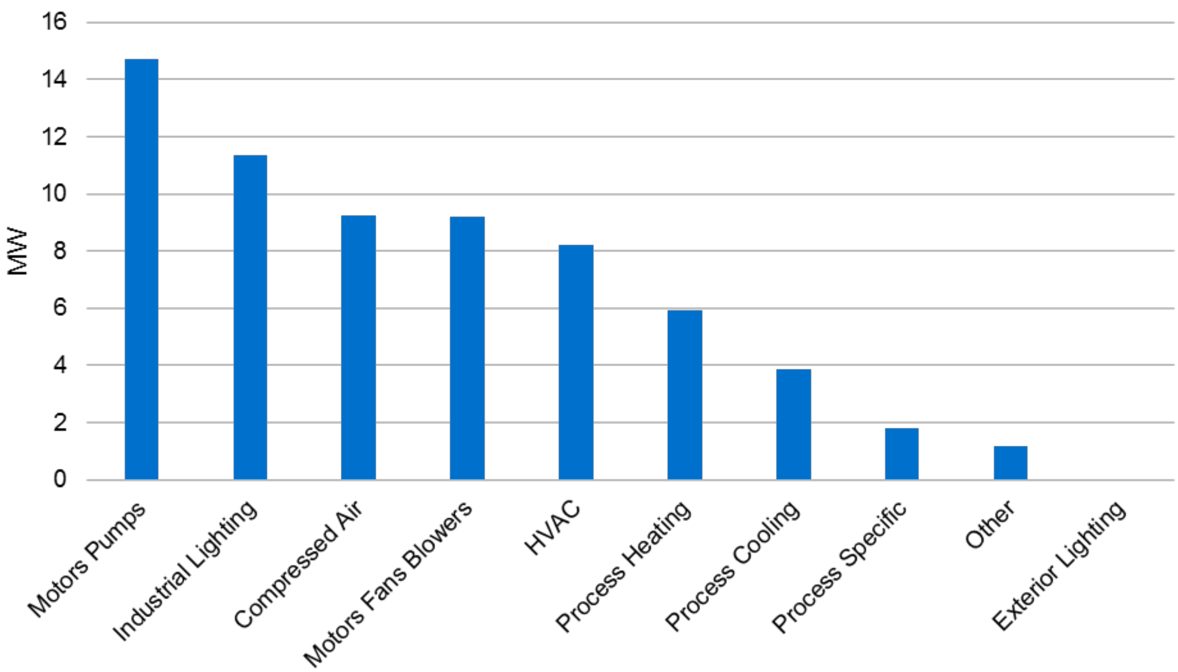


Figure 5-10: Industrial EE Technical Potential by End-Use (Winter Peak Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in DEF's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

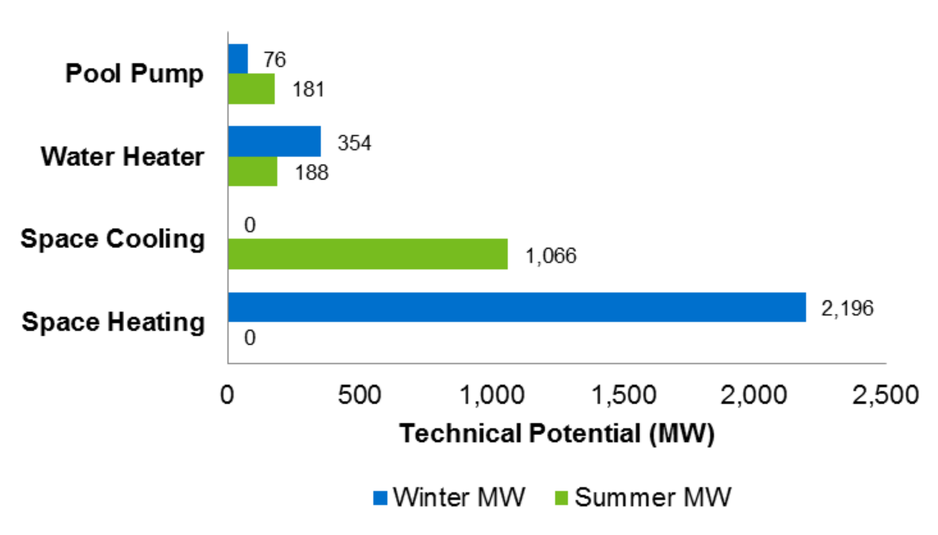
Table 5-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	1,434	2,627
Non-Residential	1,857	1,446
Total	3,292	4,073

5.3.1 Residential

Residential technical potential is summarized in Figure 5-11.

Figure 5-11: Residential DR Technical Potential by End-Use[13]

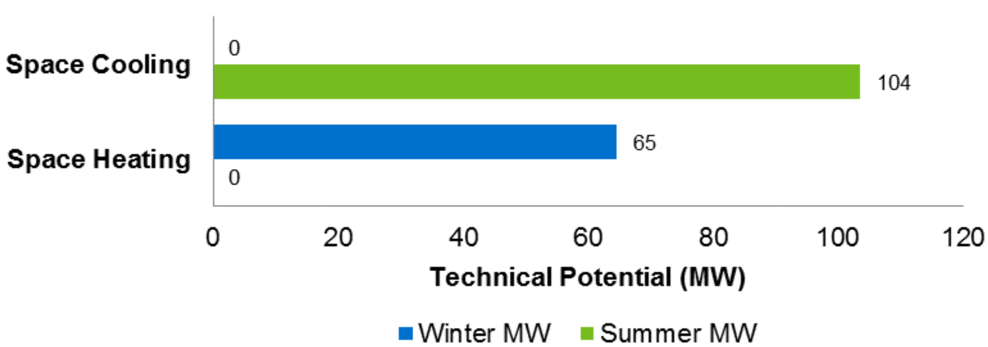


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-12.

Figure 5-12: Small C&I DR Technical Potential by End-Use[14]



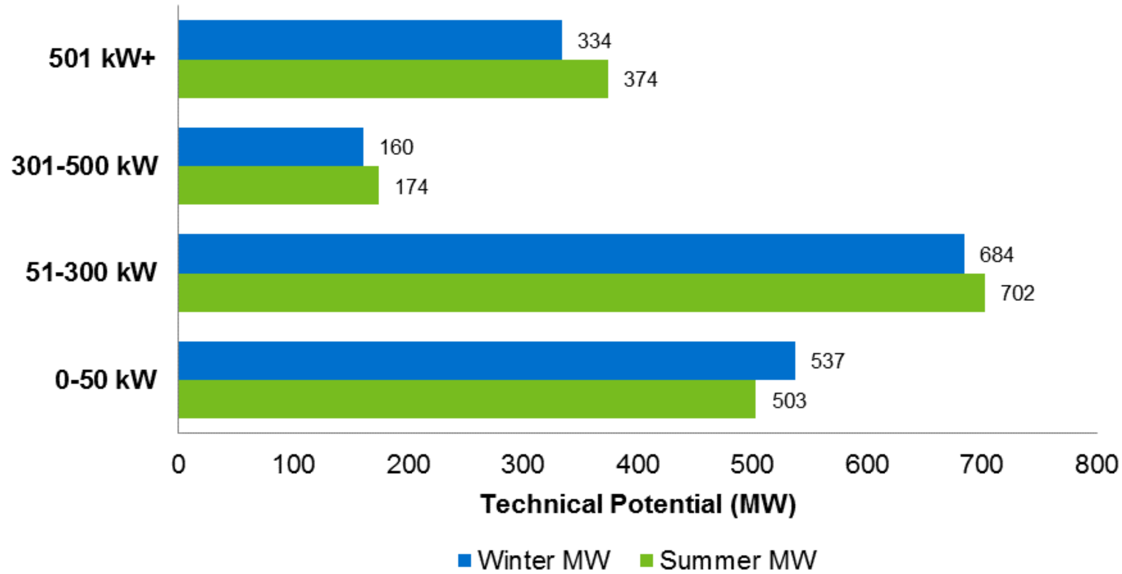
[13] All currently enrolled DR customers are excluded

[14] All currently enrolled DR customers are excluded

5.3.2.2 Large C&I Customers

Figure 5-13 provides the technical potential for large C&I customers, broken down by customer size.

Figure 5-13: Large C&I DR Technical Potential by Segment[15]



[15] All currently enrolled DR customers are excluded

5.4 DSRE Technical Potential

Table 5-3 section the results of the DSRE technical potential for each customer segment.

Table 5-3: DSRE Technical Potential[16]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	1,108	87	7,907
Non-Residential	1,953	154	13,783
Total	3,061	242	21,690
Battery Storage charged from PV Systems			
Residential	439	243	-
Non-Residential	84	-	-
Total	523	243	-
CHP Systems			
Total	891	614	4,126

[16] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

6 Economic Potential

The economic potential scenario estimates the savings potential when all technically feasible DSM measures that are cost-effective to implement are applied at their full market potential (*i.e.* 100% adoption rate). The economic potential was the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

6.1 DSM Cost-Effective Screening Criteria

6.1.1 Cost-Effectiveness Test Perspectives

When analyzing DSM measures, different cost-effectiveness tests are considered to reflect the perspectives of different stakeholders. The Ratepayer Impact Measure ("RIM") addresses an electric utility customer perspective, which considers the net impact on electric utility rates associated with a measure or program. The Total Resource Cost ("TRC") addresses a societal perspective, which considers costs of DSM measure or program relative to the benefits of avoided utility supply costs. The Participant Cost Test ("PCT") addresses a participant perspective, which considers net benefits to those participating in a DSM program.

Descriptions follow of methods for allocating costs and benefits within each cost-effectiveness indicator (RIM, TRC, and PCT); the calculations remain consistent with the Florida Cost Effectiveness Manual[17].

Table 6-1: Components of Cost-Effectiveness Calculations

Component	Definition
Customer Incremental Costs	All incremental costs incurred by the customer to purchase, install, operate, and maintain a DSM measure
Utility Program Costs	Utility administrative and marketing costs and capital expenditures required to implement a DSM measure
Utility Incentives	Costs provided by the utility to the participant to encourage the purchase, installation, operation, and maintenance of a DSM measure
Utility Supply Costs	Utility costs of supplying electricity to the customer, including generation, transmission, and distribution costs
Electric Bill Impacts	Impacts on a participating customer's electric bill due the installation of a DSM measure
Utility Electric Revenues	Impacts on the utility's electric revenues due to the installation of a DSM measure

[17] Cost Effectiveness Manual for Demand Side Management and Self Service Wheeling Proposals; Florida Public Service Commission, Tallahassee, FL; adopted June 11, 1991.

Table 6-2: Ratepayer Impact Measure (RIM)

Component	Definition
Benefit	Increase in utility electric revenues Decrease in avoided electric utility supply costs
Cost	Decrease in utility electric revenues Increase in avoided electric utility supply costs Utility program costs, if applicable Utility incentives, if applicable

Table 6-3: Total Resource Cost (TRC)

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Increase in electric utility supply costs Customer incremental costs (less any tax incentives) Utility program costs, if applicable

Table 6-4: Participant Cost Test (PCT)

Component	Definition
Benefit	Decrease in electric bill Utility incentives, if applicable
Cost	Increase in electric bill Customer incremental costs (less any tax incentives)

6.1.2 Economic Potential Screening Methodology

Based on discussion with the FEECA Utilities and consistent with prior DSM analyses in Florida, for development of the economic potential, two scenarios were considered, a RIM-scenario and a TRC-scenario, for which the following economic screening process was followed:

- Criteria for RIM Scenario:
  - Achieve a cost-benefit ratio of 1.0 or greater from the RIM perspective. For the economic potential, the RIM benefits included avoided electric utility supply costs, while RIM costs include decreases in utility electric revenues. The economic potential screening did not consider utility incentives or utility program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
  - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are

customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.

    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.

- Criteria for TRC Scenario:
    - Achieve a cost-benefit ratio of 1.0 or greater from the TRC perspective. For the economic potential, the TRC benefits included avoided electric utility supply costs, while TRC costs included customer incremental cost to implement the measure. The economic potential screening did not consider utility DSM program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
    - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.
    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.

The cost-effectiveness screening described above was applied to each DSM measure permutation based on the installation of the measure in the Base Year (2020) of the study. Therefore, avoided energy cost benefits were applied beginning in Year 1 and extended through the useful life of the measure; avoided generation costs began at the in-service year for new generation based on utility system load forecasts.

6.1.3 Economic Potential Sensitivities

Based on direction from the FEECA Utilities and the Order Establishing Procedure, the economic potential analysis included the following additional sensitivities:

- Sensitivity #1: Higher Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.
- Sensitivity #2: Lower Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast was adjusted to a "low fuel" scenario.
- Sensitivity #3: Shorter free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was reduced to one year or longer.

- Sensitivity #4: Longer free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was increased to three years or longer.
- Sensitivity #5: Carbon dioxide (CO_2) costs. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the avoided electric utility supply costs forecast was adjusted to include consideration of an additional impact for emissions assuming that there was an economic charge for carbon dioxide. The CO_2 forecast represents the average of those used by Florida Power & Light (FPL) and DEF in their respective 2019 Ten-Year Site Plans.

Each of these sensitivities resulted in a unique set of measures passing the cost-effectiveness criteria for both RIM and TRC scenarios. The economic potential for the passing measures were evaluated in Nexant's TEA-POT model, and the results of the economic sensitivities are provided in Appendix E.

6.2 EE Economic Potential

This section provides the results of the EE economic potential for each sector. Table 6-5 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 6-5: Economic Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	13	45
Commercial	14	193
Industrial	0	0
Total	27	238
TRC SCENARIO		
Residential	20	87
Commercial	39	608
Industrial	16	114
Total	75	809

6.2.1 Summary

Table 6-6 summarizes the EE economic potential by sector and by scenario (RIM and TRC):

Table 6-6: EE Economic Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	931	522	1,608
Non-Residential	104	42	290
Total	1,035	565	1,898
TRC SCENARIO			
Residential	970	550	2,138
Non-Residential	222	94	980
Total	1,192	644	3,117

6.2.2 Residential – RIM Scenario

Figure 6-1, Figure 6-2, and Figure 6-3 illustrate the residential EE economic potential by end-use for the RIM scenario.

Figure 6-1: Residential EE Economic Potential by End-Use – RIM Scenario (Energy Savings)

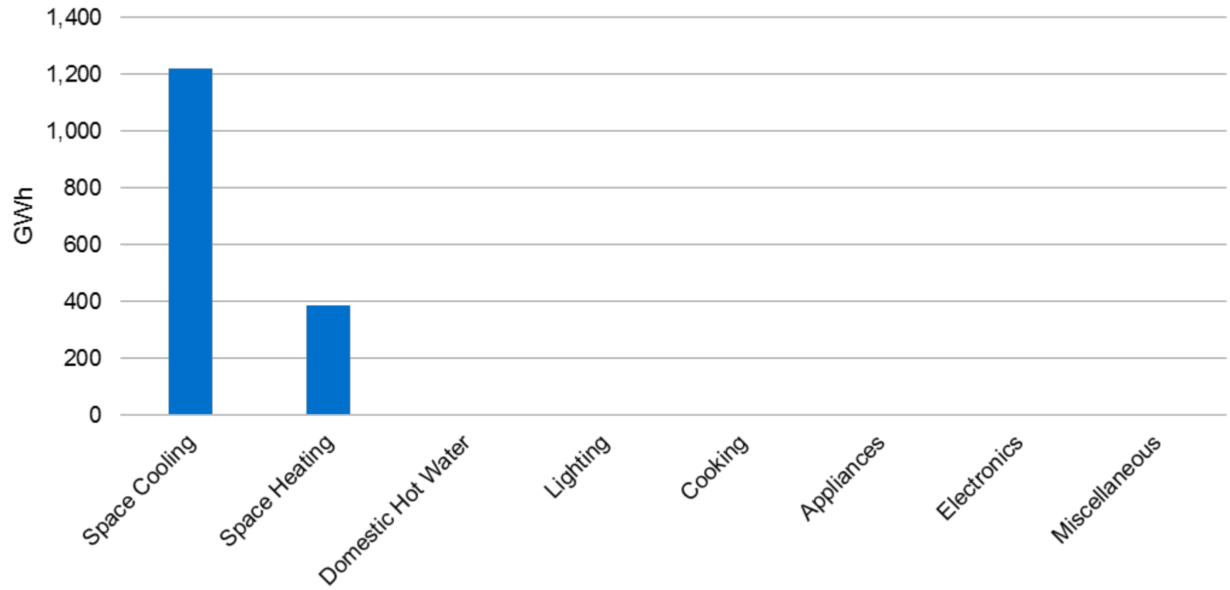


Figure 6-2: Residential EE Economic Potential by End-Use - RIM Scenario (Summer Peak Savings)

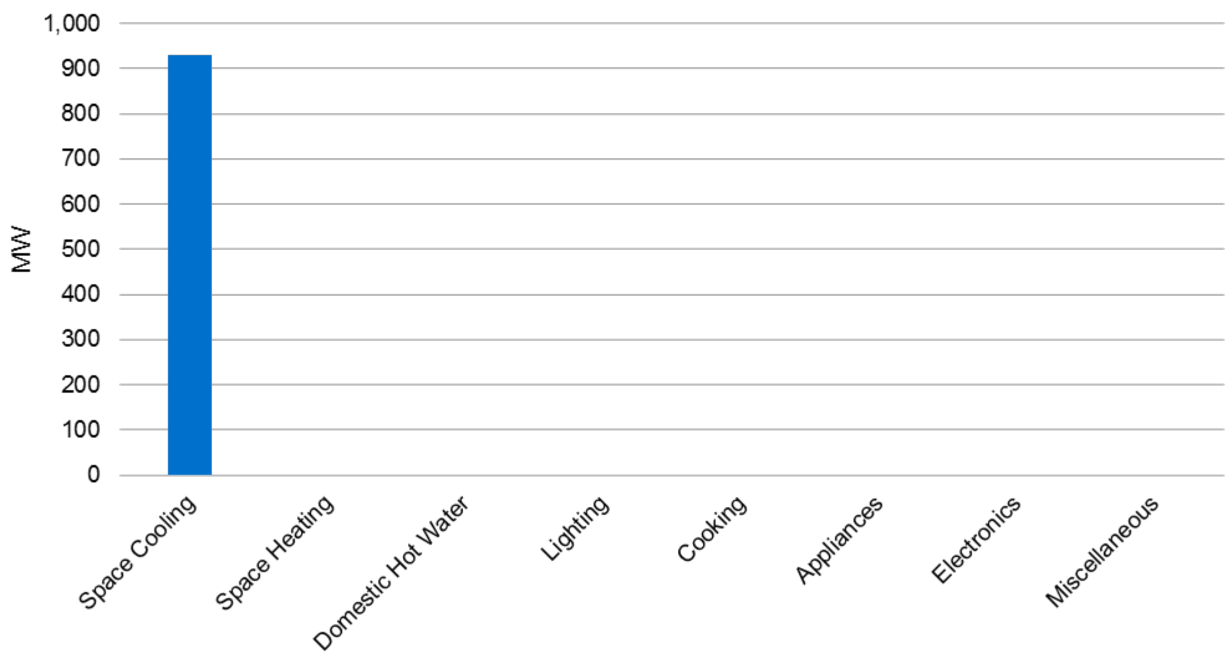
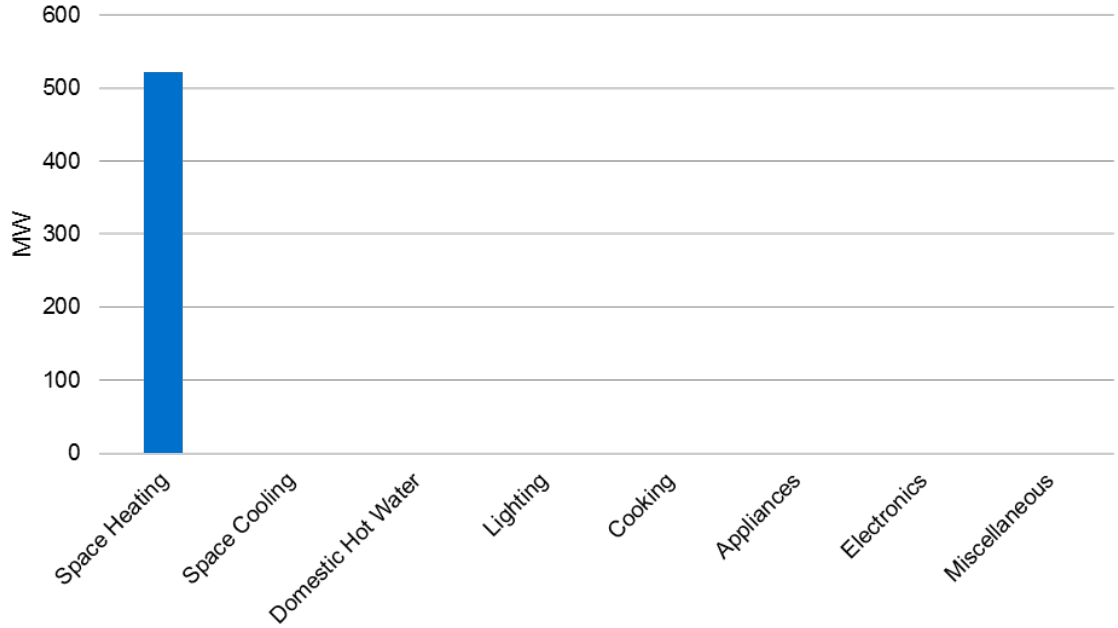


Figure 6-3: Residential EE Economic Potential by End-Use (Winter Peak Savings) - RIM Scenario



6.2.3 Non-Residential – RIM Scenario

6.2.3.1 Commercial Segments

Figure 6-4, Figure 6-5, and Figure 6-6 illustrate the commercial EE economic potential by end-use for the RIM scenario.

Figure 6-4: Commercial EE Economic Potential by End-Use (Energy Savings) – RIM Scenario

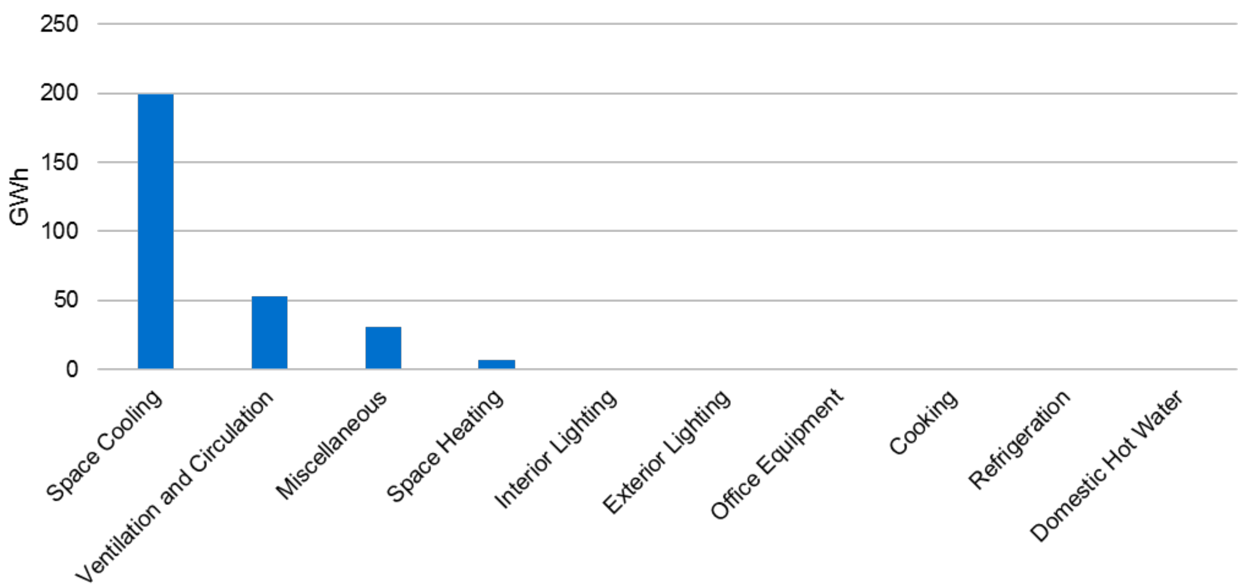


Figure 6-5: Commercial EE Economic Potential by End-Use (Summer Peak Savings) – RIM Scenario

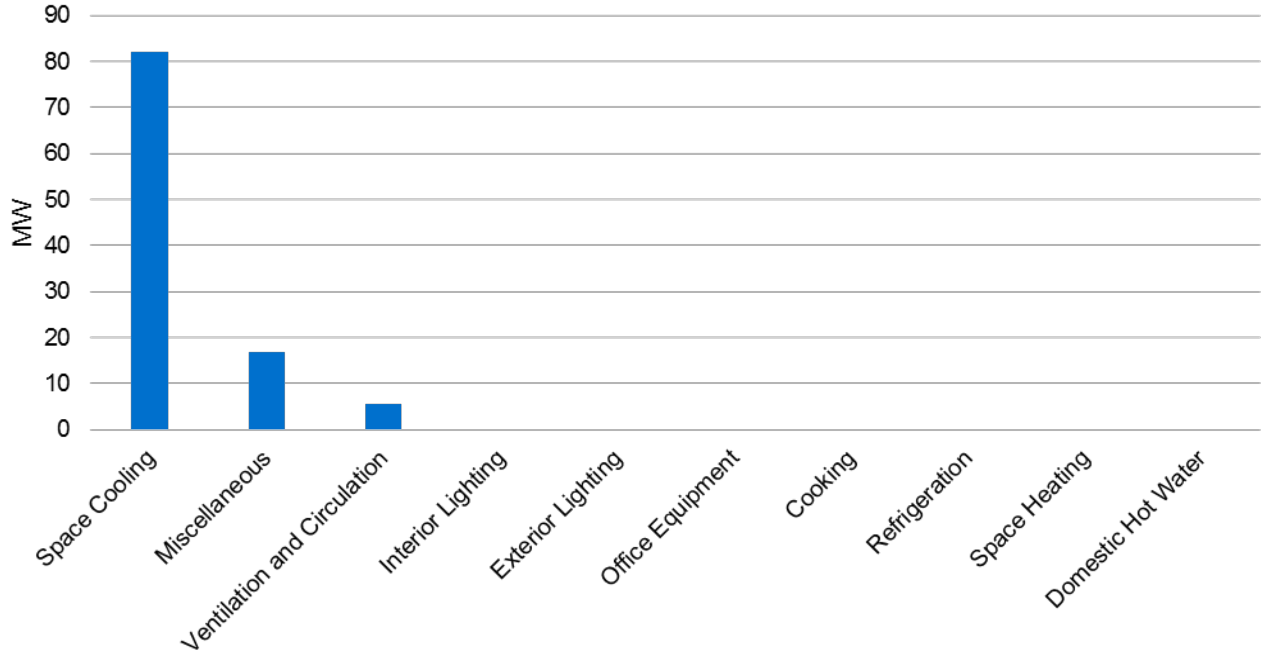
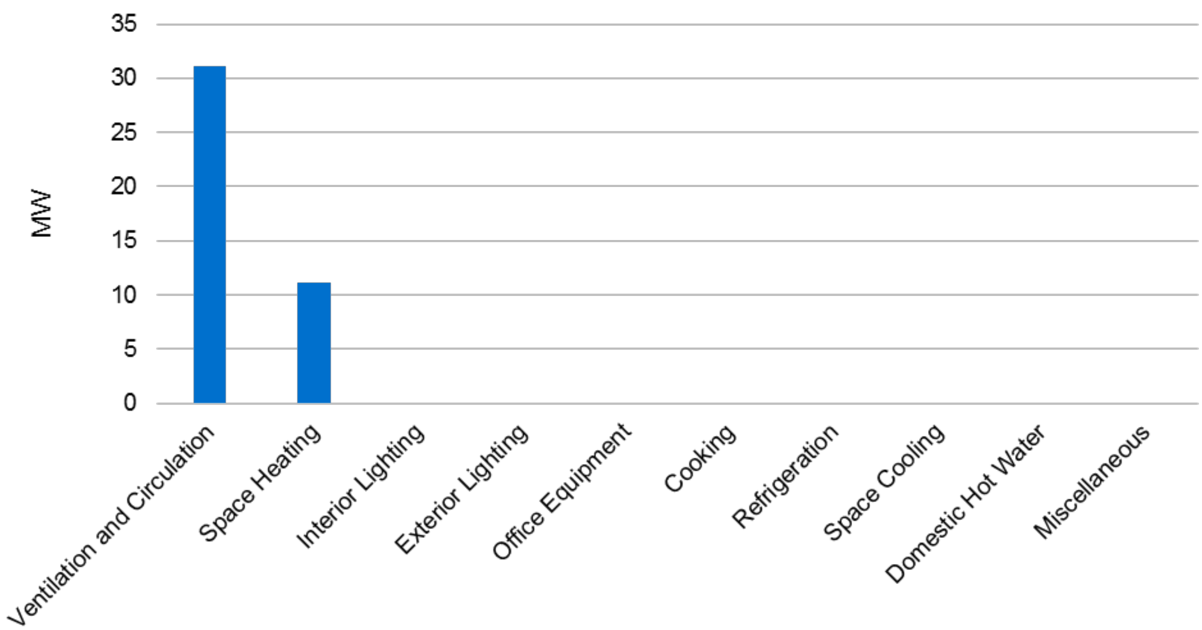


Figure 6-6: Commercial EE Economic Potential by End-Use (Winter Peak Savings) – RIM Scenario



6.2.3.2 Industrial Segments

The industrial segments did not have any EE measures that passed the economic potential cost-effectiveness screening for the RIM scenario.

6.2.4 Residential – TRC Scenario

Figure 6-7, Figure 6-8, and Figure 6-9 illustrate the residential EE economic potential by end-use for the TRC scenario.

Figure 6-7: Residential EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

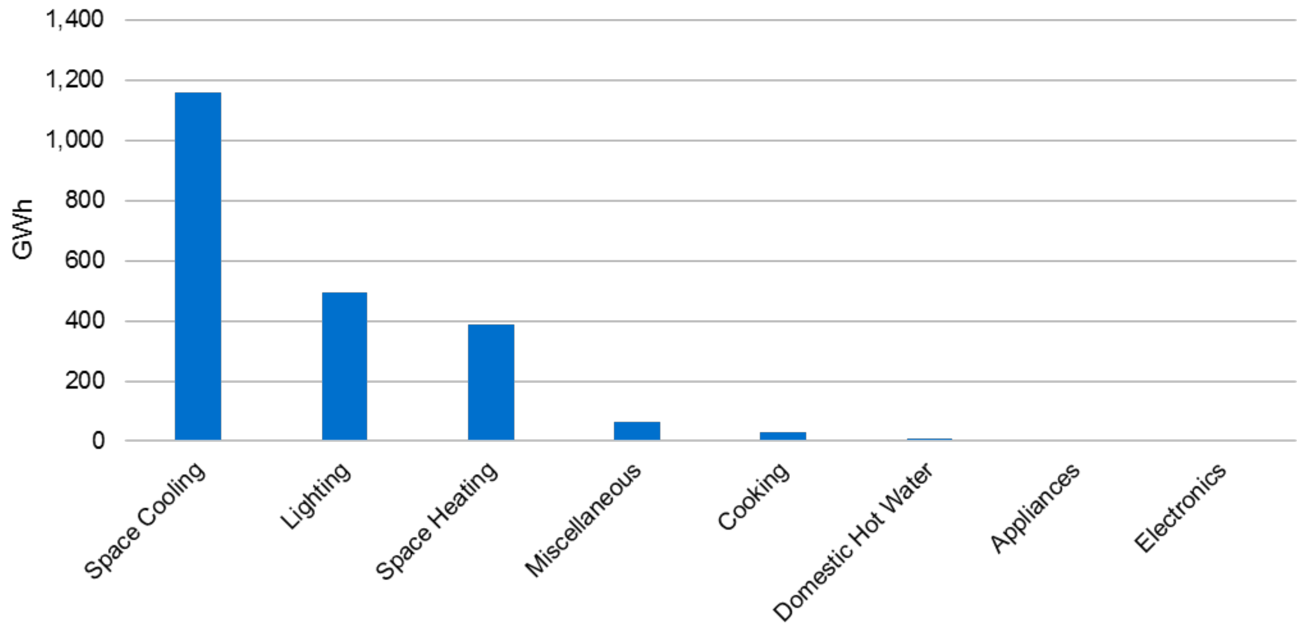


Figure 6-8: Residential EE Economic Potential by End-Use (Summer Peak Savings) - TRC Scenario

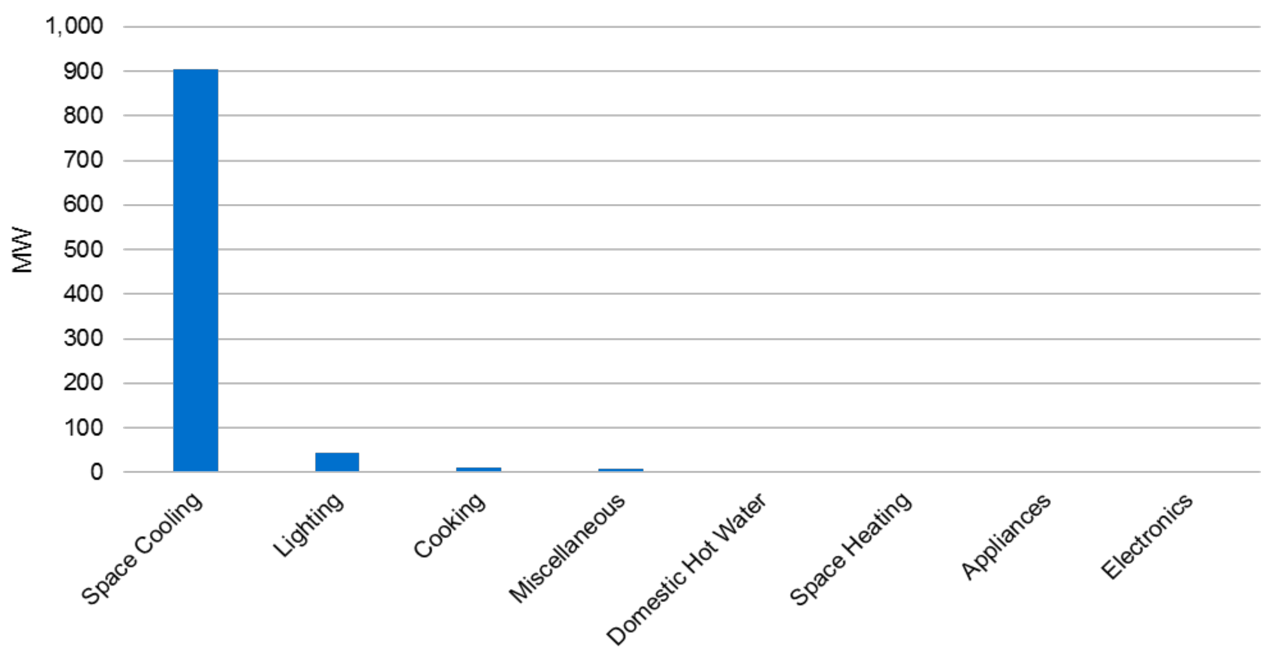
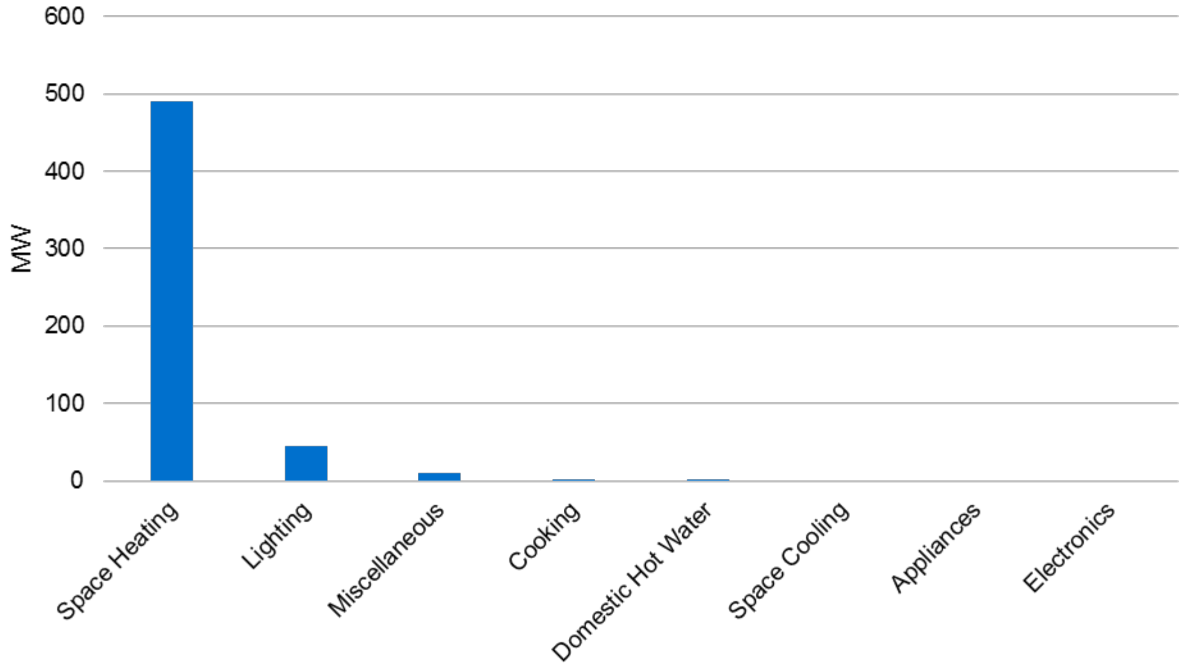


Figure 6-9: Residential EE Economic Potential by End-Use (Winter Peak Savings) - TRC Scenario



6.2.5 Non-Residential – TRC Scenario

6.2.5.1 Commercial Segments

Figure 6-10, Figure 6-11, and Figure 6-12 illustrate the commercial EE economic potential by end-use for the TRC scenario.

Figure 6-10: Commercial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

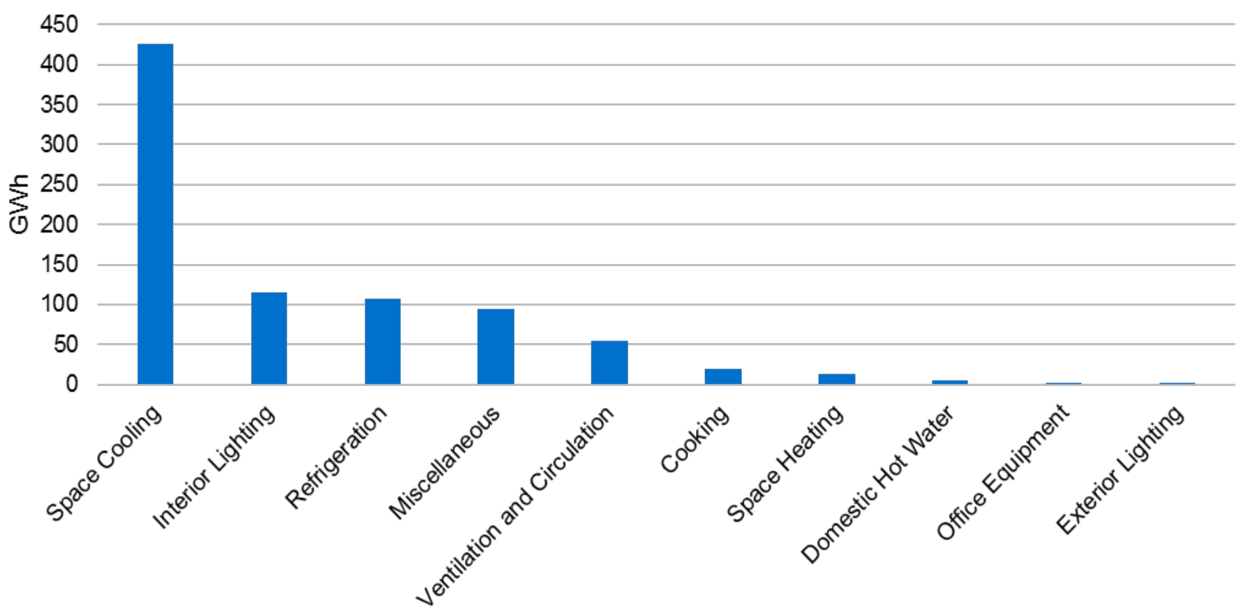


Figure 6-11: Commercial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

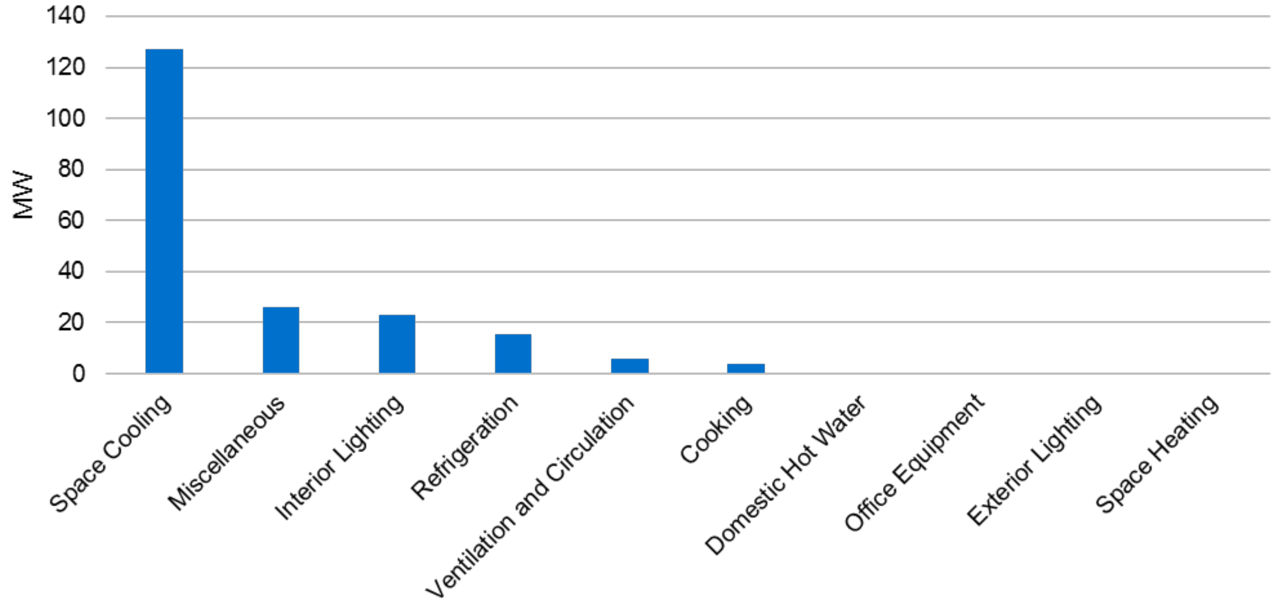
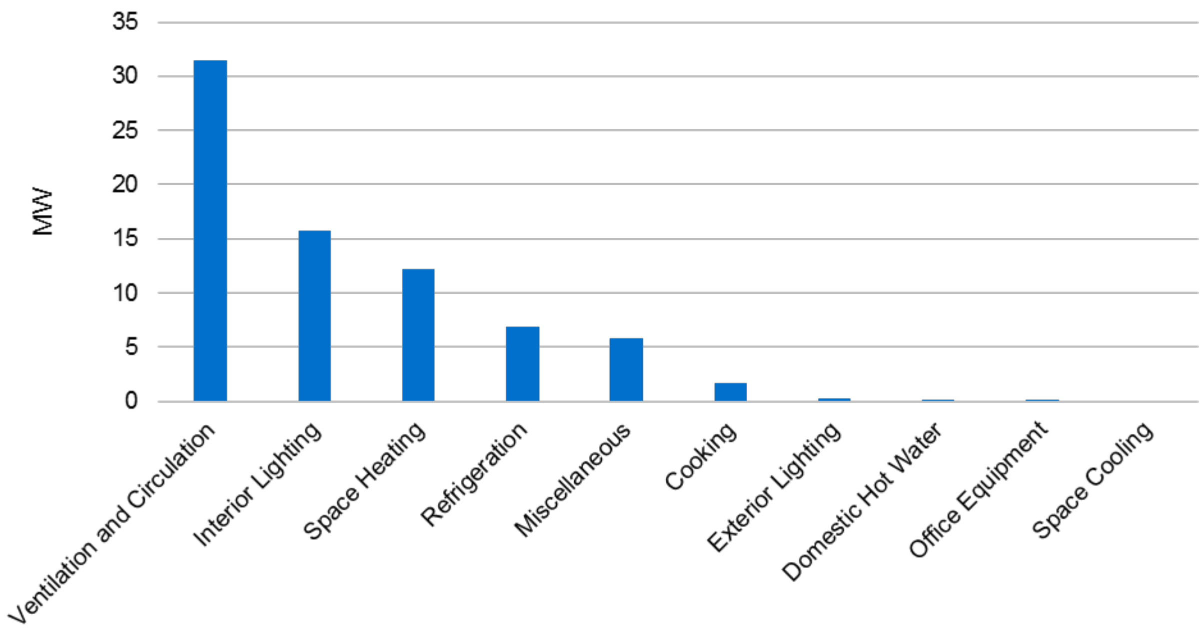


Figure 6-12: Commercial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.2.5.2 Industrial Segments

Figure 6-13, Figure 6-14 and Figure 6-15 illustrate the industrial EE economic potential by end-use for the TRC scenario.

Figure 6-13: Industrial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

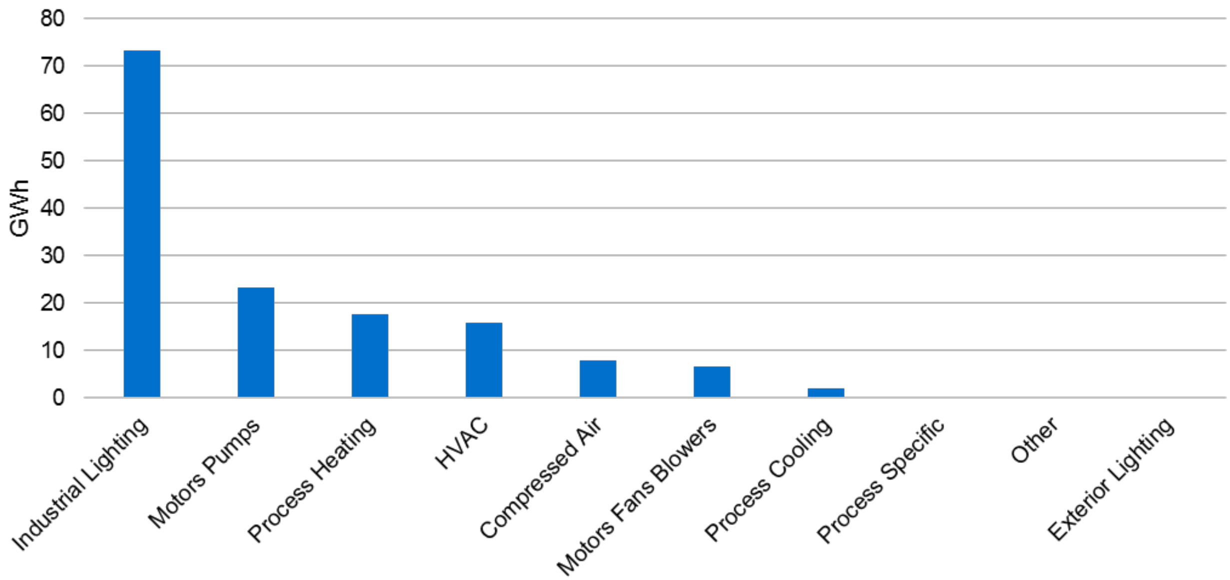


Figure 6-14: Industrial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

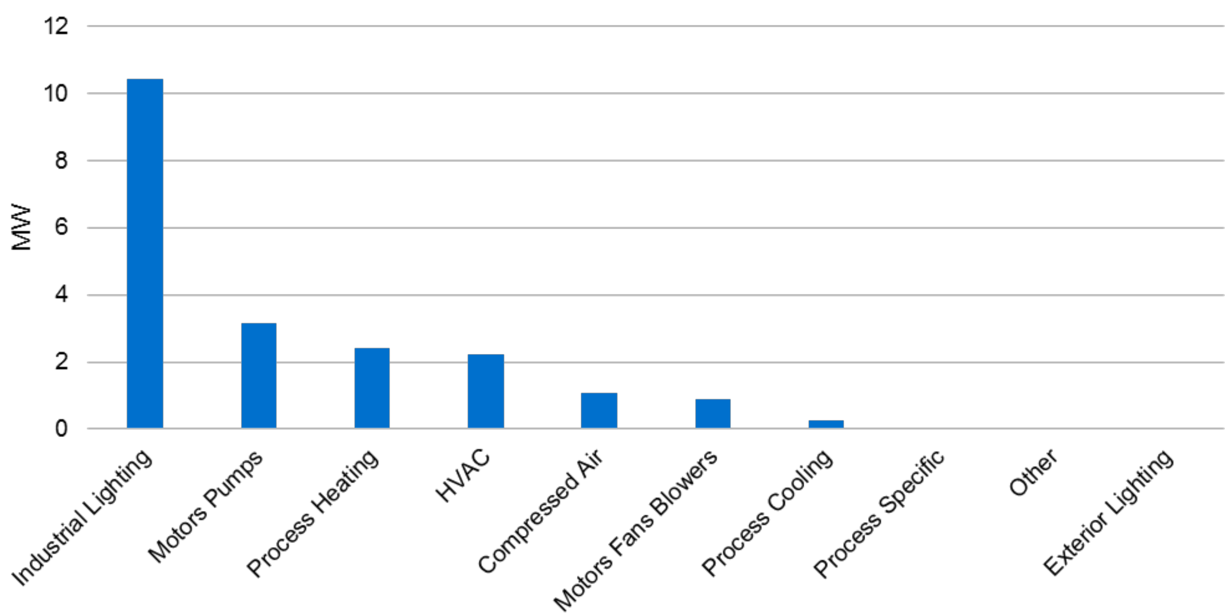
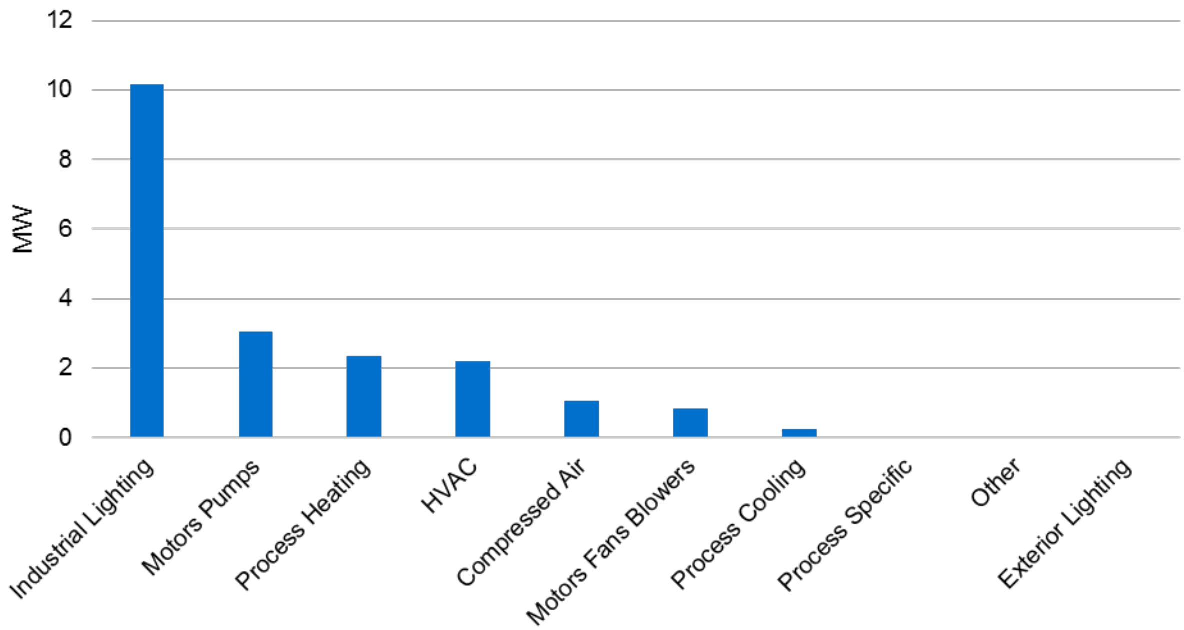


Figure 6-15: Industrial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.3 DR Economic Potential

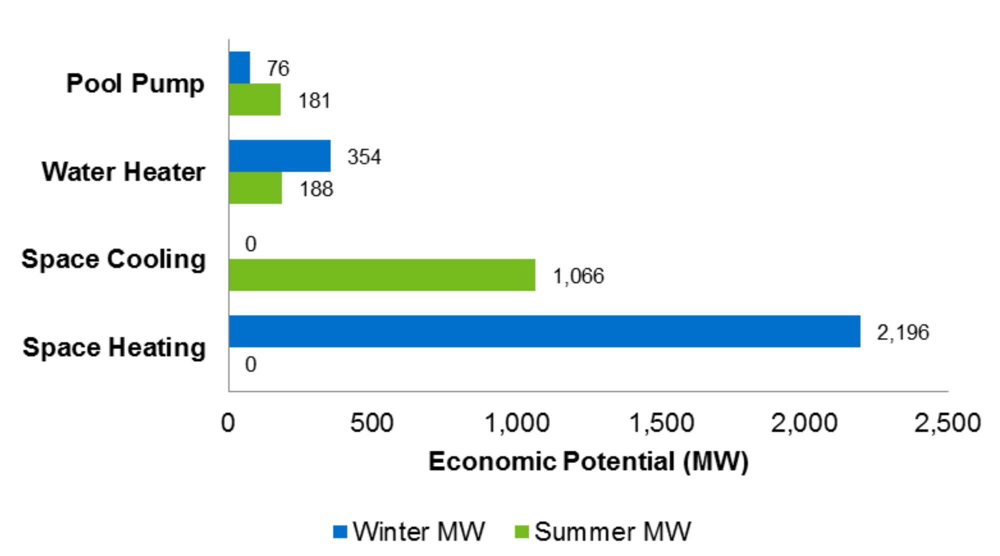
Because of the costs included in the RIM and TRC screening methodology for DR, all measures passed the EP screen for DEF. Therefore, the EP for DR is the same as the TP for DEF.

Table 6-7: DR Economic Potential[18]

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	1,434	2,627
Non-Residential	1,857	1,446
Total	3,292	4,073

Results for residential customer segments are presented in Figure 6-16. Note that because there are minimal customer costs and bill savings associated with the DR measures used, all measures passed the economic screen and the potential did not change from the technical potential, since based on the RIM and TRC screening requirements all of the load that can technically be curtailed can be curtailed cost-effectively.

Figure 6-16: Residential DR Economic Potential by End-Use – RIM and TRC Scenario[19]



[18] Excludes current DR participants

[19] All currently enrolled DR customers are excluded

Similar figures are presented for small C&I and large C&I customers.

Figure 6-17: Small C&I DR Economic Potential by End-Use – RIM and TRC Scenario[20]

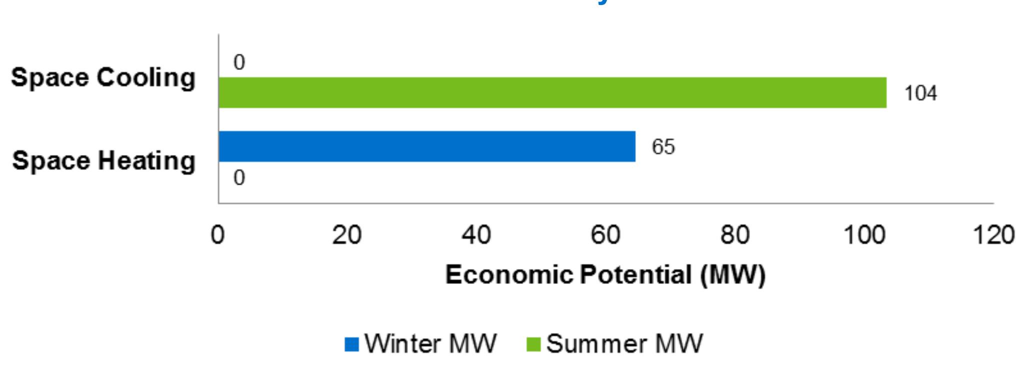
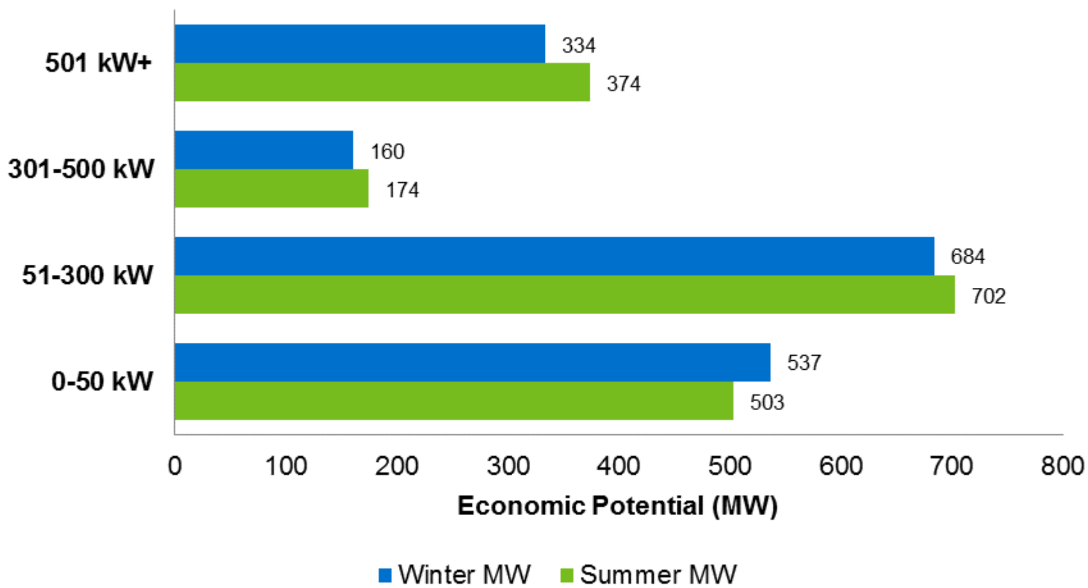


Figure 6-18: Large C&I DR Economic Potential by Segment – RIM and TRC Scenario[21]



[20] All currently enrolled DR customers are excluded

[21] All currently enrolled DR customers are excluded

6.4 DSRE Economic Potential

Nexant found there to be no cost-effective economic potential attainable for DEF for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

7 Achievable Potential

Nexant incorporated realistic assumptions about program delivery when estimating achievable market potential. Nexant estimated the cost-effective savings realistically achievable by utility-sponsored DSM programs in the DEF jurisdiction by incorporating utility program costs and utility incentive costs, and with consideration of economic constraints and market demand for DSM services in Florida.

7.1 Achievable Potential Methodology

7.1.1 Utility Program Costs and Incentives

Prior to the development of the achievable potential, Nexant performed a cost-effectiveness re-screening of all measures that passed the economic potential screening, under both the RIM and TRC scenarios, to incorporate estimated utility program costs and utility incentives for each measure. Nexant used data provided by the DEF on their current DSM program costs to estimate average utility program costs for both residential and non-residential programs. The estimated incentive amounts were developed for each measure as follows:

- In the RIM scenario, two incentive values were analyzed. First, the RIM net benefit for the measure was calculated based on total RIM benefits minus RIM costs. Next, the incentive amount that would drive the simple payback to two years for each measure was calculated. The final incentive applied for the measure was based on the lower of these two values[22].
- In the TRC scenario, the incentive amount required to drive the simple payback to two years for each measure was used as the final incentive for the measure.

7.1.2 Market Adoption Rates

To estimate the adoption rate of DSM based on the utility program costs and incentives described above, Nexant incorporated DEF DSM program data as well as secondary data from other utility sponsored DSM programs. This approach leveraged program performance data from a variety of DSM programs across many utilities to develop a meta-analysis of program performance that broadly describes customers' program adoption rates over time. This approach applied standard economic theories on product diffusion to develop a catalog of market adoption curves across a variety of DSM technologies and programs[23].

Nexant used this market performance data, historic DEF program performance data, and secondary data sources to calibrate the measures passing the cost-effectiveness screening in

[22] For DR measure incentives, if the measure is currently offered by DEF, the incentive amount that was historically used by DEF was applied. If DEF did not currently have a measure, the incentive was calculated as the maximum annual incentive that could be paid to a customer (or 1 kW of customer load for large C&I customers) and have the RIM cost-effectiveness ratio be 1.0

[23] A detailed description of Nexant's market adoption rate methodology is provided in Appendix F

the TEA-POT model. Secondary data sources for EE measures included ENERGY STAR data on qualified product shipments and other utility-sponsored program performance data. The adoption rate of DR also incorporated DEF DR marketing and participation data as well as secondary data from other well-developed DR programs. This approach leveraged historic marketing strategies and customer responses to marketing as well as incentive level.

7.2 EE Achievable Potential

This section provides the detailed results of the EE achievable potential. Table 7-1 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 7-1: Achievable Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	13	45
Commercial	13	167
Industrial	0	0
Total	26	212
TRC SCENARIO		
Residential	19	81
Commercial	36	570
Industrial	15	112
Total	70	763

7.2.1 Summary

Table 7-2 summarizes the 10-year portfolio EE achievable potential for all customers across the residential and non-residential sectors. Impacts are presented as cumulative impacts, which represent savings achieved over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

Table 7-2: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	66	39	115
Non-Residential	16	20	51
Total	82	59	166

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
TRC SCENARIO			
Residential	80	50	194
Non-Residential	53	30	238
Total	133	80	432

Figure 7-1 and Figure 7-2 show achievable energy savings potential by sector for each scenario.

Figure 7-1: Achievable Potential by Sector – RIM Scenario

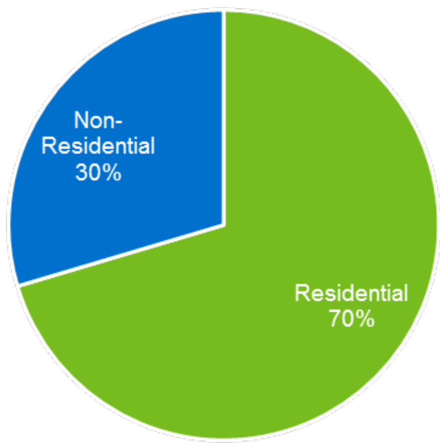
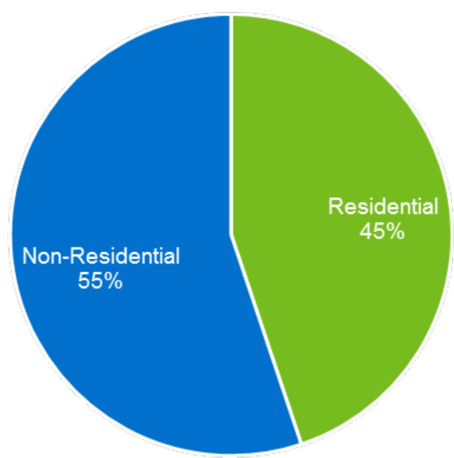


Figure 7-2: Achievable Potential by Sector – TRC Scenario



7.2.2 Residential – RIM Scenario

Table 7-3 summarizes the cumulative residential EE achievable potential by end-use for the RIM Scenario.

Table 7-3: EE Residential Achievable Potential by End-Use – RIM Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Space Heating	0	39	30
Space Cooling	66	0	85
Domestic Hot Water	0	0	0
Lighting	0	0	0
Cooking	0	0	0
Appliances	0	0	0
Electronics	0	0	0
Miscellaneous	0	0	0

Figure 7-3, Figure 7-4, and Figure 7-5 illustrate the cumulative residential EE achievable potential by end-use for the RIM scenario.

Figure 7-3: Residential EE Achievable Potential by End-Use – RIM Scenario (Energy Savings)

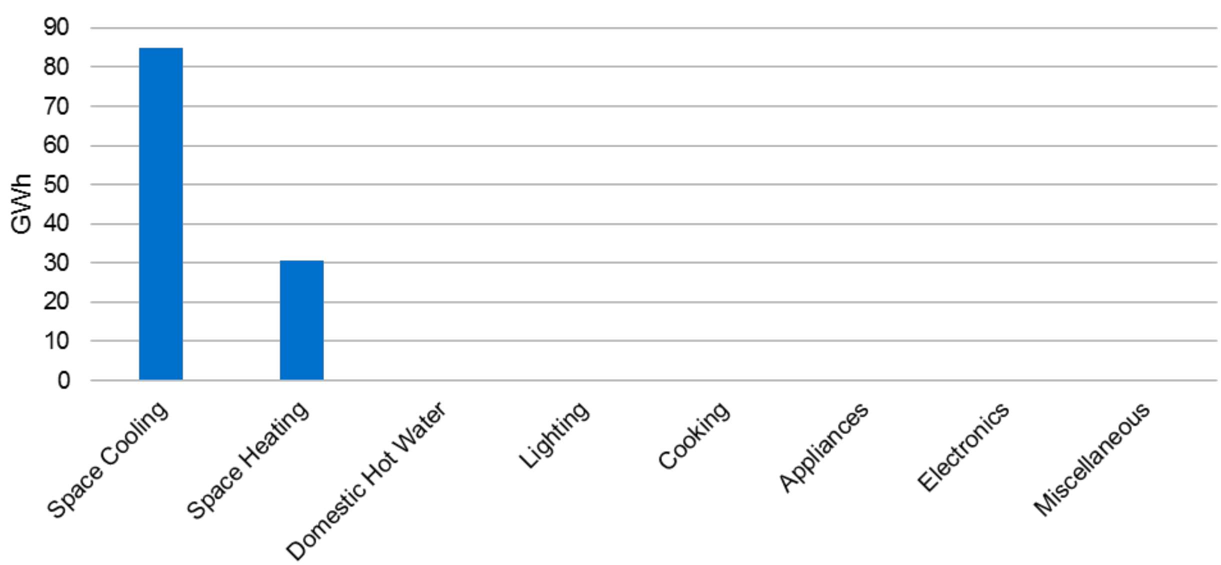


Figure 7-4: Residential EE Achievable Potential by End-Use - RIM Scenario (Summer Peak Savings)

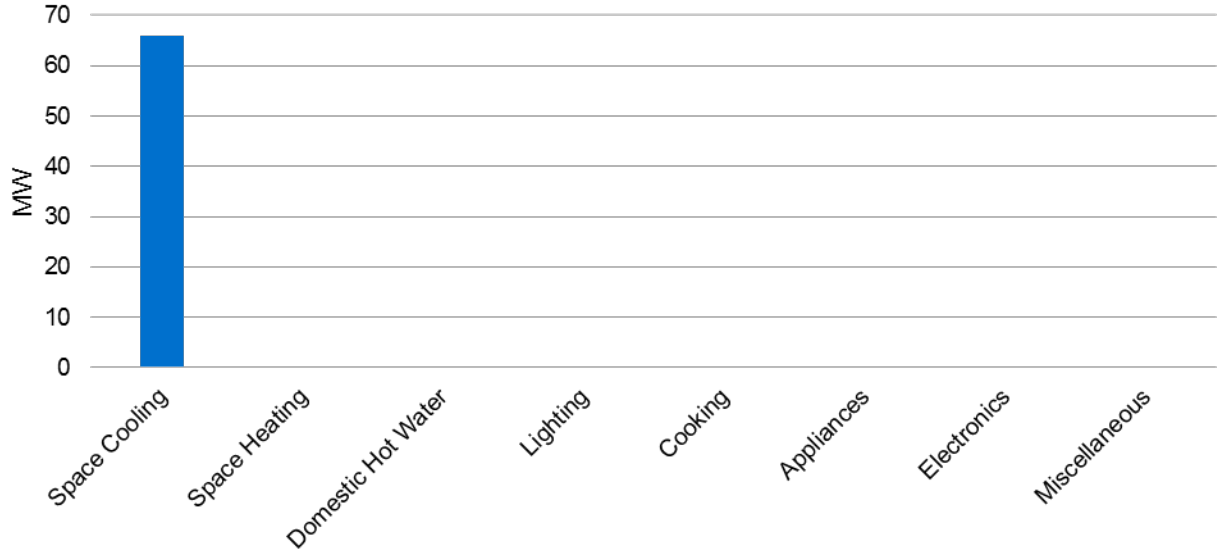
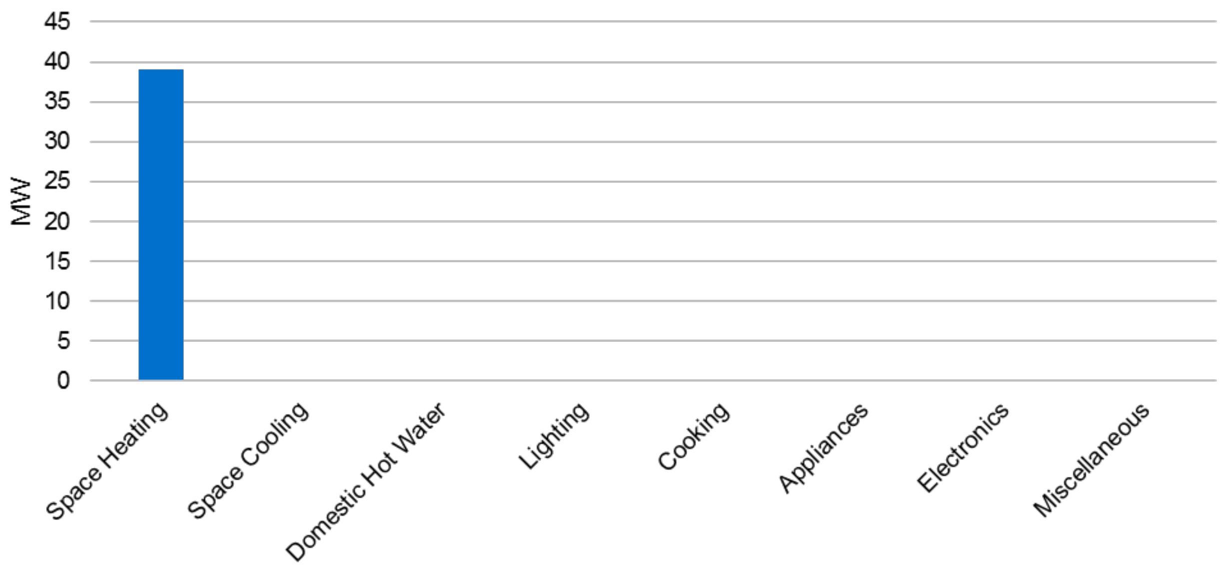


Figure 7-5: Residential EE Achievable Potential by End-Use (Winter Peak Savings) - RIM Scenario



7.2.3 Non-Residential – RIM Scenario

7.2.3.1 Commercial Segments

Table 7-4 summarizes the cumulative commercial EE achievable potential by end-use for the RIM Scenario.

Table 7-4: EE Commercial Achievable Potential by End-Use – RIM Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	0	0	0
Exterior Lighting	0	0	0
Office Equipment	0	0	0
Cooking	0	0	0
Refrigeration	0	0	0
Space Heating	0	4	1
Space Cooling	14	0	23
Ventilation and Circulation	3	16	27
Domestic Hot Water	0	0	0
Miscellaneous	0	0	0

Figure 7-6, Figure 7-7, and Figure 7-8 illustrate the cumulative commercial EE achievable potential by end-use for the RIM scenario.

Figure 7-6: Commercial EE Achievable Potential by End-Use (Energy Savings) – RIM Scenario

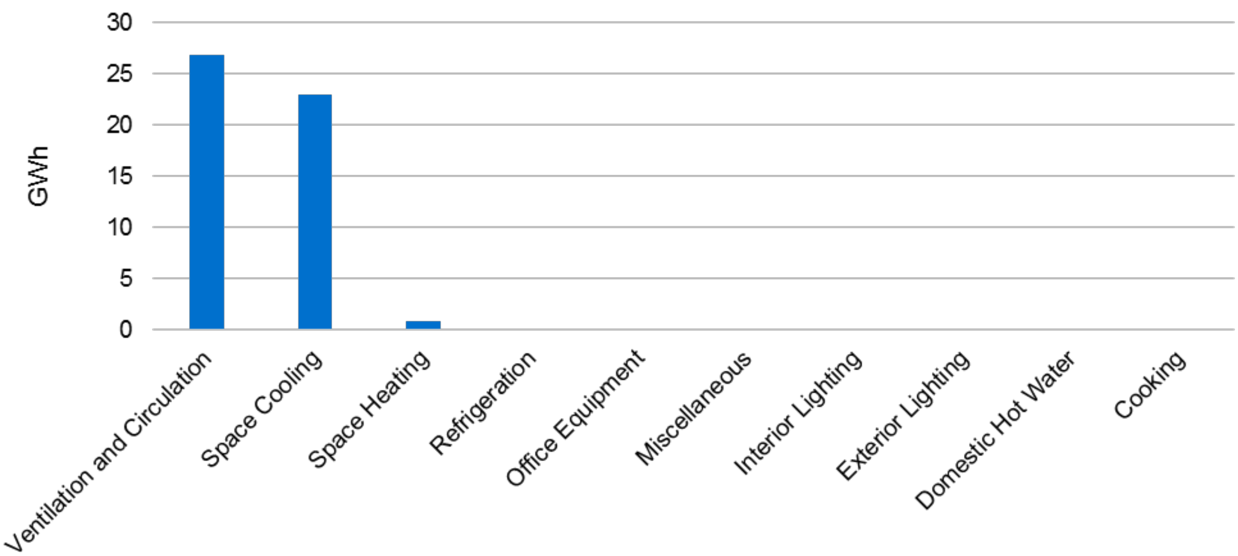


Figure 7-7: Commercial EE Achievable Potential by End-Use (Summer Peak Savings) – RIM Scenario

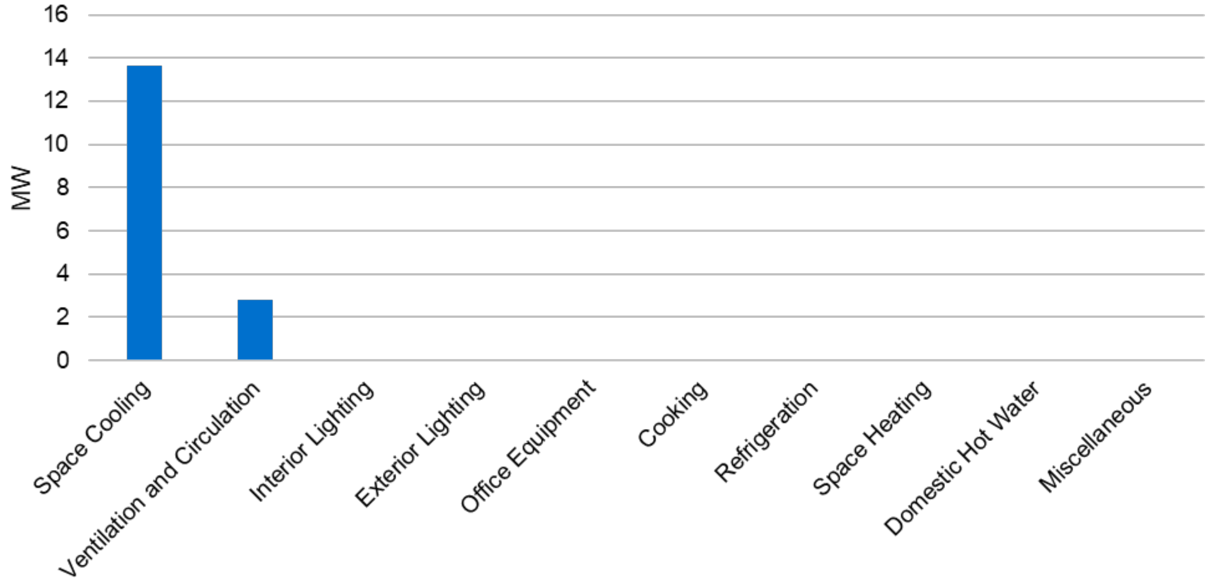
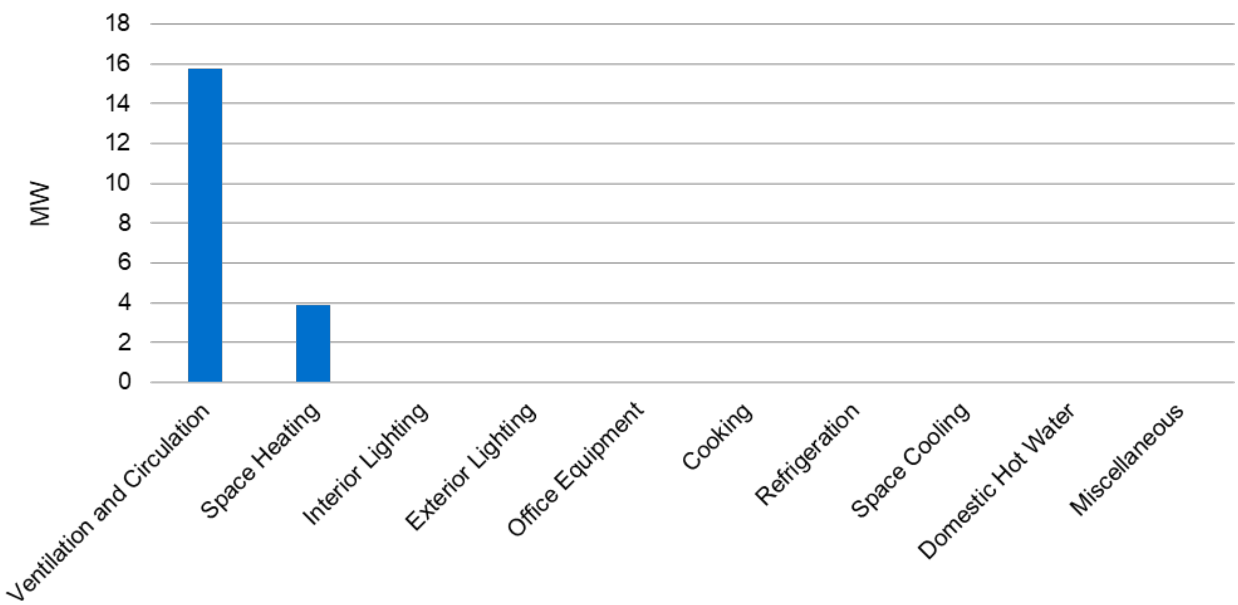


Figure 7-8: Commercial EE Achievable Potential by End-Use (Winter Peak Savings) – RIM Scenario



7.2.3.2 Industrial Segments

The industrial segments did not have any EE measures that passed the achievable potential cost-effectiveness screening for the RIM scenario.

7.2.4 Residential – TRC Scenario

Table 7-5 summarizes the cumulative residential EE achievable potential by end-use for the TRC Scenario.

Table 7-5: EE Residential Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Space Heating	0	43	32
Space Cooling	71	0	90
Domestic Hot Water	0	0	2
Lighting	5	5	52
Cooking	3	0	6
Appliances	0	0	0
Electronics	0	0	0
Miscellaneous	2	2	11

Figure 7-9, Figure 7-10, and Figure 7-11 illustrate the cumulative residential EE achievable potential by end-use for the TRC scenario.

Figure 7-9: Residential EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

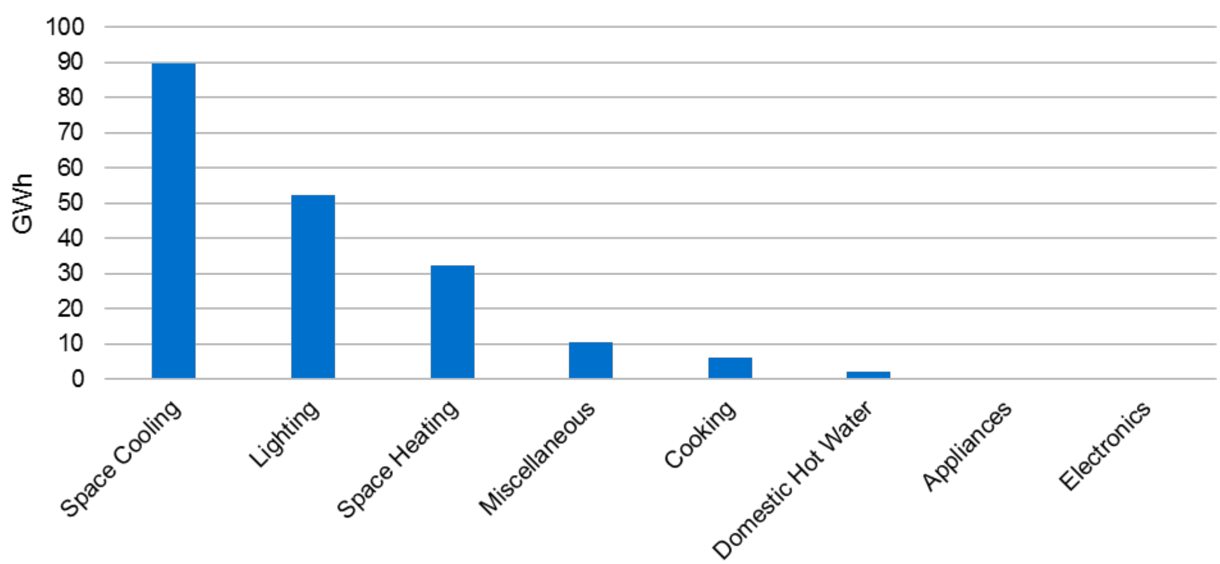


Figure 7-10: Residential EE Achievable Potential by End-Use (Summer Peak Savings) - TRC Scenario

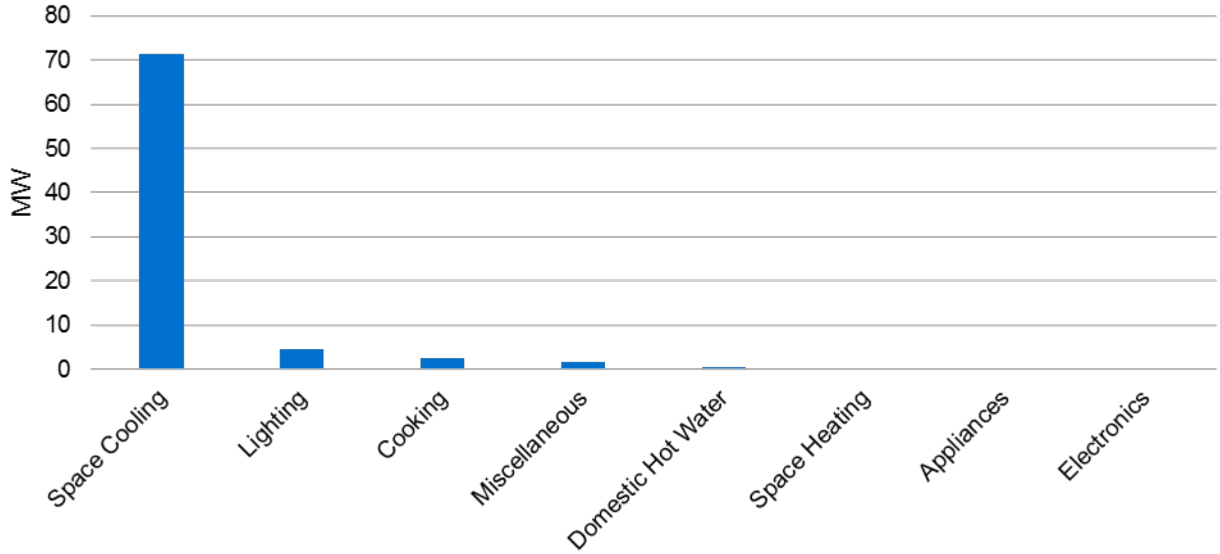
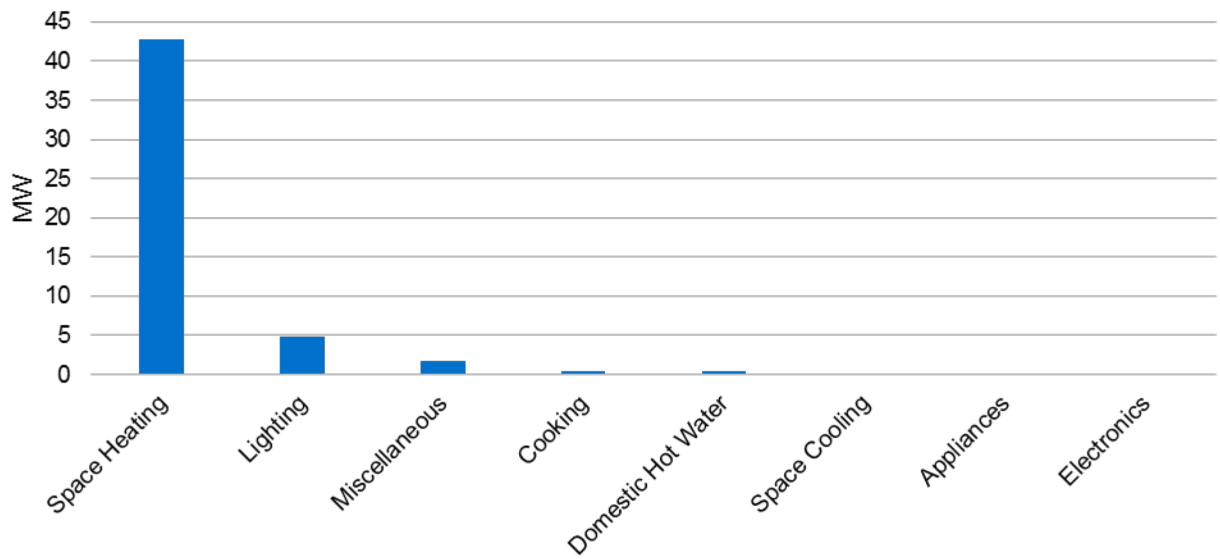


Figure 7-11: Residential EE Achievable Potential by End-Use (Winter Peak Savings) - TRC Scenario



7.2.5 Non-Residential – TRC Scenario

7.2.5.1 Commercial Segments

Table 7-6 summarizes the cumulative commercial EE achievable potential by end-use for the TRC Scenario.

Table 7-6: EE Commercial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	2	1	10
Exterior Lighting	0	0	0
Office Equipment	0	0	0
Cooking	1	1	6
Refrigeration	3	1	25
Space Heating	0	4	3
Space Cooling	26	0	85
Ventilation and Circulation	3	16	28
Domestic Hot Water	0	0	1
Miscellaneous	13	3	52

Figure 7-12, Figure 7-13, and Figure 7-14 illustrate the cumulative commercial EE achievable potential by end-use for the TRC scenario.

Figure 7-12: Commercial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

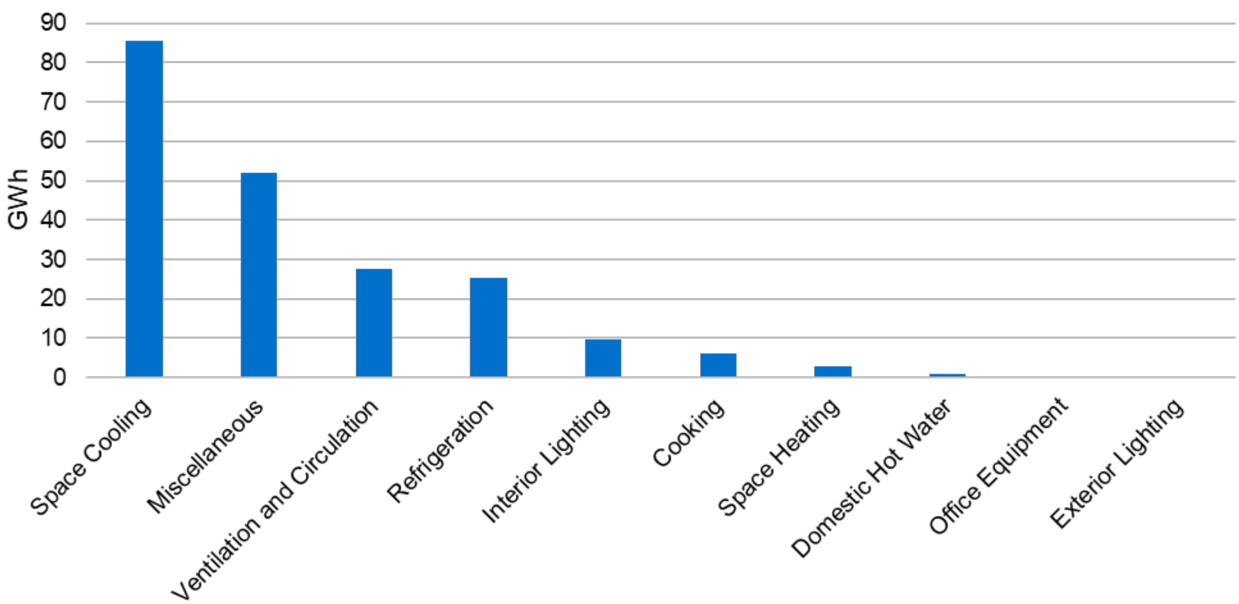


Figure 7-13: Commercial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

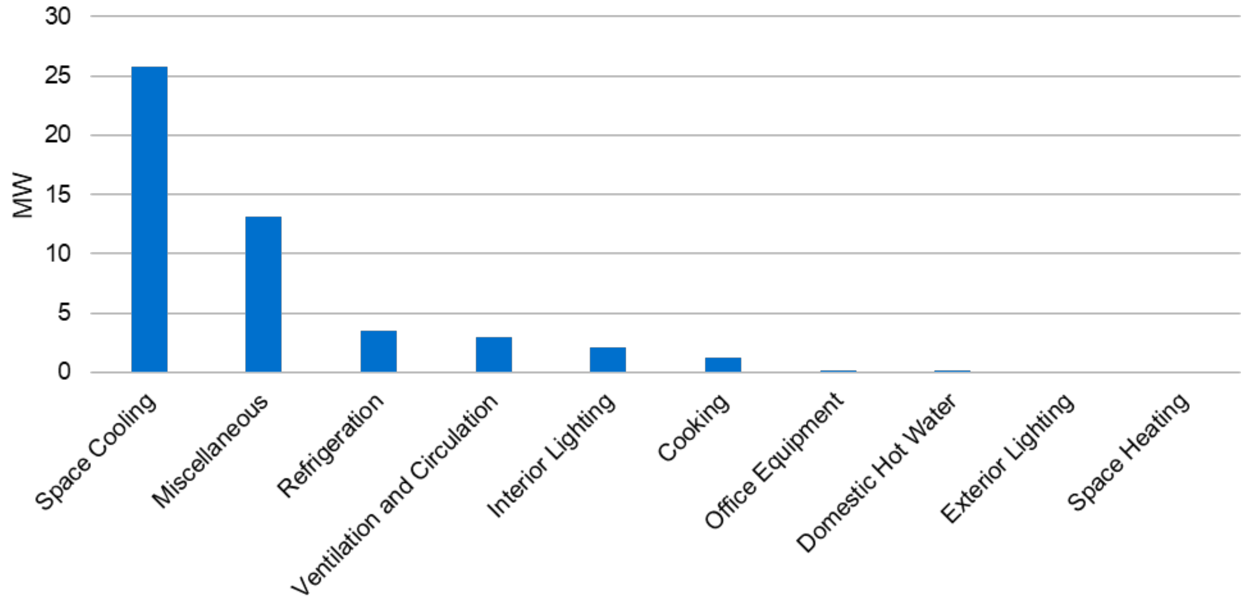
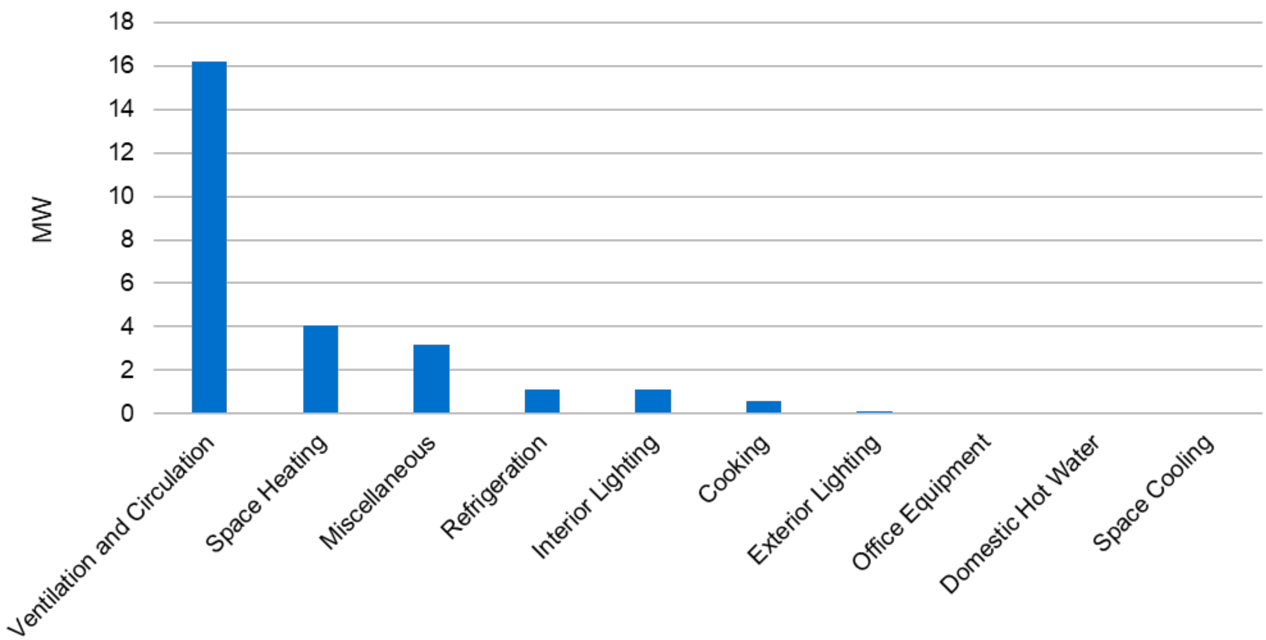


Figure 7-14: Commercial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.2.5.2 Industrial Segments

Table 7-7 summarizes the cumulative industrial EE achievable potential by end-use for the TRC Scenario.

Table 7-7: EE Industrial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Process Heating	0	0	1
Process Cooling	0	0	0
Compressed Air	0	0	1
Motors Pumps	0	0	3
Motors Fans Blowers	0	0	0
Process Specific	0	0	0
Industrial Lighting	3	3	20
HVAC	0	0	1
Other	0	0	0
Exterior Lighting	0	0	0

Figure 7-15, Figure 7-16, and Figure 7-17 illustrate the cumulative industrial EE achievable potential by end-use for the TRC scenario.

Figure 7-15: Industrial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

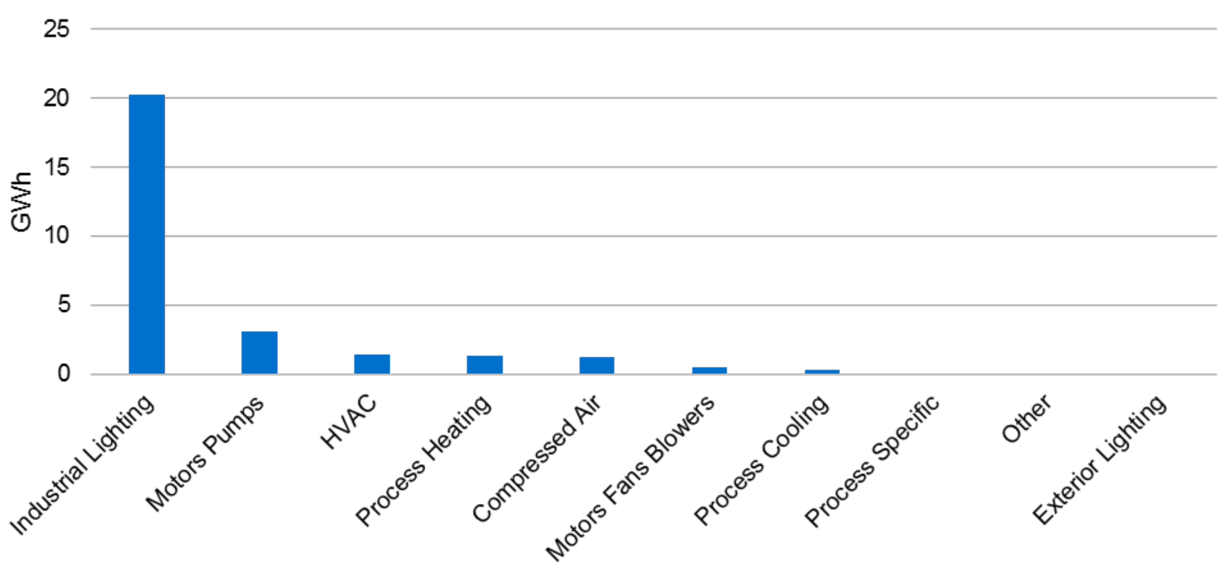


Figure 7-16: Industrial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

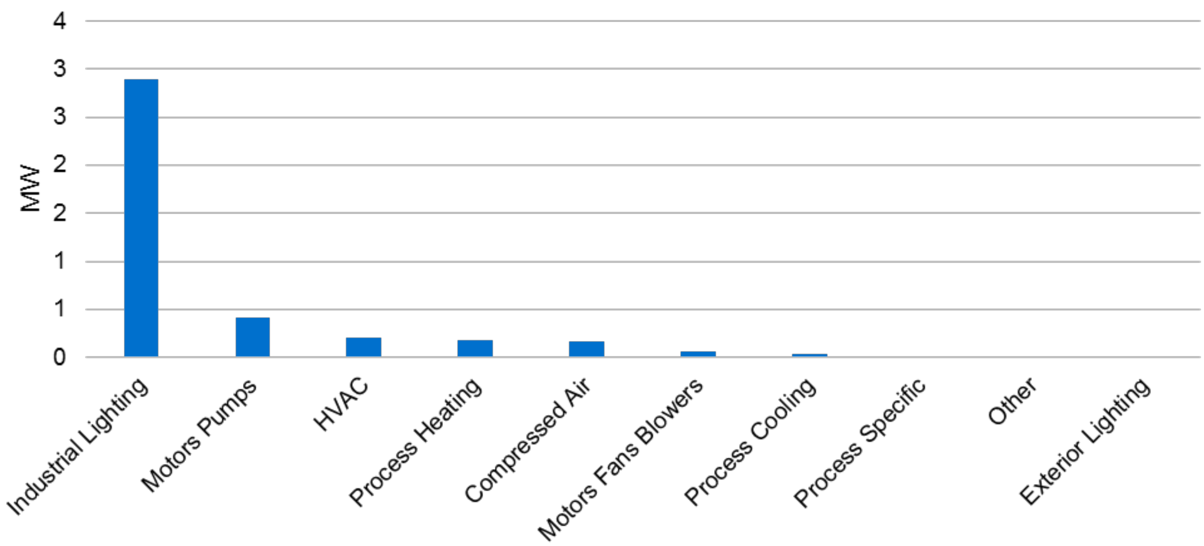
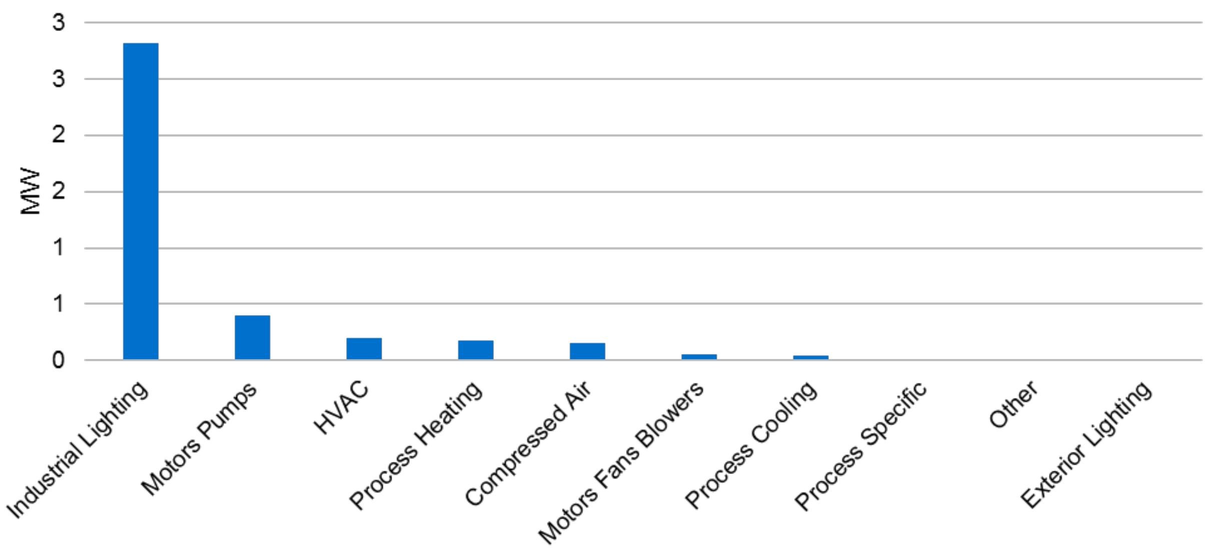


Figure 7-17: Industrial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.3 DR Achievable Potential

7.3.1 Summary

This section presents the estimated overall achievable potential for DR opportunities. The results are provided separately for summer and winter peaking capacity. The results are further broken down by customer segment and presented in the form of supply curves. All results presented reflect the projected achievable DR potential by 2029 for both RIM and TRC scenarios, as all measures either passed or failed for both screening scenarios.

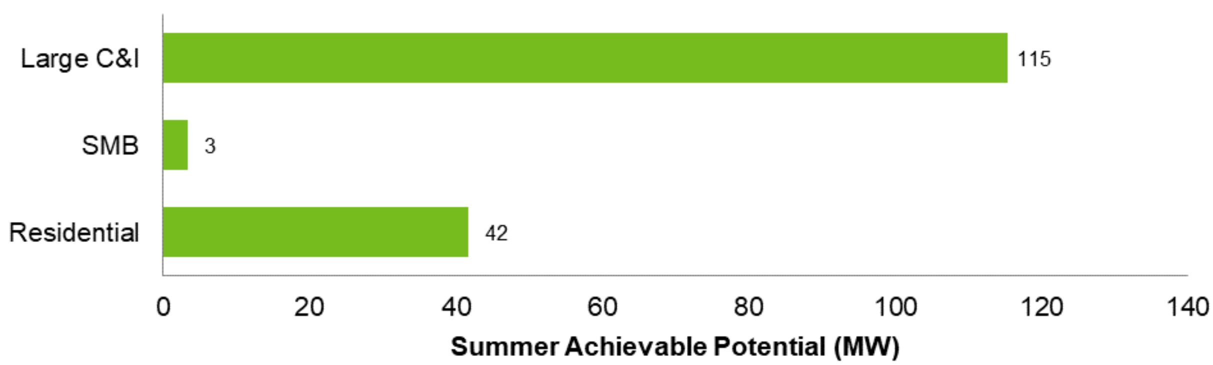
Table 7-8: DR Achievable Potential[24]

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	42	39
Non-Residential	119	101
Total	161	140

7.3.1.1 Summer Peaking Capacity

Figure 7-18 presents the overall summer peak capacity results, broken down by sector. The capacity is what is expected to be available during the peak hour of system demand. Overall, the estimated magnitude of peak capacity comes out to 161 MW. Most of the peak capacity potential comes from the large C&I sector.

Figure 7-18: DR Summer Achievable Potential by Sector[25]



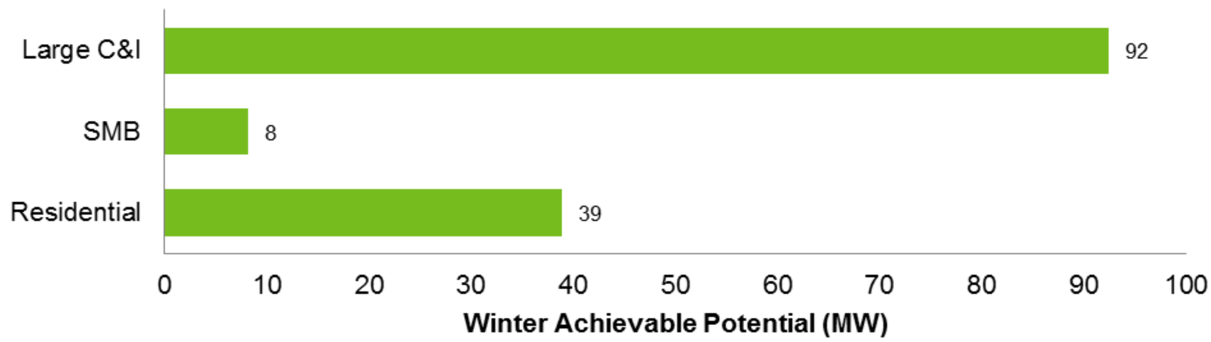
[24] Excludes current DR participants

[25] Excludes current DR participants

7.3.1.2 Winter Peaking Capacity

Figure 7-19 presents the overall winter peak capacity results for both scenarios, broken down by sector. Overall, the estimated magnitude of peak capacity is 140 MW. Most of the peak capacity potential comes from the large C&I sector.

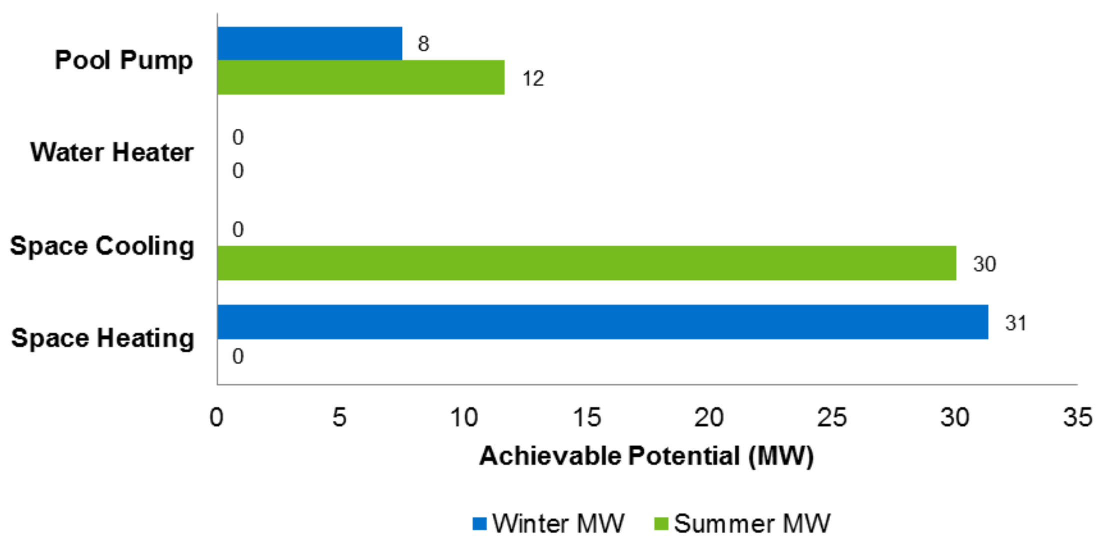
Figure 7-19: DR Winter Achievable Potential by Sector[26]



7.3.2 Residential DR Achievable Potential Details

A total of 3 different customer segments were individually analyzed for residential customers: Single Family, Multi-Family, and Manufactured Home. Figure 7-20 summarizes the cumulative residential DR achievable potential.

Figure 7-20: Residential DR Achievable Potential by End-Use – RIM and TRC Scenario[27]



[26] Excludes current DR participants

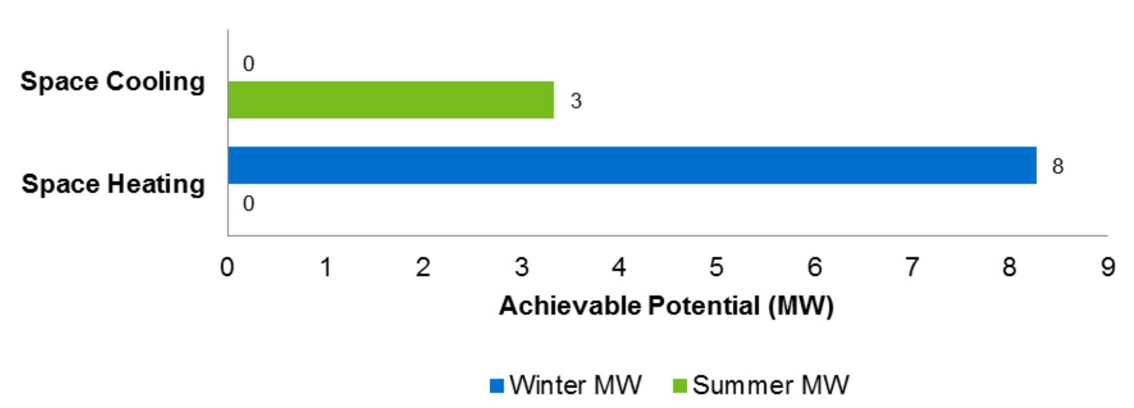
[27] Excludes current DR participants

7.3.3 Non-Residential DR Achievable Potential Details

7.3.3.1 Small C&I Achievable Potential

Small C&I customers do not provide much DR capacity, due to their being a relatively small portion of the overall system load and having relatively low participation rates.

Figure 7-21: Small C&I DR Achievable Potential by End-Use – RIM and TRC Scenario[28]

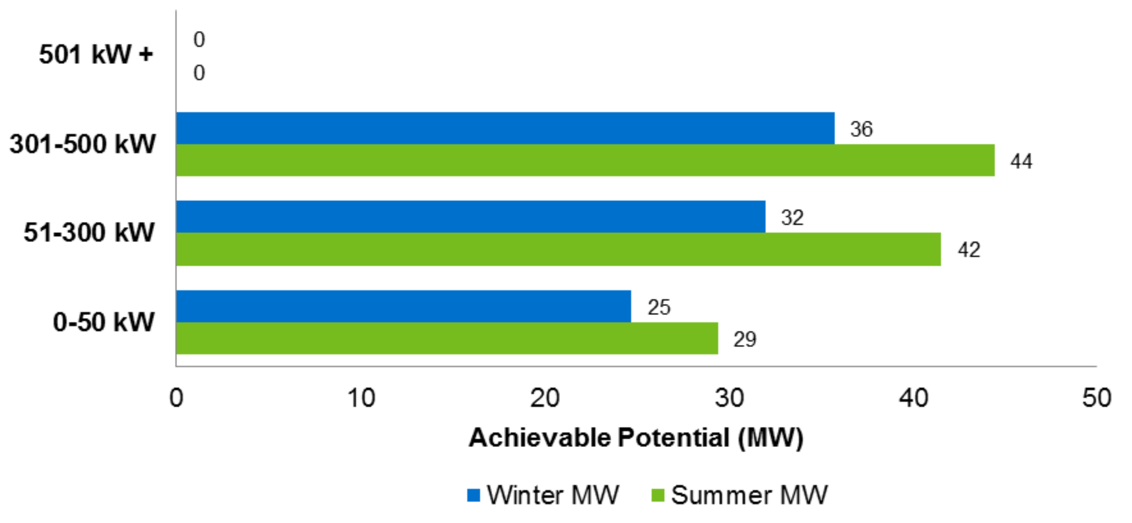


7.3.3.2 Large C&I Achievable Potential

The vast majority of the DR potential comes from the large C&I sector. These customers comprise a large portion of the overall system load, and are expected to have considerably high participation rates if incentive levels are sufficiently high. The participation rate presented here represents the percentage of the overall peak period load from each customer segment that would be available for curtailment if DR programs are properly incentivized and marketed. They reflect a saturated market (*i.e.*, all customers are properly informed of the program and given the opportunity to enroll). Figure 7-22 shows the achievable potential for each Large C&I customer segment. The largest C&I customer segment does not have any additional potential due to existing high levels of DR participation for that customer segment for DEF.

[28] Excludes current DR participants

Figure 7-22: Large C&I DR Achievable Potential by Segment – RIM and TRC Scenario[29]



[29] All currently enrolled DR load is excluded

7.4 DSRE Achievable Potential

Nexant found there to be no cost-effective achievable potential attainable for DEF for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

8 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements

Measure	End-Use	Description	Baseline
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations

Measure	End-Use	Description	Baseline
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average pump equipment
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and small C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

The cooling load shapes on the summer peak weekday and average weekdays were generated from hourly load data from the DEF 2016 load research sample. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2013 and 2014
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (among May to September). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same hourly load research profile in 2013 and 2014, and the peak day was defined as the day with system peak load during winter period. The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

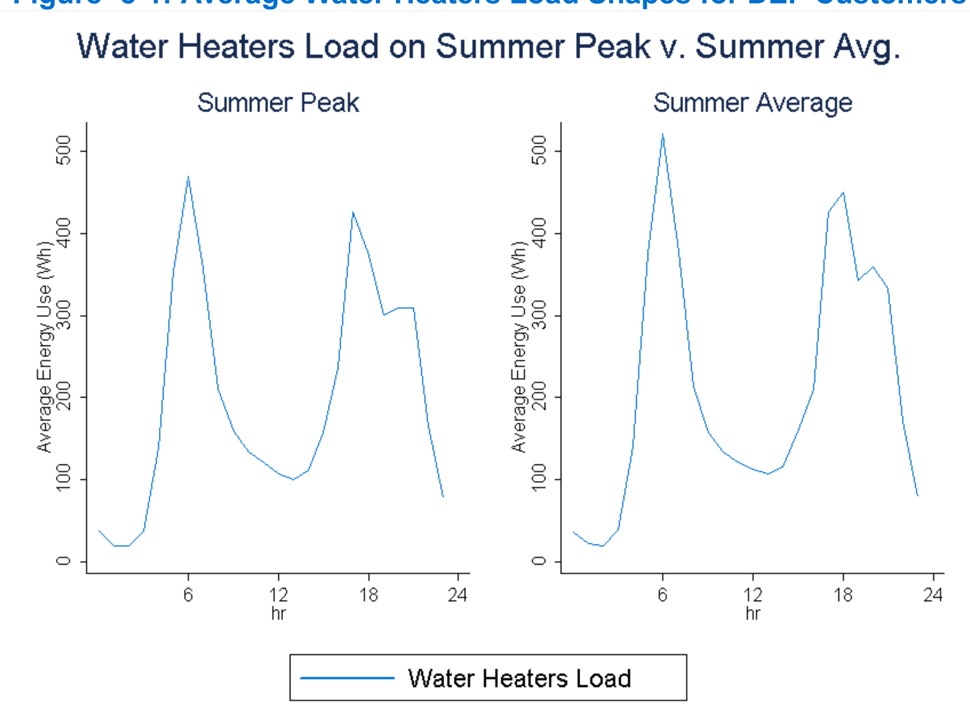
Where:

t	Hours in each day in year 2013 and 2014
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in DEF territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in DEF. The peak demand results were then adjusted to reflect the results of the Navigant DR End-Use Study performed for DEF.

Figure -8-1: Average Water Heaters Load Shapes for DEF Customers

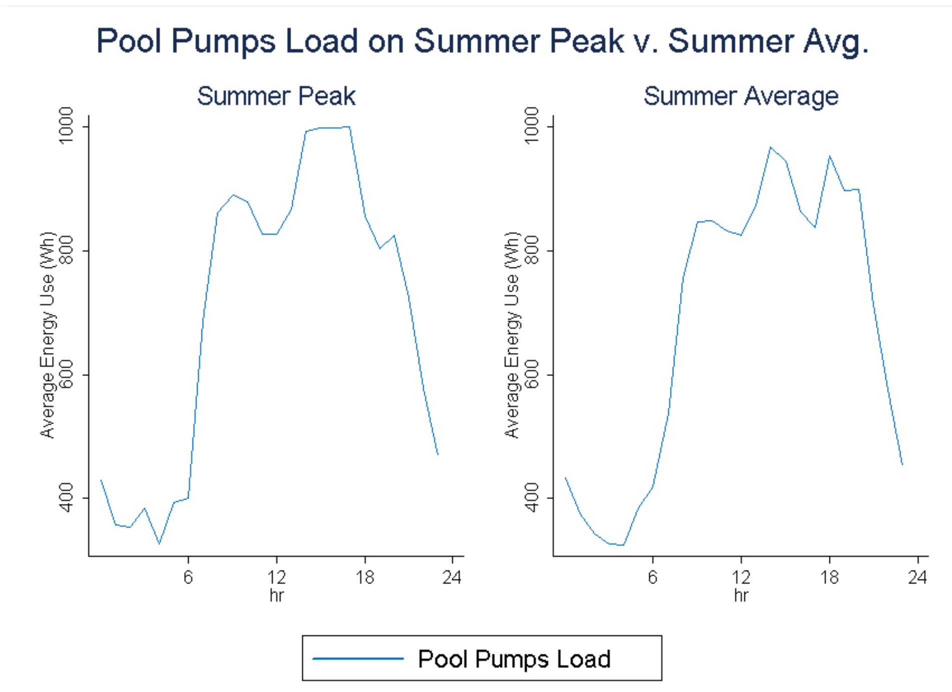


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads have low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 – 7:00 AM and 5:00 – 8:00 PM.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in DEF. The peak demand results were then adjusted to reflect the results of the Navigant DR End-Use Study performed for DEF.

Figure 8-2: Average Pool Pumps Load Shapes for DEF Customers



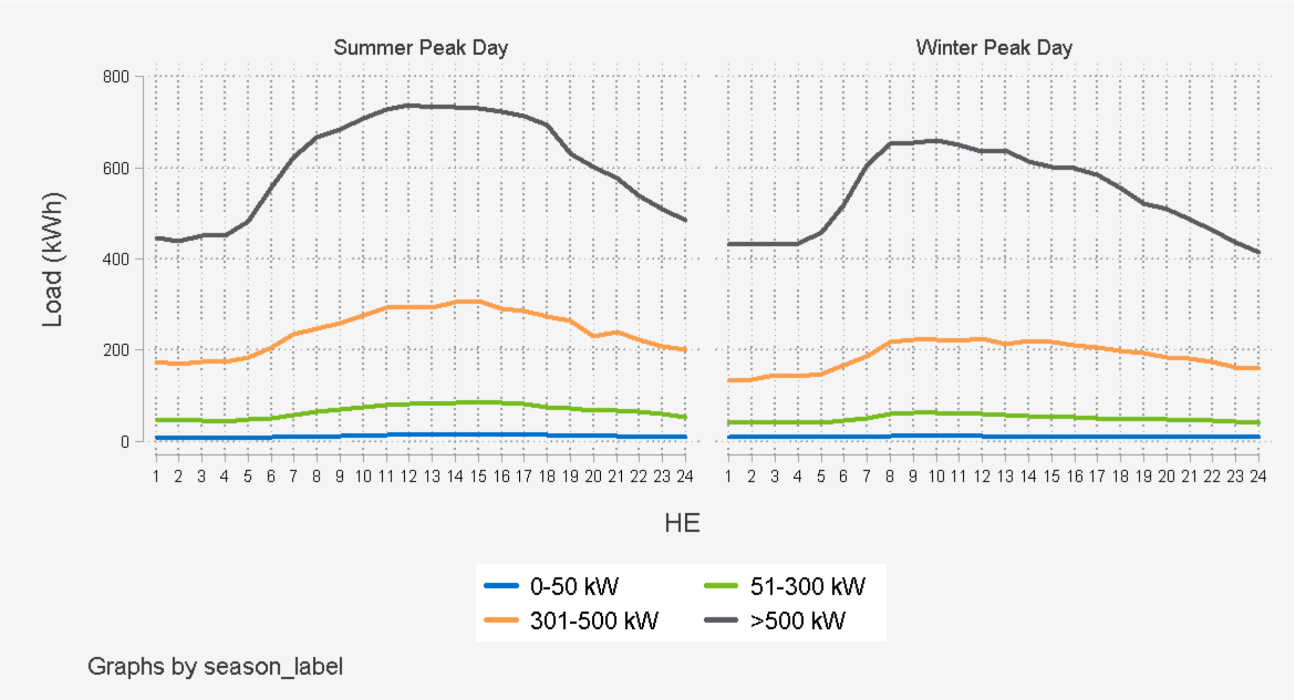
According to the Figure 8-4, the peak hours for pool pumps are 3:00 to 6:00 PM, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2016) for all customers in the GSD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential as well as examine the weather-sensitivity of each segment by comparing peak usage to the average usage in each season.

Figure 8-3: Aggregate Load Shapes for DEF Large C&I Customers



Appendix E Economic Potential Sensitivities

As part of the assessment of economic potential, the study included analysis of sensitivities related to free ridership, future fuel costs, and carbon scenarios, as follows:

Sensitivity #1: Higher Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a “high fuel” scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	15	59
Commercial	13	171
Industrial	0	0
Total	28	230
TRC SCENARIO		
Residential	25	111
Commercial	48	771
Industrial	18	122
Total	91	1,004

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	979	531	1,694
Non-Residential	94	42	276
Total	1,073	573	1,970
TRC SCENARIO			
Residential	1,045	679	2,693
Non-Residential	232	97	1,098
Total	1,276	775	3,791

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #2: Lower Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the fuel cost forecast was adjusted to a “low fuel” scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	13	45
Commercial	14	191
Industrial	0	0
Total	27	236
TRC SCENARIO		
Residential	20	87
Commercial	37	572
Industrial	15	112
Total	72	771

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	931	522	1,608
Non-Residential	104	41	289
Total	1,035	564	1,896
TRC SCENARIO			
Residential	970	550	2,138
Non-Residential	221	93	973
Total	1,191	643	3,111

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #3: Shorter free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the simple payback screening criteria was reduced to one year or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	13	45
Commercial	16	237
Industrial	0	0
Total	29	282
TRC SCENARIO		
Residential	26	117
Commercial	56	1,016
Industrial	24	362
Total	106	1,495

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	931	522	1,608
Non-Residential	133	90	399
Total	1,064	613	2,007
TRC SCENARIO			
Residential	1,006	460	2,320
Non-Residential	329	236	1,595
Total	1,334	696	3,915

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #4: Longer free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the simple payback screening criteria was increased to three years or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	13	41
Commercial	14	181
Industrial	0	0
Total	27	222
TRC SCENARIO		
Residential	15	51
Commercial	34	456
Industrial	6	40
Total	55	547

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	808	487	1,448
Non-Residential	98	25	241
Total	906	512	1,689
TRC SCENARIO			
Residential	801	456	1,449
Non-Residential	151	46	521
Total	952	502	1,970

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #5: Carbon dioxide (CO_2) costs

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the avoided electric utility supply costs forecast was adjusted to include consideration of an additional impact for emissions assuming that there was an economic charge for carbon dioxide. The CO_2 forecast represents the average of those used by Florida Power & Light (FPL) and DEF in their respective 2019 Ten-Year Site Plans.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	13	45
Commercial	14	197
Industrial	0	0
Total	27	242
TRC SCENARIO		
Residential	22	95
Commercial	40	634
Industrial	16	114
Total	78	843

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	931	522	1,608
Non-Residential	112	42	312
Total	1,043	565	1,920
TRC SCENARIO			
Residential	969	550	2,188
Non-Residential	222	94	980
Total	1,191	644	3,168

DR measures were not included in the economic sensitivities as the estimated carbon dioxide costs do not affect DR results.

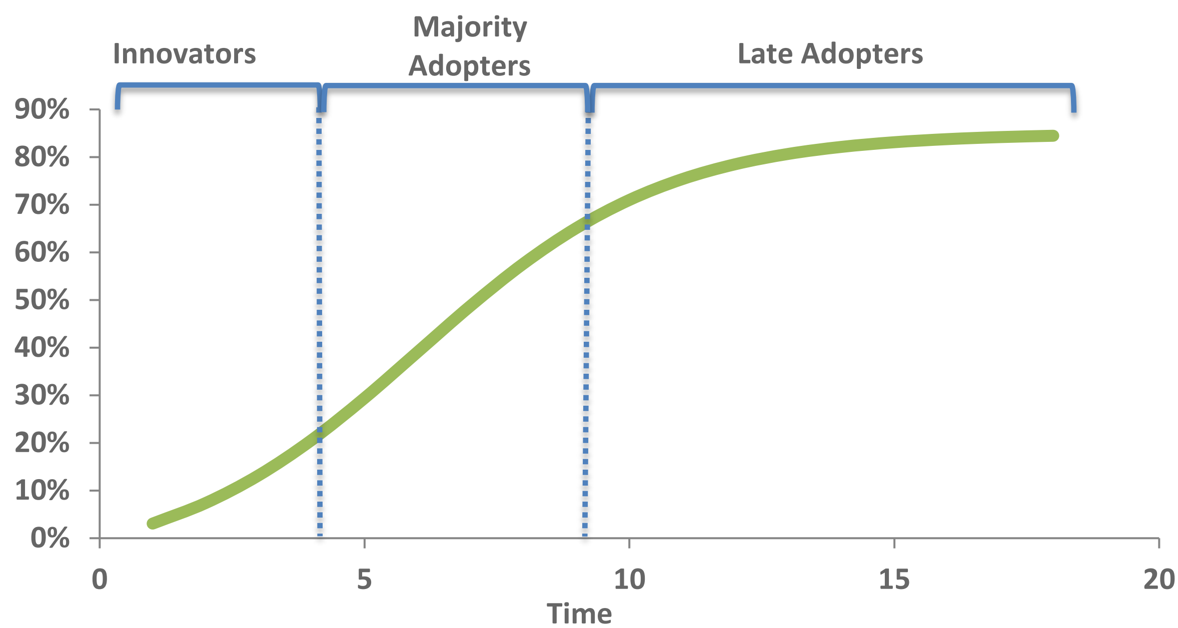
No DSRE measures passed the economic screening for this sensitivity.

Appendix F Market Adoption Rates

Nexant uses the Bass diffusion model to estimate measure adoption rates. The Bass diffusion model is a widely accepted mathematical description of how new products and innovations spread through an economy over time. The Bass Diffusion Model was originally published in 1969, and in 2004 was voted one of the top 10 most influential papers published in the 50 year history of the peer-reviewed publication *Management Science*[1]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to demand-side management in the energy industry[2]. Nexant applied the secondary data and research collected to develop and apply Bass Model diffusion parameters in the Florida jurisdiction.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept is illustrated in Figure 8-4.

Figure 8-4 Bass Model Market Penetration with Respect to Time



[1] Bass, F. 2004. Comments on "A New Product Growth for Model Consumer Durables the Bass Model" (sic). *Management Science* 50 (12_supplement): 1833-1840. http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1040.0300. Accessed 01/08/2016.

[2] Buskirk, R. 2014. Estimating Energy Efficiency Technology Adoption Curve Elasticity with Respect to Government and Utility Deployment Program Indicators. LBNL Paper 6542E. Sustainable Energy Systems Group, Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. http://escholarship.org/uc/item/2vp2b7cm#page-1. Accessed 01/14/2016.

Figure 8-4 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

$$\frac{dS(t)}{dt} = \left(p + \frac{q}{m} * S(t-1)\right) * (m - S(t-1))$$

Where:

$\frac{dS(t)}{dt} =$ the rate of adoption for any discrete time period, t

$p =$ external influences on market adoption

$q =$ internal influences on market adoption

$m =$ the maximum market share for the product

$S(t-1) =$ the cumulative market share of the product, from product introduction to time period *t-1*

Marketing is the quintessential external influence. The internal influences are characteristics of the product and market; for example: the underlying market demand for the product, word of mouth, product features, market structure, and other factors that determine the product's market performance. Nexant's approach applied literature reviews and analysis of secondary data sources to estimate the Bass model parameters. We then extrapolated the model to future years; the historic participation and predicted future market evolution serve as the program adoption curve applied to each proposed offering.

In order to estimate elasticity across different utility incentive levels, Nexant incorporated data from a regression analysis performed on EIA 861 data to understand the relative change in savings based on differing incentives. Per this analysis, a 100% increase in the total utility incentive equated to roughly a 44% increase in savings. This EIA-based elasticity rate was applied to the market adoption rates described above to estimate relative changes in market adoption for the range of maximum incentives where they vary from current or typical utility offerings.

Nexant's approach for estimating DR potential includes an additional step, based on our analysis of mature demand response programs. We estimate participation rates with the following process:

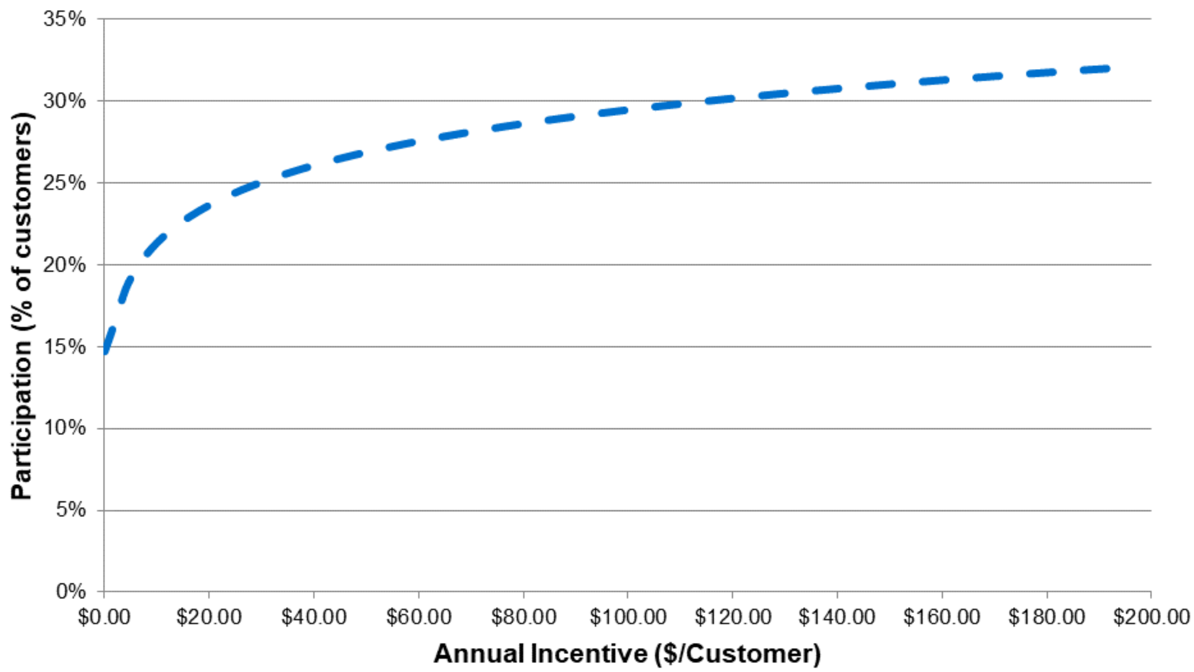
1) Use the results from prior analysis of DR program enrollment[3] to describe DR program participation as a function of customer segments and program attributes
2) Calibrate the model to reflect actual enrollment rates attained by existing DEF programs. To calibrate the models, the model constant is adjusted so that the model produces exactly the enrollment rates observed by DEF programs.

[3] Nexant Inc. Sacramento Municipal Utility District Demand Response Potential Study. October 20, 2015.

3) Predict participation rates using specific tactics and incentive levels for each measure based on the outcome of the RIM screening (or existing incentive levels).

As a demonstration of how marketing level and incentive affects participation in residential DR programs, Figure 8-5 shows the range of participation rates at a medium marketing level (phone outreach, mail, and email) as a function of the incentive paid to the customer. The curve shows that residential customers will respond to changes in incentive level if the incentive is relatively low, but are not as responsive to incentive levels after a certain point. This is why utility marketing strategies also play an important role in residential customer participation. This curve can also vary depending on the customer segments present in a utility's jurisdiction and other utility DR program characteristics (such as program age). To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

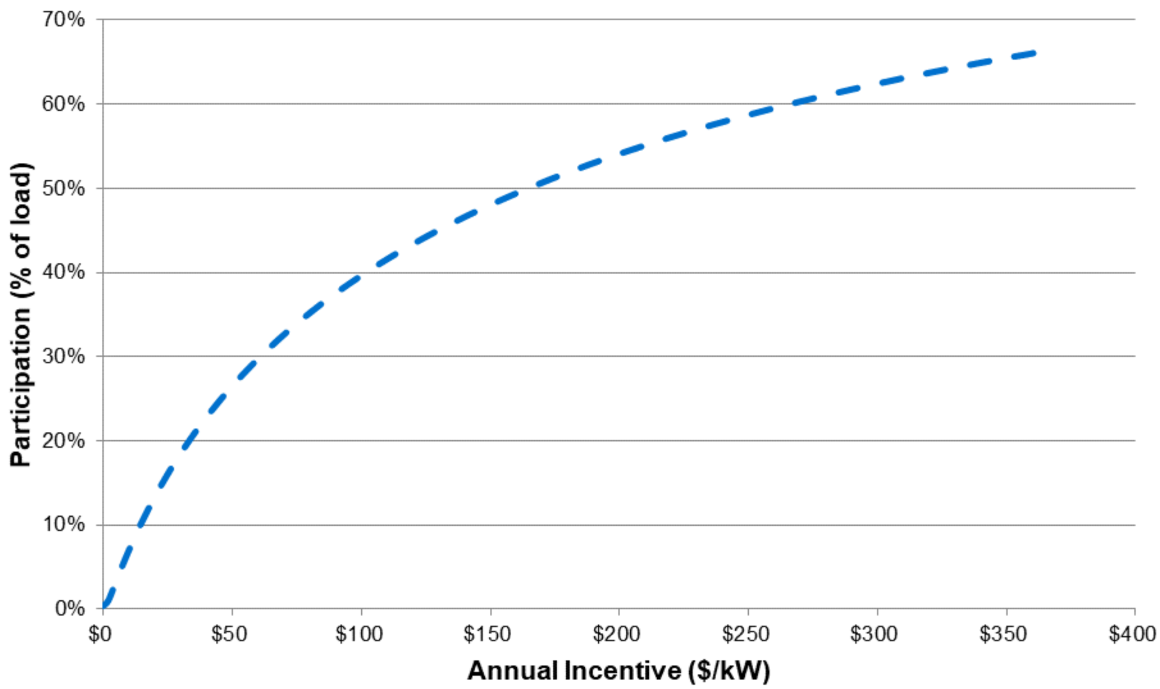
Figure 8-5: Residential Program Enrollment as a function of Incentive



For small C&I customers, a similar approach was used to estimate participation levels. However, these customers tend to have lower enrollments than larger nonresidential customers, and were scaled accordingly. Small C&I customers tend to exhibit roughly 40% of the uptake of residential customers, based on data from historic DR program analysis, which have extensively marketed these programs.

Large C&I customers were slightly different than the other two segments. Due to the large variation in customer size, participation was estimated as the percent of load enrolled in demand response rather than the number of customers. Figure 8-6 shows the participation level of large C&I customers as a function of incentive. Although customers grow less responsive to the incentive as it increases, they continue to be much more responsive to the annual incentive as it increases. This is why for technical potential, it is assumed that if a large C&I customer is paid a high enough incentive; they will curtail their entire load. Similar to the residential participation curve, this curve can vary based on existing participation rates for a utility as well as the industries that large C&I customers belong to. To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-6: Large C&I Program Enrollment as a function of Incentive



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REPORT

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Reimagine tomorrow.

Market Potential Study of Demand-Side Management in Gulf Power's Service Territory

Submitted to Gulf Power

April, 2019

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Gulf Power's (Gulf) service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in Gulf's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large C&I customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning

(HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential. The assessment further accounted for existing DR programs for Gulf when calculating the total DR potential. The large C&I programs assessment used publicly available data on mature DR programs and current Florida large C&I DR programs to derive estimates of price responsiveness to program incentives and marketing techniques. Using these estimates, the maximum incentive and enrollment scenario was calculated to estimate the potential.

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customers' PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for residential, commercial and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Nexant estimated DSM savings potential according to three standard scenarios: technical, economic, and achievable potential. Each scenario is defined using slightly different criteria, which are described in the subsequent sections.

1.2.1 EE Potential

Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	391	199	1,464
Non-Residential[1]	231	129	1,105
Total	621	328	2,568

[1] Non-Residential results include all commercial and industrial customer segments

Economic Potential

EE economic potential applies a cost-effectiveness screening to all technically feasible measures and includes full implementation of all measures that pass this screening. Measure permutations were screened individually and the economic potential represents the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

Economic potential was determined for two scenarios: a Rate Impact Measure (RIM) scenario and Total Resource Cost (TRC) scenario. Additional sensitivities were also analyzed, which are described in Section 6.1.3 and results presented in Appendix E.

The estimated economic potential results are summarized in Table 1-2.

Table 1-2: EE Economic Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	3	4
Non-Residential	75	36	110
Total	75	39	114
TRC SCENARIO			
Residential	182	173	836
Non-Residential	167	124	926
Total	348	297	1,762

Achievable Potential

Achievable potential estimates the demand and energy savings feasible with utility-sponsored programs, while considering market barriers and customer adoption rates for DSM technologies.

Similar to the economic potential analysis, measures were screened to determine which are cost-effective from both the RIM and TRC perspectives. The achievable potential includes estimated program costs and incentives, whereas the economic potential scenario does not.

Table 1-3 summarizes the results for the estimated EE achievable potential, representing the cumulative savings over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

Table 1-3: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	5	2	6
Total	5	2	6
TRC SCENARIO			
Residential	20	19	98
Non-Residential	21	10	124
Total	40	29	222

1.2.2 DR Potential

Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

The estimated technical potential results are summarized in Table 1-4.

Table 1-4: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	465	667
Non-Residential	493	430
Total	958	1,098

Economic Potential

DR economic potential incorporates the economic screening criteria described above for EE potential, and the results are summarized in Table 1-5.

Table 1-5: DR Economic Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	465	667
Non-Residential	493	430
Total	958	1,098

Achievable Potential

DR achievable potential incorporates the economic screening criteria described above for EE potential, and the results are summarized in Table 1-6.

Table 1-6: DR Achievable Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	0	0
Non-Residential	15	11
Total	15	11

1.2.3 DSRE Potential

Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems charged from PV, and CHP technologies based on the customer characteristics of each FEECA utility's customer base.

Table 1-7: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	24	104	2,072
Non-Residential	111	48	952
Total	135	151	3,024
Battery Storage charged from PV Systems			
Residential	65	222	-
Non-Residential	-	-	-
Total	65	222	-
CHP Systems			
Total	252	99	1,243

Economic Potential

DSRE economic potential incorporates the economic screening criteria described above for EE potential, and the results are summarized in Table 1-8.

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

Table 1-8: DSRE Economic Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	-	-	-
Non-Residential	-	-	-
Total	-	-	-
Battery Storage from PV Systems			
Residential	65	222	-
Non-Residential	-	-	-
Total	65	222	-
CHP Systems			
Total	-	-	-

Achievable Potential

DSRE achievable potential incorporates the achievable screening criteria described above for EE potential. Nexant found there to be no cost-effective potential attainable for Gulf for PV systems, battery storage systems, or CHP systems.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Gulf Power's (Gulf) service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- List of cost-effective EE, DR, and DSRE measures
- Potential demand and energy savings for technical, economic and achievable potential scenarios
- Estimated utility costs to acquire the achievable potential
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.

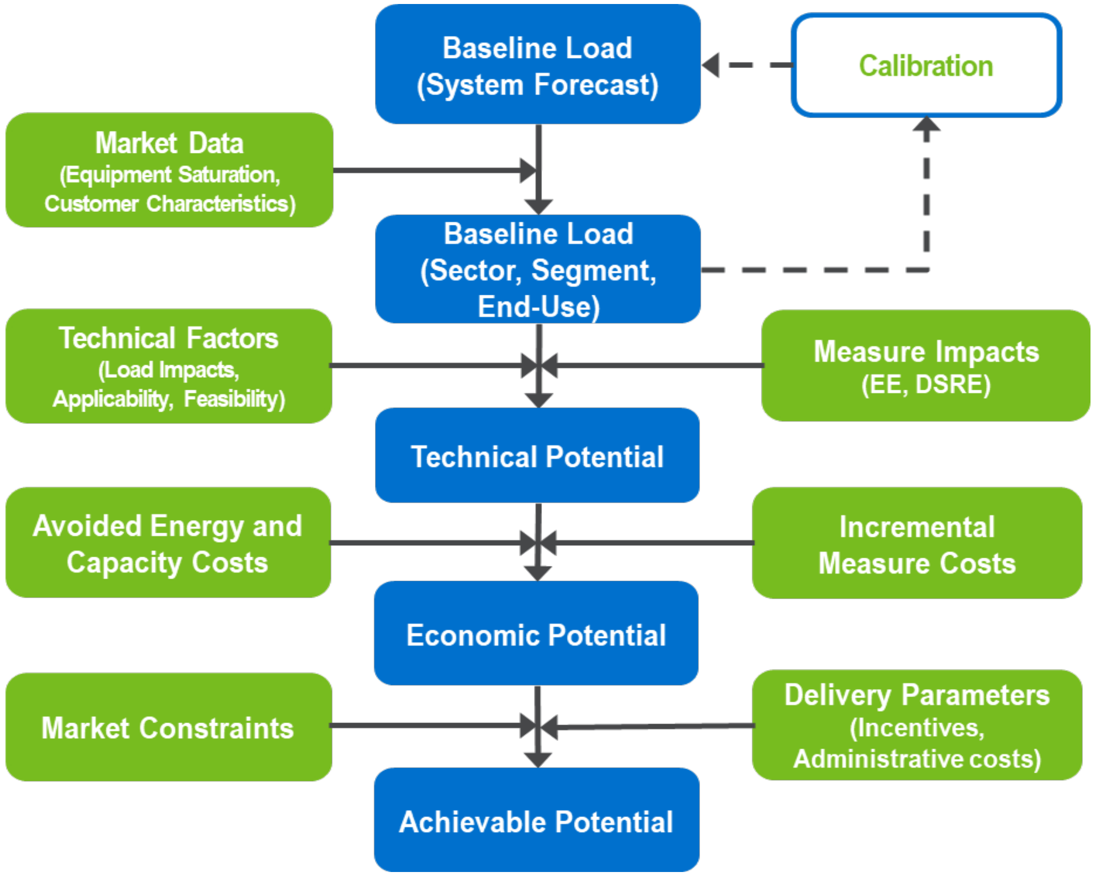
- Economic Potential is the amount of energy and capacity that could be reduced by DSM measures that are considered cost-effective. This study used the Ratepayer Impact Measure (RIM) test perspective and Total Resource Cost (TRC) test perspective, which were both coupled with the Participant Cost Test (PCT) and a two-year payback to determine cost-effectiveness.
- Achievable Potential is the DSM savings feasible when considering how utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant's achievable potential applied the same cost-effectiveness screening as the economic potential analysis, with the addition of utility program costs and incentives.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy savings, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to Gulf's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, measure impacts, and costs.

Figure 2-1 provides an illustration of the MPS process, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Market Potential Modeling



Nexant estimated DSM savings potential based on a combination of market research, analysis, and a review of Gulf's existing DSM programs, all in coordination with Gulf. Nexant examined EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions, projected customer response to DR measures, the marginal benefit and cost of recruiting a customer for DR, and customer enrollment. Customer demand was determined by looking at interval data for a sample of each customer segment and determining the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures

was developed based on the performance of existing Florida DR programs and other DR programs in the US. Cost-effectiveness was estimated based on demand reductions, how well reductions coincide with system peaking conditions, the benefits of reducing demand during peaking conditions, and cost information. Enrollment rates were determined as a function of the incentive paid to a customer as well as the level of marketing for each DR measure.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a “bottom-up” modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The Gulf base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of Gulf's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis. The goal of this further segmentation for DR was to understand which customer groups were most cost-effective to recruit and allow for more targeted marketing of DR programs.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	Other
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be

willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from Gulf. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the Gulf electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020-2029, and based it on data provided by Gulf, primarily their 2017 Ten-Year Site Plan, which was the most recent plan available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized Gulf's summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with Gulf's estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers' baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA's recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for

each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on Gulf rate class load shares and intensities.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Gulf rate class load share is based on average per customer.
  - Nexant made conversions to usage estimates generated by applying utility-provided residential saturation surveys (RSS) and EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on Gulf rate class load shares, intensities, and EIA CBECS data.
- Segment data from EIA and Gulf.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA CBECS and end-use forecasts from Gulf.

Industrial sector:

- The disaggregation was based on rate class load shares, intensities, and EIA MECS data.
- Segment data from EIA and Gulf.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA MECS and end-use forecasts from Gulf.

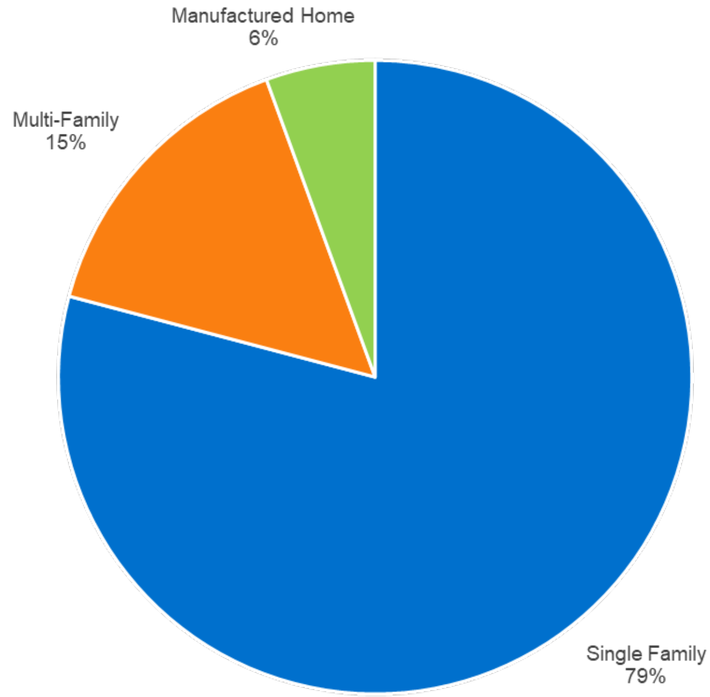
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. Gulf provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential customers, but the overall logic was consistent with the concept of expressing the customers in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I customers using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2 and Figure 3-3.

Figure 3-2: Commercial Customer Segmentation

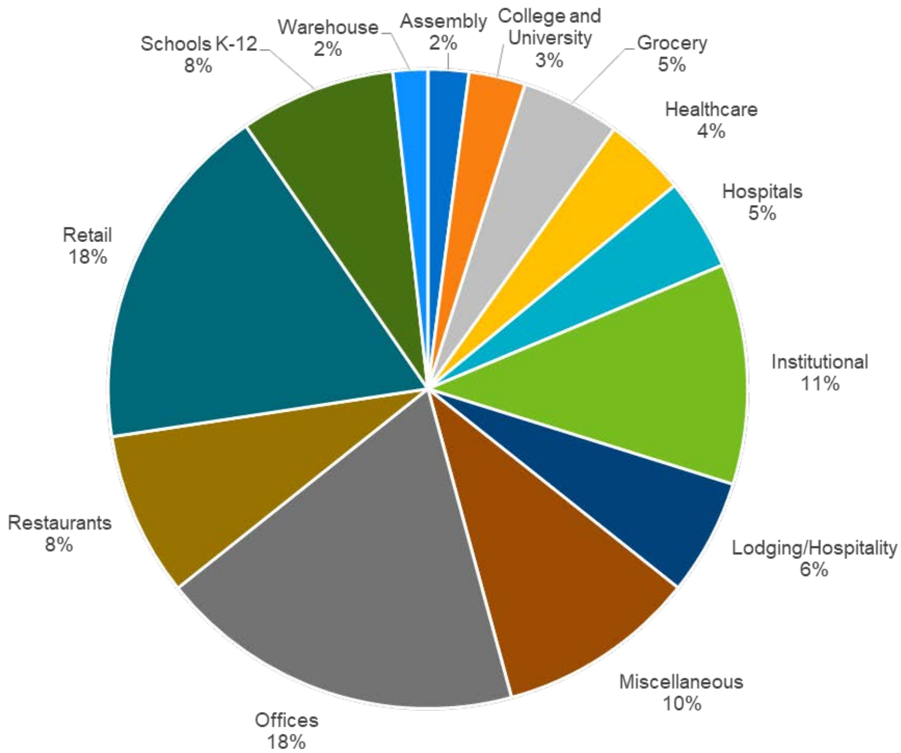
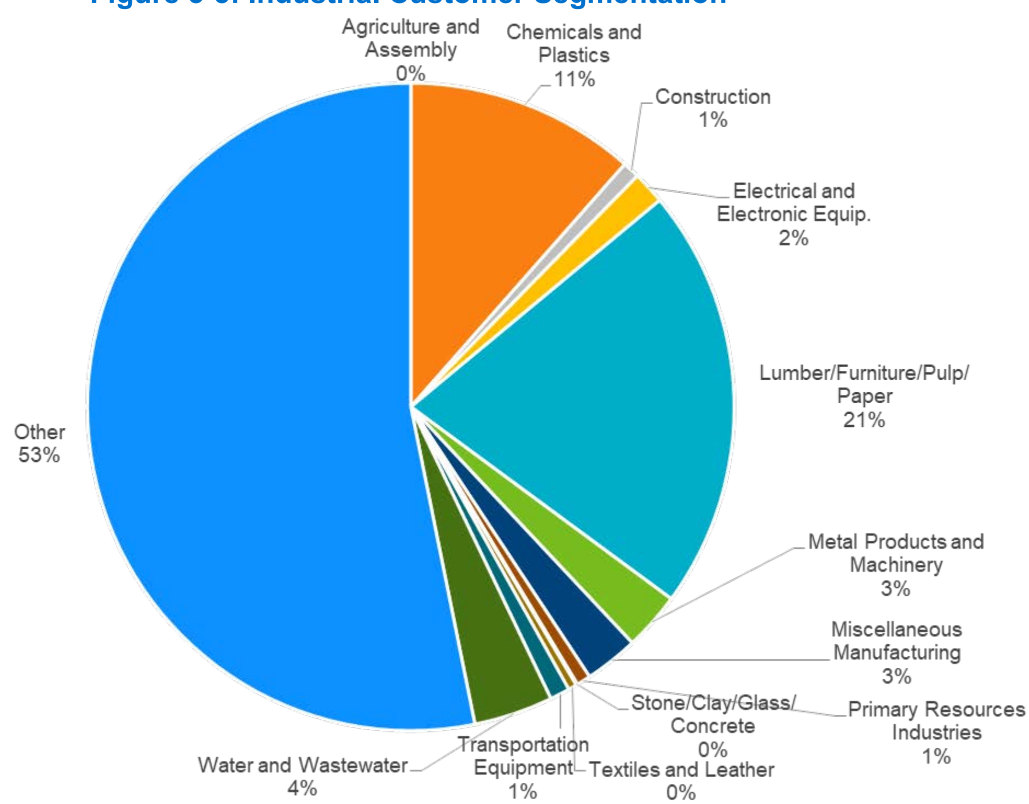


Figure 3-3: Industrial Customer Segmentation



3.2.3 Commercial and Industrial Customers (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD)[3] and Large Power Service (LP) tariff. Nexant further segmented these two groups based on customer size. For small C&I segmentation was determined using annual customer consumption and for large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by Gulf.

Table 3-3 shows the account breakout between small C&I and large C&I.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Customer Size	Number of Accounts
Small C&I	0-15,000 kWh	22,217
	15,001-25,000 kWh	4,443
	25,001-50,000 kWh	2,613
	50,001 kWh +	423
	Total	29,696
Large C&I	0-50 kW	9,686
	51-300 kW	4,903
	301-500 kW	462
	501 kW +	158
	Total	15,209

3.3 Analysis of System Load

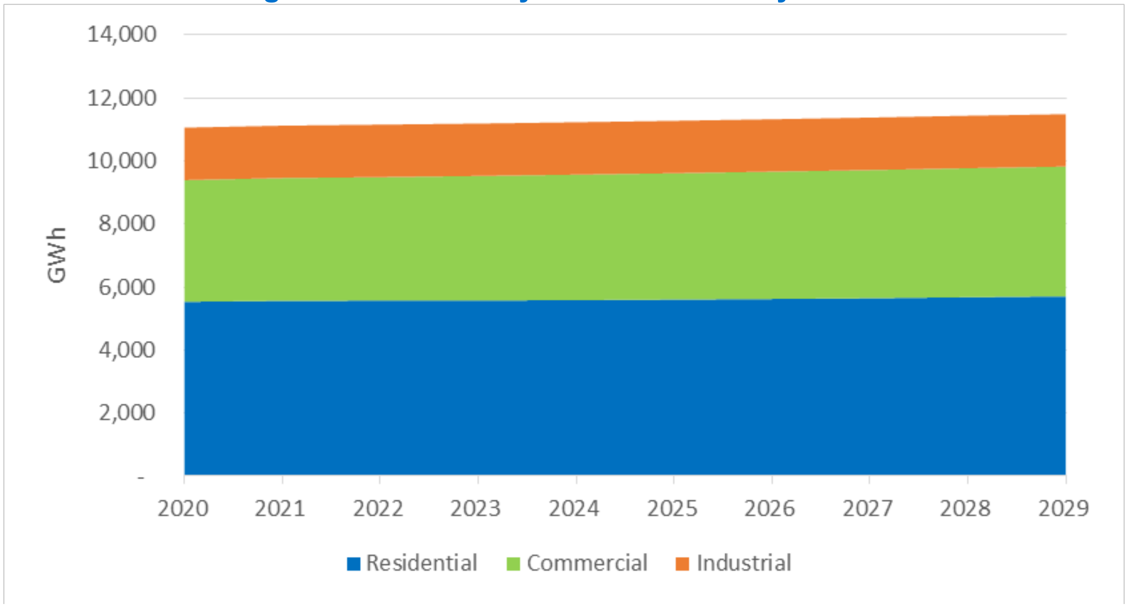
3.3.1 System Energy Sales

While the technical and economic potential are based on the year 2020's system load forecast[4], achievable potential is applied over the entire 10-year study period (2020-2029). Figure 3-4 summarizes the electric sales forecast by sector over the study period.

[3] To be eligible, customers cannot have demand less than 25 kW.

[4] From Gulf's 2017 Ten Year Site Plan

Figure 3-4: Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine when DR would be cost-effective to implement, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when DR resources will be needed was the historical system load for Gulf. The data provided contained the system loads for all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For the FEECA Utilities the summer peaking conditions were defined as July and August from 4:00-5:00 PM and the winter peaking conditions were defined as January from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are illustrated in Figure 3-5, Figure 3-6 and Figure 3-7.

Figure 3-5: Residential Baseline (2020) Energy Sales by End-Use

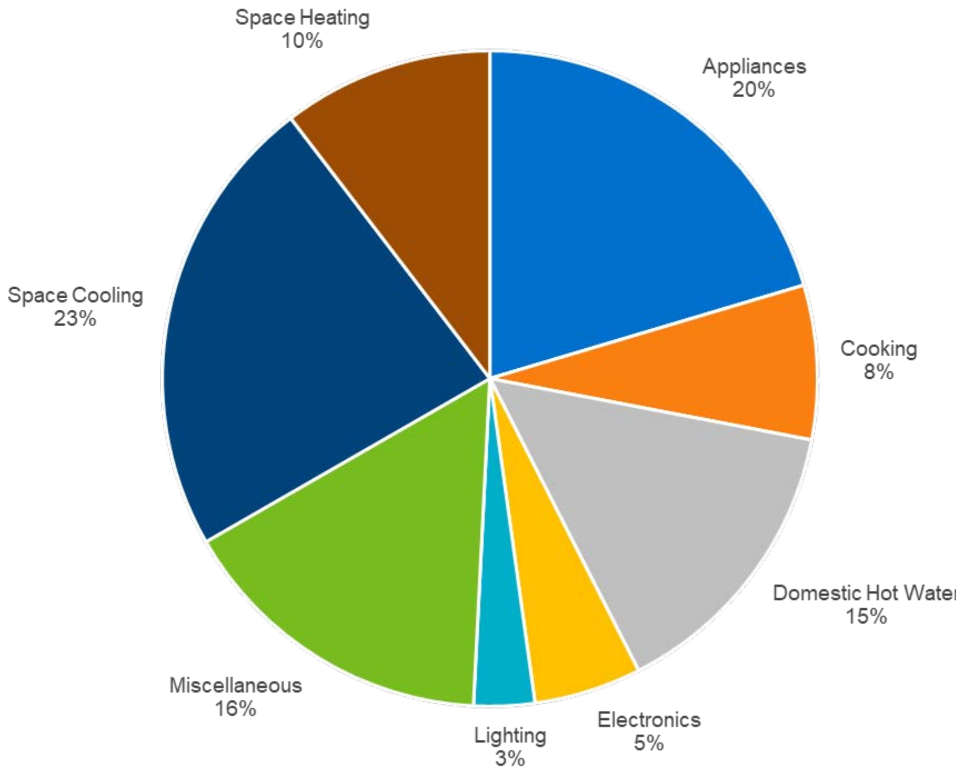


Figure 3-6: Commercial Baseline (2020) Energy Sales by End-Use

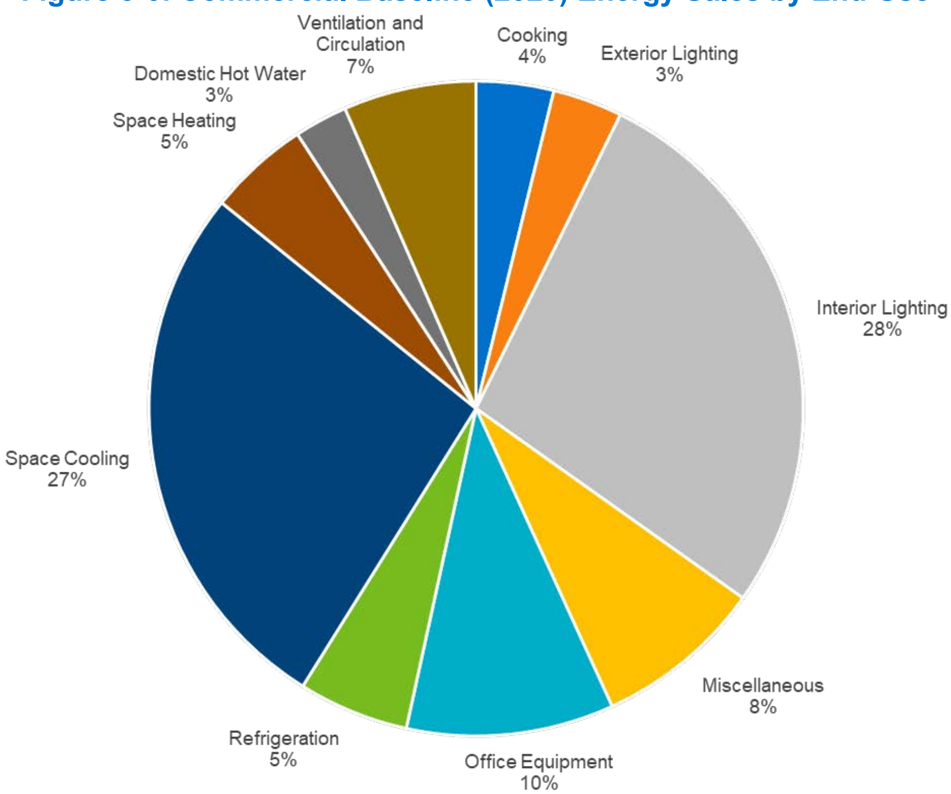
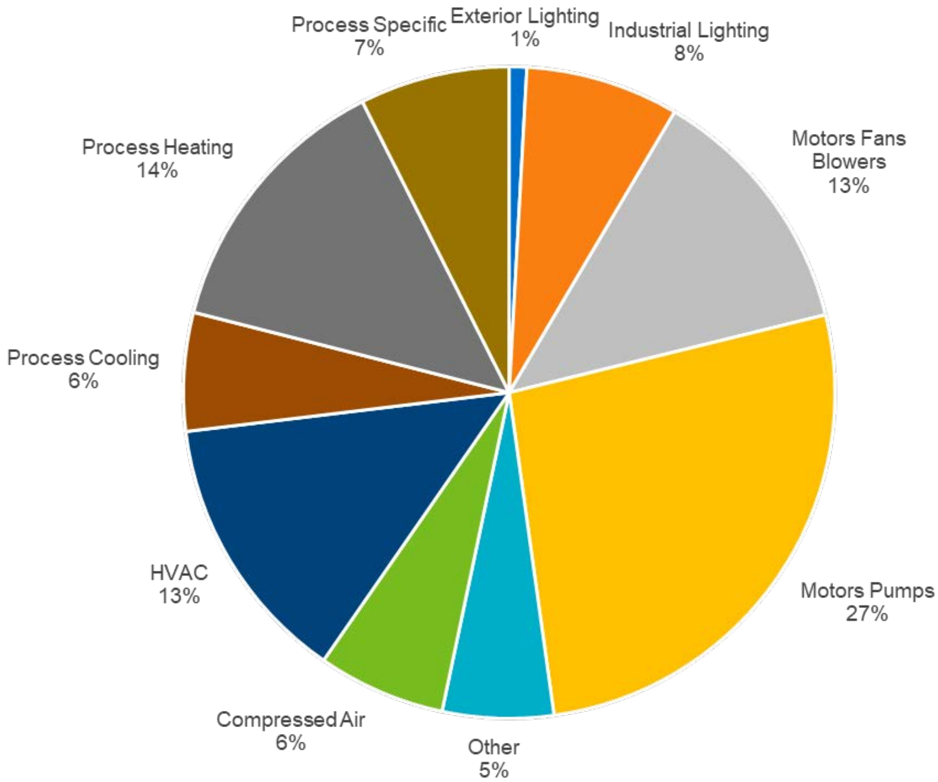


Figure 3-7: Industrial Baseline (2020) Energy Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar market potential studies conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to the residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[1]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations

[1] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.
- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used was primarily derived from data in current regional and national databases, as well as Gulf's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,186 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[2]	30	342

[2] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix A.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) with Technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.,* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or a rate discount for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed.

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end-uses estimated for technical potential. Individual measures were only considered for economic and achievable potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[3].

[3] This study did not include ground-mounted or utility-scale solar PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged from PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover technologies used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of the commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as a single numerical value for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Number of Households × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Stock Sq. Footage by Segment × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with Gulf's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I customers generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8,760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For Gulf, Nexant examined three residential segments based on customer housing type, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 11 different customer segments.

Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the

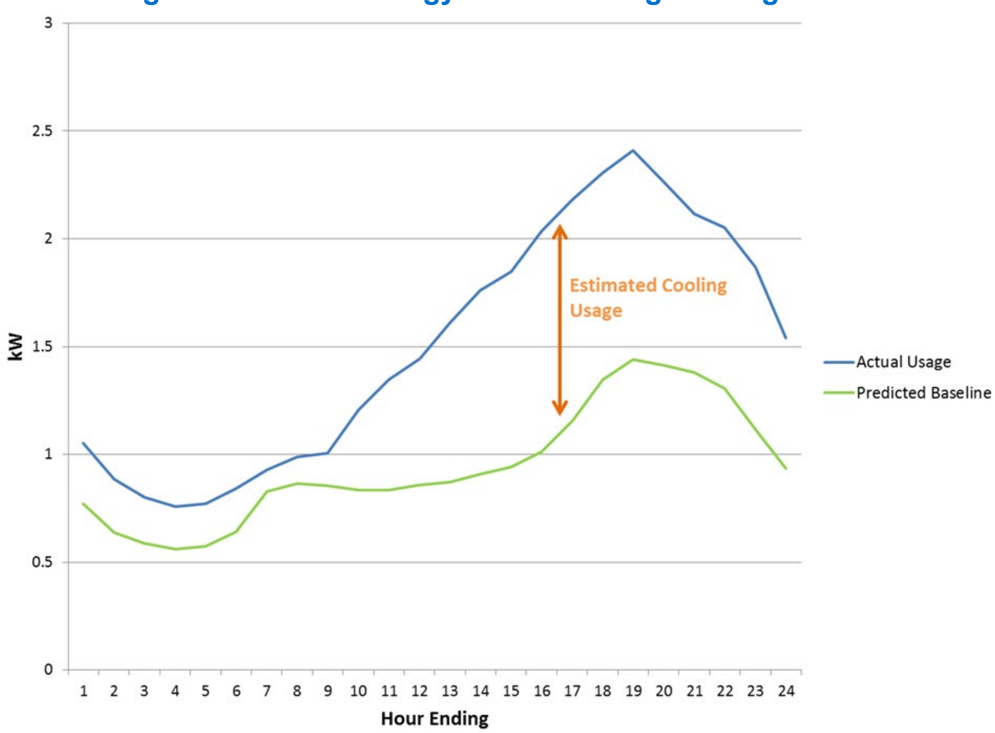
summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

AC and heating load profiles were generated for residential and small C&I customers using a sample of customers provided by Gulf. This sample included a customer breakout based on size and housing type for each rate class. Nexant then used the interval data from these customers to create an average load profile for each customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the seven different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are July and August from 4:00-5:00 PM for summer, and January from 7:00-8:00 AM for winter.

For technical potential, there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads. Individual measures are only considered for economic and achievable potential.

In order to account for existing Gulf DR programs, all customers currently enrolled in a DR offering were excluded from Gulf's technical potential. This methodology was consistent across all three sectors.

5.1.3 DSRE Technical Potential

5.1.3.1 PV Systems

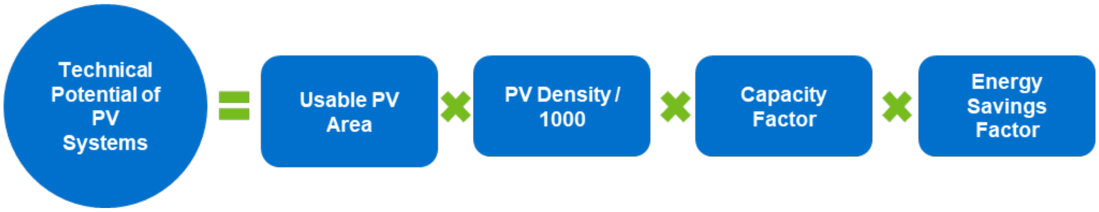
To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[8], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

[8] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Equation 5-3: Core Equation for Solar Technical Potential



Where:

Usable PV Area for Residential: (Total Floor Area[9] / Average No. of Stories[10]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[11] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PVWatts. Energy Savings Factor = Alternating Current System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

[9] Utility-provided data and US Census, South Region

[10] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[11] Floor space = based on utility data. Average floors by building type = CBECS, South Atlantic Region

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery systems do create the opportunity to store energy during period when the PV system is generating more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for "solar plus storage" systems, our methodology consisted of the following steps:

- Develop an 8,760 hour annual load shape for a PV system based on estimated annual hours of available sunlight.
- Compare the PV generation with a total home or total business 8,760 hour annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.
- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers' thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore, results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
    - For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could

impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	391	199	1,464
Non-Residential	231	129	1,105
Total	621	328	2,568

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 illustrates the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Energy Savings)

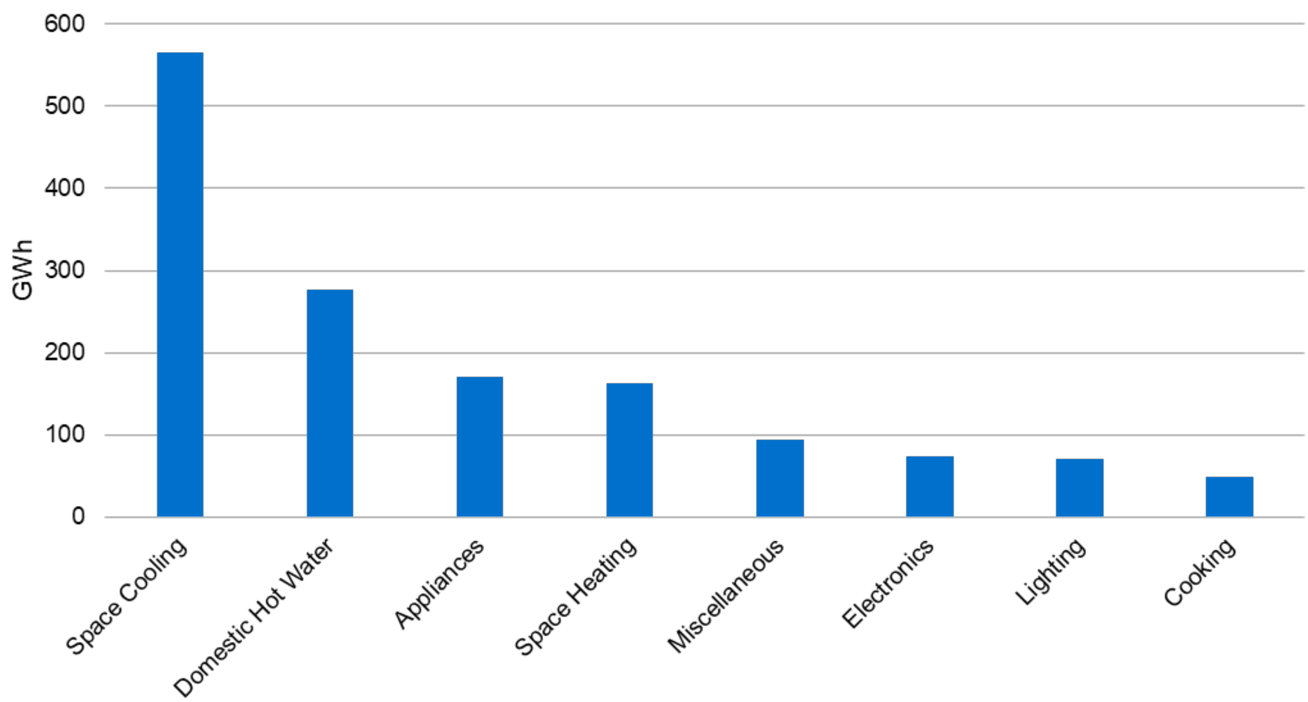


Figure 5-3: Residential EE Technical Potential by End-Use (Summer Peak Savings)

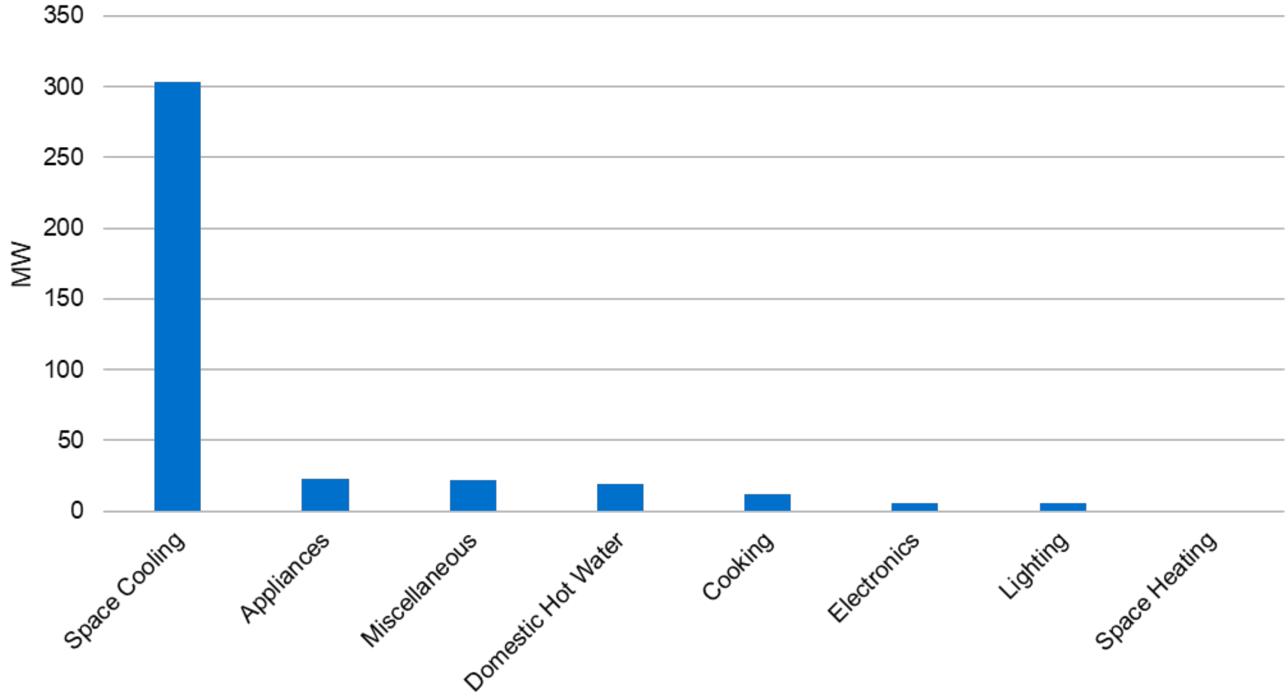
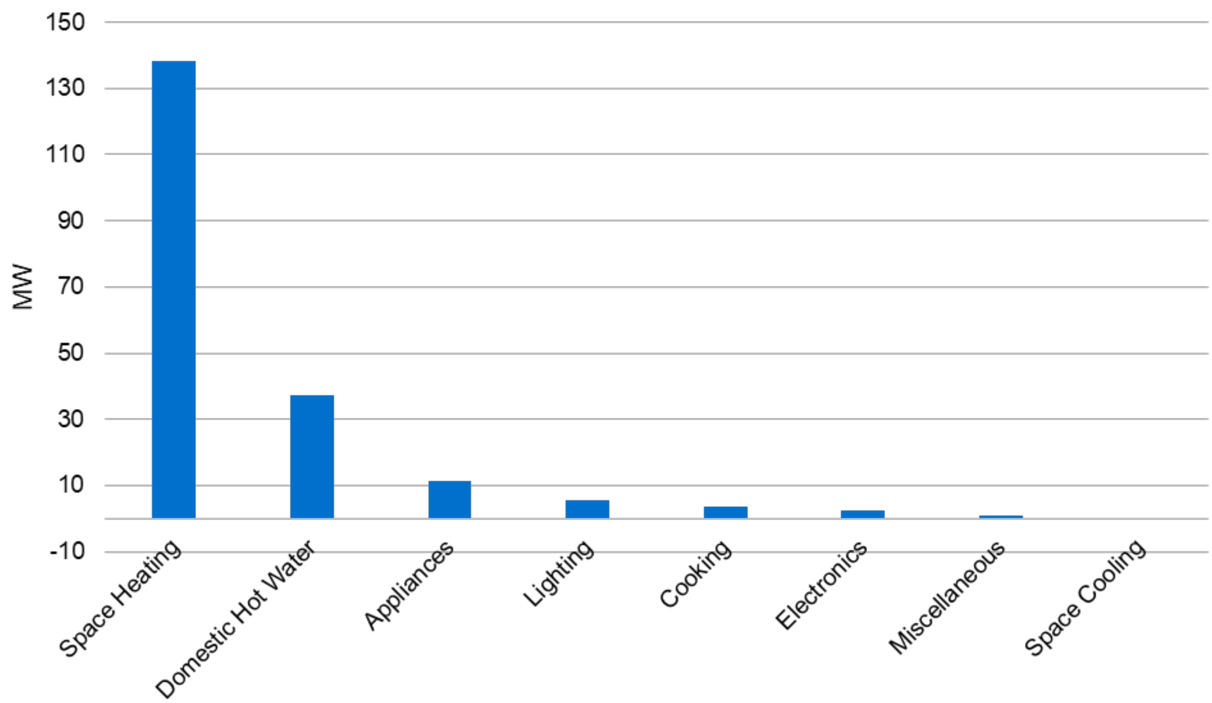


Figure 5-4: Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3 Non-Residential

5.2.3.1 Commercial Segments

Figure 5-5, Figure 5-6, and Figure 5-7 illustrates the commercial sector EE technical potential by end-use.

Figure 5-5: Commercial EE Technical Potential by End-Use (Energy Savings)

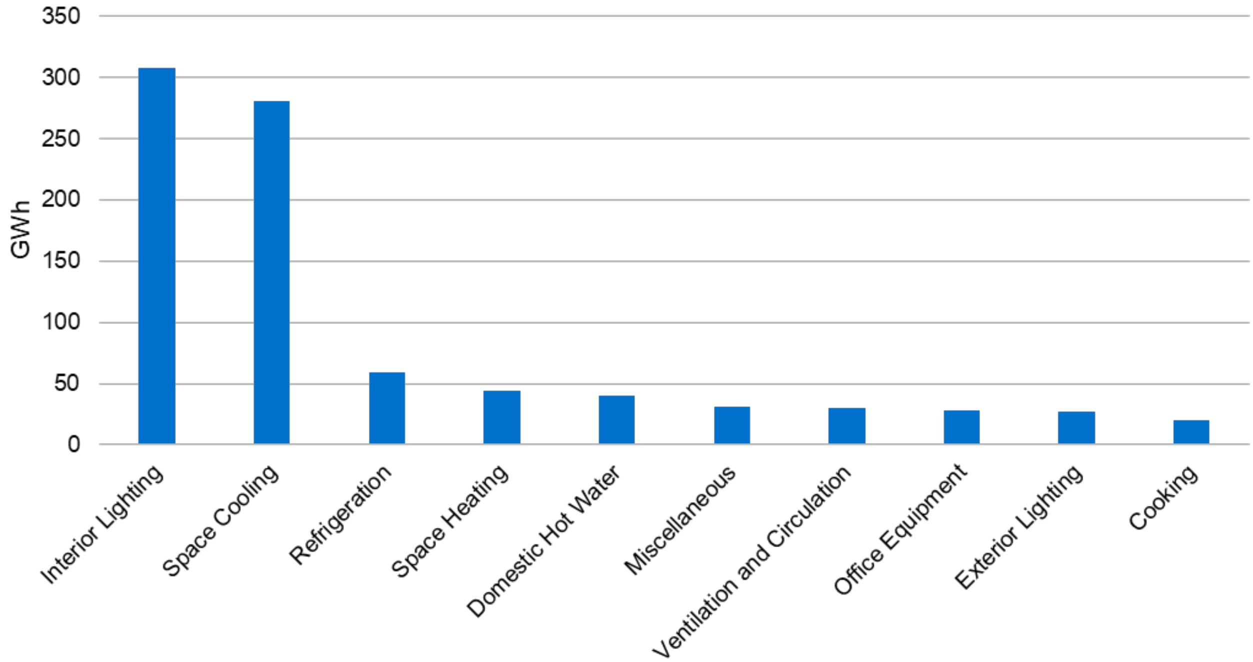


Figure 5-6: Commercial EE Technical Potential by End-Use (Summer Peak Savings)

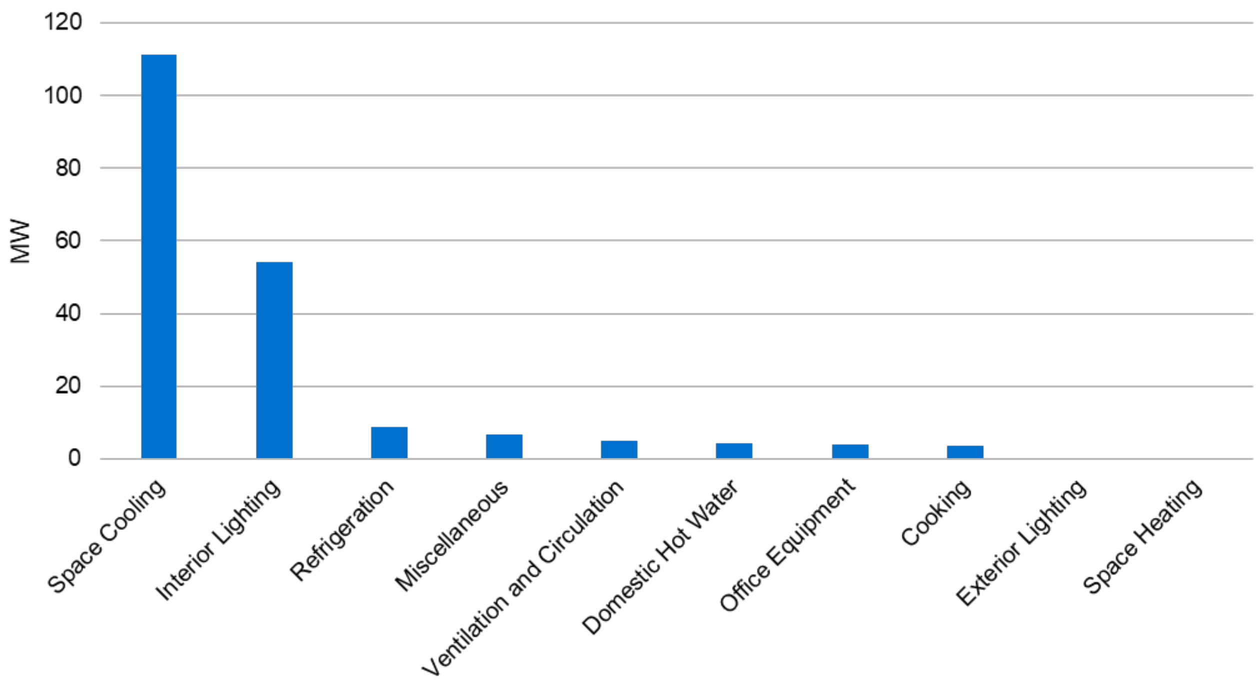
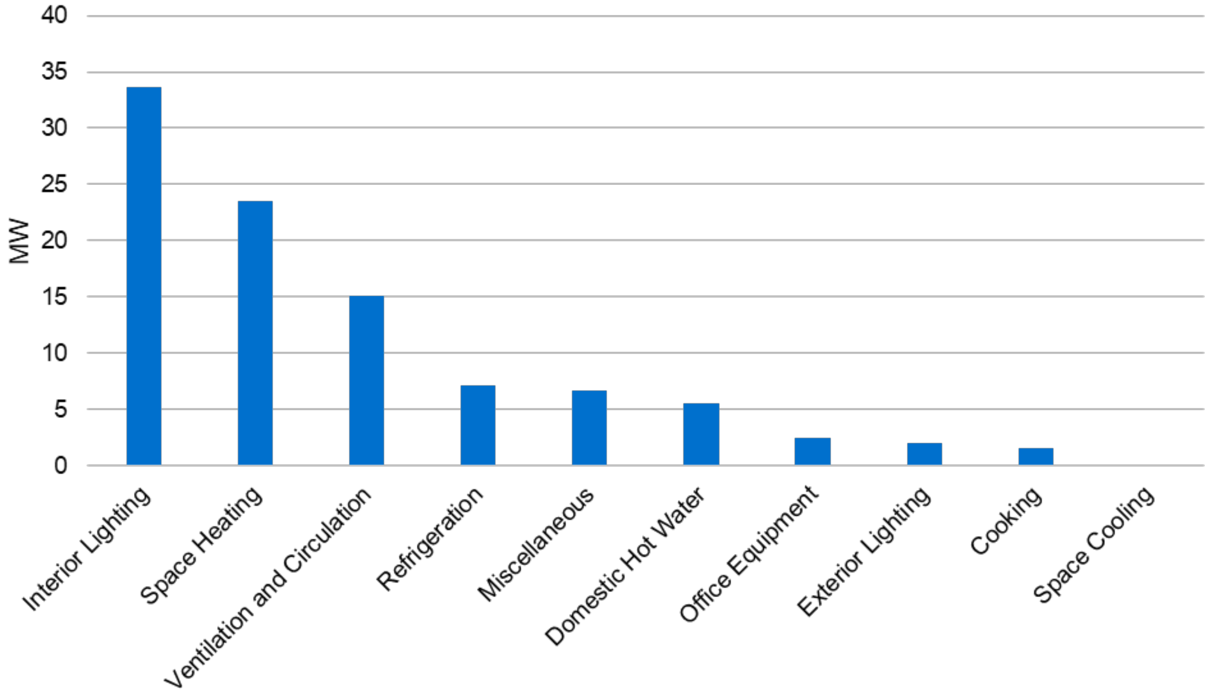


Figure 5-7: Commercial EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3.2 Industrial Segments

Figure 5-8, Figure 5-9, and Figure 5-10 illustrates the industrial sector EE technical potential by end-use.

Figure 5-8: Industrial EE Technical Potential by End-Use (Energy Savings)

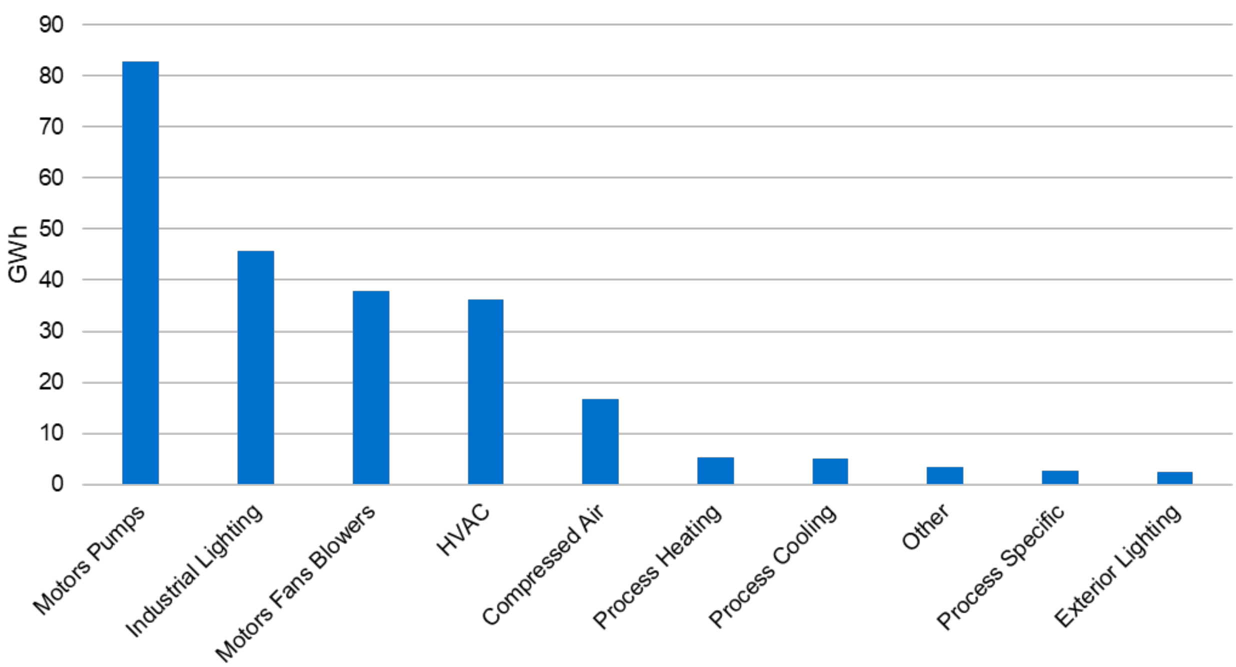


Figure 5-9: Industrial EE Technical Potential by End-Use (Summer Peak Savings)

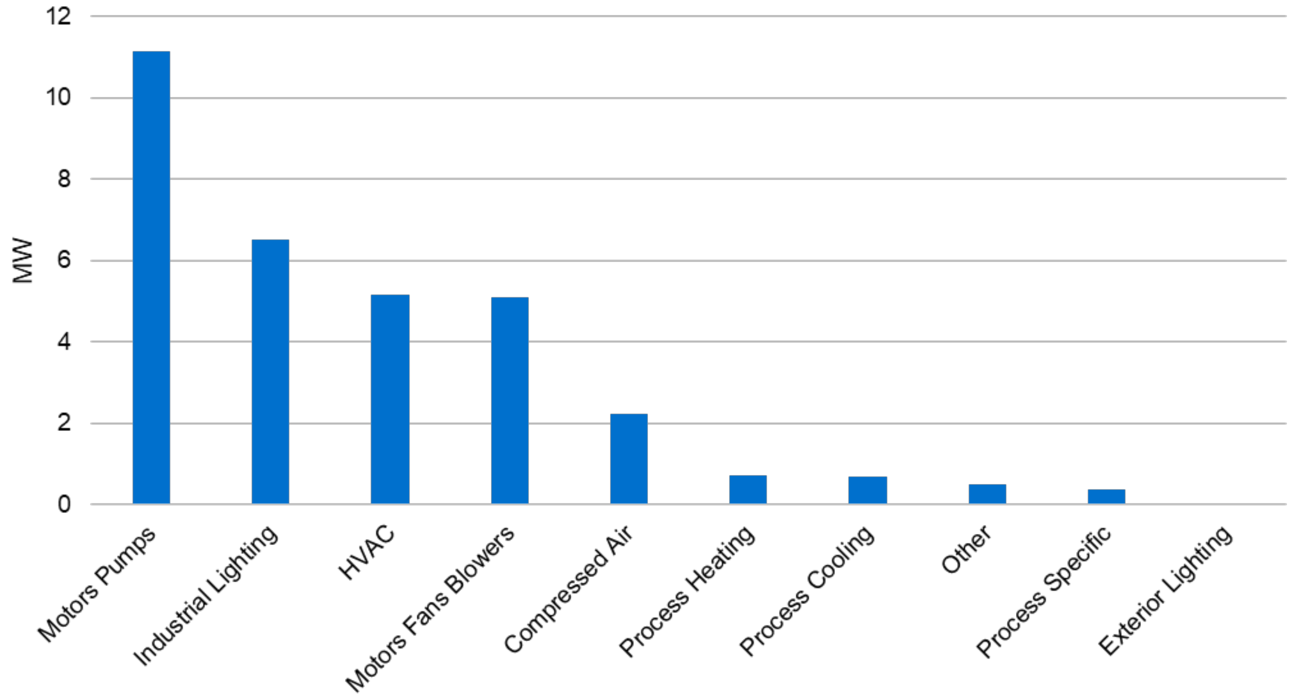
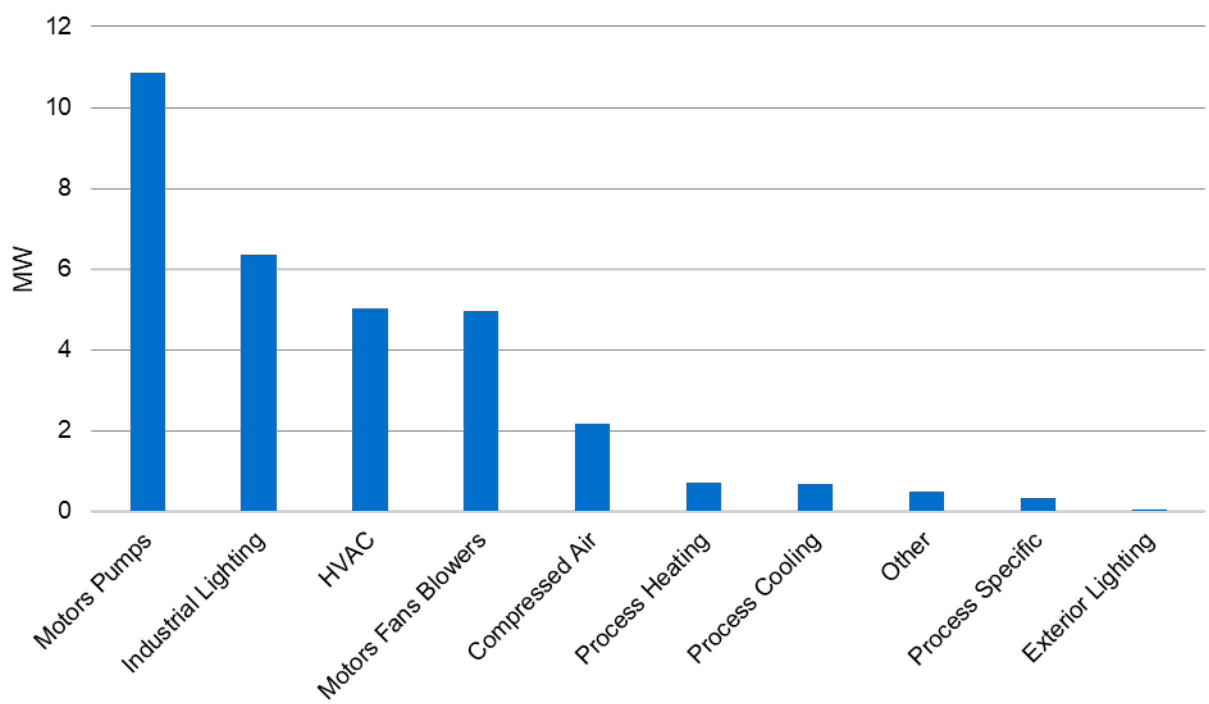


Figure 5-10: Industrial EE Technical Potential by End-Use (Winter Peak Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in Gulf's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

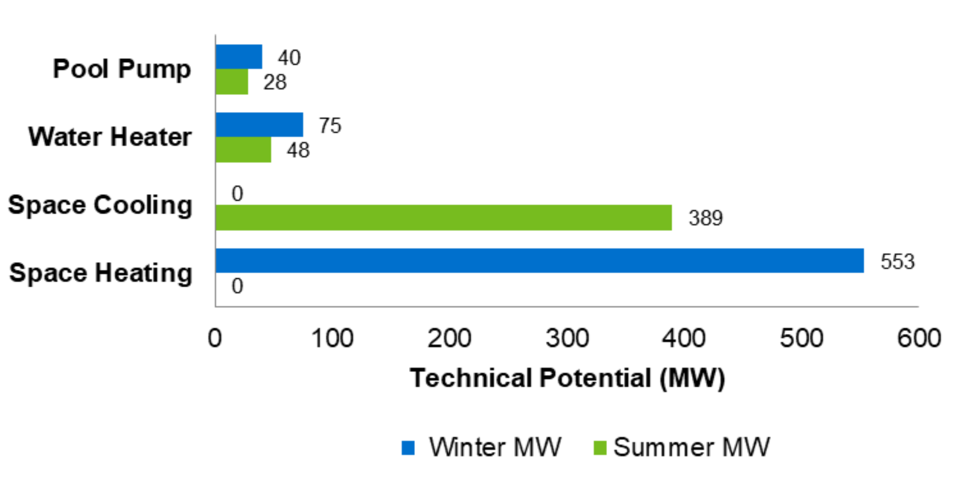
Table 5-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	465	667
Non-Residential	493	430
Total	958	1,098

5.3.1 Residential

Residential technical potential is summarized in Figure 5-11.

Figure 5-11: Residential DR Technical Potential by End-Use[12]

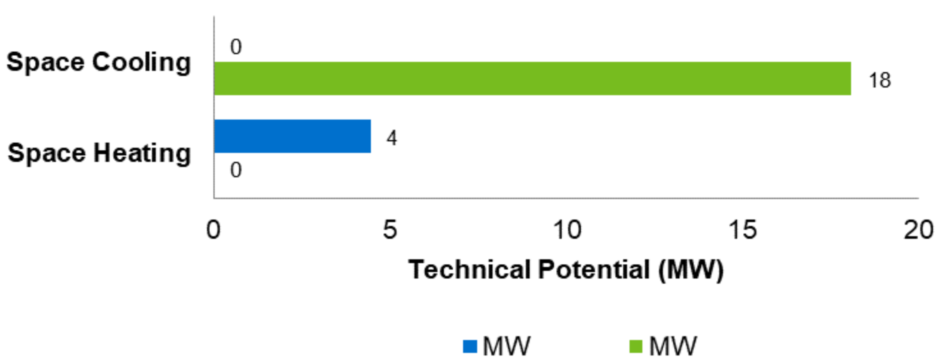


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential, Nexant looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-12.

Figure 5-12: Small C&I DR Technical Potential by End-Use[13]



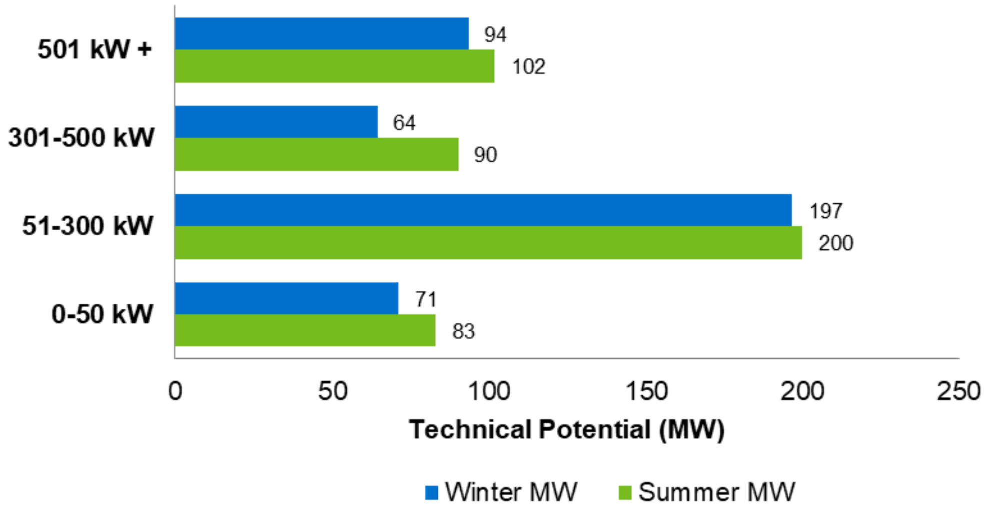
5.3.2.2 Large C&I Customers

Figure 5-13 provides the technical potential for large C&I customers, broken down by customer size.

[12] All currently enrolled DR customers are excluded

[13] All currently enrolled DR customers are excluded

Figure 5-13: Large C&I DR Technical Potential by Segment[14]



[14] All currently enrolled DR customers are excluded

5.4 DSRE Technical Potential

Table 5-3 section the results of the DSRE technical potential for each customer segment.

Table 5-3: DSRE Technical Potential[15]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	24	104	2,072
Non-Residential	111	48	952
Total	135	151	3,024
Battery Storage from PV Systems			
Residential	65	222	-
Non-Residential	-	-	-
Total	65	222	-
CHP Systems			
Total	252	99	1,243

[15] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

6 Economic Potential

The economic potential scenario estimates the savings potential when all technically feasible DSM measures that are cost-effective to implement are applied at their full market potential (*i.e.* 100% adoption rate). The economic potential was the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

6.1 DSM Cost-Effective Screening Criteria

6.1.1 Cost-Effectiveness Test Perspectives

When analyzing DSM measures, different cost-effectiveness tests are considered to reflect the perspectives of different stakeholders. The Ratepayer Impact Measure ("RIM") addresses an electric utility customer perspective, which considers the net impact on electric utility rates associated with a measure or program. The Total Resource Cost ("TRC") addresses a societal perspective, which considers costs of DSM measure or program relative to the benefits of avoided utility supply costs. The Participant Cost Test ("PCT") addresses a participant perspective, which considers net benefits to those participating in a DSM program.

Descriptions follow of methods for allocating costs and benefits within each cost-effectiveness indicator (RIM, TRC, and PCT); the calculations remain consistent with the Florida Cost Effectiveness Manual[16].

Table 6-1: Components of Cost-Effectiveness Calculations

Component	Definition
Customer Incremental Costs	All incremental costs incurred by the customer to purchase, install, operate, and maintain a DSM measure
Utility Program Costs	Utility administrative and marketing costs and capital expenditures required to implement a DSM measure
Utility Incentives	Costs provided by the utility to the participant to encourage the purchase, installation, operation, and maintenance of a DSM measure
Utility Supply Costs	Utility costs of supplying electricity to the customer, including generation, transmission, and distribution costs
Electric Bill Impacts	Impacts on a participating customer's electric bill due the installation of a DSM measure
Utility Electric Revenues	Impacts on the utility's electric revenues due to the installation of a DSM measure

[16] Cost Effectiveness Manual for Demand Side Management and Self Service Wheeling Proposals; Florida Public Service Commission, Tallahassee, FL; adopted June 11, 1991.

Table 6-2: Ratepayer Impact Measure (RIM)

Component	Definition
Benefit	Increase in utility electric revenues Decrease in avoided electric utility supply costs
Cost	Decrease in utility electric revenues Increase in avoided electric utility supply costs Utility program costs, if applicable Utility incentives, if applicable

Table 6-3: Total Resource Cost (TRC)

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Increase in electric utility supply costs Customer incremental costs (less any tax incentives) Utility program costs, if applicable

Table 6-4: Participant Cost Test (PCT)

Component	Definition
Benefit	Decrease in electric bill Utility incentives, if applicable
Cost	Increase in electric bill Customer incremental costs (less any tax incentives)

6.1.2 Economic Potential Screening Methodology

Based on discussion with the FEECA Utilities and consistent with prior DSM analyses in Florida, for development of the economic potential, two scenarios were considered, a RIM-scenario and a TRC-scenario, for which the following economic screening process was followed:

- Criteria for RIM Scenario:
  - Achieve a cost-benefit ratio of 1.0 or greater from the RIM perspective. For the economic potential, the RIM benefits included avoided electric utility supply costs, while RIM costs include decreases in utility electric revenues. The economic potential screening did not consider utility incentives or utility program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
- Criteria for TRC Scenario:
  - Achieve a cost-benefit ratio of 1.0 or greater from the TRC perspective. For the economic potential, the TRC benefits included avoided electric utility supply costs,

while TRC costs included customer incremental cost to implement the measure. The economic potential screening did not consider utility DSM program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).

The cost-effectiveness screening described above was applied to each DSM measure permutation based on the installation of the measure in the Base Year (2020) of the study. Therefore, avoided energy cost benefits were applied beginning in Year 1 and extended through the useful life of the measure; avoided generation costs began at the in-service year for new generation based on utility system load forecasts.

6.1.3 Economic Potential Sensitivities

Based on direction from the FEECA Utilities and the Order Establishing Procedure, the economic potential analysis included the following additional sensitivities:

- Sensitivity #1: Higher Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.
- Sensitivity #2: Lower Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast was adjusted to a "low fuel" scenario.
- Sensitivity #3: Baseline for free-ridership sensitivities. For this sensitivity, both the RIM and TRC scenarios were screened as described above, with the addition of utility DSM program costs as a component of the measure's cost-effectiveness. In addition, measures must achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective (utility incentives were not considered for this screening component for economic potential). Measures also must achieve a participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.
- Sensitivity #4: Shorter free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described for Sensitivity #3, but the simple payback screening criteria was reduced to one year or longer.
- Sensitivity #5: Longer free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described for Sensitivity #3, but the simple payback screening criteria was increased to three years or longer.

Each of these sensitivities resulted in a unique set of measures passing the cost-effectiveness criteria for both RIM and TRC scenarios. The economic potential for the passing measures were evaluated in Nexant's TEA-POT model, and the results of the economic sensitivities are provided in Appendix E.

6.2 EE Economic Potential

This section provides the results of the EE economic potential for each sector. Table 6-5 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 6-5: Economic Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	1	1
Commercial	8	142
Industrial	12	152
Total	21	295
TRC SCENARIO		
Residential	44	233
Commercial	90	2,032
Industrial	29	734
Total	163	2,999

6.2.1 Summary

Table 6-6 summarizes the EE economic potential by sector and by scenario (RIM and TRC):

Table 6-6: EE Economic Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	3	4
Non-Residential	75	36	110
Total	75	39	114
TRC SCENARIO			
Residential	182	173	836
Non-Residential	167	124	926
Total	348	297	1,762

6.2.2 Residential – RIM Scenario

Figure 6-1, Figure 6-2, and Figure 6-3 illustrate the residential EE economic potential by end-use for the RIM scenario.

Figure 6-1: Residential EE Economic Potential by End-Use – RIM Scenario (Energy Savings)

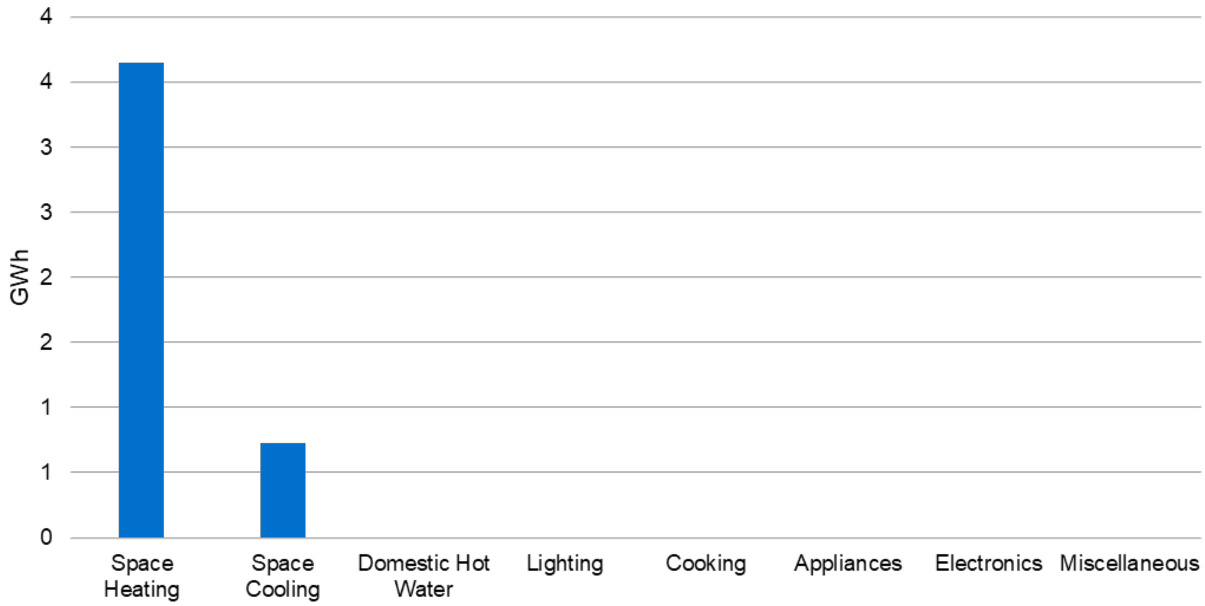


Figure 6-2: Residential EE Economic Potential by End-Use - RIM Scenario (Summer Peak Savings)

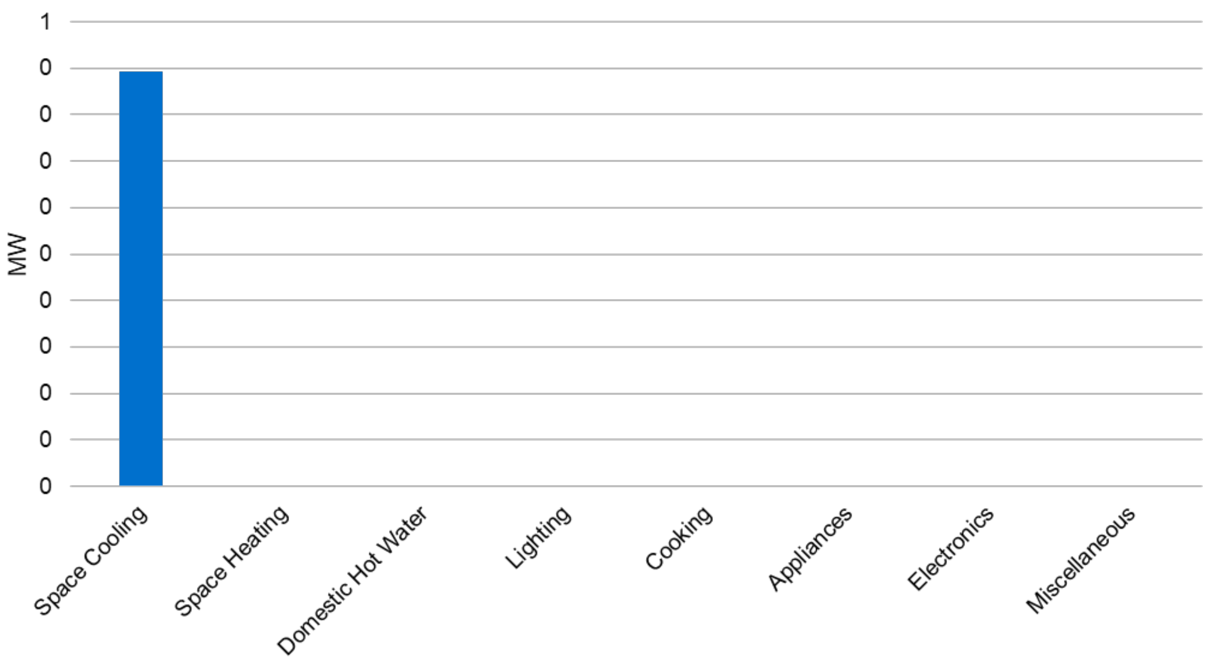
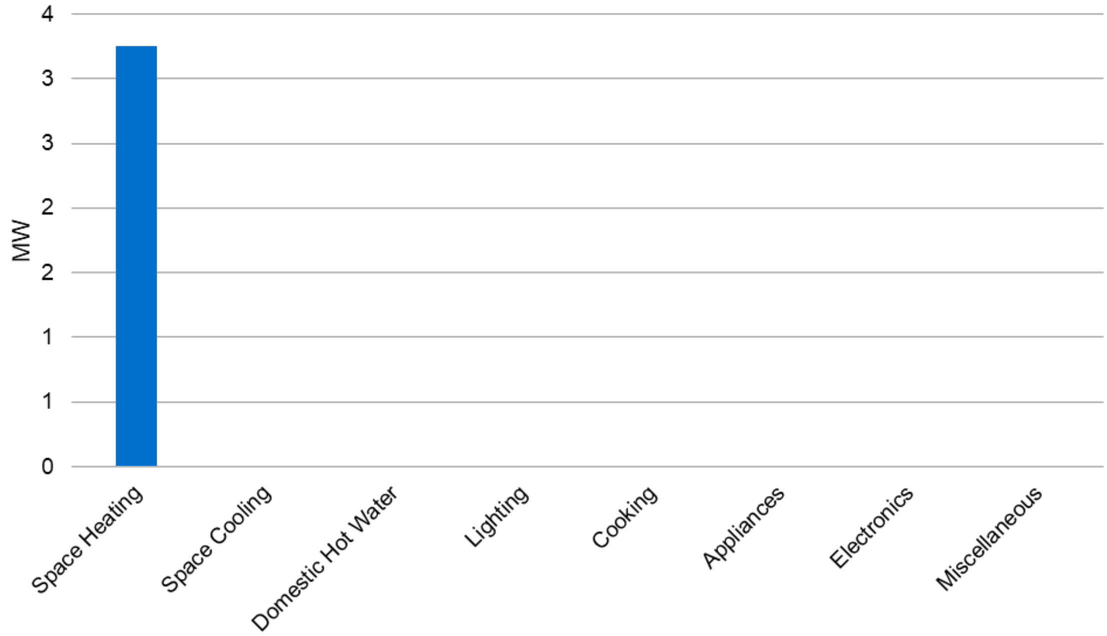


Figure 6-3: Residential EE Economic Potential by End-Use (Winter Peak Savings) - RIM Scenario



6.2.3 Non-Residential – RIM Scenario

6.2.3.1 Commercial Segments

Figure 6-4, Figure 6-5, and Figure 6-6 illustrate the commercial EE economic potential by end-use for the RIM scenario.

Figure 6-4: Commercial EE Economic Potential by End-Use (Energy Savings) – RIM Scenario

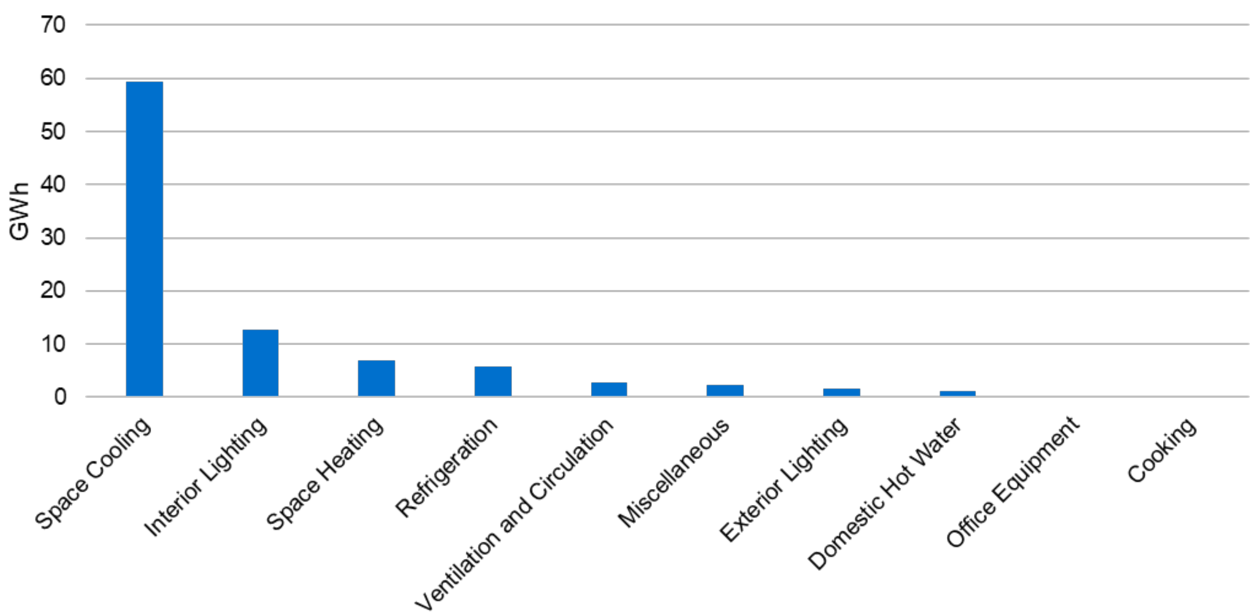


Figure 6-5: Commercial EE Economic Potential by End-Use (Summer Peak Savings) – RIM Scenario

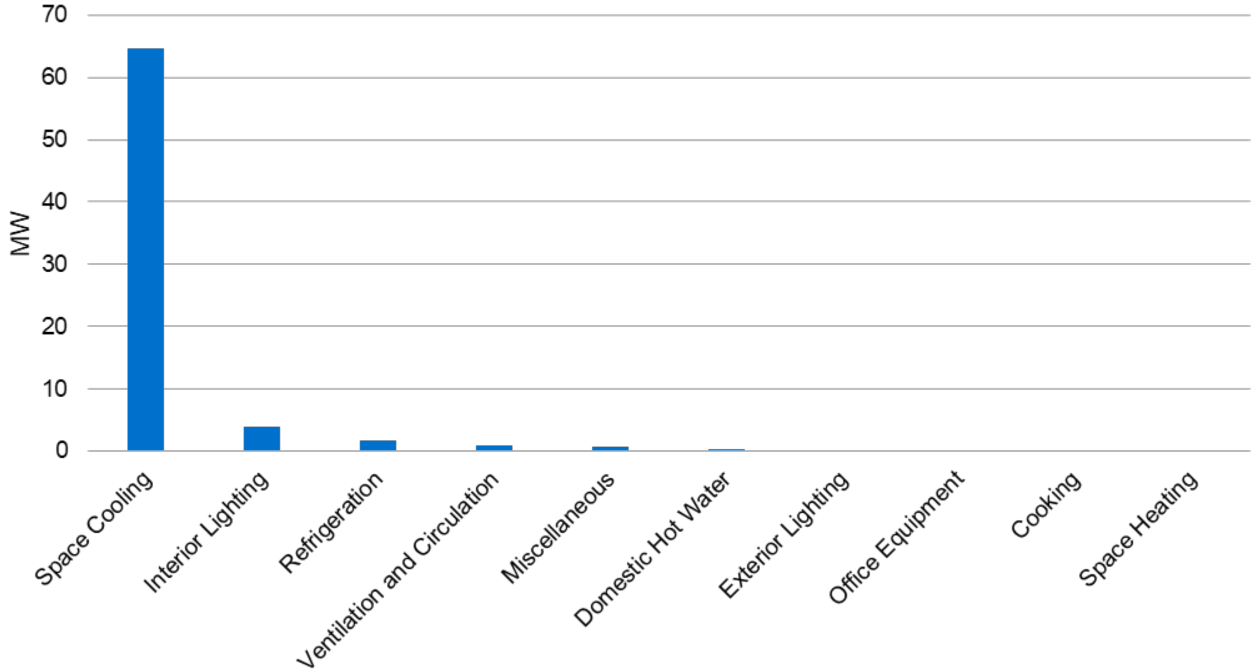
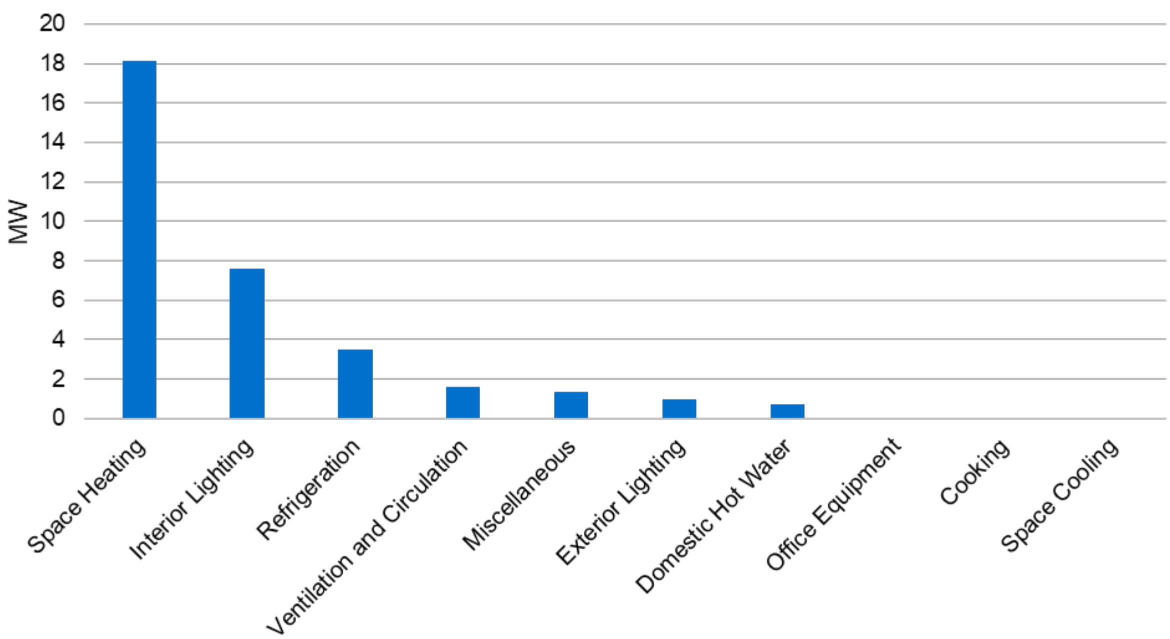


Figure 6-6: Commercial EE Economic Potential by End-Use (Winter Peak Savings) – RIM Scenario



6.2.3.2 Industrial Segments

Figure 6-7, Figure 6-8, and Figure 6-9 illustrate the industrial EE economic potential by end-use for the RIM scenario.

Figure 6-7: Industrial EE Economic Potential by End-Use (Energy Savings) – RIM Scenario

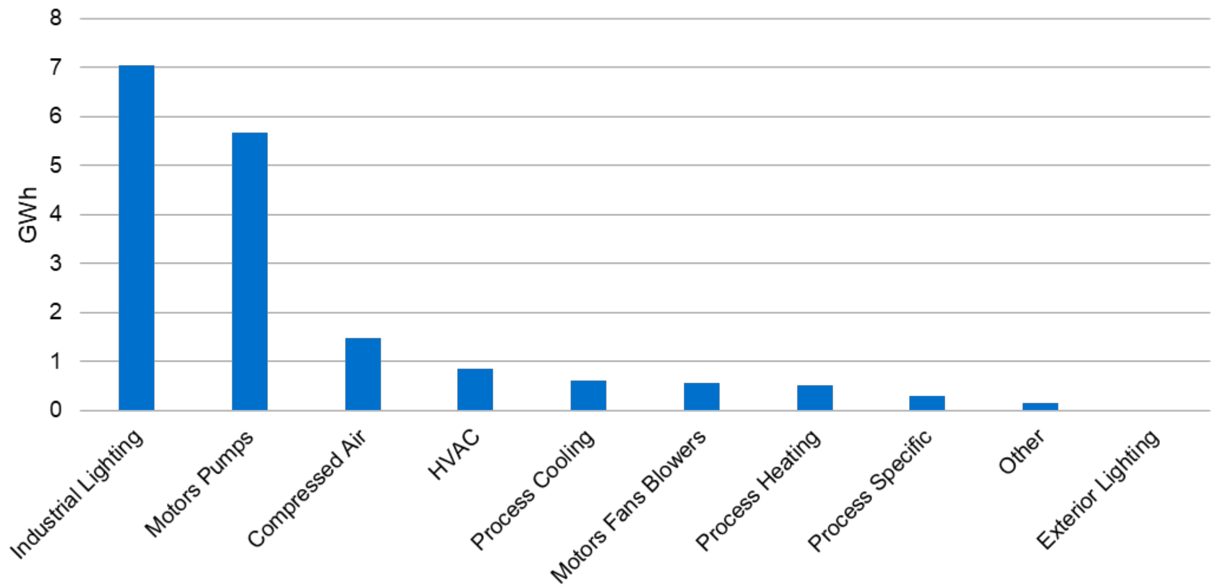


Figure 6-8: Industrial EE Economic Potential by End-Use (Summer Peak Savings) – RIM Scenario

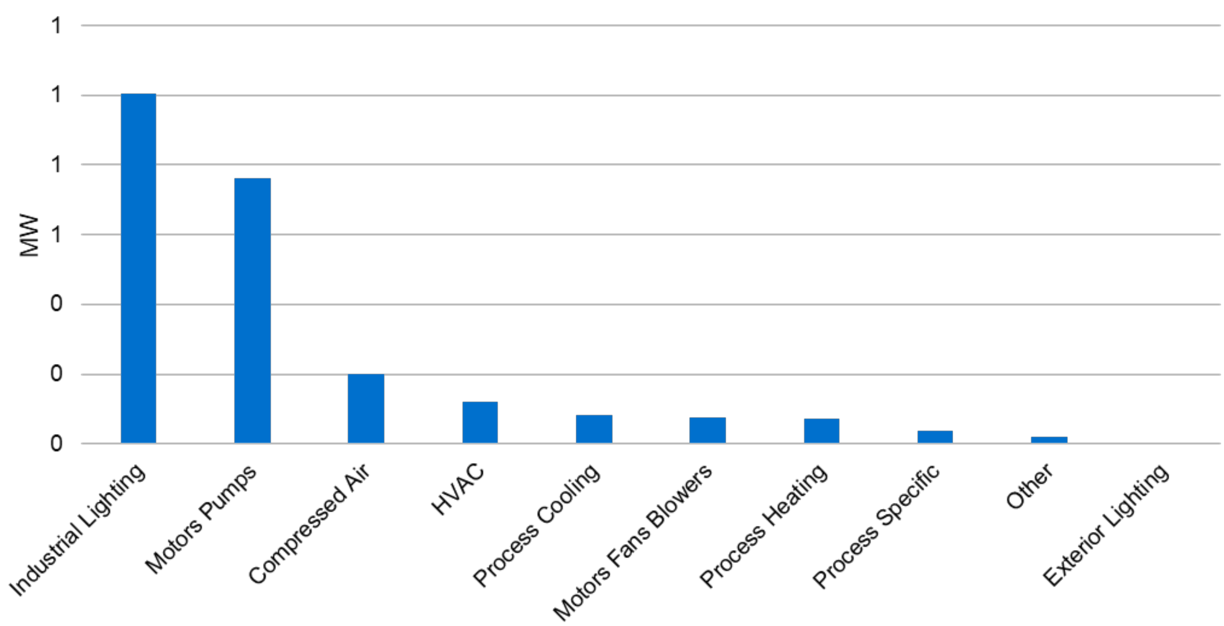
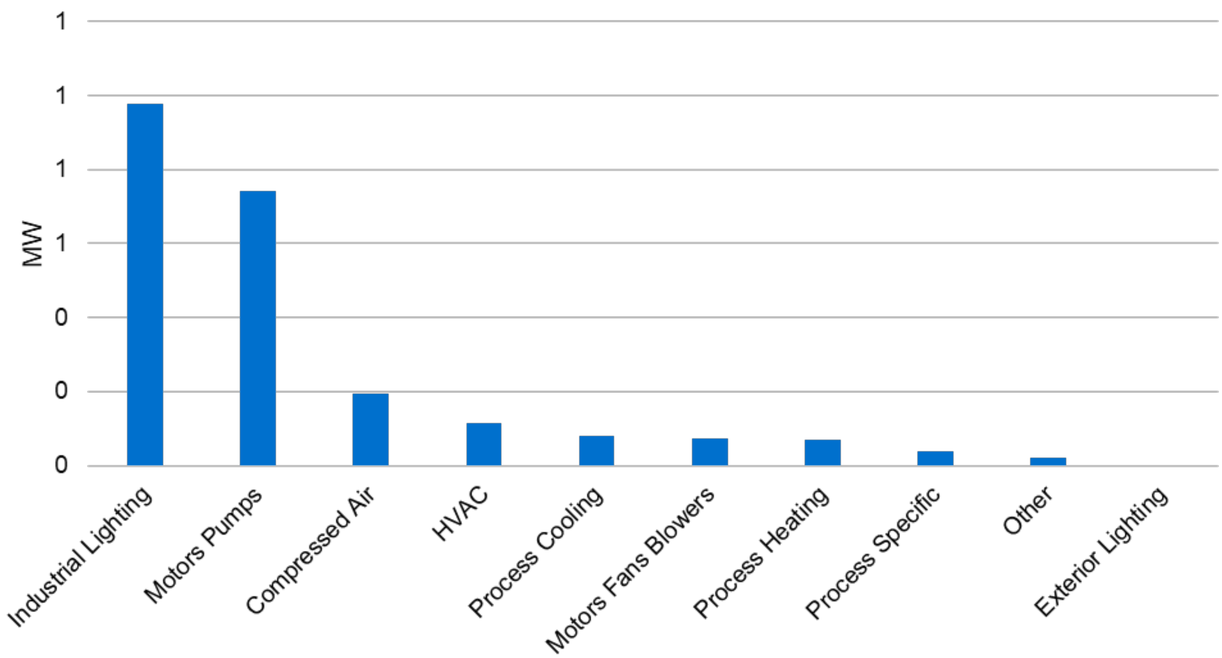


Figure 6-9: Industrial EE Economic Potential by End-Use (Winter Peak Savings) – RIM Scenario



6.2.4 Residential – TRC Scenario

Figure 6-10, Figure 6-11, and Figure 6-12 illustrate the residential EE economic potential by end-use for the TRC scenario.

Figure 6-10: Residential EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

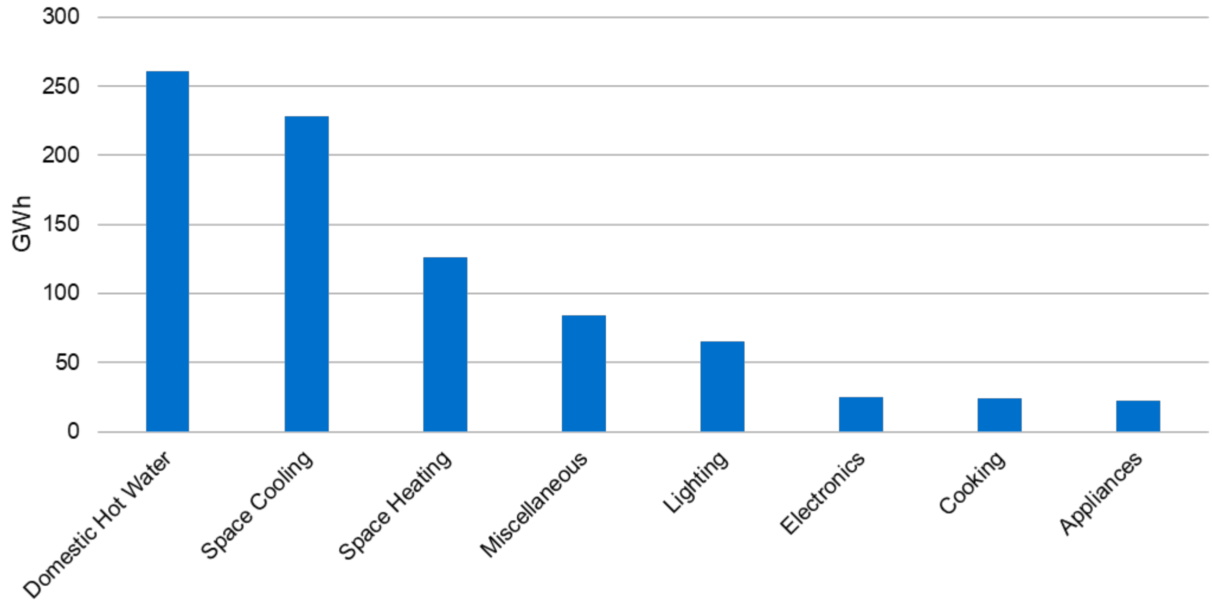


Figure 6-11: Residential EE Economic Potential by End-Use (Summer Peak Savings) - TRC Scenario

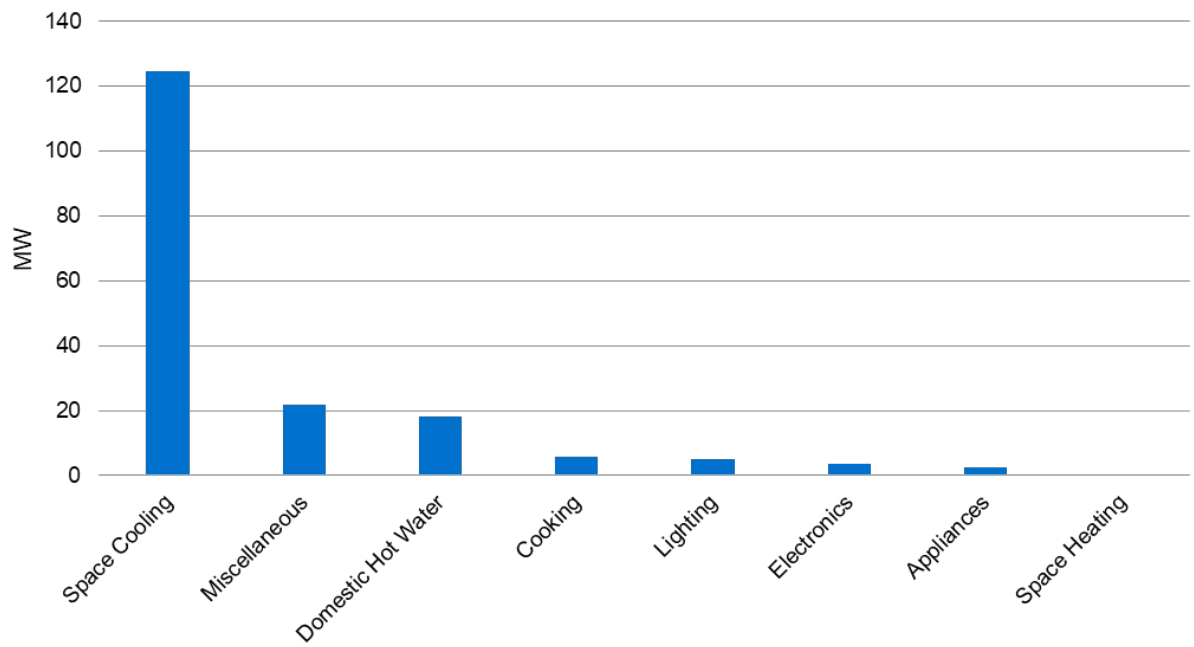
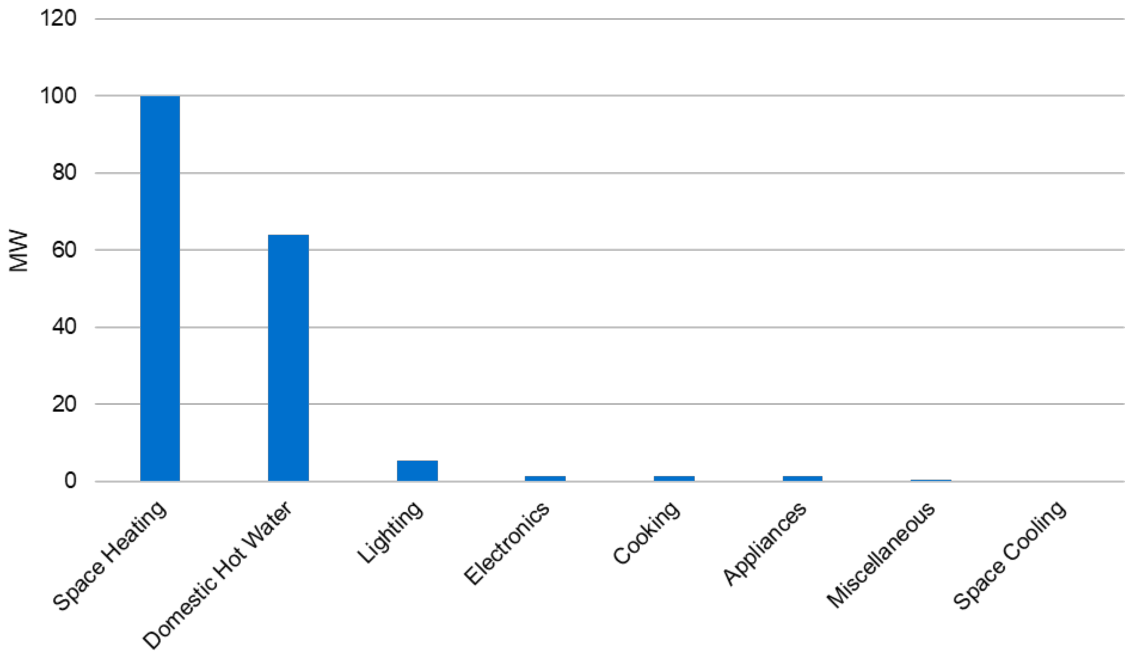


Figure 6-12: Residential EE Economic Potential by End-Use (Winter Peak Savings) - TRC Scenario



6.2.5 Non-Residential – TRC Scenario

6.2.5.1 Commercial Segments

Figure 6-13, Figure 6-14, and Figure 6-15 illustrate the commercial EE economic potential by end-use for the TRC scenario.

Figure 6-13: Commercial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

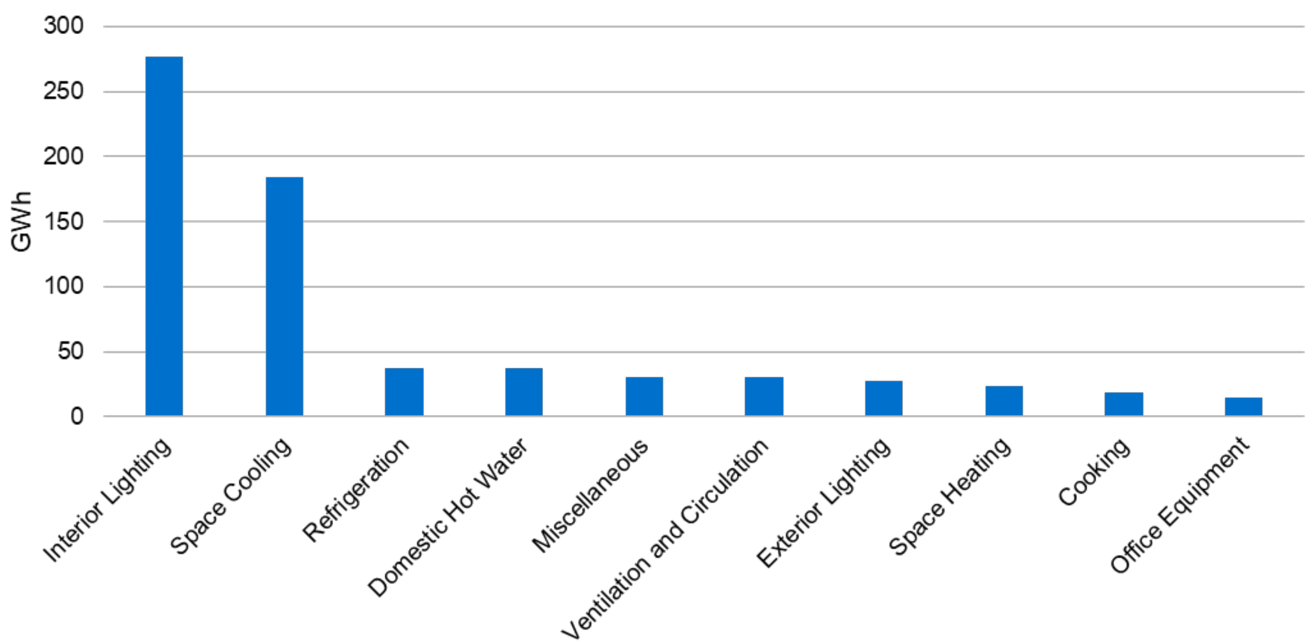


Figure 6-14: Commercial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

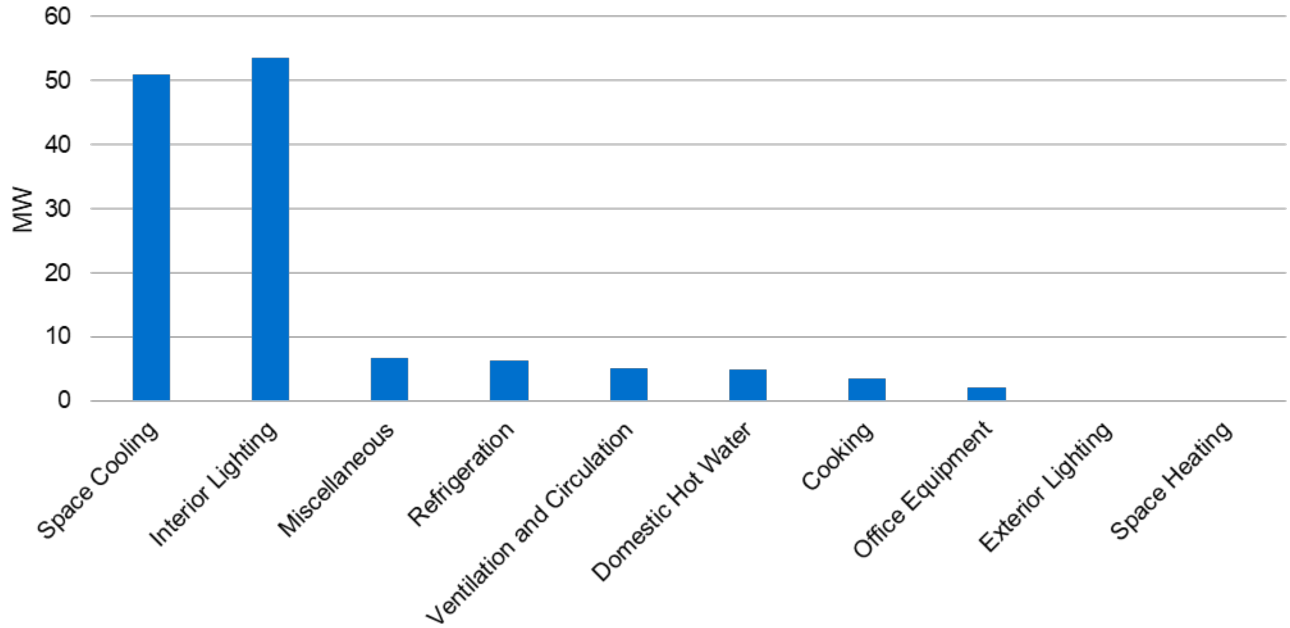
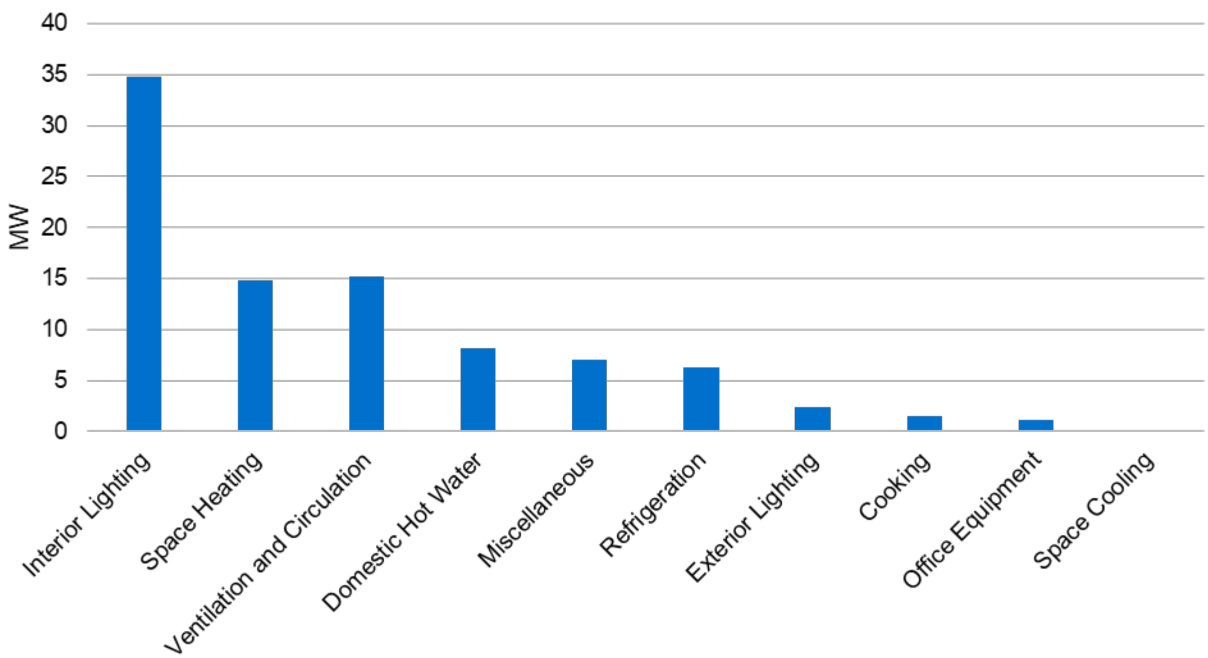


Figure 6-15: Commercial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.2.5.2 Industrial Segments

Figure 6-16, Figure 6-17 and Figure 6-18 illustrate the industrial EE economic potential by end-use for the TRC scenario.

Figure 6-16: Industrial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

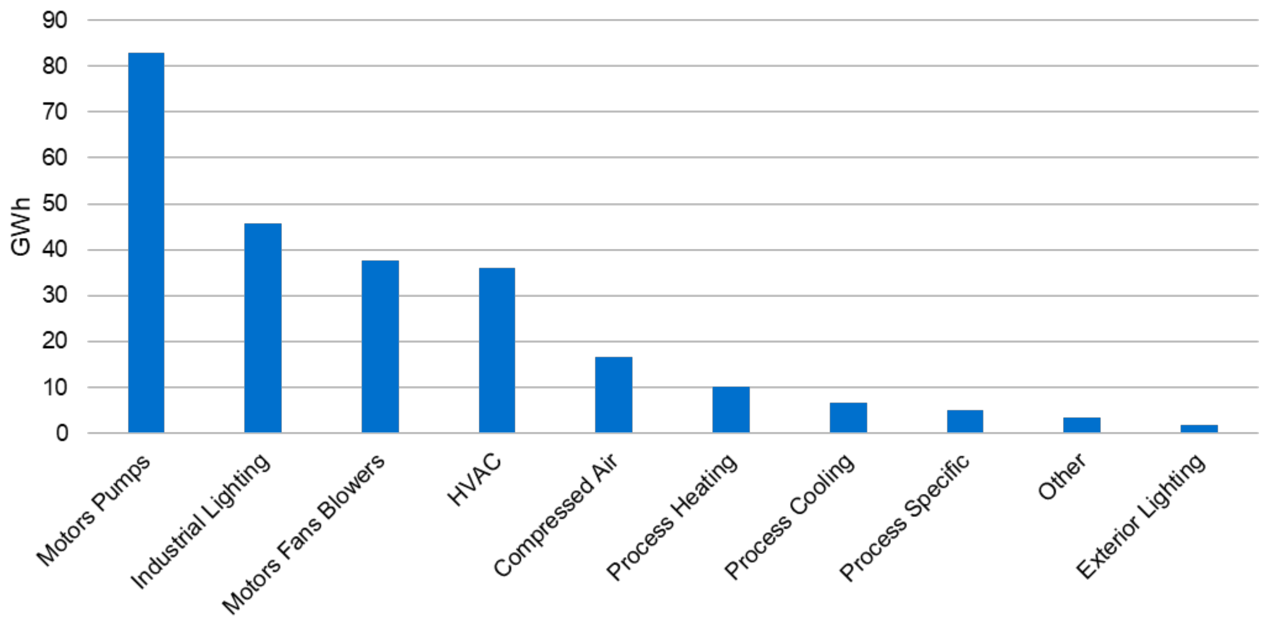


Figure 6-17: Industrial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

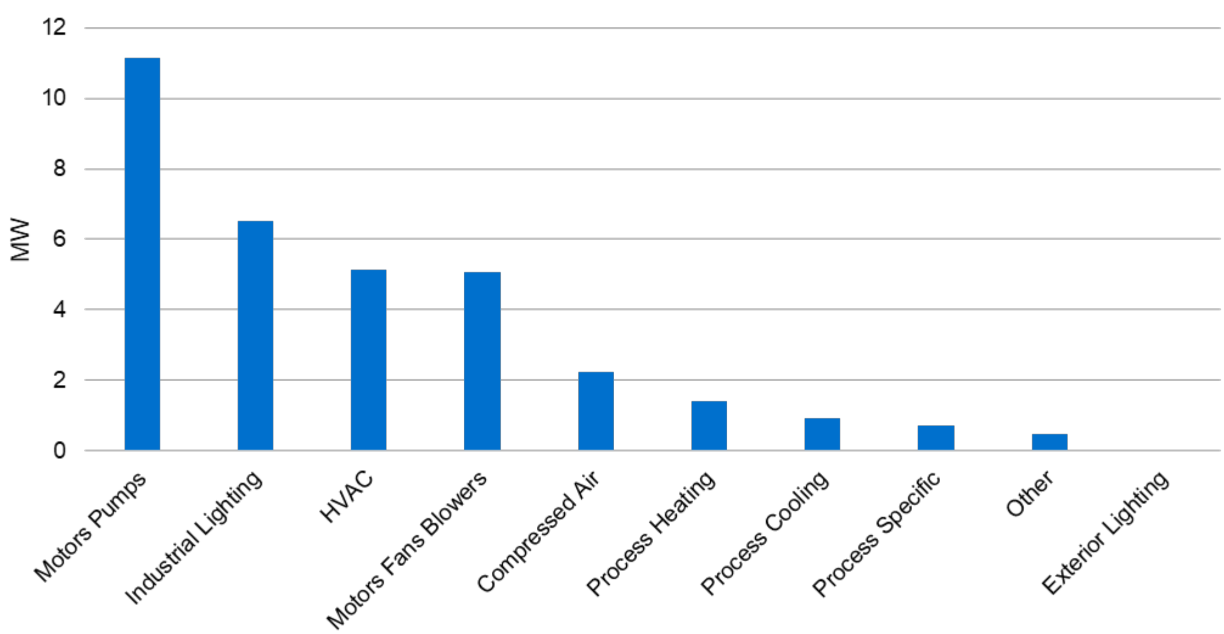
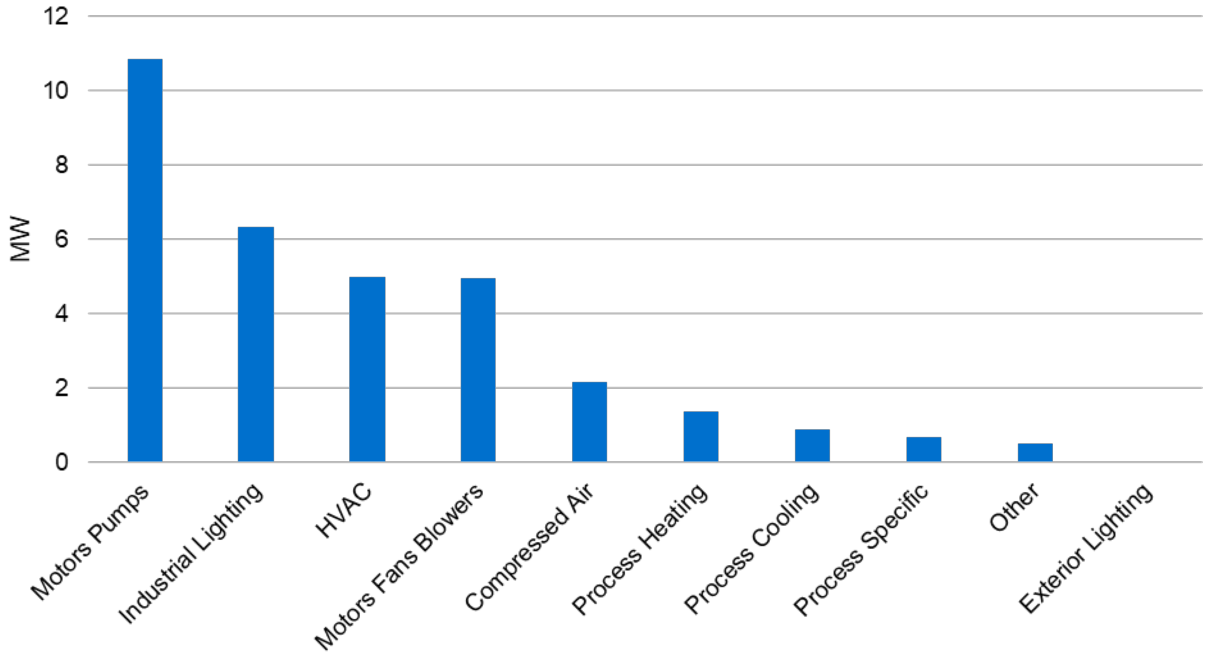


Figure 6-18: Industrial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.3 DR Economic Potential

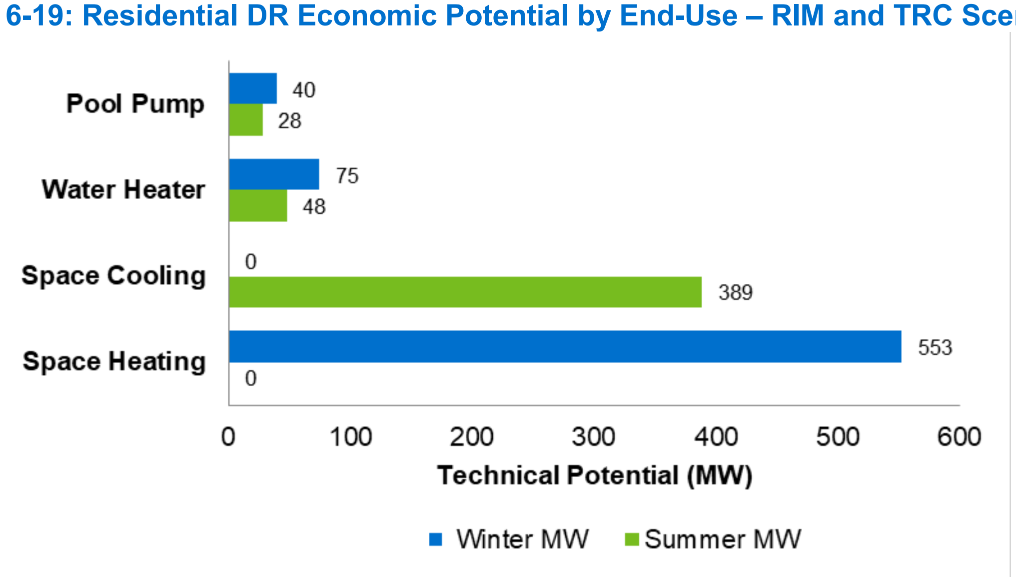
Because of the costs included in the RIM and TRC screening methodology for DR, all measures passed the EP screen for Gulf. Therefore, the EP for DR is the same as the TP for Gulf.

Table 6-7: DR Economic Potential[17]

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	465	667
Non-Residential	493	430
Total	958	1,098

Results for residential customer segments are presented in Figure 6-19. Note that because there are minimal customer costs and bill savings associated with the DR measures used, all measures passed the economic screen and the potential did not change from the technical potential, since based on the RIM and TRC screening requirements all of the load that can technically be curtailed can be curtailed cost-effectively.

Figure 6-19: Residential DR Economic Potential by End-Use – RIM and TRC Scenario[18]



[17] Excludes current DR participants

[18] All currently enrolled DR customers are excluded

Similar figures are presented for small C&I and large C&I customers.

Figure 6-20: Small C&I DR Economic Potential by End-Use – RIM and TRC Scenario[19]

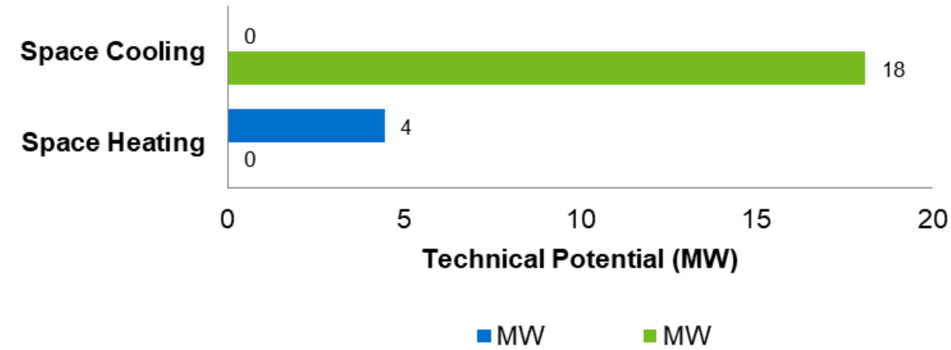
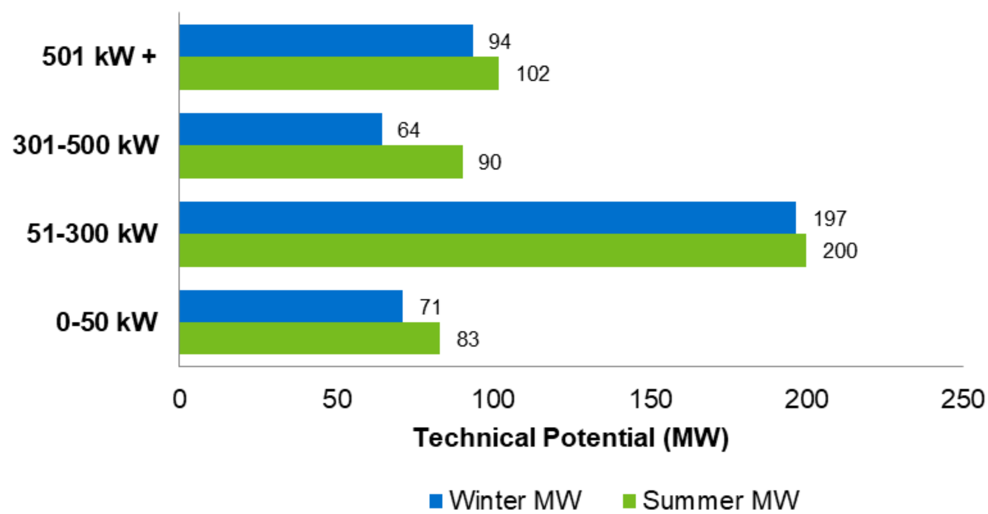


Figure 6-21: Large C&I DR Economic Potential by Segment – RIM and TRC Scenario[20]



[19] All currently enrolled DR customers are excluded

[20] All currently enrolled DR customers are excluded

6.4 DSRE Economic Potential

Table 6-8 summarizes the EE economic potential by sector for the RIM-scenario.

Table 6-8: DSRE Economic Potential[21]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
PV Systems			
Residential	-	-	-
Non-Residential	-	-	-
Total	-	-	-
Battery Storage from PV Systems			
Residential	65	222	-
Non-Residential	-	-	-
Total	65	222	-
CHP Systems			
Total	-	-	-

Nexant found there to be no cost-effective potential attainable for Gulf for PV systems, battery storage systems, or CHP systems for the TRC-scenario.

[21] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system. Therefore results for each DSRE system should not be combined for overall DSRE potential but used as independent estimates.

7 Achievable Potential

Nexant incorporated realistic assumptions about program delivery when estimating achievable market potential. Nexant estimated the cost-effective savings realistically achievable by utility-sponsored DSM programs in the Gulf jurisdiction by incorporating utility program costs and utility incentive costs, and with consideration of economic constraints and market demand for DSM services in Florida.

7.1 Achievable Potential Methodology

7.1.1 Utility Program Costs and Incentives

Prior to the development of the achievable potential, Gulf performed a cost-effectiveness re-screening of all measures that passed the economic potential screening, under both the RIM and TRC scenarios, to incorporate estimated utility program costs and utility incentives for each measure. Nexant provided Gulf with program cost estimates by sector and end-use, which were developed from data on current Florida DSM programs as well as other regional utility program offerings[22]. Gulf provided Nexant with the set of measures passing the re-screening to use for the achievable potential analysis, and the estimated incentive amount for each measure, which was developed as follows:

- In the RIM scenario, two incentive values were analyzed. First, the RIM net benefit for the measure was calculated based on total RIM benefits minus RIM costs. Next, the incentive amount that would drive the simple payback to two years for each measure was calculated. The final incentive applied for the measure was based on the lower of these two values[23].
- In the TRC scenario, the incentive amount required to drive the simple payback to two years for each measure was used as the final incentive for the measure.

7.1.2 Market Adoption Rates

To estimate the adoption rate of DSM based on the utility program costs and incentives described above, Nexant incorporated Gulf DSM program data as well as secondary data from other utility sponsored DSM programs. This approach leveraged program performance data from a variety of DSM programs across many utilities to develop a meta-analysis of program performance that broadly describes customers' program adoption rates over time. This

[22] Program cost estimates assumed average utility DSM program operations for mature, full-scale programs. However, actual program costs may vary by utility based on the program's size and scale, including the number of measures offered, participation and savings targets, and specific program delivery elements.

[23] For DR measure incentives, if the measure is currently offered by Gulf, the incentive amount that was historically used by Gulf was applied. If Gulf did not currently have a measure, the incentive was calculated as the maximum annual incentive that could be paid to a customer (or 1 kW of customer load for large C&I customers) and have the RIM cost-effectiveness ratio be 1.0

approach applied standard economic theories on product diffusion to develop a catalog of market adoption curves across a variety of DSM technologies and programs[24].

Nexant used this market performance data, historic Gulf program performance data, and secondary data sources to calibrate the measures passing the cost-effectiveness screening in the TEA-POT model. Secondary data sources for EE measures included ENERGY STAR data on qualified product shipments and other utility-sponsored program performance data. The adoption rate of DR also incorporated Gulf DR marketing and participation data as well as secondary data from other well-developed DR programs. This approach leveraged historic marketing strategies and customer responses to marketing as well as incentive level.

7.2 EE Achievable Potential

This section provides the detailed results of the EE achievable potential. Table 7-1 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 7-1: Achievable Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	4	18
Industrial	6	32
Total	10	50
TRC SCENARIO		
Residential	16	73
Commercial	53	887
Industrial	20	204
Total	89	1,164

7.2.1 Summary

Table 7-2 summarizes the 10-year portfolio EE achievable potential for all customers across the residential and non-residential sectors. Impacts are presented as cumulative impacts, which represent savings achieved over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

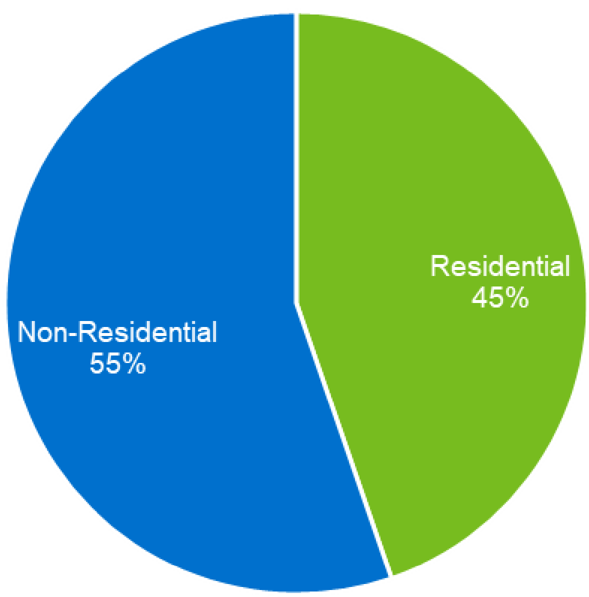
[24] A detailed description of Nexant's market adoption rate methodology is provided in Appendix F

Table 7-2: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	5	2	6
Total	5	2	6
TRC SCENARIO			
Residential	20	19	98
Non-Residential	21	10	124
Total	40	29	222

Figure 7-1 shows achievable energy savings potential by sector for the TRC scenario. The RIM scenario is not presented as only non-residential measures passed the cost-effectiveness screening.

Figure 7-1: Achievable Potential by Sector – TRC Scenario



7.2.2 Residential – RIM Scenario

The residential sector did not have any EE measures that passed the achievable potential cost-effectiveness screening for the RIM scenario.

7.2.3 Non-Residential – RIM Scenario

7.2.3.1 Commercial Segments

Table 7-3 summarizes the cumulative commercial EE achievable potential by end-use for the RIM Scenario[25].

Table 7-3: EE Commercial Achievable Potential by End-Use – RIM Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	0	0	0
Exterior Lighting	0	0	0
Office Equipment	0	0	0
Cooking	0	0	0
Refrigeration	0	0	0
Space Heating	0	2	0.4
Space Cooling	5	0	5
Ventilation and Circulation	0	0	0
Domestic Hot Water	0	0	0
Miscellaneous	0	0	0

Figure 7-2, Figure 7-3, and Figure 7-4 illustrate the cumulative commercial EE achievable potential by end-use for the RIM scenario.

[25] The four commercial measures passing the cost-effectiveness screening for the RIM scenario are measures that are not currently offered in an existing Gulf program.

Figure 7-2: Commercial EE Achievable Potential by End-Use (Energy Savings) – RIM Scenario

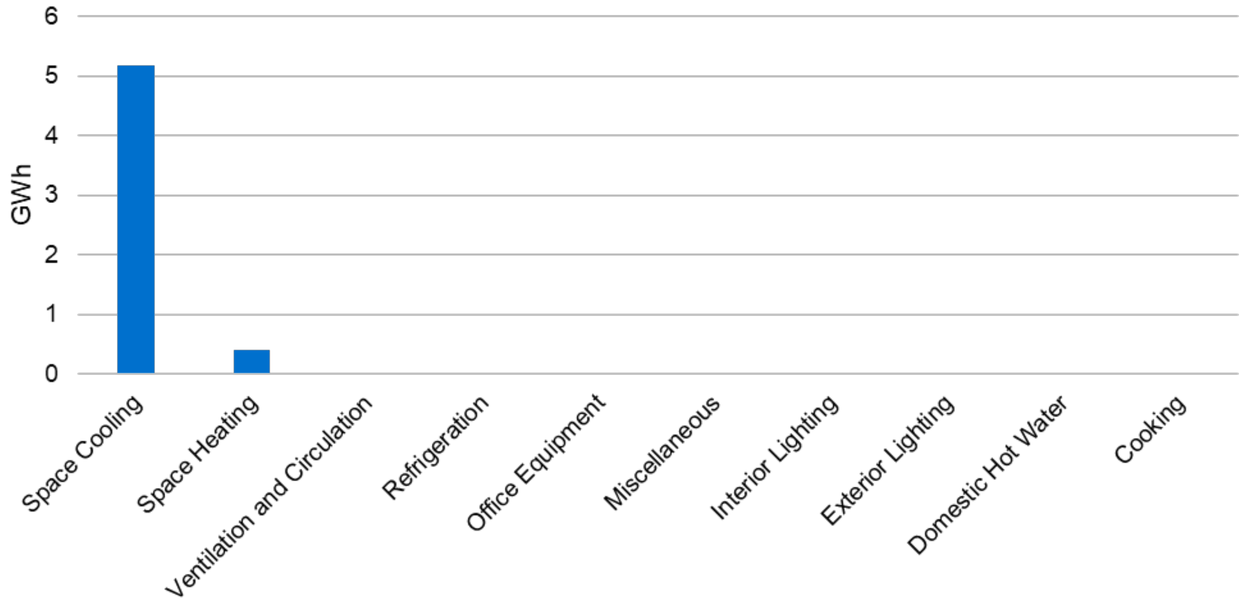


Figure 7-3: Commercial EE Achievable Potential by End-Use (Summer Peak Savings) – RIM Scenario

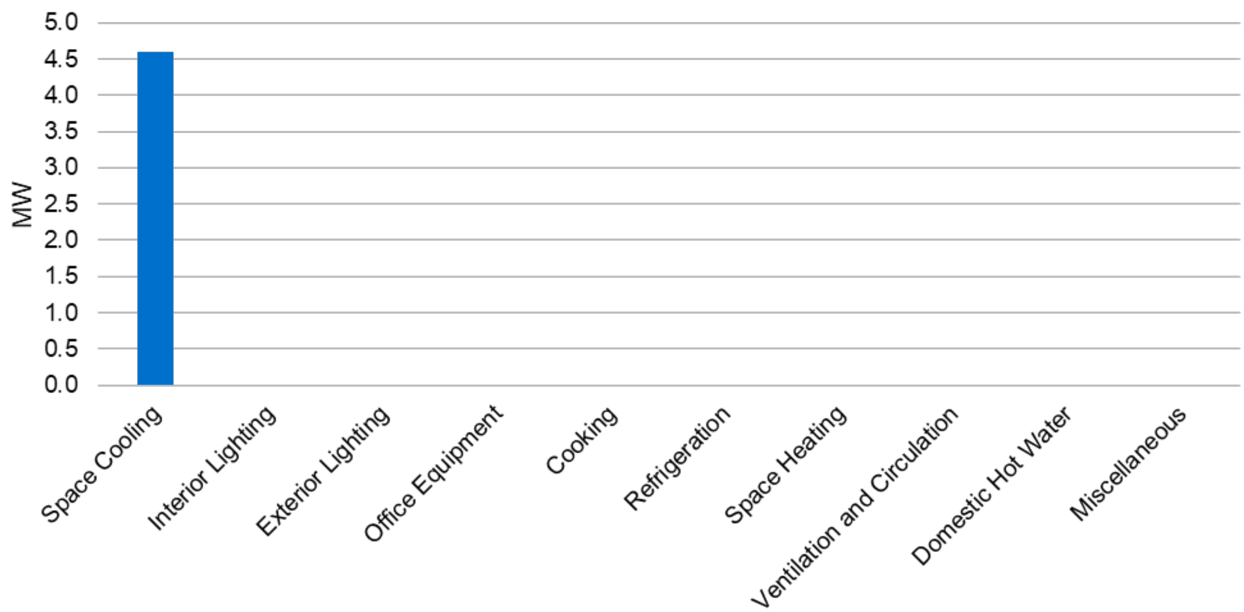
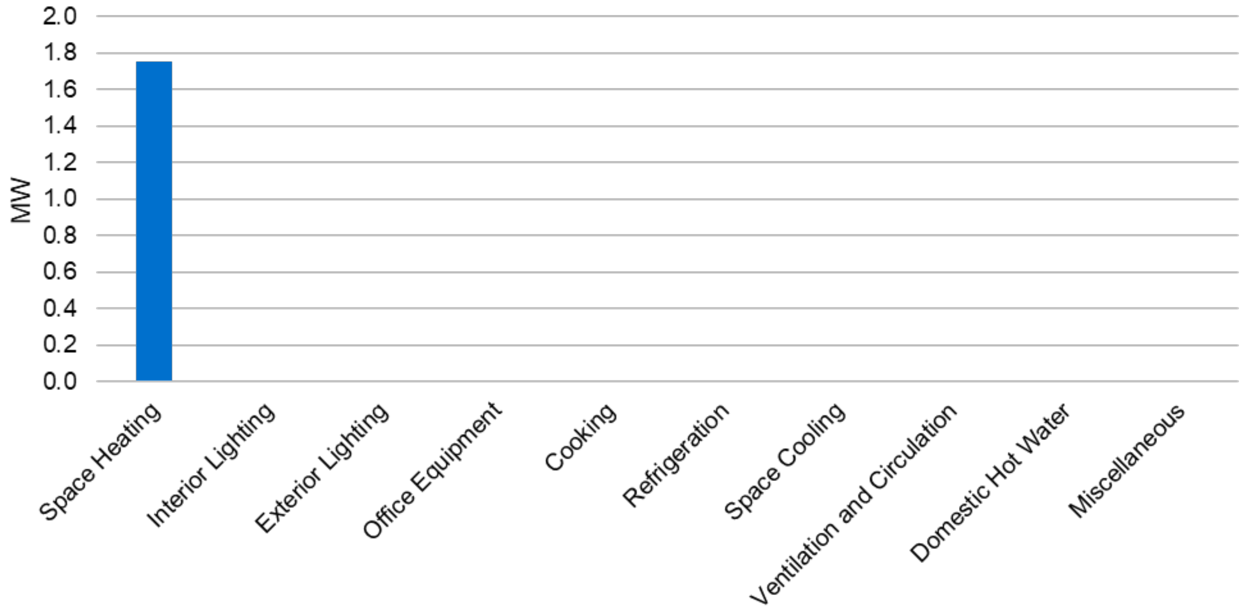


Figure 7-4: Commercial EE Achievable Potential by End-Use (Winter Peak Savings) – RIM Scenario



7.2.3.2 Industrial Segments

Table 7-4 summarizes the cumulative industrial EE achievable potential by end-use for the RIM Scenario[26].

Table 7-4: EE Industrial Achievable Potential by End-Use – RIM Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Industrial Lighting	0.04	0.04	0.3
Process Cooling	0.01	0.01	0.1
Process Heating	0.01	0.01	0.1
HVAC	0.0009	0.0009	0.006
Process Specific	0.00004	0.00004	0.0003
Compressed Air	0	0	0
Motors Pumps	0	0	0
Motors Fans Blowers	0	0	0
Other	0	0	0
Exterior Lighting	0	0	0

[26] The six industrial measures passing the cost-effectiveness screening for the RIM scenario are measures that are not currently offered in an existing Gulf program.

Figure 7-5, Figure 7-6, and Figure 7-7 illustrate the cumulative industrial EE achievable potential by end-use for the RIM scenario.

Figure 7-5: Industrial EE Achievable Potential by End-Use (Energy Savings) – RIM Scenario

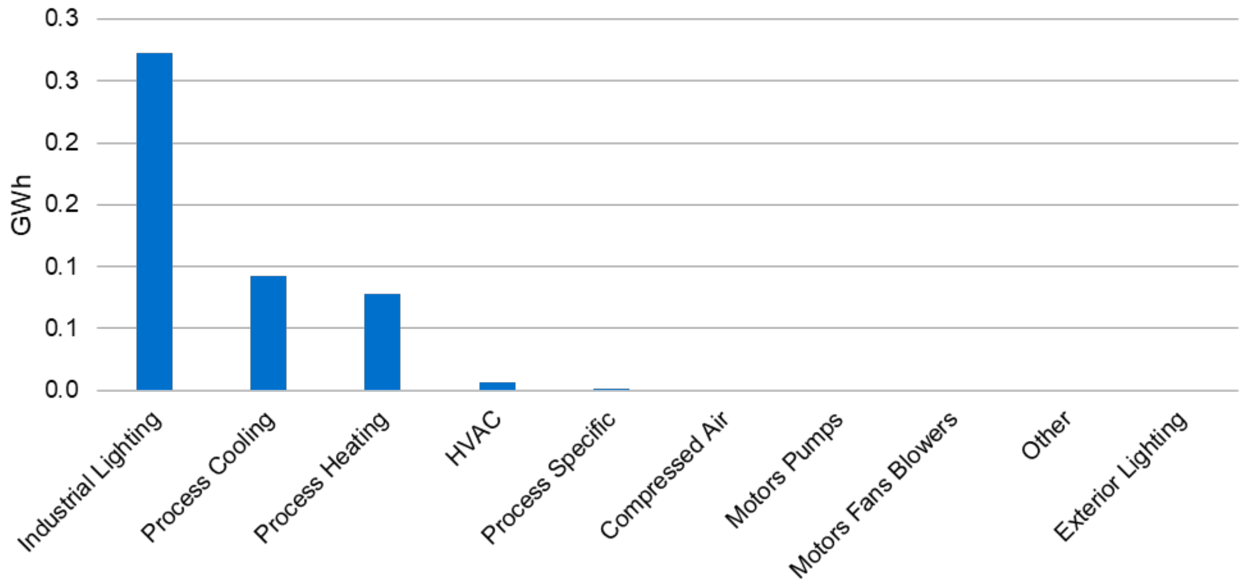


Figure 7-6: Industrial EE Achievable Potential by End-Use (Summer Peak Savings) – RIM Scenario

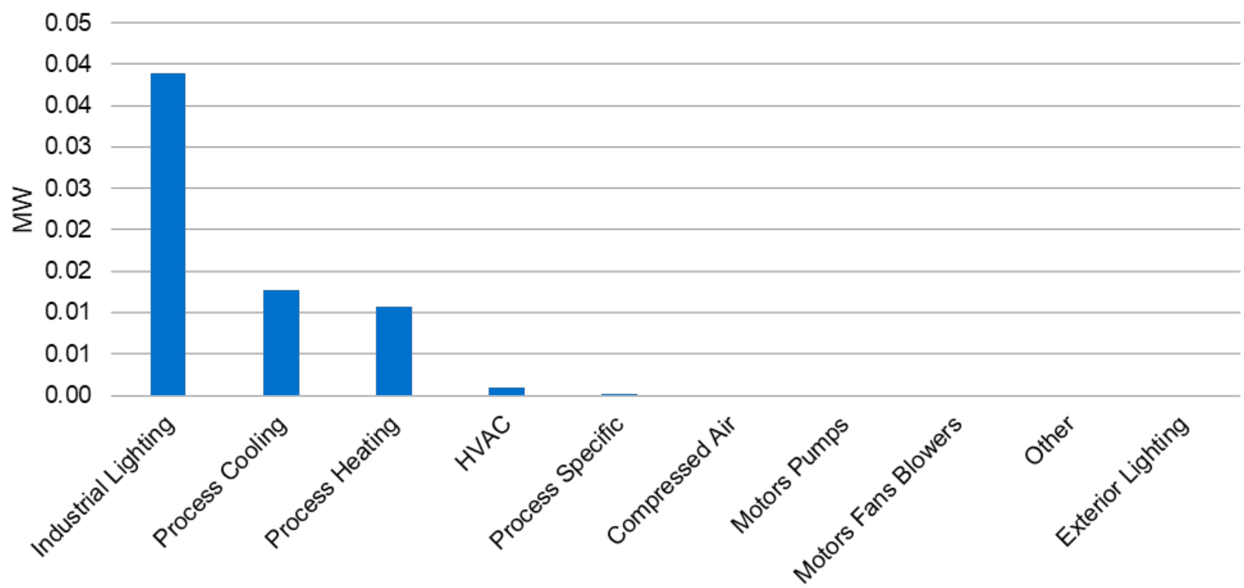
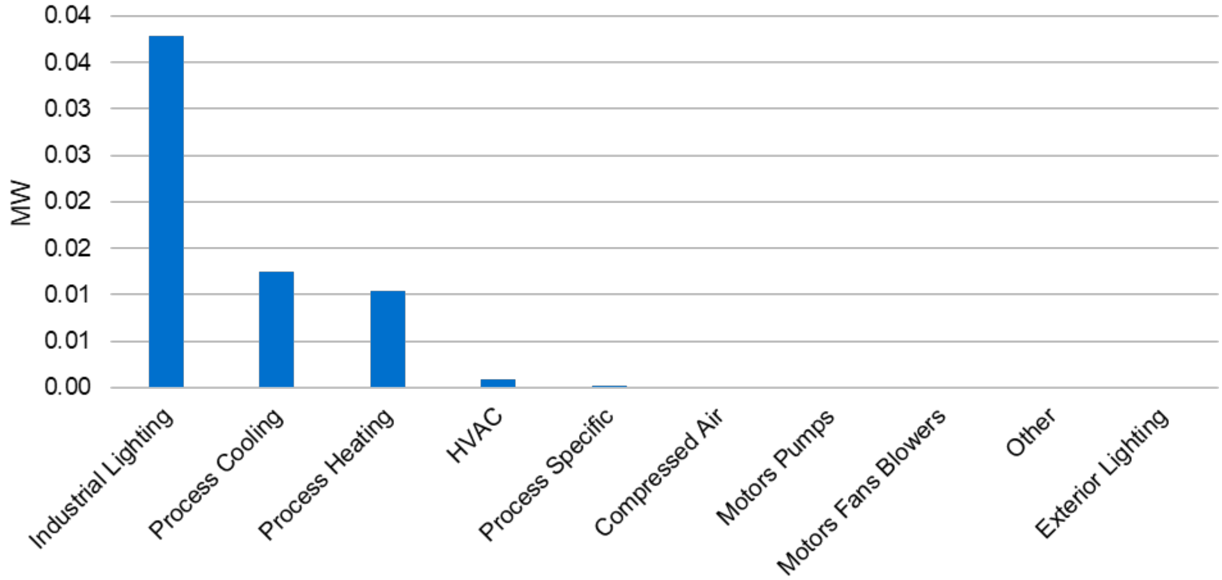


Figure 7-7: Industrial EE Achievable Potential by End-Use (Winter Peak Savings) – RIM Scenario



7.2.4 Residential – TRC Scenario

Table 7-5 summarizes the cumulative residential EE achievable potential by end-use for the TRC Scenario.

Table 7-5: EE Residential Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Space Heating	0	9	11
Space Cooling	12	0	22
Domestic Hot Water	2	8	31
Lighting	2	2	25
Cooking	1	0.2	3
Appliances	0	0	0
Electronics	0.4	0.1	2
Miscellaneous	2	0	3

Figure 7-8, Figure 7-9, and Figure 7-10 illustrate the cumulative residential EE achievable potential by end-use for the TRC scenario.

Figure 7-8: Residential EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

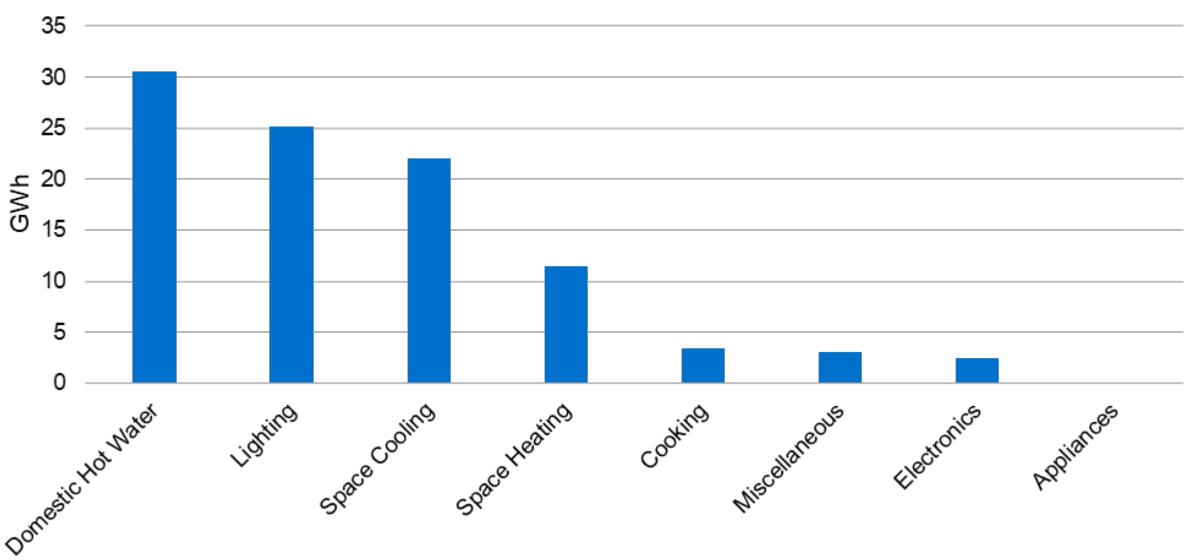


Figure 7-9: Residential EE Achievable Potential by End-Use (Summer Peak Savings) - TRC Scenario

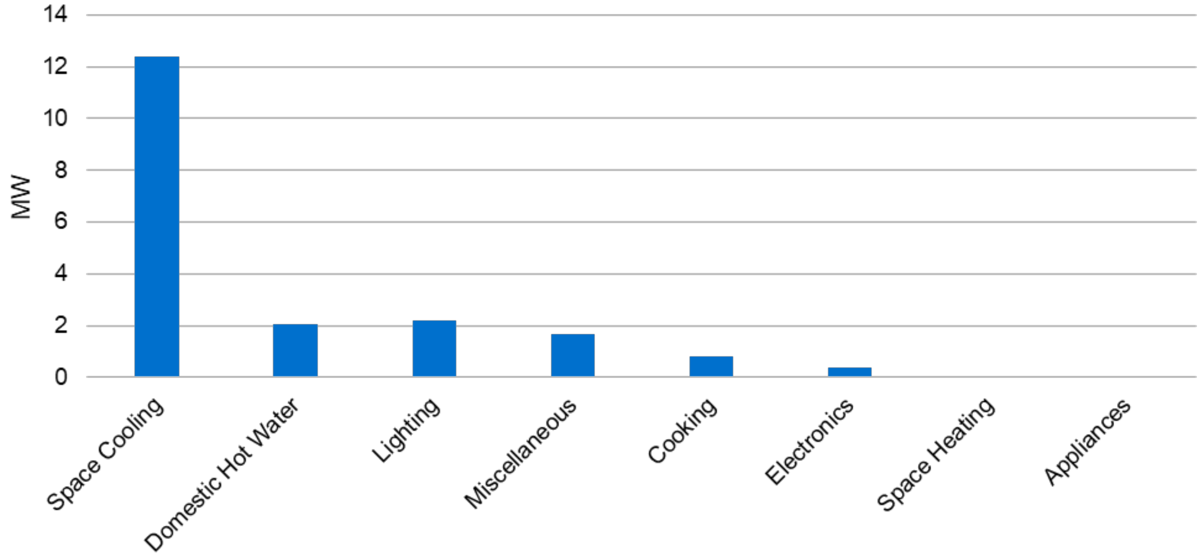
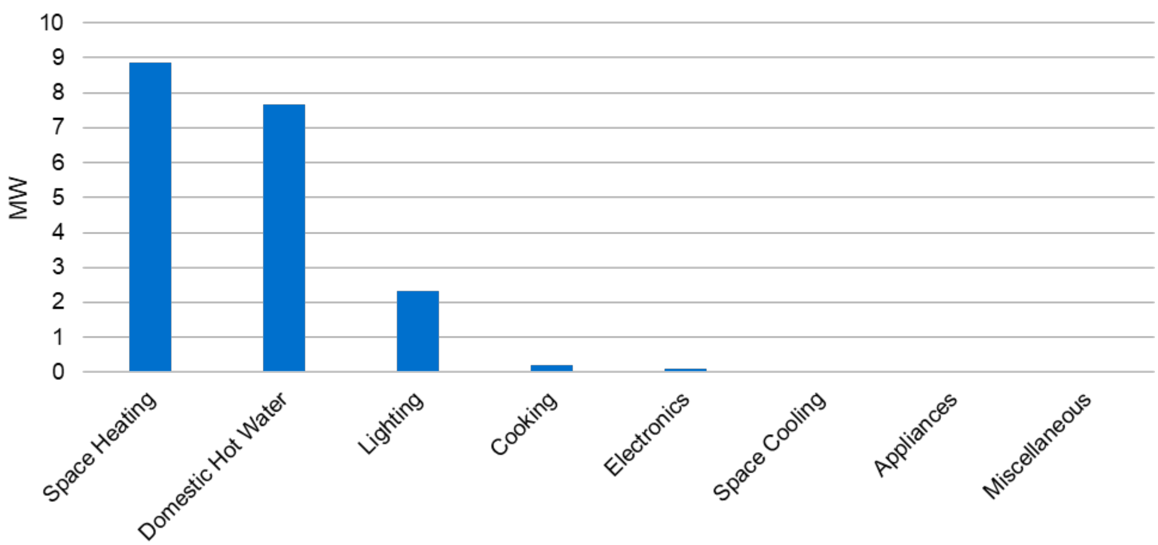


Figure 7-10: Residential EE Achievable Potential by End-Use (Winter Peak Savings) - TRC Scenario



7.2.5 Non-Residential – TRC Scenario

7.2.5.1 Commercial Segments

Table 7-6 summarizes the cumulative commercial EE achievable potential by end-use for the TRC Scenario.

Table 7-6: EE Commercial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	1	0.5	13
Exterior Lighting	0	0.02	6
Office Equipment	0.2	0.1	1
Cooking	1.1	0.5	6
Refrigeration	0.8	0.3	6
Space Heating	0	3	7
Space Cooling	11	0	47
Ventilation and Circulation	0.3	1	3
Domestic Hot Water	0.2	0.1	2
Miscellaneous	2	0.6	9

Figure 7-11, Figure 7-12, and Figure 7-13 illustrate the cumulative commercial EE achievable potential by end-use for the TRC scenario.

Figure 7-11: Commercial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

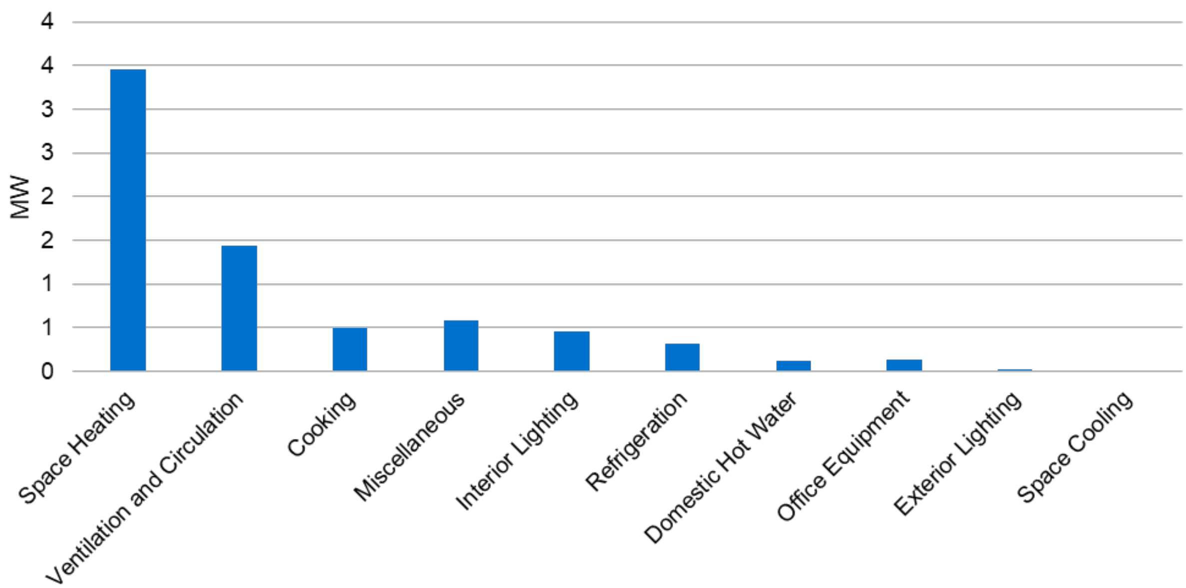


Figure 7-12: Commercial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

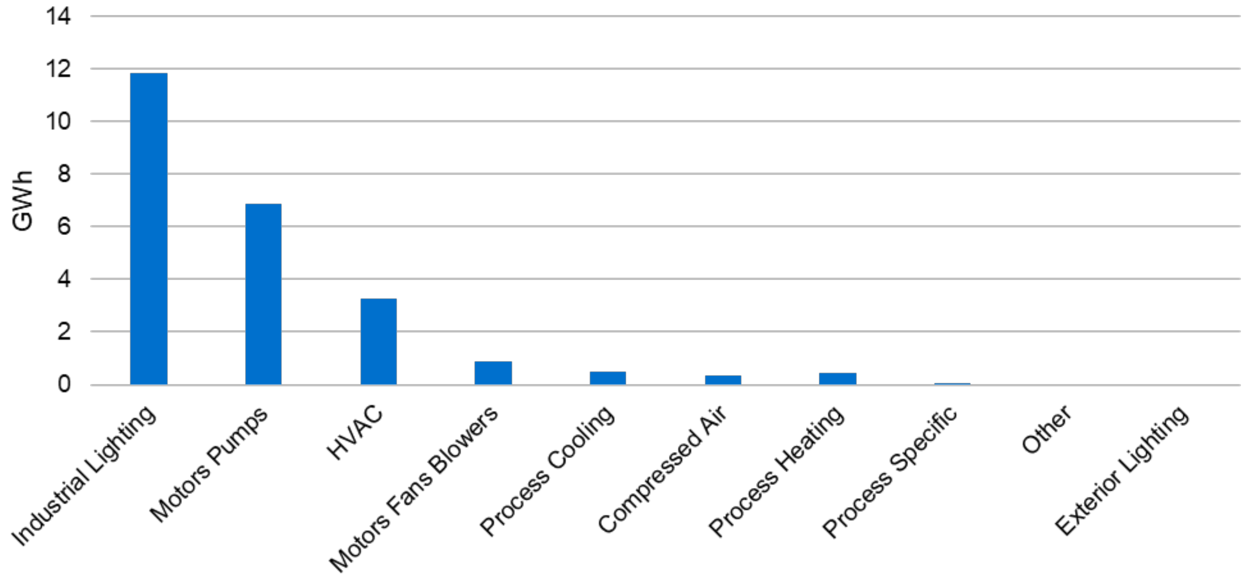
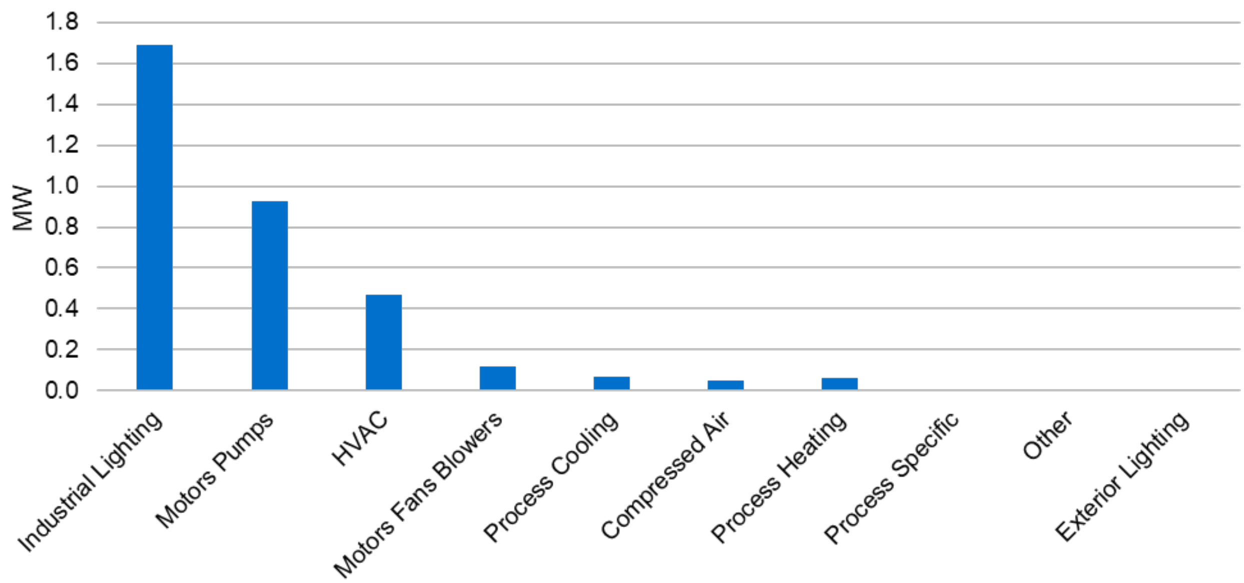


Figure 7-13: Commercial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.2.5.2 Industrial Segments

Table 7-7 summarizes the cumulative industrial EE achievable potential by end-use for the TRC Scenario.

Table 7-7: EE Industrial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Industrial Lighting	2	2	12
Process Cooling	1	1	7
Process Heating	0.5	0.5	3.27
HVAC	0.1	0.1	0.9
Process Specific	0.07	0.06	0.5
Compressed Air	0.05	0.05	0.3
Motors Pumps	0.06	0.06	0.5
Motors Fans Blowers	0.005	0.005	0.03
Other	0	0	0
Exterior Lighting	0	0	0

Figure 7-14, Figure 7-15, and Figure 7-16 illustrate the cumulative industrial EE achievable potential by end-use for the TRC scenario.

Figure 7-14: Industrial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

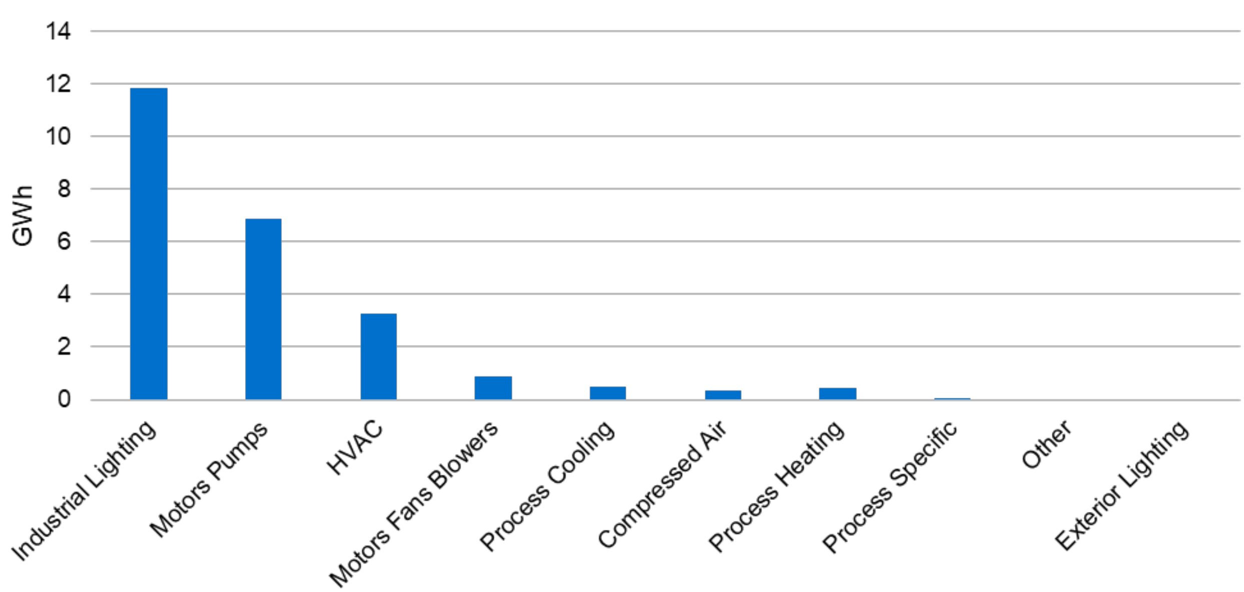


Figure 7-15: Industrial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

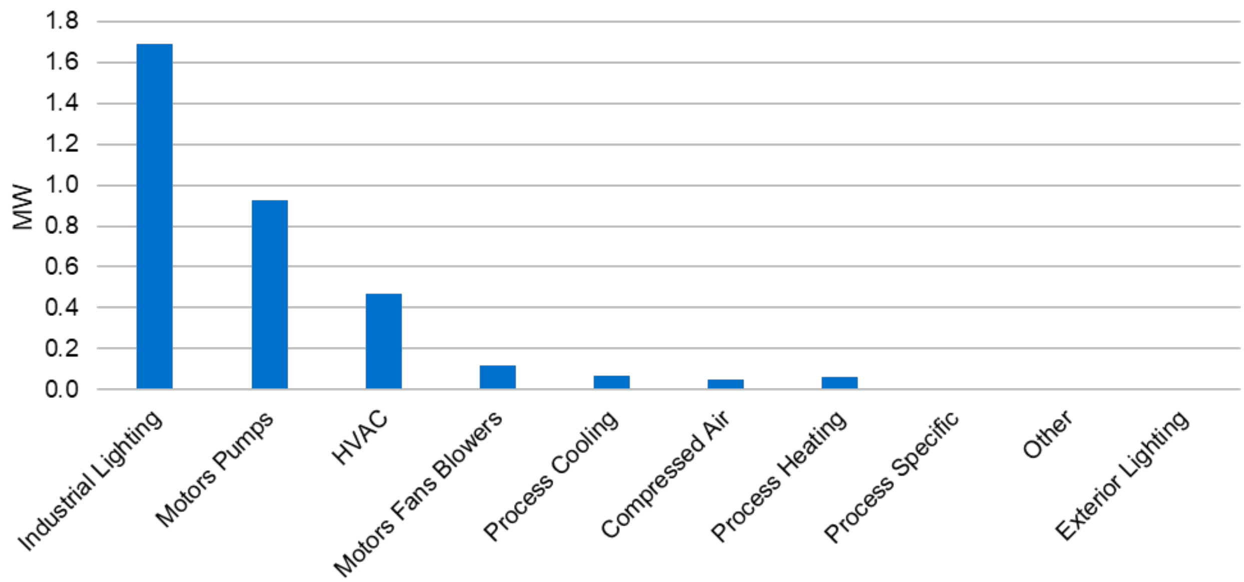
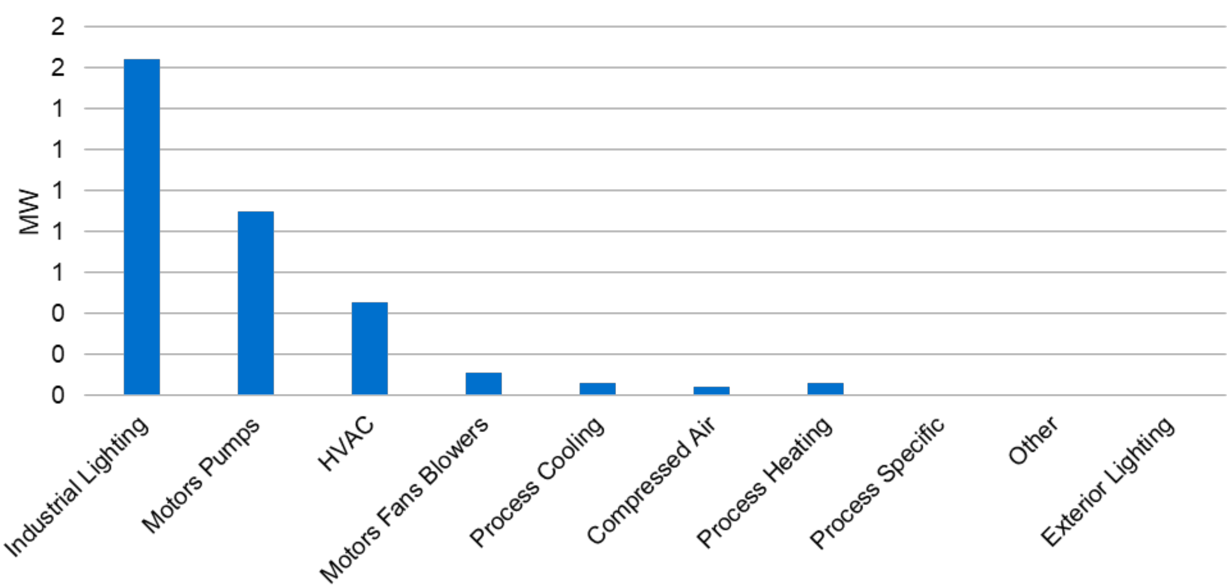


Figure 7-16: Industrial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.3 DR Achievable Potential

This section presents the estimated overall achievable potential for DR opportunities. The results are provided separately for summer and winter peaking capacity. The results are further broken down by customer segment. All results presented reflect the projected achievable DR potential by 2029 for both RIM and TRC scenarios, as all measures either passed or failed for both screening scenarios. Large C&I customers were the only customer segment that had measures pass the achievable potential screening. Therefore, only non-residential customers have incremental DR achievable potential.

Table 7-8: DR Achievable Potential[27]

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	0	0
Non-Residential	15	11
Total	15	11

7.3.1 Non-Residential DR Achievable Potential Details

7.3.1.1 Small C&I Achievable Potential

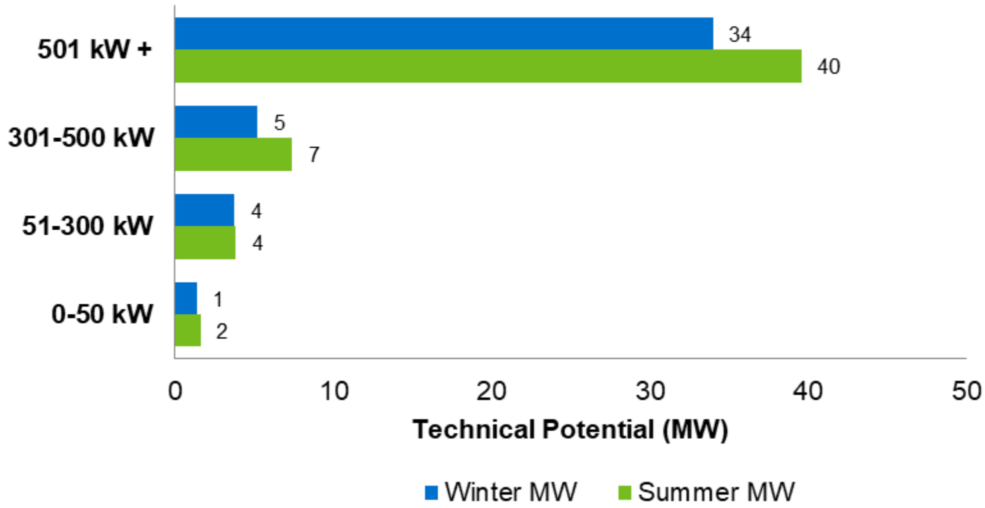
Small C&I customers do not provide any additional DR potential, as no small C&I measures passed the achievable potential screen.

7.3.1.2 Large C&I Achievable Potential

For Gulf, all of the DR potential comes from the large C&I sector. These customers comprise a large portion of the overall system load, and are expected to have considerably high participation rates if incentive levels are sufficiently high. The participation rate presented here represents the percentage of the overall peak period load from each customer segment that would be available for curtailment if DR programs are properly incentivized and marketed. They reflect a saturated market (*i.e.*, all customers are properly informed of the program and given the opportunity to enroll). Figure 7-17 shows the achievable potential for each Large C&I customer segment.

[27] Excludes current DR participants

Figure 7-17: Large C&I DR Achievable Potential by Segment – RIM and TRC Scenario[28]



[28] All currently enrolled DR load is excluded

7.4 DSRE Achievable Potential

Nexant found there to be no cost-effective potential attainable for Gulf for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

8 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements

Measure	End-Use	Description	Baseline
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations

Measure	End-Use	Description	Baseline
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average pump equipment
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and large C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

The cooling load shapes on the summer peak weekday and average weekdays were generated from hourly load research sample in Gulf territory for 2015. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2015
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (among May to September). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same hourly load research profile in 2013 and 2014, and the peak day was defined as the day with system peak load during winter period. The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

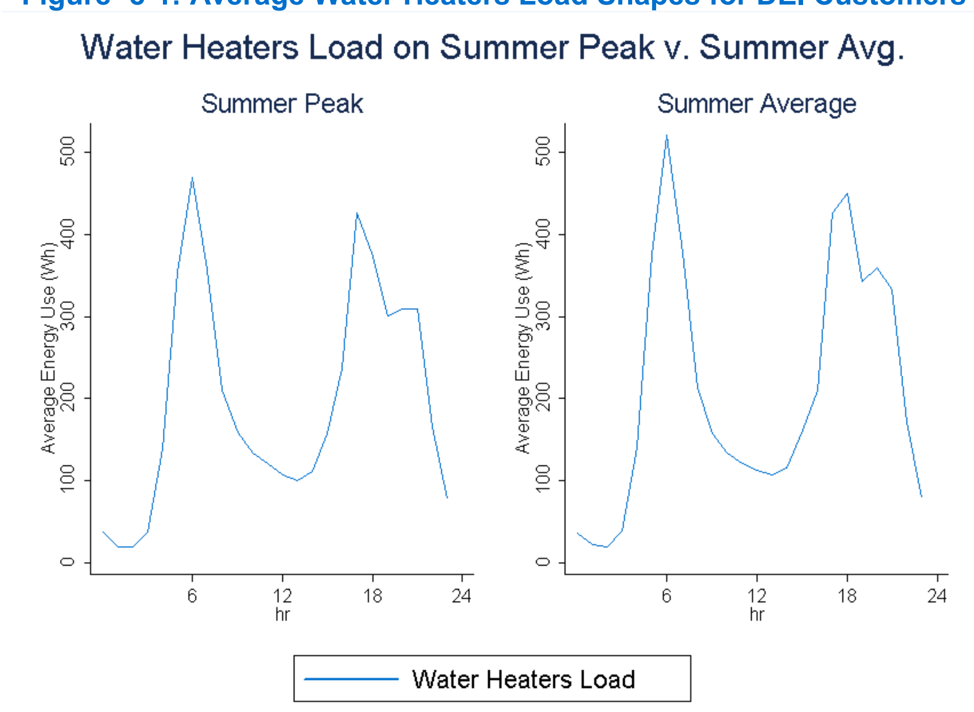
Where:

t	Hours in each day in year 2015
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in Gulf territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in Gulf territory.

Figure -8-1: Average Water Heaters Load Shapes for DEI Customers

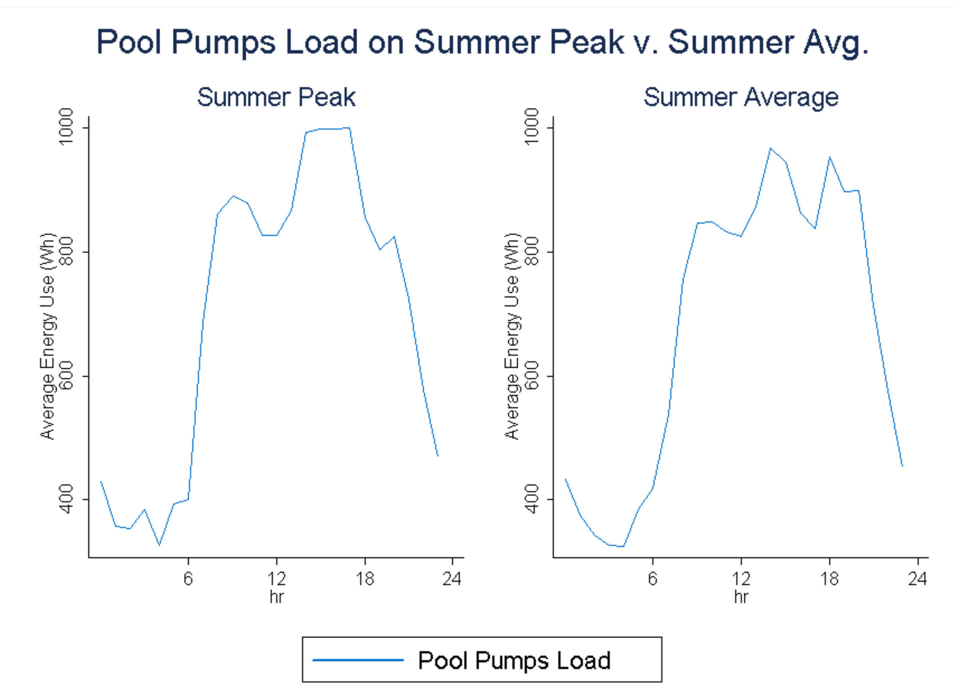


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads has low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 am – 7:00 am and 5:00 pm – 8:00 pm.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in Gulf territory.

Figure 8-2: Average Pool Pumps Load Shapes for DEI Customers



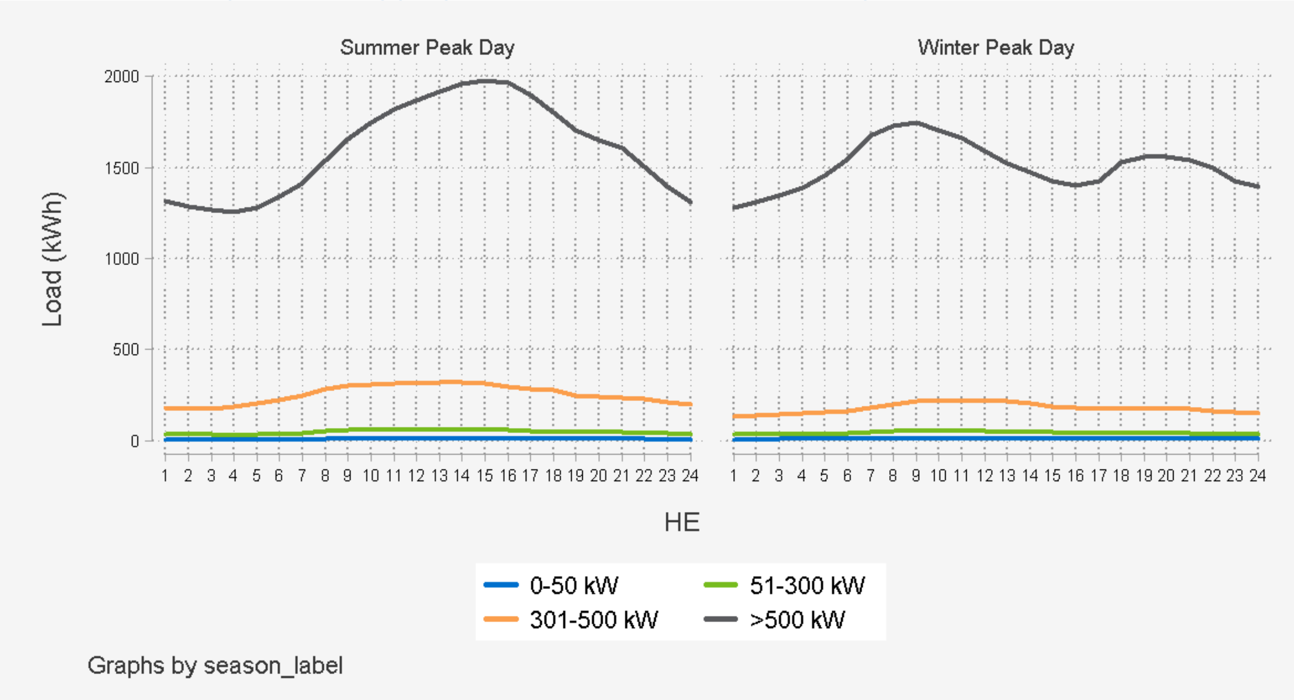
According to the Figure 8-4, the peak hours for pool pumps are 3:00 pm to 6:00 pm, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2015) for all customers in the GSD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential.

Figure 8-3: Aggregate Load Shapes for Gulf Large C&I Customers



Appendix E Economic Potential Sensitivities

As part of the assessment of economic potential, the study included analysis of sensitivities related to future fuel costs and free ridership, as follows:

Sensitivity #1: Higher Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2 (cost-benefit ratio of 1.0 for RIM or TRC, respectively), but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	1	3
Commercial	10	204
Industrial	12	158
Total	23	365
TRC SCENARIO		
Residential	48	247
Commercial	95	2,165
Industrial	29	736
Total	172	3,148

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	2	9	13
Non-Residential	87	70	194
Total	89	79	207
TRC SCENARIO			
Residential	215	200	922
Non-Residential	171	125	959
Total	386	325	1,882

DR and DSRE measures were not included in the economic sensitivities as fuel prices do not affect DR and DSRE results.

Sensitivity #2: Lower Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2 (cost-benefit ratio of 1.0 for RIM or TRC, respectively), but the fuel cost forecast was adjusted to a “low fuel” scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	8	142
Industrial	12	150
Total	20	292
TRC SCENARIO		
Residential	39	206
Commercial	82	1,854
Industrial	29	722
Total	150	2,782

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	75	36	110
Total	75	36	110
TRC SCENARIO			
Residential	167	155	751
Non-Residential	164	124	877
Total	331	279	1,628

DR and DSRE measures were not included in the economic sensitivities as fuel prices do not affect DR DSRE results.

Sensitivity #3: Baseline for free-ridership sensitivities

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2 (cost-benefit ratio of 1.0 for RIM or TRC, respectively), with the addition of utility DSM program costs as a component of the measure's cost-effectiveness. In addition, measures must achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective (utility incentives were not considered for this screening component for economic potential). Measures also must achieve a participant simple payback of two years or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	3	14
Industrial	6	32
Total	9	46
TRC SCENARIO		
Residential	16	73
Commercial	52	883
Industrial	20	204
Total	88	1,160

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	2	2	13
Total	2	2	13
TRC SCENARIO			
Residential	146	133	612
Non-Residential	50	36	370
Total	196	168	981

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #4: Shorter free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for Sensitivity #3, but the simple payback screening criteria was reduced to one year or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	4	22
Industrial	7	64
Total	11	86
TRC SCENARIO		
Residential	25	122
Commercial	67	1,309
Industrial	26	402
Total	118	1,833

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	10	14	46
Total	10	14	46
TRC SCENARIO			
Residential	150	135	646
Non-Residential	91	77	607
Total	240	212	1,253

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #5: Longer free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for Sensitivity #3, but the simple payback screening criteria was increased to three years or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	3	8
Industrial	4	26
Total	7	34
TRC SCENARIO		
Residential	12	49
Commercial	47	667
Industrial	13	108
Total	72	824

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	2	3
Total	0	2	3
TRC SCENARIO			
Residential	140	128	549
Non-Residential	31	21	219
Total	170	149	768

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

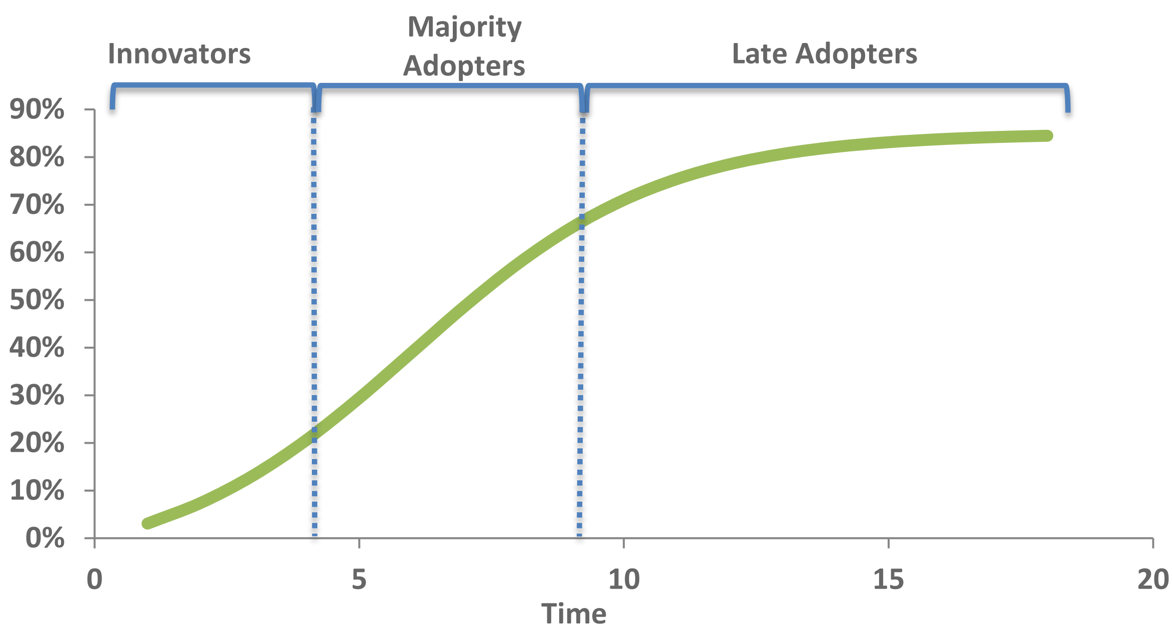
No DSRE measures passed the economic screening for this sensitivity.

Appendix F Market Adoption Rates

Nexant uses the Bass diffusion model to estimate measure adoption rates. The Bass diffusion model is a widely accepted mathematical description of how new products and innovations spread through an economy over time. The Bass Diffusion Model was originally published in 1969, and in 2004 was voted one of the top 10 most influential papers published in the 50 year history of the peer-reviewed publication *Management Science*[1]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to demand-side management in the energy industry[2]. Nexant applied the secondary data and research collected to develop and apply Bass Model diffusion parameters in the Florida jurisdiction.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept is illustrated in Figure 8-4.

Figure 8-4 Bass Model Market Penetration with Respect to Time



[1] Bass, F. 2004. Comments on “A New Product Growth for Model Consumer Durables the Bass Model” (sic). *Management Science* 50 (12_supplement): 1833-1840. http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1040.0300. Accessed 01/08/2016.

[2] Buskirk, R. 2014. Estimating Energy Efficiency Technology Adoption Curve Elasticity with Respect to Government and Utility Deployment Program Indicators. LBNL Paper 6542E. Sustainable Energy Systems Group, Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. http://escholarship.org/uc/item/2vp2b7cm#page-1. Accessed 01/14/2016.

Figure 8-4 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

$$\frac{dS(t)}{dt} = \left(p + \frac{q}{m} * S(t-1)\right) * (m - S(t-1))$$

Where:

$\frac{dS(t)}{dt}$ = the rate of adoption for any discrete time period, t

p = external influences on market adoption

q = internal influences on market adoption

m = the maximum market share for the product

$S(t-1)$ = the cumulative market share of the product, from product introduction to time period *t-1*

Marketing is the quintessential external influence. The internal influences are characteristics of the product and market; for example: the underlying market demand for the product, word of mouth, product features, market structure, and other factors that determine the product's market performance. Nexant's approach applied literature reviews and analysis of secondary data sources to estimate the Bass model parameters. We then extrapolated the model to future years; the historic participation and predicted future market evolution serve as the program adoption curve applied to each proposed offering.

In order to estimate elasticity across different utility incentive levels, Nexant incorporated data from a regression analysis performed on EIA 861 data to understand the relative change in savings based on differing incentives. Per this analysis, a 100% increase in the total utility incentive equated to roughly a 44% increase in savings. This EIA-based elasticity rate was applied to the market adoption rates described above to estimate relative changes in market adoption for the range of maximum incentives where they vary from current or typical utility offerings.

Nexant's approach for estimating DR potential includes an additional step, based on our analysis of mature demand response programs. We estimate participation rates with the following process:

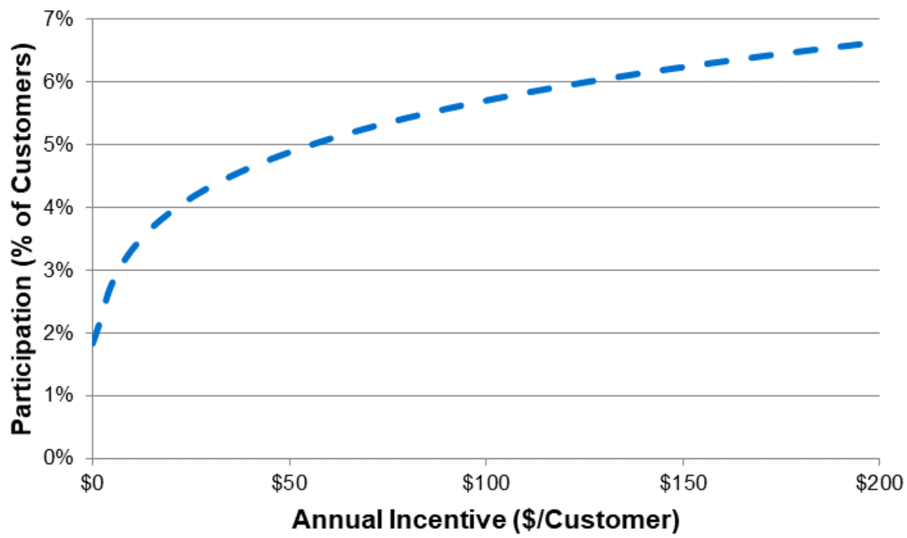
1) Use the results from prior analysis of DR program enrollment[3] to describe DR program participation as a function of customer segments and program attributes
2) Calibrate the model to reflect actual enrollment rates attained by existing Gulf programs. To calibrate the models, the model constant is adjusted so that the model produces exactly the enrollment rates observed by Gulf programs.

[3] Nexant Inc. Sacramento Municipal Utility District Demand Response Potential Study. October 20, 2015.

3) Predict participation rates using specific tactics and incentive levels for each measure based on the outcome of the RIM screening (or existing incentive levels).

As a demonstration of how marketing level and incentive affects participation in residential DR programs, Figure 8-5 shows the range of participation rates at a medium marketing level (phone outreach, mail, and email) as a function of the incentive paid to the customer. The curve shows that residential customers will respond to changes in incentive level if the incentive is relatively low, but are not as responsive to incentive levels after a certain point. This is why utility marketing strategies also play an important role in residential customer participation. This curve can also vary depending on the customer segments present in a utility's jurisdiction and other utility DR program characteristics (such as program age). To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-5: Residential Program Enrollment as a function of Incentive

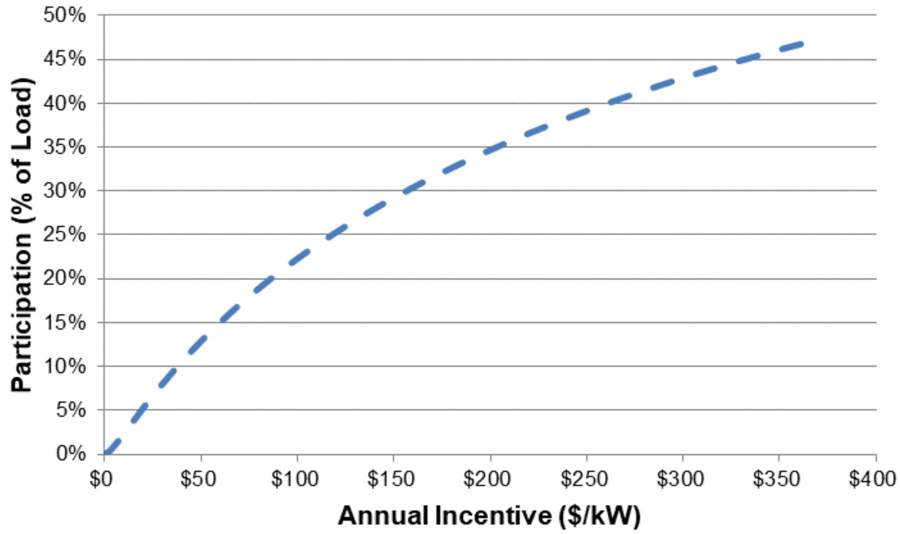


For small C&I customers, a similar approach was used to estimate participation levels. However, these customers tend to have lower enrollments than larger nonresidential customers, and were scaled accordingly. Small C&I customers tend to exhibit roughly 40% of the uptake of residential customers, based on data from historic DR program analysis, which have extensively marketed these programs.

Large C&I customers were slightly different than the other two segments. Due to the large variation in customer size, participation was estimated as the percent of load enrolled in demand response rather than the number of customers. Figure 8-6 shows the participation level of large C&I customers as a function of incentive. Although customers grow less responsive to the incentive as it increases, they continue to be much more responsive to the annual incentive as it increases. This is why for technical potential, it is assumed that if a large C&I customer is paid a high enough incentive; they will curtail their entire load. Similar to the residential participation curve, this curve can vary based on existing participation rates for a utility as well as the industries that large C&I

customers belong to. To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-6: Large C&I Program Enrollment as a function of Incentive



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REPORT

Nexant
Reimagine tomorrow.

Market Potential Study of Demand-Side Management in Florida Public Utilities' Service Territory

Submitted to Florida Public Utilities

April, 2019

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Florida Public Utilities' (FPUC) service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in FPUC's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large commercial and industrial customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning (HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential. The assessment further accounted for existing DR programs for FPUC when calculating the total DR potential. The large C&I programs assessment used publicly available data on mature DR programs and current Florida large C&I DR programs to derive estimates of price responsiveness to program incentives and marketing techniques. Using these estimates, the maximum incentive and enrollment scenario was calculated to estimate the potential.

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customer's PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for residential, commercial and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Nexant estimated DSM savings potential according to three standard scenarios: technical, economic, and achievable potential. Each scenario is defined using slightly different criteria, which are described in the subsequent sections.

1.2.1 EE Potential

Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	21	11	77
Non-Residential[1]	13	7	60
Total	34	18	137

[1] Non-Residential results include all commercial and industrial customer segments

Economic Potential

EE economic potential applies a cost-effectiveness screening to all technically feasible measures and includes full implementation of all measures that pass this screening. Measure permutations were screened individually and the economic potential represents the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

Economic potential was determined for two scenarios: a Rate Impact Measure (RIM) scenario and Total Resource Cost (TRC) scenario. Additional screening criteria for both scenarios included the Participant Cost Test (PCT) perspective, and two-year payback criterion. Additional sensitivities were also analyzed, which are described in Section 6.1.3 and results presented in Appendix E.

The estimated economic potential results are summarized in Table 1-2.

Table 1-2: EE Economic Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	2	2	10
Non-Residential	1	1	10
Total	4	4	20

Achievable Potential

Achievable potential estimates the demand and energy savings feasible with utility-sponsored programs, while considering market barriers and customer adoption rates for DSM technologies. Similar to the economic potential analysis, Nexant screened measures to determine which are cost-effective from both the RIM and TRC perspectives. The achievable potential includes estimated program costs and incentives, whereas the economic potential scenario does not.

Table 1-3 summarizes the results for the estimated EE achievable potential, representing the cumulative savings over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

Table 1-3: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	0.07	0.07	0.21
Non-Residential	0.23	0.21	1.70
Total	0.30	0.28	1.92

1.2.2 DR Potential

Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

The estimated technical potential results are summarized in Table 1-4.

Table 1-4: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	26	41
Non-Residential	28	17
Total	54	58

Economic Potential

DR economic potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective economic potential attainable for FPUC for DR.

Achievable Potential

DR achievable potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective achievable potential attainable for FPUC for DR.

1.2.3 DSRE Potential

Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems charged from PV, and CHP technologies based on the customer characteristics of each FEECA utility's customer base.

Table 1-5: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	19	-	117
Non-Residential	58	-	360
Total	78	-	477
Battery Storage charged from PV Systems			
Residential	7	7	-
Non-Residential	1	-	-
Total	8	7	-
CHP Systems			
Total	21	11	95

Economic Potential

DSRE economic potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective economic potential attainable for FPUC for PV systems, battery storage systems, or CHP systems.

Achievable Potential

DSRE achievable potential incorporates the achievable screening criteria described above for EE potential. Nexant found there to be no cost-effective achievable potential attainable for FPUC for PV systems, battery storage systems, or CHP systems.

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Florida Public Utilities' (FPUC) service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- List of cost-effective EE, DR, and DSRE measures
- Potential demand and energy savings for technical, economic and achievable potential scenarios
- Estimated utility costs to acquire the achievable potential
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.

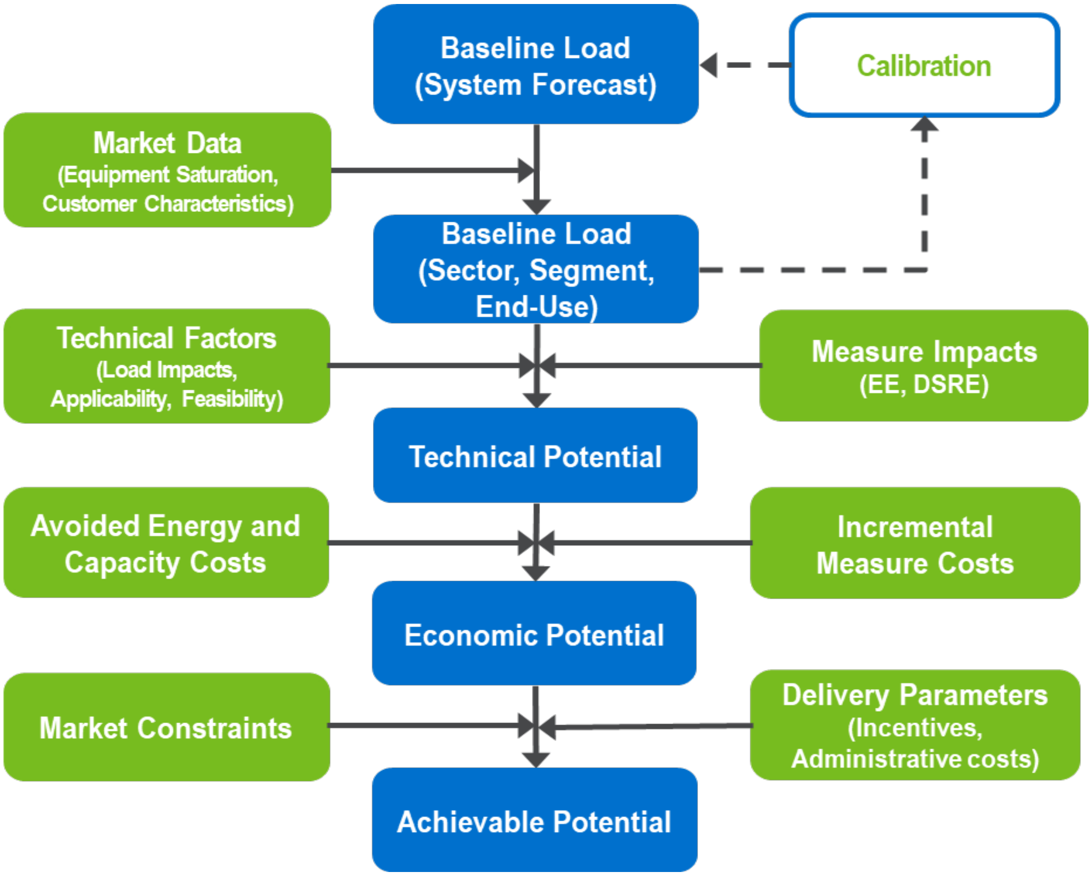
- Economic Potential is the amount of energy and capacity that could be reduced by DSM measures that are considered cost-effective. This study used the Ratepayer Impact Measure (RIM) test perspective and Total Resource Cost (TRC) test perspective, which were both coupled with the Participant Cost Test (PCT) and a two-year payback to determine cost-effectiveness.
- Achievable Potential is the DSM savings feasible when considering how utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant's achievable potential applied the same cost-effectiveness screening as the economic potential analysis, with the addition of utility program costs and incentives.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to FPUC's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, measure impacts, and costs.

Figure 2-1 provides an illustration of the MPS process, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Market Potential Modeling



Nexant estimated DSM savings potential based on a combination of market research, analysis, and a review of FPUC's existing DSM programs, all in coordination with FPUC. Nexant examined EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions, projected customer response to DR measures, the marginal benefit and cost of recruiting a customer for DR, and customer enrollment. Customer demand was determined by looking at interval data for a sample of each customer segment and determining the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures

was developed based on the performance of existing Florida DR programs and other DR programs in the US. Cost-effectiveness was estimated based on demand reductions, how well reductions coincide with system peaking conditions, the benefits of reducing demand during peaking conditions, and cost information. Enrollment rates were determined as a function of the incentive paid to a customer as well as the level of marketing for each DR measure.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The FPUC base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of FPUC's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis. The goal of this further segmentation for DR was to understand which customer groups were most cost-effective to recruit and allow for more targeted marketing of DR programs.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be

willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from FPUC. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the FPUC electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020-2029, and based it on data provided by FPUC, primarily their 2017 Northeast Florida and Northwest Florida Load Forecast, which was the most recent data available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized FPUC's summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with FPUC's estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers' baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA's recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on Gulf Power customer profile data used as proxy for FPUC rate class load shares and intensities, and EIA RECS data.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA RECS and end-use forecasts from Gulf Power.
    - Nexant made conversions to usage estimates generated by applying EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on Gulf Power customer profile data used as proxy for FPUC rate class load shares and intensities, and EIA CBECS data.
- Segment data from EIA and Gulf Power.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA CBECS and end-use forecasts from Gulf Power.

Industrial sector:

- The disaggregation was based on Gulf Power customer profile data used as proxy for rate class load shares and intensities, and EIA MECS data.
- Segment data from EIA and Gulf Power.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA MECS and end-use forecasts from Gulf Power.

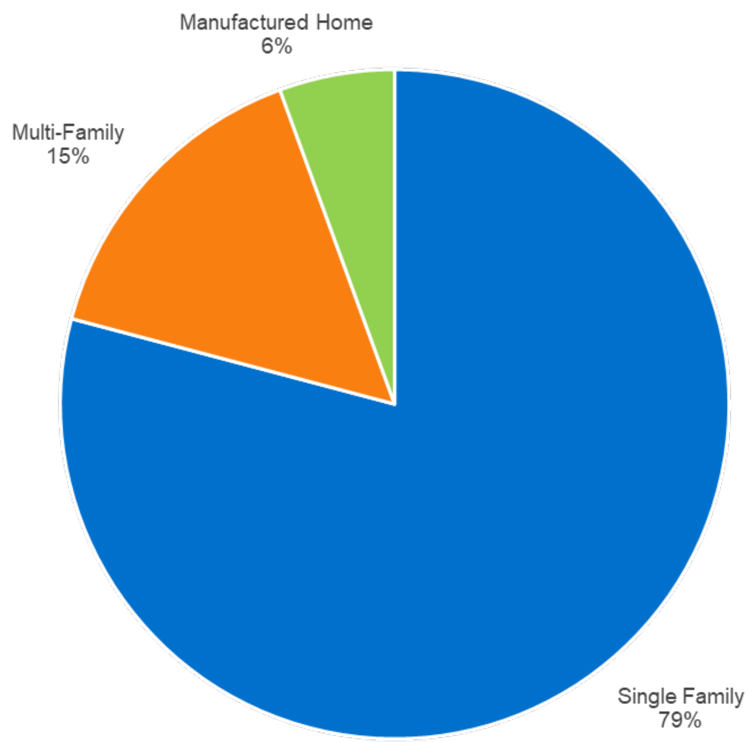
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. FPUC provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential customers, but the overall logic was consistent with the concept of expressing the customers in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I customers using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2 and Figure 3-3.

Figure 3-2: Commercial Customer Segmentation

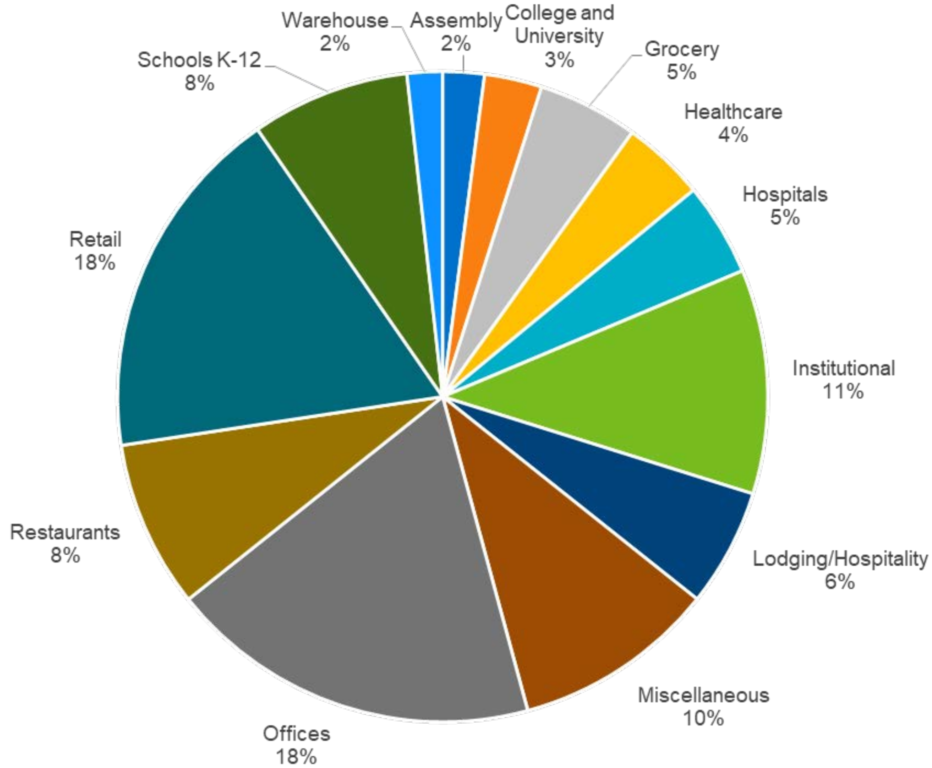
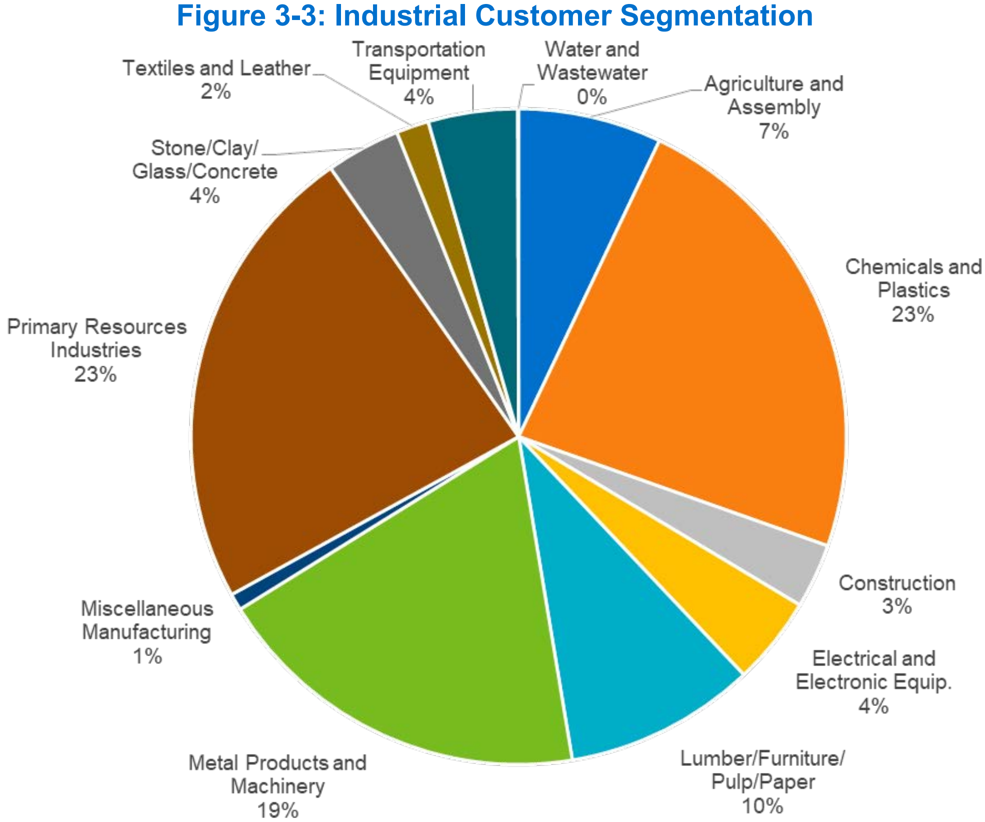


Figure 3-3: Industrial Customer Segmentation



3.2.3 Commercial and Industrial Customers (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD) tariff[3]. Nexant further segmented these two groups based on customer size. For small C&I segmentation was determined using annual customer consumption and for Large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by FPUC.

Table 3-3 shows the account breakout between small C&I and large C&I.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Customer Size	Number of Accounts
Small C&I	0-15,000 kWh	2,735
	15,001-25,000 kWh	459
	25,001-50,000 kWh	449
	50,001 kWh +	366
	Total	4,010
Large C&I	0-50 kW	216
	51-300 kW	257
	301-500 kW	28
	501 kW +	8
	Total	509

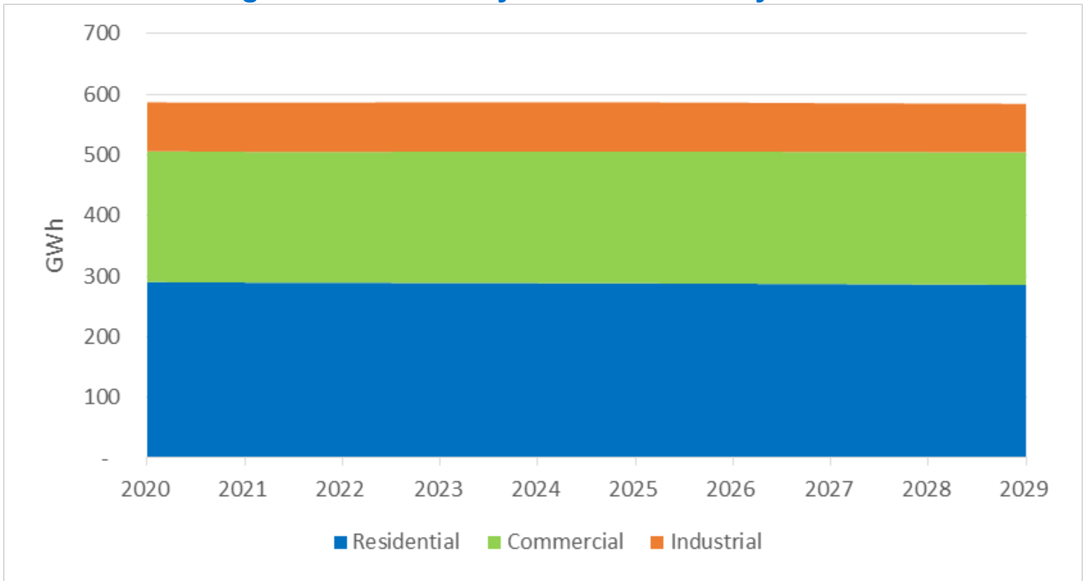
3.3 Analysis of System Load

3.3.1 System Energy Sales

While the technical and economic potential are based on the year 2020's system load forecast, achievable potential is applied over the entire 10-year study period (2020-2029). Figure 3-4 summarizes the electric sales forecast by sector over the study period.

[3] To be eligible, customers must have a maximum demand greater than 25 kW.

Figure 3-4: Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine when DR would be cost-effective to implement, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when DR resources will be needed was the historical system load for FPUC. The data provided contained the system loads all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For FPUC the summer peaking conditions were defined as July and August from 4:00-5:00 PM and the winter peaking conditions were defined as January from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are illustrated in Figure 3-5, Figure 3-6 and Figure 3-7.

Figure 3-5: Residential Baseline (2020) Sales by End-Use

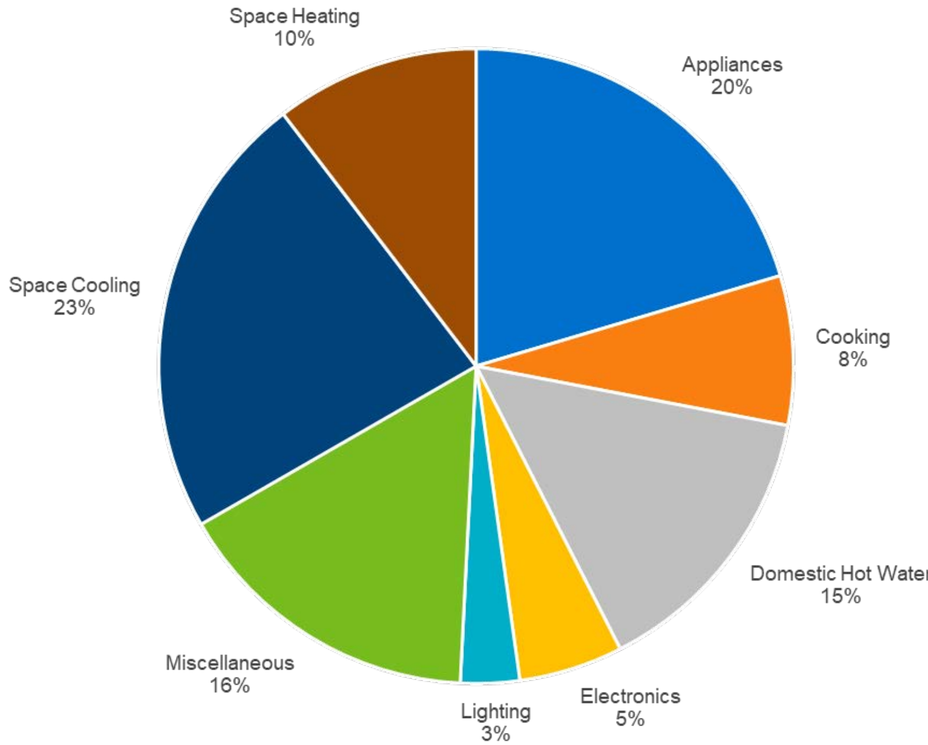


Figure 3-6: Commercial Baseline (2020) Sales by End-Use

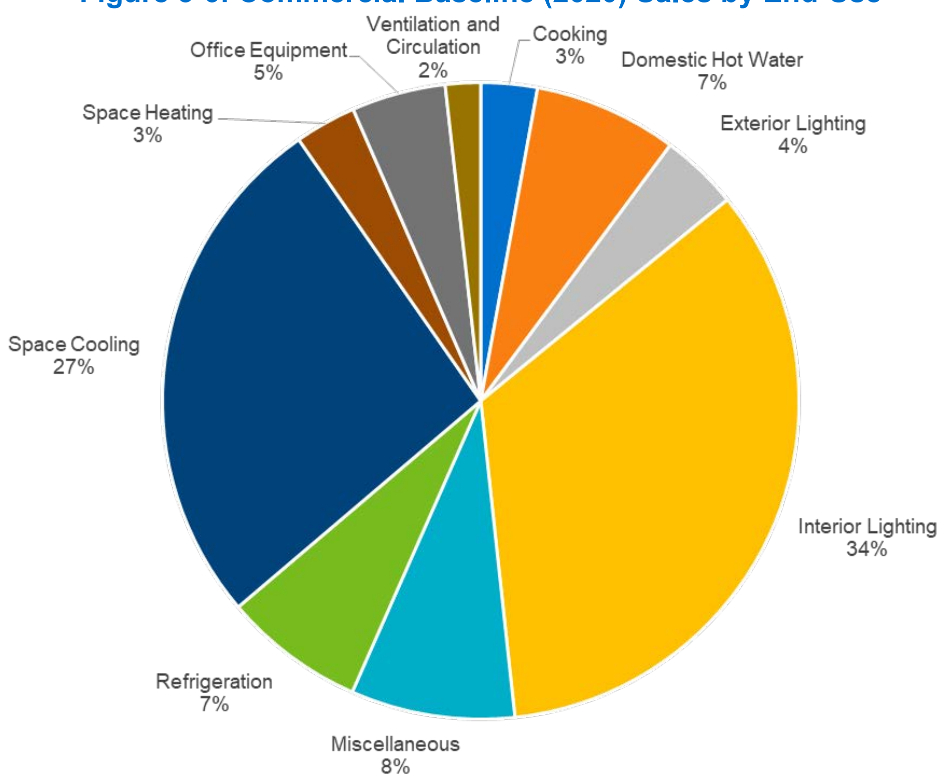
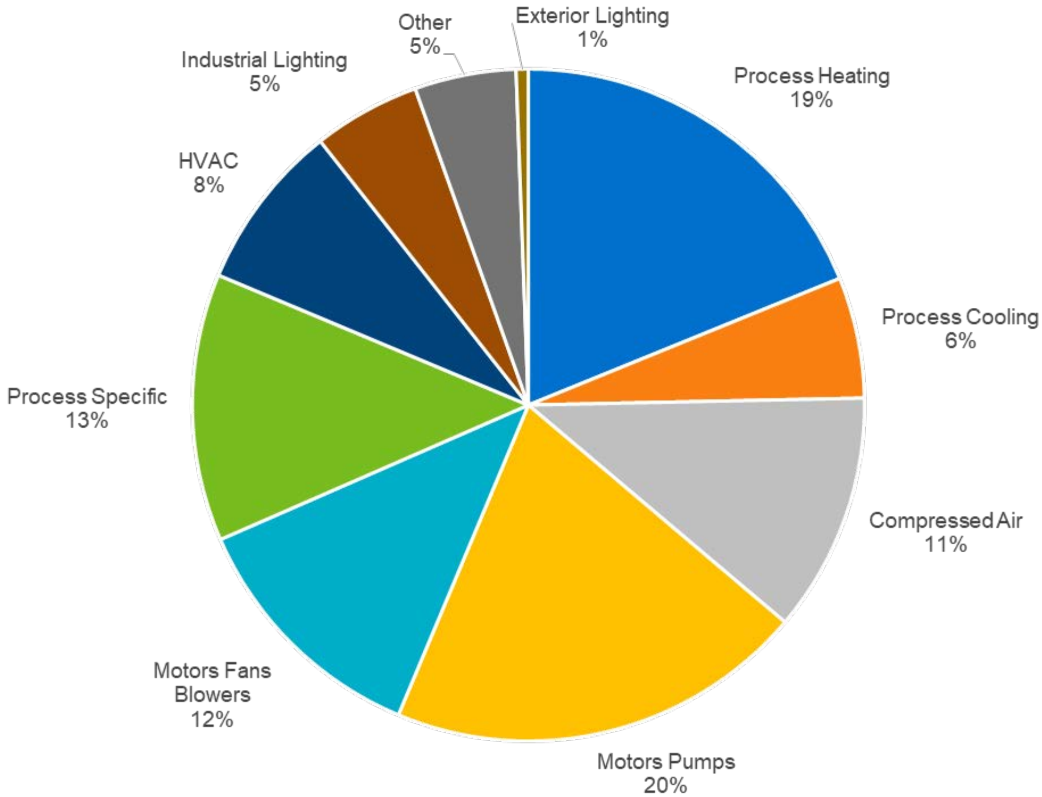


Figure 3-7: Industrial Baseline (2020) Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar MPS conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[1]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations

[1] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.
- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used was primarily derived from data in current regional and national databases, as well as FPUC's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,164 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[2]	30	320

[2] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix C.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) Programs with Technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or rate discounts for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed.

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end uses estimated for technical potential. Individual measures were only considered for economic and achievable potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[3].

[3] This study did not include ground-mounted or utility-scale solar PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged from PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover technologies used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of the commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as a single numerical value for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

$$\text{Technical Potential of Efficient Measures} = \text{Total Number of Households} \times \text{Baseline Equipment Energy Use Intensity (kWh/unit)} \times \text{Equipment Saturation Share} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

$$\text{Technical Potential of Efficient Measures} = \text{Total Stock Sq. Footage by Segment} \times \text{Baseline Equipment Energy Use Intensity (kWh/unit)} \times \text{Equipment Saturation Share} \times \text{Remaining Factor} \times \text{Applicability Factor} \times \text{Savings Factor}$$

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with FPUC's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I customers generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For FPUC, Nexant examined three residential segments based on customer housing type, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 11 different customer segments.

Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the

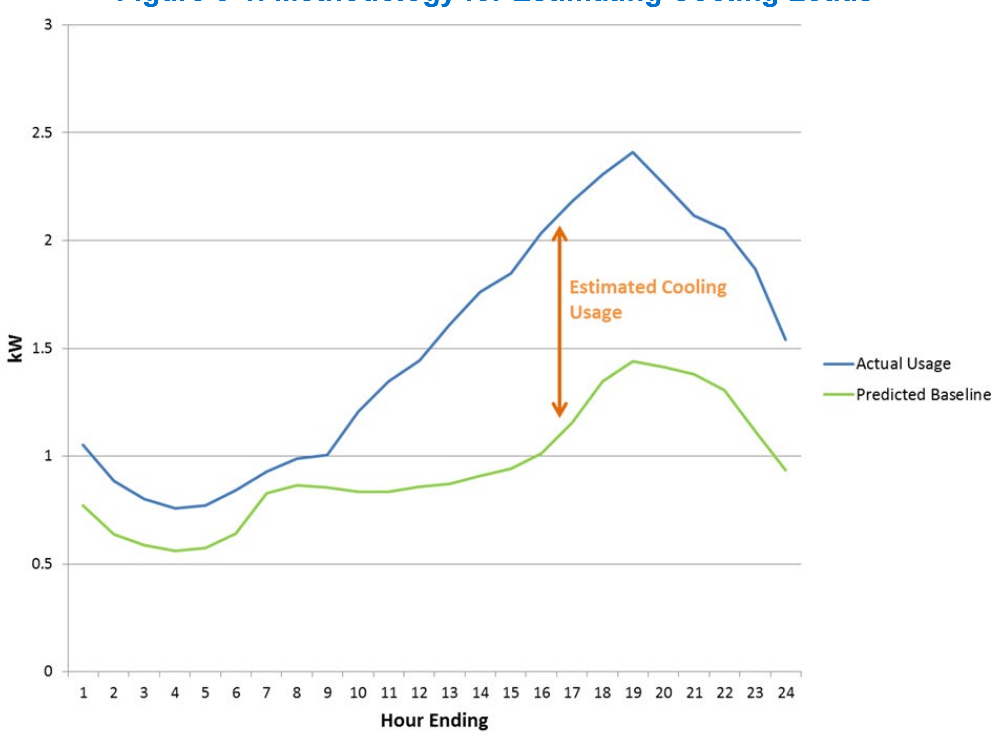
summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

Because FPUC did not have any interval data available, AC and heating load profiles were generated for residential and small C&I customers using a sample of customers provided by Gulf as a proxy. This sample included a customer breakout based on size and housing type for each rate class. Nexant then used the interval data from these customers to create an average load profile for each customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the seven different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR program.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are July and August from 4:00-5:00 PM for summer, and January from 7:00-8:00 AM for winter.

For technical potential, there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads. Individual measures are only considered for economic and achievable potential.

5.1.3 DSRE Technical Potential

5.1.3.1 PV Systems

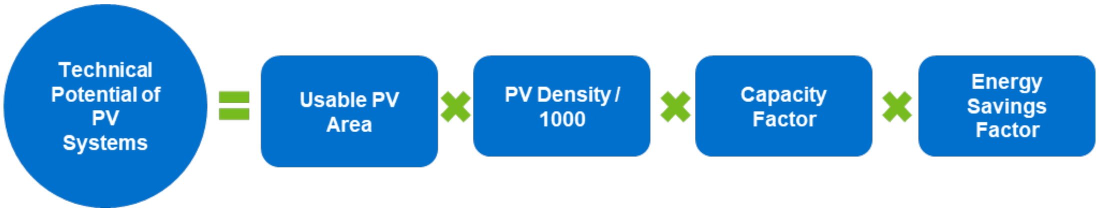
To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[7], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

[7] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Equation 5-3: Core Equation for Solar Technical Potential



Where:

Usable PV Area for Residential: (Total Floor Area[8] / Average No. of Stories[9]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[10] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PV Watts. Energy Savings Factor = Alternating Current System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

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[8] Utility-provided data and US Census, South Region

[9] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[10] Floor space = based on utility data. Average floors by building type = CBECS, South Atlantic Region

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery systems do create the opportunity to store energy during period when the PV system is generating more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for "solar plus storage" systems, our methodology consisted of the following steps:

- Develop an 8,760 hour annual load shape for a PV system based on estimated annual hours of available sunlight.
- Compare the PV generation with a total home or total business 8,760 hour annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.
- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for all commercial and industrial market segments.

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers' thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with an annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore, the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
    - For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could

impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

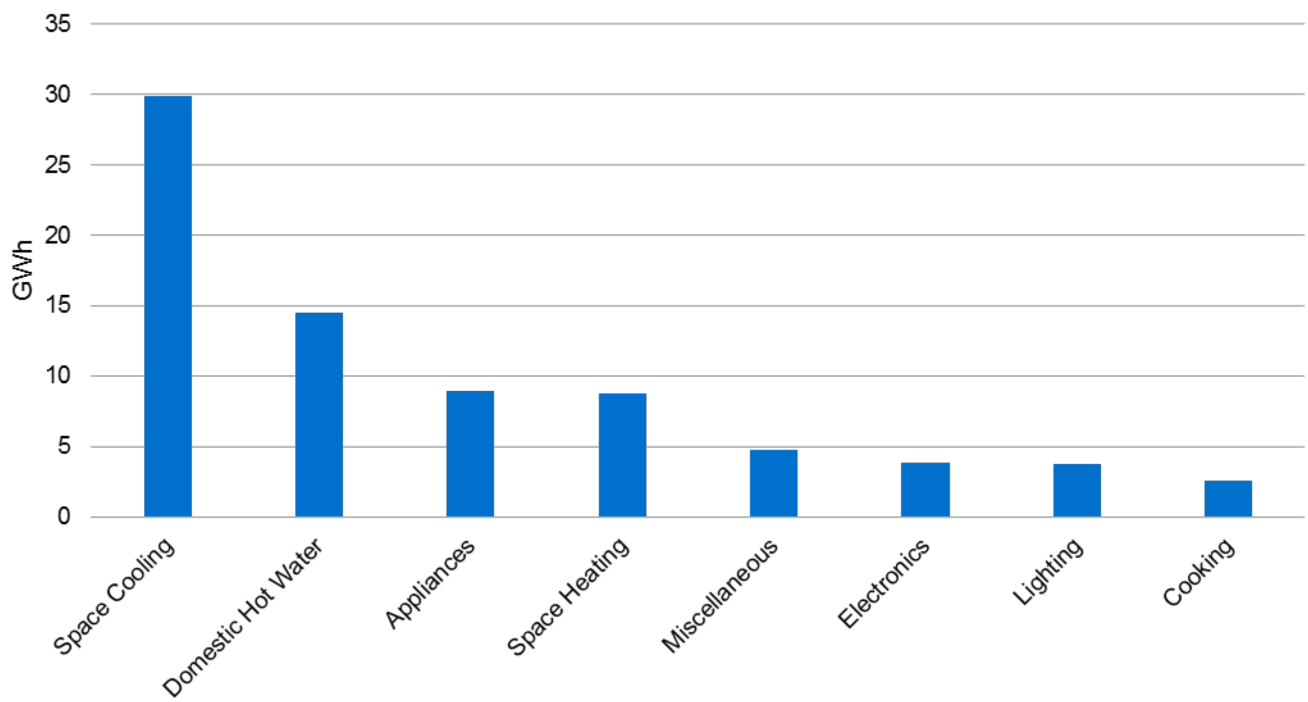
Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	21	11	77
Non-Residential[11]	13	7	60
Total	34	18	137

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 illustrate the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Energy Savings)



[11] Non-Residential results include all commercial and industrial customer segments

Figure 5-3: Residential EE Technical Potential by End-Use (Summer Peak Savings)

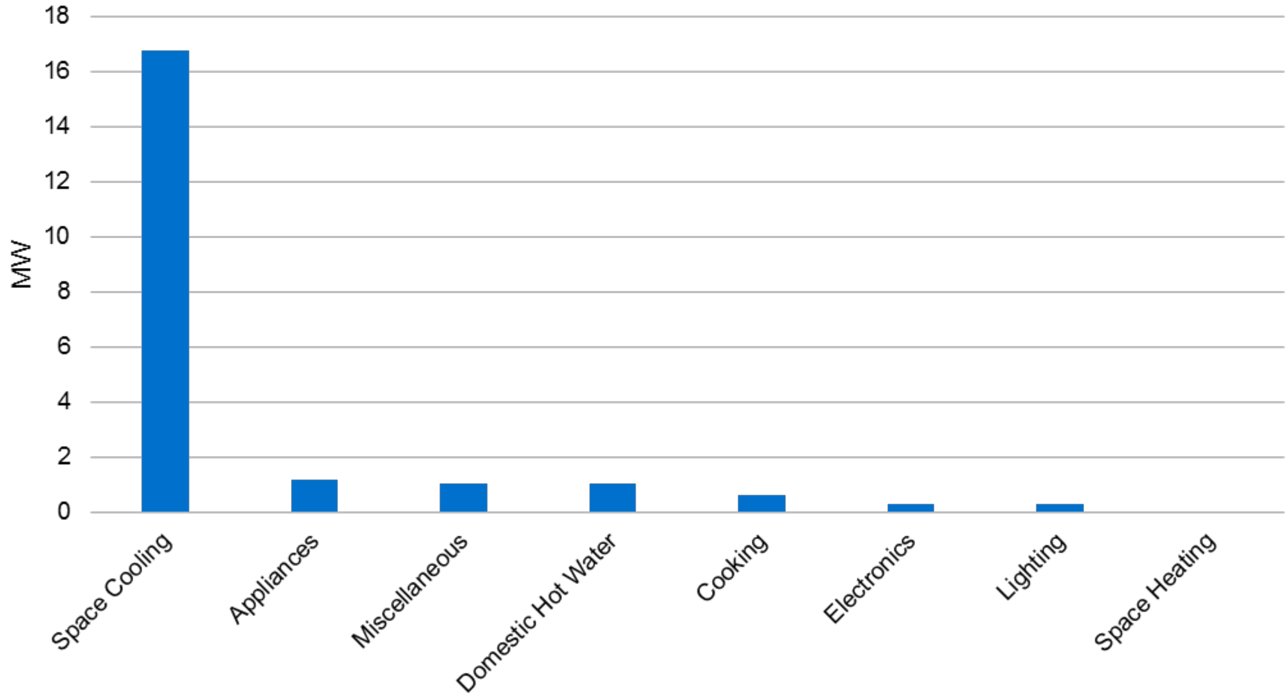
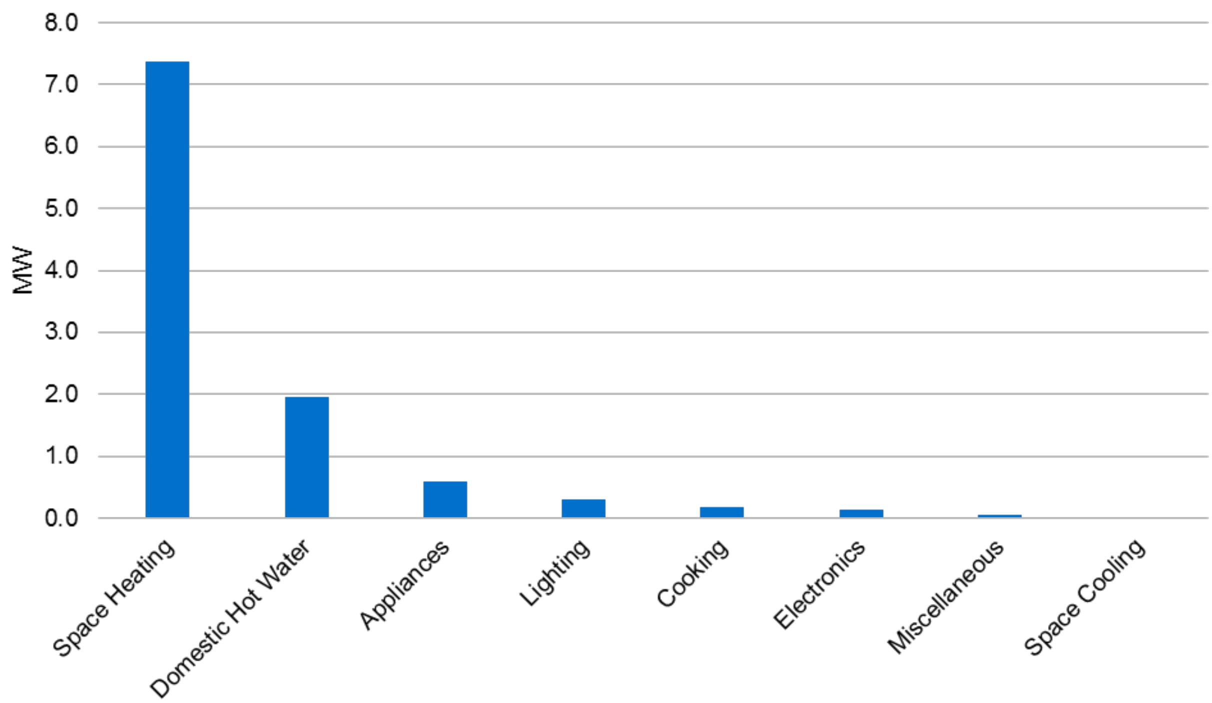


Figure 5-4: Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3 Non-Residential

5.2.3.1 Commercial Segments

Figure 5-5, Figure 5-6, and Figure 5-7 illustrate the commercial sector EE technical potential by end-use.

Figure 5-5: Commercial EE Technical Potential by End-Use (Energy Savings)

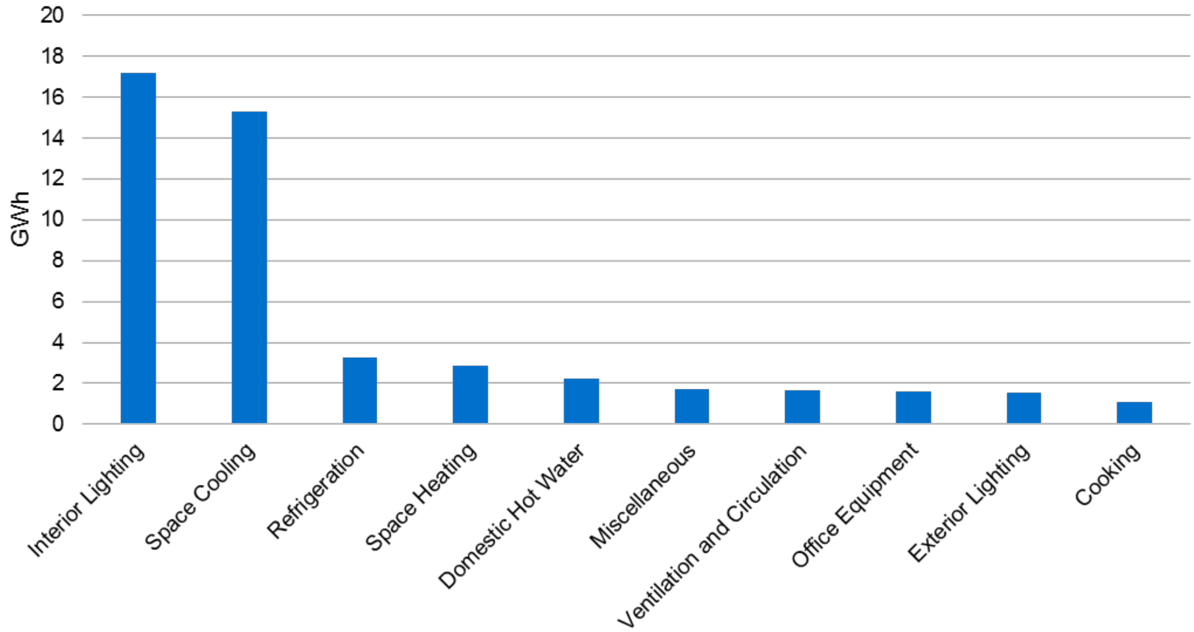


Figure 5-6: Commercial EE Technical Potential by End-Use (Summer Peak Savings)

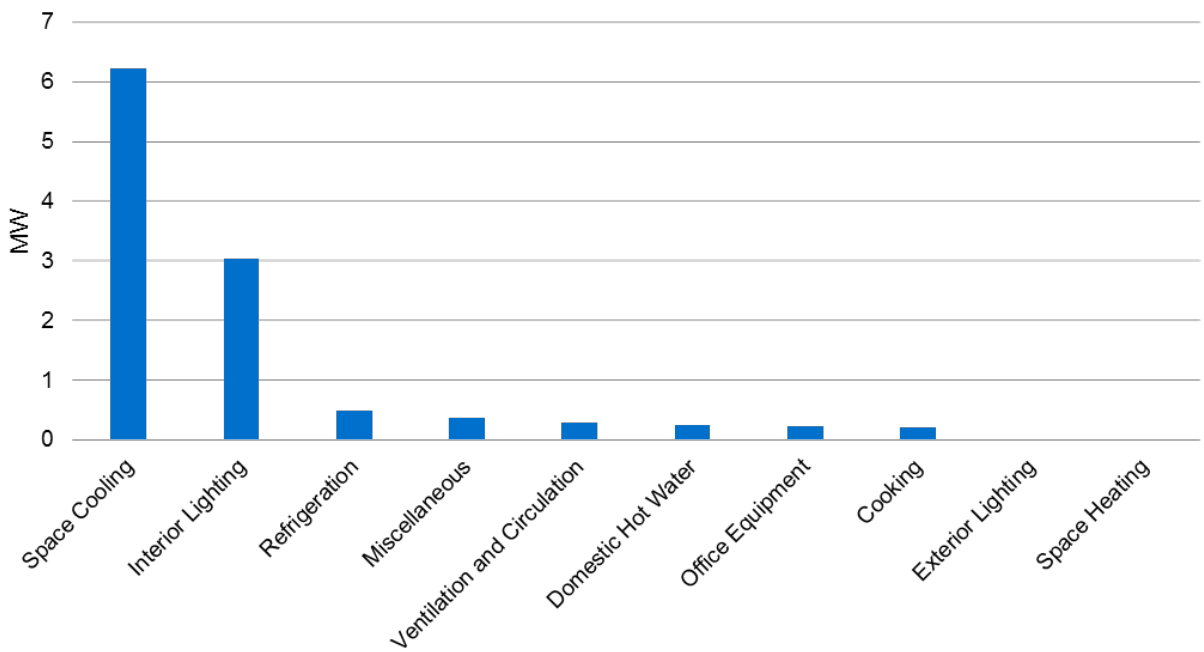
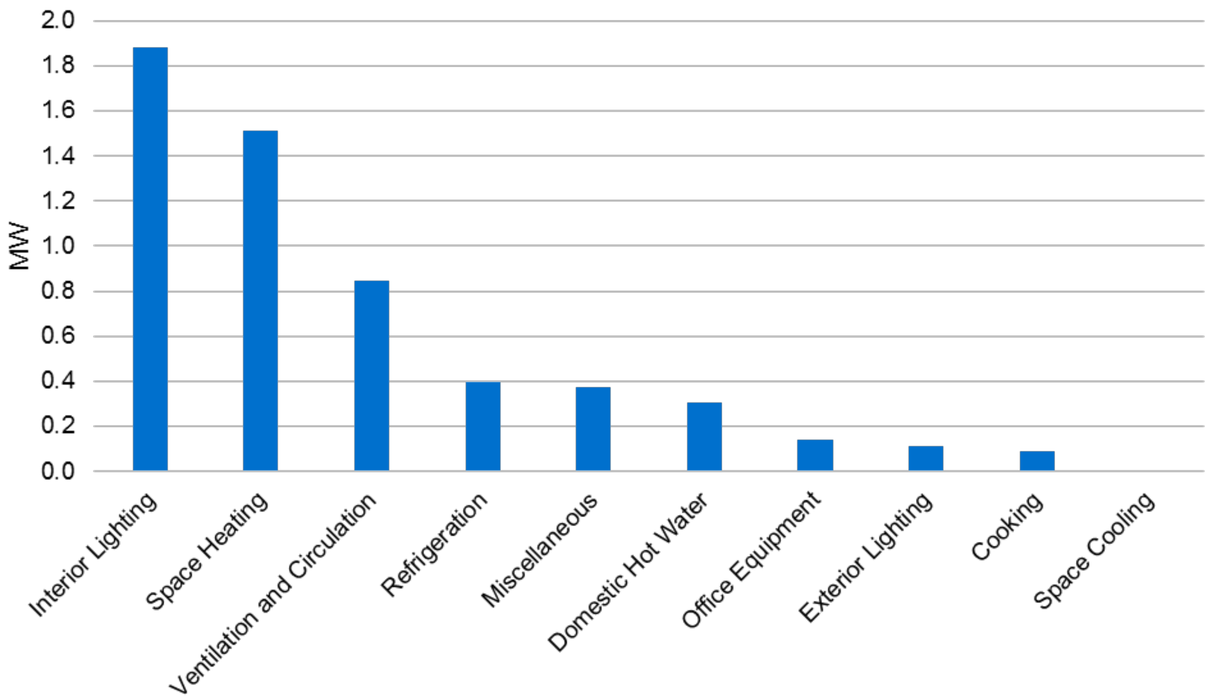


Figure 5-7: Commercial EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3.2 Industrial Segments

Figure 5-8, Figure 5-9, and Figure 5-10 illustrates the industrial sector EE technical potential by end-use.

Figure 5-8: Industrial EE Technical Potential by End-Use (Energy Savings)

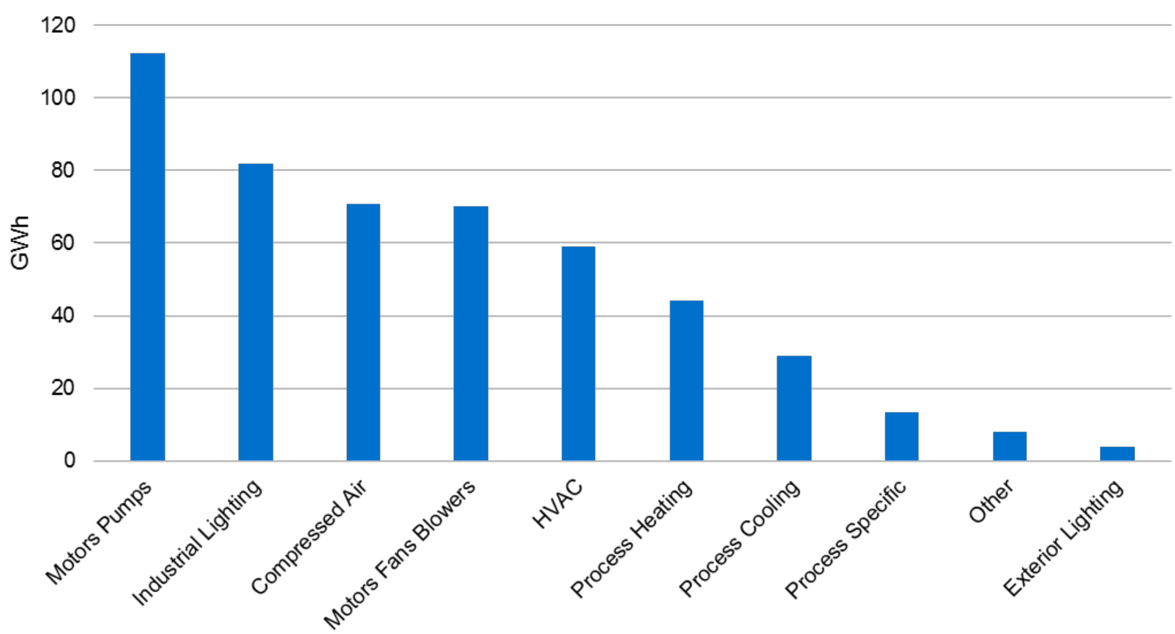


Figure 5-9: Industrial EE Technical Potential by End-Use (Summer Peak Savings)

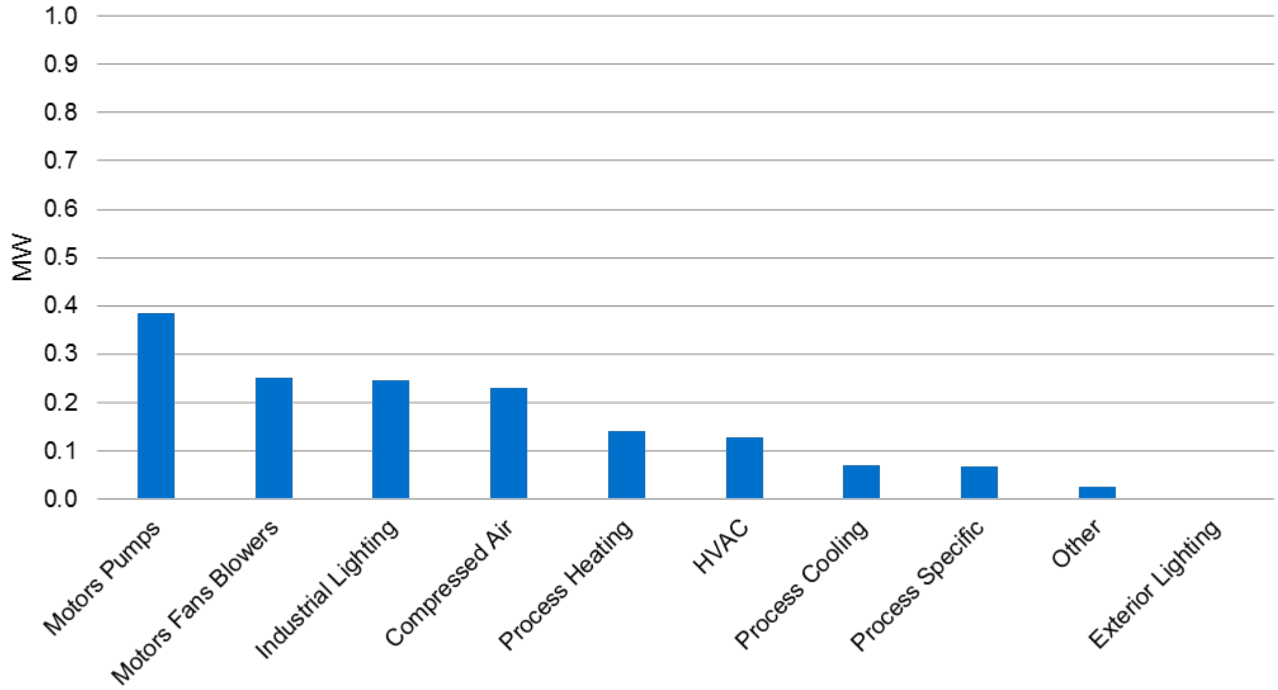
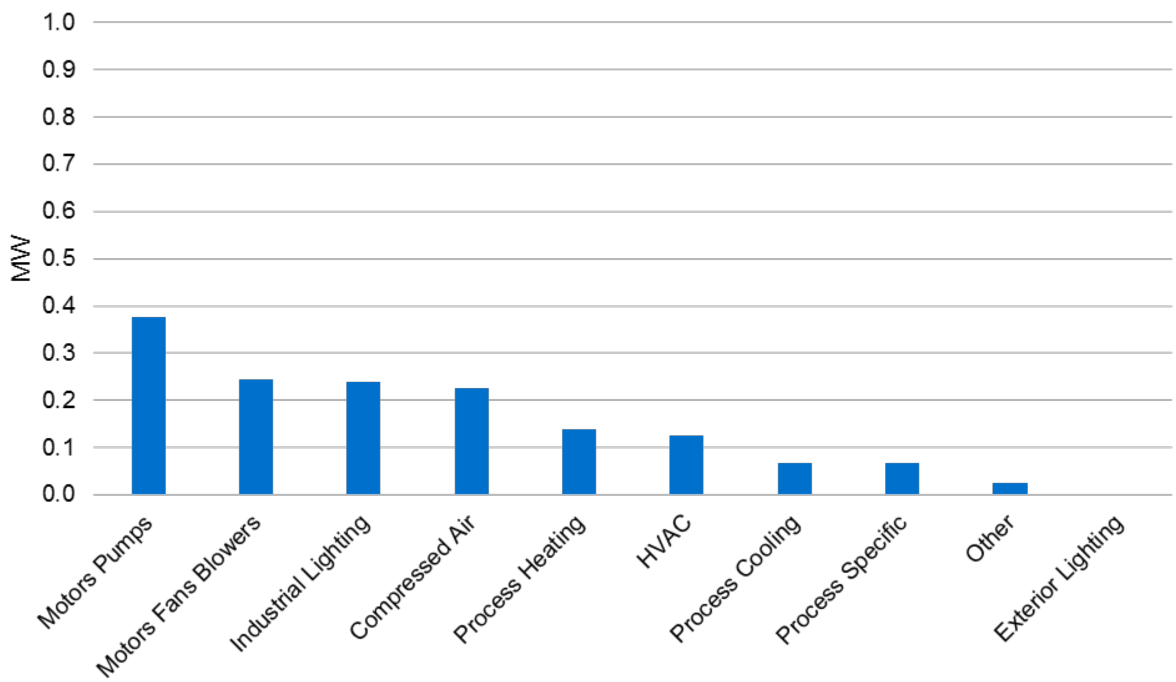


Figure 5-10: Industrial EE Technical Potential by End-Use (Winter Peak Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in FPUC's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

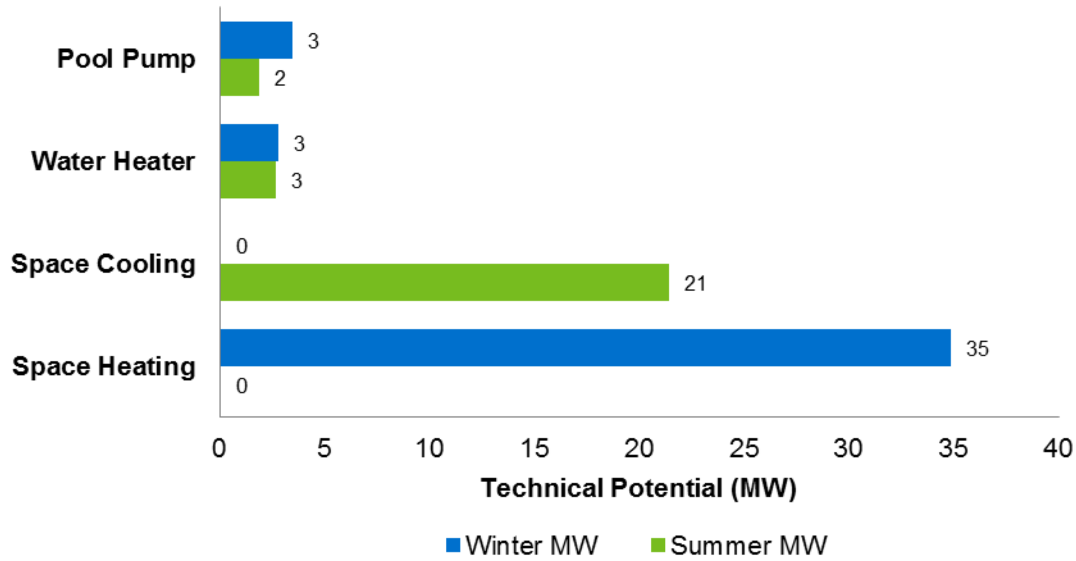
Table 5-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	26	41
Non-Residential	28	17
Total	54	58

5.3.1 Residential

Residential technical potential is summarized in Figure 5-11.

Figure 5-11: Residential DR Technical Potential by End-Use

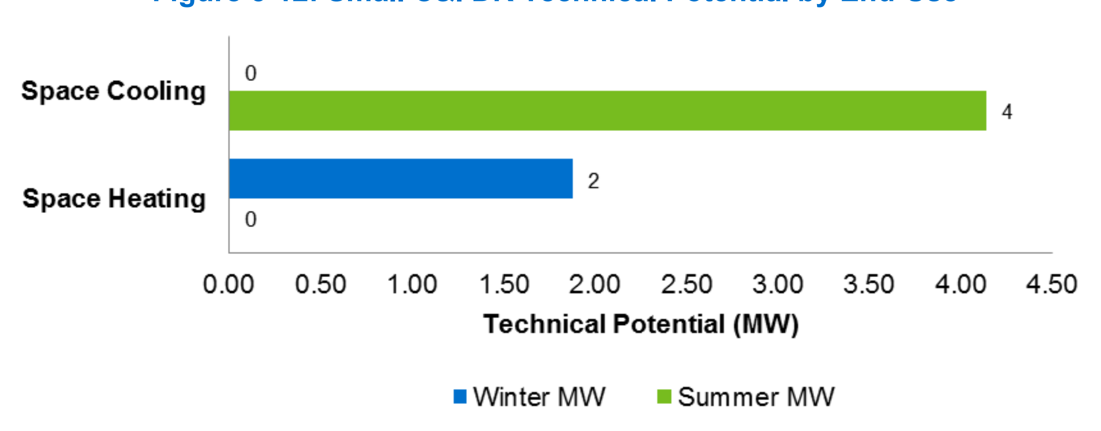


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-12.

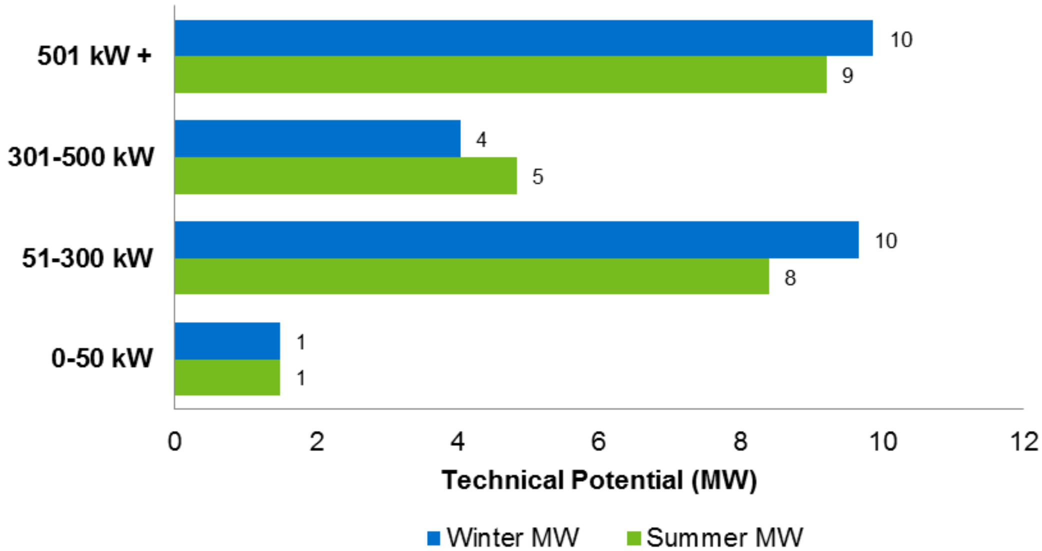
Figure 5-12: Small C&I DR Technical Potential by End-Use



5.3.2.2 Large C&I Customers

Figure 5-13 provides the technical potential for large C&I customers, broken down by customer size.

Figure 5-13: Large C&I DR Technical Potential by Segment



5.4 DSRE Technical Potential

Table 5-3 section the results of the DSRE technical potential for each customer segment.

Table 5-3: DSRE Technical Potential[12]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	19	-	117
Non-Residential	58	-	360
Total	78	-	477
Battery Storage charged from PV Systems			
Residential	7	7	-
Non-Residential	1	-	-
Total	8	7	-
CHP Systems			
Total	21	11	95

[12] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

6 Economic Potential

The economic potential scenario estimates the savings potential when all technically feasible DSM measures that are cost-effective to implement are applied at their full market potential (*i.e.* 100% adoption rate). The economic potential was the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

6.1 DSM Cost-Effective Screening Criteria

6.1.1 Cost-Effectiveness Test Perspectives

When analyzing DSM measures, different cost-effectiveness tests are considered to reflect the perspectives of different stakeholders. The Ratepayer Impact Measure ("RIM") addresses an electric utility customer perspective, which considers the net impact on electric utility rates associated with a measure or program. The Total Resource Cost ("TRC") addresses a societal perspective, which considers costs of DSM measure or program relative to the benefits of avoided utility supply costs. The Participant Cost Test ("PCT") addresses a participant perspective, which considers net benefits to those participating in a DSM program.

Descriptions follow of methods for allocating costs and benefits within each cost-effectiveness indicator (RIM, TRC, and PCT); the calculations remain consistent with the Florida Cost Effectiveness Manual[13].

Table 6-1: Components of Cost-Effectiveness Calculations

Component	Definition
Customer Incremental Costs	All incremental costs incurred by the customer to purchase, install, operate, and maintain a DSM measure
Utility Program Costs	Utility administrative and marketing costs and capital expenditures required to implement a DSM measure
Utility Incentives	Costs provided by the utility to the participant to encourage the purchase, installation, operation, and maintenance of a DSM measure
Utility Supply Costs	Utility costs of supplying electricity to the customer, including generation, transmission, and distribution costs
Electric Bill Impacts	Impacts on a participating customer's electric bill due the installation of a DSM measure
Utility Electric Revenues	Impacts on the utility's electric revenues due to the installation of a DSM measure

[13] Cost Effectiveness Manual for Demand Side Management and Self Service Wheeling Proposals; Florida Public Service Commission, Tallahassee, FL; adopted June 11, 1991.

Table 6-2: Ratepayer Impact Measure (RIM)

Component	Definition
Benefit	Increase in utility electric revenues Decrease in avoided electric utility supply costs
Cost	Decrease in utility electric revenues Increase in avoided electric utility supply costs Utility program costs, if applicable Utility incentives, if applicable

Table 6-3: Total Resource Cost (TRC)

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Increase in electric utility supply costs Customer incremental costs (less any tax incentives) Utility program costs, if applicable

Table 6-4: Participant Cost Test (PCT)

Component	Definition
Benefit	Decrease in electric bill Utility incentives, if applicable
Cost	Increase in electric bill Customer incremental costs (less any tax incentives)

6.1.2 Economic Potential Screening Methodology

Based on discussion with the FEECA Utilities and consistent with prior DSM analyses in Florida, for development of the economic potential, two scenarios were considered, a RIM-scenario and a TRC-scenario, for which the following economic screening process was followed:

- Criteria for RIM Scenario:
  - Achieve a cost-benefit ratio of 1.0 or greater from the RIM perspective. For the economic potential, the RIM benefits included avoided electric utility supply costs, while RIM costs include decreases in utility electric revenues. The economic potential screening did not consider utility incentives or utility program costs as a component of the measure’s cost-effectiveness (these are reflected in the Achievable Potential analysis).
  - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.

    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.

- Criteria for TRC Scenario:
    - Achieve a cost-benefit ratio of 1.0 or greater from the TRC perspective. For the economic potential, the TRC benefits included avoided electric utility supply costs, while TRC costs included customer incremental cost to implement the measure. The economic potential screening did not consider utility DSM program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
    - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.
    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.

The cost-effectiveness screening described above was applied to each DSM measure permutation based on the installation of the measure in the Base Year (2020) of the study. Therefore, avoided energy cost benefits were applied beginning in Year 1 and extended through the useful life of the measure; avoided generation costs began at the in-service year for new generation based on utility system load forecasts.

6.1.3 Economic Potential Sensitivities

Based on direction from the FEECA Utilities and the Order Establishing Procedure, the economic potential analysis included the following additional sensitivities:

- Sensitivity #1: Higher Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.
- Sensitivity #2: Lower Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast was adjusted to a "low fuel" scenario.
- Sensitivity #3: Shorter free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was reduced to one year or longer.
- Sensitivity #4: Longer free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was increased to three years or longer.

Each of these sensitivities resulted in a unique set of measures passing the cost-effectiveness criteria for both RIM and TRC scenarios. The economic potential for the passing measures were evaluated in Nexant's TEA-POT model, and the results of the economic sensitivities are provided in Appendix E.

6.2 EE Economic Potential

This section provides the results of the EE economic potential for each sector. Table 6-5 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 6-5: Economic Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	8	36
Commercial	19	236
Industrial	23	358
Total	50	630

6.2.1 Summary

Table 6-6 summarizes the EE economic potential by sector and by scenario (RIM and TRC):

Table 6-6: EE Economic Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	2	2	10
Non-Residential	1	1	10
Total	4	4	20

6.2.2 Residential – RIM Scenario

The residential segments did not have EE measures that passed the economic potential cost-effectiveness screening for the RIM scenario.

6.2.3 Non-Residential – RIM Scenario

6.2.3.1 Commercial Segments

The commercial segments did not have any EE measures that passed the economic potential cost-effectiveness screening for the RIM scenario.

6.2.3.2 Industrial Segments

The industrial segments did not have any EE measures that passed the economic potential cost-effectiveness screening for the RIM scenario.

6.2.4 Residential – TRC Scenario

Figure 6-1, Figure 6-2, and Figure 6-3 illustrate the residential EE economic potential by end-use for the TRC scenario.

Figure 6-1: Residential EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

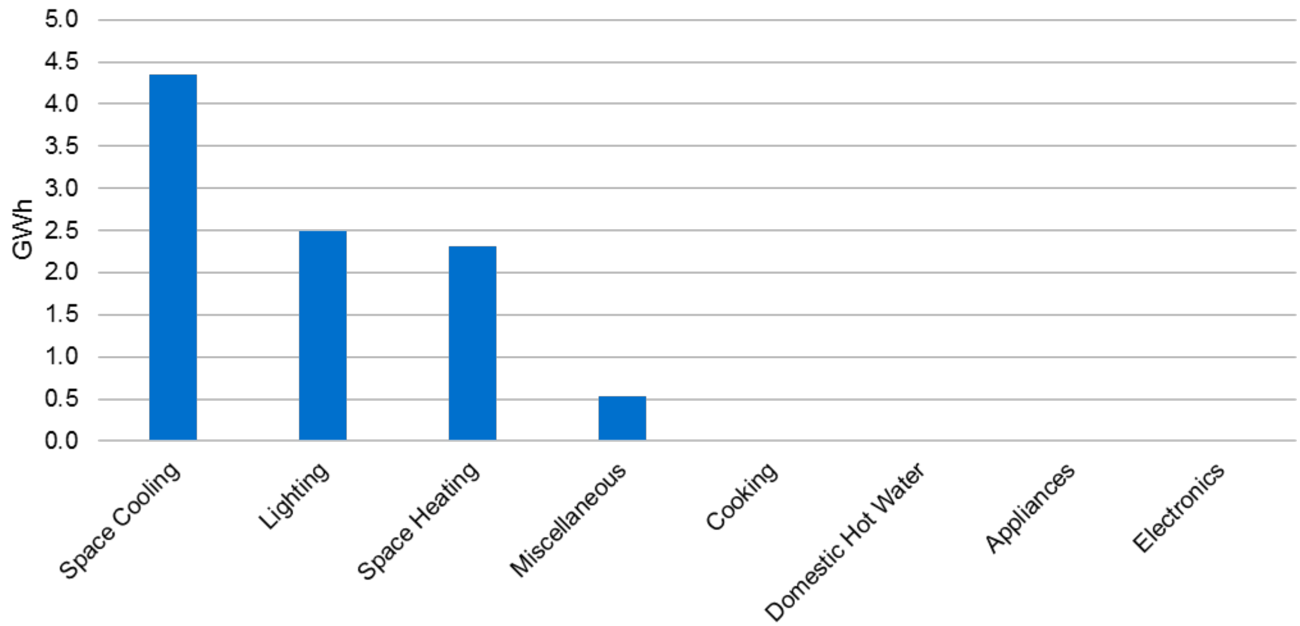


Figure 6-2: Residential EE Economic Potential by End-Use (Summer Peak Savings) - TRC Scenario

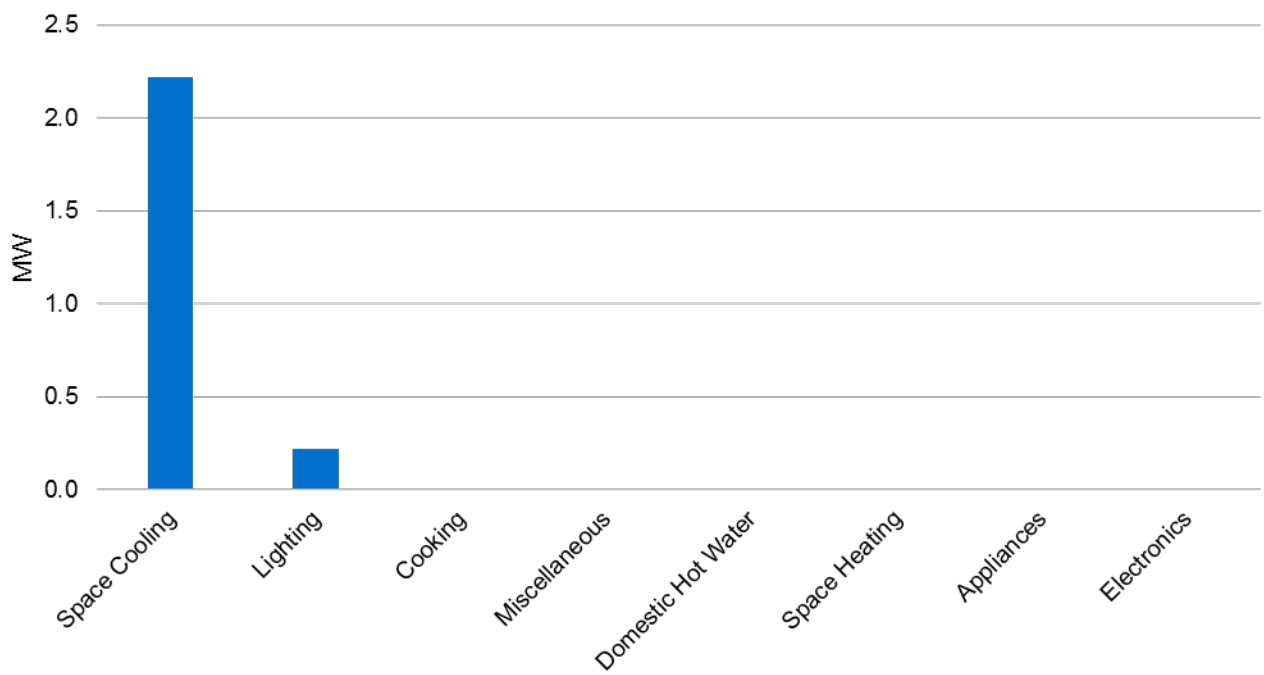
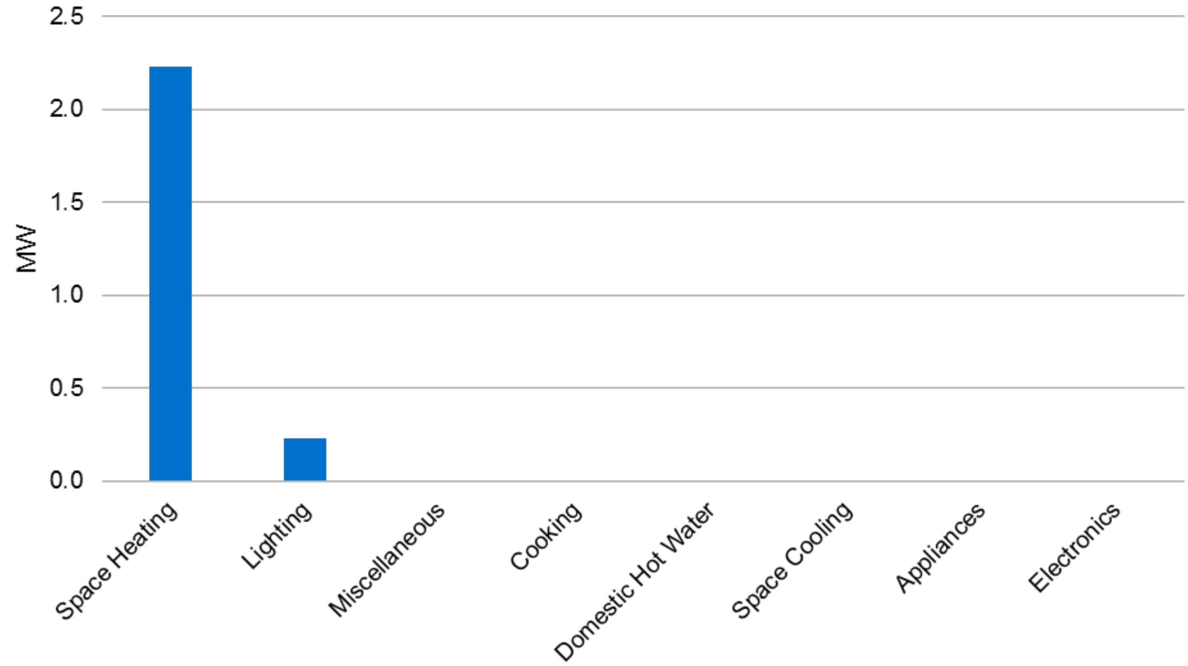


Figure 6-3: Residential EE Economic Potential by End-Use (Winter Peak Savings) - TRC Scenario



6.2.5 Non-Residential – TRC Scenario

6.2.5.1 Commercial Segments

Figure 6-4, Figure 6-5, and Figure 6-6 illustrate the commercial EE economic potential by end-use for the TRC scenario.

Figure 6-4: Commercial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

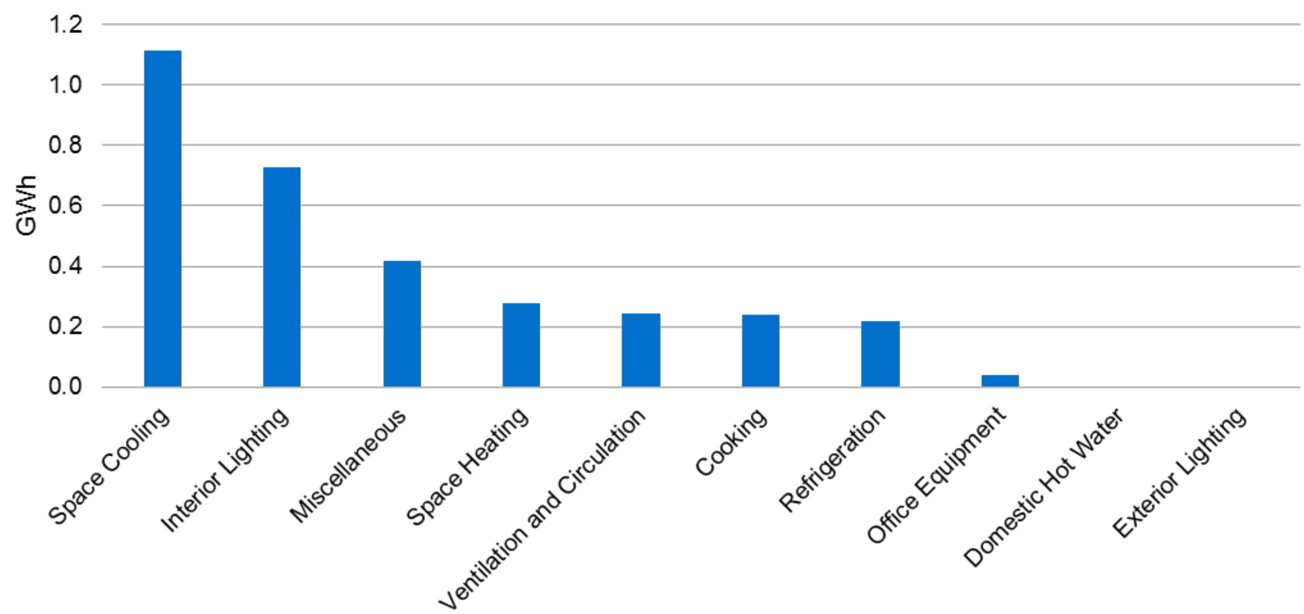


Figure 6-5: Commercial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

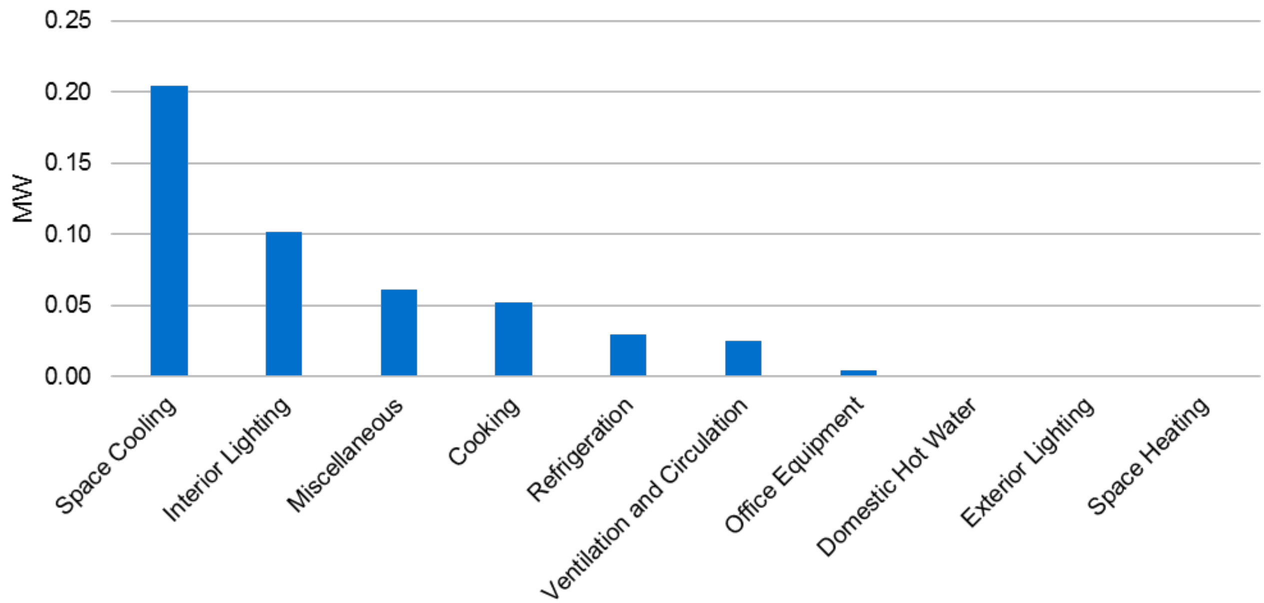
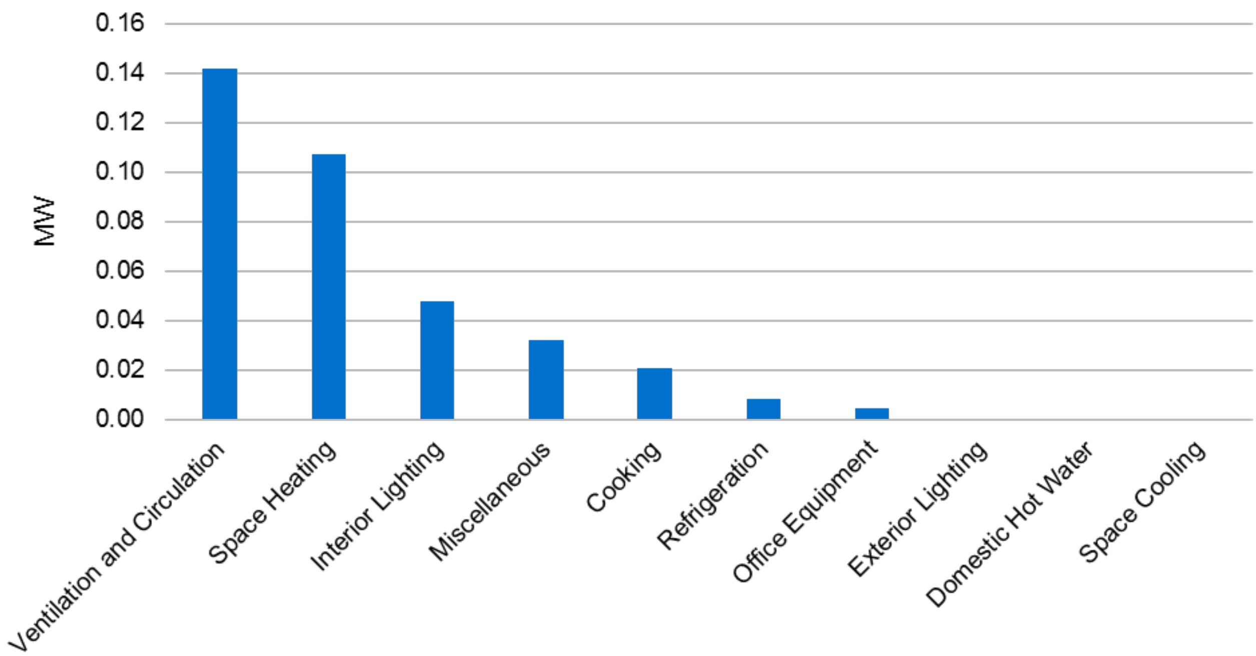


Figure 6-6: Commercial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.2.5.2 Industrial Segments

Figure 6-7, Figure 6-8 and Figure 6-9 illustrate the industrial EE economic potential by end-use for the TRC scenario.

Figure 6-7: Industrial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

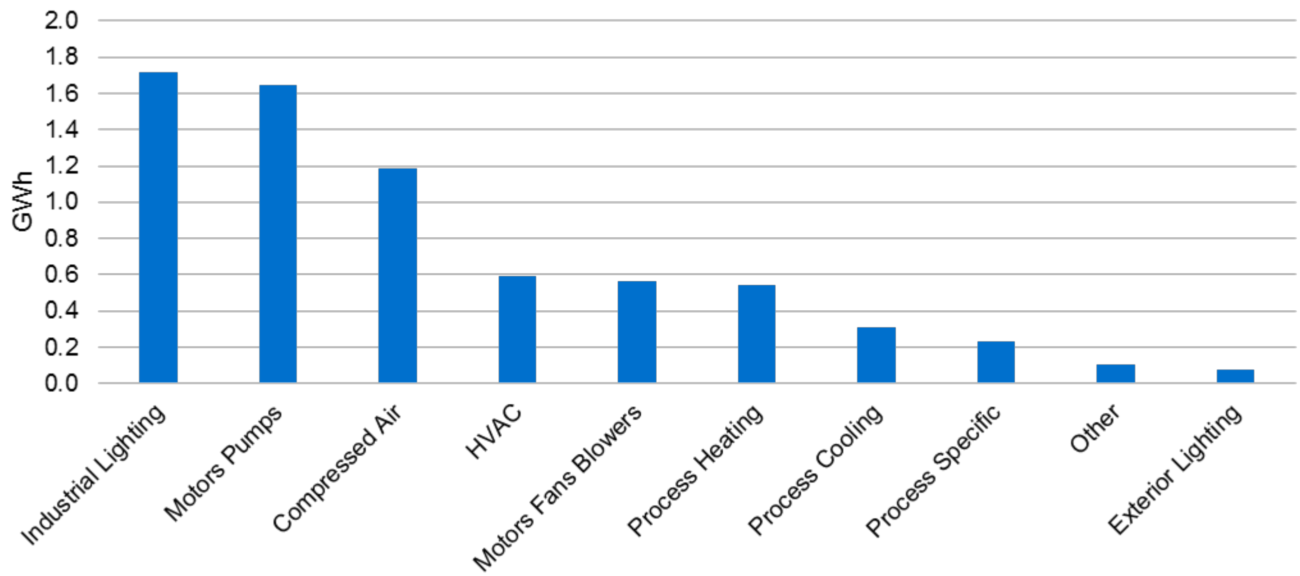


Figure 6-8: Industrial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

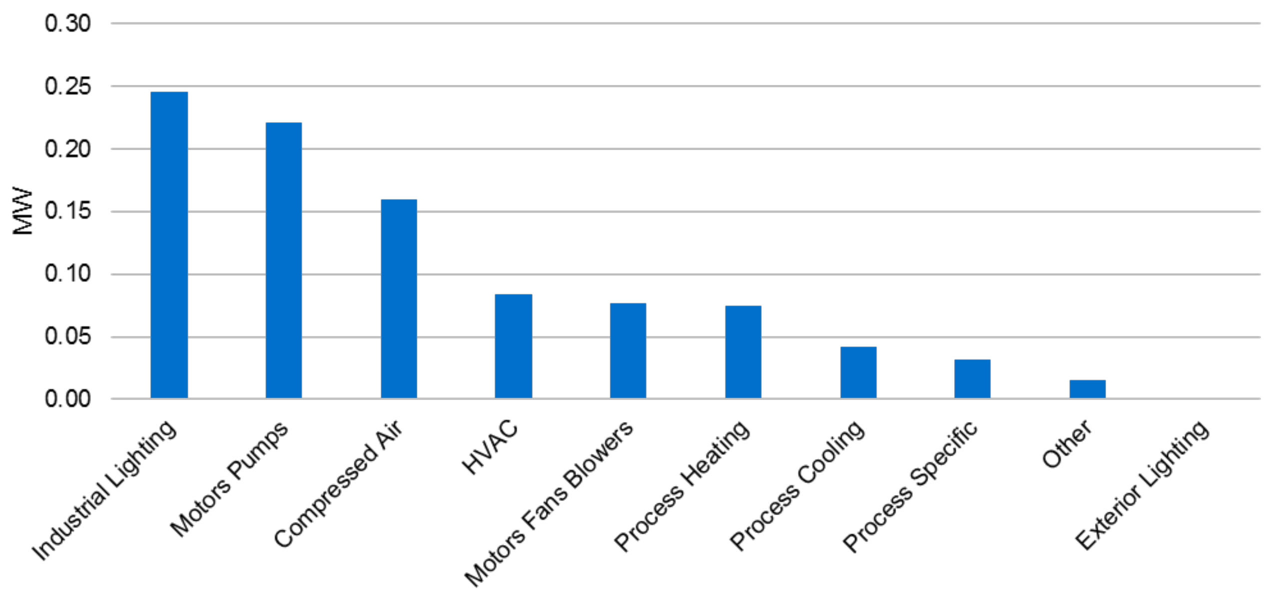
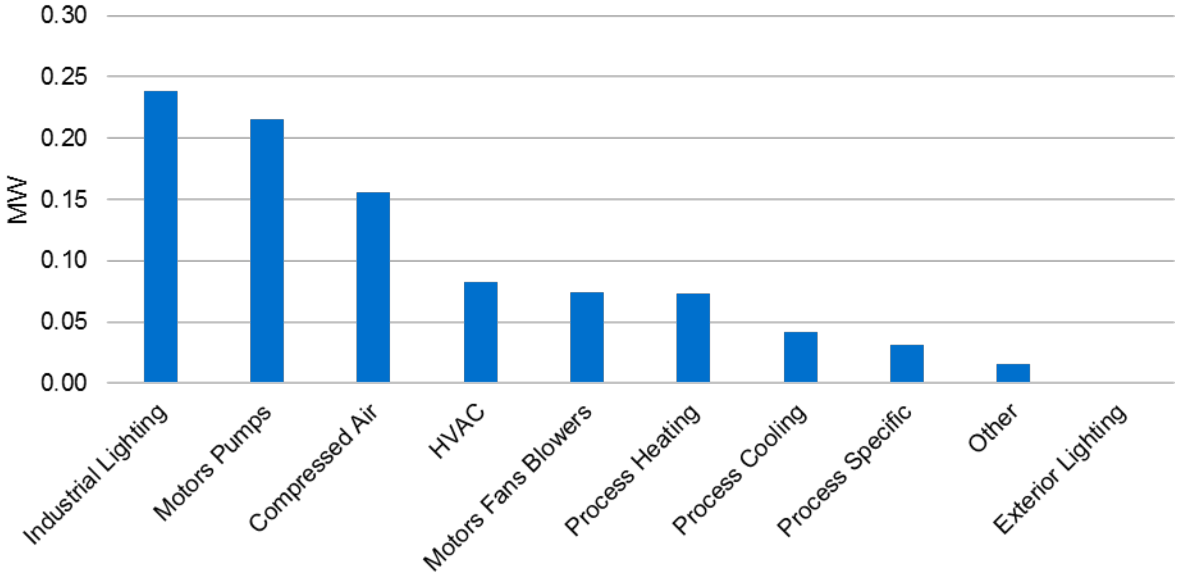


Figure 6-9: Industrial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.3 DR Economic Potential

Nexant found there to be no cost-effective economic potential attainable for FPUC for DR for the TRC-scenario or the RIM-scenario.

6.4 DSRE Economic Potential

Nexant found there to be no cost-effective economic potential attainable for FPUC for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

7 Achievable Potential

Nexant incorporated realistic assumptions about program delivery when estimating achievable market potential. Nexant estimated the cost-effective savings realistically achievable by utility-sponsored DSM programs in the FPUC jurisdiction by incorporating utility program costs and utility incentive costs, and with consideration of economic constraints and market demand for DSM services in Florida.

7.1 Achievable Potential Methodology

7.1.1 Utility Program Costs and Incentives

Prior to the development of the achievable potential, Nexant performed a cost-effectiveness re-screening of all measures that passed the economic potential screening, under both the RIM and TRC scenarios, to incorporate estimated utility program costs and utility incentives for each measure. Nexant used program cost estimates by sector and end-use, which were developed from data on current FEECA Utilities' DSM programs as well as other regional utility program offerings[14]. The estimated incentive amounts were developed for each measure as follows:

- In the RIM scenario, two incentive values were analyzed. First, the RIM net benefit for the measure was calculated based on total RIM benefits minus RIM costs. Next, the incentive amount that would drive the simple payback to two years for each measure was calculated. The final incentive applied for the measure was based on the lower of these two values.
- In the TRC scenario, the incentive amount required to drive the simple payback to two years for each measure was used as the final incentive for the measure.

7.1.2 Market Adoption Rates

To estimate the adoption rate of DSM based on the utility program costs and incentives described above, Nexant incorporated FPUC DSM program data as well as secondary data from other utility sponsored DSM programs. This approach leveraged program performance data from a variety of DSM programs across many utilities to develop a meta-analysis of program performance that broadly describes customers' program adoption rates over time. This approach applied standard economic theories on product diffusion to develop a catalog of market adoption curves across a variety of DSM technologies and programs[15].

Nexant used this market performance data, historic FPUC program performance data, and secondary data sources to calibrate the measures passing the cost-effectiveness screening in

[14] Program cost estimates assumed average utility DSM program operations for mature, full-scale programs. However, actual program costs may vary by utility based on the program's size and scale, including the number of measures offered, participation and savings targets, and specific program delivery elements.

[15] A detailed description of Nexant's market adoption rate methodology is provided in Appendix F

the TEA-POT model. Secondary data sources for EE measures included ENERGY STAR data on qualified product shipments and other utility-sponsored program performance data. The adoption rate of DR also incorporated secondary data from other well-developed DR programs. This approach leveraged historic marketing strategies and customer responses to marketing as well as incentive level.

7.2 EE Achievable Potential

This section provides the detailed results of the EE achievable potential. Table 7-1 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 7-1: Achievable Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	2	4
Commercial	15	183
Industrial	22	328
Total	39	515

7.2.1 Summary

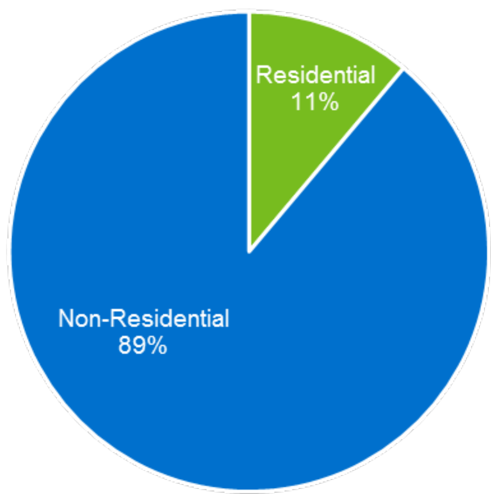
Table 7-2 summarizes the 10-year portfolio EE achievable potential for all customers across the residential and non-residential sectors. Impacts are presented as cumulative impacts, which represent the savings achieved over the ten-year study period (2020-2029) based on the sum of the annual incremental savings.

Table 7-2: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	0.07	0.07	0.21
Non-Residential	0.23	0.21	1.70
Total	0.30	0.28	1.92

Figure 7-1 shows achievable energy savings potential by sector for the TRC scenario. No cost-effective energy savings potential were identified for the RIM scenario.

Figure 7-1: Achievable Potential by Sector – TRC Scenario



7.2.2 Residential – RIM Scenario

The residential segments did not have any EE measures that passed the cost-effectiveness screening for the achievable potential RIM scenario.

7.2.3 Non-Residential – RIM Scenario

7.2.3.1 Commercial Segments

The commercial segments did not have any EE measures that passed the cost-effectiveness screening for the achievable potential RIM scenario.

7.2.3.2 Industrial Segments

The industrial segments did not have any EE measures that passed the cost-effectiveness screening for the achievable potential RIM scenario.

7.2.4 Residential – TRC Scenario

Table 7-3 summarizes the cumulative residential EE achievable potential by end-use for the TRC Scenario.

Table 7-3: EE Residential Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Space Heating	0.00	0.07	0.07
Space Cooling	0.07	0.00	0.14
Domestic Hot Water	0.00	0.00	0.00
Lighting	0.00	0.00	0.00
Cooking	0.00	0.00	0.00
Appliances	0.00	0.00	0.00
Electronics	0.00	0.00	0.00
Miscellaneous	0.00	0.00	0.00

Figure 7-2, Figure 7-3, and Figure 7-4 illustrate the cumulative residential EE achievable potential by end-use for the TRC scenario.

Figure 7-2: Residential EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

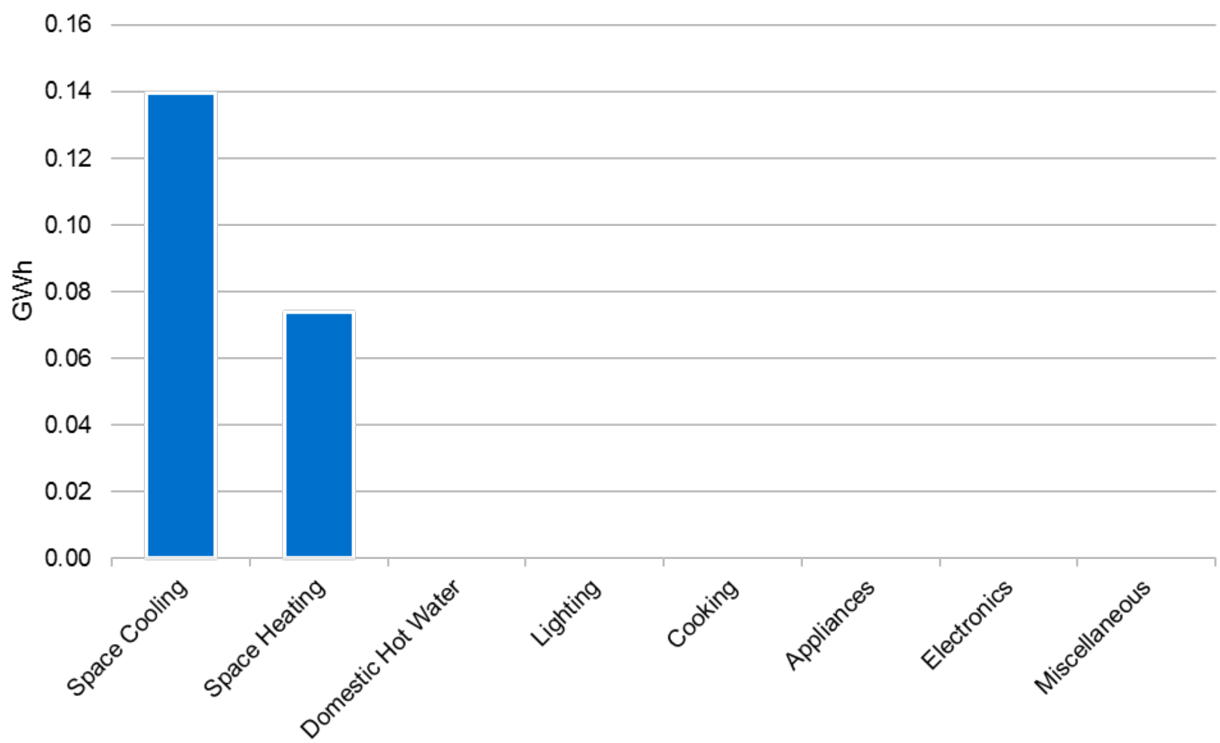


Figure 7-3: Residential EE Achievable Potential by End-Use (Summer Peak Savings) - TRC Scenario

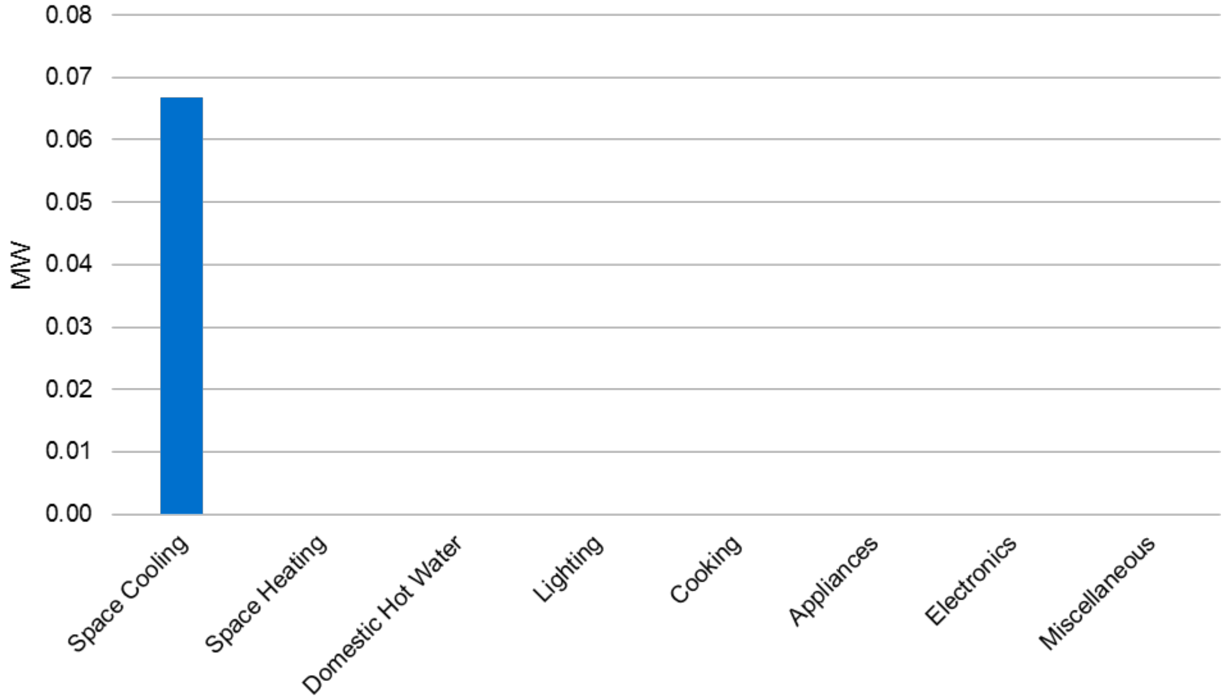
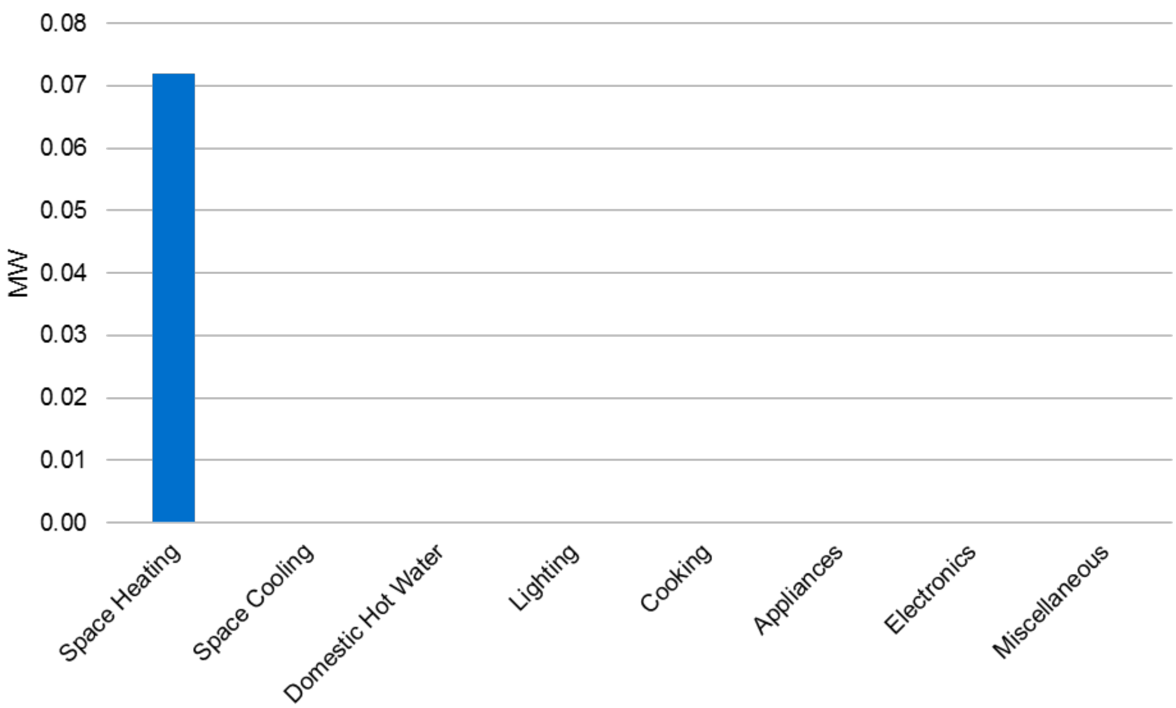


Figure 7-4: Residential EE Achievable Potential by End-Use (Winter Peak Savings) - TRC Scenario



7.2.5 Non-Residential – TRC Scenario

7.2.5.1 Commercial Segments

Table 7-4 summarizes the cumulative commercial EE achievable potential by end-use for the TRC Scenario.

Table 7-4: EE Commercial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	0.01	0.01	0.04
Exterior Lighting	0.00	0.00	0.00
Office Equipment	0.00	0.00	0.00
Cooking	0.01	0.00	0.05
Refrigeration	0.01	0.00	0.10
Space Heating	0.00	0.01	0.02
Space Cooling	0.01	0.00	0.05
Ventilation and Circulation	0.00	0.00	0.00
Domestic Hot Water	0.00	0.00	0.00
Miscellaneous	0.01	0.00	0.04

Figure 7-5, Figure 7-6, and Figure 7-7 illustrate the cumulative commercial EE achievable potential by end-use for the TRC scenario.

Figure 7-5: Commercial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

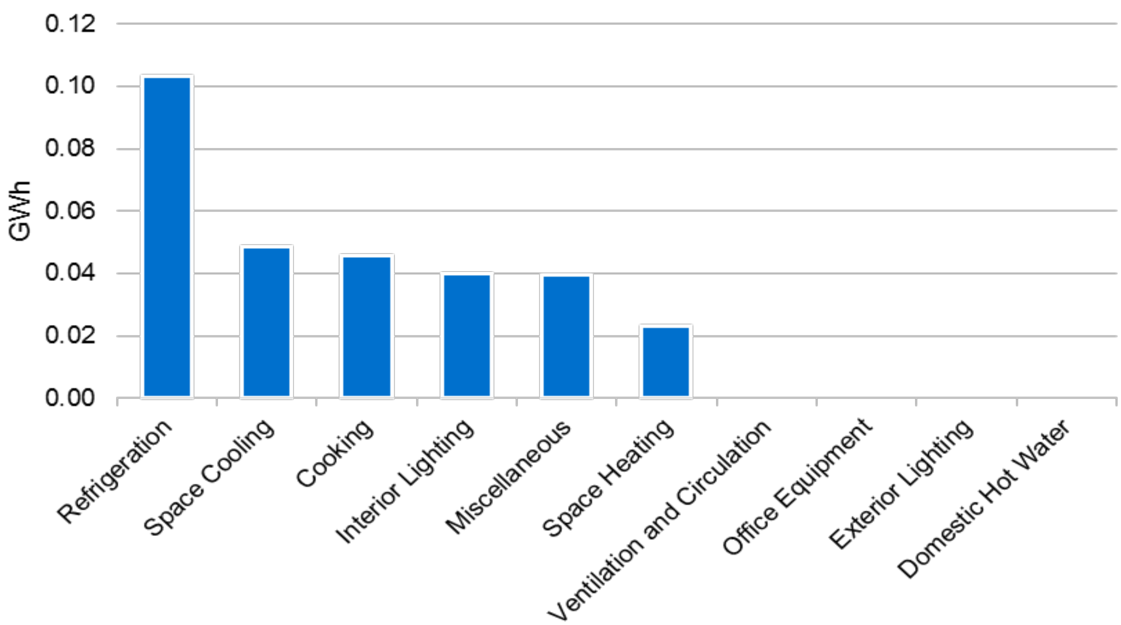


Figure 7-6: Commercial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

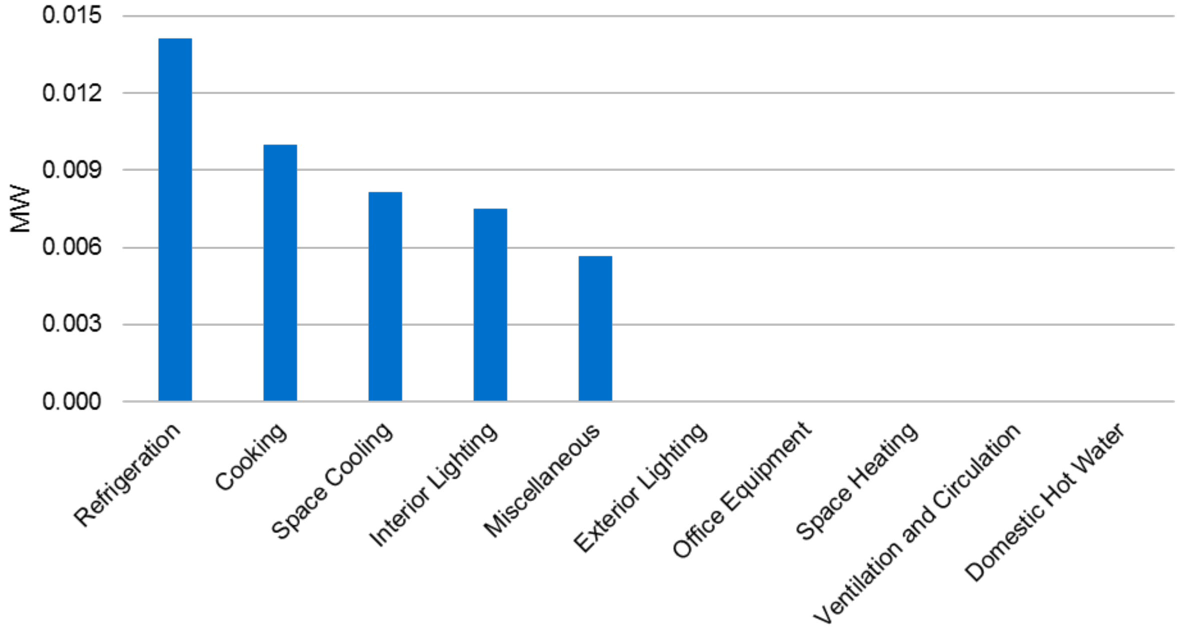
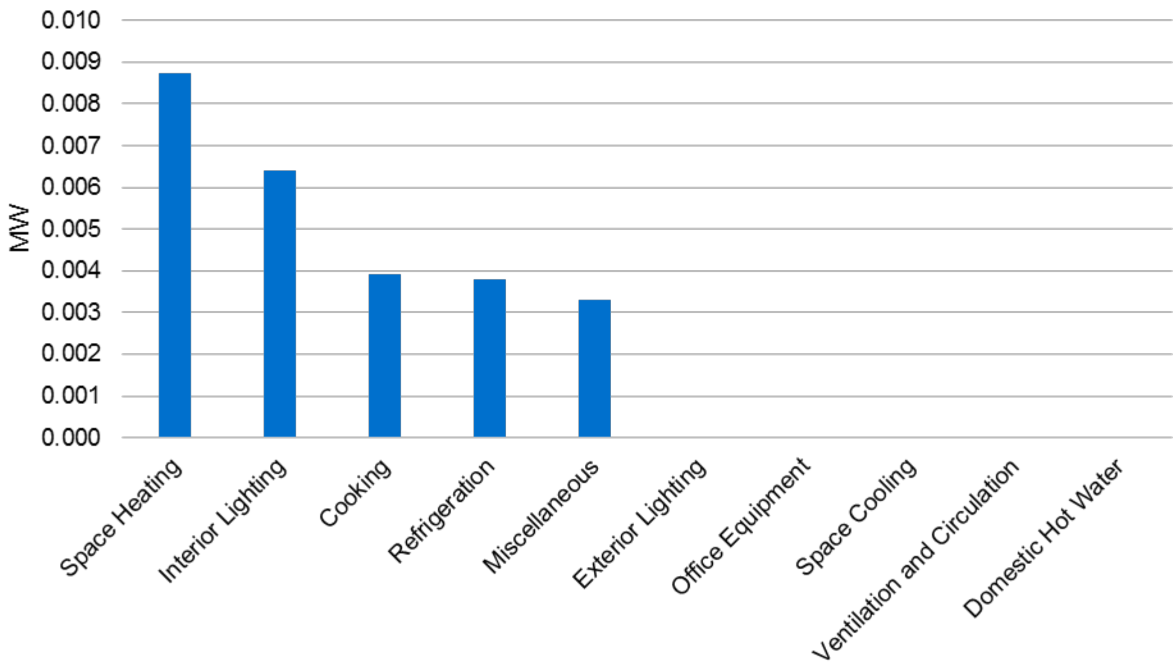


Figure 7-7: Commercial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.2.5.2 Industrial Segments

Table 7-5 summarizes the cumulative industrial EE achievable potential by end-use for the TRC Scenario.

Table 7-5: EE Industrial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Process Heating	0.02	0.02	0.13
Process Cooling	0.01	0.01	0.07
Compressed Air	0.04	0.04	0.28
Motors Pumps	0.04	0.04	0.32
Motors Fans Blowers	0.02	0.02	0.13
Process Specific	0.01	0.01	0.04
Industrial Lighting	0.03	0.03	0.24
HVAC	0.02	0.02	0.12
Other	0.00	0.00	0.03
Exterior Lighting	0.00	0.00	0.03

Figure 7-8, Figure 7-9, and Figure 7-10 illustrate the cumulative industrial EE achievable potential by end-use for the TRC scenario.

Figure 7-8: Industrial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

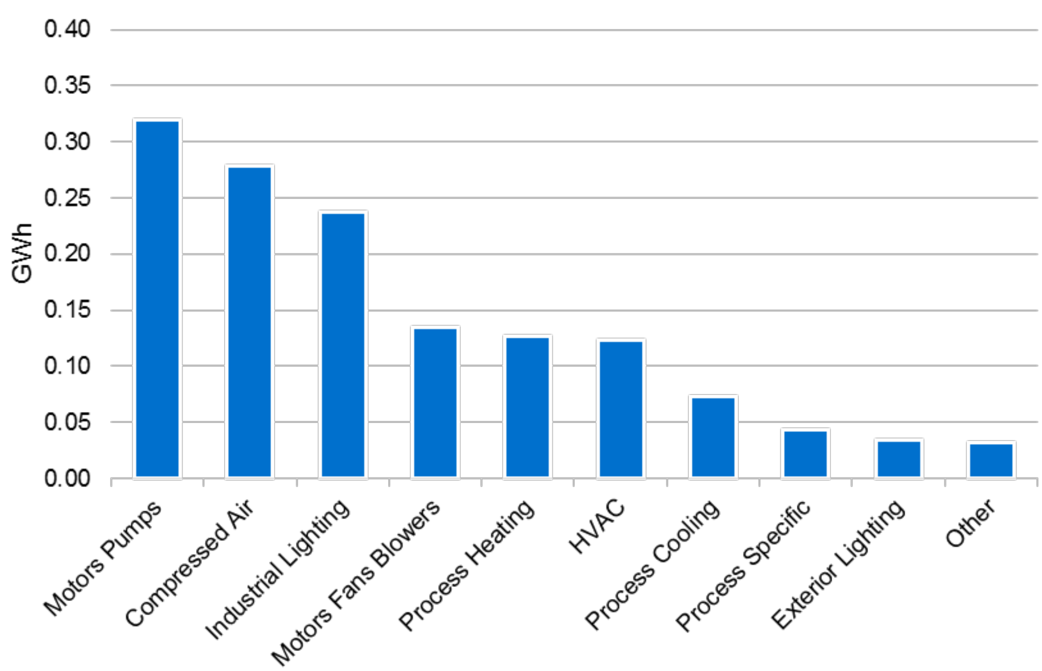


Figure 7-9: Industrial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

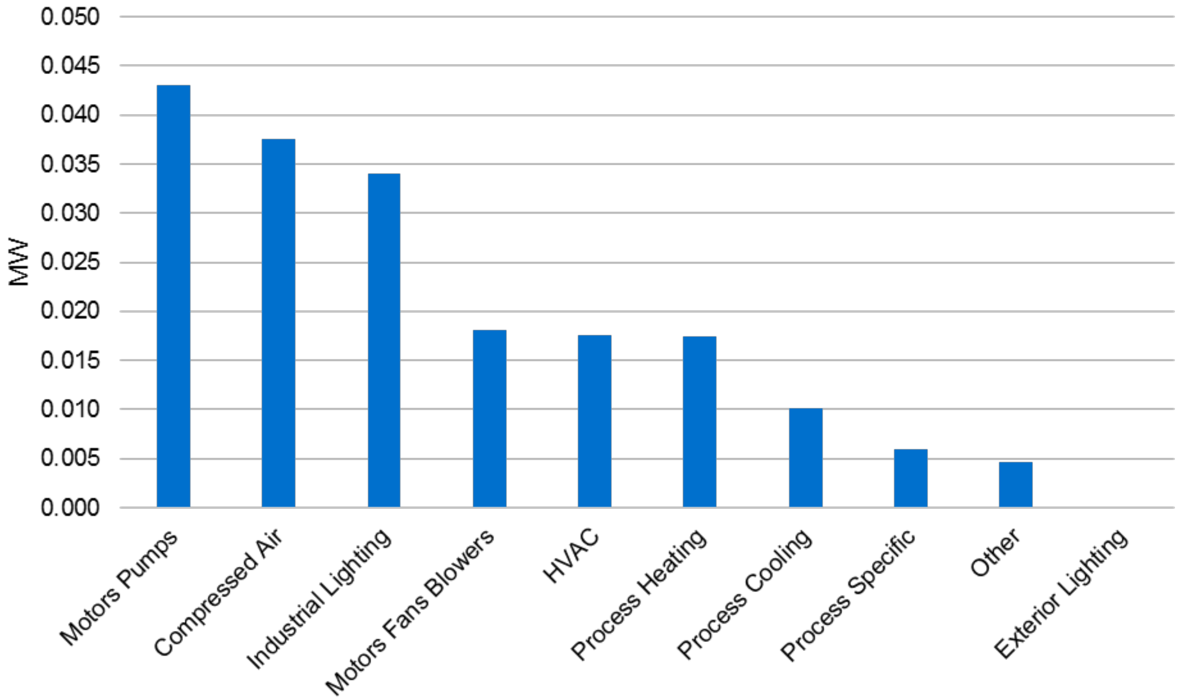
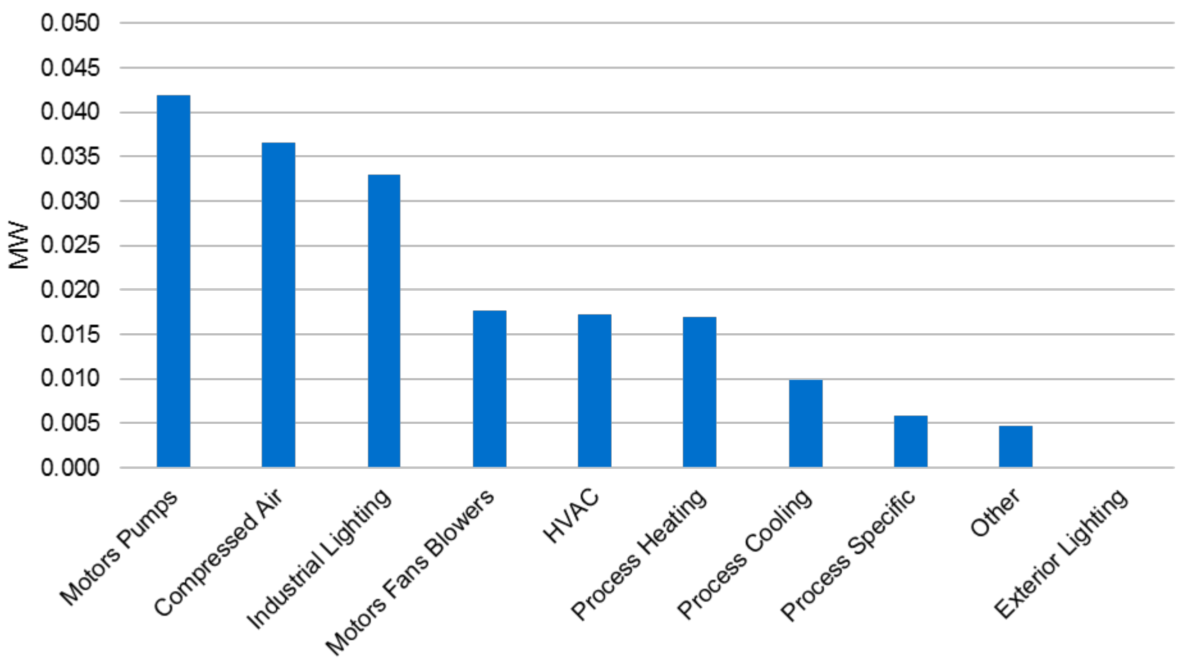


Figure 7-10: Industrial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.3 DR Achievable Potential

Nexant found there to be no cost-effective achievable potential attainable for FPUC for DR for the TRC-scenario or the RIM-scenario.

7.4 DSRE Achievable Potential

Nexant found there to be no cost-effective achievable potential attainable for FPUC for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

8 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements

Measure	End-Use	Description	Baseline
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations

Measure	End-Use	Description	Baseline
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average pump equipment
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and small C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

Interval data was not available for FPUC, so the cooling load shapes on the summer peak weekday and average weekdays were generated from hourly load data from the Gulf 2015 load research sample as a proxy. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2015
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (among May to September). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same Gulf customer interval data for 2015, and the peak day was defined as the day with system peak load during winter period. The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

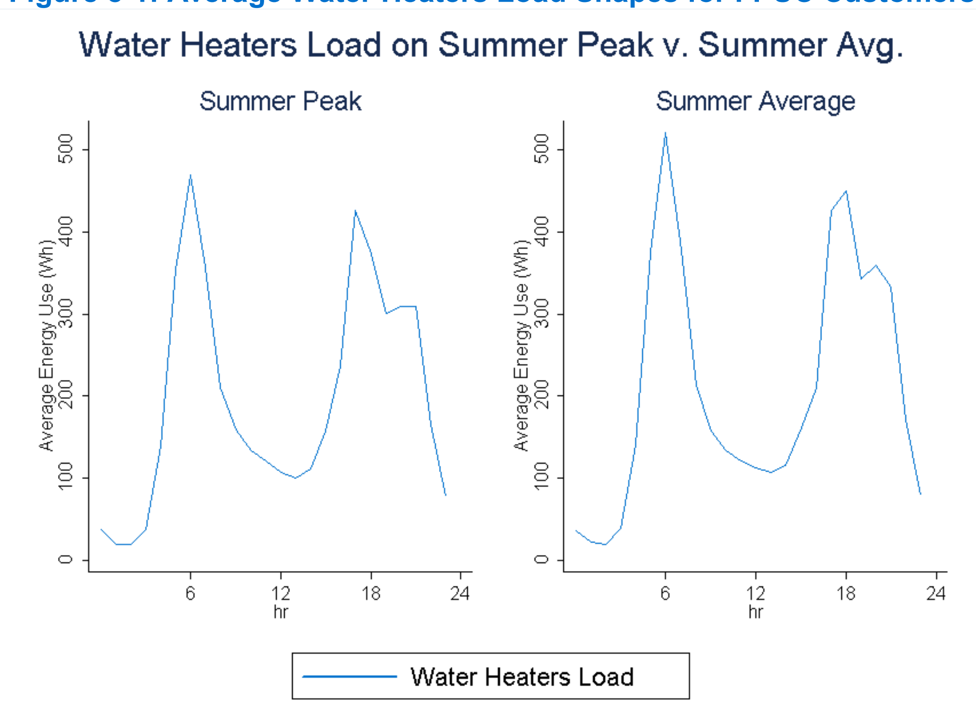
Where:

t	Hours in each day in year 2015
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in FPUC territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in FPUC.

Figure 8-1: Average Water Heaters Load Shapes for FPUC Customers

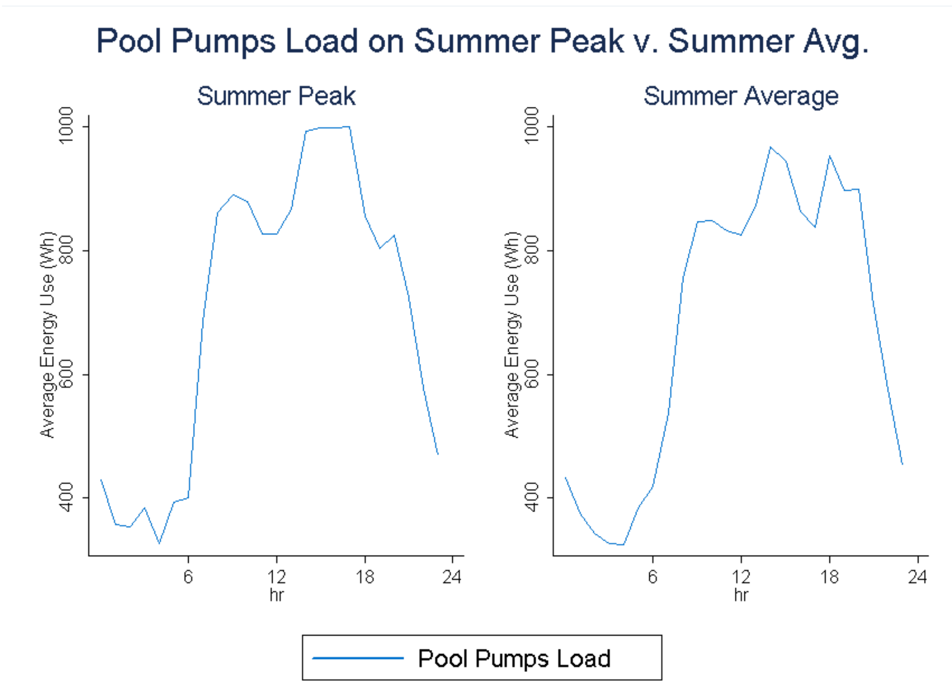


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads have low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 am – 7:00 am and 5:00 pm – 8:00 pm.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in FPUC.

Figure 8-2: Average Pool Pumps Load Shapes for FPUC Customers



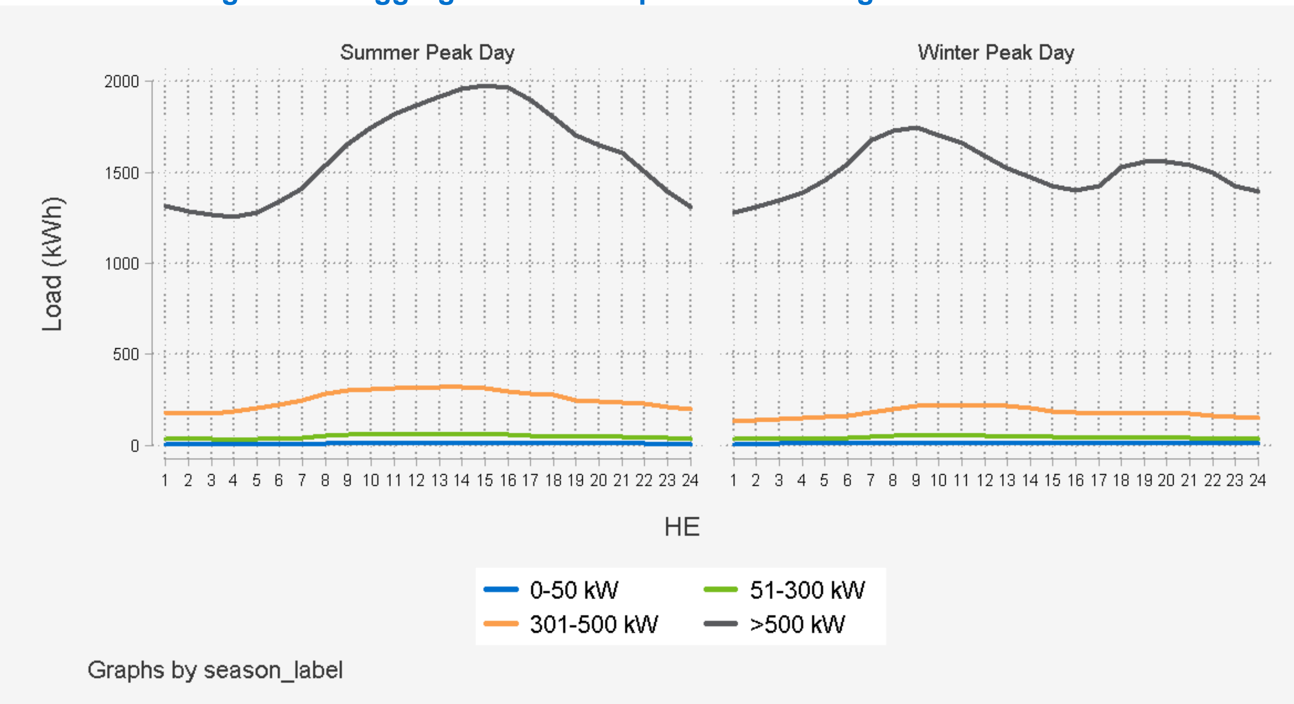
According to the Figure 8-4, the peak hours for pool pumps are 3:00 PM to 6:00 PM, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2015) for a sample of customers in the GSD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours. Since FPUC did not have any interval data available, Gulf customers were used as a proxy.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential.

Figure 8-3: Aggregate Load Shapes for Gulf Large C&I Customers



Appendix E Economic Potential Sensitivities

As part of the assessment of economic potential, the study included analysis of sensitivities related to free ridership, future fuel costs, and carbon scenarios, as follows:

Sensitivity #1: Higher Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.

Sector	Unique EE Measures	EE Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	8	36
Commercial	20	249
Industrial	23	358
Total	51	643

	EE Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	2	2	10
Non-Residential	1	1	11
Total	4	4	20

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #2: Lower Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the fuel cost forecast was adjusted to a “low fuel” scenario.

Sector	Unique EE Measures	EE Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	5	22
Commercial	18	225
Industrial	22	334
Total	45	581

	EE Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	2	2	8
Non-Residential	1	1	9
Total	3	3	17

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #3: Shorter free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the simple payback screening criteria was reduced to one year or longer.

Sector	Unique EE Measures	EE Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	14	64
Commercial	40	642
Industrial	27	482
Total	81	1,188

	EE Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	4	3	13
Non-Residential	4	3	25
Total	7	6	38

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #4: Longer free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the simple payback screening criteria was increased to three years or longer.

Sector	Unique EE Measures	EE Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	3	6
Commercial	9	82
Industrial	18	186
Total	30	274

	EE Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	0	0	1
Non-Residential	1	1	5
Total	1	1	7

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

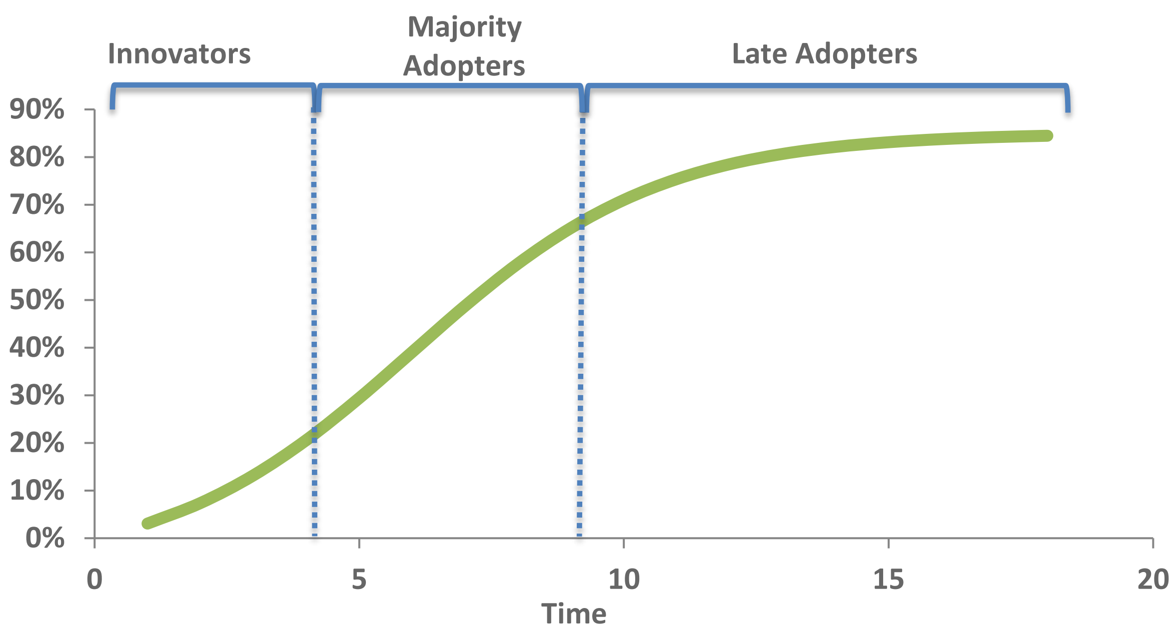
No DSRE measures passed the economic screening for this sensitivity.

Appendix F Market Adoption Rates

Nexant uses the Bass diffusion model to estimate measure adoption rates. The Bass diffusion model is a widely accepted mathematical description of how new products and innovations spread through an economy over time. The Bass Diffusion Model was originally published in 1969, and in 2004 was voted one of the top 10 most influential papers published in the 50 year history of the peer-reviewed publication *Management Science*[1]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to demand-side management in the energy industry[2]. Nexant applied the secondary data and research collected to develop and apply Bass Model diffusion parameters in the Florida jurisdiction.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept is illustrated in Figure 8-4.

Figure 8-4 Bass Model Market Penetration with Respect to Time



[1] Bass, F. 2004. Comments on “A New Product Growth for Model Consumer Durables the Bass Model” (sic). *Management Science* 50 (12_supplement): 1833-1840. http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1040.0300. Accessed 01/08/2016.

[2] Buskirk, R. 2014. Estimating Energy Efficiency Technology Adoption Curve Elasticity with Respect to Government and Utility Deployment Program Indicators. LBNL Paper 6542E. Sustainable Energy Systems Group, Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. http://escholarship.org/uc/item/2vp2b7cm#page-1. Accessed 01/14/2016.

Figure 8-4 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

$$\frac{dS(t)}{dt} = \left(p + \frac{q}{m} * S(t-1)\right) * (m - S(t-1))$$

Where:

$\frac{dS(t)}{dt} =$ the rate of adoption for any discrete time period, t

$p =$ external influences on market adoption

$q =$ internal influences on market adoption

$m =$ the maximum market share for the product

$S(t-1) =$ the cumulative market share of the product, from product introduction to time period *t-1*

Marketing is the quintessential external influence. The internal influences are characteristics of the product and market; for example: the underlying market demand for the product, word of mouth, product features, market structure, and other factors that determine the product's market performance. Nexant's approach applied literature reviews and analysis of secondary data sources to estimate the Bass model parameters. We then extrapolated the model to future years; the historic participation and predicted future market evolution serve as the program adoption curve applied to each proposed offering.

In order to estimate elasticity across different utility incentive levels, Nexant incorporated data from a regression analysis performed on EIA 861 data to understand the relative change in savings based on differing incentives. Per this analysis, a 100% increase in the total utility incentive equated to roughly a 44% increase in savings. This EIA-based elasticity rate was applied to the market adoption rates described above to estimate relative changes in market adoption for the range of maximum incentives where they vary from current or typical utility offerings.

Nexant's approach for estimating DR potential includes an additional step, based on our analysis of mature demand response programs. We estimate participation rates with the following process:

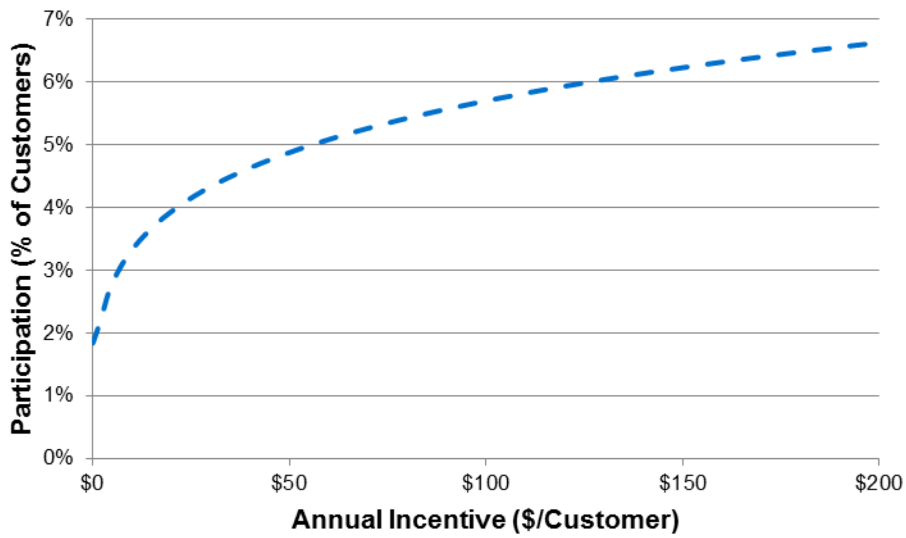
1) Use the results from prior analysis of DR program enrollment[3] to describe DR program participation as a function of customer segments and program attributes
2) Calibrate the model to reflect actual enrollment rates attained by existing FPUC programs. To calibrate the models, the model constant is adjusted so that the model produces exactly the enrollment rates observed by FPUC programs.

[3] Nexant Inc. Sacramento Municipal Utility District Demand Response Potential Study. October 20, 2015.

3) Predict participation rates using specific tactics and incentive levels for each measure based on the outcome of the RIM screening (or existing incentive levels).

As a demonstration of how marketing level and incentive affects participation in residential DR programs, Figure 8-5 shows the range of participation rates at a medium marketing level (phone outreach, mail, and email) as a function of the incentive paid to the customer. The curve shows that residential customers will respond to changes in incentive level if the incentive is relatively low, but are not as responsive to incentive levels after a certain point. This is why utility marketing strategies also play an important role in residential customer participation. This curve can also vary depending on the customer segments present in a utility's jurisdiction and other utility DR program characteristics (such as program age). To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-5: Residential Program Enrollment as a function of Incentive

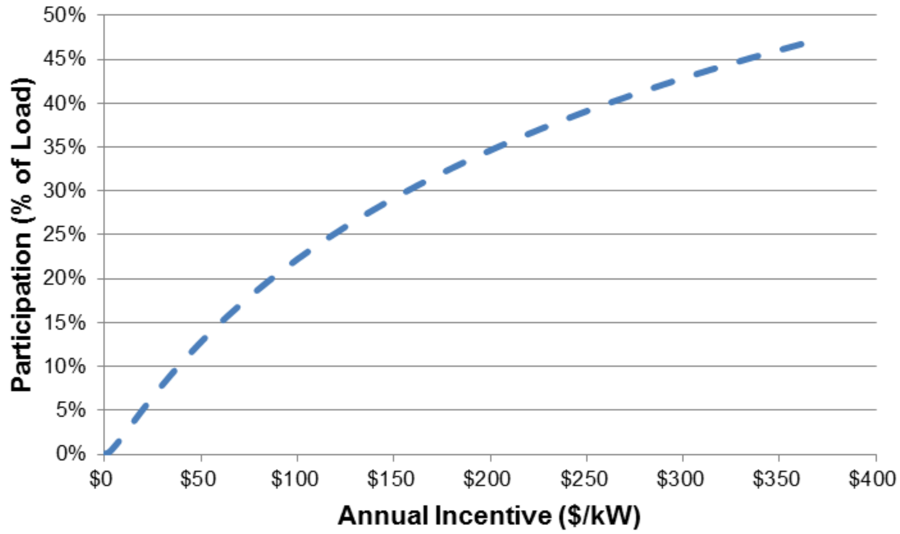


For small C&I customers, a similar approach was used to estimate participation levels. However, these customers tend to have lower enrollments than larger nonresidential customers, and were scaled accordingly. Small C&I customers tend to exhibit roughly 40% of the uptake of residential customers, based on data from historic DR program analysis, which have extensively marketed these programs.

Large C&I customers were slightly different than the other two segments. Due to the large variation in customer size, participation was estimated as the percent of load enrolled in demand response rather than the number of customers. Figure 8-6 shows the participation level of large C&I customers as a function of incentive. Although customers grow less responsive to the incentive as it increases, they continue to be much more responsive to the annual incentive as it increases. This is why for technical potential, it is assumed that if a large C&I customer is paid a high enough incentive; they will curtail their entire load. Similar to the residential participation curve, this curve can vary based on existing participation rates for a utility as well as the industries that large C&I

customers belong to. To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-6: Large C&I Program Enrollment as a function of Incentive



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REPORT

Nexant
Reimagine tomorrow.

Market Potential Study of Demand-Side Management in Orlando Utilities Commission's Service Territory

Submitted to Orlando Utilities Commission

April, 2019

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of the Orlando Utilities Commission's (OUC) service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in OUC's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large C&I customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning

(HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential. The assessment further accounted for existing DR programs for OUC when calculating the total DR potential. The large C&I programs assessment used publicly available data on mature DR programs and current Florida large C&I DR programs to derive estimates of price responsiveness to program incentives and marketing techniques. Using these estimates, the maximum incentive and enrollment scenario was calculated to estimate the potential.

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customers' PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for residential, commercial and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Nexant estimated DSM savings potential according to three standard scenarios: technical, economic, and achievable potential. Each scenario is defined using slightly different criteria, which are described in the subsequent sections.

1.2.1 EE Potential

Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	285	90	897
Non-Residential[1]	194	103	857
Total	479	192	1,754

[1] Non-Residential results include all commercial and industrial customer segments.

Economic Potential

EE economic potential applies a cost-effectiveness screening to all technically feasible measures and includes full implementation of all measures that pass this screening. Measure permutations were screened individually and the economic potential represents the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

Economic potential was determined for two scenarios: a Rate Impact Measure (RIM) scenario and Total Resource Cost (TRC) scenario. Additional screening criteria for both scenarios included the Participant Cost Test (PCT) perspective, and two-year payback criterion. Additional sensitivities were also analyzed, which are described in Section 6.1.3 and results presented in Appendix E.

The estimated economic potential results are summarized in Table 1-2.

Table 1-2: EE Economic Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.03
Total	0	0	0.03
TRC SCENARIO			
Residential	61	31	226
Non-Residential	32	11	239
Total	93	42	465

Achievable Potential

Achievable potential estimates the demand and energy savings feasible with utility-sponsored programs, while considering market barriers and customer adoption rates for DSM technologies. Similar to the economic potential analysis, Nexant screened measures to determine which are cost-effective from both the RIM and TRC perspectives. The achievable potential includes estimated program costs and incentives, whereas the economic potential scenario does not.

Table 1-3 summarizes the results for the estimated EE achievable potential, representing the cumulative savings over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

Table 1-3: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.006
Total	0	0	0.006
TRC SCENARIO			
Residential	9	7	67
Non-Residential	10	2	70
Total	19	9	137

1.2.2 DR Potential

Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

The estimated technical potential results are summarized in Table 1-4.

Table 1-4: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	92	272
Non-Residential	336	321
Total	428	593

Economic Potential

DR economic potential incorporates the economic screening criteria described above for EE potential. Because of the costs and benefits associated with DR, all DR measures passed and DR economic potential is the same as DR technical potential for OUC. The results are summarized in Table 1-5.

Table 1-5: DR Economic Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	92	272
Non-Residential	336	321
Total	428	593

Achievable Potential

DR achievable potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective achievable potential for OUC for DR.

1.2.3 DSRE Potential

Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems from PV, and CHP technologies based on the customer characteristics of each FEECA utility's customer base.

Table 1-6: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	102	15	791
Non-Residential	266	40	2,057
Total	368	55	2,848
Battery Storage charged from PV Systems			
Residential	71	50	-
Non-Residential	3	-	-
Total	73	50	-
CHP Systems			
Total	211	140	936

Economic Potential

DSRE economic potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective economic potential attainable for OUC for PV systems, battery storage systems, or CHP systems.

Achievable Potential

DSRE achievable potential incorporates the achievable screening criteria described above for EE potential. Nexant found there to be no cost-effective achievable potential attainable for OUC for PV systems, battery storage systems, or CHP systems.

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of Orlando Utilities Commission's (OUC) service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- List of cost-effective EE, DR, and DSRE measures
- Potential demand and energy savings for technical, economic and achievable potential scenarios
- Estimated utility costs to acquire the achievable potential
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.

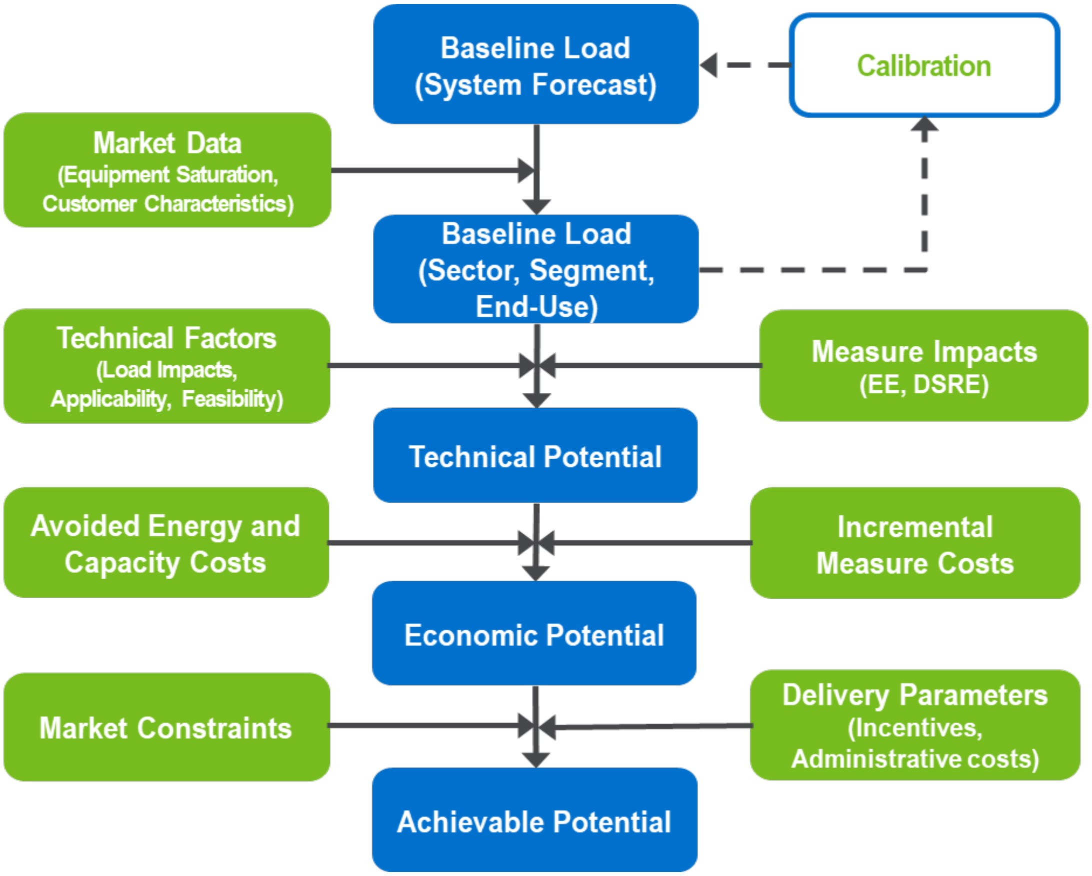
- Economic Potential is the amount of energy and capacity that could be reduced by DSM measures that are considered cost-effective. This study used the Ratepayer Impact Measure (RIM) test perspective and Total Resource Cost (TRC) test perspective, which were both coupled with the Participant Cost Test (PCT) and a two-year payback to determine cost-effectiveness.
- Achievable Potential is the DSM savings feasible when considering how a utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant's achievable potential applied the same cost-effectiveness screening as the economic potential analysis, with the addition of utility program costs and incentives.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to OUC's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, measure impacts, and costs.

Figure 2-1 provides an illustration of the MPS process, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Market Potential Modeling



Nexant estimated DSM savings potential based on a combination of market research, analysis, and a review of OUC's existing DSM programs, all in coordination with OUC. Nexant examined EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions, projected customer response to DR measures, the marginal benefit and cost of recruiting a customer for DR, and customer enrollment. Customer demand was determined by looking at interval data for a sample of each customer segment and determining the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures

was developed based on the performance of existing Florida DR programs and other DR programs in the US. Cost-effectiveness was estimated based on demand reductions, how well reductions coincide with system peaking conditions, the benefits of reducing demand during peaking conditions, and cost information. Enrollment rates were determined as a function of the incentive paid to a customer as well as the level of marketing for each DR measure.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The OUC base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of OUC's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis. The goal of this further segmentation for DR was to understand which customer groups were most cost-effective to recruit and allow for more targeted marketing of DR programs.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be

willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from OUC. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the OUC electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020-2029, and based it on data provided by OUC, primarily their 2017 Ten-Year Site Plan, which was the most recent plan available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized OUC's summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with OUC's estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers' baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA's recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for

each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on OUC rate class load shares, intensities, and EIA RECS data.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA RECS and end-use forecasts from OUC.
  - Nexant made conversions to usage estimates generated by applying EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on OUC rate class load shares, intensities, and EIA CBECS data.
- Segment data from EIA and OUC.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA CBECS and end-use forecasts from OUC.

Industrial sector:

- The disaggregation was based on rate class load shares, intensities, and EIA MECS data.
- Segment data from EIA and OUC.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
  - Rate class load share based on EIA MECS and end-use forecasts from OUC.

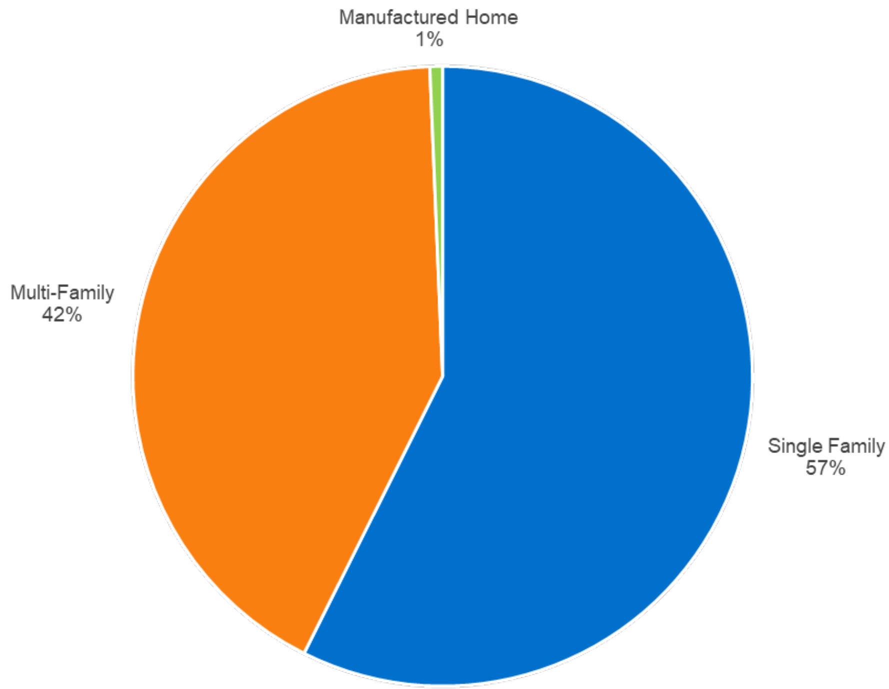
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. OUC provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential customers, but the overall logic was consistent with the concept of expressing the customers in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

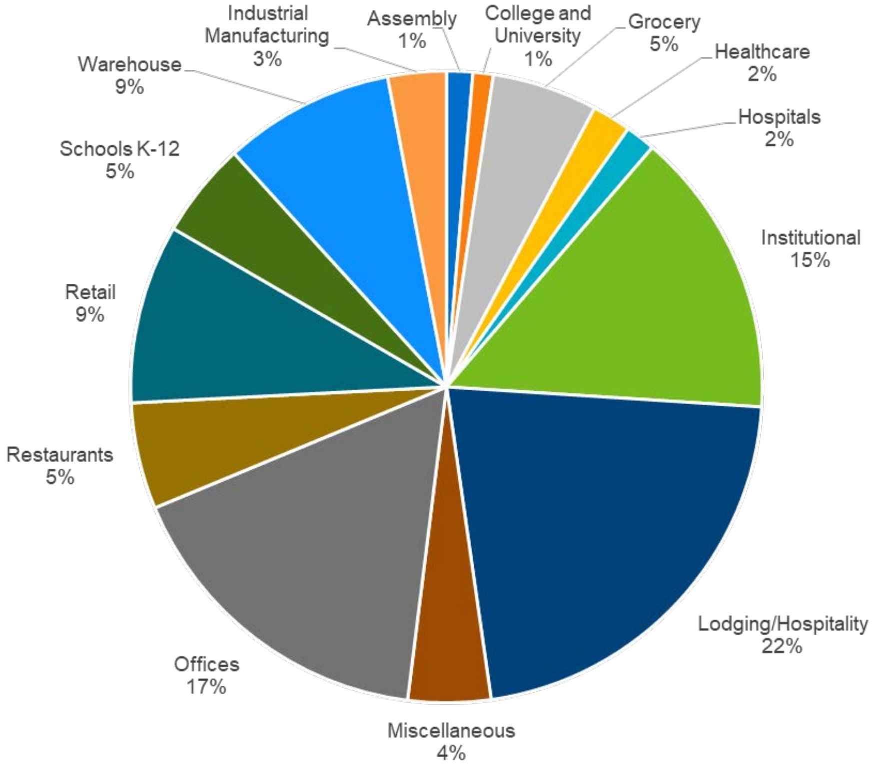
Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I customers using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers on the basis of DSM measure information available and applicable to each. Due to the small size of the Industrial sector and based on discussion with OUC, industrial segments analyzed are rolled together with commercial segments and presented for the overall non-residential sector. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2.

Figure 3-2: Non-Residential (C&I) Customer Segmentation



3.2.3 Commercial and Industrial Customers (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD) tariff[3]. Nexant further segmented these two groups based on customer size. For small C&I segmentation was determined using annual customer consumption and for large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by OUC.

Table 3-3 shows the account breakout between small C&I and large C&I.

[3] To be eligible, customers must have a max demand greater than 50 kW.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Customer Size	Number of Accounts
Small C&I	0-15,000 kWh	12,647
	15,001-25,000 kWh	2,910
	25,001-50,000 kWh	2,885
	50,001 kWh +	1,784
	Total	20,226
Large C&I	0-50 kW	2,795
	51-300 kW	2,017
	301-500 kW	224
	501 kW +	255
	Total	5,291

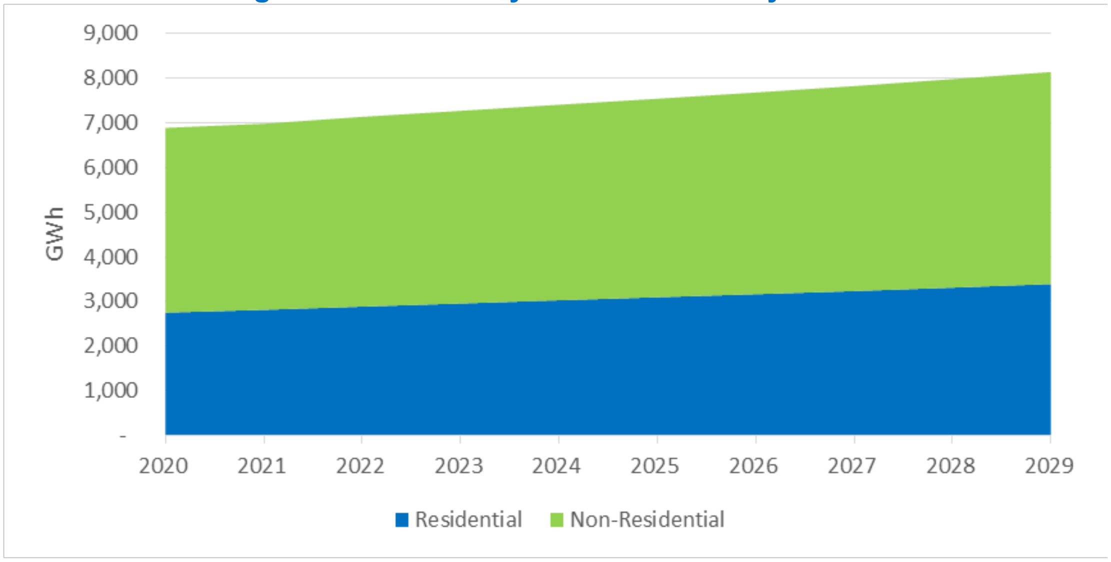
3.3 Analysis of System Load

3.3.1 System Energy Sales

While the technical and economic potential are based on the year 2020's system load forecast[4], achievable potential is applied over the entire 10-year study period (2020-2029). Figure 3-3 summarizes the electric sales forecast by sector over the study period. As described above, commercial and industrial customers are combined for reporting purposes into the non-residential sector.

[4] From OUC's 2017 Ten Year Site Plan

Figure 3-3: Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine when DR would be cost-effective to implement, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when DR resources will be needed was the historical system load for OUC. The data provided contained the system loads for all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For OUC the summer peaking conditions were defined as July and August from 4:00-5:00 PM and the winter peaking conditions were defined as January from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are illustrated in Figure 3-4 and Figure 3-5.

Figure 3-4: Residential Baseline (2020) Energy Sales by End-Use

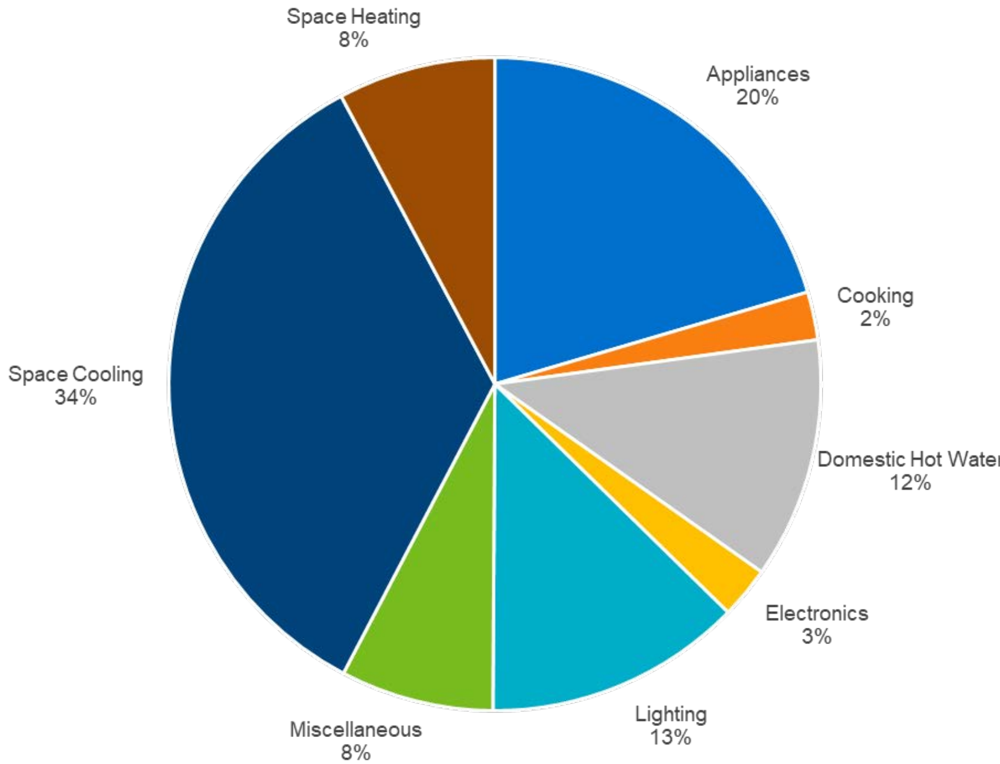
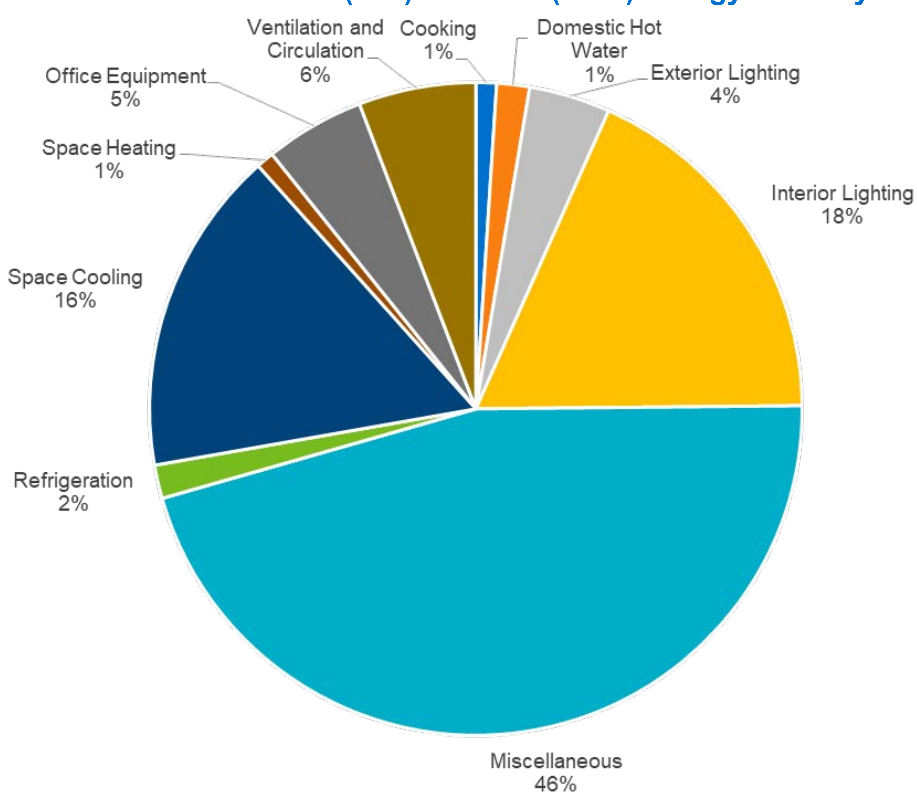


Figure 3-5: Non-Residential (C&I) Baseline (2020) Energy Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar market potential studies conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to the residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[1]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations
- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.

[1] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used was primarily derived from data in current regional and national databases, as well as OUC's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,164 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[2]	30	320

[2] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix A.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) Programs with technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.,* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or a rate discount for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Base interruptible DR**. Customers receive a discounted rate for agreeing to reduce load to a firm service level upon request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed.

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end uses estimated for technical potential. Individual measures were only considered for economic and achievable potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[3].

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[3] This study did not include ground-mounted or utility-scale solar PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged From PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of the commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as a single numerical value for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the nonresidential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Number of Households × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Stock Sq. Footage by Segment × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with OUC's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I customers generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8,760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For OUC, Nexant examined three residential segments based on customer housing type, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 11 different customer segments.

Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the

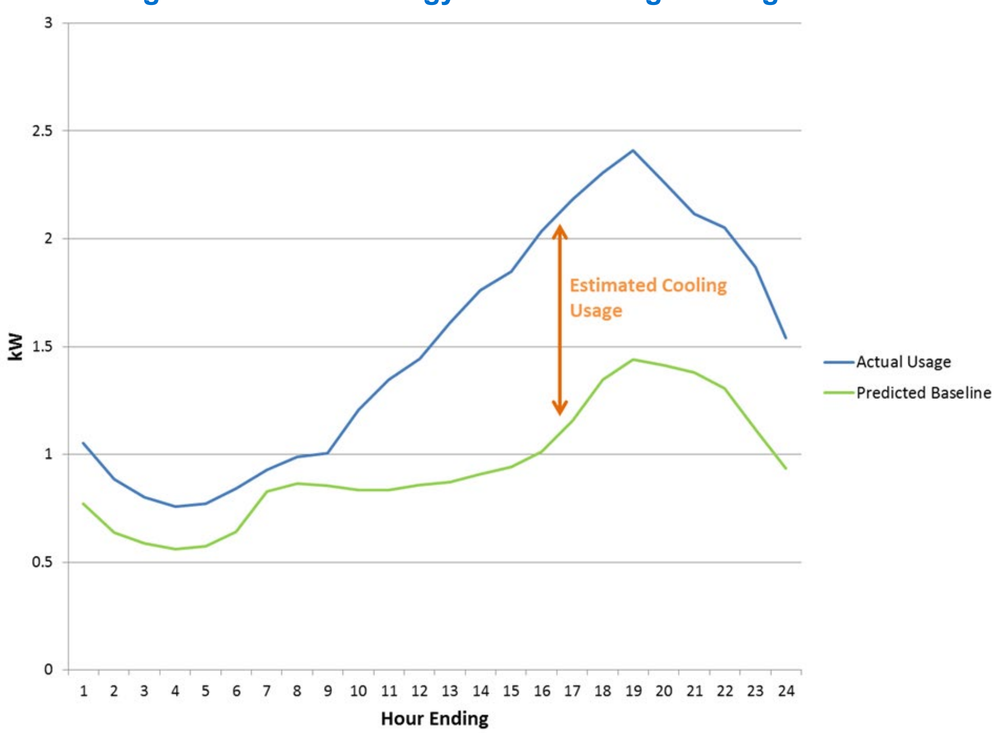
summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

AC and heating load profiles were generated for residential and small C&I customers using a sample of customers provided by OUC. This sample included a customer breakout based on size and housing type for each rate class. Nexant then used the interval data from these customers to create an average load profile for each customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the seven different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR program.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are July and August from 4:00-5:00 PM for summer, and January and February from 7:00-8:00 AM for winter.

For technical potential, there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads. Individual measures are only considered for economic and achievable potential.

5.1.3 DSRE Technical Potential

5.1.3.1 PV Systems

To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[8], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

Equation 5-3: Core Equation for Solar Technical Potential

$$\text{Technical Potential of PV Systems} = \text{Usable PV Area} \times \text{PV Density} / 1000 \times \text{Capacity Factor} \times \text{Energy Savings Factor}$$

Where:

[8] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Usable PV Area for Residential: (Total Floor Area[9] / Average No. of Stories[10]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[11] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PVWatts. Energy Savings Factor = Alternating Current System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery systems do create the opportunity to store energy during period when the PV system is generating more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for “solar plus storage” systems, our methodology consisted of the following steps:

- Develop an 8,760 hour annual load shape for a PV system based on estimated annual hours of available sunlight.
- Compare the PV generation with a total home or total business 8,760 hour annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.

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[9] Utility-provided data and US Census, South Region

[10] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[11] Floor space = based on utility data. Average floors by building type = CBECS, South Atlantic Region

- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers' thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore, the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore, results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
    - For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

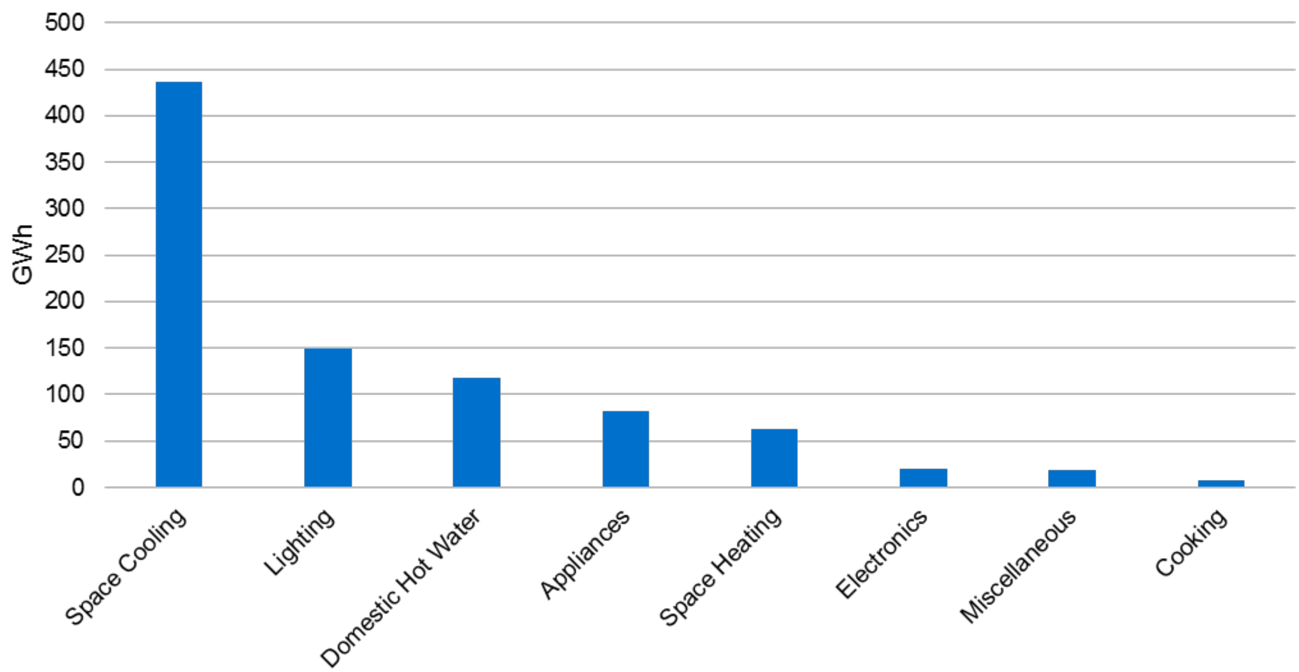
Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	285	90	897
Non-Residential[12]	194	103	857
Total	479	192	1,754

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 illustrate the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Energy Savings)



[12] Non-Residential results include all commercial and industrial customer segments

Figure 5-3: Residential EE Technical Potential by End-Use (Summer Peak Savings)

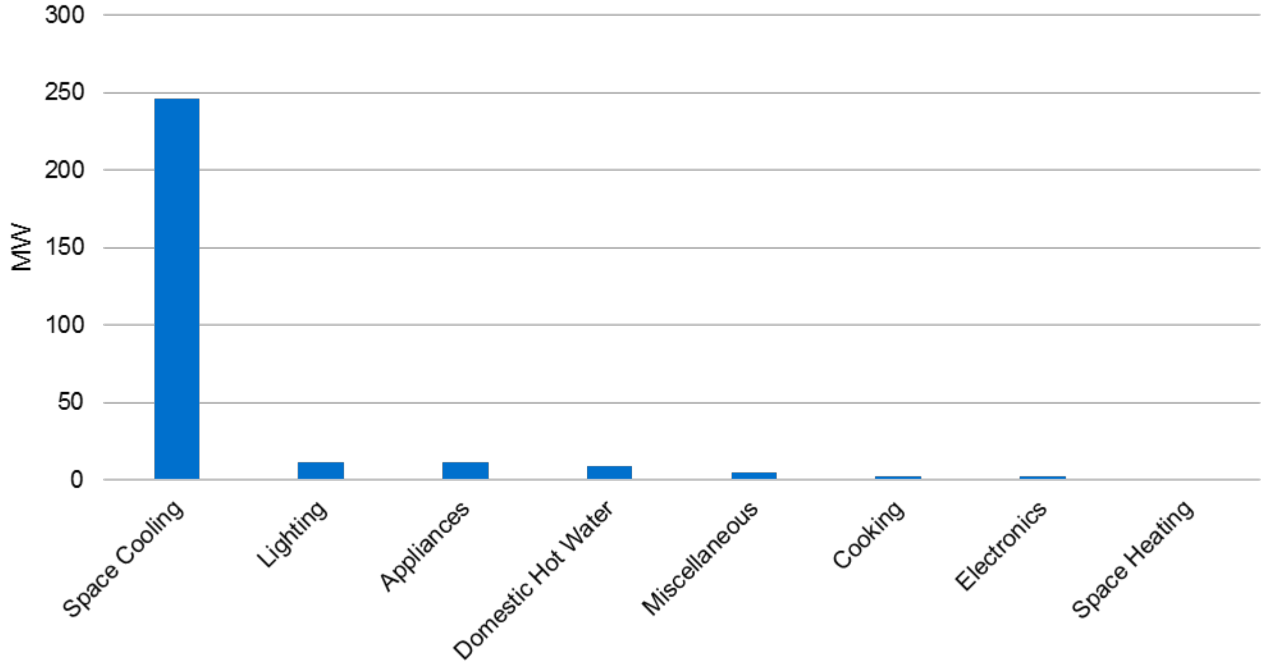
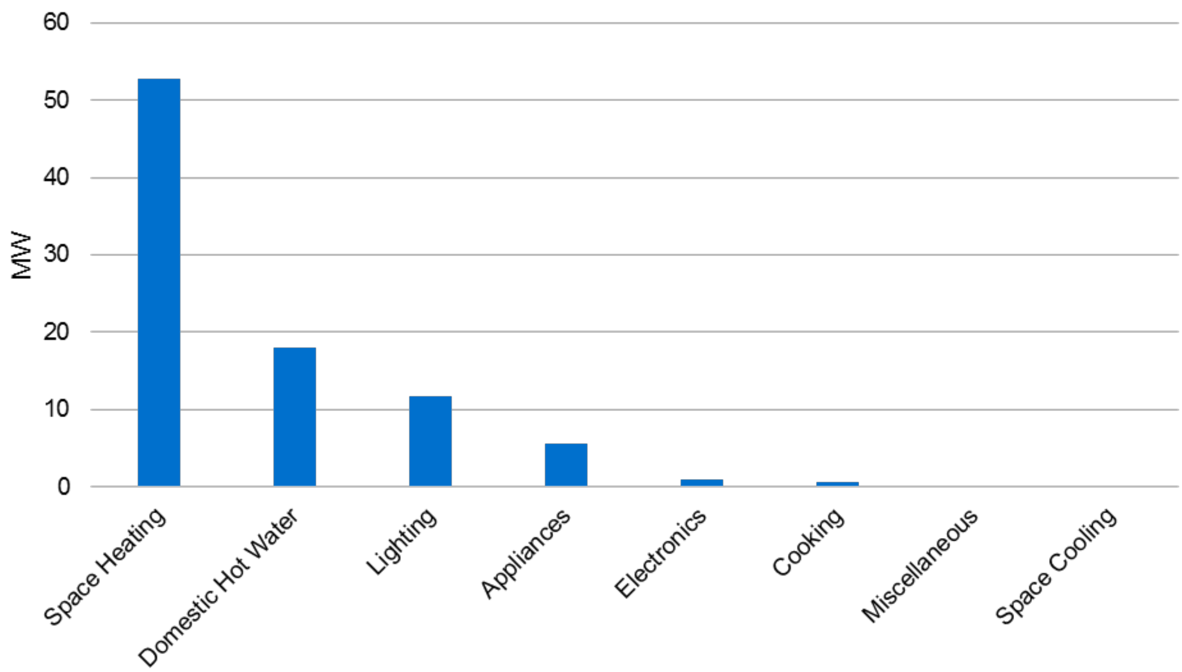


Figure 5-4: Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3 Non-Residential

Figure 5-5, Figure 5-6, and Figure 5-7 illustrate the non-residential sector EE technical potential by end-use.

Figure 5-5: Non-Residential EE Technical Potential by End-Use (Energy Savings)

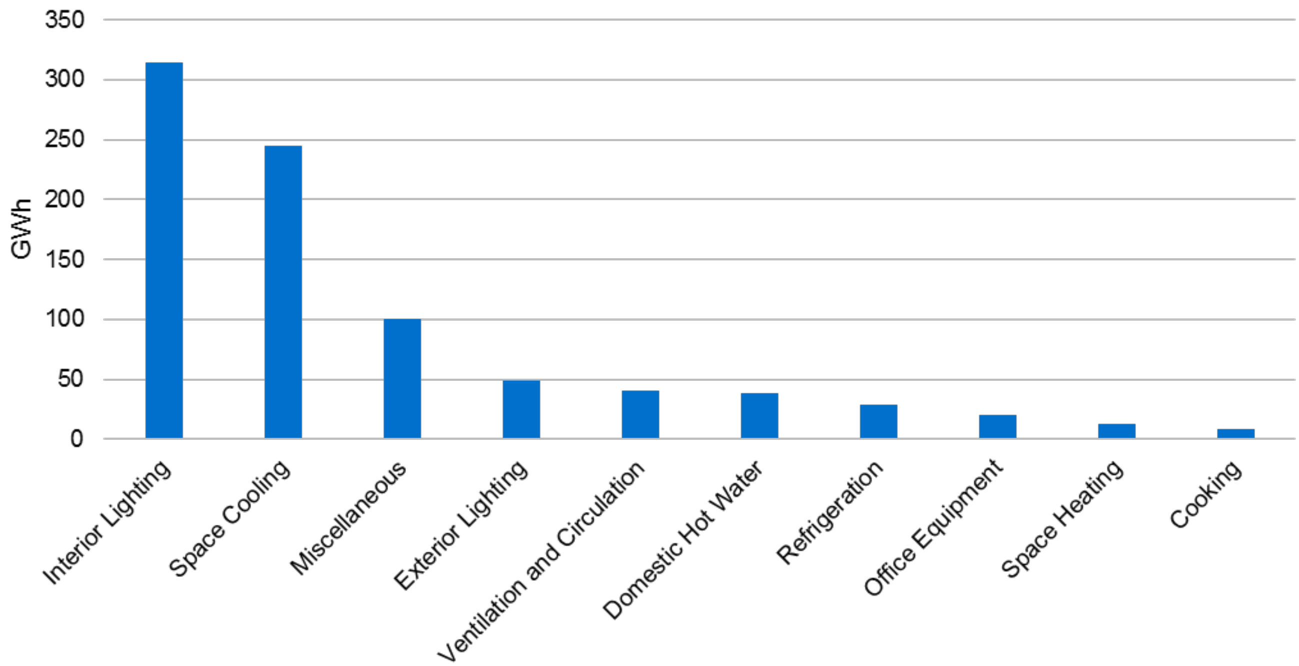


Figure 5-6: Non-Residential EE Technical Potential by End-Use (Summer Peak Savings)

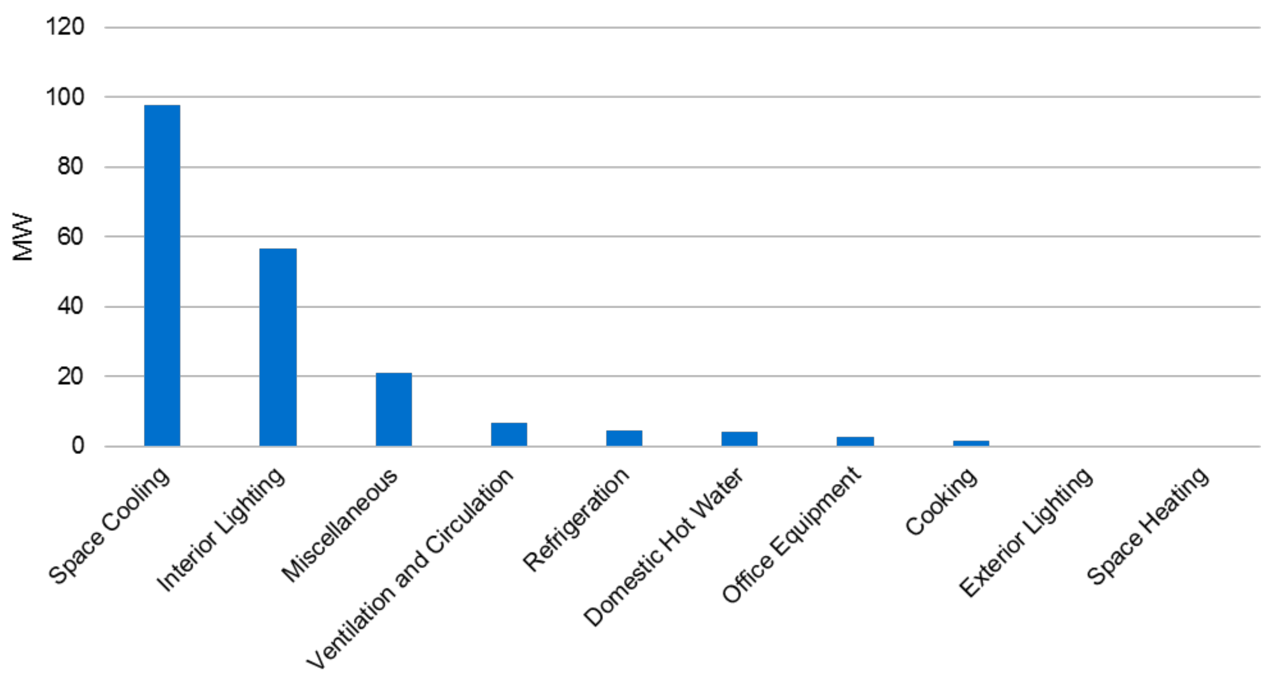
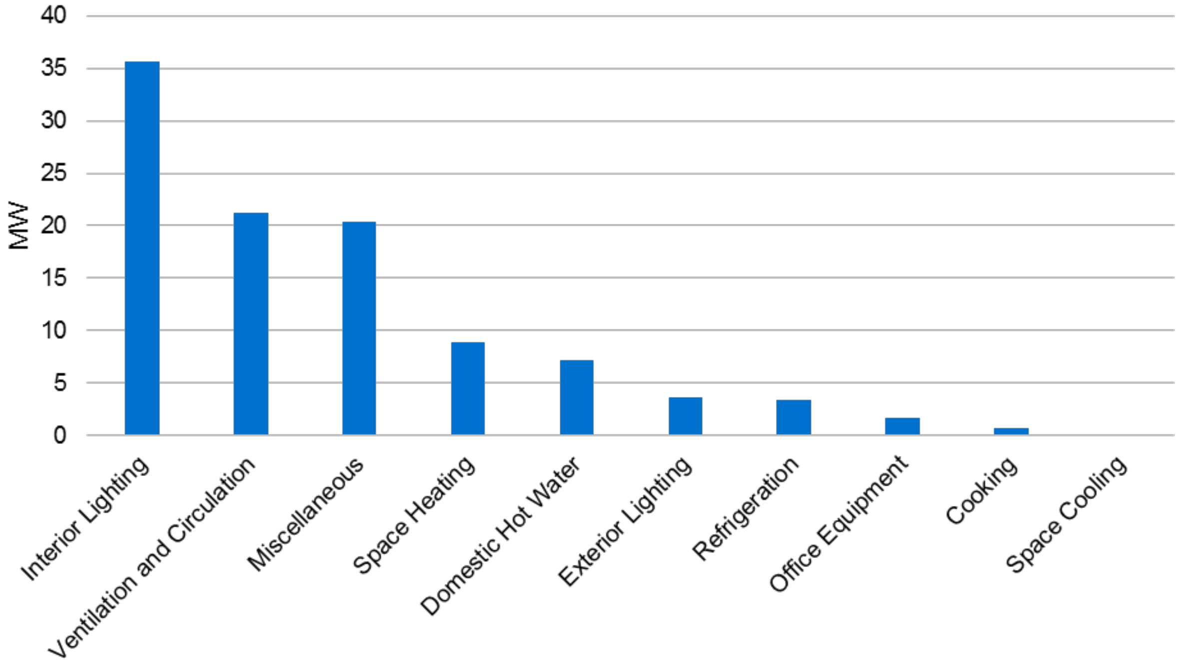


Figure 5-7: Non-Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in OUC's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

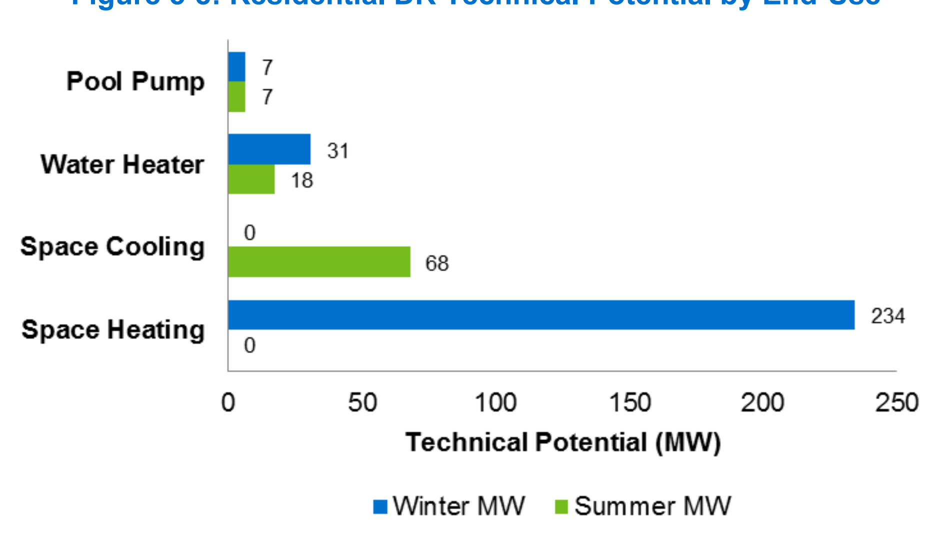
Table 5-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	92	272
Non-Residential	336	321
Total	428	593

5.3.1 Residential

Residential technical potential is summarized in Figure 5-8.

Figure 5-8: Residential DR Technical Potential by End-Use

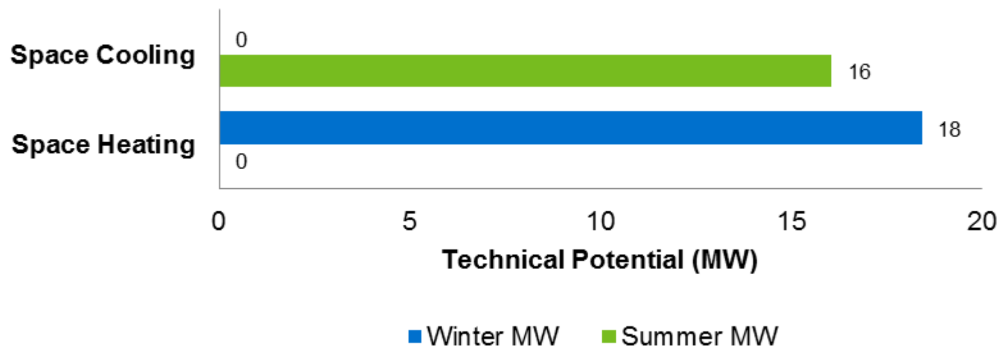


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential, Nexant looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-9.

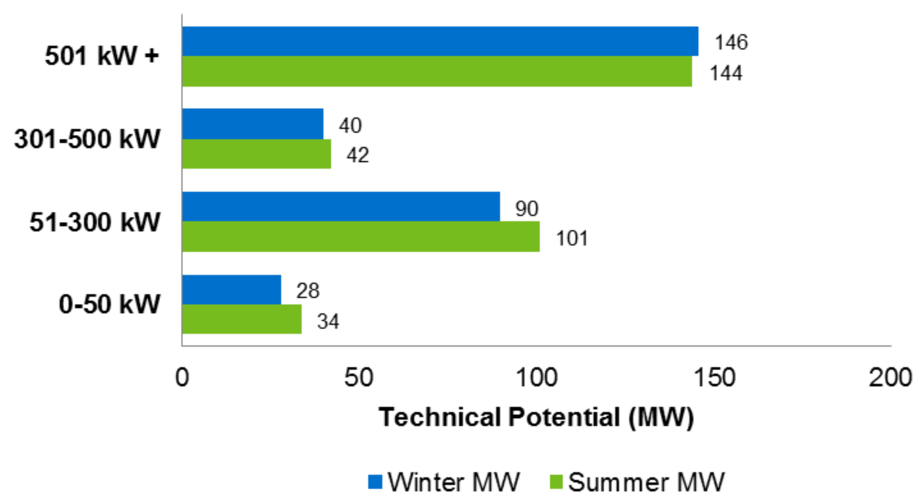
Figure 5-9: Small C&I DR Technical Potential by End-Use



5.3.2.2 Large C&I Customers

Figure 5-10 provides the technical potential for large C&I customers, broken down by customer size.

Figure 5-10: Large C&I DR Technical Potential by Segment



5.4 DSRE Technical Potential

Table 5-3 section the results of the DSRE technical potential for each customer segment.

Table 5-3: DSRE Technical Potential[13]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	102	15	791
Non-Residential	266	40	2,057
Total	368	55	2,848
Battery Storage charged from PV Systems			
Residential	71	50	-
Non-Residential	3	-	-
Total	73	50	-
CHP Systems			
Total	211	140	936

[13] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

6 Economic Potential

The economic potential scenario estimates the savings potential when all technically feasible DSM measures that are cost-effective to implement are applied at their full market potential (*i.e.* 100% adoption rate). The economic potential was the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

6.1 DSM Cost-Effective Screening Criteria

6.1.1 Cost-Effectiveness Test Perspectives

When analyzing DSM measures, different cost-effectiveness tests are considered to reflect the perspectives of different stakeholders. The Ratepayer Impact Measure ("RIM") addresses an electric utility customer perspective, which considers the net impact on electric utility rates associated with a measure or program. The Total Resource Cost ("TRC") addresses a societal perspective, which considers costs of DSM measure or program relative to the benefits of avoided utility supply costs. The Participant Cost Test ("PCT") addresses a participant perspective, which considers net benefits to those participating in a DSM program.

Descriptions follow of methods for allocating costs and benefits within each cost-effectiveness indicator (RIM, TRC, and PCT); the calculations remain consistent with the Florida Cost Effectiveness Manual[14].

Table 6-1: Components of Cost-Effectiveness Calculations

Component	Definition
Customer Incremental Costs	All incremental costs incurred by the customer to purchase, install, operate, and maintain a DSM measure
Utility Program Costs	Utility administrative and marketing costs and capital expenditures required to implement a DSM measure
Utility Incentives	Costs provided by the utility to the participant to encourage the purchase, installation, operation, and maintenance of a DSM measure
Utility Supply Costs	Utility costs of supplying electricity to the customer, including generation, transmission, and distribution costs
Electric Bill Impacts	Impacts on a participating customer's electric bill due the installation of a DSM measure
Utility Electric Revenues	Impacts on the utility's electric revenues due to the installation of a DSM measure

[14] Cost Effectiveness Manual for Demand Side Management and Self Service Wheeling Proposals; Florida Public Service Commission, Tallahassee, FL; adopted June 11, 1991.

Table 6-2: Ratepayer Impact Measure (RIM)

Component	Definition
Benefit	Increase in utility electric revenues Decrease in avoided electric utility supply costs
Cost	Decrease in utility electric revenues Increase in avoided electric utility supply costs Utility program costs, if applicable Utility incentives, if applicable

Table 6-3: Total Resource Cost (TRC)

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Increase in electric utility supply costs Customer incremental costs (less any tax incentives) Utility program costs, if applicable

Table 6-4: Participant Cost Test (PCT)

Component	Definition
Benefit	Decrease in electric bill Utility incentives, if applicable
Cost	Increase in electric bill Customer incremental costs (less any tax incentives)

6.1.2 Economic Potential Screening Methodology

Based on discussion with the FEECA Utilities and consistent with prior DSM analyses in Florida, for development of the economic potential, two scenarios were considered, a RIM-scenario and a TRC-scenario, for which the following economic screening process was followed:

- Criteria for RIM Scenario:
  - Achieve a cost-benefit ratio of 1.0 or greater from the RIM perspective. For the economic potential, the RIM benefits included avoided electric utility supply costs, while RIM costs include decreases in utility electric revenues. The economic potential screening did not consider utility incentives or utility program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
  - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.

    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.
- Criteria for TRC Scenario:
    - Achieve a cost-benefit ratio of 1.0 or greater from the TRC perspective. For the economic potential, the TRC benefits included avoided electric utility supply costs, while TRC costs included customer incremental cost to implement the measure. The economic potential screening did not consider utility DSM program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
    - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.
    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.

The cost-effectiveness screening described above was applied to each DSM measure permutation based on the installation of the measure in the Base Year (2020) of the study. Therefore, avoided energy cost benefits were applied beginning in Year 1 and extended through the useful life of the measure; avoided generation costs began at the in-service year for new generation based on utility system load forecasts.

6.1.3 Economic Potential Sensitivities

Based on direction from the FEECA Utilities and the Order Establishing Procedure, the economic potential analysis included the following additional sensitivities:

- Sensitivity #1: Higher Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.
- Sensitivity #2: Lower Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast was adjusted to a "low fuel" scenario.
- Sensitivity #3: Shorter free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was reduced to one year or longer.
- Sensitivity #4: Longer free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was increased to three years or longer.

- Sensitivity #5: Carbon dioxide (CO_2) costs. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the avoided electric utility supply costs forecast was adjusted to include consideration of an additional impact for emissions assuming that there was an economic charge for carbon dioxide. The CO_2 forecast represents the average of those used by Florida Power & Light (FPL) and Duke Energy Florida (DEF) in their respective 2019 Ten-Year Site Plans.

Each of these sensitivities resulted in a unique set of measures passing the cost-effectiveness criteria for both RIM and TRC scenarios. The economic potential for the passing measures were evaluated in Nexant's TEA-POT model, and the results of the economic sensitivities are provided in Appendix E.

6.2 EE Economic Potential

This section provides the results of the EE economic potential for each sector. Table 6-5 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 6-5: Economic Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Non-Residential	1	22
Total	1	22
TRC SCENARIO		
Residential	12	62
Non-Residential	67	975
Total	79	1,037

6.2.1 Summary

Table 6-6 summarizes the EE economic potential by sector and by scenario (RIM and TRC):

Table 6-6: EE Economic Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.03
Total	0	0	0.03
TRC SCENARIO			
Residential	61	31	226
Non-Residential	32	11	239
Total	93	42	465

6.2.2 Residential – RIM Scenario

The residential segments did not have EE measures that passed the economic cost-effectiveness screening for the RIM scenario.

6.2.3 Non-Residential – RIM Scenario

The non-residential cost-effectiveness screening for the economic potential RIM scenario resulted in one passing measure, with an economic potential of 33.9 MWh and no summer or winter peak savings.

6.2.4 Residential – TRC Scenario

Figure 6-1, Figure 6-2, and Figure 6-3 illustrate the residential EE economic potential by end-use for the TRC scenario.

Figure 6-1: Residential EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

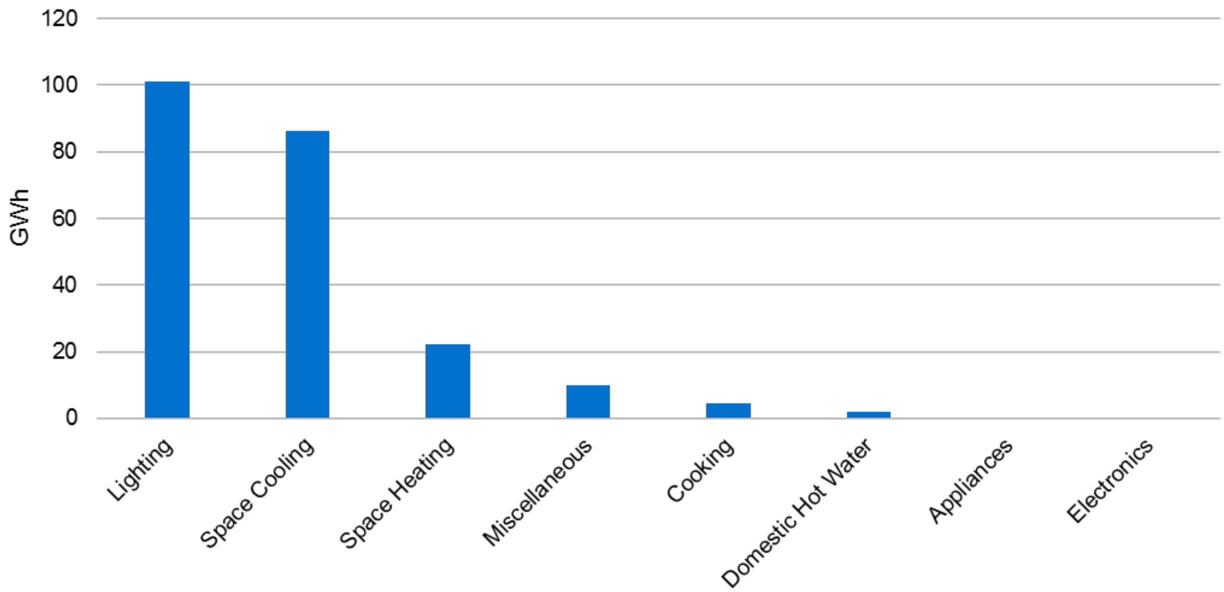


Figure 6-2: Residential EE Economic Potential by End-Use (Summer Peak Savings) - TRC Scenario

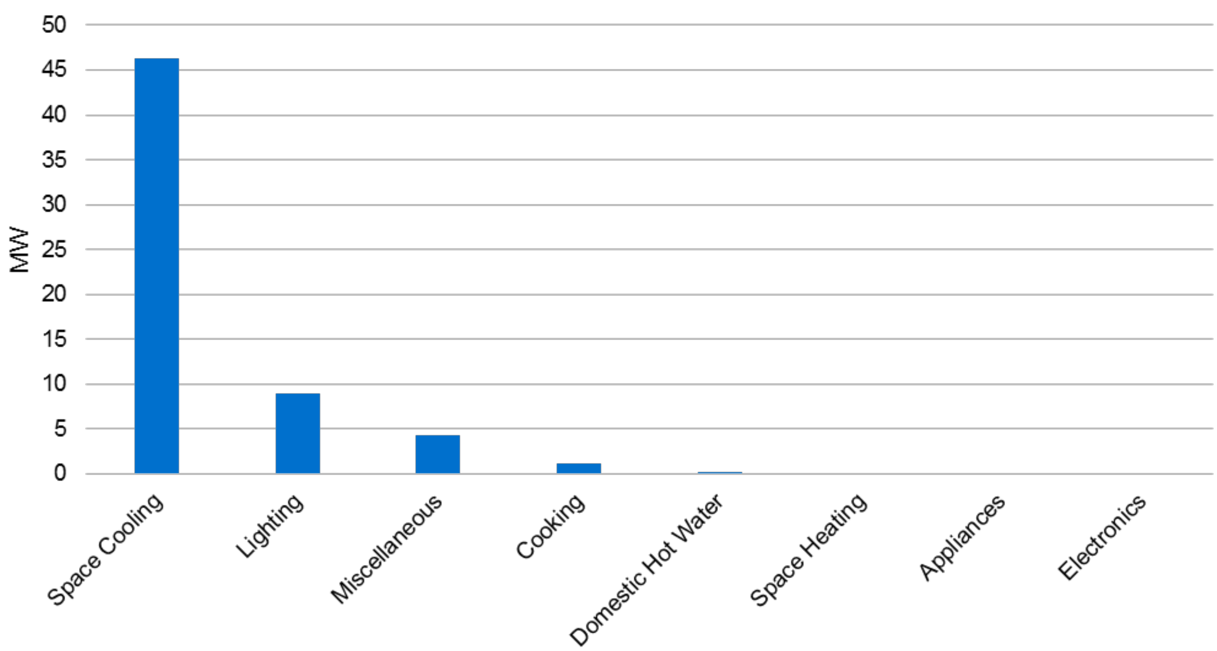
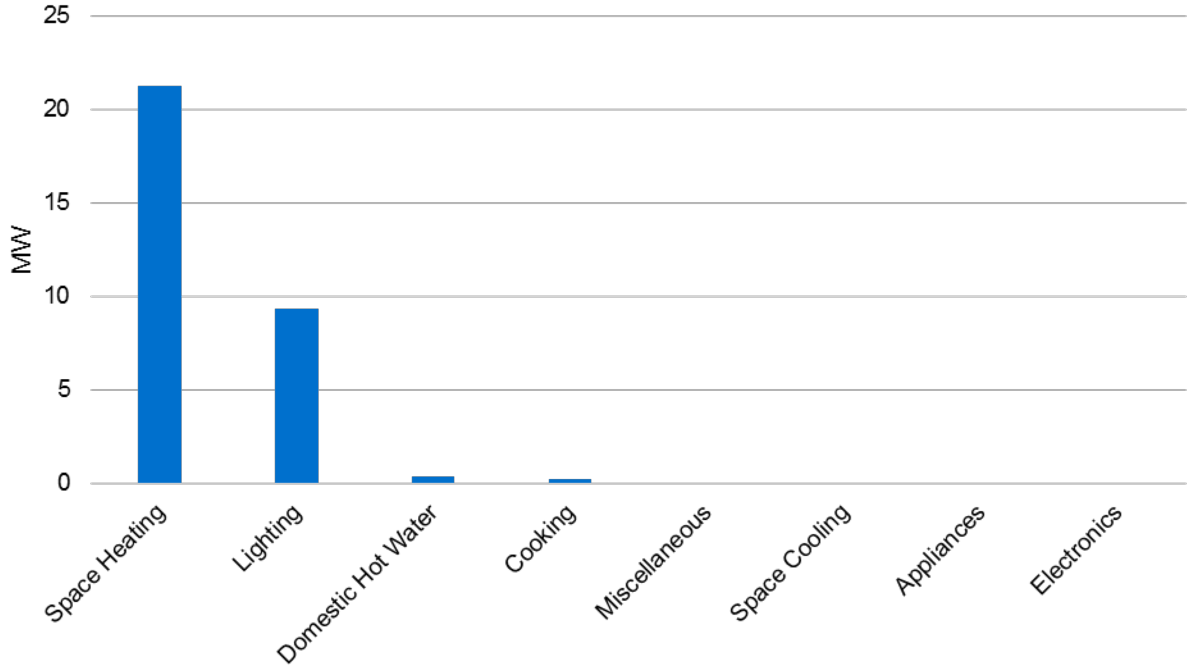


Figure 6-3: Residential EE Economic Potential by End-Use (Winter Peak Savings) - TRC Scenario



6.2.5 Non-Residential – TRC Scenario

Figure 6-4, Figure 6-5, and Figure 6-6 illustrate the non-residential EE economic potential by end-use for the TRC scenario.

Figure 6-4: Non-residential EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

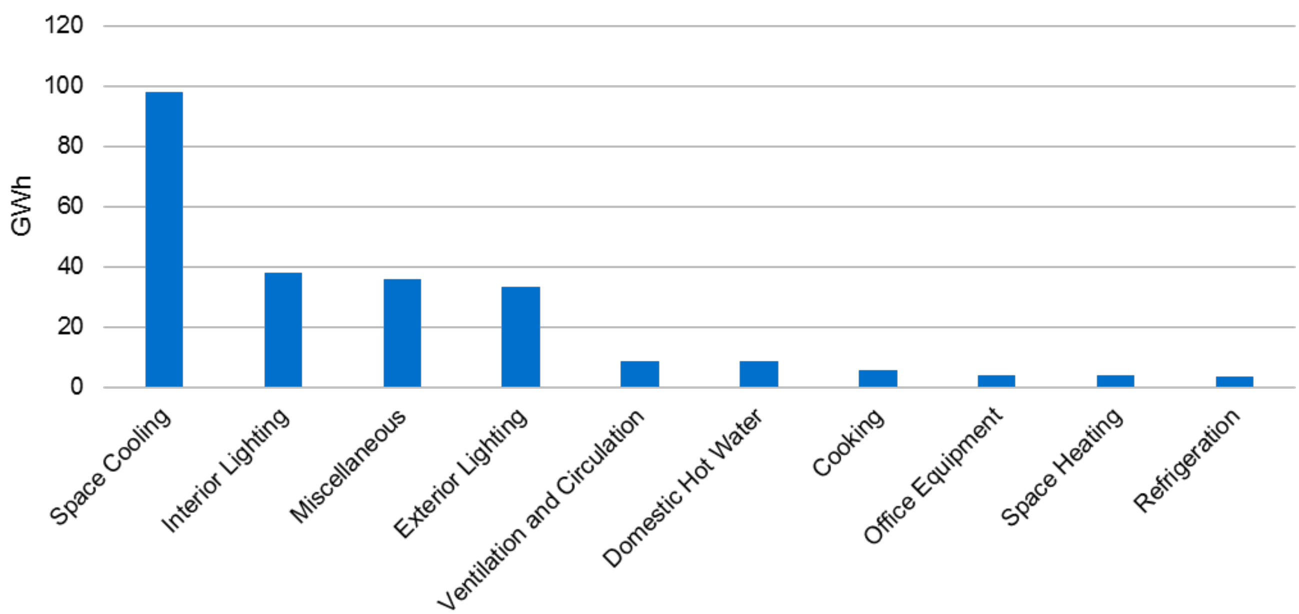


Figure 6-5: Non-residential EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

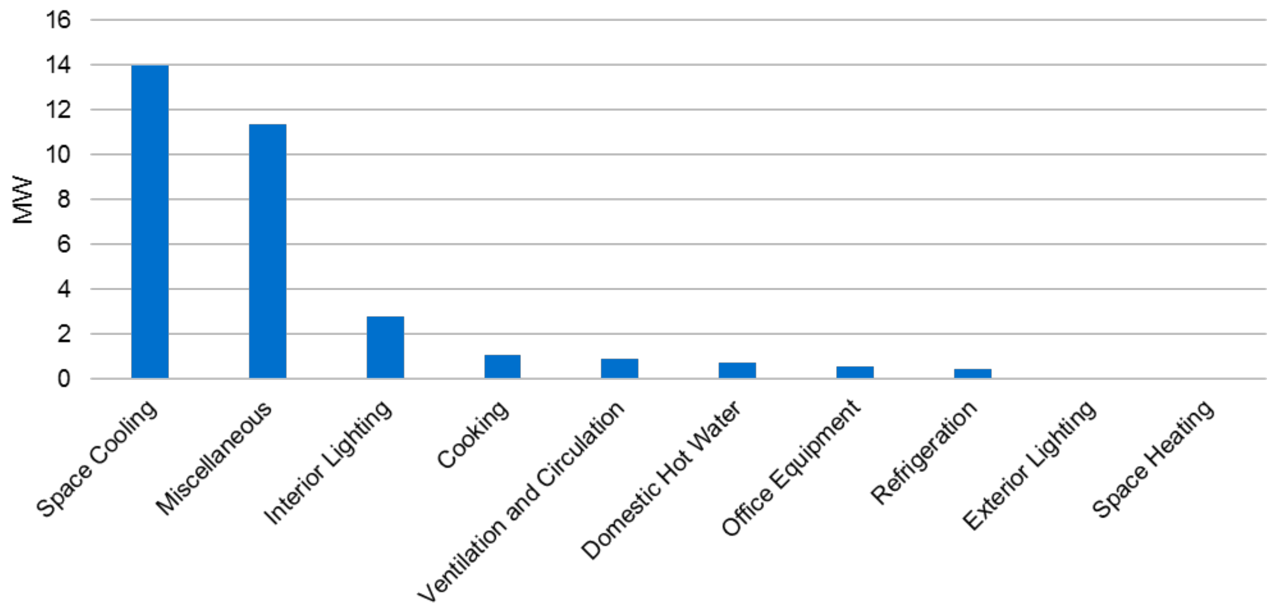
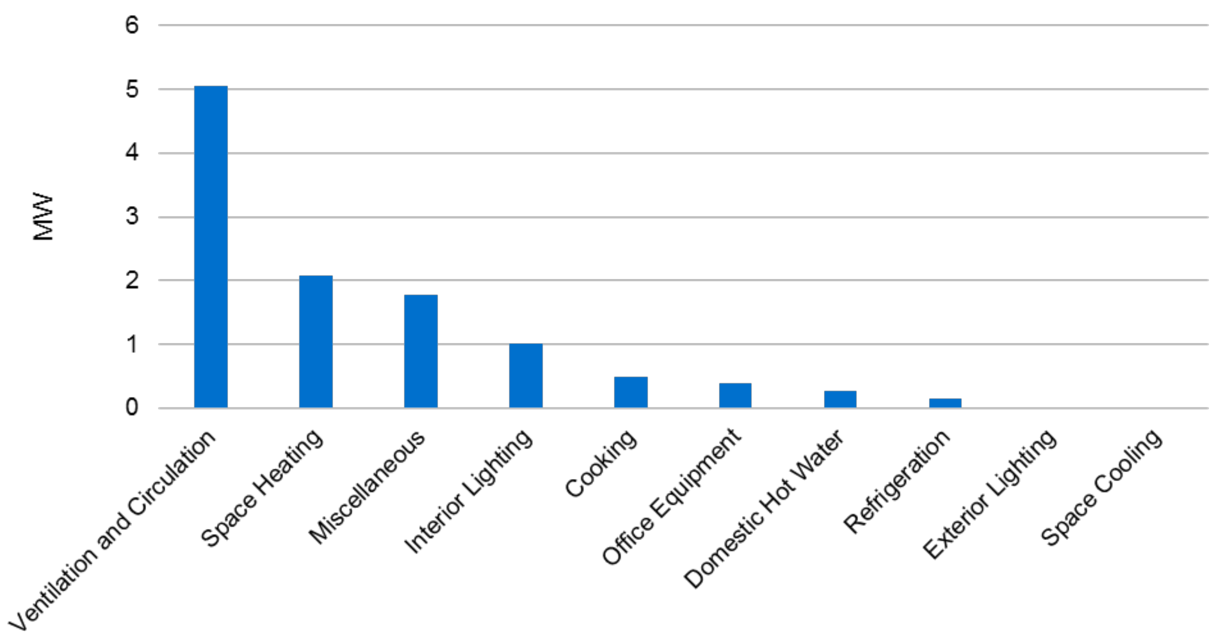


Figure 6-6: Non-residential EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.3 DR Economic Potential

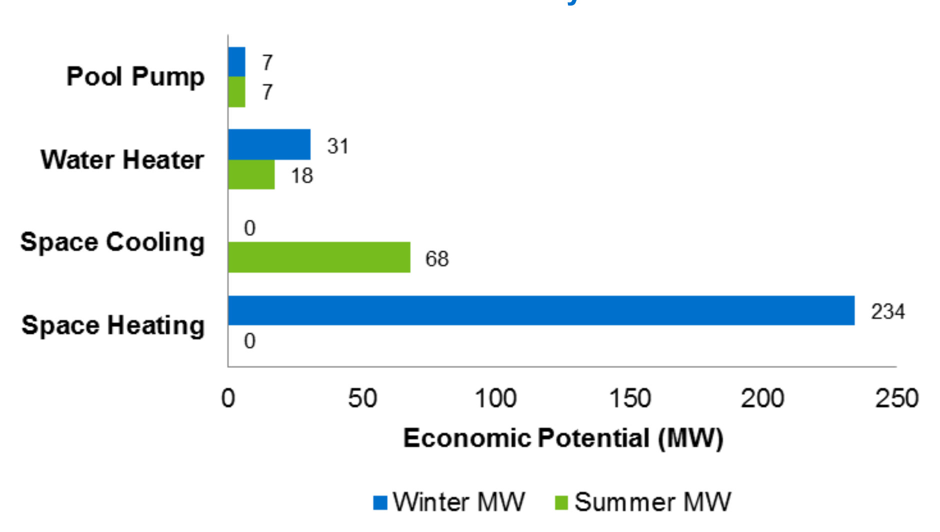
Because of the costs included in the RIM and TRC screening methodology for DR, all measures passed the economic potential screen for OUC. Therefore, the economic potential for DR is the same as the technical potential for OUC.

Table 6-7: DR Economic Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	92	272
Non-Residential	336	321
Total	428	593

Results for residential customer segments are presented in Figure 6-7. Note that because there are minimal customer costs and bill savings associated with the DR measures used, all measures passed the economic screen and the potential did not change from the technical potential, since based on the RIM and TRC screening requirements all of the load that can technically be curtailed can be curtailed cost-effectively.

Figure 6-7: Residential DR Economic Potential by End-Use – RIM and TRC Scenario



Similar figures are presented for small C&I and large C&I customers.

Figure 6-8: Small C&I DR Economic Potential by End-Use – RIM and TRC Scenario

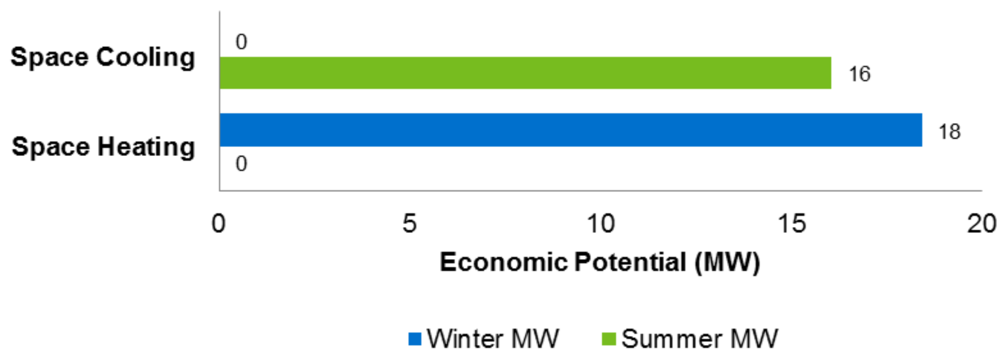
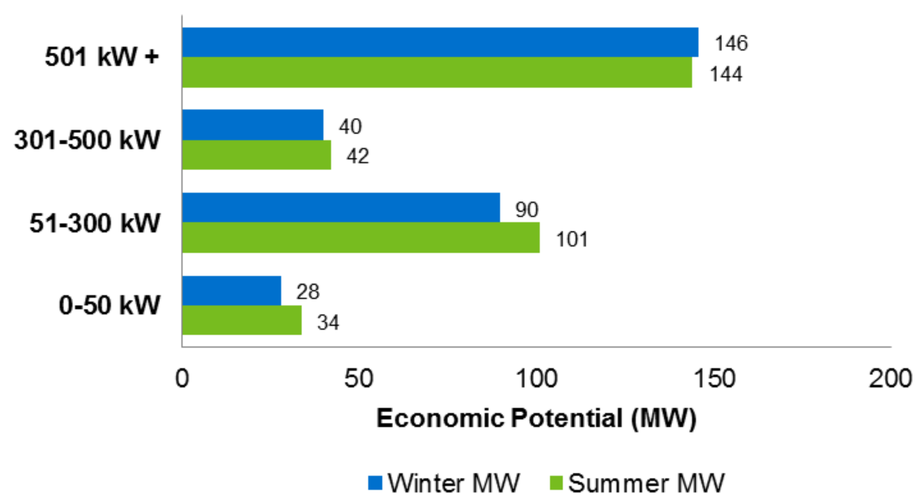


Figure 6-9: Large C&I DR Economic Potential by Segment – RIM and TRC Scenario



6.4 DSRE Economic Potential

Nexant found there to be no cost-effective economic potential attainable for OUC for PV systems, battery storage systems, or CHP systems for either the TRC-scenario or the RIM-scenario.

7 Achievable Potential

Nexant incorporated realistic assumptions about program delivery when estimating achievable market potential. Nexant estimated the cost-effective savings realistically achievable by utility-sponsored DSM programs in the OUC jurisdiction by incorporating utility program costs and utility incentive costs, and with consideration of economic constraints and market demand for DSM services in Florida.

7.1 Achievable Potential Methodology

7.1.1 Utility Program Costs and Incentives

Prior to the development of the achievable potential, Nexant performed a cost-effectiveness re-screening of all measures that passed the economic potential screening, under both the RIM and TRC scenarios, to incorporate estimated utility program costs and utility incentives for each measure. Nexant used program cost estimates by sector and end-use, which were developed from data on current FEECA Utilities' DSM programs as well as other regional utility program offerings[15]. The estimated incentive amounts were developed for each measure as follows:

- In the RIM scenario, two incentive values were analyzed. First, the RIM net benefit for the measure was calculated based on total RIM benefits minus RIM costs. Next, the incentive amount that would drive the simple payback to two years for each measure was calculated. The final incentive applied for the measure was based on the lower of these two values.
- In the TRC scenario, the incentive amount required to drive the simple payback to two years for each measure was used as the final incentive for the measure.

7.1.2 Market Adoption Rates

To estimate the adoption rate of DSM based on the utility program costs and incentives described above, Nexant incorporated OUC DSM program data as well as secondary data from other utility sponsored DSM programs. This approach leveraged program performance data from a variety of DSM programs across many utilities to develop a meta-analysis of program performance that broadly describes customers' program adoption rates over time. This approach applied standard economic theories on product diffusion to develop a catalog of market adoption curves across a variety of DSM technologies and programs[16].

Nexant used this market performance data, historic OUC program performance data, and secondary data sources to calibrate the measures passing the cost-effectiveness screening in

[15] Program cost estimates assumed average utility DSM program operations for mature, full-scale programs. However, actual program costs may vary by utility based on the program's size and scale, including the number of measures offered, participation and savings targets, and specific program delivery elements.

[16] A detailed description of Nexant's market adoption rate methodology is provided in Appendix F

the TEA-POT model. Secondary data sources for EE measures included ENERGY STAR data on qualified product shipments and other utility-sponsored program performance data. The adoption rate of DR also incorporated secondary data from other well-developed DR programs. This approach leveraged historic marketing strategies and customer responses to marketing as well as incentive level.

7.2 EE Achievable Potential

This section provides the detailed results of the EE achievable potential. Table 7-1 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 7-1: Achievable Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	1	22
Total	1	22
TRC SCENARIO		
Residential	11	55
Commercial	44	684
Industrial	21	252
Total	76	991

7.2.1 Summary

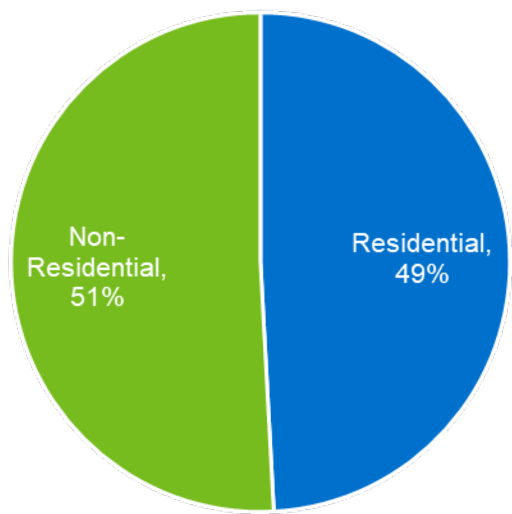
Table 7-2 summarizes the 10-year portfolio EE achievable potential for all customers across the residential and non-residential sectors. Impacts are presented as cumulative impacts, which represent the savings achieved over the ten-year study period(2020-2029) based on the sum of the annual incremental savings.

Table 7-2: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.006
Total	0	0	0.006
TRC SCENARIO			
Residential	9	7	67
Non-Residential	10	2	70
Total	19	9	137

Figure 7-1 shows achievable energy savings potential by sector for the TRC scenario. The RIM scenario is not presented as only one non-residential measure passed the cost-effectiveness screening.

Figure 7-1: Achievable Potential by Sector – TRC Scenario



7.2.2 Residential – RIM Scenario

The residential segments did not have any EE measures that passed the cost-effectiveness screening for the achievable potential RIM scenario.

7.2.3 Non-Residential – RIM Scenario

The non-residential cost-effectiveness screening for the achievable potential RIM scenario resulted in one passing measure, with an estimated cumulative achievable potential of 5,957 kWh over the 10-year study period and no summer or winter peak savings.

7.2.4 Residential – TRC Scenario

Table 7-3 summarizes the cumulative residential EE achievable potential by end-use for the TRC Scenario.

Table 7-3: EE Residential Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Lighting	5	5	58
Space Cooling	3	0	6
Space Heating	0	2	2
Miscellaneous	1	0	1
Cooking	0	0	1
Domestic Hot Water	0	0	0
Appliances	0	0	0
Electronics	0	0	0

Figure 7-2, Figure 7-3, and Figure 7-4 illustrate the cumulative residential EE achievable potential by end-use for the TRC scenario.

Figure 7-2: Residential EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

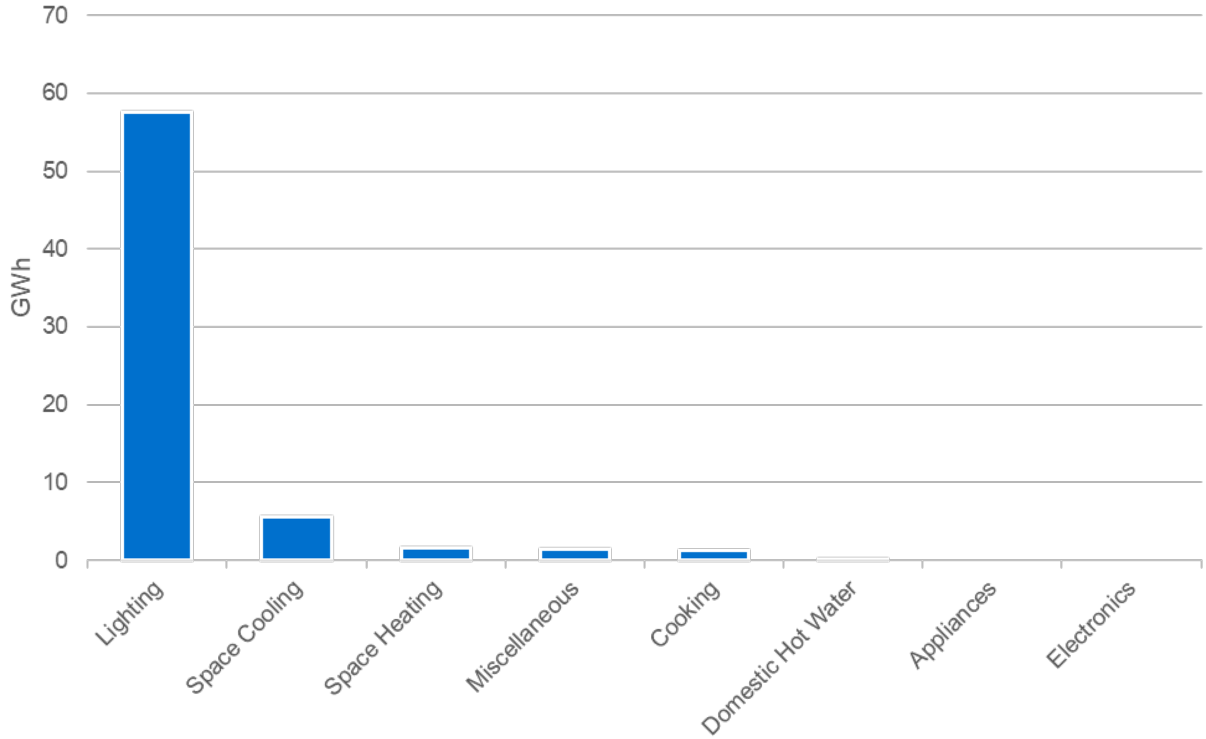


Figure 7-3: Residential EE Achievable Potential by End-Use (Summer Peak Savings) - TRC Scenario

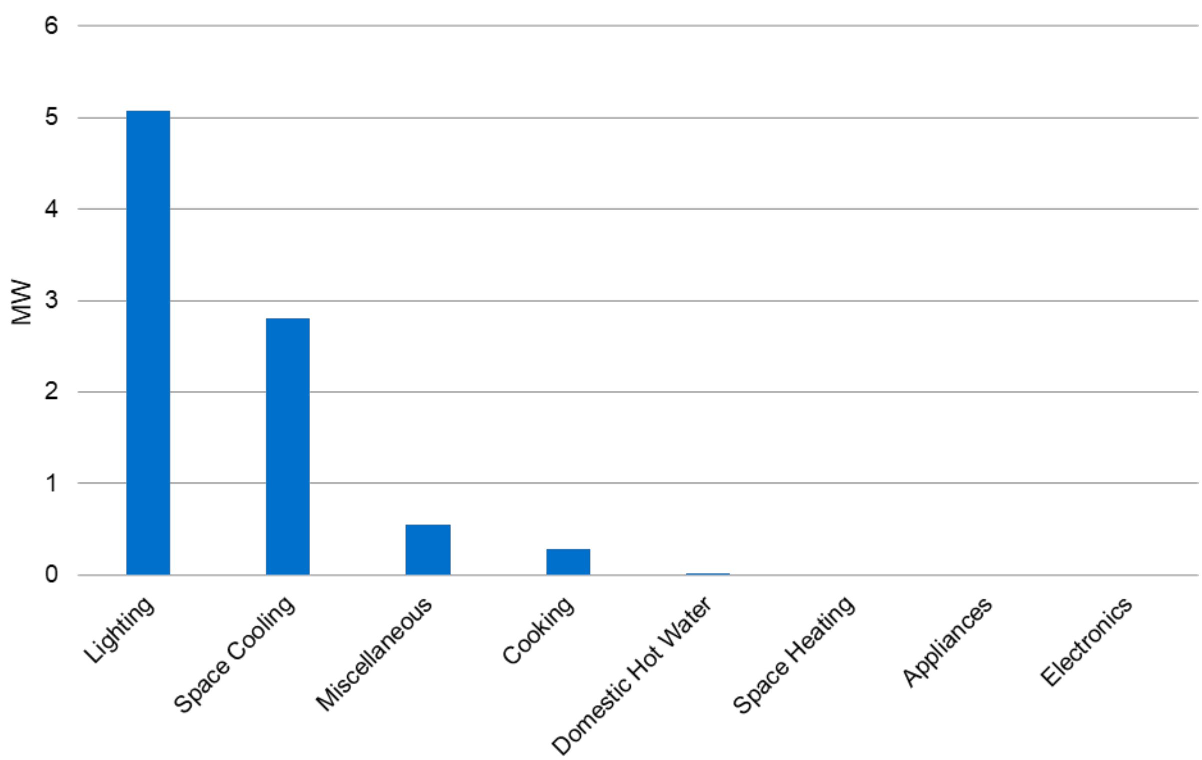
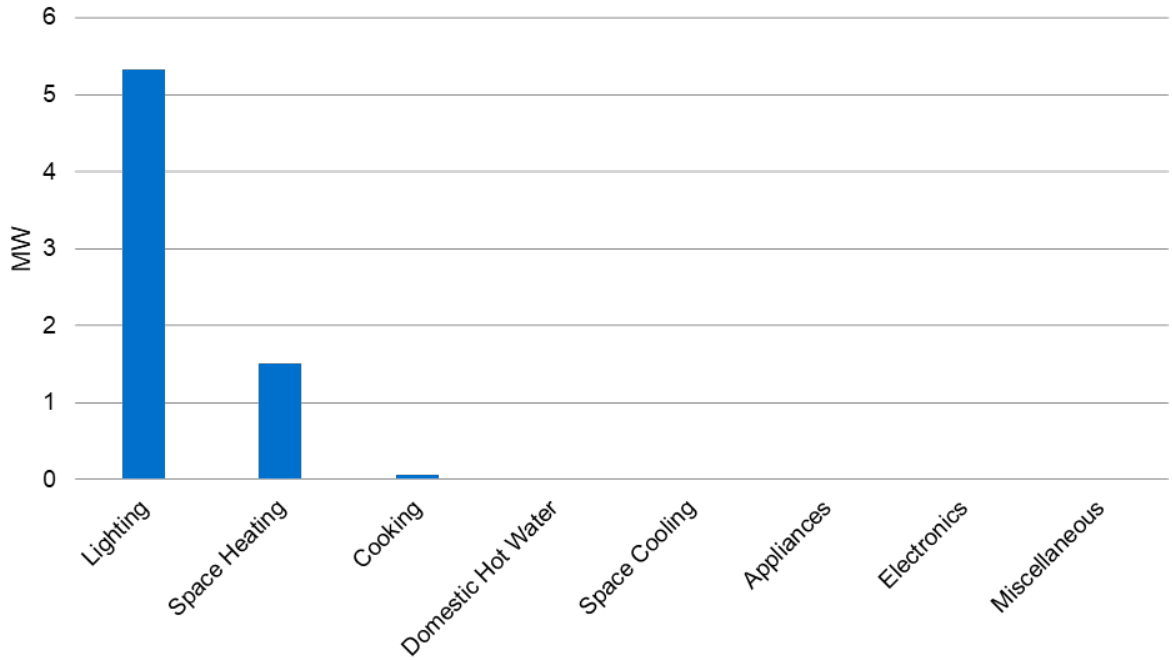


Figure 7-4: Residential EE Achievable Potential by End-Use (Winter Peak Savings) - TRC Scenario



7.2.5 Non-Residential – TRC Scenario

Table 7-4 summarizes the cumulative non-residential EE achievable potential by end-use for the TRC Scenario.

Table 7-4: EE Non-residential Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	1	0	11
Exterior Lighting	0	0	12
Office Equipment	0	0	1
Cooking	0	0	1
Refrigeration	0	0	2
Space Heating	0	1	1
Space Cooling	2	0	24
Ventilation and Circulation	0	1	1
Domestic Hot Water	0	0	1
Miscellaneous	7	1	17

Figure 7-5, Figure 7-6, and Figure 7-7 illustrate the cumulative non-residential EE achievable potential by end-use for the TRC scenario.

Figure 7-5: Non-residential EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

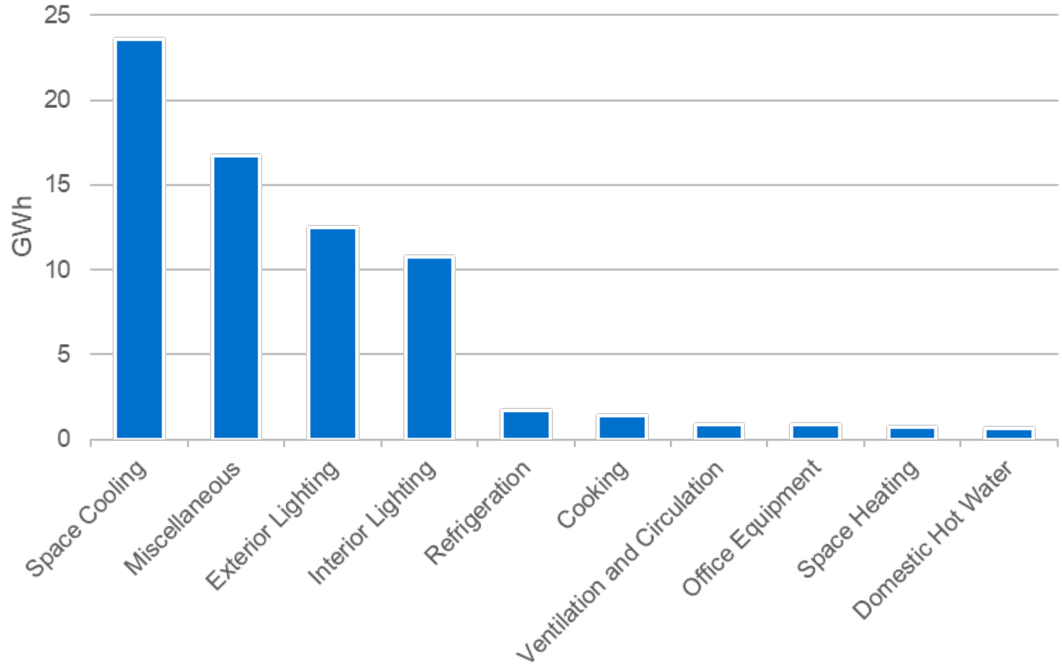


Figure 7-6: Non-residential EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

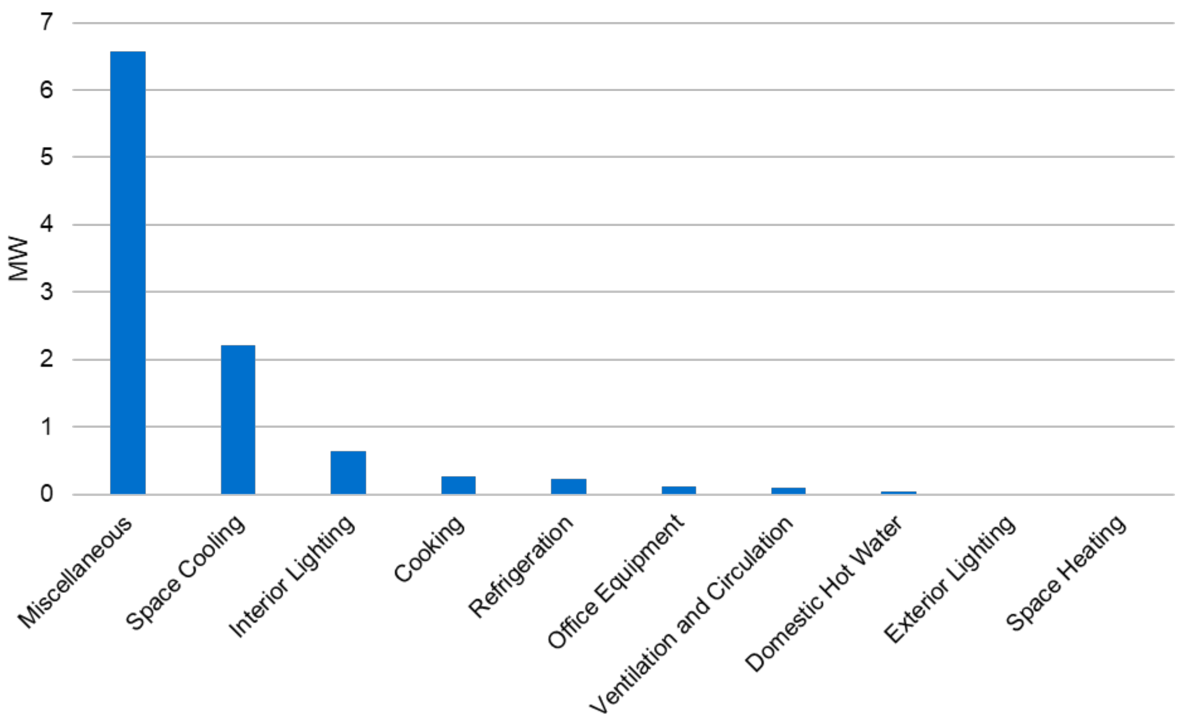
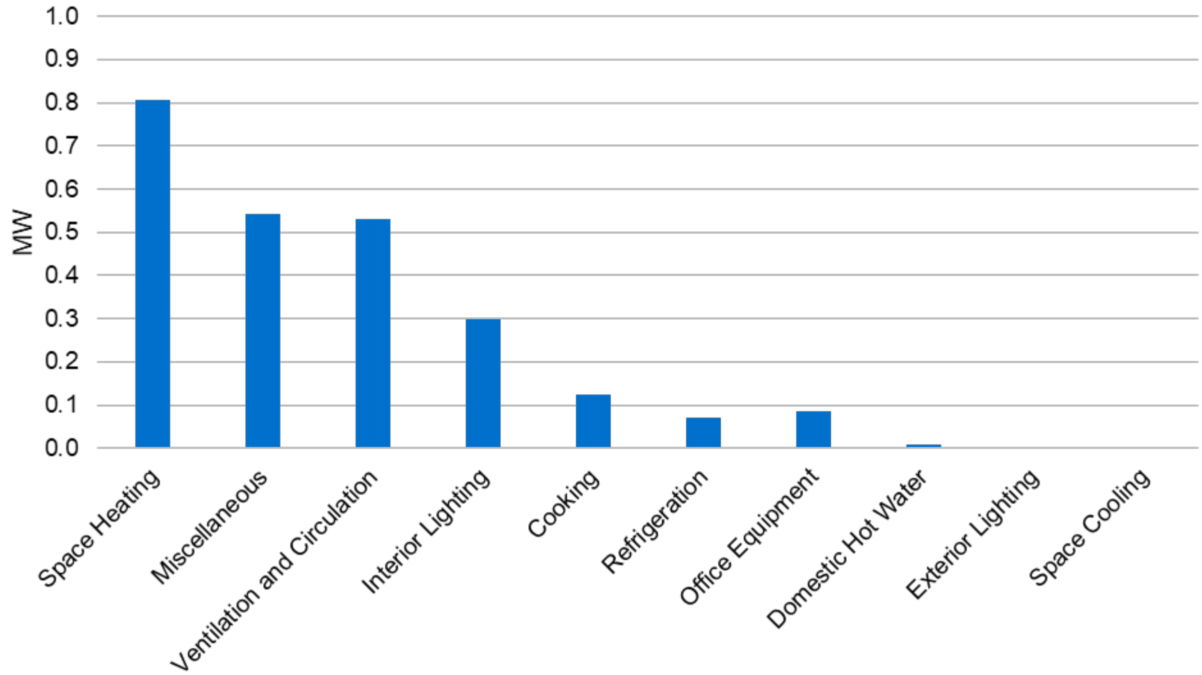


Figure 7-7: Non-residential EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.3 DR Achievable Potential

Nexant found that no Residential or small C&I measures passed the achievable potential screen for OUC. There were large C&I measures that passed the achievable potential screen, but the incentive values were so low that there was no participation expected for these measures. Therefore, Nexant found 0 MW of DR achievable potential for OUC.

7.4 DSRE Achievable Potential

Nexant found there to be no cost-effective achievable potential attainable for OUC for PV systems, battery storage systems, or CHP systems for either the TRC-scenario or the RIM-scenario.

8 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements
Floor Insulation*	Space Cooling,	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC

Measure	End-Use	Description	Baseline
	Space Heating		with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement,	Market average pump equipment

Measure	End-Use	Description	Baseline
		VFD installation	
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and small C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

The cooling load shapes on the summer peak weekday and average weekdays were generated from hourly load data from a sample of OUC customers. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2016
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (among May to September). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same hourly load research profile in 2016, and the peak day was defined as the day with system peak load during winter period. The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

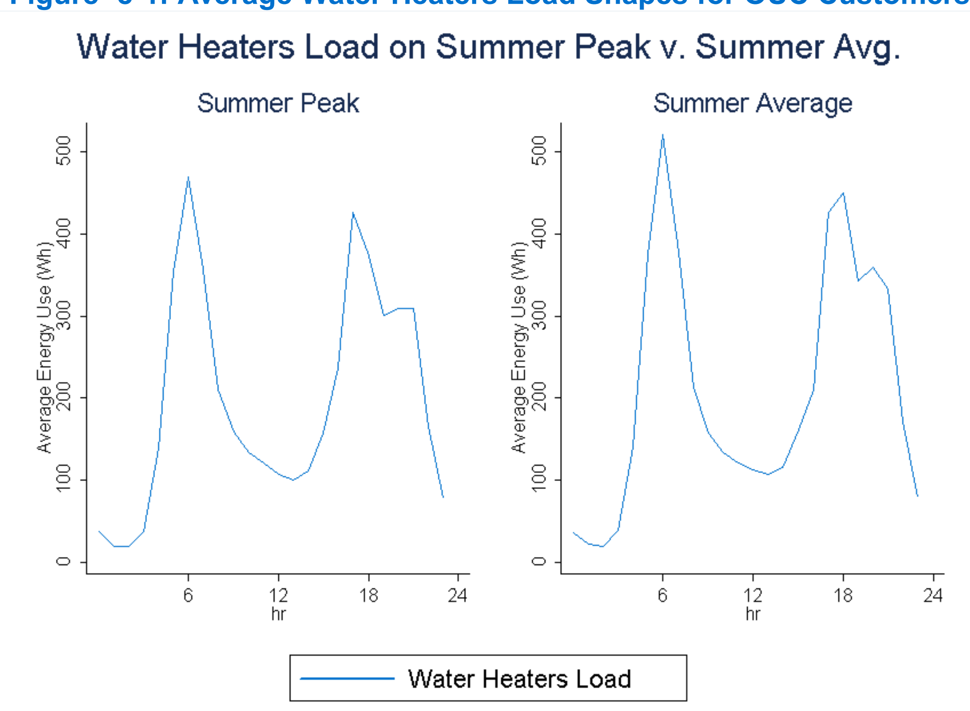
Where:

t	Hours in each day in year 2016
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in OUC territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in OUC.

Figure -8-1: Average Water Heaters Load Shapes for OUC Customers

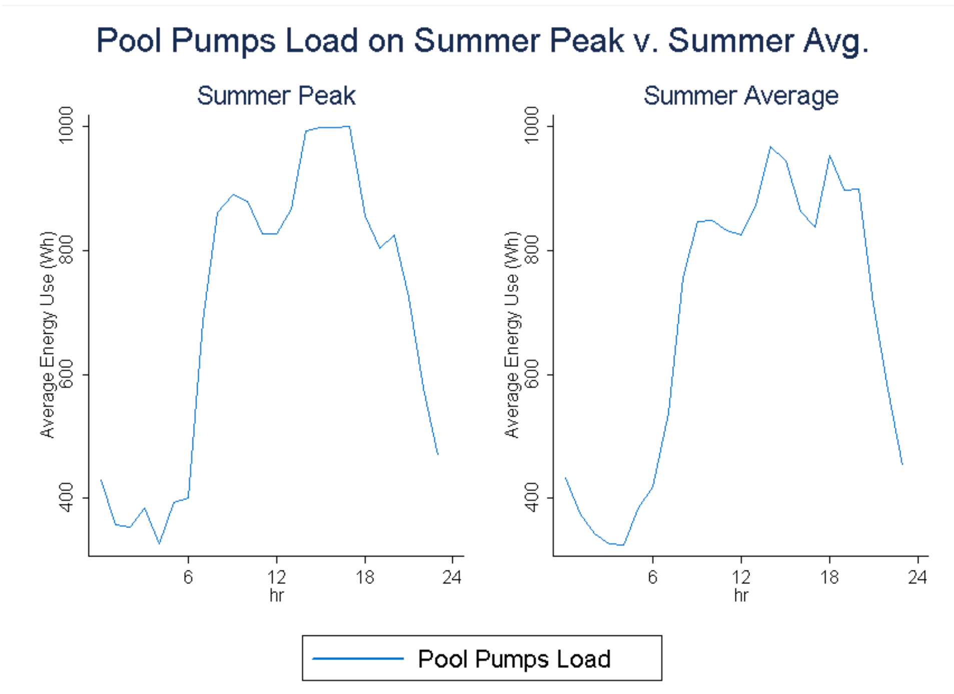


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads have low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 – 7:00 AM and 5:00 – 8:00 PM.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in OUC.

Figure 8-2: Average Pool Pumps Load Shapes for OUC Customers



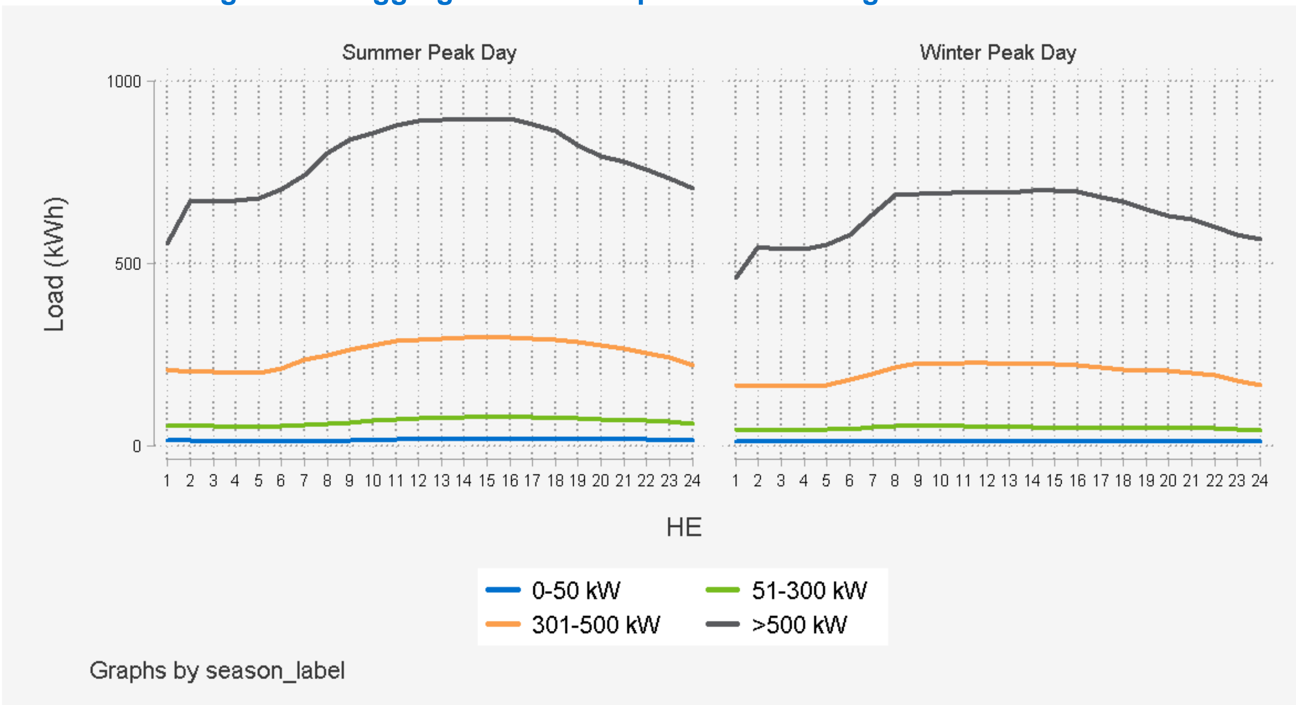
According to the Figure 8-4, the peak hours for pool pumps are 3:00 to 6:00 PM, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of interval data (2016) for a sample of customers in the GSD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below. These graphs are useful to identify the segments with the highest potential as well as examine the weather-sensitivity of each segment by comparing peak usage to the average usage in each season.

Figure 8-3: Aggregate Load Shapes for OUC Large C&I Customers



Appendix E Economic Potential Sensitivities

As part of the assessment of economic potential, the study included analysis of sensitivities related to free ridership, future fuel costs, and carbon scenarios, as follows:

Sensitivity #1: Higher Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	19	248
Total	19	248
TRC SCENARIO		
Residential	17	78
Commercial	50	857
Industrial	21	254
Total	88	1,189

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	2	1	23
Total	2	1	23
TRC SCENARIO			
Residential	65	46	287
Non-Residential	44	14	305
Total	109	59	592

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #2: Lower Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the fuel cost forecast was adjusted to a "low fuel" scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	11	50
Commercial	39	608
Industrial	19	242
Total	69	900

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	42	25	184
Non-Residential	24	11	208
Total	66	35	392

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #3: Shorter free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the simple payback screening criteria was reduced to one year or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	2	48
Total	2	48
TRC SCENARIO		
Residential	22	114
Commercial	61	1,161
Industrial	29	448
Total	112	1,723

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.1
Total	0	0	0.1
TRC SCENARIO			
Residential	66	35	280
Non-Residential	68	56	430
Total	134	91	710

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #4: Longer free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the simple payback screening criteria was increased to three years or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	9	40
Commercial	34	441
Industrial	18	122
Total	61	603

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	40	16	94
Non-Residential	22	4	125
Total	63	19	219

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #5: Carbon dioxide (CO_2) costs

For this sensitivity, both the RIM and TRC scenarios were screened as described for the Baseline scenario in Section 6.1.2, but the avoided electric utility supply costs forecast was adjusted to include consideration of an additional impact for emissions assuming that there was an economic charge for carbon dioxide. The CO_2 forecast represents the average of those used by Florida Power & Light (FPL) and Duke Energy Florida (DEF) in their respective 2019 Ten-Year Site Plans.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	1	22
Total	1	22
TRC SCENARIO		
Residential	13	64
Commercial	45	741
Industrial	21	252
Total	79	1,057

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.03
Total	0	0	0.03
TRC SCENARIO			
Residential	61	31	226
Non-Residential	39	11	265
Total	99	43	491

DR measures were not included in the economic sensitivities as the estimated carbon dioxide costs do not affect DR results.

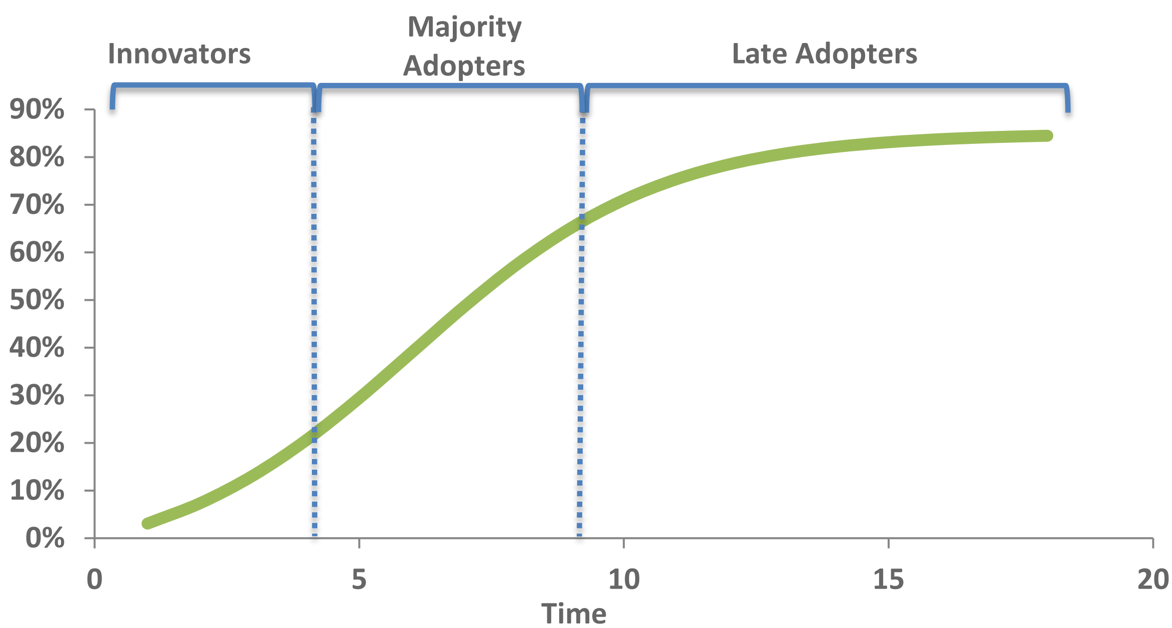
No DSRE measures passed the economic screening for this sensitivity.

Appendix F Market Adoption Rates

Nexant uses the Bass diffusion model to estimate measure adoption rates. The Bass diffusion model is a widely accepted mathematical description of how new products and innovations spread through an economy over time. The Bass Diffusion Model was originally published in 1969, and in 2004 was voted one of the top 10 most influential papers published in the 50 year history of the peer-reviewed publication *Management Science*[1]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to demand-side management in the energy industry[2]. Nexant applied the secondary data and research collected to develop and apply Bass Model diffusion parameters in the Florida jurisdiction.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept is illustrated in Figure 8-4.

Figure 8-4 Bass Model Market Penetration with Respect to Time



1 Bass, F. 2004. Comments on "A New Product Growth for Model Consumer Durables the Bass Model" (sic). *Management Science* 50 (12_supplement): 1833-1840. http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1040.0300. Accessed 01/08/2016.

2 Buskirk, R. 2014. Estimating Energy Efficiency Technology Adoption Curve Elasticity with Respect to Government and Utility Deployment Program Indicators. LBNL Paper 6542E. Sustainable Energy Systems Group, Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. http://escholarship.org/uc/item/2vp2b7cm#page-1. Accessed 01/14/2016.

Figure 8-4 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

$$\frac{dS(t)}{dt} = \left(p + \frac{q}{m} * S(t-1)\right) * (m - S(t-1))$$

Where:

$\frac{dS(t)}{dt} =$ the rate of adoption for any discrete time period, t

$p =$ external influences on market adoption

$q =$ internal influences on market adoption

$m =$ the maximum market share for the product

$S(t-1) =$ the cumulative market share of the product, from product introduction to time period *t-1*

Marketing is the quintessential external influence. The internal influences are characteristics of the product and market; for example: the underlying market demand for the product, word of mouth, product features, market structure, and other factors that determine the product's market performance. Nexant's approach applied literature reviews and analysis of secondary data sources to estimate the Bass model parameters. We then extrapolated the model to future years; the historic participation and predicted future market evolution serve as the program adoption curve applied to each proposed offering.

In order to estimate elasticity across different utility incentive levels, Nexant incorporated data from a regression analysis performed on EIA 861 data to understand the relative change in savings based on differing incentives. Per this analysis, a 100% increase in the total utility incentive equated to roughly a 44% increase in savings. This EIA-based elasticity rate was applied to the market adoption rates described above to estimate relative changes in market adoption for the range of maximum incentives where they vary from current or typical utility offerings.

Nexant's approach for estimating DR potential includes an additional step, based on our analysis of mature demand response programs. We estimate participation rates with the following process:

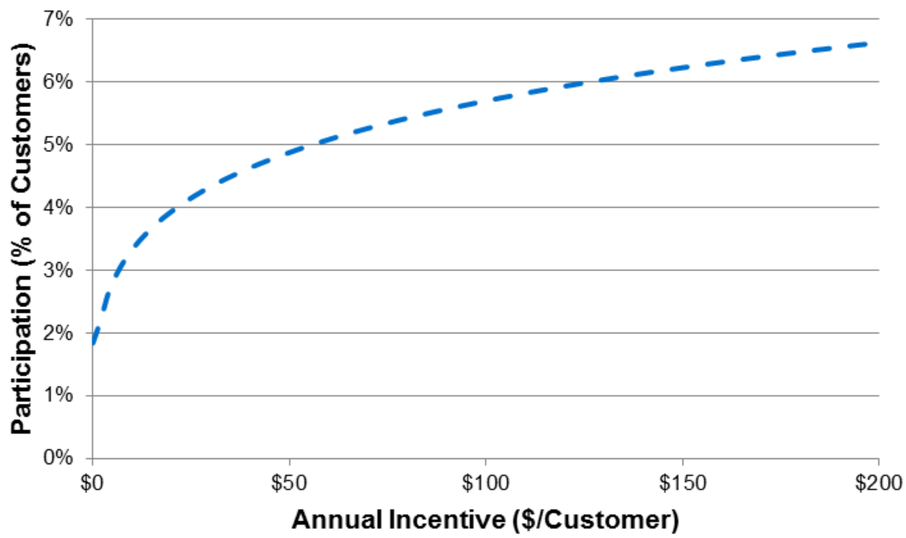
1) Use the results from prior analysis of DR program enrollment[3] to describe DR program participation as a function of customer segments and program attributes
2) Calibrate the model to reflect actual enrollment rates attained by existing OUC programs. To calibrate the models, the model constant is adjusted so that the model produces exactly the enrollment rates observed by OUC programs.

[3] Nexant Inc. Sacramento Municipal Utility District Demand Response Potential Study. October 20, 2015.

3) Predict participation rates using specific tactics and incentive levels for each measure based on the outcome of the RIM screening (or existing incentive levels).

As a demonstration of how marketing level and incentive affects participation in residential DR programs, Figure 8-5 shows the range of participation rates at a medium marketing level (phone outreach, mail, and email) as a function of the incentive paid to the customer. The curve shows that residential customers will respond to changes in incentive level if the incentive is relatively low, but are not as responsive to incentive levels after a certain point. This is why utility marketing strategies also play an important role in residential customer participation. This curve can also vary depending on the customer segments present in a utility's jurisdiction and other utility DR program characteristics (such as program age). To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-5: Residential Program Enrollment as a function of Incentive

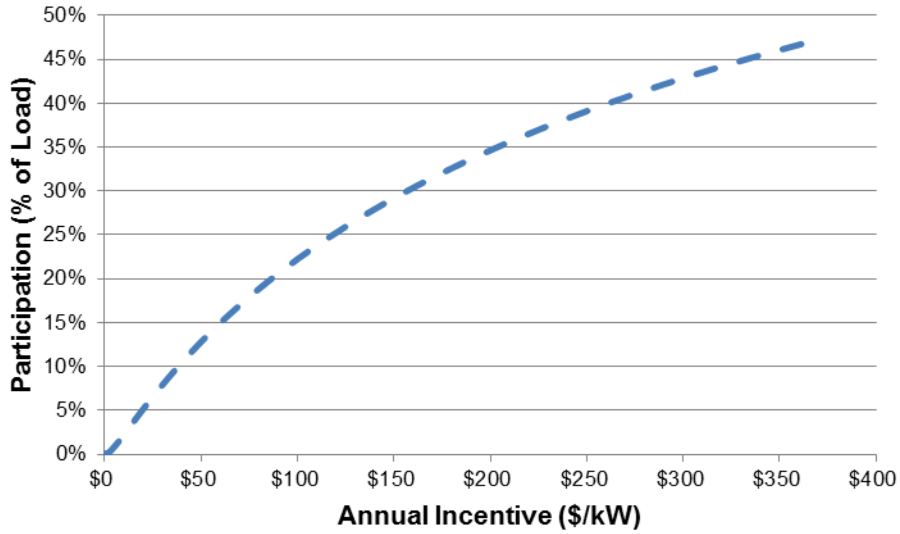


For small C&I customers, a similar approach was used to estimate participation levels. However, these customers tend to have lower enrollments than larger nonresidential customers, and were scaled accordingly. Small C&I customers tend to exhibit roughly 40% of the uptake of residential customers, based on data from historic DR program analysis, which have extensively marketed these programs.

Large C&I customers were slightly different than the other two segments. Due to the large variation in customer size, participation was estimated as the percent of load enrolled in demand response rather than the number of customers. Figure 8-6 shows the participation level of large C&I customers as a function of incentive. Although customers grow less responsive to the incentive as it increases, they continue to be much more responsive to the annual incentive as it increases. This is why for technical potential, it is assumed that if a large C&I customer is paid a high enough incentive; they will curtail their entire load. Similar to the residential participation curve, this curve can vary based on existing participation rates for a utility as well as the industries that large C&I

customers belong to. To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-6: Large C&I Program Enrollment as a function of Incentive



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REPORT

Reimagine tomorrow.

Market Potential Study of Demand-Side Management in JEA's Service Territory

Submitted to JEA

April, 2019

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1 Executive Summary

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and demand-side renewable energy (DSRE) systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of JEA's service territory.

1.1 Methodology

Nexant estimates DSM savings potential by applying an analytical framework that aligns baseline market conditions for energy consumption and demand with DSM opportunities. After describing the baseline condition, Nexant applies estimated measure savings to disaggregated consumption and demand data. The approach varies slightly according to the type of DSM resources and available data; the specific approaches used for each type of DSM are described below.

1.1.1 EE Potential

This study utilized Nexant's Microsoft Excel-based EE modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual program savings. The methodology for the EE potential assessment was based on a hybrid "top-down/bottom-up" approach, which started with the current utility load forecast, then disaggregated it into its constituent customer-class and end-use components. Our assessment examined the effect of the range of EE measures and practices on each end-use, taking into account current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the end-use, customer class, and system levels.

1.1.2 DR Potential

The assessment of DR potential in JEA's service territory was an analysis of mass market direct load control programs for residential and small commercial and industrial (C&I) customers, and an analysis of DR programs for large C&I customers. The direct load control program assessment focused on the potential for demand reduction through heating, ventilation, and air conditioning (HVAC), water heater, and pool pump load control. These end-uses were of particular interest because of their large contribution to peak period system load. For this analysis, a range of direct load control measures were examined for each customer segment to highlight the range of potential. The assessment further accounted for existing DR programs for JEA when calculating the total DR potential. The large C&I programs assessment used publicly available data on mature DR programs and current Florida large C&I DR programs to derive estimates of price responsiveness to program incentives and marketing techniques. Using these estimates, the maximum incentive and enrollment scenario was calculated to estimate the potential.

1.1.3 DSRE Potential

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems charged from customers' PV systems, and combined heat and power (CHP) systems. The study leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses, and used a "bottom-up" modeling approach to estimate the potential of the various DSRE technologies for the residential, commercial and industrial customers. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

1.2 Savings Potential

Nexant estimated DSM savings potential according to three standard scenarios: technical, economic, and achievable potential. Each scenario is defined using slightly different criteria, which are described in the subsequent sections.

1.2.1 EE Potential

Technical Potential

EE technical potential describes the savings potential when all technically feasible EE measures are fully implemented, ignoring all non-technical constraints on electricity savings, such as cost-effectiveness and customer willingness to adopt EE.

The estimated technical potential results are summarized in Table 1-1.

Table 1-1: EE Technical Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	426	193	1,582
Non-Residential[1]	287	159	1,423
Total	713	353	3,005

[1] Non-Residential results include all commercial and industrial customer segments

Economic Potential

EE economic potential applies a cost-effectiveness screening to all technically feasible measures and includes full implementation of all measures that pass this screening. Measure permutations were screened individually and the economic potential represents the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

Economic potential was determined for two scenarios: a Rate Impact Measure (RIM) scenario and Total Resource Cost (TRC) scenario. Additional screening criteria for both scenarios included the Participant Cost Test (PCT) perspective, and two-year payback criterion. Additional sensitivities were also analyzed, which are described in Section 6.1.3 and results presented in Appendix E.

The estimated economic potential results are summarized in Table 1-2.

Table 1-2: EE Economic Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.8
Total	0	0	0.8
TRC SCENARIO			
Residential	113	66	419
Non-Residential	89	52	605
Total	202	118	1,024

Achievable Potential

Achievable potential estimates the demand and energy savings feasible with utility-sponsored programs, while considering market barriers and customer adoption rates for DSM technologies. Similar to the economic potential analysis, Nexant screened measures to determine which are cost-effective from both the RIM and TRC perspectives. The achievable potential includes estimated program costs and incentives, whereas the economic potential scenario does not.

Table 1-3 summarizes the results for the estimated EE achievable potential, representing the cumulative savings over the ten-year study period (2020-2029) based on the sum of annual incremental savings.

Table 1-3: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	11	10	86
Non-Residential	23	14	176
Total	34	24	262

1.2.2 DR Potential

Technical Potential

DR technical potential describes the magnitude of loads that can be managed during conditions when grid operators need peak capacity. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale such as heating, cooling, water heaters, and pool pumps. For large C&I customers this included their entire electric demand during a utility's system peak, as many of these types of customers will forego virtually all electric demand temporarily if the financial incentive is large enough.

The estimated technical potential results are summarized in Table 1-4.

Table 1-4: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	489	1,150
Non-Residential	538	503
Total	1,027	1,654

Economic Potential

DR economic potential incorporates the economic screening criteria described above for EE potential. Because of the costs and benefits associated with DR, all DR measures passed and DR economic potential is the same as DR technical potential for JEA. The results are summarized in Table 1-5.

Table 1-5: DR Economic Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	489	1,150
Non-Residential	538	503
Total	1,027	1,654

Achievable Potential

DR achievable potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective achievable potential for JEA.

1.2.3 DSRE Potential

Technical Potential

DSRE technical potential estimates quantify all technically feasible distributed generation opportunities from PV systems, battery storage systems charged from PV, and CHP technologies based on the customer characteristics of each FEECA Utility's customer base.

Table 1-6: DSRE Technical Potential[2]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	1,108	87	7,907
Non-Residential	1,953	154	13,783
Total	3,061	242	21,690
Battery Storage charged from PV Systems			
Residential	439	243	-
Non-Residential	84	-	-
Total	523	243	-
CHP Systems			
Total	891	614	4,126

Economic Potential

DSRE economic potential incorporates the economic screening criteria described above for EE potential. Nexant found there to be no cost-effective economic potential attainable in JEA for PV systems, battery storage systems, or CHP systems.

Achievable Potential

DSRE achievable potential incorporates the achievable screening criteria described above for EE potential. Nexant found there to be no cost-effective achievable potential attainable in JEA for PV systems, battery storage systems, or CHP systems.

[2] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

2 Introduction

In October, 2017, the seven electric utilities subject to the Florida Energy Efficiency and Conservation Act (FEECA Utilities) retained Nexant, Inc. for the purpose of identifying and characterizing the market for demand-side management (DSM) opportunities, including energy efficiency (EE) improvement and building retrofits, peak load reductions from demand response (DR), and DSRE systems. The main objectives of the study included:

- Assessing technical potential of demand-side resources for reducing customer electric energy consumption and seasonal peak capacity demands.
- Assessing economic potential and achievable potential for a subset of FEECA Utilities over the 10-year study period (2020-2029).

This report provides the detailed methodology and results for the analysis of JEA's service territory.

The following deliverables were developed by Nexant as part of the project and are addressed in this report:

- DSM measure list and detailed assumption workbooks
- Disaggregated baseline demand and energy use by year, state, sector, and end-use
- Baseline technology saturations, energy consumption, and demand
- List of cost-effective EE, DR, and DSRE measures
- Potential demand and energy savings for technical, economic and achievable potential scenarios
- Estimated utility costs to acquire the achievable potential
- Supporting calculation spreadsheets

2.1 Market Potential Study Approach

DSM market potential studies (MPS) typically include three scenarios: technical, economic, and achievable potential. Each scenario is defined by specific criteria, which collectively describe levels of opportunity for DSM savings. Nexant estimates levels of DSM potential according to the industry standard categorization, as follows:

- Technical Potential is the theoretical maximum amount of energy and capacity that could be displaced by DSM, regardless of cost and other barriers that may prevent the installation or adoption of a DSM measure. For this study, technical potential included full application of commercially available DSM technologies to all residential, commercial, and industrial customers in the utility's service territory.
- Economic Potential is the amount of energy and capacity that could be reduced by efficiency DSM measures that are considered cost-effective. This study used the Ratepayer Impact

Measure (RIM) test perspective and Total Resource Cost (TRC) test perspective, which were both coupled with the Participant Cost Test (PCT) and a two-year payback to determine cost-effectiveness.

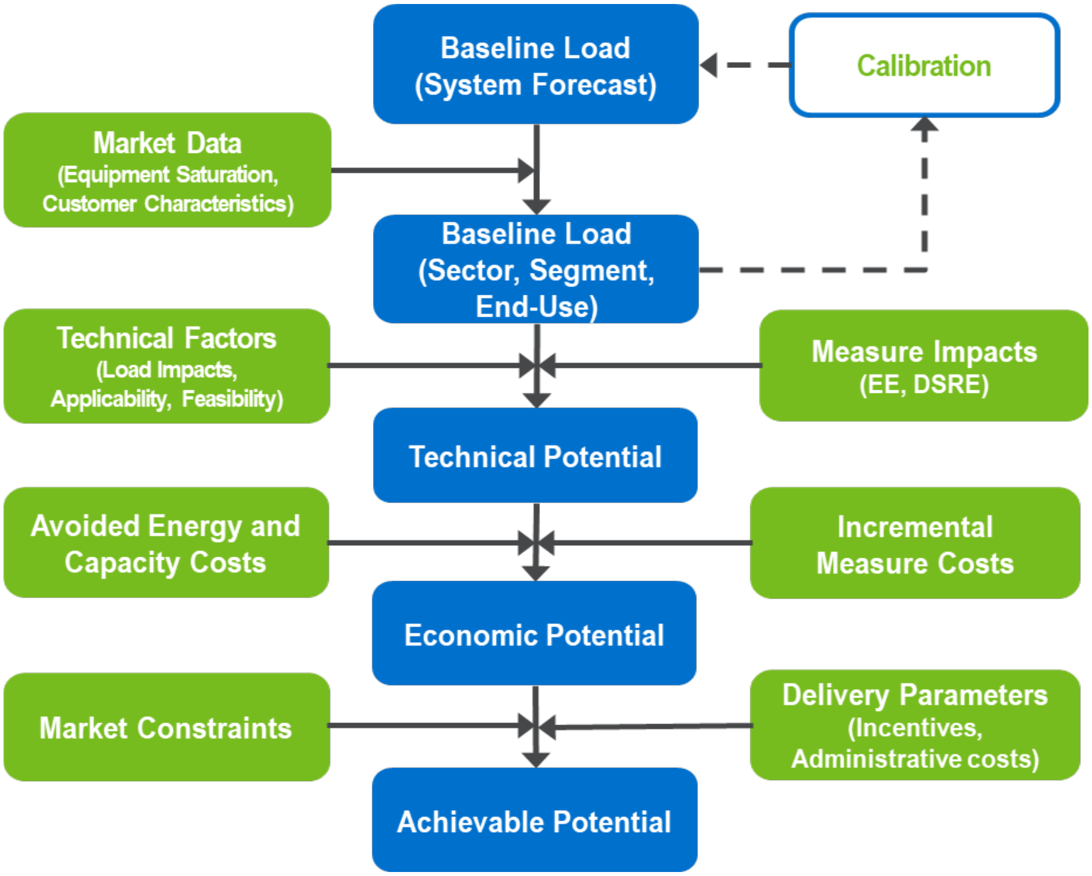
- Achievable Potential is the DSM savings feasible when considering how a utility-sponsored program might address market barriers and affect customer adoption of DSM technologies. Nexant's achievable potential applied the same cost-effectiveness screening as the economic potential analysis, with the addition of utility program costs and incentives.

Quantifying these levels of DSM potential is the result of an analytical process that refines DSM opportunities from the theoretical maximum to realistic measure savings. Nexant's general methodology for estimating DSM market potential is a hybrid "top-down/bottom-up" approach, which includes the following steps:

- Develop a baseline forecast: the study began with a disaggregation of the utility's official electric energy forecast to create a baseline electric energy forecast. This forecast does not include any utility-specific assumptions around DSM performance. Nexant applied customer segmentation and consumption data from each utility and data from secondary sources to describe baseline customer-class and end-use components.
- Collect cost and impact data for measures: For those measures passing the qualitative screening, conduct market research and estimate costs, energy savings, measure life, and demand savings. We differentiated between the type of cost (capital, installation labor, maintenance, etc.) to separately evaluate different implementation modes: retrofit (capital plus installation labor plus incremental maintenance); new construction (incremental capital and incremental maintenance); and burnout costs (incremental capital and incremental maintenance).
- Identify DSM opportunities: DSM opportunities applicable to JEA's climate and customers were analyzed to best depict DSM market potential. Effects for a range of DSM technologies for each end-use could then be examined, while accounting for current market saturations, technical feasibility, measure impacts, and costs.

Figure 2-1 provides an illustration of the MPS, with the assessment starting with the current utility load forecast, disaggregated into its constituent customer-class and end-use components, and calibrated to ensure consistency with the overall forecast. Nexant considered the range of DSM measures and practices application to each end-use, accounting for current market saturations, technical feasibility, and costs. These unique impacts were aggregated to produce estimates of potential at the technology, end-use, customer class, and system levels.

Figure 2-1: Approach to Market Potential Modeling



Nexant estimated DSM savings potential based on a combination of market research, analysis, and a review of JEA's existing DSM programs, all in coordination with JEA. Nexant examined EE, DR, and DSRE opportunities; this report is organized to offer detail on each DSM category.

2.2 EE Potential Overview

To estimate EE market potential, this study utilized Nexant's Microsoft Excel-based modeling tool, TEA-POT (Technical / Economic / Achievable POTential). This modeling tool was built on a platform that provides the ability to calculate multiple scenarios and recalculate potential savings based on variable inputs such as sales/load forecasts, electricity prices, discount rates, and actual utility program savings. The model provides transparency into the assumptions and calculations for estimating market potential.

2.3 DR Potential Overview

To estimate DR market potential, Nexant considered customer demand during utility peaking conditions, projected customer response to DR measures, the marginal benefit and cost of recruiting a customer for DR, and customer enrollment. Customer demand was determined by looking at interval data for a sample of each customer segment and determining the portion of a customer's load that could be curtailed during the system peak. Projected customer response to DR measures

was developed based on the performance of existing Florida DR programs and other DR programs in the US. Cost-effectiveness was estimated based on demand reductions, how well reductions coincide with system peaking conditions, the benefits of reducing demand during peaking conditions, and cost information. Enrollment rates were determined as a function of the incentive paid to a customer as well as the level of marketing for each DR measure.

2.4 DSRE Potential Overview

The DSRE technologies included in this study are rooftop solar photovoltaic (PV) systems, battery storage systems, and combined heat and power (CHP) systems. Nexant leveraged the customer segmentation and load disaggregation data assembled for the EE and DR analyses and used a “bottom-up” modeling approach to estimate the potential of the various DSRE technologies in the residential, commercial, and industrial sectors. Individual distributed generation models were created for the three DSRE technologies studied to estimate market potential.

3 Baseline Forecast Development

3.1 Market Characterization

The JEA base year energy use and sales forecast provided the reference point to determine potential savings. The end-use market characterization of the base year energy use and reference case forecast included customer segmentation and load forecast disaggregation. The characterization is described in this section, while the subsequent section addresses the measures and market potential energy and demand savings scenarios.

3.1.1 Customer Segmentation

In order to estimate EE, DR, and DSRE potential, the sales forecast and peak load forecasts were segmented by customer characteristics. As electricity consumption patterns vary by customer type, Nexant segmented customers into homogenous groups to identify which customer groups are eligible to adopt specific DSM technologies, have similar building characteristics and load profiles, or are able to provide DSM grid services.

Nexant segmented customers according to the following:

1) By Sector – how much of JEA's energy sales, summer peak, and winter peak load forecast is attributable to the residential, commercial, and industrial sectors?
2) By Customer – how much electricity does each customer typically consume annually and during system peaking conditions?
3) By End-Use – within a home or business, what equipment is using electricity during the system peak? How much energy does this end-use consume over the course of a year?

Table 3-1 summarizes the segmentation within each sector. The customer segmentation is discussed in Section 3.1.1. In addition to the segmentation described here for the EE and DSRE analyses, the residential customer segments were further segmented by heating type (electric heat, gas heat, or unknown) and by annual consumption bins within each sub-segment for the DR analysis. The goal of this further segmentation for DR was to understand which customer groups were most cost-effective to recruit and allow for more targeted marketing of DR programs.

Table 3-1: Customer Segmentation

Residential	Commercial		Industrial	
Single Family	Assembly	Miscellaneous	Agriculture and Assembly	Primary Resources Industries
Multi-Family	College and University	Offices	Chemicals and Plastics	Stone/Glass/ Clay/Concrete
Manufactured Homes	Grocery	Restaurant	Construction	Textiles and Leather
	Healthcare	Retail	Electrical and Electronic Equipment	Transportation Equipment
	Hospitals	Schools K-12	Lumber/Furniture/ Pulp/Paper	Water and Wastewater
	Institutional	Warehouse	Metal Products and Machinery	
	Lodging/ Hospitality		Miscellaneous Manufacturing	

From an equipment and energy use perspective, each segment has variation within each building type or sub-sector. For example, the energy consuming equipment in a convenience store will vary significantly from the equipment found in a supermarket. To account for this variation, the selected end-uses describe energy consumption patterns that are consistent with those typically studied in national or regional surveys, such as the U.S. Energy Information Administration's (EIA) Residential Energy Consumption Survey (RECS), Commercial Building Energy Consumption Survey (CBECS) and Manufacturing Energy Consumption Survey (MECS), among others. The end-uses selected for this study are listed in Table 3-2.

Table 3-2: End-Uses

Residential End-Uses	Commercial End-Uses	Industrial End-Uses
Space heating	Space heating	Process heating
Space cooling	Space cooling	Process cooling
Domestic hot water	Domestic hot water	Compressed air
Ventilation and circulation	Ventilation and circulation	Motors/pumps
Lighting	Interior lighting	Fan, blower motors
Cooking	Exterior lighting	Process-specific
Appliances	Cooking	Industrial lighting
Electronics	Refrigeration	Exterior lighting
Miscellaneous	Office equipment	HVAC
	Miscellaneous	Other

For DR, the end-uses targeted were those with controllable load for residential customers (*i.e.* HVAC, water heaters, and pool pumps) and small C&I customers (HVAC). For large C&I customers, all load during peak hours was included assuming these customers would potentially would be

willing to reduce electricity consumption for a limited time if offered a large enough incentive during temporary system peak demand conditions.

3.1.2 Forecast Disaggregation

A common understanding of the assumptions and granularity in the baseline load forecast was developed with input from JEA. Key discussion topics reviewed included:

- How are current DSM offerings reflected in the energy and demand forecast?
- What are the assumed weather conditions and hour(s) of the day when the system is projected to peak?
- How much of the load forecast is attributable to customers that are not eligible for DSM programs?
- How are projections of population increase, changes in appliance efficiency, and evolving distribution of end-use load shares accounted for in the peak demand forecast?
- If separate forecasts are not developed by region or sector, are there trends in the load composition that Nexant should account for in the study?

3.1.2.1 Electricity Consumption (kWh) Forecast

Nexant segmented the JEA electricity consumption forecast into electricity consumption load shares by customer class and end-use. The baseline customer segmentation represents the electricity market by describing how electricity was consumed within the service territory. Nexant developed these forecasts for the years 2020-2029, and based it on data provided by JEA, primarily their 2017 Ten-Year Site Plan, which was the most recent plan available at the time the studies were initiated. The data addressed current baseline consumption, system load, and sales forecasts.

3.1.2.2 Peak Demand (kW) Forecast

A fundamental component of DR potential was establishing a baseline forecast of what loads or operational requirements would be absent due to existing dispatchable DR or time varying rates. This baseline was necessary to assess how DR can assist in meeting specific planning and operational requirements. We utilized JEA's summer and winter peak demand forecast, which was developed for system planning purposes.

3.1.2.3 Estimating Consumption by End-Use Technology

As part of the forecast disaggregation, Nexant developed a list of electricity end-uses by sector (Table 3-2). To develop this list, Nexant began with JEA's estimates of average end-use consumption by customer and sector. Nexant combined these data with other information, such as utility residential appliance saturation surveys, to develop estimates of customers' baseline consumption. Nexant calibrated the utility-provided data with data available from public sources, such as the EIA's recurring data-collection efforts that describe energy end-use consumption for the residential, commercial, and manufacturing sectors.

To develop estimates of end-use electricity consumption by customer segment and end-use, Nexant applied estimates of end-use and equipment-type saturation to the average energy consumption for

each sector. The following data sources and adjustments were used in developing the base year 2020 sales by end-use:

Residential sector:

- The disaggregation was based on JEA rate class load shares and intensities.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - JEA rate class load share is based on average per customer.
    - Nexant made conversions to usage estimates generated by applying utility-provided residential appliance saturation surveys (RASS) and EIA end-use modeling estimates.

Commercial sector:

- The disaggregation was based on JEA rate class load shares, intensities, and EIA CBECS data.
- Segment data from EIA and JEA.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA CBECS and end-use forecasts from JEA.

Industrial sector:

- The disaggregation was based on rate class load shares, intensities, and EIA MECS data.
- Segment data from EIA and JEA.
- Baseline intensity was calibrated to account for differences in end-use saturation, fuel source, and equipment saturation as follows:
    - Rate class load share based on EIA MECS and end-use forecasts from JEA.

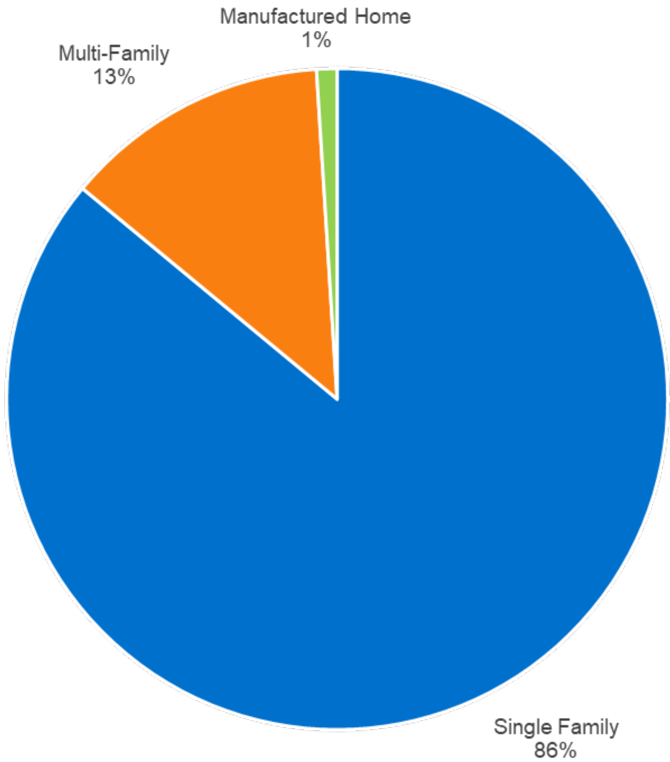
3.2 Analysis of Customer Segmentation

Customer segmentation is important to ensuring that a MPS examines DSM measure savings potential in a manner that reflects the diversity of energy savings opportunities existing across the utility's customer base. JEA provided Nexant with data concerning the premise type and loads characteristics for all customers for the MPS analysis. Nexant examined the provided data from multiple perspectives to identify customer segments. Nexant's approach to segmentation varied slightly for non-residential and residential customers, but the overall logic was consistent with the concept of expressing the customers in terms that were relevant to DSM opportunities.

3.2.1 Residential Customers (EE, DR, and DSRE Analysis)

Segmentation of residential customer accounts enabled Nexant to align DSM opportunities with appropriate DSM measures. Nexant used utility customer data, supplemented with EIA data, to segment the residential sector by customer dwelling type (single family, multi-family, or manufactured home). The resulting distribution of customers according to dwelling unit type is presented in Figure 3-1.

Figure 3-1: Residential Customer Segmentation



3.2.2 Non-Residential (Commercial and Industrial) Customers (EE and DSRE Analysis)

For the EE and DSRE analysis, Nexant segmented C&I customers using the utility's North American Industry Classification System (NAICS) or Standard Industrial Classification (SIC) codes, supplemented by data produced by the EIA's CBECS and MECS. Nexant classified the customers in this group as *either* commercial or industrial, on the basis of DSM measure information available and applicable to each. For example, agriculture and forestry DSM measures are commonly considered industrial savings opportunities. Nexant based this classification on the types of DSM measures applicable by segment, rather than on the annual energy consumption or maximum instantaneous demand from the segment as a whole. The estimated energy sales distributions Nexant applied are shown below in Figure 3-2 and Figure 3-3.

Figure 3-2: Commercial Customer Segmentation

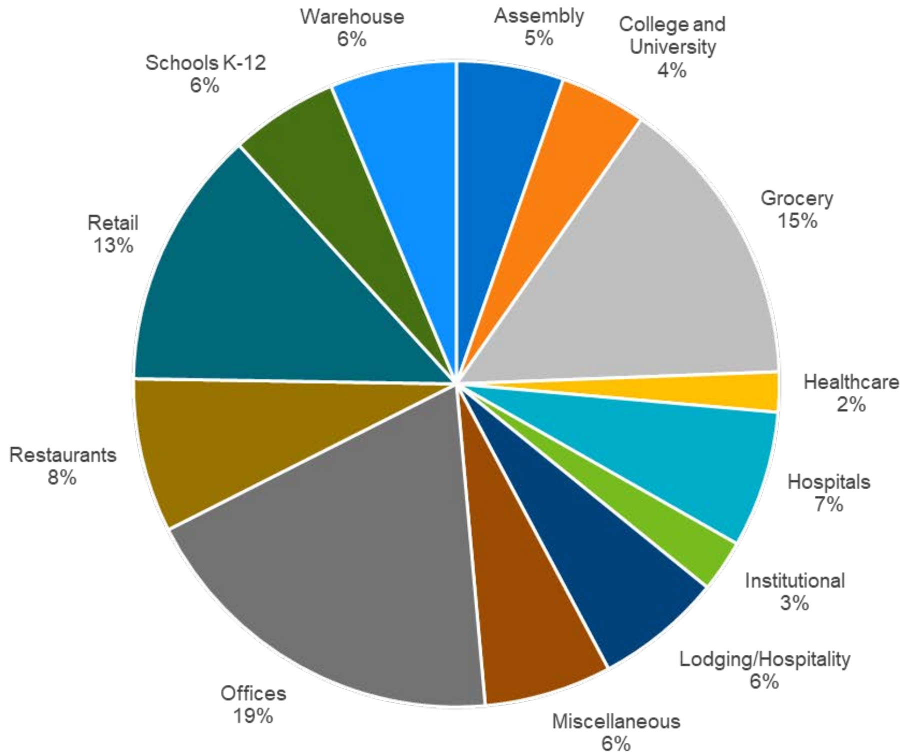
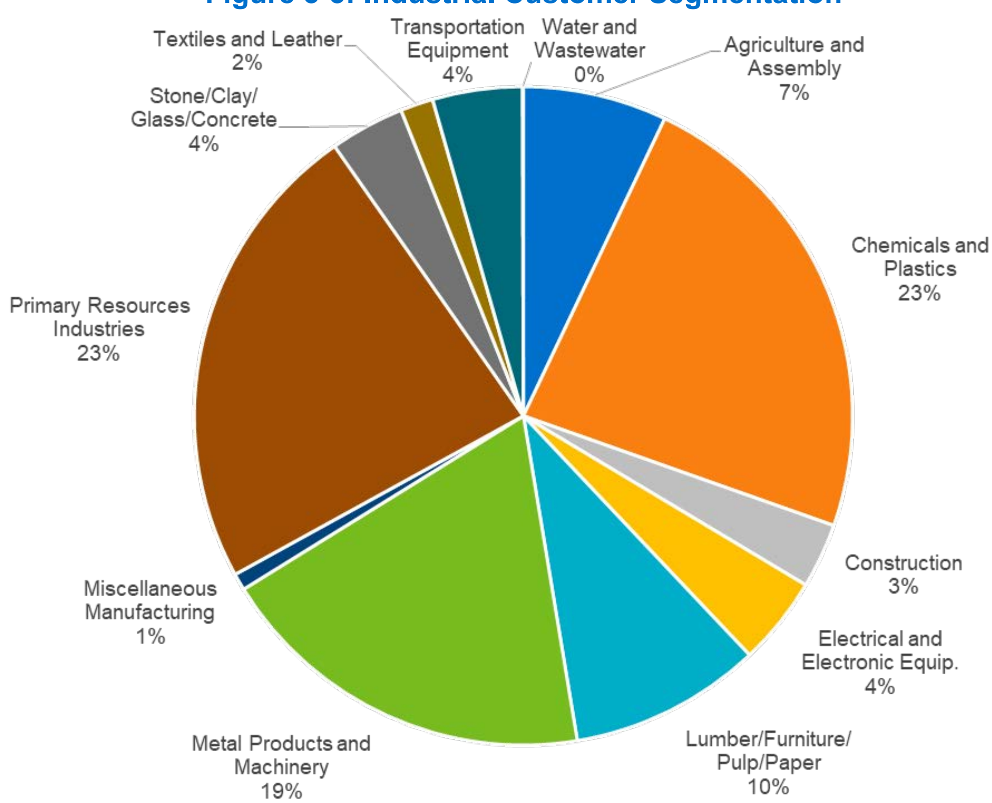


Figure 3-3: Industrial Customer Segmentation



3.2.3 Commercial and Industrial Customers (DR Analysis)

For the DR analysis, Nexant divided the non-residential customers into the two customer classes of small C&I and large C&I using rate class and annual consumption. For the purposes of this analysis, small C&I customers are those on the General Service (GS) tariff. Large C&I customers are all customers on the General Service Demand (GSD) tariff[3] and General Service Large Demand (GSLD) tariff[4]. Nexant further segmented these two groups based on customer size. For small C&I segmentation was determined using annual customer consumption and for large C&I the customer's maximum demand was used. Both customer maximum demand and customer annual consumption were calculated using billing data provided by JEA.

Table 3-3 shows the account breakout between small C&I and large C&I.

Table 3-3: Summary of Customer Classes for DR Analysis

Customer Class	Customer Size	Number of Accounts
Small C&I	0-15,000 kWh	25,797
	15,001-25,000 kWh	5,298
	25,001-50,000 kWh	1,012
	50,001 kWh +	12,469
	Total	44,576
Large C&I	0-50 kW	333
	51-300 kW	3,461
	301-500 kW	5
	501 kW +	167
	Total	3,938

3.3 Analysis of System Load

3.3.1 System Energy Sales

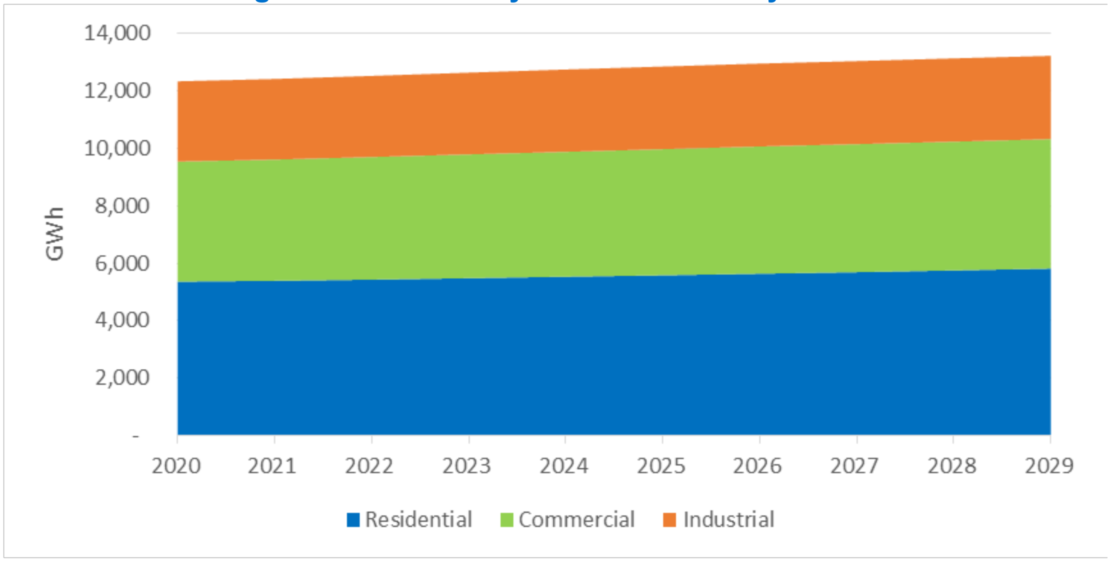
While the technical and economic potential are based on the year 2020's system load forecast[5], achievable potential is applied over the entire 10-year study period (2020-2029). Figure 3-4 summarizes the electric sales forecast by sector over the study period.

[3] To be eligible, customers must have a maximum demand between 75 kW and 1,000 kW.

[4] To be eligible, customers must have a maximum demand greater than 1,000 kW.

[5] From JEA's 2017 Ten Year Site Plan

Figure 3-4: Electricity Sales Forecast by Sector



3.3.2 System Demand

To determine when DR would be cost-effective to implement, Nexant first established peaking conditions for each utility by looking at when each utility historically experienced its maximum demand. The primary data source used to determine when DR resources will be needed was the historical system load for JEA. The data provided contained the system loads for all 8,760 hours of the most recent five years leading up to the study (2011-2016). The utility summer and winter peaks were then identified within the utility-defined peaking conditions. For JEA the summer peaking conditions were defined as July and August from 4:00-5:00 PM and the winter peaking conditions were defined as January from 7:00-8:00 AM. The seasonal peaks were then selected as the maximum demand during utility peaking conditions.

3.3.3 Load Disaggregation

The disaggregated loads for the base year 2020 by sector and end-use are illustrated in Figure 3-5, Figure 3-6 and Figure 3-7.

Figure 3-5: Residential Baseline (2020) Energy Sales by End-Use

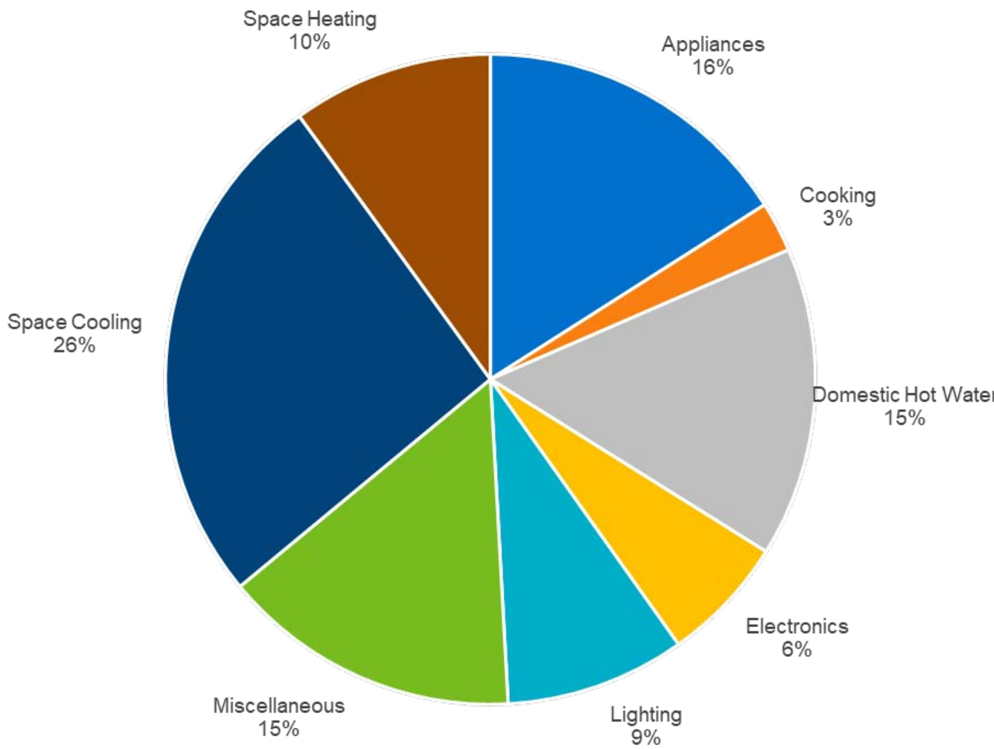


Figure 3-6: Commercial Baseline (2020) Energy Sales by End-Use

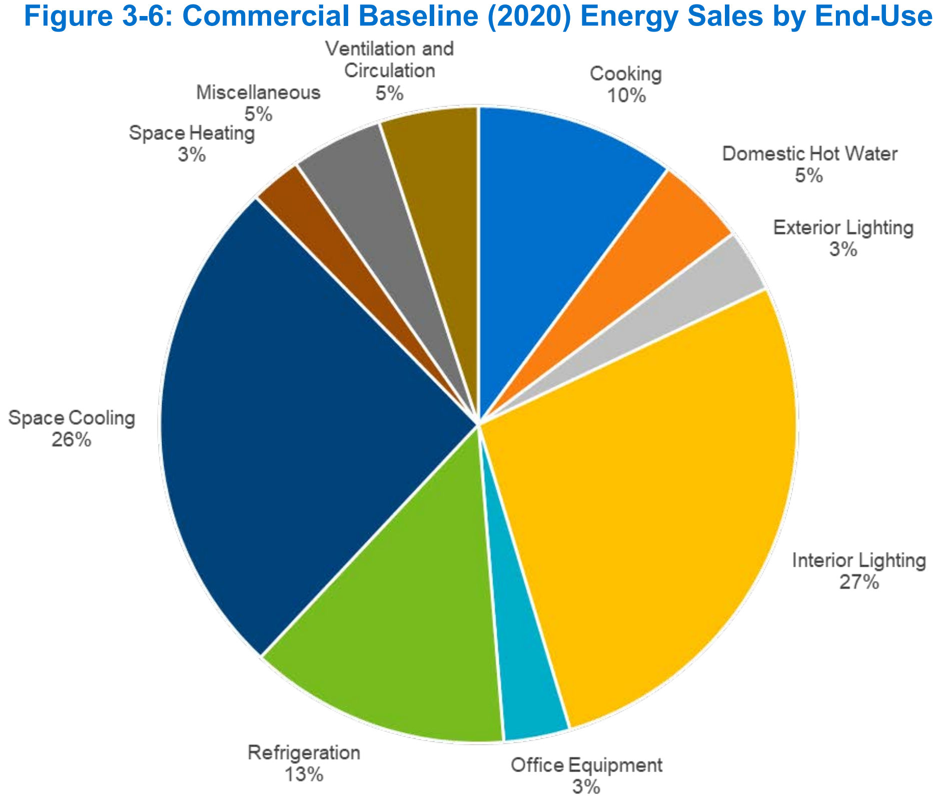
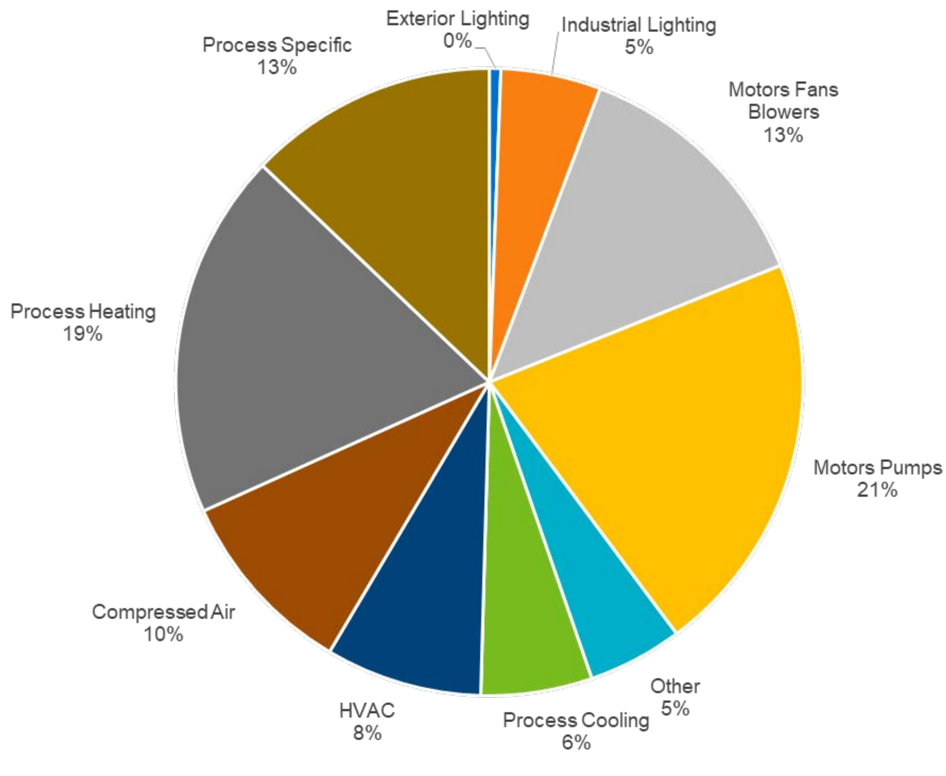


Figure 3-7: Industrial Baseline (2020) Energy Sales by End-Use



4 DSM Measure Development

Market potential is described by comparing baseline market consumption with opportunities for savings. Describing these individual savings opportunities results in a list of DSM measures to analyze. This section presents the methodology to develop the measure lists.

4.1 Methodology

Nexant identified a comprehensive catalog of DSM measures for the study. The measure list is the same for all FEECA Utilities. The iterative vetting process with the utilities to develop the measure list began by initially examining the list of measures included in the 2014 Goals docket. This list was then adjusted based on proposed measure additions and revisions provided by the FEECA Utilities. Nexant further refined the measure list based on reviews of Nexant's DSM measure library, compiled from similar market potential studies conducted in recent years throughout the United States, including recent studies for Georgia Power Company and Duke Energy Carolinas, as well as measures included in other utility programs where Nexant is involved with program design, implementation, or evaluation. In addition, Nexant evaluated whether each measure had the appropriate data available to estimate impacts in the potential analyses. A draft version of the measure list was shared with interested parties Earthjustice/Southern Alliance for Clean Energy (SACE) for Nexant and the FEECA Utilities to gather and consider their input. The results of that consideration were provided to Earthjustice/SACE and later shared with the Florida Public Service Commission Staff (Staff) and all other interested parties at an informal meeting held by Staff. The extensive, iterative review process involving multiple parties has ensured that the study included a robust and comprehensive set of DSM measures.

See Appendix A for the list of EE measures, Appendix B for the list of DR measures, and Appendix C for the list of DSRE measures analyzed in the study.

4.2 EE Measures

EE measures represent technologies applicable to the residential, commercial, and industrial customers in the FEECA Utilities' service territories. The development of EE measures included consideration of:

- Applicability and commercial availability of EE technologies in Florida. Measures that are not applicable due to climate or customer characteristics were excluded, as were "emerging" technologies that are not currently commercially available to FEECA utility customers.

- Current and planned Florida Building Codes and federal equipment standards (Codes & standards) for baseline equipment[1]. Measures included from prior studies were adjusted to reflect current Codes & standards as well as updated efficiency tiers, as appropriate.
- Eligibility for utility DSM offerings in Florida. For example, behavioral measures were excluded from consideration as they are not allowed to be counted towards utility DSM goals. Behavioral measures are intended to motivate customers to operate in a more energy-efficient manner (*e.g.*, setting an air-conditioner thermostat to a higher temperature) without accompanying: a) physical changes to more efficient end-use equipment or to their building envelope, b) utility-provided products and tools to facilitate the efficiency improvements, or c) permanent operational changes that improve efficiency which are not easily revertible to prior conditions. These types of behavioral measures were excluded because of the variability in forecasting the magnitude and persistence of energy and demand savings from the utility's perspective. Additionally, behavioral measure savings may be obtained in part from the installation of EE technologies, which would overlap with other EE measures included in the study.

Upon development of the final EE measure list, a Microsoft Excel workbook was developed for each measure to quantify measure inputs necessary for assessment of the measure's potential and cost-effectiveness. Relevant inputs included the following:

- Measure description: measure classification by type, end-use, and subsector, and description of the base-case scenario.
- kWh savings: Energy savings associated with each measure were developed through engineering algorithms or building simulation modeling, taking weather zones and customer segments into consideration as appropriate. Reference sources used for developing residential and commercial measure savings included a variety of Florida-specific, as well as regional and national sources, such utility-specific measurement & verification (M&V) data, technical reference manuals (TRM) from other jurisdictions, ENERGY STAR calculators, and manufacturer or retailer specifications on particular products. Industrial measure savings were primarily based on Department of Energy's (DOE) Industrial Assessment Center database, using assessments conducted in the Southeast region, as well as TRMs, utility reference data, and Nexant DSM program experience.

  Energy savings were applied in Nexant's TEA-POT model as a percentage of total baseline consumption. Peak demand savings were determined using utility-specific load shapes or coincidence factors.
- Measure Expected Useful Lifetime: Sources included the Database for Energy Efficient Resources (DEER), the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE) Handbook, and other regional and national measure databases and EE program evaluations

[1] As the study is being used to inform 2020-2029 DSM planning, for applicable lighting technologies, the baseline lighting standard is compliant with the 2020 EISA backstop provision.

- Measure Costs: Per-unit costs (full or incremental, depending on the application) associated with measure installations. Sources included: TRMs, ENERGY STAR calculator, online market research, RSMeans database, and other secondary sources.
- Measure Applicability: A general term encompassing an array of factors, including: technical feasibility of installation, and the measure's current saturation as well as factors to allocate savings associated with competing measures. Information used was primarily derived from data in current regional and national databases, as well as JEA's program tracking data. These factors are described in Table 4-1.

Table 4-1: Measure Applicability Factors

Measure Impact	Explanation	Sources
Technical Feasibility	The percentage of buildings that can have the measure physically installed. Various factors may affect this, including, but not limited to, whether the building already has the baseline measure (*e.g.,* dishwasher), and limitations on installation (*e.g.,* size of unit and space available to install the unit).	Various secondary sources and engineering experience.
Measure Incomplete Factor	The percentage of buildings without the specific measure currently installed.	Utility RASS; EIA RECS, CBECS; MECS; ENERGY STAR sales figures; and engineering experience.
Measure Share	Used to distribute the percentage of market shares for competing measures (*e.g.*, only blown-in ceiling insulation or spray foam insulation, not both would be installed in an attic).	Utility customer data, Various secondary sources and engineering experience.

As shown in Table 4-2, the measure list includes 248 unique energy-efficiency measures. Expanding the measures to account for all appropriate combinations of segments, end-uses, and construction types resulted in 4,164 measure permutations.

Table 4-2: EE Measure Counts by Sector

Sector	Unique Measures	Permutations
Residential	91	546
Commercial	127	3,298
Industrial[2]	30	320

[2] Due to the heterogeneous nature of the Industrial sector, including variations in equipment, operating schedule, process loads, and other segment-specific characteristics, the unique industrial measures encompass multiple individual equipment and technology improvements. Savings estimates for industrial measures reflect the implementation of these various individual improvements as summarized in the measure list in Appendix A.

4.3 DR Measures

The DR measures included in the measure list utilize the following DR strategies:

- **Direct Load Control.** Customers receive incentive payments for allowing the utility to control their selected equipment, such as HVAC or water heaters.
- **Critical Peak Pricing (CPP) with Technology.** Electricity rate structures that vary based on time of day. Includes CPP when the rate is substantially higher for a limited number of hours or days per year (customers receive advance notification of CPP event) coupled with technology that enables customer to lower their usage in a specific end-use in response to the event (*e.g.* HVAC via smart thermostat).
- **Contractual DR.** Customers receive incentive payments or a rate discount for committing to reduce load by a pre-determined amount or to a pre-determined firm service level upon utility request.
- **Base interruptible DR**. Customers receive a discounted rate for agreeing to reduce load to a firm service level upon request.
- **Automated DR.** Utility dispatched control of specific end-uses at a customer facility.

DR initiatives that do not rely on the installation of a specific device or technology to implement (such as a voluntary curtailment program) were not included.

A workbook was developed for each measure which included the same measure inputs as previously described for the EE measures. In addition, the DR workbook included:

- Expected load reduction from the measure, based on utility technical potential, existing utility DR programs, and other nationwide DR programs if needed.

For technical potential, Nexant did not break out results by measure because all of the developed measures target the end uses estimated for technical potential. Individual measures were only considered for economic and achievable potential.

4.4 DSRE Measures

The DSRE measure list includes rooftop PV systems, battery storage systems charged from PV systems, and CHP systems.

PV Systems

PV systems utilize solar panels (a packaged collection of PV cells) to convert sunlight into electricity. A system is constructed with multiple solar panels, a DC/AC inverter, a racking system to hold the panels, and electrical system interconnections. These systems are often roof-mounted systems that face south-west, south, and/or, south-east. The potential associated with roof-mounted systems installed on residential and commercial buildings was analyzed[3].

[3] This study did not include ground-mounted or utility-scale PV installations as these were determined to often not be connected to customer premise metering and therefore outside the scope of this analysis.

Battery Storage Systems Charged From PV Systems

Distributed battery storage systems included in this study consist of behind-the-meter battery systems installed in conjunction with an appropriately-sized PV system at residential and commercial customer facilities. These battery systems typically consist of a DC-charged battery, a DC/AC inverter, and electrical system interconnections to a PV system. On their own battery storage systems do not generate or conserve energy, but can collect and store excess PV generation to provide power during particular time periods; which for DSM purposes would be to offset customer demand during the utility's system peak.

CHP Systems

In most CHP applications, a heat engine creates shaft power that drives an electrical generator (fuel cells can produce electrical power directly from electrochemical reactions). The waste heat from the engine is then recovered to provide steam or hot water to meet on-site needs. Common prime mover technologies used in CHP applications and explored in this study include:

- Steam turbines
- Gas turbines
- Micro turbines
- Fuel Cells
- Internal combustion engines

A workbook was developed for each measure which included the inputs previously described for EE measures and prime mover operating parameters.

5 Technical Potential

In the previous sections, the approach for DSM measure development was summarized, and the 2020 base year load shares and reference-case load forecast were described. The outputs from these tasks provided the input for estimating the technical potential scenario, which is discussed in this section.

The technical potential scenario estimates the savings potential when all technically feasible DSM measures are implemented at their full market potential without regard for cost-effectiveness and customer willingness to adopt the most impactful EE, DR, or DSRE technologies. Since the technical potential does not consider the costs or time required to achieve these savings, the estimates provide a theoretical upper limit on electricity savings potential. Technical potential is only constrained by factors such as technical feasibility and applicability of measures. For this study, technical potential included full application of the commercially available DSM measures to all residential, commercial, and industrial customers in the utility's service territory.

5.1 Methodology

5.1.1 EE Technical Potential

EE technical potential refers to delivering less electricity to the same end-uses. In other words, technical potential might be summarized as "doing the same thing with less energy, regardless of the cost."

DSM measures were applied to the disaggregated utility electricity sales forecasts to estimate technical potential. This involved applying estimated energy savings from equipment and non-equipment measures to all electricity end-uses and customers. Technical potential consists of the total energy and demand that can be saved in the market which Nexant reported as a single numerical value for each utility's service territory.

The core equation used in the residential sector EE technical potential analysis for each individual efficiency measure is shown in Equation 5-1 below, while the core equation used in the non-residential sector technical potential analysis for each individual efficiency measure is shown in Equation 5-2.

Equation 5-1: Core Equation for Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Number of Households × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Baseline Equipment Energy Use Intensity = the electricity used per customer per year by each baseline technology in each market segment. In other words, the baseline equipment energy-use intensity is the consumption of the electrical energy using equipment that the efficient technology replaces or affects.

Equipment Saturation Share = the fraction of the end-use electrical energy that is applicable for the efficient technology in a given market segment. For example, for residential cooling, the saturation share would be the fraction of all residential electric customers that have central air conditioners in their household.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient. To extend the example above, the fraction of central air conditioners that is not already the most energy efficient technology.

Applicability Factor = the fraction of units that is technically feasible for conversion to the most efficient available technology from an engineering perspective (*i.e.,* it may not be possible to install LEDs in all light sockets in a home because the available styles may not fit in every socket).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

Equation 5-2: Core Equation for Non-Residential Sector Technical Potential

Technical Potential of Efficient Measures = Total Stock Sq. Footage by Segment × Baseline Equipment Energy Use Intensity (kWh/unit) × Equipment Saturation Share × Remaining Factor × Applicability Factor × Savings Factor

Where:

Total Stock Square Footage by Segment = the forecasted square footage level for a given building type (*e.g.,* square feet of office buildings).

Baseline Equipment Energy Use Intensity = the electricity used per square foot per year by each baseline equipment type in each market segment.

Equipment Saturation Share = the fraction of total end-use energy consumption associated with the efficient technology in a given market segment. For example, for packaged terminal air-conditioner (PTAC), the saturation share would be the fraction of all space cooling kWh in a given market segment that is associated with PTAC equipment.

Remaining Factor = the fraction of equipment that is not considered to already be energy efficient.

Applicability Factor = the fraction of the equipment or practice that is technically feasible for conversion to the efficient technology from an engineering perspective (*i.e.,* it may not be possible to install Variable Frequency Drives (VFD) on all motors in a given market segment).

Savings Factor = the percentage reduction in electricity consumption resulting from the application of the efficient technology.

It is important to note that the technical potential estimate represents electricity savings potential at a specific point in time. In other words, the technical potential estimate is based on data describing *status quo* customer electricity use and technologies known to exist today. As technology and electricity consumption patterns evolve over time, the baseline electricity consumption will also change accordingly. For this reason, technical potential is a discrete estimate of a dynamic market. Nexant reported the technical potential for 2020, based on currently known DSM measures and observed electricity consumption patterns.

Measure Interaction and Competition

While the technical potential equations listed above focus on the technical potential of a single measure or technology, Nexant's modeling approach does recognize the overlap of individual measure impacts within an end-use or equipment type, and accounts for the following interactive effects:

- Measure interaction: Installing high-efficiency equipment could reduce energy savings in absolute terms (kWh) associated with non-equipment measures that impact the same end-use, such as wall insulation. For example, installing a high-efficiency heat pump will reduce heating and cooling consumption which will reduce the baseline against which attic insulation would be applied, thus reducing savings associated with installing insulation. To account for this interaction, Nexant's TEA-POT model ranks measures that interact with one another and reduces the baseline consumption for the subsequent measure based on the savings achieved by the preceding measure. For technical potential, interactive measures are ranked based on total end-use energy savings percentage.
- Measure competition: The "measure share"—as defined above—accounted for competing measures, ensuring savings were not double-counted. This interaction occurred when two or more measures "competed" for the same end-use. For example, a T-12 lamp could be replaced with a T-8 or linear LED lamp.

Addressing Naturally-Occurring EE

Because the anticipated impacts of efficiency actions that may be taken even in the absence of utility intervention are included in the baseline forecast, savings due to naturally-occurring EE were considered separately in the potential estimates. Nexant verified with JEA's forecasting group to ensure that the sales forecasts incorporated two known sources of naturally-occurring efficiency:

- **Codes and Standards:** The sales forecasts already incorporated the impacts of known Code & standards changes. While some changes have relatively little impact on overall sales, others—particularly the Energy Independence and Security Act (EISA) and other federal legislation—will have noticeable influence.
- **Baseline Measure Adoption:** The sales forecast excluded the projected impacts of future DSM efforts, but included already implemented DSM penetration.

By properly accounting for these factors, the potential study estimated the net penetration rates, representing the difference between the anticipated adoption of efficiency measures as a result of DSM efforts and the "business as usual" adoption rates absent DSM intervention. This is true even in the technical potential, where adoption was assumed to be 100%.

5.1.2 DR Technical Potential

The concept of technical potential applies differently to DR than for EE. Technical potential for DR is effectively the magnitude of loads that can be curtailed during conditions when utilities need peak capacity reductions. In evaluating this potential at peak capacity the following were considered: which customers are consuming electricity at those times? What end-uses are in play? Can those end-use loads be managed? Large C&I customers generally do not provide the utility with direct control over particular end-uses. Instead, many of these customers will forego virtually all electric demand temporarily if the financial incentive is large enough. For residential and small C&I customers where DR generally takes the form of direct utility control, technical potential for DR is limited by the loads that can be controlled remotely at scale.

This framework makes end-use disaggregation an important element for understanding DR potential, particularly in the residential and small C&I sectors. Nexant's approach used for load disaggregation is more advanced than what is used for most potential studies. Instead of disaggregating annual consumption or peak demand, Nexant produced end-use load disaggregation for all 8760 hours. This was needed because the loads available at times when different grid applications are needed can vary substantially. Instead of producing disaggregated loads for the average customer, the study was produced for several customer segments. For JEA, Nexant examined a residential segment, four different small C&I segments based on customer size, and four different large C&I segments based on customer size, for a total of 9 different customer segments.

Technical potential, in the context of DR, is defined as the total amount of load available for reduction that is coincident with the period of interest; in this case, the system peak hour for the summer and winter seasons. Thus, two sets of capacity values are estimated: a summer capacity and a winter capacity.

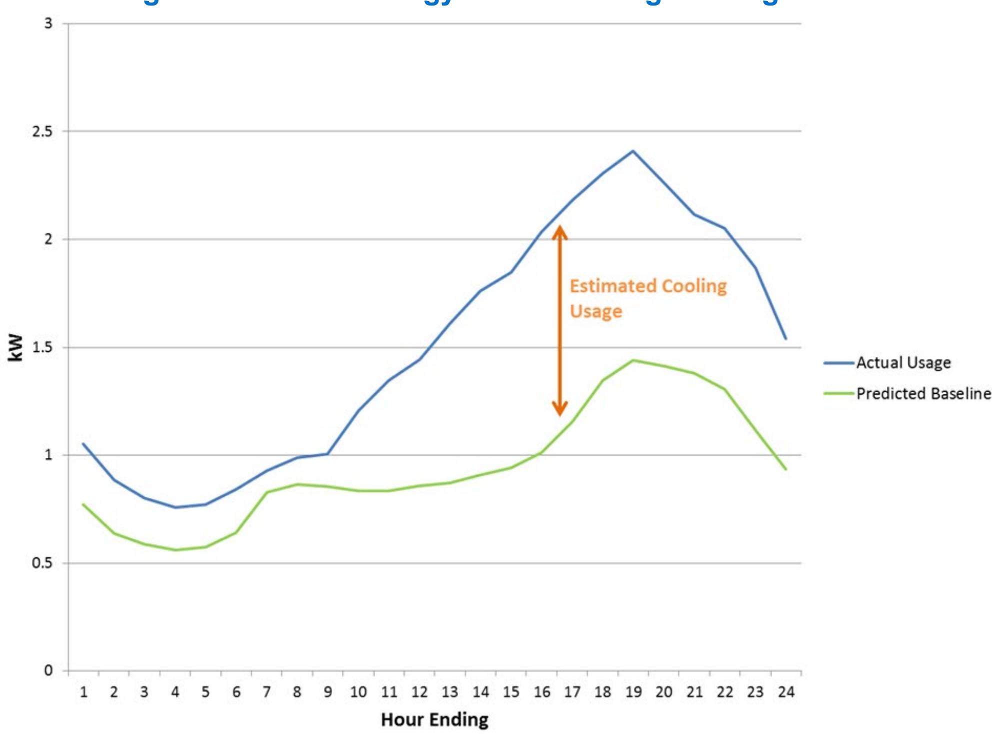
As previously mentioned, for technical potential purposes, all coincident large C&I load is considered dispatchable, while residential and small C&I DR capacity is based on specific end-uses. Summer

DR capacity for residential customers was comprised of air-conditioning (AC), pool pumps, and water heaters. For small C&I customers, summer capacity was based on AC load. For winter DR capacity, residential was based on electric heating, pool pumps, and water heaters. For small C&I customers, winter capacity was based on electric heating.

AC and heating load profiles were generated for residential and small C&I customers using load shape data provided by JEA. These load shapes included a customer breakout based on size for both the residential and non-residential sectors. Nexant then made adjustments to the JEA load profiles to create an average load profile for each Nexant customer segment.

The average load profile for each customer segment was combined with historical weather data, and used to estimate hourly load as a function of weather conditions. AC and heating loads were estimated by first calculating the baseline load on days when cooling degree days (CDD) and heating degree days (HDD) were equal to zero, and then subtracting this baseline load. This methodology is illustrated by Figure 5-1 (a similar methodology was used to predict heating loads).

Figure 5-1: Methodology for Estimating Cooling Loads



This method was able to produce estimates for average AC/heating load profiles for the five different customer segments within the residential and small C&I sectors.

Profiles for residential water heater and pool pump loads were estimated by utilizing end-use load data from CPS Energy's Home Manager DR program.

For all eligible loads, the technical potential was defined as the amount that was coincident with system peak hours for each season, which are July and August from 4:00-5:00 PM for summer, and January from 7:00-8:00 AM for winter.

For technical potential, there was also no measure breakout needed, because all measures will target the end-uses' estimated total loads. Individual measures are only considered for economic and achievable potential.

In order to account for existing JEA DR programs, all customers currently enrolled in a DR offering were excluded from JEA's technical potential.

5.1.3 DSRE Technical Potential

5.1.3.1 PV Systems

To determine technical potential for PV systems, Nexant estimated the percentage of rooftop square footage in Florida that is suitable for hosting PV technology. Our estimate of technical potential for PV systems in this report is based in part on the available roof area and consisted of the following steps:

- Step 1: Outcomes from the forecast disaggregation analysis were used to characterize the existing and new residential, commercial and industrial building stocks. Relevant parameters included number of facilities, average number of floors, and average premises square footage.
- Step 2: The total available roof area feasible for installing PV systems was calculated. Relevant parameters included share of pitched and flat roofs and unusable area due to other rooftop equipment.
- Step 3: Estimated the expected power density (kW per square foot of roof area).
- Step 4: Using PVWatts[9], secondary research, and M&V evaluations of PV systems, Nexant used its technical potential PV calculator to calculate energy generation/savings using researched system capacity factors.

The methodology presented in this report uses the following formula to estimate overall technical potential of PVs:

Equation 5-3: Core Equation for Solar Technical Potential

$$\text{Technical Potential of PV Systems} = \text{Usable PV Area} \times \text{PV Density / 1000} \times \text{Capacity Factor} \times \text{Energy Savings Factor}$$

[9] PVWatts estimates PV energy production and costs. Developed by the National Renewable Energy Laboratory. http://pvwatts.nrel.gov/

Where:

Usable PV Area for Residential: (Total Floor Area[10] / Average No. of Stories[11]) x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

Usable PV Area for Commercial: Total Floor Area[12] x ((% of Sloped Roofs x Usable Area of Sloped Roofs) + (% of Flat Roofs x Usable Area of Flat Roofs))

PV Density (Watts/Square foot): Maximum power generated in Watts per square foot of solar panel.

Capacity Factor: Annual Energy Generation Factor for PV

Energy Savings Factor: AC Energy Conversion factor for each kW of the system, obtained from PVWatts. Energy Savings Factor = Alternating Current System Output (kWh)/ Direct Current System Size (kW)

5.1.3.2 Battery Storage Systems

Battery storage systems on their own do not generate power or create efficiency improvements, but store power for use at different times. Therefore, in analyzing the technical potential for battery storage systems, the source of the stored power and overlap with technical potential identified in other categories was considered.

Battery storage systems that are powered directly from the grid do not produce annual energy savings but may be used to shift or curtail load during particular time periods. As the DR technical potential analyzes curtailment opportunities for the summer and winter peak period, and battery storage systems can be used as a DR technology, the study concluded that no additional technical potential should be claimed for grid-powered battery systems beyond that already attributed to DR.

Battery storage systems that are connected to on-site PV systems also do not produce additional energy savings beyond the energy produced from the PV system. However, PV-connected battery systems do create the opportunity to store energy during period when the PV system is generating more than the home or business is consuming, and use that stored power during utility system peak periods. To determine the additional technical potential peak demand savings for “solar plus storage” systems, our methodology consisted of the following steps:

- Develop an 8,760 hour annual load shape for a PV system based on estimated annual hours of available sunlight.

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[10] Utility-provided data and US Census, South Region

[11] Single Family = RECS, South Atlantic Region; Multi-Family = US Census, South Region https://www.census.gov/construction/chars/mfu.html

[12] Floor space = based on utility data. Average floors by building type = CBECS, South Atlantic Region

- Compare the PV generation with a total home or total business 8,760 hour annual load shape to determine the hours that the full solar energy is used and the hours where excess solar power is generated.
- Develop a battery charge/discharge 8,760 load profile to identify available stored load during summer and winter peak periods, which was applied as the technical potential.

5.1.3.3 CHP Systems

The CHP analysis created a series of unique distributed generation potential models for each primary market sector (commercial and industrial).

Only non-residential customer segments whose electric and thermal load profiles allow for the application of CHP were considered. The technical potential analysis followed a three-step process. First, minimum facilities size thresholds were determined for each non-residential customer segment. Next, the full population of non-residential customers were segmented and screened based on the size threshold established for that segment. Finally, the facilities that were of sufficient size were matched with the appropriately sized CHP technology.

To determine the minimum threshold for CHP suitability, a thermal factor was applied to potential candidate customer loads to reflect thermal load considerations in CHP sizing. In most cases, on-site thermal energy demand is smaller than electrical demand. Thus, CHP size is usually dictated by the thermal load in order to achieve improved efficiencies.

The study collected electric and thermal intensity data from other recent CHP studies. For industrial customers, Nexant assumed that the thermal load would primarily be used for process operations and was not modified from the secondary data sources for Florida climate conditions. For commercial customers, the thermal load is more commonly made up of water heating, space heating, and space cooling (through the use of an absorption chiller). Therefore, to account for the hot and humid climate in Florida, which traditionally limits weather-dependent internal heating loads, commercial customers' thermal loads were adjusted to incorporate a higher proportion of space cooling to space heating as available opportunities for waste heat recovery.

After determination of minimum kWh thresholds by segment, Nexant used the utility-provided customer data with NAICS or SIC codes as well as annual consumption data, and categorized all non-residential customers by segment and size. Customers with annual loads below the kWh thresholds are not expected to have the consistent electric and thermal loads necessary to support CHP and were eliminated from consideration.

In general, internal combustion engines are the prime mover for systems under 500kW with gas turbines becoming progressively more popular as system size increases above that. Based on the available load by customer, adjusted by the estimated thermal factor for each segment, CHP technologies were assigned to utility customers in a top-down fashion (*i.e.* starting with the largest CHP generators).

Measure Interaction

PV systems and battery storage charged from PV systems were analyzed collectively due to their common power generation source; and therefore, the identified technical potential for these systems is additive. However, CHP systems were independently analyzed for technical potential without consideration of the competition between DSRE technologies or customer preference for a particular DSRE system. Therefore, results for CHP technical potential should not be combined with PV systems or battery storage systems for overall DSRE potential but used as independent estimates.

5.1.4 Interaction of Technical Potential Impacts

As described above, the technical potential was estimated using separate models for EE, DR, and DSRE systems. However, there is interaction between these technologies; for example, a more efficient HVAC system would result in a reduced peak demand available for DR curtailment. Therefore, after development of the independent models, the interaction between EE, DR, and DSRE was incorporated as follows:

- The EE technical potential was assumed to be implemented first, followed by DR technical potential and DSRE technical potential.
- To account for the impact of EE technical potential on DR, the baseline load forecast for the applicable end-uses was adjusted by the EE technical potential, resulting in a reduction in baseline load available for curtailment.
- For DSRE systems, the EE and DR technical potential was incorporated in a similar fashion, adjusting the baseline load used to estimate DSRE potential.
    - For the PV analysis this did not impact the results as the EE and DR technical potential did not affect the amount of PV that could be installed on available rooftops.
    - For the battery storage charged from PV systems, the reduced baseline load from EE resulted in additional PV-generated energy being available for the battery systems and for use during peak periods. The impact of DR events during the assumed curtailment hours was incorporated into the modeling of available battery storage and discharge loads.
    - For CHP systems, the reduced baseline load from EE resulted in a reduction in the number of facilities that met the annual energy threshold needed for CHP installations. Installed DR capacity was assumed to not impact CHP potential as the CHP system feasibility was determined based on energy and thermal consumption at the facility. It should be noted that CHP systems not connected to the grid could impact the amount of load available for curtailment with utility-sponsored DR. Therefore, CHP technical potential should not be combined with DR potential but used as independent estimates.

5.2 EE Technical Potential

5.2.1 Summary

Table 5-1 summarizes the EE technical potential by sector:

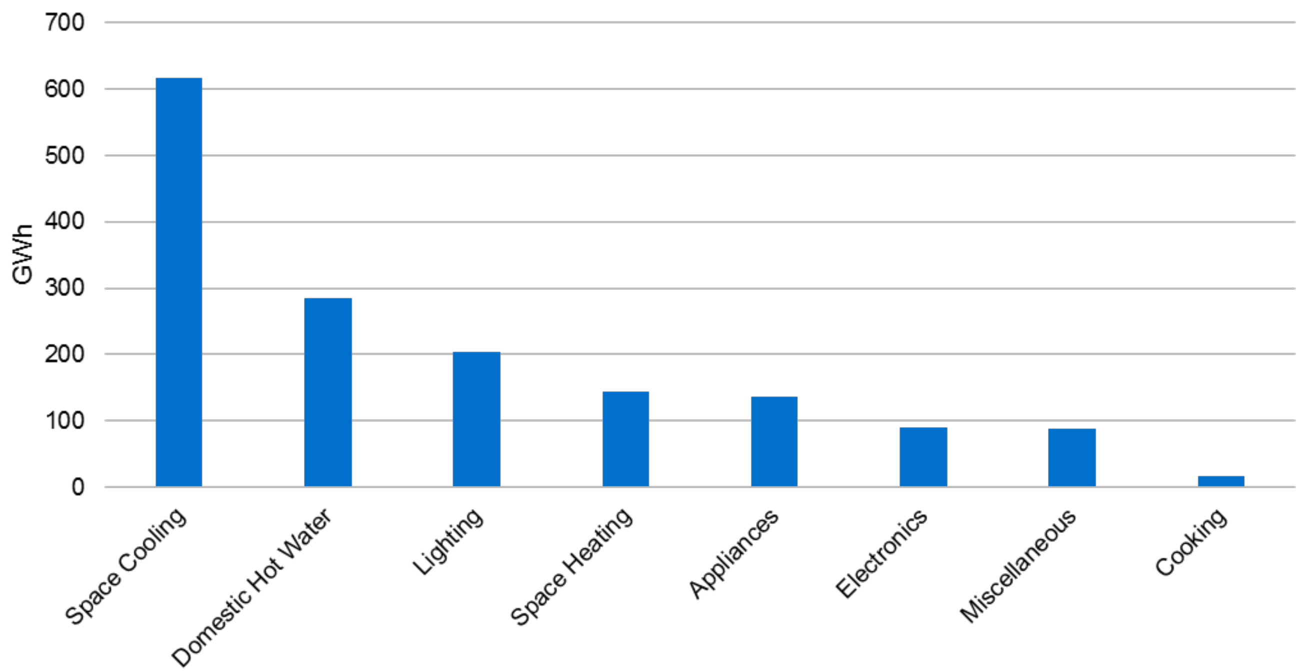
Table 5-1: EE Technical Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Residential	426	193	1,582
Non-Residential[13]	287	159	1,423
Total	713	353	3,005

5.2.2 Residential

Figure 5-2, Figure 5-3, and Figure 5-4 illustrate the residential sector EE technical potential by end-use.

Figure 5-2: Residential EE Technical Potential by End-Use (Energy Savings)



[13] Non-Residential results include all commercial and industrial customer segments

Figure 5-3: Residential EE Technical Potential by End-Use (Summer Peak Savings)

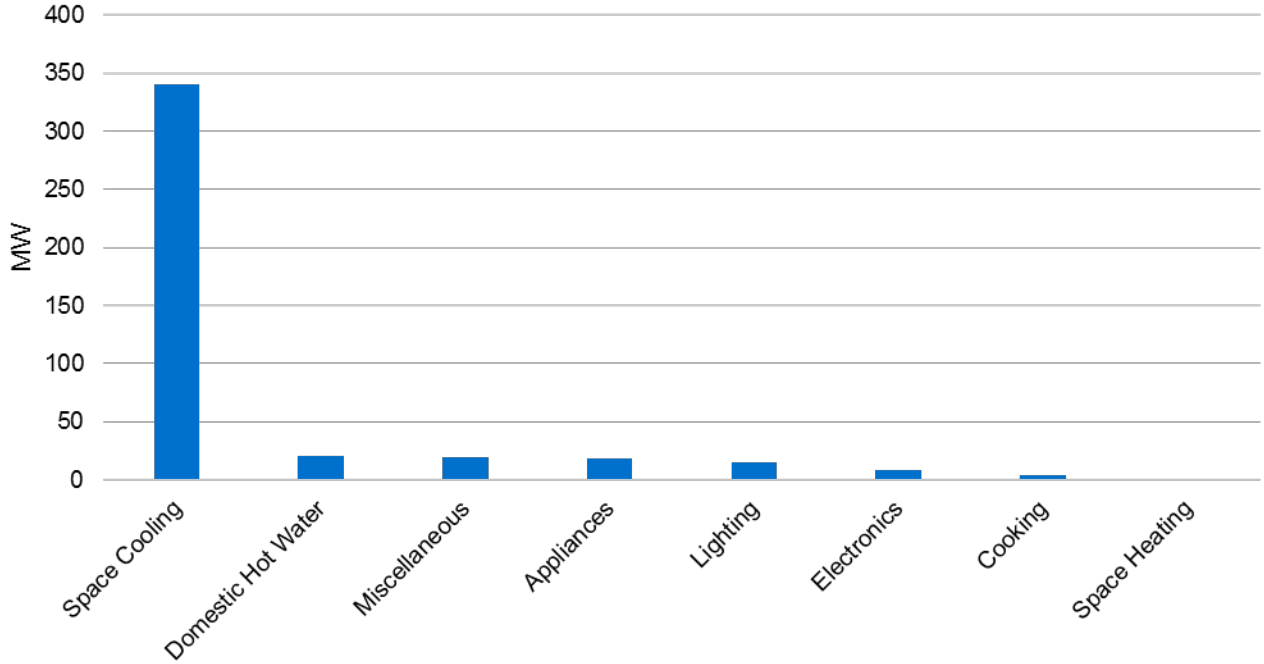
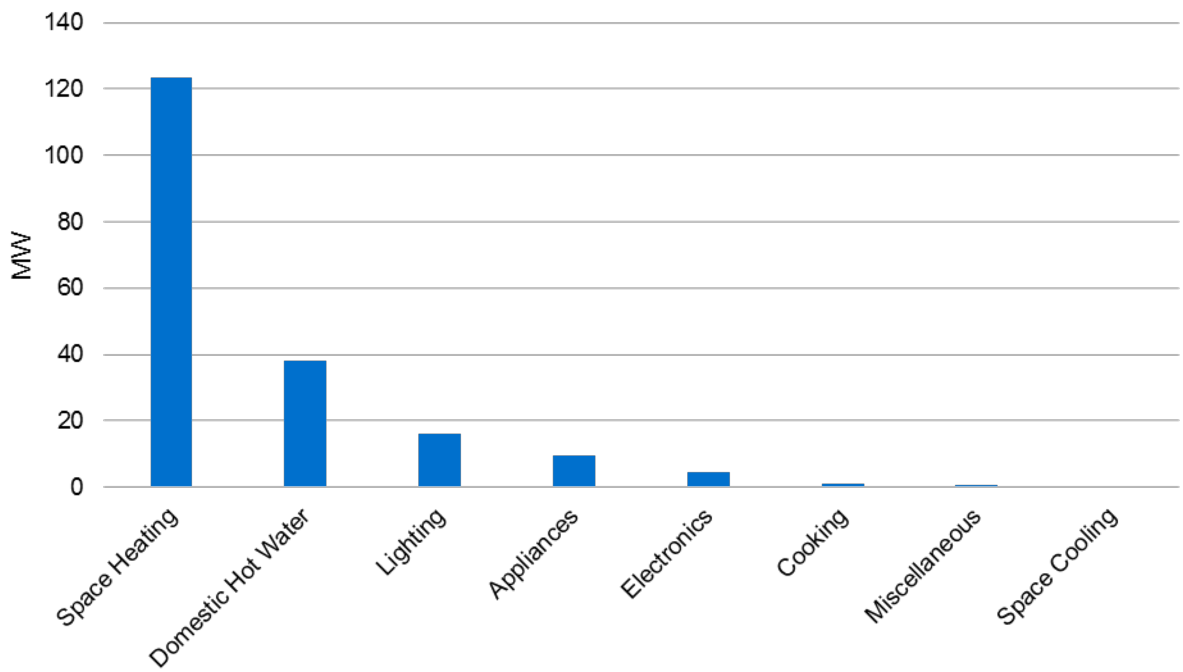


Figure 5-4: Residential EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3 Non-Residential

5.2.3.1 Commercial Segments

Figure 5-5, Figure 5-6, and Figure 5-7 illustrate the commercial sector EE technical potential by end-use.

Figure 5-5: Commercial EE Technical Potential by End-Use (Energy Savings)

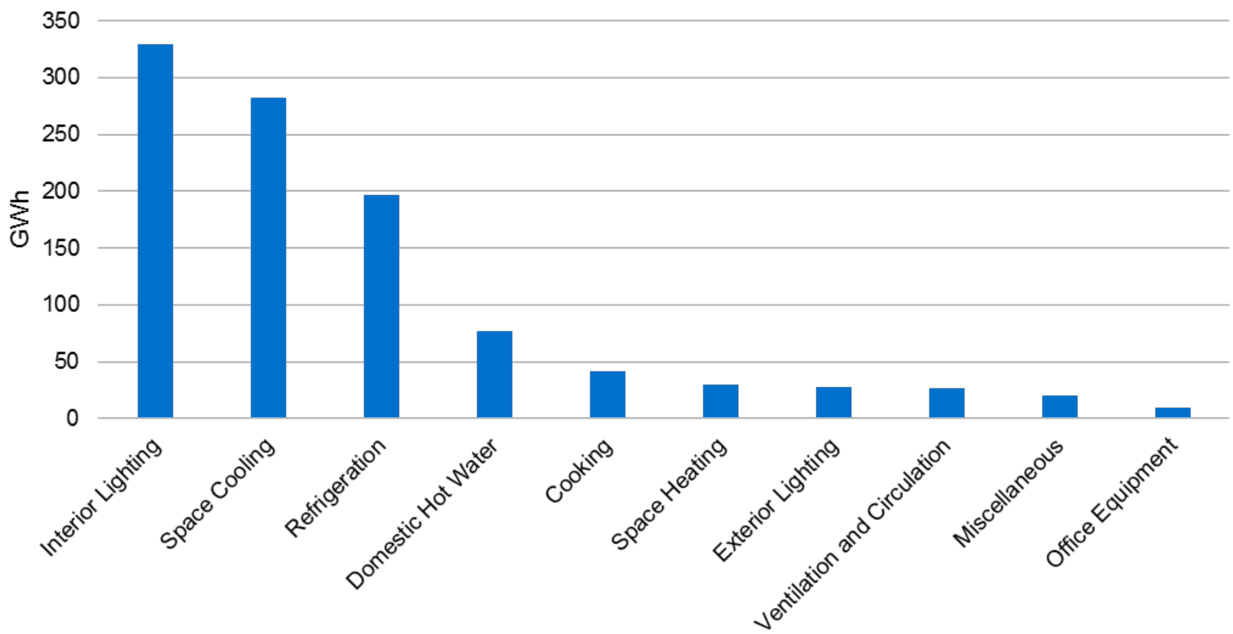


Figure 5-6: Commercial EE Technical Potential by End-Use (Summer Peak Savings)

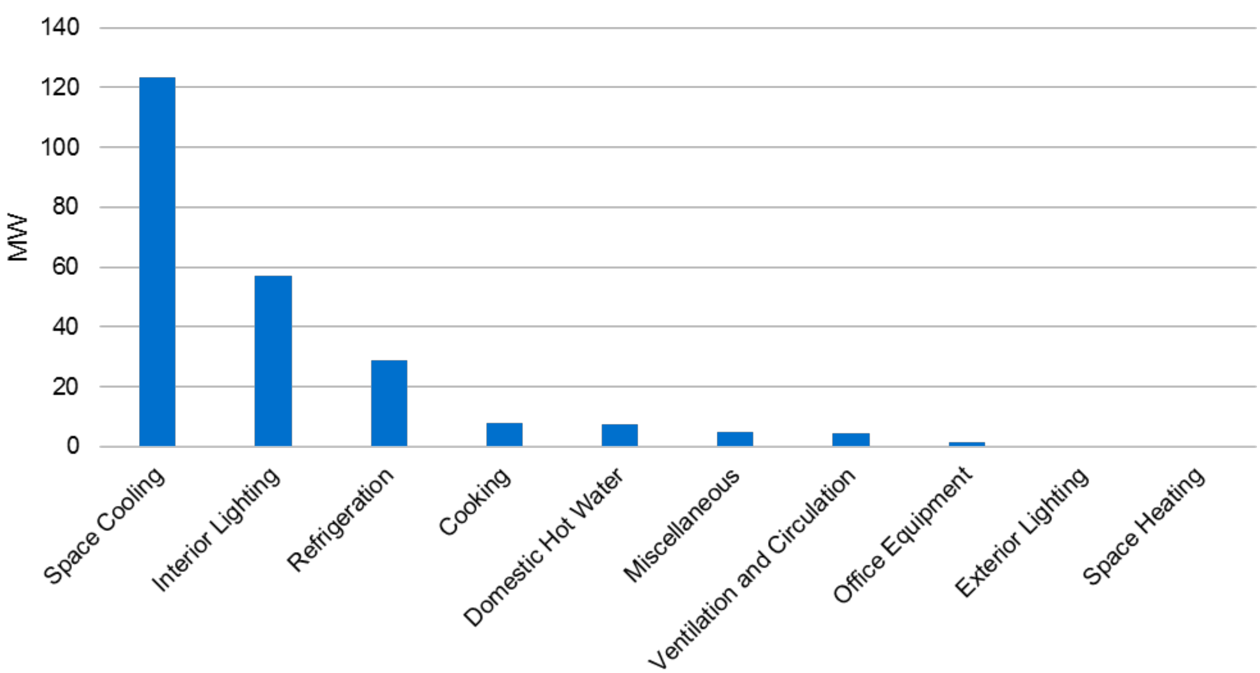
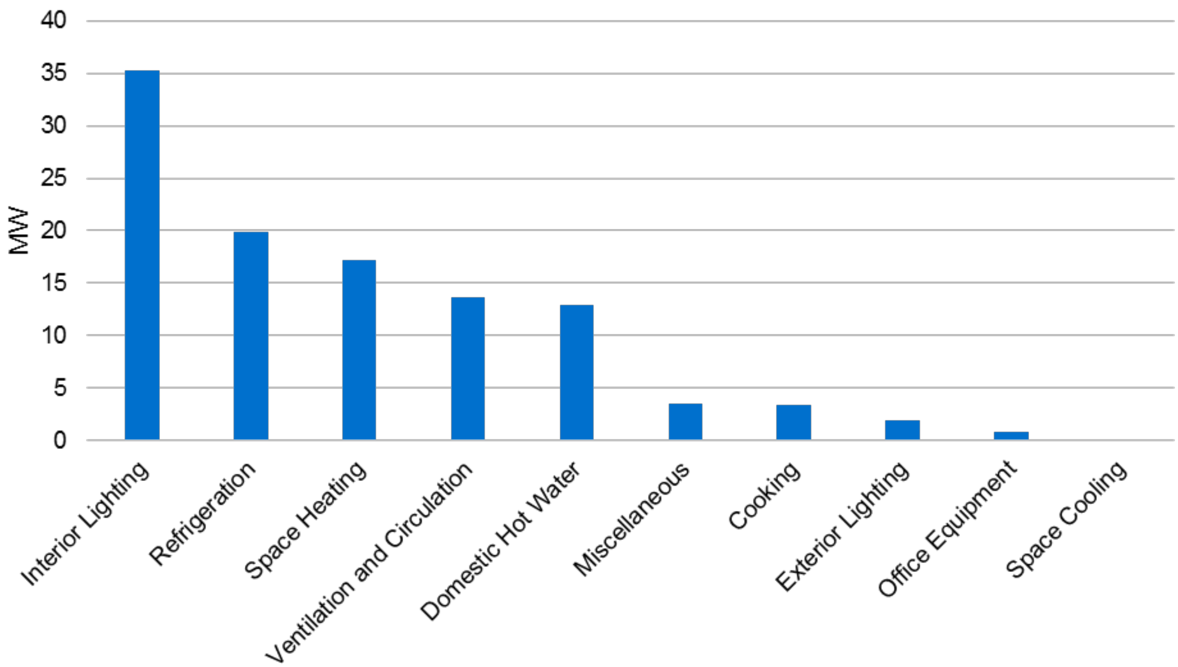


Figure 5-7: Commercial EE Technical Potential by End-Use (Winter Peak Savings)



5.2.3.2 Industrial Segments

Figure 5-8, Figure 5-9, and Figure 5-10 illustrate the industrial sector EE technical potential by end-use.

Figure 5-8: Industrial EE Technical Potential by End-Use (Energy Savings)

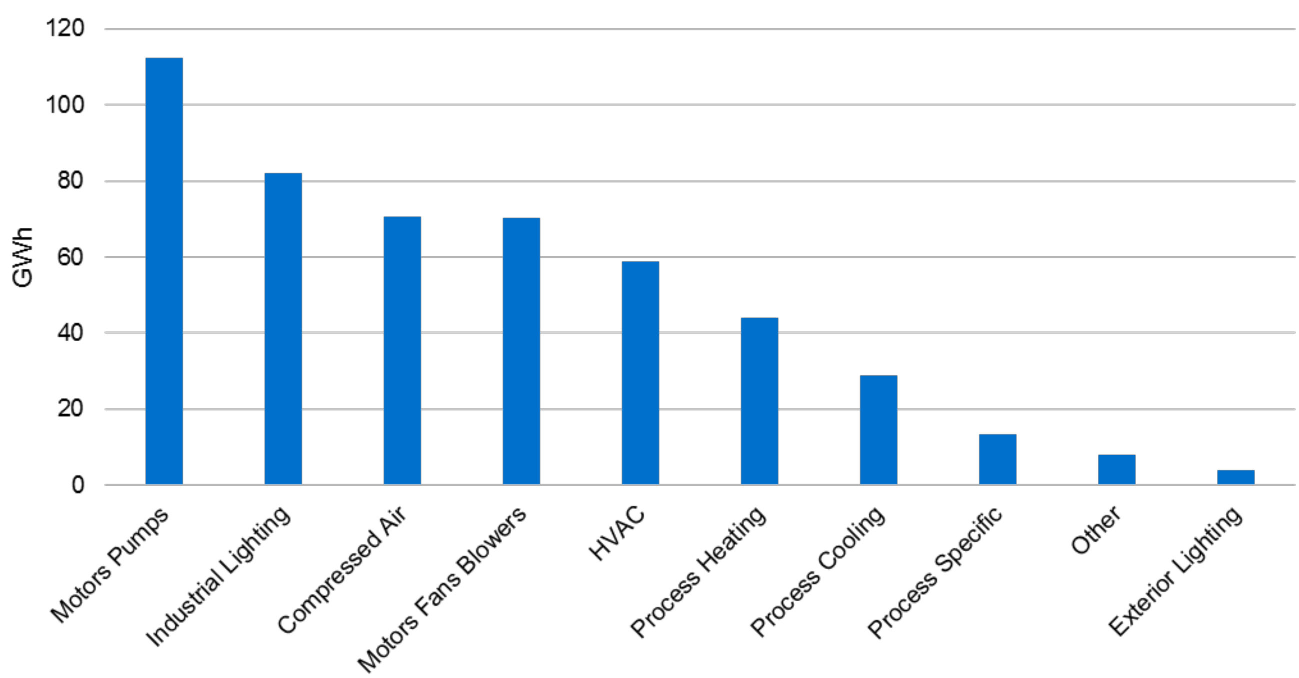


Figure 5-9: Industrial EE Technical Potential by End-Use (Summer Peak Savings)

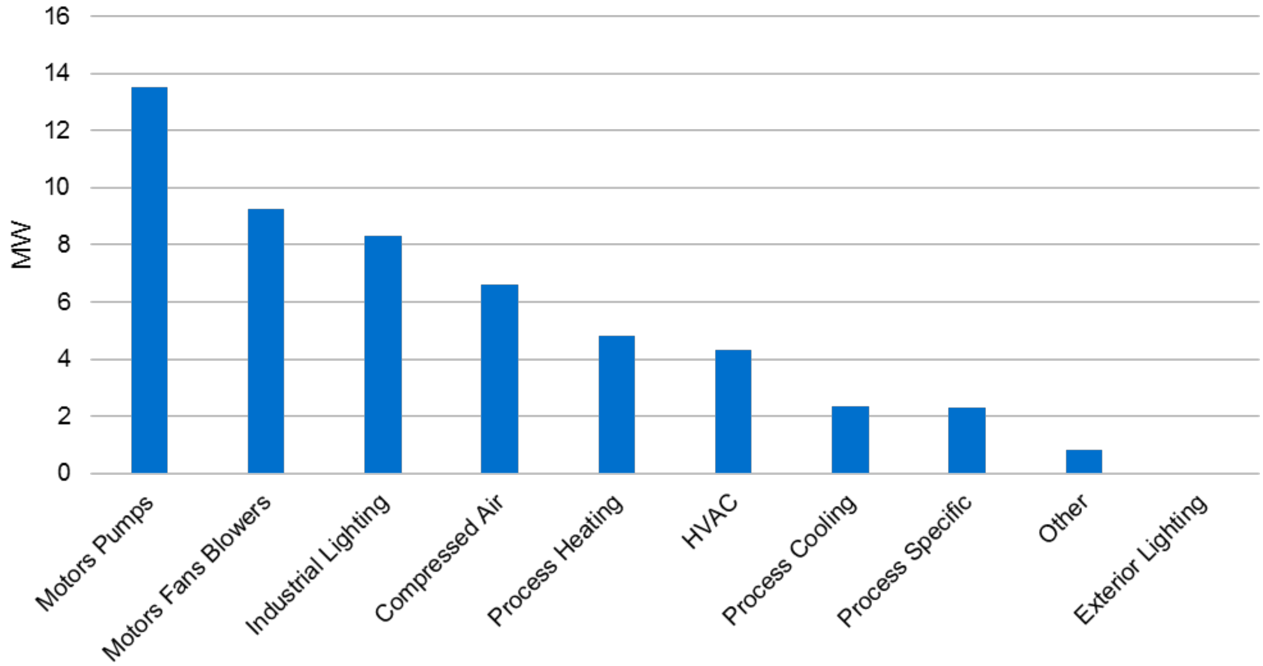
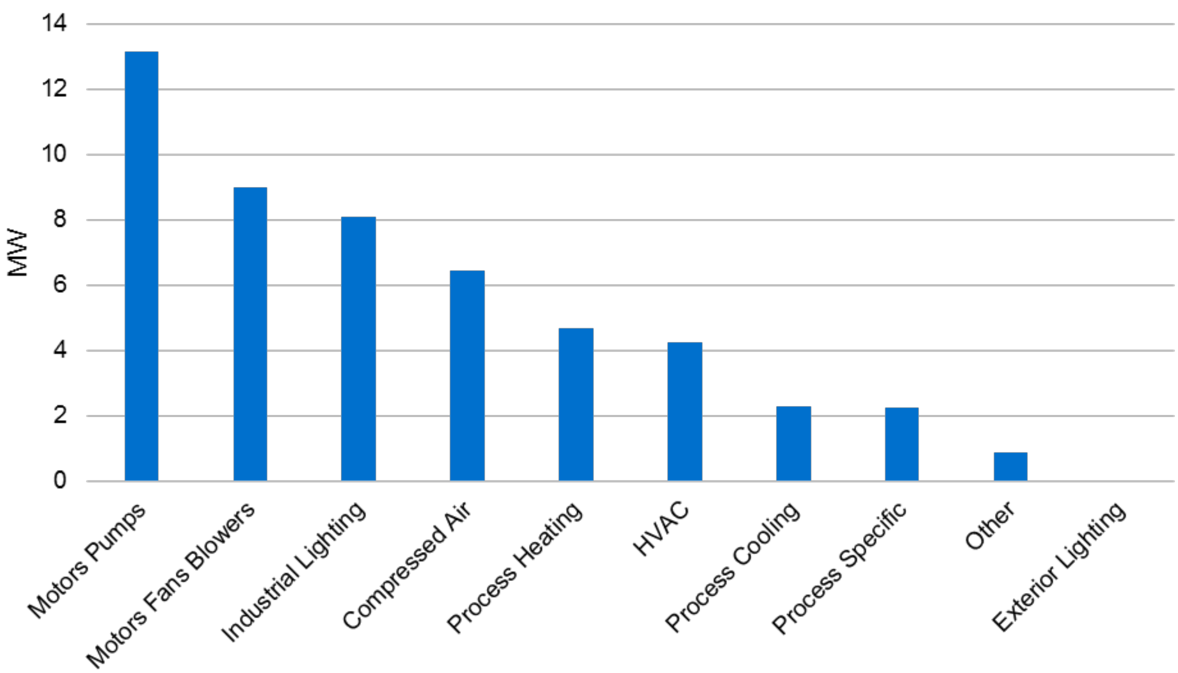


Figure 5-10: Industrial EE Technical Potential by End-Use (Winter Peak Savings)



5.3 DR Technical Potential

Technical potential for DR is defined for each class of customers as follows:

- **Residential & Small C&I customers** – Technical potential is equal to the aggregate load for all end-uses that can participate in JEA's current programs plus DR measures not currently offered in which the utility uses specialized devices to control loads (*i.e.* direct load control programs). This includes cooling and heating loads for residential and small C&I customers and water heater and pool pump loads for residential customers. Not all demand reductions are delivered via direct load control of end-uses. The magnitude of demand reductions from non-direct load control such as time varying pricing, peak time rebates and targeted notifications is linked to cooling and heating loads.
- **Large C&I customers** – Technical potential is equal to the total amount of load for each customer segment (*i.e.,* that customers reduce their total load to zero when called upon).

Table 5-2 summarizes the seasonal DR technical potential by sector:

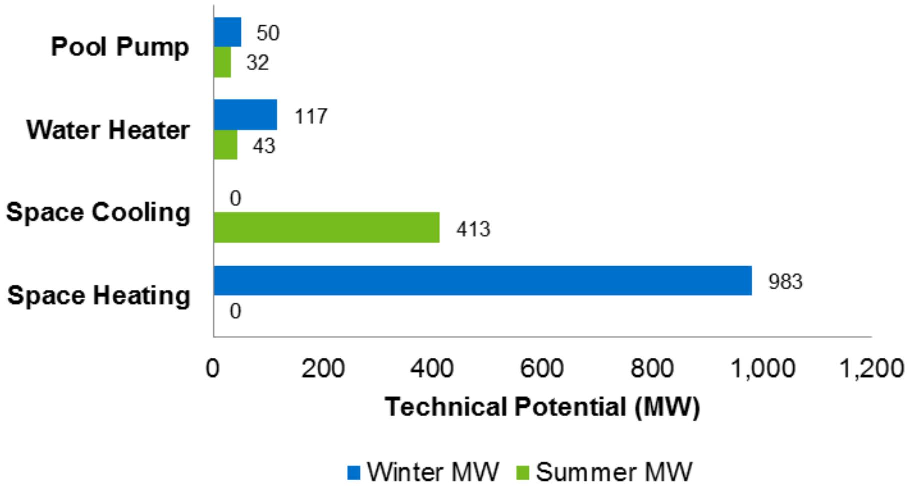
Table 5-2: DR Technical Potential

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
Residential	489	1,150
Non-Residential	538	503
Total	1,027	1,654

5.3.1 Residential

Residential technical potential is summarized in Figure 5-11.

Figure 5-11: Residential DR Technical Potential by End-Use

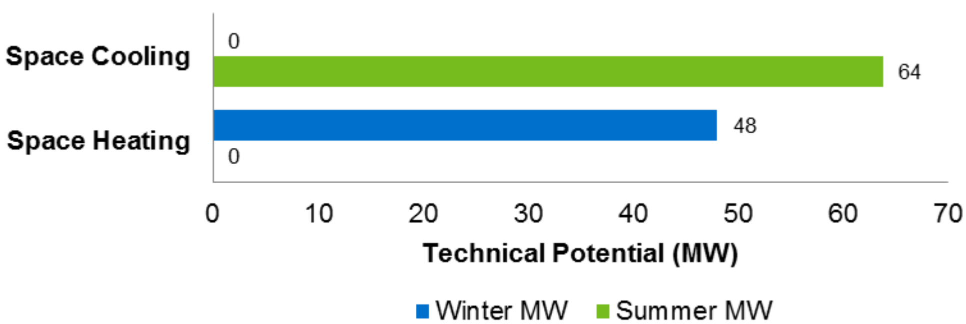


5.3.2 Non-Residential

5.3.2.1 Small C&I Customers

For small C&I technical potential looked at cooling and heating loads only. Small C&I technical potential is provided in Figure 5-12.

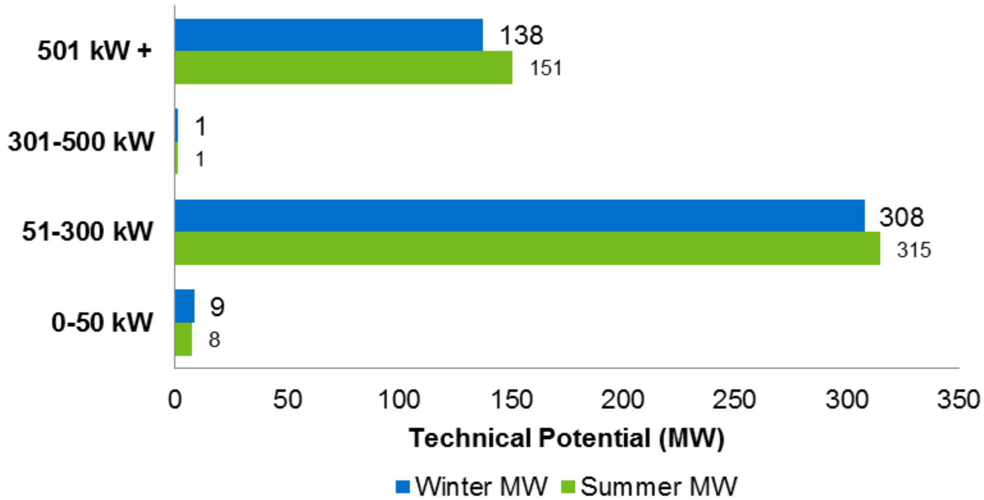
Figure 5-12: Small C&I DR Technical Potential by End-Use



5.3.2.2 Large C&I Customers

Figure 5-13 provides the technical potential for large C&I customers, broken down by customer size.

Figure 5-13: Large C&I DR Technical Potential by Segment[14]



14 All currently enrolled DR customers are excluded

5.4 DSRE Technical Potential

Table 5-3 section the results of the DSRE technical potential for each customer segment.

Table 5-3: DSRE Technical Potential[15]

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
PV Systems			
Residential	1,108	87	7,907
Non-Residential	1,953	154	13,783
Total	3,061	242	21,690
Battery Storage charged from PV Systems			
Residential	439	243	-
Non-Residential	84	-	-
Total	523	243	-
CHP Systems			
Total	891	614	4,126

[15] PV systems and CHP systems were independently analyzed for technical potential without consideration of the competition between technologies or customer preference for DSRE system.

6 Economic Potential

The economic potential scenario estimates the savings potential when all technically feasible DSM measures that are cost-effective to implement are applied at their full market potential (*i.e.* 100% adoption rate). The economic potential was the sum of the demand and energy savings associated with all measure permutations passing the economic screening.

6.1 DSM Cost-Effective Screening Criteria

6.1.1 Cost-Effectiveness Test Perspectives

When analyzing DSM measures, different cost-effectiveness tests are considered to reflect the perspectives of different stakeholders. The Ratepayer Impact Measure ("RIM") addresses an electric utility customer perspective, which considers the net impact on electric utility rates associated with a measure or program. The Total Resource Cost ("TRC") addresses a societal perspective, which considers costs of DSM measure or program relative to the benefits of avoided utility supply costs. The Participant Cost Test ("PCT") addresses a participant perspective, which considers net benefits to those participating in a DSM program.

Descriptions follow of methods for allocating costs and benefits within each cost-effectiveness indicator (RIM, TRC, and PCT); the calculations remain consistent with the Florida Cost Effectiveness Manual[16].

Table 6-1: Components of Cost-Effectiveness Calculations

Component	Definition
Customer Incremental Costs	All incremental costs incurred by the customer to purchase, install, operate, and maintain a DSM measure
Utility Program Costs	Utility administrative and marketing costs and capital expenditures required to implement a DSM measure
Utility Incentives	Costs provided by the utility to the participant to encourage the purchase, installation, operation, and maintenance of a DSM measure
Utility Supply Costs	Utility costs of supplying electricity to the customer, including generation, transmission, and distribution costs
Electric Bill Impacts	Impacts on a participating customer's electric bill due the installation of a DSM measure
Utility Electric Revenues	Impacts on the utility's electric revenues due to the installation of a DSM measure

[16] Cost Effectiveness Manual for Demand Side Management and Self Service Wheeling Proposals; Florida Public Service Commission, Tallahassee, FL; adopted June 11, 1991.

Table 6-2: Ratepayer Impact Measure (RIM)

Component	Definition
Benefit	Increase in utility electric revenues Decrease in avoided electric utility supply costs
Cost	Decrease in utility electric revenues Increase in avoided electric utility supply costs Utility program costs, if applicable Utility incentives, if applicable

Table 6-3: Total Resource Cost (TRC)

Component	Definition
Benefit	Decrease in electric utility supply costs
Cost	Increase in electric utility supply costs Customer incremental costs (less any tax incentives) Utility program costs, if applicable

Table 6-4: Participant Cost Test (PCT)

Component	Definition
Benefit	Decrease in electric bill Utility incentives, if applicable
Cost	Increase in electric bill Customer incremental costs (less any tax incentives)

6.1.2 Economic Potential Screening Methodology

Based on discussion with the FEECA Utilities and consistent with prior DSM analyses in Florida, for development of the economic potential, two scenarios were considered, a RIM-scenario and a TRC-scenario, for which the following economic screening process was followed:

- Criteria for RIM Scenario:
  - Achieve a cost-benefit ratio of 1.0 or greater from the RIM perspective. For the economic potential, the RIM benefits included avoided electric utility supply costs, while RIM costs include decreases in utility electric revenues. The economic potential screening did not consider utility incentives or utility program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
  - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.

    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.
- Criteria for TRC Scenario:
    - Achieve a cost-benefit ratio of 1.0 or greater from the TRC perspective. For the economic potential, the TRC benefits included avoided electric utility supply costs, while TRC costs included customer incremental cost to implement the measure. The economic potential screening did not consider utility DSM program costs as a component of the measure's cost-effectiveness (these are reflected in the Achievable Potential analysis).
    - Achieve a cost-benefit ratio of 1.0 or greater from the PCT perspective. For economic potential, the PCT benefits are decreases in electric bills and costs are customer incremental cost to implement the measure. Utility incentives were not considered for this screening component for economic potential.
    - Participant simple payback of two years or longer. To determine simple payback for the economic potential analysis, total customer incremental cost to implement the measure was compared with decreases in electric bills. Utility incentives were not considered for this screening component for economic potential.

The cost-effectiveness screening described above was applied to each DSM measure permutation based on the installation of the measure in the Base Year (2020) of the study. Therefore, avoided energy cost benefits were applied beginning in Year 1 and extended through the useful life of the measure; avoided generation costs began at the in-service year for new generation based on utility system load forecasts.

6.1.3 Economic Potential Sensitivities

Based on direction from the FEECA Utilities and the Order Establishing Procedure, the economic potential analysis included the following additional sensitivities:

- Sensitivity #1: Higher Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a "high fuel" scenario.
- Sensitivity #2: Lower Fuel Prices. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast was adjusted to a "low fuel" scenario.
- Sensitivity #3: Shorter free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was reduced to one year or longer.
- Sensitivity #4: Longer free-ridership exclusion periods. For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was increased to three years or longer.

Each of these sensitivities resulted in a unique set of measures passing the cost-effectiveness criteria for both RIM and TRC scenarios. The economic potential for the passing measures were evaluated in Nexant's TEA-POT model, and the results of the economic sensitivities are provided in Appendix E.

6.2 EE Economic Potential

This section provides the results of the EE economic potential for each sector. Table 6-5 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 6-5: Economic Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	1	22
Total	1	22
TRC SCENARIO		
Residential	14	64
Commercial	47	775
Industrial	22	298
Total	83	1,137

6.2.1 Summary

Table 6-6 summarizes the EE economic potential by sector and by scenario (RIM and TRC):

Table 6-6: EE Economic Potential by Sector

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0.8
Total	0	0	0.8
TRC SCENARIO			
Residential	113	66	419
Non-Residential	89	52	605
Total	202	118	1,024

6.2.2 Residential – RIM Scenario

The residential segments did not have EE measures that passed the economic cost-effectiveness screening from the RIM scenario.

6.2.3 Non-Residential – RIM Scenario

6.2.3.1 Commercial Segments

The commercial segments did not have any EE measures that passed the economic potential cost-effectiveness screening from the RIM scenario.

6.2.3.2 Industrial Segments

The industrial cost-effectiveness screening for the economic potential RIM scenario resulted in one passing measure, with an economic potential of 765 MWh and no summer or winter peak savings.

6.2.4 Residential – TRC Scenario

Figure 6-1, Figure 6-2, and Figure 6-3 illustrate the residential EE economic potential by end-use for the TRC scenario.

Figure 6-1: Residential EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

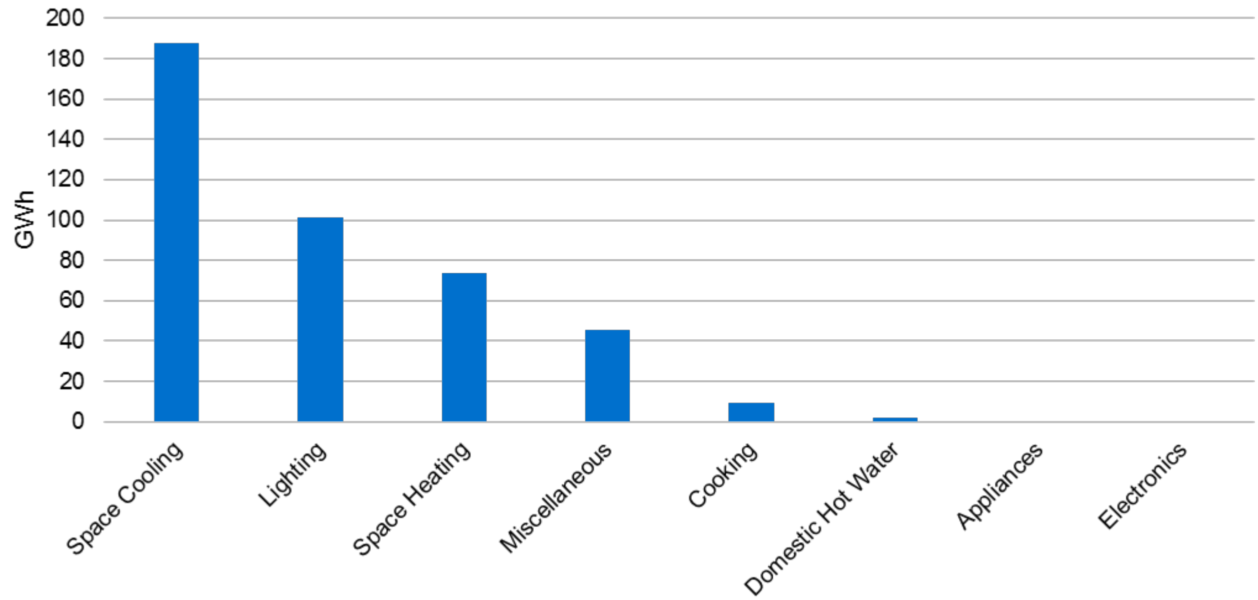


Figure 6-2: Residential EE Economic Potential by End-Use (Summer Peak Savings) - TRC Scenario

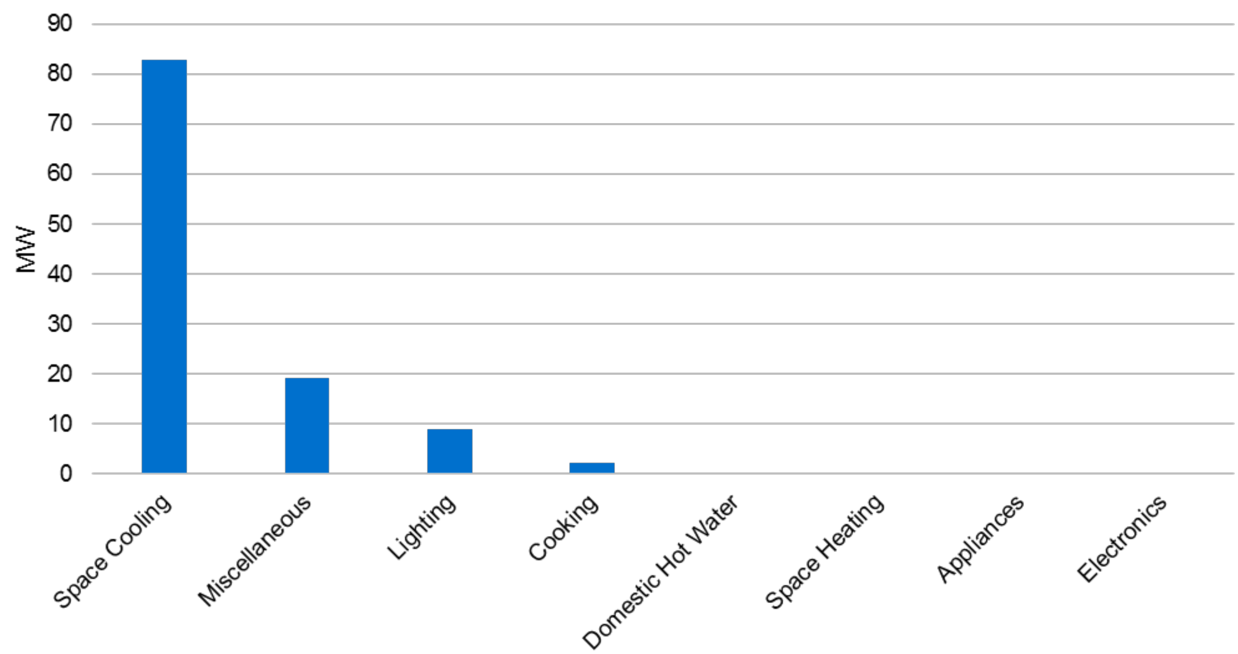
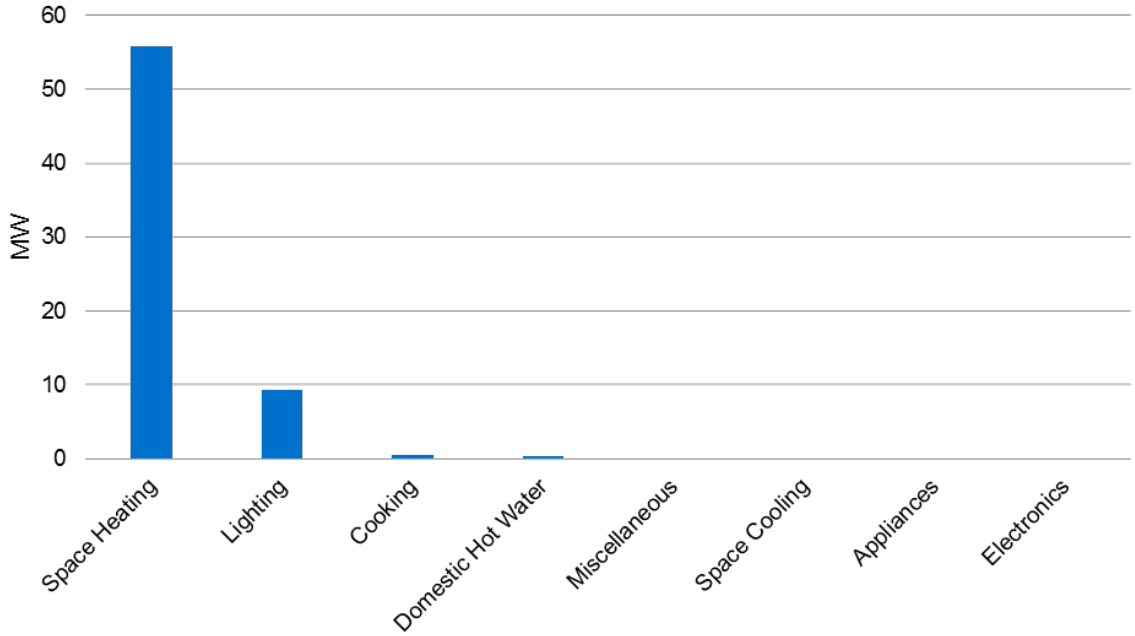


Figure 6-3: Residential EE Economic Potential by End-Use (Winter Peak Savings) - TRC Scenario



6.2.5 Non-Residential – TRC Scenario

6.2.5.1 Commercial Segments

Figure 6-4, Figure 6-5, and Figure 6-6 illustrate the commercial EE economic potential by end-use for the TRC scenario.

Figure 6-4: Commercial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

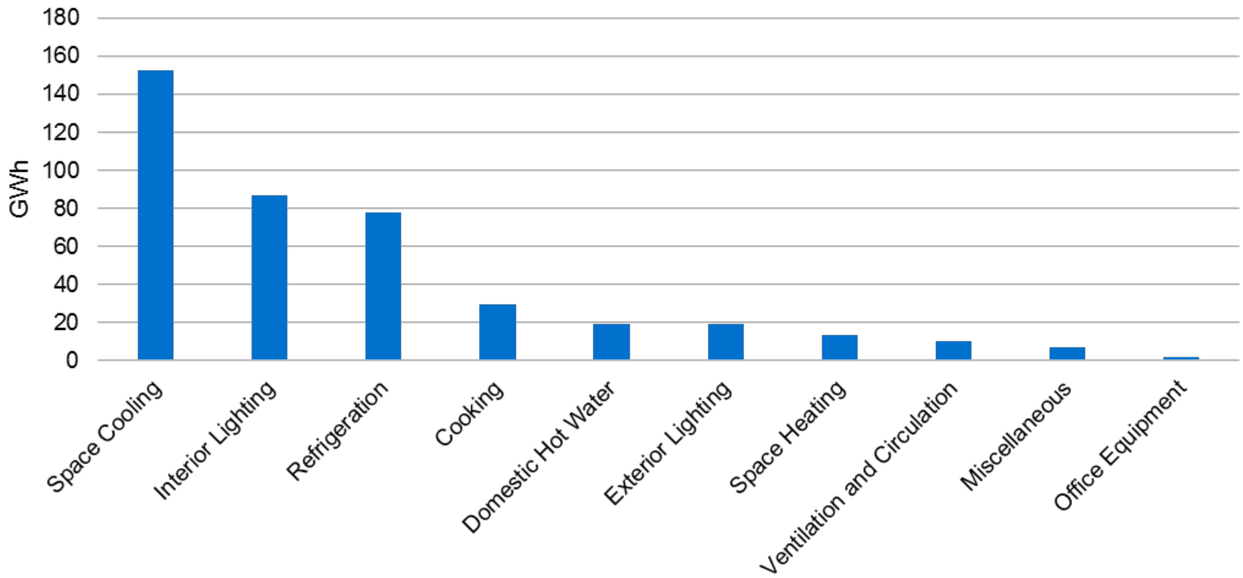


Figure 6-5: Commercial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

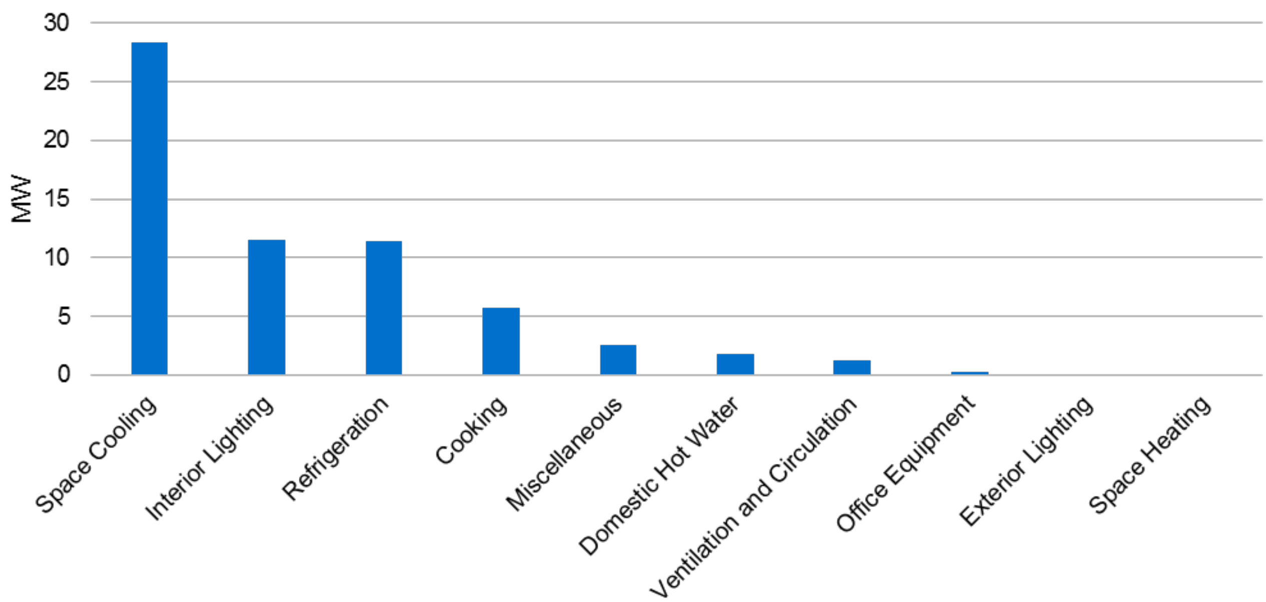
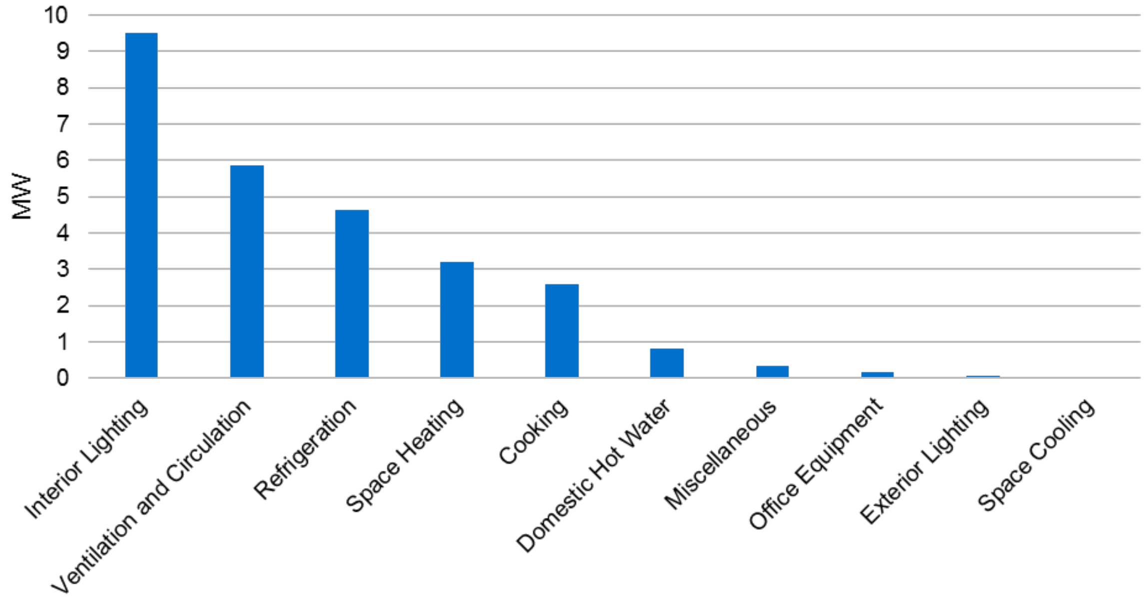


Figure 6-6: Commercial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.2.5.2 Industrial Segments

Figure 6-7, Figure 6-8 and Figure 6-9 illustrate the industrial EE economic potential by end-use for the TRC scenario.

Figure 6-7: Industrial EE Economic Potential by End-Use (Energy Savings) – TRC Scenario

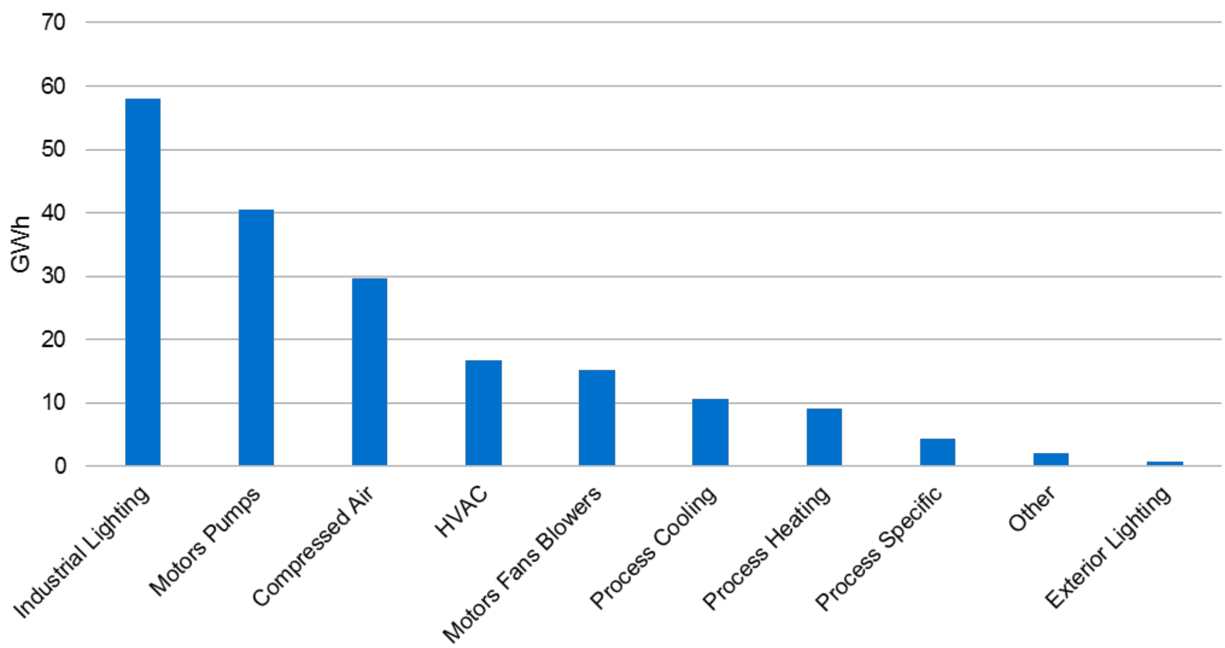


Figure 6-8: Industrial EE Economic Potential by End-Use (Summer Peak Savings) – TRC Scenario

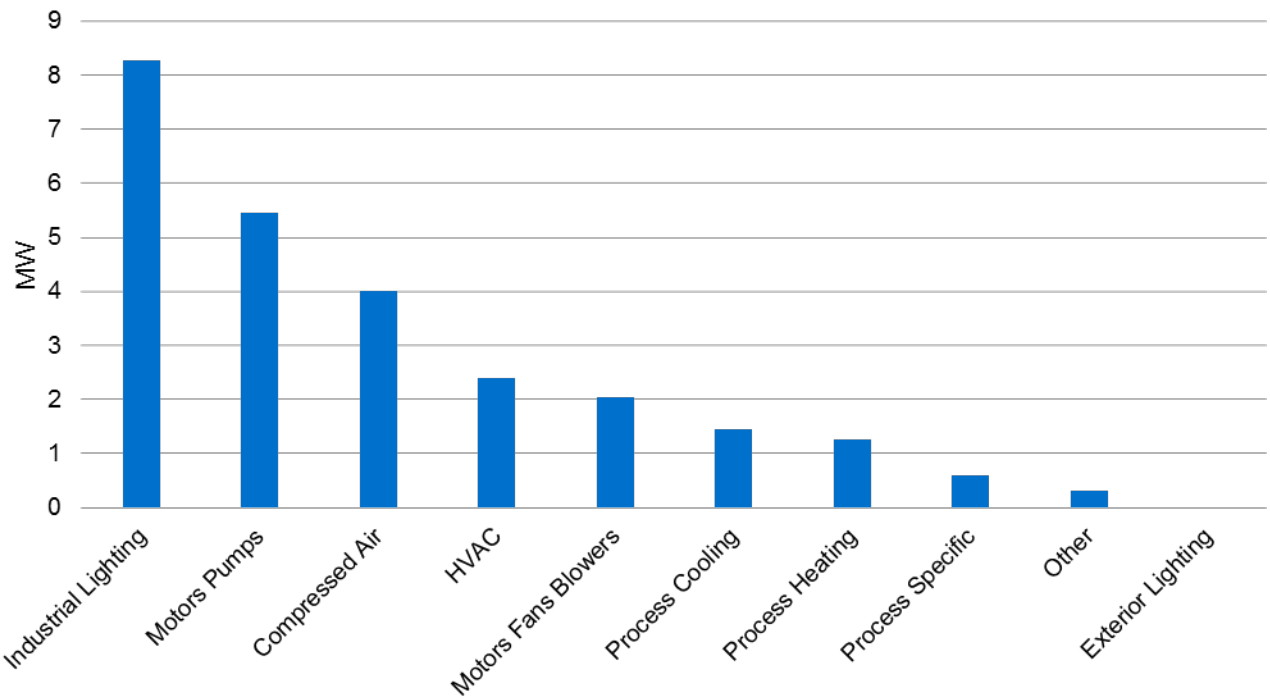
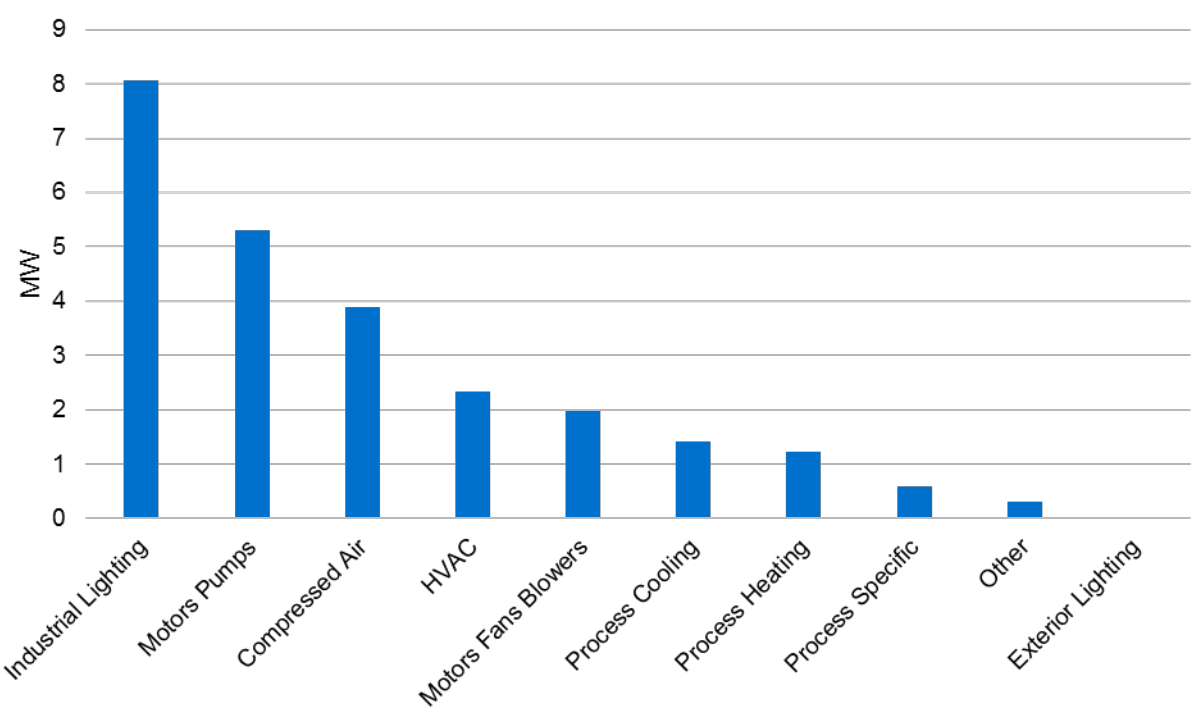


Figure 6-9: Industrial EE Economic Potential by End-Use (Winter Peak Savings) – TRC Scenario



6.3 DR Economic Potential

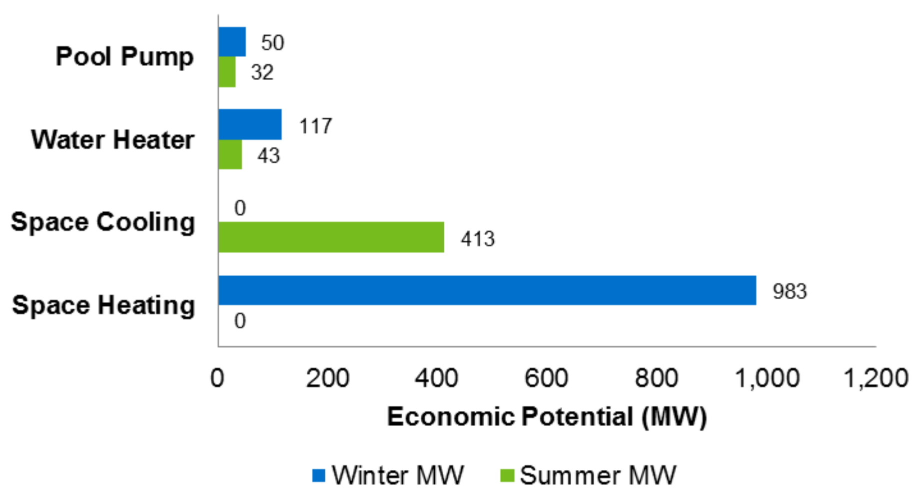
Because of the costs included in the RIM and TRC screening methodology for DR, all measures passed the economic potential screen for JEA. Therefore, the economic potential for DR is the same as the technical potential for JEA.

Table 6-7: DR Economic Potential[17]

	Savings Potential	
	Summer Peak Demand (MW)	Winter Peak Demand (MW)
RIM and TRC SCENARIO		
Residential	489	1,150
Non-Residential	538	503
Total	1,027	1,654

Results for residential customer segments are presented in Figure 6-10. Note that because there are minimal customer costs and bill savings associated with the DR measures used, all measures passed the economic screen and the potential did not change from the technical potential, since based on the RIM and TRC screening requirements all of the load that can technically be curtailed can be curtailed cost-effectively.

Figure 6-10: Residential DR Economic Potential by End-Use – RIM and TRC Scenario



[17] Excludes current DR participants

Similar figures are presented for small C&I and large C&I customers.

Figure 6-11: Small C&I DR Economic Potential by End-Use – RIM and TRC Scenario

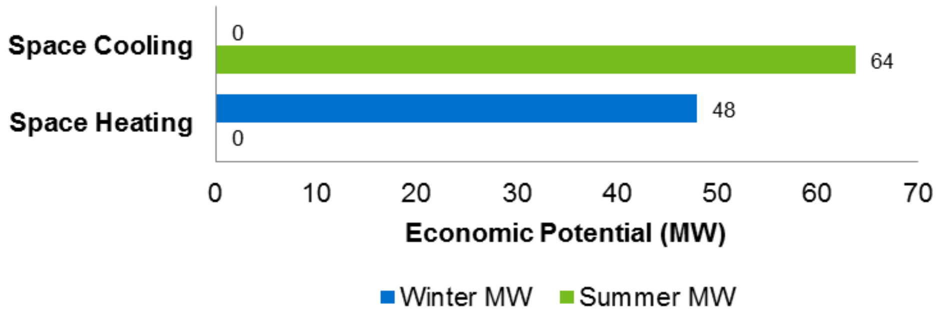
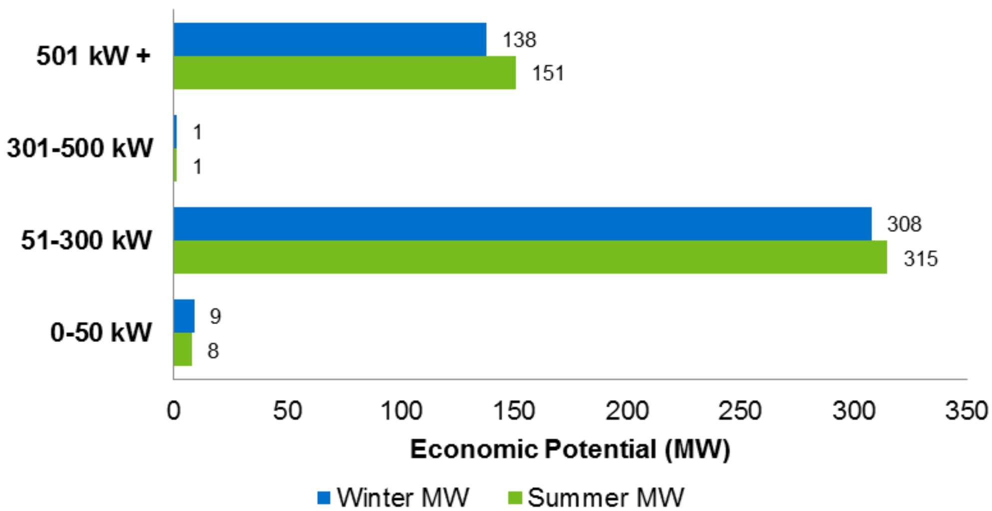


Figure 6-12: Large C&I DR Economic Potential by Segment – RIM and TRC Scenario[18]



[18] All currently enrolled DR customers are excluded

6.4 DSRE Economic Potential

Nexant found there to be no cost-effective economic potential attainable in JEA for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

7 Achievable Potential

Nexant incorporated realistic assumptions about program delivery when estimating achievable market potential. Nexant estimated the cost-effective savings realistically achievable by utility-sponsored DSM programs in the JEA jurisdiction by incorporating utility program costs and utility incentive costs, and with consideration of economic constraints and market demand for DSM services in Florida.

7.1 Achievable Potential Methodology

7.1.1 Utility Program Costs and Incentives

Prior to the development of the achievable potential, Nexant performed a cost-effectiveness re-screening of all measures that passed the economic potential screening, under both the RIM and TRC scenarios, to incorporate estimated utility program costs and utility incentives for each measure. Nexant used program cost estimates by sector and end-use, which were developed from data on current FEECA Utilities' DSM programs as well as other regional utility program offerings[19]. The estimated incentive amounts were developed for each measure as follows:

- In the RIM scenario, two incentive values were analyzed. First, the RIM net benefit for the measure was calculated based on total RIM benefits minus RIM costs. Next, the incentive amount that would drive the simple payback to two years for each measure was calculated. The final incentive applied for the measure was based on the lower of these two values.
- In the TRC scenario, the incentive amount required to drive the simple payback to two years for each measure was used as the final incentive for the measure.

7.1.2 Market Adoption Rates

To estimate the adoption rate of DSM based on the utility program costs and incentives described above, Nexant incorporated JEA DSM program data as well as secondary data from other utility sponsored DSM programs. This approach leveraged program performance data from a variety of DSM programs across many utilities to develop a meta-analysis of program performance that broadly describes customers' program adoption rates over time. This approach applied standard economic theories on product diffusion to develop a catalog of market adoption curves across a variety of DSM technologies and programs[20].

Nexant used this market performance data, historic JEA program performance data, and secondary data sources to calibrate the measures passing the cost-effectiveness screening in

[19] Program cost estimates assumed average utility DSM program operations for mature, full-scale programs. However, actual program costs may vary by utility based on the program's size and scale, including the number of measures offered, participation and savings targets, and specific program delivery elements.

[20] A detailed description of Nexant's market adoption rate methodology is provided in Appendix F

the TEA-POT model. Secondary data sources for EE measures included ENERGY STAR data on qualified product shipments and other utility-sponsored program performance data. The adoption rate of DR also incorporated JEA DR marketing and participation data as well as secondary data from other well-developed DR programs. This approach leveraged historic marketing strategies and customer responses to marketing as well as incentive level.

7.2 EE Achievable Potential

This section provides the detailed results of the EE achievable potential. Table 7-1 summarizes the number of unique measures and measure permutations by sector that passed the cost-effectiveness screening for each scenario:

Table 7-1: Achievable Potential EE Measure Counts by Scenario

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	9	39
Commercial	46	707
Industrial	22	298
Total	77	1,044

7.2.1 Summary

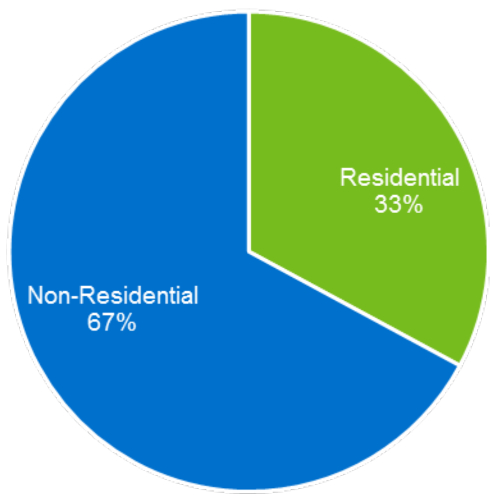
Table 7-2 summarizes the 10-year portfolio EE achievable potential for all customers across the residential and non-residential sectors. Impacts are presented as cumulative impacts, which represent the savings achieved over the ten-year study period(2020-2029) based on the sum of the annual incremental savings.

Table 7-2: EE Achievable Potential

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	11	10	86
Non-Residential	23	14	176
Total	34	24	262

Figure 7-1 shows achievable energy savings potential by sector for the TRC scenario. No cost-effective energy savings potential were identified under the RIM scenario.

Figure 7-1: Achievable Potential by Sector – TRC Scenario



7.2.2 Residential – RIM Scenario

The residential segments did not have any EE measures that passed the cost-effectiveness screening from the achievable potential RIM scenario.

7.2.3 Non-Residential – RIM Scenario

7.2.3.1 Commercial Segments

The commercial segments did not have any EE measures that passed the cost-effectiveness screening from the achievable potential RIM scenario.

7.2.3.2 Industrial Segments

The industrial segments did not have any EE measures that passed the cost-effectiveness screening from the achievable potential RIM scenario.

7.2.4 Residential – TRC Scenario

Table 7-3 summarizes the cumulative residential EE achievable potential by end-use for the TRC Scenario.

Table 7-3: EE Residential Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Space Heating	0	4	4
Space Cooling	5	0	12
Domestic Hot Water	0	0	0
Lighting	6	6	68
Cooking	0	0	0
Appliances	0	0	0
Electronics	0	0	0
Miscellaneous	0	0	2

Figure 7-2, Figure 7-3, and Figure 7-4 illustrate the cumulative residential EE achievable potential by end-use for the TRC scenario.

Figure 7-2: Residential EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

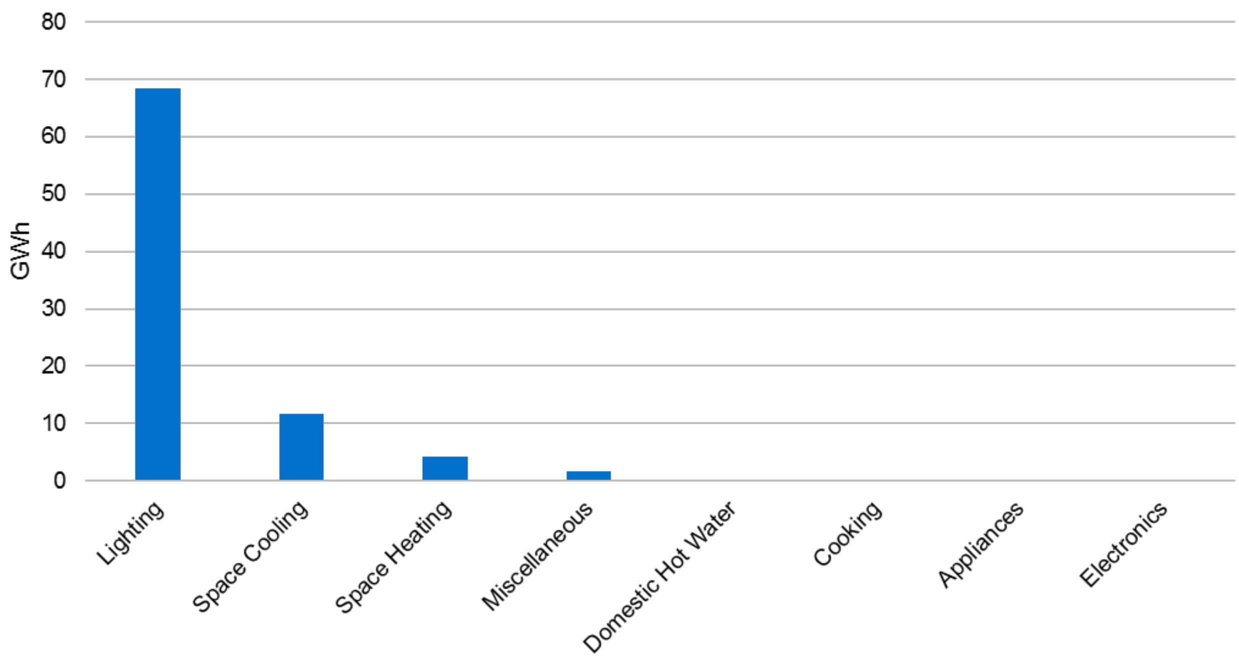


Figure 7-3: Residential EE Achievable Potential by End-Use (Summer Peak Savings) - TRC Scenario

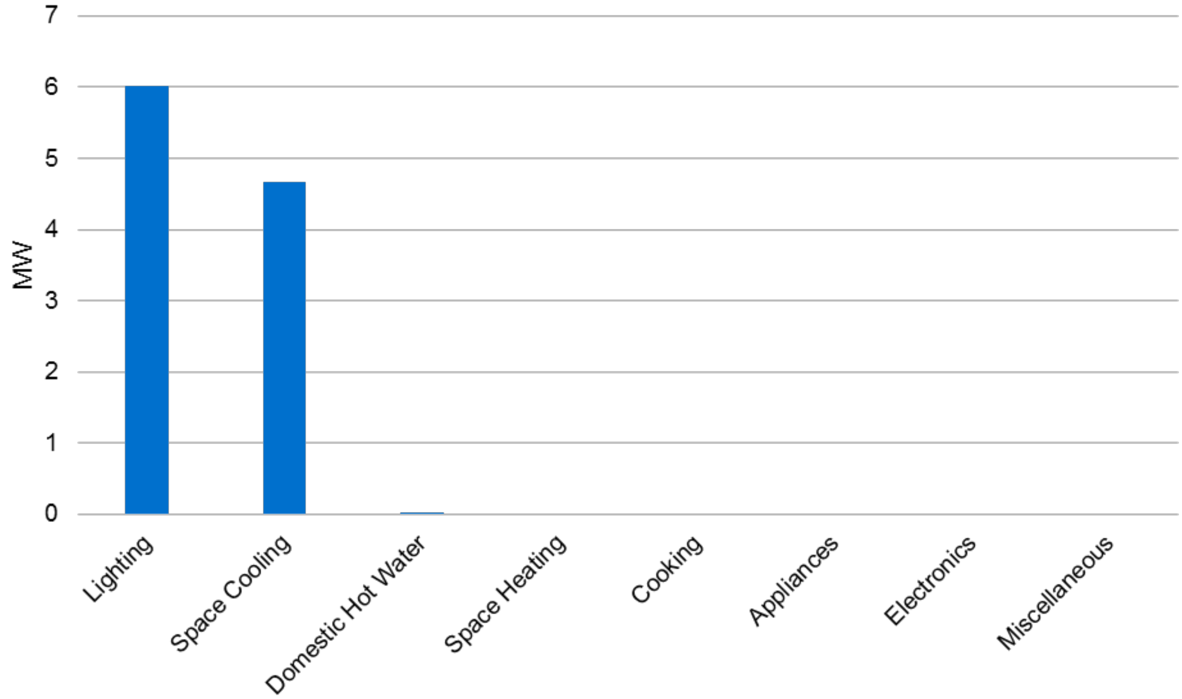
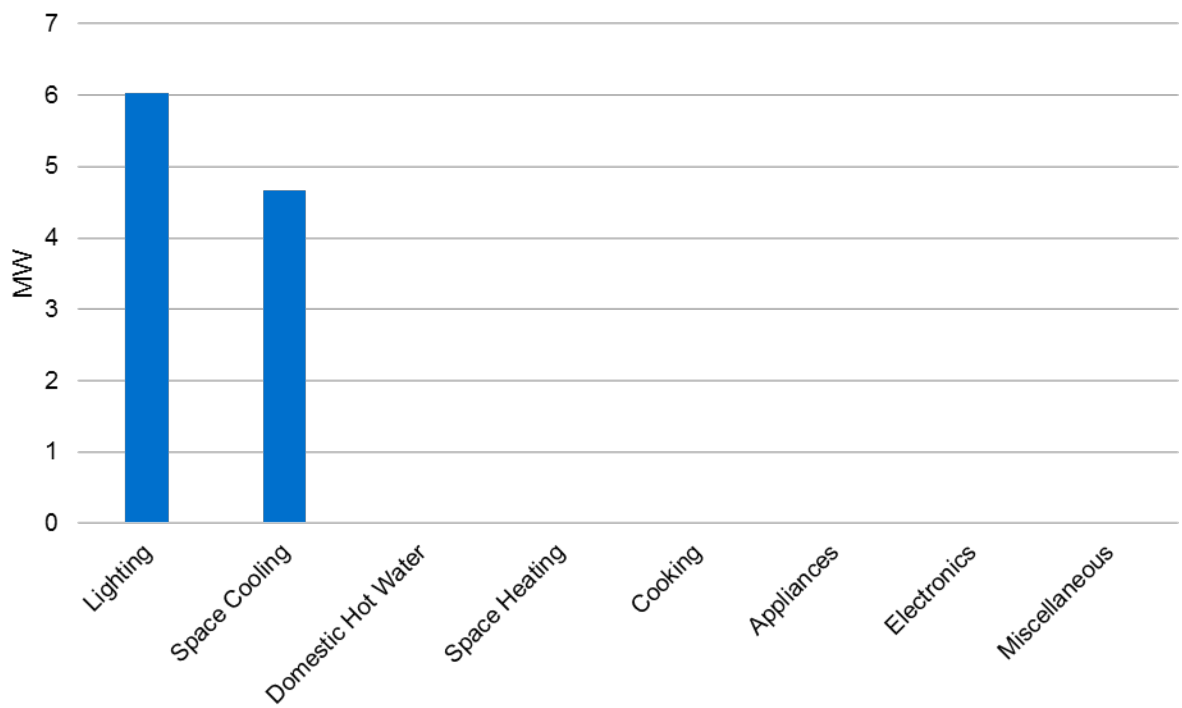


Figure 7-4: Residential EE Achievable Potential by End-Use (Winter Peak Savings) - TRC Scenario



7.2.5 Non-Residential – TRC Scenario

7.2.5.1 Commercial Segments

Table 7-4 summarizes the cumulative commercial EE achievable potential by end-use for the TRC Scenario.

Table 7-4: EE Commercial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Interior Lighting	2	2	21
Exterior Lighting	0	0.02	6
Office Equipment	0.09	0.06	1
Cooking	2	1	11
Refrigeration	5	2	34
Space Heating	0	1	4
Space Cooling	6	0	44
Ventilation and Circulation	0.2	1	2
Domestic Hot Water	0.3	0.1	3
Miscellaneous	0.2	0.1	1

Figure 7-5, Figure 7-6, and Figure 7-7 illustrate the cumulative commercial EE achievable potential by end-use for the TRC scenario.

Figure 7-5: Commercial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

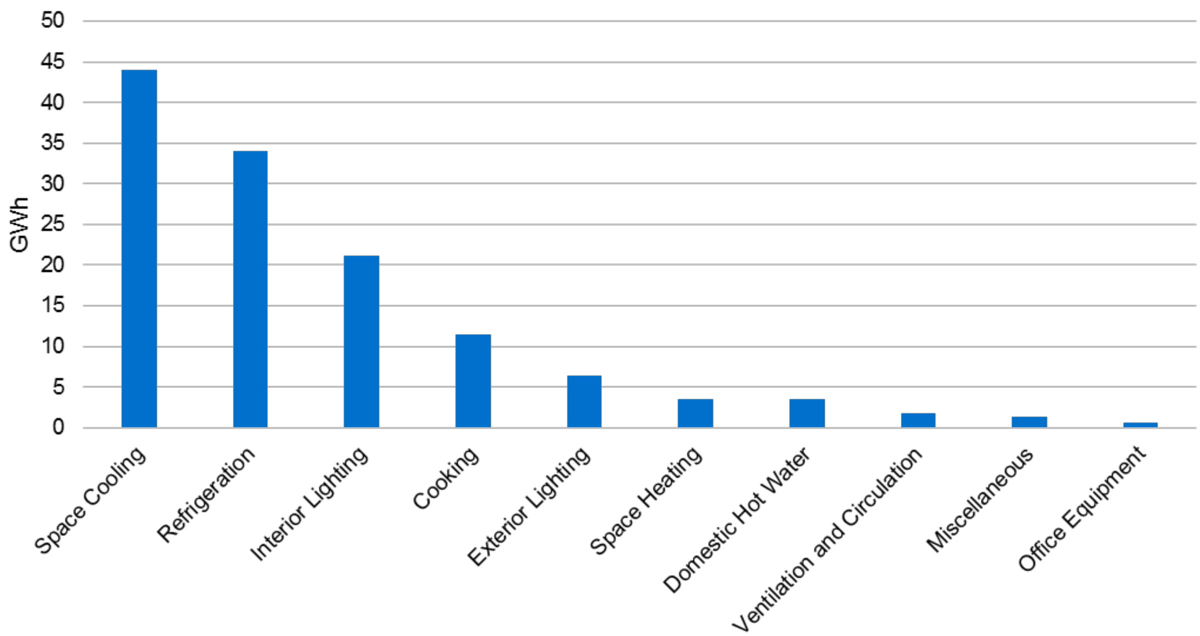


Figure 7-6: Commercial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

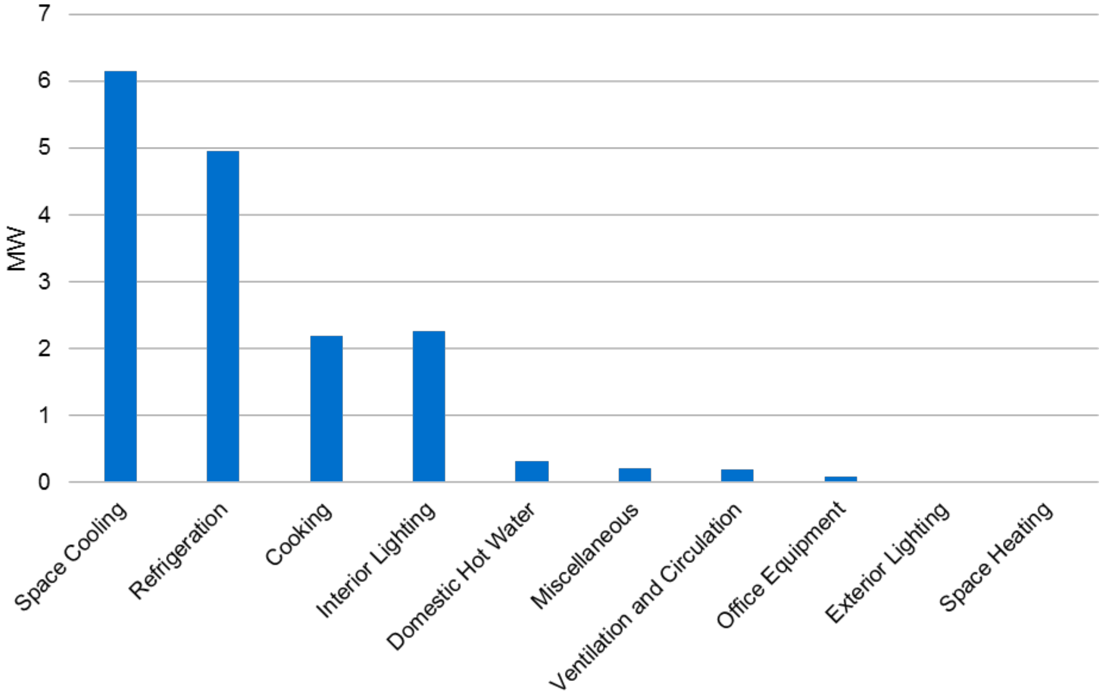
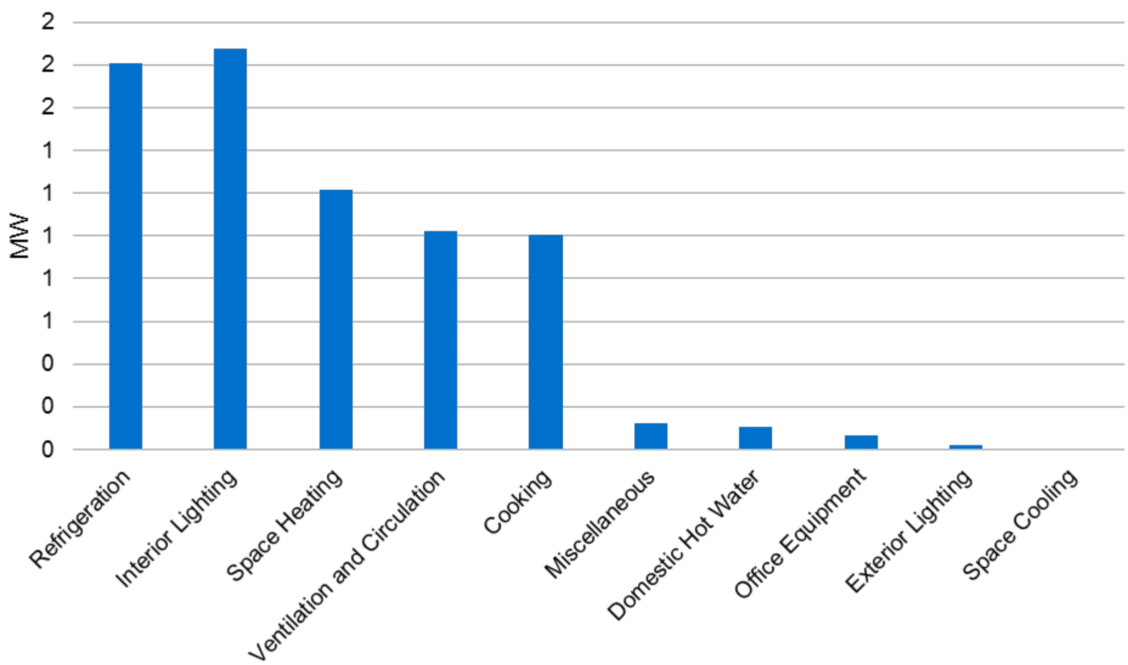


Figure 7-7: Commercial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.2.5.2 Industrial Segments

Table 7-5 summarizes the cumulative industrial EE achievable potential by end-use for the TRC Scenario.

Table 7-5: EE Industrial Achievable Potential by End-Use – TRC Scenario

	Cumulative Impacts		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
Process Heating	0.3	0.3	2
Process Cooling	0.3	0.3	2
Compressed Air	1	1	7
Motors Pumps	1	1	9
Motors Fans Blowers	0.5	0.5	4
Process Specific	0.2	0.2	1
Industrial Lighting	3	3	18
HVAC	0.5	0.5	4
Other	0.1	0.1	1
Exterior Lighting	0	0	0.1

Figure 7-8, Figure 7-9, and Figure 7-10 illustrate the cumulative industrial EE achievable potential by end-use for the TRC scenario.

Figure 7-8: Industrial EE Achievable Potential by End-Use (Energy Savings) – TRC Scenario

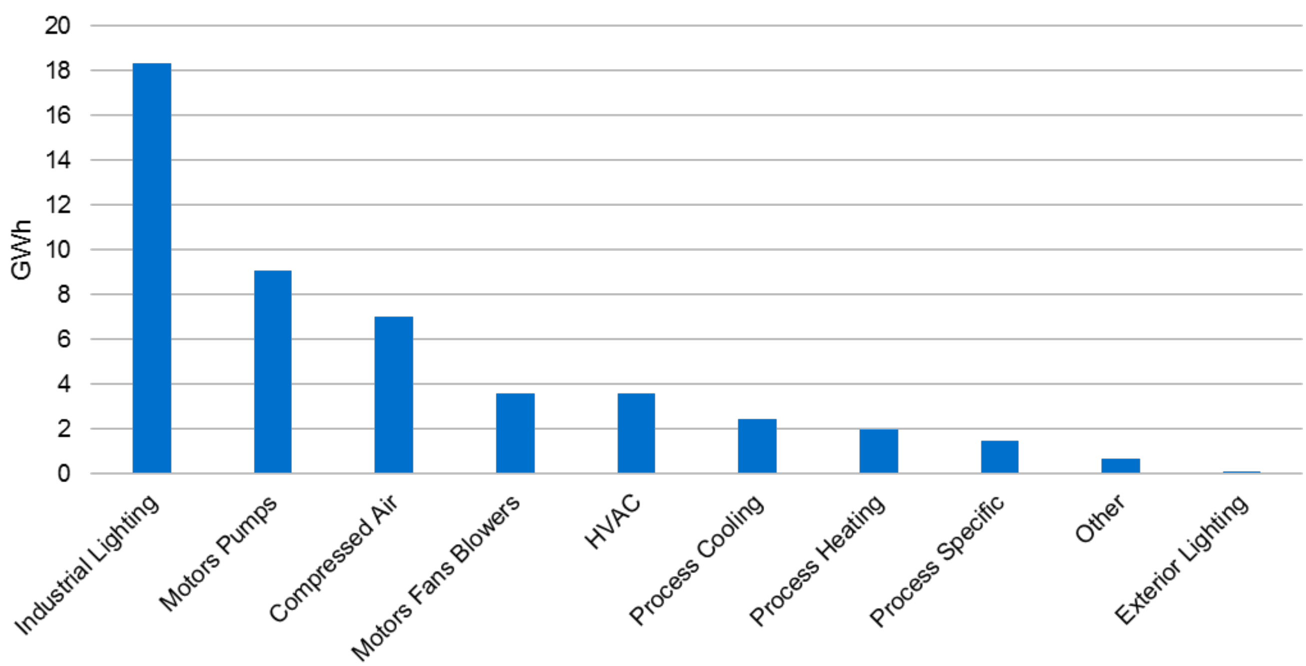


Figure 7-9: Industrial EE Achievable Potential by End-Use (Summer Peak Savings) – TRC Scenario

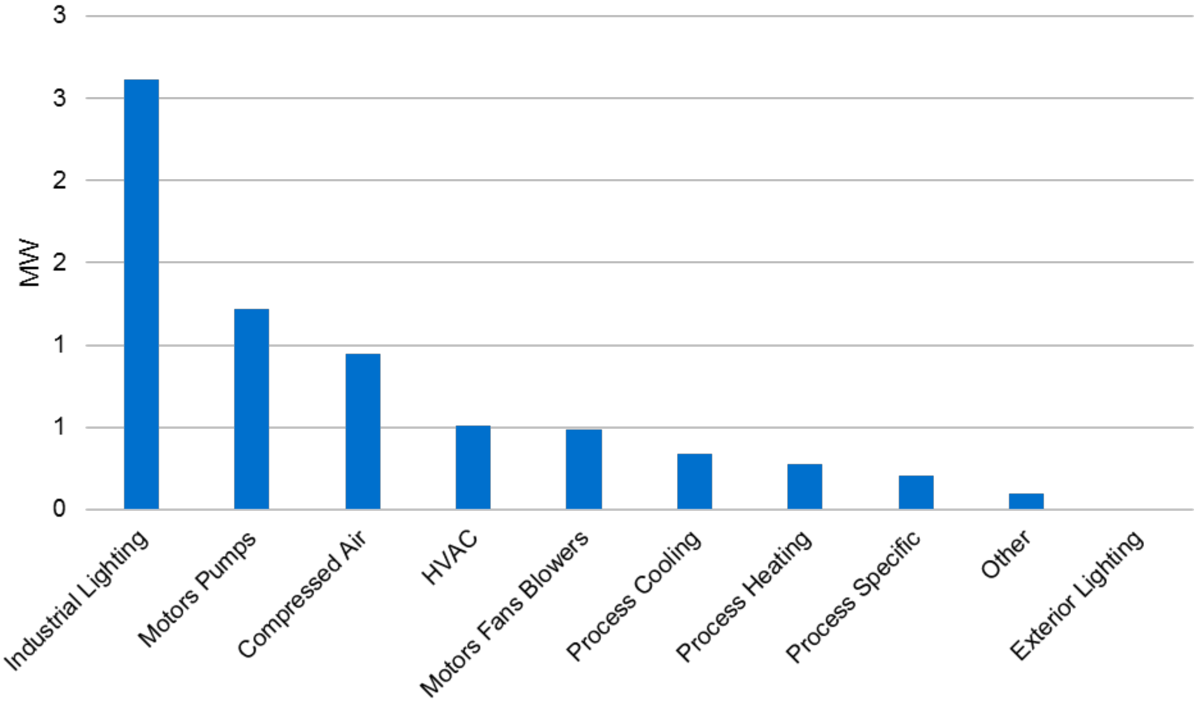
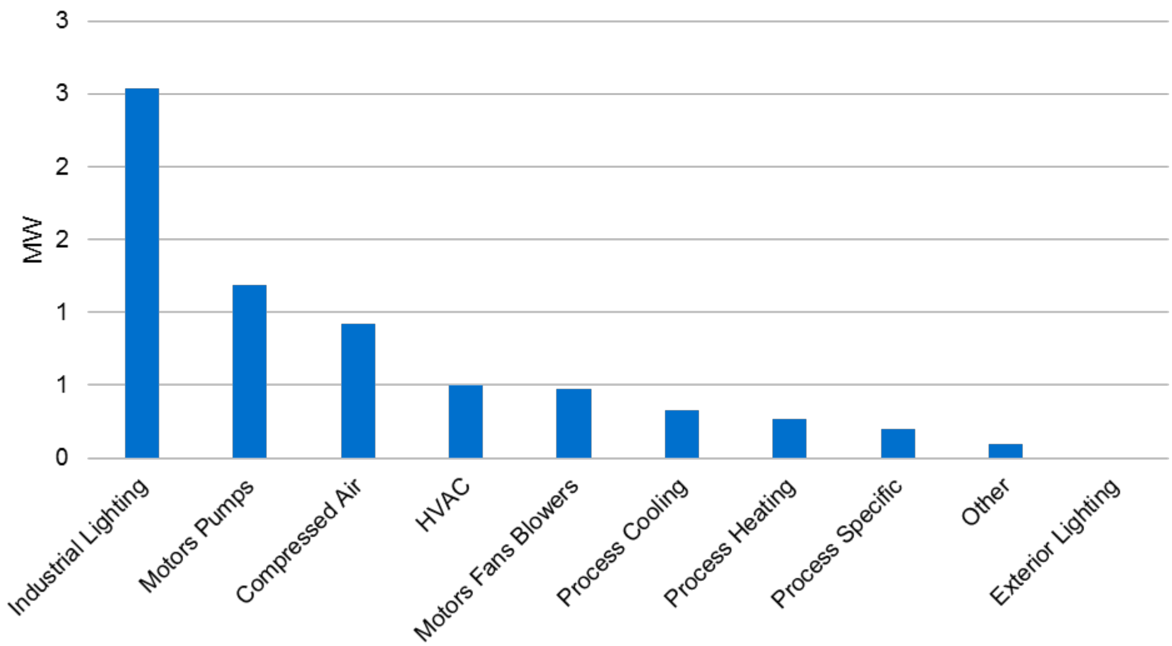


Figure 7-10: Industrial EE Achievable Potential by End-Use (Winter Peak Savings) – TRC Scenario



7.3 DR Achievable Potential

Nexant found that no Residential or small C&I measures passed the achievable potential screen for JEA. There were large C&I measures that passed the achievable potential screen, but Nexant did not find any potential incremental to JEA's existing large C&I DR programs. Therefore, Nexant found 0 MW of DR achievable potential for JEA.

7.4 DSRE Achievable Potential

Nexant found there to be no cost-effective achievable potential attainable in JEA for PV systems, battery storage systems, or CHP systems for the TRC-scenario or the RIM-scenario.

8 Appendices

Appendix A EE MPS Measure List

For information on how Nexant developed this list, please see Section 4.

Measures that are new for the 2019 MPS are indicated with an asterisk.

A.1 Residential Measures

Measure	End-Use	Description	Baseline
Energy Star Clothes Dryer	Appliances	One Electric Resistance Clothes Dryer meeting current ENERGY STAR® Standards	One Clothes Dryer meeting Federal Standard
Energy Star Clothes Washer	Appliances	One Clothes Washer meeting current ENERGY STAR® Standards	One Clothes Washer meeting Federal Standard
Energy Star Dishwasher	Appliances	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Energy Star Freezer	Appliances	One Freezer meeting current ENERGY STAR® Standards	One Freezer meeting Federal Standard
Energy Star Refrigerator	Appliances	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Heat Pump Clothes Dryer*	Appliances	One Heat Pump Clothes Dryer	One Clothes Dryer meeting Federal Standard
Removal of 2nd Refrigerator-Freezer	Appliances	No Refrigerator	Current Market Average Refrigerator
High Efficiency Convection Oven*	Cooking	One Full-Size Convection Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade Full-Size Oven
High Efficiency Induction Cooktop*	Cooking	One residential induction cooktop	One standard residential electric cooktop
Drain Water Heat Recovery*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Heat Pump Water Heater (EF=2.50)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Heat Trap	Domestic Hot Water	Heat Trap	Existing Water Heater without heat trap
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-5	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Standard Efficiency Storage Tank Water Heater
Low Flow Showerhead	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 1.84)	Code-Compliant 50 Gallon Electric Resistance Water Heater
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Water Heater Blanket	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Water Heater Thermostat Setback	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Temperature Set-point of 125°F	Market Average 50 Gallon Electric Resistance Water Heater, Temp. Set-point = 130°F
Water Heater Timeclock	Domestic Hot Water	Water Heater Timeclock	Existing Water Heater without time clock

Measure	End-Use	Description	Baseline
Energy Star Air Purifier*	Electronics	One 120 CFM Air Purifier meeting current ENERGY STAR® Standards	One Standard Air Purifier
Energy Star Audio-Video Equipment	Electronics	One DVD/Blu-Ray Player meeting current ENERGY STAR® Standards	One Market Average DVD/Blu-Ray Player
Energy Star Imaging Equipment*	Electronics	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star Personal Computer	Electronics	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star TV	Electronics	One Television meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Television
Smart Power Strip	Electronics	Smart plug strips for entertainment centers and home office	Standard entertainment center or home office usage, no smart strip controls
CFL - 15W Flood	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL - 15W Flood (Exterior)	Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
CFL-13W	Lighting	CFL (assume 13W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
CFL-23W	Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
Exterior Lighting Controls*	Lighting	Timer on Outdoor Lighting, Controlling 120 Watts	120 Watts of Lighting, Manually Controlled
Interior Lighting Controls*	Lighting	Switch Mounted Occupancy Sensor, 120 Watts Controlled	120 Watts of Lighting, Manually Controlled
LED - 14W	Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED - 9W	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (60w equivalent)	EISA-2020 compliant baseline lamp (60W equivalent)
LED - 9W Flood	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED - 9W Flood (Exterior)	Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA Compliant Halogen Lamp
LED Specialty Lamps-5W Chandelier*	Lighting	5 W Chandelier LED	Standard incandescent chandelier lamp
Linear LED*	Lighting	Linear LED Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Low Wattage T8 Fixture	Lighting	Low Wattage (28w) T8 Lamps in Linear Fluorescent Fixture	Standard (32w) T8 lamps in Linear Fluorescent Fixture
Energy Star Bathroom Ventilating Fan*	Miscellaneous	Bathroom Exhaust Fan meeting current ENERGY STAR Standards	Bathroom Exhaust Fan meeting Federal Standard
Energy Star Ceiling Fan*	Miscellaneous	60" Ceiling Fan Meeting current ENERGY STAR Standards	Standard, non-ENERGYSTAR Ceiling Fan
Energy Star Dehumidifier*	Miscellaneous	One Dehumidifier meeting current ENERGY STAR Standards	One Dehumidifier meeting Federal Standard
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Solar Powered Pool Pumps	Miscellaneous	Solar Powered Pool Pump	Single Speed Pool Pump Motor
Two Speed Pool Pump	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor

Measure	End-Use	Description	Baseline
15 SEER Central AC	Space Cooling	15 SEER Central AC	Code-Compliant Central AC, 14 SEER
16 SEER Central AC	Space Cooling	16 SEER Central AC	Code-Compliant Central AC, 14 SEER
17 SEER Central AC	Space Cooling	17 SEER Central AC	Code-Compliant Central AC, 14 SEER
18 SEER Central AC	Space Cooling	18 SEER Central AC	Code-Compliant Central AC, 14 SEER
21 SEER Central AC	Space Cooling	21 SEER Central AC	Code-Compliant Central AC, 14 SEER
Central AC Tune Up	Space Cooling	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing Typical Central AC without Regular Maintenance/tune-up
Energy Star Room AC	Space Cooling	Room AC meeting current ENERGY STAR standards	Code-Compliant Room AC
Solar Attic Fan*	Space Cooling	Standard Central Air Conditioning with Solar Attic Fan	Standard Central Air Conditioning, No Solar Attic Fan
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	14 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
15 SEER Air Source Heat Pump	Space Cooling, Space Heating	15 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
16 SEER Air Source Heat Pump	Space Cooling, Space Heating	16 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
17 SEER Air Source Heat Pump	Space Cooling, Space Heating	17 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
18 SEER Air Source Heat Pump	Space Cooling, Space Heating	18 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER Air Source Heat Pump	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating	21 SEER Air Source Heat Pump	Base AC, 14 SEER, Electric resistance heating, 3.41 HSPF
Air Sealing-Infiltration Control	Space Cooling, Space Heating	Standard Heating and Cooling System with Improved Infiltration Control	Standard Heating and Cooling System with Standard Infiltration Control
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic, existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork	Standard Electric Heating and Central AC with Uninsulated Ductwork
Duct Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard Electric Heating and Central AC with typical duct leakage
Energy Star Certified Roof Products	Space Cooling, Space Heating	Energy Star Certified Roof Products	Standard Black Roof
Energy Star Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Energy Star Windows	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Version Requirements	100ft2 of Window current FL energy code requirements

Measure	End-Use	Description	Baseline
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-13)	Standard Electric Heating and Central AC with Uninsulated Floor
Green Roof*	Space Cooling, Space Heating	Vegetated Roof Surface on top of Standard Roof	Standard Black Roof
Ground Source Heat Pump*	Space Cooling, Space Heating	Ground Source Heat Pump	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Heat Pump Tune Up	Space Cooling, Space Heating	System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Standard Heating and Cooling System without Regular Maintenance/tune-up
Home Energy Management System*	Space Cooling, Space Heating	Typical HVAC by Building Type Controlled by Home Energy Management System (smart hub and hub-connected thermostat)	Typical HVAC by Building Type, Manually Controlled
Programmable Thermostat	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Radiant Barrier	Space Cooling, Space Heating	Radiant Barrier	No radiant barrier
Sealed crawlspace*	Space Cooling, Space Heating	Encapsulated and semi-conditioned crawlspace	Naturally vented, unconditioned crawlspace
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1982-1985) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating	Open cell spray foam along roofline in older (pre-1982) homes	Existing ceiling insulation based on building code at time of construction
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating	Open cell spray foam along roofline in existing (1986-2016) homes	Existing ceiling insulation based on building code at time of construction
Storm Door*	Space Cooling, Space Heating	21ft2 of Opaque Door meeting current Energy Star Version Requirements	21ft2 of Opaque Door meeting current FL Code Requirements
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant ASHP, 14 SEER, 8.2 HSPF
Wall Insulation	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation (R-13)	Market Average Existing Exterior Above-Grade Wall Insulation
Window Sun Protection	Space Cooling, Space Heating	Window Film Applied to Standard Window	Standard Window with below Code Required Minimum SHGC
HVAC ECM Motor	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace

A.2 Commercial Measures

Measure	End-Use	Description	Baseline
Efficient Exhaust Hood	Cooking	Kitchen ventilation with automatically adjusting fan controls	Kitchen ventilation with constant speed ventilation motor
Energy Star Commercial Oven	Cooking	One 12-Pan Combination Oven meeting current ENERGY STAR® Standards	One Standard Economy-Grade 12-Pan Combination Oven
Energy Star Fryer	Cooking	One Standard Vat Electric Fryer meeting current ENERGY STAR® Standards	One Standard Economy-Grade Standard Vat Electric Fryer
Energy Star Griddle	Cooking	One Griddle meeting current ENERGY STAR® Standards	One Conventional Griddle
Energy Star Hot Food Holding Cabinet	Cooking	One Hot Food Holding Cabinet meeting current ENERGY STAR® Standards	One Standard Hot Food Holding Cabinet
Energy Star Steamer	Cooking	One 4-Pan Electric Steamer meeting current ENERGY STAR® Standards	One Standard Economy-Grade 4-Pan Steamer
Induction Cooktops	Cooking	Efficient Induction Cooktop	One Standard Electric Cooktop
Drain Water Heat Recovery	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Drain Water Heat Exchanger	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater, No Drain Water Heat Recovery
Energy Star Commercial Dishwasher	Domestic Hot Water	One Dishwasher meeting current ENERGY STAR® Requirements	One Dishwasher meeting Federal Standard
Faucet Aerator	Domestic Hot Water	Low-flow lavatory faucet aerator, flow rate: 1.0 gpm	Federal lavatory flow rate standard, 1994, flow rate: 2.2 gpm
Heat Pump Water Heater	Domestic Hot Water	Efficient 50 Gallon Electric Heat Pump Water Heater	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Hot Water Circulation Pump Control	Domestic Hot Water	Recirculation Pump with Demand Control Mechanism	Uncontrolled Recirculation Pump
Hot Water Pipe Insulation	Domestic Hot Water	1' of Insulated Pipe in Unconditioned Spaces, Insulation of R-4	1' of Pipe in Unconditioned Spaces with Code Minimum of 1"of Insulation
Instantaneous Hot Water System*	Domestic Hot Water	Instantaneous Hot Water System	Code-Compliant Electric Storage Water Heater
Low Flow Shower Head*	Domestic Hot Water	Low-Flow Handheld Showerhead, Flow Rate: 1.50 gpm	Standard Handheld Showerhead, Flow Rate: 2.50 gpm
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water	Low-Flow Pre-Rinse Sprayer with Flow Rate of 1.6 gpm	Pre-Rinse Sprayer 10% Less Efficient than Federal Standard
Solar Water Heater	Domestic Hot Water	Solar Powered 50 Gallon Electric Resistance Water Heater (EF = 4.05)	Code-Compliant 50 Gallon Electric Heat Pump Water Heater
Tank Wrap on Water Heater*	Domestic Hot Water	50 Gallon Electric Resistance Water Heater with Insulated Tank Wrap (R-11)	Market Average 50 Gallon Electric Resistance Water Heater, No Tank Wrap
Thermostatic Shower Restriction Valve*	Domestic Hot Water	Hot Water Loop with 50 Gallon Electric Resistance Heater and Pressure Balance Shower Valves	Standard Hot Water Loop with 50 Gallon Electric Resistance Heater and Standard Shower Valves
Bi-Level Lighting Control (Exterior)*	Exterior Lighting	Bi-Level Controls on Exterior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL - 15W Flood	Exterior Lighting	CFL (assume 15W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
High Efficiency HID Lighting	Exterior Lighting	One Pulse Start Metal Halide 200W	Average Lumen Equivalent High Intensity Discharge Fixture
LED - 9W Flood	Exterior Lighting	LED (assume 9W) replacing EISA-2020 compliant baseline lamp (65w flood)	EISA-2020 compliant baseline lamp (65W flood)
LED Display Lighting (Exterior)*	Exterior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Exterior Lighting	Exterior Lighting	One 65W LED Canopy Light	Average Lumen Equivalent Exterior HID Area Lighting

Measure	End-Use	Description	Baseline
LED Parking Lighting*	Exterior Lighting	One 160W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Street Lights*	Exterior Lighting	One 210W LED Area Light	Average Lumen Equivalent Exterior HID Area Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting	LED Crosswalk Sign	Energy Star Qualifying Crosswalk Sign
Outdoor Lighting Controls	Exterior Lighting	Install Exterior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
Bi-Level Lighting Control (Interior)*	Interior Lighting	Bi-Level Controls on Interior Lighting, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
CFL-23W	Interior Lighting	CFL (assume 23W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
High Bay Fluorescent (T5)	Interior Lighting	One 4' 4-Lamp High Bay T5 Fixture	Average Lumen Equivalent High Intensity Discharge Fixture
High Bay LED	Interior Lighting	One 150W High Bay LED Fixture	Weighted Existing Fluorescent High-Bay Fixture
Interior Lighting Controls	Interior Lighting	Install Interior Photocell Dimming Controls, 500 Watts Controlled	500 Watts of Lighting, Manually Controlled
LED - 14W	Interior Lighting	LED (assume 14W) replacing EISA-2020 compliant baseline lamp (100w equivalent)	EISA-2020 compliant baseline lamp (100W equivalent)
LED Display Lighting (Interior)	Interior Lighting	One Letter of LED Signage, < 2ft in Height	One Letter of Neon or Argon-mercury Signage, < 2ft in Height
LED Linear - Fixture Replacement*	Interior Lighting	2x4 LED Troffer	Lumen-Equivalent 32-Watt T8 Fixture
LED Linear - Lamp Replacement	Interior Lighting	Linear LED (21W)	Lumen-Equivalent 32-Watt T8 Lamp
Premium T8 - Fixture Replacement	Interior Lighting	Reduced Wattage (28W) T8 Fixture with Low Ballast Factor	Lumen-Equivalent 32-Watt T8 Fixture
Premium T8 - Lamp Replacement	Interior Lighting	Replace Bulbs in T8 Fixture with Reduced Wattage (28W) Bulbs	32-Watt T8 Fixture
Efficient Battery Charger*	Miscellaneous	Single-phase Ferro resonant or silicon-controlled rectifier charging equipment with power conversion efficiency >=89% & maintenance power <= 10 W	FR or SCR charging stations with power conversion efficiency < 89% or > 10 W
Efficient Motor Belts*	Miscellaneous	Synchronous belt, 98% efficiency	Standard V-belt drive
ENERGY STAR Commercial Clothes Washer*	Miscellaneous	One Commercial Clothes Washer meeting current ENERGY STAR® Requirements	One Commercial Clothes Washer meeting Federal Standard
ENERGY STAR Water Cooler*	Miscellaneous	One Storage Type Hot/Cold Water Cooler Unit meeting current ENERGY STAR® Standards	One Standard Storage Type Hot/Cold Water Cooler Unit
Engine Block Timer*	Miscellaneous	Plug-in timer that activates engine block timer to reduce unnecessary run time	Engine block heater (typically used for backup generators) running continuously
Regenerative Drive Elevator Motor*	Miscellaneous	Regenerative drive produced energy when motor in overhaul condition	Standard motor
Solar Pool Heater*	Miscellaneous	Solar Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Heat Pump Pool Heater*	Miscellaneous	Heat Pump Swimming Pool Heater	Electric Resistance Swimming Pool Heater
Two Speed Pool Pump*	Miscellaneous	Dual Speed Pool Pump Motor	Single Speed Pool Pump Motor
Variable Speed Pool Pump*	Miscellaneous	Variable Speed Pool Pump Motor	Single Speed Pool Pump Motor
Solar Powered Pool Pump*	Miscellaneous	Solar Powered Pool Pump Motor	Single Speed Pool Pump Motor
VSD Controlled Compressor	Miscellaneous	Variable Speed Drive Control - includes all non-HVAC applications	Constant speed motors & pumps
Facility Energy Management System	Multiple End-Uses	Energy Management System deployed to automatically control HVAC, lighting, and other systems as applicable	Standard/manual facility equipment controls

Measure	End-Use	Description	Baseline
Retro-Commissioning*	Multiple End-Uses	Perform facility retro-commissioning, including assessment, process improvements, and optimization of energy-consuming equipment and systems at the facility	Comparable facility, no retro-commissioning
ENERGY STAR Imaging Equipment	Office Equipment	One imaging device meeting current ENERGY STAR® Standards	One non-ENERGY STAR® imaging device
Energy Star PCs	Office Equipment	One Personal Computer (desktop or laptop) meeting current ENERGY STAR® Standards	One non-ENERGY STAR® Personal Computer
Energy Star Servers	Office Equipment	One Server meeting current ENERGY STAR Standards	One Standard Server
Energy Star Uninterruptable Power Supply*	Office Equipment	Standard Desktop Plugged into Energy Star Uninterruptable Power Supply at 25% Load	Standard Desktop Plugged into Uninterruptable Power Supply at 25% Load
Network PC Power Management*	Office Equipment	One computer and monitor attached to centralized energy management system that controls when desktop computers and monitors plugged into a network power down to lower power states.	One computer and monitor, manually controlled
Server Virtualization	Office Equipment	2 Virtual Host Server	20 Single Application Servers
Smart Strip Plug Outlet*	Office Equipment	One Smart Strip Plug Outlet	One Standard plug strip/outlet
Anti-Sweat Controls	Refrigeration	One Medium Temperature Reach-In Case with Anti-Sweat Heater Controls	One Medium Temperature Reach-In Case without Anti-Sweat Heater Controls
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration	One Medium Temperature Walk-In Refrigerator Door with Auto-Closer	One Medium Temperature Walk-In Refrigerator Door without Auto-Closer
Demand Defrost	Refrigeration	Walk-In Freezer System with Demand-Controlled Electric Defrost Cycle	Walk-In Freezer System with Timer-Controlled Electric Defrost Cycle
Energy Star Commercial Glass Door Freezer*	Refrigeration	One Glass Door Freezer meeting current ENERGY STAR® Standards	One Glass Door Freezer meeting Federal Standards
Energy Star Commercial Glass Door Refrigerator*	Refrigeration	One Glass Door Refrigerator meeting current ENERGY STAR® Standards	One Glass Door Refrigerator meeting Federal Standards
Energy Star Commercial Solid Door Freezer*	Refrigeration	One Solid Door Freezer meeting current ENERGY STAR® Standards	One Solid Door Freezer meeting Federal Standards
Energy Star Commercial Solid Door Refrigerator*	Refrigeration	One Solid Door Refrigerator meeting current ENERGY STAR® Standards	One Solid Door Refrigerator meeting Federal Standards
Energy Star Ice Maker	Refrigeration	One Continuous Self-Contained Ice Maker meeting current ENERGY STAR® Standards (8.9 kWh / 100 lbs of ice)	One Continuous Self-Contained Ice Maker meeting Federal Standard
Energy Star Refrigerator*	Refrigeration	One Refrigerator meeting current ENERGY STAR® Standards	One Refrigerator meeting Federal Standard
Energy Star Vending Machine	Refrigeration	One Refrigerated Vending Machine meeting current ENERGY STAR® Standards	One standard efficiency Refrigerated Vending Machine
Floating Head Pressure Controls	Refrigeration	Medium-Temperature Refrigeration System with 5HP Compressor and Adjustable Condenser Head Pressure Control Valve	Medium-Temperature Refrigeration System with 5 HP Compressor without Adjustable Condenser Head Pressure Control Valve
Freezer-Cooler Replacement Gaskets	Refrigeration	New Door Gasket on One-Door Medium Temperature Reach-In Case	Worn or Damaged Door Gasket on One-Door Medium Temperature Reach-In Case
High Efficiency Refrigeration Compressor	Refrigeration	High Efficiency Refrigeration Compressors	Existing Compressor
High R-Value Glass Doors	Refrigeration	Display Door with High R-Value, One-Door Medium Temperature Reach-In Case	Standard Door, One-Door Medium Temperature Reach-In Case
Night Covers for Display Cases	Refrigeration	One Open Vertical Case with Night Covers	One Existing Open Vertical Case, No Night Covers

Measure	End-Use	Description	Baseline
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration	Medium Temperature Reach-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration	Medium Temperature Walk-In Case with Electronically Commutated Evaporator Fan Motor	Medium Temperature Reach-In Case with Permanent Split Capacitor Evaporator Fan Motor
Refrigerated Display Case LED Lighting*	Refrigeration	60" Refrigerated Case LED Strip	Lumen-Equivalent 32-Watt T8 Fixture
Refrigerated Display Case Lighting Controls*	Refrigeration	Occupancy Sensors for Refrigerated Case Lighting to reduce run time	Market-Share Weighted Existing Linear Fluorescent Fixture
Strip Curtains for Walk-ins	Refrigeration	Walk-in cooler with strip curtains at least 0.06 inches thick covering the entire area of the doorway	Walk-in cooler without strip curtains
Chilled Water Controls Optimization*	Space Cooling	Deploy an algorithm package on the chiller to totalize the available power inputs and calculate the cooling load, and accordingly apply small set-point adjustments to the plant control system	Standard chilled water controls
Chilled Water System - Variable Speed Drives	Space Cooling	10HP Chilled Water Pump with VFD Control	10HP Chilled Water Pump Single Speed
Cool Roof	Space Cooling	Cool Roof - Includes both DX and chiller cooling systems	Code-Compliant Flat Roof
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling	High Efficiency Chiller (Air Cooled, 50 tons)	Code-Compliant Air Cooled Positive Displacement Chiller, 50 Tons
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling	Water Cooled Centrifugal Chiller with Integral VFD, 200 Tons	Code-Compliant Water Cooled Centrifugal Chiller, 200 Tons
Thermal Energy Storage	Space Cooling	Deploy thermal energy storage technology (ice harvester, etc.) to shift load	Code compliant chiller
Air Curtains*	Space Cooling, Space Heating	Air Curtain across door opening	Door opening with no air curtain
Airside Economizer*	Space Cooling, Space Heating	Airside Economizer	No economizer
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating	Blown-in insulation in ceiling cavity/attic	Market Average Existing Ceiling Insulation in older steep slope, residential style commercial building
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating	Code-Compliant VRF utilizing Dedicated Outdoor Air System	Code-Compliant PTHP
Destratification Fans*	Space Cooling, Space Heating	Destratification Fans improve temperature distribution by circulating warmer air from the ceiling back down to the floor level	No destratification fan
Duct Insulation	Space Cooling, Space Heating	Standard Electric Heating and Central AC with Insulated Ductwork (R-8)	Standard Electric Heating and Central AC with Uninsulated Ductwork (R-4)
Duct Sealing Repair	Space Cooling, Space Heating	Duct Repair to eliminate/minimize leaks, includes testing and sealing	Standard AC with typical duct leakage
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating	Unitary Cooling Equipment that Incorporates Energy Recovery	Current Market Packaged or Split DX Unit

Measure	End-Use	Description	Baseline
Facility Commissioning*	Space Cooling, Space Heating	Perform facility commissioning to optimize building operations in new facilities	Standard new construction facility with no commissioning
Floor Insulation*	Space Cooling, Space Heating	Increased Floor Insulation (R-19)	Market Average Existing Floor Insulation
Geothermal Heat Pump	Space Cooling, Space Heating	Geothermal Heat Pump	Code-Compliant Air Source Heat Pump
Green Roof*	Space Cooling, Space Heating	Green Roof	Code-Compliant Flat Roof
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating	Water Cooled Positive Displacement Chiller with Integral VFD, 100 Tons	Code-Compliant Water Cooled Positive Displacement Chiller, 100 Tons
High Efficiency Data Center Cooling*	Space Cooling, Space Heating	High Efficiency CRAC (computer room air conditioner)	Standard Efficiency CRAC
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating	High Efficiency DX Unit, 15 tons	Code-Compliant Packaged or Split DX Unit, 15 Tons
High Efficiency PTAC	Space Cooling, Space Heating	High Efficiency PTAC	Code-Compliant PTAC
High Efficiency PTHP	Space Cooling, Space Heating	High Efficiency PTHP	Code-Compliant PTHP
Hotel Card Energy Control Systems	Space Cooling, Space Heating	Guest Room HVAC Unit Controlled by Hotel-Key-Card Activated Energy Control System	Guest Room HVAC Unit, Manually Controlled by Guest
HVAC tune-up	Space Cooling, Space Heating	PTAC/PTHP system tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing PTAC/PTHP without Regular Maintenance/tune-up
HVAC tune-up_RTU	Space Cooling, Space Heating	Rooftop Unit (RTU) System tune-up, including coil cleaning, refrigerant charging, and other diagnostics	Existing typical RTU without Regular Maintenance/tune-up
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating	Reduced leakage through caulking, weather-stripping	Standard Heating and Cooling System with Moderate Infiltration
Low U-Value Windows*	Space Cooling, Space Heating	100ft2 of Window meeting current Energy Star Standards	100ft2 of Window meeting Florida energy code
Programmable Thermostat*	Space Cooling, Space Heating	Pre-set programmable thermostat that replaces manual thermostat	Standard Heating and Cooling System with Manual Thermostat
Roof Insulation	Space Cooling, Space Heating	Roof Insulation (built-up roof applicable to flat/low slope roofs)	Code-Compliant Flat Roof
Smart Thermostat*	Space Cooling, Space Heating	Thermostats that include "smart" features such as occupancy sensors, geo-fencing, multi-zone sensors	Standard Heating and Cooling System with Manual Thermostat
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating	Variable Refrigerant Flow (VRF) HVAC Systems	Code-Compliant PTHP
Wall Insulation*	Space Cooling, Space Heating	Increased Exterior Above-Grade Wall Insulation	Market Average Existing Exterior Above-Grade Wall Insulation
Warehouse Loading Dock Seals*	Space Cooling, Space Heating	Seals to reduce infiltration losses at loading dock	Loading dock with no seals
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating	The heat reclaim system transfers waste heat from refrigeration system to space heating or hot water	No heat recovery
Waterside Economizer*	Space Cooling, Space Heating	Waterside Economizer	No economizer
Window Sun Protection	Space Cooling, Space Heating	Window Sun Protection (Includes sunscreen, film, tinting or overhang to minimize heat gain through window)	Standard Window with below Code Required Minimum SHGC
ECM Motors on Furnaces	Space Heating	Variable Speed Electronically Commutated Motor for an Electric Furnace	Permanent Split Capacitor Motor for Electric Furnace
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation	High Efficiency 10 HP Open-Drip Proof Motor, 4-Pole, 1800 RPM	10 HP Open-Drip Proof Motor with EPACT 1992 Efficiency

Measure	End-Use	Description	Baseline
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation	Enclosed Parking Garage Exhaust with CO Control	Constant Volume Enclosed Parking Garage Exhaust
Demand Controlled Ventilation	Ventilation and Circulation	Return Air System with CO2 Sensors	Standard Return Air System, No Sensors
High Speed Fans	Ventilation and Circulation	High Speed Fan, 24" - 35" Blade Diameter	Standard Speed Fan, 24" - 35" Blade Diameter
VAV System*	Ventilation and Circulation	Variable Air Volume Distribution System	Constant Air Volume Distribution System

A.3 Industrial Measures

Measure	End-Use	Description	Baseline
Building Envelope Improvements	HVAC	Facility envelope improvements to improve thermal efficiency. Individual improvements may include additional insulation, cool roof, infiltration reduction, improved fenestration efficiency	Typical existing facility
HVAC Equipment Upgrades	HVAC	Equipment upgrades to improve operating efficiency. Includes high efficiency HVAC equipment (including DX units and chillers), HVAC VFDs, economizers, ECM motors	Market average HVAC equipment at existing facilities
HVAC Recommissioning	HVAC	Diagnostic evaluation and optimization of facility HVAC system	Comparable facility, no retro-commissioning
HVAC Improved Controls	HVAC	Improved control technologies such as EMS, thermostats, demand controlled ventilation	Standard/manual HVAC controls
Efficient Lighting - High Bay	Industrial Lighting	Efficient high bay lighting fixtures, including HID and LED	Market average high bay lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting	Efficient interior lighting, including conversion to efficient linear fluorescent, LEDs, and delamping	Market average interior lighting
Lighting Controls – Interior*	Industrial Lighting	Improved control technologies for interior lighting, such as time clocks, bi-level fixture controls, photocell controls, and occupancy/vacancy sensors	Standard/manual interior lighting controls
Efficient Lighting – Exterior*	Exterior Lighting	Efficient exterior lighting, including exterior walkway lighting, pathway lighting, security lighting, and customer-owned street lighting	Market average exterior lighting
Lighting Controls - Exterior	Exterior Lighting	Improved control technologies for exterior lighting, such as time clocks, bi-level fixture controls, photocell controls, and motion sensors	Standard/manual exterior lighting controls
Compressed Air System Optimization	Compressed Air	Compressed air system improvements, including system optimization, appropriate sizing, minimizing air pressure, replace compressed air use with mechanical or electrical functions	Standard compressed air system operations
Compressed Air Controls	Compressed Air	Improved control technologies for compressed air system, including optimized distribution system, VFD controls	Standard compressed air system operations with manual controls
Compressed Air Equipment	Compressed Air	Equipment upgrades to improve operating efficiency, including motor replacement, integrated VFD compressed air systems, improved nozzles, receiver capacity additions	Market average compressed air equipment
Fan Improved Controls	Motors Fans Blowers	Improved fan control technologies	Standard/manual fan controls
Fan System Optimization	Motors Fans Blowers	Fan system optimization	Standard fan operation
Fan Equipment Upgrades	Motors Fans Blowers	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average fan equipment
Pump Improved Controls	Motors Pumps	Improved pump control technologies	Standard/manual pump controls
Pump System Optimization	Motors Pumps	Pump system optimization	Standard pump system operations

Measure	End-Use	Description	Baseline
Pump Equipment Upgrade	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, VFD installation	Market average pump equipment
Motor Equipment Upgrades	Motors Pumps	Equipment upgrades to improve operating efficiency, including motor replacement, efficient drives, ECM motors, VFD installation	Market average motors
Motor Improved Controls	Motors Pumps	Improved motor control technologies	Standard/manual motor controls
Motor Optimization	Motors Pumps	Motor system optimization, including replacing drive belts, electric actuators, pump/motor rewinds	Standard motor operation
Process Heat Improved Controls	Process Heating	Improved process heat control technologies	Standard/manual process heat controls
Process Heat System Optimization	Process Heating	Process heat system optimization	Standard process heat system operations
Process Heat Equipment Upgrade	Process Heating	Equipment upgrades to improve operating efficiency	Market average process heating equipment
Process Other Systems Optimization	Process Specific	Process other system optimization	Standard process other system operations
Process Other Equipment Upgrades	Process Specific	Equipment upgrades to improve operating efficiency of industry-specific process equipment, such as injection molders, extruders, and other machinery	Market average process equipment
Process Refrig System Optimization	Process Cooling	Process refrigeration system optimization, including ventilation optimization, demand defrost, and floating head pressure controls	Standard process refrigeration system operations
Process Refrig Controls*	Process Cooling	Improved process refrigeration control technologies	Standard/manual process refrigeration controls
Process Refrig Equipment Upgrade*	Process Cooling	Equipment upgrades to improve operating efficiency, including efficient refrigeration compressors, evaporator fan motors, and related equipment	Market average process refrigeration equipment
Plant Energy Management	Multiple End-Uses	Facility control technologies and optimization to improve energy efficiency, including the installation of high efficient equipment, controls, and implementing system optimization practices to improve plant efficiency	Standard/manual plant energy management practices

The following EE measures from the 2014 Technical Potential Study were eliminated from the current study:

A.4 2014 EE Measures Eliminated from Current Study

Sector	Measure	2014 End-Use
Residential	AC Heat Recovery Units	HVAC
Residential	HVAC Proper Sizing	HVAC
Residential	High Efficiency One Speed Pool Pump (1.5 hp)	Motor
Commercial	LED Exit Sign	Lighting-Exterior
Commercial	High Pressure Sodium 250W Lamp	Lighting-Interior
Commercial	PSMH, 250W, magnetic ballast	Lighting-Interior
Industrial	Compressed Air-O&M	Compressed Air
Industrial	Fans - O&M	Fans
Industrial	Pumps - O&M	Pumps
Industrial	Bakery - Process (Mixing) - O&M	Process Other
Industrial	O&M/drives spinning machines	Process Other
Industrial	O&M - Extruders/Injection Moulding	Process Other

Appendix B DR MPS Measure List

B.1 Residential Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Water heater switches	Direct load control	Summer and Winter	Load control switch that is installed on a water heater
Pool pump switches	Direct load control	Summer and Winter	Load control program with switch installed on pool pump
Room AC*	Direct load control	Summer	Load control program that is focused on room AC units rather than central AC

B.2 Small C&I Measures

Measure	Type	Season	Measure Description
Central air conditioner - Load Shed	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central Heating - Load Shed*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to shed AC unit load during peak usage period.
Central air conditioner - 50% cycling	Direct load control	Summer	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Central Heating - 50% cycling*	Direct load control	Winter	Direct load control program where utility provides day ahead notification that it will send remote signal to cycle AC unit during peak usage period
Smart thermostats - Utility Installation*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
Smart thermostats – BYOT*	Direct load control	Summer and Winter	Similar to AC load control program, but allows customers to participate using a compatible smart thermostat rather than an AC switch
CPP + Tech	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.

B.3 Large C&I Measures

Measure	Type	Season	Measure Description
CPP + Tech*	Pricing	Summer and Winter	Electricity rate that varies based on time of day. Can be same rate schedule for every day during a given season (time of use, or TOU) and with critical peak pricing (CPP) days when peak period rates are substantially higher for a limited number of days per year (customers receive advance notification of CPP event). Customers also receive technology that they can pre-program to curtail load when an event is called.
Auto DR*	Utility-controlled loads	Summer and Winter	Custom load control of specific end-uses/processes that is triggered by utility signal to building management system; customer can sometimes opt-out of specific events
Firm Service Level	Contractual	Summer and Winter	Customer commits to a maximum usage level during peak periods and, when notified by the utility, agrees to cut usage to that level.
Guaranteed Load Drop*	Contractual	Summer and Winter	Customer agrees to reduce usage by an agreed upon amount when notified

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix C DSRE Measure List

C.1 Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

C.2 Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.

Appendix D Customer Demand Characteristics

Customer demand on peak days was analyzed by rate classes within each sector. Outputs presentation includes load shapes on peak days and average days, along with the estimates of technical potential by end-uses. The two end-uses, Air Conditioning and Heating, were studied for both residential and small C&I customers; however, in residential sector, another two end-uses were also incorporated into the analyses, which are Water Heaters and Pool Pumps.

Residential and Small C&I

Air Conditioning (Residential and Small C&I)

The cooling load shapes on the summer peak weekday and average weekdays were generated from hourly load shapes from the JEA 2016 load research sample. A regression model was built to estimate relationship between load values and cooling degree days (CDD) (shown as *Equation (1)*). The p-values of the model and coefficient are both less than 0.05, which means that they are of statistically significance. The product of actual hourly CDD values and coefficient would be used as cooling load during that hour in terms of per customer.

Equation (1):

$$Load_t = CDD_t * \beta_1 + i.month + \varepsilon$$

Where:

t	Hours in each day in year 2016.
$Load_t$	Load occurred in each hour
CDD_t	Cooling Degree Day value associated with each hour
β_1	Change in average load per CDD
$i.month$	Nominal variable, month
ε	The error term

To study the peak technical potential, a peak day was selected if it has the hour with system peak load during summer period (among May to September). Technical potential for residential customers was then calculated as the aggregate consumption during that summer peak hour.

Space Heating (Residential and Small C&I)

Similar to the analyses for air conditioning, the heating load shapes on peak day and average days were obtained from the same hourly load research profile in 2016, and the peak day was defined as the day with system peak load during winter period. The regression model was modified to evaluate relationship between energy consumption and heating degree days (HDD) (shown as Equation (2)), but the technical potential was calculated in the same way as illustrated earlier.

Equation (2):

$$Load_t = HDD_t * \beta_1 + i.month + \varepsilon$$

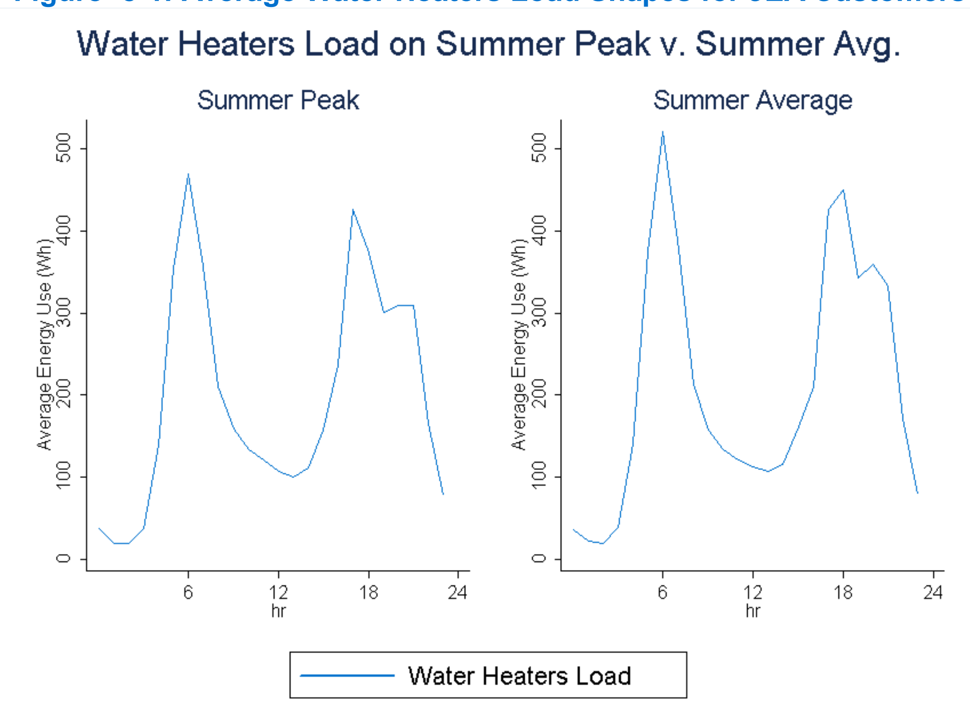
Where:

t	Hours in each day in year 2016
$Load_t$	Load occurred in each hour
HDD_t	Heating Degree Day value associated with each hour
β_1	Change in average load per HDD
$i.month$	Nominal variable, month
ε	The error term

Water Heaters (Residential Only)

Interval load data by end-use are not available for individual customers in JEA territory, so the analyses of water heaters was completed based on end-use metered data from CPS (San Antonio) Home Manager Program. As water heater loads were assumed to be relatively constant throughout the year (used for summer and winter), average load profiles for water heaters on CPS's 2013 system peak were assumed to be representative for residential customers in JEA.

Figure -8-1: Average Water Heaters Load Shapes for JEA Customers

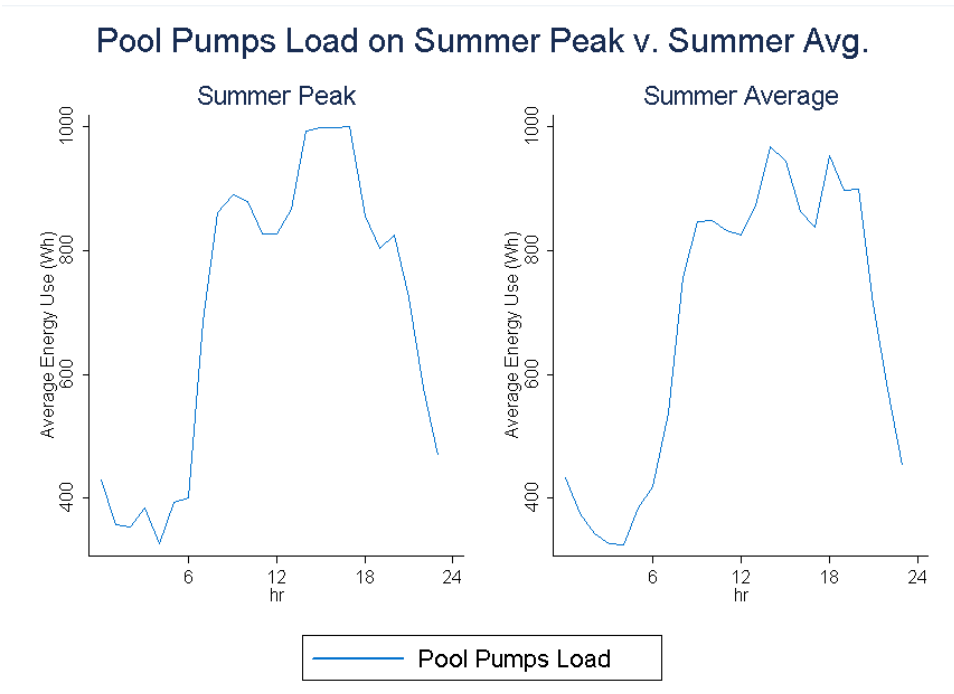


It is apparent from the Figure 8-3 that there is not much difference from peak usage and average usage, which proves that water heater loads have low sensitivity to weather. There are two spikes in a day, indicating two shifts when people would be likely to take showers. The time periods with highest consumption are 5:00 AM – 7:00 AM and 5:00 PM – 8:00 PM.

Pool Pumps (Residential Only)

Likewise, pool pump loads were assumed to be fairly constant throughout the summer time as well, so the average load profiles for pool pumps from CPS's project were also used to represent for residential customers in JEA.

Figure 8-2: Average Pool Pumps Load Shapes for JEA Customers



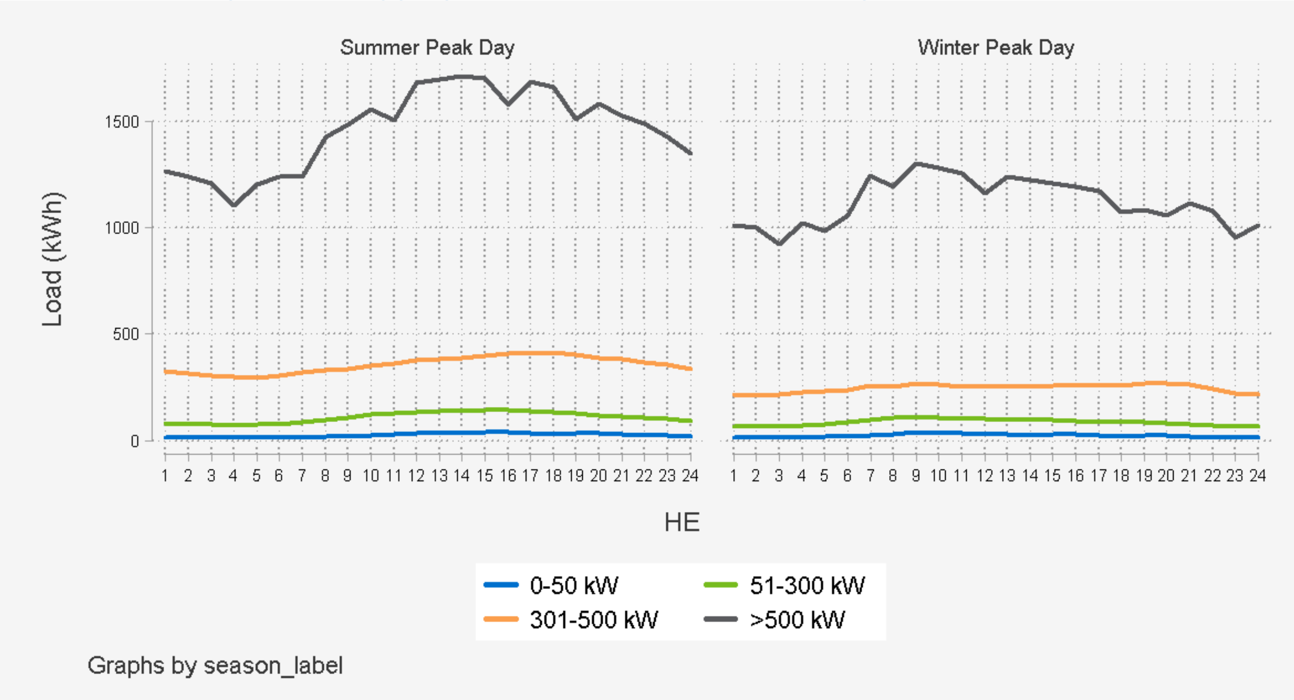
According to the Figure 8-4, the peak hours for pool pumps are 3:00 PM to 6:00 PM, and there is minor sensitivity with weather observed by comparing peak loads and average loads.

Large C&I Customers

Estimates of technical potential were based on one year of the load shapes for JEA GSD and GSLD rate classes. Customers were categorized into one of four max demand segments for the purpose of analysis. Technical potential for these customers was defined as the aggregate usage within each segment during summer and winter peak system hours.

Visual presentations of the results are shown below.

Figure 8-3: Aggregate Load Shapes for JEA Large C&I Customers



Appendix E Economic Potential Sensitivities

As part of the assessment of economic potential, the study included analysis of sensitivities related to free ridership, future fuel costs, and carbon scenarios, as follows:

Sensitivity #1: Higher Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast that is a component of the electric utility supply costs was adjusted to a “high fuel” scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	1	22
Total	1	22
TRC SCENARIO		
Residential	17	75
Commercial	50	883
Industrial	22	330
Total	89	1,288

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	1
Total	0	0	1
TRC SCENARIO			
Residential	120	70	476
Non-Residential	93	55	648
Total	213	125	1,123

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #2: Lower Fuel Prices

For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the fuel cost forecast was adjusted to a "low fuel" scenario.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	0	0
Total	0	0
TRC SCENARIO		
Residential	9	39
Commercial	39	601
Industrial	20	288
Total	68	928

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	62	56	309
Non-Residential	72	50	514
Total	133	106	823

DR measures were not included in the economic sensitivities as fuel prices do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #3: Shorter free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was reduced to one year or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	2	48
Total	2	48
TRC SCENARIO		
Residential	24	119
Commercial	63	1,207
Industrial	29	460
Total	116	1,786

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	3
Total	0	0	3
TRC SCENARIO			
Residential	132	81	551
Non-Residential	125	94	832
Total	257	176	1,383

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

No DSRE measures passed the economic screening for this sensitivity.

Sensitivity #4: Longer free-ridership exclusion periods

For this sensitivity, both the RIM and TRC scenarios were screened as described above, but the simple payback screening criteria was increased to three years or longer.

Sector	Unique Measures	Permutations
RIM SCENARIO		
Residential	0	0
Commercial	0	0
Industrial	1	2
Total	1	2
TRC SCENARIO		
Residential	11	44
Commercial	37	551
Industrial	20	146
Total	68	741

	Savings Potential		
	Summer Peak Demand (MW)	Winter Peak Demand (MW)	Energy (GWh)
RIM SCENARIO			
Residential	0	0	0
Non-Residential	0	0	0
Total	0	0	0
TRC SCENARIO			
Residential	115	64	342
Non-Residential	49	24	319
Total	164	88	661

DR measures were not included in the economic sensitivities as there is negligible customer incremental cost for DR measures and therefore differences in simple payback do not affect DR results.

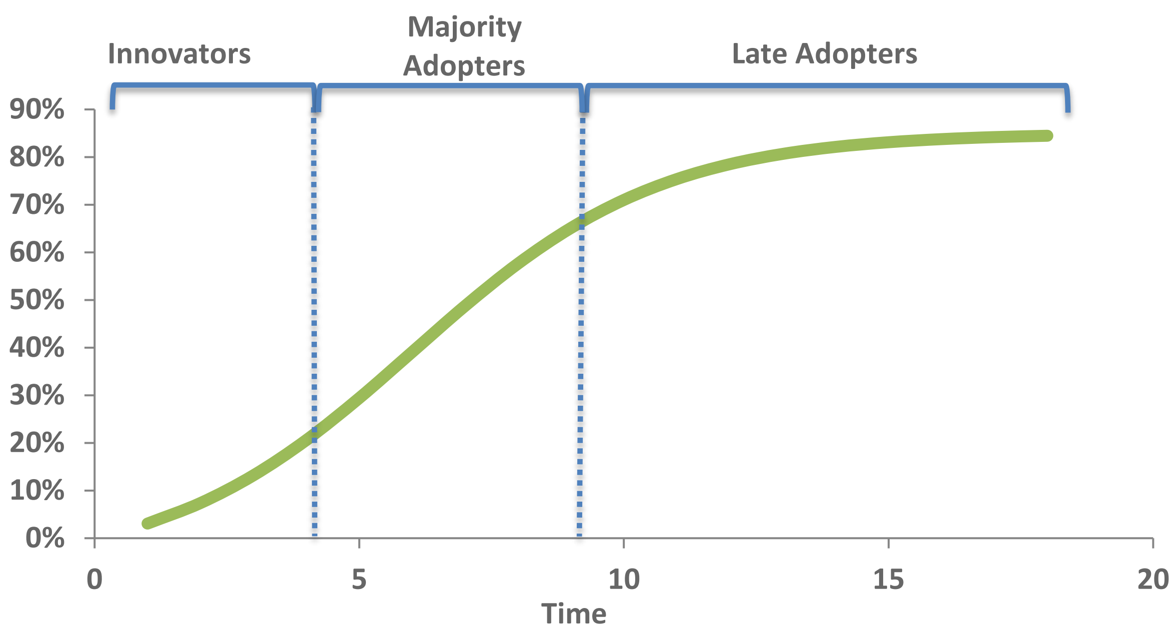
No DSRE measures passed the economic screening for this sensitivity.

Appendix F Market Adoption Rates

Nexant uses the Bass diffusion model to estimate measure adoption rates. The Bass diffusion model is a widely accepted mathematical description of how new products and innovations spread through an economy over time. The Bass Diffusion Model was originally published in 1969, and in 2004 was voted one of the top 10 most influential papers published in the 50 year history of the peer-reviewed publication *Management Science*[1]. More recent publications by Lawrence Berkeley National Laboratories have illustrated the application of this model to demand-side management in the energy industry[2]. Nexant applied the secondary data and research collected to develop and apply Bass Model diffusion parameters in the Florida jurisdiction.

According to product diffusion theory, the rate of market adoption for a product changes over time. When the product is introduced, there is a slow rate of adoption while customers become familiar with the product. When the market accepts a product, the adoption rate accelerates to relative stability in the middle of the product cycle. The end of the product cycle is characterized by a low adoption rate because fewer customers remain that have yet to adopt the product. This concept is illustrated in Figure 8-4.

Figure 8-4 Bass Model Market Penetration with Respect to Time



[1] Bass, F. 2004. Comments on "A New Product Growth for Model Consumer Durables the Bass Model" (sic). *Management Science* 50 (12_supplement): 1833-1840. http://pubsonline.informs.org/doi/abs/10.1287/mnsc.1040.0300. Accessed 01/08/2016.

[2] Buskirk, R. 2014. Estimating Energy Efficiency Technology Adoption Curve Elasticity with Respect to Government and Utility Deployment Program Indicators. LBNL Paper 6542E. Sustainable Energy Systems Group, Environmental Energy Technologies Division. Ernest Orlando Lawrence Berkeley National Laboratory. http://escholarship.org/uc/item/2vp2b7cm#page-1. Accessed 01/14/2016.

Figure 8-4 depicts the cumulative market adoption with respect to time, $S(t)$. The rate of adoption in a discrete time period is determined by external influences on the market, internal market conditions, and the number of previous adopters. The following equation describes this relationship:

$$\frac{dS(t)}{dt} = \left(p + \frac{q}{m} * S(t-1)\right) * (m - S(t-1))$$

Where:

$\frac{dS(t)}{dt} =$ the rate of adoption for any discrete time period, t

$p =$ external influences on market adoption

$q =$ internal influences on market adoption

$m =$ the maximum market share for the product

$S(t-1) =$ the cumulative market share of the product, from product introduction to time period *t-1*

Marketing is the quintessential external influence. The internal influences are characteristics of the product and market; for example: the underlying market demand for the product, word of mouth, product features, market structure, and other factors that determine the product's market performance. Nexant's approach applied literature reviews and analysis of secondary data sources to estimate the Bass model parameters. We then extrapolated the model to future years; the historic participation and predicted future market evolution serve as the program adoption curve applied to each proposed offering.

In order to estimate elasticity across different utility incentive levels, Nexant incorporated data from a regression analysis performed on EIA 861 data to understand the relative change in savings based on differing incentives. Per this analysis, a 100% increase in the total utility incentive equated to roughly a 44% increase in savings. This EIA-based elasticity rate was applied to the market adoption rates described above to estimate relative changes in market adoption for the range of maximum incentives where they vary from current or typical utility offerings.

Nexant's approach for estimating DR potential includes an additional step, based on our analysis of mature demand response programs. We estimate participation rates with the following process:

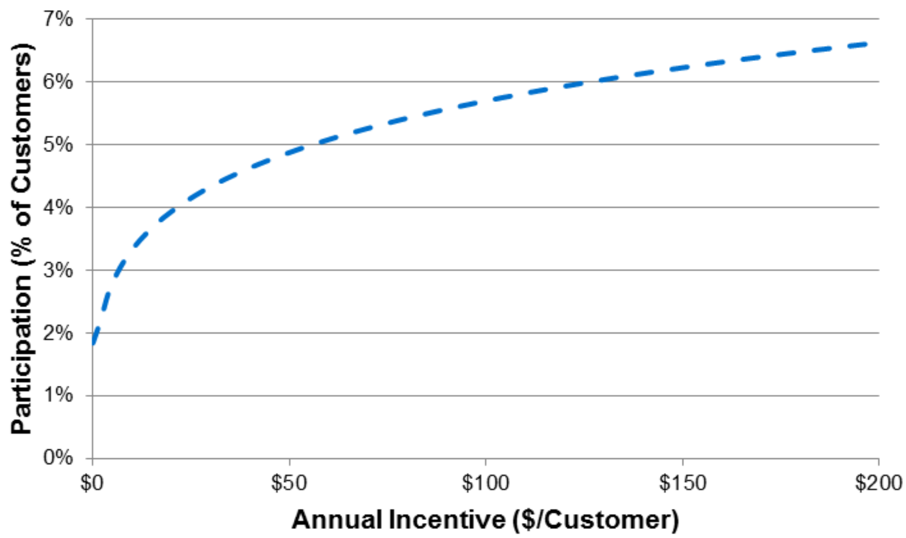
1) Use the results from prior analysis of DR program enrollment[3] to describe DR program participation as a function of customer segments and program attributes
2) Calibrate the model to reflect actual enrollment rates attained by existing JEA programs. To calibrate the models, the model constant is adjusted so that the model produces exactly the enrollment rates observed by JEA programs.

[3] Nexant Inc. Sacramento Municipal Utility District Demand Response Potential Study. October 20, 2015.

3) Predict participation rates using specific tactics and incentive levels for each measure based on the outcome of the RIM screening (or existing incentive levels).

As a demonstration of how marketing level and incentive affects participation in residential DR programs, Figure 8-5 shows the range of participation rates at a medium marketing level (phone outreach, mail, and email) as a function of the incentive paid to the customer. The curve shows that residential customers will respond to changes in incentive level if the incentive is relatively low, but are not as responsive to incentive levels after a certain point. This is why utility marketing strategies also play an important role in residential customer participation. This curve can also vary depending on the customer segments present in a utility's jurisdiction and other utility DR program characteristics (such as program age). To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-5: Residential Program Enrollment as a function of Incentive

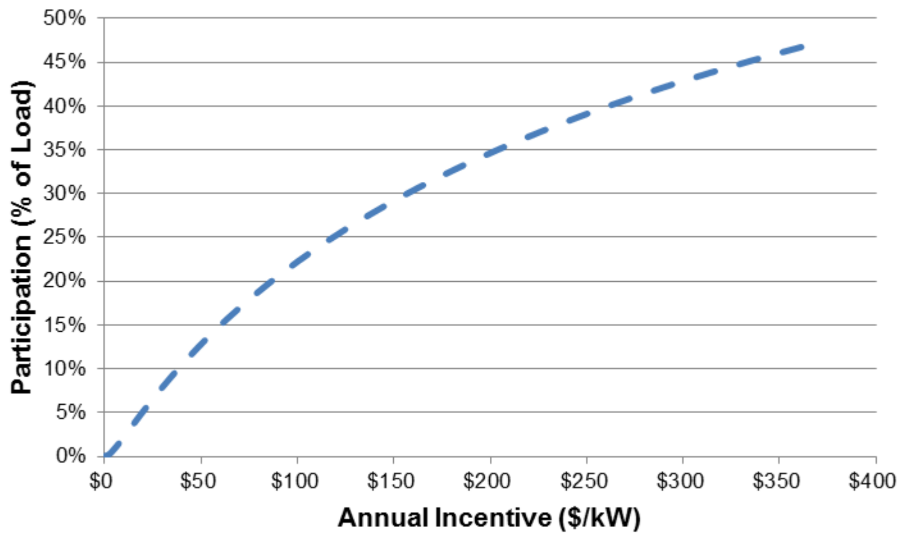


For small C&I customers, a similar approach was used to estimate participation levels. However, these customers tend to have lower enrollments than larger non-residential customers, and were scaled accordingly. Small C&I customers tend to exhibit roughly 40% of the uptake of residential customers, based on data from historic DR program analysis, which have extensively marketed these programs.

Large C&I customers were slightly different than the other two segments. Due to the large variation in customer size, participation was estimated as the percent of load enrolled in demand response rather than the number of customers. Figure 8-6 shows the participation level of large C&I customers as a function of incentive. Although customers grow less responsive to the incentive as it increases, they continue to be much more responsive to the annual incentive as it increases. This is why for technical potential, it is assumed that if a large C&I customer is paid a high enough incentive; they will curtail their entire load. Similar to the residential participation curve, this curve can vary based on existing participation rates for a utility as well as the industries that large C&I

customers belong to. To account for these differences, Nexant uses existing utility DR participation levels to calibrate its participation curve.

Figure 8-6: Large C&I Program Enrollment as a function of Incentive



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2019 Measure Lists

EE MPS Measure List

Residential Measures

Measures that are new for the 2019 MPS are indicated with an asterisk.

Measure	End-Use
Energy Star Clothes Dryer	Appliances
Energy Star Clothes Washer	Appliances
Energy Star Dishwasher	Appliances
Energy Star Freezer	Appliances
Energy Star Refrigerator	Appliances
Heat Pump Clothes Dryer*	Appliances
Removal of 2nd Refrigerator-Freezer	Appliances
High Efficiency Convection Oven*	Cooking
High Efficiency Induction Cooktop*	Cooking
Drain Water Heat Recovery*	Domestic Hot Water
Faucet Aerator	Domestic Hot Water
Heat Pump Water Heater	Domestic Hot Water
Heat Trap	Domestic Hot Water
Hot Water Pipe Insulation	Domestic Hot Water
Instantaneous Hot Water System*	Domestic Hot Water
Low Flow Showerhead	Domestic Hot Water
Solar Water Heater	Domestic Hot Water
Thermostatic Shower Restriction Valve*	Domestic Hot Water
Water Heater Blanket	Domestic Hot Water
Water Heater Thermostat Setback	Domestic Hot Water
Water Heater Timeclock	Domestic Hot Water
Energy Star Air Purifier*	Electronics
Energy Star Audio-Video Equipment	Electronics
Energy Star Imaging Equipment*	Electronics
Energy Star Personal Computer	Electronics
Energy Star TV	Electronics
Smart Power Strip	Electronics
CFL - 15W Flood	Lighting
CFL - 15W Flood (Exterior)	Lighting
CFL-13W	Lighting
CFL-23W	Lighting
Exterior Lighting Controls*	Lighting
Interior Lighting Controls*	Lighting

Measure	End-Use
LED - 14W	Lighting
LED - 9W	Lighting
LED - 9W Flood	Lighting
LED - 9W Flood (Exterior)	Lighting
LED Specialty Lamps-5W Chandelier*	Lighting
Linear LED*	Lighting
Low Wattage T8 Fixture	Lighting
Energy Star Bathroom Ventilating Fan*	Miscellaneous
Energy Star Ceiling Fan*	Miscellaneous
Energy Star Dehumidifier*	Miscellaneous
Heat Pump Pool Heater*	Miscellaneous
Solar Pool Heater*	Miscellaneous
Solar Powered Pool Pumps	Miscellaneous
Two Speed Pool Pump	Miscellaneous
Variable Speed Pool Pump	Miscellaneous
15 SEER Central AC	Space Cooling
16 SEER Central AC	Space Cooling
17 SEER Central AC	Space Cooling
18 SEER Central AC	Space Cooling
21 SEER Central AC	Space Cooling
Central AC Tune Up	Space Cooling
Energy Star Room AC	Space Cooling
Solar Attic Fan*	Space Cooling
14 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating
15 SEER Air Source Heat Pump	Space Cooling, Space Heating
16 SEER Air Source Heat Pump	Space Cooling, Space Heating
17 SEER Air Source Heat Pump	Space Cooling, Space Heating
18 SEER Air Source Heat Pump	Space Cooling, Space Heating
21 SEER Air Source Heat Pump	Space Cooling, Space Heating
21 SEER ASHP from base electric resistance heating	Space Cooling, Space Heating
Air Sealing-Infiltration Control	Space Cooling, Space Heating
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating
Duct Insulation	Space Cooling, Space Heating
Duct Repair	Space Cooling, Space Heating
Energy Star Certified Roof Products	Space Cooling, Space Heating

Measure	End-Use
Energy Star Door*	Space Cooling, Space Heating
Energy Star Windows	Space Cooling, Space Heating
Floor Insulation*	Space Cooling, Space Heating
Green Roof*	Space Cooling, Space Heating
Ground Source Heat Pump*	Space Cooling, Space Heating
Heat Pump Tune Up	Space Cooling, Space Heating
Home Energy Management System*	Space Cooling, Space Heating
Programmable Thermostat	Space Cooling, Space Heating
Radiant Barrier	Space Cooling, Space Heating
Sealed crawlspace*	Space Cooling, Space Heating
Smart Thermostat*	Space Cooling, Space Heating
Spray Foam Insulation(Base R12)	Space Cooling, Space Heating
Spray Foam Insulation(Base R19)	Space Cooling, Space Heating
Spray Foam Insulation(Base R2)	Space Cooling, Space Heating
Spray Foam Insulation(Base R30)	Space Cooling, Space Heating
Storm Door*	Space Cooling, Space Heating
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating
Wall Insulation	Space Cooling, Space Heating
Window Sun Protection	Space Cooling, Space Heating
HVAC ECM Motor	Space Heating

EE MPS Measure List

Commercial Measures

Measure	End-Use
Efficient Exhaust Hood	Cooking
Energy Star Commercial Oven	Cooking
Energy Star Fryer	Cooking
Energy Star Griddle	Cooking
Energy Star Hot Food Holding Cabinet	Cooking
Energy Star Steamer	Cooking
Induction Cooktops	Cooking
Drain Water Heat Recovery	Domestic Hot Water
Energy Star Commercial Dishwasher	Domestic Hot Water
Faucet Aerator	Domestic Hot Water
Heat Pump Water Heater	Domestic Hot Water
Hot Water Circulation Pump Control	Domestic Hot Water
Hot Water Pipe Insulation	Domestic Hot Water
Instantaneous Hot Water System*	Domestic Hot Water
Low Flow Shower Head*	Domestic Hot Water
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water
Solar Water Heater	Domestic Hot Water
Tank Wrap on Water Heater*	Domestic Hot Water
Thermostatic Shower Restriction Valve*	Domestic Hot Water
Bi-Level Lighting Control (Exterior)*	Exterior Lighting
CFL - 15W Flood	Exterior Lighting
High Efficiency HID Lighting	Exterior Lighting
LED - 9W Flood	Exterior Lighting
LED Display Lighting (Exterior)*	Exterior Lighting
LED Exterior Lighting	Exterior Lighting
LED Parking Lighting*	Exterior Lighting
LED Street Lights*	Exterior Lighting
LED Traffic and Crosswalk Lighting*	Exterior Lighting
Outdoor Lighting Controls	Exterior Lighting
Bi-Level Lighting Control (Interior)*	Interior Lighting
CFL-23W	Interior Lighting
High Bay Fluorescent (T5)	Interior Lighting
High Bay LED	Interior Lighting
Interior Lighting Controls	Interior Lighting
LED - 14W	Interior Lighting
LED Display Lighting (Interior)	Interior Lighting

Measure	End-Use
LED Linear - Fixture Replacement*	Interior Lighting
LED Linear - Lamp Replacement	Interior Lighting
Premium T8 - Fixture Replacement	Interior Lighting
Premium T8 - Lamp Replacement	Interior Lighting
Efficient Battery Charger*	Miscellaneous
Efficient Motor Belts*	Miscellaneous
ENERGY STAR Commercial Clothes Washer*	Miscellaneous
ENERGY STAR Water Cooler*	Miscellaneous
Engine Block Timer*	Miscellaneous
Regenerative Drive Elevator Motor*	Miscellaneous
Solar Pool Heater*	Miscellaneous
Heat Pump Pool Heater*	Miscellaneous
Two Speed Pool Pump*	Miscellaneous
Variable Speed Pool Pump*	Miscellaneous
Solar Powered Pool Pump*	Miscellaneous
VSD Controlled Compressor	Miscellaneous
Facility Energy Management System	Multiple End-Uses
Retro-Commissioning*	Multiple End-Uses
ENERGY STAR Imaging Equipment	Office Equipment
Energy Star PCs	Office Equipment
Energy Star Servers	Office Equipment
Energy Star Uninterruptable Power Supply*	Office Equipment
Network PC Power Management*	Office Equipment
Server Virtualization	Office Equipment
Smart Strip Plug Outlet*	Office Equipment
Anti-Sweat Controls	Refrigeration
Automatic Door Closer for Walk-in Coolers and Freezers	Refrigeration
Demand Defrost	Refrigeration
Energy Star Commercial Glass Door Freezer*	Refrigeration
Energy Star Commercial Glass Door Refrigerator*	Refrigeration
Energy Star Commercial Solid Door Freezer*	Refrigeration
Energy Star Commercial Solid Door Refrigerator*	Refrigeration
Energy Star Ice Maker	Refrigeration
Energy Star Refrigerator*	Refrigeration
Energy Star Vending Machine	Refrigeration
Floating Head Pressure Controls	Refrigeration
Freezer-Cooler Replacement Gaskets	Refrigeration
High Efficiency Refrigeration Compressor	Refrigeration
High R-Value Glass Doors	Refrigeration
Night Covers for Display Cases	Refrigeration

Measure	End-Use
PSC to ECM Evaporator Fan Motor (Reach-In)*	Refrigeration
PSC to ECM Evaporator Fan Motor (Walk-In, Refrigerator)	Refrigeration
Refrigerated Display Case LED Lighting*	Refrigeration
Refrigerated Display Case Lighting Controls*	Refrigeration
Strip Curtains for Walk-ins	Refrigeration
Chilled Water Controls Optimization*	Space Cooling
Chilled Water System - Variable Speed Drives	Space Cooling
Cool Roof	Space Cooling
High Efficiency Chiller (Air Cooled, 50 tons)	Space Cooling
High Efficiency Chiller (Water cooled-centrifugal, 200 tons)	Space Cooling
Thermal Energy Storage	Space Cooling
Air Curtains*	Space Cooling, Space Heating
Airside Economizer*	Space Cooling, Space Heating
Ceiling Insulation(R12 to R38)	Space Cooling, Space Heating
Ceiling Insulation(R19 to R38)	Space Cooling, Space Heating
Ceiling Insulation(R2 to R38)	Space Cooling, Space Heating
Ceiling Insulation(R30 to R38)	Space Cooling, Space Heating
Dedicated Outdoor Air System on VRF unit*	Space Cooling, Space Heating
Destratification Fans*	Space Cooling, Space Heating
Duct Insulation	Space Cooling, Space Heating
Duct Sealing Repair	Space Cooling, Space Heating
Energy Recovery Ventilation System (ERV)	Space Cooling, Space Heating
Facility Commissioning*	Space Cooling, Space Heating
Floor Insulation*	Space Cooling, Space Heating
Geothermal Heat Pump	Space Cooling, Space Heating
Green Roof*	Space Cooling, Space Heating
High Efficiency Chiller (Water cooled-positive displacement, 100 tons)	Space Cooling, Space Heating
High Efficiency Data Center Cooling*	Space Cooling, Space Heating
High Efficiency DX 135k- less than 240k BTU	Space Cooling, Space Heating
High Efficiency PTAC	Space Cooling, Space Heating
High Efficiency PTHP	Space Cooling, Space Heating
Hotel Card Energy Control Systems	Space Cooling, Space Heating
HVAC tune-up	Space Cooling, Space Heating
HVAC tune-up_RTU	Space Cooling, Space Heating
Infiltration Reduction - Air Sealing*	Space Cooling, Space Heating
Low U-Value Windows*	Space Cooling, Space Heating
Programmable Thermostat*	Space Cooling, Space Heating
Roof Insulation	Space Cooling, Space Heating
Smart Thermostat*	Space Cooling, Space Heating

Measure	End-Use
Variable Refrigerant Flow (VRF) HVAC Systems*	Space Cooling, Space Heating
Wall Insulation*	Space Cooling, Space Heating
Warehouse Loading Dock Seals*	Space Cooling, Space Heating
Water Cooled Refrigeration Heat Recovery*	Space Cooling, Space Heating
Waterside Economizer*	Space Cooling, Space Heating
Window Sun Protection	Space Cooling, Space Heating
ECM Motors on Furnaces	Space Heating
10HP Open Drip-Proof(ODP) Motor*	Ventilation and Circulation
CO Sensors for Parking Garage Exhaust*	Ventilation and Circulation
Demand Controlled Ventilation	Ventilation and Circulation
High Speed Fans	Ventilation and Circulation
VAV System*	Ventilation and Circulation

EE MPS Measure List

Industrial Measures

Measure	End-Use
Building Envelope Improvements	HVAC
HVAC Equipment Upgrades	HVAC
HVAC Recommissioning	HVAC
HVAC Improved Controls	HVAC
Efficient Lighting - High Bay	Industrial Lighting
Efficient Lighting - Other Interior Lighting	Industrial Lighting
Lighting Controls – Interior*	Industrial Lighting
Efficient Lighting – Exterior*	Exterior Lighting
Lighting Controls - Exterior	Exterior Lighting
Compressed Air System Optimization	Compressed Air
Compressed Air Controls	Compressed Air
Compressed Air Equipment	Compressed Air
Fan Improved Controls	Motors Fans Blowers
Fan System Optimization	Motors Fans Blowers
Fan Equipment Upgrades	Motors Fans Blowers
Pump Improved Controls	Motors Pumps
Pump System Optimization	Motors Pumps
Pump Equipment Upgrade	Motors Pumps
Motor Equipment Upgrades	Motors Pumps
Motor Improved Controls	Motors Pumps
Motor Optimization	Motors Pumps
Process Heat Improved Controls	Process Heating
Process Heat System Optimization	Process Heating
Process Heat Equipment Upgrade	Process Heating
Process Other Systems Optimization	Process Specific
Process Other Equipment Upgrades	Process Specific
Process Refrig System Optimization	Process Cooling
Process Refrig Controls*	Process Cooling
Process Refrig Equipment Upgrade*	Process Cooling
Plant Energy Management	Multiple End-Uses

DR MPS Measure List

Residential, Small C&I, Large C&I Measures

Residential Measures

Measure	Type
Central air conditioner - Load Shed	Direct load control
Central Heating - Load Shed	Direct load control
Central air conditioner - 50% cycling	Direct load control
Central Heating - 50% cycling	Direct load control
Smart thermostats - Utility Installation*	Direct load control
Smart thermostats – BYOT*	Direct load control
CPP + Tech	Pricing
Water heater switches	Direct load control
Pool pump switches	Direct load control
Room AC*	Direct load control

Small C&I Measures

Measure	Type
Central air conditioner - Load Shed	Direct load control
Central Heating - Load Shed*	Direct load control
Central air conditioner - 50% cycling	Direct load control
Central Heating - 50% cycling*	Direct load control
Smart thermostats - Utility Installation*	Direct load control
Smart thermostats – BYOT*	Direct load control
CPP + Tech	Pricing

Large C&I Measures

Measure	Type
CPP + Tech*	Pricing
Auto DR*	Utility-controlled loads
Firm Service Level	Contractual
Guaranteed Load Drop*	Contractual

DSRE Measure List

Residential & Non-Residential Measures

Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

Non-Residential Measures

Measure	Measure Description
PV System	Roof-mounted system, including multiple panels, AC/DC inverter, racking system, and electrical system interconnections
Battery Storage from PV System*	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell*	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine*	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine*	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine*	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine*	A turbine that extracts thermal energy from pressured steam to drive a generator

Comparison of 2014 Measure List to 2019 Measure List

EE MPS Measure List

Residential Measures

Residential Measures New for 2019

Measure	End-Use
Heat Pump Clothes Dryer	Appliances
High Efficiency Convection Oven	Cooking
High Efficiency Induction Cooktop	Cooking
Drain Water Heat Recovery	Domestic Hot Water
Instantaneous Hot Water System	Domestic Hot Water
Thermostatic Shower Restriction Valve	Domestic Hot Water
Energy Star Air Purifier	Electronics
Energy Star Imaging Equipment	Electronics
Exterior Lighting Controls	Lighting
Interior Lighting Controls	Lighting
LED Specialty Lamps-5W Chandelier	Lighting
Linear LED	Lighting
Energy Star Bathroom Ventilating Fan	Miscellaneous
Energy Star Ceiling Fan	Miscellaneous
Energy Star Dehumidifier	Miscellaneous
Heat Pump Pool Heater	Miscellaneous
Solar Pool Heater	Miscellaneous
Solar Attic Fan	Space Cooling
Energy Star Door	Space Cooling, Space Heating
Floor Insulation	Space Cooling, Space Heating
Green Roof	Space Cooling, Space Heating
Ground Source Heat Pump	Space Cooling, Space Heating
Home Energy Management System	Space Cooling, Space Heating
Sealed crawlspace	Space Cooling, Space Heating
Smart Thermostat	Space Cooling, Space Heating
Storm Door	Space Cooling, Space Heating
Variable Refrigerant Flow (VRF) HVAC Systems	Space Cooling, Space Heating

Residential 2014 EE Measures Eliminated from Current Study

Measure	2014 End-Use
AC Heat Recovery Units	HVAC
HVAC Proper Sizing	HVAC
High Efficiency One Speed Pool Pump (1.5 hp)	Motor

Commercial Measures New for 2019

Measure	End-Use
Instantaneous Hot Water System	Domestic Hot Water
Low Flow Shower Head	Domestic Hot Water
Low-Flow Pre-Rinse Sprayers	Domestic Hot Water
Solar Water Heater	Domestic Hot Water
Tank Wrap on Water Heater	Domestic Hot Water
Thermostatic Shower Restriction Valve	Domestic Hot Water
Bi-Level Lighting Control (Exterior)	Exterior Lighting
LED Display Lighting (Exterior)	Exterior Lighting
LED Parking Lighting	Exterior Lighting
LED Street Lights	Exterior Lighting
LED Traffic and Crosswalk Lighting	Exterior Lighting
Bi-Level Lighting Control (Interior)	Interior Lighting
LED Linear - Fixture Replacement	Interior Lighting
Efficient Battery Charger	Miscellaneous
Efficient Motor Belts	Miscellaneous
ENERGY STAR Commercial Clothes Washer	Miscellaneous
ENERGY STAR Water Cooler	Miscellaneous
Engine Block Timer	Miscellaneous
Regenerative Drive Elevator Motor	Miscellaneous
Solar Pool Heater	Miscellaneous
Heat Pump Pool Heater	Miscellaneous
Two Speed Pool Pump	Miscellaneous
Variable Speed Pool Pump	Miscellaneous
Solar Powered Pool Pump	Miscellaneous
Retro-Commissioning	Multiple End-Uses
Energy Star Uninterruptable Power Supply	Office Equipment
Network PC Power Management	Office Equipment
Smart Strip Plug Outlet	Office Equipment
Energy Star Commercial Glass Door Freezer	Refrigeration
Energy Star Commercial Glass Door Refrigerator	Refrigeration
Energy Star Commercial Solid Door Freezer	Refrigeration
Energy Star Commercial Solid Door Refrigerator	Refrigeration

Measure	End-Use
Energy Star Refrigerator	Refrigeration
PSC to ECM Evaporator Fan Motor (Reach-In)	Refrigeration
Refrigerated Display Case LED Lighting	Refrigeration
Refrigerated Display Case Lighting Controls	Refrigeration
Chilled Water Controls Optimization	Space Cooling
Air Curtains	Space Cooling, Space Heating
Airside Economizer	Space Cooling, Space Heating
Dedicated Outdoor Air System on VRF unit	Space Cooling, Space Heating
Destratification Fans	Space Cooling, Space Heating
Facility Commissioning	Space Cooling, Space Heating
Floor Insulation	Space Cooling, Space Heating
Green Roof	Space Cooling, Space Heating
High Efficiency Data Center Cooling	Space Cooling, Space Heating
Infiltration Reduction - Air Sealing	Space Cooling, Space Heating
Low U-Value Windows	Space Cooling, Space Heating
Programmable Thermostat	Space Cooling, Space Heating
Smart Thermostat	Space Cooling, Space Heating
Variable Refrigerant Flow (VRF) HVAC Systems	Space Cooling, Space Heating
Wall Insulation	Space Cooling, Space Heating
Warehouse Loading Dock Seals	Space Cooling, Space Heating
Water Cooled Refrigeration Heat Recovery	Space Cooling, Space Heating
Waterside Economizer	Space Cooling, Space Heating
10HP Open Drip-Proof(ODP) Motor	Ventilation and Circulation
CO Sensors for Parking Garage Exhaust	Ventilation and Circulation
VAV System	Ventilation and Circulation

Commercial 2014 EE Measures Eliminated from Current Study

Measure	2014 End-Use
LED Exit Sign	Lighting-Exterior
High Pressure Sodium 250W Lamp	Lighting-Interior
PSMH, 250W, magnetic ballast	Lighting-Interior

Industrial Measures New for 2019

Measure	End-Use
Lighting Controls – Interior	Industrial Lighting
Efficient Lighting – Exterior	Exterior Lighting
Process Refrig Controls	Process Cooling
Process Refrig Equipment Upgrade	Process Cooling

Industrial 2014 EE Measures Eliminated from Current Study

Measure	2014 End-Use
Compressed Air-O&M	Compressed Air
Fans - O&M	Fans
Pumps - O&M	Pumps
Bakery - Process (Mixing) - O&M	Process Other
O&M/drives spinning machines	Process Other
O&M - Extruders/Injection Moulding	Process Other

DR MPS Measure List

Residential, Small C&I and Large C&I Measures

Residential Measures New for 2019

Measure	Type
Smart thermostats - Utility Installation	Direct load control
Smart thermostats – BYOT	Direct load control
Room AC	Direct load control

Small C&I Measures New for 2019

Measure	Type
Central Heating - Load Shed	Direct load control
Central Heating - 50% cycling	Direct load control
Smart thermostats - Utility Installation	Direct load control
Smart thermostats – BYOT	Direct load control

Large C&I Measures New for 2019

Measure	Type
CPP + Tech	Pricing
Auto DR	Utility-controlled loads
Guaranteed Load Drop	Contractual

No DR measures from the 2014 Technical Potential Study were eliminated from the current study.

DSRE Measure List

Residential & Non-Residential Measures

Residential Measures New for 2019

Measure	Measure Description
Battery Storage from PV System	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation

Non-Residential Measures New for 2019

Measure	Measure Description
Battery Storage from PV System	Lithium-ion battery system designed to integrate with an on-site PV system to store and discharge excess energy from PV generation
CHP – Fuel Cell	An electrochemical cell-based generator that reacts hydrogen fuel with oxygen
CHP – Micro Turbine	Small combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Gas Turbine	A combustion turbine that burns gaseous or liquid fuel to drive a generator
CHP – Reciprocating Engine	An engine that uses one or more pistons to convert pressure into rotational motion
CHP - Steam Turbine	A turbine that extracts thermal energy from pressured steam to drive a generator

No DSRE measures from the 2014 Technical Potential Study were eliminated from the current study.