

# NEW YORK ENERGY \$MART<sup>SM</sup> PROGRAM EVALUATION AND STATUS REPORT

FINAL REPORT  
MAY 2005



**NEW YORK ENERGY \$MART<sup>SM</sup> PROGRAM  
EVALUATION AND STATUS REPORT**

**REPORT TO THE SYSTEM BENEFITS CHARGE  
ADVISORY GROUP**

**May 2005**

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## EXECUTIVE SUMMARY

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This report presents evaluation results for the **New York Energy \$mart<sup>SM</sup>** public benefits program (Program) for activities completed through year-end 2004.<sup>1</sup> The report was prepared jointly by staff of the New York State Energy Research and Development Authority (NYSERDA) and a team of evaluation assistance and specialty contractors acting under the terms and conditions of a Memorandum of Understanding (MOU)<sup>2</sup> between NYSERDA, 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 Group<sup>3</sup> (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 upon the evaluation framework and model used to guide prior evaluation efforts, summarized below under Evaluation Approaches, and constitutes the most comprehensive assessment to date of the **New York Energy \$mart<sup>SM</sup>** Program.

New York's public benefits program was initiated in 1998 by Order<sup>4</sup> 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. Justification for continuation of public benefits programs in a competitive market economy is based on the premise that important benefits are available that the private sector is not capturing fully. Public sector programs are able to serve unmet market needs and provide benefits for consumers they would not otherwise enjoy.

The **New York Energy \$mart<sup>SM</sup>** Program was created, in part, in response to recommendations made by the New York State Energy Planning Board<sup>5</sup> which was under legislative mandate to monitor the State's energy and environmental development. It identified the continuing challenges faced by New York in maintaining energy security, supporting sustainable economic growth, and increasing customer choices in energy decisions in a fair and equitable manner while contributing to a cleaner, healthier environment. The Energy Planning Board recognized that achieving these goals presented different and sometimes conflicting challenges:

- Increasing energy security requires investment in energy diversity, which could include new fossil-fueled and renewable electricity generation.
- Sustainable economic growth requires reducing energy costs and creating and expanding employment opportunities.
- Environmental improvements require investments in technologies and strategies to lessen the impact of energy use on the environment.

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<sup>1</sup> Previous annual reports dated September 2000, January 2002, May 2003, and May 2004 presented cumulative results from the Program's inception on July 1, 1998. Annual reports and quarterly reports are available on NYSERDA's website at [www.nyserdera.org](http://www.nyserdera.org).

<sup>2</sup> 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.

<sup>3</sup> 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

<sup>4</sup> Cases 94-E-0952 *et al.*, *In the Matter of Competitive Opportunities Regarding Electric Service*, Opinion No. 9612, issued May 20, 1996.

<sup>5</sup> The New York State Energy Planning Board is chaired by the President of NYSERDA and has as members the Commissioners of the Departments of Transportation, Environmental Conservation, and Economic Development and the Chairman of the Public Service Commission. The Board's enabling legislation expired in 2004.

Published in 1998 and 2002 by the New York State Energy Planning Board, the *New York State Energy Plan and Environmental Impact Statement*<sup>6</sup> contains numerous recommendations for ways that New York can meet its energy goals, setting targets for reductions in energy use and greenhouse gases. In response to these challenges, the State has implemented numerous strategies, including implementation of the **New York Energy \$mart**<sup>SM</sup> Program with system benefits charge (SBC) funds. By 2006, SBC funds will have provided almost \$1 billion to support a full range of programs to help the State meet its energy challenges.<sup>7</sup>

Also, creation of the **New York Energy \$mart**<sup>SM</sup> Program was, in part, a strategy to maintain important public purpose benefits during New York's electric industry restructuring as reported by the extensive record in the proceeding initiated by the PSC.<sup>8</sup>

The State's energy policy is based on the principle that heightened economic activity, improved environmental quality, and increased energy efficiency can be achieved by promoting competition among energy service providers and relying on competitive markets to deliver services to consumers. This principle is a cornerstone of the **New York Energy \$mart**<sup>SM</sup> Program.

The **New York Energy \$mart**<sup>SM</sup> 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 *Contract Reporter*.

The Advisory Group, created by order of the PSC, consists of twenty-four individuals representing diverse backgrounds and interests including utility companies, business and environmental groups, community organizations, professional and trade associations, other State agencies, and national energy efficiency and R&D experts. The Advisory Group serves as the Independent Program Evaluator and provides guidance and feedback on program administration. The Advisory Group meets three or four times each year.

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<sup>6</sup> New York State Energy Planning Board, *New York State Energy Plan and Final Environmental Impact Statement*, 1998, 2002.

<sup>7</sup> In addition to NYSERDA's **New York Energy \$mart**<sup>SM</sup> 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.

<sup>8</sup> Cases 94-E-0952 *et al.*, *In the Matter of Competitive Opportunities Regarding Electric Service*, Opinion No. 9612, issued May 20, 1996.

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.

NYSERDA's 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.

### **NEW YORK ENERGY \$SMART<sup>SM</sup> BUDGET AND SPENDING STATUS**

As shown in Table ES-1, the Program has an 8-year budget of approximately \$961.8 million. The budget has been allocated among four program areas:

- Business and Institutional program initiatives account for the largest share, 37.3% of the 8-year **New York Energy \$smart<sup>SM</sup>** Program budget, or \$359.1 million.
- Research and Development, including renewable technology deployment, accounts for 21.9% of the 8-year budget, or \$210.8 million.
- Residential Program initiatives account for 17.7% of the 8-year budget, or \$170.7 million.
- Funding for Low-Income Program initiatives accounts for 13.4% of the total 8-year budget, or \$128.4 million over this time period.

In addition to these major program areas, the 8-year program also funds an environmental disclosure program (\$2.9 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, 2004.

**Table ES-1. New York Energy \$mart<sup>SM</sup> 8-Year Funding Allocation Summary**

	8-Year Funding Allocation	Percent of Program Areas Budget	Percent of Total SBC Funding
<b>New York Energy \$mart<sup>SM</sup> Program Areas</b>			
Business and Institutional	\$359.1 million	41.3%	37.3%
Residential	\$170.7 million	19.6%	17.7%
Low-Income	\$128.4 million	14.8%	13.4%
Research and Development	\$210.8 million	24.3%	21.9%
<i>Subtotal Program Areas</i>	<i>\$869.0 million</i>	<i>100%</i>	<i>90.4%</i>
<b>New York Energy \$mart<sup>SM</sup> Other Costs</b>			
Administration	\$64.6 million	--	6.7%
Evaluation	\$16.2 million	--	1.7%
<i>Subtotal Administration and Evaluation</i>	<i>\$80.8 million</i>	<i>--</i>	<i>8.4%</i>
Environmental Disclosure	\$2.9 million	--	0.3%
NYS Cost Recovery Fee	\$9.0 million	--	0.9%
<b>Total 8-Year Budget<sup>a</sup></b>	<b>\$961.8 million</b>	<b>--</b>	<b>100%</b>
<sup>a</sup> Totals may not add due to rounding.			
Source: New York Energy \$mart <sup>SM</sup> Program – Financial Status Report, as of December 31, 2004.			

**Table ES-2. Financial Status of the New York Energy \$mart Program**

Program Area	8-year Budget (millions)	Funds Committed (millions)	% of 8-year Budget Committed	Funds Encumbered (millions)	% of 8-year Budget Encumbered
Business/Institutional	\$359.1	\$328.5	91.5%	\$299.6	83.4%
Residential	\$170.7	\$157.2	92.1%	\$154.3	90.4%
Low-Income	\$128.4	\$111.3	86.7%	\$86.1	67.1%
Research and Development	\$210.8	\$160.7	76.2%	\$137.2	65.1%
Environmental Disclosure	\$2.9	\$1.1	35.9%	\$0.7	22.2%
Evaluation	\$16.2	\$10.8	66.5%	\$10.3	63.4%
Administration	\$64.6	\$43.2	67.0%	\$43.2	67.0%
NYS Cost Recovery Fee	\$9.0	\$4.1	45.1%	\$4.1	45.1%
<b>Total<sup>a</sup></b>	<b>\$961.8</b>	<b>\$816.9</b>	<b>84.9%</b>	<b>\$735.5</b>	<b>76.5%</b>
<sup>a</sup> Totals may not add due to rounding.					
Source: New York Energy \$mart <sup>SM</sup> Program – Financial Status Report, as of December 31, 2004.					

## PORTFOLIO-LEVEL FINDINGS

NYSERDA's portfolio includes a full complement of energy efficiency and demand-reduction programs that serve most of New York. While NYSERDA's programs are organized internally according to traditional sector breakdowns, NYSERDA takes a systems-based approach to portfolio development and evaluation. Designation of a single program administrator permits information sharing among staff, planned collaboration, and allows management to exploit naturally occurring and manufactured synergies. The systems-based approach allows NYSERDA to actively manage programs and respond to changes in markets, technologies, and social trends. This approach allows NYSERDA to quickly modify program designs and implementation and delivery mechanisms.

The **New York Energy Smart<sup>SM</sup>** 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.

In addition, NYSERDA identified six objectives that describe what the Program expects to accomplish in meeting the public policy goals:

1. Reduce peak demand through improved energy management and load reduction.
2. Improve energy efficiency and reduce electricity use.
3. Save consumers, businesses, and institutions money.
4. Reduce the environmental impacts of energy use by promoting renewable energy and sustainable building practices and by monitoring and reducing the emissions of criteria air pollutants and greenhouse gases.
5. Foster long-term market changes, so benefits will be sustained.
6. Develop next generation technologies.

**Table ES-3** summarizes the progress NYSERDA and the **New York Energy Smart<sup>SM</sup>** Program have made toward achieving the PSC's goals.

**Table ES-3. Progress Toward Goals**

<b>Progress Toward Goals</b>
<b>Goal 1: Improve system-wide reliability and peak reduction through end user efficiency actions</b>
<ul style="list-style-type: none"> <li>▪ The <b>New York Energy \$mart<sup>SM</sup></b> programs have reduced peak demand through installed efficiency measures by 325 MW and have enabled 535 MW of callable load reduction.</li> <li>▪ Two of the largest <b>New York Energy \$mart<sup>SM</sup></b> programs – the Commercial/Industrial Performance Program (CIPP) and the Technical Assistance Program (TA) – are saving participating customers more than 830 GWh annually and have lowered peak demand by more than 135 MW.</li> <li>▪ The New Construction Program (NCP) has affected a significant percentage of non-residential new construction activity occurring in New York, increasing from slightly more than 1% in 2000 to a steady 10% to 11% per year from 2002 to 2004. When all new construction activity occurring during the five-year period 2000 to 2004 is considered, the Program’s penetration rate is nearly 10%.</li> <li>▪ Approximately 18% (526) of New York’s 2,900 unique architecture and engineering (A&amp;E) firms worked on <b>New York Energy \$mart<sup>SM</sup></b> non-residential new construction projects in the past two years. Approximately 174 energy services companies (ESCOs), A&amp;E firms, contractors, and manufacturers and more than 1,000 end-use customers have participated in the CIPP Program. Approximately 2,300 customers have completed Technical Assistance studies and audits, and another 300 projects are pending.</li> <li>▪ The percentage of residents in the <b>New York Energy \$mart<sup>SM</sup></b> territory who shift their laundry and dishwashing tasks to off-peak hours has grown steadily between 2002 and 2004 due to the Keep Cool and Stay Cool marketing campaigns, increasing from 42% to 90% for laundry and from 57% to 84% for dishwashing. These activities have resulted in an average hourly load shift of over 100 MW.</li> </ul>
<b>Goal 2: Improve energy efficiency and access to energy options for underserved customers</b>
<ul style="list-style-type: none"> <li>▪ As of year-end 2004, the Assisted Multifamily program (AMP) has affected approximately 13% of eligible low-income apartment units; 6.8% of units installed energy efficiency measures and 6.2% received audits.</li> <li>▪ Forty-seven percent of participants in the Smart Equipment Choices (SEC) program reported a significant increase in familiarity with energy efficiency over the past 5 years compared with 22% of non-participants. Nearly one-half (48%) of the contractors participating in the Technical Assistance Program stated that their familiarity with energy efficiency equipment has increased significantly in the past five years compared to 21% of the non-participating contractors. Awareness of the ENERGY STAR<sup>®</sup> label has increased steadily, from 34% in 1999 to 62% in 2003.</li> <li>▪ More than 18% of new residential homes are being built to ENERGY STAR<sup>®</sup> specifications. In the Home Performance with ENERGY STAR<sup>®</sup> (HPwES) program, 20% of homeowners doing remodeling report awareness of the program. The proportion of the home improvement market installing measures through the program increased from 0.21 – 0.34% in 2001 to 1.65 – 2.86% in 2003 and was 1.69 – 2.74% in 2004.</li> <li>▪ As of year-end 2004, nearly 9,000 advanced meters have been installed in apartments, primarily in Con Edison’s service territory. Over 90% of consultants, contractors, and manufacturers say their promotion of advanced metering to multifamily buildings has increased in the past two years, and 42% of consultants, contractors, manufacturers, and participating building owners say the availability of advanced metering has improved in the past two years.</li> </ul>
<b>Goal 3: Reduce environmental impacts of energy use</b>
<ul style="list-style-type: none"> <li>▪ The <b>New York Energy \$mart<sup>SM</sup></b> portfolio of energy efficiency and renewable energy projects reduced NOx emissions by 1,280 tons per year, SO<sub>2</sub> emissions by 2,320 tons per year, and CO<sub>2</sub> emissions by one million tons per year.</li> <li>▪ The Wholesale and End-Use Renewables programs have delivered 102 GWh of clean generation. The programs have achieved a summer coincident peak demand reduction of about 7 MW from installation of small and large-scale wind and photovoltaic systems.</li> </ul> <p>Over 125 peer-reviewed journal articles have been published based on Environmental Monitoring, Evaluation, and Protection Program (EMEP) research. Several EMEP research projects are providing the scientific foundation for the development of a PM2.5 State Implementation Plan, which will ultimately affect utilities and other fossil fuel combustion systems in New York. EMEP support of the two Mercury Deposition Network stations in New York, as well as mercury surveys on common loons and fish, are providing an environmental baseline that will be used to evaluate effectiveness of new mercury emission reductions affecting utilities.</p>

## Progress Toward Goals

### Goal 4: Facilitate competition to benefit end users

- The annual energy bill savings for participating **New York Energy \$mart<sup>SM</sup>** customers is estimated to be nearly \$200 million through year-end 2004. In the business and institutional sectors, **New York Energy \$mart<sup>SM</sup>** programs directly influenced the installation of energy efficiency measures by consumers not directly participating in the program. These measures contributed an additional 15% savings to New York customers.
- Sixty-three percent (63%) of customers agree that ENERGY STAR<sup>®</sup> equipment is higher quality than standard equipment.
- The ENERGY STAR<sup>®</sup> Products program has resulted in sales of more than 800,000 energy efficient appliances and almost 1.4 million efficient lighting products. In the residential sector, NYSERDA's program efforts have helped increase the market penetration of ENERGY STAR<sup>®</sup> refrigerators among retail partners from 24% in 1999 to 44% in 2004; from 24% to 73% for dishwashers; from 13% to 37% for clothes washers; from 22% to 76% for room air conditioners; and from 39% to 49% for compact fluorescent lamps.
- ESCO activity in New York has increased during the past five years with nearly half of the participating and non-participating contractor respondents reporting increased activities by ESCOs and improved quality of work by ESCOs. More than half of the end-use customers (55%) and 41% of the ESCOs participating in the CIPP program stated that the availability of energy efficiency measures has become less of a market barrier in the past five years.
- Nearly 84% of motor vendors in New York have participated in the Premium Efficiency Motors (PEM) program.

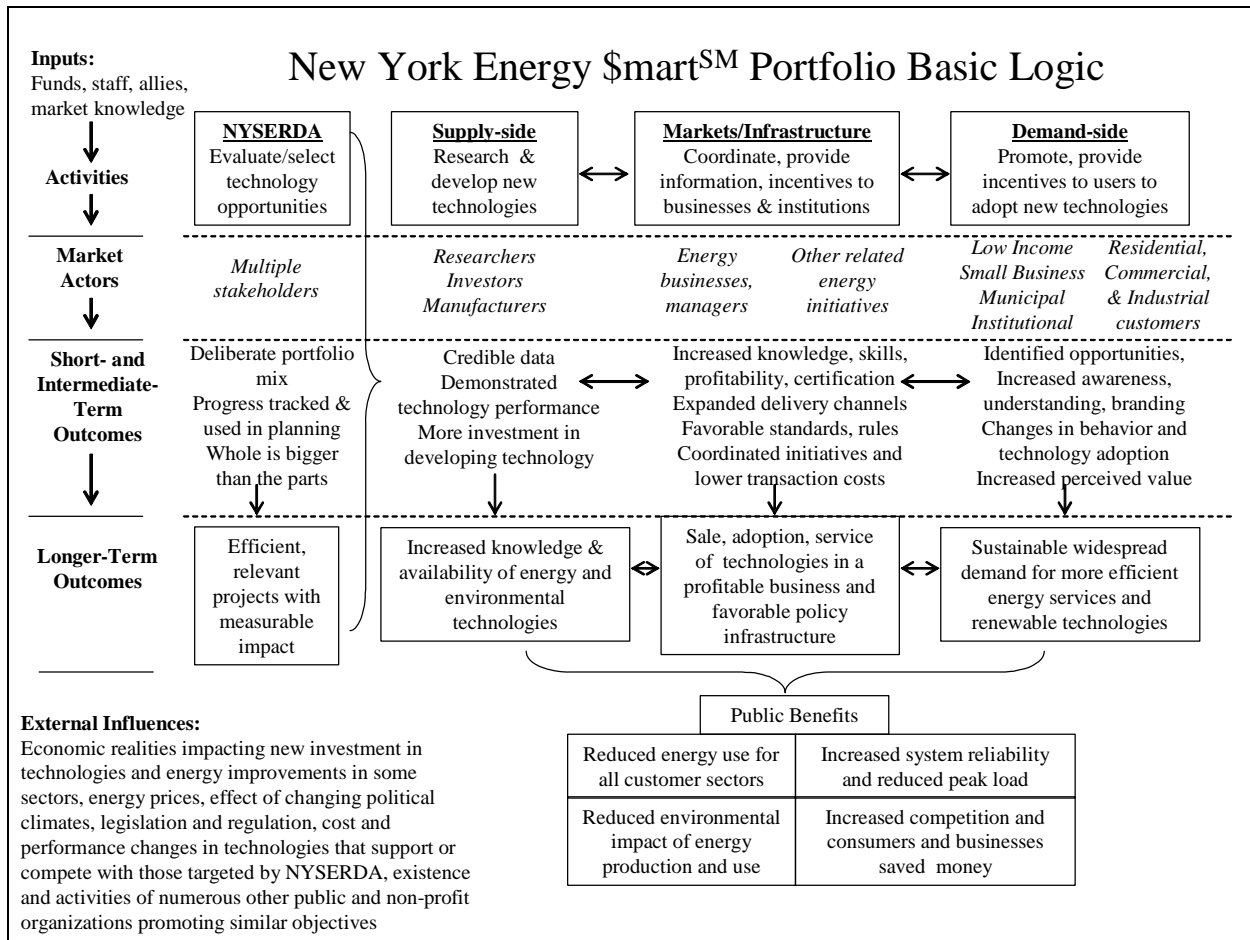
## Portfolio Theory and Logic<sup>9</sup>

Figure ES-1 presents the **New York Energy \$martK** portfolio-level logic diagram. In the diagram, **New York Energy \$martK** Program activities are shown in boxes across the top. The logic diagram continues, from top to bottom, showing how these activities work with program inputs and market actors to achieve certain outputs and short-term outcomes for the purpose of achieving intermediate and long-term goals (shown at the bottom of the diagram in text boxes). A logic chain for the **New York Energy \$martK** Program evaluation, program selection and management activities, and inputs and potential external influences are also noted on the diagram.

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<sup>9</sup> This model first appeared in the May 2004 **New York Energy \$martK** Program Evaluation and Status Report. A review and update will be included in the May 2006 **New York Energy \$martK** Program Evaluation and Status Report.

**Figure ES-1. New York Energy \$mart<sup>SM</sup> Program Portfolio Logic**



### **Summary Of Program Benefits**

Table ES-4 provides a summary of quantifiable benefits achieved by the **New York Energy Smart<sup>SM</sup>** portfolio of programs for the past three years.

**Table ES-4. Cumulative Program Benefits from Installed Measures**

<b>Benefits</b>	<b>Through Year-End 2002</b>	<b>Through Year-End 2003<sup>10</sup></b>	<b>Through Year-End 2004</b>
Electricity Savings From Energy Efficiency and On-Site Generation (Annual GWh)	690	1,000	1,400
Peak Demand Reduction (MW)	652	880	860
Permanent Measures	218	270	325
Curtable	434	610	535
Annual Energy Bill Savings (\$ Million)	\$103	\$140	\$195
Net savings for gas and oil (Annual MMBtu)	na	na	2,600,000
Renewable Energy Generation (Annual GWh)	103	103	102
Jobs Created and Retained per Year	3,200	3,500	4,200
Job Years <sup>11</sup>	na	na	42,000
NOx Emissions Reductions (Annual Tons)	790	950	1,280
SO <sub>2</sub> Emissions Reductions (Annual Tons)	1,270	1,700	2,320
CO <sub>2</sub> Emissions Reductions (Annual Tons)	640,000	750,000	1,000,000
Equivalent number of cars removed from New York roadways.	127,000	150,000	200,000

### **Portfolio-Level Process Recommendations**

NYSERDA and its specialty contractors formed a process evaluation team to conduct a process evaluation of the **New York Energy Smart<sup>SM</sup>** Program during the past two years. A process evaluation reviews how program activities and customers interact and recommends ways to improve program processes to increase efficiency and effectiveness. A detailed description of the process evaluation team's portfolio-level activities is in Section 4.

Two groups of process themes reoccur – success themes and challenge themes – with extensive interactions among them. Some areas with challenges show evidence of moving to successful resolution and some areas are successful because they emerged from challenges in earlier years.

<sup>10</sup> Energy and emissions benefits not adjusted for overlap among programs.

<sup>11</sup> Job years refers to the creation of full-time equivalent positions over the term of the activity credited to the program. For example, one job is the equivalent of one person working full time for one year. The same position lasting ten years is equivalent to ten job years. Job years are usually estimated in ten-year blocks. 4,200 jobs for 10 years yields 42,000 job years.

Key success themes are: capable staff, effective use of implementation contractors, sound program management for programs operated internally by NYSERDA staff, and satisfied program participants.

Key challenge themes that remain opportunities for improvement are: policy issues, funding delays, slow NYSERDA processes, perceptions of complexity by potential participants, limited use of feedback among NYSERDA staff, and inadequate databases.

It is evident from the process team's activities that project staff have developed strong program management skills; are creative, and display knowledge of NYSERDA's administrative processes. These skills used in the implementation of the **New York Energy \$mart<sup>SM</sup>** programs have led to satisfied program participants.

## **COST-EFFECTIVENESS OF PROGRAMS**

In assessing the cost-effectiveness of the **New York Energy \$mart<sup>SM</sup>** Program, two methods are necessary. For deployment and market transformation programs for which energy and demand savings can be estimated, an economic benefit/cost (B/C) 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. For these programs, the value/cost analysis was developed to assess the benefits qualitatively and to monitor progress toward measurable energy, economic, and environmental benefits.

### **Benefit/Cost Analysis**

Starting in 2003, a team of specialty contractors verified reported program savings, measured market effects, assessed the degree to which NYSERDA might claim credit for the energy savings, estimated non-energy benefits for selected programs, and conducted an analysis of the macroeconomic benefits attributable to the programs. A total of eighteen programs were included in the B/C analysis: nine business and institutional programs, six residential programs, and three low-income programs. Two general tests were used. The total market effects test (TMET) compares the benefits to both the program and customer costs. The program efficiency test (PET) compares the benefits to just program costs.

Various scenarios were addressed in the B/C analysis. Scenarios include one that limits benefits to just energy savings and those that also include the impacts of programs on energy prices, non-energy benefits such as comfort and equipment performance, and macroeconomic benefits such as increased employment opportunities. The TMET ratio for the scenario that limits benefits just to energy savings is most similar to the total resource cost test formerly used by utilities.

Because the **New York Energy \$mart<sup>SM</sup>** Program is a public benefits program, diverse objectives and benefits are sought that, in many cases, cannot be easily quantified. For example, low-income programs emphasize equity and certain Business and Institutional programs work to strengthen the support infrastructure for energy services companies. Therefore, individual B/C ratios alone are not used as evidence to support or curtail program efforts. NYSERDA includes B/C ratios as one element among numerous decision criteria for this purpose. Programs are continually reviewed and revised by NYSERDA in response to customer feedback and evaluation findings.

Nevertheless, a B/C analysis is an important indicator of a program's efficiency. In general, a total resource cost B/C ratio equal to or greater than 1.0 is ideal, indicating that benefits equal or exceed costs. Within the diverse NYSERDA portfolio, some programs in the low-income sector have B/C ratios below 1.0. Since these programs in the portfolio are designed to have broad, non-specific impact on the energy efficiency market, B/C ratios less than one for these programs are not unexpected. However, when

programs are viewed as a portfolio, the B/C ratio is 2.1 even using just the energy savings and is 3.9 when additional quantified benefits are added.

Table ES-5 shows the results of the sector-level benefit/cost analysis, both with and without sector costs that are not attributable to any one program, *e.g.*, energy efficiency awareness publicity and energy conservation tips campaigns. Table ES-6 shows the portfolio-level ratios.

**Table ES-5. Benefit/Cost Analysis**

		Total-Market-Effects Test <sup>12</sup>		Program-Efficiency Test <sup>13</sup>	
		Without Additional Sector Costs	With Additional Sector Costs	Without Additional Sector Costs	With Additional Sector Costs
<u>Scenario #1</u> Includes avoided costs and spillover	Business / Institutional	2.8	2.7	6.5	6.0
	Residential	1.3	1.1	3.4	2.2
	Low-Income	1.0	0.9	1.2	1.0
<u>Scenario #2</u> Includes #1 plus energy market price benefits	Business / Institutional	3.2	3.1	7.4	6.8
	Residential	1.5	1.2	3.7	2.4
	Low-Income	1.1	1.0	1.3	1.1
<u>Scenario #3</u> Includes #2 and non-energy benefits	Business / Institutional	4.8 – 6.5	4.6 – 6.2	11.0 – 14.9	10.1 – 13.7
	Residential	2.0 – 2.6	1.7 – 2.2	5.2 – 6.7	3.4 – 4.4
	Low-Income	1.6 – 2.0	1.3 – 1.7	1.8 – 2.2	1.5 – 1.9
<u>Portfolio</u> Includes macroeconomic benefits		5.9 – 7.2	5.4 – 6.6	13.5 – 16.4	11.0 – 13.4

**Table ES-6. Portfolio-Level Benefit/Cost Ratios**

	TMET		PET	
	Without Additional Sector Costs	With Additional Sector Costs	Without Additional Sector Costs	With Additional Sector Costs
Scenario #1	2.3	2.1	5.1	4.3
Scenario #2	2.5	2.3	5.8	4.8
Scenario #3 <sup>1</sup>	3.8 – 5.0	3.4 – 4.6	8.5 – 11.4	7.1 – 9.5
Scenario #4 <sup>2</sup>	5.9 – 7.2	5.4 – 6.6	13.5 – 16.4	11.0 – 13.4

<sup>12</sup> The Total-Market-Effects Test compares program costs and participant costs with total benefits over the average life of the program measures.

<sup>13</sup> The Program-Efficiency Test compares program costs with total benefits over the average life of the program measures.

### Value/Cost Analysis

The goals of R&D programs are reducing energy use, reducing demand, and, in the long term, providing economic benefits for New Yorkers. Value/cost analysis attempts to measure and ascribe values to long-term-benefits, and leading indicators can show whether programs are on target for meeting them. As a first step in the value/cost effort, a preliminary logic model was developed for a select group of R&D projects. In the second pilot phase, methods were identified for measuring and tracking leading indicators and long-term outcomes. The following programs were selected for analysis in the pilot phase of the value/cost evaluation:

- In 2000, NYSERDA embarked on a multi-year program to promote **Truck Stop Electrification (TSE)**. Funding is provided to install equipment and infrastructure that allow truck operators access to electric power without idling their engines during rest periods. The availability of alternative power saves long-haul truckers fuel costs and has significant emissions reduction benefits.
- The **Air-Conditioning and Refrigeration Technology Institute (ARTI) 21<sup>st</sup> Century Research Program** identifies, prioritizes, and conducts research related to air-conditioning and refrigeration technologies. Goals of the program are decreasing energy consumption, increasing indoor environmental quality, and safeguarding the environment.
- The goal of the **Continuous Ambient Particulate Monitor Development and Innovative Instrument for Ambient Air Particles Projects** was to enhance the capabilities of an existing instrumentation technology that measures the ambient levels of PM<sub>2.5</sub> particulates.
- NYSERDA's **Aggregating Distributed (Backup) Generators** project was a three-year effort to demonstrate that, when aggregated, existing backup generators could be cost-effectively dispatched to provide spinning reserve capacity and peaking energy.
- The **Compressed Air System Efficiency Program** sought to increase the use of efficient compressed air technologies by small and medium-sized manufacturers in New York. The program assisted vendors in developing a low-cost, credible compressed air system service.

The following is a partial list of the criteria being used to conduct the value/cost evaluation of these projects:

- The realized and potential energy, economic, and environmental benefits attributable to the project.
- The extent to which the project has attracted capital for advancing commercialization, including resources provided by collaborative partners.
- The extent to which the project has accomplished important technical achievements, including the development of prototypes.
- The extent to which project activities have helped to overcome key market barriers and move the technology closer to commercialization as evidenced by increased awareness of a technology through demonstrations at customer sites, development of sustainable business models, changes in market penetration, employment changes occurring within the company and in companies leading the project, and number of recognition awards.
- Number of journal articles, newspaper articles, press releases, and media presentations published and the effectiveness of media distributions.
- Number and types of reports and fact sheets published and the effectiveness of distributions.
- The number of patents and copyrights filed and granted.

- Number and purposes of conferences, workshops, seminars, and other presentations and size and type of audiences reached.
- Websites developed, number of hits on websites, and counts of reports, articles, fact sheets, and other publications that have been downloaded.

#### Value/Cost Analysis Results

Assessments of the five projects using the above criteria were conducted by a peer group of experts in the R&D and energy communities. Preliminary findings indicate that, in general, NYSERDA's R&D portfolio: does a good job of balancing risk; covers a wide range of technologies designed to create and disseminate knowledge, advances progress toward commercialization, and achieves energy, economic, and environmental benefits; leverages funds at a ratio of \$4.3 dollars realized for each \$1 spent; and engages a variety of public and private organizations and institutions.

The pilot process presented NYSERDA with a "learning curve" with respect to value/cost analyses and validated the peer review method. Lessons learned included:

- Reviewers can assess a fair amount of information if the information is presented in a clear, organized format.
- Reviewers were able to provide thoughtful assessments of the projects based on the information provided.
- Indicators were valid and reliable for a diverse mix of R&D projects addressing different technologies at different stages of development.
- Recruiting and obtaining ratings from peer reviewers on specific projects is manageable and achievable at relatively small cost.

### **MACROECONOMIC IMPACT ANALYSIS**

Previous economic evaluations of the **New York Energy Smart<sup>SM</sup>** 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.

The macroeconomic impact analysis of the programs undertaken for this report quantified the programs' net impacts by estimating the impacts of program expenditures and energy savings that would have resulted if the programs had not been implemented and if the system benefits charges had not been paid by ratepayers and comparing those estimates to spending resulting from program activities. The net macroeconomic impacts are expressed in terms of annual employment, labor income, total industry output, and value added. The analysis covered the eight years of Program implementation from 1999 to 2006 and the ten years following Program implementation, from 2007 to 2016.

The analysis used an input-output model<sup>14</sup> to characterize the myriad interdependencies in New York's economy and to describe how the expenditures of each group in the economy differ. An input-output model is a detailed representation of a pattern of transactions among industries in an economy and describes the interrelationships among these industries and the other sectors of the economy (*e.g.*, households and government entities). An input-output model allows the analyst to use the information in the model to estimate the total economic effects of a change in expenditures starting with decreased

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<sup>14</sup> The input-output model used the IMPLAN Pro software system (Version 2.0) developed by the Minnesota IMPLAN Group.

expenditures for electricity and extending to such consequences as decreased employment in industries that supply the electricity sector.

The first step in the analysis was to develop a Base Case to estimate the impact on the New York economy if public benefits funds had been retained by customers of participating utilities. The analysis then developed a Program Case to estimate the impact on the New York economy as funds allocated to the **New York Energy \$mart<sup>SM</sup>** Program were spent on goods and services. By comparing the impacts of the Base Case and Program Case, the analysis provided a comprehensive assessment of the net macroeconomic impacts of the **New York Energy \$mart<sup>SM</sup>** programs.

The analysis includes the estimated impacts of the following primary factors:

- **New York Energy \$mart<sup>SM</sup>** Program expenditures.
- Co-funding expenditures by program participants.
- Stream of energy bill savings by program participants.
- Opportunity cost of **New York Energy \$mart<sup>SM</sup>** Program expenditures (*i.e.*, the potential impacts of the amount of funds collected from customers if they were to be spent by the contributing customers in the absence of the **New York Energy \$mart<sup>SM</sup>** Program).
- Opportunity cost of co-funding expenditures (*i.e.*, the potential impacts of the co-funding expenditures if they were spent in normal consumption and investment patterns in the absence of the **New York Energy \$mart<sup>SM</sup>** Program).
- Impact of reduced economic activity in the energy-providing sector due to reduced purchases.

Table ES-7 summarizes the results of the analysis and illustrates the ultimate finding that the Program provides net macroeconomic benefits to New York in the form of increased employment, labor income, total output, and value added. Averaged over the 18-year analysis period, the Program creates and sustains more than 4,400 jobs, increases labor income by \$168 million per year, increases total output by \$220 million per year, and increases value added by \$94 million per year. Note that the previous year’s results are also included in the table.

**Table ES-7. Summary of Macroeconomic Impacts of the New York Energy \$mart<sup>SM</sup> Program**

Economic Variable	Program Implementation Years (1999-2006)		Years Following Program Implementation (2007-2016)		Annual Average over 18-Year Analysis Period (1999-2016)	
	2003	2004 Update	2003	2004 Update	2003	2004 Update
Jobs	5,492	4,779	4,201	4,109	4,774	4,407
Labor Income	\$236 million	\$211 million	\$138 million	\$134 million	\$182 million	\$168 million
Total Output	\$428 million	\$407 million	\$61 million	\$71 million	\$224 million	\$220 million
Value Added	\$221 million	\$205 million	\$9 million	\$5 million	\$103 million	\$94 million

Substantial net macroeconomic benefits to New York take the form of increased employment during the Program implementation years (1999-2006) and throughout the years following implementation (2007-2016) as energy efficiency measures implemented by the program continue to accrue annual energy savings. An estimated average net gain of more than 4,400 jobs was found in each year over the 18-year analysis period. The increase in jobs created during Program implementation years (1999-2006) largely reflects the impacts of Program expenditures as programs are developed. The impacts of energy savings

increase each year during the implementation years as more energy efficiency and demand reduction measures are installed and begin operating. The jobs created and sustained in the years following Program implementation are a result of the continuing stream of energy bill savings that results from the measures installed under the Program.

During the Program implementation years (1999-2006), the Program Case will create and sustain nearly two times the number of jobs as the Base Case (a 171% increase). In the years following Program implementation, the Program Case will create and sustain more than 21 times the number of jobs as the Base Case (or 2,186%).

Increased labor income is another area in which the analysis indicates that the **New York Energy \$mart<sup>SM</sup>** Program provides substantial net macroeconomic benefits to New York. The estimated result is an average net gain of more than \$168 million in labor income in each year for the 18-year analysis period. During the Program implementation years (1999-2006), the Program Case will provide two and one-half times more labor income than the Base Case (149% increase). In the years following Program implementation, the Program Case will provide more than three times (238% increase) more annual labor income than the Base Case.

## EVALUATION APPROACHES

The comprehensive evaluation program undertaken by NYSERDA and its specialty contractors uses numerous approaches which are presented briefly below and described in detail in Appendix B. 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.* A theory and logic evaluation describes and refines the theoretical underpinnings of market transformation and resource acquisition programs for NYSERDA's portfolio and individual programs, reviews the logic of the portfolio and program approaches, and develops researchable issues and success indicators to assess progress toward goals. For NYSERDA's portfolio-level program logic, see Figure ES-1, **New York State Energy \$mart<sup>SM</sup>** Program Portfolio Logic.

*Measurement and Verification (M&V).* The goal of an M&V evaluation is to determine the extent to which processes for measuring, calculating, and reporting energy efficiency savings and renewable energy generation are sufficiently rigorous and accurate to be relied upon with confidence. An M&V review consists of record reviews, checking engineering calculations and savings algorithms, reviewing project records, and conducting project inspections on site to ensure that equipment is properly installed and operated. The result of an M&V evaluation is a realization rate, *i.e.*, the percentage of reported savings that were confirmed.

*Process Evaluation.* A process evaluation reviews how program activities and customers interact and recommends ways to improve program processes to increase efficiency and effectiveness.

*Cycle Time Evaluation.* Cycle time evaluation is a subset of process evaluation and measures how quickly and efficiently applications, solicitations, and other paperwork are handled.

*Market Characterization, Assessment, and Causality (MCAC).* MCAC evaluation uses a multifaceted approach that defines and describes market actors and facilities targeted by NYSERDA programs (market characterization), determines the effect of program activities on market progress indicators (market assessment), and examines freeridership<sup>15</sup>, spillover<sup>16</sup>, and non-energy benefits, such as increased comfort and lower operating costs, generated by programs to determine the effect of programs (causality).

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<sup>15</sup> Actions that received funding and that evaluators estimate would have been taken anyway. This concept is also known as naturally occurring adoption.

<sup>16</sup> Actions that did not receive funding from programs but were still influenced by the programs.

*Benefit/Cost and Value/Cost Analysis.* NYSERDA uses two methodologies to assess cost effectiveness of its programs. Deployment and market transformation programs for which energy and demand savings can be estimated are analyzed using an economic benefit/cost analysis that monetizes savings and compares them to costs. R&D programs that are designed to accomplish objectives that cannot be easily monetized are analyzed using a value/cost analysis.

*Macroeconomic Impact Analysis.* For the **New York Energy \$mart<sup>SM</sup>** Program, NYSERDA's uses an input-output model to characterize the economic impact of the program in terms of annual employment, labor income, total industry output, and value added.

## **BUSINESS AND INSTITUTIONAL PROGRAMS**

Business and 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 program area are discussed in detail in Section 5.

Since the inception of the **New York Energy \$mart<sup>SM</sup>** Program in 1998, B/I programs have made substantial progress improving the system-wide reliability and stability of the electric grid. Progress has been made by implementing a number of strategies including educating end users and supporting new energy markets and infrastructure. Owners and operators of large commercial, industrial, and multifamily buildings have been provided with information and training to understand the advantages of making good energy management choices such as reducing their demand for electricity during peak periods and shifting load from peak to non-peak periods. Such energy management choices have benefits for consumers by reducing their costs and contribute significantly to the stability of the electric grid, especially in heavily populated "load pockets" downstate.

Reducing energy use also has positive environmental benefits as does avoiding the need for new generation. Another area where B/I programs have had a significant impact is development of awareness of the value of sustainable design. Financial and technical assistance has led to a growing number of "green" buildings built to LEED<sup>TM</sup> guidelines.

Of special interest is the recent finding from a survey of contractors that evidence of NYSERDA's support and affiliation with contractors adds credibility to their business models and raises the level of trust among potential customers and, perhaps more important, among potential financial backers.

A major goal of the B/I program remains elusive. Strengthening the competitive electricity market remains important, but realization is frustrated by structural barriers. For example, providing metering technologies that will allow consumers to fully understand and select time-of-use electricity rates is stymied. At the present time, utility customers in residential rate classes are ineligible for time-of-use rates and movements to remove the limitation have been unsuccessful to date.

B/I staff continue battling the intractable problem of providing energy efficiency information and services to hard-to-reach customers such as small commercial businesses and residents in rental buildings who pay for electricity but do not benefit from cost savings that accrue from energy projects. Until NYSERDA and other program administrators seeking to save energy and costs can figure out how to provide savings benefits to renters and lessees, this problem will remain a challenge.

B/I staff, like all NYSERDA program staff, continually scan the horizon for opportunities to improve the efficient use of energy, reduce energy use, and improve the environment.

## **Business and Institutional Program Evaluation Findings**

Key findings from B/I Program evaluation activities include:

- NYSERDA brings credibility to the various services offered through its programs and contractors in two ways: (1) helping contractors sell the programs and energy efficiency measures, and (2) giving end-use customers a higher level of confidence.
- Most barriers to energy efficiency (*e.g.*, lack of availability of products, services and information; lack of experience; and uncertainty about savings and other benefits) have decreased to some extent; however, first cost has remained a key barrier to purchasing and installing energy efficiency measures.
- An appropriate level of freeridership indicates that programs are in line with the market and that market transformation is under way. The B/I programs also resulted in spillover of energy savings.
- In addition to direct energy savings, the programs provide non-energy benefits to customers. Non-energy benefits could be promoted as reasons for participation and used by NYSERDA for marketing purposes.
- Program participants consistently report higher levels of awareness of energy efficiency than non-participants for the New Construction, CIPP, Smart Equipment Choices, and Technical Assistance programs.
- The CIPP and Technical Assistance programs together have saved participating customers more than 830 GWh and lowered peak demand by more than 140 MW.
- The New Construction Program has established a solid marketing position and continues to meet its stated goal of affecting 5% to 10% of annual new construction activity occurring in New York. About one-half of the top ten architect and engineering firms have participated in the New Construction Program.
- The process evaluations for the CIPP and New Construction programs found that participants are satisfied with the programs and are making investments in energy efficiency as a result of these programs. A process evaluation of nine mid-market B/I programs focused on implementation contractors and found them to be capable and knowledgeable about their markets.

## **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 6.

Beginning in 1998, NYSERDA developed an innovative residential energy program that is now a model for numerous programs elsewhere in the United States. The residential programs have two major strategies. Recognizing that consumers drive the market and having a firm commitment to market transformation, one major strategy of NYSERDA's residential programs is to focus on increasing consumer demand by convincing them of the multiple benefits of investment in energy-efficient products and services. Because the residential market is huge in numbers but small in individual impacts, reaching a broad audience is important. While remaining an essential component of residential programs, approaching individual consumers in the traditional manner, for example, owners and operators of small, independent multifamily buildings, cannot alone accomplish the necessary large-scale impacts. Therefore, in conjunction with education and awareness activities, NYSERDA's second major strategy is







