

New York State Energy Research and Development Authority

Operating Plan for Technology and Market Development Programs (2012–2016)

System Benefits Charge

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Case 10-M-0457





NYSERDA's Promise to New Yorkers:

New Yorkers can count on NYSERDA for objective, reliable, energy-related solutions delivered by accessible, dedicated professionals.

Our Mission: Advance innovative energy solutions in ways that improve New York's economy and environment.

Our Vision: Serve as a catalyst—advancing energy innovation and technology, transforming New York's economy, and empowering people to choose clean and efficient energy as part of their everyday lives.

Our Core Values: Objectivity, integrity, public service, and innovation.

Our Portfolios

NYSERDA programs are organized into five portfolios, each representing a complementary group of offerings with common areas of energy-related focus and objectives.

Energy Efficiency and Renewable Programs

Helping New York to achieve its aggressive clean energy goals – including programs for consumers (commercial, municipal, institutional, industrial, residential, and transportation), renewable power suppliers, and programs designed to support market transformation.

Energy and the Environment

Helping to assess and mitigate the environmental impacts of energy production and use – including environmental research and development, regional initiatives to improve environmental sustainability, and West Valley Site Management.

Energy Technology Innovation and Business Development

Helping to stimulate a vibrant innovation ecosystem and a clean energy economy in New York – including programs to support product research, development, and demonstrations, clean-energy business development, and the knowledge-based community at the Saratoga Technology + Energy Park®.

Energy Data, Planning and Policy

Helping to ensure that policy-makers and consumers have objective and reliable information to make informed energy decisions – including State Energy Planning, policy analysis to support the Regional Greenhouse Gas Initiative, and other energy initiatives; and a range of energy data reporting including *Patterns and Trends*.

Energy Education and Workforce Development

Helping to build a generation of New Yorkers ready to lead and work in a clean energy economy – including consumer behavior, youth education, and workforce development and training programs for existing and emerging technologies.

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Executive Summary

The New York Public Service Commission's (PSC) decision to establish a System Benefits Charge (SBC) program over a decade ago has led to one of the nation's most vibrant energy efficiency and renewable energy markets in the country. The PSC reaffirmed its commitment to the continuation of the SBC program and to the important role that the SBC plays in meeting State policy goals by issuing the *Order Continuing the System Benefits Charge and Approving an Operating Plan For A Technology and Market Development (T&MD) Portfolio of System Benefits Charge Funded Programs* (the Order). The Order, issued on October 24, 2011, approved the T&MD portfolio proposed by the New York State Energy Research and Development Authority

(NYSERDA) for the five-year period of January 1, 2012 through December 31, 2016, with some modifications. The October 24, 2011 Order directed NYSEDA to submit a supplemental revision to the T&MD Operating Plan (by December 23, 2011) to incorporate the changes as a result of the Order. On September 13, 2012, the PSC issued an *Order Authorizing the Reallocation of Uncommitted System*

Benefits Charge III Funds, based on a Petition that NYSEDA had submitted on March 30, 2012. The Order added \$25,760,672 of uncommitted SBC III funds to the T&MD Portfolio which is reflected in NYSEDA's Supplemental Revision to the T&MD Operating Plan that was filed on November 13, 2012.

On December 17, 2012, the PSC issued an *Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives*. The Order transferred \$35,915,573 of re-allocated Energy Efficiency Portfolio Standard (EEPS-2) funds, and \$49,972,830 of uncommitted EEPS-1 funds to the T&MD Portfolio, which will be used for the Combined Heat and Power (CHP) Performance Program and the Workforce Development Program.¹ The Order also transferred \$1,510,002 of uncommitted SBC III funds to the T&MD Portfolio for Program Evaluation funding associated with the program funds transferred in the September 13, 2012 Order. Further, the Order directs NYSEDA to file a Supplemental Revision to the T&MD Operating Plan by February 15, 2013. In total, the T&MD Operating Plan includes approximately \$523 million of

Mission of the T&MD Portfolio

Test, develop, and introduce new technologies, strategies and practices that build the statewide market infrastructure to reliably deliver clean energy to New Yorkers

¹ NYSEDA filed a Petition for Combined Heat and Power Performance Program Funding on March 30, 2012, based on the October 24, 2011 Order which directed NYSEDA to identify potential sources of funds for the Program. NYSEDA also filed the Petition for Allocation of Uncommitted EEPS funds for Workforce Development Initiatives on March 30, 2012.

SBC funds over five years with an average annual budget of \$104.70 million. The budget represents average annual funding of \$89.94 million in program costs for nine T&MD Initiatives.

Benefits to New York and New York Ratepayers

The purpose of the T&MD investments is to advance the achievement and realization of the PSC's policy objectives, as reflected in the Energy Efficiency Portfolio Standard (EEPS) and Renewable Portfolio Standard (RPS), and to advance New York's clean energy goals including economic growth and job creation. The T&MD portfolio contained in this Operating Plan will allow New York to capitalize on its many innovation assets to achieve a vibrant, clean-energy economy.

The next phase of the SBC is designed to effectuate long-lasting and significant contributions to New York's energy and economic future by: catalyzing innovation and strategic investments in the power delivery system; enhancing system reliability; promoting advanced building design, retrofits and "smarter" buildings; advancing electrification of the transportation sector; developing New York State's indigenous renewable resources; reducing electricity use and load in crucial New York sectors; and supporting behavioral and market research to maximize system and ratepayer benefits.

While the T&MD portfolio is generally not a resource acquisition program, it will contribute substantially to the 15 by15 goal. In addition to electricity savings, the T&MD portfolio will deliver other critical benefits to New York that are vital to New York's longer-term clean energy and economic development goals. These include reducing fossil fuel use, reducing and better managing demand, stimulating technology innovation and job growth in New York, developing a clean energy workforce, informing policy development and utility smart-grid capital investments, and leveraging investment in clean energy technology.

Following are **highlights** of the T&MD Portfolio benefits that are estimated to accrue:

- At full implementation, the T&MD Portfolio is estimated to achieve 1,189,300 MWh of electricity savings, over 6,125,800 MMBtu of fossil fuel savings, and to have reduced peak demand by 375.4 MW.
- Of the 1,189,300 cumulative annual MWh that the T&MD portfolio is expected to achieve when fully implemented, 365,200 MWh are estimated to be achieved by 2015. This is about 60% higher than the 225,550 MWh of the 2015 wedge assigned to the SBC-funded T&MD portfolio.²
- On-site generation representing 47.5 MWs of summer peak demand reduction is expected to be installed, generating an estimated 337,250 MWhs, and providing 438,425 MMBtus of primary energy savings.

² Several other non-EEPS NYSERDA programs, including those funded by the American Recovery and Reinvestment Act (ARRA) and the Regional Greenhouse Gas Initiative (RGGI), will also contribute to the 15 by 15 policy goal, as outlined in Appendix C.

- CO₂ emissions are expected to be reduced by nearly 850,000 tons.
- More than 89 advanced technologies will reach commercial availability or be adopted by the market.
- Approximately \$799.5 million of funding will be leveraged (co-funding or outside investment).
- Commercial sales of new and improved technologies will be over \$184 million.
- Approximately 39,000 training opportunities will be provided for practitioners.³
- Over 725 clean energy companies will be assisted with 162 startups graduating from Clean Tech incubators.
- NYSERDA will have developed partnerships with 1,750 retail and supply businesses to increase market share of energy efficient products.
- New policy recommendations and business models and practices to break down market barriers will have been developed and tested.

Objectives and Priorities of the T&MD Portfolio

In developing the proposed T&MD portfolio, NYSERDA considered: opportunities to address challenges that face the State's utility systems and ratepayers; technical and market opportunities and barriers to clean energy; areas where benefits to New York could be great; different technology and market development needs across the State's diverse regions (i.e., geographic balance); and its experience in running the current SBC program. NYSERDA used the input from 225 organizations that participated in an intensive stakeholder outreach process leading up to development of this T&MD Operating Plan. Stakeholder input and feedback was invaluable and will continue to be an important element of the implementation of the T&MD program going forward. NYSERDA has created a T&MD advisory group comprised of experts and stakeholders.

Objectives of the T&MD Portfolio

Move new/underused technologies and services into marketplace to serve as a "feeder" to help achieve EEPS & RPS goals

Validate emerging energy efficiency, renewable, and smart grid technologies/strategies and accelerate market readiness in NY

Stimulate technology and business innovation to provide more clean energy options and lower cost solutions, while growing NY's clean energy economy

Spur actions and investments to achieve results distinct from incentive-based programs

³ Individuals may participate in more than one training.

Selection and funding criteria for the Initiatives that are included in the Operating Plan are based on their potential to provide benefits associated with the following priorities (in order of importance):

Priority I: Electric and gas system-wide benefits

- Potential to reduce energy use and demand, increase reliability and safety of the utility system, moderate wholesale prices, mitigate increases in delivery costs, or diversify energy resources.

Priority II: Other economic and environmental benefits

- Economic development benefits - including potential to create or retain jobs in the clean energy sector in New York;
- Environmental benefits - including potential to reduce the environmental and health impact of energy production and use in New York;
- Consumer cost savings – in the form of potential reduction in expenditures for the energy consumers use and for the clean energy products they purchase, compared to what they otherwise would have expended;
- Strengthen ability to leverage resources, or fill critical funding gaps – allowing New York to better address its clean energy goals with limited available resources and to take advantage of unanticipated funding opportunities.

Priority III: Unique and/or critical New York opportunity

- Opportunities unique to and important to New York and New York ratepayers – addressing our building stock, our industrial profile, our distinct natural resource base, our unique electrical grid, our innovation assets, and our diverse urban/rural landscape.

The T&MD Portfolio

The T&MD portfolio is comprised of nine Initiatives within three program categories. In developing the portfolio, NYSERDA considered the ability of each Initiative to make meaningful progress toward achievement of the T&MD objectives and the State's clean energy goals. The portfolio and budget allocation is consistent with the prioritization criteria.

Power Supply and Delivery: \$36.11 million average annual budget

Comprised of three Initiatives that focus on: opportunities related to the future Smart Grid; clean power generation that will allow New York to further integrate renewable energy sources into the Grid; and peak load demand benefits that can be achieved through combined heat and power applications.

Building Systems: \$18.40 million average annual budget

Comprised of two Initiatives that focus on the substantial opportunities that exist to reduce energy use and improve energy performance in buildings through development and incorporation of innovative and efficient technologies and practices, advanced energy codes and standards, and demand management systems.

Clean Energy Infrastructure: \$33.93 million average annual budget

Comprised of four "cross-cutting" Initiatives that focus on market development strategies to accelerate the supply and demand for clean energy solutions; consumer education; workforce development; business growth in the clean energy sector; and research and analysis of the environmental effects of the production and use of energy.

Table ES-1 provides a brief description of the proposed T&MD Initiatives along with the average annual program budget for each.

Defining Success

The T&MD portfolio is designed to provide a range of benefits and outputs during and well beyond the five-year funding period. Both quantitative and qualitative metrics have been defined to measure program progress and success. Evaluation techniques will address T&MD program efficiency, effectiveness, outcomes and impacts related to achievement of the objectives.

ES-1. Brief Description of Technology and Market Development Initiatives

POWER SUPPLY & DELIVERY	
<p>Smart Grid and Electric Vehicle Infrastructure</p> <p>Average Annual Budget: \$10.76 million</p>	<p>Goal: Accelerate the market readiness of emerging smart grid and grid-powered vehicle infrastructure technologies and strategies that can enhance system performance, reliability, and environmental quality.</p> <ul style="list-style-type: none"> ➤ Demonstrate and evaluate innovative technologies, new business models, and policy options that can improve performance of the electric power delivery system. ➤ Support and prepare for the integration and increase in market penetration of renewable energy and electric vehicles. ➤ Demonstrate and evaluate the value of Smart Grid technologies and strategies for customers. ➤ Coordinate with electric utilities, the New York Smart Grid Consortium, and the New York Battery and Energy Storage Technology Consortium to accelerate technology integration/adoption. ➤ Leverage opportunities for federal and private funding.
<p>Advanced Clean Power</p> <p>Average Annual Budget: \$10.35 million</p>	<p>Goal: Reduce barriers and costs and increase market acceptance of clean power generation in New York.</p> <ul style="list-style-type: none"> ➤ Develop and demonstrate clean power technologies including offshore wind, tidal/current energy, advanced solar PV materials and components, and advanced airfoil technologies. ➤ Reduce the balance-of-system costs of PV systems that lead to increased adoption. ➤ Demonstrate capacity to develop available renewable resources, with an emphasis on the needs of the New York City load center. ➤ Develop inventory of sites, fuel/resource supplies, and project development opportunities. ➤ Focus on near-term opportunities to reduce cost of renewable energy, for example through reduced balance-of-system and installation costs for PV and optimization of large-scale wind energy.
<p>Combined Heat and Power</p> <p>Average Annual Budget: \$15.0 million</p>	<p>Goal: Reduce barriers and costs and increase market penetration of combined heat and power (CHP) in New York.</p> <ul style="list-style-type: none"> ➤ Implement pilot program to promote pre-engineered modular-based CHP systems and to break down barriers to broader use of CHP in various markets. ➤ Provide performance-based payments for custom CHP systems that benefit summer peak demand periods.
BUILDING SYSTEMS	
<p>Advanced Buildings</p> <p>Average Annual Budget: \$15.06 million</p>	<p>Goal: Reduce barriers and costs and increase market acceptance of high-performance, high-efficiency building technologies and practices in New York.</p> <ul style="list-style-type: none"> ➤ Develop and demonstrate new and improved technologies, strategies, business models, and practices that can reduce energy waste, increase use of on-site energy, and better manage load in New York’s building stock. ➤ Use stake-holder process to develop large-scale, multi-site pilots that expose engineers, architects and service providers to new technology and accelerate market acceptance of emerging technology and methods to achieve deep energy savings. ➤ Enable buildings to manage load and to participate in demand response programs and direct load control pilots through use of automated controls and communication protocols compatible with emerging demand-side energy and ancillary services markets.
<p>Advanced Energy Codes and Standards</p> <p>Average Annual Budget: \$3.34 million</p>	<p>Goal: Maximize the real-world energy savings from energy codes and standards in New York and continue to push the envelope through the development of more stringent voluntary codes.</p> <ul style="list-style-type: none"> ➤ Train building design and construction community, and provide on-site assistance to local building code officials to help the State achieve Energy Code compliance goal of 90%. ➤ Develop a stretch energy code that is 20% - 30% more efficient than the current levels that could be voluntarily adopted by communities. ➤ Advance standards for additional equipment categories not covered by federal standards to capture savings in the New York.

CLEAN ENERGY INFRASTRUCTURE	
<p>Market Development</p> <p>Average Annual Budget: \$ 14.07 million</p>	<p>Goal: Develop the supply chain for energy efficient products and services and continue to build market demand for emerging and high-performance energy systems.</p> <ul style="list-style-type: none"> ➤ Conduct market research and data analysis for specific market sectors & technologies to obtain information and insights to guide programs. ➤ Address market barriers to technology adoption that need to be overcome. Pilot novel behavioral, financing, and marketing approaches. ➤ Build supply, demand and market delivery infrastructure for emerging and underused technologies and practices. ➤ Educate and inform market stakeholders and consumers about emerging clean energy choices.
<p>Clean Energy Business Development</p> <p>Average Annual Budget: \$8.35 million</p>	<p>Goal: Catalyze innovation and foster an entrepreneurial climate for business creation and growth of early-stage companies in New York that can bring new and improved clean energy technologies to market.</p> <ul style="list-style-type: none"> ➤ Establish new university-industry partnerships in New York through “Proof-of-Concept” centers that will move university-based innovations to market. ➤ Support the development of clean energy clusters in New York, working in concert with the Regional Economic Development Councils. ➤ Identify leveraging opportunities with private capital, the federal government, and other public-private partnerships to help grow clean energy companies in New York.
<p>Workforce Development</p> <p>Average Annual Budget: \$7.8 million</p>	<p>Goal: Provide the workforce with the skills necessary for proper installation, operation, and maintenance of energy efficiency, renewable energy, and advanced technology systems.</p> <ul style="list-style-type: none"> ➤ Identify and develop necessary certifications with third-party professional certifying organizations. ➤ Work with community colleges and other organizations to support and expand the network of qualified training facilities. ➤ Develop courses that can be offered as continuing education to practitioners and as integrated components of college certificate and degree programs and trades training. ➤ Link workforce training to business and industry through initiatives such as on-the-job training, internships and apprenticeships
<p>Environmental Monitoring, Evaluation and Protection</p> <p>Average Annual Budget: \$3.71 million</p>	<p>Goal: Increase the understanding and awareness of the environmental impacts of energy choices and emerging energy options by providing a strong scientific, technical foundation for formulating effective, equitable energy-related policies and practices.</p> <ul style="list-style-type: none"> ➤ Enhance the understanding of the ecological and health impacts and co-benefits of emerging alternative energy technologies. ➤ Support energy-related environmental accountability through analysis of long-term monitoring and modeling. ➤ Enhance the understanding of emission source types, source regions, and specific pollution components contributing to major energy-related environmental problems in New York. ➤ Use stakeholder and expert input through Program and Science Advisory Groups to guide research agenda.

1 Overview of Technology and Market Development Operating Plan

This supplemental revision of the T&MD Operating Plan updates NYSERDA's November 13, 2012 submittal to comport with the Public Service Commission's December 17, 2012 Order. Specifically, this supplemental revision adds \$35,915,573 of re-allocated EEPS-2 funds, \$49,972,830 of EEPS-1 funds that were uncommitted to specific projects as of December 31, 2011, and \$1,510,002 of SBC III funds that were uncommitted as of December 31, 2011 to the T&MD Portfolio. Of this amount, \$50 million of program funds are being added to the CHPS Initiative for the CHP Performance Program that was authorized in the October 24, 2011 Order but not funded at that time, and \$24 million of program funds are added for a Workforce Development Initiative with a focus on energy efficiency training. In this supplemental revision, \$15 million of T&MD funds for renewable energy and advanced technology training included in the Market Development Initiative are being moved to the Workforce Development Initiative.

This is the third supplemental revision of the T&MD Operating Plan. The first supplemental revision to the T&MD Operating Plan filed on December 23, 2011, updated NYSERDA's May 16, 2011 submittal⁴ to comport with the Public PSC's October 24, 2011 SBC Order. That Order approved the T&MD portfolio proposed by NYSERDA, with some modifications, for the five-year period of January 1, 2012 through December 31, 2016, with an average annual budget of \$93.8 million, initially allocated among T&MD programs as set forth in Appendix A of the October 24, 2011 Order. Of this amount, \$82.06 million was funded from SBC collections that the PSC authorized to continue in accordance with a collections schedule included in Appendix B of the Order. The balance of the budget was for the expanded CHP initiative, the funding source(s) of which were identified by NYSERDA in its proposal submitted to the PSC on March 30, 2012.

The second supplemental revision filed on November 13, 2012 added \$25,760,672 of SBC III funds that were uncommitted to projects as of December 31, 2011 to three Initiatives in the T&MD Operating Plan: the Smart Grid and Electric Vehicle Infrastructure Initiative;⁵ Advanced Clean Power Initiative; and the Advanced Buildings Initiative.

This Operating Plan was initially developed by NYSERDA in response to the PSC's December 30, 2010 *Order In the Matter of the System Benefits Charge IV*. This Plan builds upon the concepts articulated in

⁴ Operating Plan for Technology and Market Development Programs, 2012-2016

⁵ The September 13, 2012 Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*, included \$10 million for an energy storage initiative within the Smart Grid Program. Of this amount, \$7.5 million was to provide cost-sharing support for an application for U.S. DOE funding to establish an Energy Storage Innovation Hub within New York, and \$2.5 million was to be used to support the New York BEST Commercialization and Testing Laboratory. NYSERDA notified DPS on December 5, 2012 that DOE funds were not awarded for the Energy Storage Innovation Hub. Pursuant to the Order, a Petition for consideration of alternative uses for those funds was to be filed within 60 days of such notification. NYSERDA requested an extension, and on January 24, 2013, the extension request for a filing date of April 5, 2013 was granted.

the document entitled “System Benefits Charge in New York: A Vision for the Future (Vision Statement),”⁶ and takes into account the extensive and invaluable input provided by hundreds of organizations, stakeholders, and individuals. The proposed mission, objectives, selection criteria and priorities for the T&MD program are described in three categories: Power Supply & Delivery; Building Systems; and Clean Energy Infrastructure. Justification for ratepayer investment in each of nine Initiatives within those three categories is provided, including the benefits that are expected to accrue as a result of the investment. A budget for each of the Initiatives is provided, which includes the Approved SBC IV Program Budgets listed in Appendix A of the October 24, 2011 Order, the allocation of uncommitted SBC III funds addressed in the September 13, 2012 Order, and the allocation of uncommitted EEPS funds and re-purposed EEPS funds addressed in the December 17, 2012 Order

For each Initiative, this Operating Plan addresses: (i) the problem to be targeted; (ii) why current R&D investments are insufficient; (iii) why New York ratepayers should be making the financial commitments; (iv) expected benefit to New York in terms of increased safety and/or reliability, improved environment, wholesale energy price reduction, economic development and jobs; (v) results of similar projects previously funded by NYSERDA or others; (vi) likelihood of leveraging dollars; and (vii) the expected link between the proposed projects and the ability to meet the PSC’s clean energy goals.

⁶ The Vision Statement can be found at: www.nyserdera.org/pdfs/sbc-iv-white-paper.pdf

2 Background

The SBC program was initially established by Order of the PSC in 1998 when it restructured the utility industry. The PSC recognized that in a more competitive industry, certain critical public benefit programs would no longer be supported by utility companies. The PSC established the ratepayer-supported SBC and designated NYSERDA as the Administrator of the SBC public benefit program. The SBC program was re-authorized in 2001 and again in 2006 for five year terms, attesting to the value that the PSC ascribed to the ratepayer benefits associated with the uses of these funds. The PSC's decision to introduce competitive options for energy consumers and subsequent decisions to maintain policy and financial support for energy efficiency, renewable energy, and other advanced energy technology development and demonstration programs has provided New York with one of the nation's most robust energy markets. Nevertheless, the energy challenges that New York faces today - from an aging infrastructure to carbon constraints and concerns over petroleum dependency and price volatility - are tremendous. The imperative to transform New York's energy system has never been greater.

For the period from 2006 through 2011, program funding for the SBC was \$154 million per year, of which approximately half has focused on energy efficiency resource acquisition/deployment activities and half on technology and market development activities. The benefits of the SBC program have been proven to be more than double the cost of the programs.⁷

Realizing there were potential administrative efficiencies to be gained, in its September 20, 2010 Petition to the PSC for continuation of the SBC, NYSERDA proposed some modifications to the program, including consolidating and moving the resource acquisition/deployment programs to the EEPs portfolio. The Petition, taking the form of a Vision Statement, also summarized the history and accomplishments of the program and described how New York could strategically leverage the next generation of SBC, focusing on a T&MD Portfolio, to propel the state toward a clean-energy economy and a more reliable, secure, and affordable energy system that is protective of the environment within the current policy and economic climate.

In Case 10-M-0457, the PSC issued a Notice of Proposed Rulemaking on October 6, 2010 and asked for comments on NYSERDA's proposal to be submitted by November 22, 2010. NYSERDA and the Department of Public Service (DPS) conducted a Technical Conference on November 4, 2010, to provide stakeholders and interested parties with more information on the potential uses of SBC funds for the T&MD Program. The PSC issued an SBC Order on December 30, 2010 which "reaffirmed its high level commitment to the continuation of SBC programs and to the important State policy goals they support." The December 30, 2010 Order continued SBC funding through the end of 2011 but deferred a decision concerning funding for NYSERDA's proposed T&MD Program, pending a more robust stakeholder input process (described in Section 4) and submission of an Operating Plan.

⁷ NYSERDA, New York's System Benefits Charge Programs Evaluation and Status Report, Quarterly Report to the Public Service Commission, Quarter Ending March 31, 2010, Final Report May 2010.

On May 16, 2011, NYSERDA submitted its Operating Plan for Technology and Market Development Programs. That Operating Plan requested average annual program funding of \$70 million for seven Initiatives, plus \$15 million for an incremental CHP Initiative. Notices of Proposed Rulemaking concerning the PSC's consideration of the Operating Plan were published in the State Register on June 8, 2011. A separate notice was issued by the Secretary soliciting comments in two rounds with initial comments due July 25, 2011, and reply comments due August 15, 2011.

The PSC addressed the T&MD Operating Plan at its October 13, 2011 Public Session, and on October 24, 2011, the Commission issued the *Order Continuing the System Benefits Charge and Approving an Operating Plan For a Technology and Market Development Portfolio of System Benefits Charge Funded Programs*. The October 24, 2011 Order approved the T&MD portfolio proposed by NYSERDA for the five-year period of January 1, 2012 through December 31, 2016, with some modifications. The Order required NYSERDA to submit a supplemental revision to the T&MD Operating Plan within 60 days of the issuance of the Order (by December 23, 2011) to incorporate the changes as a result of the Order.

The Order approved the general framework set forth in NYSERDA's budget contingency Option C⁸ with some additional requirements. The budget was authorized at an average annual budget of \$93.8 million, representing \$80 million in program costs and \$13.8 million for administration, evaluation, and New York State Cost Recovery Fees. This included \$65 million in program costs (\$76.2 million total) for NYSERDA's "base" T&MD Initiatives and \$15 million in program costs (\$17.6 million total) for a CHP Initiative. Of the \$15 million for CHP, \$5 million in SBC funds was approved in the Order to be used for the CHP Aggregation and Acceleration Program, and, at NYSERDA's option, for feasibility studies. The remaining \$10 million for the CHP Performance Program was to be derived from a source or sources other than the SBC funds approved in the October 24, 2011 Order. As required, NYSERDA submitted a plan for funding the balance of the CHP Initiative on March 30, 2012.

The Order also directed NYSERDA to submit by March 31, 2012 an accounting of SBC III funds that were uncommitted⁹ as of December 31, 2011. NYSERDA filed the accounting on March 9, 2012, and subsequently filed a Petition for Allocation of Uncommitted SBC Funds for Strategic Initiatives on March 30, 2012. On September 13, 2012 the PSC issued an *Order Authorizing the Reallocation of Uncommitted SBC III Funds* which approves the use of \$25,760,672 of SBC III funds to be added to the T&MD Portfolio.

On December 17, 2012, The PSC issued an *Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives*, approving \$85,888,403 of EEPS and \$1,510,002 of SBC III funds for the T&MD Portfolio.

⁸ NYSERDA responded to the PSC's September 15, 2011 request to present budget contingency scenarios. Option C proposed to reduce funding for the core initiatives to \$65 million annually, and fund the CHP program at \$15 million (as recommended in the Operating Plan), with \$10 million of the funds to come from an optimization of NYSERDA's EEPS budgets or some other source.

⁹ Per the Order, uncommitted funds means unencumbered funds that have not been allocated to a completed application that has been determined by NYSERDA to meet basic eligibility criteria but for which NYSERDA does not yet have a fully executed contract.

3 Planning Context for T&MD Program Portfolio

With heightened awareness of the State's and nation's energy challenges and the dire need for economic growth, the re-authorization of SBC is occurring at a pivotal time and provides enormous opportunities for New York State. The proposed Initiatives represented in the T&MD portfolio will strengthen New York's ability to capitalize on its unique assets to achieve a vibrant, clean-energy economy, and to respond to the need for resiliency within the energy sector. The next phase of the SBC can make durable and significant contributions to New York's energy and economic future by addressing immediate challenges and catalyzing future innovation.

Since the PSC's initial establishment of the SBC program in 1998, the federal and State energy policy landscape has changed significantly. New York and the nation have come to a clearer recognition of our energy dependencies and the associated economic, environmental, and security implications. The policy initiatives that frame and support the continuation of the SBC are well developed in the *2009 New York State Energy Plan*. Over the past few years, significant changes in the energy landscape have occurred on many fronts including increased policy development activity at the national and state level, increased private investment and public-private partnerships in clean energy,¹⁰ new market participants, and increased consumer demand for clean energy. On the State policy level, the PSC's leadership in advancing the 45 by 15 clean-energy strategies (*i.e.*, adoption of the 15 by 15 energy-efficiency goal and the 30 by 15 renewable-energy goal through the EEPS programs and Renewable Portfolio Standard (RPS) programs respectively) and the State's consideration of an 80 by 50 greenhouse gas reduction goal represent landmark energy and environmental policy decisions.

Collectively, these changes warrant major strategic adjustments in the focus of future SBC investments, as reflected in this Operating Plan.

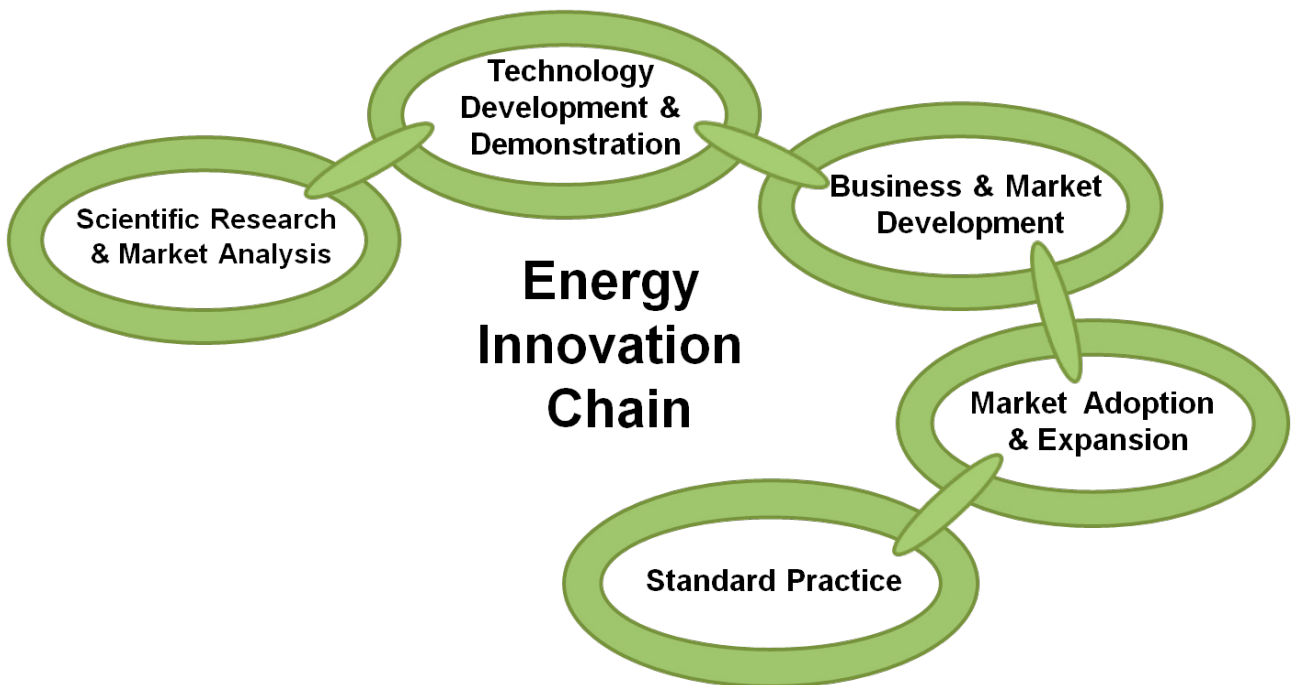
On the federal level, there has been renewed emphasis on energy innovation, R&D and market development. Opportunities to leverage federal funds consistent with New York's clean energy economy goals continue and should be exploited; however, the extent of future federal funds is uncertain given the probability of funding cuts. This increases the importance of assuring that New York has a stream of resources to support investment in areas of critical concern.

The next phase of SBC can make long-lasting and significant contributions to New York's energy and economic future by catalyzing innovation and strategic investments in the transmission and distribution system; enhancing system reliability; promoting advanced building design, retrofits and "smarter" buildings; advancing electrification of the transportation sector; developing the state's indigenous renewable resources; reducing electricity use and load in crucial New York sectors; and supporting behavioral, market, and load research to maximize system and ratepayer benefits.

¹⁰ Clean energy is defined here to include energy efficiency, renewable energy, and low-carbon technologies.

3.1 The Innovation Chain

Much of the success of New York’s SBC program can be attributed to a portfolio approach that includes a comprehensive set of clean-energy programs supporting both near-term and longer-term investments. Historically, SBC investments have supported each stage of the innovation chain, from the early stages of scientific research and analysis, to technology development and demonstration, to business and market development, to market adoption and expansion and, finally, to the adoption of new standard practices. Resource acquisition programs, now funded through EEPS and RPS, focus on the Market Adoption and Expansion "link" of the innovation chain. The proposed T&MD portfolio captures activity in the other links of the chain to strengthen the commitments in EEPS and RPS and to support these investments over time with sufficient and improved technology options and a stronger market infrastructure. The majority of the portfolio focuses on technology development and demonstration, as well as business and market development, to ensure that new products and services are developed to support continued success of the EEPS and RPS programs. This comprehensive approach to program activity is key to the success of the State's clean energy policies as they ensure programs are targeted to capture New York’s unique clean energy opportunities as well to sustain these achievements over time.



4 Stakeholder Engagement

In compliance with the PSC's Order, NYSERDA engaged in an intensive outreach process and systematically collected input and advice from stakeholders with a wide variety of interests, expertise or resources in specific program areas. NYSERDA's outreach process accomplished the following:

- Twenty two (22) outreach meetings were conducted representing a diverse group of stakeholders. Approximately 225 organizations participated. At these meetings, NYSERDA received input on its initial ideas for the T&MD program objectives, priority criteria, and proposed portfolio. A list of the stakeholder groups, as well as the individual organizations that attended the meetings or provided input in some other way, is included in the Appendices to this Operating Plan.
- A dedicated webpage was posted on NYSERDA's website (http://www.nyserda.ny.gov/System-Benefits-Charge/System-Benefits-Charge.aspx?sc_database=web). Approximately 500 people received periodic updates.
- A Technical Conference, open to the public, was conducted (March 22, 2011). The Conference took place in the PSC Conference room in Agency 3 of the Empire State Plaza in Albany, with video-conference to the PSC offices in New York City, and was also webcast. At the Technical Conference, NYSERDA senior management and program staff discussed stakeholder feedback and the preliminary program framework and engaged the attendees in a discussion about the future uses of the SBC funds. A Briefing Paper was made available prior to the Technical Conference to help prepare the participants for the discussion. Approximately 100 individuals participated. A copy of the Power Point presentation which summarizes the input received from stakeholders can be found at: <http://www.nyserda.ny.gov/System-Benefits-Charge/System-Benefits-Charge/SBCIV-Documents.aspx> .

Stakeholder input and feedback was integral to the development of this Operating Plan and will continue to be an important element of the implementation of the T&MD Program going forward. To accomplish this, NYSERDA has established a T&MD Advisory Committee, comprised of experts, within the first quarter of program implementation. The Advisory Committee will meet at least once per year to discuss future directions and to review program progress. To supplement this high-level advisory function, program-specific Technical Advisory Groups will be established where needed, with existing program-specific Technical Advisory Groups used where appropriate. For example, as currently envisioned, the Environmental Research Advisory Group established under the SBC would likely continue, and the Smart Grid Consortium would serve as a program-specific Technical Advisory Group for the proposed SBC Smart Grid program. NYSERDA will expect to coordinate and meet with key stakeholder groups as needed (e.g., utilities, Regional Economic Development Councils, NYC, environmental and business groups etc). To facilitate broader exchange, NYSERDA will hold annual program conferences, open to the public and to stakeholders, at which information about success to date and plans for the upcoming

year will be presented. In addition, as directed by the October 24, 2011 Order, NYSERDA will make a progress presentation to the Commission following the submission of its 2013 annual report.

NYSERDA will make every effort to ensure that information on the T&MD portfolio is publically available in a timely manner throughout the duration of the program, providing stakeholders with relevant information on an ongoing basis. This will include case studies, fact sheets, and an on-line searchable database covering all R&D projects.

5 *Mission, Objectives and Priorities of the T&MD Portfolio*

The Mission of the proposed T&MD program is to:

- *Test, develop, and introduce new technologies, strategies and practices that build the statewide market infrastructure to reliably deliver clean energy to New Yorkers.*

5.1 Objectives and Considerations

Specific *Objectives* of the T&MD program are to:

- Move new or underused technologies and services into marketplace to serve as a "feeder" to help achieve EEPS and RPS goals;
- Validate emerging energy efficiency, renewable, and smart grid technologies/strategies and accelerate market readiness in NY;
- Stimulate technology and business innovation to provide more clean energy options and lower cost solutions, while growing NY's clean energy economy;
- Spur actions and investments to achieve results distinct from incentive-based programs.

In developing the T&MD portfolio, NYSERDA considered a number of factors, including the following:

- Major challenges to utility systems and ratepayers;
- Technical and market opportunities and barriers to clean energy;
- Areas where benefits to New York State could be great;
- Opportunities to leverage funds;
- Experience in running the current SBC program; and
- Input from the hundreds of stakeholders who participated in the extensive stakeholder process, as well as other market participants and DPS staff.

NYSERDA also considered the different technology and market development needs across the state's diverse regions, i.e., geographic balance. Accordingly, the T&MD portfolio addresses a range of clean energy needs – from those related to dense urban areas to needs in rural New York.

5.2 Selection, Funding Criteria, and Priorities

Selection and funding criteria for the Initiatives are based on their potential to provide benefits associated with the following *Priorities* (in order of importance):

Priority I: Electric and gas system-wide benefits

- Potential to reduce energy use and demand, increase reliability and safety of the utility system, moderate wholesale prices, mitigate increases in delivery costs, or diversify energy resources;

Priority II: Other economic and environmental benefits

- Economic development benefits - including potential to create or retain jobs in the clean energy sector;
- Environmental benefits - including potential to reduce the environmental and health impact of energy production and use in New York;
- Consumer cost savings – in the form of end-users’ potential reduction in expenditures for the energy they use and for the clean energy products they purchase, compared to what they otherwise would have expended;
- Strengthen ability to leverage resources, or fill critical funding gaps – allowing New York to better address its clean energy goals with limited available resources and take advantage of unique or unanticipated funding opportunities;

Priority III: Unique and/or critical New York opportunity

- Opportunities unique to and important to New York and New York ratepayers – addressing our building stock, our industrial profile, our distinct natural resource base, our unique electrical grid, our innovation assets, and our diverse urban/rural landscape.

In developing the programs and allocating funding, NYSERDA considered the magnitude of the potential benefits relative to the cost of the program. Given the nature of the T&MD mission, this assessment of potential benefits and program costs was considered on a relative and qualitative basis. More quantitative evaluation of benefits and costs will be conducted post project-completion, as described in Section 8.

6 **Technology and Market Development Portfolio**

This Operating Plan includes nine Initiatives in three program categories: Power Supply and Delivery; Building Systems; and Clean Energy Infrastructure.

In developing this portfolio, NYSERDA considered the ability of these Initiatives to make meaningful progress towards achievement of the T&MD objectives (listed in Section 5.1) over the course of the next five years and beyond. Table 6-1 illustrates alignment of the initiatives with the four T&MD objectives.

Each of the Initiatives contributes in some important way to the state's clean energy goals related to: energy efficiency; addition of renewable resources to diversify generation sources; transition to a Smart Grid; and peak load management. Table 6-2 illustrates this linkage.

The program portfolio and budget allocation is consistent with the prioritization criteria in Section 5.2. Table 6-3 reflects the extent to which each provides benefits under the identified prioritization criteria. The criteria are shown in order of relative importance starting with Electricity and Gas System-wide Benefits being the most critical in the left column. Each Initiative comports with the prioritization and funding criteria, and each provides benefits.

Each Initiative received a ranking of high on at least three of the six criteria and the overall portfolio of selected programs provides substantial coverage of all of the criteria. The specific manner in which each initiative is aligned with the priorities is described in Section 9.

The prioritization criteria were developed to assess the *potential* benefits of various initiatives in developing the overall T&MD portfolio. Specific projects to be funded will be selected through competitive solicitations with responses reviewed by Technical Evaluation Panels of internal and external experts, taking into consideration these priorities as well as other criteria germane to the particular program. For example, as noted in the Order, projects driven primarily by anticipated economic development benefits will be selected taking into consideration, among other things, the likelihood that recipients will "stand on their own" within the five-year period and beyond. A representative from DPS will be invited to serve on every Technical Evaluation Panel to help ensure continued alignment with Commission priorities.

The T&MD portfolio is designed to integrate with other rate-payer supported activities and other ongoing efforts that will allow New York to pursue a comprehensive set of clean-energy programs. The specific role that this portfolio plays along the Innovation Chain is illustrated in Table 6-1.

NYSERDA has developed a T&MD portfolio that:

- strikes an appropriate balance of near and long term benefits;
- is geographically balanced as it provides benefits across the state with many focused on the downstate area where load reduction is of critical concern; and
- provides opportunities for many sectors of New York's economy to benefit.

Table 6-1. Linkage Between T&MD Objectives and Initiatives

Technology & Market Development Objectives Technology & Market Development Initiatives	<i>Move technologies & services into marketplace to help achieve clean energy goals</i>	<i>Validate technologies / strategies and accelerate market readiness in NY</i>	<i>Stimulate innovation to provide more and lower cost options, while growing NY's clean energy economy</i>	<i>Spur actions and investments to achieve results distinct from incentive-based program</i>
POWER SUPPLY & DELIVERY				
Smart Grid and Electric Vehicle Infrastructure	X	X	X	
Advanced Clean Power	X	X	X	
Combined Heat and Power	X	X	X	
BUILDING SYSTEMS				
Advanced Buildings	X	X	X	X
Advanced Codes	X			X
CLEAN ENERGY INFRASTRUCTURE				
Market Development	X			X
Clean Energy Business Development		X	X	
Workforce Development	X	X		
Environmental Monitoring, Evaluation and Protection (EMEP)				X

Note: "X" and Shading indicates a linkage exists between the T&MD objective and T&MD initiative.

Table 6-2. Linkage Between Clean Energy Goals and T&MD Initiatives

<i>Clean Energy Goals</i>	<i>Energy Efficiency</i>	<i>Renewable Resources</i>	<i>Transition to Smart Grid</i>	<i>Peak Load Management and Reduction</i>
Technology & Market Development Initiatives				
POWER SUPPLY & DELIVERY				
Smart Grid and Electric Vehicle Infrastructure		X	X	X
Advanced Clean Power		X	X	X
Combined Heat and Power	X	X		X
BUILDING SYSTEMS				
Advanced Buildings	X	X	X	X
Advanced Codes	X		X	
CLEAN ENERGY INFRASTRUCTURE				
Market Development	X	X	X	X
Clean Energy Business Development	X	X	X	X
Workforce Development	X	X		X
Environmental Monitoring, Evaluation and Protection (EMEP)	X	X	X	X

Note: "X" and Shading indicates a linkage exists between the clean energy goal and T&MD initiative.

Table 6-3. Relationship between Prioritization Criteria and T&MD Initiatives

		← ← ← Highest Priority Criteria						
		Group 1	Group 2			Group 3	Potential Benefits for Level/Scale of Investment	
Technology & Market Development Initiatives	Priority Criteria	Electricity and Gas System-wide Benefits	Economic Development Benefits (Including Jobs)	Environmental Benefits	Consumer Cost Savings	Leveraging Resources or Filling Gaps	Opportunities Unique to New York	
	POWER SUPPLY & DELIVERY							
	Smart Grid and Electric Vehicle Infrastructure	●	●	●	◐	●	●	◐
	Advanced Clean Power	●	●	●	◐	●	●	◐
	Combined Heat and Power	●	◐	◐	●	●	●	◐
BUILDING SYSTEMS								
	Advanced Buildings	●	●	●	●	◐	●	◐
	Advanced Codes	●	○	●	●	●	◐	●
CLEAN ENERGY INFRASTRUCTURE								
	Market Development	●	◐	●	◐	●	●	●
	Clean Energy Business Development	◐	●	◐	○	●	●	●
	Workforce Development	●	●	●	◐	◐	●	◐
	Environmental Monitoring, Evaluation and Protection (EMEP)	○	◐	●	○	●	●	●

● High ◐ Medium ○ Low or None

Table 6-4. Relationship Between Innovation Chain and T&MD Initiatives

Innovation Chain Technology & Market Development Initiatives	Scientific Research & Market Analysis <i>Support energy-related environmental research and market assessment to better understand impacts of energy options</i>	Technology Development and Demonstration <i>Accelerate the development of new and improved clean-energy technologies</i>	Business and Market Development <i>Develop the supply chain; Increase the number of service providers for a clean energy economy; Build market demand</i>	Market Adoption and Expansion <i>Accelerate and increase penetration of new and high-potential clean energy technologies and practices</i>	Standard Practice <i>Push new standard practices; Codes and standards; Enabling Compliance</i>
POWER SUPPLY & DELIVERY					
Smart Grid and Electric Vehicle Infrastructure	●	●	●	●	○
Advanced Clean Power	●	●	●	○	○
Combined Heat and Power	○	●	●	●	○
BUILDING SYSTEMS					
Advanced Buildings	●	●	●	●	○
Advanced Codes	○	○	○	○	●
CLEAN ENERGY INFRASTRUCTURE					
Market Development	●	○	●	●	○
Clean Energy Business Development	○	●	●	○	○
Workforce Development	○	○	●	●	●
Environmental Monitoring, Evaluation and Protection (EMEP)	●	○	○	○	○

● High ● Medium ○ Low or None

7 Summary Budget and Expected Results

7.1 Funds for the Technology and Market Development Program

This Operating Plan addresses a total of \$523,475,600¹¹ in SBC funds over five years, representing an average annual budget of approximately \$104.7 million. This budget is inclusive of \$449.76 million for program costs for nine Initiatives, as well as funding for administration, evaluation, and NYS Cost Recovery Fees (CRF) associated with the T&MD portfolio. As a benchmark, the annual funding for the T&MD portfolio represents only 0.32% of the annual amount spent by electric and natural gas consumers in New York in 2010 alone. The Summary Budget for the T&MD portfolio is presented in Table 7-1.

In the T&MD Operating Plan submitted on May 16, 2011, NYSERDA requested base average annual funding of \$70 million in program costs for seven T&MD Initiatives, plus incremental annual funding of \$15 million for an eighth CHP Initiative. The October 24, 2011 Order, however, approved base average annual funding of \$65 million in program costs for the seven T&MD Initiatives, plus \$5 million in annual funding for the Aggregation and Acceleration program of the CHP Initiative. The revised supplemental T&MD Operating Plan, submitted in December 2011, reflected those modifications, and the funding distribution included in Appendix A of the October 24, 2011 Order, representing funds expected to be committed each year of the five year period, commencing in 2012.¹²

The September 13, 2012 Order re-allocated \$25,760,672 of uncommitted SBC III funds to three Initiatives within the T&MD Program. The addition of funds was reflected in the supplemental revision of the T&MD Operating Plan submitted on November 13, 2012.

For this supplemental revision, the Summary Budget in Table 7-1 has been further modified to reflect the addition of \$87,398,405 of funds pursuant to the December 17, 2012 Order. The distribution of funds within the two year periods for both these new funds, and the funds added in the November 13, 2012 Supplemental Revision varies from the budget included in Appendix 2 of the December 17, 2012 *Order Modifying Budgets and Targets for Energy Efficiency Portfolio*

¹¹ The December 17, 2012 Order (Appendix 2) provided a revised budget for the T&MD portfolio of \$527,269,251, but this included \$3,793,651 in additional funding for Program Administration and NYS Cost Recovery Fees that were not included in NYSEDA's Petition for transfer from the SBC III and EEPS portfolios, and furthermore are not funds available for transfer. NYSEDA's Budget in Table 7-1 reflects only the transfer of program funds in accordance with its Petition.

¹² The October 24, 2011 Order also authorized an additional \$10 million to fund the CHP Performance program and directed NYSEDA to submit a proposed plan by March 31, 2012, to fund this "increment" from reductions in its EEPS budgets, uncommitted SBC III funds, or from other sources that can be realized without an increase in ratepayer collections.

Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives, but is more reflective of the anticipated commitment of funding for particular efforts. There are other inconsistencies between the budget in Appendix 2 of the Order and the Summary Budget in Table 7-1 related to administrative costs and CRF amounts. These inconsistencies which relate to the amount of SBC III and EEPS funds available for transfer to the T&MD Portfolio, are expected to be resolved through further discussion with DPS staff.

Timing of the commitment of funds varies by Initiative and takes into account factors such as: near term priorities; market readiness; program development and ramp up periods; continuation of current activities requiring little new start-up time; and anticipated solicitation cycles including several that are staged over the course of the five years to optimize new opportunities and the availability of new technology innovations.

While funds are expected to be fully committed by the end of the term, expenditures will continue beyond the five-year period. This lag is typical, particularly for the R&D-type programs that comprise much of the T&MD Portfolio. As the October 24, 2011 Order allows for the flexibility to shift funds among the nine Initiatives over the five-year period, adjustments can be made to address emerging opportunities, public policy considerations, and program progress. Such transfers will be made only upon approval by DPS staff.

Table 7-1. Technology and Market Development Program Budget¹³

Technology and Market Development Program Budget January 1, 2012 -- December 31, 2016					
	Average Annual (\$million)	2012-2013 \$	2014-2015 \$	2016 \$	Total \$
POWER SUPPLY AND DELIVERY	\$36.11				
Smart Grid and Electric Vehicle Infrastructure	10.76	9,889,778	16,704,104	27,187,500	53,781,382 ¹⁴
Advanced Clean Power	10.35	22,855,836	21,416,126	7,500,000	51,771,962 ¹⁵
Combined Heat and Power	15.00	30,000,000	30,000,000	15,000,000	75,000,000 ¹⁶
BUILDING SYSTEMS	\$18.40				
Advanced Buildings	15.06	33,848,129	29,779,647	11,708,384	75,336,160 ¹⁷
Advanced Energy Codes and Standards	3.34	8,313,500	6,960,044	1,406,250	16,679,794
CLEAN ENERGY INFRASTRUCTURE	\$33.93				
Market Development	14.07	28,840,428	27,758,602	13,781,250	70,380,280
Clean Energy Business Development	8.35	17,643,096	15,961,700	8,156,250	41,761,046
Workforce Development	7.8	19,630,000	16,370,000	3,000,000	39,000,000 ¹⁸
Environmental Monitoring, Evaluation and Protection	3.71	8,313,502	7,424,046	2,812,500	18,550,048
Smart Grid Pending Reallocation	1.5	7,500,000			7,500,000¹⁹
TOTAL PROGRAM	\$89.94²⁰	\$186,834,269	\$172,374,269	\$90,552,134	\$449,760,672
Administration ²¹	7.95	15,296,600	16,028,136	8,440,797	39,765,533
Evaluation ²¹	5.27	10,164,375	10,621,585	5,577,498	26,363,458
NYS Cost Recovery Fee ²¹	1.50	2,857,004	3,012,455	1,716,485	7,585,944
TOTAL*	\$104.7	\$215,522,248	\$201,666,445	\$106,286,914	\$523,475,600

*Totals may not sum exactly due to rounding.

¹³ The December 17, 2012 Order (Appendix 2) provided a revised budget for the T&MD portfolio of \$527,269,251, but this included \$3,793,651 in additional funding for Program Administration and NYS Cost Recovery Fees that were not included in NYSERDA's Petition for transfer from the SBC III and EEPS portfolios, and furthermore are not funds available for transfer. NYSERDA's Budget in Table 7-1 reflects only the transfer of funds in accordance with its Petition.

¹⁴ This amount includes \$2.5 million of reallocated SBC III funds, pursuant to the September 13, 2012 Order, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*.

¹⁵ This amount includes \$10 million of reallocated SBC III funds, pursuant to the September 13, 2012 Order, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*.

¹⁶ This budget reflects the December 17, 2012 Order, *Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives*, which authorized NYSERDA to use \$50 million comprised of reallocated EEPS funds and EEPS funds that were uncommitted as of December 31, 2011 for the CHP Performance Program.

¹⁷ This amount includes \$5,760,672 of reallocated SBC III funds, pursuant to the September 13, 2012 Order, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*.

¹⁸ This budget reflects the December 17, 2012 Order in Case 10-M-0457, *Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives*, which authorized NYSERDA to use \$24 million of EEPS program funds that were uncommitted as of December 31, 2011 for a Workforce Development Initiative focusing on energy efficiency. The budget also reflects \$15 million of T&MD funds previously included in the Market Development Initiative, which focus on workforce development activities related to renewable energy and advanced technologies.

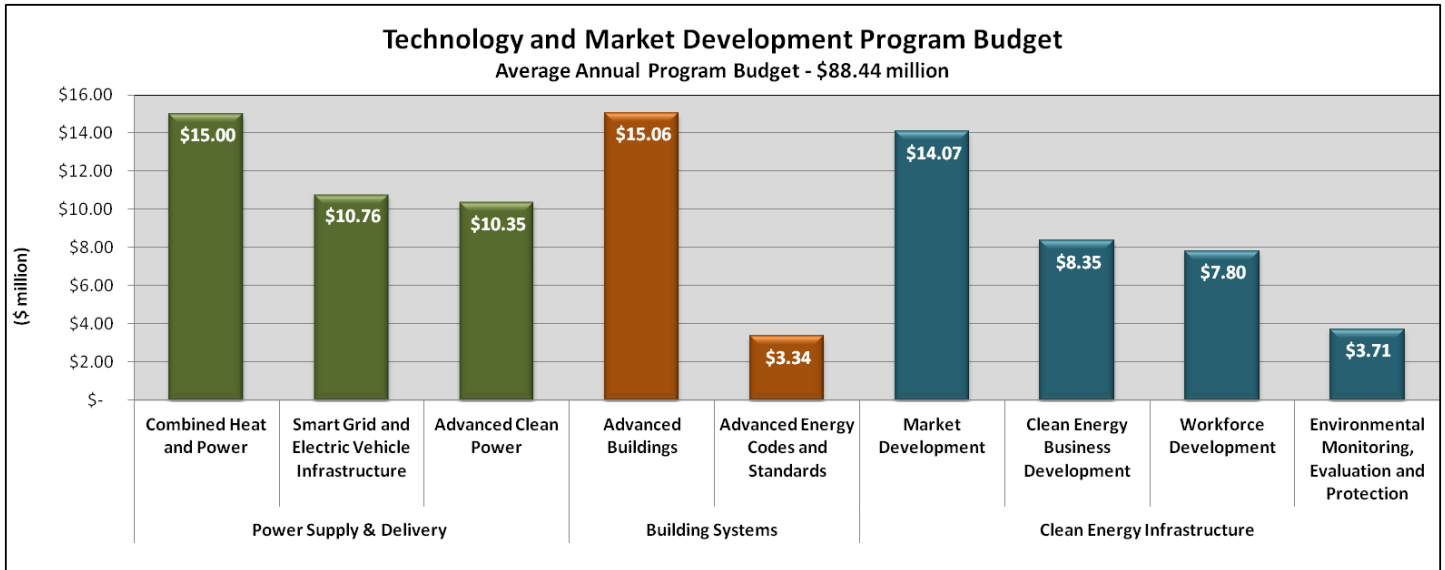
¹⁹ This budget reflects the reallocated SBC III funds for the Smart Grid Energy Hub pursuant to the September 13, 2012 Order. NYSERDA notified DPS on December 5, 2012 that federal funds for the Energy Hub were not awarded. A Petition for use of the funds is pending, to be submitted to DPS by April 5, 2013.

²⁰ Average annual amounts are based on budgets over five years; the funds authorized in the December 17 2012 Order for the CHP Initiative and the Workforce Development Initiative have four year budgets.

²¹ See Section 11 of this Operating Plan for an explanation of the administrative cost rate and the NYS Cost Recovery Fee. The cost rate for evaluation is addressed in Section 8.1.3.

Figure 7-1 illustrates the average annual program budget for the nine Initiatives.

Figure 7-1



7.2 Summary of Expected Results: T&MD Value Proposition

The T&MD portfolio will provide substantial benefits to New York and New York ratepayers over the course of the five-year term and well beyond. Quantitative and qualitative metrics and benefits for each of the nine Initiatives are included in the individual write-ups in Section 9. Note that some of the metrics have been revised in this supplemental revision to reflect new budgets, corrections, and further refinement of assumptions.

The T&MD portfolio, combined with the resource acquisition programs of EEPS and RPS, is an extremely powerful tool to help New York achieve its energy goals, while providing significant benefits to ratepayers.

While the T&MD portfolio is generally not a resource acquisition program, it will contribute substantially to the 15 by 15 goal. In addition to electricity savings, the T&MD Portfolio will deliver other critical benefits to New York that are vital to New York's longer-term clean energy goals. These include reducing fossil fuel use, reducing and better managing demand, stimulating technology innovation and job growth in New York, addressing resiliency issues within the energy sector, developing a clean energy workforce, informing policy development and utility smart-grid capital investments, and leveraging investment in clean energy technology.

Alternative measures for reporting the benefits of the CHP Initiative have been introduced in this supplemental revision in response to the December 17, 2012 Order which calls for the inclusion of such measures that more accurately reflect end-use energy savings and other benefits produced by CHP installations. The quantity of peak load MW and the MWh/yr from on-site electric

generation as a result of the Initiative will be tracked and reported. Primary energy savings²² will also be calculated for the CHP Initiative and will be reported separately from the on-site efficiency benefits of the other Initiatives in the T&MD Portfolio. This represents a change in methodology from the previous manner in which CHP benefits were included as part of overall reported electricity savings. NYSERDA will continue to consult with DPS staff to consider other performance milestones that could be tracked and reported for the CHP Initiative.

Following are **highlights** of the T&MD Portfolio benefits that are estimated to accrue:

- At full implementation, the T&MD Portfolio is estimated to achieve 1,189,300MWh of electricity savings, over 6,125,800 MMBtu of fossil fuel savings, and to have reduced peak demand by 375.4 MW.
- Of the 1,189,300 cumulative annual MWh that the T&MD portfolio is expected to achieve when fully implemented, 365,200MWh are estimated to be achieved by 2015. This is about 60% higher than the 225,550 MWh of the 2015 wedge assigned to the SBC-funded T&MD portfolio.²³
- On-site generation representing 47.5 MWs of summer peak demand reduction is expected to be installed, generating an estimated 337,250 MWhs, and providing 438,425 MMBtus of primary energy savings.
- CO₂ emissions are expected to be reduced by nearly 850,000 tons.
- More than 89 advanced technologies will reach commercial availability or be adopted by the market.
- Approximately \$799.5 million of funding will be leveraged (co-funding or outside investment).
- Commercial sales of new and improved technologies will be over \$184 million.
- Approximately 39,000 training opportunities will be provided for practitioners.²⁴
- Over 725 clean energy companies will be assisted with 162 startups graduating from Clean Tech incubators.
- NYSERDA will have developed partnerships with 1,750 retail and supply businesses to increase market share of energy efficient products.

²² Primary Energy Savings for CHP systems (expressed in MMBtu) is based on the difference between the amount of energy displaced at grid-level generators and the energy used on-site by the CHP installations, accounting for both the avoided energy losses over the transmission and distribution system and the energy saved due to replacement of the on-site boiler with more efficient equipment. The energy displaced at grid-level generators is estimated based on the electricity system simulation model used in the New York State Energy Plan process.

²³ Several other non-EEPS NYSERDA programs, including those funded by the American Recovery and Reinvestment Act and the Regional Greenhouse Gas Initiative, will contribute to the 15 by 15 policy goal, as outlined in Appendix C.

²⁴ Individuals may participate in more than one training.

- New policy recommendations and business models and practices to break down market barriers will have been developed and tested.

A summary "roll-up" of expected results for many of the common milestones and benefits across Initiatives is provided in Table 7-2. Table 7-3 illustrates the benefits attributed to each of the nine Initiatives. Achievement of these results will be closely tracked (and reported) over the course of the five year term and will be subject to evaluation (as described in Section 8 of this Operating Plan).

Table 7-2. Summary of Anticipated Cumulative T&MD Benefits (at full implementation)

	2012 - 2016	Out Years	Total
On-site Electricity Savings from Energy Efficiency Projects, Technologies, Replications, and Codes & Standards (Cumulative Annual ²⁵ MWh)	541,600 MWh	647,700 MWh	1,189,300 ²⁶ MWh
<i>MWh Savings from Funded Project and Technology Installations</i>	<i>171,600</i>	<i>900</i>	<i>172,500</i>
<i>MWh Savings from Anticipated Replications not Directly Funded by Program</i>		<i>29,800</i>	<i>29,800</i>
<i>MWh Savings from Codes & Standards Activities supported by the Program</i>	<i>370,000</i>	<i>617,000</i>	<i>987,000</i>
On-site Fossil Fuel Savings from Energy Efficiency Projects, Technologies, Replications, and Codes & Standards (Cumulative Annual ⁸ MMBtu)	3,323,200 MMBtu	2,802,600 MMBtu	6,125,800 ²⁷ MMBtu
<i>MMBtu Savings from Funded Project and Technology Installations</i>	<i>965,200</i>	<i>7,800</i>	<i>973,000</i>
<i>MMBtu Savings from Anticipated Replications not Directly Funded by Program</i>		<i>231,800</i>	<i>231,800</i>
<i>MMBtu Savings from Codes & Standards Activities supported by the Program</i>	<i>2,358,000</i>	<i>2,563,000</i>	<i>4,921,000</i>
On-site Demand Reduction from Energy Efficiency Projects, Technologies and Replications (Cumulative MW)	133 MW	242.4 MW	375.4 MW
<i>Demand Reduction from Funded Project and Technology Installations</i>	<i>43</i>	<i>5.3</i>	<i>48.3</i>
<i>Demand Reductions from Anticipated Replications not Directly funded by Program</i>		<i>30.1</i>	<i>30.1</i>
<i>Demand Reductions from Codes & Standards Activities supported by the Program</i>	<i>90</i>	<i>207</i>	<i>297</i>
On-site Generating Capacity Installed from CHP Projects, Technologies, and Replications (Cumulative MW) ²⁸	18	29.5	47.5
<i>MWs Installed from Funded Project and Technology Installations</i>	<i>18</i>	<i>19.5</i>	<i>37.5</i>
<i>MWs Installed from Anticipated Replications not Directly Funded by Program</i>	<i>0</i>	<i>10</i>	<i>10</i>
On-site Electricity Generated from CHP Projects, Technologies, and Replications (Cumulative Annual MWh) ²⁹	121,000	216,250	337,250
<i>MWhs Generated from Funded CHP Project and Technology Installations</i>	<i>121,000</i>	<i>155,250</i>	<i>276,250</i>
<i>MWhs Generated from Anticipated Replications not Directly Funded by Program</i>	<i>0</i>	<i>61,000</i>	<i>61,000</i>

²⁵ Cumulative annual savings refers to the savings that are achieved in a particular year (“annual”) from all measures installed (“cumulative”) as a result of program activities through the year of reporting; e.g., T&MD cumulative annual savings for 2016 are the energy savings achieved in 2016, as a result of energy efficiency measures installed from January 2012 through December 2016.

²⁶ For this supplemental revision to the T&MD Operating Plan, MWh associated with CHP systems have been removed from the calculation of on-site electricity savings.

²⁷ For this supplemental revision to the T&MD Operating Plan, natural gas usage associated with CHP systems has been removed from the calculation of fossil fuel savings.

²⁸ This benefit associated with CHP systems is included in the T&MD Operating Plan for the first time in this supplemental revision.

²⁹ This benefit associated with CHP systems is included in the T&MD Operating Plan for the first time in this supplemental revision.

	2012 - 2016	Out Years	Total
Primary Energy Savings from CHP Installations (Cumulative Annual MMBtus) ³⁰	157,300	281,125	438,425
<i>MMBtu Consumed from Funded Project and Technology Installations</i>	157,300	201,825	359,125
<i>MMBtu Consumed from Anticipated Replications not Directly Funded by Program</i>	0	79,300	79,300
System-wide CO ₂ Emission Reductions – On-site and Central Station (Annual Tons)	418, 512 Tons	432,209 Tons	850,721 Tons
Advanced Technologies Reaching Commercial Availability	47 Technologies	42 Technologies	89 Technologies
Improved Technologies Adopted by the Market or Further Supported by Deployment Programs	10 Technologies	9 Technologies	19 Technologies
Commercial Sales of New and Improved Supported Technologies	\$26.5 million	\$157.7 million	\$184.2 million
Funding Leveraged (co-funding and outside investment) by NYSERDA's Investment	\$696.5 million	\$103 million	\$799.5 million
Clean Energy Businesses Graduating from Incubators	90 Businesses	72 Businesses	162 Businesses
Clean Energy Companies Receiving Support	525 Companies	200 Companies	725 Companies
Retail and Supply Chain Businesses Partnering with NYSERDA to Increase Market Share of Energy Efficient Products	1,750 Partners		1,750 Partners
Clean Energy Training for Practitioners ³¹	39,056 Trainees	9 Trainees	39,065 Trainees
Support for Workers Entering Clean Energy Job Market			
Supply Chain Training to Facilitate Adoption of Energy Efficient Products	1,525 Partner Employees		1,525 Partner Employees
Adoption of Clean Energy Business Models, Practices or Strategies	Record will be maintained and reported		
Policy Development and Decisions Supported by NYSERDA studies, assessments and data ³²	Record will be maintained and reported		
Net Additional Jobs as a Result of NYSERDA Investment ³²	Portfolio Macroeconomic Benefits to be calculated annually and reported		
Change in GSP as a Result of NYSERDA Investment ³²			

³⁰ Primary Energy Savings for CHP systems (expressed in MMBtu) is based on the difference between the amount of energy displaced at grid-level generators and the energy used on-site by the CHP installations, accounting for both the avoided energy losses over the transmission and distribution system and the energy saved due to replacement of the on-site boiler with more efficient equipment. The energy displaced at grid-level generators is estimated based on the electricity system simulation model used in the New York State Energy Plan process.

³¹ Individuals may participate in more than one training.

³² These benefits will accrue from past investments, as well as T&MD portfolio investments.

Table 7-3. Summary of Anticipated T&MD Benefits by Program (at full implementation)

	POWER SUPPLY & DELIVERY			BUILDINGS		CLEAN ENERGY INFRASTRUCTURE				TOTAL
	Smart Grid & EV Infrastructure	Advanced Clean Power	Combined Heat & Power (CHP)	Advanced Buildings	Advanced Energy Codes & Standards	Market Development	Clean Energy Business Development	Workforce Development	Environmental Monitoring, Evaluation & Protection (EMEP)	
Electricity Savings from Energy Efficiency Projects, Technologies, Replications (Cumulative Annual MWh)				40,300 MWh	987,000 MWh	162,000 MWh				1,189,300 MWh
Fossil Fuel Savings from Energy Efficiency Projects, Technologies, Replications (Cumulative Annual MMBtu)				309,800 MMBtu	4,921,000 MMBtu	895,000 MMBtu				6,125,800 MMBtu
Demand Reduction from Energy Efficiency Projects, Technologies, Replications (Cumulative MW)				78.4 MW	297 MW					375.4 MW
MW of New Clean Generating Capacity from Projects, Technologies, and Replications (Cumulative MW)			47.5 MW							47.5 MW
Electricity Generated from Projects, Technologies, and Replications (Cumulative Annual MWh)			337,250 MWh							337,250 MWh
Primary Energy Savings from Projects, Technologies, Replication (Cumulative Annual MMBtu)			438,425 MMBtu							438,425 MMBtu
Advanced Technologies Reaching Commercial Availability	32 Technologies	9 Technologies		7 Technologies			40 Technologies			88 Technologies
Improved Technologies Adopted by Market or Further Supported by Deployment Programs	9 Technologies			8 Technologies		3 Technologies				20 Technologies
Commercial Sales of New and Improved Supported Technologies	\$15,000,000	\$62,200,000		\$87,000,000			\$20,000,000			\$184,200,000

	POWER SUPPLY & DELIVERY			BUILDINGS		CLEAN ENERGY INFRASTRUCTURE				
	Smart Grid & EV Infrastructure	Advanced Clean Power	Combined Heat & Power (CHP)	Advanced Buildings	Advanced Energy Codes & Standards	Market Development	Clean Energy Business Development	Workforce Development	Environmental Monitoring, Evaluation & Protection (EMEP)	TOTAL
Funding Leveraged (co-funding and outside investment) by NYSERDA's Investment	\$131,000,000	\$80,700,000	\$340,000,000	\$45,500,000			\$150,000,000	\$11,250,000	\$11,000,000	\$799,450,000
Clean Energy Businesses Graduating from Incubators							162 Businesses			162 Businesses
Clean Energy Companies Receiving Support	64 Companies	73 Companies		33 Companies			555 Companies			725 Companies
Retail and Supply Chain Businesses Partnering with NYSERDA to Increase Market Share Products						1,750 Partners				1,750 Partners
Clean Energy Training for Practitioners ³³		2,000 Trainees			15,000 Trainees		45 Trainees	22,020 Trainees		39,065 Trainees
Supply Chain Training to Facilitate Adoption of Energy Efficient Products						1,525 Partner Employees				1,525 Partner Employees
Adoption of Clean Energy Business Models, Practices or Strategies	Contributor		Contributor			Contributor	Contributor			
Policy Development and Decisions Supported by NYSERDA studies, assessments and data ³⁴	Contributor	Contributor	Contributor		Contributor	Contributor			Major Contributor	
Net Additional Jobs as a Result of NYSERDA Investment ³⁴	Contributor	Contributor	Contributor	Contributor	Contributor	Contributor	Contributor	Contributor		
Change in GSP as a Result of NYSERDA Investment ³⁴	Contributor	Contributor		Contributor			Contributor			

³³ Individuals may participate in more than one training.

³⁴ These benefits will accrue from past investments, as well as T&MD portfolio investments.

8 *Evaluation and Reporting*

8.1 Program Evaluation and Expected Results

8.1.1 Defining Success

The T&MD portfolio is designed to provide a range of benefits and outputs during and well beyond the five-year funding period. Both quantitative and qualitative metrics have been identified to measure program progress and success in terms of realized and potential benefits along the energy innovation chain. Evaluation techniques will address T&MD program efficiency, effectiveness, outcomes and impacts related to achievement of the objectives.

In order to best assess these objectives and define program success, key metrics and indicators are identified, quantitatively where possible, in each of the Initiative write-ups Section 9. Key metrics and indicators are defined in the following categories for each program:

- **Outputs/Leading Indicators** represent important program progress milestones. Tracking on these milestones will illustrate progress made by Initiatives, mostly in the near term.
- **Outcomes/Impacts** focus mostly on market progress and technology innovation milestones, as well as lasting energy and economic benefits to New York State. Some program outcomes/impacts will occur during the five-year SBC funding cycle, *e.g.*, energy savings from installed demonstration projects, while others will occur in the out-years, *e.g.*, energy savings from demonstration project replications, or sales and potential energy benefits of products developed. Program evaluation will be integral to accurately assessing the stated program outcomes/impacts.

NYSERDA has defined Outputs/Leading Indicators and Outcomes/Impacts based on its program experience and available industry/market information sources. Still, the very nature of technology and market development programs makes these metrics difficult to precisely forecast. The proposed stage-gate program implementation process³⁵ for many of the technology commercialization Initiatives defined in this Operating Plan will facilitate further definition and quantification of metrics as projects proceed through various phases of development. It will also help ensure that program attention and resources are focused on projects that have the greatest likelihood of achieving success in terms of the metrics laid out in the Operating Plan. The information gained and assessed as part of the stage-gate implementation approach will allow NYSERDA to further refine its metrics for reporting purposes and will permit a better evaluation design.

³⁵ The state-gate process incrementally funds product development projects based on achievement of defined technology and business readiness goals and performance milestones.

8.1.2 Evaluation Components and Methodology

The evaluation approach for these “next generation” T&MD initiatives has been and will continue to be informed by strategies developed by best-practice resources, such as the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy,³⁶ as well as by the expert input of third-party evaluation contractors. Evaluation objectives and approaches will be designed based on the nature of the program and developed at the onset of the evaluation.

Program Theory/Logic and Evaluability

As the T&MD programs commence, the initial evaluation tasks will include development of a program theory and logic model and an assessment of each major program to ensure readiness for future evaluation. By identifying and documenting inputs, activities, outputs, outcomes and external influences relevant to the program, theory and logic models are a good practice that will help to guide program implementation and program evaluation. Evaluability assessments will help ensure early on that the necessary program tracking or other data is being collected and recorded in a manner that will support examination, through a robust evaluation, of the ultimate outcomes and indicators identified for each program.

Process Evaluation

Formative process evaluations will be conducted on major programs during the early stages of implementation and repeated periodically to examine program efficiency and effectiveness in light of a program’s stated outcomes and impacts. Process evaluations typically include an assessment of customer and stakeholder satisfaction with programs. The goal of process evaluation is to facilitate real time adjustments and maximize program efficiency and effectiveness. These studies will mainly be conducted through in-depth, qualitative primary research, and will be supported by secondary research, such as review of program documents, as appropriate. Evaluations of NYSERDA’s internal processes may also be conducted.

Impact and Market Evaluation

At this stage, some key evaluation questions that the market and impact evaluation effort will seek to answer in terms of the T&MD portfolio’s near- and potential long-term effects are outlined in Table 8-1 for each major T&MD objective. Though not an exhaustive or fully complete list at this time, these evaluation questions and associated approaches are intended to align with the metrics defined for the portfolio and each major initiative and illustrate the manner in which the evaluation will be undertaken. An important goal of the evaluation work will be to assess realization of the portfolio and program level metrics and projected goals included in this Operating Plan. Table 8-1 as well as the metrics defined in each initiative section, will serve as the basis for further development of impact and market evaluation plans once the T&MD Initiatives commence.

³⁶ See U.S. Department of Energy Office of Energy Efficiency and Renewable Energy, Overview of Evaluation Methods for R&D Programs: A Directory of Evaluation Methods Relevant to Technology Development Programs, March 2007.

Table 8-1. Market and Impact Evaluation Questions and Approaches

Objective: Move new/underused technologies and services into the marketplace to help achieve EEPS and RPS goals	
Key Evaluation Questions to Assess Program Outcomes and Impacts	Evaluation Approaches
<ul style="list-style-type: none"> • Is the program effectively targeting and reducing barriers to more widespread adoption of the energy efficiency, renewable or smart grid technology or strategy? • Is the program increasing the number and knowledge base of market participants involved with the technology or strategy? • What are the energy savings and other benefits and costs associated with funded projects? • To what extent have funded projects spurred additional implementation of the technology/strategy, and what are the realized energy benefits from this spillover? • How many technologies have been transferred to deployment programs or adopted by the market, and what is their potential in terms of market penetration and energy benefits? 	<p>Surveys and interviews with program participants and non-participants</p> <p>Case studies on funded projects</p> <p>Review of project tracking data and engineering analyses</p> <p>On-site measurement and verification of energy savings from funded demonstration projects</p> <p>Technology commercialization tracking, including examination of the number of technologies commercialized and extent of commercialization</p>
Objective: Validate emerging energy efficiency, renewable and smart grid technologies/strategies and accelerate market readiness in NY	
Key Evaluation Questions to Assess Program Outcomes and Impacts	Evaluation Approaches
<ul style="list-style-type: none"> • Is the project achieving its technical and economic milestones? • Has any intellectual property been developed? • Have the factors influencing the industry’s adoption/lack of adoption of the energy efficiency, renewable or smart grid technology been clearly identified, and effectively addressed by the program? • How many technologies have reached commercial availability as a result of the programs? To what extent has commercialization been achieved? • What is the dollar value of commercial sales of supported technologies? How long does it take to generate the technology’s first sales? • To what extent have the outputs supported further development or commercialization of the energy efficiency, renewable or smart grid technology? • What are the potential benefits and costs of the technology at different levels of market penetration? • What evidence is there of spillover or replication from the funded technologies/projects? • For demonstration projects, what are the energy savings and other benefits and costs, including benefits to the utility ratepayer, associated with funded projects and replications? • What are the overall macroeconomic effects on NY’s economy? • Did the project influence subsequent investment in utility infrastructure? 	<p>Surveys and interviews with program participants and non-participants</p> <p>Case studies on funded projects</p> <p>Review of project tracking data and engineering analyses</p> <p>On-site measurement and verification of energy savings from funded demonstration projects</p> <p>Technology commercialization tracking, including examination of the number of technologies commercialized and extent of commercialization</p> <p>Historical tracing, including linking downstream innovation to upstream R&D efforts</p>

Objective: Stimulate technology and business innovation to provide more clean energy options and lower cost solutions, while growing NY’s clean energy economy	
Key Evaluation Questions to Assess Program Outcomes and Impacts	Evaluation Approaches
<ul style="list-style-type: none"> • Has the program increased the knowledge base of energy efficiency, renewable energy, and smart grid opportunities in New York State? • Have new business models and/or practices developed to advance energy efficiency, renewable energy, and smart grid in the state? • Has the program increased the number of clean energy businesses in NY? • To what extent has the program played a role in leveraging private capital and other investments in clean energy businesses? • Has the program increased the overall extent of energy efficiency, renewable energy, and smart grid development and investment in New York State? • To what extent are program funding recipients “standing on their own” following SBC funding? 	<p>Surveys with market actors</p> <p>Case studies</p> <p>Collection and analysis of available longitudinal market data, e.g., clean energy businesses active in the market; sales and market share of energy efficient supported products/technologies</p>
Objective: Spur actions and investments to achieve results distinct from incentive-based programs	
Key Evaluation Questions to Assess Program Outcomes and Impacts	Evaluation Approaches
<ul style="list-style-type: none"> • What role did the program play in initiating research in this area? • To what extent has the target audience been reached and has the information been used? • How noteworthy are the results? • Have additional project relationships developed among researchers, businesses, and end users of the work? • To what extent have the outputs supported further development or commercialization of the technology? • To what extent have the outputs of research supported policy decisions? • To what extent has the program supported energy efficiency actions, investments and savings separate and apart from incentive programs? 	<p>Bibliometrics</p> <p>Citation analysis, including frequency</p> <p>Network analysis, including examination of connections established among related research entities</p> <p>Technology commercialization tracking, including examination of the number of technologies commercialized and extent of commercialization</p> <p>Surveys with policy makers and other users of the program supported research and analysis</p> <p>Use of baseline and follow up studies on code compliance rates, along with surveys of market actors to determine program attribution</p>

In order to capture the economic benefits from the T&MD portfolio, NYSERDA's evaluation plan also includes conducting a *macroeconomic analysis*. This study would examine the net impact of T&MD portfolio benefits and costs on economic indicators including job creation and gross state product in New York State. Similar analyses have been conducted in the past for NYSERDA's SBC portfolio and Research & Development product development activities. Lessons learned on conducting this type of assessment for R&D programs will be applied in order to strengthen the analysis of SBC program economic impacts. The evaluation will also judge the *cost-effectiveness* of the T&MD programs and portfolio by examining realized and, where applicable, potential energy and economic benefits against the program and participant costs. Evaluation could also assess the rate of return on T&MD investments at the portfolio level.

It is important to note that the type of T&MD programs offered as part of this portfolio typically do not lend themselves to the same level of evaluative accuracy as resource acquisition programs given the generally more dispersed and longer term nature of benefits. NYSERDA will endeavor to use national best practices for technology and market development evaluation and make the best assessment possible given available funding.

Evaluation of Workforce Development Initiative

The planned evaluation approach and research questions for the Workforce Development Initiative, added to the T&MD Portfolio by the December 17, 2012 Order, are presented in Appendix D. These research questions and approach for this Initiative, given its unique nature, represent the result of collaboration between NYSERDA program and evaluation staffs, NYSERDA's evaluation contractors and DPS staff. Further refinements are expected through a continued collaborative effort as the evaluation work commences.

Use of Evaluation to Improve Programs

NYSERDA will ensure that interim and final evaluation results and recommendations are integrated into ongoing program implementation on a "real time" basis in order to support a process of continual program improvement. Process evaluation and periodic review of program performance (*e.g.*, spending status, assessment of outputs/leading indicators and outcomes/impacts against goals defined in this plan) will enable NYSERDA to assess the T&MD portfolio's progress and redeploy funds as necessary to best meet the overarching program objectives.

8.1.3 Evaluation Implementation, Funding and Timeline

Evaluation Implementation

Evaluation work will be conducted by independent, competitively selected expert contractors overseen and managed by NYSERDA's evaluation staff in Energy Analysis. Energy Analysis is a separate department within NYSERDA without any program implementation or administration responsibilities. Energy Analysis has been responsible for conducting evaluation of NYSERDA's various program portfolios, working with independent evaluation contractors, since the late 1990s and has the experience and staff to support this function for the T&MD portfolio.

Evaluation contractors will assist with further planning evaluation strategies and metrics most appropriate for the T&MD programs and will advance best practices in their studies of these programs. Thus, the approaches outlined in this document may evolve as NYSERDA engages these contractors and further reviews best practices most appropriate for the ultimate program offerings. NYSERDA will engage Department of Public Service (DPS) staff in this evaluation planning process.

Evaluation Budget

The T&MD portfolio evaluation budget has been set at 5% of program funding. The majority of the evaluation budget will be used to support the work of independent contractors. Of the total budget allocated to evaluation contractors, approximately 30% is expected to support process evaluation, program theory and logic, and evaluability assessments. The remaining 70% will be used for impact and market evaluation. Evaluation budgets for individual programs within the T&MD portfolio will be set as specific evaluation plans are finalized, but it is expected that some programs will require more than their proportional allocation of the 5% evaluation budget and, therefore, others will receive less. These evaluation budget considerations will be weighed as plans are developed and will be provided to DPS staff for input.

Evaluation Timing

Since the technology innovation, market development and energy/economic outcomes and impacts of NYSERDA's proposed T&MD programs are expected to occur over a longer time horizon, evaluation efforts will need to be timed accordingly in order to examine program effectiveness and capture initial impacts when information is needed to support decision-making related to program implementation and future program planning. In addition, given the long-term nature of the expected benefits of the T&MD program portfolio, some evaluation funds will be reserved for a more complete assessment of program impacts in the out-years, after the five-year funding period. It is expected that process evaluation efforts will occur in the early years of program rollout, in order to assess efficiency and effectiveness, and identify areas for improvement. Impact/market evaluation will occur during the latter half and beyond the five-year funding cycle, most likely in two phases, in order to inform decision making and capture benefits as comprehensively as possible. For some programs that are a continuation of prior SBC program activities, impact/market evaluations may be initiated earlier and could examine more of the historical progress. To the extent possible, evaluation activities will be designed to provide information – including program progress, accomplishments, lessons learned, successes and failures, and recommendations for possible mid-course corrections -- to support the required “mid-term” review of the T&MD portfolio in March 2014.

8.2 Reporting

NYSERDA will provide monthly reports on the financial status of the program. Not later than March 31 of years 2012 through 2016, NYSERDA will file an accounting of uncommitted balances at the end of the previous calendar year. Also, not later than June 30 of each year from 2012 through 2015, NYSERDA will submit a forecast of estimated end-of-year cash balances, expenditures and commitments, through 2018.

Each year, NYSERDA will complete a semiannual and annual report on the progress, outputs and outcomes of the T&MD portfolio and Initiatives. The semiannual/annual report will include budget and spending status and will illustrate NYSERDA's progress against the quantitative and qualitative goals stated in this Operating Plan, and against the main T&MD portfolio objectives. Over time, as the portfolio effects begin to accrue, the semiannual and annual reports will also present qualitatively and quantitatively the benefits to New York State and utility ratepayers in terms of increased reliability and safety, an improved environment, economic development, job creation, and wholesale energy price mitigation. In accordance with the metrics presented in this Operating Plan, reports will quantify leveraging of funds from other external sources, and evaluation activities can assess the extent to which the leveraged funds would have been available without the SBC funds through the T&MD Program. As projects are selected and then implemented, reports will also describe progress collectively for funded projects toward defined milestones in the technology development and commercialization process. The program stage-gate process and project monitoring, along with evaluation activities, can assess the likelihood that fund recipients will be self sustaining when the SBC funding expires. As this information is available, it will be addressed in reporting as well.

The semiannual report will be submitted 60 days after the first six months of each calendar year. Annual reports will be submitted 90 days after the end of each calendar year. NYSERDA will also make publicly available all T&MD evaluation studies completed by its independent contractors, including summary reports on recommendations made as a result of the evaluation efforts and NYSERDA's response and follow up actions related to those recommendations.

Also, following the submission of its 2013 annual report due March 31, 2014, NYSERDA will make a progress presentation to the PSC, describing the state of the T&MD portfolio, achievement of milestones, outcomes and evaluation results.

9 *T&MD Initiatives*

This section of the Operating Plan describes the nine Initiatives that comprise the T&MD portfolio within three program categories: Power Supply and Delivery; Building Systems; and Clean Energy Infrastructure. Power Supply and Delivery Initiatives focus on: (1) opportunities related to the future Smart Grid; (2) clean power generation that will allow New York to integrate renewable energy sources into the Grid; and (3) peak load reduction that can be achieved for the Grid through combined heat and power applications. The Building Systems category includes Initiatives that focus on the substantial opportunity that exists to reduce energy use and incorporate resiliency in buildings through incorporation of efficient technologies, energy codes and standards, and increased participation in demand response programs. Clean Energy Infrastructure Initiatives are "cross-cutting" and focus on market development strategies to accelerate the supply and demand for clean energy solutions, consumer education, workforce development, business growth in the clean energy sector, and research and analysis of the environmental effects of the production and use of energy.

For each Initiative, a brief synopsis of the targeted problem is presented, including the current state of technology or knowledge related to that Initiative, and why the proposed activities are important to New York and New York's ratepayers. Program goals for the short and long term are noted, and the manner in which each of the Initiatives aligns with the T&MD objectives is highlighted. Proposed program design is described, including various program components. The expected benefits that align with the priorities for the T&MD portfolio are listed. NYSERDA's past experience delivering programs similar to those proposed in this Operating Plan is presented.

Tables illustrating the proposed funding by major component are included for each Initiative. A table, showing the performance milestones and expected results, is provided to illustrate the near term impacts and indicators of success, as well as the longer term outputs and impacts expected to accrue as a result of the investment of rate-payer funds. These performance "metrics" will be used to assess progress in meeting the objectives of the T&MD portfolio over the course of the five years and beyond.

Strategic outreach and technology transfer efforts will be designed and applied based on the opportunity to positively influence outcome and increase the effectiveness of program delivery.

9.1 Power Supply and Delivery Initiatives

9.1.1 Smart Grid and Electric Vehicle Infrastructure

Targeted Problem

New York's present electric power delivery infrastructure was not designed to meet the needs of a restructured electricity marketplace, the increasing demands of a digital society, or the increased use of renewable power production and electric vehicles. The existing infrastructure is aging, raising potential reliability concerns. Investments in transmission and distribution expansion and maintenance are highly scrutinized.

The Smart Grid could provide enhancements that: ensure higher levels of security, quality, reliability, and availability of electric power; improve economic productivity; and minimize environmental impacts while maximizing sustainability. A properly designed Smart Grid will be characterized by pervasively collaborative distributed intelligence that features sensors, controls and two-way communication. This will include flexible wide band gap communication, dynamic sharing of intelligent electronic devices, and distributed command and control. Achieving this vision requires careful policy formulation; timely infrastructure investment; and greater commitment to public/private research, development, and demonstration.

Grid-powered electric vehicles (GPV) also referred to as plug-in electric vehicles, represent a new technology responsible for accelerating the need to develop a reliable Smart Grid. Governmental policies are promoting greater use of GPVs. This will have impacts on the electric grid -- impacts that are not yet fully understood, but will need to be addressed in order to take advantage of the new automotive technology. To facilitate informed decisions on potential large-scale deployment, the Smart Grid and Electric Vehicle Infrastructure Initiative will provide a systematic approach for evaluating the performance, cost, and benefit of emerging technologies in targeted applications that support the vision for a reliable and robust Smart Grid.

Current State of Technology or Knowledge

The rapid pace of change in grid modernization, largely fueled by federal ARRA funds, has resulted in billions of dollars invested in projects supporting the Smart Grid/GPV infrastructure. Many of the demonstration pilot projects could result in a favorable cost-to-benefit ratio, while others will likely reveal technical, cost, or reliability issues. The Electric Power Research Institute's (EPRI) 2011 Technical Report, titled, "Estimating the Cost Benefit of the Smart Grid," identifies the potential benefits of the Smart Grid as well as the uncertainty associated with determining the actual costs. This report and others like it³⁷ demonstrate that cost effective approaches for smart charging and smart distribution systems are required to meet short duration, on-peak power demands generated from a substantially increased new electric load coupled with growth in the electric transportation sector.

³⁷ Including: the "Report of the Cross-Sector Electric-Grid-Powered Vehicle Sub-group of the New York State Climate Action Plan"; 2010 EPRI Report "Understanding the Grid Impact of Plug-in Vehicles on the New York State Electric System"; and the "New York State Smart Grid Roadmap" prepared by the New York State Smart Grid Consortium.

As technology options rapidly emerge, careful timing of implementation and thoughtful selection of options meriting investment are imperative. Premature support of less desirable options can be costly and unsuccessful in achieving the anticipated benefits. Conversely, delayed investment could negatively impact reliability or hinder economic growth opportunities.

Why This is Important for New York and New York Ratepayers

To achieve the potential of system benefits and economic competitiveness through the integration of GPVs, significant capital expenditures are likely to be required. In addition to electrification of the transportation system, the electric grid will need to accommodate increased penetration of intermittent sources of energy such as large-scale wind, wide adoption of rooftop solar systems, and expanded customer participation in demand response and price-elastic consumption related to dynamic rates.

To support New York's transition to a 21st century electric grid, this Initiative will:

- Support statewide coordination of Smart Grid activities and work with stakeholders to identify targeted assessments, investigations and pilot programs that could enable cost benefit analysis of emerging options;
- Provide a mechanism for innovative policy and rate structure evaluation;
- Develop and demonstrate innovative technologies and strategies that improve the performance of the electric power delivery system; and
- Enable consumers to enjoy the benefits of clean renewable resources and low-cost GPVs that are expected to gain a sizeable market share by 2020.

Electrification of the transportation sector through the Smart Grid requires managing additional loads and addressing on-peak demand. Unique aspects of GPV charging offer the potential for the new load to improve grid reliability, provide ratepayer cost reductions, and contribute to New York's greenhouse gas reduction targets.

The Initiative will address all aspects of technology commercialization including technical, business, and regulatory innovation. The program will specifically engage the Department of Public Service (DPS), the State's investor-owned utilities (IOUs), and the New York State Smart Grid Consortium (Smart Grid Consortium) in a collaborative dialogue to identify research priorities and potential societal benefits resulting from investments that could further the widespread use of GPVs and support the Smart Grid.

Program Goals

The goal of this Initiative is to accelerate the market readiness of new and emerging Smart Grid and GPV infrastructure technologies and strategies in order to achieve cost-effective performance, reliability and environmental benefits. Results informing cost-effective, phased incorporation of technologies that can provide near and long-term optimization of grid performance will be shared with DPS. This may include engineering studies, product development, demonstration projects and pilot programs that: promote a diverse supply of low-carbon electric-power generation; enhance transmission and distribution reliability, efficiency, control and interoperability; enable end users to

reduce energy consumption and cost; and support business models and rate structures that facilitate transition to a transportation sector more heavily powered by electricity.

Program implementation would be through competitive solicitations designed to:

- Leverage federal and private funding for State investment in demonstration pilots;
- Accelerate technology innovation and adoption of best practices in New York;
- Explore new business models and policies for improving transmission, distribution and load management and for accelerating adoption of GPVs and associated infrastructure through innovative financing and risk-sharing arrangements;
- Prepare the grid for the upcoming increase in electric vehicle charging load;
- Develop and demonstrate innovations that improve grid reliability, including technologies like GPVs and energy storage systems that can help smooth electric grid loads;
- Qualify and validate the cost/benefits of new products that improve power delivery reliability and efficiency; and
- Provide statewide benefits through technology transfer studies, analysis and “lessons learned” from pilot programs and demonstrations.

Program priorities and overall program design would be informed by the Smart Grid Consortium with guidance and rulings ultimately provided by the PSC. In addition, the New York Battery and Energy Storage Technology Consortium (NY-BEST) would provide input regarding the energy storage components of the program. Specific areas of focus will evolve as Smart Grid and GPV technology develop and as public policy and consumer preferences change.

At the conclusion of the T&MD cycle, the effort could support the following:

- Uniform statewide diagnostics to assess transmission and distribution (T&D) system reliability;
- Integrated advanced communication, control, and monitoring technologies, power electronics, and innovative T&D technologies;
- Deployment and validation of remote sensing devices for continuous monitoring of T&D infrastructure with real-time monitoring of real and reactive power;

Alignment with T&MD Objectives

The Smart Grid and Electric Vehicle Infrastructure Initiative focuses on proving emerging technologies and accelerating the market readiness of options that can provide cost effective benefits to the electric rate base. The effort will also stimulate technology/business innovation and validate actual performance to mitigate risk of a new technology. Working closely with the utilities, new technologies will be moved into the marketplace to achieve New York’s clean energy and reliability goals.

- Delivery of electricity from large-scale and distributed renewable generation resources including wind and solar;
- Technologies such as energy storage, flow batteries, flywheels, stationary batteries and compressed air energy storage to reduce the intermittency of renewable resources;
- Demonstration of advanced distribution management systems;
- Demonstration and validation of technology and business models that minimize negative grid impacts from GPV charging;
- Dissemination of lessons learned and best practices from smart grid programs worldwide;
- Research evaluating new technologies, design methodologies, policies and other barriers to implementation of the Smart Grid; and
- Demonstration and documentation of impacts of various GPV infrastructure technical approaches and business scenarios.

Specific near-term and long-term performance milestones related to these goals and objectives are presented at the end of this section.

Program Design

Efforts under this Initiative include engineering studies, product development, demonstration projects and pilot programs. Implementation will be through competitive solicitations, and direct support may be used as cost-share for proposals to competitive federal programs. Selection of proposed demonstration and pilots projects throughout the state will be based on the ability to:

- Promote a diverse supply of low-carbon electric-power generation;
- Enhance transmission and distribution reliability, efficiency, control and interoperability;
- Enable end-use customers to reduce energy consumption and cost;
- Leverage funds; and
- Support technology, business and rate structures that facilitate a rapid and smooth transition to a transportation sector primarily powered by electricity.

Over the course of the T&MD cycle, specific areas of focus will emerge as smart grid technology evolves, and the Smart Grid Consortium technology roadmap is updated. Initial areas of focus will include: interoperability; enhanced grid reliability; preparation for electric vehicle market penetration; and energy storage. The program will also act as technology transfer clearing house, facilitating coordination and sharing of lessons learned in order to minimize redundancy.

Examples of potential projects include:

- Innovative rate structure pilot projects and analysis;

- Energy storage system development and integration with renewable, load shifting, ancillary services, investment deferral and reliability;
- Large-scale pre-deployment demonstration programs that verify performance and benefits at sufficient scale (technology and number of consumer participants) to provide meaningful results;
- Development and demonstration of approaches such as stationary energy storage, mini-grid, and Smart Grid load management devices that mitigate adverse impacts to the distribution system;
- Technology and component development with original equipment manufacturers and businesses to assure continued performance improvement;
- Advanced behavioral research and analysis of regulatory issues to provide policymakers information addressing barriers to adoption;
- Development of GPV-to-grid communication technology and various financial transaction models that engage midstream entities such as demand response providers to aggregate customer load.

Funds will also support the NY-BEST Testing and Commercialization Center to improve industry testing, prototyping and validation capabilities and ensure that critical and unique New York storage issues are addressed in a manner that provides additional State benefits. NY-BEST is dedicated to fostering collaboration among the State's universities and industry to increase the speed of innovation in energy storage technologies and develop storage research and manufacturing facilities in New York State.³⁸

NYSERDA will present final and interim results throughout the five-year program period and assist DPS staff in the identification of specific opportunities where smart grid technologies are ready for wide scale deployment.

Expected Benefits

This section describes the expected benefits associated with the Smart Grid and Electric Vehicle Infrastructure initiative in relation to the seven priorities articulated in Section 5.2. The following describes several qualitative and "big picture" benefits, providing an important context for the initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-2.

System-wide Energy Benefits: Potential energy benefits include: peak load and energy reductions by developing technologies that improve two-way communication systems and enable greater

³⁸ The September 13, 2012 Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*, included \$10 million for an energy storage initiative within the Smart Grid Program. Of this amount, \$7.5 million was to provide cost-sharing support for an application for U.S. DOE funding to establish an Energy Storage Innovation Hub within New York, and \$2.5 million was to be used to support the New York BEST Commercialization and Testing Laboratory. NYSERDA notified DPS on December 5, 2012 that DOE funds were not awarded for the Energy Storage Innovation Hub. Pursuant to the Order, a Petition for consideration of alternative uses for those funds was to be filed within 60 days of such notification. NYSERDA requested an extension, and on January 24, 2013, the extension request for a filing date of April 5, 2013 was granted.

dynamic load flexibility for end users; reduced system losses with improved voltage and power factor control; and enhanced system reliability and security to reduce power outages for all consumers. By enabling higher penetration of renewable resources, diversification of New York's entire electric system fuel mix will be increased. Improved performance at the transmission and distribution levels of the system will be monitored, and reduced losses and improved power quality will accrue to all ratepayers.

Economic Development Benefits: Economic benefits include: leveraged investment for New York; creation of new businesses and products; increased product sales and jobs; energy cost savings for pilot demonstration project host sites; and system-wide energy cost savings due to reduced demand and location-based marginal electric prices. Long-term economic benefits will result from the self-sustaining research and commercial activities catalyzed by initial funding.

Environmental Benefits: Smart Grid program components, such as energy storage, can improve the dispatch ability of low-cost, clean renewable power and support an accelerated transition to an electrified transportation sector that reduces greenhouse gas (GHG) emissions. The transportation sector alone is responsible for approximately 40% of the state's GHG emissions.

Consumer Cost Savings: The core goals of the Initiative are to improve the efficiency and reliability of the power delivery system and the electrification of the transportation sector in order to provide consumers with gasoline/diesel and energy cost reduction options. By improving GPV charging technologies, a significant new electric load can be shifted to off-peak times when grid T&D assets are underused. Generating additional revenue through greater use of these existing assets can lower the capital amortization and O&M cost per unit of electricity to all consumers.

Opportunities Unique to New York: The power delivery system in New York includes rural, suburban and dense urban networks and provides an opportunity to evaluate a variety of technologies across the full spectrum of service territories. Products developed to serve the New York market can be commercialized to support domestic and international applications. The State's Smart Grid organizational leadership; that includes NYSERDA working with GE, IBM, Brookhaven National Laboratory, the Smart Grid Consortium, NY-BEST, and the five Energy Frontier Research Centers; provides a unique opportunity to harness a diverse set of indigenous resources.

Leveraging Resources or Filling Gaps: Near-term benefits will result from leveraging significant investments from the federal government and private sectors. Historically, this leveraging has exceeded 5:1, and resulted in clusters of technical expertise in battery/energy storage, advanced communication technologies, and innovative grid visualization tools. Efforts will be coordinated with Brookhaven National Laboratory to exploit opportunities for securing federal funding.

Scale of Potential Benefits Relative to Program Costs: Close coordination with all of New York State's electric utilities is essential to ensure maximum benefit at the lowest cost to consumers. Projects providing broad statewide benefit and avoiding duplication with ongoing utility activities will be supported. Targeted projects, including cost-shared pilot demonstrations, will be solicited for their strategic value in guiding regulatory and policy decisions.

Annual capital expenditures on New York’s electric utility T&D vary depending on the infrastructure projects needed to satisfy planned consumer load growth and to achieve system reliability targets. In recent years, T&D capital expenditures have exceeded \$2 billion annually; the proposed program will evaluate all opportunities for Smart Grid technologies to reduce these overall costs. Strategic pilot demonstration projects, with the potential to delay or avoid new capital expenditures and increase the use of existing assets, will be supported. A recent study completed by the Pacific Northwest National Laboratory (PNNL), titled, “Potential Impacts of High Penetration of Plug-in Hybrid Vehicles on the U.S. Power Grid,” concluded that the increased utility revenues associated with off-peak GPV smart charging could reduce overall power delivery costs by 7% for all consumers. Savings accrue from the increased use of existing assets and the associated reduction in grid capital amortization costs.

Program Experience

The existing Smart Grid program currently supports more than 30 projects designed to make advancements in: integrating advanced communication systems; control and monitoring technologies; power electronics; remote sensing for continuous monitoring of infrastructure; real-time monitoring of real and reactive power; voltage conservation; demand-side ancillary services; and integration and delivery of electricity from renewable generation resources. Technologies supported include flow batteries, flywheels, stationary batteries, compressed-air energy storage, phasor-measurement units, reactive-power correction, and advanced distribution management and demand-response solutions. The program has supported several research studies to evaluate new technologies and design methodologies; development of Smart Grid implementation policy; and the technical, business innovation and regulatory issues critical to technology commercialization.

NYSERDA has extensive experience with electric vehicle technology and charging infrastructure. Twenty-eight active projects support vehicle development and acquisition, charging infrastructure development and deployment, analysis of impact of high adoption rates of GPVs in (downstate) Zones J and K of the State’s electrical grid, and identification of cost and design parameters associated with electrification of large-scale GPV fleet parking facilities. These projects represent a decade of research development and commercialization of GPV products and have resulted in manufacturing facilities for hundreds of electric postal vans, transit busses, and critical subsystems such as battery packs. NYSERDA is also currently participating in Ford and Chrysler GPV development programs.

Funding and Performance Milestones

The average annual budget of \$12.26million for this Initiative will be leveraged with resources from New York’s electric utilities, and is expected to leverage additional resources from outside the state. Funding is increased in the out-years to further align with expected technology market adoption and penetration. Funding will support select, larger flagship projects and smaller projects and studies.

Proposed priorities in 2012 include a focus on understanding/defining the fundamental links between electric vehicle infrastructure and utility distribution circuits. The activities are inexorably linked, and a coordinated approach is critical in order to realize program goals. A particular emphasis is placed on how distribution-level energy storage technologies can be used to enhance grid reliability where electric vehicle market penetration is likely to be significant.

Table 9-1. Smart Grid and Electric Vehicle Infrastructure Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Smart Grid	9.46	8,042,334	12,992,081	18,750,000	47,284,415
Electric Vehicle Infrastructure	2.80	1,847,444	3,712,023	8,437,500	13,996,967
Total: Smart Grid/EV	\$10.76	\$9,889,778	\$16,704,104	\$27,187,500	\$53,781,382³⁹

³⁹ This budget has been amended to remove the \$7.5 million made available to provide cost-sharing support for an application to U.S. DOE to establish an Energy Storage Innovation Hub in New York, The \$2.5 million to be used to support the New York BEST Commercialization and Testing Laboratory, included in the September 13, 2012 Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*, remains in this budget.

Table 9-2. Smart Grid and Electric Vehicle Infrastructure Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/ Leading Indicators					
Smart Grid	Sign contracts for 29 technology development, demonstration and pilot projects, including several large flagship projects	7	10	12	
	Complete 29 technology development, demonstration and pilot projects, including several flagship projects.		5	9	15
	Sign contracts for 8 research studies on technologies, market barriers and policies related to increased smart grid implementation in NY	2	3	3	
	Complete 8 research studies on technologies, market barriers and policies related to increased smart grid implementation in NY		2	3	3
	34 clean energy companies receiving support	8	12	14	
	Develop business models to advance smart grid infrastructure				
	Facility operator agreement executed with 3rd party for Commercialization Center	Executed agreement			
Electric Vehicle Infrastructure	Sign contracts for 25 grid powered vehicle technology development, demonstration and pilot projects	4	9	12	
	Complete 25 grid powered vehicle technology development, demonstration and pilot projects		3	6	16
	Contract 8 research studies on technologies, market barriers and policies related to increased grid powered vehicle implementation in NY	4	2	2	
	Complete 8 research studies on technologies, market barriers and policies related to increased grid powered vehicle implementation in NY		4	2	2
	30 clean energy companies receiving support	5	10	15	
	Develop business models to advance GPV infrastructure				

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outcomes/Impacts*					
Smart Grid	\$112 million in leveraged funds (co-funding and outside investment) for smart grid infrastructure	\$18M	\$42M	\$52M	
	3 smart grid technologies reaching commercial availability			1	2
	6 Improved Technologies Adopted by the Market or Further Supported by Deployment Programs			2	4
	\$6 million commercial sales of new and improved supported technologies ⁴⁰				\$6M
	Smart grid technologies and practices are considered in utility resource planning and infrastructure decisions				
	Technologies, tools and information provided by the Program support improved grid performance reliability				
	\$7 million in leveraged funds (co-funding and outside investment) for the Commercialization Center	\$2M	\$2M	\$1M	\$2M
	\$10M Revenue generated from facility use of the Commercialization Center	\$150k	\$2.2M	\$1.4M	\$6.3M
	41 Product development tests (technology readiness level (TRL) 7+) in the Commercialization Center	2	8	6	25
	25 tested or prototyped products commercialized from the Commercialization Center	1	4	4	16
	Change TRL for technologies examined in Commercialization Center				
Electric Vehicle Infrastructure	\$42 million in leveraged funds (co-funding and outside investment) for electric vehicle infrastructure	\$4M	\$14M	\$24M	
	4 electric vehicle technologies reaching commercial availability		1	1	2
	3 Improved Technologies Adopted by the Market or Further Supported by Deployment Programs			1	2
	\$9 million commercial sales of new and improved supported technologies ⁴⁰				\$9M
	Program supports preparedness for electric vehicle charging load				

*Impacts related to effects on New York's economy, e.g., jobs and gross state product changes, to be assessed at T&MD portfolio level.

⁴⁰ There is not enough historical sales data for these technologies available, making it difficult to forecast value of sales.

9.1.2 Advanced Clean Power

Targeted Problem

Increasing indigenous renewable generation and the overall efficiency of energy generation are priorities articulated in the New York State Energy Plan. Developing a pipeline of renewable resources is necessary to meet the state's renewable power generation (RPS) and energy efficiency (EEPS) goals and address the combined threats of climate change and dependency on volatile fossil fuel markets. Performance improvements and cost reductions require continued investment in technology innovation and marketplace acceptance. The development and testing of new power conversion systems and supporting technologies – such as energy storage that fosters integration into the power grid– will benefit New York State's economy and exploit more fully the value of clean resources.

The contribution of land-based wind projects to long term clean energy goals will be challenged by increased siting limitations and transmission constraints. Offshore wind energy, often considered the next frontier of renewable resource development, faces the additional challenges – as identified by the U.S. Department of Energy (DOE)⁴¹ – of high capital costs, lengthy permitting, and insufficient site characterization. All such challenges will continue to be addressed as New York directs its focus on the offshore marine environments of the Great Lakes, Long Island, and the Atlantic Ocean.

Current State of Technology or Knowledge

Current vintage solar photovoltaic (PV) technology is relatively inefficient and expensive. While much attention has focused on reducing the cost of PV modules, the cost of the balance-of-system and installation still accounts for close to half of total cost and presents a significant opportunity for improvement.

Analysis of the performance of the national fleet of large wind turbines indicates that incremental improvement on the order of 3-8% may be achievable in turbine performance. The infrastructure needed to harvest the energy potential abundant in the State's marine environments and next generation technologies, like kinetic hydro and offshore wind, are at early stages of development in the U.S. Knowledge has not been well developed regarding the marine environment, various and potentially competing public uses, suitability for energy generation and required infrastructure. This deficit of information may cause delays in New York's ability to move forward in planning for introduction of marine-based resources, jeopardizing New York's ability to compete for investment dollars. Supporting the development of this knowledge base with stakeholders will attract interest from the development community and, more importantly, satisfy state and federal authorities' goals to coordinate and collaborate on ocean spatial planning and expedite permitting processes.

New technologies – such as kinetic hydro generation capable of extracting power from tidal and river currents – show promise in addressing the challenge of integrating intermittent renewable generation with geographically-separated load pockets and downstate load profiles. Major,

⁴¹ DOE-EERE, A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States, February 2011.

promising advances in solar system efficiency and small wind generation, coupled with analytical tools for urban siting and energy integration, are under development and demonstration. Although technically challenging, the high value of on-peak power downstate offers near-term opportunity for competitive systems employing these technologies.⁴²

Current research at several Energy Frontiers Research Centers (Columbia, Cornell, SUNY Stony Brook, and Brookhaven National Laboratory) is supported by federal funding and limited NYSEDA SBC funding. Activities include research on: electrode reactions in fuel cells, batteries, and solar photovoltaic technologies; chemical energy storage systems; high-temperature superconducting capacity; and the conversion of sunlight into electricity in nanometer-sized thin films. While the current SBC helped to leverage these substantial federal resources into New York, the proposed future SBC program will transform this research into product and system design, development, and testing to address New York's energy opportunities and needs.

Why This is Important for New York and New York Ratepayers

A 3-8% improvement in the performance of New York's wind turbine fleet of about 1,500 MW would avoid the annual generation of approximately 110-290 GWh of energy from conventional generation. Increased performance of wind turbines will increase the cost effectiveness of renewables, putting downward pressure on costs associated with achieving environmental goals and providing a long-term hedge against volatile and increasing fossil fuel prices. These benefits can be achieved through investment in efforts such as development of performance-enhancing software and research on advanced turbine blade geometries. Performance advancements and cost reductions in PV, kinetic hydro and waste heat power generation can also facilitate generation within load pockets, and fuel cell technology emerging from the auto industry could provide the cleanest possible fossil fuel generation in environmentally-sensitive urban locations. New York can play a pivotal role in developing marine-based wind resources by using existing research laboratories and universities and exploiting their centralized locations and existing port and transportation capacities.

By 2020, offshore wind energy and solar will be the primary renewable technologies expected to deliver clean energy and associated economic growth benefits to New York City. Offshore wind energy may produce energy at capacity factors in the range of 40 to 45% with three times more rated capacity at times of peak demand than produced by wind energy upstate.

Program Goals

The Advanced Clean Power Initiative will reduce costs and increase market acceptance of clean power generation. The core goal is to provide consumers new clean power options with improved performance and lower cost. Specific goals of improving the performance of current technologies, expanding the resource base, and developing next generation technologies will enable accelerated ratepayer benefit. During the term of the T&MD cycle, the commercialization pipeline will accelerate the market readiness of new options through validation of performance benefits, testing and demonstrations. These activities will demonstrate technical and economic readiness and set the

⁴² Guide to Estimating, Benefits and Market Potential, for Electricity Storage in New York, Distributed Utility Associates, & The E Cubed Company, LLC 2007.

stage for private sector investment and large-scale deployment. Efforts will complement other NYSERDA programs associated with clean energy business development and integrate clean energy generation and grid powered vehicles into the transmission and distribution system.

Marine resource and site assessment activities will result in increased knowledge of coastal marine energy assets and their suitability for power development. Such information can stimulate developer activity and support expedited federal permitting for sites with the potential to produce 1,000 MW of rated capacity at peak and almost four million MWh of electric energy annually.

The following outcomes are expected from the Initiative:

- Demonstrated capacity to exploit available tidal/current, ocean and offshore wind energy, with an emphasis on meeting the needs of the New York City load center;
- Reduced balance-of-system (BOS) costs for PV;
- Advanced material/components for PV cells resulting in improved performance;
- Higher capacity factors through design/application of advanced condition monitoring processes and intelligent diagnostics for wind generation;
- Advances in airfoil technology that reduce dynamic loading/stress on turbine blades and increase efficiency;
- Increased probability of project development and success through standardization of designs, business models and analytical tools;
- New products and patents, with increased product sales and economic benefits including jobs and infrastructure;
- Improved options for power quality, diversity, flexibility and reliability for the State and individual sites; and
- New clean power product options with demonstrated performance improvements.

Alignment with T&MD Objectives

The Advanced Clean Power Initiative will develop and validate emerging technologies, strategies, and practices that can be implemented to achieve RPS and EEPS clean energy goals while stimulating technology and business innovation. It will focus on opportunities to improve performance, lowering the cost of renewable and clean generation options using products innovated by New York's industrial base, and strategies that move those technologies to the marketplace.

Specific near term and long term performance milestones related to these goals are presented at the end of this section.

Program Design

The Advanced Clean Power Initiative is comprised of three components:

Clean Power Technology Innovation Program: This program will support New York business and academic institutions in technology advancement and development of new and improved renewable power generation products. The program will focus on emerging technologies from inception through field testing and pre-commercial deployment. A stage-gate process⁴³ will be used to more effectively conduct diligence and invest funding (timing and magnitude) through the complete product development cycle. Once a product has become commercially-viable (having received necessary approvals and certifications and able to offer a warranty), continued support may be available through other means such as NYSERDA's clean business development, deployment, and RPS programs. Developing products to this point of transition is a fundamental goal of the Initiative.

Product development cycles, possibly requiring more than five years from inception to commercial sales, are typically funded in phases marked by milestones achieved. By supporting project development at no greater than 50% of cost, NYSERDA will ensure the developer's commitment and be able to support a variety of development efforts.

Projects submitted for consideration through the Clean Power Technology Innovative Program will be competitively evaluated by industry experts and selected on the ability to meet the program's goals and objectives. Program focuses will include:

- Efficiency improvements and cost reductions for balance-of-system PV installations and other clean energy products;
- Development of products and systems that enable increased adoption of clean and renewable power generation in urban environments;
- Analytical tools for improved siting and performance of clean power systems; and
- Innovation in business models that accelerate clean power market adaptation.

Stage-gate Process

The stage-gate process is commonly employed in industrial R&D labs to increase return on R&D investments.

The stage-gate process incrementally funds product development projects based on achievement of defined technology and business readiness goals and performance milestones. This approach favors projects that demonstrate alignment with program goals and accelerates projects most likely to provide the desired benefits. This approach represents an evolution of NYSERDA's traditional R&D

⁴³ Cooper, Robert G. "Optimizing the Stage-Gate Process - What Best Practice Companies are Doing" N.p.: Stage-Gate Inc, 2006. "Stage-Gate Innovation Management Guidelines," Version 1.3 ed. N.p.: U.S. Department of Energy ITP, 2007.

Solar PV Cost Reduction Program:⁴⁴ This program will help achieve the goals of the NY-Sun Initiative⁴⁵ through activities that reduce the balance-of-system (BOS) costs of solar PV installations and that support priority PV technology development in New York State. BOS costs include non-module hardware, labor, design, permitting and interconnection, and can amount to approximately one-half of the installed cost of a PV system. A dialogue with representatives of the industry, permitting authorities and various stakeholders will be conducted through workshops and other means to develop a thorough understanding of the PV project development process and the elements that constitute BOS cost components. Based on this information, activities are likely to include, but not be limited to:

- Development of training programs and materials to educate local government planners, code officials, fire department personnel, home owner associations, and other local stakeholders;
- Development and promotion of streamlined and standardized procedural requirements for permitting and interconnection;
- Programs and materials to address electrical requirements, safety practices, and the requirements of the National Electric Code and State law;
- Development of new business models that reduce business or financing costs associated with PV systems;
- Development of best practices for incorporating PV into new buildings and making buildings "PV-friendly" for easy PV retrofit at a later time, and educating architects and developers on these practices;
- Demonstration of new and underused technologies that have the potential to reduce the installed cost of PV systems; and
- A series of strategic pilot demonstration projects that optimize the full value of all BOS cost reductions when implemented as a fully-integrated PV system.

Resource Development Program: This program will focus on activities that can stimulate development of new renewable energy supply and technologies and businesses with the greatest potential to meet near-to-intermediate-term energy and environmental goals. Similar to previous efforts that supported land-based wind development in the upstate region, emphasis here will be given to offshore wind energy. As the federal research agenda for offshore wind⁴⁶ and kinetic hydro energy matures, ample opportunities will arise for New York's industries, academic institutions and government to collaborate in support of transformational advances in technology.

The program will address market barriers through collaboration, planning and education; assessment, modeling and surveying; and supply chain, service industry and infrastructure

⁴⁴ The September 13, 2012, Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Fund*, included \$10 million for a new initiative within the Advanced Clean Power Program focused on reducing the balance-of-system costs for solar PV installations and the development of priority PV technology.

⁴⁵ In his 2012 State of the State Address, Governor Cuomo announced the NY-Sun initiative, designed to install, in 2013, four times the customer-sited PV capacity installed in 2011, while protecting the ratepayer by keeping costs under control.

⁴⁶ DOE-EERE, A National Offshore Wind Strategy: Creating an Offshore Wind Energy Industry in the United States, February 2011.

development. Most program funds will be dedicated to characterizing operating environments, developing assessment practices, understanding resource usage and market perceptions, and conducting site and resource-specific assessments (e.g., geophysical, meteorological, biological, and energy production). Remaining funds will be used to conduct assessments of New York's infrastructure including the capacity to manufacture, construct and service kinetic hydro and offshore wind generating project components (e.g., transmission, ports, and vessels). Competitive solicitations will be issued to the maximum extent possible, and cost sharing will be pursued as appropriate. NYSERDA would consider pursuing recoupment of public funds where public funding is used to support permanent offshore surveying structures or similar devices that capture data valuable to private interests.

Expected Benefits

This section describes the expected benefits associated with the Advanced Clean Power initiative, in relation to the seven priorities articulated in Section 5.2. The following describes qualitative and "big picture" benefits, providing an important contextual framing for the initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-4.

Electric and Gas System-wide Benefits: By improving the performance, cost effectiveness and market readiness of renewable and clean generation options, energy price volatility will be reduced; peak load reduction achieved; increased usage of power system assets enabled; energy efficiency, environmental performance, and the reliability and quality of power improved. Wholesale price moderation, mitigation of increases in delivery costs and, ultimately, reduced cost of clean energy to the consumer will occur with the diversification of energy resources and generation cost reductions.

Economic Development Benefits: Economic benefits will include: leveraged investment into the state; new businesses and products; improved product sales and jobs; energy cost savings for host sites; and energy cost savings for a wide range of ratepayers due to reduced demand and reduced LBMPs for both electric and natural gas service. Longer-term economic benefits will result from the self-sustaining research and commercial activities catalyzed by initial funding. Recent examples of investments rooted in earlier SBC funding include battery and wind manufacturing facilities, solar research and manufacturing facilities, and Energy Frontier Research Centers focused on energy storage.

Environmental Benefits: Long-term environmental benefits will accrue from large-scale use of the products and services developed with support from the Initiative and from the development of new, clean, generating facilities. For example, a 5% improvement in the energy-weighted availability of the state's current wind generation inventory equates to an increase in renewable generation (without increased plant investment) and the annual displacement of about 180,000 MWh from conventional resources, resulting in an annual reduction on CO₂ emissions of about 74,000 tons. At the scale likely for New York State's first offshore wind project, a .6-1.3 million ton reduction in CO₂ emissions could be realized before 2020.

Consumer Cost Savings: The core goal of the Initiative is to provide consumers new, more secure clean power options with improved performance and lower cost. Additional program components will reduce costs by developing tools for improved availability and capacity from large scale renewable generation and reduce developmental risks.

Opportunities Unique to New York: The Initiative will support New York business and academic institutions in the development of technologies such as kinetic hydro and acquisition of tidal/off-shore renewable generation that benefits the downstate urban load pocket. The Resource Development Program will focus on New York businesses and activities that stimulate development of indigenous renewable energy resource.

Leveraging Resources or Filling Gaps: Near-term benefits of clean power research will result from leveraging significant federal and private sector investments. Historically, this leveraging has exceeded a ratio 5:1 and resulted in clusters of technical expertise in battery/energy storage, solar PV, and wind turbine technologies.

Scale of Potential Benefits Relative to Program Costs: In 2009, of the \$21.7 billion spent on fossil fuels for the generation of electricity, approximately one-third or \$7 billion flowed out of the State's economy⁴⁷. At a \$10.35 million annual funding level, the Advanced Clean Power initiative is a modest investment given the potential to establish greater independence from fossil fuel supply interruption and price volatility, cycle ratepayer dollars within the state's economy, reduce the unit costs of existing technologies, and offer options to mitigate climate change.

Program Experience

The Clean Power Technology Innovation Program will continue NYSERDA's successful Power Systems Technology Development program that has invested in 60 product development efforts with specific relevance to New York markets: 13 PV, 10 wind, six hydroelectric, and 31 other projects advancing power from waste heat, biomass, and energy storage technologies. These projects range from technology and market studies through the product development and field testing phases required for successful new product commercialization. Although many projects are underway, 13 product commercialization successes have been produced, an R&D commercialization success rate comparable to private industry standards. As a direct result of the predecessor program, the New York Battery and Energy Storage Consortium (NY-BEST) was established to capitalize on the energy storage technology cluster and to accelerate the creation of a vibrant energy storage industry in the state.

The PV Solar Cost Reduction Program will build on NYSERDA's experience in technology and workforce development as well as its relationship with local officials and the buildings industry through which over 15,000 individuals have been trained on aspects of the New York State Energy Code. The program will also draw from the experience and input of installers involved in more than 4,800 PV projects that NYSERDA has funded.

The Resource Development Program will be similar in to the existing program that has assisted with the development and siting of land-based wind in upstate New York over the last decade. The

⁴⁷ NYSERDA Patterns and Trends

subsequent adoption of an RPS program leveraged this early development effort, and more than half of the site areas have been developed at a combined cost of approximately \$707 million. Even without considering wholesale price moderation and environmental improvement, the economic benefit from this development activity – measured in jobs, materials/infrastructure, property leases, and payments in lieu of taxes – approaches \$4.5 billion⁴⁸. The acceleration of resource development in the off-shore environment provides a similar opportunity for New York. NYSERDA has a strong track record of partnership and leveraging federal funding in the advanced clean power area, using limited State dollars. Such efforts include the successful Energy Frontier Research Centers, noted above, which leveraged over \$73 million into New York State, and the recently announced federal funding to develop lower-cost PV manufacturing processes at Albany NanoTech, which is bringing in over \$50 million of federal funding.

Funding and Performance Milestones

The average annual budget for the Advanced Clean Power initiative is \$10.35 million. The budget reflects a front-loaded annual level of spending for the Clean Power Technology Innovation Program. Greater funding is requested in the later years for the Resource Development Program to allow an assessment of the market and development of research and development priorities to be conducted in the later years of the funding period.

Priorities in 2012 for the Clean Power Technology Innovation and Resource Development Programs include: issuing an Advanced Renewable Generation Product Development solicitation focusing on solar, PV balance-of-system components, small wind, and urban clean energy applications; providing analytical support to help complete a coastal zone management plan for New York; and engaging with stakeholders regarding offshore wind development in New York to establish program research, implementation and funding priorities. The new PV Solar Cost Reduction Program will commit funds in the early years in order to maximize opportunities for achieving the NY-Sun Initiative goal for increased PV capacity in the State.

Table 9-3. Advanced Clean Power Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Technology Innovation	5.56	11,084,669	12,992,080	3,750,000	27,826,749
Resource Development	2.79	2,771,167	7,424,046	3,750,000	13,945,213
Solar Cost Reduction	2.00	9,000,000	1,000,000		10,000,000
Total: Advanced Clean Power	\$10.35	\$22,855,836	\$21,416,126	\$7,500,000	\$51,771,962⁴⁹

⁴⁸ *New York Main Tier RPS: Impact and Process Evaluation*, KEMA Inc., March 2009, Data from evaluation report used to estimate direct economic benefits of project development associated with five completed Main Tier solicitations.

⁴⁹ This budget reflects the September 13, 2012 order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*, which added \$10 million for a new initiative within the Advanced Clean Power Program focused on reducing the balance-of-system costs for solar PV installations and the development of priority PV technology.

Table 9-4. Advanced Clean Power Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/Leading Indicators					
Clean Power Technology Innovation	Contract 51 clean power technology projects	15	26	10	
	Complete 51 clean power technology projects		10	15	26
	64 clean energy companies receiving support	19	32	13	
Resource Development	6 studies, surveys, and plans contracted	3	2	1	
	6 studies, surveys, and plans completed	1	1	2	2
	3 engagements with stakeholder organizations and consortia in support of developing a research /program agenda	2	1		
Solar Cost Reduction	200 training sessions on aspects of PV for authorities having jurisdiction, local officials and trainers	180	20		
	2,000 trainees attending training sessions on aspects of PV for authorities having jurisdiction, local officials and trainers	1,800	200		
	10 Projects to develop tools/practices, studies/surveys, or workshops/engagements, to reduce PV costs contracted	7	2	1	
	10 Projects to develop tools/practices, studies/surveys, or workshops/engagements, to reduce PV costs completed		5	3	2
	10 balance-of-system technology development or demonstration projects contracted	7	3		
	10 balance-of-system technology development or demonstration projects completed		2	5	3
	9 clean energy companies receiving support	6	2	1	

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
	10 Workshops/engagements as a result of balance of system projects	1	4	3	2
Outcomes/Impacts*					
Clean Power Technology	8 clean power technologies reach commercial availability		1	2	5
	\$55M in commercial sales of supported clean power technologies	\$1M	\$1M	\$3M	\$50M
	\$65M of leveraged funds (co-funding and outside investment)for clean power technology projects	\$20M	\$32M	\$13M	
Resource Development	\$2.5-5.0 M of leveraged funds (co-funding and outside investment)	up to \$0.5 M	\$1-1.5 M	\$1.5-3.0 M	
	Site-development potential of 1,000 MW investigated/evaluated				1,000MW
	Increased knowledge and ease of development of renewable energy opportunities in the state				
Solar Cost Reduction	7 tools/practices, studies/surveys to reduce PV costs available for use in the market		3	2	2
	1 PV balance of system technology reaches commercial availability				1
	\$7.2M in commercial sales of supported PV balance of system technologies				\$7.2M
	\$13.2M of leveraged funds (co-funding and outside investment)for balance of system projects	\$5.52M	\$5.04M	2.64M	
	Reduced cost of PV systems in New York				

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

9.1.3 Combined Heat and Power

Targeted Problem

Accelerating and expanding the deployment of Combined Heat and Power (CHP) generation options will help address system reliability and provide important energy security and environmental benefits. Increasing the efficiency of energy generation is a priority articulated in the New York State Energy Plan. Improving performance and achieving cost reductions requires continued investment in technology, innovation, and the marketplace. Overcoming institutional impediments, such as challenging multi-party coordination or delays and uncertainty with the permitting process, requires creative solutions.

Adoption of CHP options can reduce costs to ratepayers and minimize costly investment in new electric central generation and distribution capacity needed for load growth. Customer-sited CHP offers numerous benefits to the customer, the electric grid system, and, ultimately, to the State, including:

- Higher energy efficiency, reliability and security;
- Permanent demand reduction;
- Avoided line losses;
- Deferred transmission and distribution upgrades;
- Flexible energy scheduling and emergency shelter options;
- Faster, easier siting processes in comparison with central station power plants;
- Use of renewable fuels; and
- Improved system wide environmental performance, in particular for peak-load emissions.

Current State of Technology or Knowledge

Deployment of CHP is recognized at national, state and local levels as a successful approach to reduce site energy costs and grid constraints and to enhance site power supply reliability and flexibility, economic development, environmental performance, and overall efficiency. Nevertheless, these benefits are tempered by barriers, risks, and the need for support and encouragement. Widespread implementation has been hindered by the complexity and cost of some projects, interconnection and environmental challenges, and proof of performance and persistence. The Combined Heat and Power Initiative will advance CHP technologies and systems, reduce investment risk, accelerate marketplace adoption, drive and prove high levels of energy and environmental performance, and open pathways to integrated economic development, and renewable energy use. Techniques to better ensure system performance and persistence of savings such as metering and verification (M&V) and commissioning and re-commissioning will be explored.

Technology for CHP projects is widely available and deployed in many areas of the world. DOE emphasizes that near-term market penetration of significant amounts of CHP^{50,51} can be achieved. DOE's report notes that CHP is now installed at more than 3,500 commercial, industrial, and institutional facilities across the nation and produced 506 billion kilowatt-hours (kWh) of electricity in 2006 – more than 12% of total power generation for that year, which DOE seeks to increase to 20% by 2030. For certain end-use sectors, more streamlined approaches may benefit projects installing megawatt-scale and smaller modules as compensation for the loss of “economy-of-scale”. Specifically, the New York State Standard Interconnection Requirement (SIR) enhances the ability to accelerate the installation of new distributed generators 2MW or less connected in parallel with utility distribution systems. Lessons from earlier CHP projects demonstrate that addressing known barriers can reduce the time required for new system implementation. CHP modules in capacities of one megawatt and less are commercially available and can be grouped to meet thermal and electric loads for a variety of building types and operating schedules. Still, market barriers and fixed costs have hampered the expansion of CHP.

DOE has made significant investment in U.S. manufacturers of CHP components to ensure that individual components can be properly matched to create overall systems.^{52,53} These pre-engineered systems, including those assembled at New York factories, span all types of prime movers including induction engines, inverter engines, synchronous engines, and microturbines. Many modules include pre-selected chillers that improve the CHP's overall thermal usage and efficiency and reduce electric demand by offsetting electric chiller use at the site, thus relieving the grid at critical times including peak summer demand occasions.

Why This Is Important for New York and New York Ratepayers

While all energy sources present production, delivery, and use risks, developing diverse and flexible technology options is critical to safe, secure and reliable provision of power and energy. The distributed nature of CHP provides the opportunity to advance diversity and reliability, minimize risk, provide efficiency and siting benefits, leverage non-utility private financing, and promote opportunities to integrate economic development, and renewable fuel.

Anticipated load growth in New York, particularly in the state's densest urban areas, will increase demands on already stressed distribution grids. CHP programs can provide an alternative to new central generation plants at dollar-per-megawatt-hour (\$/MWh) costs to electric ratepayers comparable to cost effective commercial/industrial energy efficiency programs.^{54,55} Because CHP

⁵⁰ Combined Heat and Power – A Decade of Progress, A Vision for the Future (USDOE, August 2009)

⁵¹ Combined Heat and Power: Effective Energy Solutions for a Sustainable Future (Oak Ridge National Laboratory, December 2008)

⁵² USDOE Funding Awards announced in 2001 for US-based equipment manufacturers to engineer packaged CHP modules <http://www.chpcentermw.org/pdfs/010618PressRelease.pdf>

⁵³ USDOE Funding Awards announced in 2010 for US-based equipment manufacturers to engineer packaged CHP modules http://www1.eere.energy.gov/industry/distributedenergy/pdfs/itp_foa_awards.pdf

⁵⁴ Nevertheless, unlike energy efficiency, the wholesale/retail delivery system must still provide natural gas needed to generate the electricity. CHP program costs to ratepayers in terms of dollars-per-megawatt-hour (\$/MWh) are comparable to commercial/industrial energy efficiency programs primarily because the fuel supply costs are borne by the CHP site.

can operate during periods of peak electric demand, these systems can provide efficient, reliable, clean power and peak load reduction within load centers. CHP can play a role in development of micro-grids to provide resiliency through redundancy within the power sector. This advantage was highlighted in the draft interim reports of the Commissions established by Governor Cuomo in the wake of Super Storm Sandy.

While CHP opportunities exist throughout New York State (up to 8,500 MW of technical potential), there is a significant abundance of opportunities concentrated in New York City. A 2002 study assessing opportunities to construct new CHP systems determined the technical potential in the New York City area to be 1,000 MW of capacity for systems greater than 5 MW, and an additional 3,500 MW of capacity for systems less than 5MW. Of the latter, 2,000 MW of capacity reflects systems less than 1MW.⁵⁶ Nevertheless, there are several critical barriers that would need to be addressed to substantially increase CHP throughout the five boroughs of New York City, including the lack of a well-coordinated approval process to allow firing-up of a newly-installed system. Numerous regulatory authorities have jurisdiction, spanning the electric utility, the various natural gas utilities, where applicable the steam utility, the building department, and the fire department, each providing short-duration temporary approvals while awaiting comparable approvals from the others.

Program Goals

The Combined Heat and Power Initiative will reduce costs and increase market acceptance of CHP. Expanding the resource base and developing techniques to accelerate installations will enable accelerated rate payer benefit.

The Initiative will seek to accelerate the rate of progress in the CHP marketplace. The Initiative's encouragement of installations with new generating capacity will improve performance, transform the structure of host site/developer relationships, simplify and accelerate design and installation of modular systems, push markets to higher levels of efficiency and environmental performance, and promote opportunities to integrate renewable fuels, and economic development. Because the Initiative is only indirectly supported by the RPS program, and not supported in EEPS, proposed funding will fill gaps and sustain momentum, realize the potential of existing program infrastructure, and provide opportunities to improve the integration of renewable energy options.

Alignment with T&MD Objectives

The CHP Initiative will move underused technologies into the marketplace by reducing market barriers and increasing customer acceptance of CHP systems. The Initiative will promote innovative solutions to provide more and lower cost technology options in this sector.

⁵⁵ CHP funded through T&MD will be more energy efficient than incremental, electric-grid-supplied power due to the program required minimum fuel conversion efficiency and the elimination of electric transmission and distribution losses.

⁵⁶ Combined Heat and Power Market Potential for New York State, (Energy Nexus Group - Onsite Energy Corporation, 2002)

The following outcomes are expected:

- Increased installation of CHP, especially in New York City, with reduced costs, expedited installation schedules, and increased performance;
- Increased probability of project development and success through efficient operation, design standardization, and better business models and analytical tools; and
- Improved options for power quality, diversity, flexibility and reliability for the state and individual sites.

Specific near-term and long-term performance milestones related to these goals are presented at the end of this section.

Program Design

The Combined Heat and Power Initiative will be available statewide but focused on the Con Edison service territory. The Initiative as described in this revised supplemental Operating Plan includes the CHP Aggregation and Acceleration Program and the CHP Performance Program.

The ***CHP Aggregation and Acceleration Program*** will promote pre-engineered/pre-qualified systems intended to accelerate the transformation of the marketplace structure of vendor/host-site relationships. This pilot program will fund projects installing modular-based CHP systems where the pre-engineered system provides strong expected cost, timeliness, and/or performance benefits. Eligible projects will include those with individual modules not exceeding one megawatt, multiple, aggregated modules not exceeding two megawatts on any customer's specific meter (as required by New York's accelerated/streamlined Standard Interconnection Requirement – SIR), and multi-megawatt-scale capacity blocks created by the aggregation of numerous sites. The program will demonstrate systems that will be more easily deployed in the marketplace.

These efforts will also accelerate marketplace and regulatory acceptance and reduce the time and cost required for design, installation and commissioning. Specific activities will include:

- Development of a catalog of pre-qualified/pre-engineered modularized systems;
- Education and outreach related to equipment, progressive ownership/financing models such as the Build-Own-Operate-Maintain heating contract, performance contracting, and lease-to-own with declining buy-out clauses;
- Demonstration of advanced systems via cost-shared projects intended to widen interest and acceptance of CHP systems;
- Project commissioning and periodic re-commissioning to ensure continued performance and to provide a portfolio-wide assessment of data and lessons learned for dissemination to the marketplace;
- Market development activities such as testing and demonstrating equipment as a means to vet for inclusion in an expanded catalog of pre-qualified systems;

- Technology transfer efforts such as development of best practice guides, analyses of barrier busting policy and technology initiatives, conferences, and web-based materials; and
- Efforts supporting a coordinated approval process for newly installed systems.

The **CHP Performance Program**⁵⁷ will fund installations of CHP systems using energy, demand, efficiency, and environmental performance-based payments. The Program will promote efficient systems that generate power and heat for on-site use, focusing on systems that use commercially-available technology based on site-specific designs. The Program will fund clean, efficient, cost-effective gas fired systems that maximize ratepayer benefit and system operation during summer peak demand periods. In accordance with the Order, systems will be required to meet a minimum fuel conversion efficiency of 60% and a maximum of 1.6 pound/MWh of NOx emissions. To quantify the performance-based payments, the program will apply rigorous, multi-year system performance measurements, a groundbreaking approach for energy efficiency program administrators.

Additional incentives will be tailored to favor projects that:

- offer greater potential value to the distribution system;
- operate at higher overall efficiency levels; and
- are located at critical infrastructure, including facilities of refuge.

Additional incentives for projects that offer greater potential value to the distribution system will initially be limited to the Con Edison service territory. NYSERDA will work with the other investor-owned utilities to identify analogous opportunities

In the December 17, 2012 Order, the PSC addressed the interaction of CHP development with operation of the Con Edison Steam System.⁵⁸ In accordance with the Order, the following procedures will be instituted:

- Con Edison is directed to provide NYSERDA, upon request, minimum steam load data specific to any CHP applicant that is a steam customer.
- NYSERDA will notify Con Edison of each approval of a project involving an applicant that is a current steam system customer, with information sufficient to support a steam displacement analysis.
- Con Edison is directed to perform an annual review of the impact of approved CHP projects on its minimum steam load at the same time that it completes its annual official steam sales forecast, and will file the results of its annual review with the PSC. If Con Edison determines that the net aggregate impact of approved projects would be a reduction

⁵⁷ The December 17, 2012 Order in Case 10-M-0457, Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives, authorized NYSERDA to use \$50 million of funds made available by the reductions to the budgets of two EEPS programs to fund the CHP Performance Program within the T&MD Portfolio. Budget and target reductions for the Energy Reduction in Master-Metered Buildings program; and the Benchmarking and Operations Efficiency program are addressed in the revised EEPS Plan filed on February 15, 2013.

⁵⁸ Order Modifying Budgets and Targets for the Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives (issued December 17, 2012) page 48.

in minimum steam system load of 50 Mlb/hour or more, it is directed to notify NYSERDA that this threshold has been reached. At that time, NYSERDA will provide Con Edison an opportunity to review the potential impacts of any additional projects prior to approving any specific applications. Con Edison will have up to 30 days after being notified of an application to notify NYSERDA and provide a detailed analysis showing that the proposed project would have a substantial impact on minimum load and would contribute substantially to a risk of curtailment of the East River Units. Con Edison's notification to NYSERDA must be accompanied by a detailed analysis. If such a notification is not provided within 30 days, NYSERDA may proceed with the approval of the application. If Con Edison does provide a notification to NYSERDA, Con Edison will have 60 days within which to reach an agreement with NYSERDA and the applicant or in the alternative to petition the PSC for relief related to that particular application. Such a petition must include both a project-specific analysis and a system-wide analysis of current and projected minimum steam loads sufficient for the PSC to determine the continued usefulness and adequacy of the minimum load threshold. If Con Edison has not filed such a petition within 60 days of notifying NYSERDA of its concern, NYSERDA may proceed with approval of the application.

The PSC also included additional criteria that will be included in the CHP Performance Program:

- NYSERDA will notify Con Edison of any CHP applications within 250 feet of a steam main.
- The program's impact on the Con Edison steam system will be limited to a total annual sales volume of 1,000 MMBtu/year
- The program will implement, to the extent relevant, recommendations of the various commissions created as a result of Super Storm Sandy.

CHP system viability is affected by external variables such as the spark spread (difference in cost of grid-supplied electricity and pipeline-supplied natural gas), siting and space constraints, adequate fuel supplies, environmental compliance, and interconnection issues. The Program will assist end users in developing solutions to the interaction of these variables with cost shared technical assistance.

Expected Benefits

This section describes the expected benefits associated with the Combined Heat and Power initiative, in relation to the seven priorities articulated in Section 5.2. The following describes qualitative and "big picture" benefits, providing an important contextual framing for the initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-6.

Electric and Gas System-wide Benefits: CHP generating capacity will be installed at distributed locations at or near the load, reducing stress on the electric grid. Benefits will be energy price volatility and peak load reduction; increased use of power system assets enabled; and energy efficiency, environmental performance, reliability and power quality. An important component to

the diversification of energy resources, this Initiative can help moderate wholesale prices, mitigate increases in delivery costs and, ultimately, reduce the cost of energy to the consumer.

Economic Development Benefits: Economic benefits will include leveraged investment into the state through new and expanded businesses; improved product sales and jobs; and energy cost savings for host sites and ratepayers due to reduced demand and resultant reduced location-based-marginal-prices (LBMPs).

Environmental Benefits: Long-term environmental benefits will accrue from large-scale use of the products supported by the Initiative. The Initiative will drive the market to install clean equipment consistent with NYSERDA's current program emission requirements that are more stringent than state and federal standards.

Consumer Cost Savings: The core goal of the Initiative is to provide consumers new, clean heat and power options with improved performance and lower cost.

Opportunities Unique to New York: The difference in cost of grid-supplied electricity and pipeline-supplied natural gas in the state, particularly in the New York City metropolitan area, is among the best in the nation for promoting CHP. This provides the opportunity for New York to build upon its position as a nationally recognized leader in CHP programs.

Leveraging Resources or Filling Gaps: Near-term benefits of clean power development will result from leveraging significant federal and private sector investments that, historically, have exceeded a 4:1 ratio. The programs identified in this Initiative will fill a gap, since CHP is only indirectly supported in RPS and not supported in EEPS.

Scale of Potential Benefits Relative to Program Costs: The proposed \$15 million annual funding level is a modest investment given the potential to increase independence from fossil fuel supply interruption and price volatility, increase system reliability, cycle ratepayer dollars within the State's economy, reduce the unit costs of existing technologies, and offer options to mitigate climate change.

Program Experience

The *CHP Program* will further the success of NYSERDA's CHP Demonstration Program, which received a 2010 *States Stepping Forward Program Award* from the American Council for an Energy-Efficient Economy (ACEEE). This program already has 116 projects collectively installing 137 MW of new generation capacity: 70 of these, representing 92 MW, are already fully operational. The CHP Demonstration Program's most recent solicitations (PON1931 in December 2010, and PON 2373 in October 2011) included a significant number of meritorious projects using pre-engineered modular systems, confirming the proper and timely alignment of this program's focus on pre-engineered/pre-qualified measures in an evolving marketplace.

The CHP section of NYSERDA's Existing Facilities Program will be developed into the CHP Performance Program. NYSERDA will continue to work collaboratively with stakeholders, developers, and potential customers to adjust program design to expand the program, adapt to marketplace opportunities and policy needs, meet established goals, and increase value to the State's energy performance, reliability and security.

Funding and Performance Milestones

The average annual budget for the CHP Program is \$15.0 million.

Planning for the introduction of the CHP Aggregation and Acceleration Program began in 2012. The full five-year funding for both components of the CHP Initiative will be made available to applicants starting in 2013. Actual commitment of funds during this period will depend on market activity.

Performance Milestones and Anticipated Results for the CHP Performance Program have been added in this supplemental revision, and alternative measures for reporting the benefits of the Program have been introduced in response to the December 17, 2012 Order which calls for the inclusion of such measures to more accurately reflect end-use energy savings and other benefits produced by CHP installations. The quantity of peak load MW and the MWh/yr from on-site electric generation as a result of the Initiative will be tracked and reported. Primary energy savings⁵⁹ will also be calculated for the CHP Initiative and will be reported separately from the on-site efficiency benefits of the other Initiatives in the T&MD Portfolio. This represents a change in methodology from the previous manner in which CHP benefits were included as part of overall reported electricity savings. NYSERDA will continue to consult with DPS staff to consider other performance milestones that could be tracked and reported for the CHP Initiative.

Table 9-5. Combined Heat and Power Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
CHP Aggregation & Acceleration	5.0	10,000,000	10,000,000	5,000,000	25,000,000
CHP Performance Program	10.0	20,000,000	20,000,000	10,000,000	50,000,000
Total: Combined Heat and Power	\$15.0	\$30,000,000	\$30,000,000	\$15,000,000	\$75,000,000⁶⁰

⁵⁹ Primary Energy Savings for CHP systems (expressed in MMBtu) is based on the difference between the amount of energy displaced at grid-level generators and the energy used on-site by the CHP installations, accounting for both the avoided energy losses over the transmission and distribution system and the energy saved due to replacement of the on-site boiler with more efficient equipment. The energy displaced at grid-level generators is estimated based on the electricity system simulation model used in the New York State Energy Plan process.

⁶⁰ This budget reflects the December 17, 2012 Order in Case 10-M-0457, *Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives*, which authorized NYSERDA to use \$50 million of funds made available by the reductions to the budgets of two EEPS programs to fund the CHP Performance Program within the T&MD Portfolio. Budget and target reductions for the Energy Reduction in Master-Metered Buildings program and the Benchmarking and Operations Efficiency program are addressed in NYSERDA's revised EEPS Operating Plan filed on February 15, 2013.

Table 9-6. Combined Heat and Power Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/Leading Indicators					
CHP Aggregation & Acceleration Program	20 Pre-packaged CHP Systems “pre-qualified” for catalog	10	8	2	
	37 CHP Aggregation Sites – Contracted	15	15	7	
	37 CHP Aggregation Sites – Installed	3	18	9	7
	10 Technology transfer activities such as development and dissemination of “Best Practices” guidebooks, analyses of barriers busting policy and technology initiatives, conferences, and web-based materials	4	4	2	
	12.5 MW peak load electric generation- Contracted	5 MW peak load	5 MW peak load	2.5 MW peak load	
	76,250 MWh/yr peak load electric generation- Contracted	30,500 MWh	30,500 MWh	15,250 MWh	
	99,125 MMBtu/yr primary energy savings - Contracted	39,650 MMBtu	39,650 MMBtu	19,825 MMBtu	
CHP Performance	16 Projects Performance Based-Contracted	2	7	7	
	16 Projects Performance Based - Installed		1	4	11
	25 MW peak load electric generation – Contracted	3 MW peak load	11 MW peak load	11 MW peak load	
	200,000 MWh/yr electric generation – Contracted	20,000 MWh	90,000 MWh	90,000 MWh	
	260,000 MMBtu/yr primary energy savings - Contracted	26,000 MMBtu	117,000 MMBtu	117,000 MMBtu	

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017- 2020)
Outcomes/Impacts*					
CHP Aggregation & Acceleration Program	12.5 MW peak load electric generation- Installed	1 MW peak load	6 MW peak load	3 MW peak load	2.5 MW peak load
	76,250 MWh/yr electric generation- Installed	6,100 MWh	36,600 MWh	18,300 MWh	15,250 MWh
	99,125 MMBtu/yr primary energy savings - Installed	7,930 MMBtu	47,580 MMBtu	23,790 MMBtu	19,825 MMBtu
	\$50 million in leveraged funds (co-funding and outside investment) for installed CHP systems	\$20M	\$20M	\$10M	
	Replication: 10 MW peak load electric generation via projects at other sites in NY				10 MW
	Replication: 61,000 MWh/yr electric generation via projects at other sites in NY				61,000 MWh
	Replication: 79,300 MMBtu/yr primary energy savings from other sites in NY				79,300 MMBtu
	\$40 million in leveraged funds (co-funding and outside investment) for replications				\$40M
	Streamline the approval process to allow firing-up of a newly installed CHP system in NYC				
CHP Performance	25 MW peak load electric generation – Installed		2 MW peak load	6 MW peak load	17 MW peak load
	200,000 MWh/yr electric generation – Installed		10,000 MWh	50,000 MWh	140,000 MWh
	260,000 MMBtu/yr primary energy savings - Installed		13,000 MMBtu	65,000 MMBtu	182,000 MMBtu
	\$250 million in leveraged funds (cofounding and outside investment)	\$30M	\$110M	\$110M	

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

9.2 Building Systems Initiatives

9.2.1 *Advanced Building Technologies.*

Targeted Problem

Buildings represent a large and dynamic portion of electricity requirements for New York and are responsible for 62% of the state's total energy consumption and 50% of the state's greenhouse gas (GHG) emissions. Increasing energy efficiency in buildings can deliver system efficiency and cost-savings to ratepayers. Buildings are a long-lived asset, relatively inflexible to, but dependent on, changing energy supply and delivery infrastructure conditions. They are also a large source of the peak/off-peak swing that must be accommodated by electricity supply, transmission and distribution systems. Costs during these excursions from steady-state operations are disproportionately high, particularly in load pockets, because of increased use of inefficient peaking units and transmission congestion. Use of demand management technologies and clean, on-site renewable resources can help mitigate these effects, improving overall system efficiencies.

The building sector is risk averse and does not take full advantage of available technology that can reduce energy intensity, exploit renewable resources, and/or use on-site power generation that makes electricity and waste thermal energy immediately available. While Smart Grid operations could more effectively manage the underlying load characteristics of the building sector, the uncertainty associated with customer interaction with the grid has limited Smart Grid investments. Increasing building load flexibility through expanded load management and Demand Response (DR) resources could enable utilities, system operators, and third party load curtailers to facilitate more efficient dispatch, but it requires building owners to pay for and appropriately use flexible load-enabling features.

Available technologies for new and existing buildings are limited, and the value propositions for too many owners remain inadequate or not well understood. Moreover, energy costs as a percentage of overall budgets remain relatively small in many situations, and the initial cost of performance enhancing technologies can be high. This gap is exacerbated by actual and perceived reliability, component compatibility, impact on end users' lifestyles and business practices, and uncertainty throughout the delivery chain associated with marketing, warranty, installer capabilities and post-installation support. Finally, the unfamiliarity and complexity of transactions associated with verifying energy savings and selling negative load to a supplier, and the challenges of modeling energy savings cash flows to facilitate financing, are barriers that must be overcome.

Current State of Technology or Knowledge

Most traditional building equipment (heating, cooling, ventilation, distribution systems) has an efficiency gap of 10-30% between the installed base and the best commercially available technology. A lesser gap exists between the efficiency of new equipment and best available technology. Adoption of higher efficiency building technologies is impeded by market factors, including: emergency equipment replacement; bias towards over-sizing to avoid service call backs; low value propositions that result in low market penetration; and variances in construction and installation practices.

Further improvements are hindered by institutional barriers that include regulatory difficulties that prevent the use of clear price signals (i.e., submetering in multifamily housing). In addition, new technologies that promise greater savings struggle for marketplace acceptance. For example, the potential for added energy savings from solid state lighting is challenged by the variability of performance and high cost of current products. Knowledge to create monolithic air barriers to tighten building envelopes exists, but this must be better coordinated with blower door testing applied at intermediate stages of construction rather than building completion, and an increased use of heat recovery ventilation systems that are commercially available but not widely used.

Technologies that enable growth in DR and other customer grid interactions are nascent. It is still difficult to acquire and operate end use appliances (window air conditioners, lighting systems) with built-in capability to support building monitoring and control. Standardization of protocols that support building-to-network operation center is also lacking.

Why This Is Important for New York and New York Ratepayers

During peak demand summer hours, electric reliability is strained, costs are high, and there is increased reliance on older and dirtier plants. Within New York City, the Hudson Valley and other downstate areas, the issues are particularly acute and create pressure for costly and difficult-to-site transmission and distribution infrastructure improvements. Increasing market penetration of underused and emerging technologies that reduce the energy intensity of buildings can help mitigate this situation and provide significant benefit to participating ratepayers and New York as a whole through improved system load profile, wholesale price moderation, deferral of delivery service cost and improved environmental quality. Increasing load flexibility within buildings, allowing for greater load management by customers, and increased participation in NYISO and utility DR programs will improve system reliability and mitigate pressures for costly T&D upgrades.

The proposed Advanced Building Initiative will address New York-specific building needs and the barriers to full market adoption of new and improved building technology and practices. Because increasingly stringent codes and standards will raise energy baselines, EEPS' long-term success will depend on a continued flow of new technical solutions. This Initiative will accelerate adoption of underused and emerging technologies, and ultimately lower the cost and increase clean energy options for consumers.

Program Goals

The goal of this Initiative is to work with building stakeholders to accelerate the market adoption of underused and emerging high-performance building technologies and practices and to develop the next generation of new and improved, market-ready building technologies and systems.

Replicable advanced building technologies, “reference projects,” implemented across the full range of residential, multifamily, and commercial and institutional building sectors, coupled with stakeholder engagement and information dissemination, will permit NYSERDA to affect the adverse barriers limiting market acceptance and to demonstrate market opportunities to customers, technology vendors and service providers. Market replication of the reference projects is expected to occur during and after the 5-year T&MD program.

Through the technology development effort, NYSERDA will advance the technical and market readiness of new and improved building products and services. The technology development effort will fill the EEPS technology pipeline to ensure continued and cost-effective energy saving opportunities.

Through the DR effort, increased participation and reliability of performance in utility and NYISO programs can contribute to suppressed wholesale energy costs, reduced congestion costs, increased reliability, and reduced run time of highly polluting peaking generation and, for T&D infrastructure, deferral of upgrade costs. The development of enabling DR technologies and new demand management models will increase the technical potential of DR in New York. DR is not currently supported in the EEPS program.

The following is a sample of targeted outcomes:

- Deep retrofit design and construction methods, materials and equipment offering energy savings of 25-40% for existing buildings and 40% or more for new buildings;
- Increased market confidence and uptake of underused or emerging building technologies such as solid state lighting, condensing boilers, and wireless building energy management systems;
- Introduction of new and improved high impact technologies and practices into EEPS programs to achieve the 15x15 goal;
- Expansion of on-site renewables through integration with automated/flexible building loads to minimize intermittency limitations of renewal technology;
- Increased clean energy and cost effective alternative heating and cooling technologies that leverage New York's available renewable resources;
- Increased participation and reliable performance in current and emerging DR programs;
- Increased market penetration of building control technology that enables DR and facilitates energy efficiency
- Demonstration of buildings capable of interacting with a Smart Grid; and
- Integrated building design practices emphasizing deeper load reduction, energy recovery and onsite renewable energy harvesting and power production.

Alignment with T&MD Objectives

The focus of the Advanced Building Technologies Initiative is to move underused technologies and services into the marketplace and develop, validate and accelerate market readiness of new emerging technologies. Using a stakeholder-involved process, the most promising technologies will be selected for highly visible, reference projects in order to show benefits and expand replication across the electric and gas customers and sectors. New and emerging technologies can potentially reduce costs, have better functionality and help realize greater efficiency gains for end-users. Efforts will also focus on market penetration of existing technologies that reduce building load intensity and increase load flexibility (for load management and participation in DR programs).

Program Design

The Advanced Building Initiative is fuel neutral and will embrace systems-based and whole-building approaches that consider the interaction of systems. The Initiative will bring together industry stakeholders in the technology innovation, commercialization and market development processes. This may be accomplished by leveraging existing industry resources, such as the Consortium for Energy Efficiency, National Home Performance Council, and New York-based trade associations as well as academic resources. NYSERDA will use such forums as resources for stakeholder input into T&MD programmatic decision making as well as for disseminating information about new technologies and opportunities, promoting participation in large-scale reference demonstration projects, and encouraging networking among stakeholders.

NYSERDA will use this stakeholder input model to identify critical technology needs, barriers and opportunities with regard to energy efficiency, demand response and load management in buildings. Due to the diversity of the buildings sector (commercial, retail, residential, and multi-family), sector-specific stakeholder engagement will likely be warranted. Use of existing forums, social media platforms and other forms of electronic interaction will be explored to engage stakeholders in a cost effective manner. Stakeholder engagement that captures market feedback on key barriers, identifies innovative strategies and successful approaches, and facilitates information and knowledge transfer is essential for New York to meet its 45x15 energy and renewable targets.

The Advanced Building Initiative is comprised of three components:

Emerging Technology/Accelerated Commercialization (ETAC) – Buildings:

A new, deliberate approach to accelerating commercial introduction of emerging or underused building technologies and strategies will be constructed on lessons learned from program precedents.⁶¹ This component will serve as a feeder program to support EEPS and other New York clean energy programs and will include the following:

- ***Stakeholder Engagement:*** Stakeholders in targeted market segments will be engaged to discuss underused and promising technologies and strategies with market value, including identification of technologies ready for multi-site demonstration and efforts required to address various commercialization impediments. Stakeholders will include technology developers, builders, financial and real estate industries, design professionals, public and private sector building owners and operators, academic and research organizations, code agencies and organizations, manufacturers and suppliers, building trades, and utility program representatives. While similar efforts in other states have largely focused on feeding the pipeline for incentive-based energy efficiency programs, this effort will also support promising technologies and strategies that can succeed without incentives and innovative approaches to address nonfinancial barriers.
- ***Large-Scale Multi-Site Demonstrations and Market Acceleration:*** Customized approaches to address market sector needs and to accelerate the most promising technologies and practices will be developed. Activities will include coordination with

⁶¹ These include programs of Bonneville Power Administration's Energy Efficiency Emerging Technologies (E3T) and California's Emerging Technologies Coordinating Council (ETCC).

existing R&D and deployment programs and utilities and application of strategies such as targeted market research, large-scale demonstrations at multiple sites and integration into existing programs. Highly visible, large-scale reference projects will demonstrate opportunities, performance economics and impediments (e.g., savings validation, cost factors, regulatory obstacles). Candidate markets could include underserved building types (e.g., mixed use or low-rise multifamily), large commercial buildings, or residential developments. Coordination with other ETAC programs around the country will share information and expertise, demonstrate the possible aggregation of various ETAC programs of smaller demonstration projects, and stimulate a national market more attractive to suppliers. ETAC will coordinate closely with the Market Development Initiative to identify and address supply and demand needs in the marketplace, including workforce development needs.

- ***Deep Energy Savings Initiative:***⁶² Three or four pilot projects that demonstrate the achievement of 25-40% or more of energy efficiency savings in existing commercial buildings and 40% or more of savings in new construction will be conducted. Research indicates that savings in this range are feasible but approaches taken to achieve this level have not yet been proven in New York State with its unique building stock. Barriers to deeper savings will be identified and addressed, not merely through additional capital incentives, but also by intervening in the market to influence business models and the design process. For example, deep savings may be achieved via a novel integration of conventional technologies, integrated building design practices, or building control technology. Pre- and post- installation energy consumption, construction costs, capacity cost savings, non-energy benefits, and energy bill savings will be monitored in order to produce a series of reference case studies that document the cost-effectiveness of deep energy savings approaches. This effort will inform both the construction and retrofit industries as well as energy efficiency program administrators of the benefits of deep energy savings approaches.
- ***Performance Economics and Knowledge Transfer:*** A strategy to communicate the performance economics of emerging technology and practices will be implemented. Knowledge transfer by colloquia, webcasts and enhanced web access will target and direct a broad cadre of interested market actors (buyers and sellers) with specific interests in delivering the technology or service. The strategy will be supported through published summaries, primers and case studies on market ready products. General outreach and coordination will occur with other programs and providers including utilities, contractors, laboratories, innovators, universities, and developers.

Technology Development

With stakeholder input, NYSERDA will undertake targeted technology development activities that address the technical and economic barriers, and opportunities of, new or emerging technology products. Technology areas of focus include: improvements to the building envelope with least

⁶² The September 13, 2012 Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*, provided \$2,760,672 for an initiative to pursue deep energy savings in commercial buildings (within the T&MD Emerging Technology/-Accelerated Commercialization component).

cost and greatest performance; next generation HVAC and lighting technologies with high efficiency and load flexibility; building automation and controls; design guidelines; best practices for optimized performance of natural gas condensing boilers; high efficiency natural gas condensing hot water heaters; and integration of renewable energy.

Integration of individual technologies can optimize energy savings and offer a lower total system cost. Examples include improved building envelope performance as a means to use smaller and more efficient mechanical systems, self-powered heating equipment, and alternative air conditioning technologies. Solid state lighting – valuable for its efficiency, configurability, and controllability – can encourage the use of daylighting systems by taking advantage of improvements in the dimming capabilities and costs of LEDs, and having the capability of being directly powered by photovoltaic DC output, leveraging cost reductions and conversion losses of the PV inverter and the LED driver.

Technology development activities will focus on advanced energy performance of new and existing buildings and will include the following:

- Building envelope materials and systems that reduce thermal and infiltration losses;
- Discrete end use equipment including heating, air conditioning, lighting and other plug loads to reduce absolute loads;
- Compressor-less equipment and other air conditioning cycles that reduce summer peaking loads;
- Low- and self-powered heating systems that address ancillary electric loads (blowers, pumps) with improved reliability during outages;
- Solid state lighting technologies that accelerate renewable energy integration, including direct power from photovoltaic DC output;
- Daylighting systems leveraging LED dimming capabilities;
- Automation technologies (including Open ADR)⁶³ to enable load flexibility and smarter background operations;
- Integrated design practices emphasizing deeper load reduction, energy recovery and onsite renewable energy harvesting and power production; and
- Informatics to present energy information in a convenient manner that simplifies managing building operations.

To stimulate and manage the development of new and improved technologies, a rigorous stage-gate process⁶⁴ – discovery (scoping/analysis), business case, development, testing, and launch – will be used for supporting new product development from idea to commercialization. At each stage of the

⁶³ A communications infrastructure to improve the reliability, repeatability, robustness, and cost-effectiveness of DR in commercial buildings, and performance based incentives for participation in evolutionary load management and DR activities.

⁶⁴ Cooper, Robert G. "Optimizing the Stage-Gate Process - What Best Practice Companies are Doing." N.p.: Stage-Gate Inc, 2006. Print "Stage-Gate Innovation Management Guidelines." Version 1.3 ed. N.p.: U.S. Department of Energy ITP, 2007. Print.

product development process, progress will be evaluated to determine if the effort should advance to the next stage. Use of the stage-gate process will help direct NYSERDA support to projects with the highest technical and business case potential, accelerate speed-to-market, increase the likelihood of product success, and introduce portfolio management and investment discipline.

In addition, NYSERDA will competitively select a proposal to establish an Advanced Building Consortium (ABC)⁶⁵. The ABC will be used to conduct targeted and high priority technology development and demonstration projects that help accelerate the introduction of emerging technology into New York markets, including technologies that make buildings more resilient. The ABC will have broad representation from technology developers, designers, builders, building supply industries, and operators and owners, and will improve the coordination between end-users and developers of building technologies. A stakeholder forum will be used to identify technology gaps and priorities; support early-stage feasibility and development (with an emphasis on New York-based manufacturing); and facilitate introduction of new products and services to owners and operators in New York. The ultimate goal is to achieve higher energy and environmental performance and resiliency of New York's building stock.

Enabling Demand Response (DR) and Load Management

The Advanced Building Initiative will develop a large capacity of Smart Grid-ready, demand-side resources at various end use customer sites throughout the state. To accomplish this, every stage of the innovation chain – including product development, demonstration, market development, deployment and standards setting – must be engaged. NYSERDA will leverage its active membership in the Association for Demand Response and Smart Grid (ADS), which is facilitating the National Action Plan on Demand Response (NAP) Coalition, a partnership of non-government associations collaborating to provide tools and resources to Demand Response program administrators, to address identified research gaps.⁶⁶ Where possible, the Initiative's program elements will be aligned with the research gaps identified by NAP.

To be Smart Grid ready, the DR infrastructure developed and supported through the Initiative must be able to participate in the available DR markets and use automated controls and communication protocols compatible with emerging demand side energy and ancillary services markets. Moreover, it must be linked to utility direct load control pilots and automated responses to price or reliability signals likely to be part of the development of the Smart Grid. Since FERC now requires demand side resources to receive equal compensation with generation in wholesale energy markets,⁶⁷ products and demand side resources capable of performing as reliably as generation will be supported. This will increase the market value of demand side resources and help move DR beyond its primary model in New York as a reliability focused resource.

⁶⁵ The September 13, 2012 Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III Funds*, provided \$3 million for an Advanced Buildings Consortium within the Technology Development component of the Advanced Buildings program of the T&MD Portfolio.

⁶⁶ *National Action Plan on DR*. FERC, 2010

⁶⁷ *DR Compensation in Organized Wholesale Energy Markets*. FERC Docket No. RM10-17-000; Order No.745

Expected Benefits

Electric and Gas System-wide Benefits: According to a 2008 study,⁶⁸ the potential for electricity and natural gas savings in residential and commercial buildings was 28%- 30%, and 34%- 35%, respectively. That potential has been only modestly tapped through existing resource acquisition and market transformation programs. The key to maximizing this potential includes: introducing market ready, underused and emerging technologies and strategies to increase the options available to customers, service providers and program administrators; and producing choices for cost-effective energy efficiency and load management technologies and strategies that serve the end users and provide system benefits. As this potential is reached through broader acceptance of these technologies and strategies, projects reducing on-peak consumption will influence supply-side asset usage and demand when system peaks threaten reliability.

DR offers a range of system benefits including moderation of wholesale energy costs, reduction of congestion costs, deferral of costs for T&D infrastructure upgrades, increased reliability, and reduced run time of highly polluting peaking generation. Energy efficiency, on-peak electric reductions, load management and DR program provide further benefits through increased, more diverse and reliable program participation, and the development of new demand management models.

Economic Development Benefits: Fostering technology development through large scale commercialization of underused technologies and strategies will increase demand for product manufacturing capacity and for skilled labor in the construction and energy services industries. Commercial innovations will create jobs in engineering, sales and manufacturing, and investments in facilities and equipment. A recent impact evaluation study of NYSERDA's R&D technology development efforts credited the program with creating approximately 5,400 net job years between 1999 and 2008.⁶⁹ The DR and Smart Grid industries, including DR aggregators and technology companies, are also responsible for significant job creation.

Environmental Benefits: Buildings are the largest contributor to GHG emissions in the state, responsible for approximately 50% of New York's emissions. The NYS Climate Action Plan⁷⁰ warns that the level of the state's future GHG emissions will be directly affected by patterns in electricity consumption and fuel use in buildings. Given the correlation between energy use and emissions, advancements in energy efficient building technologies and their adoption can significantly reduce GHG emissions. During critical demand periods, peak generation most commonly depends on oil and, to a lesser extent, natural gas.⁷¹ DR can help reduce the need to rely upon dirtier, less efficient peaking generators during critical demand periods.

Consumer Cost Savings: Advancements in technology offer consumers energy savings opportunities at lower cost and with increased functionality. The Initiative will explore the

⁶⁸ U.S. Building-Sector Energy Efficiency Potential, Brown, Borgeson, Koomey, Biermayer, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, 2008.

⁶⁹ Result of program investments made from 1996 through 2005.

⁷⁰ <http://nyclimatechange.us/InterimReport.cfm>

⁷¹ Electricity Assessment: Resources and Markets. New York State Energy Plan, 2009.

opportunity to leverage the recent advancements in wireless and mobile communication as a means to empower consumers with choices, information and control regarding their energy use.

On-peak electric reductions, load management and DR can reduce participant utility bills and overall electricity costs. The Electric Power Research Institute (EPRI) estimated that 1% of load reduction at peak times can reduce real time wholesale electricity costs by as much as 10% in any given market⁷² depending on location and market conditions. In New York City, one study noted that a 1% load reduction could reduce prices by 2%-14%.⁷³

Opportunities Unique to New York: Compared to other sectors, buildings have an extremely long life. More than 70% of New York's housing units were built before the first oil embargo in 1973. Downstate New York presents an additional challenge. In contrast to national and regional statistics for building size, this area of the state has a substantial percentage of very large commercial and multifamily buildings. As price volatility and the cost of energy rises, and with projections for the state's building stock to grow less than 10% over the next 20 years,⁷⁴ existing buildings that are most inefficient and unimproved will increase the economic hardship on residents, owners, and the New York State economy. The long life of buildings is also an important consideration for new construction. Today's design and construction decisions will affect building performance and durability, and thus the supporting supply-side energy infrastructure, for the remainder of the century. To address this sector, cost-effective systems-based and whole building technologies and practices must be developed and demonstrated.

A significant opportunity to address this situation lies with building envelope improvements. NYSERDA's R&D program has demonstrated that a 70% reduction in thermal energy use in existing residential buildings is possible by deploying deep-retrofit practices. Similar practices incorporated into new construction can offer 30% savings above current ENERGY STAR[®] home standards. Additional effort is needed both to reduce the cost and establish standardized approaches that will adapt to different building styles and original construction methods and then demonstrate the replicability of those approaches

Demonstrations will seek to introduce technologies and products developed and manufactured in New York, possibly with assistance of NYSERDA's R&D program, Brookhaven National Laboratory, and New York State universities and incubators.

There is a substantial percentage of very large commercial and multi-family buildings in the downstate area, presenting a challenge and opportunity apart from typical building sizes in the rest of the country and region. These buildings need to be addressed from both energy intensity and a peak load perspective.

Highly load-constrained NYISO Zones J (New York City) and K (Long Island) have some of the highest capacity, supply and distribution costs in the country and, consequently, highest potential for economic benefits from energy efficiency and DR. Under NYSERDA's active participation and leadership, the state's DR community will continue to encourage new markets through integration

⁷² Summer in San Diego Revisited: The Case for Customer DR in California. EPRI, 2000.

⁷³ 2004 NYISO DR Program Evaluation. Neenan Associates, 2005.

⁷⁴ <http://nyclimatechange.us/InterimReport.cfm>

with efficiency and renewable resources. Given capacity constraints and energy and capacity price increment downstate, efforts will include technology development, market acceleration and support for diverse and reliable participation in efficiency and DR programs, and increased penetration and participation in Con Edison service territory.

Leveraging Resources or Filling Gaps: The Advanced Building Initiative will leverage NYSERDA's relationship with local and national organizations including, but not limited to, the following:

- United States Department of Energy Building Technologies Program: the Program works to improve the efficiency of buildings and the equipment, components, and systems within them. The program supports research and development (R&D) activities and provides tools, guidelines, training, and access to technical and financial resources.
- National Association of State Energy Officials (NASEO): Organization focused on improving the effectiveness and quality of state energy programs and policies, providing policy input and analysis, and sharing successes among states;
- Lighting Research Center (Troy): Internationally recognized, university-based research and education organization devoted to lighting;
- Syracuse Center of Excellence: Center, including laboratories and office space, for environmental and energy technologies, building innovations, research, and business collaborations for products and services;
- American Council for an Energy-Efficient Economy (ACEEE): Nonprofit organization dedicated to advancing energy efficiency as a means of promoting economic prosperity, energy security, and environmental protection;
- Brookhaven National Laboratory: Multi-program, Long Island-based national laboratory;
- National Resource Defense Council (NRDC): Environmental action organization focused on resolution of the most pressing, current environmental and energy related issues;
- Real Estate Board of New York (REBNY): Organization dedicated to expanding New York's economy, encouraging the development and renovation of commercial and residential real property, enhancing the city's appeal to investors and residents, and facilitating property management;
- National Home Performance Council: Organization that encourages improved whole-house performance of residential buildings by facilitating research and coordination among federal and state government and industry stakeholders;
- Affordable Comfort: Organization dedicated to improving the performance of residences through research and education regarding the use of best practices based on sound building science;

- Consortium for Energy Efficiency: Consortium of energy efficiency program administrators who work together on approaches to increase energy efficiency across all building sectors; and
- New York State Builders Association Research and Education Foundation: Organization dedicated to advancing the housing industry through research and education.

The Program will work with the New York's Investor Owned Utilities (IOUs) to advance technologies and practices that enable mutually benefiting building – grid interaction. The IOUs, in particular Con Edison, are considering investments in Automated Demand Response (Auto-DR) programs that, during critical periods, permit the utility to automatically send an Internet signal to customers' energy control systems in order to initiate a series of pre-programmed, pre-authorized demand reduction strategies. In order for IOU investments to pay system dividends, customers must be enabled to participate. Initiative deployment funds will be leveraged against IOU investment in Auto-DR infrastructure to buy down the customer cost and risk.

Program budgets will be leveraged by requiring project participant cost sharing. Knowledge transfer through case studies, seminars, webinars, and web resources will help maximize adoption rates and replication of new and used technologies and practices.

Scale of Benefits Relative to Program Costs: Consumers in New York spend \$34 billion per year on energy to heat and power their buildings. This \$13.9M/yr Advanced Building program seeks to develop and implement technologies and strategies to reduce those costs and increase clean energy options for end-use applications in New York. Where possible, emphasis will be on technologies and practices having applicability across the building sectors (residential, multi-family, commercial). The Initiative will strive to leverage technology resources and skills of the various universities, Centers of Excellence and national laboratories.

Coordination with other parts of the T&MD program portfolio, including Market Development, can shorten the timeline required for broad commercialization of new products and strategies. Once these are commercially viable, factors such as the scale of production and a trained workforce will influence cost and readiness for market adoption with or without incentives. The proving ground and knowledge transfer aspects of the Initiative invite broader acceptance, higher levels of market penetration, and replication, culminating with collective cost savings and environmental benefits.

DR reduces electricity costs through deferral of T&D upgrades, reduced congestion costs, moderation of real time wholesale prices and, when fully integrated into the system planning process, reduced capacity costs. The Initiative will maximize return of ratepayer investment in load management activities by focusing on critical junctures in market development where significant barriers can be overcome.

Program Experience

The Advanced Building Initiative will build on NYSERDA's success with current and previous efforts: the Next Generation Emerging Technology, Peak Load Reduction, DR and Time Sensitive Rate, Multi-family Performance Program, Home Performance with ENERGY STAR,[®] New York

ENERGY STAR[®] Homes, Empower New YorkSM and Existing Facility programs under SBC.⁷⁵

NYSERDA's 20 years of leadership and support of research and product development of fuel-efficient oil heating systems (Brookhaven National Laboratory, New York State manufacturers - Fulton Boiler, HeatWise, ECR International and others) and partnerships with the U.S. Department of Energy and the National Oilheat Research Alliance, have produced more than \$5 billion in estimated accumulated energy savings for New York consumers and over 30 million metric tons of CO₂ emissions avoid in the state.⁷⁶

NYSERDA has advanced DR as part of the State's energy solution through technology R&D, market design support, funding of demonstrations, financial and technical support for the development of load curtailment plans, and financial incentives for the installation of DR enabling equipment since the first customer participation in 2001. NYSERDA's deployment program is responsible for 571 MW of registered load with 15 different RIPs and 1874 different customer sites. DR resources activated by the NYISO in Zone J during the 2010 summer capability period were responsible for avoiding a peak demand record. NYSERDA is a recognized national leader in the DR community and was recently recognized by the Association for DR and Smart Grid for work in this area.

NYSERDA has extensive experience designing, managing, and evaluating large-scale demonstrations and leveraging the lessons learned from these into full programs. Home Performance with ENERGY STAR, initiated by NYSERDA and replicated nationally, was the first program capable of delivering energy efficiency upgrades to the residential market that did not rely solely on direct measure-based incentives. NYSERDA also developed the ENERGY STAR Label for High-Rise Multi-family Buildings. This effort, recently launched as a national program by the U.S. EPA, included the creation of a standardized protocol to assist designers and builders of multi-family buildings.

Numerous technologies now commercially available and recognized as best practice also started as technology development activities within NYSERDA's Building R&D and expanded to large-scale demonstrations through NYSERDA's deployment programs. Bi-level stairwell lighting, heat pump hot water heaters, load shedding fluorescent ballasts, and wireless energy management systems are examples of technologies NYSERDA has advanced through market awareness, understanding of the principles of technology diffusion, and access to the innovators and early adopters in the market.

NYSERDA has also established partnerships with building professionals throughout the state through SBC, EEPS and RPS deployment programs to demonstrate technologies and practices that

⁷⁵ According to an impact evaluation study of NYSERDA's R&D product demonstration activities from 2004-2007: demonstration and replication projects achieved annual net savings of nearly 252 GWh and 12.3 MW in New York; and 74% of respondents surveyed reported having replicated the technology or process in a similar market or application. For the 13-year period from 1996-2008, sales of products supported by NYSERDA's product development efforts have led to the following macroeconomic impacts: 5,400 net job-years created; and a change in Gross State Product (GSP) of 5.2 dollars to every 1-dollar of program funds invested.

⁷⁶ Savings were calculated as part of a GAO audit for a review of investments at U.S. National Laboratories. Savings and reductions for New York were inferred using EIA data, New York accounting for 20% of the nation's residential fuel oil use. NYSERDA was a large co-sponsor over the last 20 years of activities in this area both at Brookhaven National Laboratory and New York companies.

improve energy efficiency, including the 2010 Deep Retrofit pilot for low income households. Contractors educated in advanced building practices of super insulation, air sealing, combined space/water heating systems, air-to-air heat exchangers, etc., conducted deep retrofits of five dwellings near Utica. The result was an estimated 70% reduction in energy bills, building improvements that prolong the life of the buildings served, and a methodology replicable for middle- and low-income housing.

Funding and Schedule of Implementation

The Advanced Building Initiative budget averages \$15.06 million annually. Due to the long lead time from development to product commercialization, the technology development budget is front loaded to accelerate the introduction of new products. Technology Development priorities in 2012 will include building envelope materials and systems, building automation (energy management) technologies, and discrete end-use equipment. It is anticipated that ETAC efforts in year one will focus on soliciting stakeholder input to identify and rank promising technologies and strategies for large-scale reference demonstrations.

Table 9-7 Advanced Buildings Budget

Budget (committed funds)					
	Average Annual (\$millions)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Emerging Technology/Accelerated Commercialization	6.49	12,415,046	13,994,670	6,036,497	32,446,213
Technology Development	6.72	17,722,390	12,074,284	3,816,541	33,613,215
Demand Response	1.85	3,710,693	3,710,693	1,855,346	9,276,732
Total: Advanced Buildings	\$15.06	\$33,848,129	\$29,779,647	\$11,708,384	\$75,336,160⁷⁷

⁷⁷ The September 13, 2012 Order in Case 10-M-0457, *Order Authorizing the Reallocation of Uncommitted System Benefits Charge III funds*, includes \$5,760,672 for the Advanced Buildings Initiative, of which \$3 million is for an Advanced Buildings Consortium (which is part of the Technology Innovation component). Also, \$2,760,672 was provided for an initiative to pursue deep energy savings in commercial buildings within the Emerging Technology/Accelerated Commercialization component.

Table 9-8. Advanced Buildings Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/ Indicators – Quantifiable Targets					
Emerging Technology/Accelerated Commercialization	13-22 Stakeholder meetings on emerging and underused technologies and strategies	7-10	5-9	1-3	
	38-70 Knowledge/Technology Transfer Activities across the commercial and residential sectors (webcasts, reference case studies, and other knowledge transfer mechanisms)	8-18	17-26	10-18	3-8
	17-36 Contracted reference demonstration ⁷⁸ projects across the commercial and residential sectors (including large-scale demonstrations)	3-6	8-14	6-16	
	17-36 Completed reference demonstration projects across the commercial and residential sectors (including large-scale demonstrations)	1-2	5-14	6-12	5-8
Technology Development	46-74 Advanced building technology projects contracted (including some large-scale projects) ⁷⁹	23-36	18-29	5-9	
	46-74 Advanced building technology projects completed (including some large-scale projects) ⁸⁰		23-36	18-29	5-9
	23-37 clean energy companies receiving support	12-18	9-14	2-4	
	15-30 Stakeholders engaged in the Advanced Buildings Consortium (ABC)	5-10	10-15	0-5	
	16-35 ABC Stakeholder meetings, advisory meetings, workshops, conferences, events, etc.	2-5	8-20	6-10	
	3-5 Product development projects completed associated with the ABC		1-2	1-2	1
	3-5 Building practices and products demonstrated in the market associated with the ABC		1-2	1-2	1
	10-15 clean energy companies receiving support through ABC	3-5	6-8	1-2	
Demand Response	46 MW Registered	9 MW	14 MW	18 MW	5 MW

⁷⁸ For this program, a demonstration project is defined as highly visible, large-scale demonstration of a technology or technologies at one or more sites. For example, a demonstration of load-shedding ballast in a number of different building locations would be considered one demonstration.

⁷⁹ Using a stage-gate process, technology opportunities will be explored and only the most promising technologies (select few) will be advanced to large-scale projects.

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outcomes/Impacts – Quantifiable Targets *⁸⁰					
Emerging Technology/Accelerated Commercialization	\$6.5 -13 Million of leveraged funds (co-funding and outside investment) for demonstration projects	\$1-3M	\$3.5-5.5M	\$2-4.5M	
	10,500 MWh of energy savings from supported demonstration projects ⁸¹	2,000 MWh	4,200 MWh	3,400 MWh	900 MWh
	78,000 MMBtus of energy savings from supported demonstration projects ⁸²	5,000 MMBtu	31,200 MMBtu	34,000 MMBtu	7,800 MMBtu
	2,300 Peak kW reduction	550	700	750	300
	Increased knowledge base on emerging technologies for buildings/Increased number of service providers familiar with emerging technology				
	Increased marketing and promotion of emerging technologies resulting from knowledge gained				
	Reduced barriers, including non-financial, to emerging technology adoption				
	29,800 MWh from replication of supported projects/technologies ⁸²				29,800 MWh
	231,800 MMBTUs from replication of supported projects/technologies ⁸²				231,800 MMBtu
	7,100 peak kW from replication of supported projects/technologies				7,100
	\$21-35 Million of leveraged funds (co-funding and outside investment) for replication of demonstration projects				\$21-35M
	8-17 improved technologies adopted by the market or further supported by deployment programs		0-2	4-8	4-7

⁸⁰ Estimates based on savings per program dollar invested in projects.

⁸¹ It is difficult to estimate savings for these new feeder programs. Estimates are conservative given the difficulty of assessing replication impacts. Estimates are based on previous NYSERDA evaluation studies of replication from demonstration projects.

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outcomes/Impacts – Quantifiable Targets ^{*82}					
Technology Development	\$14-23 Million in leveraged funds (co-funding and outside investment) for advanced building technologies	\$7-10M	\$5-10M	\$2-3M	
	6-11 Advanced building technologies reach commercial availability		1-3	4-6	1-2
	\$83-120 Million of commercial sales of new and improved supported technologies			\$8-20	\$75-100
	\$4-6 Million in leveraged funds (co-funding and outside investment) for ABC technologies		2-3	2-3	
	1 ABC technology reaches commercial availability			1	
	\$4-6 Million of commercial sales of new and improved technologies supported through ABC			1-2	3-4
	11-19 publications, policy research, briefings, market intelligence & code reform through ABC		5-9	6-10	
Demand Response	23 Additional MW registered ⁸³				23 MW

**Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.*

⁸² Estimates based on savings per program dollar invested in projects.

⁸³ Additional demand response provided by contracted participants beyond the initial registered amount.

9.2.2 Advanced Energy Codes & Standards

Targeted Problem

Implementation of codes and standards is among the most cost-effective means to achieve energy and emissions savings, but the opportunity is not being fully realized. Despite the last decade's low economic growth, New York produced 58,000 non-residential construction projects (576 million sq. ft. of area; \$112.5 billion in construction) and more than 150,000 single family homes between 2000 and 2007. Thousands of renovation projects, including those with new mechanical and electrical equipment, have also been implemented.

Code advances have significant impact on all aspects of the building marketplace – from the smallest contractors to the architects working on the state's largest projects. To assure that proposed code changes are appropriate to New York's new and existing buildings, code-targeted policy development, education and compliance support efforts are essential. To a large degree, the New York State Energy Code follows the International Energy Conservation Code (IECC) national model code. In the State's next code cycle (2014), buildings may be required to be 30% more energy efficient than those constructed under the 2007 code. Moreover, the U.S. Department of Energy's (DOE) goal is that building energy performance be improved an additional 25% by 2016. These aggressive code-performance advancements are in sharp contrast to the annual 1% increases over the previous two decades, and they will require dedicated efforts to overcome long-standing knowledge gaps and ambivalence from code officials, design professionals, and contractors.

There is a substantial energy savings gap between the targeted rate of code compliance, where 100% of code requirements are met through project design and construction, and the actual rate of code compliance, i.e., the measured performance of the completed building.⁸⁴ Acceptance of ARRA funds requires New York to implement a plan to achieve 90% compliance with the Energy Code by 2017. Aggressive increases of building performance through advanced energy code adoption may exacerbate the gap between targeted and actual energy savings. Reducing this gap and increasing the actual rate of compliance can be accomplished through training and other support efforts focused on the entire design and construction community and annual measurement of the rate of compliance. No other funding source exists to help New York meet the required compliance level.

For appliance and equipment standards, a forthcoming study from the American Council for an Energy Efficient Economy and the Appliance Standards Awareness Project will identify about 25 products ripe for new or updated federal standards.⁸⁵ New York's involvement in standards development has been essential to progress made. For select products, State Energy Program funding has permitted NYSERDA's participation through public comments in federal standards development and adoption of state standards. For other product areas, NYSERDA has relied on

⁸⁴ "The actual" code compliance rate could be as low as 30% of the target code, considering the variables of building design, construction and operation. While 100% compliance with the target code is theoretically possible, recent studies have identified 80%-90% compliance as more realistic.

⁸⁵ "Appliance & Equipment Efficiency Standards: A Money Maker & Job Creator," Rachel Gold et al., American Council for an Energy-Efficient Economy, January 2011.

cooperative work with other regional and national organizations.⁸⁶ With the overall increase in development activity, NYSERDA will not be able to advance New York's interests in key appliance and equipment standards areas without additional funding. To meet New York's best interests, a strong voice in the federal standards rulemaking processes is essential.

Current State of Technology or Knowledge

While NYSERDA's incentive programs have demonstrated that achieving above-minimum code performance is cost-effective and in high demand,⁸⁷ large market segments are untouched by these programs and maximum energy savings are unrealized. Based on national data and experience, the Building Codes Assistance Project (BCAP) has identified the following barriers to closing the compliance gap and maximizing savings potential:

- Wide variation in code officials' skills relative to review of project plans and specifications;
- Limited availability of advanced products;
- Unfamiliarity with new technologies;
- Lag in the development of State and federal appliance and equipment standards;
- Weak federal standards that do not challenge the marketplace or respond to regional variations;
- Lack of enforcement resources to address large, complex building projects;
- Lack of contractor training for proper installation of energy-savings devices;
- Limited use of building commissioning to assure correct design and installation;
- Difficulty in maintaining equipment and automated systems as designed; and
- Poor building operation and maintenance.

Other barriers include:

- Slow translation of new concepts and greater stringency into design and construction practices;
- Increased enforcement responsibilities for municipalities undergoing funding reductions;
- Unfamiliarity with strategies such as stretch codes (alternate, above-minimum codes) and green planning;

⁸⁶ The Appliance Standards Awareness Project, the American Council for an Energy Efficient Economy, Northeast Energy Efficiency Partnerships, and others.

⁸⁷ NYSERDA's New Construction Program has affected more than 30% of all state commercial construction: average energy savings are 17-19% above the Energy Code. The ENERGY STAR® Home Program has influenced over 16% of the single-family residential construction starts, with projected savings of 30%. Results for the Multi-Family Performance Program average 20% above-code in more than 80,000 housing units built since 2006.

- Decreased funding for code administration and training at the Department of State (DOS) and other agencies.⁸⁸

These lists provide the foundation for a working agenda for the Advanced Energy Codes & Standards Initiative.

In 2009, NYSERDA received two, one-time grants through the American Recovery and Reinvestment Act (ARRA) to develop training and plan review support services, to conduct a statewide baseline Energy Code compliance assessment, and to evaluate the effectiveness of these efforts. The ARRA-funded programmatic activities will be completed in 2012, and no further funding is currently available for continued or similar efforts. The activities proposed herein will build upon the initial ARRA-funded efforts, with enhancements and refinements made to reflect three years of lessons learned.

Why This is Important for New York and New York Ratepayers

Advancing energy codes and standards, including raising compliance with the energy code, can deliver significant energy and cost savings to New York State consumers. Energy codes and standards activities account for more than 30% of the savings identified in the 15x15 wedge, and if benefits are not realized through this highly effective approach, more funding for ratepayer incentive programs may be needed. Advancing energy codes and standards is also a key component to reducing greenhouse gas emissions. The proposed activities will provide leadership opportunities for local government and help to create replicable and cost-effective green planning and code implementation strategies. Successful activities will be able to be shared with local communities throughout New York State.

Program Goals

The Advanced Energy Codes & Standards Initiative has the following program goals for energy codes and appliances standards. Meeting these goals requires an integrated effort that incorporates education, training and enforcement support, monitoring technical and manufacturing advances, advancing state and national standards, and testing innovative delivery approaches. Both NYSERDA and DOS will have primary roles in these efforts.

The Advanced Energy Codes and Standards Initiative will result in more efficient codes and standards, better compliance and enforcement, and the promotion of stretch and green planning codes. Proposed activities will also enable New York to meet the compliance requirements of ARRA funding.

⁸⁸ Since the NYS Energy Law Article 11 revision in 1999, which transferred responsibility for the Energy Code to DOS from DHCR, no State legislative funding has provided for the responsibilities associated with this agency mandate.

Energy Code – Short-term:

- Explore and test alternative approaches to energy-related building enforcement and implementation;
- Evaluate code-ready energy-saving technologies and new construction materials and assemblies in the context of durability and building science;
- Increase the (actual) statewide code compliance rate to the federally-mandated 90%;
- Explore regulatory means to extend energy-saving approaches to more existing buildings;
- Develop prototypical stretch codes and green planning approaches for localities;
- Prepare the marketplace and design and construction communities for advancing code requirements and technical/manufacturing innovations.

Energy Code – Long-term:

- Promote adoption of alternative compliance and enforcement systems;
- Promote adoption of energy-saving technical provisions including those incorporating durability and new technologies;
- Expand energy provisions in codes for existing buildings;
- Promote stretch codes and green planning principles;
- Facilitate the integration of code advances into the marketplace; and
- Maintain the alignment of New York’s requirements with national standards and codes revised on three-year cycles.

Appliance Standards – Short-term:

- Evaluate and test products and equipment to understand and support standards opportunities;
- Prioritize appliance and equipment standards for energy savings opportunities;
- Actively participate in the federal rulemaking processes.

Alignment with T&MD Objectives

Advances in energy codes and standards spur far greater savings than savings available through incentive programs. Whether through higher performance thresholds or increased compliance, resulting changes in practices and energy savings are incorporated into every project across the construction marketplace. Advances also indirectly raise the bar for incentive programs. Higher codes and standards for buildings and equipment eliminate the least efficient products in the market and stimulate opportunities for pursuit of new advanced technologies. An example of this is the upcoming federal general service light bulb standards and the emergence of more efficient halogen and LED light bulbs.

Appliance Standards – Long-term:

- Ensure timely enactment and implementation of appliance and equipment standards; and
- Identify and analyze the potential impact of appliance and equipment standards on the New York market.

Specific near-term and long-term performance milestones related to these goals are presented at the end of this section.

Program Design

Four principal strategies have been identified to advance codes and standards. Stakeholder input will be sought on a regular basis from representatives of the utilities, real estate, local government, low-income housing, code enforcement, design and construction, historic preservation, and other communities to guide the development and application of these strategies. NYSERDA will continue to work closely with DOS to implement these initiatives.

Annual Statewide Compliance Assessments – NYSERDA will competitively select contractors to conduct annual statewide compliance assessment studies to track trends responsive to increased stringency in codes and standards. NYSERDA’s first comprehensive statewide baseline compliance study, scheduled for completion in June 2011, will identify areas of low compliance and energy savings gaps. Lessons learned through this initial study will be leveraged to design future assessments, which will in turn inform future allocation of NYSERDA resources.

For appliance and equipment standards, NYSERDA will assess conformance to selected State or federal product standards. Products with higher energy impacts and greater likelihood of non-compliance will receive the greatest focus in baseline assessments.

Development and Delivery of Advanced Training and Tools – Training to support new and advanced codes and standards is critical, particularly at points of adoption. Training efforts will build upon those developed using ARRA funds, with new or enhanced training modules and approaches. The modules may focus on code requirements in the context of: building science and equipment; enforcement options, including third party personnel; above-code designs; lighting; renewables; advanced inspection; and green planning. Both in-person and on-line training will be provided, with sessions ranging from introductory to expert-level tailored for each intended audience. Site-specific and hands-on-training are also likely.

Educational tools supporting increased compliance will be developed to improve access to code-related information and facilitate submission or review of compliance documentation. Examples include: updates to the ARRA-funded (2011) *User’s Guide to the Energy Code*; Volume 2 of the ARRA-funded contractors’ (2011) *Field Guide* targeted to mid-size residential and commercial buildings; and an electronic cataloging of energy-related construction details available for product specifiers and purchasers.

For appliance and equipment standards, NYSERDA will ensure that recent tools, including the online product certification MultiState Compliance Database developed with NYSERDA participation, are updated and New York-appropriate.

For delivery of advanced training and tools, NYSERDA will use a mix of competitive solicitations and cooperative training arrangements in order to seek innovative strategies that reach broadest audiences.

Technical Support, Studies, and Resources – Technical consulting and market research firms will be competitively selected to provide support and the objective review necessary for considering codes and standards changes, to implement new strategies, and to conduct other activities as assigned by NYSERDA necessary to managing the program. These efforts will increase New York’s proactive response to federal standard proposals and national energy code changes. Examples of potential study topics include:

- Analysis or testing of products or equipment to determine suitability and cost-effectiveness of proposed code and equipment standards;
- Creation and assessment of a database of New York-specific building types and associated modeling to determine greatest opportunities for energy savings;
- Development of policy strategies on topics such as full code integration of renewable technologies or the impact of code-mandated commissioning requirements;
- Evaluation of the cost-effectiveness of advanced codes that achieve 30% and 50% more energy savings than ASHRAE 90.1;
- Demonstration of the state-required 10-year payback period for Energy Code enhancements; and
- Identification of barriers for new code-related products ready for the market place (a complement to other NYSERDA programs supporting market research targeting experimental and emerging products).

To influence national advances in codes and appliance standards and assure the benefit to New York, NYSERDA and DOS will participate in national and regional development efforts, including travel to rulemaking meetings and code and standards development workshops and hearings.

Pilots and Expanded Implementation Assistance – Pilots testing new implementation and business models for appliance and equipment standards, improved code compliance and enforcement strategies, and stretch and green planning efforts will be competitively solicited. Examples of potential pilots include:

- Innovative approaches to reaching new markets;
- Innovative opportunities to increase the efficacy of energy-related efforts at local and state agencies;
- Implementation strategies for adoption of stretch codes and green planning strategies;
- Alternate/supplemental approaches to local Energy Code enforcement;

- Municipal partnerships to advance energy savings in key community buildings.

NYSERDA also will support the construction and code enforcement communities by strategically providing expanded implementation assistance to increase compliance with new and advanced codes and standards. Two potential examples include: a “hotline” for answering Energy Code questions, or specific statewide assistance resulting from a successful pilot. This assistance will be competitively selected or, potentially in the case of expanding successful pilots, negotiated based on earlier competitively selected efforts.

Expected Benefits

This section describes the expected benefits associated with the Advanced Energy Codes and Standards Initiative, in relation to the seven priorities articulated in Section 5.2. The following describes qualitative and "big picture" benefits, providing an important contextual framing for the Initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-9.

System-wide Energy Benefits: Advances to and improved compliance with codes and standards raise the market floor and reduce energy use, demand and environmental emissions across New York. For the activities proposed, preliminary annual energy and demand savings estimates are: 988 GWh of electricity, 297 MW of peak demand, and 4,920 billion Btus of natural gas by 2020.⁸⁹ Program activities will also provide opportunities to incorporate strategies into advanced energy codes and standards that can increase grid reliability. Related to the Commission’s Clean Energy goals (e.g., EEPS/RPS), the Advanced Codes and Standards Initiative will ready the design and construction community and design infrastructure for future renewable efforts.

Economic Development Benefits: Advanced codes and standards have an indirect impact on economic development. Training and support efforts will enhance the skills and marketability of all participants, and the addition of new energy-related requirements for existing buildings will result in increased construction and renovation work.

Environmental Benefits: For the activities proposed, estimated environmental benefits are a 408,332-ton reduction in greenhouse gas emissions, and a 1,280- ton reduction in air pollutant emissions by 2020.⁶⁰

Consumer Cost Savings: For the activities proposed, consumer cost savings are estimated to be \$224 million/year by 2020.

Opportunities Unique to New York: New York is unique in terms of the large number of local governments that need to be reached. The local governments have diverse needs, varying significantly in size and sophistication. These needs will require a wide range of strategies to be successful statewide.

The Energy Code is enforced by local code officials in approximately 1,600 municipalities. Energy Code responsibilities of DOS include overall administration and training and certification of code

⁸⁹The ARRA-funded baseline compliance assessment, to be completed in Summer 2011, will provide information permitting further refinement of these estimates.

officials. Energy training represents only five of 126 required certification hours with no requirement for ongoing training. DOS has no dedicated programs for training architects/engineers, lighting designers, contractors, commissioning agents and others in the design and construction community. Training programs by professional and trade/membership organizations have historically been few in number and limited in scope. Because existing DOS training is not energy code intensive, its efforts will not on their own effectively contribute to meeting the federal 90% compliance mandate. The activities to be conducted through this initiative will contribute directly to New York's ability to meet the compliance mandate.

Current ARRA-funded and past code training efforts confirm the criticality of extending Energy Code training and support services beyond the code enforcement community. Code officials are increasingly burdened by expanded energy and other code requirements at a time of diminishing municipal resources. Consultation with third party raters and inspectors are likely to be more common, presenting a new audience requiring training and support. Ninety percent code compliance by 2017 will not be possible with a business-as-usual approach, focused solely on traditional classroom training for the code official. Improved compliance will require developing and testing new approaches and reaching broader audiences.

DOS's relationships with the local code enforcement community will be leveraged to encourage participation in the Advanced Energy Codes and Standards training initiatives. DOS will participate in curriculum development and assist with continuing education accreditation for code officials. NYSERDA's efforts are a necessary complement to DOS responsibilities and essential for improved local code enforcement and compliance.

At the national level, federal appliance standards rulemaking has been increasingly dominated by the manufacturing community and, in some cases, lagging in its attention to various product categories. NYSERDA's standards activities will ensure the State is duly informed of efficiency standards impacting the State and provide the opportunity to steer federal attention where it is lacking or necessary to meet the State's interests.

Scale of Potential Benefits Relative to Program Costs: Implementation of codes and standards is among the most cost-effective means to achieve energy and emissions savings.⁹⁰ The Advanced Energy Codes and Standards Initiative is anticipated to deliver savings at a program cost of \$6.86/first-year Megawatt hour (MWh) saved and \$20.13/first-year million Btu (MMBtu) saved. The recommended budget to accomplish this (\$3.336 million average annual) is consistent with the level of ARRA funds currently being used for the types of activities represented in this Initiative. NYSERDA has found that this level is appropriate to reach the intended audience.

Program Experience

Through current ARRA-funded Energy Code training and support services, NYSERDA has trained over 8000 code officials, architects, engineers, builders, and trade professionals, among others, on

⁹⁰ As cited in "Utility Codes and Standards Programs: How Much Energy Do They Save?," Allen Lee et al, 2008 ACEEE Summer Study on Energy Efficiency in Buildings, page 8-165, an evaluation of the California utility Codes & Standards Program, savings were achieved at a Program cost of about \$0.01/first-year kWh, or \$10/MWh. This compares to costs/first year MWh for New York EEPs incentives programs of \$407.96/MWh for Con Ed, \$239.56/MWh for National Grid, and \$116.31/MWh for NYSERDA.

current provisions of the code, with training modules tailored to the needs of the audience. Other program efforts include:

- Energy Code plan review targeted at code officials, architects/engineers, design/build firms and others using a performance-based compliance approach;
- A regional Energy Code advisors pilot to provide dedicated code support to communities with limited code enforcement resources;
- On-line Energy Code training developed from in-person training;
- A Builder’s Field Guide and Energy Code User’s Manual; and
- Design and launch of a dedicated website for in-person and plan review registration, and for providing on-line training opportunities.

Feedback from training and initial response on program efforts in-progress indicates that the demand and the need for NYSERDA’s support are high. The construction and code enforcement communities benefit from well-conceived training and support initiatives and, as the emphasis on and rigors of code compliance increase, continued efforts have considerable value to the marketplace and to New York State’s energy and greenhouse gas reduction goals.

Funding and Performance Milestones

Annual funding allocations reflect the need to maintain the continuity and momentum of training and support services developed and offered through ARRA, which end in early to mid 2012. Solicitations for training and compliance assessment are anticipated in 2012. Multiple rounds of pilot and implementation assistance efforts are anticipated to balance between assuring that pilots and implementation assistance projects are completed and results more broadly disseminated, and that funding is available for innovative pilot and implementation assistance ideas that emerge as a result of early Program activities. Technical support resources will be committed as they are needed over the course of the Program.

Table 9-9 Advanced Energy Codes and Standards Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Total: Advanced Energy Codes and Standards	\$3.34	\$8,313,500	\$6,960,044	\$1,406,250	\$16,679,794

Table 9-10 Advanced Energy Codes Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/Leading Indicators					
Annual Statewide Compliance Assessments	Conduct 5 annual code compliance assessments	2	2	1	
	Conduct 3 compliance efforts with appliance and equipment vendors to assess conformance to State and federal standards	1	1	1	
Development and Delivery of Advanced Training and Tools	Develop 12-16 new or expanded code training modules	6-8	6-8		
	Train 15,000 individuals on code requirements	7,000	6,000	2,000	
	Develop or update educational or other tools to help support code compliance and NY appliance/equipment standards				
Technical Support, Studies and Resources	Issue 2 competitive solicitations to hire consulting and market research firms to provide program support	1	1		
	Participation by NYSERDA and DOS in rulemaking, code development hearings and codes and standards development workshops				
Pilots and Expanded Implementation Assistance	Issue 2 competitive solicitations for pilots and program implementation assistance	1	1		

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017- 2020)
Outcomes/Impacts*					
Annual Statewide Compliance Assessments	Information from code compliance assessments and standards research supports policy decisions on future code/standard changes				
Development and Delivery of Advanced Training and Tools and Technical Support, Studies and Resources	Ongoing use and sustained knowledge of training elements and tools fosters increased code compliance toward the goal of 90% compliance by 2017				
	Code compliance efforts lead to 631 GWh of cumulative annual electricity savings	84 GWh/yr	140 GWh/yr	90 GWh/yr	317 GWh/year by 2020 ⁹¹
	Code compliance efforts lead to 129 MW of cumulative annual peak demand savings	18 MW/yr	28 MW/yr	19 MW/yr	64MW/yr By 2020 ⁹²
	Code compliance efforts lead to 4,921,000 MMBtu of cumulative annual fossil fuels savings	575,000 MMBtu/yr	1,057,000 MMBtu/yr	726,000 MMBtu/yr	2,563,000 MMBtu/yr by 2020 ⁹²
	Equipment and appliance standards efforts lead to 356 GWh of energy savings		5 GWh/yr	51 GWh/yr	300 GWh/year by 2020 ⁹²
	Equipment and appliance standards efforts lead to 168 MW of annual peak demand savings		2 MW/yr	23 MW/yr	143 MW/yr by 2020 ⁹³

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

⁹¹ Out-years reflect annual energy code savings in 2017 applied through to 2020 based on code changes enacted at the end of 2014.

⁹² Out-years reflect annual energy savings for appliance standards through to 2020 based on available savings projections for federal standards from Appliance Standards Awareness Project through to 2020.

9.3 Clean Energy Infrastructure Initiatives

9.3.1 Market Development

Targeted Problem

The market supply chain plays a critical role in ensuring that high quality energy efficiency and renewable energy products and services reach energy consumers in a routine and consistent manner. Without the active engagement of the distributors, contractors, vendors and service providers that comprise the supply chain, as well as a steady consumer demand, many opportunities to increase efficiency of buildings or to integrate efficiency and renewable energy options into our everyday lives will be lost. Fostering demand and assuring that products are available to meet that demand are critical elements in transforming markets and achieving the State's ambitious energy and environmental goals. Monetary incentives alone do not ensure replication of choices or continued demand for energy efficient products, operations or construction practices. Market intervention strategies are needed to prepare the supply chain for the advent of new technologies and solutions and to effectuate market transformation which can provide long lasting changes in the marketplace and achieve energy efficiency benefits without continued incentives.

Despite progress in addressing market conditions related to supply and demand, certain market barriers persist. Market supply chains require information and encouragement to adopt business practices that promote the benefits of newer cost-effective technologies, strategies, and business models that can deliver enhanced efficiency or clean energy resources. End users, often unfamiliar with the value of energy efficiency and clean energy technologies and strategies, need credible information about their choices and the corresponding benefits.

Many other factors – a focus on short-term investment strategies, tenant/landlord agreements where the energy costs and return on investment for energy efficiency investments are misaligned, lack of meaningful data and full market intelligence, energy price volatility, lack of awareness of financing options, unfamiliarity with new technologies and strategies—are also impediments that affect the market acceptance of energy efficiency and renewable energy products and services.

Current State of Knowledge and Technology

New technologies for buildings are constantly emerging and evolving. For example, new building controls that incorporate sensors and solid state lighting (light emitting diodes or LEDs) options are coming on the market, and if we are to see increased rates of adoption, distributors and building operators need credible information regarding benefits and associated costs. Design professionals must have sufficient confidence and information to incorporate these products in new projects and to install them correctly. Innovative energy saving strategies, behavioral approaches, and financing and model lease options are being tested in New York and elsewhere that have the potential to drive more energy efficiency decisions. Over 65% of the non-residential electric load and 78% of the non-residential gas volume is now purchased from competitive commodity providers, instead of

investor-owned utilities.⁹³ Strategies that encourage the commodity service providers to also offer energy efficiency services has the potential to open up otherwise untapped markets.

Based on a 2010 national study of ENERGY STAR awareness conducted by the Consortium for Energy Efficiency (CEE), states with programs that promote energy efficiency and the ENERGY STAR label see a significant increase in recognition of the ENERGY STAR label that consumers and businesses equate with increased energy efficiency. Still, products with efficiency ratings better than ENERGY STAR continue to enter the market. Market share incentives for higher tier clothes washers, refrigerators, and other appliances continue to be needed to influence consumer choices and willingness to pay for higher efficiency products.

Why This is Important for New York and New York Ratepayers

Market Development activities include identifying new market opportunities and informing suppliers about technological innovations while providing the technical tools, and resources, necessary to promote energy efficiency options to customers. Despite progress in increasing the efficiency of New York's buildings and processes, continued attention to strategies that result in lasting improvements in energy consumption patterns are needed to achieve the State's energy and environmental goals. Resource acquisition programs alone include risks that one-time energy savings will be diminished by the consumer's return to previous purchase patterns if financial incentives are eliminated. However, ongoing consumer investment in cost-effective technologies and strategies and behavior changes rooted in an understanding of the value of energy efficiency decisions are essential elements of market transformation.

Absent a sustained effort, New York's energy consumers may not have the objective information and messages to guide energy decisions and behavior in ways that effect change. Ongoing education about savings associated with the application of advanced and renewable technologies and cost-effective strategies is necessary. Market information on energy consumption patterns among customer classes and regions (i.e., upstate vs. downstate), building types and ownership and financing models is necessary to guide strategic investment and to develop responsive and targeted behavioral and program strategies.

An educated and engaged service and supply sector focused on making existing buildings more efficient is especially important in New York where, in the downstate region alone, over 50% of the commercial buildings were built before 1945 and contain aging infrastructure and antiquated mechanical systems.⁹⁴ Similarly, over 70% of New York's existing housing units were built before the first oil embargo in 1973.⁹⁵

⁹³ See http://www.dps.ny.gov/Electric_Migration_dec_10_revised.pdf

⁹⁴ "The Five Ws of Downstate New York: Characterizing the Market for Energy Efficiency," Summit Blue Consulting, LLC, July 1, 2009.

⁹⁵ American Housing Survey, 2005.

Program Goals

The Market Development Initiative will complement EEPS and RPS initiatives by facilitating the development of a growing and consistent demand for efficient products, buildings, and renewable resources. By ensuring a responsive supply chain and service provider network, the Market Development Initiative will create the foundation for long-term market changes. Immediate goals for the Initiative are as follows:

- Identify future programmatic opportunities for transforming the market;
- Support the development of sustainable business models that incorporate clean energy technologies and practices;
- Promote the stocking, specification, installation, maintenance, financing, and use of energy efficient products and strategies across all sectors;
- Identify and address market and institutional barriers to the adoption of emerging and underused technologies and strategies;
- Identify, communicate, and address opportunities and gaps in the financing of energy efficiency and distributed energy resources (DER); Identify and communicate innovative approaches to resolving the split-incentive issue; and
- Establish community partnerships, energy workshops and curriculum to educate end users on opportunities available through adopting energy efficiency and renewable energy.

Long-term goals for the Market Development Initiative are:

- Increase market share of energy efficiency and renewable technologies;
- Reduce the hurdles presented by certain lease options and high first costs by enabling energy-aligned model leases and communicating the long term benefits of energy efficient technologies and servicing strategies;
- Support the knowledge transfer between the upstream and midstream market supply channels and service providers (or partners) such that mid-stream partners communicate and supply new technologies and strategies to end users;

Alignment with T&MD Objectives

The Market Development initiative will develop the infrastructure to quickly transition new and underused technologies into the market place through a variety of market intervention strategies. Efforts will be informed by market research. Businesses in the supply chain will expand their energy efficiency offerings. New markets will arise from the introduction of new technologies and strategies. End-user information and behavior strategies will help spur actions distinct from incentive programs to drive energy efficiency practices and new technologies.

- Expand market channels to include new service providers, such as competitive commodity providers, to offer integrated energy efficiency and demand response services;
- Establish paths to markets for underused and emerging technologies;
- Increase end users' awareness of the impact of their energy consumption choices, operations and behaviors and the value of adopting clean energy products and services; and
- Educate future end users about clean energy technologies.

Specific near-term and long-term performance milestones related to these goals and objectives are presented at the end of this section.

Program Design

Market Development is comprised of three components:

Market Research Component will identify market and institutional barriers to technology and product adoption that must be overcome to achieve broader program participation, obtain critical early stage information and insights to guide investment decisions, and further advance the reach of T&MD and EEPS programs and other public policy goals. The goal is to amass specific market intelligence and identify program opportunities that will increase program implementation efficiency and effectiveness.

To deepen market intelligence, efforts will use data from new sources, (such as New York City building performance benchmarking efforts), to provide information reflecting building characteristics, energy use, demand, cost, and end use energy consumption. This information may help identify new host sites and applications for energy efficiency and new energy technologies. For example, by applying data sets from this output, the Advanced Building program proposed in this T&MD portfolio could reveal new program opportunities through the use of proposed Infomatics. These new information resources may identify energy trends that will further define other Market Development activities, inform other T&MD partnership activities, and enhance stakeholder engagement and interactions among property owners/operators, ESCOs and Program Administrators.

Market research activities will include:

- Deep and focused research on specific sub-sector or customer populations (e.g., data centers) that need further definition in terms of current energy use, saturation, future trends, decision making and energy efficiency opportunities;
- Analysis of energy market issues and trends (e.g., load profiles/growth, economics, distributed energy resources) affecting energy behavior and decision making among customers, or that have significant cost impact or benefit opportunities;
- Assessment of the merits and potential energy benefits of new strategies that can deliver a broader selection of services to consumers (i.e., analyzing the added value associated with whole building approaches or determining the incremental cost of high efficiency buildings); and

- Analysis of technology development and commercialization processes, progress, potential and barriers in order to optimize the transition of early stage and underused technologies to market readiness. Where appropriate, focus will be on targeted market segments.

Market Pathways address the primary factors that affect operations, business models, and behavior of customers and the supply chain that serves them; identifies new market opportunities and channels to deliver energy efficiency and renewable energy products and services; identifies opportunities and gaps in the financial markets; and illustrates the effectiveness of integrating non-first cost strategies with operations and capital decisions. The Market Pathways component will work across the supply chain and all sectors to promote the stocking, specification, sales, installation, maintenance, and use of energy efficient products and strategies. New market channels, such as working with competitive commodity providers to provide integrated demand response, energy efficiency and DER services, will be explored. NYSERDA will provide tools, business strategies, and business and marketing materials to manufacturers, suppliers, distributors, retailers, service providers, designers, specifiers, contractors, and builders. Market Pathways will include the following:

- The **Energy Smart Products Program** will assist businesses that supply emerging, underused, or high efficiency products with high first cost. The Program will build on the existing platform of over 1,300 retailers and 43 manufacturers to increase the availability and awareness of energy efficient products and appliances. In addition to working with ENERGY STAR[®], Design Lights Consortium (DLC), the Consortium for Energy Efficiency, and other collaborating organizations, NYSERDA will expand its efforts with manufacturers, distributors and retailers to ensure quality products are stocked and available. Solid state lighting and lighting design, emerging technologies that will prepare businesses and residents for Smart Grid options, informational displays, energy management devices, and super-efficient HVAC, appliances, and electronics will be addressed. For example the Products Program worked with over 12 manufacturers over the past few years and established new supplies of advanced power strips at over 20 retailers statewide representing approximately 390 participating partner storefronts. In addition, due to the program influence, two large hardware chains now promote advanced power strips to all of its franchisees. Particular effort will be made to ensure that products emerging from R&D projects or demonstrated through the Advanced Buildings Initiative are established in the supply chain.
- **Midstream Partner Support** will help NYSERDA's service providers in the midmarket supply chain, including, but not limited to, designers, energy consultants, specifiers, distributors, manufacturer representatives, contractors, and installers to address the primary factors affecting customers' operations, business models, and energy decisions. The program will help these service providers understand energy decision making processes, barriers, attitudes, and opportunities. Business models that support customers' embracing of energy efficiency strategies, such as load management, network-enabled energy information systems, proper sizing, quality lighting and HVAC installations, and whole building approaches will be introduced for adoption by midmarket partners. Based on feedback, NYSERDA recently began a series of business development and

marketing training for home performance contractors. The training provides valuable information to contractors to help them market their services, differentiate themselves and their credentials from other contractors, and grow their business while maintaining the high quality of their work. Similarly NYSERDA has successfully engaged lighting contractors, designers, and distributors to adopt a business model that addresses not just the energy efficiency of a lighting project, but the quality of the lighting as well. This business model has enabled the lighting industry in New York to respond successfully to more stringent codes and standards and has encouraged incorporation of new technologies (i.e., LEDs and controls) and strategies (i.e., life cycle cost tools) into core business practices, thus expanding business opportunities.

This component, serving as a pathway for the introduction of new technologies and tools into midmarket partner and service providers business practices, may include modeling software, life cycle cost models, technology primers, webinars, fact sheets, and design guidelines. Additional strategic and financial support for co-op advertising, contractor equipment and software incentives, and contractor accreditation incentives will be provided.

- ***Innovative Strategies*** will test and prove new, innovative approaches to conveying the energy efficiency message to building owners, operators and the financial sector. Past Market Development efforts successfully introduced benchmarking tools and strategies to the market. The commercial real estate market embraced benchmarking in recognition of the opportunities it provides real estate owners and managers to measure overall buildings performance and to more easily identify poorly performing buildings. The benefits of benchmarking set the stage for New York City to adopt legislation requiring benchmarking for commercial buildings.
- Going forward, NYSERDA will introduce other innovative strategies and tools with specific emphasis on overcoming split incentives and by providing innovative financing as a means to overcome first cost barriers. For example, commercial and multifamily building owners and operators will be provided with tools to evaluate and secure financing as well as to adopt energy aligned leases (using model leases such as those recently introduced in the New York City market) to encourage changes in how owners, operators and tenants address energy costs and energy management. Adoption of such leases will encourage operations and capital investments that are cost-effective for all parties, the potentially greater market value proposition of energy efficient buildings will be conveyed to the financial sector. The data from innovative financing initiatives and New York City's benchmarking efforts and other data will document the value of energy efficiency improvements and be shared with service providers, lenders, real estate professionals, underwriters, and assessors through case studies and webinars. Innovative financing models will be investigated, catalogued, piloted and communicated to end users through demonstrations, case studies, web portals and other means. Financing partnerships with the public and private sector, will be developed, including sector oriented initiatives (e.g. small business, healthcare, commercial real estate, colleges/universities).

The ***Education to Change Behavior and Influence Choices Component*** will address the long-term and permanent changes in energy consumption patterns possible from a deeper understanding of energy choices and changes in attitude and behavior. End users will be made aware of the value, implications and benefits of their decisions and behaviors, and be empowered to make better choices based on this awareness. Increased demand for efficient products, buildings and renewable resources will ensure a responsive supply chain that is complemented by decreased energy consumption and more effective use of energy resources. These efforts will be implemented through competitive solicitations.

- The ***Energy Smart Communities Program*** will use Community Resource Experts to provide on-the ground outreach and support in targeted areas to promote the value of energy efficiency, sustainable growth practices, and clean energy technologies, practices and innovations using carefully constructed public-private partnerships. Behavioral change approaches will support further penetration of markets with newly proven products and practices. The program will align resources across existing programs including Focus Programs, Climate Smart Communities; Cleaner Greener Communities; Green Jobs – Green NY, and BeamNY.org Outreach.
- ***Behavioral Pilots*** will support further penetration of new products and practices through behavior change strategies. Informational platforms such as web portals, social media, and targeted communications that identify low- and no-cost energy options will be demonstrated. Tactics to influence decision making by targeted consumer groups will be explored and tested in order to demonstrate how large scale adoption of energy efficient behavior can be achieved with little or no financial incentives.
- NYSERDA will provide continued support to the ***Low- Income Forum on Energy (LIFE)***, the longest running statewide low-income energy policy dialogue in the nation. LIFE will conduct a number of Statewide Conferences and Regional meetings and provide information on low-income energy issues and programs through the website, newsletter, webinars, and case studies.

Expected Benefits

This section describes the expected benefits associated with the Market Development initiative, in relation to the seven priorities articulated in Section 5.2. The following describes qualitative and "big picture" benefits, providing an important contextual framing for the initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-10.

Electric and Gas System-wide Benefits: Market Development programs are needed to maximize the potential of reducing the State's demand for energy and overall energy use across all sectors. These programs will facilitate end user investment in new and emerging technologies that will benefit the utility system and ratepayers. An informed and engaged market infrastructure will help avoid poorly designed, installed and operated systems, which studies have shown can reduce anticipated savings by 15-25%. Without the market infrastructure to spur decisions and encourage new technologies and practices, EEPs and RPS achievements and costs, as well as sustained markets, may be at risk.

Economic Development Benefits: Market Development activities will strengthen the market for energy efficient products and systems that can create and expand businesses in the State. Programs will encourage knowledge transfer between upstream product manufacturers, midstream market partners and end users. Increased end user demand will signal the upstream product developers and manufacturers to introduce new products and systems. Providing clean energy training resources will also support economic development activities that can attract new employers to the state as well as retain and engage New York State's unemployed workers.

Environmental Benefits: NYSERDA's Market Development Initiative supports a portfolio of clean energy programs designed to reduce energy demand and increase renewable energy generation. Less generation from fossil fuel-fired units results in reduced impact on climate change through lower emissions of air pollutants including nitrous oxides, sulfur dioxide, and greenhouse gases.

Consumer Cost Savings: Market Development programs will help reduce end user energy costs by encouraging residential, commercial and industrial customers to adopt energy conservation practices and by introducing energy efficient technologies and systems in new and existing buildings. New market channels that can provide integrated strategies to deliver demand response and energy efficiency projects will reduce energy costs and potentially provide a new revenue stream for customers. Strategies that stimulate demand and increase the availability of energy efficient technologies and systems, including education for sales staff, cooperative promotional activities, stocking or market share incentives, and point-of-sale training, will help reduce first costs and significantly increase market share of these products. For example, in 1999, NYSERDA implemented the *Keep Cool* Program that evolved into several other initiatives, ending with *Stay Cool* in 2008 to create consumer demand for ENERGY STAR room air conditioners. NYSERDA worked with retail partners through market share incentives, buy-downs and rebates over the nine year period while educating consumers about the cost savings associated with ENERGY STAR air conditioners. Market share for ENERGY STAR room air conditioners increased from just over 20% in 2000 to just under 80% in 2010, two years after the program ended. Additional opportunities for increasing market share and consumer cost savings still exist in areas such as LEDs, lighting fixtures, and higher efficiency appliances.

Opportunities Unique to New York: New York, through its long standing Market Development efforts, is a national leader in working with the supply chain to move energy efficient products and services into the marketplace. The thousands of partnerships that have been forged through NYSERDA's programs place New York State in a unique position to expand the number of partnership opportunities. Such partnerships can ensure that New York's aging building stock is updated by knowledgeable entities, trained on the latest clean energy technologies. New York City's Benchmarking Law provides NYSERDA a unique opportunity to leverage benchmarking efforts to affect efficiency improvements in the city's buildings.

In New York City and Westchester County alone, nearly half of the households lease housing in buildings with 20 or more units, and it is estimated that more than two-thirds of commercial tenants lease their space.⁹⁶ Working with New York City stakeholders, NYSERDA can replicate an

⁹⁶ "The Five Ws of Downstate New York: Characterizing the Market for Energy Efficiency," Summit Blue Consulting, LLC, July 1, 2009

energy-aligned lease into a model that addresses the split incentive issue in commercial real estate and multifamily buildings statewide.

Leveraging Resources or Filling Gaps: EEPS and RPS programs focus primarily on devices and projects. Market Development activities, only funded through T&MD, support EEPS, RPS, and other T&MD programs by addressing the supply and demand for underused and newly emergent clean energy options and strategies. The proposed programs will leverage the resources of business partners, manufacturers, suppliers and community partners as well as other state (GJGNY, RGGI, NYS DOL, HRC) and federal (DOE, EPA) resources to overcome hurdles and build market capacity and sustained markets. The Market Development Initiative will help bridge the gap between demand for energy efficiency project implementation and end user access to financing. Programs will encourage the financial sector to support modification of underwriting standards and assessment practices to consider the value of energy efficiency improvements.

Scale of Potential Benefits Relative to Program Costs: Between the utilities and NYSERDA, the EEPS program budget is over \$300 million per year primarily focused on incentives to reduce up-front costs for energy efficiency projects. The Market Development Initiative has an average annual budget of \$14.07 million, that will bolster the market's ability to respond to new technologies and strategies and deliver the services to achieve EEPS goals, is a relatively small investment in comparison. A mix of interventions across the entire supply chain in conjunction with end-user incentives through EEPS will be more cost effective than providing consumer incentives alone, and will lead to a more sustainable market for energy efficiency strategies and products.

Program Experience

NYSERDA is a pioneer in developing and implementing Market Development programs. Many other programs across the U.S. have replicated the Home Performance with ENERGY STAR, New York Energy SmartSM product initiatives, and the Commercial Lighting Business Partners programs. NYSERDA has been recognized by The American Council for an Energy-Efficient Economy (ACEEE) for its contributions to the field of energy efficiency, renewable resources and our efforts to reduce energy use while protecting the environment. Programs developed to promote sustainable energy were found to be exemplary by ACEEE, having both a significant impact on the energy market. Further, for the past several years, NYSERDA's programs have been recognized by the US Environmental Protection Agency (EPA) as a model for reducing greenhouse gas emissions by setting and achieving aggressive goals, employing innovative approaches, and showing others what can be achieved through energy efficiency. US EPA recognizes NYSERDA sustained efforts in the ENERGY STAR program including energy-efficient products, services, new homes and buildings in the commercial, industrial and public sectors.

The infrastructure exists to engage and enable the many links in the supply chain, and NYSERDA has signed approximately 1,350 retail storefronts and 43 manufacturers as partners to promote energy efficient lighting, power management, appliances and electronics. In the commercial/industrial sector, over 1,600 Lighting Business Partners have been trained, hundreds of Motor Business Partners have performed motors inventories, and HVAC Business Partners are embracing new quality maintenance strategies. End user demand for and market share of energy efficient products and services continues to grow.

A March 2010 draft market characterization assessment for the Energy Smart Products Program highlighted increased end user awareness and understanding of the ENERGY STAR label, but it also noted that the higher cost of ENERGY STAR products remains a barrier. This finding underscores the need to better educate end users about the long-term savings available through energy saving technologies. End user education efforts undertaken to date have been successful, including hundreds of clean energy workshops for K-12 teachers and events and presentations in communities statewide.

Funding and Performance Milestones

In the first two years of the program, Market Research activities will be a priority. Market Research will be needed to quickly assess barriers, opportunities and future program directions. . The near-term focus of Market Pathways will be to develop new partnerships, facilitate new business and financial models, and to introduce new products and strategies for suppliers and end-users.

Table 9-11 Market Development Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Market Research	.928	2,343,678	1,802,765	493,697	4,640,140
Market Pathways	11.1	22,284,000	22,284,000	11,142,000	55,710,000
Education/Behavior	2.0	4,212,750	3,671,837	2,145,553	10,030,140
Total: Market Development	\$14.07	\$28,840,428	\$27,758,602	\$13,781,250	\$70,380,280

Table 9-12 Market Development Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/Leading Indicators					
Market Pathways	Enlist 1,240 Energy Smart Products partners participants	940 ⁹⁷	200	100	
	Enlist 510 Midstream Partner participants	430 ⁹⁸	55	25	
	Train 500 Product Partner employees on sales of high efficiency equipment	200	200	100	
	Train 1,025 Midstream Partner business owners or their staff ⁹⁹ on advanced strategies and technologies	375	375	275	
	Investigate, catalog and communicate innovative energy efficiency investment strategies through 6-9 fact sheets and 10 seminars	3-4 fact sheets; 4 seminars & webinars	2-3 fact sheets; 4 seminars & webinars	1-2 fact sheets; 2 seminars & webinars	
	Facilitate 30-45 customers accessing innovative energy efficiency investment strategies	20-25 projects	5-10 projects	5-10 projects	
	Energy-aligned leasing (EAL) arrangements (10-15) and other approaches to split incentive issue	4-6 EAL evaluations; 4 seminars & webinars	4-6 EAL evaluations; 4 seminars & webinars	2-3 EAL evaluations; 2 seminars & webinars	
	Provide supply chain with tools, strategies, marketing materials, and information to incorporate into their businesses operations (9-12 factsheets; 9-12 seminars)	4-5 fact sheets; 4-5 seminars & webinars	4-5 fact sheets; 4-5 seminars & webinars	1-2 fact sheets; 1-2 seminars & webinars	
Education/Behavior Change	Sponsor and support 5 annual LIFE conferences	2	2	1	
	Support 600 community partnerships	250	250	75	
	Sponsor up to 8-12 behavioral pilots	5-8	3-4		
Market Research	Conduct 4-6 research studies	2-3	1-2	1	

⁹⁷Includes approximately 840 of NYSERDA’s current program partners expected to renew their participation agreements and 400 new partners signed up by the end of the program.

⁹⁸Includes approximately 400 current program partners expected to renew their participation agreements and 110 new partners signed up by the end of the program.

⁹⁹Midstream Partner business owners and their staff may participate in more than one training.

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out- Years (2017- 2020)
Outcomes/Impacts *					
Market Pathways	125 GWH saved through supporting emerging technologies and higher efficiency products with Energy Smart Partners ¹⁰⁰	50 GWH	50 GWH	25 GWH	
	895,000 MMBtu saved through supporting emerging technologies and higher efficiency products with Energy Smart Partners	254,000 MMBtu	419,000 MMBtu	222,000 MMBtu	
	Increase market share of 3-6 technologies and higher efficiency products	1-3	1-3	1	
	Midstream Partner participants change business models/practices to encourage load management, network-enabled energy information systems, proper sizing, quality HVAC and lighting and systems based/whole building approaches				
	37 GWH saved through Midstream Partner projects ¹⁰¹	15 GWh	15 GWh	7 GWh	
	Complete 20–35 customer projects that accessed innovative energy efficiency investment strategies	5-8 projects	10-15 projects	3-7 projects	2-5 projects
	Support policy development and decisions with studies, assessments and data				
Education/ Behavior Change	Complete and evaluate 8-12 behavioral pilots		3-4	4-6	1-2
	Integrate successful pilots into program design at a wider scale				
Market Research	Provide trend and sector data to support future program and policy decisions, and system planning				

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

¹⁰⁰Some savings may overlap with end user incentive programs.

¹⁰¹ Estimated savings after net-to-gross adjustment. Past program experience suggests that approximately 60% or 24 GWH of savings will be reported in end user incentive programs.

9.3.2 Clean Energy Business Development

Targeted Problem

The Clean Energy Business Development Initiative, designed to bring new cost-effective and economically sustainable clean energy technologies to the consumer, requires the transformation of knowledge and technology into innovative viable business practices. Stimulating innovative activities that deliver solutions to the State's energy needs will bring economic growth through the increased productivity of firms and new choices for consumers. Innovation-driven economies push the boundaries of the technological frontier and successfully exploit commercial opportunities in new markets.¹⁰² The ability of state economies to form new, innovative companies is critical to its economic vitality.¹⁰³

Current State of Technology or Knowledge

In the global clean technology sector, of the top 100 most promising companies around the world in 2010, only eleven were founded prior to 2000 and the mean founding year was 2002.¹⁰⁴ Entrepreneurial business startups, firms less than five years old, were the source of much of the net job generation in the U.S. Without startups, overall net job change might have been negative in most of the years since 1980.¹⁰⁵ As a driving force behind innovation and economic growth, early-stage companies face a significant challenge in raising the necessary capital to transform innovation into a viable business.

There are two investment "valleys of death" for clean energy technologies. The first comes at the stage when the potential commercial applicability of the technology is not clear; the second comes when the technology needs capital investment to reach commercial scale.¹⁰⁶ While global investment in clean technology continues to grow, it is becoming increasingly common for companies starting in the U.S. to subsequently move overseas, or simply start and remain overseas.¹⁰⁷

Why This is Important for New York and New York Ratepayers

New York has significant research and development activity, complemented by actively-engaged players in government, academia and industry, in areas associated with clean technology. These resources help position New York for the creation of significant economic impact through an impressive portfolio of clean technology assets and policies.¹⁰⁸

¹⁰² New York City Economic Development Corporation, NYCEDC Innovation Index, 2011

¹⁰³ Atkinson, Robert D. and Scott Andes; 2010 State New Economy Index; Information Technology & Innovation Foundation; <http://www.itif.org/files/2010-state-new-economy-index.pdf>

¹⁰⁴ Cleantech Group LLC; 2010 Global Cleantech 100: A Barometer of the Changing Face of Global Cleantech Innovation; September 2010; <http://cleantech.com/research/upload/2010-Global-Cleantech-100-Report.pdf>

¹⁰⁵ Stangler, Dane and Robert E. Litan; 2009; Where will all the jobs come from?; Ewing Marion Kauffman Foundation; November, 2009.

¹⁰⁶ Zindler, Ethan. Testimony to the US Senate Energy and Natural Resources Committee. Bloomberg New Energy Finance, March 17, 2011.

¹⁰⁷ Coleman, Will. Testimony to the US Senate Energy and Natural Resources Committee. Mohr Davidow Ventures, March 17, 2011.

¹⁰⁸ New York Academy of Sciences. Innovation and Clean Technology in New York State. May 18, 2009.

While New York is a national leader in research and development, it lags in the translation of that research into viable business enterprises.¹⁰⁹ New York companies are also lacking in the ability to attract the venture-backed funding necessary to address the first valley of death. From 2007 to 2009, Massachusetts' clean-energy companies lured \$1.1 billion in venture capital and private investment deals, well ahead of third-place New York's \$855 million.¹¹⁰ In 2010, Silicon Valley was the top region for venture capital, attracting 40% of all U.S. investment and 30% of venture deals. The metropolitan New York region was a distant third, following New England, with 8% of the U.S. investment. The upstate New York region was near the bottom of the ranking, with only 0.05% of U.S. venture funding.¹¹¹

The energy challenges in New York's complex market, ranging from New York City to the rural Adirondacks, provide business opportunities to innovators and entrepreneurs. As has been the experience of the SBC--funded regional clean energy business incubators, linking new product research with the implementation of creative business models increases the likelihood that investments made in product research and development will result in the delivery of customer-focused products and services. Innovative and entrepreneurial individuals will start businesses in the incubators to meet the market needs in their respective regions. This includes, for example, plug-load management hardware and software in New York City and data center energy efficiency technology in Rochester.

For New York to realize the opportunities and benefits from innovation in the clean energy market there will need to be increased emphasis on the: creation of a more entrepreneurial environment; increase of early stage capital for technology startups; encouragement of networking and connection among innovation actors; and promotion of an innovation-friendly legal and regulatory environment.¹¹²

Program Goals

The goal of the Clean Energy Business Development Initiative is to catalyze innovation and foster an entrepreneurial climate for business creation and growth of early-stage companies that bring *new-and-improved* clean energy technologies to market to meet the needs of New York ratepayers.

The initiative will complement NYSERDA's R&D and product development efforts to accomplish the following:

- Develop, attract, and support clean energy entrepreneurs, managers, and technologists who seek to commercialize new clean energy technologies benefiting New York consumers and ratepayers;
- Develop and attract private risk capital to commercialize new clean energy technologies for New York markets; and

¹⁰⁹ Task Force on Diversifying the New York State Economy through Industry-Higher Education Partnerships, Final Report, December 2009

¹¹⁰ Clean Edge. A Future of Innovation and Growth: Advancing Massachusetts' Clean-Energy Leadership. April 2010

¹¹¹ Price Water House Coopers. MoneyTree Report Q4 2010/Full-year 2010. 2011

¹¹² New York Academy of Sciences, Implementing Key Recommendations to Foster Innovation in New York State, June 2010

- Connect necessary stakeholders to build teams that identify and pursue opportunities to commercialize new clean energy technologies benefiting New York consumers and ratepayers.

Within the T&MD five-year planning horizon, the Clean Energy Business Development program will improve the environment for technology entrepreneurs in New York and translate innovative ideas into investment worthy and commercially-viable clean energy business enterprises. This will require capitalizing on New York State’s inherent strengths, attracting the attention of the investment and venture communities to the state’s entrepreneurs, and providing focused business mentoring to companies with creative solutions to New York’s energy needs.

Initiative priorities and overall program design will evolve with significant input by the private research and investment communities. By the conclusion of the five-year T&MD funding cycle, the following results are anticipated:

- New regional programs linking research activities at New York institutions with the investment community;
- New programs that develop and rapidly transfer highly innovative technologies to the marketplace;
- An expanded knowledge base and business focus necessary to address New York’s energy challenges;
- Regional clean energy technology clusters of public-private partnerships among government, industry, and academia;
- Increased involvement of the private investment sector in supporting early-stage New York-based clean energy technology companies; and
- Increased entrepreneurial attention on opportunities in clean energy technologies.

Alignment with T&MD Objectives

The Clean Energy Business Development initiative will *stimulate technology and business innovation* and provide more clean energy options and lower cost solutions while growing New York’s clean energy economy. The initiative will also build the long-lasting capacity for clean energy innovation and entrepreneurship in New York and *spur action and investments* that provide ratepayer benefits without the need for long-term public investment.

Consistent with the State Energy Plan recommendation for building a clean energy economy, the program will set the stage for the development of a long-lasting entrepreneurial environment dedicated to clean energy technology through the establishment of initiatives that will continue to operate after T&MD funding support has expired. This includes, for example, the six clean energy business incubators and the planned proof-of-concept centers.

Specific near-term and long-term performance milestones related to these goals are presented at the end of this section.

Program Design

The integrated approach to building entrepreneurship and innovation capacity in the clean energy market is comprised of the following programs. Funding will be allocated through competitive solicitations and involve evaluation panels comprised of technologists and experienced entrepreneurs. Performance-based payment structures will be implemented throughout the program.

Innovation/Entrepreneurial Capacity Building

Representing the majority of the Initiative's funding, this program will provide an environment supporting rapid innovation in clean energy technologies and growth of entrepreneurial companies bringing these technologies to market. The activities will stimulate and support the establishment of institutions and other infrastructure to meet the ongoing needs of clean energy innovators. The existing Clean Energy Business Incubator program,¹¹³ funded under the current T&MD, is an example of activities to be included. In addition to supporting the incubators, the following new activities will be added to the portfolio:

Proof-of-Concept Centers. Through a facilitated linkage between the university researcher and investor, centers will be established to accelerate the commercialization and move-to-market of university innovations in clean energy technologies. Five principal focus areas have been identified as most important to improve the university-investor interface: understanding investor motivations, supporting entrepreneurs, streamlining bureaucracy, improving access and visibility, and fostering a culture of innovation on campus.¹¹⁴ This will be accomplished through supporting relationships between the university technology transfer office, university researchers and the private sector to identify and validate concepts in the early stages of development.

Centers will provide nominal funding to university researchers to complete the validation steps identified by the potential investor. Success will be measured by the long-term development and commercialization of clean energy technologies resulting from the linkages made between the university innovation ecosystem and New York's entrepreneurial community.

Identifying and selecting Proof-of-Concept Centers will involve one or more competitive solicitations. Proposals must demonstrate a feasible strategy to focus and expand existing core competencies in clean energy technology and leverage the private capital required to develop and commercialize the technologies; the Center's potential to amass a research budget that can create a critical mass of projects; access to a community of industry, entrepreneurs, and investors that can be engaged and mobilized; and a commitment to enhance the Center's innovation ecosystem and share lessons learned with other Centers.¹¹⁵

¹¹³ NYSERDA Clean Energy Business Incubators are located at NYU/Poly, SUNY-CNSE, Syracuse TechGarden, RIT, SUNY Stony Brook and SUNY Buffalo.

¹¹⁴ Holly, Krisztina, Venture Capital–University Interface: Best Practices to Make Maximum Impact (June 22, 2009). *Tomorrow's Technology Transfer*, Vol. 1, No. 2, Summer 2009. Available at <http://ssrn.com/abstract=1479827>

¹¹⁵ Holly, Krisztina. The Full Potential of University Research: A Model for Cultivating New Technologies and Innovation Ecosystems. *Science Progress*. June 2010. Available at: http://www.scienceprogress.org/wp-content/uploads/2010/06/holly_innovation.pdf

Emerging Clean Energy Business Investment. This activity will increase access to capital for clean energy technology companies with particular emphasis on early-stage and pre-revenue companies with high-growth potential. Because this stage of funding is difficult to receive from private investors, the program will be designed to stimulate private investment through initiatives facilitating the relationship between the investment community and New York companies and by direct NYSERDA investment. NYSERDA may implement the program by mirroring the process used by private and public seed or venture funding organizations and reliant on transparent decision criteria and evaluation/recommendation by a qualified investment panel. Only businesses offering the potential to deliver a new-and-improved product/service for the New York market will be supported.

Clean Energy Cluster Development. To accelerate the development of new products and services and create new business models, this activity will convene multi-disciplinary market participants to promote new networks of interrelated clean energy firms. These clusters, building upon unique regional assets, can drive productivity and innovation and serve as an important driver of regional competitiveness. NYSERDA will collaborate with the Regional Economic Development Regional Councils to identify and target clusters that optimize the local capability of the region. The program will follow a three step strategy¹¹⁶: a market analysis to identify the natural presence of clusters; nominal financial support to support cluster initiatives across various regions and industries; and activities to link, leverage, and align existing programs and initiatives to support clusters.¹¹⁷ The first area of focus will be on energy informatics with a geographic emphasis on New York City.

Market Intelligence

Because innovation responds to market signals, this program will include activities to track and analyze business and financial information in the New York clean energy technology area. The intent is to increase the awareness of investment activity in New York, to benchmark New York relative to other states and similar initiatives, and to provide feedback to the program. The program will coordinate with organizations that have similar data interests to avoid duplication of efforts and work with business development stakeholders to regularly assess the type of data and analysis of greatest value. Another component to be implemented by competitively selected contractors will focus on the identification of market gaps and opportunities that could be effectively exploited by early-stage New York businesses. This will permit periodic collection and distribution of innovation performance metrics critical to understanding best practices and to influencing the behavior of the research and business community.

A Clean Energy Innovation and Entrepreneurial Network will be developed to link the geographically-dispersed clean energy entrepreneurs and established companies, universities, and other innovation stakeholders and to enable collaborations and partnerships throughout the state.

¹¹⁶ Muro, Mark and Kenan Fikro. Job Creation on a Budget: How Regional Industry Clusters Can Add Jobs, Bolster Entrepreneurship, and Spark Innovation. Brookings-Rockefeller Project on State and Metropolitan Innovation, January 2011

¹¹⁷ Porter, Michael E. 2007(rev. 2009). Clusters and Economic Policy: Aligning Public Policy and the New Economics of Competition. Harvard Business School. ISC White Paper. November 2007. Revised October 27, 2009.

Direct Support for Business Acceleration

With previous SBC funding, NYSERDA implemented a series of initiatives providing targeted business support to companies selected through competitive solicitations or using the services of experienced entrepreneurs or business consultants. This aspect of the Clean Energy Business Development Initiative will address any business development gaps in NYSERDA's technology and market development. Examples include competitive programs providing support to early-stage companies in attracting first sales and independent technology validation and addressing the needs for business management and entrepreneurial expertise.

Expected Benefits

This section describes the expected benefits associated with the Clean Energy Business Development initiative, in relation to the seven priorities articulated in Section 5.2. The following describes qualitative and "big picture" benefits, providing an important contextual framing for the initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-12.

System-wide Energy Benefits: The Initiative provides support and expertise to companies developing products that will provide direct benefits to New York ratepayers. For example, within the existing incubator program, more than 70 early-stage client companies are working on new and improved energy efficiency and clean power generation technologies. This benefit would likely be realized over the long-term.

Economic Development Benefits: The primary near-term benefit will be in the area of Economic Development:

- Creation of a risk-capital climate that increases the availability of early-stage investment for clean-energy technology start-up companies.
- Establishment of sustainable, long-lasting actions to translate university research into a pipeline of clean energy technology company deal flow.¹¹⁸
- Formation of a network of business mentoring incubators and initiatives that increase the probability that innovative clean energy technologies will achieve commercial success and serve the needs of the New York market.
- Facilitation of research and business clusters around areas of energy technology permitting New York's resources to be combined to improve the rate of innovation, technology commercialization, and deployment.

Environmental Benefits: The focus on clean energy generation and energy efficiency technology will encourage the development and commercialization of technology with better performance and lower cost. Environmental benefits will be realized as the marketplace adopts these improved technologies.

¹¹⁸ Throughout the T&MD program, each of the 3 – 4 New York Proof-of-Concept Centers is expected to be able to show significant progress toward the goals of: increased enthusiasm and engagement of the research community in the innovation and entrepreneurship process involving clean energy technology, annual movement of 5 clean energy technologies into commercial start up and the establishment of a local community that supports the innovation ecosystem around the Center.

Consumer Cost Savings: To achieve success, companies must market products and services to New York customers. While near-term market opportunities benefit from incentivization, the long-term viability of a clean energy business will be based on products providing value to the customer without subsidy. Fundamental program objectives are to provide early-stage companies with the knowledge and expertise to evaluate New York market needs, to determine the demand for the product/service, and to develop strategies to articulate the value of the product/service relative to its cost.

Opportunities Unique to New York: A major focus of this initiative is to use the State's innovation capacity to build and nurture companies that will translate New York-based research in clean energy technologies into commercially viable products. Support of entrepreneurial activities on a regional basis will encourage early-stage companies to focus on market opportunities available within their regions.

Leveraging Resources or Filling Gaps: Economic development activities of the Empire State Development Corporation and many other agencies have traditionally focused on linking out-of-state companies with available operational facilities and providing various tax and financial incentives to encourage relocation to New York. Limited attention has been given to early-stage business formation and growth and the programs are inherently technology agnostic. Rather than supplanting other economic development programs, T&MD funds will focus on the growth of businesses that can deliver products and services benefiting the ratepayer. To increase investment in New York companies, the program will initiate activities to attract and partner with the private capital market. Private sector investment in early-stage, clean energy companies is expected to be on the order of 10:1 the NYSERDA investment.

Maximum Benefits for Level/Scale of Investment: T&MD funding will have long-term benefits extending beyond the funding cycle, in particular from the Proof-of-Concept Centers and the existing incubator programs, where ongoing mentoring and support for early-stage companies and continued emergence of innovative clean energy technologies are anticipated. As quantified below, almost as many clean energy businesses are expected to be established in the four years following the T&MD cycle.

Program Experience

In 2011, the Clean Energy Business Development Initiative was initiated, building upon the success and experience of earlier NYSERDA business innovation efforts. The largest component involved six clean energy business incubators that offer startup, clean energy technology companies structured programs that help refine business strategies and successfully attract private funding. These programs provided technical assistance, mentorship and entrepreneurial development, opportunity assessment, business planning, marketing and business development support, legal and financial planning support, networking, and introductions to investors and strategic partners. In the 18-month period following program initiation this effort achieved the following milestones:

- 72 client companies supported by incubators;
- Assisted client companies in raising \$16,465,000 in private capital;
- Created 217 jobs at client companies within the incubators;

- Developed and further refined 26 new products to serve the clean energy market; and
- Assisted client companies in attracting \$11,028,000 in federal funding.

One effort that will continue through the T&MD cycle is an executive/entrepreneurial transition program to bring business leadership to early-stage clean energy technology companies. The program model will be based on experience gained through the Cleantech Executives program, where graduate executives have started six, new clean energy companies.

Additional experience is available through the existing Clean Energy Entrepreneurs-in-Residence (EIR) program (at High Tech Rochester) that provides mentoring services to early-stage firms that are typically operated by engineers or scientists. As of the end of 2010, 40 mentors in the program committed 300 service days to early-stage clean energy companies selected from within NYSERDA’s portfolio of active projects. The EIRs, previously C-level executives in at least one startup company, work with startup businesses on a limited basis to develop strategies for market plan development, methods to approach investment opportunities and other management functions. Fifteen companies are currently receiving services under this program.

Funding and Performance Milestones

In developing the funding allocation, the scale and duration of funding necessary to establish programs that would be viable past the conclusion of T&MD funding were considered. For example, in the case of the Proof-of-Concept Centers, outcome-based funding is expected to be provided for at least three years. The budget to provide direct support to businesses is expected to cover a transitional period during the implementation of a stage-gate process in other R&D product development activities. Under the stage-gate process, business development activities are supported concurrently with product development.

Table 9-13 Clean Energy Business Development Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Innovation Entrepreneurial Capacity	6.31	14,003,096	11,621,700	5,936,250	31,561,046
Market Intelligence	1.16	2,000,000	2,500,000	1,300,000	5,800,000
Direct Support for Business	0.88	1,640,000	1,840,000	920,000	4,400,000
Total: Clean Energy Business Development	\$8.35	\$17,643,096	\$15,961,700	\$8,156,250	\$41,761,046

Table 9-14 Clean Energy Business Development Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017 - 2020)
Outputs/Leading Indicators					
Innovation/Entrepreneurial Capacity	Support 405 clients in incubators or Proof-of- Concept Centers ¹¹⁹	65	90	50	200
Market Intelligence	Create 5 annual “benchmark reports” on clean energy business and financial indicators for New York State	2	2	1	
	Support dissemination of clean energy benchmark information through 500 website downloads	100	200	200	
Direct Support for Business Acceleration	Provide support for 150 companies with new and improved products serving New York markets	59	59	32	

¹¹⁹ Because Proof-of-Concept Centers are a new NYSERDA initiative, estimating program outcomes requires the use of surrogates. One leading example is the Deshpande Center at MIT. Since beginning operation in September 2002, through the end of 2010 The Center reviewed over 500 proposals and funded 80 projects with \$11 million in grants. This investment has resulted in the creation of 23 companies that raised over \$300 million in funding and have over 400 employees. The Center funds approximately 18 projects per year. Translating these outcomes to New York’s new Proof-of-Concept Centers must take into account the limited technology/market focus of the New York program and the time required to establish a program and build momentum.

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017 - 2020)
Outcomes/Impacts *					
Innovation/ Entrepreneurial Capacity	Help clean energy businesses attract \$150 million in leveraged funds (co-funding and outside investment)	\$40M	\$45M	\$25M	\$40M
	Graduate 162 businesses from incubators	36	36	18	72
	40 advanced technologies reaching commercial availability	5	10	10	15
	\$20 million in commercial sales of new and improved supported technologies ¹²⁰	\$2.5M	\$5.0M	\$5.0M	\$7.5M
	486 Incremental FTEs associated with incubator graduates	108	108	54	216
Market Intelligence	Clean energy investors use benchmark information to support decision making related to New York operations				
Direct Support for Business Acceleration	Supported businesses or technologies are transitioned/integrated into product development efforts				
	Transition 45 business executives to the clean energy technology industry.		18	18	9

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

¹²⁰ This is an estimate only for sales dollars. The program will support a variety of technologies making it difficult to forecast the value of sales. In addition, some of the products developed through incubators may participate in other NYSERDA product development efforts.

9.3.3 Workforce Development¹²¹

Targeted Problem

New York's ambitious energy and environmental goals will only be met with an adequate supply of workers with the appropriate skills who are able to meet the market demands of the energy efficiency, renewable energy and advanced technology sectors. In the past decade alone, technological advancements in these fields have grown significantly leading to the creation of entirely new job descriptions. Workers need to continually upgrade skills to keep pace with technology and to obtain and retain valuable certifications. Products and services are entering the market at a rapid pace to meet the ever-changing consumer demand in today's society. Unfamiliarity with new technologies and strategies and the lack of an adequate supply of trained workers capable of designing, installing, maintaining, and servicing new technologies are often impediments that affect the market acceptance of energy efficiency, renewable energy and advanced technology products and services.

As discussed in the Market Development Initiative (Section 9.3.1), the market supply chain plays a critical role in ensuring that high quality energy efficiency, renewable energy, and advanced technology products and services reach energy consumers in a routine and consistent manner. Workforce Development activities focus directly on architects, engineers, contractors, services providers and other practitioners who are a critical link to ensuring quality services are provided in these areas. Other strategies that focus on key components of the supply chain are addressed in the Market Development Initiative.

Current State of Technology or Knowledge

Despite the previous investment, labor market research and NYSERDA program experience in this area shows that an unmet need remains for continued energy and technology-related workforce development and training, particularly in specific target areas and market sectors (new construction, existing homes and commercial facilities, operation and maintenance, low-income programs, and commercial and industrial facilities) and for certain technologies (customer-sited renewable energy systems, HVAC, lighting, advanced monitors and controls, smart grid technologies, building management systems and weatherization and air sealing techniques). Continued funding for these efforts will enable NYSERDA to build on the initial investment of EEPS funds for workforce development and to meet the goals as put forth the Governor and the PSC. For example, in his 2012 State of the State address, Governor Cuomo announced several key initiatives focusing specifically on energy efficiency efforts geared toward consumers and State facilities that will increase the demand for trained workers with expanded skills.

¹²¹ The December 17, 2012 Order in Case 10-M-0457, Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives, authorized NYSERDA to use \$24 million of EEPS program funds that were uncommitted as of December 31, 2011, to fund a Workforce Development initiative within the T&MD portfolio. A new Workforce Development initiative is being added to the T&MD Operating Plan through this supplemental revision, that includes both the re-allocated EEPS funds, which focus on workforce development activities related to energy efficiency, and \$15 million of T&MD funds previously included in the Market Development Initiative of the T&MD Operating Plan, which focus on workforce development activities related to renewable energy and advanced technologies.

Market research and evaluation efforts conducted by NYSERDA,¹²² as well as information from the New York State Department of Labor (NYSDOL) Green Jobs Study,¹²³ shows that continued New York workforce skill upgrades are necessary to ensure quality work and safe and reliable efficiency services. A trained and credentialed workforce can improve the competitive landscape for contractors implementing EEPS and RPS initiatives. A recent study by McGraw Hill¹²⁴ states that firms with credentialed workers are more apt to maintain a competitive advantage while also benefiting individual workers; 71% of firms find that having certified employees increases the competitiveness of their firms to win contracts; 68% believe certified employees help them grow their green business; 77% of individuals feel certification helps them gain valuable knowledge they can use on the job, and 75% believe it brings them more job opportunities.

Why this is Important for New York and New York Ratepayers

Workforce Development activities provide the training necessary to promote and sustain energy efficiency, renewable energy, and advanced technology options to New York ratepayers. Prudent use of ratepayer funds for EEPS and RPS programs requires that work performed by technicians, installers, and other professionals participating in these programs is of the highest possible quality. Discussions with several EEPS utility Program Administrators (PAs) suggest that technical training is a necessary component in meeting individual PA energy savings goals and the overall targets of the 15 by 15 effort.

Evaluation studies currently underway by NYSERDA indicate that continued training of building staff is necessary to maintaining high performance in a building designed to be energy efficient. Closing the gap between predicted and actual building performance through additional energy modeling training and certification is critical to achieving and verifying energy efficiency targets. Providing training and opportunities to acquire credentials to the State's clean energy workforce provides improved performance and energy savings of installed systems, improved safety and productivity and ensures safe and reliable service from practitioners properly trained and credentialed.¹²⁵

Energy efficiency and renewable energy systems perform and operate better when designed and installed by trained and certified installers. While studies in this area are limited, a 1999 report by the American Council for an Energy Efficient Economy (ACEEE) concludes that while efficiency programs result in significant savings, there is a growing body of evidence that shows that improving the way in which equipment is installed could have greater impacts on actual operating efficiency, while reducing maintenance costs and resulting in longer equipment life.¹²⁶ As ratepayers invest in a renewable energy system, a new construction project or a home energy

¹²² Building Performance Contractor Association, Home Performance Contractor Committee Survey, issued April 12, 2010. Research into Action, EEPS Workforce Development Program, DRAFT Process Evaluation Report, May 2012.

¹²³ NYS Department of Labor (DOL), Green Jobs Study, 2011: <http://www.labor.ny.gov/stats/green/index.shtm>.

¹²⁴ McGraw Hill Construction SmartMarket Report: Construction industry Workforce Shortages: Role of Certification, Training and Green Jobs in Filling the Gap, McGraw Hill, 2012.

¹²⁵ McGraw Hill Construction SmartMarket Report: Construction industry Workforce Shortages: Role of Certification, Training and Green Jobs in Filling the Gap, McGraw Hill, 2012

¹²⁶ Energy Saving Potential From Addressing Residential Air conditioner and Heat Pump Installed Problems", Neme, Proctor, Nadel, 1999

retrofit, it is important to ensure that energy and associated bill savings will not be lost due to a poorly-designed or installed system.

An example of the impacts of certification on system quality can be seen in a study done looking at photovoltaic (PV) installations. A 2008 study by Research Into Action, Inc., examined the links between PV installer workforce development activities and PV system outcomes in New York State, found that nationally certified installers had fewer problems during an installation inspection review than non-certified installers.¹²⁷

Health and safety benefits can also be realized when properly trained practitioners conduct energy services as they are best able to identify health and safety problems in the dwelling, such as high carbon monoxide levels, gas leaks, moisture, or incorrect venting of appliances. When trained in the “whole house” approach, work scopes can be developed that address these issues and preventative measures (such as CO detectors) can be pursued, thereby increasing consumer confidence that any energy efficiency improvements in the dwelling will not have a negative effect on the health of the home or occupants.

Program Goals

The Workforce Development Initiative will capitalize on training infrastructure and resources previously developed and, where necessary, assist in developing new training initiatives and infrastructure to quickly advance the skills of existing and emerging workers and facilitate the adoption of new and underused technologies into the marketplace. The skills of existing workers will be upgraded and emerging workers will be trained through programs that link new workers to jobs or the next level of training necessary to obtain a job. Immediate goals for the initiative are as follows:

- Roll-out a comprehensive portfolio of technical training that is offered routinely throughout the year and across the state, focusing on established courses at established training facilities;
- Add new community colleges to the training network, where gaps exist, and with community colleges that can demonstrate linkages to businesses and job placement success;
- Develop advanced courses for renewable energy that can be offered as continuing education to practitioners and as integrated components of college certificate and degree programs, trades training, etc.;
- Expand on-the-job training, internship, and apprenticeship initiatives;
- Identify and develop necessary certifications with third-party professional certifying organizations;
- Provide the clean energy workforce with the skills necessary for proper installation, operation, and maintenance of energy systems in order to realize anticipated energy

¹²⁷ “PV Workforce Development and the Market for Customer-Sited PV”, McCrae, Moran, Peters, Nemore, Gonzales, Ferranti, 2008.

savings and energy production, targeting professional services and construction industries (contractors, builders, energy engineers, design engineers, architects, and LEED supervisors and coordinators, etc.);

- Better defined career path related to training initiatives with a clear direction leading to a job or certification.

Long-term goals for the Workforce Development Initiative are:

- Expand on existing relationships between training organizations and companies such as HVAC contractors, electricians, plumbers, builders, and general contractors, etc. to ensure successful linkages between training and jobs.
- Full integration of renewable energy and energy efficiency training into certificate and college degree programs;
- Stackable credentials for workers that are portable, (i.e. recognized and accepted across the industry); and
- Self-sustaining training programs.

Specific near-term and long-term performance milestones related to these goals and objectives are presented at the end of this section.

Program Design

Workforce Development activities will be delivered through competitive solicitations and open enrollment incentive offerings. Activities supported will include work standards and certification development, curriculum development, training for trainers, training institution accreditation, practitioner certification, tuition support, etc. Courses will include workshops, seminars, one-week courses, credit-bearing classes, degrees (two-and four-year) and certificate programs and professional development initiatives that provide continuing education credits. Courses may be delivered in classrooms, at the work place or job-site and on-line.

Specific strategies will be designed to improve the design, installation, inspection, operation, maintenance, control and monitoring of systems, technologies, or measures on the customer side of the meter, across three areas:

- Renewable Energy - includes energy that is generated by natural resources, such as the sun, wind and biogas. Goals for use of these resources in New York State are addressed in the State's RPS. Activities under the Workforce Development Initiative will help achieve these clean energy goals by addressing, among other things, the demand for advanced training and skilled labor to keep pace with new technologies and certifications.
- Advanced Technologies - emerging renewable energy or energy efficiency technologies are proven technologies (or technologies that emerge over the next 3-5 years) that typically result from R&D efforts and show potential benefits such as efficiency gains or performance or reliability improvements, yet are not commercialized or have not yet met some threshold of market penetration. This can represent a new technology,

improvements to an existing technology or new applications of existing technologies. Workforce Development activities that address advanced technologies may include pilot-scale trainings focused on specific technologies. Once the technology or practice takes hold in the market, training initiatives would be included in the more traditional energy efficiency or renewable energy training components.

- Energy Efficiency - measures that help consumers and businesses use less energy while providing the same or an improved level of system performance, comfort and convenience. Energy efficiency can provide savings related to the building shell, lighting, HVAC systems, insulation, motors, building controls, appliances, or system operation and maintenance. Workforce Development initiatives for energy efficiency focus on certification-based training for existing practitioners as well as for new entrants to the workforce seeking skills training to better compete for employment opportunities.

The following delivery mechanisms will be utilized across all three areas:

Technical Training programs are designed to improve the production, output or performance of a measure or system which ultimately ensures that an energy efficiency or renewable energy technology will meet or exceed consumer expectations. Technical training initiatives will be designed to provide:

- 1) new, transitional or emerging workers with the basic principles as well as the applied science and math skills necessary for an occupation like energy auditor or renewable energy system installation assistant or salesperson; and
- 2) practitioners (i.e., lighting, HVAC, PV, Wind, building operator, inspector, etc.) with the technical skills to obtain or retain certifications, build or advance skills specific to their industry or trade or adapt to technological change.

Career pathways initiatives are designed to provide a clear, articulated progression of training courses and other services for high school students and adults preparing for employment or advancement in a field or occupation. Initiatives include career planning and entry-level technical education for high school students and emerging workers, entry-level skills, technical training (as described for new/emerging workers above), internships, apprenticeship programs and on-the-job training (as further described below).

On-The-Job Training (OJT) initiatives are designed to help new or transitioning workers acquire both general and specific work skills through hands-on, experiential learning in the field and takes place under normal working and salary conditions. OJT can also be used to help an incumbent employee advance their career to the next step on a career ladder (i.e., team lead, crew chief or supervisor). OJT typically includes a written training plan and workplace training of inexperienced workers led by a more experienced worker or supervisor. The workplace training can sometimes be supplemented by additional classroom technical training as needed. Under the WFD Program, OJT actions will be designed and implemented in close coordination with NYSDOL and will integrate many of the successful elements in NYSERDA and NYSDOL's very successful OJT program being implemented under the Green Jobs-Green New York Program (GJGNY).

Internships will be supported, in some cases as part of a career pathways program, to provide supervised practical experience for beginners in an occupation to help them gain experience of a given period of time. Typically an internship will follow basic level technical training, at a minimum.

Technical training, on-the-job training and career pathways initiatives will address the need for clean energy technology-based training as identified in NYSDOL's May 2009 report, New York State's Clean Energy Industry: Labor Market and Workforce Intelligence Report. Advances in technology and emerging fields in the clean energy economy require new and updated curriculum for system installers and inspectors, attorneys, leasing agents, engineers, architects, and third-party certifiers. This includes identification of professional development opportunities as well as new certificate and degree programs imbedded throughout the education and training network.

It is important to note that technical training is a constant thread to all initiatives. While technical training may be a stand-alone initiative for a skilled practitioner (i.e., an advanced lighting course for an electrician) it is an important step in a career pathways initiative and it is typically the main goal of on-the-job training. Additionally, a career pathway can result in an on-the-job training initiative. Ideally, a new entrant to the clean energy workforce receives technical training as part of a career pathways plan. Potential employers benefit from on-the-job training programs because the financial burden of hiring and training a new worker is reduced through wage and training subsidies.

The existing training provider network of over 70 training institutions will be used to offer regional training opportunities that meet specific employer needs. Using input from stakeholders, new training partners will be added as gaps are identified and as supported by market demand. Financial assistance will be provided to training institutions to offset the cost of delivering training such that the cost to the training participant is reduced or eliminated. Training initiatives will need to demonstrate a link to industry needs and market demand. Training initiatives that include practical hands-on training, where students learn with equipment relative to the trade or industry, will be promoted.

Expected benefits

Electric and Gas System-wide Benefits: A skilled workforce will help avoid poorly designed, installed and operated systems, which studies have shown can reduce anticipated savings by 15-25%. Additionally, in order for New York to consider energy efficiency as a viable component of system planning, it is imperative that estimated savings are realized. Workforce development efforts focused on proper modeling, installation and commissioning techniques meet these needs.

Economic Development Benefits: Providing clean energy training resources will support economic development activities that can attract new employers to the State as well as retain and engage New York State's unemployed workers. Workforce Development provides essential support to New York State companies by helping upgrade the skills of existing workers, minimizing the risk and costs associated with hiring a new worker, making critical linkages between training organizations such as community colleges and unions to employers and offsetting training and certification costs so companies can utilize resources for marketing and other needs. Working closely with NYSDOL, these Workforce Development initiatives are combined with other state services to provide

employers with a comprehensive package of benefits to help them expand and remain competitive. Furthermore, career pathways programs targeting the unemployed help to reduce reliance on public benefits and, where job seekers are connected with employers, increases the number of self-sustaining taxpayers resulting in a compound economic benefit.

Environmental Benefits: A skilled workforce delivering energy efficiency and renewable energy services will maximize environmental benefits by ensuring work is performed to high standards and the resultant energy savings are realized.

Consumer Cost Savings: A skilled workforce delivering energy efficiency and renewable energy services will maximize consumer cost savings by ensuring work is performed to high standards and the resultant energy savings are realized.

Opportunities Unique to New York: In 2012, On-Bill Recovery Financing (OBR) was initiated in New York State for consumer energy efficiency upgrades. Through an agreement with utility providers to allow consumers to pay for these upgrades, it is anticipated that 40,000 homes across New York State will participate over the next several years, thereby increasing the demand for trained workers. Governor Cuomo has made the acceleration of energy-saving improvements at State-owned facilities a priority which, alone are expected to reduce the lifecycle greenhouse gas emissions by 8.1 million metric tons while creating thousands of high-skilled jobs.

Leveraging Resources or Filling Gaps: The proposed initiatives will leverage workforce training as well as other state (GJGNY, RGGI, NYSDOL, HRC) and federal (DOE, EPA) resources to overcome hurdles and build market capacity and sustained markets. During EEPS-1, NYSERDA's \$2 million in career pathways funding has leveraged an additional \$17million in NYSDOL career pathways grants. Currently, there are over 3,500 individuals actively participating in NYSDOL career and employment services. NYSERDA funds have helped to leverage career pathways initiatives by funding additional basic skills and worker readiness training and have helped to leverage the existing infrastructure for training disadvantaged workers. NYSERDA will continue to work closely with NYSDOL and other state agencies to leverage federal funding and coordinate state funding and industry partnerships to maximize the impact of WFD programs. Discussions with NYSDOL are underway to leverage federal funding available to NYSDOL workforce development support for veterans.

Scale of Potential Benefits Relative to Program Costs: The EEPS and RPS portfolio of programs statewide invests approximately \$238.5 million and \$542.8 million per year respectively on energy efficiency and renewable energy programs. The Workforce Development budget of \$7.8 million per year is a modest investment in relation to the millions of dollars of rate-payer funded work it can affect.

Program Experience

NYSERDA has developed a comprehensive network of over 70 training partners which includes community colleges, universities, unions, trade groups and community-based organizations. Since 2008, NYSERDA has provided training and workforce assistance to approximately 22,740 individuals. NYSERDA has partnered with NYSDOL to integrate program offerings into the State's One Stop Career Centers. In partnership with EEPS-1 workforce training activities alone,

NYSERDA leveraged NYSDOL efforts that trained an additional 3,000 career pathway individuals. Through GJGNY, NYSERDA's on-the-job training program, implemented in partnership with NYSDOL, enabled 34 energy efficiency and solar thermal businesses to hire and train 100 new employees and supported the development of new skills and career advancement for nine existing employees. These efforts have leveraged additional NYSDOL support services for the new employees. NYSERDA is completing a curriculum assessment to help refine training needs necessary to support a clean energy economy. NYSERDA has also worked closely with stakeholders through working groups, advisory groups and boards, stakeholder meetings, contractor focus groups and surveys and program evaluation efforts.

Funding and Performance Milestones

The average annual budget for Workforce Development is \$7.8 million. Activities for the Renewable Energy/Advanced Technologies component, which was previously included in the Market Development Initiative of the T&MD Operating Plan, were initiated in 2012. Activities related to the Energy Efficiency component will begin in 2013 and be ramped up quickly.

Table 9-15: Workforce Development Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Renewable Energy and Advanced Technologies	3.0	7,000,000	5,000,000	3,000,000	15,000,000 ¹²⁸
Energy Efficiency	4.8 ¹²⁹	12,630,000	11,370,000	0	24,000,000
Total: Workforce Development	7.8	19,630,000	16,370,000	3,000,000	39,000,000¹³⁰

Pursuant to the December 17, 2012 Order, NYSERDA worked in consultation with DPS staff to develop enhanced reporting protocols and a revised reporting scheme to provide a greater level of information on the results of these efforts. See Section 8.1.2 and Appendix D for a description of the methodology that will be used to evaluate the program.

¹²⁸ It is estimated that approximately 20-25% of the total Renewable Energy and Advanced Technologies budget will be spent on WFD initiatives targeting Advanced Technologies.

¹²⁹ This calculation is based on average over 5 years, however the Energy Efficiency funding approved in the December 17, 2012 Order provided four year funding.

¹³⁰ This budget reflects the December 17, 2012 Order in Case 10-M-0457, Order Modifying Budgets and Targets for Energy Efficiency Portfolio Standard Programs and Providing Funding for Combined Heat and Power and Workforce Development Initiatives, which authorized NYSERDA to use \$24 million of EEPs program funds that were uncommitted as of December 31, 2011 for a Workforce Development Initiative in the T&MD Program, focusing on energy efficiency. The budget also reflects \$15 million of T&MD funds previously included in the Market Development Initiative of the T&MD Operating Plan, which focus on workforce development activities related to renewable energy and advanced technologies.

Table 9-16: Workforce Development Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outputs/Leading Indicators					
Renewable Energy & Advanced Technology	Technical training on RE/AT for 2,000 incumbent workers and high school students preparing for technical careers ¹³¹	500	1,000	500	
	Support 480 disadvantaged, unemployed or underemployed individuals seeking entry-level employment	90	200	190	
	OJT and Hands-on RE/AT Training for 680 individuals	150	380	150	
	Develop advanced courses to be integrated components of college certificate and degree programs & trades trainings	2	4	2	
	Additional Community Colleges and training organizations added to training network ¹³²	2	3	1	
	Identify need for and support development of new certifications and supporting curriculum	0	2	1	
Energy Efficiency	Technical training on EE for 13,793 incumbent workers and high school students preparing for technical careers	3,448	5,517	4,828	
	Support 3,200 disadvantaged, unemployed, or underemployed individuals seeking entry-level employment	800	1,280	1,120	
	OJT and Hands-on EE Training for 1,867 individuals	467	747	653	
	Community Colleges and other training organizations added to training network ¹³²	2	3	1	
	Identify need for and support development of new certifications and supporting curriculum	0	2	1	

¹³¹ Individuals may participate in more than one training.

¹³² Community Colleges may offer RE, AT and EE courses.

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017-2020)
Outcomes/Impacts *					
Renewable Energy & Advanced Technology	Leverage federal and third-party funding to support workforce development	750,000	2,250,000	\$1,250,000	
	Ongoing use and sustained knowledge of training elements by employed workers (achieving and retaining certifications, job advancement, etc.)				
	Higher quality installations and O&M when conducted by trained and certified individual (less call-backs, customer satisfaction, etc.)				
	Increased employee retention and job experience with OJT training program				
	Increase the availability of skilled workers to meet industry needs				
	Facilitate linkages between training organizations and businesses, industry sectors and intermediaries				
Energy Efficiency	Leverage federal and third party funding to support workforce development	\$1,250,000	\$3,750,000	\$2,000,000	
	Ongoing use and sustained knowledge of training elements by employed workers (achieving and retaining certifications, job advancement, etc.)				
	Higher quality installations and O&M when conducted by trained and certified individual (less call-backs, customer satisfaction, etc.)				
	Increased employee retention and job performance with OJT training program				
	Increase the availability of skilled workers to meet industry needs				
	Facilitate linkages between training organizations and businesses, industry sectors and intermediaries				

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

9.3.4 Environmental Monitoring, Evaluation and Protection (EMEP)

Targeted Problem

Electricity generation is responsible for adverse environmental and economic impacts including: degradation of lakes, streams, forests, and buildings from acid deposition; elevated levels of mercury in fish and other wildlife; human morbidity and mortality from poor air quality related to ozone and particulate matter; and habitat alterations from alternative energy development. While emission reduction efforts have resulted in some improvements, these impacts continue to affect New York's sensitive ecosystems and vulnerable populations. Environmental monitoring and assessment programs have been recently reduced at the State and federal levels. Monitoring sites in New York have been closed due to lack of federal, State and institutional funding. While NYSERDA-sponsored environmental research efforts have succeeded in leveraging significant co-funding, contributions from the Environmental Monitoring, Evaluation and Protection Initiative (EMEP) will be increasingly important going forward.

Current State of Technology or Knowledge

Despite recent environmental improvements, research indicates that recovery from the effects of acidification is not likely for many sensitive areas without additional decreases in acid deposition. Over half of the streams in the Western Adirondacks and many Adirondack lakes cannot support fish life because of acid deposition. Modeling suggests that trends showing recent improvements in some areas may actually have reversed, resulting in new acidification – a result tied to a reduction in the acid neutralizing capacity of watersheds in response to long-term exposure to acid precipitation.

EMEP-supported mercury research showed that nearly 20% of lakes surveyed outside of the Adirondack and Catskill regions had mercury levels high enough to result in fish consumption advisories. Over 60% of the lakes within the Adirondack and Catskill regions had elevated mercury levels, resulting in the first regional advisory from the New York State Department of Health. It is now known that mercury bioaccumulation is not limited to aquatic organisms, but it is much more pervasive across the food web.

Out-of-state contributions to sulfate and nitrate continue to greatly exceed in-state sources. Ozone and particulate matter (PM) continue to cause regional-scale air pollution problems in the northeast corridor with many areas in non-attainment. Effectively addressing environmental justice issues related to air quality issues continues to be a challenge.

Although the understanding of the environmental consequences to New York of climate change and the increase of alternative energy sources is in its initial stages, these issues and those associated with environmental justice require continued investigation.

Why This Is Important for New York and New York Ratepayers

A component of the Public Service Commission's mission is to "stimulate innovation, strategic infrastructure investment, consumer awareness, competitive markets where feasible, and the use of resources in an efficient and *environmentally sound manner*." Environmental monitoring and associated research and analysis are critical for assessing the environmental soundness and

effectiveness of energy programs and for permitting researchers and policymakers to design and implement new policies and programs.

New York continues to be adversely impacted from energy-related pollution, both environmentally and economically. SO₂, NO_x, CO₂, and mercury emission reductions from power plants and other source sectors are needed. Some emission reductions can be achieved through: implementing regulations that address transport of ozone and fine particles; rules affecting mobile sources; State Implementation Plans to achieve National Ambient Air Quality Standards; and future rules to reduce air toxics and other pollutants from power plants.

EMEP underpins the environmental foundation for all of NYSERDA's Clean Energy initiatives. The program provides the knowledge necessary to reduce the adverse impacts associated with electricity generation that damages New York's ecosystems and the health of its citizens, and it can help plan for cleaner alternative options. Additionally, informing the clean energy technology industry about life cycle environmental impacts early in the development stage can minimize unanticipated negative effects and document the energy and environmental attributes of products.

In addition to supporting the environmental component of PSC's mission, as described above, EMEP provides critical energy-related environmental research to help support the regulatory responsibilities of a range of other agencies in New York including the Department of Environmental Conservation, Department of Health, Department of State, and the Office of the Attorney General.

Program Goals

EMEP is a state and national leader in supporting sound, scientific research to inform policies and decision making. EMEP embraces the goal of increasing the understanding and awareness of the environmental impacts of energy choices and emerging energy options by providing a scientific, technical foundation for formulating effective, equitable, energy-related environmental policies and practices. EMEP has five strategic objectives:

- Enhance the understanding of the environmental impacts of emerging technologies, energy systems, and energy-related pollution control technology;
- Support energy-related environmental accountability through analysis of long-term monitoring records and modeling:
 - Provide the necessary research to assess changes in the environment, specifically in relation to changes in emissions and energy technology;
 - Support research that will help evaluate the effectiveness of energy-related air quality management strategies for acid deposition, mercury, ozone and co-pollutants, particulate matter, and climate-forcing agents;
 - Provide insight on potential changes to energy-related environmental protection policies that can better protect environmental and public health; and
 - Where strategic opportunities exist, support efforts to augment compliance monitoring to provide scientifically robust information to advance understanding of the fate and transport of energy-related pollution in New York and the region;

- Support research that will enhance understanding of the source types, source regions, and specific pollution components contributing to major energy-related environmental problems in New York State:
 - Provide insight on the relative contribution of the combustion of fossil fuel in the various sectors (e.g., electricity production, heating, transportation) to the state’s major environmental problems; and
 - Help prioritize opportunities for mitigation and identify cross-sector, potentially market-based pollution control strategies;
- Evaluate the individual and combined impacts of energy-related pollution sources in New York;
- Support efforts to examine the health and ecological co-benefits of alternative energy and technology solutions; and
- Support an environmental research capability to better address the critical problems facing the State and region and to create opportunities for innovation:
 - Help foster collaborative, interdisciplinary research to better use limited resources available for research.
 - Provide seed funding to attract other resources to further develop energy-related environmental research capability that can be sustained and grow beyond ratepayer funding available to NYSERDA.

Alignment with T&MD Objectives

EMEP provides accountability for efforts to develop *clean* energy in New York by measuring environmental successes and identifying remaining challenges. By helping to develop a sound and equitable energy-related environmental regulatory framework, EMEP supports advancement of clean energy actions distinct from ratepayer incentive programs.

Within five years, EMEP will help advance science-based policies addressing energy-related air quality issues in urban and rural areas, water quality issues resulting from the deposition of in-state and transboundary pollution, and related ecosystem impacts. With a focus on emerging technology, EMEP will help identify and mitigate environmental barriers – such as those associated with siting and operating onshore and offshore wind generation and kinetic hydroelectric generation – thereby facilitating the development of environmentally-sound alternative energy technologies. The program will also support research on the impacts of, and adaptation to, changing climate and the relationship to the pollution concerns listed above.

The long-term monitoring element of EMEP is critical to measuring the success of NYSERDA’s environmental policies and will continue to serve as the foundation for many related research and planning efforts. Specific near-term and long-term performance milestones related to these goals and objectives are presented below.

Program Design

A Program Advisory Group and separate Science Advisory Committee currently guide EMEP and help maintain a focused program, relevant from both policy and scientific perspectives. This

effective advisory structure will be continued with periodic assessment of the composition of the groups. The program currently focuses on evaluating the effectiveness of energy-related environmental quality management strategies for acid deposition, mercury, ozone and co-pollutants, particulate matter, and climate-forcing agents. Based on a robust stakeholder-driven framework, the EMEP research agenda will continue to develop and integrate an evolving energy–environmental landscape that identifies information gaps and research needs. For example, the program will consider how the following evolving issues relate to the identified research needs: changes in industry market structure/deregulation, fuels, and pollution control technologies; emerging energy technologies; volatile energy prices; concern for the long-term security of energy supplies and meeting peak energy demands; and recognition that greenhouse gases and other climate-forcing agents must be addressed along with conventional combustion-related pollutants.

The program will also consider the broader, evolving environmental policy context, including:

- Increased reliance on market-based environmental protection strategies;
- Increased need to evaluate real-world effectiveness of environmental policies, i.e., “environmental accountability;”
- Increased sensitivity to pollution hot spot concerns and environmental justice;
- Scarcity of resources for adequate long-term monitoring programs; and
- Need for coherent multi-pollutant policies and programs.

EMEP will consider the availability of other funding sources for energy-related environmental research, such as proceeds from the sale of emission allowances under the RGGI. If new RGGI funds become available, EMEP climate research will be primarily supported through RGGI; however in this SBC plan, research related to both mitigating and preparing for a changing climate is included as a contingency should RGGI funds not become available.

Targeted program opportunity notices will be issued on a regular basis over the five-year program term. Most EMEP projects will be selected competitively by technical evaluation panels and products will be peer-reviewed prior to publication. EMEP will continue support the Adirondack Lake Water Quality Monitoring Program with the Adirondack Lakes Survey Corporation and the NYS Department of Environmental Conservation, as well as the New York State Fine Particulate and Ozone Air Quality Research Program (one of several U.S. EPA "Supersites") led by the University at Albany/Atmospheric Sciences Research Center. These monitoring programs critically inform State policies related to water and air quality. Project results will be communicated to multiple audiences in a variety of formats – from peer-reviewed scientific journal articles to concise project summaries targeting decision makers.

Expected Benefits

This section describes the expected benefits associated with EMEP, in relation to the seven priorities articulated in Section 5.2. The following describes qualitative and "big picture" benefits, providing an important contextual framing for the initiative that corresponds to direction provided in the December 30, 2010 Order. More specific, often quantifiable performance milestones and expected results are provided in Table 9-14.

Electric and Gas System-wide Benefits: The main system-wide benefit of EMEP relates to the diversification of energy resources. EMEP supports research to better understand and mitigate environmental issues related to the development of new, cleaner, alternative energy technologies, thereby facilitating their entry into New York State’s generation mix.

Economic Development Benefits: The majority of economic benefits resulting from EMEP are tied to environmental improvements. Policies and regulations on the State and federal level that have relied on EMEP data in their formulation have produced cleaner air and associated health benefits (reduced mortality and morbidity, sick days, hospital visits) and ecosystem improvements that support fishing, hunting and recreational activities. While placing a dollar value on improved health and ecosystem services is difficult, the value is defensibly substantial when considering the environmental improvements observed over the past 10 years that have relied upon information generated from EMEP.

Environmental Benefits: In contrast to the majority of the State’s energy initiatives focused directly on energy efficiency and renewable energy strategies, EMEP promotes the “clean” component of the program goal by monitoring and evaluating energy options from an environmental perspective and by promoting technologies with reduced environmental footprints. Investments through EMEP have had a major impact on energy production and use in New York, informing mercury control policies affecting energy production, fine particle pollution standards, acid deposition control policy, and greenhouse gas emission policies. The continuation of EMEP will greatly assist New York in reducing environmental impacts of both existing and emerging energy technologies and inform future energy-related environmental policies and goals that improve environmental quality.

Consumer Cost Savings: Although there are significant savings to consumers related to the environmental and economic benefits described above, not to mention any associated public health benefits, direct cost savings to consumers are difficult to quantify.

Opportunities Unique to New York: New York is the recipient of a significant amount of transboundary pollution from upwind sources. To create effective State Implementation Plans compliant with environmental regulations, monitoring and research is necessary to characterize in-state and out-of-state sources and to understand the processes that influence pollution behavior.

New York also has unique ecosystems sensitive to the effects of acidic and mercury deposition. While some parts of the U.S. show significant improvements as a result of emission reduction strategies, areas of New York, such as the Adirondack and Catskill regions, continue to experience severe adverse environmental impacts resulting in numerous lakes and streams unable to support fish life. Benefits from the state’s numerous water bodies are severely limited in areas where fish consumption advisories are issued due to mercury pollution. Monitoring and understanding trends in these ecosystems is critical to providing accountability for environmental improvement initiatives.

New York is a large state with diverse environmental justice issues and needs. Highly-populated urban areas as well as rural areas with significant low-income populations face numerous energy-related environmental impacts that are often not addressed. Opportunities to expand the use of New York State’s indigenous energy resources – onshore or offshore wind generation, kinetic or

conventional hydroelectric generation, or development of Marcellus shale natural gas resources – require evaluation, monitoring and study to ensure that approaches are environmentally responsible.

Leveraging Resources or Filling Gaps: EMEP has been very successful in leveraging funds for supported projects. Outside entities have provided significant financial support as well as intellectual capital. External co-funding for EMEP projects has averaged 40% of total project costs with approximately \$12 million of co-funding expected at the proposed funding level.

A 2010 program process evaluation determined that EMEP provides a unique opportunity for scientists to link research with broader public policy goals and encourages researchers to consider the policy implications of their work. EMEP-funded activities also result in follow-up work by researchers, not otherwise possible. EMEP’s focus on linking science and policy sets the program apart from other organizations that fund similar research but supports two distinct audiences, scientists and policymakers. Both audiences view the program positively.

Scale of Potential Benefits Relative to Program Costs: The low level of funding typically dedicated to the scientific foundation for environmental policies is inconsistent with the tremendous economic consequences of environmental policies and decisions. In contrast, providing sufficient resources to guide energy-related environmental policies is an extremely economical means to improving the likelihood of “getting it right”.

With respect to the cost/benefit of the program, the value of EMEP has been well documented in the science and policy communities. Comments received during the preparation of an EMEP evaluation characterize program value to date (“Overview of Accomplishments Prepared for the September 19, 2006, EMEP Program Review”):

- “Few research programs can honestly list the variety and significance of accomplishments that EMEP has.”
- “This program is a bargain for NYSERDA. The program is very well managed.”
- “A final comment relative to costs and added value is to express amazement that the oversight of the program is conducted with only 2.5 FTEs. This is a clear tribute to the effectiveness of the EMEP staff and represents research program administration that is admirable in its effectiveness.”
- “Especially given its size, considerable information has been generated that is of great value to the State.”
- “The values of the EMEP program accomplishments to New York, U.S. and even the world are quite significant for 2.5 full-time-equivalent NYSERDA effort.”

Program Experience

EMEP projects have an impressive track record of positively affecting energy-related environmental policy; future efforts will be based on a similar program approach. Evidence of EMEP data and studies providing critical information to support policy development is demonstrated in the following examples:

Acid Deposition: Data from the Adirondack Lakes Survey Corporation's (ALSC) Long-Term Monitoring project, of which EMEP is the primary funder, have been used as supporting technical rationale for New York's Acid Deposition Reduction Program, which requires reductions of pollutants from electricity generators in the state.

EMEP-sponsored data have been cited by the U.S. EPA as supporting technical information in evaluating the Clean Air Act Amendments of 1990 and the Clean Air Interstate Rule, which regulate emissions from electric generators.

EMEP-funded "Western Adirondack Stream Survey" was presented as a case study in the U.S. EPA document "Acid Rain and Related Program: 2008 Environmental Results." Based in part on this research, this document includes the following statement by the U.S. EPA on the efficacy of existing policies to restore surface water systems: "Although water quality has improved, many lakes and streams still have acidic conditions harmful to their biota and further emission reductions are needed for full ecosystem protection and recovery of sensitive aquatic systems."

Mercury: EMEP research identified the vast extent of mercury contamination in fish in waters across New York, much of which originates from coal-burning power plants. Monitoring data have resulted in one of the largest changes in over a decade in fish consumption advisories by the Department of Health.

EMEP mercury research was used in determining the need for a New York State ruling for mercury control at power plants. Relevant EMEP research used by the NYSDEC included: mercury transport and source attribution modeling, wet deposition monitoring data, and mercury surveys in fish and loons.

Fine Particles and Ozone: EMEP data on fine particle emissions from stationary natural gas combustion were used to update the National Emissions Inventory, the basis for air quality management plans in New York and the United States.

Results on the speciation of PM_{2.5} and role of PM precursors from the Supersites programs, including early results of the NY Supersite, were used in EPA's consideration of the Transportation Conformity Rule Amendments for the New PM_{2.5} National Ambient Air Quality Standard: PM_{2.5} Precursors.

EMEP research was used to update EPA's Guidance on Models and Other Analyses in Attainment Demonstrations for the 8-hour Ozone NAAQS and more recently was used in EPA's Technical Support Document for the Final Clean Air Interstate Rule, Air Quality Modeling.

Health Effects: New York State Department of Health recommended that EMEP findings on the effects of short-term SO₂ exposure on asthma be considered in EPA's review of the SO₂ national ambient air quality standard. EPA recently announced a new one-hour standard for SO₂.

Research on ultra-fine particles at the University of Rochester Medical Center shows cardiac health effects at UFP exposure levels experienced by subjects in a cardiac rehabilitation program. The UFP hypothesis and realization of cardiovascular health effects due to air pollution is an important focus of the state of the science on air quality and health effects.

Climate Change: Two EMEP projects – the greenhouse-gas cost curves study and the “ClimAID” impacts and adaptation assessment – are serving as the foundations for the New York State Climate Action Plan as called for through Executive Order 24. The Plan identifies near-term actionable policies and those requiring additional policy development or research.

Alternative Energy: EMEP coordinated and facilitated a working group to assist State policymakers and local governments in decisions related to wind siting issues. This effort aided in the development of the NYSDEC Guidelines for “Conducting Bird and Bat Studies at Commercial Wind Energy Projects,” thereby improving the efficiency of the environmental reviews required for commercial wind turbine siting.

Funding and Performance Milestones

The budget will support energy-related environmental research activities associated with New York’s science and policy needs related to acid deposition, mercury pollution, fine particles, ozone, alternative energy, crosscutting and emerging energy issues, and climate change, as well as new initiatives such as environmental life-cycle assessments for clean technologies and products. The funding is expected to support a number of large flagship projects as well as numerous smaller studies.

The average annual EMEP budget is \$3.71 million. In developing the proposed allocation below, NYSERDA considered the time needed to work with stakeholders and experts in year one to update the EMEP strategic plan. Priority solicitations would be issued as early as possible in 2012/2013, given that many energy-related environmental research projects require multiple years of data collection. For example, potential 2012 priority areas may include: characterizing and mitigating the environmental impacts of shale development in New York State, addressing environmental justice issues related to energy-related pollution, support of critical monitoring needs, and assistance with New York State air quality planning efforts in response to new air quality standards.

Table 9-17. Environmental Monitoring Evaluation and Protection Budget

Budget (committed funds)					
	Average Annual (\$million)	2012-2013 (\$)	2014-2015 (\$)	2016 (\$)	Total (\$)
Total: EMEP	\$3.71	\$8,313,502	\$7,424,046	\$2,812,500	\$18,550,048

Table 9-18. Environmental Monitoring Evaluation and Protection Performance Milestones and Anticipated Results

Performance Milestones and Anticipated Results					
		2012-2013	2014-2015	2016 (End of Program)	Out-Years (2017- 2020)
Outputs/ Leading Indicators					
Environmental Monitoring Evaluation and Protection	Update multi-year EMEP research plan with input from policymakers, scientists, and stakeholders				
	Sign 60 contracts for research studies, including several large flagship projects	23	28	9	
	Hold 5 Program Advisory Group meetings	2	2	1	
	Hold 5 Science Advisory Committee meetings	2	2	1	
	Sponsor 14 workshops, conferences or seminars	5	6	3	
	Complete 65 research studies	5	23	23	9
	Convene 30 briefings on research projects with policy- makers or other stakeholders	12	12	6	
Outcomes/Impacts*					
Environmental Monitoring Evaluation and Protection	3,000 citations of EMEP research outputs by other researchers and studies (primary citations)			3,000	
	\$11 M in leveraged funds (co-funding and outside investment) to support projects and sponsored research	\$3.5M	\$4.5M	\$3M	
	Publish 119 peer-reviewed scientific journal articles based on program-supported research	10	35	45	29
	Support (research output) for policy decisions				

*Longer term impacts related to effects on New York's economy, e.g., jobs and gross state product changes, will be assessed at the portfolio level for T&MD programs.

10 *Other Initiatives Considered*

Several other important initiatives that address New York's energy challenges and achievement of clean energy economy goals were considered as part of the process leading up to submission of this Operating Plan. Starting with the Vision Paper submitted to the PSC in September, 2010, which served as the underpinning for the PSC's December 2010 Order, NYSERDA identified several areas where strategic investment of SBC funds could provide substantial benefits. In its Order, the PSC directed NYSERDA to better define priorities for funding and to seek stakeholder input on an initial portfolio of proposed initiatives. NYSERDA did this as part of its intensive stakeholder process described in Section 4 of this Operating Plan, including presentation of a Briefing Paper at its March 22, 2011 Technical Conference, that laid out the nine initiatives that NYSERDA was considering for inclusion in its final proposal to the PSC.

Stakeholder input before and after the Technical Conference affirmed the importance of all the initiatives that NYSERDA had identified and suggested some modifications. Some stakeholders raised the concern that the T&MD portfolio attempted to cover too much, potentially leading to resources being spread too thin. Using this input, and upon consultation with DPS Staff, NYSERDA was asked to further refine and apply the priority criteria, and to consider other funding sources that could be tapped in addition to the SBC.

As a result, two of the Initiatives originally considered -- ***Industrial Process and IT Productivity, and Whole Building-Lower Income*** -- have been eliminated from the T&MD portfolio and are being proposed to be funded from proceeds from auction of CO2 emission allowances as part of NYSERDA's administration of the Regional Greenhouse Gas Initiative (RGGI). This will allow these important programs, which provide critical "gap-filling" and energy, environmental and economic development benefits, to proceed, while reducing the number of initiatives proposed to be funded by the SBC as part of the T&MD portfolio.

Should the RGGI funds identified above not materialize, NYSERDA may need to re-evaluate the funding dedicated to the nine Initiatives identified in the T&MD Operating Plan, and some adjustments in the funding allocation and program design may need to be considered, subject to DPS Staff and Commission approval.

Also, whereas funding for CHP was previously identified in NYSERDA's March 18, 2011 Briefing Paper as part of an Advanced Clean Power initiative, this Operating Plan includes a "stand-alone" CHP Initiative, with a focus on New York City.

11 Administration and Oversight

NYSERDA remains committed to the management and administration of the T&MD portfolio of programs in a manner that is fiscally prudent, efficient, economical, transparent, accountable, and customer focused.

As described in Section 4, NYSERDA will use an open, stakeholder-driven planning process to develop, implement and administer the T&MD Portfolio. NYSERDA will solicit stakeholder advice on program performance, including recommendations on whether or not programs are meeting their goals and objectives, and how programs should evolve over the five-year term. In addition, NYSERDA will continue to integrate performance measurements into program planning beginning with the development phase, throughout implementation, and continuing post-implementation to evaluate the impacts on New York's businesses and residents.

11.1 Procurement Policies and Procedures

NYSERDA's Procurement Contract Guidelines, approved annually by NYSERDA's Board of Directors, generally requires NYSERDA to use its best efforts to secure offers from potential contractors on a competitive basis and requires advance notice of pending solicitations to be published in the *State Contract Reporter*. NYSERDA will continue to use competitive solicitations to attract customers to its various programs. Over the four year period from July 1, 2006 through June 30, 2010, NYSERDA issued roughly 300 competitive solicitations and awarded over 14,000 contracts and purchase orders with 97% of the contracts and purchase orders awarded on a competitive basis.

Selection of contracts is accomplished in a transparent manner. Proposals submitted in response to due date solicitations are reviewed and evaluated in accordance with the criteria noted in the solicitation by a Technical Evaluation Panel (TEP), comprised of NYSERDA staff and outside reviewers with relevant expertise; the number of outside reviewers always exceeds the number of NYSERDA staff reviewers. DPS Staff are invited to participate on all the TEPs for the SBC-funded programs, and this practice will be continued. The TEP makes recommendations to program staff, who present the results for review and approval to the Management Review committee comprised of NYSERDA Officers.

Applications submitted in response to an open enrollment, standard offer are reviewed by NYSERDA staff and Technical Assistance contractors to ensure program eligibility requirements are met and the incentive award is accurately established.

11.2 Financial Tracking Systems

NYSERDA will provide for an efficient and accurate accounting of all T&MD program expenditures and administrative costs using its well-established system of internal controls and a variety of systems and procedures. Some of NYSERDA's control procedures include:

- NYSERDA's bank accounts are under the control of the Commissioner of the Department of Taxation and Finance, NYSERDA's statutory fiscal agent. NYSERDA follows generally accepted accounting principles (GAAP) and is current with all governmental accounting standards board (GASB) pronouncements. NYSERDA's accounting system is operated on a "fund" basis and provides for the segregation of funds. Each fund is created for carrying out a specific activity in accordance with law or dictated by generally accepted accounting practices. Each fund has a set of self balancing set-of-accounts for recording income and expenditure transactions.
- Pursuant to NYSERDA's By-laws, contracts and agreements may only be signed by one of NYSERDA's Officers. This centralized authorization function provides for effective segregation of financial and contracting duties and facilitates effective accountability.
- All payment requests receive a multi-disciplinary review prior to payment. Finance department staff checks the mathematical accuracy of the invoice and compliance with contract budget terms. Project management staff ensures that costs are appropriate and that the contractor's activities are consistent with the statement of work. Contract Management department staff ensure that terms and conditions of the contract such as insurance requirements are followed.

NYSERDA uses an automated financial management system, the NYSERDA Enterprise Information System (NEIS), using one of the best-in-class financial management systems, PeopleSoft, which facilitates an accurate and timely accounting of all SBC-funded program expenditures. Staff salary costs charged to the SBC-funded programs are based upon staff time allocations and the allocation of staff salary costs to various activity and funding codes is reviewed and approved by management quarterly. Contractual arrangements are entered, maintained and monitored in NEIS; the system tracks each individual contract or agreement, recording the amount of the contract agreement and expenditures incurred to date.

The NEIS system described above allows NYSERDA to produce various monthly financial reports that are distributed to NYSERDA management and program staff for review. In addition, this information is used to prepare evaluation and financial status reports provided to the DPS Staff.

11.3 Programmatic and Fiscal Management

NYSERDA has established strong program and financial management processes to provide for effective internal controls over the management of all funds administered by NYSERDA. NYSERDA has been audited eight times since 2004 by the Office of the State Comptroller for

various aspects of its financial and program administration, and in each case the Comptroller's Office has issued reports which are complimentary of the Authority's fiscal and program management procedures and have only provided minimal suggestions for further improvement. For example, the SBC II program was reviewed and audited by the Office of the State Comptroller and a draft audit report was issued on January 20, 2006 stating that: "*The Authority has established good controls to ensure that SBC funds are expended on authorized programs and used to achieve the goals set by the Commission.*" [Emphasis supplied.]¹³³

Additionally, the SBC program is subject to an annual independent audit by an independent public accounting firm selected by NYSERDA's Board as part of the annual audit of its financial statements. Since inception of the SBC, NYSERDA's financial statements have included an unqualified opinion from the independent auditors.

NYSERDA will continue to use an open, transparent, stakeholder-based process in developing, operating and evaluating its programs. As a Public Authority, NYSERDA is subject to the State Freedom of Information and Open Meetings Law (Public Officers' Law Articles 6 and 7). Its members and employees are subject to Public Officers' Law Sections 73 (business and professional activities) and 74 (Code of Ethics).

11.4 System Efficiencies and Staff Capabilities

Regular reviews of internal administrative processes are performed to identify opportunities for improving and enhancing operational efficiencies. Time-gates from the release of competitive solicitations and submission of proposals, to the selection of projects and execution of agreements, have been developed, and methods are being developed to reduce the amount of time it takes for NYSERDA to execute contracts. From revising solicitation and contract documents to accepting applications online, continuous improvements are an ongoing process, and NYSERDA will continue to look for ways to streamline operations, enhance business practices and improve customer service.

In addition, NYSERDA will continue to recruit and retain a staff of highly skilled engineers, scientists, and analysts, as well as a strong administrative team. During its stakeholder outreach process leading up to development of this Operating Plan, NYSERDA often heard about the value that NYSERDA staff bring to the table. NYSERDA staff are experts in their field, many nationally renowned, and routinely provide the type of direction and guidance needed to make projects successful. NYSERDA will strive to maintain this high standard for the implementation of the T&MD portfolio.

¹³³ New York State Office of the State Comptroller, Administration of the System Benefits Charge, 2005-S-16, January 20, 2006, page 2.

11.5 Administrative Funding Level

The October 24, 2011 Order provided 8% of total funding for program administrative costs incurred consistent with the most recently approved rate for SBC-funded programs.¹³⁴

Further, the PSC's September 13, 2012 and December 17, 2012 Orders did not provide any additional administrative funding related to program funds transferred to the T&MD portfolio from the SBC III portfolios¹³⁵, consistent with NYSERDA's March 30, 2012 Petition. Therefore, program administration costs related to these funds will be covered using T&MD portfolio administration funding provided for in the October 24, 2011 Order.

The Program Administration budget covers program administration activities through 2016 only, but does not include program administration costs beyond this date. This approach is consistent with prior practices for the System Benefits Charge program portfolio (SBC I through SBC III). NYSERDA will make every effort to manage the program conservatively within the administrative funding provided. Should this administrative funding level appear to be inadequate to properly oversee the T&MD investments and deliver maximum value to ratepayers, NYSERDA may request reconsideration of this administrative funding by the Commission.

11.6 NYS Cost Recovery Fee

In addition to program administration costs, NYSERDA is assessed an annual charge by the State for central governmental services under Section 2975 of the Public Authorities Law. This fee is allocated across all NYSERDA programs in proportion to each program's total expenses. For fiscal year 2011-12, NYSERDA's total assessment was \$10.74 million, representing approximately 2.7% of total expenses. NYSERDA's assessment for fiscal year 2012-13 increased to \$11.64 million. Prior to the issuance of the October 2011 Order, NYSERDA estimated that the future annual CRF assessments would remain at its then current level of approximately \$10.7 million. Therefore, NYSERDA estimated that the allocable share of annual assessments over the expected periods for the expenditure of the initially-funded T&MD Portfolio would total \$6,975,381, or about 1.7% of total funding (\$410,316,530). This was the amount of CRF funding provided in the October 2011 Order.

Subsequently, the PSC's September 13, 2012 and December 17, 2012 Orders authorized additional program funds to be transferred to the T&MD portfolio with only \$610,563 of CRF funding available to be transferred. NYSERDA estimates the additional allocable CRF expense related to the \$99,760,672 of reallocated program funding to be approximately \$1,725,261, which

¹³⁴ Program administration costs include salary and fringe benefit costs for NYSERDA staff involved in managing programs, allocable salary and fringe benefit costs for administrative support staff, direct program management expenses (travel and other costs), and allocable administrative, facility and equipment expenses.

¹³⁵ The December 17, 2012 Order (Appendix 2) provided a revised budget for the T&MD portfolio of \$527,269,251, but this included \$3,793,651 in additional funding for Program Administration and NYS Cost Recovery Fees that were not included in NYSERDA's Petition for transfer from the SBC III and EEPS portfolios, and furthermore are not funds available for transfer. These inconsistencies are expected to be resolved through further discussion with DPS staff.

is not included in the Budget Table 7-1. To the extent that future annual assessments change, or the program's relative share changes, NYSERDA will seek an adjustment through a subsequent Petition. Similar adjustments in other portfolios have historically been funded from uncommitted interest earnings.

APPENDICES

Appendix A

LIST OF STAKEHOLDERS

ACE Energy
Adirondack Alternative Energy
Adirondack Council
Adirondack Research Consortium
AERTC- Stony Brook
Albanese Organization
Alliance for Clean Energy NY
Alteris
AM&T
Anello Tech
Antek Inc
Applied Biorefinery Sciences
Applied Resources, Inc.
Association for Energy Affordability
Association of Energy Engineers
Audubon NY
AWR Energy
AWS TruePower
Ballston Spa Central Schools
BESS Technologies
BOMA NY Energy Committee
Braemar Energy Ventures
Brookhaven National Lab
Business Council of New York State, Inc.
Cattaraugus Community Action
CB Insights
CDH Energy
Center for Economic Growth
Central Hudson Gas & Electric Corp.
Ceres Power Limited
CG Power
CHA Companies
Citizens Campaign for the Environment
City of New York
Clarkson University
Clear Channel
Clearpoint Ventures
College of Nanoscience and Engineering
Columbia Tech Transfer
Columbia University
Community Power Network of NYS
Competitive Shared Services
Conservation Services Group
Consolidated Edison of NY
Consolidated Edison Solutions, Inc
Constellation Energy
Consumer Power Advocates
Cook + Fox
Coolcentric
Cooper Hill
Corning
Couch White, LLP
CUNY BPL
Cushman and Wakefield
David Homebuilders
Demand Response Partners
Dept. of Environmental Protection City of New York
Directed Energy
Distributed Wind Generation Society
Dresser-Rand CHP Solutions
Earth Justice
Earth Kind Energy
Ecological
Eco-Technology Group
Ecovative Design
ECR international, Inc.
E-Cubed, LLC
EET
Efficiency First Advocates

Emerald Technologies
Empire State Development
Endicott Interconnect
Endurant Energy LLC
Energy Concepts Engineering, PC
Energy Curtailment Specialists
Energy Masters
Energy Materials Corporation
Energy Spectrum Development
Enernoc
Environmental Advocates of NY
Environmental Defense
Environmental Energy Alliance of NY
Excell Partners
EYP Power
Farm Bureau of New York
Fisher Brothers
Glenwood
Global Change Associates
Gotham Property
Green Light
Grubb and Ellis
Haledyne, Inc.
Heslin, Rothenberg, Farley & Mesiti
Hess Corporation
High Peaks
Hines
Hinman Straub
HRA Advisors
HTR, EIR
Hudson Valley Clean Energy
Huen Energy Solutions
Hughes
HV Center for Innovation
IBM
Intel Corporation
Intelligen Power Systems LLC.
Jordan Energy & Food Enterprises
King and King Architects
Kraft Power Systems LLC
LakeMaster Corp (CEI)
LIPA
Lockheed Martin

M.J. Beck
Magnolia Star
Malkin Holdings
Marathon Energy, LLC.
Mentor Business Group
Moinian Group
MTECH Laboratories
Multiple Intervenors
National Association of Energy Service
Companies
National Fuel Gas
National Grid
Natural Resources Defense Council
Nature Conservancy of NY
New York Biomass Energy Alliance
New York Building Congress
New York Energy Consumers Council, Inc.
New York Power Authority
New York Solar Energy Industry Association
New York State Community Action Association
New York State Smart Grid Consortium
Newworld Capital Group
Nexeon Energy Solutions
Northeast Clean Heat and Power Initiative
Northeast Combined Heat and Power Initiative
Northeast Natural Homes, Inc.
NY Angels
NY Chapter of Association of Energy Engineers
NY League of Conservation Voters
NYC Environmental Justice Alliance
NYC Tech Connect
NYS Attorney General's Office
NYS Consumer Protection Board
NYS Department of Environmental Conservation
NYS Department of Health
NYS Department of Labor
NYS Department of State
NYS Department of Transportation
NYS Department of Public Service
NYS Homes and Community Renewal
NYS Office for the Aging
NYS Office of Temporary and Disability
Assistance

NYS Smart Grid Cons
NYS Weatherization Directors Association
NYSEG/ RG&E
NYSTAR
NYU- Poly
Onondaga Community College
Orange and Rockland Utilities
Pace Energy and Climate Center
Partnership for New York City
Performance Systems Developments
Peter Young Associates
Plummer Associates LLC
Public Utility Law Project
Real Estate Board of New York
Renewable Energy Long Island
Reuste - Mentor Business Group
Revolution Energy, LLC.
RIT Clean Energy Incubator
RIT Venture Creations
RIT Center for Integrated Manf. Studies
RIT Office of Research
RIT Pollution Prevention Institute
RPI
RREEF Property Management
SL Green
Solar Alliance
Solar One
State University of NY Stonybrook
Summerhill Biomass Systems
Sun Edison
SuperPower - Hiniman Straub
SweetWater Energy
Syracuse Center of Excellence
Tecogen Inc.
The Altamont Program, Inc.
The Center for Industrial Effectiveness
The LeFrak Organization
The Related Companies
The Tech Garden
ThinkEco
Tishman Speyer
TSEC
Ulster County BOCES

United Way of Orange County
UPROSE
Urban Green Council
US Clean Heat and Power Association
US Geological Survey/National Atmospheric
Deposition Assessment Program
USDA Rural Development
UTC Power
VHB Engineering
Viridityenergy
Vnomics
Vornado Realty
Vote Solar
WDI- Workforce Development Institute
WE Act
Whisper Tech Limited
Wind Products

Appendix B

Schedule of Outreach meetings

Technology and Market Development Schedule of Stakeholder Outreach Meetings	
January, 2011	Environmental Organizations
	Con Edison
February, 2011	New York City agencies
	NYC Commercial Real Estate interests
	Business Council of New York State, Inc.
	New York State Smart Grid Consortium
	Clean Energy interests
	Northeast Combined Heat and Power Collaborative
	Demand Response Providers
	Low-Income interests
	Environmental Justice groups
	Rochester Institute of Technology (Incubator) and Western New York companies
	Syracuse University Tech Garden (Incubator), Center of Excellence, and Central New York companies
	Center for Nanotech Science and Engineering (Incubator) and Capital District companies
	New York University Poly (Incubator) and New York City companies
March, 2011	National Grid
	Battery Energy Storage Technology Consortium
	Energy Product and Service providers
	Multiple Intervenors
	Armonk Group
	New York Energy Regional Innovation Cluster
	TECHNICAL CONFERENCE -- Albany, New York
April, 2011	State Agencies and Authorities

Appendix C

15 by 15 SBC Wedge Analysis

As of December 2010, NYSERDA had exceeded the 2010 electricity savings assigned to the SBC3 “wedge.” The original NYSERDA contribution from the SBC3 to the 15 by15 wedge, estimated in the June 23, 2008 Order, was 1,413,500 cumulative MWh for the year 2010. Based on actual performance results cited in the March 2011 SBC Programs Evaluation and Status Report, NYSERDA’s SBC3 programs saved 1,627,900 cumulative MWh in 2010, exceeding the 2010 wedge estimate by 214,400 MWh.

In addition, NYSERDA is managing a number of programs that were not considered in the 15 by 15 wedge analysis, including those funded by the American Recovery and Reinvestment Act (ARRA) and Regional Greenhouse Gas Initiative (RGGI). The ARRA programs contributed 4,500 MWh in 2010 and are expected to contribute an additional 76,000 MWh/yr of energy savings to the 15 by 15 goal, by the end of 2012. The RGGI programs saved over 8,000 cumulative annual MWh as of the end of 2010.

Evaluation studies have not yet been completed for the ARRA and RGGI savings. These programs will be evaluated to the same “90:10” standard as the EEPS programs. In addition, ongoing SBC3 evaluation studies may produce final savings values that vary from these reported values due to adjustments to net-to-gross factors and corrections for program overlap.

Appendix D

Evaluation of Workforce Development Initiative

The Workforce Development Program evaluation will rely on an adapted Kirkpatrick four-level framework for evaluating training programs which emphasizes:¹³⁶

1. **Reaction:** Response of the trainee to the training
2. **Learning:** Degree to which trainees acquire the intended knowledge, skills, attitudes, etc. based on their participation in the training event
3. **Behavior:** Performance in the workplace that can be attributed to training
4. **Results:** Degree to which targeted outcomes occur as a result of training and subsequent reinforcement, i.e., effects of training on the workplace

The most recent evaluation of the EEPS-funded WFD Program, completed in 2012, mainly focused on the first two Kirkpatrick levels. While the planned evaluation will continue addressing the first two levels, assuming access to trainees and employers¹³⁷, it will also add greater emphasis on levels three and four in order to assess the impacts of training on trainee performance in the workplace, and on how training affects the workplace.

Table D-1 provides more information on potential research questions and evaluation approaches for the WFD Program.

¹³⁶ Adapted from *Kirkpatrick Four Levels: A Fresh Look after 50 Years 1959-2009*, (2009). Available at: [Kirkpatrick Partners Website](#).

¹³⁷ Inclusion of the pre/post surveys in all WFD funded programs is now a contract requirement, so unbiased population is anticipated, but not assured, as completion of the surveys by trainees is voluntary.

Table D-1. WFD Evaluation Questions and Approaches

Key Evaluation Questions	Proposed Evaluation Approach
Trainee Research	
<ul style="list-style-type: none"> • What is the trainee’s response to the training? Did course meet trainee needs/goals? • What has the trainee learned during training and the impact of training on student skill level and certification? • Trainee workplace performance experience and changes attributed to training? • Impact of training on employment status (e.g., how well did training prepare students for employment)? • Has training/certification led to advancement, change in responsibilities, or wages in current job or a new job? • For Career Pathways (CP) trainees, how have employees (formerly unemployed) used new skills to connect with current employment? • For CP trainees, has training led to higher levels of training aimed toward certification? 	<p>Pre/post-training surveys of trainees</p> <p>Follow up telephone surveys of trainees</p> <p>Analysis of program data on training completed and certifications obtained</p>
Employer Research	
<ul style="list-style-type: none"> • What is the perceived value of training and certification to employers? • Are there areas of continuing demand for technical training to meet employer needs? If so, what are those areas? • Are there areas of growing need for additional technical training to meet hiring needs? If so, what are they? • What is the impact of training/certification on trainee employment retention/promotion? • Has employee training or certification resulted in business expansion for employers? • Have employers noted improved worker performance as a result of trained/certified workers? • Have employers hired additional employees as a result of WFD sponsored training/certification? 	<p>Telephone survey of employers</p> <p>Possible telephone survey of similar employers who have not had any employees partaking in WFD training</p>
Training Partner (TP) Research	
<ul style="list-style-type: none"> • How well have TPs developed and leveraged connections with important partners (e.g., DOL one stops, workforce investment boards, community and four-year colleges, employers) and how has this affected employment outcomes or facilitated the movement of trainees toward higher levels of training and eventual certification? • Are on-the-job training programs and apprenticeships in place and are they adding value to training programs and helping to provide a more direct connection to employment? 	<p>Surveys or in-depth-interviews with training organization representatives</p> <p>Analysis of program data from training organizations to identify referrals to next-level employment or training</p>
Quality of Installations	
<ul style="list-style-type: none"> • How do certified/trained technician installations/jobs compare to those conducted by uncertified/trained technicians in terms of installation practices and, subsequently, performance? • How do certified/trained technician jobs compare to installations/jobs conducted by uncertified/trained technicians in terms of customers’ perceptions of the quality of installations and ultimate satisfaction? • Do installations/jobs conducted by trained/certified technicians experience less call backs when compared to those conducted by non-trained/certified technicians? 	<p>Surveys with customers who completed jobs with trained/certified technicians as well as surveys with customers who completed jobs with technicians not participating in WFD training¹³⁸</p> <p>Possible site visits to compare installations completed by certified/trained employers vs. non-participating employers/ employees.</p> <p>Possible analysis of NYSERDA program QA/QC</p>

¹³⁸ This plan assumes that evaluators will be able to obtain access to a valid population and sufficient sample of non-participating technicians’ jobs to compare to the participating/certified technicians’ jobs. This portion of the plan will require further research as to population and sampling options and their validity. This research will be undertaken by evaluation contractors and options will be outlined in evaluation plans provided to DPS for review and input.

NYSERDA, a public benefit corporation, offers objective information and analysis, innovative programs, technical expertise and funding to help New Yorkers increase energy efficiency, save money, use renewable energy, and reduce their reliance on fossil fuels. NYSERDA professionals work to protect our environment and create clean-energy jobs. NYSERDA has been developing partnerships to advance innovative energy solutions in New York since 1975.

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State of New York
Andrew M. Cuomo, Governor

Technology and Market Development Program Operating Plan for 2012–2016

System Benefits Charge
As submitted December 22, 2011
Revised November 13, 2012
Revised February 15, 2013

New York State Energy Research and Development Authority
Francis J. Murray, Jr., President and CEO