SUMMIT BLUE
CONSULTING, LLC

ENERGY EFFICIENCY MARKET ASSESSMENT OF NEW JERSEY CLEAN ENERGY PROGRAMS

BOOK I – PORTFOLIO ASSESSMENT

FINAL

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E. EXECUTIVE SUMMARY

New Jersey's Clean Energy Program™ (NJCEP), administered by the NJ Board of Public Utilities (BPU), provides information and financial incentives to help New Jersey residents, businesses, and communities reduce their energy use, lower costs and protect the environment. The program's objective is to transform the energy marketplace in New Jersey toward more energy-efficient and renewable-energy technologies. The energy efficiency programs assessed in this evaluation are currently administered by the seven New Jersey investor-owned electric and natural gas utilities: Public Service Electric and Gas, Jersey Central Power and Light, Rockland Electric, Atlantic City Electric, New Jersey Natural Gas, South Jersey Gas, and Elizabethtown Gas.

This project consists of a detailed assessment of the New Jersey energy efficiency market and the New Jersey Clean Energy Programs. This report contains specific findings on each of the 5 major New Jersey Clean Energy Programs as well as recommendations for improving the programs and the overall New Jersey Clean Energy Program portfolio. A large number of specific findings and recommendations are presented in the report; however, five over-arching themes from the research illustrate the overall direction of the research findings. The five research themes are shown below:

Theme 1. The New Jersey Clean Energy Programs have been mostly successful at transforming the markets for energy efficiency. Some of the programs have achieved more market penetration than other programs, but overall the programs have been successful at moving the markets.

Theme 2. The New Jersey Clean Energy portfolio of programs assessed in this report represents a good mix of programs and the programs are well structured. While the fundamentals of the portfolio are solid the programs need to be updated to keep current with the changes in the market.

Theme 3. The protracted process of transitioning from utility administration of energy efficiency programs to the Market Managers has had some significant, impacts on the energy efficiency programs. Utility staffing levels have declined and restrictions on marketing have led to a reduced presence in the market. It has also resulted in less than optimal focus on those kinds of markets that take significant staff attention, particularly new construction, where relationships with trade allies are key and being actively involved in the market is critical for getting into projects before designs are fixed. The transition from program implementation from the utilities to Market Managers, as called for by the New Jersey Board of Pubic Utilities, is forcasted by the NJBPU to be completed in 2006. As part of this transition, the programs should be returned to full operation, i.e. marketing and training efforts should be increased to previous levels.

Theme 4. Many of the programs depend on the active involvement of trade allies for success. Trade allies market the programs, identify opportunities, sell and install program-incented equipment, and often fill out program paperwork. If they are going to be effective program allies, they have to commit time and resources to training and marketing program-related measures. They will be willing to commit those resources only if they believe that doing so will improve their business in the long run. Thus one of the most critical factors in a program's success can be in how effectively it can plan for the long-term future and convey to its trade allies that it will be a consistent presence in the market.

Theme 5. The programs studied showed the benefits of leveraging key aspects of program marketing through stakeholder groups. One example is the leveraging of funds by working with stakeholders on cooperative advertising and marketing. Opportunities for leveraging both program and stakeholder/trade ally relationships in the successful delivery of programs should continue to be aggressively sought out in future efforts.

Due to the breadth of topics covered in this report, it has been broken into three books to make it more manageable. The section program sections include a number of specific, detailed recommendations regarding opportunities to increase the effectiveness of the programs.

- Book I – Executive Summary and Portfolio Level Market Assessment
- Book II – Residential Programs Market Assessments
- Book III – Commercial and Industrial Programs Market Assessments

The individual program assessments in Book I and Book II include a number of specific, detailed recommendations regarding opportunities to increase the effectiveness of the programs.

E.1 Project Overview

By Order EO02120955 dated September 11, 2003, the BPU accepted the Clean Energy Council's (CEC) recommendation that the Office of Clean Energy (OCE) replace the state's utilities as the primary administrators of New Jersey's Clean Energy Program. The OCE would be responsible for hiring entities to manage and implement the programs. The CEC also recommended that New Jersey's Clean Energy Program funds be managed as a single integrated fund, rather than having each utility manage its own account. The report recommended that the Board pursue the designation of a fiscal agent to hold funds received by the utilities. By the end of 2003 the OCE assumed the role as primary administrator of the programs and began the development of plans to transition from utility to BPU administration of the programs. At the time of this evaluation the OCE has received bids, but has not selected contractors to manage three aspects of the Clean Energy Programs: Residential Energy Efficiency Market Manager, Commercial and Industrial Energy Efficiency Market Manager, and Renewable Energy Market Manager. The OCE anticipates that an RFP for a Program Coordinator will be reissued in the near future. The impacts of this 3-year transition from utility management of the NJCEP to third-party management of these programs will be reviewed as part of this evaluation.

The BPU has engaged Rutgers Center for Energy, Economic, and Environmental Policy (CEEEP) at the Edward J. Bloustein School of Public Policy and Planning to manage an independent evaluation of New Jersey's Clean Energy Program. The program evaluations will serve as an ongoing feedback loop whereby program administrators, managers, and implementers are provided with the information needed to objectively assess whether goals and objectives are being met and to improve programs and processes. The evaluation process can contribute to the BPU's strategic planning activities by providing information to be used in the development and assessment of program goals and objectives.

As part of this evaluation process the Summit Blue Team (Summit Blue Consulting and partners Quantec, LLC and Gabel Associates) was selected to conduct a market assessment of the energy efficiency market in New Jersey. The results of this market assessment will assist the BPU's Office of Clean Energy (OCE) in understanding the energy product markets in general and the markets for energy efficiency technologies promoted by New Jersey's Clean Energy Program. The results of this evaluation are intended to help OCE adjust and modify the programs so they more effectively shift the New Jersey markets toward the use of more energy-efficient technologies. The ultimate goal is market transformation, such that the purchase of energy efficiency technologies becomes the standard purchasing practice in New Jersey without the need for rebates or incentives.

Specifically, energy efficiency market assessments were conducted for the following programs in New Jersey's Clean Energy Program (NJCEP) portfolio:

Residential Energy Efficiency Programs:

1. Residential Electric and Gas HVAC Program
2. New Jersey ENERGY STAR Homes Program
3. ENERGY STAR Products Program

Commercial and Industrial Energy Efficiency Programs:

1. C&I Energy-efficient Construction Program
2. Combined Heat and Power Program

This project has three main objectives:

- Update baseline studies and estimates used as performance indicators.
- Assess the energy efficiency markets building upon market potential studies recently completed by Navigant Consulting, Inc. and KEMA, Inc. as well as other studies that address New Jersey (NJ) markets.
- Provide information from the evaluation assessments and work efforts, as well as other studies and analyses that can be used as the basis of recommendations for future efforts. This might include information to support modifying the portfolio of programs, modifying rebate levels, adding or removing technologies eligible for rebates, or increasing the minimum efficiencies to be eligible for rebates.

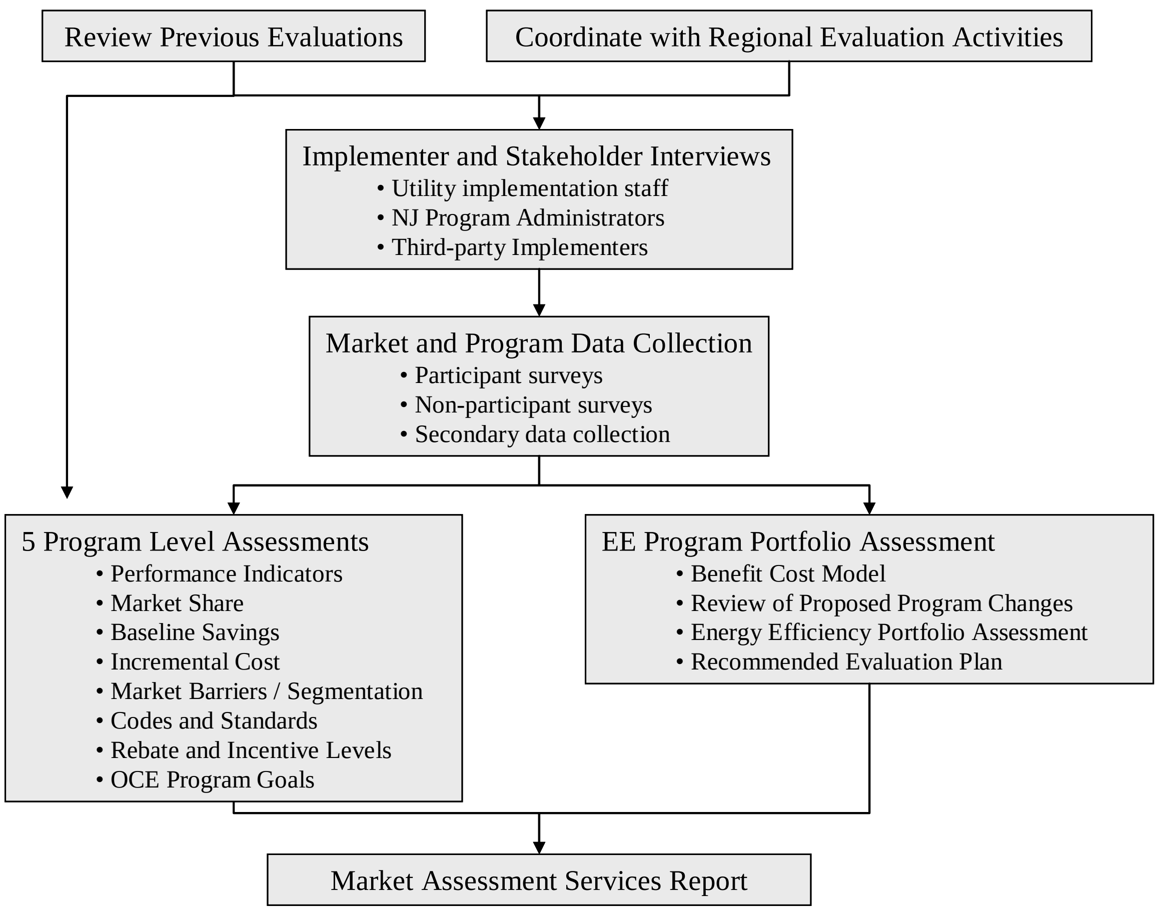
In addition to these main objectives, this market assessment was framed by the following set of principles:

- The evaluation should assess program performance, but also seek out lessons learned to help inform forward-looking decision making for current and future programs.
- The evaluation should provide information that can be used in making policy (e.g., pros and cons of the available options). Focusing in particular on practical information that supports decision making.
- The inter-relationships and cross-implications between programs should be considered to assist the CEEEP and NJBPU in developing a strategic vision.
- The evaluation should examine the factors that influence energy efficiency purchase decisions. What are the factors affecting the market? The evaluation should take a 'private sector' perspective considering how NJBPU can best enter a new market with a new product, including anticipation of what the market may look like several years forward.
- Provide the analysis and data to enable CEEEP and OCE to establish well-founded near-term and stretch goals for each program. One focus of this effort will be on developing information on the incremental cost of installed energy efficiency measures.
- Provide high level information on proposed program revisions to support defining 2006 goals and budgets.

- Coordinate with regional and national evaluation and market assessment efforts and identify areas where information from these studies can supplement the ongoing work.

Figure E-1 presents the workflow diagram for this project. The evaluation team reviewed the previous evaluation reports for background information and to determine the starting points for our assessments. Professional organizations, such as the Northeast Energy Efficiency Partnership (NEEP) and the Consortium for Energy Efficiency (CEE), were contacted to determine if there were any ongoing studies that could be leveraged as part of this evaluation. As detailed in the program assessments, this evaluation was able to use several ongoing studies. Interviews were also conducted with the current program administrators from each of the seven utilities. Using this background data and information being collected by the regional studies, the evaluation team designed surveys of key stakeholders. These surveys were used to collect the primary data for the individual program market assessments and for the portfolio market assessment. These primary data sources were supplemented with secondary data sources such as publicly available technology reports, energy efficiency program annual reports, conference proceedings, and other publicly available sources. The results of the program surveys and secondary research were analyzed and summarized in the five program market assessments and the portfolio assessment. These six market assessments are combined into this Market Assessment Services report.

Figure E-1. Project Workflow



In-depth market assessments were conducted for each of the five programs included in this study. A general summary of these program assessments is included below. More details on the individual program market assessments can be found in the program sections in Book II: Residential Program Market Assessments and Book III: Commercial and Industrial Program Market Assessments. These program market assessments included the following set of assessments for each of the five programs:

Market Assessments performed for each Program

MA-1: Performance Indicator Assessment

MA-2: Market Share Assessment

MA-3: Baseline Savings Assessment

MA-4: Incremental Cost Assessment

MA-5: Market Barriers Assessment

MA-6: C&I Market Segmentation Assessment (C&I Program only)

MA-7: Upgrade of Energy Efficiency Code and Standards Assessment

MA-8: Rebate and Incentive Level Assessment

MA-9: Program Goals Assessment

The overall Energy Efficiency Portfolio Assessment included the following assessments:

Portfolio Assessments

PA-1: Benefit-cost Model Assessment

PA-2: Current Program Proposal Assessment

PA-3: Energy Efficiency Portfolio Assessment

PA-4: Recommended Evaluation Plan

MA-1: Performance Indicators Assessment. This assessment reviewed the current set of indicators to determine if these were the right indicators. The assessment provides recommendations to adding and deleting indicators based on their value for in measuring how the program is doing in transforming the markets

MA-2: Market Share Assessment. The market share assessment will address changes in the overall market and market share. It will focus on many of the market indicators and will rely on both the primary and secondary data collection activities.

MA-3: Baseline Savings Assessment. The objectives of the Baseline Savings Assessment task were to update the baseline against which the energy savings will be calculated and to measure the program success.

This assessment included a review of the current market activities to determine if the baseline practices had changed. A detailed review of the most recent protocols to measure resource savings approved by the BPU, “New Jersey Clean Energy Program Protocols to Measure Resource Savings”, was conducted and updates to the protocols were recommended.

In addition to the in-depth reviews, as discussed in the data collection chapter, on-site investigations were performed on a separate sample of program participants. On-site investigations allow for an unbiased assessment of the project, including measure applicability, operating conditions, etc. These investigations were used to determine the accuracy of the report project savings. The results of the investigations were used to in the review of the protocol assumptions.

MA-4: Incremental Cost Assessment. Summit Blue collected both primary and secondary data on the incremental cost of energy efficiency measures through the data collection activities. Measure level data was compiled and summarized in the program market assessments.

MA-5: Market Barriers Assessment. Market barrier analyses were conducted for each of the programs. This analysis provided an overall summary of key barriers to the specification and purchase of energy efficiency equipment and energy-efficient system designs including building designs, mechanical designs, and lighting designs.

The market barriers analysis will help OCE identify key market barriers to the installation of energy efficiency technologies. We also examined the effectiveness of OCE programs in supporting the development of competitive markets for energy efficiency, including an assessment of the extent to which trade allies and vendor businesses rely on OCE programs to support their energy efficiency activities. We assessed whether the trade allies and vendors truly changed their practices or if they will simply revert to their old practices if the OCE programs are discontinued.

MA-6: C&I Market Segmentation Assessment (C&I Construction Program only). As part of developing the sample frame for the market assessment surveys, the team characterized of the size of the C&I market segmentations. Sample data and the demographic data collected in the surveys were used to segment the C&I market by the following market characteristics:

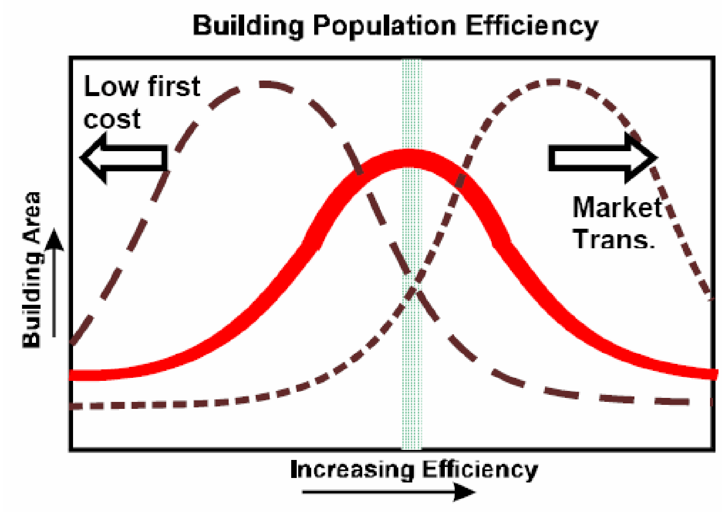
- Standard commercial and industrial classes including schools (K-12)
- Installation type (retrofit, equipment replacement, and new construction), and ownership and management type

More details on this assessment can be found in Book III: Commercial and Industrial Program Assessments.

MA-7: Upgrade of Energy Efficiency Code and Standards Assessment. The team reviewed the existing codes and standards, interviewed key federal standard administrators and state code officials, and analyzed participant and nonparticipant survey results to determine if there are significant opportunities to "lock in" savings through upgrades to energy efficiency codes and standards.

As programs change the market, codes and standards need to be upgraded. The conceptual graph in the Figure E-2 below illustrates the unique role of energy efficiency standards in the marketplace. Raising standards brings more laggards to improved efficiency, reduces the drag on market transformation efforts to push the efficiency curve forward, and reduces costs of better efficiency as incentives are not needed. Market transformation programs can push the limits of new standards.

Figure E-2. Impact of Standards



The federal government has mandated equipment standards for many appliances and several states have adopted standards for other equipment. New Jersey adopted standards on several C&I measures in 2005; these standards were subsequently superseded by the federal standards set in the Energy Policy Act of 2005.

The evaluation team also compared the current New Jersey codes and standards to other states to determine where New Jersey currently ranks relative to the energy efficiency level of the building codes.

MA-8: Rebate and Incentive Level Assessment. In an effort to assess the incentive levels (and the tradeoff between adoption and free-riders), the evaluation team conducted a benchmarking analysis that compared the New Jersey Clean Energy Programs to industry best practices for similar programs throughout the United States. With the recent proliferation of energy efficiency programs, a number of organizations have commissioned best practices studies to assess what features are most critical in designing effective programs. In addition to these studies, our analysis was also based on our experience designing and evaluating energy efficiency programs. We compared and contrasted the New Jersey Clean Energy Programs with the programs identified as having employed best practices.

In addition, the evaluation team examined the impacts of the upcoming changes to the ENERGY STAR qualified SEER level for residential central air conditioning. The team examined the changes to the ENERGY STAR specifications, reviewed how similar programs are responding to these changes, and provided recommendations for adjustments to the Residential HVAC program.

MA-9: Program Goals Assessment. Based on the review of the program tracking databases and the primary and secondary data collected, the evaluation team quantified how well the programs are doing relative to the program goals. In addition these goals were evaluated to determine whether they are providing the correct incentives to ensure the success of the program.

For each of the programs the team provided an assessment of actual results to each goal, recommended future specific goals for each program, and recommended how to track and measure how program managers are doing against these new goals. The relationship between the baselines developed in the Baseline Savings Assessment and the impacts on future program goals was also investigated.

The Energy Efficiency Portfolio assessments included the following studies.

PA-1: Benefit-Cost Model Assessment. An overview and comparison of different benefit-cost (B/C) models used throughout the country was developed. The B/C models used in California, Massachusetts, Vermont and New Hampshire, the Visual Basic B/C model used by many of the utilities in the Northeast (created by Summit Blue), and the model currently being used in New Jersey were examined. These models were compared and recommendations are provided on which commercially available model the OCE should adopt, if any.

PA-2: Current Program Proposal Assessment. To support the OCE as it considers proposals and potential changes in programs, a set of objective criteria for ranking programs and program changes was developed. The OCE will develop the relative weighting for these criteria to determine an overall assessment of proposed program changes.

OCE has recently solicited proposals for program changes and new programs from key market stakeholders. These proposals were reviewed, and based on the objective criteria, feedback on the pros and cons of each proposal was provided. The impact of how each of the proposed changes will impact the overall energy efficiency program portfolio was evaluated.

PA-3: Energy Efficiency Portfolio Assessment. The evaluation team conducted an assessment of the current portfolio of energy efficiency programs in New Jersey in order to help OCE determine where to allocate its resources. This is a high-level assessment using data collected in other tasks in this effort supported by readily available data. The goals of this assessment were to: 1) establish inter-relationships and cross-implications of program changes, 2) perform portfolio cost-effectiveness analysis, 3) develop procedures for performing portfolio trade-off analysis (examining not just B/C but also political/strategic funding requirements), and 4) develop protocols and procedures for CEEEP to evaluate changes to the program portfolio.

PA-4: Recommended Evaluation Plan. Recommendations regarding the level and implementation of evaluation activities (including process, impact, and market assessment activities) that are necessary to support the program efforts were developed.

E.2 Overall Portfolio Findings

Looking back over the past five years, the State of New Jersey has been offering some of the best energy efficiency programs in the country. The New Jersey Clean Energy Programs have won four ENERGY STAR Partner of the Year Awards during this period. In 2002 the ENERGY STAR award was for the NJ ENERGY STAR Homes Program, in 2004 the ENERGY STAR award was for the NJ Clean Energy Portfolio of Energy Efficiency Programs, and in 2004 and 2005 NJ won the ENERGY STAR award for the NJ ENERGY STAR Products program. However, the delay in the transition in program management from the utilities to the Market Managers has begun to impact the programs. The program have been idling the past couple of years, with just enough effort put into the program to keep them running. Program marketing and outreach has decreased and the market momentum, created when the programs were fully staffed, is also beginning to decline. The basic structure is sound, but the programs need to be updated. These detailed recommendations for updating the programs, which are described fully in Book II and Book III of this study, should be implemented by the utilities or by the Market Managers once they are selected.

The same logic was used across the programs for updating the program protocols, incremental costs, incentive levels, and goals. The general methodology for updating these programs is described below. In order to focus this Executive Summary on key program findings and recommendations, the details of the program protocols, incremental costs, incentive levels, and goals are not included here. For the detailed findings and recommendations, see the individual program market assessments in Book II and Book III.

A detailed review of the most recent protocols to measure resource savings approved by the BPU, "New Jersey Clean Energy Program Protocols to Measure Resource Savings", was conducted in September 2004 and updates to the protocols were recommended. The protocols were updated using data from previous Baseline Studies, results of the on-site visits, results of the surveys, and review of the program tracking data. The assessment reviewed each of the assumptions used in the protocols, and if better data existed in these data sources, then recommendations were made to update the protocols. In addition, the calculation methodologies were reviewed and updated if necessary.

The measure-specific incremental costs were updated using a combination of secondary and primary data. Summit Blue has recently completed an extensive review and update of the Database for Energy Efficient Resources (DEER) measure cost data for California's IOUs. The Summit Blue team used the California measure cost data as the basis to determine the cost differential between the energy efficiency technology and the conventional technology. The California data was adjusted, where necessary, based on data collected during the stakeholder surveys. The data collected during the surveys of retailers, contractors, and distributors was compared to the DEER data to determine its validity. If the incremental cost data provided by the stakeholders was reliable these values superseded the values in the DEER database. Other secondary sources of incremental costs where also used in this analysis. The detailed updated incremental cost data can be found in the Program Market Assessments.

Using the results of the market share assessment and the incremental costs, measure incentive level changes were recommended. As the markets for energy efficiency technology transform, the market share of the high efficiency equipment increases and the incremental costs for this equipment decreases. For program measures that showed progress towards market transformation, i.e., increased market share and reduced incremental costs, it was recommended that the incentives be reduced. For some of the measures that did not show any progress towards market transformation, it was recommended that the incentive levels be increased. The Energy Policy Act of 2005 included tax credits for several of the measures included in the NJCEP programs. These tax credits are set to expire in 2007. For some of the measures that are eligible for tax credits it was recommended that the NJCEP incentives be reduced so that the total incentive to the customer using the tax credit would be not be too high. The recommended changes to the measure incentive levels can be found in the Program Market Assessments.

It is recommended that the program goals be updated based on how well the programs are doing achieving these goals and the impacts that recommended program changes may have on the programs. The findings of the Program Market Assessments resulted in recommended changes to the programs. These changes may impact the number of participants in the programs, the amount of savings achieved, and other goals. Changes to the program goals were recommended to help the program adjust for these proposed changes. For example due to the change in the federal efficiency standard for central air conditioners, 13 SEER units will no longer be rebated. Approximately twenty-five percent of central air conditioning units rebated last year were 13 SEER units. It was recommended that the program goals be adjusted downward to account for this change in the market. As the market moves to the high efficiency central air conditioning units, this goal should increase. The recommended program goals can be found in the Program Market Assessments.

The following sections provide a high level summary of key findings and recommendations for each of the five programs and for the portfolio overall. The program market assessments in Book II and Book III contain the detailed findings and recommendations for each of the programs. The Program Market Assessments contain detailed research to guide the program managers in updating the programs.

E.3 Residential HVAC Findings and Recommendations

The recent change in the Federal Minimum Appliance Standard for central air conditioning units will have a major impact on the program over the coming year. Based upon our research with the market actors, there appears to have been sufficient lead time for the change in the standards so that equipment availability and awareness of the change will not adversely impact the market. However, making future cooling-related program changes during the fall and heating-related program changes during the spring will insure that the market actors can respond effectively.

Key Findings

The following are selected findings from the market assessment:

- Overall participant satisfaction with the rebate program was quite high. On a 1-5 scale, where 1 means "very dissatisfied" and 5 means "very satisfied", the mean response was 4.5. While most (78%) said that there were no specific problems with the program,
- Most participants (73%) found out about the rebate program through their contractor. None of the customers learned about the rebate program through radio, TV, or newspaper ads.
- The program has successfully increased the market share of high efficiency HVAC equipment in NJ. Since the 2001 New Jersey Residential HVAC Baseline Study, the market share for high efficiency HVAC products has increased. The market share for central air conditioning units with SEER 13 or greater increased from 56% to 65% for retrofit projects and from 42% to 51% for new construction projects. The market share for high efficiency furnaces stayed the same (42%) for existing homes and increased from 27% to 45% for new homes. The market share for high efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.
- The 2001 Baseline Study found the market share for high efficiency furnaces was 42% for existing homes and 27% for new homes. Considering the nonparticipant responses only, in new construction projects the market share for furnaces has significantly increased (27% to 45%); however, for retrofit projects the market share for high efficiency furnaces has remained the same (41%). The surveyed nonparticipant contractors indicated that they did 79% of their HVAC installations in existing homes and 21% of their HVAC installations in new homes. Using these installation figures, the weighted average market share for high efficiency furnaces by nonparticipating contractors is 42%. Again considering the nonparticipant responses only, the market share for high efficiency boilers has increased from 18% to 33% for retrofit projects and from 13% to 19% for new construction projects.
- The NJ HVAC Program was one of the first residential HVAC programs in the country to require proper sizing and proper installation to receive an incentive for high efficiency HVAC equipment. Since then other programs have adopted these requirements. Some programs, Massachusetts for example, have gone a step further and have begun requiring third party verification of proper sizing and installation.
- Contractors report that first cost is still the biggest customer market barrier in purchasing high efficiency HVAC equipment.
- Market barriers continue to include lack of information and training of contractors and lack of information for consumers. The current program is designed to overcome these barriers and should continue.

- According to the results of the nonparticipating contractor surveys, the market for high efficiency air conditioning equipment is already well above the building code. Nonparticipating contractors report that they are installing equipment that meet or **exceed** the current NJ Energy Code, on 65% of retrofit projects and on 51% of new construction project.
- Based on the preliminary findings from the STAC study there was little difference between the quality of installation by NATE certified contractors and contractors that are not NATE certified. These preliminary results indicate that there is no statistically significant difference on refrigerant charge or air flow between contractors with 75% NATE certified technicians versus contractors that are unknown by or not responding to Eastern Heating and Cooling Council calls.

Recommendations

Continue with successful aspects of the existing program. The existing program appropriately promotes both the sale of qualifying energy-efficient HVAC equipment and proper system sizing and installation "best practices" that affect operating efficiency. Since the incremental savings of the high efficiency CAC units is lower as a result of the change in federal standards, proper sizing and installation have become a larger portion of the savings and should continue to be emphasized.

Require third-party verification of proper installation. As a result of the increase in national standards, the difference between standard efficiency and high efficiency cooling equipment has been decreased. For high efficiency cooling equipment installation, the majority of the savings will come from proper sizing and installation rather than the improved equipment efficiency. Therefore, the program should require third-party in-field verification of the proper refrigerant charge and airflow using a qualified diagnostic tool, e.g., Honeywell Service Assistant tool or the Proctor Engineering CheckMe!™ tool. The tool should be able to provide a report indicating whether the unit has been installed properly.

Require proper sizing and installation of high efficiency furnaces and boilers. Similar to the cooling measures, the proper sizing and proper installation of furnaces and boilers can save 10%-15% of their energy use. Manual J should also be used to properly size furnaces and boilers. Conduct a duct blower test to ensure proper airflow across the blower.[1]

Increase the outreach to contractors. The program contractors are the channel through which most participants learn about the program. The program needs to continue to work closely with the contractors. The ENERGY STAR sales training should be continued. The program should work with contractors to develop sales materials that may help them with their promotion of high efficiency HVAC equipment. A return on investment matrix (or payback period matrix) could be developed that shows the return on their investment versus the cost of energy. The matrix or graph will help the contractors explain to the customers that investing in energy efficiency now will help them hedge against higher energy costs. The matrix will show that the more that fuel prices increase, the better investment the high efficiency equipment becomes.

Increase program marketing budget. Increase spending on marketing from 1.3% of expenditures in 2005 to 3% of expenditures in 2006. This will be mostly for materials to help contractors sell the program.

[1] For the details of properly sizing and testing proper installation heating equipment see “Specification of Energy-Efficient Installation and Maintenance Practices for Residential HVAC Systems” by Rick Karg for Consortium for Energy Efficiency, July 2000.

Continue NATE training. Continue training efforts at current levels until results of the STAC study are finalized. If NATE certification of contractors is not producing higher quality installations than non-NATE contractors, then this training budget may not be cost-effective.

Explore the addition of a maintenance program for older central air conditioning and heat pump units. Up to a 24.4% cooling energy savings and up to 12% heating savings can be accomplished by a program that diagnoses and repairs duct leakage, airflow, and overcharge on residential central air conditioners and furnaces. The Cool Smart program in Massachusetts is a good example of this type of program. Cool Smart promotes the QIV Digital Checkup to measure for proper refrigerant charge and air flow of the central air conditioner or heat pump systems. A COOL SMART trained air conditioning technician tests the system while it's running and takes a series of measurements which are analyzed via computer. Within a few minutes the technician and homeowner know how the system is performing.

Develop joint promotions with HVAC manufacturers, distributors, and/or contractors. The program should approach manufacturers and distributors about offering co-op advertising and joint promotions rather than the current arrangement to simply communicate and educate these stakeholders.

Include duct sealing in contractor training. Leaky air distribution ducts often waste 7-12% of heating and cooling energy used by your home. By sealing the leaky ducts, one can improve the efficiency of the heating and cooling system. In addition, sealing ducts has both health and safety benefits. Expand installation training to include how to properly size equipment and seal, balance, and test ducted distribution systems.

Add an incentive for duct sealing to the program. Add a $150 incentive for duct sealing to the program. The contractors should be required to show documentation of their work. The program should inspect 50% of the duct sealing projects during the first year of the rebate and phase the quality assurance inspections down to 10% of duct sealing rebates by the third year that this measure is offered.

Add incentives for mini-split ductless systems to the program. Incentives for ductless or “mini-split” systems should be added to the Residential HVAC Program. According to the analysis from the STAC study, these units pass the societal benefit-cost test. Ductless systems are made up of four components: the condensing unit, located outside the building; the indoor unit, or units, which can be wall or ceiling mounted; refrigerant lines, which connect the outdoor unit to the indoor unit; and a hand-held wireless remote or wall monitor which controls the entire system. The recommended incentive levels are presented in the Residential HVAC section in Book II.

Do not use short-term rebate increases to promote high efficiency equipment. Short term increases in high efficiency natural gas equipment incentives should not be used. An increase in energy costs improves the economics of purchasing high efficiency equipment and an additional incentive should not be necessary. Also, if short term incentive increases are used, the market could be conditioned to only buy new units in the winter when the rebates are higher. This market reaction may lead to short-term bottlenecks for contractors and distributors.

Reduce the incentives for ground source heat pumps. Reduce the ground source heat pump rebate from $500 to $200, so that this equipment does not receive too high an incentive when combined with the federal tax credit.

Reduce the incentives for central air conditioning and heat pumps. As a result of the change in federal minimum efficiency standards for residential central air conditioning and heat pumps, the high efficiency tier levels for these types of equipment need to be updated and the corresponding rebate levels need to be adjusted. The recommended incentive levels are presented in the Residential HVAC section in Book II.

Reduce the incentives for furnaces and boilers. The market for high efficiency is gradually becoming transformed; as the market gets nearer to transformation, incremental costs will have decreased or first cost have become less of a barrier and the rebate levels should be decreased. In addition, rising fuel prices have made high efficiency furnaces and boilers by economical. As a result of the improved economics, the market should not need as high an incentive to purchase the high efficiency equipment. The recommended incentive levels are presented in the Residential HVAC section in Book II.

E.4 New Jersey ENERGY STAR Homes Program Findings and Recommendations

The market assessment focused on market indicators that might be influenced by the New Jersey ENERGY STAR Homes Program. The following are selected findings from the market assessment:

- The NJ ENERGY STAR Homes Program has made significant progress enrolling builders over the last three years. Many of the largest production builders, including for example, K. Hovnanian, Pulte Homes, Ryan Homes, Orleans Home Builders, Beazer Homes, and D.R.Horton, not only participate in the program but all reported that 100% of their new homes are now all ENERGY STAR rated. This is a tremendous program achievement.
- New Jersey ENERGY STAR Homes Program market share has steadily increased, and has the largest market share of ENERGY STAR homes of the programs we examined. In 2005, ENERGY STAR certified homes made up 28% of Certificates of Occupancy issued.
- New Jersey's builder incentives are extremely high, significantly higher than any other program we examined. This was also the case in a 2003 study conducted by VEIC, MaGrann, and EAM.
- Changes and uncertainty in the program administration led to curtailing marketing to consumers around 2003. This shift away from marketing to consumers has had an impact on the program. Builders, implementers, and utility staff all call for renewed funding for consumer marketing.
- Restricting incentives only to areas designated Smart Growth has had an impact on the program. A large number of homes were enrolled in 2002 and 2003 to grandfather in the incentives. A few builders have now left the program because incentives are not available outside Smart Growth areas.
- HERS raters are employees of the program implementers and are not independent contractors as they are in nearby states such as New York. There is some interest in moving to an independent rating system.
- New Jersey ENERGY STAR home buyers are aware of the ENERGY STAR home label. About 40% fewer purchasers of non-ENERGY STAR homes are aware of the ENERGY STAR home label.
- A recent study for Long Island reported the costs for the most cost-effective upgrades were $1,084 for reaching 86 points, $2,605 for reaching 88 points, and $4,757 for reaching 90 points. The study estimated that an 86 point home costs, approximately, an extra $6.50/month on a 30 year mortgage, but results in $30/month in savings.

A number of recommendations are offered in response to feedback by builders, home buyers, utility staff and program administrators, as well as the professional judgment of the evaluators. Recommendations are suggested to improve the internal functioning of the program, its presence in the marketplace, and the program structure.

Program Structure

Reduce builder equipment incentive levels and shift funds to direct and cooperative marketing. This program has largely been driven by builder incentives, which, we found, are far higher than program incentives offered by other programs. Transforming the market for ENERGY STAR homes requires consumer demand for the product. The program cannot be driven by builder incentives alone. This assessment and an earlier VEIC study found incentive reductions were warranted. We recommend reducing the core rebates by 20% for the 2007 program, and reducing a number of rebates for HVAC equipment as well. Initially, the savings from incentive reductions should be wholly dedicated to marketing to drive the consumer market and offset reduced incentives. We strongly encourage leveraging marketing funds with the use of cooperative marketing and advertising. The impact of the 2007 changes should be evaluated to determine additional reductions in equipment incentives for 2008.

Develop a high profile marketing plan for the ENERGY STAR homes program directed at consumers. Builders and other market actors all called for renewed consumer marketing to increase program visibility and consumer awareness. We recommend the program be marketed in a highly profiled manner, such as in the neighboring state of New York where, for example, primetime television ads and mass marketing are used. Greater consumer awareness and knowledge of the benefits of ENERGY STAR should increase demand and raise the value of labeled homes, reducing the need for builder incentives. This will be especially important once incentives ramp down and phase out. For the market to fully transform, consumers must be asking for the product.

Develop reasonable exceptions to restrictions in non-Smart Growth areas. Since the Smart Growth policies were enacted, there has been concern about builders' reactions to incentive restrictions. Builders did express dissatisfaction with the restrictions and some stated they were leaving the program because of the restrictions. We recommend the following exceptions to the restrictions: begin with allowing replacement new construction (demolitions) to qualify for ENERGY STAR incentives and certification. This market niche represents a lost opportunity for energy efficiency unless it is included as a program opportunity.

Increase emphasis on the prescriptive path (Building Option Package (BOP) approach) to ENERGY STAR certification as described within the EPA ENERGY STAR requirements. The prescriptive approach to ESH labeling, where a home would qualify for the ENERGY STAR label if specific criteria are met, allowable under EPA ENERGY STAR guidelines, could encourage increased program participation. In both the prescriptive and performance paths to certification, the home requires a pre-drywall, thermal inspection checklist, and final inspection with blower door and duct blaster. The prescriptive path eliminates the plans analysis and HERS rating, and could reduce program cost.

Allow inspection and verification sampling where applicable. EPA requires 100% inspection and verification of homes to meet ENERGY STAR standards. However, in subdivisions with production builders, sampling is allowed when the same model or set of models is built within the subdivision. Sampling can be patterned after the guidelines employed by the Energy Trust of Oregon. Those guidelines stipulate that if the sample home fails the inspection, the builder must pay to have all homes in the subdivision certified. We recommend sampling where applicable to reduce program cost and ease the number of inspections in production developments.

Allow any RESNET-certified HERS rater to operate within New Jersey and provide full service to the builder. In the current program, HERS raters are employees of the program implementation agencies. Very few independent raters could be identified. Independents are currently allowed to certify a home but cannot apply for the builder's rebates. Implementers and builders stated that the presence of knowledgeable independent HERS raters will be needed once the program incentives have been phased out. There was support for a transition to independent raters. When the program management moves to a third party provider, allow independent raters to complete all the steps necessary to apply for the incentive for the builder. Certified HERS raters will also be needed under the BOP option, which requires on-site inspections. Shifting to independent HERS raters has the added advantage of reducing the program administrative fees.

Remove the requirement for the two existing program implementers to operate in only specified areas. Geographic boundaries based on utility service territory currently define the areas where each of the two program implementers provide services. Builders who build across territories must use the designated service provider. Builders and implementers expressed the need to remove boundaries and allow other options. We recommend builders be allowed to select their implementer(s) regardless of the location of the building. Geographic boundaries should be eliminated immediately, or alternatively eliminated once a Market Manager has been selected, to begin to allow builders these options. Builders may choose to work with one or more than one implementer depending on their needs. Several builders already work across boundaries and utilities have processes in place to accommodate builders who work with implementers without geographic boundaries.

Increase the visibility of the ENERGY STAR label within the homes. Consumers expect that an ENERGY STAR-labeled home contain ENERGY STAR-labeled equipment. The current program pays supplemental incentives for ENERGY STAR lighting beyond the required three installations, and pays a supplemental incentive for mechanical ventilation and ENERGY STAR washers. We recommend the program incorporate additional requirements for lighting (e.g., the Advanced Lighting Package that will be reviewed by the EPA in 2008) and appliances (e.g., ENERGY STAR-labeled dishwashers) in the home package. Dishwashers, like clothes washers, are common appliances and should be ENERGY STAR.

Consider additional incentivized equipment to improve home efficiencies particularly with respect to home and water heating products. We recommend tankless water heaters. Most readily available tankless water heater systems include those which are a minimum of 80% efficient (gas) and 99% efficient (electricity). Federal tax credits of up to $300 may be applied toward the purchase price. Marketing advantages include on-demand hot water and significantly reduced unit sizes. We also recommend, as also found in Residential HVAC assessment, “split air” systems, commonly referred to as “ductless split systems” or “mini-splits.” These systems significantly reduce energy losses compared to conventional systems and are also eligible for federal tax credits of up to $300. The HVAC assessment suggests a $200 rebate for a standard mini-system and $300 rebate for a high efficiency system.

Internal Administration

Develop uniform forms and tracking database to consistently record data needed to evaluate the program. Data elements were not readily available in a common database or were inconsistent across utility and implementer databases. A uniform tracking database would include the full name, address, and zip code of each purchaser. Drop down menus with builders’ business names, townships, cities, etc. would eliminate the multiple spellings that result in an inability to easily generate reports. Collection of consistent housing and rebate data, including house type, square footage, purchase price, gas rebate amount, electric rebate amount, qualifying measures installed, and efficiency rating (SEER, EER, AFUE), would further assist in being able to describe program accomplishments. In addition, it would allow a cross check to determine whether builders have applied for both the HVAC incentives and the ENERGY STAR home incentives, which is not allowed under current guidelines. Common rebate application forms should be used by all utilities to eliminate completing different forms for different utilities.

Involve evaluators in the design of the database. Data that was not available in a common database included the full address with zip code and the buyer’s name and phone number. Other items not readily available or inconsistent in a common database are as noted in the preceding recommendation. Involving an evaluator in the design or development of a common database will ensure that data will be readily available to inform key metrics when program evaluations are conducted.

Enable the program manager to process rebates 'in house' and eliminate the utility's role in receiving and processing paperwork. Builders stated there is too much time and trouble associated with receiving the rebate. Handling rebates through the utilities adds unnecessary time to the rebate process. At least one utility has implemented a system where the program administrator issues the rebate check, eliminating the need to bundle paperwork and reducing the wait for the builder to receive the incentive. This issue should be resolved as the program is taken over by the Market Manager; however if this transition continues to be delayed this recommendation so be implemented.

E.5 ENERGY STAR Products Program Findings and Recommendations

The New Jersey ENERGY STAR Products program was created to enhance the promotion of energy-efficient products to consumers throughout the state. The program has been an evolving work-in-progress throughout the past five years.

The ultimate goal of the program is to transform the New Jersey market into one where ENERGY STAR products are standard. The main tool used to achieve this is the encouragement of sales of ENERGY STAR qualified residential appliances, lighting products, and windows. Various methods are also employed to assist in this process. For instance, the program promotes public education, provides marketing tools for participating retailers, supports the development of separate state appliance standards, and offers rebates/incentives in order to shift the purchasing behavior of the public.

While few explicit program goals exist, the program has been relatively successful. The program has achieved high levels of awareness, retailer participation, and indications of high market share for ENERGY STAR. The products program specifically was recognized in 2004 and 2005 as an ENERGY STAR Partner of the Year for Excellence in Energy Efficiency and Environmental Education.

Key Findings

Market assessment tracks changes in markets over time with a specific focus on market indicators that might be influenced by the ENERGY STAR Products program. The following are selected findings from the market assessment:

- The threat of program suspension, the uncertainty regarding program budgets, and the delays with program planning have impeded program progress. These factors have limited the ability of the program to work with a number of manufacturers. The program can only rely on previous "momentum" and established relationships with loyal partners for so long before these get "stale" and require a new infusion of marketing and incentive initiatives.
- The program has established a strong infrastructure with retailer participants that represent more than half of the storefronts in the state and account for more than three-quarters of the product sales.
- Participating retailers have increased their efforts to promote ENERGY STAR-labeled products, providing additional product options and dedicating additional floor space.
- New Jersey consumers are aware of the ENERGY STAR label and recognize the efficiency benefits of products bearing the label.

- New Jersey's ENERGY STAR appliance market shares have at least doubled for most products over the past five years.
- The program has achieved significant energy savings at a low cost of conserved energy.
- The program is somewhat effective in addressing the primary barriers to adoption of energy-efficient technologies (those being lack of awareness and understanding and the first cost) with program marketing materials and available incentives.
- Opportunities for program improvements exist to ensure that the program is effective at reducing market barriers to selection of ENERGY STAR products.

Recommendations

Structure the program in a clear, consistent way for retailers and consumers. The assessment team received a great deal of feedback that retailers and the public were confused about the timeframe for the rebates and incentives offered. Future designs should be structured around a consistent year-round promotion effort, with targeted periods of more intense efforts that coincide with purchasing patterns (e.g., targeting room air conditioners during summer months).

Develop more systematic communication between retailers and program implementers. The retailers had widely disparate experiences with regard to their program representatives, some reporting frequent interaction and others reporting little or no interaction since program sign-up.

Integrate a program training effort that is conducted with all participating retailers on a regular basis. The program training is currently conducted primarily on an ad-hoc, informal basis, with only 14% of the responding retailers reporting that they had participated in program sponsored training. Instead, most retailers currently obtain their product information from the manufacturers. The NJ ENERGY STAR Program can offer more objective (not brand-specific) information and training about what high-efficiency products are, the advantages to retailers offering them, and benefits to consumers purchasing them.

Significantly expand the cooperative advertising program. Cooperative advertising can greatly leverage funds, reinforce the commitment on the part of participating retailers and manufacturers, and overcome barriers such as awareness and perceived value. This directly addresses a major concern of the retailers, who overwhelming said that they would like to see more marketing/education of the public about what ENERGY STAR is and the clear benefits of the program. It also allows some of the smaller retailers who would like to have more opportunities through the program to take advantage of cooperative advertising funds.

Conduct formal mystery shopping activities. The NJ ENERGY STAR Products Program should participate in the EPA mystery shopping multi-state study. Currently, the program will occasionally dispatch field staff to check on stocking, POS displays, and retailer awareness of ENERGY STAR. This is an informal process and used primarily for quality assurance, not as a formal assessment of program efficacy. The EPA study, referred to as the Retail Store Level (RSL) assessment, contains three components: a sales staff evaluation (SSE) to evaluate the use of ENERGY STAR in sales pitch, a display check inventory (DCI) to check the presence of marketing materials, and the product shelf inventory (PSI) to check on stocking practices.

Regularly track program progress and evaluate performance. Once specific metrics are established and a more robust database to track program activity is developed, regular review of program progress toward meeting established goals should be conducted. Automated reporting of key metrics on a quarterly basis could facilitate regular tracking of the program. Comprehensive evaluations, conducted bi-annually, can assess the overall program performance, effect on market barriers, and changes in the baseline from which to measure market effects. Interim assessments, triggered by market activity such as changes in standards or ENERGY STAR requirements, should also be done to ensure the program pushes the envelope in terms of the adoption of more efficient technologies by New Jersey residents that otherwise would not have purchased them.

Revive the ENERGY STAR Windows component. Given the potential savings, particularly for gas utilities, a clear, structured program to promote ENERGY STAR windows should be created with specific offerings, i.e., scheduled training, marketing support, or consumer incentives.

Move to a year-round incentive approach for lighting products. A year-round approach, with a more aggressive marketing campaign during the fall months (in conjunction with the national Change-a-Light initiative), would allow retailers to stock qualifying products throughout the year, eliminate consumer confusion, lead to higher retailer satisfaction, and facilitate program implementation. Provide incentives at the retail level (rather than simply manufacturer or retailer buy-downs) to increase consumer awareness of the Clean Energy programs and greater recognition of the benefits of ENERGY STAR-labeled products. Include incentives for fixtures that provide more persistent savings.

Offer targeted incentives for ENERGY STAR appliances. Incentive offerings should be determined based on current market share, potential for savings, and incremental costs. Based on these criteria, the evaluation team sees potential for tiered clothes washer rebates. Incentive strategies in general should consider branding a “best of the best” or “ENERGY STAR Plus” effort that identifies models that exceed the ENERGY STAR requirement significantly.

Continue efforts to track market share. One key measurement of the efficacy of the New Jersey ENERGY STAR program efforts is the market share of ENERGY STAR products. In order to track program impacts and estimate savings, it is important that market share be tracked on a regular basis. The New Jersey ENERGY STAR Program should conduct basic market share tracking every year by relying on the EPA National Partner data collected by D&R International. These data are free of charge, and readily available from the ENERGYSTAR.gov website. At a minimum the program should replicate the analysis conducted for this study by selecting a comparison group of states based on income and education levels and examining trends in market share for ENERGY STAR products as reported by the national retailer partners.

The program should also attempt to enforce sales data reporting by state retailer partners. When combined with the national retailer data, partner data will represent over 90% of all sales for many of the products, thus providing a fairly precise examination of market share. In addition, getting partner retailers to provide sales for lighting products will help fill a missing gap that is not covered through other sources, including the EPA Partner data.

Establish clear and measurable goals to assess program success. The following quantitative threshold goals are recommended. These reflect attainable targets that reach beyond current program achievements.

Program Goal	Quantitative Target
Co-op advertising	25% of participating retailers utilize co-op advertising
Co-op advertising	20% of the program expenditures are allocated to co-op advertising
Co-op advertising	Retailer expenditures on co-op advertising match program advertising expenditures
Training	20% of participating retailers participate in a formal training session
Market Share	Market share for targeted products should increase by 2% a year above the figures in this report

E.6 Commercial and Industrial Construction Program Findings and Recommendations

The C&I Energy-Efficient Construction Program (C&I Program) is marketed as New Jersey SmartStart Buildings. The C&I Program is the umbrella name for three individual programs or components for targeted market segments:

1) Commercial New Construction
2) Commercial Retrofit
3) Schools, including new construction and retrofit

The program targets buildings of all sizes in the commercial, educational, governmental, institutional, industrial, and agricultural sectors.

Incentives for new construction projects are available only for projects in state-designated “Smart Growth” areas, although exemptions are made for grades K-12 public schools and for some public-use buildings such as municipally owned buildings, hospitals, and military facilities.

The programs were designed to address key market barriers to efficient building construction and design on the part of developers, designers, engineers, and contractors including: unfamiliarity or uncertainty with energy-efficient building technologies and designs; bias toward first cost versus operating costs; compressed time schedules for design and construction; aversion to perceived risk-taking despite the proven reliability of efficient technologies and designs; and incentive structures and priorities for engineers, designers, and contractors which are at variance with efficiency considerations.

Key Findings

Market assessment tracks changes in markets over time with a specific focus on market indicators that might be influenced by the program. The following are selected findings from the market assessment:

Performance Indicator Findings

- Retrofit projects dominate the program. These projects represented 71% of spending and 81% of participants in 2005. Schools represented 14% of spending and New Construction 15%. The retrofit incentives are predominantly prescriptive and custom rebates. The program promotes a whole-building approach by providing multi-measure bonuses as well as services such as design support. However, the level of effort spent on supporting the whole building approach is relatively small and it has been diminishing in recent years.

- Participants were not very familiar with the SmartStart Buildings programs in general and its financial incentives and services. Nonparticipants were even less familiar. Participants were most familiar with the lighting incentives. One third or fewer were aware of other incentives. Ten percent of nonparticipants knew the program offers lighting incentives and less than 10% were aware of other incentives.

- The low level of end user awareness of program incentives and services casts doubt on any argument for the program having had a broad impact on the market. The one exception may be in lighting, where awareness levels were higher.

- Participants thought the financial incentives were quite important in their decision to implement energy-efficient measures (4.2 on a 5-point scale). They thought the program was moderately important in influencing the timing of the measure installation (3.8 on a 5-point scale). Participants thought the program was quite effective (4.1 on a 5-point scale).

- Most trade allies indicated that their participation in this program has not led to any increased business or an increased number of customer referrals.

- Participants on average were quite satisfied with the features of the program we examined. They were most satisfied with the energy-efficient equipment purchased and the cost of participation. They were least satisfied with the quality of informational materials and the amount of paperwork required to participate.

Market Share Assessment

- Over two-thirds of nonparticipants had installed lighting in the past two years and 92% of those said they had installed energy-efficient lighting. This most likely reflects an overestimation on the respondents' part but it does indicate that a significant fraction of the market is probably already installing energy-efficient lighting.

- On average, 60% of lighting contractors' sales are energy-efficient, which supports the conclusion from the nonparticipant survey that a significant portion of the market has already moved to energy-efficient products.

- Energy-efficient products probably represent less than half of all sales in the HVAC market in New Jersey. This estimate is roughly the same as in NEEP's 2006 Cool Choice program and less than in NYSERDA. Approximately half of motor sales in New Jersey are of energy-efficient motors, which is higher than in California and Wisconsin but lower than in NYSERDA. On average, 63% of the sales of trade allies who said they sell chillers are energy-efficient.

Incremental Cost Assessment

- For motors and lighting, the incremental cost of energy-efficient products is not high enough to provide a significant barrier to market acceptance. For motors, availability is a bigger issue than cost.

Market Barriers Assessment

- The biggest market barriers, according to trade allies, are the bias towards first cost and a lack of awareness, and perhaps availability, of energy-efficient products and services. End users also viewed the bias towards first cost as a significant market barrier, especially among participating customers.

- Barriers were not significantly different for schools than for other types of companies. Lack of access to financing and first cost were the highest barriers for schools, and the second and third highest for everyone else, following awareness of products and services. The financial incentives were not quite as important to the school participants as to other participants.

- Lack of program awareness was the single biggest reason given by trade allies for not participating in the program, cited by 85 percent of the nonparticipating trade allies. It was also the primary reason cited by nonparticipating end users.

- Both participating and nonparticipating end users were not very familiar with the program's services. As expected, participating end users are significantly more familiar with the program's services than nonparticipants.

- The participating trade allies indicated that the program is not particularly effective in reducing market barriers (3.3 rating on a 5-point scale).

- The current program is designed to provide support to architects and owners so that they will incorporate energy efficiency in the design of new buildings. However, utility staff attrition has left this function under-emphasized.

C&I Market Segmentation

- Program penetration is relatively higher in education, healthcare, government, and lodging. It is relatively lower in grocery and religious worship.

- Five or fewer trade allies are responsible for half of all sales in several categories of equipment, including lighting, motors and generators, and armature rewinding.

Upgrade of Energy Efficiency Codes and Standards

- New Jersey's building code meets ASHRAE 90.1-1999. This is the same as 10 states in the Northeast plus Texas but it is lower than codes adopted by 33 states and the District of Columbia, including most of the West and Southwest, and Pennsylvania, Ohio, and Virginia.

Incentive Caps

- The program tracking data do not provide any evidence to suggest that a wealth of projects would come in if the incentive cap were raised modestly. The program budgets could support a few larger incentives but more than a few would likely affect the distribution of other projects. New Jersey's incentive cap is within the most common range of the programs we examined around the country. It is lower than the average.

Schools

- The proportion of all schools participating in the program is relatively higher than for many other types of companies. Program staff have been disappointed in the level of success in attracting public school participation in the program.

- The single biggest barrier to schools to participate in the program is awareness of the program. The nonparticipating schools interviewed were quite **un**familiar with the services and incentives offered by the program. On a scale where 1 is "not at all familiar" and 5 is "very familiar" seven of the eight responded "1" and the eighth responded with a "2" for an average of 1.1.

Recommendations

Maintain trade ally design support. The current program is designed to provide support to architects and owners so that they will incorporate energy efficiency in the design of new buildings. However, utility staff attrition has left this function under-emphasized. This design should be maintained and appropriate staffing levels achieved so that the program can focus on developing strong relationships with trade allies, particularly architects, and place the focus on identifying projects early in the design phase to maximize energy savings.

Assign customer account representatives to key trade allies. Five or fewer trade allies are responsible for half of all sales in several categories of equipment, including lighting, motors and generators, and armature rewinding. Specific program staff should be assigned the responsibility for maintaining regular contact with these companies.

Upgrade the New Jersey Energy Code. New Jersey should consider upgrading its energy code standards to at least ASHRAE 90.1 - 2001 and plan to upgrade to ASHRAE 90.1 – 2004. Otherwise building efficiency levels will be established at levels lower than can actually be achieved, which in the new construction market will result in lost opportunities. In addition, as in California, New Jersey could implement state codes to further drive up the level of equipment efficiency.

Shift incentive resources. The C&I Program should shift resources away from mainstream energy-efficient lighting and motors to newer technologies (e.g., ceramic metal halide, LED, Super T-8 and high pressure sodium), and technologies affecting specific business types (e.g., cooking equipment). In conjunction with the recommendation on whole-building approaches, consider offering incentives for components of energy-efficient building construction (e.g., thermal envelope measures). Specific recommendations for rebate levels are discussed in the program section.

Revise incentive cap restriction. The programs should change from using utility account numbers to, at a minimum, the Federal Tax ID to calculate incentives paid to individual companies. If this change is adopted, then we recommend that no exceptions be allowed. The incentive cap for individual companies should be kept at $100,000. This will provide a consistent rule to the market and one that is reasonably fair.

Increase program outreach to schools. The single biggest barrier to schools to participate in the program is awareness of the program. The program should increase marketing to schools and to trade allies that specialize in servicing the schools market, including architects.

Increase efforts supporting the whole building approach. The Retrofit program, and to a certain extent the New Construction and Schools programs, focuses on providing financial rewards that are predominantly prescriptive and custom rebates, even within New Construction. The programs promote a whole-building approach by providing multi-measure bonuses as well as services such as design support. However, the level of effort spent on supporting the whole building approach is relatively small and it has been diminishing in recent years. This effort has been diminishing mostly as a result of the transition from utility to independent administration of the energy efficiency programs. The BPU has placed restrictions on utility marketing in recent years and utilities have faced some significant staff attrition as they transition away from administering the energy efficiency programs. The current program design should be maintained and appropriate staffing levels achieved so that the program can focus on developing strong relationships with trade allies, particularly architects, and place the focus on identifying projects early in the design phase to maximize energy savings.

E.7 Combined Heat and Power Program Findings and Recommendations

The Combined Heat and Power (CHP) Program was initiated in 2004 on a pilot basis as an addition to the OCE's portfolio of Commercial & Industrial EE programs. The overall stated goals and objectives of the program are: (1) to enhance energy efficiency through on-site power generation with recovery and productive use of waste heat; (2) to provide reliability solutions for New Jersey by reducing existing and new peak demands to the electric power grid; and (3) to encourage the use of emerging technologies.

Key Findings

- The number of applications dropped between the first (2004) and second (2005) application rounds by about 64%, but the program is still oversubscribed (total requested incentives exceed available funds). The project attrition rate for 2004 awardees exceeded 50%. It is too early to determine the attrition rate of 2005 awardees.

- There is no formal or extensive marketing plan for the program; however, the limited amount of funds argues against a broad-based marketing campaign.

- Average project size of both applicants and awardees increased between the 2004 and 2005 rounds. This mirrors trends experienced in CA and NY which have similar CHP incentive programs. Most developers and manufacturers surveyed indicate a focus on the larger end of the market. The market may be neglecting small-scaled projects due to a combination of lack of end user awareness/focus and lack of economies.

- There are only a few fully operational CHP projects funded through the OCE program, and those have only been operating for a few months. As such, there is virtually no actual operational data. Studies performed in CA assessing the impact of funded CHP projects raise questions concerning the actual achieved efficiencies and cost-effectiveness of funded CHP units.

- The capacity of OCE-funded CHP projects represents only a small percentage of in-state market potential identified in a 2004 study commissioned by the OCE. In-state CHP project development activity outside of the program appears to be limited.

- Initial cost and operating costs are the most oft-cited market barriers to CHP, and market actors indicate that these barriers have actually increased over the past 2 years, despite the introduction of the CHP program incentives.

- Rising natural gas prices have not been completely offset by higher electricity prices, and overall CHP project economics and payback periods have worsened over the past several years, and over the past 2 years in particular.

- Speculative projects seem to have been prevalent amongst the 2004 applicants and awardees; although it is too early to make definitive conclusions, it appears that due to more stringent application requirements and other market factors, the 2005 application round included less speculative projects.

- Protocols used by the local utility companies for reporting program energy and emissions savings are based on those used for other EE and renewables programs; and in some cases they do not recognize the unique nature of CHP systems.

- There are currently no specific program goals or performance indicators associated with the pilot CHP program.

Recommendations

Add site-specific feasibility studies to the program services. Consider setting aside a portion of program funds, or identifying an alternate funding source, for site-specific CHP technical and economic feasibility studies for smaller customers, similar to the program run by NYSERDA.

Create primary point of contact. Consider establishing a primary program contact point at the OCE (either staff or contractor), akin to a customer service representative, for program applicants to contact with questions or for status reports throughout the application and evaluation process. This may occur as the programs transition to third-party management.

Promote replicable projects. Make efforts to identify and encourage projects that may lend themselves to replication (i.e., projects at sites that have numerous homogenous locations throughout the state). This could be combined with a follow-up impact assessment/case study/education initiative aimed specifically at the energy managers of the other homogenous locations.

Target CHP projects in distribution constrained areas. Include a more targeted focus on localized distribution system constraints. It is questionable whether individual, scattered DG applications currently impact distribution utility planning and design and ultimately displace distribution system investment. Electric distribution utilities could be asked to report on constrained distribution pockets, current planning and design criteria, and the impact of single versus multiple DG applications in targeted areas. Such an effort could lead to conclusions on whether the realization of actual distribution cost savings requires more geographic focus on program criteria or evaluation.

Conduct an impact and benefit-cost analysis of program. There are sufficient open questions related to the overall impact and cost-effectiveness of the CHP Program relative to other, more-established EE programs, to warrant caution in considering at this time a significant re-allocation of finite funds away from other programs. The OCE should continue to gather additional information, consider some of the recommended program modifications, and look carefully toward the results of impact assessments and benefit-cost studies before making decisions with respect to major changes in funding levels for the CHP Program.

Keep incentive levels the same. At this relatively early stage in program life and pending the results of future impact assessment and benefit-cost studies, the incentive levels should not be modified at this time. We further recommend not altering (i.e., reducing) incentive levels to reflect the impacts of federal tax credits implemented for microturbines and fuel cells for tax years 2006 and 2007, since the availability of the tax credits can serve to offset the general decline in project economics since the CHP incentive levels were established in 2004.

Keep minimum efficiency levels the same. At this relatively early stage in program life and pending the results of future impact assessment and benefit-cost studies, the minimum 60% CHP system efficiency levels should not be modified at this time. The impact assessment should include a close review of operating CHP projects and should be utilized to critically evaluate whether efficiency levels claimed in applications are accurate. In addition, while not recommended at this time for program savings reporting purposes, in future benefit-cost studies the societal impacts should take into consideration the efficiency (i.e., heat rate) of grid generation that is displaced by CHP to determine net changes in fossil fuel Btu's consumed as a result of the CHP program.

The following specific program goals and recommendations should be considered:

- Lengthening the open application period by perhaps an additional four weeks.
- Receive at least 5 CHP applicants annually with installed capacity of 100 kW or less (Stretch goal: 10 applicants).
- At least 3 CHP incentive awardees annually with installed capacity 100 kW or less (Stretch goal: 5 winners).
- Receive at least 10 CHP applicants annually with installed capacity of 500 kW or less (Stretch goal 15 applicants).
- At least 6 CHP incentive awardees annually with installed capacity 500 kW or less (Stretch goal: 9 winners).
- For each program funding cycle, receive at least one demonstrated example of a replicated project installed within 18 months of installation of funded project. (Stretch goal: 2 documented replications per program cycle).
- For each program funding cycle, receive at least one application for a technology not previously funded (Stretch goal: 2 applications).
- Complete evaluation of applications and announce incentive winners within 90 days of close of application period.
- Starting with the 2006 cycle, achieve an annual project attrition rate of 40% or less (Stretch goal: 30% or less).
- Actual achieved CHP system efficiencies as demonstrated via future impact assessments or other monitoring programs, should be no less than the 60% minimum program requirement, **and** no more than 7.5% less than the application technical worksheet (as verified through evaluation process) reported system efficiencies. *For example, if system efficiency reported in technical worksheet is 75%, actual measured efficiency should be no less than 67.5%.* (Stretch goal: no more than 5% less than reported).

Program savings reporting should be changed as follows:

- CHP output should continue to be reported, as on-site generation is an important contribution to system diversity and is indicative of overall program impact. However, CHP system output should not be reported as electricity savings. Moreover, CHP output that is predominantly fueled by natural gas cannot be considered as renewable energy generation. Rather, CHP output should be reported as a separate category of DG generation.
- Thermal savings should be stated on a consistent basis by all applicants, and in turn by all LDCs to the OCE, as the reduction in fuel related to the recapture of thermal energy (e.g., reduction fuel used in the boiler resulting from the recapture of waste heat from the CHP engine or turbine). The

reduction in boiler natural gas displaced by CHP waste heat recapture should be reported consistently as Dtherm savings.

- Electricity savings associated with absorption chillers are legitimate and should be reported.
- Current reporting quantifies emissions savings as avoided grid emissions. Emissions from the CHP engines and turbines should be offset against the displaced grid emissions to reflect net electric-side emissions benefits.

E.8 Benefit-cost Model Assessment Findings and Recommendations

Five widely used benefit cost models were reviewed. These models are used by utilities throughout the country and represent the current industry standard. If NJ decides that none of these models meet their needs, several firms, including Summit Blue Consulting and Quantec, have the expertise to develop a custom model for NJ.

The commercially available benefit cost models included in this review were:

- DSM Portfolio Manager,
- Optimal Energy Benefit/Cost Model,
- DSMore,
- GDS Benefit/Cost Model, and
- E3 Calculator.

Of the models included in this review the GDS Model should provide the NJCEP programs with an easy to use tool for conducting benefit cost analysis. Some of the tools reviewed, DSM Manager and the Optimal Energy model, offer more complex analysis and may provide more detailed results. Unlike the other models, which just provide point estimates of the benefits and costs; the added scenario analysis capabilities of the DSM Manager model will provide a better analysis of the probability distribution associated with the cost-effectiveness of the measures and programs.

E.9 Object Criteria for Ranking Program Modifications

One of the objectives of this study is provide information to help OCE make informed decisions regarding future program changes. To support the OCE as it considers proposals and potential changes to the programs the Evaluation Team has developed a set of objective criteria for ranking programs and program changes. The OCE will develop the relative weighting of these criteria to determine the overall rankings of the propose program changes.

The Evaluation Team developed the objectives using their professional program design and implementation expertise and interviews with energy efficiency program managers throughout the country. The Evaluation Team interviewed managers of similar portfolios of energy efficiency programs throughout the country. These program managers were asked, based on their experience, how their organizations decided which programs and programs changes to fund. All program managers responded that their organizations did not use specific rules to decide which programs or program changes to fund. Most managers responded that they took a number of criteria into consideration, but that these criteria were just used as guidance. The final decision on what programs to fund and which not to fund was based mostly on the managers' experience.

The following, based upon the interviews and the Evaluation Team's experience, are the recommended objective that should be used to evaluation programs and program changes.

Benefit Cost Ratios – The proposed measures and programs should pass the cost-effectiveness test required by the OCE. The OCE should include the inputs for particular benefit cost test as part of the program proposals. In addition to the program proposal data described above this should include: measure lifetime, savings by rate period, and incremental measure costs.

Cost of conserved energy – The cost of conserved energy is a calculation that is useful for comparing the cost of savings across programs. The cost of conserved energy is calculated as the lifetime energy savings divided by the cost of the program to achieve that savings. This should be a required calculation of the program proposals.

Economic Development – The proposal evaluators will need to deicide if the proposed program or program changes will create economic advantages in targeted areas of the State. These advantages are not usually captured in the Benefit Cost Analysis, but may substantial benefits to funding a proposed program.

Allocation by sector – Some jurisdiction have a requirement that energy efficiency spending be distributed across the sectors, i.e. residential, commercial and industrial sectors. Some states require that the energy efficiency program spending be proportional to the amount of the energy efficiency funds collected in each sector. Other states use a fixed percentage to allocate the program spending by sector. When deciding upon which programs to fund, the program managers need to consider how it will impact the energy efficiency program spending by sector.

Geographic equity - Similar to the allocation by sector there may be a requirement that energy efficiency funds be spent throughout the state in proportions to where the funds were collected. Vermont has a requirement that energy efficiency program spending needs to be spread equitably across the counties of Vermont. New Jersey has a requirement that incentives for new construction are for homes built in Smart Growth areas only.

Distribution constraints – Another criterion that should be considered is whether the program or program changes will help relived congestion in a distribution constrained area. Again these benefits may not be captured in traditional Benefit Cost Analysis. For example, Southwestern Connecticut is a very capacity constrained area. Added benefits may be considered for program proposals that will help alleviate the distribution congestion in this area.

Optimizing portfolio – This criterion will be discussed in more detail in Section 5. The proposal evaluators should consider how the proposed programs or program changes will fit with the programs in he portfolio o energy efficiency programs. They will need to assess how the new program or program changes complements or balances the other programs. They should consider if the proposed program adds risk or uncertainty to the portfolio or helps to balance the risk from the other programs.

E.10 Portfolio Assessment Findings and Recommendations

The following points summarize the portfolio level assessment findings and recommendations:

The portfolio goal requirement that program impacts increase by the amount of any spending increases + 10% is achievable, but places undue emphasis on cost of conserved energy as the measure of portfolio effectiveness and compromises the ability to address other, broader measures of portfolio effectiveness. The goal was met or exceeded in 2004 and 2005 for electric savings, and exceeded in 2005 for gas savings. In addition, review of a number of other utility and regional efficiency portfolios revealed that this goal is achievable. However, the goal is extremely aggressive at lower spending increases: if the spending increased by 5% then the savings should increase by 15%, equating to an increase in savings of 300% relative to the increase in spending. This aggressive goal, therefore, places undue emphasis on cost of conserved energy as the measure of portfolio effectiveness and compromises the ability to address other, broader measures of portfolio effectiveness (e.g., an equitable distribution that benefits all sectors, segments, and regions). In addition, it creates an incentive to move away from market transformation programs that require significant investment up-front, but yield longer term savings. While the current goal may be achievable in the short-term, this approach may hamper the long-term success of the programs.

An alternative goal, implementing a fixed or ratcheted multiplier, may provide a better balance between aggressive savings goals and other program priorities. The evaluation team recommends that NJ consider an alternative goal, including setting a minimum increase commensurate with spending increases, a fixed multiplier, or a ratcheted multiplier that increases with spending increases. Of these mechanisms, the evaluation team recommends adoption of a simple multiplier. This would be relatively easy to administer and would challenge program administrators to continuously improve the return on program investments, but not at the expense of other program portfolio objectives. A proposed multiplier of 1.2 would provide the proper balance between an aggressive, yet not unreasonable, goal by producing higher savings goals at higher spending increases (over 50%) than the current spending increase +10% approach, but not creating unduly high savings goals for lower spending increases.

The current mix of spending by program is consistent with the potential analysis and benefits a broad group of ratepayers, such that substantial shifts in funding are not recommended. The savings, by sector, is not substantially different than the potential analysis conducted in 2004. In addition, the programs effectively serve all sectors, including a proportion for the low-income sector that is higher than a number of other portfolios across the country. A small reallocation of funding (5%) of funding from the commercial sector to the residential sector may provide even closer alignment between potential and achieved savings. The NJ CEP should also consider a number of program specific recommendations that could impact cost-effectiveness. In addition, the NJ CEP should consider examining and incorporating engineering and market effects net-to-gross ratios.

E.11 Recommended Evaluation Plan

In order to assist the NJ CEP with evaluation planning, the evaluation team conducted interviews with efficiency program administrators from six state/regions. The interviews provided a benchmark on which to develop an evaluation plan for the NJCEP.

Based upon the findings of these surveys evaluation of the NJCEP should occur at fixed intervals during the program life. There are three primary types of evaluations that should be performed to ensure that the programs are functioning as they were designed: impact evaluation, process evaluation and market characterization studies.

Impact Evaluation The impact evaluation focuses on identifying and estimating the amount of energy and demand the program actually provides. Estimates of actual savings are ex-post savings; program savings that can be documented after the program has made the changes that are to produce the savings. Savings induced by the program are called “net” savings, as they are beyond or in addition to what would have occurred without the program. Ex-post net savings are the savings estimates as measured/verified as being achieved by the program.

Process Evaluation The process evaluation is a systematic assessment of an energy efficiency program for the purposes of documenting program operations at the time of the examination and identifying improvements that can be made to increase the program's efficiency or effectiveness for acquiring energy resources. In addition, a process evaluation can also help increase the effectiveness of other programs by providing other program planners and administrators with the evaluation results. These planners can then review the process evaluation results to determine if their programs can benefit from the evaluation's findings and recommendations.

Market Characterization Studies The market characterization studies focus on the evaluation of program-induced market effects when the program being evaluated has a goal of making longer-term lasting changes in the way a market operates. These evaluations examine changes within a market that are caused, at least in part, by the energy efficiency programs attempting to change that market. These evaluations are challenging, as markets are constantly in a state of change as new and competing technologies are offered or as other non-program market transformation efforts compete with the program's efforts.

As a result of the research the following evaluation plan was developed:

- Impact evaluations should be conducted every two years.
- Process evaluations should be conducted within a year of launching new programs (e.g., the Home Performance with ENERGY STAR Program) or after more substantial changes to program implementation occur.
- Market characterization studies should be conducted every two to five years to support potential analysis, program development, and baseline assessment.
- There should be one full time evaluation coordinator to manage 4-6 programs.
- The evaluation budget should range between 2% to 4% of total expenses.
- The allocation of dollars within evaluation should be based on a combination of program budgets and expected savings, but also need to ensure that all sectors are represented and all stakeholder needs are considered through a collaborative process.
- Net-to-gross impacts, from both the engineering and market effects perspectives, should be factored into savings estimates.
- Develop a data collection and tracking matrix for individual programs and the overall portfolio.

1. BACKGROUND

As specified in the Request for Proposals for this project, New Jersey's Clean Energy Program (NJCEP) is a statewide program designed to help all classes of ratepayers reduce energy use, lower costs and protect the environment. The program is administered by the New Jersey Board of Public Utilities' (BPU) Office of Clean Energy (OCE). It provides education, information, and financial incentives for renewable energy systems and energy efficiency measures including combined heat and power generation. Funding is provided through the Societal Benefits Charge (SBC), which is paid by customers of the State's investor owned electric and gas utilities and includes contributions to a "Clean Energy Public Trust Fund". BPU established the OCE to administer this fund.

BPU ordered that $140 million be collected in 2005 and that a total of $745 million be collected in the years 2005 through 2008 to fund NJCEP. The administrative budget for OCE represents approximately ten percent of the total available funds and includes funds to support a market assessment and other evaluation activities.

On February 9, 1999, the Electric Discount and Energy Competition Act, N.J.S.A. 48: 3-49 et seq. (EDECA or Act) required that within four months of its effective date, and every four years thereafter, the BPU shall initiate a proceeding and cause to be undertaken a comprehensive resource analysis (CRA) of energy programs and determine the appropriate level of funding for energy efficiency and Class 1 renewable energy and the programs to be funded. EDECA requires that energy efficiency and renewable energy programs be funded for a minimum of eight years and sets out a minimum funding level.

By Order dated March 9, 2001, Docket Nos. EX99050347 et al., BPU issued its first CRA decision that addressed program administration, program funding levels and programs to be funded for the first four years. That Board Order established an overall statewide funding level of $358.452 million for the years 2001 through 2003. The Order also approved specific programs and program budgets to be funded. By Order dated July 27, 2004, Docket No. EX03110945 et al., the BPU established a 2004 funding level of $124.126 million.

By Order dated January 22, 2003, Docket No. EX99050347 et al., the BPU established the New Jersey Clean Energy Council (CEC) to advise the BPU on matters related to NJCEP. Over the course of 2003, the CEC considered various issues related to the administrative structure of NJCEP. The CEC submitted its initial recommendations to the BPU in a report dated July 21, 2003.

By Order dated September 11, 2003, Docket No. EO02120955, the BPU adopted the recommendations set out in the report of the CEC. The BPU directed the OCE to assume the role of administrator of NJCEP after an adequate transition period and to establish a fiscal agent to administer program funds.

Most of the energy efficiency programs (those being the Residential Energy Efficiency Programs and the Commercial and Industrial Energy Efficiency Programs) are currently managed and delivered by the state's electric and gas utilities and the renewable energy programs are managed and delivered by the OCE. The OCE is in the process of selecting program managers to manage and deliver the energy efficiency and renewable energy programs. The transition of program management from the utilities to the selected program managers is expected to occur later in 2006.

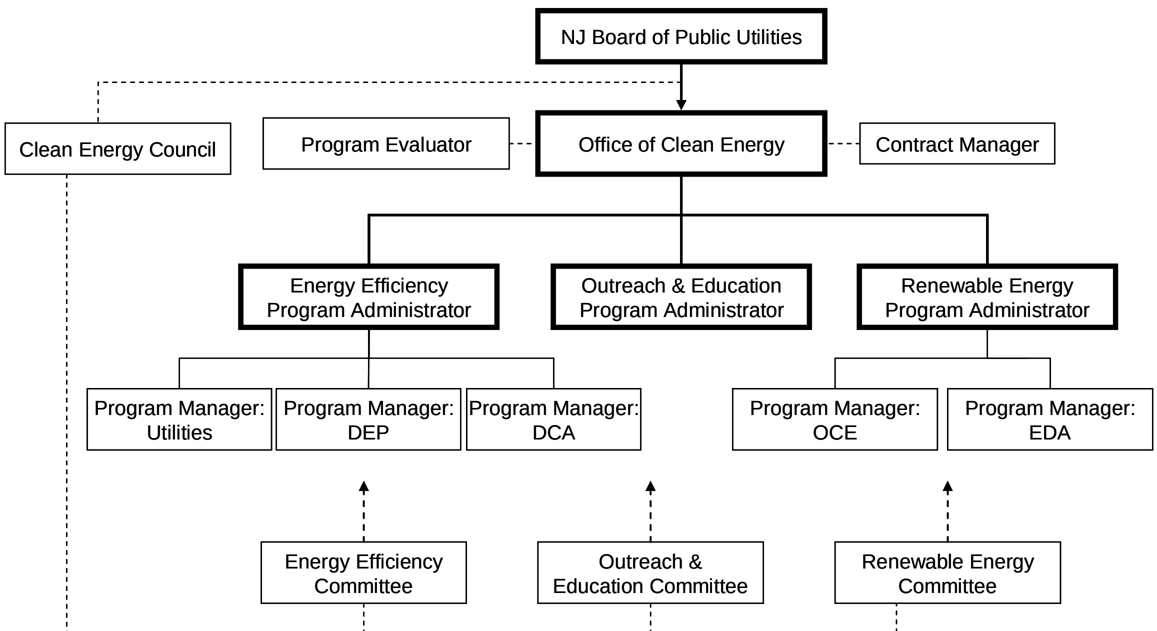
The CEC provides the BPU with recommendations regarding programs and program budgets on an annual basis and provides high level review and input regarding evaluation activities. The OCE manages the renewable programs and provides direct oversight of the programs managed by other entities that currently includes the utilities, the New Jersey Economic Development Authority (EDA), the New Jersey

Department of Community Affairs (DCA) and the New Jersey Department of Environmental Protection (DEP).

The BPU initiated the second CRA proceeding in May of 2004. By Order dated December 23, 2004, Docket No. EX04040276, the BPU approved the funding levels for the years 2005 through 2008 and determined 2005 programs and budgets. The BPU established a four year funding level of $745 million for energy efficiency and renewable energy.

Rutgers University's Center for Energy, Economic and Environmental Policy (CEEEP) has been engaged by the BPU to manage and in some cases conduct evaluations of activities funded by NJCEP. For this project CEEEP performed the duties of the BPU Contract Manager. Figure 1-1 presents the administrative structure of New Jersey's Clean Energy Programs.

Figure 1-1. New Jersey's Clean Energy Program Administrative Structure



As set out in the RFP, the two primary purposes for conducting evaluations and research regarding energy efficiency programs are:

1) to reliably document program effects, and 2) to recommend changes in program designs and operations with the intent to make these programs more effective at meeting energy savings or other program goals.

Evaluation and research activities are intended to provide a continuous feedback loop to policymakers, program administrators and program managers. The evaluation and research activities will supplement various evaluations recently performed or currently underway. Program evaluation and related research is best done systematically in steps over several years. Periodic evaluations are vital to track progress and improve and adjust program designs to meet the targeted objectives of different programs. In addition to achieving energy savings, many programs are intended to reduce barriers to the penetration of new technologies.

One of the purposes of this project is to evaluate the energy saving technologies and to suggest new and better ways to reduce barriers that impede the use of new technologies. The chief goal of evaluation is to objectively study the qualitative and quantitative effects of the programs. *Qualitative effects* involve customers' awareness and understanding of the benefits of the programs and the energy efficient technologies. They also include: 1) assessments of the program's design and implementation;2) barriers that limit program performance; 3) changes to codes and standards, and 4) other actions that signify progress towards the programs goals.

Quantitative effects include the measurable reductions of kW, kWh and therm demand that are the result of efficiency improvements that can be attributed to the OCE programs. Evaluation of programs also includes the use of performance indicators. *Performance indicators* include quantitative and qualitative measures specifically designed to monitor progress towards the goals of market transformation. Performance indicators for market transformation programs evolve over time. Specific performance indicators developed for each market transformation program reflect that progression, starting with indicators of awareness. As the programs evolve, understanding and behavioral change should also be assessed.

As part of this evaluation process the Summit Blue Team (Summit Blue Consulting and partners Quantec, LLC and Gabel Associates) was selected to conduct a market assessment of the energy efficiency market in New Jersey. The results of this market assessment will assist the BPU's Office of Clean Energy (OCE) in understanding the energy product markets in general and the markets for energy efficiency technologies promoted by New Jersey's Clean Energy Program. The results of this evaluation are intended to help OCE adjust and modify the programs so they more effectively shift the New Jersey markets toward the use of more energy-efficient technologies. The ultimate goal is market transformation, such that the purchase of energy efficiency technologies becomes the standard purchasing practice in New Jersey without the need for rebates or incentives.

Specifically, energy efficiency market assessments were conducted for the following programs in New Jersey's Clean Energy Program (NJCEP) portfolio:

Residential Energy Efficiency Programs:

1. Residential Electric and Gas HVAC Program
2. New Jersey ENERGY STAR Homes Program
3. ENERGY STAR Products Program

Commercial and Industrial Energy Efficiency Programs:

1. C&I Energy-efficient Construction Program
2. Combined Heat and Power Program

This project has three main objectives:

- Update baseline studies and estimates used as performance indicators.
- Assess the energy efficiency markets building upon market potential studies recently completed by Navigant Consulting, Inc. and KEMA, Inc. as well as other studies that address New Jersey (NJ) markets.
- Provide information from the evaluation assessments and work efforts, as well as other studies and analyses that can be used as the basis of recommendations for future efforts. This might include information to support modifying the portfolio of programs, modifying rebate levels,

adding or removing technologies eligible for rebates, or increasing the minimum efficiencies to be eligible for rebates.

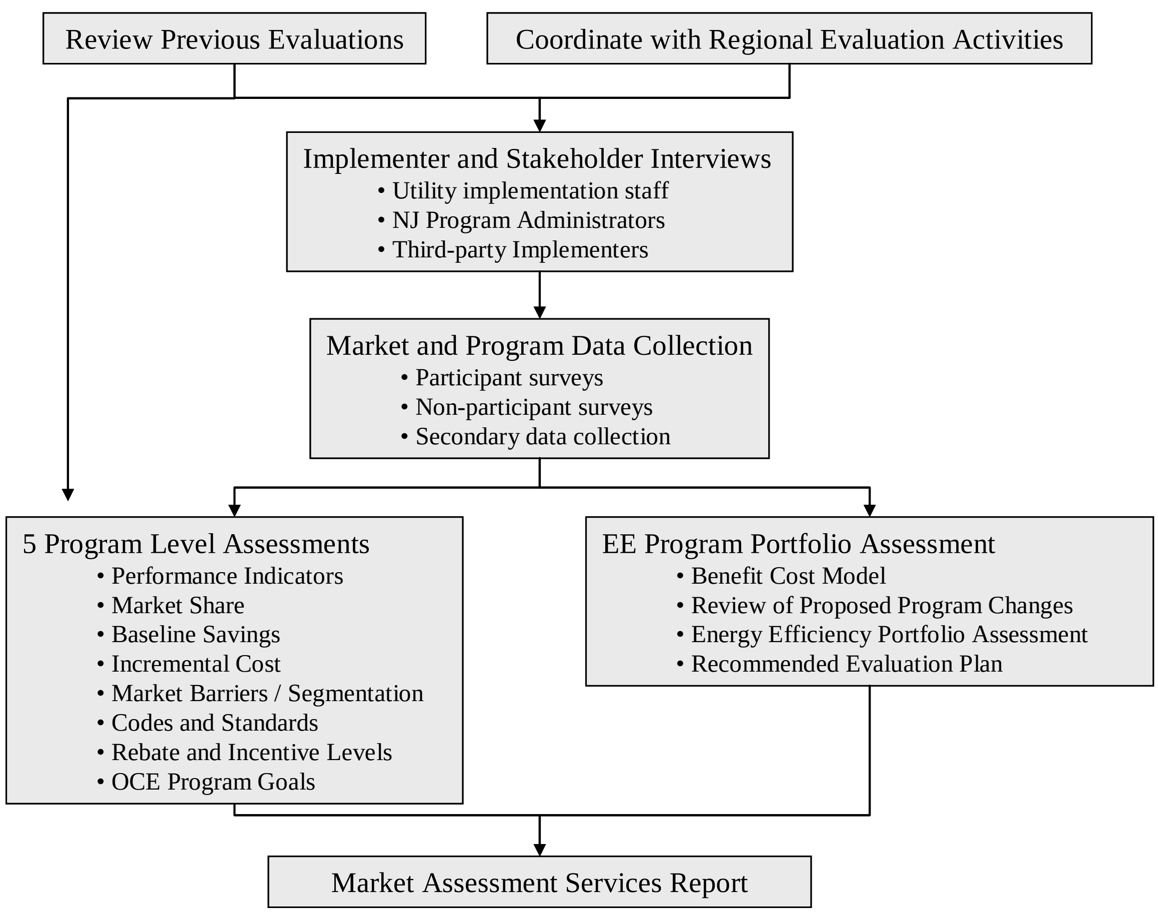
In addition to these main objectives, this market assessment was framed by the following set of principles:

- The evaluation should assess program performance, but also seek out lessons learned to help inform forward-looking decision making for current and future programs.
- The evaluation should provide information that can be used in making policy (e.g., pros and cons of the available options). Focusing in particular on practical information that supports decision making.
- The inter-relationships and cross-implications between programs should be considered to assist the CEEEP and NJBPU in developing a strategic vision.
- The evaluation should examine the factors that influence energy efficiency purchase decisions. What are the factors affecting the market? The evaluation should take a ‘private sector’ perspective considering how NJBPU can best enter a new market with a new product, including anticipation of what the market may look like several years forward.
- Provide the analysis and data to enable CEEEP and OCE to establish well-founded near-term and stretch goals for each program. One focus of this effort will be on developing information on the incremental cost of installed energy efficiency measures.
- Provide high level information on proposed program revisions to support defining 2006 goals and budgets.
- Coordinate with regional and national evaluation and market assessment efforts and identify areas where information from these studies can supplement the ongoing work.

2. MARKET ASSESSMENT METHODOLOGY

This section describes the methodology used to conduct this market assessment. Figure 2-1 presents the workflow diagram for this project. The evaluation team reviewed the previous evaluation reports for background information and to determine the starting points for our assessments. Professional organizations, such as the Northeast Energy Efficiency Partnership (NEEP) and the Consortium for Energy Efficiency (CEE), were contacted to determine if there were any ongoing studies that could be leveraged as part of this evaluation. As detailed in the program assessments, this evaluation was able to use several ongoing studies. Interviews were also conducted with the current program administrators from each of the seven utilities. Using this background data and information being collected by the regional studies, the evaluation team designed surveys of the key stakeholders. These surveys were used to collect the primary data for the individual program market assessments and for the portfolio market assessment. These primary data sources were supplemented with secondary data sources such as publicly available technology reports, energy efficiency program annual reports, conference proceedings, and other publicly available sources. The results of the program surveys and secondary research were analyzed and summarized in the five program market assessments and the portfolio assessment. These six market assessments are combined into this Market Assessment Services report.

Figure 2-1. Project Workflow



In-depth market assessments were conducted for each of the five programs included in this study. A general summary of these program assessments is included below. More details on the individual program market assessments can be found in the program sections:

- Book II: Residential Program Market Assessments and
- Book III: Commercial and Industrial Program Market Assessments.

The program market assessments included the following set of assessments for each of the five programs:

Market Assessments performed for each Program

MA-1: Performance Indicator Assessment

MA-2: Market Share Assessment

MA-3: Baseline Savings Assessment

MA-4: Incremental Cost Assessment

MA-5: Market Barriers Assessment

MA-6: C&I Market Segmentation Assessment (C&I Program only)

MA-7: Upgrade of Energy Efficiency Code and Standards Assessment

MA-8: Rebate and Incentive Level Assessment

MA-9: Program Goals Assessment

The overall Energy Efficiency Portfolio Assessment included the following assessments:

Portfolio Assessments

PA-1: Benefit-cost Model Assessment

PA-2: Current Program Proposal Assessment

PA-3: Energy Efficiency Portfolio Assessment

PA-4: Recommended Evaluation Plan

MA-1: Performance Indicators Assessment. This assessment reviewed the current set of indicators to determine if these were the right indicators. The assessment provides recommendations to adding and deleting indicators based on their value for in measuring how the program is doing in transforming the markets. Outcome indicators will be compared to a baseline, assessing longitudinal changes in the measurements of interest by asking such questions as:

- Has awareness of energy-efficient products changed over time?
- Have public attitudes towards efficient products changed over time?
- Have market barriers, such as the incremental cost for efficient measures and lack of availability of efficient measures, decreased over time?

The Performance Indicator Assessment will include:

- Estimated values for program performance indicators
- Recommended changes to performance indicators
- Recommended performance indicators for new programs

- Recommendations on how to track and measure how program managers are doing against performance indicators

MA-2: Market Share Assessment. The market share assessment will address changes in the overall market and market share. It will focus on many of the market indicators and will rely on both the primary and secondary data collection activities. Some of the questions that were explored include:

- How has the market for HVAC and lighting equipment and installation practices changed?
- How have changing standards impacted the market? How may future changes impact the market?
- Has the Residential New Construction Program transformed the new construction market? How so? How far has this transformation extended?
- Have there been changes in the market for ENERGY STAR products? Increased marketing, promotion, and demand?
- Have there been changes in the market for equipment and practices promoted by the C&I program?
- How have program interventions mitigated market barriers?

MA-3: Baseline Savings Assessment. The objectives of the Baseline Savings Assessment task were to update the baseline against which the energy savings will be calculated and to measure the program success. This included updating the baselines for:

- Electric savings
- Gas savings
- Market share
- Incremental cost impacts
- Infrastructure impacts

The quantification and verification of the energy savings resulting from the programs was based on existing program records, a review of a sample of the energy savings calculations, and a sample of on-site investigations. For each program, the projects were segmented by project type (e.g., residential HVAC heat pump projects) and the samples for engineering review and on-site investigations were weighted by the number of projects in that segment.

This assessment included a review of the current market activities to determine if the baseline practices had changed. A detailed review of the most recent protocols to measure resource savings approved by the BPU, "New Jersey Clean Energy Program Protocols to Measure Resource Savings", was conducted and updates to the protocols were recommended.

In addition to the in-depth reviews, as discussed in the data collection chapter, on-site investigations were performed on a separate sample of program participants. On-site investigations allow for an unbiased assessment of the project, including measure applicability, operating conditions, etc. These investigations were used to determine the accuracy of the report project savings. The results of the investigations were used to in the review of the protocol assumptions.

For each technology installed under the programs Summit Blue reviewed and updated the assumptions for each of the measures. This includes, but was not limited to, measure incremental costs and expected savings.

MA-4: Incremental Cost Assessment. Summit Blue collected both primary and secondary data on the incremental cost of energy efficiency measures through the data collection activities. Measure level data was compiled and summarized in the program market assessments.

MA-5: Market Barriers Assessment. Market barrier analyses were conducted for each of the programs. This analysis provided an overall summary of key barriers to the specification and purchase of energy efficiency equipment and energy-efficient system designs including building designs, mechanical designs, and lighting designs.

The market barriers analysis will help OCE identify key market barriers to the installation of energy efficiency technologies. We also examined the effectiveness of OCE programs in supporting the development of competitive markets for energy efficiency, including an assessment of the extent to which trade allies and vendor businesses rely on OCE programs to support their energy efficiency activities. We assessed whether the trade allies and vendors truly changed their practices or if they will simply revert to their old practices if the OCE programs are discontinued.

MA-6: C&I Market Segmentation Assessment (C&I Construction Program only). As part of developing the sample frame for the market assessment surveys, the team characterized of the size of the C&I market segmentations. Sample data and the demographic data collected in the surveys were used to segment the C&I market by the following market characteristics:

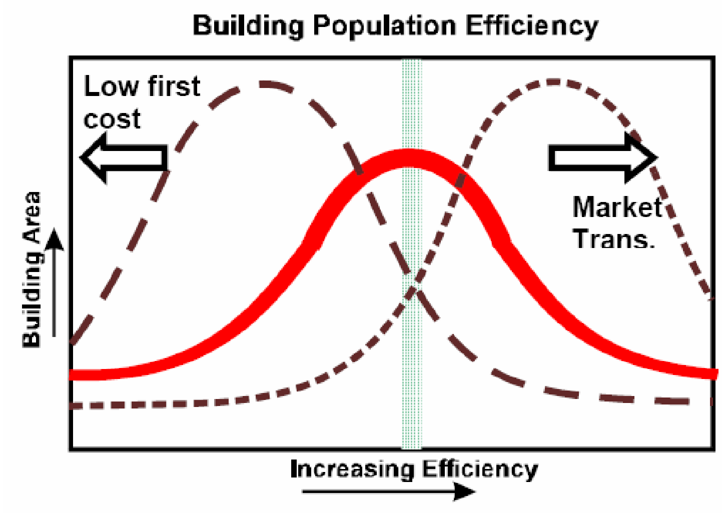
- Standard commercial and industrial classes including schools (K-12)
- Installation type (retrofit, equipment replacement, and new construction), and ownership and management type

More details on this assessment can be found in Book III: Commercial and Industrial Program Assessments.

MA-7: Upgrade of Energy Efficiency Code and Standards Assessment. The team reviewed the existing codes and standards, interviewed key federal standard administrators and state code officials, and analyzed participant and nonparticipant survey results to determine if there are significant opportunities to “lock in” savings through upgrades to energy efficiency codes and standards.

As programs change the market, codes and standards need to be upgraded. The conceptual graph in the **Error! Reference source not found.** below illustrates the unique role of energy efficiency standards in the marketplace. The heavy, bell-shaped curve in the center represents the distribution of buildings and their energy efficiency in the market. The dashed line to the left represents the distribution of efficiency that might result if lowest first cost prevailed; builders are always pushed to reduce costs for measures that are less important to consumers, such as energy efficiency. The dotted line to the right represents the distribution of efficiency we might attain if we achieve market transformation. The vertical bar represents the mandated level of efficiency. Standards are part of the latter stages of the technology adoption cycle, coming after efficient technologies have been developed and proven effective. For example, many standards changes in California were supported by efforts made through the ongoing utility market transformation programs; some changes were only possible because of the familiarity with the technologies that new construction and retrofit programs developed. As time goes on and market transformation programs shift the curve to the right, it is important to also move the vertical bar representing standards to the right, by setting new, more stringent ones. Raising standards brings more laggards to improved efficiency, reduces the drag on market transformation efforts to push the efficiency curve forward, and reduces costs of better efficiency as incentives are not needed. Market transformation programs can push the limits of new standards.

Figure E-3. **Impact of Standards**



The federal government has mandated equipment standards for many appliances and several states have adopted standards for other equipment. New Jersey adopted standards on several C&I measures in 2005; these standards were subsequently superseded by the federal standards set in the Energy Policy Act of 2005.

All energy efficiency codes and standards appropriate for the programs were reviewed and analyzed for potential upgrades. In addition, other external market influences were examined to determine how the baseline may be changing over time and what influence rising energy costs may have on energy usage.

As discussed below under the rebate and incentive level assessment, we paid particular attention to the upcoming changes to the SEER level requirements for residential central air conditioning systems, and incorporated the impact of these changes into recommendations for program design.

The evaluation team also compared the current New Jersey codes and standards to other states to determine where New Jersey currently ranks relative to the energy efficiency level of the building codes.

MA-8: Rebate and Incentive Level Assessment. In an effort to assess the incentive levels (and the tradeoff between adoption and free-riders), the evaluation team conducted a benchmarking analysis that compared the New Jersey Clean Energy Programs to industry best practices for similar programs throughout the United States. With the recent proliferation of energy efficiency programs, a number of organizations have commissioned best practices studies to assess what features are most critical in designing effective programs. In addition to these studies, our analysis was also based on our experience designing and evaluating energy efficiency programs. We compared and contrasted the New Jersey Clean Energy Programs with the programs identified as having employed best practices, examining:

- Normalized results/impacts
- Participation rates (normalized for eligible participants)
- Rebate costs (normalized per participant)
- Non-rebate costs (normalized per participant)

The evaluation team conducted a thorough review of the program measures and incentives, particularly with regard to energy efficiency and combined heat and power (CHP). This review was combined with the data collected in the market assessment surveys/interviews and the secondary data sources to:

1. Assess if incentives are set at an appropriate percentage of the incremental cost of the efficiency measure or practice.

2. Evaluate and recommend adjustments to rebates and incentives based on analysis as part of the market assessment and the baseline study.

3. Recommend what technologies or practices should be added to or deleted from the list of measures eligible for incentives and whether the existing portfolio of programs should be modified.

In addition, the evaluation team examined the impacts of the upcoming changes to the ENERGY STAR qualified SEER level for residential central air conditioning. The team examined the changes to the ENERGY STAR specifications, reviewed how similar programs are responding to these changes, and provided recommendations for adjustments to the Residential HVAC program.

MA-9: Program Goals Assessment. Based on the review of the program tracking databases and the primary and secondary data collected, the evaluation team quantified how well the programs are doing relative to the program goals. In addition these goals were evaluated to determine whether they are providing the correct incentives to ensure the success of the program.

Of particular importance was the sliding scale for energy savings established by the BPU. The goal is that for every percent increase in funding the energy savings will increase by that percentage plus 10%. In other words, if the funding is increased by 5% then the energy savings should increase by 15%. This portfolio level savings goal was assessed, evaluated if it is achievable, and any program changes that may be necessary to help meet this goal were recommended.

For each of the programs the team provided an assessment of actual results to each goal, recommended future specific goals for each program, and recommended how to track and measure how program managers are doing against these new goals. The relationship between the baselines developed in the Baseline Savings Assessment and the impacts on future program goals was also investigated.

The Energy Efficiency Portfolio assessments included the following studies.

PA-1: Benefit-Cost Model Assessment. An overview and comparison of different benefit-cost (B/C) models used throughout the country was developed. The B/C models used in California, Massachusetts, Vermont and New Hampshire, the Visual Basic B/C model used by many of the utilities in the Northeast (created by Summit Blue), and the model currently being used in New Jersey were examined. These models were compared and recommendations are provided on which commercially available model the OCE should adopt, if any.

Updated data (e.g., incremental costs, etc.) for use in the benefit-cost tests are provided as part of program assessment reports. The measure level data in the program assessments should be used in the selected benefit-cost model.

PA-2: Current Program Proposal Assessment. To support the OCE as it considers proposals and potential changes in programs, a set of objective criteria for ranking programs and program changes was developed. The OCE will develop the relative weighting for these criteria to determine an overall assessment of proposed program changes.

OCE has recently solicited proposals for program changes and new programs from key market stakeholders. These proposals were reviewed, and based on the objective criteria, feedback on the pros and cons of each proposal was provided. The impact of how each of the proposed changes will impact the overall energy efficiency program portfolio was evaluated.

PA-3: Energy Efficiency Portfolio Assessment. The evaluation team conducted an assessment of the current portfolio of energy efficiency programs in New Jersey in order to help OCE determine where to allocate its resources. This is a high-level assessment using data collected in other tasks in this effort supported by readily available data. The goals of this assessment were to: 1) establish inter-relationships and cross-implications of program changes, 2) perform portfolio cost-effectiveness analysis, 3) develop procedures for performing portfolio trade-off analysis (examining not just B/C but also political/strategic funding requirements), and 4) develop protocols and procedures for CEEEP to evaluate changes to the program portfolio.

PA-4: Recommended Evaluation Plan. Recommendations regarding the level and implementation of evaluation activities (including process, impact, and market assessment activities) that are necessary to support the program efforts were developed. The analysis explored:

- The scope of evaluation activities (e.g., budgets, primary vs. secondary data sources, etc.)
- The management evaluation activities (e.g., the development of evaluation plans, selecting contractors, etc.)

3. BENEFIT COST MODEL ASSESSMENT

The cost effectiveness of energy efficiency measures and programs is usually determined by a benefit cost test using a benefit cost model. There are a variety of benefit cost models and benefit cost tests in use throughout the country. This section examines the different benefit cost tests, the data used in these tests and the models used to perform the cost effectiveness analysis. In particular this section will examine 5 publicly available benefit cost models and recommend which of these models may best meet the needs of the NJCEP.

3.1 Overview of Benefit Cost Analysis in New Jersey

Several cost-effectiveness tests have been utilized in the past by the BPU to evaluate the costs and benefits of New Jersey Clean Energy Programs. Cost-effectiveness tests have been used to assess program benefits and costs from a variety of perspectives (e.g., utility, program participant, society). New Jersey has moved from pay for savings and pay for technology programs to market transformation programs.

The cost-effectiveness analysis undertaken by the NJ BPU is not intended to be utilized for setting total spending levels, for establishing prices to be paid for energy savings or to determine which programs to implement. Spending levels, prices to be paid for energy savings and the program lineup are determined taking into consideration a number of factors including the restructuring legislation, existing national, regional and utility energy efficiency efforts, environmental impacts and equity issues. Given the limited purpose and use of the cost-effectiveness analysis, it was decided to use the Total Resource Cost (TRC) test with and without externalities.

The TRC test assesses the benefits of the programs over the life of the measures, which in some cases will be more than twenty years. There is no Board policy concerning the value of any of the inputs to the cost-effectiveness test including long term forecasts of energy and capacity prices, avoided transmission and distribution values and externalities. Given the lack of policy on the inputs and the inherent uncertainties in forecasting program costs and savings, program cost-effectiveness analysis are calculated with and without externalities to provide a range of expected benefits.

The intended purposes and uses for cost-effectiveness analysis are to:

- Inform program planning
- Demonstrate the relative economic value of programs
- Assess program results
- Guide program implementation

New Jersey Approach to program cost-effectiveness analysis

The following summarizes the approach that the New Jersey BPU has adopted to program cost-effectiveness screening:

1. The primary objective of clean energy program planning and implementation is to meet the legislative mandates to transform markets, capture lost opportunities, make energy services more affordable for low income customers, and eliminate subsidies for energy services that can be delivered in the marketplace without utility customer funding. In meeting these mandates,

program planning seeks to maximize the economic value from program expenditures. Cost-effectiveness analysis provides information to assist this planning. It also provides information to guide program design and implementation.

2. Program cost-effectiveness analysis recognizes the public purpose and unique characteristics of lost opportunity and market transformation programs, which involve an approach different from past cost-effectiveness of resource-acquisition programs. Accordingly, the cost-effectiveness analysis of market transformation programs:

    a. Encompasses a statewide perspective with some regional interaction;

    b. Includes benefits and costs consistent with a market orientation, such as program-induced market effects (including changes in measure costs);

    c. Adopts a multi-year analysis horizon;

    d. Uses market penetration as the basic unit of analysis;

    e. Estimates market baselines to determine current and future standard practice; and

    f. Recognizes and manages uncertainty in the analysis (e.g., through scenario analysis).

3. Common tools for program and measure cost-effectiveness analysis are used to perform the analysis.

4. Program cost-effectiveness analysis will be conducted by the Center for Energy, Economic & Environmental Policy at Rutgers University subject to review and final approval by the management team.

3.2 Benefit Cost Tests

To better understand the difference in the available Benefit Costs models, we will summarize the difference types of benefit costs tests currently used in the U.S. In reviewing the approaches to measuring cost-effectiveness used across the country, a summary of the approaches was found in an ACEEE paper, "How Do We Measure Market Effects? Counting the Ways, and Why It Matters" by the Northeast Energy Efficiency Partnership.[2] The section will summarize the findings in this paper and will be supplemented by other data sources.

While there are a couple of main cost effectiveness tests, each state may use slight variations of the common tests. Table 3-1 identifies and defines the types of cost-effectiveness tests currently in use in the U.S. As this table shows, the tests range from narrowly focused to widely inclusive with respect to the number and type of benefits and costs included. **Error! Reference source not found.** presents a summary of the inputs for each of these tests.

[2] Titus, Elizabeth and Nevius, Monica. 1998. *How Do We Measure Market Effects? Counting the Ways, and Why It Matters*. Lexington, MA: Association for an Energy Efficient Economy

Table 3-1. General Description of Types of Cost-Effectiveness Tests

Test Name(s)	Measurement Approach	General Costs Included	General Benefits Included
Utility Test[1,2]	Measures net costs taking perspective of utility. Excludes participant costs.	Utility costs	Avoided supply, T&D, generation and capacity costs during load reduction periods
Program Administrator Cost Test[2]	Measures net costs based on administrative costs only	Program administrative costs; incentives; increased supply costs during periods of increased load.	Net avoided supply costs; marginal cost of reduction in T&D, generation, and capacity during load reduction periods
Participant Test[1,2]	Measures quantifiable costs and benefits taking customer perspective	Expenses incurred by customers, increase in customer utility bills, value of customer time spent arranging program participation.	Reduction in customer utility bills, incentive paid, tax credits, gross energy savings
Ratepayer Impact Measure (RIM), a.k.a. Non-Participant Test[1,2]	Measures program impacts on customer bills or rates	Initial & annual program costs incurred by administrator and any other parties, incentives paid, decreased revenue from load reduction periods, increased supply costs from load increase periods	Savings from avoided supply costs, including T&D and generation; capacity costs reduction during load reduction periods; increased revenue during load increase periods.
Total resource Cost Test (TRC)[1,2]	Measures net costs taking perspective of utility, but includes participant and non-participant costs. Applied at program and/or measure level. Usually focuses on measures or activities for a single year.	Program costs paid by utility and participants; increase in supply costs during load increase periods; spillover	Avoided supply costs; reduction in T&D, generation and capacity costs; tax credits
Societal Test[1,2,3]	Based on TRC, but takes perspective of society. Applied at program and/or measure level. May use higher marginal costs than TRC; should use societal discount rate; excludes tax credits & interest	All costs included in TRC, plus: externalities, some non-energy costs (including costs to participants and society).	All benefits included in TRC, plus: externalities (avoided environmental damage, increased system reliability, fuel diversity), some non-energy benefits (including benefits to participants and society).
Public Purpose Test (PPT)[1,2,3]	Based on Societal Test; takes societal perspective; takes long-term view. Applied at Portfolio level	Same as Societal, but takes into account market effects & broader array of externalities	Same as Societal, but takes into account market effects & broader array of externalities, non-energy benefits; spillover

[1] Sebold, Frederick D, Alan Fields, Lisa Skumatz, Shel Feldman, Miriam Goldberg, Kenneth Keating and Jane Peters. 2001. A Framework for Planning and Assessing Publicly Funded Energy Efficiency. March 1. Study PG&E-SW040. San Francisco: Pacific Gas & Electric.

[2] California State Governor's Office. 2001. Standard Practice Manual: Economic Analysis of Demand-Side Management Programs. October 2001.

[3] TecMarket Works Framework Team. 2004. The California Evaluation Framework. May. Project Number K2033910. Rosemead Calif.: Southern California Edison.

Table 3-2. Summary of the Various Benefits and Costs Considered by B/C Tests

Inputs	Total Resource Cost Test	Ratepayer Impact Measure	Utility Cost Test	Participant Cost Test	Societal Test
Benefits					
Avoided Power Supply Costs	√	√	√		√
Avoided T&D Costs	√	√	√		√
Bill Reductions				√	
Conservation "Adder" (Environmental)					√
Costs					
Direct Utility Costs	√	√	√		√
Direct Customer Costs	√			√	√
Utility Program Administration	√	√	√		√
Lost Revenues		√			

Error! Reference source not found. lays out approaches taken to measuring cost-effectiveness by state. Market transformation is not an explicit program goal in most of these states. The prevailing practice among states that offer market transformation programs is the Societal Test, or some variation of this test.[3] In six states (about one third of those surveyed by NEEP) multiple tests are used. Wisconsin and Connecticut represent two examples of the multiple-test approach. Wisconsin supplements its Societal Test with a Public Purpose Test to document the results of market transformation programs. The Public Purpose Test explicitly allows credit for non-energy benefits, and also recognizes a multi-year timeframe for assessing programs designed to produce market effects. Connecticut applies a TRC test in cases where program benefits and costs include externalities. Multiple tests allow administrators and policymakers to examine program results from different perspectives and to rely on those most relevant for a particular program type.

[3] For example, in Massachusetts, the modified TRC includes participant non-resource benefits, avoided environmental compliance costs, and low-income benefits along with more traditional TRC benefits and costs.

Table 3-3. Approaching to Measuring Cost-Effectiveness, by State

Region/ State	B/C Test	Uses Multiple Tests	Market Effects: Spillover	Market Effects: Forecasts	Non-energy Effects: Water	Non-energy Effects: Customer Benefits	Non-energy Effects: Quantified Adder	Non-energy Effects: Non-quantified Adder
Northeast								
ME[1]	Mod. Societal							
NH[2]	Mod. TRC		Y		Y	Y	Y	15%
VT[3]	Societal		Y	Y	Y	Y	Y	Y
MA[4]	Mod. TRC		Y	Y	Y	Y	Y	
RI[5]	Mod. Utility		Y		Y			
CT	Utility	Y	Y					
NY[6]		Y	Y	Y	Y	Y	Y	
NJ[7]	Societal		Y		Y			2¢/kWh
Midwest								
WI	Mod. Societal	Y	Y	Y	Y	Y	Y	
OH[8]						Y	Y	
IA	Societal	Y						
MN	Mod. Societal		Y					
IL	Utility							
Pacific Northwest								
NEEA[9]	TRC	Y	Y	Y	Y	Y	Y	
OR[10]	Societal	Y			Y	Y	Y	
Other States								
California	Societal	Y						
Texas	Utility							20%
Colorado	TRC							
Florida	RIM							

[1] Maine's cost-effectiveness test is under development.

[2] New Hampshire market effects include participant and nonparticipant spillover. An adder is used for non-resource effects. Resource effects are quantified.

[3] Vermont adds 0.07 ¢/kWh for environmental externalities and an 11% adder for risk mitigation. Market transformation is a minor goal which is not explicitly rewarded in Efficiency Vermont's contract.

[4] Massachusetts market effects include participant and nonparticipant spillover, and in some cases, market penetration.

[5] Rhode Island market effects include participant spillover.

[6] Information on Long Island Power Authority is not included in this analysis.

[7] New Jersey program administartion is in transition.

[8] Ohio uses retail electircity prices and assesses programs from the customer perspective.

[9] Northwest Energy Efficiency Alliance (NEEA) uses the TRC for long-term impacts and the Utility Test for short-term impacts.

[10] Oregon utilities rely on the Northwest Alliance for market transformation program cost-effectiveness measurement. The Energy Trust of Oregon includes $15/ton for carbon offsets in their cost-effectiveness analysis.

Source: Based on Maine Public Utilities Commission (Maine PUC). 2002. Electric Energy Conservation Programs (Chapter 380), Order Adopting Rule and Statement of Factual and Policy Basis. Docket 2002-43, November 6.

3.3 Assessment of Benefit Cost Models

In this section five widely used benefit cost models are reviewed. These models are used by utilities throughout the country and represent the current industry standard. If NJ decides that none of these models meet their needs, several firms, including Summit Blue Consulting and Quantec, have the expertise to develop a custom model for NJ.

The commercially available benefit cost models included in this review are:

- DSM Portfolio Manager,
- Optimal Energy Benefit/Cost Model,
- DSMore,
- GDS Benefit/Cost Model, and
- E3 Calculator.

Table 3-4 presents a summary of the 5 Benefit Cost models that were reviewed. Further details on each of the models are presented in the following sections.

Table 3-4. Summary of Reviewed Benefit Cost Models

Model Name	Developer	Primary State(s) Of Use	Model Format	B-C Tests Covered	Hourly Analysis?	Standard Benefits Included?	Unique Benefits Included?	Max Years of Analysis	Risk/ Uncertainty Analysis?	Usable by Unskilled Modeler?	Model Analysis Costs
DSManager	EPRI	Multiple	?	5 CA tests	48 day types	Yes	No	20?	No	No	Labor only
DSMore	Integral Analytics	IN, OH, WI	Excel + C	5 CA tests +	Yes	Yes	Adders	30	Weather /Pricing	No	$30 for licensing
DSM Portfolio Manager	Quantec	IA, NV, UT	Excel + Simtools	5 CA tests	Yes	Yes	No	30	Monte-Carlo	No	$50k-$70k for set-up
E3 Calculator	Energy and Environmental Economics	CA	Excel + Visual Basic	4 CA Tests	Yes	Yes	Yes	30	No	No	$25k + for customizing
GDS Benefit/Cost Model	GDS	Multiple	Excel	5 CA tests	4 Periods	Yes	Adders	50	No	Yes	$1k for model
Optimal Energy B/C Model	Optimal Energy	Northeast	Excel + Visual Basic	5 CA tests	Multiple Periods	Yes	Adders	20 +	No	No	$30k-$60k for customizing

3.3.1 DSM Portfolio Manager

Vendor: Quantec, an energy consulting firm headquartered in Portland, OR

Quantec

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Portland, OR 97205

503-228-2992

http://www.quantecllc.com/

Main contact: Lauren Miller Gage, Project Director

Background: DSM Portfolio Manager is Quantec's latest DSM benefit-cost analysis software tool, supplanting their previous model called DICE in July 2005.

Main Clients: MidAmerican Energy, Nevada Power, and PacifiCorp.

Format/Summary: Microsoft Excel-based analysis and simulation tool. MS Excel 2000 or higher and Windows XP are required to run the model. A free simulation add-in tool (Simtools) from the University of Chicago is also used as part of the model. The model contains references to three external workbooks that are associated with the model, including the two input databases (common assumptions and interim database that contains program inputs and outputs) and one output database (final program data).

Users can build programs from a built-in measure database and obtain cost-effectiveness results, run both scenarios and risk analysis around each measure, a program, or a portfolio of programs. DSM Portfolio Manager gives users the option to combine measures into programs and programs into portfolios (such as residential, commercial, industrial) and assess their outcomes under alternative assumptions.

Availability and Pricing: Quantec generally treats DSM benefit-cost analysis as a consulting assignment, not a software sale. It generally costs about $50,000 to $70,000 to set up the model, plus additional time to run additional program iterations.

Methodology Overview [4]

According to the model User's Guide, this model is designed to support the following cost effectiveness tests[5]:

- Participant Test
- Ratepayer Impact Measure (RIM)
- Utility Cost Test
- Total Resource Cost (TRC) Test
- Societal Test

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[4] This review is based on the model user's guide from July 2005, which is attached as an appendix to this report. In addition, Summit Blue interviewed Quantec's manager for this product, Lauren Miller Gage.

[5] California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects www.energy.ca.gov/greenbuilding/documents/ background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF.

The current version of the model allows analysis for up to 30-year simulation periods. The model also allows risk analysis. When a user chooses to run a risk analysis, they must choose which program or portfolio to use. The user has the option to create distributions around four variables: measure life, deemed savings, market penetration, and avoided costs. The model then runs a Monte Carlo simulation around these variables and determines costs, benefits, and benefit-cost test results at the 95th percentile. The user will define the number of runs (e.g., 10, 100, or 1,000) and the seed value (value that starts the random number generator so that results can be replicated in the future).

Cost and Benefit Components:

Generation Avoided Costs – These costs have several components: capacity costs, hourly energy costs, and escalator factors. The user can input as many years of data as are available, and the model will extrapolate future values using the escalator value.

Transmission & Distribution Avoided Cost – Avoided T&D costs and escalator factors.

Environmental Avoided Cost – The model allows either the use of environmental "adders", fixed percentage increases to overall DSM benefits, or specifications for individual pollutants. For the latter method, the pounds of pollutant per kWh and a dollar amount per pound of pollutant must be specified.

DSM costs are divided up into three categories: 1) Direct (customer) acquisition costs, such as for equipment and installation labor; 2) Direct (utility) administration costs, such as program development, administration, marketing, and other; 3) Maintenance DSM costs, such as for administration or evaluation.

Lost revenues—current retail rates for each customer class are specified, as well as escalation factors.

Advantages

The MS Excel format for this model makes the model more transparent than Quantec's previous DICE benefit-cost analysis model. Iowa regulators had been concerned about what seemed to them as the "black-box" nature of the DICE model. The pre-specified but updateable DSM measure database is a feature that should facilitate use of the model. The ability to conduct Monte Carlo simulations is also a useful model feature.

Disadvantages

That the model is complicated enough that a Quantec or a similarly skilled analyst or consultant is necessary to run it is a disadvantage to end users that would prefer to run the model with their existing staff. Also, this model relies on forecasts of future avoidable electric generation costs. For many applications this approach may be reasonable. Without generation production, power flow, and expansion plans, however, the model is limited in its ability to capture the full complexity of locational marginal pricing (as a practical note, we have not identified a commercially available B/C tool that does). The methods of calculating emissions may not be applicable in regions where both coal and gas plants operate on margin.

3.3.2 Optimal Energy Benefit/Cost Model

Author: Optimal Energy, an energy consulting firm headquartered in Bristol, VT

Optimal Energy

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http://www.optenergy.com/

Main contact: Phil Mosenthal

Background: The Optimal Energy Benefit/Cost model is Optimal's latest benefit-cost analysis tool for performing measure and program and portfolio cost-effectiveness analysis.

Main Clients: NYSERDA, Vermont, Massachusetts utilities, New Hampshire utilities.

Format/Summary: Microsoft Excel-based analysis and simulation tool. MS Excel 2000 or higher and Windows XP are required to run the model. In September 2003 the model's calculations were converted from cell formulas to Visual Basic. This allows the tool to handle a larger number of measures (currently configured for 1,000 measures), prevents accidental formula changes and is able to quickly process a large number of measures. The tool also was expanded to accommodate 20 measure-installation years. The model is self contained and includes user-friendly input screens.

Users can assign measures to different programs and sectors and obtain cost-effectiveness results by measure, program, sector, and at the portfolio level. This model, like DSM Manager, provides users the option to combine measures into programs and programs into portfolios (such as residential, commercial, industrial) and assess their outcomes under alternative assumptions.

Availability and Pricing: Optimal Energy generally treats benefit-cost analysis as a consulting assignment, not a software sale. It generally costs about $30,000 to $60,000 to customize the model for the specific end user requirements and to run the analysis.

Methodology Overview

This model can be customized to support the following cost effectiveness tests:

- Participant Test
- Ratepayer Impact Measure (RIM)
- Utility Cost Test
- Total Resource Cost (TRC) Test
- Societal Test

The current version of the model allows analysis for up to 20-year simulation periods, but this can be expanded. The model is extremely flexible and can be customized to meet the needs of the customers. The model allows risk analysis.

Cost and Benefit Components:

Generation Avoided Costs – These costs have several components: capacity costs, and energy costs.

Transmission & Distribution Avoided Cost – Avoided T&D costs and escalator factors.

Environmental Avoided Cost – The model allows either the use of environmental "adders", fixed percentage increases to overall benefits, or specifications for individual pollutants.

DSM costs are divided up into two categories: 1) customer acquisition costs, such as for equipment and installation labor and O&M costs; and 2) utility administration costs, such as program development, administration, marketing, and other

Advantages

The MS Excel format for this model makes the model more transparent than some other models. The use of Visual Basic (VBA) for the processing of the data makes the model more robust and potentially easier to understand. Previous versions of the model used complicated cell formulas that were difficult to interpret and easily changed. Using VBA for the calculations allows the tool to be customized for each application.

Disadvantages

Like the DSM Manager the model is complicated enough that a Optimal Energy or a similarly skilled analyst or consultant is necessary to run it is a disadvantage to end users that would prefer to run the model with their existing staff. Also, the use of VBA makes this model harder for non-developers to customize. The VBA, although well documented, may appear to some to be a “black-box”. Like the other models reviewed here this model relies on forecasts of future avoidable electric generation costs; which for many applications may be reasonable. This limits the model’s ability to capture the full complexity of locational marginal pricing.

3.3.3 DSMore

Author

Developed by Integral Analytics. Integral Analytics is a market research and engineering consulting firm, focusing on the retail energy market.

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Contact: Norm Baker, President and CEO

Background

DSMore was developed by Integral Analytics (IA) in 2003 for application to Duke Energy (formerly Cinergy) program design and evaluation within both regulated and deregulated markets. This application is unique in that it values DSM using a risk-based approach, in much the same way that asset planners approach their valuations. The covariance between prices and loads is captured at the hourly level to accurately measure the risk-based DSM value.[6]

[6] Personal Communications. (April 13 - 14, 2006) Tom Osterhus, Manager of Market Research, Duke Energy.

Format

The DSMore model combines a Microsoft Excel spreadsheet with a separate component (programmed in C) designed to efficiently calculate hourly data for many modeling scenarios simultaneously. The user interfaces only with the Excel spreadsheet, which accepts inputs and returns outputs. The C application is embedded and invisible to the user. This format was designed for speed in calculation, and will be less transparent than calculations residing exclusively in a spreadsheet. The spreadsheet can be set up to import intermediate results from the C application, however, to provide the end-user additional information on the back-end calculations.

Availability

DSMore is a proprietary model owned and licensed by Integral Analytics.

Current Use and Clients

DSMore was initially developed for Duke Energy (formerly Cinergy) in 2003.

Additional clients include Public Service Indiana, Union Light Heat and Power, Cincinnati Gas and Electric, Wisconsin Energy Conservation Corporation. It is under consideration by other companies including East Kentucky Power, and Wisconsin Power and Light.[7,8]

Methodology Overview

The current version of this model supports the cost effectiveness tests defined by the California Standard Practice Manual[9] as follows:

- Participant Test – YES
- Ratepayer Impact Measure (RIM) Test - YES
- Utility Cost Test - YES
- Program Administrator Test – YES
- Total Resource Cost (TRC) Test -YES
- TRC Societal Test - YES

The model also performs an Option Value Test to test long run cost effectiveness, a Minimum Test Value under the mildest weather and lowest production costs, and a Maximum Value Test under extreme weather and high avoided market price scenarios.

A key feature of DSMore is its probabilistic analysis, which provides a distribution of possible benefit cost values across many scenarios. The output includes an average value that is comparable to the single value reported by deterministic assessment (i.e. a single B/C value per measure or program). A typical

[7] Morgan, Rick (2006) “DSM Modeling Tool Panel Session – What is Out There?” 16th National Energy Services Conference. February 6-8, 2006. San Diego, CA.

[8] Personal Communications. (April 14 – 17, 2006) Norm Baker. Integral Analytics.

[9] California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects www.energy.ca.gov/greenbuilding/documents/ background/07_CPUC_STANDARD_PRACTICE_MANUAL.PDF.

modeling forecast period is 25 years. Programs are evaluated over 30+ weather years and 20+ wholesale and retail market price scenarios.

Energy Efficiency Data/Assumption Requirements

Model inputs used to characterize energy efficient measures include: load and energy savings, participation (implementation, free ridership, technology degradation, incentives), program costs, peak clipping assumptions and interrupt schedules.

DSMore uses one to five years of historic load data and uses regression models to build many load scenarios based on 30+ years of weather data. The model assists in load shape assessment and adjustment as follows[10]:

> "Five options are available for load savings assessment. Quick load savings analyses are available that 1) reduce pre loads by a fixed percentage annually (from impact evaluation study), 2) by a fixed percentage each month, 3) by a fixed kwh annually (from impact evaluation study), 4) by a fixed kwh per month, or 5) user can not only adjust the load shape as with DSManager, user can adjust the standard deviations uniquely by hour, month, season or day-type if desired."

The model can assess demand response in three ways: 1) a percent load reduced from original load, 2) a load reduction down to a fixed load floor, and 3) a fixed, absolute load reduction irrespective of the original load.[11]

Cost Components:[12]

Generation Avoided Cost – DSMore considers both cost-based avoided costs and market based avoided costs. For cost-based analysis, a peaker proxy is typically used for capacity savings and hourly energy production costs for energy savings. Market based prices are calculated for all anticipated pricing scenarios (monthly forward prices provide a benchmark forecast out through many scenarios). GARCH time series estimation methods are used to develop hourly price curves based on weather, time of day, month and day of week.

Transmission & Distribution Avoided Cost – Traditional avoided T&D costs are user-defined values input in terms of $/kW. Costs may also be input to reflect T&D deferral, or unique incremental avoided commodity costs attributable to locational marginal price (i.e. RTO zonal prices).

Environmental Avoided Cost – DSMore has inputs for the assessment of costs associated with nitrogen oxides (NO_x), sulfur dioxide (SO_2), and particulate matter (PM), carbon monoxide (CO), carbon dioxide (CO_2), and methane (CH_4).

Other Costs - Avoided gas distribution costs are a possible input to the model, as are adders for risk, ancillary services/reserves.

Commercial Terms

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[10] Morgan, "DSM Modeling Tool Panel Session – What is Out There?"

[11] Ibid.

[12] Osterhus, Tom. (2006) "Using DSMore (DSM Option/ Risk Evaluator) For Cost Effectiveness Testing in Cinergy". Presentation for 16th National Energy Services Conference. February 6-8, 2006. San Diego, CA..

DSMore is currently licensed for $30,000 in the initial year (up to 2 users), with renewal fees of $12,000 per year. Sometimes, extra enhancements are requested by client for items such as processing additional customer loads or profiles, developing multiple market based hub prices, adjusting weather data or customizing a special rate or tariff. These tasks are charged typically on time and materials basis.

Advantages

The key advantages of this tool are a sophisticated approach to risk-based valuation (regression modeling based on weather and the evaluation of the load distributions over 700 price/weather combinations). The model is designed for 3rd party distribution and should therefore be readily customized for any location. It is designed to be applicable in both cost-based (traditional IRP) settings and market-based settings. The model literature also cites ease of use (a single spreadsheet page for inputs) and a high degree of flexibility to adjust the model for specific needs.

Disadvantages

This model may carry significant fees for licensing, customization, and maintenance. Initial setup likely requires significant effort by Integral Analytics, whereby hourly load and market modeling is done "up front" and embedded into the model.[13] The market-based concepts are complex and may not be readily transparent.

3.3.4 GDS Benefit/Cost Model

Author

GDS Associates (GDS). GDS is a consulting and engineering firm specializing in electric, gas water, and wastewater utilities.

GDS Associates

1850 Parkway Place, Ste. 800

Marietta, GA

Contacts:

Dick Spellman, Vice President (770) 425-8100

Scott Albert, Principal and Northeast Regional Manager (603) 656-0336

Background

Development of this tool by GDS has evolved over the past 6+ years. The GDS model is designed to enable simple and user-friendly cost-benefit analysis for electric and gas energy efficiency program planning, detailed measure, sector and portfolio-level program design, budget development, and for prospective and retrospective program performance assessments and associated regulatory filings. This model can also be used by program implementation staff as a field measure-specific, customer-level project screening tool.

Format

[13] Personal Communications. (April 13 - 14, 2006) Tom Osterhus, Manager of Market Research, Duke Energy.

This tool is a Microsoft Excel spreadsheet application with no embedded code or macros and no password protected or hidden components. Certain formulas can be write-protected to prevent accidental over-writing, but remain visible to the end-user. The spreadsheet is designed for simple customization, with user-defined inputs color-coded in blue, and default assumptions color-coded in green.

Availability

The GDS model is proprietary and available on CD for $1,000 with documentation. This fee has been waived for GDS clients in the past. A 60-day trial version is available from GDS at no cost. Training and customization can be provided by GDS, but following initial familiarization with the model's input needs and associated functionality, training is not reportedly necessary (still the majority of applications are administered by GDS).[14] According to the developer, the end-user should be able to update and maintain the application with little or no consulting support.

Current Use and Clients

The GDS Model has been used for DSM assessment in approximately 6 – 10 jurisdictions by over a dozen electric, gas utility and state agency clients, and used for regulatory filings in approximately 3 – 5 jurisdictions.[15] The tool has been "customized regularly for electric and gas utility clients to address specific needs and enhance functionality."[16] The tool has only recently been re-tooled to support 3rd party distribution (e.g., allow it to be purchased and customized without consulting support).

Methodology Overview

The current version of this model supports the cost effectiveness tests defined by the California Standard Practice Manual[17] as follows:

- Participant Test – YES
- Ratepayer Impact Measure (RIM) Test - YES in terms of percent increases or decreases
- Utility Cost Test - YES
- Program Administrator Test - YES
- Total Resource Cost (TRC) Test – YES
- TRC Societal Test – YES

Annual energy impacts for energy efficiency measures are allocated in the model over 4 time periods (summer-on peak, summer-of peak, winter-on peak, and winter-off peak) to approximate hourly impacts (the model is not designed to evaluate at the actual hourly impact levels). Avoided costs must either be averaged over the same four time periods, or can be input as an average annual value. The model accepts 10 years of program or measure forecast inputs and considers avoided electric, gas, oil, water and other resource cost savings forecasts for up to 50 years. The model is used both for program planning and evaluation. It can also be used to provide project/customer-specific field analysis support for program

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[14] Personal Communications. April 14 & 19, 2006. Scott Albert. Principal and Northeast Regional Manager. GDS Associates.

[15] Ibid.

[16] "DSM Modeling Tool Panel Session – What is Out There?" 16th National Energy Services Conference. February 6-8, 2006. San Diego, CA.

[17] California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects www.energy.ca.gov/greenbuilding/documents/ background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF.

implementers. While not designed for probabilistic modeling, the model does directly enable and encourage multiple scenario assessments.

Energy Efficiency Data/Assumption Requirements

The GDS tool can evaluate cost effectiveness for up to 110 energy efficiency measures alone or within up to ten programs in each model run. Model inputs used to characterize energy efficient measures include: measure cost (full cost or incremental cost), measure energy and demand savings, measure life, replace on burn-out or retrofit or early retirement, free-ridership, spillover, broader "with program" market effects, maximum achievable penetration rates, interactive measure effects, and kWh and kW load shapes. Program assumptions required include: number of future operating years, incentives paid and other associated administration, implementation, marketing, and evaluation budgets, number of projected participants with and without the program.[18]

The model uses simplified load shapes to allocate annual energy savings between four typical operational periods: summer peak/off-peak and winter peak/off-peak. For each measure a maximum demand reduction is calculated, as well as a coincidence factor to reflect what percentage of the kW demand savings will exist coincident with summer and winter peak demand. Default simplified load shape assumptions are included for 14 measure types, which may be overwritten or supplemented by the model user.

Cost Components[19]

Electric Generation Avoided Cost – Consistent with the load shapes, avoided generation costs are input as four averaged values: summer peak/off-peak and winter peak/off-peak. User-defined generation avoided costs can be either cost-based or market based, but must be aggregated and averaged to match the four prescribed segments. Avoided capacity costs are considered for both summer and winter peak. The model allows for avoided costs to be entered in either real or nominal terms. In addition, electric retail rate forecasts can also be entered.

Electric Transmission & Distribution Avoided Cost – Traditional avoided T&D costs are user-defined values input in terms of $/kW and includes consideration of T&D losses and reserve margin multipliers.

Natural Gas and Other Resource Avoided Cost – Avoided costs are considered for natural gas (multiple projections to capture new construction and retrofit markets, residential, commercial, industrial sectors) and other fuels (oil –various grades, propane, kerosene, wood, etc.).

Environmental Avoided Cost – The GDS tool allows for use of separate electric and gas environmental externality adders and has emissions inputs for nitrogen oxides (NO_x), sulfur dioxide (SO_2), particulate matter (PM-10), and carbon dioxide (CO_2). This model also uniquely considers avoided costs of water consumption.

Other Quantifiable Costs/Benefits - The tool has inputs for avoided O&M benefits or costs, other quantifiable impacts and may be customized for additional considerations.

[18] "The GDS Low Cost, User-Friendly Benefit/Cost Model for Analysis of DSM Programs". Presentation for the 16th National Energy Services Conference. Richard F. Spellman, Vice President, GDS Associates, Inc.

[19] Personal Communications. April 14 & 19, 2006. Scott Albert. Principal and Northeast Regional Manager. GDS Associates.

Commercial Terms

The GDS model is proprietary and available on CD for $1,000 with documentation. This fee has been waived in the past for GDS clients (or has been incorporated within the cost of providing related consulting services. Outside of the purchase price, setup of the generic and program/measure-specific model inputs and minimal training on the model for an end-user is required. Estimated cost for these activities are typically below $5,000, but can vary depending on the amount of effort provided by the end-user in developing and specifying the critical model inputs (e.g., avoided cost forecasts, measure costs, program budgets, rebate levels, measure lives, estimated energy and capacity savings, load shapes, T&D loss factors, etc.).

Advantages

The open source spreadsheet format provides complete transparency. The model has been designed to be readily transferable to any location, and has been used in several states. This tool is designed to be simple and user friendly, and does not require generation of hourly data. Cost/benefit calculations are instantaneous allowing simple, interactive scenario analysis. It is available at low cost with reportedly little consulting support required. Default simplified load shape assumptions are included for 14 measure types, which may be overwritten or supplemented.

Disadvantages

The simpler format of the avoided costs in this model, while a potential advantage to some users, may be a disadvantage to other users seeking more sophisticated analysis. Measure impacts and avoided costs are time averaged over 4 segments (as opposed to hourly), which must be consistent with the needs of the user. The model does not assist the estimation of avoided costs. It is not designed to provide probabilistic or risk-based assessments.

3.3.5 E3 Calculator

Author

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Background

Development of this model was initiated by E3 in September 2003, for the purposes of evaluating the resource value of California energy efficiency programs.[20] The associated tools include both the E3 calculator, and spreadsheets to develop long-term forecasts of electric and gas avoided costs. The tool accommodates hourly cost information by climate zone as well as hourly measure impact shapes by climate zone.[21]

Format

The E3 calculator and associated avoided cost tools are open source Microsoft Excel spreadsheets, with embedded Visual Basic macros. There are no hidden or password protected calculations. The vast majority of calculations are contained within the spreadsheet, and not the macros, creating transparent applications that are relatively large.

Availability

A PG&E customized version of the E3 Calculator (PG&E Tool 2d3.xls) is available for download at http://ethree.com/cpuc_avoidedcosts.html. There are no licensing requirements or restrictions on use. Customized applications for all California investor owned utility (IOU) are maintained by E3.

Avoided cost spreadsheets and significant supporting documentation are available for download at http://ethree.com/cpuc_avoidedcosts.html. Calculations used to generate avoided costs are contained in three spreadsheets: Electric Avoided Costs (cpucAvoided26.xls), Natural Gas Avoided Costs (gasModel9.xls), and Natural Gas Forecast Inputs (gasInputs4-7-2005.xls).

Current Use and Clients

This tool is mandated in California for IOU reporting of energy efficiency cost-effectiveness. In addition, the IOUs are using this tool for third party solicitations for program management (bidders fill out the tool as part of the bidding process).[22] This tool is subject to an open comment process, involving many stakeholders. Documentation of this process is available at both E3 and CPUC websites.

This application is not specifically designed for distribution to 3rd parties. While there are thorough descriptions of methods, there is no specific guidance to enable customization of the tool outside of California. E3 has customized similar tools for other clients including public utilities in California (in addition to the IOUs), NYSERDA, and several utility clients outside of California.[23]

Methodology Overview

[20] Energy and Environmental Economics, Inc. (2004) "Methodology and Forecast of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs". Prepared for the California Public Utilities Commission Energy Division. http://ethree.com/cpuc_avoidedcosts.html

[21] "DSM Modeling Tool Panel Session – What is Out There?" 16th National Energy Services Conference. February 6-8, 2006. San Diego, CA.

[22] Telephone Interview. (April 12, 2006) Mr. Snuller Price, Partner. Energy and Environmental Economics, Inc.

[23] Ibid.

The current version of this model supports the cost effectiveness tests defined by the California Standard Practice Manual[24] as follows:

- Participant Test – NO, but could be adapted to do so.[25]
- Ratepayer Impact Measure (RIM) Test - YES
- Utility Cost Test - YES
- Program Administrator Test - YES
- Total Resource Cost (TRC) Test - YES
- TRC Societal Test – NO, designed to assign costs to externalities for TRC test

The model is deterministic and designed for regulatory reporting of program cost-effectiveness. The model is not currently intended for program planning and is not designed to run probabilistically.[26] The model is set up to provide state-wide avoided costs (projected out 30 years), but many of the key costs are calculated at the utility level (see below). According to E3 model documentation:[27]

> "Generally speaking, the avoided cost methodology and resultant costs presented herein are most appropriate for evaluating resources that a) reduce load or produce energy for hundreds of hours per year in a predictable pattern, b) are relatively small (such that they can be installed behind the customer meter), and c) are expected to be installed in large numbers. For application to other types of resources, some modifications may be required."

Energy Efficiency Data/Assumption Requirements

The E3 Calculator uses both area (climate zone and utility planning area) and time (TOU or hourly) specific data. The tool provides monthly estimates of therm, kWh and peak kW savings for up to 30 years in the future, recognizing "both the intra-year timing of installations, and the disappearance of those reductions as the installed measures reach the end of their expected useful lives."[28] For demand response measures, the pattern of response has to be pre-determined (based on the avoided costs) and input as any other measure impact shape. The model has a module to produce these pre-determined shapes, based on the operating limitations of a DR or LC program. Hourly load shapes are used when available. When not available, then the available data for TOU period is used and the hourly avoided costs are averaged across those periods.[29]

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[24] California Standard Practice Manual: Economic Analysis of Demand-Side Programs and Projects www.energy.ca.gov/greenbuilding/documents/ background/07-J_CPUC_STANDARD_PRACTICE_MANUAL.PDF.

[25] Telephone Interview. (April 12, 2006) Mr. Snuller Price, Partner. Energy and Environmental Economics, Inc.

[26] Ibid.

[27] Energy and Environmental Economics, Inc. (2004) "Methodology and Forecast of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs". Prepared for the California Public Utilities Commission Energy Division. http://ethree.com/cpuc_avoidedcosts.html

[28] "DSM Modeling Tool Panel Session – What is Out There?" 16th National Energy Services Conference. February 6-8, 2006. San Diego, CA.

[29] Ibid.

Avoided Cost Components[30]

Generation Avoided Cost – Short-term forecasts are based on commercial forward price curves for electricity and natural gas. For long-term projected costs, an hourly stream of market prices is defined by adjusting a pre-determined market price curve shape to match a forecasted utility average annual market price (long run marginal cost plus recovery of fixed capital costs). The assumed long-run marginal cost is based on a combined cycle gas turbine.

Transmission & Distribution Avoided Cost – Avoided T&D costs are developed by a substantial modeling effort that develops utility and climate-zone specific hourly costs. This approach is designed to credit demand reductions occurring in regions where anticipated costs for T&D maintenance and expansion are high. Forecast costs are for 5 – 10 years, with long-term costs are extrapolated at the rate of inflation.

Environmental Avoided Cost –Emissions are calculated by multiplying an hourly emission rate of the forecasted marginal plant in each hour by a pollutant specific emission cost. Marginal emissions are assumed to occur from a gas-fired technology, and a system heat rate is adjusted to account for high-efficiency and low efficiency gas combustion. The emission cost is forecast out for the duration of simulation for nitrogen oxides (NO_x), carbon dioxide (CO_2), and particulate matter (PM-10).

Reliability Adder – The reliability adder is intended to capture the cost of reducing total reliability services needed by the system due to reduction in demand. Ancillary service costs are calculated from “a straight percentage of the energy costs in a given hour, calculated from historical data.”[31]

Price Elasticity of Demand Adder – The E3 Calculator estimates the consumer savings from the demand reduction’s resulting decrease in day-ahead market prices.

Natural Gas Avoided Cost – The E3 Calculator considers the avoided cost of purchase and delivery of natural gas.

Commercial Terms

A typical arrangement would be consulting on a time and materials basis, with not to exceed limit based on the scope of work. Project sizes range from small (less than $25,000) to large.

Advantages

A California utility version of this tool is available for free and is open source. The transparency of the open source spreadsheet format and a formal process of public input by diverse stakeholders, likely ensure a high degree of competence for this model. In addition to the B/C tests, additional spreadsheet models may support the estimation of a wide range of avoided costs, some of which may not be captured in other models (e.g., avoided natural gas procurement, price elasticity of demand). While actively maintained for California only, the model inputs are designed for frequent updating and should be readily transferable to other locations.

[30] Energy and Environmental Economics, Inc. (2004) “Methodology and Forecast of Long Term Avoided Costs for the Evaluation of California Energy Efficiency Programs”. Prepared for the California Public Utilities Commission Energy Division. http://ethree.com/cpuc_avoidedcosts.html

[31] Ibid.

Disadvantages

This tool has not been optimized for ease of use to the end user. A more sophisticated approach would segregate model inputs into small files for each program, and rely on macros for repetitive calculations to reduce the calculator file size. Both of these issues have been brought up in workshop proceedings. A significant modeling effort is required to determine hourly avoided costs. The methods of calculating emissions may not be applicable in regions where both coal and gas plants operate on margin. The model is not currently designed to function probabilistically for risk analysis.

3.4 Recommendations

Using one of these DSM benefit-cost analysis models could have the following benefits to the NJ BPU. Several of these benefits are mutually exclusive, and would depend on which model the NJ BPU selected.

1. DSM Portfolio Manager, DSMore, and the E3 Calculator would permit more robust analyses of DSM's benefits and costs. The first two of these models would allow the NJ BPU to incorporate risk analysis into its DSM benefit-cost analysis.

2. GDS' model would allow more simplified benefit-cost analysis, and not require sophisticated computer modeling skills in order to run the model.

3. Switching to a model that is actively supported by a consulting firm would have some insurance value to the NJ BPU. The model sponsor would be available to ensure that the model did not crash, or would be available to help the NJ BPU recover if this did occur.

However, switching to one of these DSM benefit-cost analysis models would also have costs and concerns for the NJ BPU as well. Switching to a new DSM benefit-cost analysis model would require significant setup and customizing time and expense.

If the NJ BPU is interested in a new DSM benefit-cost analysis model that has additional capabilities compared to the current spreadsheet model used by CEEEP, we suggest engaging in additional discussions with Quantec regarding their DSM Portfolio Manager model. This model can incorporate a broader range of uncertainty analysis than the DSMore model, and the NJ BPU would not incur an annual licensing fee, as would be the case with DSMore.

If the NJ BPU wants a simpler benefit-cost analysis model, we suggest talking to GDS further about their model to ensure that it is as simple and user-friendly as advertised. Summit Blue would be happy to assist the NJ BPU in its discussions with either Quantec or GDS, including testing the models ourselves.

4. PROGRAM CHANGE PROPOSALS

This section presents the assessment of the proposed program changes that the OCE received from vendors and stakeholders. During the past two years the OCE has received a number of proposals for program changes. This section presents objective criteria for the OCE to use to evaluate these types of proposals and an evaluation of the proposals that OCE has received through December 2005.

After receiving several of these proposals for program changes the OCE released guidelines for the submittal of these proposals. Despite the requirement to follow a prescribed template, the Summit Blue team found that many of these proposals did not provide sufficient data to evaluate the proposed recommendations. Where possible, data from similar programs in other jurisdictions were used to evaluate the proposals.

The proposals submitted by the vendors and stakeholders should the following sections[32]:

1. A description of the program
2. Identification of the target market and of customer eligibility
3. A description of the program offerings and customer incentives
4. A description of the program delivery methods
5. A description of quality control provisions
6. Detailed budgets that included at a minimum a breakdown of costs by the following categories, if applicable:
    a. Administrative
    b. Incentive and grants
    c. Training
    d. Direct installation
    e. Sales, marketing, and promotions
    f. Implementation contractors
7. Program goals including specific energy savings or renewable generation goals
8. Minimum requirements for program administration

4.1 Objective Criteria for Ranking

One of the objectives of this study is provide information to help OCE make informed decisions regarding future program changes. To support the OCE as it considers proposals and potential changes to the programs the Evaluation Team has developed a set of objective criteria for ranking programs and program changes. The OCE will develop the relative weighting of these criteria to determine the overall rankings of the propose program changes.

[32] State of New Jersey Board of Public Utilities, "In the Matter of Comprehensive Energy Efficiency and Renewable Energy Resource Analysis for 2005-2008", Docket Number EX04040276

The Evaluation Team developed the objectives using their professional program design and implementation expertise and interviews with energy efficiency program managers throughout the country. The Evaluation Team interviewed managers of similar portfolios of energy efficiency programs throughout the country. These program managers were asked, based on their experience, how their organizations decided which programs and programs changes to fund. All program managers responded that their organizations did not use specific rules to decide which programs or program changes to fund. Most managers responded that they took a number of criteria into consideration, but that these criteria were just used as guidance. The final decision on what programs to fund and which not to fund was based mostly on the managers' experience.

The following, based upon the interviews and the Evaluation Team's experience, are the recommended objective that should be used to evaluation programs and program changes.

Benefit Cost Ratios – The proposed measures and programs should pass the cost-effectiveness test required by the OCE. The OCE should include the inputs for particular benefit cost test as part of the program proposals. In addition to the program proposal data described above this should include: measure lifetime, savings by rate period, and incremental measure costs.

Cost of conserved energy – The cost of conserved energy is a calculation that is useful for comparing the cost of savings across programs. The cost of conserved energy is calculated as the lifetime energy savings divided by the cost of the program to achieve that savings. This should be a required calculation of the program proposals.

Economic Development – The proposal evaluators will need to deicide if the proposed program or program changes will create economic advantages in targeted areas of the State. These advantages are not usually captured in the Benefit Cost Analysis, but may substantial benefits to funding a proposed program.

Allocation by sector – Some jurisdiction have a requirement that energy efficiency spending be distributed across the sectors, i.e. residential, commercial and industrial sectors. Some states require that the energy efficiency program spending be proportional to the amount of the energy efficiency funds collected in each sector. Other states use a fixed percentage to allocate the program spending by sector. When deciding upon which programs to fund, the program managers need to consider how it will impact the energy efficiency program spending by sector.

Geographic equity - Similar to the allocation by sector there may be a requirement that energy efficiency funds be spent throughout the state in proportions to where the funds were collected. Vermont has a requirement that energy efficiency program spending needs to be spread equitably across the counties of Vermont. New Jersey has a requirement that incentives for new construction are for homes built in Smart Growth areas only.

Distribution constraints – Another criterion that should be considered is whether the program or program changes will help relived congestion in a distribution constrained area. Again these benefits may not be captured in traditional Benefit Cost Analysis. For example, Southwestern Connecticut is a very capacity constrained area. Added benefits may be considered for program proposals that will help alleviate the distribution congestion in this area.

Optimizing portfolio – This criterion will be discussed in more detail in Section 5. The proposal evaluators should consider how the proposed programs or program changes will fit with the programs in he portfolio o energy efficiency programs. They will need to assess how the new program or program changes complements or balances the other programs. They should consider if the proposed program adds risk or uncertainty to the portfolio or helps to balance the risk from the other programs.

The following sections apply these criteria where applicable to the proposed program changes received by the OCE. Recommendations for the next steps for each of these proposals are provided.

4.2 Addition: Pilot Program for Sustainable and Energy Efficient Retrofits of Multi-Family Affordable Housing

Premise:

- New Jersey Housing and Mortgage Finance Agency (NJHMFA) finances affordable rental units, and has 43,000 units in its mortgage portfolio and under its monitoring and oversight.
- Property managers have limited maintenance, repair and capital improvement budgets and focus on keeping rents down
- High utility costs reduce affordability for tenants threaten viability of developments

Program Description:

- Based on NYSERDA affordable multi-family program with a few modifications
- Target market is property managers.
- Provide technical assistance to property managers to help them assess, plan for and finance property improvements that reduce long-term energy consumption.
- Comprehensive building energy assessment identifies and recommends energy and renewable resource measures for implementation, and financial specialists coordinate loans, incentives and grants with the owner.
- Integrate energy efficiency upgrade process with existing standard capital improvement budgeting process. Integrated approach allows NJHMFA capital improvement financing to be leveraged for energy efficiency measures. Estimate 4:1 leveraging ratio based upon NYSERDA program.
- Program staff holds property manager’s hand through entire process.
- Measures include: insulation and weather stripping, replacement of appliances, efficient lighting, heating equipment, domestic hot water systems, building-wide management systems.
- The following functions will be performed by program staff and/or consultants: outreach to property managers and owners; application intake and screening; comprehensive energy review of property; capital needs assessment; financial assessment of private and governmental funding programs to create optimal financial package; combine the energy, capital needs and financial assessments to create an integrated capital improvement plan; work with property manager to package financial resources; implementation/oversight; and monitoring/evaluation.

Proposed Budget (based on 1,000 rental units included in pilot):

Cost Category	NJHMFA	CEP Funds
Administration		$140,000
Operations		$100,000
Building Review		$280,000
Financing	$1,000,000	
Subsidy Fund		$880,000
TOTAL	**$1,000,000**	**$1,400,000**

Pros

- Proposed program modeled on successful NYSERDA program.
- Help control rising utility costs
- Help reduce operating costs per square foot
- If competitive market, reducing utility expenses should increase occupancy rate.
- Serves a segment of the low-income community often not reached through weatherization

Cons
- Proposal is labor intensive, auditors, marketers, etc.
- Requires developing a strong relationship with the key market actors, so that the program can impact new capital improvements

Estimated Cost of Energy Conserved

Program Costs		
NJHMFA Loans	$1,000,000	
CEP Funds	$1,400,000	
Financing Cost	$417,490	($1,000,000 at 5% for 15 years)
Total Societal Costs	$2,817,490	

Average Energy Savings	2,800	kWh/Unit (from proposal)
Number of Units	1,000	
Avg. Annual Energy Savings	2,800,000	kWh
Avg. Life of measures	15	years
Cumulative Savings	42,000,000	kWh
Cost of Savings	$0.067	/kWh

Recommendations:

Coordinate with Community Based Organizations (CBOs) and others serving low-income communities. Do not require the installation of full list of recommended measures to receive financing; this was barrier to full participation for NYSERDA Assisted Multifamily Program. Ensure that specific projects are designed to yield benefits for both property owners/managers and tenants.

4.3 Addition: Energy Efficient Operations and Maintenance Program for Commercial and Institutional Buildings

Description:

Conduct a technical feasibility and financial viability study of a new program focused on energy efficient operation in existing commercial buildings. The study will result in a set of recommendations for implementing a "Operate Smart" program whose goal would be to transform the market by relying on public and private building owners, not CEP funds, to implement the program over time.

Scope of Work:
- Establish Advisory Group of stakeholders

- Characterize the market to include owner-occupied, owner-managed, and speculative facilities, REIT-owned properties, and state-owned and operated buildings. Size, scope, energy use characteristics and potential savings in each segment will be determined.
- Analyze current O&M procedures in each market segment to determine how existing protocols might be modified, and how owners currently consider and monitor energy usage in their procedures.
- Analyze private sector energy/O&M vendor offerings to determine current O&M services offered and their nature
- Analyze national best O&M practices and assess applicability to NJ market
- Develop two complementary "model" programs
- Circulate model programs for comment
- Finalize model programs and submit

Timeline and Budget:

Completion: 15 months Budget: $200,000

Pros
- O&M measures have a relatively low cost per $/kWh saved
- If the market is characterized by poor O&M practices, potential savings will be significant.
- Can coordinate with existing C&I efforts to ensure persistence of savings.

Cons
- After the feasibility study is completed the amount of labor required to implement the program and the potential savings will be better understood.
- Key issues for research: current state of maintenance in New Jersey, free-ridership, persistence, net to gross ratios.
- Need to consider how this program may overlap with the current C&I program. Would this program balance the risk of the portfolio or add to the risk?

Recommendations:
- Request additional preliminary information
- The budget for this type of evaluation should not exceed $75,000
- Research should include examples of 1-2 successful O&M programs, and the results achieved from them.

4.4 Addition: Residential Second Refrigerator Turn-In Program

Rationale and Objective:
- Due to increasing federal appliance standards, the gap between Energy Star labeled and federal standard appliances is narrowing and the incremental savings available from swaying new appliance purchases is shrinking, to as little as 10% on new refrigerators. Appliance turn-in can significantly improve a program's energy reduction and cost-effectiveness.
- Refrigerators topped the list in national surveys of popularity of appliance turn-in. A program should be aimed at early retirement of secondary refrigerators. This minimized free riders and maximizes savings.
- The program must also ensure proper recycling to assure that removed appliances are not landfilled or returned to use through the used appliance market.
- The program must also achieve the development of a NJ infrastructure for turn-in and recycling.

- The program will also evaluate the benefit and logistics of incentivizing replacement of existing refrigerators and freezers with new ENERGY STAR appliances, taking into account free riders

Incentives:
- The incentive amount will be calculated based on the energy savings potential. The program will pay for the cost of recycling.
- If the cost benefit evaluation is positive, the program will strive to have manufacturers/retailers contribute to program costs

Performance Indicators:
- # participants
- Comparison of participants to other jurisdictions where similar program offered
- Energy savings
- Cost effectiveness

Pros
- Can be significant gross savings, since secondary refrigerators are often very old, in poor operating condition and are often not keep full. Each unit may use 1,000 kWh or more. However, freeridership may significantly reduce savings.
- The market penetration for secondary refrigerators is about 20%-40% (based on MEEA)

Cons
- No program participation or impact estimates provided in proposal.
- No specific program budget requested.
- Main issues: freeridership (most participants would probably do it anyway), and lifetime (avg remaining life ~1 year)
- Based on other utility experience, the benefit cost ratio may be less than one
- Relatively high overhead costs for collection and disposal (average costs per participant of $200).

Estimated Cost of Energy Conserved

Cost of Pickup and Disposal	$200	
Administrative Costs	20%	
Program Costs/Refrigerator	$240	
Secondary Refrigerator uses	1,200	kWh/yr
(20 yr old unit EPA estimate www.standardsasap.org/fig1.pdf)		
Remaining Life	2	years
Cumulative energy savings	2,400	kWh
Cost of energy conserved	$0.10	/kWh

Recommendations: Request additional critical information to provide adequate basis for funding decision:
1. Conduct a benefit cost analysis of the measure using free-ridership and measure lifetime data from other utilities.
2. Descriptions of 1-2 similar programs operating successfully elsewhere and the results and costs for these programs.

3. Estimated program participation, impacts, and budgets, by category, for at least the first year of program operation.

4.5 Addition: Pilot Program for Solar Water Heating

Premise:

- There is substantial customer demand for affordable solar energy as evidenced by the manufacture and distribution of solar water and space heating systems by New Jersey-based companies in the late 1970's and early 1980's. Successful distribution programs by Meenan Oil Co. and incentive programs by Long Island-based utility LILCO continued up until the expiration of federal solar tax credits in 1985.
- With the advent of federal tax credits for solar water heating beginning January 2006 resulting from the Energy Policy Act of 2005, and with escalating fossil fuel prices, customer demand for solar is poised to increase again.
- System types required for New Jersey range in cost from $4,000 to $6,000 per residence when sold singly as a retrofit (as compared to multiple, adjacent new home installments in the Southwest U.S. which range from $1,500 to $2,500).
- According to the SRCC, energy savings from solar water heating range from 1,800-3,300 kWh electricity per year, or 100-130 therms per year. Using weather data from Atlantic City, SRCC analysis shows this load to be 4,500 kWh for systems using an electric water heater.[33]
- With proposed rebates and federal tax incentives, simple payback is estimated to range from about 6 years for electricity to almost 17 years for natural gas.
- Long payback is a function of relatively high system costs; as the market expands, competition will result in lower prices.

Program Description:

- Based on programs offered in Delaware and Maryland where solar water heating systems are eligible for incentives up to 50% of the installed cost
- Rebate dollars not to exceed $3.5M during pilot phase. Rebates reserved on first come-first served basis.
- 15% of total budget set-aside for low-to-moderate income families. Of the remaining 85% of funds, no more than 70% available for residential single family system applications and no more than 30% for multi-family applications.
- Rebate amount (single family): no more than 40% of installed cost up to $2,500
- Rebate amount (multi-family): no more than 40% of installed cost up to $100,000 per system and not to exceed $1,000 per dwelling unit.
- Rebate amount (if integrated into space heating applications): no more than 40% of installed cost up to $5,000 per residential dwelling and up to $100,000 per multi-family system.
- Eligibility: must be Solar Rating and Certification Corporation (SRCC)-certified system and must be sized to meet specific hot water needs (displace no more than 75% of historical or expected amount of electricity of fossil fuel consumed for water heating purposes.
- Pre-Installation Application Form must be completed and submitted. If application complete, program will issue a commitment letter to applicant. Program will reserve funds for the project

[33] Based on data from the Solar Rating and Certification Corporation (SRCC) and the U.S. Department of Energy. The SRCC savings values are based on detailed computer models that use these inputs: New Jersey weather data from TMY2s (Typical Meteorological Year), detailed thermal models of commercial solar water heating systems submitted to SRCC for certification by solar manufacturers and U.S. Department of Energy standard water heating load of 64 gallons per day.

for 6 months from the date of commitment letter for residential projects and for 12 months for multi-family projects.

- Vendors must submit a Participating Vendor Application
- Program requires 5-year warranties on systems, code compliance, meeting specified collector orientation and tilt requirements, as well as maximum collector shading requirements

Estimated Program Effects (assuming $3.5M pilot budget):

- 1,500 systems installed, saving up to 172,500 therms natural gas per year or up to 4.05 MWh/year electricity, valued at about $400,000 to $526,000, respectively.

Pros

- Examples of similar programs operating elsewhere provided as part of proposal, but results from recent programs not specified.
- Can provide the homeowner with a hedge against rising fuel prices. Rising fuel and electricity prices will help make the units more economically for consumers.
- The current tax credit helps to defray the higher incremental cost of the system.
- Stimulate the market and potentially reduce equipment and installation costs.
- The program impact estimates appears to be in line with other states. 4.05 million kWh saved per year from 1,500 systems is an average of 2,700 kWh per system saved. Maryland assumes an annual savings of 2,500 kWh per system. The average use for all water heaters prior to the 2004 new DOE minimum efficiency standards was 3,459 kWh according to DOE's water heater standards analysis[34]. Solar hot water systems typically replace the larger DHW units, 60 gallon to 80 gallon units, so the average energy use should be higher than the DOE average. According to the SRCC model the average energy use of an 80 gallon electric DHW unit is 4,500 kWh, which seems to be a reasonable estimate.

Cons

- Assuming that the solar systems last for 20 years, and that the savings do not decrease over time, which are quite optimistic assumptions, the cost of conserved energy from solar water heating systems would be about 10 cents per lifetime kWh (using the revised savings estimates). This is likely to be marginally cost effective, or less so if the optimistic assumptions are not realized. The average cost of conserved energy for the current residential program is 1.4 cents per lifetime kWh and is the highest for low income programs at 4 cents per lifetime kWh. Comparing the cost of conserved energy, it appears that solar water heating may not pass the societal benefit cost test.
- In the past solar hot water heating has failed the societal benefit cost test in Vermont and New York. However, given the recent changes in the fuel and electricity costs and a slight decrease in the incremental costs, this measure should be re-screened using updated avoided costs.

Estimated Cost of Energy Conserved

Assume all units replaced are electric DHW

Units	1,500
Total Rebate	$3,000,000
Overhead	$500,000

[34] Federal Register, Vol. 66, No. 11, Wednesday, January 17, 2001/Rules and Regulations, p. 4474.

Customer Portion	$4,500,000	*Avg Cost – Rebate = $5,000 - $2,000 = $3,000/unit*
Total Costs	$8,000,000	
Savings/Unit	2,700	kWh/yr
Tot Savings	4,050,000	kWh/yr
Lifetime	20	years
Cum Savings	81,000,000	kWh
Cost/Saving	$0.0987	/kWh

Assume all units replaced are gas DHW

Units	1,500	
Tot Rebate	$3,000,000	
Overhead	$500,000	
Customer Portion	$4,500,000	*Avg Cost – Rebate = $5,000 - $2,000 = $3,000/unit*
Total Costs	$8,000,000	
Savings/Unit	180	therm/yr
Tot Savings	270,000	therm/yr
Lifetime	20	years
Cum Savings	5,400,000	therms
Cost/Saving	$1.48	/therm

Recommendation: Request additional information to help assess the program’s feasibility and cost effectiveness:

1. Conduct a benefit cost test on this measure using the updated avoided costs and current incremental costs.
2. Assess the actual results of the similar programs being conducted in Delaware and Maryland. Program participation rates, savings, and costs by category are of particular interest. The Evaluation Team was able to obtain information from the pilot solar DHW program in Maryland.
3. The program should describe the basis of the proposed participation rate estimate of 1,500 customers per year, and how that compares to the actual participation rates in Delaware and Maryland. The current Solar DHW Maryland program is in the pilot stage and has only about 55 SDHW participants in the past two years.
4. The Maryland pilot program has a budget of $100,000 per year and has had 75 SDHW and PV participants in the past 2 years. This equates to $1,333 spent per participant on average. The proposal program, if it met its goals, would have a much higher spending per participant, $2,333.
5. Installation MUST include 6 month, 12 month, and 24 month inspections by qualified installers. Past experience has show systems that are inoperable because the homeowner did not operate it correctly or there was another failure. Early detection of failures will ensure the system lives and provides savings over the expected lifetime.

4.6 Addition: C&I Direct Install program

Premise:

- The small commercial and industrial (C&I) sector is currently underserved by the CEP, and faces some of the greatest barriers to pursuing efficiency, including the fact that many buildings are tenant-occupied, financial and technical resources are limited, and/or that energy consumption is low. Different delivery and incentive strategies are required. The energy savings potential is overwhelmingly found in inefficient lighting, so the program should focus on direct installation of efficient fixtures, lamps, ballasts and occupancy sensors. However, the program should be comprehensive and address all cost-effective opportunities including refrigeration, HVAC and hot water systems.

Program Description:

- Target market is small businesses and public and institutional buildings with peak demand <= 150kw.
- Local direct install contractors are selected by competitive procurement. Selected contractors would provide free audits, then offer turnkey specification and installation of proposed measures.
- Contractors are given lists of small customers who meet qualification criteria by geographic area, and contact them directly by phone and in-person. Thus, very little administrative costs for program.
- All customers will be pre-qualified
- A minimum of 10% of treated sites will be subject to quality assurance review and pre and post-installation inspection.

Combine rebates/incentives with simple, easy-to-use financing to create immediate positive cashflow. Some successful state programs provide incentives up to 80% of the capital cost.

Pros

- Serves a hard-to-reach segment of business customers that otherwise are otherwise unlikely to participate in efficiency programs
- Program addresses the small business market, which is typically underserved by DSM programs. The small C&I sector is notoriously difficult to pull into program participation. The direct install approach is probably the most reliable way to achieve targeted savings in this sector, particularly for tenant-occupied buildings.

Cons

- Target population may be resistant to participate even with a small, required contribution.
- Focus service delivery in economically disadvantaged areas with hard-to-reach small business customers (i.e., operating in leased space, English as a second language, few employees)
- Direct install programs often do not compare favorably with other C&I programs on a cost-per-kWh-saved basis. Similarly programs targeted at small C&I do not compare favorably with other C&I programs on a cost-per-kWh-saved basis.
- It will probably be difficult to find trade allies qualified to identify and then provide **comprehensive** services – that is services not just focused on a single technology or measure type. If single-focus trade allies are used (e.g., those focused on lighting or HVAC), then getting them to identify savings potential outside their area of expertise is often very difficult. Similarly, it is usually very difficult to get them to share leads with other companies to implement measures outside their area of expertise. As a result, unless the program design pays particular attention to relevant features, the vast majority of projects implemented will likely be single-technology projects.
- No estimated program participation rates or impacts are provided. No specific budget request is provided.
- Other successful state programs are mentioned, but no details on such programs are provided.

- No program cost effectiveness or costs of conserved energy estimates are provided.
- Customer information privacy considerations are likely to make the suggested practice of giving contractors customer names and information difficult or impossible.

Estimated Cost of Conserved Energy

San Diego B.E.S.T. Program data[35]

2002-2003 Budget	$2,047,500
Estimated Lifetime Savings	71,051,855 kWh
Estimated Cost of Conserved Energy	$0.0288/kWh
2004-2005 Budget	$4,833,629
Estimated Lifetime Savings	133,467,166 kWh
Estimated Cost of Conserved Energy	$0.036/kWh
Total Resource Cost Test	2.17

Recommendation: Request additional information needed to provide the basis for a funding decision:

1. Provide estimates for participation, impacts, and budgets. Also specify the assumptions behind these estimates.
2. Assess the likely customer data privacy issues associated with giving contractors customer contact information.

If the pilot is funded, pay particular attention to the organization of the competitive procurement and the structure of the contracts to maximize the potential that cost-effective non-lighting measures are not overlooked.

4.7 Modifications: Home Performance with ENERGY STAR

Since this program proposal was received the OEC has implemented the full Home Performance with ENERGY STAR program.

Premise:

- A hole in the existing CEP portfolio is a program that encourages EE improvements of all existing homes owner-occupied by those who don't qualify for Comfort Partners (low-income).
- Develop an infrastructure of EE businesses serving the non-low income market
- Expand on pilot program now being offered in Atlantic County

[35] The B.E.S.T. Program targets the hard-to-reach (HTR) small businesses from 20 kW to 100 kW in the San Diego Area. The B.E.S.T. Program offers a "turnkey" approach in which marketing, energy education, site-specific energy analysis, financial incentives, equipment procurement, and installation are provided. This turnkey marketing and implementation process takes customers quickly from interest and intent to the actual installation of measures. The primary focus of this program is to maximize the implementation of cost-effective high-efficiency lighting measures, while also addressing some HVAC, refrigeration and customized measures. Program staff performs pre- and post-inspections at 100% of the sites to verify equipment installation and energy savings.

- Emphasize consumer education, value and ‘one-stop’ problem solving
- Has been offered over the past 4 years in NY and WI, and more recently in VT, CA, and MA.

Program Description:

- Whole-house approach
- Home energy inspection performed by private contractors (leads to targeted advice and sales pitch for improvements)
- Homeowners pay the audit fee (between $100-$250) which is rebated if they install recommended measures
- Diagnostic testing and “best practice” installments
- One-stop shopping for comprehensive home energy improvements
- Quality assurance through contractor certification, accreditation of participating firms by the national Building Performance Institute, and on-site inspections.
- Training of contractors offered by a state technical institution
- Participating contractors can perform any and all improvements on a fee basis, or maintain a list of providers for those services not provided directly.
- Reduced interest rate financing available from Fannie Mae home improvement load program; for homeowners not taking loan a 10% incentive is available

Start-up costs significant and a long ramp-up period is expected. Recommended budget, targets for enrolled contractors and homes improved is:

Year	CEP Budget ($)	Contractors Enrolled	Homes Improved
1	$ 200,000	8	30
2	$3,000,000	30	400
3	$4,000,000	100	1,800

Pros

- The program could have significant potential in NJ, since the programs are sponsored jointly by electric and gas SBC.
- Help existing home owners control their utility expenditures
- Before rising fuel prices, it was hard to educate consumer to Home Performance benefits. Now there is a large demand for these services.
- Development of Building Performance Institute (BPI) certified contractor market in NJ.
- Proposal references similar programs operating elsewhere, but no details provided on such.

Cons

- No estimated program impacts included.
- Long ramp up time to get contractors trained on techniques
- Large investment up front before savings can be claimed
- Potential logistical concerns, dissatisfaction with contractors will need to be addressed by implementers
- High inspection costs, many sites may not meet program standards
- It is unclear how the costs per home served will decline from $7,500 to $2,222 from the second to the third year of program implementation.

- Few details provided regarding program management and marketing plans.
- Program has large increase in participating contractors and homes from the second to the third year, but it's unclear how that will be achieved.

Estimated Cost of Energy Conserved

Year	Contractors Enrolled	Homes Improved	CEP Budget	Part Costs[36]
2005	8	30	$200,000	$175,440
2006	30	400	$3,000,000	$2,339,200
2007	100	1,800	$4,000,000	$10,526,400
		2,230	$7,200,000	$13,041,040
Total Societal Costs for 3 years				$20,241,040

Primary Fuels Only	MMBtu Per House[37]		Share of Program Costs by Fuel Type
Natural Gas	34.63	81.27%	$16,450,031
Oil	4.17	9.79%	$1,981,959
Propane	0.41	0.96%	$194,464
Electricity	3.40	7.98%	$1,614,586
Totals	42.61		$20,241,040

Primary Fuels	MMBtu Per House	Savings Per House	Units	Measure Lifetime (years)	Lifetime Savings Per House	Total Measure Lifetime Savings	Units
Natural Gas	34.63	346	therms	20	6,925	15,443,414	therms
Oil	4.17	30	gals	20	602	1,341,609	gals
Propane	0.41	4	gals	20	82	182,565	gals
Electricity	3.40	996	kWh	20	19,922	44,425,140	kWh

[36] Average participant costs from CSG 2006 NJESwHP Proposal = $5,848. Total costs per home = $8,000. Two-thirds of homes will be market rate and receive $1,200 incentive. On third of homes will be assisted homes and will receive $4,000 incentive. ($8,000-$1,200)*0.66 + ($8,000-$4,000)*0.34 = $5,848/home

[37] Based on NYSERDA HPwES per home savings from program start through Q4 2005

Primary Fuels Only	Share of Program Costs by Fuel Type	Total Measure Lifetime Savings	Units	Cost	
Natural Gas	$16,450,031	15,443,414	therms	$1.07	/Therm
Oil	$1,981,959	1,341,609	gals	$1.48	/gal
Propane	$194,464	182,565	gals	$1.07	/gal
Electricity	$1,614,586	44,425,140	kWh	$0.04	/kWh

Recommendation: This program has been implemented. No additional information is necessary at this time.

4.8 Modification: Performance and Prescriptive Lighting Programs

Nature of Change:

Remove height restriction (HR) from the “High Bay” lighting applications

Rationale:

- The HR reduces the incentive for the same fixture if its mounting height is lowered. In the industry, mounting height is adjusted up or down according to light quality and quantity needs. Lower mounting heights to achieve increased light levels allow a lower wattage fixture to be used, resulting in increased energy savings. In most cases these types of fixtures require design changes and cost the same if not more than the standard “high bay.”
- If the energy savings benefits are equal to or better than the existing incentive method the HR should be removed. The criteria should be the # lamps/fixture and the total ANSI watts used

Current Incentive Structure

T-5 and T-8 lamps with electronic ballast (replacing T-12 lamps)

For existing facilities with load ≤75 kW..$20/fixture (1-4 lamps)

For existing facilities with load >75 kW..$10/fixture (1-4 lamps)

High Bay 1 ....$50/fixtures

- T-5 and T-8 lamps with electronic ballast with at least 2 lamps
- Replacing incandescent, T-12 fluorescent or HID fixtures 250 W – 399 W
- All fixtures installed at least 14’ from floor
- Replaced fixtures on one-for-one basis

High Bay 2 ....$75/fixtures

- T-5 and T-8 lamps with electronic ballast with at least 3 lamps
- Replacing incandescent, T-12 fluorescent or HID fixtures > 400W
- All fixtures installed at least 18’ from floor
- Replaced fixtures on one-for-one basis

Suggested Incentive Criteria:

- Minimum of 4 F32T8 lamps with 1.15 or > high ballast factor

- Minimum of 4 F54T8 lamps with 1.00 or ballast factor
- Proof that the incentive does not exceed 45% of fixture cost

Pros

- Addresses a market barrier to efficient high bay lighting systems.
- The existing incentive structure pays more incentive for more savings. Proposal would not alter that.
- The height restriction was to help differentiate what type of fixtures being replaced. The replaced wattage restrictions accomplishes the same objective.

Cons

- No program participation rates or impact estimates provided.
- No program incentives or budget specified.
- No program cost effectiveness or cost of conserved energy estimates provided.
- No program management or marketing plans specified.

Cost of Conserved Energy

No specific budget and savings data provided in proposal.

Recommendation:

Summit Blue recommends removing the height restrictions for the high bay fixtures and keeping all the other restrictions in place. As long as the High Bay incentives are based upon the wattage being replaced the higher incentives are justified. If these replacement wattage specifications were not included then all the T-5 and T-8 fixture rebate levels should be the same.

4.9 Modifications: New Jersey ENERGY STAR Homes (Residential New Construction) Program

Proposed modifications to the existing residential ENERGY STAR program have been presented in the form of proposed redlines to the current program template, rather than as a proposed new template with rationale and explanation. The following represents a description of the redlined changes being proposed. See New Jersey ENERGY STAR HOMES Program section of detailed recommendations.

Current Program:

The current program is designed to increase the efficiency and environmental performance of residential new construction in the State. The long-term goal is to transform the market to one in which all new homes are built at least as efficiently as the current EPA ENERGY STAR homes standards.

Proposed modifications:

- EPA is in the process of introducing a new technical compliance standard which will apply to all new units committed to the NJ ENERGY STAR Homes Program effective January 1, 2006. In accordance with EPA requirements, the standard will also apply to all units previously committed to the program and not completed until after December 31, 2006. As a result, the NJ ENERGY STAR Homes Program will have the following requirements. A home must: (1) meet a performance standard at least equal to the EPA ENERGY STAR Homes performance standard, including the Thermal Bypass Checklist and all other mandatory requirements; (2) document proper HVAC equipment sizing and installation; (3) fully duct all HVAC supplies and returns; (4) fully seal all duct system joints and seams in accordance with program guidelines; (5) properly air seal the home for reduced air leakage; (6) install mechanical ventilation; and (7) install a minimum of three ENERGY STAR hard-wired light fixtures.

The HVAC equipment incentives will be updated in 2006 in accordance with those offered under the Residential Electric and Gas HVAC Program (including an additional $100 incentive introduced September, 2005 for an ECM fan motor installed in conjunction with qualifying furnace equipment). See the HVAC rebates discussed in Section 2 above.

Pros

- Changes will allow New Jersey to continue to leverage the ENERGY STAR label in their new homes program Proposal will update New Jersey's version of the program, and bring it up to date with the latest EPA program changes.
- Taps in to existing technology.
- Encourages cross marketing with Home Performance with Energy Star efforts
- Allows shift of incentives to customer marketing to increase demand for product

Cons

- Total incentives available to builders may be reduced, making them less likely to participate. No program impact estimates specified. No proposed 2006 budget specified.
- May require infrastructure support for some technologies (ground source heat pumps)
- Washing machine incentive should be pegged to highest Tier.
- ECM motors may only save energy in prolonged use

Cost of Conserved Energy

<u>2005 Results (Actual and Committed)</u>

Expenditures	$66,953,000
Lifetime kWh Savings	487,684,000 kWh (9.5% of Program Btu savings)
Lifetime Gas Savings	158,002,400 Therms (90.5% of Program Btu savings)

Cost of kWh Savings	$66,953,000 x 9.5% / 487,684,000 kWh = $0.0130/kWh
Cost of Gas Savings	$66,953,000 x 90.5% / 158,002,400 Therms = $0.38/Therm

NOTE: *These costs of conserved energy do not include customer costs*

Recommendation: Request the information specified in the above section to provide an adequate basis for a funding decision.

- Provide builder training on new requirements and why they are being implemented.
- Continue public education efforts to ensure the benefits of the ENERGY STAR-labeled new homes are recognized by buyers and other market actors (real estate agents, lenders).

4.10 Modification: ENERGY STAR Products

Proposed modifications to the existing residential ENERGY STAR Products program have been presented in the form of proposed redlines to the current program template, rather than as a proposed new template with rationale and explanation. The following represents a description of the redlined changes being proposed. See ENERGY STAR Program section for detailed recommendations.

Current Program:

The ENERGY STAR Products Program promotes the sale and purchase of ENERGY STAR rated and labeled products including lighting, appliances and windows.

The long-term goal of the program is to transform the market into one in which ENERGY STAR products become the standard purchasing practice of NJ consumers.

Proposed modifications:

Lighting –Historically, the program has focused on time-limited initiatives, particularly through cooperative promotions with industry partners in concert with national Change A Light campaign. Due to the enormous potential for cost-effective savings and provided that CFL lighting as determined by the market assessment currently being performed in NJ still possesses the ability to substantially increase in market share, beginning in 2006, the program may aggressively promote the sale of CFLs through cooperative marketing and incentive offerings that are year-round. The Fall Change-A-Light campaign will become the most intensive period of program marketing and activity, rather than the only time of year incentives and cooperative marketing are offered. This is the same recommended as described above.

Pros

- Sends a consistent message to the market place throughout the year, and not just during limited period program promotions.
- Addresses concerns of retailers and manufacturers
- Ensures broad product availability throughout the program
- Reduces consumer confusion and frustration

Cons

- No estimated program participation or impact estimates provided.
- No budget request or provided.
- No cost effectiveness estimates or cost of conserved energy estimates provided.
- No changes or updates to program management and marketing plans specified.
- Potentially more freeridership

Cost of Conserved Energy

<u>2005 Results (Actual and Committed)</u>

Expenditures	$5,973,000
Lifetime kWh Savings	537,995,000 kWh (100% of Program Btu savings)
Cost of kWh Savings	$5,973,000 / 537,995,000 kWh = $0.0111/kWh

NOTE: *These costs of conserved energy do not include customer costs*

Recommendation:

- Adopt some tiered incentives
- Request the information in the above section to encourage greater depth of participation (more bulbs or fixtures per home) as well as breadth.
- Provide an adequate basis for a funding decision.

4.11 Modification: Residential Gas and Electric HVAC Program

Most of the proposed changes have been captured in the HVAC program recommendations in Section 6.

Proposed modifications to the existing residential HVAC program have been presented in the form of proposed redlines to the current program template, rather than as a proposed new template with rationale and explanation. The following represents a description of the redlined changes being proposed.

Current Program:

Promotes both the sale of high efficiency equipment and improvements in sizing and installation practices that effect operating efficiencies.

Proposed modifications:

- With new federal efficiency and ENERGY STAR standards for central A/C and heat pumps to go into effect in early 2006, program would place greater emphasis on quality installations and less on equipment efficiency.
- ENERGY STAR rating required for central A/C and heat pumps in order to qualify for rebate
- Joint promotions with HVAC manufacturers, distributors and/or contractors rather than current arrangement to simply communicate and educate these stakeholders.
- Expand installation training to include how to properly size equipment, and seal, balance and test ducted distribution systems
- Include promotion of qualified contractors to consumers.

New efficiency levels germane to rebates would be as follows:

- Tier 1: SEER 14, EER 11.5 and (in the case of heat pumps) HSPF 8.2 (to be modified in accordance with final 2006 ENERGY STAR standards)
- Tier 2: SEER 15, EER 12.5 and (in the case of heat pumps) HSPF 8.5

The program also promotes:

- Ground source heat pumps with an EER meeting at least the ENERGY STAR qualification standards for open loop systems (16.2 EER / 3.6 COP) and closed loop systems (14.1 EER / 3.3 COP).
- Additional incentives may negotiated as part of an industry promotions initiative as well as for field verification of quality installation and system performance at time of installation.

Additional recommended modifications:

- Expand program to include a **diagnostic and repair service** for existing central A/C and heat pump systems, with respect to refrigerant charge, air flow, duct leakage and operation. Program will

include training and qualification of participating contractors. After diagnosis the program will offer either repair services or unit replacement under Cool Advantage program.
- Electric and gas goals will be developed to account for national standards changes and incentives adjustments.

Pros:
- Program rebates specified in considerable detail.
- Updates the central AC incentives based upon the change in the federal standards

Cons:
- CAC rebates do not include CEE Tier 1 level
- 66% reduction in CAC 15 SEER incentives
- 33% reduction in high-efficiency natural gas furnace and boiler incentives from 2005 levels
- 60% reduction in furnace incentives from 11/1/05-4/1/05 incentive levels
- 73% reduction in boiler incentives from 11/1/05-4/1/05 incentive levels

Cost of Conserved Energy

2005 Results (Actual and Committed)

Expenditures	$13,117,000
Lifetime kWh Savings	224,957,000 kWh (23.5% of Program Btu savings)
Lifetime Gas Savings	24,938,120 Therms (76.5% of Program Btu savings)
Cost of kWh Savings	$13,117,000 x 23.5% / 224,957,000 kWh = $0.0137/kWh
Cost of Gas Savings	$13,117,000 x 76.5% / 24,938,120 Therms = $0.40/Therm

NOTE: *These costs of conserved energy do not include customer costs*

Recommendation: See Residential Gas and Electric HVAC Program section for detailed recommendations.

5. ENERGY-EFFICIENCY PORTFOLIO ASSESSMENT

The evaluation team conducted a high-level assessment of the current portfolio of energy-efficiency programs in New Jersey in order to help the OCE determine where to allocate its resources. This assessment relies on the data collected during the program market assessments, a review of other energy efficiency programs across the country, and other readily available data sources. The goals of this assessment are to 1) establish inter-relationships and cross implications of the recommended program changes from the program market assessments, 2) assess the current portfolio savings goals, 3) develop procedures for performing portfolio trade-off analysis and 4) develop recommendations for adjustments to the program for achieving the program goals.

5.1 Review and Assessment of Portfolio Goal

For the portfolio of NJ energy efficiency programs, progress in meeting energy savings goals is measured relative to the levels of spending on the energy efficiency programs. For every percentage increase in spending compared to 2003 spending levels, the goal is to increase energy savings over 2003 levels by the percentage increase in spending plus 10%.[38] Funding levels are used to set the targeted savings goals; however, the actual spending and actual savings achieved (which may deviate from targeted) are used to determine if the portfolio met this savings goal. If the programs under spend their budgets, as has happened the past couple years, the savings increases are relative to the actual spending increase. If spending was increased by X% over the 2003 spending levels than the savings are expected to have increased by X% plus 10%. For example, if the NJ Clean Energy programs spent 9% more in the current year compared to 2003 then the annual savings should increase by 19%.

5.1.1 Review of Savings Results

Table 5-1 presents the actual program results for 2003, 2004 and 2005. In 2004 the program expenditures increased relative to 2003 by 5%. Following the savings goal formula the associated targeted savings should have increased by 15% (5% + 10%). In 2004, the actual **annual** electricity energy savings matched this goal by saving 15% over the 2003 energy savings levels. However the actual **annual** gas energy savings only increased by 6% in 2004, well below the goal of a 15% increase.

In contrast, the 2005 savings results were much higher than the goals. In 2005 the program expenditures decreased relative to 2003 by 3%. Following the savings goal formula the associated targeted savings should have increased by 7% (-3% + 10%). In 2005 the actual annual electric energy savings significantly exceeded this goal by saving more than 34% over the 2003 energy savings levels. The actual annual gas energy savings in 2005 also greatly exceeded the savings goal, increasing 51% over the 2003 savings.

Table 5-1. NJ Clean Energy Program Portfolio Actual Expenditures and Savings 2003-2005

				% Change	
	2003	**2004**	**2005**	**2004**	**2005**
Actual CEP Expenses ($000)	$88,313	$92,752	$85,414	5%	-3%
Actual Annual Energy Savings (MWh)	285,576	328,512	382,845	15%	34%
Actual Annual Gas Savings (Dtherms)	408,853	432,758	617,261	6%	51%

[38] New Jersey Clean Energy Program 2004 Annual Report, p. 9.

Source: New Jersey Clean Energy Program 2003, 2004 and 2005 4th Quarter Quarterly Reports

To better understand these expenditures and savings figures, the spending and savings results for each program were examined. The Commercial and Industrial Construction Program experienced the most notable changes over this time period. Program expenditures, relative to the 2003 baseline, decreased by 3% in 2004 and by 20% in 2005, yet actual energy savings (MWh) during this period, relative to the 2003 baseline, increased by 3% in 2004 and by 46% in 2005 (Table 5-2). The actual gas savings (Dtherms) during this period, relative to the 2003 baseline, decreased by 38% in 2004 but increased by 116% in 2005.[39]

Table 5-2. Commercial and Industrial Construction Program Actual Expenditures and Savings 2003-2005

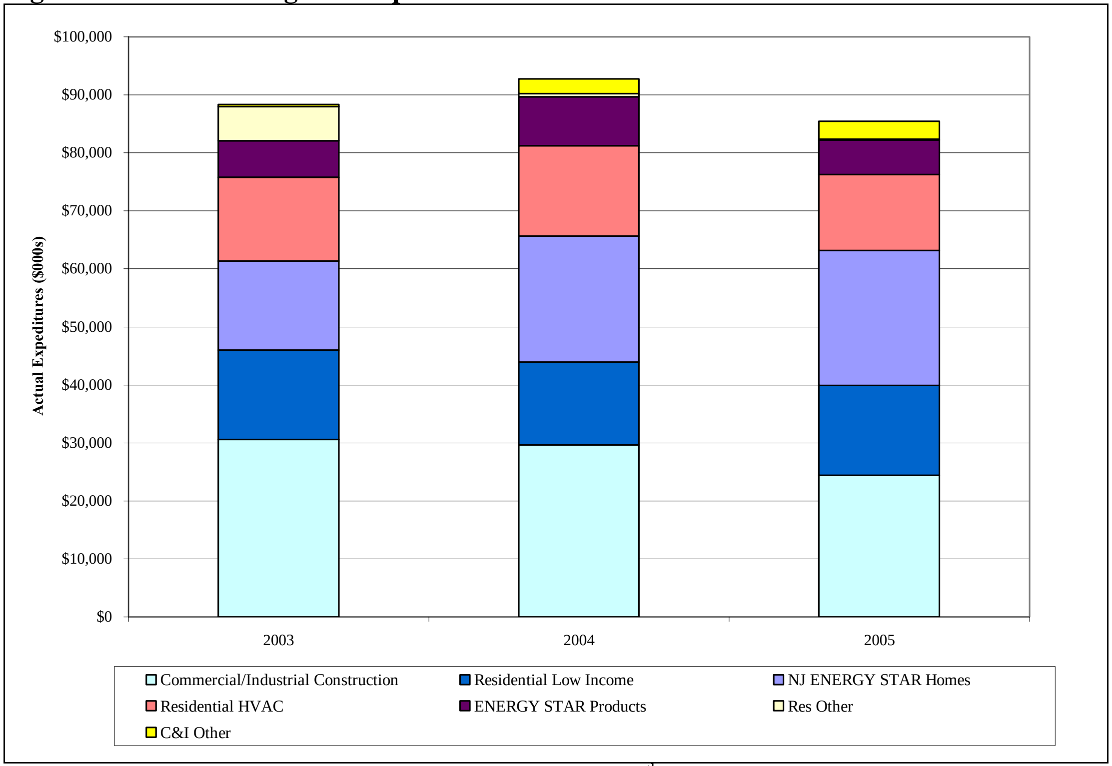
				% Change	
	2003	**2004**	**2005**	**2004**	**2005**
Actual CEP Expenses ($000)	$30,555	$29,661	$24,437	-3%	-20%
Actual Annual Energy Savings (MWh)	197,347	204,144	287,671	3%	46%
Actual Annual Gas Savings (Dtherms)	88,005	54,644	190,001	-38%	116%

Source: New Jersey Clean Energy Program 2003, 2004 and 2005 4th Quarter Quarterly Reports

The following charts (Figure 5-1, Figure 5-2, and Figure 5-3) show the changes in expenditures and savings by program. The impact of the changes in the Commercial and Industrial Construction Program on the overall portfolio can be seen in these charts.

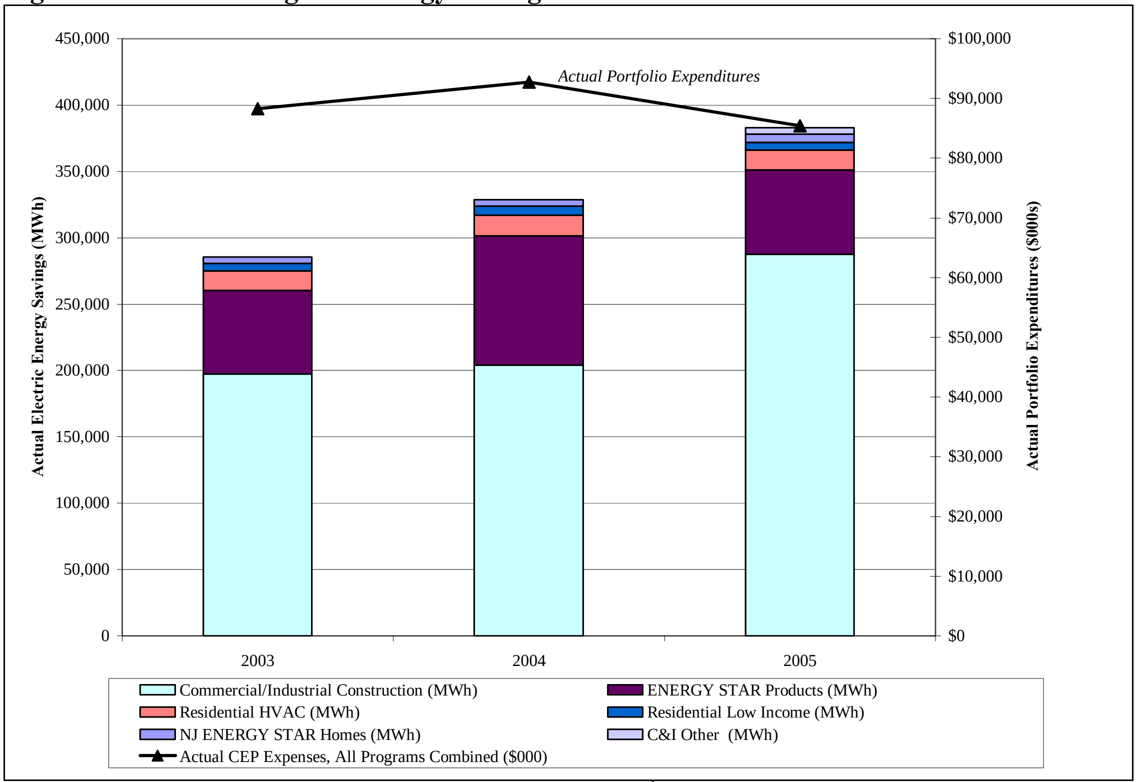
[39] The mix of projects may explain this increase in savings. According to the program data there were fewer smaller projects in 2005 relative to 2004. The smaller projects have high incentives per energy savings than the larger projects. With fewer smaller projects the lower cost larger projects produce more savings per dollar spent for the program.

Figure 5-1. Actual Program Expenditures 2003-2005



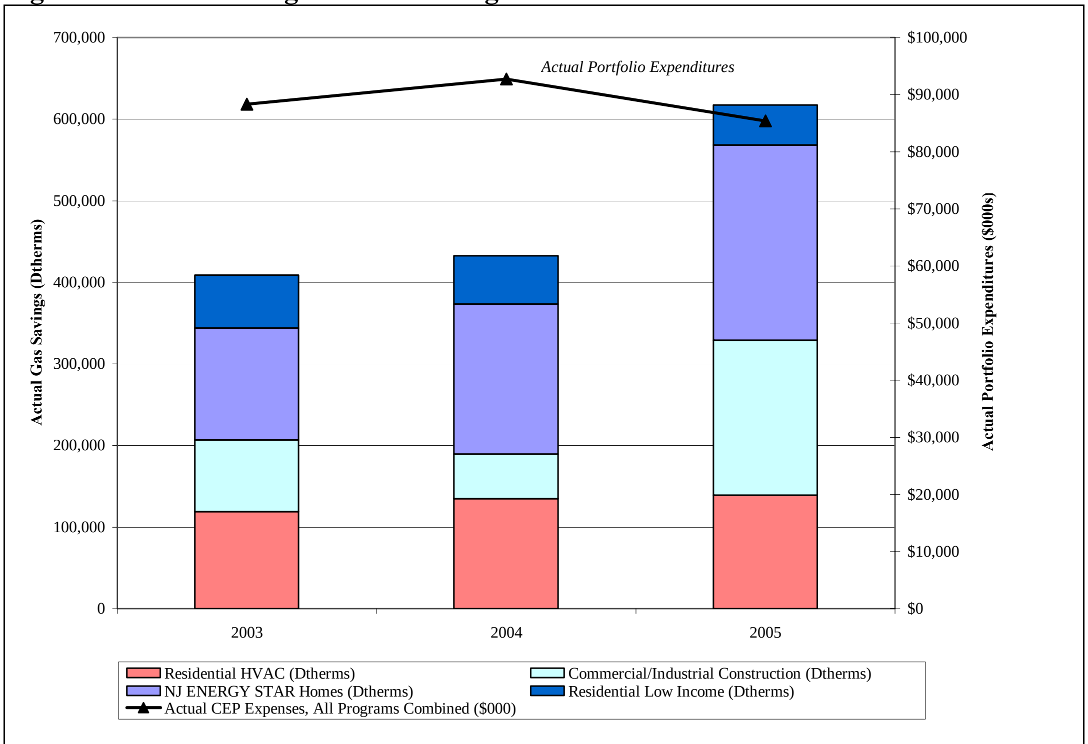
Source: New Jersey Clean Energy Program 2003, 2004 and 2005 4th Quarter Quarterly Reports

Figure 5-2. Actual Program Energy Savings 2003-2005



Source: New Jersey Clean Energy Program 2003, 2004 and 2005 4th Quarter Quarterly Reports

Figure 5-3. Actual Program Gas Savings 2003-2005



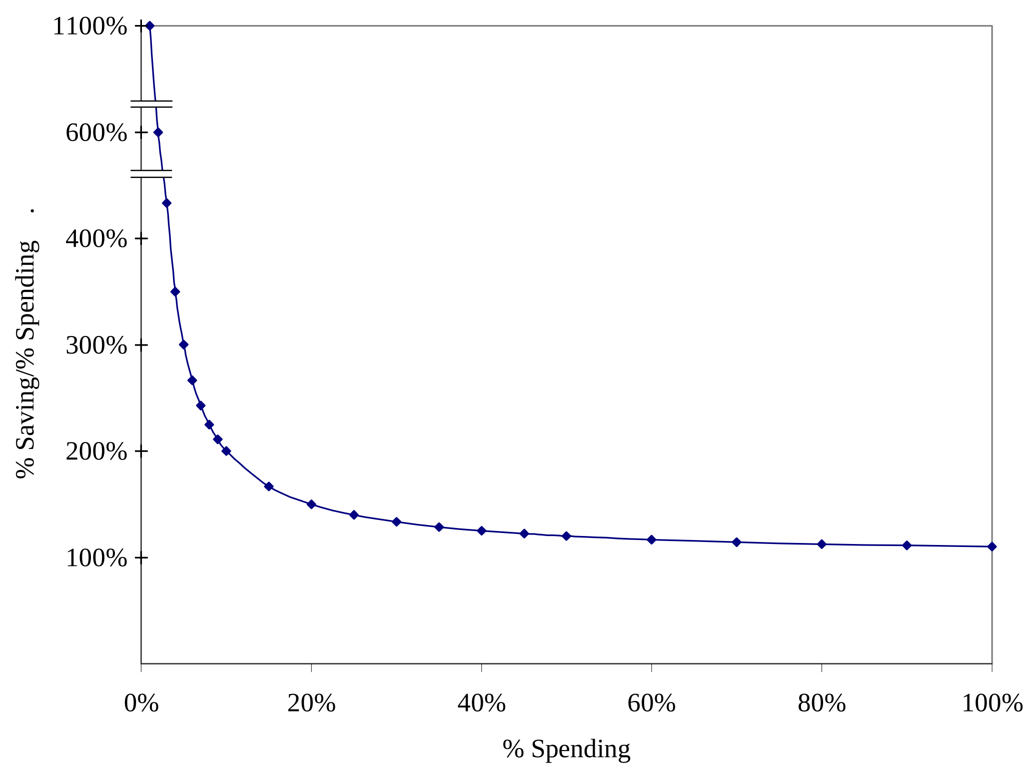
Source: New Jersey Clean Energy Program 2003, 2004 and 2005 4th Quarter Quarterly Reports

5.1.2 Assessment of Savings Target Methodology

Although the energy efficiency portfolio of programs was able to achieve the targeted electricity and gas savings goals in 2005 and the targeted electricity savings in 2004, the formula used to calculate the savings targets may not be the best method for setting these goals for a number of reasons.

First, we examined the relation of spending to the savings as defined by the current savings formula. Based on the savings formula a 40% increase in spending should result in a 50% increase in savings. This equates to an increase in savings of 125% relative to the increase in spending. This is an aggressive goal, but with the right mix of programs the portfolio could probably achieve an increase in savings of 50%. However, if the spending increased by 5% then the savings should increase by 15%. This equates to an increase in savings of 300% relative to the increase in spending. It will be much more difficult to increase the savings by this amount. As the spending increases become smaller the increase in savings relative to spending becomes exceedingly larger. An increase in spending of just 1% results in an increase in savings of 1,100% relative to the increase in spending. While a comparison of impacts relevant to increases in spending is provided here, it is important to note that an implied goal of the program is to increase the impacts of the existing programs. That is, even if spending is held constant, the goal would be to obtain 10% more savings from the programs. At the lower levels of spending increases, the increase savings goal will be extremely difficult to meet. Figure 5-4 shows the relationship of between increases in spending and the resulting increases in % savings relative to the increase in spending.

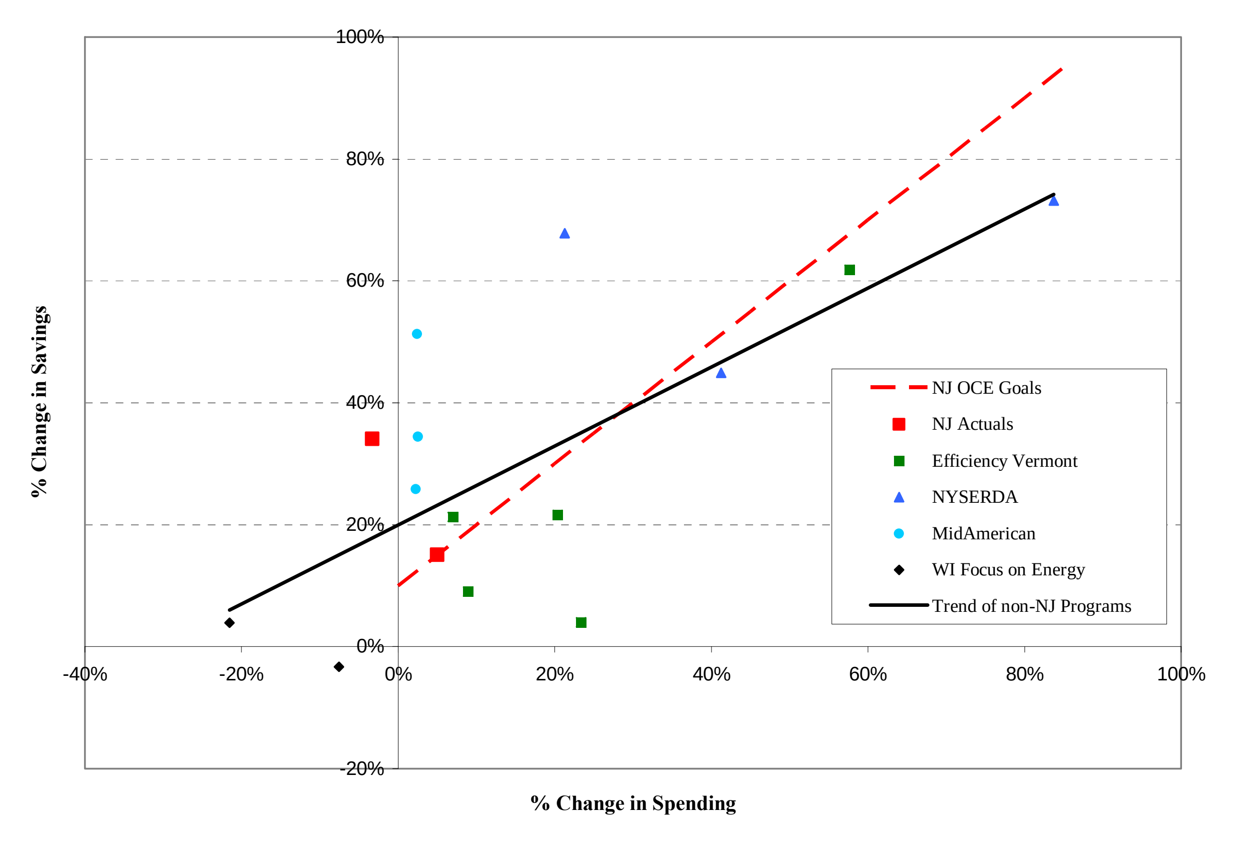
Figure 5-4. Comparison of % Spending versus % Savings for Current NJ Goal



Second we examined several of the leading energy efficiency programs in the country to assess whether the formula for determining saving targets is viable. The comparison programs included the portfolio of programs offered by Efficiency Vermont, NYSERDA, MidAmerican Energy and Wisconsin's Focus on Energy.[40] These energy efficiency programs were also selected to match the level of maturity and comprehensive nature of New Jersey's portfolio of programs. In markets where energy efficiency programs are just beginning, programs are able to achieve a much larger increase in savings relative to an increase in their spending than more mature programs. Also programs that focus more on larger projects can achieve an increase in savings relative to an increase in their spending easier than programs that focus on small projects, whereas long-running programs in markets with high efficiency saturation, the remaining savings may be more difficult to capture. Section 5.2 addresses this issue further. Figure 5-5 shows how the changes in spending for these programs impacted the actual portfolio level savings.

[40] Data used for the chart is from the 2003-2005 annual program reports and conversations with the program managers.

Figure 5-5. Change in Spending versus Change in Savings



Source: Data for this graph was collected from the various program annual reports and planning documents. Multiple data points for the same implementer indicate multiple years of data (2003-2005 data were examined). The *Trend of non-NJ Programs* represents the best fit line to the other utilities data. A linear representation was used to best compare to the linear aspect of the NJ saving goal.

The slope of the NJ formula is a one to one relationship with a 10% offset. This formula results in a comparable increase in savings no matter what the change in funding. In comparison, the other programs have experienced a lower correlation between the change in spending and the change in savings. For every X% increase in funding these programs have achieved, there has been an increase savings of often less than X%. As can be seen in Figure 5-5 the data for the other programs is scattered and the line on the chart does not fully capture the relationship between the change in spending and the change in savings at spending increases of less than 25%. Again depending upon the age of the program and the programs current market penetration a small change in spending may or may not have a dramatic impact on the savings achieved. It is also important to note that how the increase in spending is allocated will greatly impact the savings achieved. For example, if the increase in funding is directed towards the Commercial and Industrial Programs there will be a much larger impact on the savings than if the funding was directed towards the Low Income Program.

The programs included in Figure 5-5 have operated under a variety of constraints, and as such these programs are not trying to maximize savings for each dollar spent. Examples of the constraints that the programs operate under include:

- required spending on low income programs,
- focus on market transformation,
- requisite geographic diversity, and

- focus on new construction market

Finally, in researching this issue interviews were conducted with the managers of similar portfolios of energy efficiency programs throughout the country.[41] These program managers were asked, based on their experience, if they thought the current NJ formula for calculating savings goals was viable. All of the interviewed managers felt that the goal was too aggressive. Some cited that the goal may be achievable, but that other program goals (low income spending, market transformation), may be ignored in order to achieve the savings goal. The following quotes are from the interviewed portfolio managers when asked about the current NJ savings goal formula.

> *"On a larger scale, as the market penetration for certain measure classes or programs increase, it also tends to become more expensive and more difficult to attain additional penetration. In short, the suggested method can not be used unless fixed costs can be maintained fairly constant, and the market demand can absorb the additional funding."*

> *"This goal will run up against the theory of diminishing returns. As markets are transformed the last amounts of savings will cost the most to achieve."*

Given that NJ Clean Energy Programs are operating under similar constraints, the relationship between the changes in budget and changes in energy savings is expected to be more in the line with what the other programs have been experiencing. Although the goal is achievable it may mean moving funds from programs where savings are more expensive (e.g., programs promoting measures with already high market penetration, market transformation programs with front-loaded costs, or low income programs), to programs where the savings are less expensive (e.g., large C&I projects). However, moving funds to programs with less expensive savings potential may mean ignoring other portfolio priorities.

In summary, the evaluation team concludes that the portfolio goal that program impacts increase by the amount of any spending increases + 10% would places undue emphasis on cost of conserved energy as the measure of portfolio effectiveness and would compromise the ability to address other, broader measures of portfolio effectiveness. For example, it may shift money away from a more equitable distribution that benefits all sectors, segments, and regions. In addition, it will create incentives to move away from market transformation programs that require significant investment up-front, but yield longer term savings. While the current goal may be achievable in the short-term, this approach may hamper the long-term success of the programs.

The following section discusses the trade-offs that will have to be made to achieve the current portfolio savings goal.

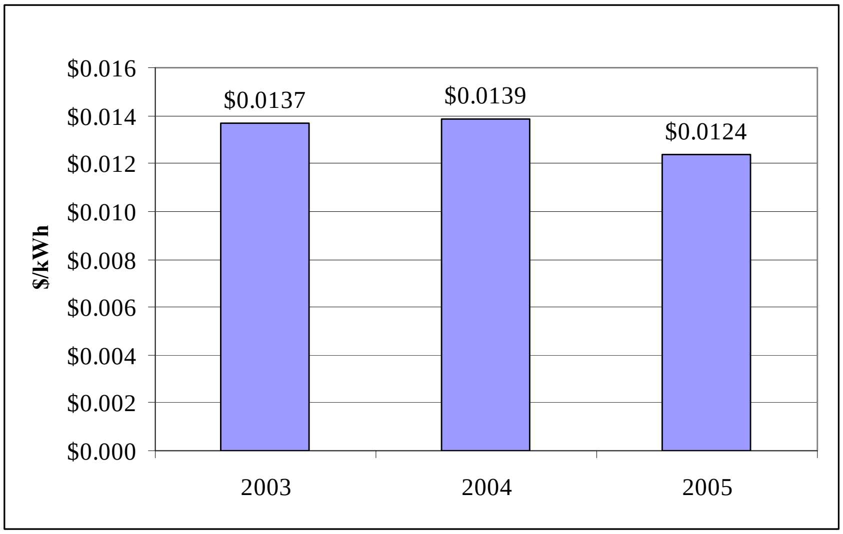
5.2 Portfolio Trade-off Analysis

There are many measures available to assess the effectiveness of an efficiency program portfolio. While the primary objective of a portfolio of energy efficiency programs is to achieve cost-effective energy and demand savings (often measured in terms of cost of conserved energy), they often seek to achieve other objectives, such as comprehensiveness and equitability. These goals, while not necessarily mutually exclusive, must be balanced in order to achieve an optimal program portfolio.

[41] Interviews were conducted with eight program administrators in New York, Massachusetts, Vermont, Texas, the Midwest (Wisconsin and Iowa) and the Pacific Northwest.

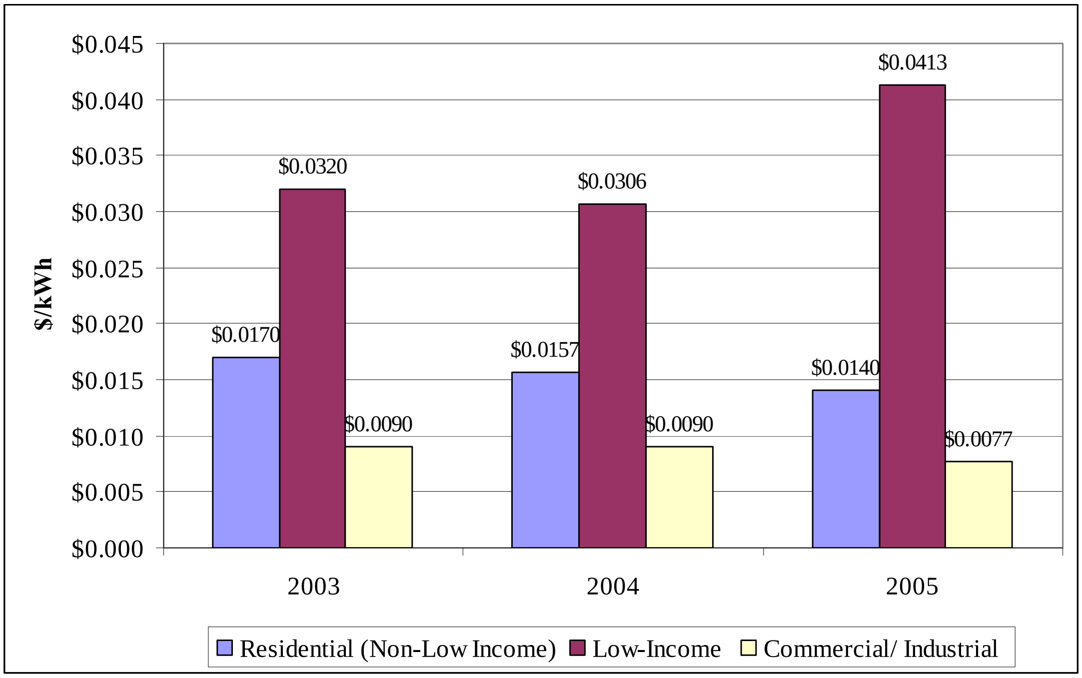
The simplest measure of portfolio effectiveness is the cost of conserved energy, which can be assessed either at the portfolio or program level. Figure 5-6 shows the cost of conserved energy (CCE) of the program portfolio from 2003 to 2005, whereas Figure 5-7 shows the CCE across key sectors – residential, commercial and industrial and low-income customers.

Figure 5-6. Cost of Conserved Energy – Total NJ Clean Energy Program Portfolio



Source: New Jersey Clean Energy Program 2003, 2004 and 2005 Annual Reports, annual expenditures divided by lifetime energy saved (converting DTh to kWh).

Figure 5-7. Cost of Conserved Energy – By Sector/Segment

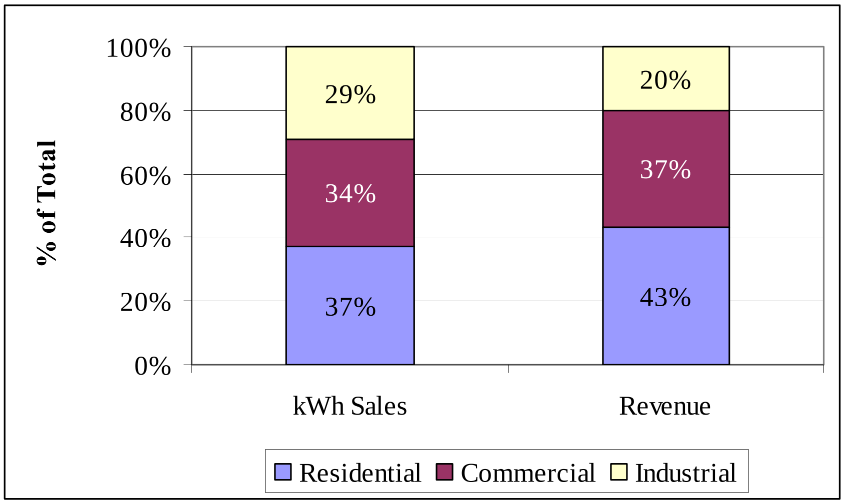


Source: New Jersey Clean Energy Program 2003, 2004 and 2005 Annual Reports, annual expenditures divided by lifetime energy saved (converting DTh to kWh).

Whereas the CCE is higher for residential programs and even more so for the low-income programs, these programs are critical components of the overall portfolio, as they provide an opportunity for all customers of New Jersey's utilities to participate in program initiatives. Costs for low-income programs are particularly high because of the need for the program to cover most, if not all, of the incremental measure costs to allow for participation.

Comprehensiveness can include an effort to provide broad coverage of customer segments, buyer types, end-uses and technologies. New Jersey's program best demonstrates the comprehensiveness and diversity of their program portfolio with its spending across sectors. Figure 5-9 shows the breakdown of electricity sales and revenue in New Jersey over 2003 and 2004.[42]

Figure 5-8. Electricity Sales and Revenue by Sector



Source: http://www.eia.doe.gov/cneaf/electricity/epa/revenue_state.xls; http://www.eia.doe.gov/cneaf/electricity/epa/sales_state.xls

Figure 5-9 shows the spending across the key sectors – residential, commercial and industrial and low-income customers. Since 2003, New Jersey has allocated between 32% and 37% of program budget to commercial and industrial initiatives, between 15% and 19% to programs to serve low-income consumers, and the balance to residential customers.[43] New Jersey's commitment to low-income programs is especially notable when viewed this way.

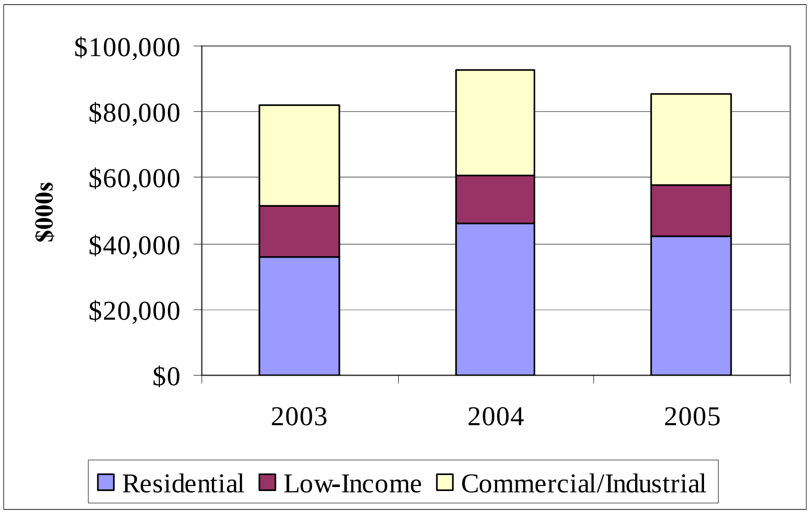
Because of the difference in CCE for the different sectors, however, the distribution of impacts differs slightly from the distribution of expenses. For example, the significantly lower CCE of the commercial and industrial programs, those programs yield greater impacts (72% of the total impact in 2005) with the

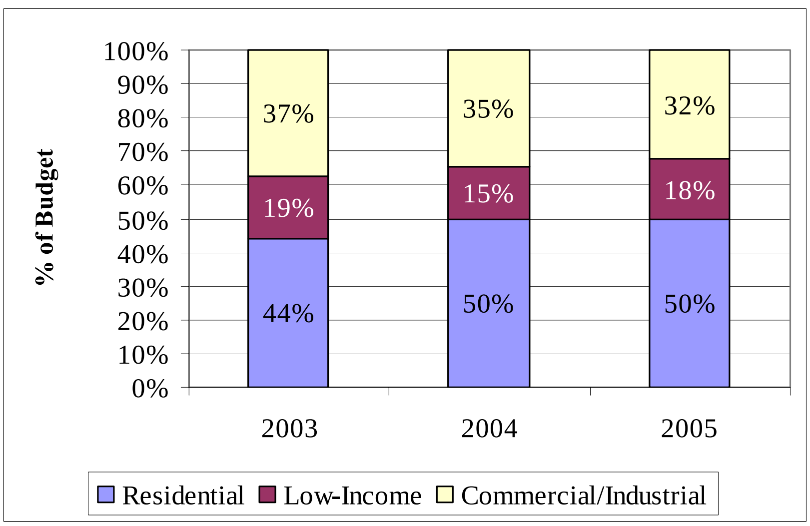
[42] 2004 was the latest data available. Review of historical data (prior to 2003) indicated that the relationship of sales and revenue across sectors was static.

[43] This is one of the more aggressive commitments to funding of programs targeted to low-income energy consumers. California allocates approximately 9% of its overall efficiency budget to low-income programs (http://www.calseia.org/CECPGC3web.html), Vermont has a mandate that 15% go to low-income programs, and New York (NYSERDA) spends approximately 15% of program area budgets for low-income programs.

slightly lower investment (32% of budget in 2005) (Figure 5-9 and Figure 5-10). Low income programs, on the other hand, accounted for 18% of expenditures in 2005 yet only 3% of savings. Similarly, residential programs accounted for 50% of expenditures in 2005 yet only accounted for 25% of savings.

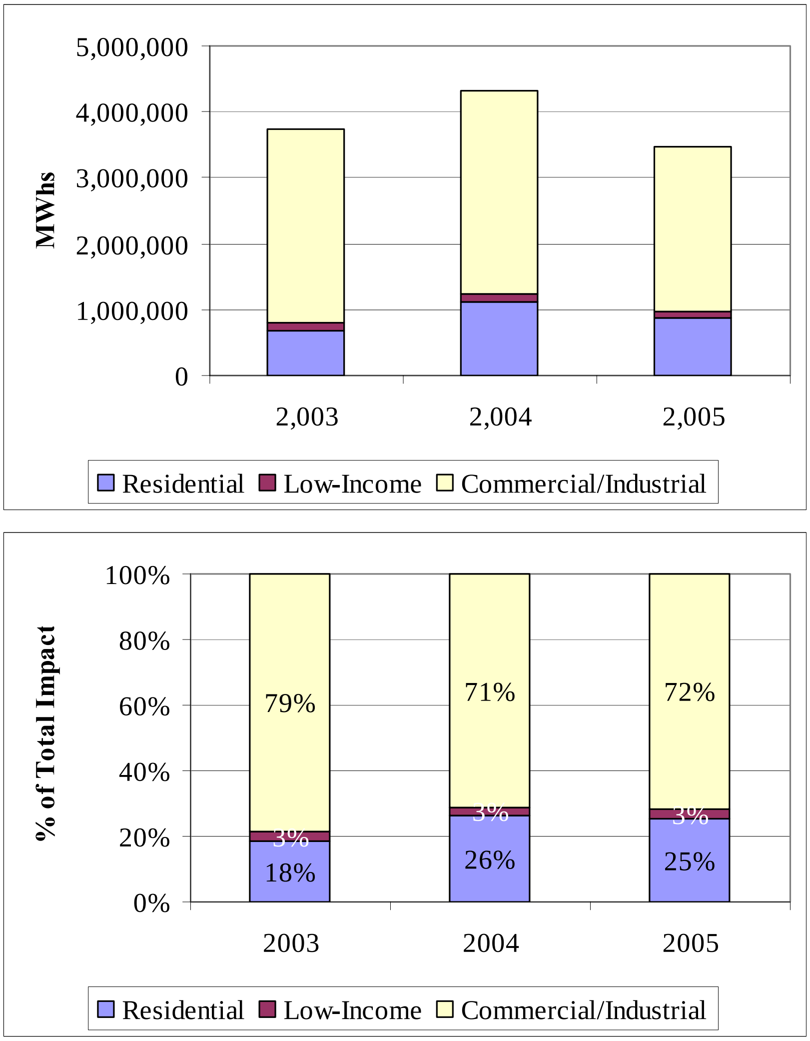
Figure 5-9. Program Expenditures – By Sector/Segment





Source: New Jersey Clean Energy Program 2003, 2004 and 2005 Annual Reports

Figure 5-10. Program Savings – By Sector/Segment



Source: New Jersey Clean Energy Program 2003, 2004 and 2005 Annual Reports (total energy savings determined by converting DTh to kWh).

Based on the relationship of cost of conserved energy between the residential and commercial/industrial programs, relatively more investment is required compared to the percent of sales or revenue that each sector represents for the residential sector than for the commercial sector. While the CCE is as much as 80% higher for residential programs, it still represents a very cost-effective investment in energy efficiency. While residential customers (which would include low-income customers) represent about 43% of the revenue in the state, they have accounted for about 50% of the NJCEP spending.

Based on this review of the New Jersey Clean Energy Program and other program portfolios, the historical and current allocation of funding across sectors and segments accounts for all sectors and segments. The precise allocation, however, should be reviewed each year in the planning cycle and revised as necessary to meet other portfolio and stakeholder objectives.

Other measures or considerations in assessing the overall program portfolio effectiveness include:

- Clarity of goals and objectives – that is, how well the objectives of each program, and the portfolio as a whole, are articulated

- Risk mitigation – are efforts made to manage risk though a broad range of programs and approaches and address various uncertainties in the planning process through careful implementation and evaluation

- Leveraging – are there opportunities to coordinate with other regional or national efforts to support success of the local programs

- Innovation – is there effort to employ new programmatic strategies or to promote emerging technologies

- Coordination – is there a plan or mechanism to help implementers of each program work together to ensure success of individual programs and the portfolio as a whole – including mechanisms to make adaptive management decisions and shift resources as needed

- Alignment with identified efficiency potential – do the programs attempt to capture the cost-effective energy efficiency potential

While many of these objectives have not been explicitly identified, the New Jersey Clean Energy Programs do serve to fulfill them. In particular, for the CEP energy efficiency programs:

- The Office of Clean Energy, in coordination with the utilities and the Clean Energy Council, issues an annual program plan that details program budgets, implementation strategies, and where they exist, program goals.

- The energy efficiency programs cover a broad range of customers and technologies and utilize conservative assumptions for assessing program impacts both at the technology level and the credit taken for market impacts (e.g., influencing market share of ENERGY STAR appliances such as refrigerators and clothes washers).[44]

- The programs are highly leveraged, and take advantage of national and regional ENERGY STAR efforts. The New Jersey program utilize program standards and requirements consistent with ENERGY STAR program qualifications (e.g. New Homes), coordinate with regional and national campaigns (e.g. Change-A-Light), and include participation of retailers and manufacturers participating at both the state and national levels.

- Coordination between the utilities, the BPU Office of Clean Energy, and the Clean Energy Council seems to effectively drive program implementation. Coordination amongst program implementers allows for mid-year shifting of resources as required.

Another consideration in determining the reasonableness and achievability of this portfolio savings goal is the program life cycle, particularly the life-cycle of market transformation initiatives. All programs have a natural life-cycle as shown in Figure 5-11.[45]

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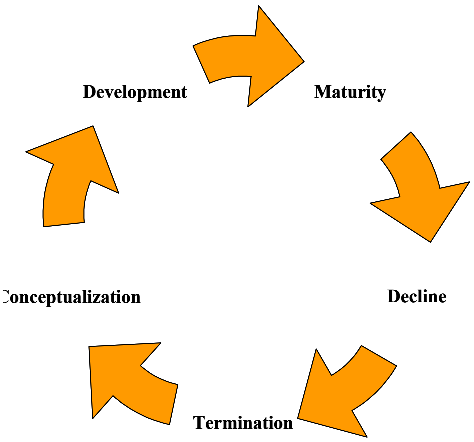
[44] Currently, no credit is taken for such program impacts.

[45] Bowling, Chester. Using Program Life Cycle Can Increase Your Return on Time Invested. Journal of Extension, June 2001 Volume 39 Number 3.

Figure 5-11. Program Life Cycle



As a program moves from development to maturity, there may be opportunities to get significantly greater increases in impacts than the increases made to spending.

In the conceptualization and development stages, significant effort may be required to “get the programs going.” This effort may seem to yield little benefit (in this case, savings impacts). This development stage is especially critical for market transformation programs where a strong market-based infrastructure is required for long term program success. Resource acquisition programs that focus on short-term increases in measure installations (usually via rebates or incentives rather than market structure changes) may not have such steep start-up costs.

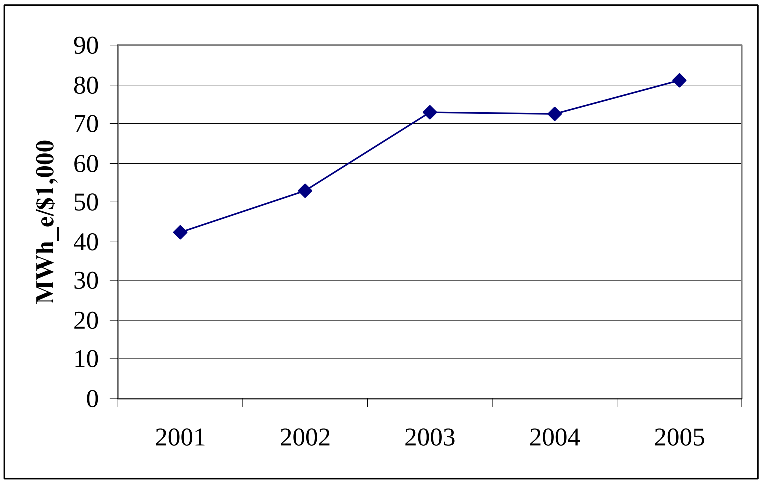
As programs move into and through the maturity stage, they are typically operating at peak efficiently. While some of the suggested recommendations of the program evaluations are likely to yield greater savings return on investment, these improvements are incremental and not exponential. Programs pass maturity and enter into decline when market penetration for targeted measures reaches a high enough point that the incremental cost for savings increases greatly (i.e., the market has already been transformed).

The proposed savings goal must consider where each program is in its lifecycle to determine the appropriateness and achievability of the proposed goal adjustment, and particularly the capacity of the infrastructure to absorb additional activity. As one of the program administrators indicated:

> *“This would imply that more savings on the margin are cheaper when that is often not the case. The easy stuff is always cheap, but the theory in the EE business is as funding increases, and the subsequent kWh goals increase, it can become more and more expensive as the kWh are harder to obtain, or the market sectors are harder to reach. In other words, if a given program can absorb more volume without having to invest in more capacity, kWh's should become cheaper, but if programs are running at capacity and require additional capacity building, the kWh will not necessarily come cheaper.*

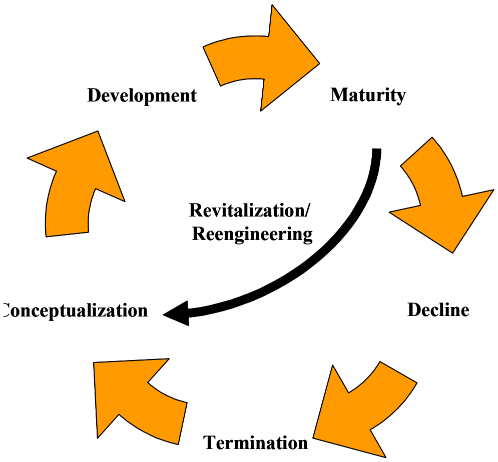
While individual programs are introduced each year that are in the development stage, the programs that account for most of the savings impacts are in a state of maturity. This is best evidenced by the leveling off of impacts per dollar spent. Figure 5-13 shows the lifetime MWh_e, the lifetime energy savings including the natural gas savings converted to MWh equivalent, from each thousand dollar program investment from 2001 through 2005. While program impacts dollar invested grew significantly from 2001 to 2002 and 2002 to 2003, growth has leveled off.

Figure 5-12. Program Impacts per $1,000 Spent



As New Jersey continues to offer these programs, they will need to periodically assess program performance and market needs, and where appropriate, reengineer programs to maintain relevance and effectiveness, to meet increasing savings goals and to prevent program decline (Figure 5-13).

Figure 5-13. Program Life Cycle for Long-Term Program Success



5.2.1 Modern Portfolio Theory

So far the Evaluation team has considered the standard industry approaches for assessing how well NJ has constructed the portfolio of programs. In this next section the evaluation team presents an unique approach and attempts to apply the Modern Portfolio Theory used to create efficient stock portfolios to the programs in the NJCEP. The goal of this discussion is to provide another point of reference for determining if the current mix of NJCEP programs is optimal. The analysis is a first order approximation at determining the most efficient mix of programs for NJ. Further research and more detailed savings estimates may provide a different allocation of spending than the one presented here.

Modern Portfolio Theory, unlike traditional asset management, which focuses on predicting individual stock price movements using fundamental or technical analysis, looks at the performance of a portfolio of assets based on the combination of its components' risk and return.[46]

As discussed previously, one of the fundamentals of a successful portfolio, be it stocks or energy efficiency programs, is diversification. Diversification helps spread risk between countries, currencies and markets. It provides investors with a means of hedging investments against geo-political events (such as war or oil shortages) and unexpected market events (stock market crashes or natural disasters). Diversification reduces risk. Modern portfolio analysis has shown that even a random mix of investments is less risky than putting all your money in a single stock. In other words for the same amount of risk, diversification can increase returns.

The financial economics and probability and statistical theory that support the modern portfolio theory are complex and beyond the scope of this discussion. To understand how diversification reduces the risk of a portfolio, consider a portfolio that contains two risky energy efficiency programs: one that saves energy during a cold winter and another that saves energy if the winter is particularly mild. Adding one risky program to another can reduce the overall risk of the portfolio. The crucial insight of modern portfolio theory is that the risk of an individual asset is of little importance to the investor; what matters is its contribution to the portfolio's risk as a whole.

Like stock portfolios, energy efficiency program portfolios are trying to provide as much return for the investment with as little risk as possible. For energy efficiency programs the return they are providing is actual energy savings and the risk is the uncertainty that these savings will be achieved.

Using the modern portfolio theory investors are able to create an "efficient portfolio". An efficient portfolio is one which has the smallest attainable portfolio risk for a given level of expected return (or the largest expected return for a given level of risk). The curve in Figure 5-14 shows the relationship between risk and return for an optimized portfolio. If the portfolio lies below the curve then they are not efficient; the same return could be achieved with lower risk. The goal is to design a stock portfolio or a energy efficiency program portfolio that optimizes the return (or overall savings) and minimizes the risk (uncertainty that the savings will be achieved).

To add to the complexity of the portfolio, most stocks, and arguably energy efficiency programs, are correlated to some extent. The correlation between two stocks indicates how closely they move together. A positive correlation means that the stock values move in the same direction. A negative correlation means that the stock values move in the opposite direction. As with stocks, two energy efficiency programs can be correlated. For example you would expect a strong correlation between energy efficiency programs in the same sector.

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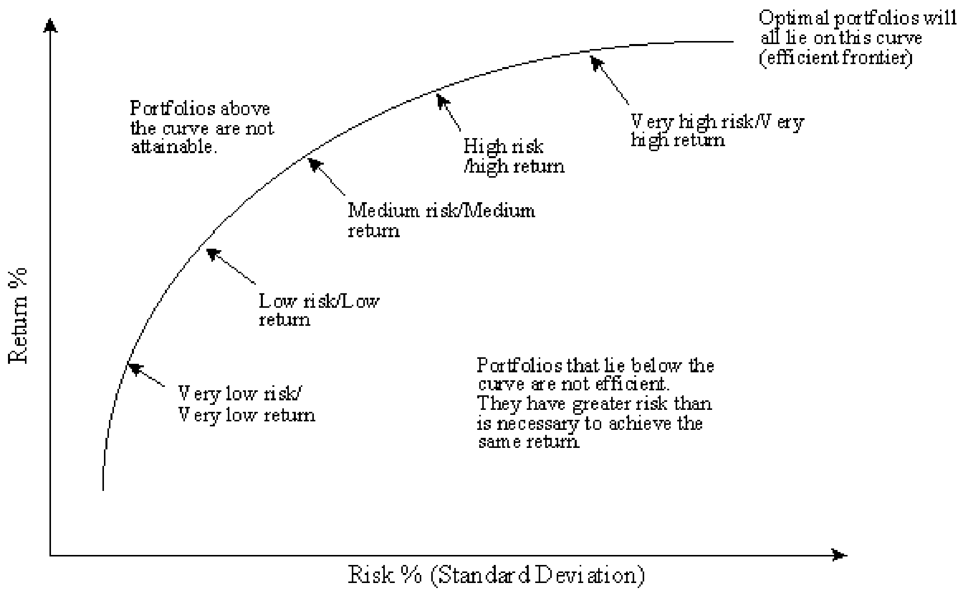
[46] Modern portfolio theory was developed by Harry Markowitz in 1952.

Figure 5-14. Optimal Portfolios



5.2.2 Calculation of Efficient NJCEP Portfolio

The modern portfolio theory was applied to the NJCEP Portfolio to determine if the current portfolio is efficient, in terms of maximizing the return (Savings/Spending) while minimizing the risk (uncertainty). First, the annual return for each program was calculated for 2001- 2005. The annual return was defined as the lifetime savings achieved per actual spending during that program year. The lifetime energy savings included the natural gas savings converted to MWh equivalent (MWh_e).

Table 5-3. Lifetime Savings per Actual Annual Program Expenditures

	Lifetime Savings per Expenditures (Lifetime MWh_e/$000s)				
Program	**2001**	**2002**	**2003**	**2004**	**2005**
Commercial/Industrial Construction	52.22	60.41	110.86	111.33	132.21
ENERGY STAR Products	86.60	-	59.21	95.15	90.07
NJ ENERGY STAR Homes	0.28	50.75	58.44	53.73	65.64
Residential HVAC	55.01	58.50	59.27	60.72	72.87
Residential Low Income	66.22	38.75	31.30	32.69	24.19
Total Lifetime Savings per Expenditures	**42.53**	**52.92**	**72.79**	**72.48**	**80.92**

By examining the savings performance for each of the programs over this five year period, the average performance and variance in the performance of each of the programs was calculated. The programs have been evolving over the past five years and the current programs are much different than the programs were in 2001. To account for this change in the programs, weightings or probabilities were assigned to each year to indicate the likeliness that that year's performance would be representative of the program's performance in 2006. Table 5-4 shows the assigned probabilities for each program and each year. This table also shows the expected return (or weighted average of the performance) and the uncertainty (standard deviation) for each of the programs.

In addition the data in Table 5-4 was used to calculate the correlation and the co-variance between the programs in this portfolio. The relationship of the performance of the programs relative to each other is an important aspect in developing an efficient portfolio.

Table 5-4. Lifetimes Savings per Expenditures – Expected Values and Uncertainty (Lifetime MWh_e/$000s)

Year	Probability of Predicting 2006 Performance[47]	C&I	ES Products	NJESH	Res. HVAC	Res. LI
2001	**5%**	52.22	86.60	0.28	55.01	66.22
2002	**5%**	60.41	-	50.75	58.50	38.75
2003	**20%**	110.86	59.21	58.44	59.27	31.30
2004	**25%**	111.33	95.15	53.73	60.72	32.69
2005	**45%**	132.21	90.07	65.64	72.87	24.19
Expected Return		115.13	80.49	57.21	65.50	30.57
Uncertainty (Std Dev)		35.06	39.54	26.04	6.82	16.27

Table 5-5 presents the annual program spending from 2001 through 2005. The 2005 percent spending by program was used as to calculate the expected return and the risk associated with the current portfolio.

Table 5-5. Actual Annual Program Expenditures ($000s)

Program	**2001**	**2002**	**2003**	**2004**	**2005**	**2005** Distribution
C&I Other	$155	$569	$294	$2,557	$3,074	n/a
Commercial/Industrial Construction	$12,346	$38,271	$30,555	$29,661	$24,437	30%
ENERGY STAR Products	$2,493	$2,803	$6,305	$8,449	$5,973	7%
NJ ENERGY STAR Homes	$15,758	$10,945	$15,365	$21,736	$23,261	28%
Residential HVAC	$15,823	$18,490	$14,444	$15,564	$13,117	16%
Residential Low Income	$10,354	$13,268	$15,435	$14,266	$15,467	19%
Total Annual Expenditures	**$56,929**	**$84,346**	**$82,398**	**$92,233**	**$85,329**	**100%**

Optimization algorithms were used to determine the most efficient distribution of spending among the programs at different levels of risk and return. Table 5-6 shows the comparison of the several portfolios examined. As Figure 5-15 shows, although the current mix of program spending is below the efficient frontier it is quite close to the frontier. The spending allocation of the current portfolio could be adjusted to provide the same return with less risk. By reallocating program spending to 49% C&I and 51% Residential and Low Income the risk can be reduced from 103 to 48, or 53%. Likewise, if the current risk level is acceptable the return can be increased from 72.42 to 81.81 MWh_e/$1,000, or 13%, by reallocating the spending 61% to C&I and 39% to Residential Low Income.

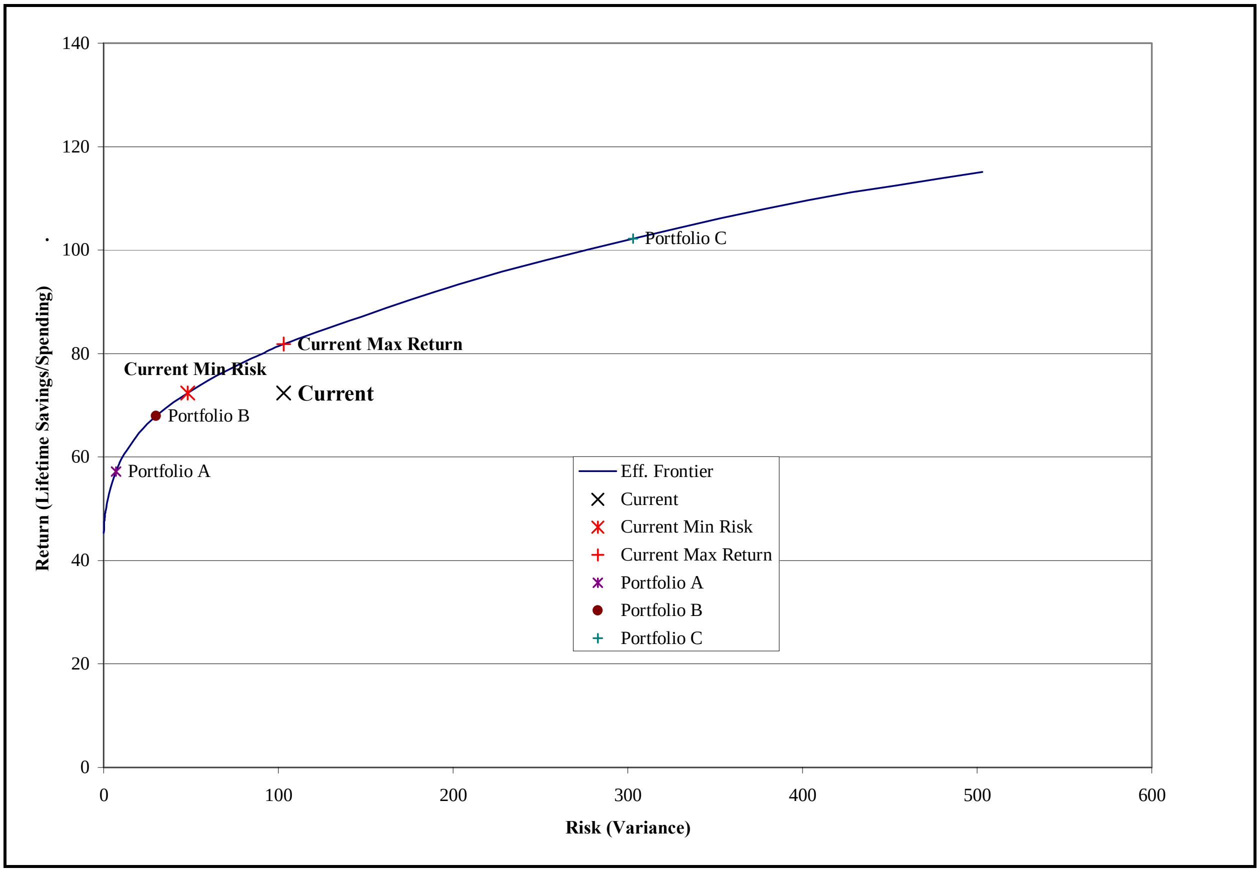
[47] More recent years are likely to better predict the performance in the current year than earlier years would.

Table 5-6. Comparison of Portfolios

Portfolio	Risk (Uncertainty)	Return	% of Portfolio Spending				
			C&I	ES Products	NJESH	Res. HVAC	Res. LI
Current	103.03	72.42	30%	7%	28%	16%	19%
Current - Min Risk	48.05	72.42	49%	0%	0%	0%	51%
Current - Max Return	103.03	81.811	61%	0%	0%	0%	39%
Portfolio A	7.05	57.183	24%	0%	4%	15%	57%
Portfolio B	30.05	67.945	44%	0%	0%	0%	56%
Portfolio C	303.03	102.231	85%	0%	0%	0%	15%

Figure 5-15 shows how the current portfolio relates to the efficient frontier portfolios. This figure also shows the relative risk and return of each of the six portfolios analyzed above.

Figure 5-15 New Jersey Clean Energy Programs Efficient Portfolio



A similar analysis can be done for programs not currently in the portfolio if historical data is available. For example if NJ was to consider adding a new industrial program; performance data (savings per spending) of a similar program in a different state could be used to determine the risk and return of that program. This data would be added to the previous analysis and the optimal portfolio could be recalculated.

Per the previous discussion, optimizing the savings per dollar spent is not the only goal of the NJCEP. This portfolio also has the goal of transforming the markets, which often has a very low savings per actual spending, because the savings often happen in the future. In order to capture these impacts a more detailed analysis would have to be performed that captures the savings from market transformation programs.

This analysis also doesn't take into account other portfolio constraints, such as minimum spending on low income programs (although this does not seem to be an issue with the efficient portfolios), minimum spending splits between residential and non-residential programs, and geographical equity.

This analysis is a first-order approximation of how to optimize the NJCEP energy efficiency portfolio. The analysis does not adequately take into account the lifetime effects of market transformation programs, many of which are residential programs. The actual lifetime savings for market transformation programs would include not only the savings achieved from the measures in the year the program funds were spent, but also the savings achieved from the measures installed in subsequent years due influence of the program. Quantifying the impact savings of these market transformation programs is outside the scope of this project. However, it is expected that if these market transformation savings were included, the return for the residential programs would increase and the optimized portfolio would have a higher share of residential program spending than was calculated here.

5.3 Recommended Portfolio Savings Goal

As discussed above, the goal established for the New Jersey programs related to spending increases is extremely aggressive when modest increases in program budgets occur, and less so as budget increases grow. In addition, although the savings goal might be achievable, it may compromise other program goals such as equitable spending by sector or region. The evaluation team recommends the following alternatives approaches to establishing goals in light of spending changes.

1. **Have goals increase commensurate with spending increases**: This would be the simplest and most conservative approach to establishing new goals. For example, a 10% increase in actual spending should result in a minimum 10% increase in savings.

2. **Determine a fixed multiplier:** When increasing spending by X%, goals would be increased by X * (1+Y%) where Y is the percent increase in goals over and above the increase in spending. For example, a 10% increase in spending should result in a minimum 11% of savings (i.e., 10% * 110%).

3. **Employ a ratcheted multiplier:** Similar to option two, this factor may be relatively small for moderate increases in spending, up to 50%, and then get larger as bigger spending increases allow the realization of greater economies of scale. See Table 5-7 below for an example of ratcheted multipliers.

Table 5-7. Example of Savings Goals with Ratcheted Multipliers

Spending Increase	Multiplier for Spending Increase Range	Effective Savings Goal Increase
1-19%	1.1	1.1-20.9%
20-49%	1.2	24-58.8%
50 and above	1.3	65% +

Of these mechanisms, the evaluation team recommends adoption of a fixed multiplier. This would be relatively easy to administer and would challenge program administrators to continuously improve the return on program investments, but not at the expense of other program portfolio objectives. A proposed multiplier of 1.2 would provide the proper balance between an aggressive, yet not unreasonable, goal by producing higher savings goals at higher spending increases (over 50%) than the current spending increase +10% approach, but not creating unduly high savings goals for lower spending increases.

In addition to adoption of a modified savings goal, the evaluation team would recommend – to maintain an equitable distribution of program funding and ensure that the programs continue to capture savings potential across all sectors – that a minimum level of spending on residential programs, with a specific level for low-income spending, be established. Recommended minimum spending levels would be 50% [48] for residential programs (excluding low-income) and 15% for low-income programs.

5.4 Recommended Portfolio Changes

5.4.1 Specific Program Changes

Books I and II contain the market assessments for each of the five programs included in this evaluation. The finding and recommendations were summarized in the Executive Summary and the detailed findings and recommendations can be found in the program sections. Some of these recommendations will impact the overall portfolio savings. If these recommendations are implemented, then there will have to be adjustments to the overall portfolio to compensate for any decrease in program savings by shifting funds between programs or increasing savings in other programs. The following are the key recommendations that will impact the overall portfolio savings:

- Due to the increase in the minimum Federal Standard for air conditioning efficiency and the resulting change in the residential HVAC incentive structure, 13 SEER central air conditioners and heat pumps will no longer be rebated. These units made up about 25% of the cooling equipment rebates in the 2005 Residential HVAC program. The portfolio will need to find additional savings to make up for the loss of these units. Eventually the market will shift towards the higher efficiency units and the savings will return to the 2005 levels. However, that transition will take a couple of years. In addition, the shift in the baseline will reduce savings for units rated SEER 14 and higher.

- Increase spending on marketing in the Residential HVAC Program from 1.3% of 2005 expenditures in 2005 to 3% of expenditures in 2006. This will be mostly for materials to help contractors sell the program. This increase in marketing should not greatly impact the cost of conserved energy for this program.

- In the NJ ENERGY STAR Homes Program, reduce builder equipment incentive levels and shift funds to direct and cooperative marketing. We recommend reducing the core rebates by 20% for the 2007 program, and reducing a number of rebates for HVAC equipment as well. Rebates for new technologies should be retained. Shifting of the funds from incentives to marketing if done in the proposed manner will increase the program savings by attracting new builders, and could actually reduce program spending. The reduction in incentive levels will most likely not be enough to drive builders from the program.

- Develop a high profile marketing plan for the NJ ENERGY STAR Homes program directed at consumers to increase program visibility and consumer awareness. Greater consumer awareness and

[48] Consistent with current expenditures for residential programs.

knowledge of the benefits of ENERGY STAR should increase demand, and raise the value of labeled homes, reducing the need for builder incentives. This will be especially important once incentives ramp down and phase out. For the market to fully transform, consumers must be asking for the product. This should help to improve the cost of conserved energy for this program.

- In the NJ ENERGY STAR Homes program, allow inspection and verification sampling where applicable. EPA requires 100% inspection and verification of homes to meet Energy Star standards. However, in subdivisions with production builders, sampling is allowed when the same model or set of models is built within the subdivision. We recommend sampling where applicable to reduce program cost and ease the number of inspections in production developments. This should help to improve the cost of conserved energy for this program.

- Allow any RESNET-certified HERS rater to provide ratings for the NJ ENERGY STAR Homes Program. Shifting to independent HERS raters has the added advantage of reducing the Program administrative fees and improving the cost of conserved energy.

- Significantly expand the cooperative advertising program for the NJ ENERGY STAR Products Program. Cooperative advertising can greatly leverage funds, reinforce the commitment on the part of participating retailers and manufacturers, and overcome barriers such as awareness and perceived value. This could increase savings by encouraging the marketing – and increased sales – of products with and without incentives. Following an increased marketing initiative it is also important to estimate savings from additional measures, such as refrigerators and clothes washers, that are not currently being included in program savings estimates.

- Shift resources from the Commercial and Industrial retrofit market to the new construction market. The annual savings impact per project may improve as the new construction projects are more comprehensive. The lifetime savings per project will increase as new construction measures typically have long lifetimes than retrofit projects. The increase in the lifetime savings per project will reduce the cost of conserved energy.

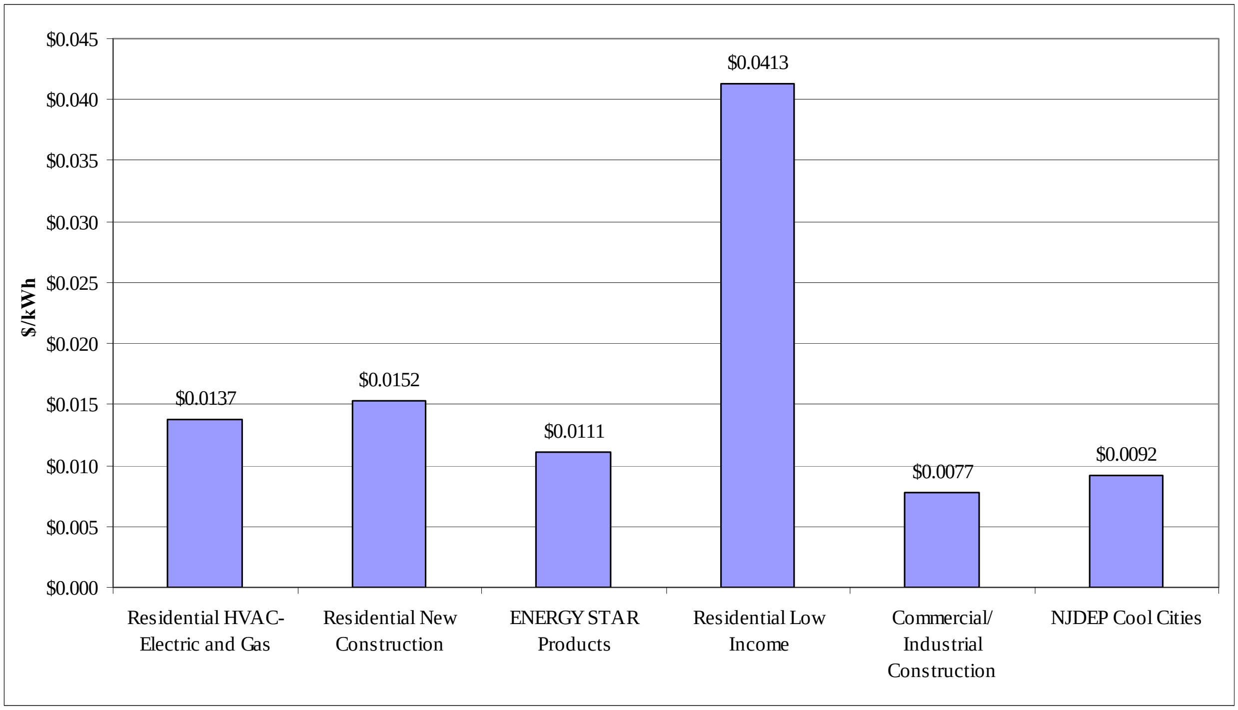
- It is also recommended that within the Commercial and Industrial Program to shift incentive dollars away from lighting and motors measures to other measures with lower market shares. Lighting and motor measures have a relatively high savings per dollar spent. The other measures have lower savings per dollar spent so shifting funds to these measures will increase the cost of conserved energy.

- There are no recommended changes in the CHP Program that will significantly impact the overall portfolio.

5.4.2 Portfolio Level Changes

The evaluation team also examined the allocation of program spending across the entire portfolio of programs to assess what changes, if any, should be made. As shown in Figure 5-16 and discussed above, the cost of conserved energy is highest for the low-income program and lowest for the C&I construction. If simply reducing the levelized cost of conserved energy were the only goal, the obvious action would be to shift funds from programs with the highest cost of conserved energy to those with the lowest.

Figure 5-16. Cost of Conserved Energy by Program - 2005



Source: New Jersey Clean Energy Program 2003, 2004 and 2005 Annual Reports, annual expenditures divided by energy saved (total energy savings determined by converting DTh to kWh).

However, to investigate the overall effectiveness of Program spending, the evaluation team compared actual energy savings to potential energy savings. In 2004, KEMA conducted a New Jersey Energy Efficiency and Distributed Generation Market Assessment and identified economic electric and natural gas efficiency potential for the residential, commercial and industrial sectors. Figure 5-17 compares the efficiency potential identified and the savings achieved across sectors, and demonstrates generally good alignment between potential savings and actual impacts. For example, the potential study estimated that 40% of all electric savings came from the residential sector, and the residential sector has represented 30% of the actual savings.[49] For gas savings the efficiency potential and actual savings by sector match exactly (23% C&I and 77% residential).

The savings achieved to date as a percent of economic efficiency potential is shown in Table 5-8. In only two years the programs have achieved 4.1% of the electric residential economic potential and 6.5% of the electric C&I economic potential. Realization of the gas savings potential, however, lags, with only 0.8% of economic potential achieved in both the residential and C&I sectors.

[49] The study did not provide more detailed information achievable savings by sector or end-use, economic potential is used as the basis of comparison. Note the study also estimated 2004 as the baseline year, with savings through 2020, so the comparison with actual savings uses 2004 and 2005 program years only.

Figure 5-17. Efficiency Potential and Savings Achieved by Fuel and by Sector

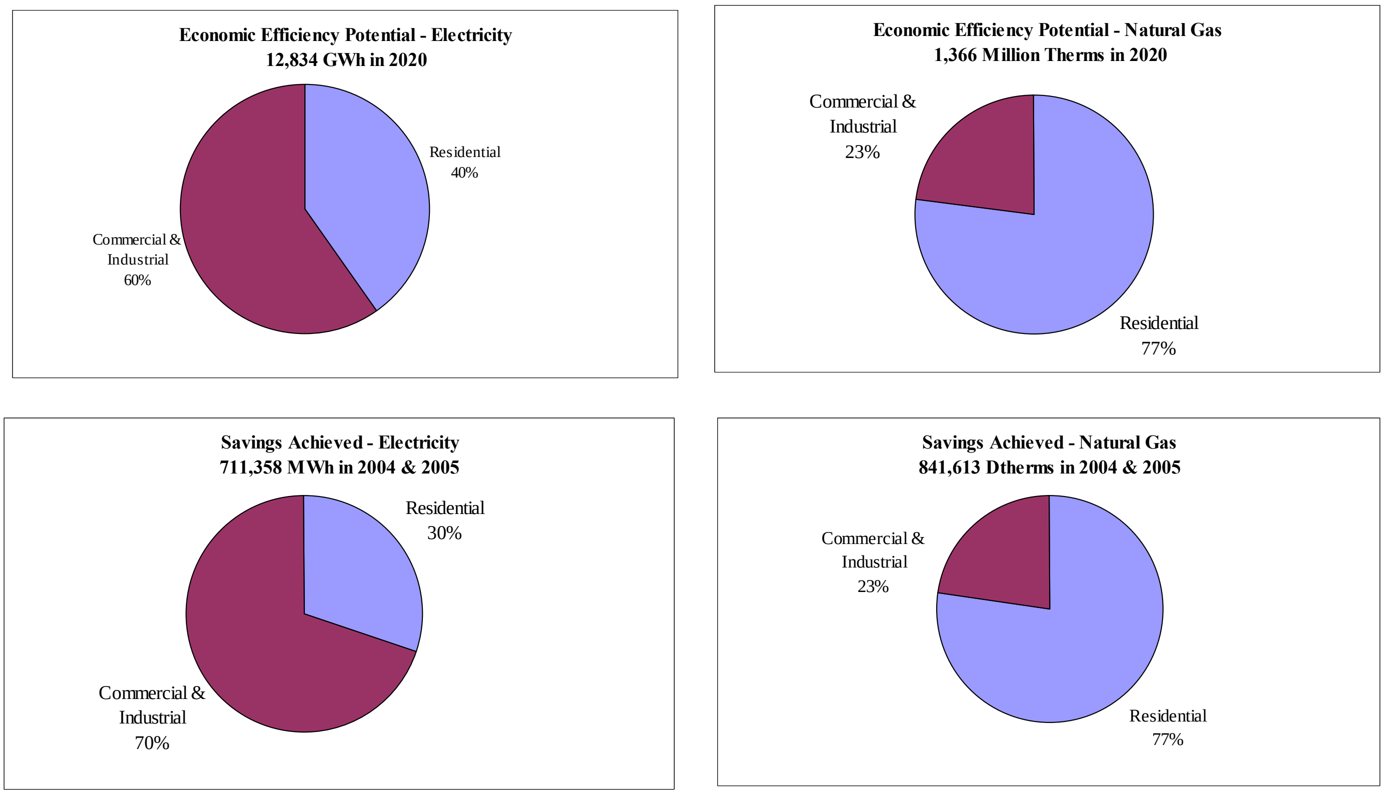
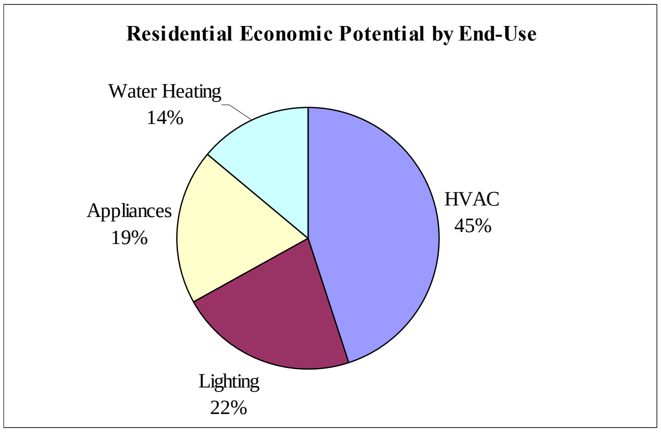


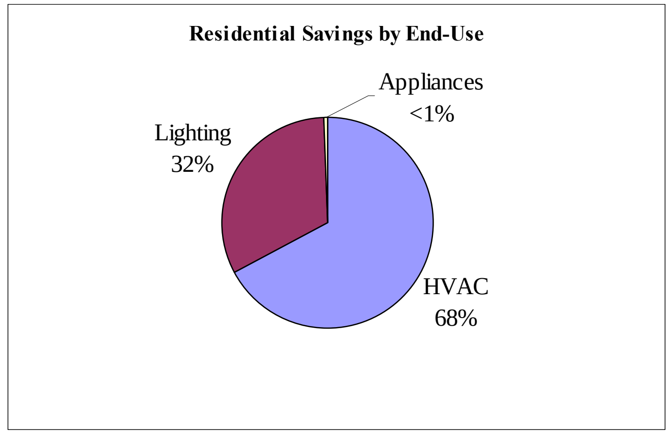
Table 5-8. Economic Efficiency Potential and Savings Achieved by Fuel and by Sector

	Residential	Commercial and Industrial
Electricity	4.1%	6.5%
Natural Gas	0.8%	0.8%

In terms of economic potential by end-use, the 2004 study estimated that there were potential savings from HVAC (45%), lighting (22%), appliances (19%), and water heating (14%) (Figure 5-18) in the residential sector. The programs, however, have primarily achieved actual savings through HVAC (68%) and lighting (32%) measures.

Figure 5-18. Efficiency Potential and Savings Achieved by Fuel and by Sector





Based on the alignment of achieved savings with the recognized potential, spending on the residential sector may be slightly low. These results indicate that the current mix of spending by program is effective and benefits a broad group of ratepayers, but could improve with a small reallocation of funding from the commercial/industrial sector to the residential. Reallocations should be made gradually to ensure minimal infrastructure disruption, with a 5% shift in allocation recommended (increasing the percent of total budget allocated to residential programs to 555 of the total.

In addition to the program specific recommendations presented above, the NJ CEP should consider these additional factors that may impact overall portfolio level cost-effectiveness:

- ***The NJ CEP should consider examining net-to-gross ratios***. Net-to-gross ratios can be conducted from an engineering perspective, examining operating assumptions and equipment performance, or a market effects perspective, examining freeridership and spillover. Because the NJCEP programs are designed to "move the market,"[50] they are likely to generate impacts beyond what is measured directly through program activity. These adjustments can have substantial impacts on program savings. For example, NYSERDA has found that a comprehensive engineering assessment can reduce electricity savings for some programs by as much as 15% and increase savings for other programs by as much as 100%.[51] In addition, the market effects studies for NYSERDA have found net-to-gross ratios that range from 0.70 to 1.22.[52] Clearly, incorporating net-to-gross factors, particularly based on market effects, can have a substantial impact on estimated energy savings and the achievement of program goals.

- ***Annually revisit the mix of programs and consider removing or adding to the program "mix."*** The interviews conducted with program administrators from around the country revealed that program selection is a collaborative process, involving multiple stakeholders. The NJ CEP should continue its current process which includes a committee that meets annually to review the program "mix" and see if certain programs should be removed or added. This can be facilitated

[50] Energy savings from changes in market share were measured in the evaluation of the ENERGY STAR Products program, New Jersey Market Assessment, Book II, Section 3.4.4.

[51] NYSERDA, **New York Energy $mart[SM]** 2005 annual report, May 2006 (forthcoming).

[52] Note that some utilities and jurisdictions have determined that freeridership and spillover generally cancel each other out, and the effort to measure them is not warranted.

by reviewing the selection of other program portfolios across the country, particularly in neighboring states. For example, NYSERDA achieves over half of its energy savings from the Technical Assistance Program and the Commercial Industrial Performance Program (CIPP). Currently the NJ portfolio does not have equivalent programs.[53] Reviewing the programs of neighboring states and considering incorporating additional programs could also leverage the efforts of these other programs through interstate crossover of energy efficiency providers. The addition of the Home Performance with ENERGY STAR Program for 2006 is a good example of this type of activity.

5.5 Summary of Findings and Recommendations for Portfolio Level Assessment

The following points summarize the portfolio level assessment findings and recommendations:

The portfolio goal requirement that program impacts increase by the amount of any spending increases + 10% is achievable, but places undue emphasis on cost of conserved energy as the measure of portfolio effectiveness and compromises the ability to address other, broader measures of portfolio effectiveness. The goal was met or exceeded in 2004 and 2005 for electric savings, and exceeded in 2005 for gas savings. In addition, review of a number of other utility and regional efficiency portfolios revealed that this goal is achievable. However, the goal is extremely aggressive at lower spending increases: if the spending increased by 5% then the savings should increase by 15%, equating to an increase in savings of 300% relative to the increase in spending. This aggressive goal, therefore, places undue emphasis on cost of conserved energy as the measure of portfolio effectiveness and compromises the ability to address other, broader measures of portfolio effectiveness (e.g., an equitable distribution that benefits all sectors, segments, and regions). In addition, it creates an incentive to move away from market transformation programs that require significant investment up-front, but yield longer term savings. While the current goal may be achievable in the short-term, this approach may hamper the long-term success of the programs.

An alternative goal, implementing a fixed or ratcheted multiplier, may provide a better balance between aggressive savings goals and other program priorities. The evaluation team recommends that NJ consider an alternative goal, including setting a minimum increase commensurate with spending increases, a fixed multiplier, or a ratcheted multiplier that increases with spending increases. Of these mechanisms, the evaluation team recommends adoption of a simple multiplier. This would be relatively easy to administer and would challenge program administrators to continuously improve the return on program investments, but not at the expense of other program portfolio objectives. A proposed multiplier of 1.2 would provide the proper balance between an aggressive, yet not unreasonable, goal by producing higher savings goals at higher spending increases (over 50%) than the current spending increase +10% approach, but not creating unduly high savings goals for lower spending increases.

The current mix of spending by program is consistent with the potential analysis and benefits a broad group of ratepayers, such that substantial shifts in funding are not recommended. The savings, by sector, is not substantially different than the potential analysis conducted in 2004. In addition, the programs effectively serve all sectors, including a proportion for the low-income sector that is higher than a number of other portfolios across the country. A small reallocation of funding (5%) of funding from the commercial sector to the residential sector may provide even closer alignment between potential and

[53] The Technical Assistance Program offers incentives for energy audits for commercial and industrial customers, while the CIPP attempts to promote the performance contracting market.

achieved savings. The NJ CEP should also consider a number of program specific recommendations that could impact cost-effectiveness. In addition, the NJ CEP should consider examining and incorporating engineering and market effects net-to-gross ratios.

6. EVALUATION PLANNING

In order to assist the NJ CEP with evaluation planning, the evaluation team conducted interviews with efficiency program administrators from six state/regions.[54] The interviews were all conducted over the telephone, and were designed as a benchmarking exercise to explore the practice of efficiency program evaluation around the country. The interviews explored a number of questions, including:

- What method do you use to determine evaluation budgets (e.g., fixed budget, percentage of implementation budget, allocation between programs, etc.)?
- How are evaluation objectives or tasks determined?
- Do you have a long-term Evaluation Plan?
- If so, how often are process, impact, M&V, market assessment, and potential studies conducted?
- Do you have in-house evaluation staff? If yes, how many FTE?
- What percentage of evaluation costs are for staffing?

The findings from the interviews are summarized below.

Impact evaluations: Impact evaluations are given highest priority among implementers throughout the country due to the importance of truing up savings estimates and the desire to focus spending on program implementation. Net energy savings are usually determined on an annual basis, but evaluations can be run every two to three years (and applied until a subsequent evaluation). Impact evaluations are normally conducted through engineering analysis, billing analysis, metering, or a combination of these approaches. The International Performance Measurement and Verification Protocols (IPMVP) includes recommended approaches for determining energy savings from efficiency programs.[55] The IPMVP guidelines have become the de facto standards for California and other regions throughout the United States.

Normally, in years in between impact evaluations basic metrics such as market share can be tracked. For example, the ENERGY STAR Products section of this report discusses cost-effective approaches for using National Retailer Partner sales data (collected by D&R International) to examine annual estimates of ENERGY STAR product market share, and the Residential New Construction section of the report presents a methodology for tracking market share for ENERGY STAR new homes. Wherever possible, similar approaches should be used for all products/measures included in the programs.

Process evaluations: Process evaluations are considered less important than impact evaluations, but can be critical to ensuring effective, efficient implementation. Process evaluations are typically conducted within a year of implementation of new programs or following substantial changes to programs.

[54] Interviews were conducted with representatives from New York (New York State Energy and Research Development Authority), Oregon (Energy Trust of Oregon), the Northwest (Northwest Energy Efficiency Alliance), Iowa (Mid-American), Vermont (Efficiency Vermont), and Texas (Texas Public Utility Commission).

[55] The guidelines can be downloaded at www.ipmvp.org

Market characterization studies: Some regions also conduct periodic market characterization (or market research) studies. These are typically conducted less frequently (usually on an "as needed' basis), and are often custom studies designed to assist with potential analysis, program development, or baseline assessment. Other administrators, however, like to conduct regular market characterization studies, although usually less frequently (e.g., every two to five years) than impact or process evaluations.

Evaluation focus. One respondent noted a trend to measure items that are "nice to know" but less pertinent to program measurement or management. Other respondents echoed the need to make sure evaluations address both the regulatory needs (e.g., program impacts) as well as the needs of program implementers. A number of administrators have established a collaborative process so that both external and internal stakeholders (e.g., the program implementers) can ensure that the evaluation activities focus on meeting their specific needs.

Allocating the evaluation budget: Prioritization should be given based on a number of factors, including the implementation budgets, expected savings, and market sector (so all are given some attention). Another important consideration is the risk factor: programs with a history of evaluation in NJ, with proven measures and good secondary data, should be considered less risky than programs that institute newer, less proven measures (i.e., newer measures should be given evaluation priority).

Calculation of market effects: Market effects, or attribution analysis, includes the examination of freeridership and spillover. Traditional resource acquisition programs that offer incentives and little training/education are the best candidates for freeridership and spillover analysis. Market transformation programs that emphasize education, training, and long-term market effects need to look at incremental impacts of market indicators (e.g., penetration levels, awareness levels, etc.) to assess program impacts. This should be done by the use of comparison states and market share data, where available.

Evaluation budgets and staffing: Evaluation budgets for other implementers throughout the country are typically in the 2% to 4% of annual program budgets, and this seems to be sufficient.[56] Note this usually does not include full-time evaluation staff, whose salaries and benefits are typically allocated to organizational overhead or program implementation. At least one full-time equivalent (FTE) should initially be assigned to manage evaluation activities, expanding as the need increases. Evaluation staff should be able to manage approximately 4-6 programs year.

Outsourcing evaluations: An attempt should be made to outsource as much research as possible to maximize objectivity and avoid any potential conflict of interest.

Primary data collection: Evaluation staff should work with program implementation staff at the early stages of implementation to ensure that the necessary data are being collected for evaluation. Sufficient budgets should be allocated for database design, which should be outsourced to a qualified firm or conducted by third party implementation contractors. Reports on program activity should be produced quarterly, at a minimum, to validate the progress of program activities and ensure that high level metrics (e.g., number of participants, incentive levels, etc.) are available for evaluation.

[56] According to the 2003-2005 annual reports, NJ is spending about 1-2%/year on both market research and evaluation.

Example of Data Collection and Tracking

For any successful evaluation effort it is imperative to track a number of key measure and program metrics. Good documentation, database design, and database use provide the cornerstone for a solid, effective evaluation.

The evaluation team has worked on a number of comprehensive efforts to assist program implementers with designing data tracking systems. As shown in Figure 6-1, there are many potential data points that can be tracked, including details about measures, projects, evaluation adjustments, utility billing information, customer information, contractor/trade ally information, and general planning. The figure also provides an example of the user groups that use the data and take responsibility for collecting and updating the data, as well as potential sources of information to supply the data. The figure is meant to serve as an example for the type of data collection matrix that NJ should consider developing to ensure that all data points that are necessary for proper planning and evaluation efforts are collected.

Summary of Recommendations for New Jersey

- Impact evaluations should be conducted every two years and should attempt to follow the IPMVP guidelines.

- Process evaluations should be conducted within a year of launching new programs (e.g., the Home Performance with ENERGY STAR Program) or after more substantial changes to program implementation occur.

- Market characterization studies should be conducted every two to five years to support potential analysis, program development, and baseline assessment.

- There should be one full time evaluation coordinator to manage 4-6 programs.

- The evaluation budget should range between 2% to 4% of total expenses.

- The allocation of dollars within evaluation should be based on a combination of program budgets and expected savings, but also need to ensure that all sectors are represented and all stakeholder needs are considered through a collaborative process.

- Market effects/attribution analysis that determines a net-to-gross estimate based on freeridership and spillover should be factored into savings estimates; if these effects are not included, evidence should be presented for their exclusion (e.g., research determining that program design minimizes freeridership and they cancel each other out).

- Develop a data collection and tracking matrix for individual programs and the overall portfolio.

Figure 6-1. Example of Data Tracking Matrix[57]

	Need				Update Cycle		
Data Element	**Evaluation**	**Planning**	**Responsibility**	**Source**	**Planning**	**Implem.**	**Eval.**
1. Measure Detail							
1.1 Measure Savings/generation							
1.1.1 Deemed (Perscriptive)	X	X	PMC	Planning	X		
1.1.1.1 How calculated, input deck	X	X	Planning	Planning	X		X
1.1.1.2 Cut Sheets (what was installed)	X		PMC	TA			
1.1.2 Calculated Estimate (Prescriptive Projects)							
1.1.2.1 Input Documents for Calculation	X		PMC	PMC/ TA		X	
1.1.2.2 Tools used to calculate							
1.1.2.3 Soft copy of tool used w/ Version level	X	X	PMC	Planning/PMC	X		X
1.1.2.4 Input Deck	X		PMC	Planning/ PMC	X		X
1.1.2.5 Hard copy of final output w/ Version level	X		PMC	PMC/ TA			X
1.1.3 PMC Calc verification method	X		PMC	PMC			X
1.1.3.1 Metered data	X		Eval	Eval			X
1.4.1 Calculated Estimate (Custom Projects)							
1.4.1.1 Calculation Assumptions	X	X	PMC	PMC/ TA	X		X
1.4.1.2 Tools used to calculate							
1.4.1.3 Soft copy of tool used w/ Version level	X	X	PMC	Planning/ PMC	X		X
1.4.1.4 Hard copy of tool used w/ Version level	X		PMC	PMC/ TA			X
2. Project Detail							
2.1 Baseline assumptions							
2.1.1 Load shape	X	X	Planning	Planning	X		X
2.1.2 Measure lives		X	PMC/ Planning	Planning	X		
2.1.3 Assumed Pre-Project conditions	X	X	PMC/ Planning	Planning	X		X
2.2 Measure interactive effects (net savings)	X	X	Planning	Planning	X		X
2.2.1 How calculated, input data		X	Planning	Planning	X		X
2.3 Quantity of Measure per project (how count?)	X	X	PMC/ TA	PMC	X		X
2.4 Project sector (e.g. residential)							
2.4.1 Building Type (% by SIC)	X	X	PMC/ TA	PMC			X
2.4.2 Square Footage (% by SIC & Total)	X	X	PMC/ TA	PMC			X
2.4.3 Year Building Built (if retrofit)	X	X	PMC/ TA	PMC			X
2.5 Technical specifications (cut sheets)							
2.5.1 Product rating/efficiency	X		PMC/ TA	PMC		X	
2.5.2 Equipment Model Numbers	X		PMC/ TA	PME		X	
2.5.3 Measure end-use		X	PMC/ TA	Planning			X
2.5.4 Old Equipment removed							
2.5.4.1 Approx date installed (age)	X	X	PMC/ TA	PMC		X	
2.5.4.2 Model/Mfg	X	X	PMC/ TA	PMC		X	
2.5.4.3 Nameplate info	X	X	PMC/ TA	PMC		X	
2.6 Quality Assurance Paperwork							
2.6.1 Installed Savings (QC pre-evaluation)							
2.6.1.1 Verification method/documents	X		PMC	PMC		X	X
2.6.1.2 Project final paperwork	X		PMC	PMC		X	X
3. Evaluation Adjustments							
3.1 Measure Net-to-Gross							
3.1.1 Typical for program type	X	X	Eval	Eval	X		X
3.1.2 Actual evaluated results							
3.1.2.1 End use		X	Eval	Eval			X
3.1.2.2 Program	X	X	Eval	Eval			X
3.1.3 Future planning NTG assumptions		X	Planning	Eval	X		
4. Utility Account Information							
4.1 Customer Account Numbers (Gas & Elect)	X		PMC/ TA	PMC		X	X
4.2 Energy Information Release Signature	X		PMC/ TA	PMC		X	
4.3 Utility Meter Numbers (Gas & Elect) (C&I only)	X		PMC/ TA	PMC		X	X
4.4 Access & Evaluation Release Language	X		PMC	PMC		X	
5. Customer Contact Info							
5.1 Rent/Own	X		PMC/ TA	PMC		X	
5.2 Owner vs. project lead vs. Architect (C&I only)	X		PMC	PMC		X	
5.3 Current contact information	X		PMC	PMC		X	
5.4 9-digit zip	X	X	PMC	PMC		X	
5.5 Client demographics ($low income)		X	Eval	Eval			X
6. Contractor Info							
6.1 TA vs. sub-contractor	X		PMC	PMC		X	
6.1.1 Dates current TA vs. no longer in program	X		PMC	PMC		X	
6.2 PMC lead/contact (e.g. PDC) for Project	X		PMC	PMC		X	
7. PMC Planning							
7.1 Actuals (monthly, quarterly, yearly)							
7.1.1 By measure, utility and sector	X	X	PMC	PMC		X	X
7.2 Planned (next month, next quarter, year)							
7.2.1 By measure, utility and sector--rolling forecast	X	X	PMC	PMC	X		
7.3 Planning assumptions							
7.3.1 Close rate (%) on projects identified		X	PMC	PMC	X		
7.3.2 Mean Time to Complete (Identification to Completion)		X	PMC	PMC			X
7.3.3 T&D assumptions		X	Planning	Planning	X		
7.3.4 Project forecasts by measure, utility and sector	X	X	PMC	PMC	X		
7.4 Utility spending/savings splits[1]	X	X	Planning	Planning/ PMC	X		
7.5 Program/Project Information							
7.5.1 Program Projects							
7.5.1.1 Measures Offered	X	X	PMC/ PM	Planning/ PM/ PMC	X		
7.5.1.2 Conflicts w/ similar measures in other programs		X	Eval	PM/ PMC	X		
7.5.2 Target Market Sectors (e.g. residential)	X	X	PMC/ PM	Planning/ PM/ PMC	X		
7.5.3 Project qualification critria	X	X	PMC/ PM	PMC	X		
7.5.4 Incentive caps & promo's	X	X	PMC/ PM	Planning/ PM/ PMC	X		
7.6 Key Market Assumptions							
7.6.1 Current Code	X	X	Planning	PMC/ Planning	X		
7.6.2 Expected market changes & timing		X	Planning	PMC/ Planning	X		

Notes: 1. Fuel Savings splits noted in two places because resides in both FT and the measure screening tools

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[57] Note the following acronyms and abbreviations apply: PMC (Program Management Contractor, or implementer of program); TA (Trade Ally); Eval (Evaluation staff, including third party evaluators and utility staff); Planning (Planning staff).