Preliminary Evaluation Plan for Duke Energy's

Smart Energy Now
Envision Charlotte Program

Prepared for
Duke Energy

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Purpose of this Preliminary Evaluation Plan

The purpose of this Preliminary Evaluation Plan is to present a draft plan to Duke Energy's Evaluation and Program Managers for review and comment. As a result of this review, the evaluation plan will be adjusted or refocused to meet the evaluation needs of Duke Energy and the North Carolina Utilities Commission as stated in Docket No. E-7 Sub 961 of Feb 14, 2011. This plan provides a starting place for those discussions and the resulting adjustments to the plan.

The plan includes a process and impact evaluation of Smart Energy Now (SEN)/Envision Charlotte. The plan presents a broad-scope evaluation effort designed to document the energy impacts associated with Smart Energy Now and Envision Charlotte. The evaluation is focused not only on the energy savings achieved in the participating SEN buildings, but also on the spillover energy impacts achieved within the homes of the building owners, managers, and operators as a result of SEN. The plan is also structured to assess the SEN/Envision Charlotte's program's reach outside of the SEN participants to non-participating SEN buildings and homes as a function of the program's spillover effects. This effort is designed to assess the program's impacts within the greater Charlotte area as noted in the Commission decision approving the pilot for cost recovery and evaluation recommendations (Docket No. E-7 Sub 961). The evaluation efforts are also structured to assess the design and operational components of the SEN program through a series of process evaluation efforts. As a result of these efforts, the evaluation team will develop recommendations for program design and operational changes to be considered for future commercial building information programs.

Program Description

As part of Duke Energy's Smart Energy Now initiative, the Company is conducting a new pilot called the Smart Energy Now Behavior (SEN) Pilot program designed to create energy and capacity reductions through behavioral modifications. The program is a significant component of a larger program being implemented in Charlotte, called Envision Charlotte. President Clinton kicked-off the Envision Charlotte program (*http://www.youtube.com/watch?v=X89Vf63rors*) as part of the Clinton Global Initiative in September 2010. The North Carolina State Utilities Commission approved the SEN pilot study and its associated costs in early 2011.

Figure 1. President Clinton kicking off Envision Charlotte

The SEN program is projected to impact the energy use of three different types of people and entities. These are:

1. The **building owners and managers** who operate the building and who are responsible for the performance of the capital equipment of the building. These individuals directly control the building's energy systems and purchasing decisions and have a good deal of control over the building equipment and energy management systems and approaches. This group includes personnel that operate and maintain the building HVAC and lighting systems, as well as the personnel that operates and maintains information on tenant technologies (if any).
2. The **occupants of the participating building** who have some control over the use of energy within their individual office and their leased common areas. These individuals may take action as a part of the motivational pushes of the SEN program by lowering their energy usage associated with the operations of their office spaces. These individuals may also bring home the energy efficiency ethic and implement additional energy saving approaches in their Charlotte-area homes.
3. The **non-participating residences of the Charlotte area** who may be motivated by the program to take actions in their homes or businesses. SEN is going to be positioned in the Charlotte market as a community-focused program. As a result, it may be that non-participating building owners, managers, and occupants will take advantage of some of the public events and media coverage of the program to make their own buildings and homes more efficient as a result of the program's effects on the Charlotte area commercial and residential markets.

The North Carolina Utilities Commission has specifically noted that they are interested not only in the energy savings associated with the actions of owners, managers, and occupants, but also would like to understand if there are program impacts beyond the enrolled buildings, within the non-participating businesses and homes of the greater Charlotte area. These would be the spillover or market effects of the SEN program. We understand at this time there appears to be a near census of participation in the downtown Charlotte area; however, given the Commission direction, the evaluation team will work to understand this type of spillover to the extent that it is viable and practical.

The SEN program will target information and education efforts at two key primary types of individuals: building owners/managers and the occupants of those buildings.

Building Owners and Managers

The program will target owners and managers of commercial buildings by providing them with real-time, web-based information directly to their office computers via their links to Duke Energy's program support website and the associated customer-specific energy databases using the Energy Profiler Online tool. This web-based link will provide information on the building's energy use and display how their building is performing compared to other buildings of similar size and use conditions. In addition, the website will also provide recommendations to owners and operators on what kinds of actions can have an impact on energy use and which actions can be taken at little or no cost (such as changing temperature set points or set point schedules). It is also anticipated that the website will include testimonials and limited-focus case studies to

showcase what participating owners and managers are doing and the expected energy savings of their actions. In addition, it is anticipated that the website will also include an SEN blog in which owners and managers can communicate with other participants about their efforts and their successes and experiences. Essentially, the SEN program provides the platform on which and from which information can be communicated, shared, and enhanced, leading to greater actions taken across the participants as experience and success stories are communicated.

In addition to the web-site, information will be provided to owners, managers (and occupants) via large real-time active public-area displays that will provide detailed information on the building's energy usage, allowing viewers to make comparisons between their building's energy performance and other buildings within their community. As a building's energy efficiency is improved, that information is displayed so that viewers of the displays can see how their buildings compare to others.

The building owners and managers will have real-time access to their building's energy use information (via Energy Profiler Online) along with information on how other buildings being used in similar ways (large office buildings for example) are performing. Owners and managers can also have access to professional energy experts that can help them understand what kinds of actions can be taken to control energy use and understand what types of energy savings equipment and equipment use approaches can provide savings. This help is offered via Duke Energy's other energy efficiency programs. To augment the behavior change savings, building owners and managers will have full access to Duke Energy's Smart $aver® Custom and Prescriptive programs, and the Non-Residential Energy Assessment program. Savings for these other programs will not be credited to the SEN program, but will be included in the Company's savings estimates for those programs. However their participation in the other programs will be tracked to help quantify energy savings achieved by both SEN and actions that are taken via Duke Energy's array of energy efficiency programs.

Occupants of the Participating Buildings

As noted above, occupants of the buildings are also expected to acquire energy savings beyond that acquired by the building owners and managers. These savings will come from the actions taken by the occupants as they strive to lower energy use in their offices. To help achieve savings from occupants, each participating building will be equipped with a large display screen installed in the building's lobby or other accessible location (same display as noted above for the building owners and managers). The display will be updated in real time to display the energy consumption of their building as well as the energy consumption of similar buildings. Individuals viewing the display can see how well their building is performing relative to other buildings of similar size, configuration, and use. The display screen is expected to make energy use more visible to the occupants and make them more motivated and engaged in the efforts to reduce energy use. The display screen is a key factor in the program because it is thought to be a key motivational element in pushing occupants to help save energy at their place of work.

Non-Participating Residents of the Charlotte Metro Area

The SEN program is also expected to have some level of impact within the homes and businesses of the Charlotte area who are not SEN participants or who participate only nominally. There has been and will be considerable media attention and scheduled events to showcase the SEN

program and the achievements made as the program moves forward. This attention is expected to have an impact on the owners and operators of other buildings and possibly in the homes of individuals exposed to the program and its accomplishments. The North Carolina Utilities Commission specifically asked the evaluation to look into the effects of the program not just on program participants and building occupants, but also on the greater Charlotte area.

This pilot program will run for 3 years, with the goal of launching a larger full-scale commercial offer as soon as enough verified energy savings is documented to validate the pilot concept and help shape the final program design. If successful, the Company would expect to seek full program approval in less than 3 years.

The Targeted Area

This program will target commercial office buildings in downtown Charlotte. The pilot has targeted over 60 commercial office buildings within Charlotte's city center (as defined by the I-277 loop). Participating buildings must be focused on commercial operations and have at least 10,000 square feet of commercial operations. The majority of the commercial buildings greater than 10,000 square feet have indicated that they would like to become participants.

Future Potential of Program

Once commercial viability of the program has been documented, this program may be open to all other communities in the Duke Energy service territory that contain a concentration of commercial buildings, and may be adapted to expand beyond the focus on office buildings to other commercial building types (such as hotels and retail space). According to Duke Energy program managers, approaching energy efficiency at the community level has the potential to greatly speed the adoption rate of low cost efficiency measures through greater attention, better information, and peer motivation.

Rationale for the SEN Pilot Program

Duke Energy North Carolina commercial building energy efficiency program portfolio currently has a variety of traditional efficiency programs. However, Duke Energy did not have a non-residential behavioral modification or community-based program. Residential behavioral modification programs have recently been tested by other utilities, and are currently being tested by Duke Energy in the residential market in other jurisdictions. Given the unique nature of commercial building operations, where the energy efficiency of the building is affected by the decisions and behaviors of three parties – building owners, facility managers, and occupants – an effectively designed program that get these three stakeholders working in unison to save energy provide an opportunity for large, low-cost energy savings. In particular, by targeting facility owners and managers (a small population of individuals who have a large influence on achieving potential efficiency savings) it may be possible to expand the energy savings being achieved by other, more conventional programs. In addition, by targeting building occupants, not only is there an opportunity to achieve meaningful energy savings in the commercial building space, but there is also an opportunity to raise awareness and cause a ripple effect in the residential market as they bring a heightened awareness home.

Based on the ability of the groups targeted for assessment in this study to affect the energy consumption of commercial buildings, Duke Energy expects to achieve higher energy savings from commercial behavior modification than in the residential space.

In addition to the potential benefits of a behavioral modification program for commercial buildings, there is also an opportunity to approach behavioral programs from a community perspective – increasing the speed at which energy efficiency can be deployed, and providing important points of comparison and peer pressure to push individual participants to greater savings.

The Evaluation Plan

This evaluation plan incorporates two different types of evaluation efforts (process and impact evaluations) into one combined, coordinated study focusing on 4 different areas from which energy impacts are expected. The purpose of this document is to present the planned evaluation efforts to key parties in order to convey the purpose, scope, and approach for the program evaluation.

These efforts include:

1. **A process evaluation** that focuses on assessing the design and implementation approach for the program in order to make recommendations for changes that can be expected to improve the impacts from or operational efficiency of the program. This assessment will examine the operations of the behavior change aspects of the program, but also look at how the program interfaces with other core programs to encourage retrofits and program participation. This assessment includes understanding why customers took part in the program and what caused (or acted as barriers to achieving) energy impacts. The process evaluation will also assess the way in which the program is designed and implemented, the way it is placed in and interacts within the market, the levels of and drivers for participant satisfaction with the program operations and offerings, and other investigative areas.

2. **An impact evaluation** of the SEN program that will examine the savings associated with the behavior changes made by building owners, managers, occupants, and to the extent possible, the people of the greater Charlotte area who may be influenced by the program. Because the participating buildings now have or are expected to soon have interval demand data[1], when possible, the impact study will employ time series analysis techniques which use the interval data. Time series analysis will be applied to behavioral changes where the impacts are expected to be great enough to be statistically identified by analyzing the pre and post change interval data for the parts of the building impacted by the program. The analysis will use the data collected from the interval meters installed in the participating buildings. When the interval metered data is not capable of documenting savings, engineering analysis will be employed to estimate impacts. In these cases, the engineering analysis will be informed by on-site measurement and verification

[1] Many of the buildings in the target population are already equipped with recording demand meters that provide 15 minute average demand time series data. It is anticipated that all participants will be upgraded to "Smart" meters that will provide time series data on a 15 minute or faster frequency.

data collection (M&V). Where metered data is not available but is required to estimate impacts, the evaluation team will request that Duke Energy install meters on those systems, or the evaluation contractor will install meters to collect the necessary information.

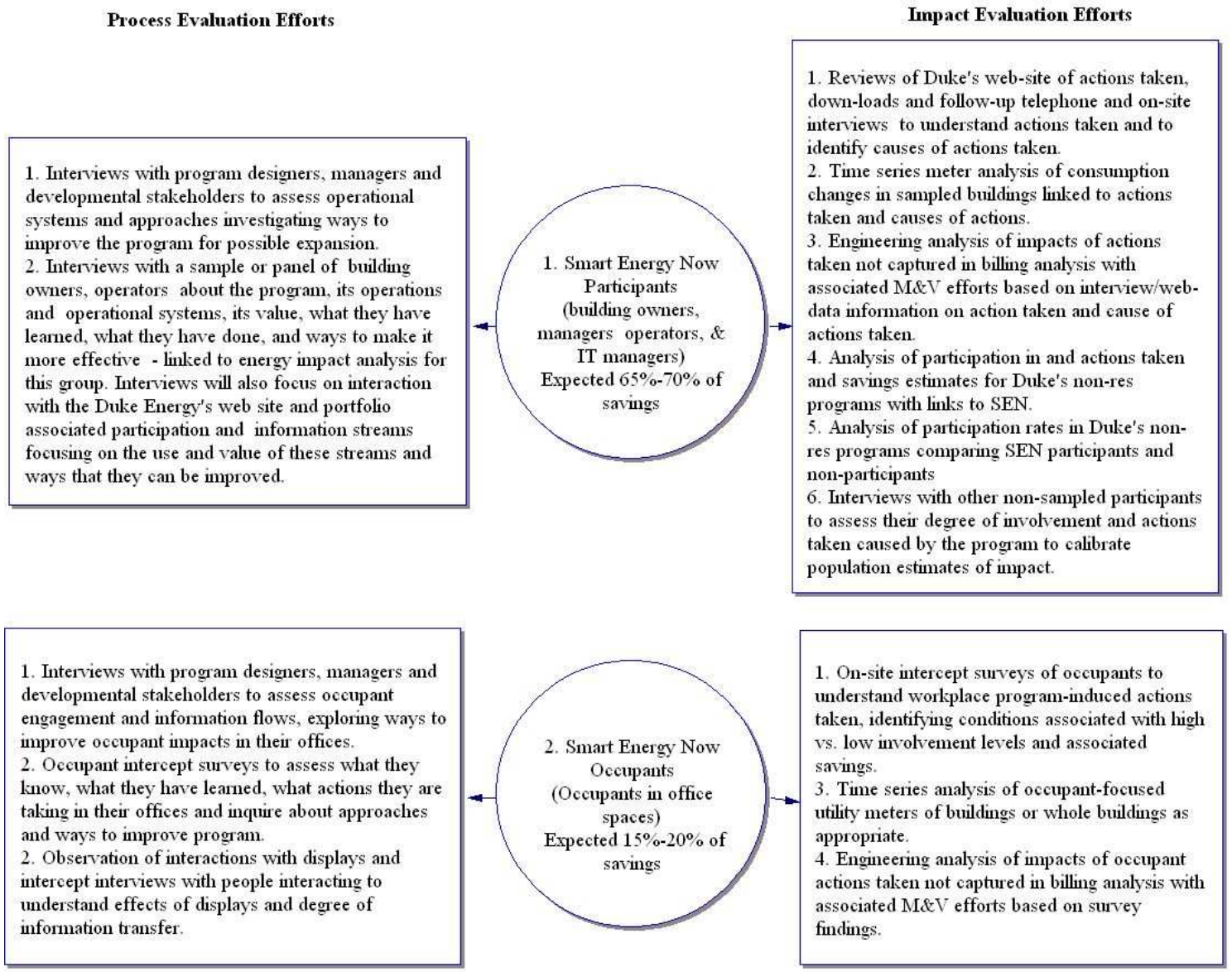
To help the reader understand the evaluation efforts associated with this complex evaluation, the evaluation plan is structured into four components. Each component represents one of the primary areas from which energy savings are expected to occur. These include:

1. Participating Building Owners and Managers – savings in the participating buildings
2. Occupants of Participating Buildings – savings in the offices of participating buildings
3. Owners, Managers, and Occupants – taking actions to save energy in their homes
4. Greater Charlotte Area Non-Participants – savings in offices and homes of non-participants in the Charlotte area

These four evaluation components make up the Smart Energy Now evaluation efforts. The elimination of any one of the individual components of this plan means that the energy savings and associated behavior driven changes that occur within that target group will be excluded from the evaluation effort. However, component #4 is dependent on the viability and practicality of funding and completing the necessary tasks to assess these savings.

The evaluation efforts associated with this plan are presented in the following diagram and are discussed in more detail following the diagram.

Smart Energy Now and Envision Charlotte Evaluation Components



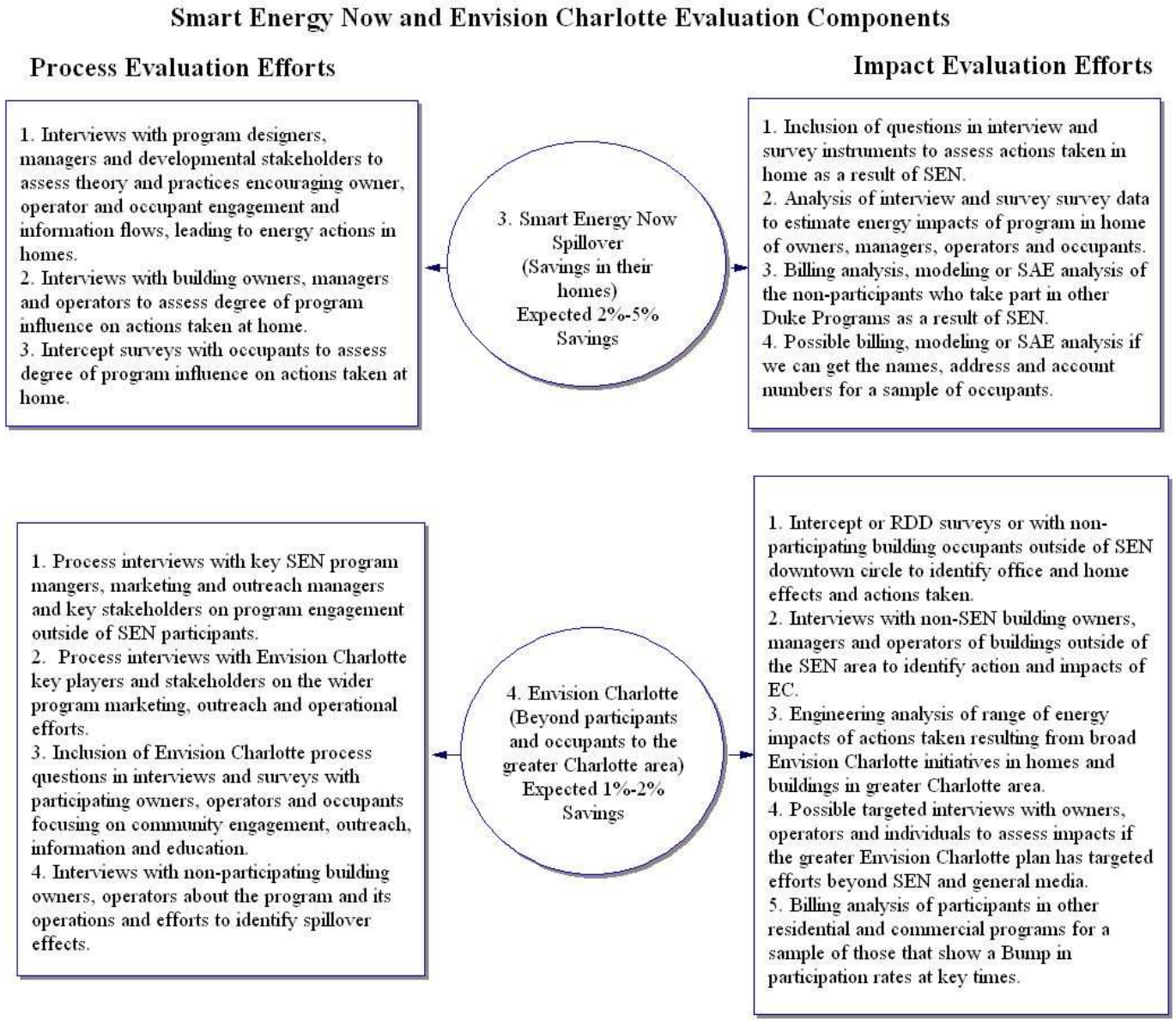


Figure 3. Overview of the Evaluation Effort

While this document provides a presentation of the planned evaluation efforts, it is expected that minor adjustments to the evaluation plan will occur as the program is formed as additional program information becomes available to the evaluation team. Because the program is being developed at the same time as the evaluation plan is being drafted there will be a need for revising the evaluation plan as the program is finalized and implemented. It is expected that a final evaluation plan will be developed after final approval of the evaluation efforts (primarily component four) have been approved by Duke Energy.

Detailed Evaluation Plan

Each of the four components of the evaluation plan are presented below in the order described above. The component evaluation efforts are discussed separately to inform the reader about the evaluation efforts planned, however, they are in reality implemented as a single integrated evaluation. This integration assures the success of the overall evaluation effort, but also reduces evaluation costs and improves evaluation efficiency. For example, the field efforts that are associated with the analysis of the owner and operator impacts will also inform the impacts of these individuals saving energy in the office and in their homes. The same situation exists for building occupant savings, with the interviews or surveys with occupants informing both the in-office and in-home impact analysis.

Component 1: Building Owners and Managers

This behavior change evaluation includes a process evaluation and an impact evaluation assessing the savings achieved by the non-incentivized energy efficiency and energy conservation initiatives undertaken by a sample of participants of the SEN program in response to the program's communications and information. The sample must be representative of the population of participants as a whole so that program-wide savings can be estimated. The evaluation is not assessing the behavior change associated energy impacts of each of the over 60 participants because of evaluation budget limits[2]. In order estimate savings and control evaluation costs, a representative sample will be used to estimate the energy impacts of the population of participants.

There are 16 tasks associated with this study. These include:

1. Kickoff meeting with the evaluation and program teams
2. On-site familiarization visit
3. Preparation of sample selection criteria
4. Preliminary selection of sampled buildings
5. On-site visit of preliminary sample of buildings
6. Final selection of sampled buildings
7. Coordination with the Smart $aver Custom and Prescriptive programs for rebated savings sample
8. Interviews with participants to assess possible behavior changes
9. Identification of appropriate impact evaluation approach(es)
10. Process evaluation interviews with program managers and stakeholders
11. Interviews with participants on actions considered and taken

[2] Such a study would cost between $1.8 and $2.2 million for the field metering needs and another $500,000 for the behavior change and process interviews and the associated impact and process analysis efforts.

12. Interviews with all remaining participants on actions taken
13. Analysis of energy impacts for actions taken by participants
14. Compilation of savings across the population of participants
15. Process evaluation analysis of operational systems and approaches
16. Draft and final report of process and impact evaluation results

Each of these tasks are summarized below, leading to estimated impacts for behavior change actions and savings estimates for the program as a whole, including both rebated technology associated changes (credited to other Duke Energy programs) and behavior change savings credited to the SEN program. The evaluation tasks are:

1. Kickoff meeting

This task consists of a kickoff meeting with the TecMarket Works evaluation team, Duke Energy's evaluation management staff, and key Envision Charlotte program managers. The kickoff meeting will occur once the budget for the study is finalized and accepted by Duke Energy and after this draft evaluation plan has been revised to match the budget allocations and research needs of the project. This draft workplan presents the evaluation needs of the study as understood by TecMarket Works. It will need to be revised to match the research needs specified by Duke Energy's Evaluation Manager and the approved research budget. The kickoff meeting allows all evaluation team and program managers to discuss the evaluation plan so that the evaluation needs, approaches, and costs are reflections of the evaluation efforts required by Duke Energy and the NC Commission. The meeting will also fine-tune the evaluation timeline to be reflected in the final evaluation plan. The meeting will be held in person in Cincinnati or Charlotte or via conference call.

2. On-site familiarization visit

The evaluation efforts began in December 2010 with an on-site familiarization visit of the types of buildings participating in the program. The purpose of the on-site visit was to begin to classify the types of buildings into building categories by the size and type of the building (square footage, stories, age, construction type, etc.) as well as the operations occurring within the buildings (office, retail, educational, medical, etc.).

3. Preparation of sample selection criteria

Following task 1 we will develop participant sample selection criteria to apply to the participant population. Criteria will include such metrics as building type, equipment profiles and use conditions as well as building size and use, architectural configuration, type of revenue meter installed, occupancy status and population, business categories and types, and other criteria. The criteria will then be used to populate a sample selection category matrix in which multiple participants (buildings) will be placed in clusters according to the degree of homogeneity for the buildings within a category. The buildings that will be sampled will have to be representative of the population of participating buildings. The clusters will need to include a set of representative, randomly selected buildings within each cluster so that any single building within each cluster can be considered as a representative building for that cluster. In this selection effort, we will need to coordinate with the Duke Energy program managers to assure that the sample represents the typical participating building and SEN interaction for that cluster of buildings. The number of clusters will depend on the types of buildings and their use conditions as defined by the

selection criteria. While it is not now possible to predict, we expect that we will identify from 5 to 10 building types and use clusters. The limiting factor for the size of the evaluation sample is the evaluation budget. Once the clusters are defined and identified, the evaluation team will identify buildings that have interval meters that can provide time-series demand data. These buildings will then be identified as potential representative buildings for that cluster. However, if there are not enough buildings within a cluster to pull a random representative sample for the evaluation, then shadow interval meters will need to be installed by Duke Energy on additional buildings in order for the sample to be representative.

4. Preliminary selection of sample buildings

Identification of representative buildings will be made by the evaluation contractor. Criteria for selecting representative buildings for the sample will be made following additional on-site examinations (see next task). The sample will include primary and backup sites to allow for sample reduction for any number of reasons, including program drop-out, lack of permission to participate in the evaluation effort, and lack of response to requests to participate in the evaluation.

5. On-site visit of preliminary sample of buildings

In this task we will visit the preliminary sample of buildings and conduct more detailed examinations of the buildings' design, configuration, equipment profiles, and use conditions. This effort will allow a more complete understanding of the type and operational conditions and status of the building and its occupants. This visit will also focus on the association of the building meters to the metered equipment and floor area to assess the viability of using existing meters to measure the expected behavior change associated impacts. Interviews with building managers who are expected to impact the way in which behavior changes are made will be interviewed. The interview will focus on intent to take energy-saving actions, the equipment that will be influenced by those actions, and a preliminary estimate of the expected impacts.

6. Final selection of sampled buildings

Following the on-site visit and the interviews, a final selection of sample buildings will be made by the evaluation team. This sample will need to reflect the population of participants and the types of actions that are expected.

7. Coordination with Smart $aver Custom and Prescriptive programs for rebated savings sample

The final sample of selected buildings will be coordinated with the Smart $aver Prescriptive and Custom programs to make sure that the SEN participating buildings that take part in other Duke Energy programs are part of the stratified sampling approach[3] for the other program evaluations. This will ensure that the savings associated with the SEN participants can be reported so that a more complete understanding of impacts can be made. The savings for the rebated program measures will not be counted as SEN savings because they will be reported as savings from the relevant incentive programs. However, these savings will be reported as savings associated with the participants of the SEN program. This coordination task will ensure that the participants will be part of the rebate programs' stratified sample approach.

[3] Buildings that are in the SEN sample that are participants in other Duke incentive programs and not already in the M&V samples for those programs will be assigned to a separate SEN stratum.

8. Interviews with participants to assess possible behavior changes

Once the final selection of sampled building has been completed, and the program has had enough time to engage the owners and managers so that they begin to consider what actions are appropriate for their buildings, in-depth interviews with building managers and key management stakeholders will be made to identify those actions that are most likely to be taken in those buildings. These actions will then be isolated to specific systems within each building so that a determination for the appropriate impact estimation technique can be made for the anticipated actions for that building. Property managers, building operating engineers, and individuals familiar with tenant technologies will be targeted for these interviews.

In addition to these interviews, the evaluation team will coordinate with Duke Energy to monitor progress of the program and the interaction with the participants. It is our understanding that Duke Energy is considering establishing a web-based actions reporting page in which participant actions are reported as they are being considered, planned, or implemented. If this database is developed and used by the participants, it will supplement the interviews with building owners and managers and provide additional information to plan the building-specific evaluation approach.

9. Identification of appropriate impact evaluation approach

The impact evaluation approach associated with each action will be chosen from the following options:

- Engineering calculation approach
- Prototypical building energy model
- Detailed building energy model
- Datalogging of selected mechanical and/or electrical systems
- Time series analysis of whole-building interval demand data

A brief explanation of each method follows. The estimated costs for each method are listed in the "Level of Effort" matrix in the budget section.

Engineering Calculation Approach. Simple engineering estimates using onsite survey data and secondary research will be used to estimate energy savings. This method of performing these analyses will be similar to those used in deemed savings approaches embodied in various Technical Reference Manuals (TRM), and will use Charlotte's climate data.

Prototypical Building Energy Model. This approach would likely be appropriate for smaller buildings and/or portions of buildings. A typical building model will be created to generate impacts for various actions across typical building and HVAC system designs. Sub-sections of a specific building might also be modeled under this approach. For example, if a tenant that occupies 6 floors of a 50-floor building desires to change operating hours, we would model just those floors. Separate parking garages and retail spaces may also fit into this designation.

Detailed Building Energy Model. In this approach, a detailed building energy simulation model of a particular sampled building will be created. This approach may be used to understand the impacts of a complicated set of responses in a particular high-profile building.

Due to the cost and complexity of preparing detailed models of specific buildings, this approach will only be used as necessary.

Datalogging of Selected Mechanical and/or Electrical Systems. Metering equipment[4] will be installed or building automation system (BAS) trend logs will be established on equipment affected by the behavior changes. Monitoring will occur over a sufficient period of time to observe the changes in energy consumption associated with the changes made and will be used to project annual gross impacts. The evaluation team will periodically check the monitoring equipment to assure their reliable operations and to download consumption information from installed metering and/or BAS trend logs. The downloaded consumption information will be examined to confirm the data is accurate and reliable. When data quality issues are identified, the field M&V team will replace the meters or work with the building engineers or BAS vendor to correct the problem causing the data quality issue.

Time-Series Analysis of Whole-Building Interval Demand Data. If the efforts from task 7 indicate that the behavior change associated savings are expected to be visible (analytically identified) within the building's interval meter (Duke Energy's meter or the M&V shadow meter) there will be no need to install metering equipment on specific building systems. A time series analysis of the whole building interval data will be conducted. Due to the cost advantages of this technique, it will be the first option for the impact analysis.

10. Process evaluation interviews with program managers and stakeholders

In this task, detailed process evaluation interviews will be conducted with program managers and key stakeholders associated with the program. Interviews will be conducted with Duke Energy managers, program implementation managers, city officials, and key staff instrumental in helping design and launch the SEN program and the larger Envision Charlotte efforts. Interviews will be conducted with other key stakeholders identified during these interviews as having significant input or interaction with the SEN program and Envision Charlotte. The interviews will focus on the program's designs, marketing, communications, collaboration, technologies, and operational procedures. The interviews will identify activities and initiatives that worked well, as well as where improvements can be made to the program. These interviews will provide information to assess the program's operations and to make recommendations for program improvements.

11. Detailed project interviews with participants on actions considered and taken

In this task, in-depth process and behavior change interviews will be conducted with the building managers and stakeholders of each sampled building. The purpose of this task is to fully understand the engineering aspects associated with the behavior change action taken by the sampled participants to drive the impact analysis. The surveys will be targeted at both building managers and occupants, to capture behavioral changes motivated by information supplied to each group and the specific changes that were considered and made. Within the building manager category, property managers, building operating engineers, and information technology (IT) managers will likely be targeted. These individuals will be surveyed at appropriate time intervals to assess the effectiveness of the messages and the resulting behavior changes and to

[4] Portable monitoring equipment will be supplied by AEC for use in the project. Permanent monitoring equipment will be supplied at extra cost.

understand the exact nature of the changes made. In addition, the interviews will assess the role of the energy use displays (in the building lobby areas) on the efforts to understand energy savings potentials, identify ways to save energy and decisions to implement actions to save energy. The assessment will also focus on the effectiveness of displays as an information dissemination and capability building tool.

The interviews will also ask about what, if any, of the changes made would have been implemented without the market push efforts associated with the SEN program. Because of the short-focused nature of the program, we expect that most changes will be a result of the program. However, this assumption must be tested in the interviews.

12. Interviews with non-impact sample owners and managers on actions taken

In addition to the sample participant interviews, interviews will also be performed with remaining non-sampled participants in order to understand the behavior change actions taken by the non-sampled participants. The interviews with the non-sampled participants will allow for the identification of changes made within the buildings in each cluster of buildings. The interview information will feed both the process evaluation assessment and the impact analysis efforts for the non-sampled participants as explained in the following task. As with the sampled participants, the interviews will also ask which (if any) of the changes made would have been implemented without the market push efforts associated with the SEN program. Again, because of the short-focused nature of the program, we expect that most changes will be as a result of the program. However, this assumption must be tested in the interviews.

13. Analysis of energy impacts for actions taken by participants

Analysis of sampled building savings:

The energy savings for the sampled participants will be calculated based on the selected impact evaluation technique. Energy savings for each observed technique will be normalized per square foot of conditioned floor space or per ton of cooling capacity as appropriate to project the impacts across all sampled buildings where the action was taken.

Analysis of non-sampled building savings:

Impact estimates for sampled buildings will be projected to the population based on available obtained via a survey for the non-sampled buildings. In situations where survey data are not available, a simple projection of savings per square foot of conditioned floor area will be made.

Process evaluation analysis:

The analysis of the results of the process evaluation will be based on the results of the interviews with key program managers and stakeholders and with both sampled and non-sampled participants. The assessment will use standard professional evaluation approaches to classify, categorize and report findings in tabular, graphic, and text presentations. The interview results will be used to develop evaluation findings and recommendations for changes to the program that can be expected to improve the energy savings, the rates of participation, and the operational effectiveness and efficiency of the program.

14. Compilation of savings across the population of participants

In this task, the savings from the sampled participant assessments and the non-sampled participants will be aggregated into a presentation of the total owners/managers behavioral change-induced gross and net savings estimates, with detailed information on each action taken and the resulting savings from those actions across the participating buildings. In this analysis, savings from the sampled buildings will be normalized to a standard metric (for example square feet) and applied to the non-sampled population of participants indicating that an action was taken.

15. Process evaluation analysis of operational systems and approaches
In this task, the process evaluation team will compile the results of the participant associated process-related data collection efforts and assess the information to document the operations of the program and to identify issues that impact the success of the program. The process evaluation will also develop specific recommendations for changes to the program than can be expected to increase the energy impacts of the program or the program's cost effectiveness.

16. Draft and final report of process and impact evaluation results
The evaluation team will prepare draft and final reports presenting the results of the process evaluation and recommendations for program changes. The report will also provide the estimates of savings for the program from the changes made by the building owners, operators, and key managers. The draft report will be provided to Duke Energy and key stakeholders in electronic format and presented at an on-site presentation. During the on-site presentation we will present the research approach, the findings, and the recommendations for discussion. Following the receipt of comments from Duke Energy and key stakeholders, a final report will be prepared and delivered to Duke Energy.

Component 2: Occupants of Participating Buildings

As currently planned, the evaluation will include an evaluation of the occupant components of the SEN Envision Charlotte efforts. This part of the evaluation focuses on the energy savings achieved in the participating buildings as a result of actions taken by the building occupants. In the majority of the SEN participating buildings, the occupants lease building space from the building owners or their property management contractors. While these people have limited impact on the operations and efficiency of the building's capital equipment systems, they do have some control over the energy they use in their offices. This component focuses on the savings achieved by these occupants. Because the savings are typically small compared to what can be achieved through adjustments in the way the capital equipment is used, there are some savings that can be achieved by effective management of the energy used in these offices. This evaluation will use occupant intercept survey techniques to identify energy actions taken in these offices and estimate impacts for those actions. The impact analysis approach will depend on the actions being taken. If they are significant enough that they can be identified via meter analysis of area circuits and plug loads then a billing analysis will be used when those circuits and loads can be isolated to a Duke Energy meter. However, if they are not considered significant enough to be identified via a billing analysis, then statistically adjusted engineering estimates will be employed to estimate savings based on the actions being taken.

The evaluation will also focus on how the energy use display boards are being used and the impacts of these displays on the knowledge of the viewer and the energy use decisions of the occupants.

There are 6 tasks (17-22) associated with this study. These include:

17. Interviews with program designers, mangers and program development stakeholders
18. Occupant intercept surveys with building occupants
19. Observations of interactions with displays and follow-up interaction surveys
20. Analysis of energy impacts
21. Process evaluation analysis of operational systems and approaches
22. Draft and final report presenting the results of the process and impact evaluation

Each of these tasks are summarized below, leading to estimated impacts for behavior change actions and savings estimates for individual building occupants and for occupant savings for the program as a whole. The evaluation tasks are:

17. Interviews with program designers, managers and program development stakeholders
These interviews will be conducted with the interviews associated with the component 1 evaluation efforts. The interviews will focus on understanding the program's efforts and offerings that are designed to engage the interests of the building occupants. The interviews will explore what type of information and interaction with the occupants was considered and what aspects were incorporated into the SEN program.

18. Occupant intercept surveys with building occupants
The evaluation will conduct intercept surveys with individuals going into and out of the buildings to assess if they work for any of the offices in the building. If they are employed in the buildings and are not associated with capital equipment building operations they will be surveyed for their knowledge about Envision Charlotte and their interaction with SEN or their offices efforts to save energy as part of SEN or Envision Charlotte. Those that are knowledgeable about SEN or Envision Charlotte and their offices efforts will be asked about the actions that are being employed in their office space to save energy. The results of the survey will be compiled to identify which offices in the participating building are taking actions and what actions they are taking. The surveys will be conducted to gain an understanding of the actions taken, the offices taking those actions, and the areas of the building to which those actions apply and are expected to have an energy impact. Because the surveys will focus on the sampled buildings from component 1 of the evaluation, it will be necessary to survey enough occupants to get a statistically valid sample of occupants.

19. Observations of interactions with displays and follow-up interaction surveys
Intercept surveys will also be conducted with people viewing the lobby displays of energy consumption and comparisons with other buildings, and other information provided on the displays. The questions to be addressed will be developed once the displays are configured and the information to be presented is finalized. They will be asked about what they were viewing, their level of interest in that subject, the information that they gained from the display and how the display influenced their interest in saving energy. They will also be asked about the actions that they and their office have been taking to save energy to support SEN and Envision

Charlotte. In addition they will be asked to provide their recommendations for ways the displays can be improved. The information on actions taken will be included with the results of the lobby intercept surveys.

20. Analysis of energy impacts
In this task, the evaluation team will estimate the energy savings associated with the actions reported in the occupant surveys. The approach to assessing the impacts will be similar to the approach for assessing building savings discussed in evaluation component 1. When the actions taken are thought to be significant enough to support a time-series analysis, the metered data associated with those sections of the building and those circuits will be analyzed to identify savings levels. When the actions are not significant enough to be identified in a time series analysis or when there are no meters to which the actions taken can be isolated, the engineering analysis or building simulation modeling will be used as appropriate. The savings will be structured to be average savings per square foot over the building area, distributed into the population of participants according to the degree of those efforts showing up in the population. That is, savings will be assigned to represent the building rather than the office. This allows all buildings reporting those actions to be credited with those savings in a way that reflects the average savings per square foot for those actions taken.

21. Process evaluation analysis of operational systems and approaches
In this task, the process evaluation team will compile the results of the occupant-associated, process-related data collection efforts and assess the information to document the operations of the program and to identify issues that impact the success of the program. The process evaluation will also develop specific recommendations for changes to the program than can be expected to increase the energy impacts associated with building occupants of the program or the programs' cost effectiveness.

22. Draft and final report of process and impact evaluation results
A draft and final report will be provided within the component 1 report. The evaluation team will prepare draft and final reports presenting the results of the process evaluation for this component and recommendations for program changes. The report will also provide the estimates of savings for the program from the changes made by the building occupants. The draft report will be provided to Duke Energy and key stakeholders in electronic format and presented at an on-site presentation. During the on-site presentation we will present the research approach, the findings, and the recommendations for discussion. Following the receipt of comments from Duke Energy and key stakeholders, a final report will be prepared and delivered to Duke Energy.

Component 3: Owner, Manager, and Occupant Savings in Homes

If the evaluation effort is to also document the spillover effects of SEN and Envision Charlotte in the homes of the participating buildings' managers, operators, and building occupants save energy in their homes, Component 3 of the evaluation can be conducted.

In this component, the evaluation will document the energy-saving ideas brought home from the participating buildings and implemented in the homes of the building owners, managers, operators, and occupants. This component will also include a process evaluation focusing on the

aspects of the program designed to build spillover savings in homes. The purpose for the impact evaluation is to estimate the range of savings expected from the actions taken in the home as a result of SEN Envision Charlotte efforts. The purpose of the process evaluation is to assess the effectiveness of the spillover efforts and to make recommendations for changes that will increase the savings achieved in the homes of owners, managers, operators, and occupants. This component will depend significantly on the actual efforts undertaken by the pilot and the pilot's ability to capture data on which participants are "touched" or even invited to participate in Envision Charlotte events and other Duke Energy program offers. Several options exist for evaluating this type of spillover, and the best approaches will, in part, depend on the implementation approaches ultimately selected by the program implementer. For example, it may be possible to identify savings (relayed from energy conservation behaviors) from statistical analysis of meter data. Challenges to this approach include: the need to identify employees touched by the program, match those names to Duke account numbers and the dates of contact. Timing of touches can assist in wading through the signal to noise concerns that is typically a problem in identifying relatively small savings against relatively variable home energy consumption. However, given that the cost for a statistical analysis of meter data is not great, it is worth considering depending on information available to evaluators and the degree of expected effects on the touched population.

An additional and possibly complementary approach would be to attempt to track whether participation in Duke Energy residential programs is caused (directly or indirectly) by SEN events. Given that residential programming is associated with better understood measures and persistence than behaviors, this may prove worth investigating. As indicated above, this will depend in part on the ability to have good data control, e.g. special bar codes on sign up forms if they originate from an SEN event, or failing that, it may be possible to attempt to find a "comparable" city to identify uptake rates over the same time period. This may not yield precise numbers, but should provide a qualitative sense of how well the program drives participation in additional programming.

There are 6 tasks (23-28) associated with this study. These include:

23. Interviews with program designers, managers and development stakeholders
24. Interviews with building owners, managers, and operators
25. Intercept surveys with building occupants and display viewers
26. Analysis of savings from actions taken that are caused by SEN
27. Process evaluation analysis of operational systems and approaches
28. Draft and final report of process and impact evaluation results of impacts in homes

Each of these tasks are summarized below, leading to estimated impacts for behavior change actions and savings estimates achieved in the homes of the owners, managers, operators, and occupants. The evaluation tasks are:

23. Interviews with program designers, managers, and development stakeholders
In this task, the interviews with program designers, managers, and developmental stakeholders will include questions related to how the program was designed to effect impacts within the homes of program participants and occupants of those buildings. The focus of these questions will be to identify the behavior change theory associated with spillover effects in the homes and

then track the development of program operational efforts, display materials, and other tools to engage the people who are expected to take actions in their homes.

24. Interviews with building owners, managers, and operators
For this task, additional questions pertaining to the flow of program information leading to energy efficiency actions taken in the homes will be added to the interview instruments. The questions will focus on the role of SEN/Envision Charlotte in stimulating behavior change by causing actions to be taken by owners, managers, and building operators. In addition, questions will be added to identify the specific actions taken by the exposed owners, managers, and operators. Additional question will be added to the instruments that focus on methods for encouraging owners, managers, and operators about engagements and service offerings that can be expected to increase saving in the homes.

25. Intercept surveys with building occupants and display viewers
In this task additional question will be added to the occupant surveys (intercept and display). These questions will focus on the flow of program information leading to energy efficiency actions taken in homes by the occupants. The questions will focus on the role of SEN/Envision Charlotte in stimulating spillover behavior changes by causing actions to be taken at home by occupants. In addition, question will be added to identify the actions taken by the exposed occupants. Additional questions will be added to the instruments that focus on methods for encouraging owners, managers, and operators about engagements and service offerings that can be expected to increase saving in the homes.

26. Analysis of savings from actions taken that are caused by SEN
Energy impact estimates of savings from actions taken in the homes of owners, managers, operators, and occupants will be estimated via the use of engineering analysis approaches typical of approaches found in residential Technical Reference Manuals for Charlotte's typical weather patterns. The analysis will be based on the survey results and will be calculated to represent the typical average savings achieved at home from those taking actions so that the savings can be estimated for the total population of owners, managers, operators, and occupants associated with SEN Envision Charlotte. This analysis will be augmented by researching Duke Energy's program records and data warehouse to identify individuals enrolled in Duke Energy's programs compared to enrollment rates outside of the Envision impact area. This review will provide support for assessing total SEN impacts when a part of those impacts are caused by increased enrollments in Duke Energy's programs (however, energy savings will not be credited to SEN, because they will already be counted in the impacts of the other Duke Energy programs).

27. Process evaluation analysis of operational systems and approaches
In this task, the process evaluation team will compile the results of the home spillover-associated data and assess the information to document the operations of the program that influenced the spillover home savings and to identify issues that impact the success of the program impacts in the influenced homes. The process evaluation will also develop specific recommendations for changes to the program than can be expected to increase the energy impacts associated with in-home spillover of the program, or the programs' cost effectiveness, should home savings be allowed to count as official energy impacts.

28. Draft and final report of process and impact evaluation results of impacts in homes
The draft and final report can be provided as a stand-alone spillover report, or it can be included with the evaluation Component 1 report.

The evaluation team will prepare draft and final reports presenting the results of the process evaluation for this component and recommendations for program changes. The report will also provide the estimates of home spillover savings for the program from the changes in the typical home of the participants and occupants. The draft report will be provided to Duke Energy and key stakeholders in electronic format and presented at an on-site presentation. During the on-site presentation, we will present the research approaches, the findings, and the recommendations for discussion. Following the receipt of comments from Duke Energy and key stakeholders, a final report will be prepared and delivered to Duke Energy.

Component 4: Greater Charlotte Area Non-Participants Savings

According to the Commission decision approving the SEN program (Docket No. E-7 Sub 961), the Commission is interested in determining if there are any greater Charlotte area impacts associated with the SEN program and Envision Charlotte. Evaluation Component 4 addresses that need. This component of the evaluation will focus on if and how the SEN program and its Envision Charlotte interaction influenced homes and businesses within and around Charlotte who are not participants in the program and who have no employees working in the participating buildings. The evaluation focuses on general area spillover beyond those directly touched, in some way by the program services to participants. This component is contingent upon viability and practicality given the final budget that is approved.

The study component has 7 tasks (29-35) described below:

29. Interviews with SEN program managers, marketing and outreach managers, and key stakeholders
30. Interviews with key stakeholders of Envision Charlotte
31. Inclusion of greater SEN Envision Charlotte effects questions in interviews and surveys with participating building owners, managers, operators, and occupants
32. Interviews with non-participating building owners, operators, managers, and residential customers
33. Analysis of SEN's educational and motivational impacts on non-participants
34. Analysis of general area market spillover energy impacts on non-participants
35. Draft and final report of process and impact evaluation results for area non-participants

Each of these tasks is summarized below, leading to a documentation of the degree of influence that SEN has on the greater Charlotte area. The evaluation will focus on what area residents have heard about Envision Charlotte and SEN, and if those efforts have influenced their energy related behaviors or buying activities in any way. The impact evaluation will estimate a general range of energy impacts based on the assessment of engagement efforts and an analysis of survey results.

29. Interviews with SEN program managers, marketing and outreach managers, and key stakeholders

These interviews will focus on programmatic aspects that are expected to reach beyond the program participants and touch area residence in ways that can be expected to have an influence on their energy use behaviors. These interviews will focus on understanding the marketing outreach and promotional events that are designed to engage people beyond the downtown loop. It will be important for the evaluation team members to understand the way in which Envision Charlotte and SEN engage the market in order to understand the series of cause and effect relationships between information dissemination and customer reaction.

30. Interviews with key stakeholders of Envision Charlotte

Interviews with Envision Charlotte key stakeholders will be conducted to understand the broader Envision Charlotte efforts and activities and to understand how these efforts impact homes and businesses in the Charlotte area. The interviews will focus on identifying the cause and effect relationship between the Envision Charlotte efforts and potential spillover actions taken that save energy.

31. Inclusion of greater SEN Envision Charlotte effects questions in interviews and surveys with participating building owners, managers, operators, and occupants

This effort will include the addition of questions relating to SEN and Envision Charlotte efforts that building owners, managers, operators, and occupants are aware of. The responses to these questions will help us understand the degree of reach for the marketing, outreach, and educational efforts associated with SEN.

32. Interviews with non-participating building owners, operators, managers, and residential customers

Once the tasks above have been completed, the evaluation team will build survey instruments that assess the exposure to the marketing, outreach, and educational events that are expected to inform, educate, and alter the behaviors of area residents. Two survey instruments will be developed. The first instrument will be tailored toward business owners, managers, and operators. This survey will investigate how area buildings were reached and influenced by the SEN program and the Envision Charlotte events. The surveys will focus on identifying the information gained, the importance of that information to the interviewee, and if that information has resulted in changes in their behavior or anticipated behavior (taking actions, participating in a program, etc.). We will discuss with Duke Energy the potential for using utility records to identify non-participating building owners, managers, and operators. If this is not possible, then we may need to purchase that contact information from a private supplier or to structure contacts from the Charlotte area business directories.

A second interview instrument will be developed for decision makers within Charlotte area homes. This instrument will investigate what decision makers know about Envision Charlotte and SEN and if they recall any of the programs messages, outreach efforts, offerings, or events. Those that recall these efforts will be asked a battery of questions pertaining to what they recall, if it was of interest to them, if it provided new information, and if that information (new or not) influenced their intent to take any energy related actions in their home. If the efforts had an

influence, they will be asked to describe the actions that they have taken or intend to take as a direct or indirect result of SEN or Envision Charlotte.

33. Analysis of SEN's educational and motivational impacts on non-participants
Once the survey of area businesses and homes is complete, an analysis of the effects of SEN Envision Charlotte will be conducted. The analysis will be fed by the interview results with SEN and Envision Charlotte managers and stakeholders, and the responses to the surveys with building owners, managers, and operators, and with area residential customers. This analysis will focus on what worked in reaching beyond participants, and focus on recommendations for improving the reach and impact of Envision Charlotte.

34. Analysis of general area market spillover energy impacts on non-participants
This task assesses the responses from the two surveys to understand if the program has led to actions or energy-related behavior changes in non-participating area businesses and homes. When a change is reported, the estimated impacts from that change will be calculated using standard engineering estimation approaches consistent with those found in energy efficiency Technical Reference Manuals. The analysis will be conducted for those who took actions that can be related in some way to the events and information provided by the program, but will be reported for the average area business and home within the program's impact zone. We will identify that impact zone though interviews with SEN and Envision Charlotte stakeholders, but expect that zone to be small, encompassing only the general Charlotte area.

35. Draft and final report of process and impact evaluation results for area non-participants
The draft and final report will be provided as a stand-alone general Charlotte area spillover report, or it can be included with the evaluation component 1 reports.

The evaluation team will prepare draft and final reports presenting the results of the process evaluation for this component and recommendations for program changes that can be expected to improve the reach of the program beyond participants. The report will also provide the estimates of Charlotte area non-participant spillover savings for the program from the changes made in the typical business or home in the Charlotte area. The draft report will be provided to Duke Energy and key stakeholders in electronic format and presented at an on-site presentation. During the on-site presentation we will present the research approach, the findings, and the recommendations for discussion. Following the receipt of comments from Duke Energy and key stakeholders, a final report will be prepared and delivered to Duke Energy.

Evaluation Timeline

The SEN Envision Charlotte evaluation as presented in this document will consist of 35 tasks which will be performed from December 2010 through June 2013. It is anticipated that not all of the evaluation components will be approved for implementation. As the evaluation components are accepted, modified, or deleted, a revised evaluation plan will be provided. The timeline for the 35 tasks presented in this draft are reflected in the following evaluation activities table.

Task	Evaluation Effort	Timing
Evaluation Component 1: Savings in Buildings by Owners, Managers, Operators		
1	Kickoff meeting	September 2011
2	On-site familiarization visit	December 2010
3	Preparation of sample selection criteria	February 2011
4	Preliminary selection of sampled buildings	February 2011
5	On-site visit of preliminary sample of buildings	March 2011
6	Final selection of sampled buildings	May 2012
7	Coordination with Smart $aver Custom and Prescriptive programs for rebated savings sample	May 2012
8	Interviews with participants to assess possible behavior changes	April 2012 - October 2012
9	Identification of appropriate impact evaluation approach	May 2012
10	Process evaluation interviews with program managers and stakeholders	April-May 2012
11	Interviews with participants on actions considered and taken	April 2012 - October 2012
12	Interviews with all remaining participants on actions taken	April 2012 - October 2012
13	Analysis of energy impacts for actions taken by participants	October 2012
14	Compilation of savings across the population of participants	November 2012
15	Process evaluation analysis of operational systems & approaches	June 2012
16	Draft and final report of process and impact evaluation results	February 2013
Evaluation Component 2: Occupant Savings In Participating Buildings		
17	Interviews with program designers, managers, and program development stakeholders	April-May 2012
18	Occupant intercept surveys with building occupants	October 2011 and October 2012
19	Observations of interactions with displays and follow-up interaction surveys	April-May 2012
20	Analysis of energy impacts	October 2012
21	Process evaluation analysis of operational systems and approaches	June 2012
22	Draft and final report of process and impact evaluation results	February 2013
Evaluation Component 3: Savings in Homes		
23	Interviews with program designers, managers, and development stakeholders	April-May 2012
24	Interviews with building owners, managers, and operators	April-May 2012
25	Intercept surveys with building occupants and display viewers	October 2012
26	Analysis of savings from actions taken that are caused by SEN	November 2012
27	Process evaluation analysis of operational systems and approaches	June 2012
28	Draft and final report of process and impact evaluation results of impacts in homes	February 2013

Evaluation Component 4: Greater Charlotte Area Non-Participant Savings		
29	Interviews with SEN program managers, marketing and outreach managers, and key stakeholders	April-June 2012
30	Interviews with key stakeholders of Envision Charlotte	June 2012
31	Inclusion of greater SEN Envision Charlotte effects questions in interviews and surveys with participating building owners, managers, operators, and occupants	April-May 2012
32	Interviews with non-participating building owners, operators, managers, and residential customers	April-May 2012
33	Analysis of SEN's educational and motivational impacts on non-participants	June 2012
34	Analysis of general area market spillover energy impacts on non-participants	June-September 2012
35	Draft and final report of process and impact evaluation results for area non-participants	February 2013

Overview of Data Collection Efforts

The following table provides an overview of the data collection efforts associated with this evaluation. The table provides the evaluation component and the type of evaluation (process or impact) associated with that component and the data collection efforts that are required to address the evaluation issues.

Evaluation Information Source Table for Participating Buildings Process and Impact Evaluation

Evaluation Component	Process or Impact	Information Source											
		SEN Duke web actions tracking system**	Program Manager Interviews	Owner, Property Manager, and Operator Interviews	IT Manager Interviews	Occupant Intercept Surveys	Interval Meter Data Analysis	Building /DOE-2 Analysis	Participation Analysis in Duke Programs	RDD Area Business Survey*	RDD Area Home Survey *	Occupant Surveys (if we can get the data)	Envision Charlotte Stakeholder Interviews
1. Owner, Operator, Manager Savings in Participating Buildings	Process	✓	✓	✓	✓	✓							✓
1. Owner, Operator, Manager Savings in Participating Buildings	Energy Impacts	✓	✓	✓	✓		✓	✓					
2. Occupant Savings in Participating Buildings	Process		✓			✓		✓					✓
2. Occupant Savings in Participating Buildings	Energy Impacts		✓	✓		✓	✓	✓					

*-May not be needed if we can get building occupant name and home address information – discuss with SEN Manager
**- Need to discuss this with SEN Manager to determine what will be on the SEN web-site (recommendations, actions taken, blogs of chatter about who is doing what, etc.

Evaluation Information Source Table for Assessing In-Home Processes and Impacts

Evaluation Component	Process or Impact	Information Source											
		SEN Duke web actions tracking system**	Program Manager Interviews	Owner, Property Manager, and Operator Interviews	IT Manager Interviews	Occupant Intercept Surveys	Metered Data Analysis	Building / DOE-2 Analysis	Participation Analysis in Duke Programs	RDD Area Business Survey*	RDD Area Home Survey *	Occupant Surveys (if we can get the data)	Envision Charlotte Stakeholder Interviews
3. Savings in Homes of Owners, Operators, and Occupants	Process		✓			✓			✓			✓	
3. Savings in Homes of Owners, Operators, and Occupants	Energy Impacts					✓	✓?	✓	✓			✓	
4. Greater Charlotte Area Savings	Process		✓						✓	✓	✓	✓	✓
4. Greater Charlotte Area Savings	Energy Impacts						✓	✓	✓	✓	✓	✓	

*-May not be needed if we can get building occupant name and home address information – discuss with SEN Manager
**- Need to discuss this with SEN Manager to determine what will be on the SEN web-site (recommendations, actions taken, blogs of chatter about who is doing what, etc.
?-Need to discuss this with SEN Manager to see if we can get occupant name and address information.

✓ = Primary data collection activity

✓ = Secondary data collection activity

Appendix A: Draft SEN Program Baseline Data Information

This section of the plan presents the draft baseline data needs document. This draft document is to help inform the discussions with Envision Managers about baseline data needs from the evaluation team. The data presented below represent the Capital and Equipment baseline needs, but does not include the occupant behavior baseline data needs. These will be updated to this planning document by the evaluation team once the specific recommendations and information to be provided to the occupants is more refined by the program implementation team.

Capital and Equipment Baseline Data Needs

The baseline survey is a component of the overall process of establishing the baseline conditions for the evaluation. Baseline data collection will balance the desire to collect information over a wide variety of building attributes, essentially amounting to a full building survey, against the very real concern of burdening the customer with an onerous data request. The key is to anticipate the range of actions that may result from participation in SEN, identify existing data sources relevant to the anticipated range of actions, and identify gaps that need to be filled by the baseline survey.

Anticipated actions fall into two general categories:

1. Behavior changes utilizing the existing building systems
2. Capital improvement projects affecting building energy systems

Baseline information will come from a variety of sources, including:

1. Energy Star Portfolio Manager (PM)
2. Duke Efficiency Program Applications and Documentation
3. Self-funded Capital Improvement Project Documentation
4. Baseline Survey

Energy Star Portfolio Manager

Building description data entered into PM will be used to establish the baseline data for the covered data elements. Note, these data may be updated over time, so it is important to gather and archive the initial data entries. Building types covered by PM are shown below:

- Data Center
- Hospital
- Hotel
- House of Worship
- K-12 School
- Medical Office
- Multifamily Housing
- Office

- Other
- Parking
- Refrigerated Warehouse
- Residence Hall/Dormitory
- Retail Store
- Senior Care Facility
- Supermarket/Grocery Store
- Swimming Pool
- Warehouse
- Wastewater Treatment Plant
- Water treatment and Distribution

These building types cover the majority of the building uses in the SEN program[5]. Although there are a few common elements, the specific data requirements vary across building types. All buildings require gross floor area as a primary data element for computing the benchmark score. Most buildings also require percent of floor space that is heated and/or air conditioned, number of workers per shift, weekly operating hours and number of personal computers. Beyond these common data elements, building type specific questions relating to process loads and occupancy seasonality are also used to compute the benchmark score.

The Energy Star Portfolio Manager data entry process allows for some latitude in the level of data entry detail. For multiuse buildings, which comprise most of the buildings in the SEN program, the guidance on partitioning the building into the various use categories and entering the data for each use category is fairly general. The data entry process is generally conducted by facilities personnel at each building, who will likely take a variety of approaches to data entry. It will be necessary to review the data entered for each building to ensure a level of consistency and comparability across the buildings. In particular, the multi-use partitioning of the building will be combined with other building occupancy data to define the activity areas in subsequent surveys.

Duke Efficiency Program Applications and Documentation

It is anticipated that capital improvement projects undertaken within the SEN program will receive funding through the Duke Energy Non-Residential Smart $aver programs. The rebate applications and associated documentation will be used to establish baseline and improved system characteristics. Note: the Smart $aver Prescriptive program application collects limited data on existing systems, while the documentation requirements for the Smart $aver Custom program are more comprehensive. Customers planning to apply for rebates under the Smart $aver Prescriptive program should contact Duke Energy prior to initiating the project so that the appropriate baseline data can be collected.

[5] Notable exception is restaurants. Although there are probably no standalone restaurants in the SEN program, many of the multiuse buildings have a restaurant tenant.

Self-Funded Capital Improvement Project Documentation

Customers will be asked to inform the evaluation team of any self-funded capital improvement projects affecting the energy consumption of the building, including lighting, HVAC, and building shell projects, as well as projects affecting process loads such as data centers, foodservice facilities, refrigeration, and so on. Baseline data will be collected on those projects on an as-needed basis.

Behavioral Baseline Survey

The following baseline data elements relate to expected behavioral interventions taken by the SEN program. These are characterized by actions taken by three general populations within the building:

1. Building Occupants
2. Facilities Operations and Maintenance
3. Information Technology (IT) Department

The responsibility for changing the operations and use of the building across the anticipated range of interventions will vary across buildings. For example, smaller buildings may have local occupant control of space temperatures, while larger buildings may have centralized control accessible only by the facilities operations personnel. Some facilities may have a dedicated IT department, while others may have a variety of individuals responsible for establishing IT equipment operation policies. The baseline questions listed below will be targeted at the appropriate building occupants according to their responsibilities.

Building Cleaning

1. Please describe the time of day and days of the week when the building is cleaned.
2. Please describe the protocols with respect to the use of overhead lighting and HVAC that are established for the cleaning crews.

Space Comfort Control

1. Please describe the room heating and cooling temperature setpoints and schedule by activity area. (provide list of activity areas)
2. Is the space temperature subject to local control or override?
3. Do occupants have access to operable windows?
4. If so, do occupants open windows to regulate space temperatures? Which months are operable windows generally used?
5. What is the typical reason for opening windows? (reduce cooling energy, compensate for excessive heat in winter, compensate for excessive cooling in summer)
6. What is the approximate fraction of the floor space influenced by operable windows?
7. Please list the approximate fraction of desks or workstations with portable electric heaters?
8. If portable electric heaters are used, which months are they typically in operation?

Task Lighting

1. Please describe the type(s) of task lighting used in the building: incandescent, halogen, CFL, furniture integrated fluorescent, LED, other (describe).
2. What is the approximate % of each type?
3. What is the general operating schedule of task lights?

Overhead Lighting

1. What are the general operating hours of overhead lighting systems by activity area (list activity areas).
2. Do occupants manually control overhead lights in response to natural daylight?
3. If yes, please indicate approximate % of lights controlled for daylight.
4. Do occupants manually turn off lights in unoccupied spaces?
5. If yes, please indicate approximate % of lights controlled for occupancy.

Outdoor Lighting

1. Please list the outdoor lighting systems associated with this building (parking lot, parking garage, walkways, façade, signage, other (describe)).
2. What are the operating hours of each outdoor lighting system?
3. What type of control systems are used for each outdoor lighting system (time clock, photocell, time clock + photocell, other (describe))?

Computers and Office Equipment

1. Please describe the typical operating schedule for desktop computers and monitors (stay on all the time, turn off at night, other (describe)).
2. What is the typical strategy for computer power management? (No power management used, monitor in sleep mode when not in use, computer in sleep mode when not in use, other (describe).)
3. Please describe the typical operating schedule for printers and copiers (stay on all the time, turn off at night, other (describe)).
4. What is the typical strategy for printer and copier power management? (No power management used, equipment in sleep mode when not in use, other (describe).)

HVAC System Fans

1. Please describe the operating strategy for the HVAC system fans (starts and stops on a schedule, runs continuously, runs as necessary to keep building comfortable).
2. If the fans run on a schedule, please list the start and stop times for weekdays, weekends and holidays.

HVAC System Economizers

1. Does the HVAC system utilize an airside economizer?

2. If so, what type (temperature, enthalpy, other (describe))?
3. Does the HVAC system utilize a waterside economizer?
4. If so, what type (plate/frame heat exchanger, strainer cycle, other (describe))?
5. Which months of the year does the waterside economizer typically operate?

Supply Air Temperature and Pressure Control

1. What is the HVAC system supply air temperature control strategy? (fixed setpoint, reset with outdoor air temperature, reset with zone temperature)
2. What is the supply air temperature setpoint? (if reset, list range)
3. What is the supply duct static pressure control strategy? (fixed setpoint, reset with system flow, other (describe))

Water Loop Temperature Control

1. What is the chilled water temperature control strategy? (fixed setpoint, reset with outdoor temperature, other (describe))
2. What is the chilled water temperature setpoint? (if reset, list range)
3. What is the condenser water temperature control strategy? (fixed setpoint, reset with outdoor wet-bulb temperature, other (describe))
4. What is the condenser water temperature setpoint? (if reset, list range)
5. What is the hot water temperature control strategy? (fixed setpoint, reset with outdoor temperature, other (describe))
6. What is the hot water temperature setpoint? (if reset, list range)

Chiller, Cooling Tower and Boiler Control

1. Please list the size (tons), type (reciprocating, screw/scroll, centrifugal, other (describe)) and age of each chiller in the building.
2. Please describe the sequencing strategy for each chiller listed above.
3. Do the chillers run year round, or are they shut down for some portion of the year?
4. If the chillers are shut down, please indicate which months.
5. Please list the size (tons) and age of each cooling tower in the building.
6. Please describe the sequencing strategy for each cooling tower listed above.
7. Do the boilers run year round, or are they shut down for some portion of the year?
8. If the boilers are shut down, please indicate which months.

Appendix B: Energy Star Portfolio Manager Data Elements

Building Type	Data Type	Data Element
Bank/Financial	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
	Required	# of personal computers
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
Courthouse	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
	Required	# of personal computers
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
Data Center	Required	Gross floor area (SF)
	Required	IT Energy Configuration
	Required	IT Energy Data – 12 months of measured energy consumption data
	Optional	UPS System Redundancy (N, N+1, N+2, 2N, greater than 2N, none of the above)
	Optional	Cooling System Redundancy (N, N+1, N+2, 2N, greater than 2N, none of the above)
Hospital	Required	Gross floor area (SF)
	Required	# of licensed beds
	Required	Number of floors
	Required	Tertiary care facility – yes or no
	Optional	Laboratory on-site – yes or no
	Optional	Laundry facilities on site – yes or no
	Optional	Number of Buildings
	Optional	Ownership Status (drop down of options)
Hotel	Required	Gross floor area (SF)
	Required	# of rooms
	Required	# of workers on main shift
	Required	# of commercial refrigeration/freezer units
	Required	On-site cooking – yes or no
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
	Optional	Hours per day the guests are on-site
	Optional	Number of guest meals served
	Optional	Square footage of full-service spas
	Optional	Square footage of gym/fitness center
	Optional	Laundry processed at site (drop down of options)
	Optional	Annual quantity of laundry processed on-site
	Optional	Average Occupancy (%)

Building Type	Data Type	Data Element
House of Worship	Required	Gross floor area (SF)
	Required	Maximum seating capacity
	Required	Weekdays of operation
	Required	Weekly operating hours
	Required	# of personal computers
	Required	Presence of cooking facilities - yes or no
	Required	# of commercial refrigeration/freezer units
K-12 School	Required	Gross floor area (SF)
	Required	# of personal computers
	Required	# of walk-in refrigeration/freezer units
	Required	High school - yes or no
	Required	Open weekends – yes or no
	Required	On-site cooking – yes or no
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
	Optional	Months of use
	Optional	School District
Medical Office	Required	Gross floor area (SF)
	Required	# of workers on main shift
	Required	Weekly operating hours
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
Multifamily Housing	Required	Gross floor area (SF)
	Optional	# of units
	Optional	Number of bedrooms
	Optional	Number of floors
	Optional	Percent of square footage devoted to individual units
	Optional	Number of laundry hookups in each unit
	Optional	Number of laundry hookups in common area
	Optional	Number of dishwashers in each unit
	Optional	Percent of floor area that is air conditioned
	Optional	Percent of floor area that is heated
	Optional	Affordable or market rate
Other	Required	Gross floor area (SF)
	Optional	# of personal computers
	Optional	Weekly operating hours
	Optional	# of workers on main shift
Office	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
	Required	# of personal computers
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated

Building Type	Data Type	Data Element
Parking	Required	Gross floor area that is enclosed (SF)
	Required	Gross floor area that is not enclosed with a roof (SF)
	Required	Gross floor area that is open (SF)
	Required	Weekly operating hours
Residence Hall/Dormitory	Required	Gross floor area (SF)
	Required	# of rooms
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
	Optional	Computer lab on-site – yes or no
	Optional	Dining Hall on-site– yes or no
Retail Store	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
	Required	# of personal computers
	Required	# of cash registers
	Required	# of walk-in refrigeration/freezer units
	Required	# of open or closed refrigeration/freezer cases
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
	Required	Exterior entrance to the public – yes or no
Senior Care Facility	Required	Gross floor area (SF)
	Required	# of units
	Required	Average Number of Residents
	Required	Total Resident Capacity
	Required	# of workers on main shift
	Required	# of personal computers
	Required	# of commercial refrigeration/freezer units
	Required	# of commercial washing machines
	Required	# of residential washing machines
	Required	# of residential electronic lift systems
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
Supermarket/Grocery Store	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
	Required	On-site cooking – yes or no
	Required	# of walk-in refrigeration/freezer units
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
	Optional	# of open or closed refrigeration/freezer cases
	Optional	# of registers and/or personal computers

Building Type	Data Type	Data Element
Warehouse	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
	Required	# of walk-in refrigeration/freezer units
	Required	Percent of floor area that is air conditioned
	Required	Percent of floor area that is heated
	Optional	Distribution Center – yes or no
Refrigerated Warehouse	Required	Gross floor area (SF)
	Required	Weekly operating hours
	Required	# of workers on main shift
Swimming Pool	Required	Swimming pool size class
	Required	Indoor or outdoor
	Optional	Months of use
Wastewater Treatment Plant	Required	Average influent flow (mgd)
	Required	Average influent biological oxygen demand (BOD5)
	Required	Average effluent biological oxygen demand (BOD5)
	Required	Plant design flow rate (mgd)
	Required	Presence of fixed film trickle filtration process – yes or no
	Required	Presence of nutrient removal process – yes or no
Water treatment and Distribution	Required	Average flow (mgd)

Appendix C: Behavior Change Push Items – Draft September 2011

The program's behavior change push efforts will focus on convincing building occupants to take the following actions in their offices.

1. Enable the power saving features on your computer
2. Shutting down your monitor when not in use
3. Community action to turn off idle monitors and computers
4. Daylighting
5. Delamping
6. Lighting automation
7. Power strips
8. Take the stairs
9. Use revolving doors
10. Groups action of revolving doors and walking the stairs
11. Think before you print
12. Change the default printer settings
13. Collaborative printing
14. Coffee machines
15. "Coffee Talk" Energy efficiency discussions
16. Office energy audit
17. Office blinds for the sunny side of the building
18. Use whole office fans
19. Change setting on thermostat
20. Clean the coils on the fridge
21. Install vending misers on office vending machines