APPENDIX C
FLORIDA ENERGY EFFICIENCY WHITE PAPER

White Paper on "Key Ingredients for Assessing the Value and Cost-Effectiveness of Energy Efficiency Initiatives"

February 28, 2008

On Behalf of the Petitioners in
Florida Public Service Commission
Proceedings to Amend Rule 25-17.008

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Prologue

This white paper provides detailed information on policy and methodology issues relating to assessing the value and cost effectiveness of energy efficiency measures and programs. It has been prepared based on significant actual experience working with these issues, and after careful review of many technical reports and conference papers relating to this issue. This white paper can help advance debate, narrow the focus on key issues, and identify potential solutions with respect to cost-effectiveness testing for Florida energy efficiency programs.

This paper presents a practical foundation for the analyses we believe are necessary to ensure that the maximu achievable cost effective energy efficiency potential is achieved in Florida. Major areas covered include:

- Appropriate Tests for Cost-Effectiveness Analysis
- Procedures for Screening and Program Selection
- Environmental and Other Non-Energy Benefits Adders
- Indicators of Market Effects of energy efficiency programs
- Importance of Measuring and Forecasting Baselines
- Benefit/Cost Screening Tool

Petitioners recognize that electric and natural gas utilities across the US have different needs and perspectives pertaining to cost effectiveness analysis and program screening. The concepts presented in this white paper outline a recommended approach for cost effectiveness analysis and program screening and recognize that a program selection process should not be reduced entirely to a mechanistic computer calculation or a single benefit/cost ratio. notes that achieving consensus on a generic framework and on critical input variables is important and in the best interest of fostering new, cost effective energy efficiency programs in Florida .

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Chapter 1 – Cost Effectiveness Tests

1.0 Appropriate Tests for Cost Effectiveness Analysis

1.1 Overview of Cost Effectiveness Tests

This chapter presents an overview of appropriate tests for cost effectiveness analysis of proposed energy efficiency programs and discusses other issues relating to cost effectiveness. The chapter also addresses some limitations of the various tests. Highlights of this chapter include the following:

- The State of Florida lags far behind other states in the amount of kWh savings achieved (as a percent of electric retail sales) from electric energy efficiency programs.

- The cost effectiveness test that is used the most across the US is the Total Resource Cost (TRC) Test.

- Acknowledgement that there is no single correct cost effectiveness test that will meet the needs of all perspectives (society, utilities, ratepayers, participants, etc.)

- According to the California Standard Practice Manual, the Rate Impact Measure (RIM) test is the weakest of all of the cost effectiveness tests. In fact, measures such as tearing attic insulation out of a house or taking insulation jackets off electric water heaters will pass the RIM test. The RIM test is not a test of economic efficiency; the RIM test is only a test of fairness or equity.

- The State of Florida should consider including non-energy benefits (such as operations and maintenance savings, and savings of other resources) in cost effectiveness calculations so long as they are generally quantifiable and understood.

Petitioners generally support the use of the Total Resource Cost (TRC) test as a key starting point for energy efficiency program screening, program design, and program evaluation. Petitioners believe that this Test should not be used as the sole criterion to determine the level of utility budgets for energy efficiency programs, and should not be the sole criterion used for program screening, program evaluation, or for analysis of the overall effectiveness of an energy efficiency program. There are other issues which should be considered, such as reductions of power plants emissions, reduction in water used in power plants to generate electricity, and other non-energy benefits of electric energy efficiency programs. Furthermore, while Petitioners find that the TRC Test is a reasonable cost effectiveness test from the perspective of all ratepayers, other tests are useful to examine when considering other perspectives (utility, participant, society, etc).

Petitioners find compelling reasons why the RIM test should never be used as a mandatory test for energy efficiency programs.

Petitioners recognize that energy efficiency and market transformation programs are impacted by additional factors (both positive and negative) that are not easily captured in a mechanistic benefit/cost calculation. However, we believe that some effort should be taken to categorize non-energy benefits so that a reasonable quantification can be included in any cost-effectiveness test. For example, a compact fluorescent lightbulb has a useful life that is at least ten times longer than an incandescent bulb. When a CFL is purchased and installed, it eliminates the need to purchase ten incandescent bulbs, resulting in dollar savings to the purchaser. Later in this paper we present our recommendations on how these other benefits might be factored into a benefit/cost model and also considered in program screening, ranking, and evaluation.

1.2 Definitions of Benefit Cost Tests

A standard methodology for energy efficiency program cost effectiveness analysis was published in California in 1983 by the California Public Utilities Commission and updated in December 1987 and October 2001.[1] It was based on experience with evaluating conservation and load management programs in the late 1970's and early 1980's. This methodology examines five perspectives:

- the Total Resource Cost Test
- the Participant Test
- the Utility Cost Test (or Program Administrator Test)
- the Rate Impact Measure (RIM) Test
- the Societal Cost Test

Table 1-1 below summarizes the major components of these five benefit/cost tests. Examining this table is useful when trying to understand the differences among the five benefit/cost tests.

[1] California Public Utilities Commission and California Energy Commission, Standard Practice Manual, Economic Analysis of Demand-Side Programs and Projects, 1987 and 2001.

Table 1-1
Components of Energy Efficiency Benefit/Cost Tests

	PARTICIPANT TEST	RATE IMPACT MEASURE TEST	TOTAL RESOURCE COST TEST	UTILITY COST TEST	SOCIETAL TEST
BENEFITS:					
Reduction in Customer's Utility Bill	X				
Incentive Paid By Utility	X				
Any Tax Credit Received	X		X		
Avoided Supply Costs		X	X	X	X
Avoided Participant Costs	X		X		X
Participant Payment to Utility (if any)		X		X	
External Benefits					X
COSTS:					
Utility Costs		X	X	X	X
Participant Costs	X		X		X
External Costs					X
Lost Revenues		X			

The five cost-benefit tests are defined by the California Standard Practice Manual as follows:

1.2.1 The Total Resource Cost Test

The Total Resource Cost (TRC) test measures the net costs of a demand-side management or energy efficiency program as a resource option based on the total costs of the program, including both the participants' and the utility's costs.[2]

Benefits and Costs: The TRC test represents the combination of the effects of a program on both the customers participating and those not participating in a program. In

[2]California Public Utilities Commission, California Standard Practice Manual, Economic Analysis of Demand-Side Management Programs and Projects, October 2001, page 18.

a sense, it is the summation of the benefit and cost terms in the Participant and the Ratepayer Impact Measure tests, where the revenue (bill) change and the incentive terms intuitively cancel (except for the differences in net and gross savings).

The benefits calculated in the Total Resource Cost Test include the avoided electric supply costs for the periods when there is an electric load reduction, as well as savings of other resources such as fossil fuels and water. The avoided supply costs are calculated using net program savings, which are the savings net of changes in energy use that would have happened in the absence of the program.

The costs in this test are the program costs paid by the utility and the participants plus any increase in supply costs for periods in which load is increased. Thus all equipment costs, installation, operation and maintenance, cost of removal (less salvage value), and administration costs, no matter who pays for them, are included in this test. Any tax credits are considered a reduction to costs in this test.

1.2.2 The Participant Test

The Participant Test is the measure of the quantifiable benefits and costs to program participants due to participation in a program. Since many customers do not base their decision to participate in a program entirely on quantifiable variables, this test cannot be a complete measure of the benefits and costs of a program to a customer.[3] This test is designed to give an indication as to whether the program or measure is economically attractive to the customer. Benefits include the participant's retail bill savings over time, and costs include only the participant's costs.

1.2.3 The Rate Impact Measure Test

The Ratepayer Impact Measure (RIM) Test measures what happens to customer bills or rates due to changes in utility revenues and operating costs caused by a program. Rates will go down if the change in revenues from the program is greater than the change in utility costs. Conversely, rates or bills will go up if revenues collected after program implementations are less than the total costs incurred by the utility in implementing the program. This test indicates the direction and magnitude of the expected change in customer rate levels.[4] Thus, this test evaluates an energy efficiency program from the point of view of rate levels. The RIM test is a test of fairness or equity; it is not a measure of economic efficiency. The October 2001 California Standard Practice Manual states that the "Results of the RIM test are probably less certain than those of other tests because the test is sensitive to the differences between long-term projections of marginal costs and long-term projections of rates, two cost streams that are difficult to quantify with certainty."[5] Another major problem with the RIM test that it is never applied to new supply-side options, such as a new coal-fired power plant, or a new transmission line.

[3] Ibid., page 9.
[4] Ibid., page 17.
[5] Ibid., page 14

The RIM Test is the **WRONG** test for Florida for the following twelve reasons:

- **The RIM Test is an "extreme" screening test.** As demonstrated by the efficiency measure screening done recently by such utilities as Georgia Power Company, the City of Gainesville, Florida, and other utilities in Florida, nearly all energy efficiency measures will fail the RIM test, even if the efficiency can be gained at no cost. Furthermore, as agreed to in recent oral testimony by Georgia Power Company, if a philanthropist gave a donation of millions of dollars to Georgia Power Company to run "free" DSM programs, GPC would have to return the money to the philanthropist because many "free" electric energy efficiency programs fail the RIM test.
- **The RIM Test prevents "integrated resource planning".** The IRP process is designed to provide the most efficient and reliable electricity system, and energy efficiency is an important resource that must be considered. Use of the RIM Test prevents supply-side and demand-side resources from being integrated into a balanced portfolio of resources to meet customer needs.
- **The RIM test is not a test of economic efficiency**. According to the California Standard Practice manual, the RIM test examines the equity or fairness of a DSM program, and whether electric rates will increase to participants and non-participants due to the concern that electric rates might have to increase to recover lost revenues. The Total Resource Cost Test, on the other hand, measures the economic efficiency of a DSM program and whether it is less expensive than an alternative supply-side resource.
- **Lost revenues are a myth**. The RIM Test considers lost revenues as a cost. Lost revenues are not a "true economic costs", and given the rate of load growth in the service areas in Florida, such lost revenues are not likely to occur. In addition, the RIM test ignores the significant impacts of "found revenues" due to the economic growth created from energy efficiency programs.
- **The RIM test is never applied to supply-side investments.** Electric utilities do not apply the RIM Test to any other investments that they make (like the $3.6 billion in planned new T&D investments included in the 10-Year Transmission Plan for Georgia Power Company). Thus the RIM test is clearly discriminatory and arbitrary. Furthermore, the rate impacts of supply-side investments clearly dwarf the rate impacts of DSM programs (as even Georgia Power has admitted in testimony in past IRP dockets).
- **Load building programs pass the RIM test, but energy efficiency programs typically do not.** Supporting the RIM test supports policies that will encourage the excessive and unwise use of electricity. In fact, Georgia Power Company witnesses stated under cross examination at the Georgia Public Service Commission that programs to tear insulation out of attics in Georgia homes or to tear insulation jackets off electric water heaters would pass the RIM test. Furthermore, Company witnesses further stated under cross examination that the popular and effective ENERGY STAR Homes program of the US Environmental Protection Agency would be "harmful" to Georgia ratepayers because of the RIM test. Clearly this is a counter-intuitive

result that should have no place the development of utility integrated resource plans.

- **Many factors exist to eliminate or counterbalance lost revenues**. Many electric utilities conduct load building programs (such as programs to encourage homeowners to install HVAC systems fueled by electricity) that will offset load reductions from DSM programs, and thus these "found revenues" will mitigate any small rate impacts associated with energy efficiency programs. Second, electric utilities can use innovative program design to have customers pay as much of the program cost as possible. This can also help to mitigate adverse rate impacts. Third, the service areas of many utilities in Florida are growing rapidly, as indicated by recent publicly available data on historical load growth from FERC Form 1's of Florida utilities. This natural load growth will also help to mitigate the adverse rate impacts of conservation programs. Fourth, electric utilities in Florida continue to conduct effective peak load management programs, which can also help mitigate any small rate impacts from energy efficiency programs. Even Georgia Power Company admitted in a data response to -4-50 in Docket 5601-U that the vast majority of rate impacts in the Georgia Power IRP are due to supply-side investments, not DSM programs.
- **Rate impacts of DSM programs are negligible**. A study conducted in 1994 by the American Council for an Energy Efficient Economy (ACEEE) concluded that the rate impacts caused by utility DSM programs are very minor.[6] In addition, a follow-up study published by Oak Ridge National Laboratory in November 1994 concluded that the rate impacts of DSM programs are small both in absolute terms and relative to the many other factors that affect electricity prices.[7]
- **The RIM Test ignores important benefits of DSM programs**. The RIM Test formula ignores key economic and environmental benefits of DSM programs, such as job creation due to DSM programs, reduced use of water for power plants, reduced use of natural gas in homes and businesses, the value of reduced air emissions, and the value of increased competitiveness of Florida businesses.
- **Use of the RIM Test encourages load building programs.** Most load building programs pass the RIM test. Such load building programs exacerbate electric load growth and air emission problems and increase customer electric bills. Use of the RIM test is inconsistent with efforts of Federal and State agencies to curb air emissions problems in the metro Atlanta region.
- **Use of the RIM Test ignores the needs of low income and senior citizen customers.** Energy efficiency programs for low income and senior citizen customers fail the RIM Test. Clearly these two residential customer segments have unique needs. Even a Georgia Power witness testified that the

[6] Nadel, Steven; Pye, Miriam, "Rate Impacts of DSM Programs: Looking Past the Rhetoric, American Council for an Energy-Efficient Economy, Washington, DC, 1994.
[7] Hirst, Eric; Hadley, Stan, "Price Impacts of Electric-Utility DSM Programs", Oak Ridge National Laboratory, November 1994, pages 29-30.

Company would be willing to expand funding of the low income program if there existed a huge backlog of low income customers waiting for energy efficiency services. Thus the RIM Test alone is not a useful public policy tool, and it stands in the way of true integrated resource planning.

- **The claim by some utilities that their customers do not want DSM programs is simply not supported by fact.** Electric utilities have not provided any market research studies to support their claim that their customers do not want DSM programs.
- **The Companies' claims that they are environmental leaders are lip service.** If electric utilities in Florida were truly concerned about improving the environment in Florida and saving customers hundreds of millions of dollars on their electric bills, they would be supportive of utility-sponsored energy efficiency programs that save kWh year -round.
- **The Florida Commission is one of only two Commissions in the country that rely on the RIM Test for screening of DSM programs.** As a result, Florida investor-owned utilities lag far behind their counterparts in other States when it comes to saving electricity and lowering customers' bills.

1.2.4 The Utility Cost Test

The Utility Cost Test (also known as the Program Administrator Test) measures the net costs of a demand-side management program as a resource option based on the costs incurred by the utility (including incentive costs) and excluding any net costs incurred by the participant. The benefits are similar to the Total Resource Cost Test benefits. Costs are defined more narrowly, and only include the utility's costs.[8] This test compares the utility's costs for an energy efficiency program to the utility's avoided costs for electricity and/or gas. It is important to remember that the Utility Cost Test ignores participant costs. This means that a measure could pass the Utility Cost Test but not be cost effective from a more comprehensive perspective. Thus the utility test does not allow comparison of supply-side and demand-side options on a level playing field.

1.2.5 The Societal Test

The Societal Cost Test is structurally similar to the Total Resource Cost Test. It goes beyond the TRC test in that it attempts to quantify the change in total resource costs to society as a whole rather than to only the service territory (the utility and its ratepayers). In taking society's perspective, the Societal Cost Test utilizes essentially the same input variables as the TRC test, but they are defined with a broader societal point of view.[9] An example of societal benefits is reduced emissions of carbon, nitrous and sulfur dioxide and particulates from electric utility power plants.[10] When calculating the Societal Cost Test benefit/cost ratio, future streams of benefits and costs are discounted to the

[8] Ibid., page 33.
[9] Ibid., page 27.
[10] The Vermont Public Service Board Order in Docket No. 5270 cites the following as such societal benefits: reductions in acidic precipitation, carbon dioxide and other greenhouse gases, reduction in habitat destruction, and reduction in nuclear waste disposal risks).

present using a discount rate. The avoided costs of electricity, natural gas, propane, #2 fuel oil, kerosene and water used in this study are provided in Appendix F of this report.

In is interesting to note that the Societal Test calculation in Vermont used to include a 5 percent adder to program electric energy benefits for non-energy benefits (for environmental benefits), and a 10% reduction to costs to account for the risk diversification benefits of energy efficiency measures and programs. The Vermont Public Service Board subsequently adopted an environmental adder of $.0070 per kWh saved (in $2000). This adder replaces the original 5% adder for environmental externalities.

1.3 A Single Test Should Not Be Used As the Sole Criterion for Decision-Making

Petitioners acknowledge that multiple economic factors, and rarely a single benefit/cost test should be used as the sole criterion for implementation decisions on energy efficiency programs.[11] Petitioners recommend that the framework for individual program decision-making be expanded to include a comprehensive discussion of the other factors that should be considered for program screening, program ranking and evaluation in addition to a benefit cost ratio, such as long-term market effects and environmental effects. For example, collection and analysis of data on indicators of market transformation are necessary in order to determine if the process of market transformation is actually working. Categories of such indicators for decision-making should include at least the following: customer knowledge and awareness; customer perceptions of product performance and reliability; quality of installation; product availability; product maintenance infrastructure and market penetration. The final decision-making framework should include a discussion of how one measures improvement in such indicators over time. Petitioners believe that a benefit/cost ratio calculation is but one input to decisions regarding programs, not the sole criterion for decision-making.

1.4 Policy Issues Relating to Benefit/Cost Tests

From a theoretical perspective, Petitioners believe that the RIM test is the "wrong test." Each cost effectiveness test represents a different point of view and has different efficiency and equity considerations. There is no "best" perspective[12]. If the United States were in the middle of a severe energy crisis, as it was in 1973 and 1974, the Societal Test could be the correct test. If cross subsidization and fairness are the only issues, then the RIM test is the correct test (although Petitioners maintain their position that RIM entails far too many flaws to be a reliable test). In general, all five perspectives provide valuable information in the evaluation of an energy efficiency program. If a program "fails" from one perspective, the program may be redesigned. In addition, other

[11] This caution is also stated in the MECo report on page IV-44.

[12] This conclusion is supported by Clark Gellings of the Electric Power Research Institute and John Chamberlin of Barakat and Chamberlin in their 1993 book entitled "Demand-Side Planning" (Fairmont Press, Lilburn, Georgia).

public policy considerations may outweigh the “failure” of one perspective. Petitioners find that in selecting an appropriate test or perspective, it is important to understand the policy impacts that result from selection of one test over another.

From a practical perspective, however, Petitioners recommend the use of the Total Resource Cost Test as the main test for program screening, program ranking, and program evaluation. The pragmatic selection of the TRC Test is one that we believe will:

- Will allow the State of Florida to capture far more of the reservoir of electric energy efficiency potential in the State.
- lead to implementation of energy efficiency programs that are cost effective, and cost less (on a cost per lifetime kWh saved basis) than the avoided costs of electricity; and
- Allow Florida to use a test that is the most widely used across the US.

1.7 Summary of View on Cost Effectiveness Tests

Petitioners believe that cost effectiveness analysis is a key component in decision-making, which is most appropriately combined with other vital measures in judging the total value of energy-efficiency programs or the ranking of a program in a portfolio. Cost effectiveness analysis is one of many possible and necessary methods for determining what measures could provide positive value to the State of Florida. However, it is not appropriate to use just one benefit cost test as the sole criterion for program decision-making.[13] Due to its many, many flaws and weaknesses, the RIM test should never be used as a mandatory test.

There are other perspectives (discussed earlier in this Chapter) that should and must be reviewed for valuing energy efficiency initiatives. Looking across the U. S., the most widely used test is the Total Resource Cost Test.

[13] Petitioners agree with the statement in the paper prepared for the Northeast Energy Efficiency Partnerships (NEEP) by Joseph Eto of Lawrence Berkeley Laboratory that “while important, cost effectiveness analysis, alone, does not provide a wholly adequate basis for making energy-efficiency program decisions.” (p. 7 of Eto paper). Eto implies in the paper he prepared for NEEP that the societal perspective is the most appropriate for assessing the overall value of an energy efficiency initiative (p. 5). agrees that this is an important perspective, but does not believe that it is the only theoretically correct perspective for program development, implementation and evaluation.

Chapter 2 - Procedures for Screening and Selecting Market Transformation and Other Energy Efficiency Programs

2.0 Introduction

In the past, utilities and other program administrators have approached energy efficiency markets through direct intervention programs (i.e. subsidies). In the late 1990's, this approach was replaced by a market transformation approach[14] which has the goal of making energy efficiency markets self sufficient or self driven. With the market transformation approach increasing in popularity, utilities and other energy efficiency organizations across the country are reviewing on-going national and regional market transformation activities, to determine which initiatives to participate in over the next few years. In addition, utilities and organizations are considering which other energy efficiency programs to operate as a complement to market transformation initiatives within predefined budgets.

As an aid to making these decisions, utilities and organizations are frequently conducting screening exercises, in which prospective targets for market transformation initiatives and other programs are systematically compared and contrasted, and ultimately ranked based on specified criteria. Such screening allows decision-makers to order and make sense of the many considerations that affect their decision. Screening can also be used to identify the most promising opportunities for more detailed investigation and likewise to separate out options with limited promise which are not worth investigating further.

However, not all of the factors that affect final decisions on which programs to pursue can be objectively screened and ranked, and thus screening results must be combined with such factors as professional and societal judgment before final decisions can be made. Typically, decision-makers (including utility managers, state officials and intervenor groups) use screening results to develop initial lists of potential program offerings, and then add, subtract, combine and modify from these initial lists based on their own professional and societal judgments, as well as taking into account the judgments of other interested parties. In other words, screening does not make decisions, but screening can be an important aid to decision-making.

This chapter discusses a recommended approach to screening, the role of cost-effectiveness analyses in this screening, and how the screening approach compares to approaches being used elsewhere in the country. We conclude with recommendations for future Hoosier Energy screening exercises.

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[14] A market transformation approach is one that focuses on reducing market barriers that prevent the purchase and installation of energy efficiency measures. A market transformation approach involves developing programmatic strategies to remove or reduce such barriers and that will lead to changes in practices and behaviors so that consumers will continue to purchase and install energy efficiency measures long after a program has been withdrawn, reduced or changed.

2.1 Screening Approach

This screening and ranking approach for demand-side options can be used to screen and set priorities among numerous potential market transformation and resource acquisition energy efficiency measures or programs. This screening approach is a valuable aid in the planning process, In this section, we describe the screening approach used for market transformation and resource acquisition energy efficiency programs, but also note some of the ways the basic approach can be modified to suit other types of programs that have different objectives.

The intent of the screening approach is to develop a simple process that incorporates key decision factors but does not require extensive and burdensome analyses. The process begins by listing potential energy efficiency measures in which can become involved, proceeds to developing screening criteria and a screening form, continues with data collection and ranking, and concludes with tentative decisions on energy efficiency initiatives for further development. Each of these steps is discussed in the following sections.

2.1.1 Identify Potential Measures

The first step in the screening process is to identify energy-saving technologies and practices (hereafter collectively called *measures*) that could be potential candidates for Florida's energy efficiency initiatives. Suggestions for potential measures can come from a wide array of sources including utilities and government agencies in Florida, national laboratories (such as ORNL, LBL and PNL), the Southeast Energy Efficiency Alliance (SEEA), the Midwest Energy Efficiency Alliance, the Northwest Energy Efficiency Alliance, the Alliance to Save Energy, the US Environmental Protection Administration (EPA), other electric utilities in the region, Northeast Energy Efficiency Partnership (NEEP), the Consortium for Energy Efficiency (CEE), the American Council for an Energy Efficient Economy (ACEEE), EPA, DOE, Hoosier Energy staff and consultants, and outside interveners.

2.1.2 Screening Criteria and Forms

In order to screen these different measures, several screening criteria can be developed and refined. These criteria can be based on criteria previously developed by NEEP and by the American Council for an Energy-Efficient Economy (ACEEE) in a project for Pacific Gas & Electric Company (PG&E).[15] Four criteria are included in the screening analysis as follows:

1. Energy savings in 2012 assuming achievement of aggressive but realistic goals for a market transformation initiative in operation from 2008 to 2012.

[15] These and other screening approaches are summarized in an ACEEE report prepared by Steven Nadel and Margaret Suozzo.

2. Likelihood of sustained success by 2012.

3. Cost-effectiveness

4. Meeting Florida's energy needs.

Energy Savings in 2012: One of the major objectives of past DSM programs and one of the major objectives of the new programs funded by targeted public or utility funds is to save energy. The more energy that can be saved cost effectively, all other things being equal, the more attractive the measure. For the screening process, energy savings can be estimated in a preliminary fashion based on the Company's sales by sector, saturation and other forecast data, and estimates of stock turnover, average energy savings per installation, and cumulative participation rate by 2012. Given the preliminary nature of these calculations, savings estimates are condensed into five different categories ranging from savings of less than 5 Gwh in 2012 to savings of 100 Gwh or more by 2012. In developing these estimates, we assume that programs achieve aggressive but realistic participation goals and that all energy efficiency programs end in 2012.

Likelihood of Sustained Success by 2012: We want our energy efficiency initiatives to be successful, and achieving success (e.g. largely transforming specific markets) will be more difficult for some initiatives than others given the nature of different markets and the market barriers that need to be overcome. The State of Florida should also interested in initiatives that result in permanent transformation, rather than initiatives where changes may not be sustained after the initiative ends. We are most interested in initiatives that can achieve success by 2012, relative to initiatives that will likely require additional time to successfully transform markets. All of these considerations were captured by a single rating of the likelihood of sustained success by 2012 (using a poor/fair/good/excellent scale). Ratings can be developed based on answers to a series of questions as follows:

- Does the program seem practical and doable?
- Is there interest and enthusiasm among potential allies in Florida and the region?
- Is the infrastructure in place or can it be quickly developed?
- Does information about the market already exist?
- Does the initiative coincide with the agenda of others?
- Does the concept need another push which is not happening anyway?
- Has some momentum already been developed in Florida?
- Do the barriers appear surmountable in five years (by 2012)?
- Is an exit strategy available?
- Is the measure cost-effective to consumers in Florida? What is the typical simple payback?
- Are there non-energy benefits that will also help sell the measure?

Cost-Effectiveness: Measure cost-effectiveness is important for several reasons. First, measure cost-effectiveness is very important for convincing consumers to implement a measure. If measures are very expensive relative to the benefits, achieving substantial market share will be near impossible. Second, the Florida Public Service Commission IRP rule requires consideration of cost effectiveness. Several different variables can be used in the screening analysis as a proxy for cost-effectiveness. These are discussed in the next section of this chapter.

Meeting Florida's Energy's Needs: In addition to the criteria discussed above, Petitioners recommend the consideration of a number of other criteria against which potential initiatives need to be measured including:

- Can the initiative be administered without high administrative costs?
- Can the effects be measured?
- Is the initiative likely to satisfy regulators and other public officials?
- Will the initiative help meet the growing demand for Energy in Florida?

Answers to these questions are compiled and a single rating developed as to how likely an initiative is to meet these needs. Ratings are on a three point scale; with a score of three most likely to meet Florida's needs.

Data Forms: In order to compile information for the screening process, has developed simple two-page forms that can be filled out for each energy efficiency measure or program using readily available data. The intent of this screening and ranking process is to quickly compile the best available information in order to identify measures most appropriate for additional investigation and screening.

2.1.4 Ranking

Based on the ratings on the four criteria, scores and rankings can be developed for each energy efficiency measure or program. In this recommended screening process, scores can be developed based on the following weights:

1. Likelihood of sustained success by 2012: 40% of total score
2. Energy savings in 2012: 25% of total score
3. Cost-effectiveness: 20% of total score
4. Meets Florida's Energy needs: 15% of total score

Likelihood of success can be most heavily weighted because the State of Florida should be interested in achieving market transformation as soon as possible. Potential energy savings should be strongly weighted because saving energy is the ultimate objective of these market transformation programs. Cost-effectiveness is weighted less than the previous two factors because measures with a poor cost-effectiveness will generally have a low likelihood of success score (due to the barriers of high measure costs and/or limited measure benefits). Meeting Florida's needs, while important, was assigned the lowest weight.

A measure with the maximum score in all categories receives a total score of 100 points. Measures with the minimum score in all categories receive no points. Other measures receive proportional total scores based on their scores on the four criteria. Measures are then ranked from highest to lowest score. The intent of these scores and rankings is to guide but not determine decision-making. Other subjective criteria can also influence decision-making as discussed elsewhere in this chapter.

While the relative weights given to the different screening factors may appear to be critical, the specific weights are of secondary importance. In addition to the basic scoring and ranking, Petitioners maintain that it is possible to develop several alternative scenarios based on different weights assigned to the different scoring factors. In past screening exercises, none of these alternative scenarios resulted in significant changes to the rankings. Under all scenarios none of the measures varied in rank by more than two positions relative to the base case (e.g. a measure ranked fifth in the base case was somewhere between third and seventh in all of the alternative scenarios).[16]

2.2 Variations for Other Energy Efficiency Programs

The basic screening approach described above can be modified for other types of energy efficiency programs. For example, for programs with significant demand impacts, it is possible to included both energy and demand savings into a single savings variable. For programs with different objectives than market transformation, key objectives can be defined and likelihood of success assessed relative to the appropriate objective. However, screening processes such as the approach described above are generally most useful for comparing potential program options with the same broad objectives (e.g. market transformation) because the objectives provide the yardstick by which options are compared. It is more difficult to compare options that have some common objectives (e.g. saving energy and being cost-effective) but also some different objectives. And where objectives differ in fundamental ways, subjective judgment plays a large role.

2.3 Preliminary Selections

Based on the rankings discussed above, measures with the highest scores are selected for additional review and analysis. However, there are exceptions to this rule. For example market impacts for otherwise highly ranked measures would be difficult to assess if there was no other market transformation work taking place on this measure in the region. It is preferred that a list of measures for additional investigation be developed as part of a successful regional initiative, in order to reach a plan that all parties can agree to.

2.4 Relationship of Cost-Effectiveness Analysis to Screening

[16] Ibid.

As discussed above, cost-effectiveness is only one factor among several in the screening and ranking process. While all energy efficiency programs must ultimately be found to be cost-effective before they are offered, the relative degree of cost-effectiveness is only one factor to consider in making program selections. For example, energy efficiency programs are designed to save energy, and since there are limits on the number of programs that can be offered for both administrative and marketing reasons (if there are too many programs, customers get confused), it often makes sense to offer fewer programs with large energy savings than many programs with small energy savings, no matter how cost-effective these small programs may be. Likewise, in the case of market transformation programs, likelihood of sustained success is of critical importance in order to have concrete achievements at the end of the restructuring transition period and to maintain public and legislative support for these programs.

Another important issue for screening is which cost-effectiveness metrics to use for screening. As noted earlier in this paper, the IRP rules of the Florida Public Service Commission requires that a benefit/cost test be calculated for each measure or program. Calculating this benefit/cost ration requires extensive data collection and analysis. When many different options need to be screened and a subset selected for further analysis, it will often make sense to use simpler cost-effectiveness approaches for the initial screening (such as only the TRC test) and to use multiple tests as part of the final selection process.

2.5 Approaches Used by Others

Energy efficiency program screening exercises have been conducted by numerous electric utilities and energy efficiency organizations, such as Duke Energy, Pacific Gas & Electric, Northeast Energy Efficiency Partnerships, the Northwest Energy Efficiency Alliance, and the Consortium for Energy Efficiency.[17]

In general, the screening approaches used by these other utilities and organizations have had a lot of similarities to the approach recommended by in that all include: (a) energy savings, (b) cost-effectiveness, and (c) likelihood of success. In addition, many but not all of the other approaches have incorporated other factors that were germane to their decision-making processes such as relationship to California's energy efficiency goals (in the case of PG&E), regional distribution of energy savings (in the case of NEEP), need for intervention, fuel share impact (will an initiative cause significant fuel switching?), and the presence of non-electric fuel benefits (the latter three are used by the NW Alliance).

One significant difference between the screening approaches is in the technical rigor of the screening estimates. NEEP uses a subjective approach to rate each of its screening variables, some utilities use approximate calculations for key variables (e.g., savings and cost-effectiveness), while the other studies have used more detailed calculations. We believe that the approach is a reasonable middle ground on this continuum.

[17] See note 15, supra [Nadel and Suozzo].

In addition, there are many technical differences among the different screening studies. These are discussed elsewhere and are often of secondary importance.[18]

2.6 Conclusions

The energy efficiency program screening approach (as well as the similar approaches used by others) has served a useful purpose by distilling large amounts of data into a format which decision-makers can consider as they make decisions on which market transformation initiatives and other energy efficiency programs to pursue. In particular, these studies can focus attention on high-ranked measures which decision-makers may not be fully aware of. However, decision-makers must also consider factors not explicitly included in the screening analysis, since no screening analysis can include and properly weight all factors that are relevant to a decision.

Cost-effectiveness analysis is an important part of the screening process. While all programs must ultimately be found to be cost-effective to proceed, the relative degree of cost-effectiveness is only one among several factors that should be considered in selecting which programs to offer. Furthermore, there are several different metrics that can be used to assess cost-effectiveness. While complex approaches (such as the Societal Test used in Massachusetts and Vermont) have a critical role to play, often these complex approaches should be reserved for the latter stages of the program selection process, with simpler approaches used for preliminary screening during the earlier stages. In this way, limited resources can be used to screen many program options, and resource-intensive analyses can be reserved for a more limited number of "finalists."

The screening process has worked well in the past and represents a middle ground between totally subjective and detailed objective approaches.

Chapter 3 – Environmental and Other Non-Energy Benefits Adders

3.0 Incorporation of Environmental and Other Non-Energy Benefits into Cost Benefit Analysis

3.1 Overview of Adders for Environmental and Other Non-Energy Benefits in CBA

Recent studies (such as the July 2006 National Action Plan for Energy Efficiency) demonstrate that there are both tangible and intangible benefits attributable to utility-sponsored or program administrator-sponsored energy efficiency programs that go well beyond that of simply energy savings. One of the most obvious of these benefits are the possible reduction of adverse environmental impacts and the lowering of possible mitigation costs associated with rectifying adverse environmental impacts. This has been a controversial topic to say the least, and has been the topic of study in many regions of the nation.

[18] Ibid.

There are several recent studies that demonstrate that there are indeed benefits that should be attributable to energy efficiency and market transformation programs during their valuation that can be categorized as environmental and "other" non-energy based. It is sometimes difficult to monetize some of these impacts. The National Action Plan for Energy Efficiency notes that "these benefits include environmental improvement, support for low-income customers, economic development, customer satisfaction and comfort, and other potential factors such as reduced costs for bill collection and service shut-offs, improvements in household safety and health, and increased property values. As an economic development tool, energy efficiency attracts and retains businesses, creates local jobs, and helps business competitiveness and area appeal. Environmental benefits, predominantly air emissions reductions, might or might not have specific economic value, depending on the region and the pollutant. The market price of energy will include the producer's costs of obtaining required emission allowances (e.g., nitrogen oxides [NOX], sulfur dioxide [SO2]), and emission reduction equipment. Emissions of carbon dioxide (CO2) also are affected by planning decisions of whether to consider the value of unregulated emissions."

The costs of CO2 were included in California's assessment of energy efficiency on the basis that these costs might become priced in the future and the expected value of future CO2 prices should be considered when making energy efficiency investments. Even without regulatory policy guidance, several utilities incorporate the estimated future costs of emissions such as CO2 into their resources planning process to control the financial risks associated with future regulatory changes. For example, Idaho Power Company includes an estimated future cost of CO2 emissions in its resource planning, and in determining the cost-effectiveness of efficiency programs. Many of these benefits do not accrue directly to the utility, raising additional policy and budgeting issues regarding whether, and how, to incorporate those benefits for planning purposes. Municipal utilities and governmental agencies have a stronger mandate to include a wider variety of non-energy benefits in energy efficiency planning than do investor-owned utilities (IOUs). Regulators of IOUs might also determine that these benefits should be considered. Many of the benefits are difficult to quantify. However, non-energy benefits can also be considered qualitatively when establishing the overall energy efficiency budget, and in developing guidelines for targeting appropriate customers (e.g., low income or other groups).

Petitioners recommend that environmental and non-energy benefits of energy efficiency programs be included in the calculations of program benefits when these benefits can be identified and quantified.

Chapter 4 – Indicators of Market Effects

4.0 Introduction

This chapter discusses 's general methodology for assessing the success of market transformation energy efficiency programs.

4.1 The importance and uses of measuring and tracking indicators of market effects

Estimates of cost-effectiveness require a clear understanding of program effects as well as a clear accounting of the costs involved and the nexus between the two. This chapter focuses on the issue of identifying and estimating the long-term market effects of market transformation energy efficiency programs designed to reduce energy use and demand as well as associated environmental costs. The problem of valuing these long-term market effects will be noted; however, it lies beyond the current scope of discussion and will not be treated fully at this time.

After almost three decades of learning how to assess the effectiveness of energy-efficiency programs, evaluators face a new challenge. The resource acquisition paradigm directed those interested in the cost-effectiveness of relevant programs to estimate the energy and demand savings achieved through relatively direct means. Evaluators could meter energy use and demand before and after energy-efficient equipment was installed or energy-saving practices were implemented. Alternatively, they could compare metering results of program participants and non participants. Lacking access to direct metering or the requisite funding, they could consult billing records (again, using before-after or participant-non participant comparisons). Less directly, they could resort to statistically adjusted engineering estimates of savings generated by new equipment or practices, relying on the accumulated results of dozens of earlier studies.

As numerous writers have noted, the market transformation paradigm for energy efficiency program implementation requires different approaches to estimating the savings achieved by programs designed to increase energy efficiency. The relevant programs are not designed to replace the equipment of specific individuals in a limited area over a restricted time period. Rather they are intended to prepare and develop entire markets—markets that encompass customers intending to increase their energy efficiency and those who are not; markets that may be regional or national in scope; markets that may be expected to change over many years. Accordingly, the use of metering and billing analyses of program participants is of no value. Only a variation on the engineering analysis method is pertinent. In its simplest form, the approach is to estimate the savings attributable to a market transformation program as the product of the per-unit savings attributable to an energy-efficient technology by the increase in sales resulting from the program.

Two immediate difficulties can be recognized in the effort to implement this approach. The first is the need for comprehensive, accurate sales data. This has not been a trivial problem until now, particularly when the interest of the evaluators lies in regional or sub-regional data.[19] The second (discussed further in a separate chapter) is the need for some way of estimating the appropriate baseline—the sales that would have occurred in the absence of the intervention program.

The success of this approach is also hostage to a more fundamental problem, however. Specifically, it must be recalled that most markets require considerable time to change. Thus, sales—which do clearly constitute the ultimate indicator of change—trail other indicators of program effectiveness. Accordingly, while the proposed approach is theoretically appropriate, it is not useful in many practical situations, unless the cost-effectiveness tests are to be conducted on a purely retrospective basis some five to ten years after the relevant program has been instituted (and, in many cases, completed).

To overcome the timing and data-acquisition problems associated with the reliance on sales information, several evaluators have recommended attention to proximate indicators of market change—data that tend to be associated with sales, but tend to change more rapidly and are more readily available. Examples of such indicators include changes in manufacturer involvement in the market, such as entry of new firms, development of new models, development of a maintenance and repair infrastructure, and retooling. Other such indicators might be changes in the distribution system, such as the number of dealers who carry the product and the broadening of the market segments they serve. At the customer level, such indicators might include increases in awareness of the product or increases in willingness to pay the efficiency premium.

The use of these proximate indicators has another virtue, as well. Specifically, proximate indicators can be selected to reflect progress in overcoming specific barriers to the efficiency of the market for the energy-efficient product or service. Thus, evaluators can not only gauge the overall effect of the intervention program, they can also provide valuable feedback to program designers and implementers as to the success of specific program elements.

Several examples may help to illustrate this point. First, consider the market for residential lighting fixtures and lamps: Few customers request and install pin-based compact fluorescent lamps, in part at least because of limited awareness of the technology and its benefits and in part because few lighting dealers display and promote those items. Accordingly, intervention programs are likely to focus on reducing these barriers by promoting the technology and its benefits in consumer advertising and by encouraging manufacturers to produce and ship more of the energy-efficient units to their dealers. The ultimate measure of program effectiveness will be, as noted earlier, the actual penetration of energy-efficient fixtures. But it will certainly be simpler, at least today, to monitor changes in customer awareness and dealer displays. Moreover, the monitoring of awareness will yield direct assessments of the advertising themes and channels used, providing immediate indications of any need for modification or

[19] Some signs of increased willingness of manufacturers and national retailers to provide comprehensive sales data have been detected by consortia organized to conduct market transformation programs. The U.S. Department of Energy provides assistance in collecting those data.

enhancement. Similarly, the monitoring of dealer displays and promotion will yield direct assessments of such factors as the strength of manufacturer efforts, the variety of models offered, and needs for training of sales staff, again providing information of any needs for program modification.

Second, consider the residential new construction market. Many HVAC suppliers tend to oversize the heating and cooling units they sell and install, thus contributing to overuse of energy resources. An important barrier to more efficient practices is thought to be the reliance of these suppliers on rules of thumb designed to minimize customer complaints and callbacks related to inadequate heating or cooling performance. Programs to address this problem are likely to offer training courses or materials and software intended to provide easy-to-apply specifications for appropriate sizing. Once again, the ultimate measure of program effectiveness will be the actual number of installations of correctly sized HVAC units. But evaluators can far more readily assess program effectiveness by monitoring not only the number of HVAC sellers and installers who attend training courses or request estimation software but also the responses of those professionals to questions about the value, ease of use, and accuracy of the information they have been given. Moreover, by monitoring this type of information, evaluators can provide the program designers and implementers specific feedback regarding requirements for modification of such program elements as the software, other materials, the courses, and recruitment for the courses.

Such illustrations are not limited to the residential sector, of course. For example, one of the barriers to the specification and purchase of premium-efficiency motors has been the reliance on first-cost rather than life cycle cost as a selection criterion by many businesses. Efforts to educate customers on the benefits and application of life cycle costing can be monitored rather easily and provide far more useful information regarding the effectiveness of the relevant programs than do data on sales of premium-efficiency motors. Indeed, this example underlines one of the problems with reliance on sales data: Sales are not only an ultimate indicator, but they are also affected by a wide variety of factors. The use of first-costs as a decision factor is far from the only barrier to the sale of premium-efficiency motors. Thus, changes in sales may not be a true indicator of program effectiveness. Furthermore, the program might have been effective even if sales do not change, since some other factors (e.g., an economic downturn) may have had important, countervailing effects.

4.2 Steps for Gauging Effectiveness

This analysis suggests that gauging the effectiveness of a market transformation program requires the following steps.[20]

- Specify hypothesized barriers

[20] This discussion assumes a prospective approach and the opportunity to conduct a planned before-after design. The proposed approach can, of course, be modified and adapted to other designs. However, the nature of the programs involved limit the evaluators' ability to conduct retrospective studies or to find appropriate comparison groups for cross-sectional analysis.

- Identify potential indicators or measures for each barrier
- Develop and implement initial baseline data collection
- Review results and select indicators for tracking
- Track indicators
- Test changes in indicators for significance

Each of these will be discussed briefly in the remainder of this chapter.

4.2.1 Specify hypothesized barriers

The most commonly accepted justification for conducting market transformation programs is that the deployment of energy-efficient technologies and practices are limited by certain reducible or removable barriers. Among those barriers are first-cost, several types of perceived risk (e.g., performance uncertainty), hassle (e.g., search costs), and information limitations (e.g., asymmetry of information available to buyers and sellers). If those barriers could be reduced, removed, or circumvented, then the sales or use of the energy-efficient alternatives would be greatly facilitated.

Following this logic, market transformation programs should be designed to address specific market barriers. Therefore, the success of such programs can be gauged by the degree to which the targeted barriers are in fact reduced, removed, or circumvented.

4.2.2 Identify potential indicators for each barrier

It is tempting, but usually unrealistic, to search for one indicator of success for each program or for each program element. In reality, success is likely to be multi-faceted, with no clear priority among the different indicators. Returning to the example of residential lighting fixtures, product availability may differ from one type of retail outlet to another and customer awareness may differ from one segment to another. Moreover, these same measures may differ for hard-wired fixtures as distinguished from lamps and torchières and for the new construction market as compared with the replacement market. Similarly, it is likely that measures of changes in the understanding of sizing by HVAC sellers or the use of life cycle costing by motors specifiers will be subject to differences among segments and differences among specific questions.

What is necessary is a systematic effort to identify the range of measures that can reasonably and usefully reflect the status of the particular barrier of interest. Attention should be given to such standard measurement criteria as meaningfulness, theoretical defensibility, ease of application, cost, reliability, sensitivity, and verifiability.

4.2.3 Develop and implement initial baseline data collection

Once the potential indicators have been identified, evaluators must lay out and complete the data collection strategies and tactics. These include the selection of data collection techniques and the development of measuring instruments, as well as the specification of the samples from which these data are to be collected (e.g., which market actors, which customer segments).

Each of these decisions involve the problem of conducting the research in the most economical fashion. An example of the latter issue may be seen in current programs to develop the residential market for tumble-action clothes washers. Awareness and willingness to pay the efficiency premium appear to have increased considerably among higher-income customers, but not necessarily among others. Is such segment-specific change acceptable as a program outcome? The answer to this question will help determine the sampling and analysis strategies of the evaluators.

4.2.4 Review results and select indicators for tracking

It is likely that some of the indicators selected for each barrier will provide ambiguous results or will suggest that the barrier is already low or, conversely, is unlikely to reflect program effects in a timely manner. Accordingly, this step is provided, to review the baseline results and hone the selection of indicators. The following criteria are recommended for screening which indicators to retain.

- Reasonable causal relationship—based on the previous steps in this approach, selected indicators should connect the program elements to both the indicators and broader program objectives
- Independence and diversity—the indicators selected should be measured independently from one another
- Sensitivity—the indicators selected should have some likelihood of moving within the time frame over which the research is conducted
- Avoidance of ceiling effects—the indicators selected should have room to improve

4.2.5 Track indicators

Insofar as possible, the same data collection protocols should be repeated at appropriate intervals to gauge program effects. Of course, evaluators will wish to modify their data collection protocols to eliminate those measures that need not be tracked and eliminate any other unnecessary costs, so long as any such modifications do not jeopardize the integrity of the replication effort.

The appropriate data collection interval will depend to some extent on the product and the market involved (i.e., the expected speed of change). It will also depend upon the interval over which cost-effectiveness is to be assessed and the purpose of the evaluation. With respect to the latter issue, it should be noted that tracking as feedback to program managers may require shorter time intervals and intervals connected to program modifications.

4.2.6 Test changes in indicators for significance

The final step in this approach is determining the degree to which the market intervention has been successful. The program administrators and those to whom they are responsible have several options here, but none of them is without problems. The appropriate choice will reflect the philosophy of the program's sponsors and those with oversight responsibility.

In the resource acquisition paradigm, the appropriate indicator could be denominated directly as estimated kWh or kW savings or as estimated reductions in emissions, etc. With sales data or projected sales data, similar estimates can be developed. Some effort has also been advanced to monetize reductions in market barriers by translating them into estimated transaction cost reductions.

Recognizing the complexities of these approaches, other evaluators have opted to assess program success on the basis of barrier reductions per se. In this approach, interested parties first stipulate the relative importance of each barrier to the energy-efficient technology or service and assign a value to successfully reducing, overcoming, or circumventing that barrier. They then review the observed changes in indicators for each barrier to determine whether the program has successfully addressed it. (Obviously, the use of multiple indicators and relatively short time periods complicates this assessment. In the case where this approach is being most fully explored, the parties have agreed to use a "preponderance of the evidence" standard. In terms of statistical significance tests, this translates into application of the binomial test to determine whether more indicators have moved in the appropriate direction than would be expected by chance alone.)

Chapter 5 - The Importance of Measuring and Forecasting Baselines

5.0 Introduction

As noted elsewhere in this document, the analysis of program cost-effectiveness does not only require estimates of program effects and costs. It also entails estimates of the level of savings or reductions in market barriers that would have occurred in the absence of the market transformation program. This chapter explains 's views on the importance of determining baseline levels of energy efficiency adoption in the absence of energy efficiency initiatives.

5.1 The Challenges of Measuring Baselines

In the resource acquisition paradigm, the estimation of changes in energy use or demand in the absence of the program evaluated was somewhat easier than it is in the market transformation paradigm. At the aggregate level, it was possible—at least in theory—to identify other service territories with key characteristics similar to the territory under study, but without the relevant energy-efficiency programs. Thus, direct cross-sectional comparisons could be used to help estimate program effects. Similarly, at the individual level, program participants could be matched with non participants on critical demographic or firmographic variables and the effects of program participation could be estimated.[21]

In the market transformation paradigm, the opportunity to appeal to cross-sectional comparisons is extremely limited. As pointed out in other chapters, individual comparisons are inappropriate because it is not possible to identify program participants and non participants in a region for most market transformation programs. Moreover, the ability to make aggregate-level comparisons is compromised by the spillover effects of intervention programs. Markets tend to change on a regional basis rather than a strictly local basis. Moreover, those changes tend to have ramifications on other regions and, at times, nationally. For example, manufacturers may initially increase their shipments of energy-efficient models to meet demand in a region with a strong market transformation program by reducing their shipments of those models to other regions. If demand continues to rise, they may increase their production of the energy-efficient units and then increase their promotion and shipping in other areas as well. Given these obstacles to their use of cross-sectional comparisons, evaluators must develop other approaches to comparing sales or market barrier status observed under program conditions against those anticipated under naturally occurring conditions.

[21] In practice, of course, the problem was far more complicated. Among the relevant problems were the fact that program participants tended to be highly self-selected; in addition, some program participants appeared to be "free riders"—customers who would have undertaken the energy-efficient purchases or behaviors in the absence of the program. However, over the years, evaluators have been able to develop data collection instruments and statistical correction procedures that led to consensus estimates of the baselines involved.

5.2 Common approaches to sales forecasting

Fortunately, the problem of estimating technology sales in the absence of a market intervention program is not new or unusual. This is not to say that the problem has been solved; it is, rather, to note that several reasonable approaches have been developed and applied over the years. Evaluators can familiarize themselves with approaches from market research and market management professionals and apply those that appear most likely to be pertinent to the specific energy-efficient technology or service involved.

In brief, there appear to be three generic approaches to sales forecasting.

- Historical: Project current or recent trends or replicate previously observed models
- Statistical: Apply mathematical models or similar formal decision tools
- Expert opinion: Develop estimates based on the aggregated forecasts of market actors or others familiar with the particular market of interest

Each of these will be discussed in turn.

5.2.1 Historical

It is always extremely tempting to project current or recent sales or rates of growth, at least as an initial estimate of future sales. The drawback of this approach is that however simple the development of such projections may be, they offer little guarantee of success.

Suppose that compact fluorescent lamps command a market share of 5% and that share has grown by about one share point each year over the past two years. It may seem reasonable to project that same level of growth into the next 2-3 years. Accordingly, if the share observed after a program has been instituted were to reach 15% at the end of three years, it might be argued that the program doubled expected sales. Of course, the estimation of growth in this example ignores the very real possibilities of faster growth in a naturally occurring market, as the result of such factors as increased word-of mouth among consumers, increased promotion by retailers as they observe repeat buying among the early adopters of the technology, or increased production and distribution by manufacturers as they receive positive feedback from dealers and customers.

Conversely, it is tempting to assume that good initial acceptance of a technology or rapid growth in its sales will perpetuate itself. To the dismay of many investors and the companies they support, it is not only pet rocks that suffer precipitous declines in sales after early successes. Consumers may find that a product is unreliable, that it fails to have the expected longevity or fails to deliver the level of benefits anticipated. In some cases, the product may become outmoded rapidly by even newer products or changes in customer needs. Or the product may become the victim of strong counter-selling by the technology or models it was intended to supplant.

Another historical approach is to search the record for the sales curve of highly similar products. Thus, for example, a manufacturer of DVD players might forecast the growth of sales for the technology on the basis of the observed growth of CD players, assuming that the same factors that powered or inhibited the market growth of the earlier technology will determine the market growth of the newer one. The problems with this approach are twofold. First and foremost, no clear rubric exists for determining what products are highly similar to one another. Thus, the claim that the adoption curve for one technology or product should parallel that of another is more a matter of art than of science. Second, even if the products are themselves similar, it does not follow that the adoption curves will be similar—no guarantee is available that external conditions such as the economic environment or the competitive arena are the same for the new technology as they were for the old.

5.2.2 Statistical

Several statistical models have been brought forward to explain and forecast sales growth. The input data to these models can be either aggregate data (e.g., size of the target population, product prices, advertising budget) or individual data (e.g., customer preferences, willingness to pay, family income).

The most generic approach to statistical modeling of sales at the aggregate level is the use of multiple regression models. In these models, sales (or other variables of interest, such as customer awareness) is correlated with other causal and environmental variables, such as product price, advertising expenditures in normally occurring markets for the product of interest, and disposable personal income. A form of this approach has been adopted and implemented in the NEEP benefit/cost model.

An important addition to the generic approach is the use of multiple scenarios. Here, a range of forecasts is developed through changing the input levels of different predictors of sales (e.g., product price). By systematically varying those inputs, evaluators are able to estimate the relative importance of different variables as precursors of sales—an important planning tool—and to assess the *range* of sales that may be expected under different conditions.[22] As discussed elsewhere in this document, Hoosier Energy strongly recommends the use of scenario analysis in the development of cost-effectiveness estimates.

Perhaps the best-known statistical model in the energy-efficiency field is the family of S-shaped curves most commonly associated with the diffusion of innovation literature (e.g., the key works of Bass and of Rogers). In the typical model, there is a relatively slow growth in sales (or awareness or adoption) over time, followed by a rapid rise, and in turn by a slowing of growth as it reaches some asymptotic level. The early phase is generally associated with sales to innovators and then sales to early adopters. The

[22] As an evaluation tool, this approach has the virtue of setting up more realistic expectations than traditional *point estimates*. However, it does then require that market effects also be expressed as a range rather than a point estimate.

rapid run-up is associated with sales to majority members (particularly the early majority) and the last phase, with late adopters or laggards. This model is not only useful as a descriptive tool; it also offers an explanatory component. In particular, it attempts to relate changes in sales levels and the recruitment of different types of buyers on the basis of mass media impressions and the growth of interpersonal communication regarding the technology or the product.

Modeling at the individual level is most commonly based on expressed or revealed preference data. The most common example of expressed preferences is the collection of survey data regarding the preferences or intentions of potential buyers. In those surveys, members of the target population are asked directly such questions as whether they are interested in the product, whether they believe it offers them specific benefits, whether they would prefer it to a competing product, and whether they intend to buy it.

In studies of revealed preferences, customers are not asked their intentions regarding the purchase of a specific product in so direct a manner. In conjoint studies, for example, they are presented with a series of choices among products that vary systematically in their attributes and associated benefits and costs. Through careful statistical analysis of the pattern of choices, the importance of and preference for particular attributes is revealed. These preference data can then be used as inputs for predicting the sales of products or services embodying those attributes.

5.2.3 Expert opinion

One straightforward method of obtaining sales forecasts is simply to ask those who are most familiar with a market to provide their expert opinions as to what will occur in that market in the absence of intervention. Indeed, many companies simply ask members of their sales force what they believe customers will do in the coming quarter or coming year. Similarly, many manufacturers rely on feedback from their distributors and dealers when developing their production schedules.

A more systematic and somewhat more complex method of gathering expert opinion is the Delphi technique. This technique is intended to develop consensus estimates from a panel of experts, through an iterative process. First, the members of the panel are polled for independent estimates of critical quantitative data. In different variants of the technique, they are also asked to specify a reasonable range around their estimate and/or the factors that would cause their estimates to rise or fall. A summary of the panel's initial responses is then communicated to the members and they are asked to provide new estimates that take into account the feedback received as well as their initial thinking. In almost all cases, some convergence of ranges and of the central tendency is achieved. Again, depending on the variant, the process may be repeated one or more times until no further changes are evident or some broad consensus is attained. (A recent application of the technique in the energy services industry—with very different objectives—is described by Mortensen *et al.* in the Proceedings of the 1997 National Energy Program Evaluation Conference.) As can be seen, this method improves on the direct questioning method through the use of systematic discussion among the experts. It also has the virtue of highlighting critical assumptions and identifying the most important inputs to sales, through the discussion process.

One sample application of the Delphi method to the development of forecasts in the market transformation paradigm, looked at two energy-efficient technologies (residential clothes washers and integral T-frame motors of less than 100 hp) under each of two conditions (no program—"naturally-occurring"—and planned Hoosier Energy program).

Two pieces of critical quantitative information were obtained. First, for each calendar year from 1998 through 2005, the process focused on the expected penetration of the efficient technology (the market share for current sales, relative to directly competitive products -- The range of years allows the Delphi process to provide information for projecting the magnitude of market effects both before and after the termination of Hoosier Energy's programs.) Second, for each year, the process assessed the saturation (cumulative ownership; percent of all competitive installations) of the existing technology. In addition, qualitative information was developed as to the critical factors that would be expected to increase or decrease the relevant penetration or saturation of the energy-efficient technology in each year. (This included not only general economic factors and new product introductions, but also program-related activities such as changes in promotional budgets.) Where appropriate, efforts were made to identify the mechanisms through which those factors exerted their effects (e.g., customer awareness; availability of the product, product maintenance infrastructure). However, to limit the burden on Delphi-group participants, no efforts were made to estimate specific levels of barriers or proximate indicators (e.g., awareness; availability; maintenance structure) for each year.

5.3 Forecasting the status of market barriers

The discussion in the previous section focuses entirely on sales forecasting, largely because that has been the focus of market managers. In most marketing applications, market managers do not address the status of market barriers.[23] Few have the mandate or the resources other than advertising budgets or sales force budgets to address the wide variety of barriers that may be of interest to those attempting to increase the deployment of energy-efficient products and services. For these reasons, there do not seem to be approaches specifically developed for forecasting the status of various market barriers over time.

Nonetheless, it seems reasonable to adapt most of the models described for use in forecasting barrier levels. Evaluators could project current barrier levels or changes in barrier levels based on analogies with similar products. They could also develop and apply statistical models based on aggregate data. Of most interest in the current context, the use of expert opinion offers a ready approach to estimating future barrier levels.

[23] Customer awareness is the most notable exception to this point. Several models do address this factor directly, in part because it can be closely tied to advertising expenditures. It should also be noted that awareness data can be a useful input to diffusion models.

The Delphi approach requires no major additions to its methods or data collection costs. All that is required is to add questions about specific barriers to the discussion protocol. The experts assembled for the forecasting effort can be expected to be readily able to estimate current levels of distribution, customer awareness, price levels, availability of financing, and related factors, and to be able to forecast future values of those factors. Indeed, it is likely that the experts use just those estimates—albeit implicitly—when making their sales forecasts.

5.4 Concluding remarks

In brief, no magic solution is available for use in forecasting the naturally occurring adoption of energy-efficient technology or practices, as a standard against which to measure the effectiveness of a market transformation program. Each of the approaches described above has some virtues, such as simplicity, theoretical elegance, ease of development, or statistical rigor. But each also suffers from some defects, such as cost of data collection, lack of theoretical grounding, or reliance on analogy.

Petitioners recommend the use of the Delphi approach and the use of scenario analysis to identify the relative importance of various environmental factors and program inputs.

6.0 Florida Lags Far Behind on Electric Energy Efficiency Savings

6.1 Introduction to this Analysis

This Chapter provides information on how Florida compares to other States in achieving electricity savings from energy efficiency programs. Several of Florida's investor owned electric utilities do offer energy efficiency programs. The actual energy efficiency program savings performance for these utilities (based on 2002 data from the EIA Form 861 database) in the year 2002 ranged from a low of **.07%** of annual kWh sales to a high of **.22%** of annual kWh sales (see Table 6-1 below). The Florida investor-owned utilities rank far below the utilities that are saving the most electricity (as a percent of their annual kWh sales). Each of the top ten ranked utilities in the EIA database saved over 1% of annual kWh sales per year with energy efficiency programs, far more than is being saved by Florida's investor-owned electric utilities. Unfortunately, Florida's electric IOUs are just "scratching the surface" with their energy efficiency program efforts.

Table 6-2 below shows that the Florida electric IOUs also rank fairly low on the percent of annual system peak load saved with energy efficiency programs in 2002. The Florida IOU's rank in the bottom third of all electric utilities that reported data on energy efficiency program kW demand savings as a percent of system peak load in 2002. The top ten ranked utilities saved over 14% of system peak load from energy efficiency measures installed in 2002. The peak demand savings from EE programs for the Florida IOUs ranged from 0.3% to 0.6% of actual 2002 peak load.

Table 6-1 - Ranking of Percent of Annual kWh Sales saved with Energy Efficiency Programs - 2002 (EIA Form 861 Data for 2002)

Utility Code	Name of Utility	Percent of Annual kWh Sales saved with EE	Rank (with "1" being highest)	Total Number of Utilities With Data
6452	Florida Power & Light	0.22%	82 of 242	242
6455	Progress Energy Florida	0.07%	121 of 242	242
6457	Florida Public Utilities	NO DATA	NA	242
7801	Gulf Power	0.12%	104 of 242	242
18454	Tampa Electric	0.10%	108 of 242	242

Note: In this table, "1" would be the ranking for the highest % savings

Table 6-2 - Ranking of Percent of Annual System Peak Load Saved with Energy Efficiency Programs - 2002 (EIA Form 861 Data for 2002)

Utility Code	Name of Utility	Percent of Annual kW Peak Load saved with EE	Rank (with "1" being highest)	Total Number of Utilities With Data
6452	Florida Power & Light	0.61%	118 of 172	172
6455	Progress Energy Florida	0.42%	128 of 172	172
6457	Florida Public Utilities	NO DATA	NA	172
7801	Gulf Power	0.33%	137 of 172	172

Figure 6-1 below shows how Florida investor-owned utilities rank compared to other utilities in the United States on kWh savings from energy efficiency programs in 2002 as a percent of 2002 annual mWh sales. Figure 6-2 shows how Florida investor-owned utilities rank compared to other utilities in the United States on MW savings from energy efficiency programs in 2002 as a percent of 2002 annual peak load. Figure 6-3 shows how Florida investor-owned utilities rank compared to other utilities in the United States on energy efficiency program spending in as a percent of 2002 annual retail revenues. The detailed data supporting these rankings is provided in Appendix A of this report. As you can see the Florida investor-owned utilities rank far from the top ranked electric utilities in the US on all three attributes of energy efficiency program savings and spending.

Figure 6-1: Ranking of 2002 Energy Efficiency Program mWh Savings as a % of Annual mWh Sales

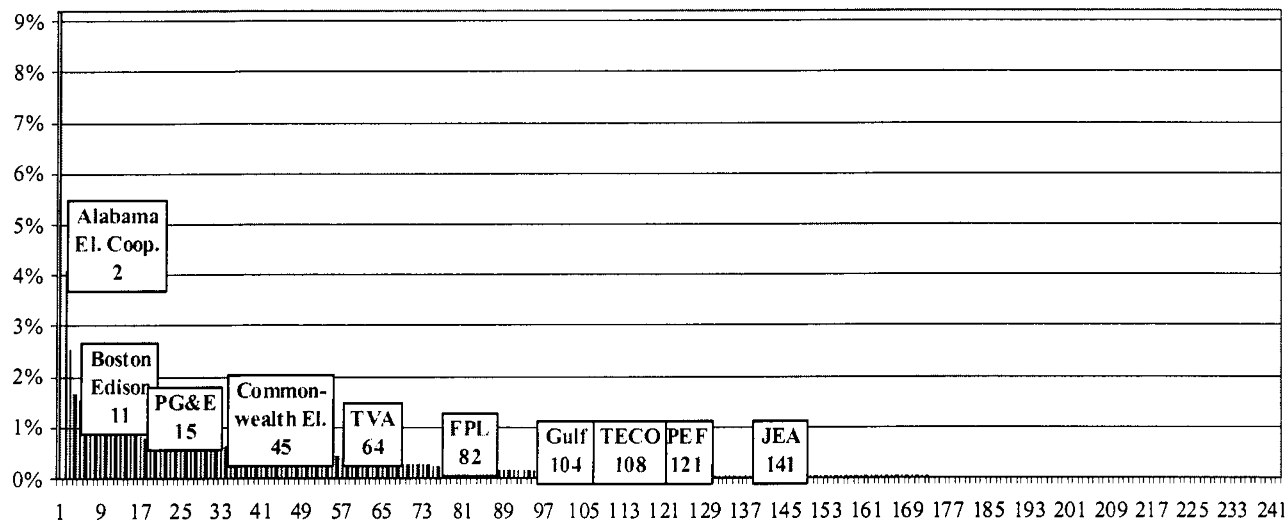


Figure 6.1A: Ranking of 2006 Energy Efficiency Program mWh Savings as a % of Annual kWh Sales

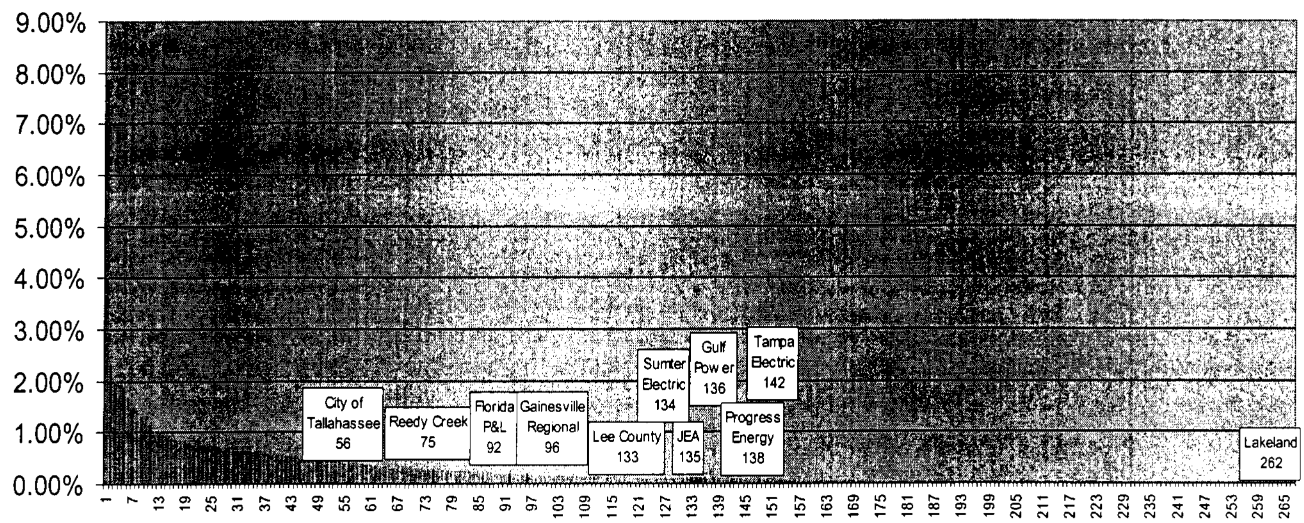
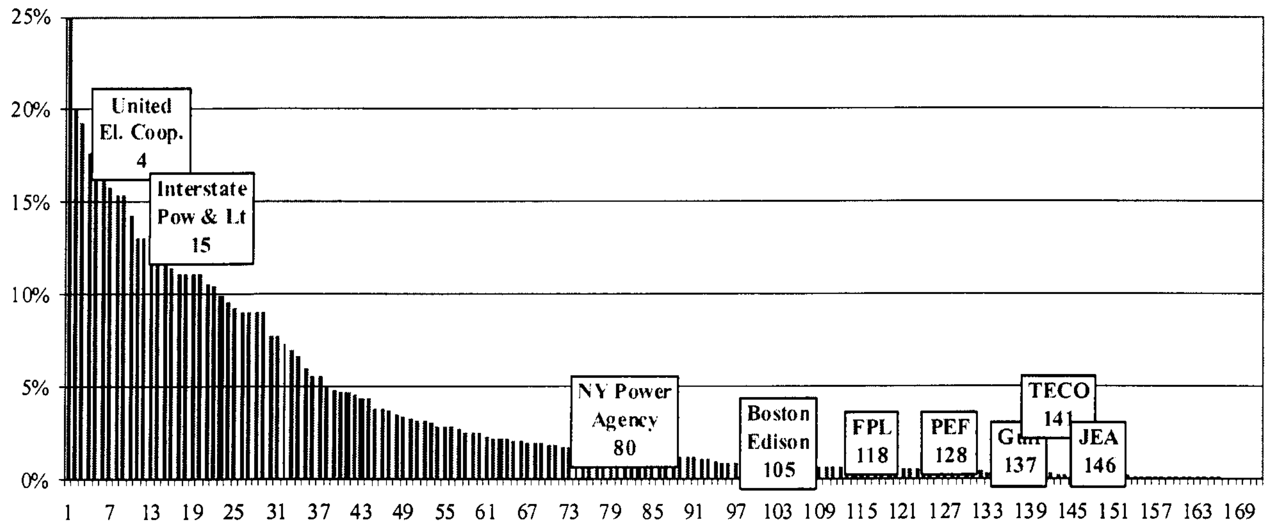


Figure 6-2: Ranking of 2002 Energy Efficiency Program Annual MW Savings as a % of 2002 System Peak Load (MW)



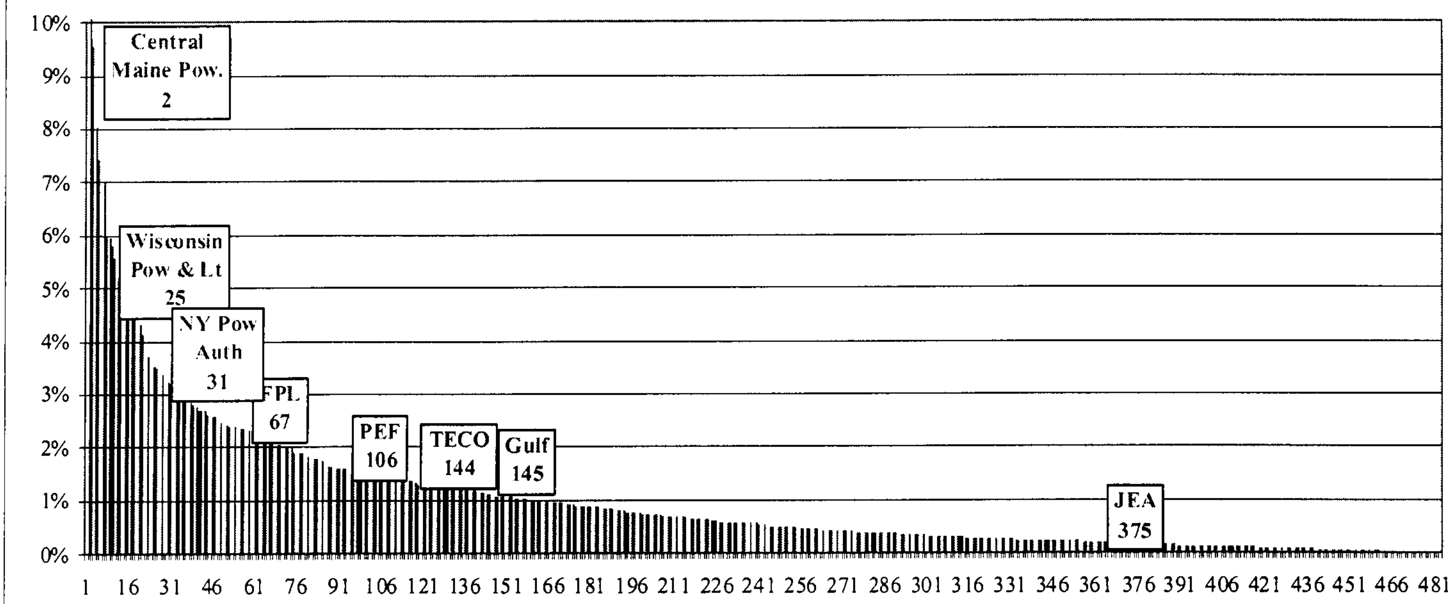


Figure 6-3: Ranking of Energy Efficiency Program Spending in 2002 as a % of 2002 Revenues

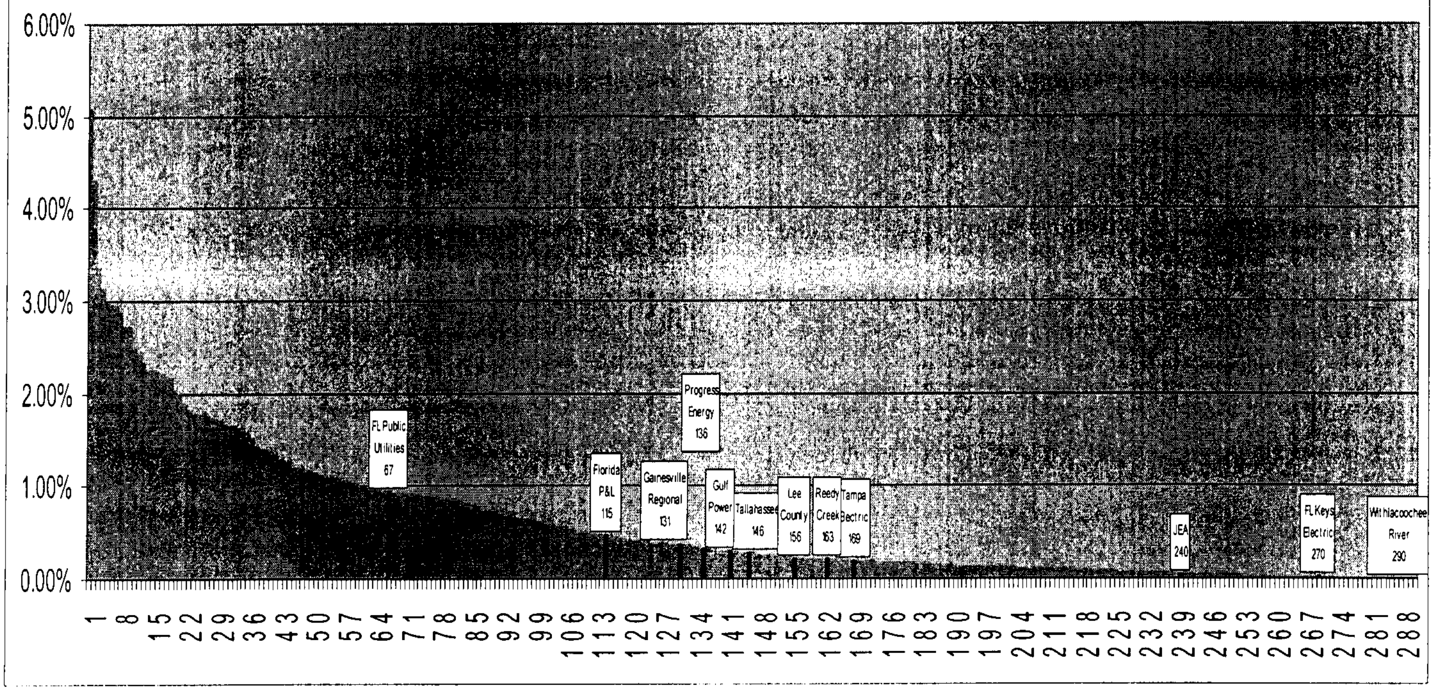


Figure 6.3A Ranking of Energy Efficiency Program Spending in 2006 as a % of 2006 Revenues

Figures 6-4 to 6-7 below show the latest available information on the penetration of ENERGY STAR appliances in the State of Florida. This data reflects Florida compares to other states with respect to the penetration of Energy Star air conditioners, clothes washers, dishwashers and refrigerators. Florida ranks 39th, 35th, 34th and 27th place respectively on the penetration of these Energy Star appliances in the state (as compared to other states). This is another clear indication of the huge remaining potential for energy efficiency in the state, and an indication that Florida is lagging far behind most other states.

Figure 6-4: Ranking of Penetration of Energy Star Room Air Conditoners by State - Florida Ranks 39th at 16.4%

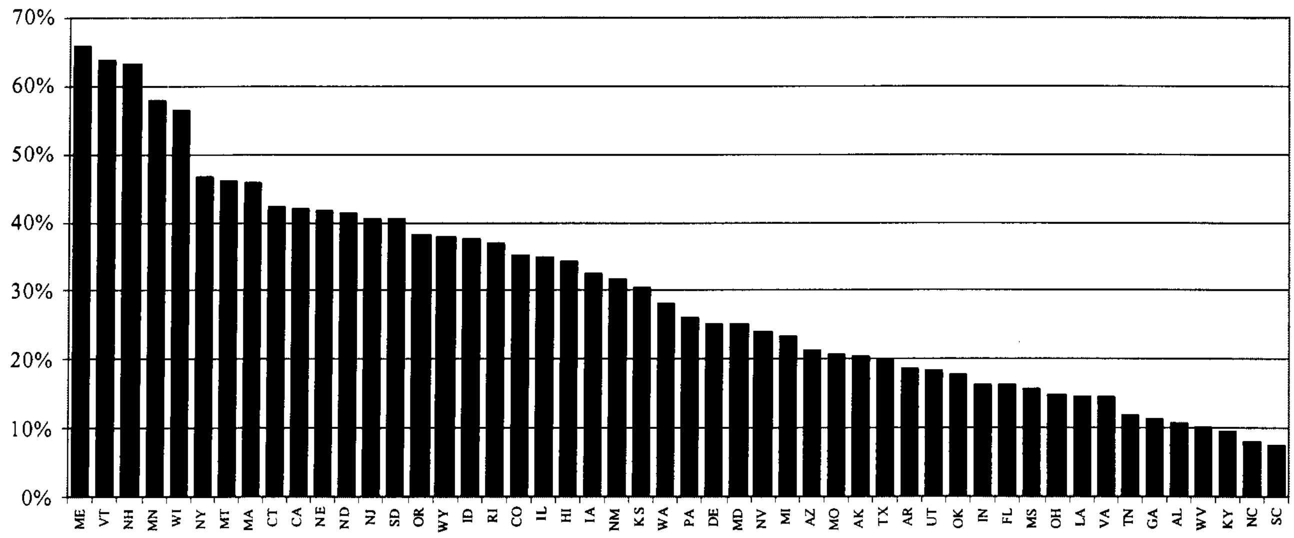


Figure 6-5: Ranking of Penetration of Energy Star Clothes Washers by State - Florida Ranks 35th at 19.7%

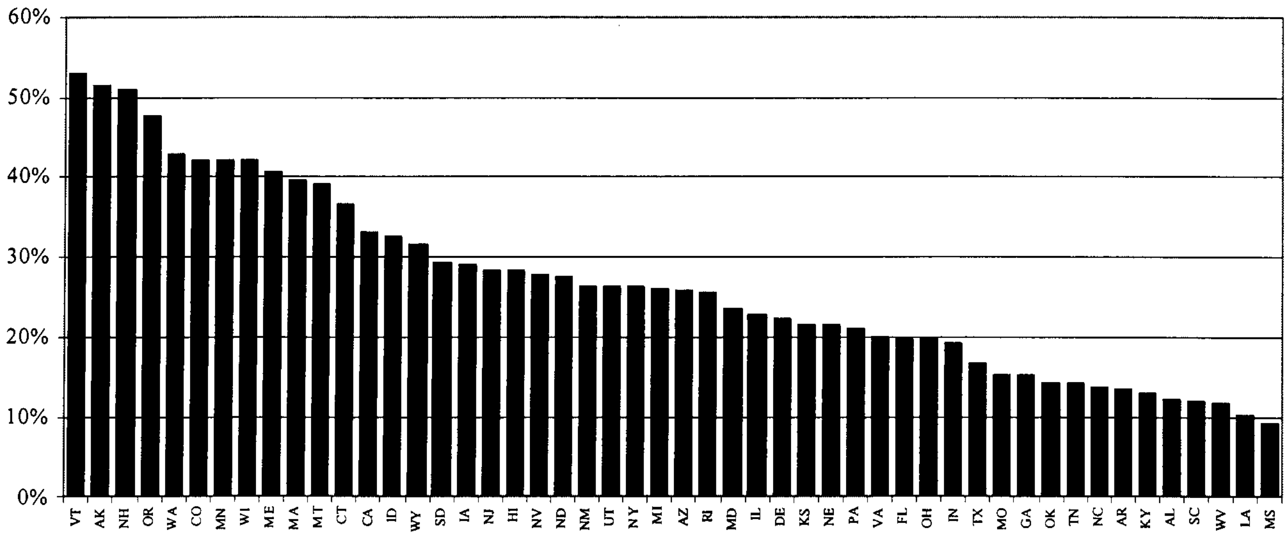


Figure 6-6: Ranking of Penetration of Energy Star Diswashers by State - Florida Ranks 34th at 55.1%

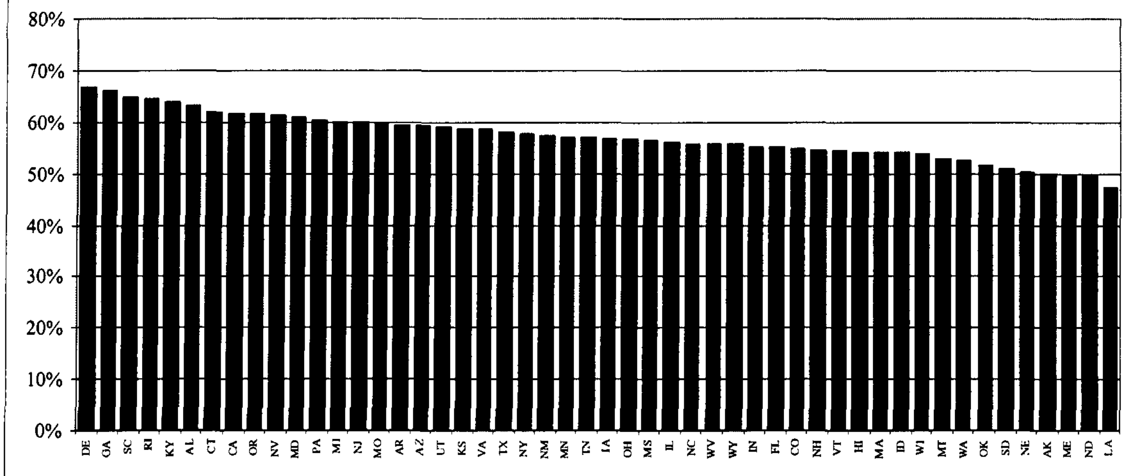


Figure 6-7: Ranking of Penetration of Energy Star Refrigerators by State - Florida Ranks 27th at 25.3%