
Executive Summary

This report presents evaluation results for the **New York Energy \$martSM** public benefits program (Program) for activities completed through year-end 2005.¹ The report was prepared jointly by staff of the New York State Energy Research and Development Authority (NYSERDA) and a team of third-party evaluation assistance and specialty contractors acting under the terms and conditions of a Memorandum of Understanding (MOU)² between NYSEDA, the New York State Department of Public Service (DPS), and the New York State Public Service Commission (PSC). This report was reviewed before being finalized by the System Benefits Charge Advisory Group³ (Advisory Group), which serves as the Independent Program Evaluator in accordance with the MOU. The report is tendered to the PSC by the Advisory Group in fulfillment of its responsibilities under the terms of the MOU.

The report builds on the evaluation framework and model used to guide prior evaluation efforts, described below under Evaluation Approaches, and constitutes the most comprehensive assessment to date of the **New York Energy \$martSM** Program.

On December 21, 2005, the PSC ordered⁴ New York's public benefits program extended for five years, from July 1, 2006 through June 31, 2011. The next annual evaluation report to be issued in Spring 2007 will include program activities through July 31, 2006, the end of the current five-year system benefits charge program, and for the initial six months of the new program.

New York's public benefits program was initiated in 1998 by Order⁵ of the PSC as a strategy for preserving, within the emerging competitive energy market, energy efficiency, environmental, and low-income programs previously offered by regulated utilities. By mid-2006, SBC funds will have provided almost \$1 billion to support a full range of programs to help the State meet its energy challenges.⁶

¹ Previous annual reports dated September 2000, January 2002, May 2003, May 2004, and May 2005 presented cumulative results from the Program's inception on July 1, 1998. The most recent annual and quarterly reports are available on NYSEDA's website at www.nyserda.org and by request.

² Memorandum of Understanding between the New York State Public Service Commission, New York State Department of Public Service, and New York State Energy Research and Development Authority, March 11, 1998, revised December 6, 2001.

³ The Advisory Group consists of 24 individuals representing varied interests, including utilities, business and environmental groups, energy services companies, community organizations, professional and trade associations, and national energy efficiency and energy research and development (R&D) organizations

⁴ Case 05-M-0090, In the Matter of the System Benefits Charge III, Order Continuing the System Benefits Charge (SBC) and the SBC-Funded Public Benefit Programs, issued and effective December 21, 2005.

⁵ Cases 94-E-0952 et al., In the Matter of Competitive Opportunities Regarding Electric Service, Opinion No. 9612, issued May 20, 1996.

⁶ In addition to NYSEDA's **New York Energy \$martSM** Program, funded through the SBC, the New York Power Authority (NYPA) and Long Island Power Authority (LIPA) each offer complementary public benefits programs of their own. The three authorities coordinate program design and service delivery wherever practicable to maximize the use of public funds for the programs and to ensure a coordinated statewide effort to meet public policy goals. The results of the NYPA and LIPA programs are not included in this report.

The **New York Energy \$martSM** Program portfolio consists of numerous initiatives promoting energy efficiency and load management, providing services to low-income New Yorkers, and conducting research and development activities. The activities pursued by the Program include disseminating information to increase consumer energy awareness, marketing, providing subscription-based and co-funded financial incentives, product development and testing, technology commercialization, and data and information gathering.

Program Administration

NYSERDA has instituted numerous policies to ensure that the Program is administered in an open, fair, and equitable manner. Ninety-seven percent (97%) of projects are competitively selected. The remaining 3% of projects involve contracts less than \$15,000 each, unsolicited proposals that are deemed to support the Program's goals, and sole-source contracts with unique, specially-skilled contractors.

Contract awards are recommended to NYSERDA management for consideration and approval by expert panels that review all competitive proposals. The panels consist of technical experts, and external members are drawn from government and industry. Panels are required to have more external reviewers than internal NYSERDA reviewers. The panels provide feedback on the contents and composition of each program solicitation to ensure that solicitations reach the widest possible audience of potential proposers. All solicitations are published in the New York State *Contract Reporter*.

The evaluation function is overseen by NYSERDA and conducted by a team of independent evaluation contractors. All contractors were selected through competitive solicitation with a member of the Advisory Group and DPS staff serving on each review panel. The Advisory Group and DPS staff help allocate the evaluation budget, identify evaluation activities to be conducted, and establish timelines for evaluation activities. Evaluation analyses and reports are reviewed by the Advisory Group and DPS before being finalized and submitted to the PSC for approval. The Advisory Group is independent of NYSERDA; its members are selected by DPS and NYSERDA, it corresponds directly with the PSC, and members of the group participate in selection of evaluation contractors, receive evaluation reports, when requested, directly from evaluation contractors, and have independent access to those contractors. The Advisory Group meets three or four times each year.

New York Energy \$martSM Budget and Spending Status

As shown in Table ES-1, the Program has an eight-year budget of approximately \$961.8 million. The budget has been allocated among four program areas:

- Business/Institutional initiatives account for the largest share, 37.3% of the eight-year **New York Energy \$martSM** Program budget, or \$359.1 million.
- Research and Development, including renewable technology deployment, accounts for 21.9% of the eight-year budget, or \$210.8 million.
- Residential initiatives account for 17.7% of the eight-year budget, or \$171.2 million.
- Funding for Low-Income initiatives accounts for 13.4% of the total eight-year budget, or \$128.4 million over this time period.

In addition to these major program areas, the eight-year Program also funds an environmental disclosure program (\$2.4 million), program administration (\$64.6 million), program evaluation (\$16.2 million), and includes a cost recovery fee (\$9 million), a mandatory payment into the general fund assessed by the New York State Comptroller for state support functions.

Table ES-2 shows the financial status of the programs as of December 31, 2005.

Table ES-1. New York Energy \$martSM Eight Year Funding Allocation Summary

			Percent of Total SBC Funding
New York Energy \$martSM Program Areas			
Business/Institutional	\$359.1 million	41.3%	37.3%
Residential	\$171.2 million	19.6%	17.7%
Low-Income	\$128.4 million	14.8%	13.4%
Research and Development	\$210.8 million	24.3%	21.9%
Subtotal Programs	\$869.5 million	100%	90.4%
New York Energy \$martSM Other Costs			
Administration	\$64.6 million	-	6.7%
Evaluation	\$16.2 million	-	1.7%
Subtotal Administration and Evaluation	\$80.8 million	-	8.4%
Environmental Disclosure	\$2.4 million	-	0.3%
NYS Cost Recovery Fee	\$9.0 million	-	0.9%
Total 8-Year Budget¹	\$961.8 million	-	100%

¹Totals may not add due to rounding.

Source: **New York Energy \$martSM Program** – Financial Status Report, as of December 31, 2005.

Table ES-2. Financial Status of the New York Energy SmartSM Program

					% of 8-year Budget Encumbered
Business/Institutional	\$359.1	\$222.8	62.0%	\$330.5	92.0%
Residential	\$171.2	\$164.1	95.8%	\$176.9	103.3%
Low-Income	\$128.4	\$70.6	55.0%	\$110.4	86.0%
Research and Development	\$210.8	\$93.8	44.5%	\$153.6	72.9%
Environmental Disclosure	\$2.4	\$0.6	25.0%	\$0.7	30.8%
Evaluation	\$16.2	\$12.5	77.2%	\$14.3	88.3%
Administration	\$64.6	\$52.9	81.9%	\$52.9	81.9%
NYS Cost Recovery Fee	\$9.0	\$8.2	91.1%	\$8.2	91.1%
Total ²	\$961.8	\$625.5	65.0%	\$847.5	88.1%

¹ Encumbered funds are funds associated with signed contracts and purchase orders. Final spending by program area cannot exceed budgeted amounts.

² Totals may not add due to rounding.

Source: **New York Energy SmartSM Program** – Financial Status Report, as of December 31, 2005.

Portfolio Level Findings

NYSERDA’s portfolio includes a full complement of energy efficiency and demand-reduction programs that serve most of New York. The **New York Energy SmartSM** portfolio of programs were selected to achieve the following public policy goals set for it by the PSC:

1. Improve system-wide reliability and peak reduction through end user efficiency actions.
2. Improve energy efficiency and access to diverse energy options for underserved customers.
3. Reduce environmental impacts of energy production and use.
4. Facilitate retail electric competition to benefit end users.

Table ES-3 summarizes the progress NYSERDA and the **New York Energy SmartSM** Program have made toward achieving the PSC’s goals.

Table ES-3. Progress Toward Goals

Goal 1: Improve system-wide reliability and peak reduction through end user efficiency actions.
<ul style="list-style-type: none"> The New York Energy \$martSM Program has improved system-wide reliability and peak reduction, enabling 593 MW of callable load reduction and installing efficiency measures that reduce peak demand by 443 MW.
Goal 2: Improve energy efficiency and access to energy options for underserved customers.
<ul style="list-style-type: none"> Approximately 33,000 eligible New York low-income customers received direct assistance through the New York Energy \$martSM Program, resulting in \$300/year in average customer energy bill savings for this under served population.
Goal 3: Reduce environmental impacts of energy use.
<ul style="list-style-type: none"> The annual reduction of emissions resulting from the New York Energy \$martSM Program's energy savings is 1,750 tons of nitrogen oxide (NO_x), 3,170 tons of sulfur dioxide (SO₂), and 1,400,000 tons of carbon dioxide (CO₂).
Goal 4: Facilitate retail electric competition to benefit end users.
<ul style="list-style-type: none"> The energy service companies (ESCOs) operating in New York State have during the past six years, increased from less than ten to over 180 companies, spurred by New York Energy \$martSM B/I Programs. Of the ESCOs that provide electricity to New York State's non-residential customers, 11% are participants the Commercial/Industrial Performance Program.

Summary of Program Benefits

Table ES-4 provides a summary of quantifiable benefits achieved by the **New York Energy \$martSM** portfolio of programs for the past three years.

Table ES-4. Cumulative Program Benefits from Installed Measures

	-	-	Through Year-End 2005
Electricity Savings From Energy Efficiency and On-Site Generation (Annual GWh)	1,000	1,400	1,950
Peak Demand Reduction (MW)	880	860	1,040
Permanent Measures	270	325	445
Curtable	610	535	595
Annual Energy Bill Savings (\$ Million)	\$140	\$195	\$275
Net savings for gas and oil (Annual MMBtu)	2,800,000	2,600,000	4,000,000
Renewable Energy Generation (Annual GWh)	103	102	103
Jobs Created and Retained per Year	5,500	4,800	4,700
NO _x Emissions Reductions (Annual Tons)	950	1,280	1,750
SO ₂ Emissions Reductions (Annual Tons)	1,700	2,320	3,170
CO ₂ Emissions Reductions (Annual Tons)	750,000	1,000,000	1,400,000
Equivalent number of cars removed from New York roadways.	150,000	200,000	275,000

Cost Effectiveness of Programs

In assessing the cost-effectiveness of the **New York Energy \$martSM** Program, NYSERDA uses two methods. For deployment and market transformation programs for which energy and demand savings can be estimated, an economic benefit/cost analysis is used that monetizes savings and compares them to costs. For R&D programs, such as next-generation technologies, distributed generation, new product development, and strategic reliability technologies, the economic benefit/cost methodology is inappropriate because these programs are designed to accomplish a range of objectives, many of which cannot be monetized in the early years.

Benefit/Cost Analysis of Deployment Programs

The benefit/cost analysis calculates both a Total Market Effects Test (TMET) and a Program Efficiency Test (PET). The TMET differs from the PET in that the former includes participant costs and the latter does not. Three scenarios were constructed for each test with each successive scenario adding additional benefits that can be quantified and attributable to the **New York Energy \$martSM** Program:

- In Scenario #1, only the avoided costs associated with energy, capacity, natural gas, oil, propane, and water savings arising from participant actions and from market spillover were used as benefits.⁷
- In Scenario #2, the energy and capacity market price benefits that accrue to all ratepayers from lowering the requirements for energy and capacity, given available supplies, were added to the resource benefits.
- In Scenario #3, non-energy benefits were calculated and added to the resource and market price benefits.

The value added component of the macroeconomic benefit was added at the portfolio level. Environmental benefits such as reductions in emissions of sulfur dioxide, nitrogen oxides, and carbon dioxide were not included as a benefit primarily because the monetary value of these reductions are too uncertain at this time. For each scenario, benefit/cost ratios were calculated with and without macroeconomic benefits. These ratios are presented in Table ES-5. TMET ratios ranged from 3.2 to 6.8 and PET ratios ranged from 6.0 to 12.9 depending on the scenario and whether macroeconomic benefits were excluded or included. The present value of the macroeconomic benefits anticipated from program spending through year-end 2005 was estimated to be \$982 million.

⁷ Scenario 1 TMET is similar to the Total Resource Cost Test that was used in the past by the utilities.

Table ES-5. Portfolio-Level Benefit/Cost Ratios

		Portfolio-Level Ratios With Macroeconomic Benefits
Scenario 1 TMET	3.2	4.3
Scenario 1 PET	6.0	8.2
Scenario 2 TMET	3.9	5.0
Scenario 2 PET	7.4	9.6
Scenario 3 TMET	5.6	6.8
Scenario 3 PET	10.7	12.9

Benefit/cost ratios for the business/institutional, residential, and low-income sectors are shown in Table ES-6. The TMET ratios ranged from 3.7 to 6.6 for the business/institutional sector, from 2.5 to 4.2 for the residential sector, and from 1.3 to 2.3 for the low-income sector. The PET ratios ranged from 9.0 to 16.3 for the business/institutional sector, from 3.6 to 6.1 for the residential sector, and from 1.4 to 2.5 for the low-income sector.

Table ES-6. Sector-Level Benefit/Cost Ratios

			Low-Income
Scenario 1 TMET	3.7	2.5	1.3
Scenario 1 PET	9.0	3.6	1.4
Scenario 2 TMET	4.5	3.1	1.4
Scenario 2 PET	11.1	4.5	1.6
Scenario 3 TMET	6.6	4.2	2.3
Scenario 3 PET	16.3	6.1	2.5

Value/Cost Analysis

For the 2005-2006 evaluation year, a peer review assessment will be conducted for the Distributed Generation/Combined Heat and Power Program (DG/CHP) and the Environmental Monitoring, Evaluation, and Protection Program (EMEP). The peer review assessment consists of the following components:

1. Development of an accomplishments packet that summarizes program accomplishments.
2. Recruitment of peer reviewers.
3. Presentation of accomplishments to peer reviewers in written form and in a face-to-face presentation.
4. Peer reviewer assessment of program impacts on five dimensions of performance.
5. Peer reviewer group discussion of assessments.

6. Revised peer review assessments after group discussion.
7. Analysis of peer review scores to assess program accomplishments and value given program resources.

The six performance dimensions are defined as follows:

1. Significance of Knowledge Creation such as the number of technical papers, articles, citations, patents and licenses.
2. Significance of Knowledge Dissemination such as availability of knowledge products.
3. Commercialization Progress such as capital attraction, technical achievement, and market advancement.
4. Realized and Potential Energy Benefits.
5. Realized and Potential Economic Benefits such as jobs, manufacturing activities, and sales revenues.
6. Realized and Potential Environmental and Health Benefits.

To date, logic models have been developed for EMEP and separately for the CHP demonstration projects and the DG product development projects. Data will be collected in the Spring of 2006 to develop the accomplishment packets.

Macroeconomic Impact Analysis

Previous economic evaluations of the **New York Energy \$martSM** Programs focused on tracking program costs and identifying direct benefits to program participants reported as energy bill savings. However, expenditures made by NYSERDA and program participants have substantial macroeconomic impacts that go far beyond direct benefits. Purchases of goods and services through the Program initiate a ripple effect as spending and re-spending influence various sectors of New York's economy and, in turn, affect the level and distribution of employment and income in the State. A macroeconomic impact analysis⁸ of the programs was previously conducted and reported in detail in earlier reports. The analysis was updated for this report and the results are presented in Table ES-7. Averaged over a 19-year analysis period, the Program creates and sustains on average more than 4,100 jobs, increases labor income by \$182 million per year, increases total output by \$244 million per year, and increases value added by \$104 million per year. Note that the previous year's results are included in the table.

⁸ The input-output model used the IMPLAN Pro software system (Version 2.0) developed by the Minnesota IMPLAN Group

Table ES-7. Summary of Macroeconomic Impacts of the New York Energy \$martSM Program

					Annual Average over 19-Year Analysis Period (1999-2017)	
						2005 Update
Net Job Growth	4,779	4,677	4,109	3,706	4,407	4,166
Labor Income	\$241 million	\$230 million	\$153 million	\$138 million	\$192 million	\$182 million
Total Output	\$466 million	\$427 million	\$81 million	\$80 million	\$252 million	\$244 million
Value Added	\$234 million	\$211 million	\$6 million	\$7 million	\$107 million	\$104 million

Evaluation Approaches

The comprehensive evaluation program undertaken by NYSERDA and its specialty contractors uses the approaches that are listed below. A variety of evaluation approaches are necessary to ensure that the successes and failures of diverse programs are accurately and appropriately measured and reported, individually and at the portfolio level.

- Program theory and logic
- Measurement and Verification (M&V)
- Process Evaluation
- Cycle Time Evaluation
- Market Characterization, Assessment, and Causality (MCAC)
- Benefit/Cost and Value/Cost Analyses
- Macroeconomic Impact Analysis

Business/Institutional Programs

Business/Institutional (B/I) Programs identify opportunities to improve energy efficiency and load management and try to effect changes in energy decision making by building owners and operators. The B/I Programs target diverse market actors, including architects and engineers who work primarily with large buildings and projects, and contractors and distributors whose primary focus is small buildings. B/I Programs address the efficient use of electricity, petroleum, and natural gas and seek to provide customers with comprehensive, attractive incentives and financing packages. Programs in the B/I area are discussed in detail in Section 4.

Business/Institutional Program Findings

The **New York Energy \$martSM** Programs targeted at the business and industrial sector provide a wide range of services and financial resources to address the needs of most of the market segments and actors. There are efforts addressed to new construction and retrofits; to upstream providers, mid-market actors and end users; and to meeting information needs, overcoming technical barriers and offsetting first cost hurdles. Overall, the NYSERDA program offerings have made solid gains in achieving energy savings, in reducing peak demand, and in helping to move markets toward greater energy efficiency. The programs appear to be having positive effects on market demand, supply, and infrastructure, and these signs of market progress are generally in line with the length of time spent and the resources invested.

While the specific findings for each B/I sector program are presented in the following sections, there are some general findings that apply to the efforts across the sector. For example, there has been significant progress in increasing awareness of NYSERDA's program offerings. Increasing awareness is further evidence of NYSERDA's spreading influence in the market. Highlights include:

- Surveys of customers and program participants are finding that NYSERDA programs are being cited more often as an important factor in the decision to install energy efficiency measures and equipment. These findings are especially significant because respondents are citing NYSERDA unaided; in other words, the survey questions do not even list NYSERDA as one of several factors, yet respondents indicate NYSERDA.
- End-use customers continue to gain more experience, education, and trust in energy efficiency measures, equipment, and services. Historically, these were lacking among customers, and were often cited as reasons for not taking action on energy efficient purchases or services.
- Even customers who have not participated directly in NYSERDA program offerings have shown increasing levels of familiarity with energy efficient measures and equipment. In surveys carried out this year, 72% of non-participant end-use customers and 58% of non-participant contractors reported higher levels of familiarity than in previous years.
- Surveys indicate high levels of awareness of **New York Energy \$martSM** programs, with 88% of end-use customers and 81% of contractors reporting awareness of at least one program offering.
- Respondents were more familiar with NYSERDA programs in general, and were less aware of specific program offerings. This indicates that NYSERDA is achieving a greater degree of brand recognition than are the numerous individual program names.

Another important indicator of progress is the perceived value that NYSERDA programs offer. The survey results indicate that NYSERDA is becoming a trusted source for information and support in the adoption of energy efficient practices. Respondents report that NYSERDA brings credibility to the various services offered through its programs and contractors by:

- Helping contractors sell the programs and energy efficiency measures to customers
- Giving end-use customers a higher level of confidence that the measures will work as expected and produce the savings anticipated

B/I customers who participated in **New York Energy \$martSM** Programs expressed high satisfaction levels of 80%-90% with project results. This suggests that they are likely to continue working with NYSERDA in the marketplace to improve efficiency.

Examples of the high perceived value of NYSERDA programs, can be found in the evaluation results of three of the larger B/I Programs. Over the past five years, the Commercial/Industrial Performance Program (CIPP) has seen increased activity by an increasing number of energy service companies (ESCOs). Half of the contractors (both participating and non-participating) reported higher ESCO activity, and improved quality of work by ESCOs. For the Peak Load Reduction Program (PLRP), 90% of participants are satisfied and expect to continue with the program. Further, they report that positive experiences with the program have resulted in their exploring participation in additional programs. This kind of synergistic effects can make all NYSERDA programs more effective and extend their reach into the market. Evaluation results from the New Construction Program (NCP) show that, over the past five years, focus on energy efficiency in the marketplace has increased. Participants report that technical assistance services offered by the program are a valuable tool for promoting investments in energy efficiency, indicating that NCP is effective at overcoming significant market barriers in the new construction arena. NCP evaluation findings also indicate that both participating and non-participating architecture and engineering firms are increasing their marketing and recommendations of energy-efficient measures and designs. These are key market allies and opinion leaders with the ability to influence not only their current projects, but future projects as well.

These findings of awareness, satisfaction and perceived value show up as additional energy savings for the programs. Evaluators estimate that, in addition to the direct savings attributable to program incentives, there has been a significant amount of non-participant spillover. This spillover produces an additional 14% of savings from non-participating projects, beyond the direct savings and spillover savings being counted for participants.

In addition to direct and spillover savings in energy use, customers continue to report significant non-energy impacts related to efficiency improvements. NEIs help motivate customers to act on efficiency improvements and can have real economic impacts for both customers and the State.

The fact that respondents report key market barriers are decreasing is further evidence of market progress. NYSERDA programs are perceived to be increasing the availability of energy efficient equipment, reducing problems related to lack of experience with newer energy efficiency technologies, and reducing the perceived uncertainty associated with efficiency investments and savings. Notwithstanding this progress, however, respondents report that higher first cost continues to be a significant barrier to purchasing and installing efficiency measures.

While it would be valuable to know and track the penetration of efficiency measures in the market, market penetration data are only available for a few programs, due to the difficulty of obtaining data that describes both the overall market size and the magnitude of program influences. For example, it has been determined that the Premium Efficiency Motors (PEM) Program has been effective in increasing the sales of NEMA Premium efficiency motors to about 20% of all motors sold. Another important market penetration statistic is that the New Construction Program (NCP) has directly influenced between 10% - 12% of the new construction activity, on a square footage basis, in New York. Further research (and data resources) will be needed to estimate market penetration for more programs. However, some general observations about market share and penetration can be made. It is known, from the savings impacts estimated for the **New York Energy SmartSM** Programs, that the absolute value of energy savings and peak demand reductions are large and cost effective. We also know that they represent only a small fraction of all energy use in New York, and therefore of the potential market that the programs could influence. A more thorough understanding of the characteristics of the existing building stock and the penetration of efficiency measures would be needed in order to better understand program achievements and remaining market potential. Program staff believes that it would be difficult to achieve significantly greater market influence because of finite and limited program resources.

One of the most important evaluation activities in 2005 was the completion of a market-wide characterization and assessment of the existing buildings population in the B/I sector. It provided a broad overview of the “what” and “where” by describing building types, energy uses, breakdowns by geographic areas, and many other details. These provide useful strategic insights into the characteristics and efficiency opportunities represented by the existing building stock. The study was limited, however, to a modest effort at primary data collection and had to rely for the most part on telephone surveys and secondary data.

NYSERDA’s Measurement and Verification (M&V) contractor assessed the energy and peak demand savings reported for its B/I Programs. Methods used in this assessment included on-site verification of equipment installation and functionality, and review of NYSERDA’s files for reasonableness and accuracy. Based on this review, the M&V contractor adjusted the savings reported by NYSERDA. In turn, the Market Characterization, Assessment and Causality/Attribution (MCAC) contractor further adjusted these figures to account for freeridership and spillover. Estimated electrical energy, peak demand reduction, and fuel savings for the B/I Programs, as well as key progress indicators, are shown in Section 4.

Residential Programs

Residential energy efficiency programs influence decisions regarding energy use by homeowners, renters, and participants in the residential energy services and new construction industries. The programs also work with the multifamily building industry to improve the efficient use of electricity, petroleum, and natural gas. Programs in the Residential Program area are described in detail in Section 5.

Residential Program Evaluation Findings

The residential programs in the **New York Energy \$martSM** portfolio addresses critical residential electricity uses. There are efforts promoting efficient lighting, appliances, new homes, and whole house efficiency assessments and improvements. Overall, the evaluation contractors conclude that the NYSERDA’s programs provide significant gains in efficiency while also helping to improve the quality of energy-related services for New Yorkers. The programs appear to be having positive effects on market demand, supply, and infrastructure development, and these signs of market progress are generally in line with the length of time spent and the resources invested. The NYSERDA efforts leverage the national investment in ENERGY STAR by incorporating it throughout the residential programs, and in fact enhance the range of residential markets it influences.

The ENERGY STAR label is the overarching symbol tying together NYSERDA’s residential programs, so it is essential for consumers to be aware of the label. New Yorkers’ recognition of the ENERGY STAR label has increased steadily, from 34% in 1999 to 77% in 2005. Awareness in the **New York Energy \$martSM** area consistently exceeds national levels, even in other high-publicity areas with ENERGY STAR programs.

Once aware of the ENERGY STAR label, it is important that consumers also understand the meaning of the label. The proportion of consumers in New York who show high understanding of the label has increased from 34% in 1999 to 87% in 2005.

There is also evidence linking people’s awareness and understanding directly to NYSERDA’s efforts. In 2005, 63% of New York consumers saw television ads related to ENERGY STAR.

Another key program element is increasing the visibility and availability of ENERGY STAR products. The percentage of ENERGY STAR-qualified models out of all models on display in partner stores increased, for example, from 14% in 1999 to 35% in 2005 for refrigerators, from 10% to 82% for dishwashers, from 16% to 39% for clothes washers, and from 26% to 61% for room air conditioners.

NYSERDA's program efforts from 1999 to 2005 have helped lead to increases in the market share of ENERGY STAR refrigerators among NYSERDA partners from 28% to 47%; from 48% to 76% for dishwashers; from 24% to 41% for clothes washers; and from 45% to 76% for room air conditioners. The proportion of new single-family homes sold that are ENERGY STAR-labeled has increased from 0.3% in 2001 to 13.5% in 2004. The proportion of the home improvement market installing efficiency measures through the Home Performance with ENERGY STAR Program has increased from 0.2%-0.3% in 2001 to 2.1%-3.3% in 2005.

Process evaluation surveys and interviews indicate that much of the success of ENERGY STAR Products, New York ENERGY STAR Labeled Homes, and Home Performance with ENERGY STAR is attributable to: innovation and commitment to quality by NYSERDA staff; program implementation contractors' commitment and performance, and the relationships with retail and contractor partners that have resulted from the programs; teamwork and communication between the staff at NYSERDA and the implementation contractors; staff commitments to consumer education and awareness; and use of retailers and contractors to reach consumers. NYSERDA has been very effective in recruiting partners in appropriate markets, and in providing them with tools—such as training and marketing—to help them persuade consumers to adopt more efficient products and behaviors. Association with NYSERDA's programs and with energy efficiency has helped many of these partners differentiate themselves from their competitors. Moreover, nearly all parties involved in these programs—from retailers to builders to insulation and HVAC contractors to consumers—indicate a high degree of satisfaction with these programs.

NYSERDA has developed innovative residential program approaches with implications beyond New York. For example, the dramatic increases in the market penetration of ENERGY STAR room air conditioners resulting from the Stay Cool! Program, according to interviews with manufacturers, increased the subsequent production of ENERGY STAR room air conditioners across the entire country, essentially “jump-starting” the market. NYSERDA's Home Performance with ENERGY STAR Program has been serving as a pilot program for the U.S. Environmental Protection Agency (EPA), and now is being widely adopted by other states.

NYSERDA's residential programs are also designed and implemented to support each other. The reliance on ENERGY STAR as an overarching symbol is an example of this approach, with resulting synergies across product lines. There are specific efforts to cross-sell, such as promoting ENERGY STAR products (appliances and lighting) within the New York ENERGY STAR Labeled Homes Program. There are also efforts to support NYSERDA's partners across programs, such as developing a business model with HERS raters – necessary to the New York ENERGY STAR Labeled Homes Program – also serving as contractors in the Home Performance with ENERGY STAR Program.

NYSERDA's Measurement and Verification (M&V) contractor assessed the energy and peak demand savings reported for its residential programs. Methods used in this assessment included on-site verification of equipment installation and functionality, and review of NYSERDA's files for reasonableness and accuracy. Based on this review, the M&V contractor adjusted the savings reported by NYSERDA. In turn, the Market Characterization, Assessment and Causality/Attribution (MCAC) contractor further adjusted these figures to account for freeridership and spillover. Estimated electrical energy, peak demand reduction, and fuel savings for the residential programs, as well as key progress indicators, are shown in Section 5.

Low-Income Programs

Low-Income programs reduce the energy burden⁹ on low-income households by improving their efficient use of energy and providing them with energy management and aggregated energy procurement services. Initiatives in this program include: providing technical support for and installing a variety of energy-efficient electric end-use measures in low-income housing; paying a portion of the incremental cost of energy efficiency measures and electric heat conversions in publicly-assisted housing; helping low-income households aggregate energy purchases; incorporating energy-efficient equipment and design specifications into State and federally assisted housing; and educating customers about the benefits of energy efficiency. Programs in the Low-Income Program area are discussed in detail in Section 6.

Low-Income Program Evaluation Findings

With the exception of some M&V activity for the EmPower New YorkSM Program, and the development of a Low-Income Sector Logic Model, no evaluation activity occurred during 2005. The M&V activity was directed at the savings calculator tool used in the EmPower New YorkSM Program. As the calculator was reviewed and improvements made prior to reporting savings, no adjustments to program-reported savings were recommended. The Low-Income Logic Model was developed after the remaining evaluations had been completed, and the results of the logic model development, including indicators and testable hypotheses should be seen more as a guide for future evaluations, rather than a tool for organizing past evaluations.

Because of the limited evaluation activity in 2005, and the fact that a full range of evaluation activities were conducted only for the Assisted Multifamily Program, this section largely restates the findings from past evaluation reports.

The Assisted Multifamily Program (AMP) is the largest low-income program administered by NYSERDA, and, over the years, evaluation activity has been concentrated in this area. An important evaluation finding in the AMP is that 6.8% of eligible units had efficiency measures installed through the program, and an additional 6.2% had participated in the audit offered by the program. This sums to 13% of the eligible population of the low-income multifamily market that had participated in some aspect of the program. Awareness of energy efficiency is high, among both participating and non-participating building owners. Non-energy benefits were seen as being an important component to the decision to participate in the program. Two-thirds of participants in 2003 were satisfied with their participation in the program. Finally, a majority of building owners and managers declared their intention to replace equipment with more efficient models in the future.

Estimated electrical energy, peak demand reduction, and fuel savings for the low income programs, as well as key progress indicators, are shown in Section 6.

Research and Development Programs

NYSERDA's R&D activities are organized into five primary program areas: energy resources, transportation and power systems, environment, industry, and buildings. Projects in each of these program areas address technologies and mechanisms that affect the energy supply and meet the needs of end users. As a result, crosscutting areas such as environmental protection, waste management, energy

⁹ Energy burden is the percentage of household income used to pay for energy.

product development, and renewable energy technologies are addressed in several areas. Programs in the R&D Program area are discussed in detail in Section 7.

Research and Development Program Evaluation Findings

Four types of projects were identified in the logic model developed for the R&D Program area:

- Pre-deployment: Projects that install commercially available products with high costs and risks.
- Demonstration: Projects that install commercially available technologies that involve a high degree of design and other risks.
- Product Development: Projects that involve proof of concept, development of a new prototype, testing of prototypes, or development and implementation of a commercialization or manufacturing plan for a new product.
- Research and Support: Projects that involve research, as in the Environmental Monitoring, Evaluation, and Protection Program, or involve market potential or assessment studies, or other activities designed to influence stakeholders such as policy makers, the research community, and the general public.

Analysis of the portfolio has led to the following observations:

- The CHP demonstration projects are a large part of the overall portfolio. The CHP demonstration program and will result in over 100 MW of peak demand reduction when all currently planned systems are operational.
- The financial support of other organizations is being enlisted to share risks. Co-funding from other organizations is higher for demonstration projects than for product development projects due to the lower risk for demonstration projects. Co-funding from other government entities is highest for the research projects.
- Knowledge is created through a variety of mechanisms including feasibility studies, demonstration projects, policy analysis, environmental monitoring, and other forms of applied research.
- Knowledge is disseminated to both the research and end-user communities.
- Installations of PV systems have resulted in 1.9 MW of installed capacity (1.3 MW of on-peak reduction) and nearly 3,000 MWh of annual production.
- The EMEP Program was successful in contracting most of its funding early in the program life and is now positioned to reap the benefits of the multi-year research projects.
- The Next Generation of Energy-Efficient End-Use Technologies Program has become more targeted in the solicitations in recent years by issuing technology-specific solicitations rather than casting a wide net.
- The wholesale market for renewable energy has been advanced through the support of a Green Marketing Program and by increasing the availability of wind resources.
- Renewable energy generation and electricity generation from CHP total over 185,000 MWh per year

The following are program-specific findings:

- The DG/CHP Program is comprised of two components. The first is Demonstrations which provide funding for site-specific demonstrations that contribute to the growth of CHP in New York. To date, the demonstration component has achieved a co-funding ratio of 4.5:1 and annual electricity generation of 66,182 MWh. In addition, the outreach effort has produced significant increases in awareness and knowledge among both end-use customers and developers.
- The second component of the DG/CHP Program is Power Systems Technology which aims to develop and field test innovative distributed generation technologies that enhance the environment and improve grid reliability. In recent years, greater emphasis has been placed on hydropower and DG aggregation and reduced emphasis on microturbines. As new businesses and products developed in this program emerge as viable commercial options, they have become eligible for supported under the deployment programs. Two recent examples of this pass-off to deployment are the commercial introduction of the “ecoJoule 3000” inverter and Plug Power’s GenCore 5T, a backup generator fuel cell product designed for the telecommunications market.
- End-Use Renewables (EUR) Program is designed to develop and grow the New York market for customer-sited renewable energy technologies. Since 2003, the number of participating installers has increased 128 percent and the average full-time equivalents employed by PV installer firms has increased 142 percent. It has been estimated that NYSERDA-funded PV systems account for 29% of the total PV installed capacity on record with the PSC and NYSERDA’s small wind installations represent 25% of the state’s total small wind energy capacity on record with the PSC.
- The Wholesale Renewable Energy Market Development Program is designed to develop the supply and demand for green power. Significant progress has been made in increasing awareness of residential customers with 66% having some understanding of green power. As of 2004, nearly 14,000 residential customers, 140 commercial customers and eight industrial customers have contracted to purchase nearly 128,000 MWh of green power. As of 2005, over 205,000 MWh was being sold by three green power marketing companies.
- The Environmental Monitoring, Evaluation, and Protection (EMEP) Program is designed to provide objective and policy-relevant research that results in: 1) enhanced understanding of the nature and characteristics of energy-related pollution and its impact on the environment and human health, 2) characterization of sources of energy-related pollution, and 3) identification of opportunities for emissions reduction. Its research efforts are split almost evenly between air quality and ecosystems with a small percentage devoted to crosscutting research. A total of 49 projects have been initiated, and 11 have been completed. Environmental monitoring data from hundreds of field sites throughout New York have been collected to support program goals. Achievements in knowledge dissemination have been significant with over 125 articles published in peer-reviewed journal. A citations analysis was conducted in mid-2005 revealed that the number of citations of articles published by EMEP researchers have been increasing steadily, from three citations during the 1996 to 2000 time period to 272 during the 2000 to 2004 time period. EMEP projects have affected energy-related environmental policy and research such as the development of Governor Pataki's Acid Deposition Reduction Initiative.
- The Strategic Energy Reliability Program aims to enhance the reliability of electric power by developing technologies and fuels that can provide grid support and end user reliability options during times when the electric system is operating at peak capacity or having power quality problems. Energy storage, liquefied natural gas, and truckstop electrification represent the top three areas in terms of funding.

- Next Generation of Energy-Efficient End-Use Technologies Program seeks to accelerate the demonstration and commercialization of emerging technologies such as smart sensors, superconductivity, innovative controls, and advanced diagnostics. For example, time-sensitive pricing projects encourage residential and small to medium-sized commercial/industrial customers to participate in demand response programs.