THE NEW YORK STATE ENERGY RESEARCH AND DEVELOPMENT AUTHORITY

Technology and Market Development Portfolio

System Benefits Charge

Briefing Paper

March 18, 2011

DRAFT—FOR DISCUSSION

nyserda
Energy. Innovation. Solutions.

Technology and Market Development

Overview

Purpose of the Briefing Paper

This briefing paper presents an overview of the initiatives that the New York State Energy Research and Development Authority (NYSERDA) is considering including in its proposal to the Public Service Commission for the next phase of the System Benefits Charge (SBC) program, from 2012 through 2016. This paper builds on the concepts articulated in the document entitled System Benefits Charge in New York: A Vision for the Future (Vision Statement), taking into account the guidance provided by the Public Service Commission (PSC) in its December 30, 2011 Order In the Matter of the System Benefits Charge IV, and extensive input provided to date by hundreds of organizations, stakeholders, and individuals.

NYSERDA intends to use this briefing paper as a basis for further discussion on how future SBC funds could be invested to address New York's energy challenges and support New York's ambitious energy goals. NYSERDA will use that input to frame its Operating Plan for the Technology and Market Development Program that will be submitted to the PSC by May 1, 2011, for their consideration.

As noted in the Vision Statement, the consideration of the re-authorization of SBC is occurring at a pivotal time and provides enormous opportunities for New York State. The proposed initiatives will lead New York to capitalize on its unique assets to achieve a vibrant, clean-energy economy. The next phase of the SBC can make long-lasting and significant contributions to New York's energy and economic future by addressing challenges and catalyzing innovation.

Background

The SBC program was started in 1998 when the utility industry was being deregulated. The PSC recognized that, in a competitive energy industry, certain critical public benefit programs would no longer be supported by utility companies. The PSC established the SBC and designated NYSERDA as the Administrator of the SBC public benefit program. 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.

The SBC has historically supported energy efficiency, load management, low-income programs, and energy R&D. The benefits of the SBC program have been proven to be more than double the cost of the programs.[1] For the period from 2006 through 2011, program funding for the SBC was approximately $160 million per year, of which approximately half has focused on energy efficiency resource acquisition/deployment activities, and half on technology and market development activities.

On September 20, 2010, NYSERDA submitted a petition requesting approval of a proposal for the continuation, with modifications, of programs funded through the System Benefits Charge that is paid by utility ratepayers. The Vision Statement laid out a transition strategy for certain deployment programs to be consolidated and moved to the Energy Efficiency Portfolio Standard (EEPS), and proposed a separate Technology and Market Development Program. The Commission issued a Notice of Proposed Rulemaking on October 6, 2010 (Case 10-M-0457), and asked for comments 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 Technology and Market Development Program.

1. 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.

Overview

The PSC issued the 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 Order continued SBC funding through the end of 2011, but deferred a decision concerning funding for NYSERDA's proposed Technology and Market Development Program, pending a more robust stakeholder input process and submission of an Operating Plan.

Per the Commission's Order, for each proposed initiative, the Operating Plan will need to address: (i) the problem to be targeted, (ii) why existing R&D initiatives are not adequate, (iii) why New York ratepayers should be making the proposed financial commitments, (iv) expected benefit to New York in terms of increased safety and/or reliability, and 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, (vii) expected link between projects and meeting the Commission's clean energy goals, (viii) project evaluation criteria that demonstrate that recipients will stand on their own prior to the end of the 5-yr SBC term.

Stakeholder Outreach

The PSC Order requires NYSERDA to engage in an intensive outreach process and to put in place a process to systematically reach out in advance of its submission of the Operating Plan to stakeholders with particular interests, expertise or resources in specific program areas. NYSERDA's outreach process has accomplished the following:

- Twenty two (22) outreach meetings have been conducted representing a diverse group of stakeholders. Approximately 250 organizations have participated. At these meetings, NYSERDA received input on its initial ideas for the T&MD program objectives, priority criteria, and proposed portfolio.
- A dedicated webpage was posted on NYSERDA's website (www.nyserda.org/SBC4). Approximately 500 people have been added to an email listserve to receive periodic updates.
- A Technical Conference, open to the public, is being conducted (March 22, 2011). The Conference takes 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 is being webcast. NYSERDA staff will discuss the stakeholder feedback received to date and the preliminary program framework and engage the attendees in a dialogue about the future uses of the SBC funds. Stakeholders are encouraged to submit follow-up comments to NYSERDA through March 31, 2011.
- NYSERDA is conferring with federal agencies, national organizations, and other states and utilities that represent "best practices" in the energy arena.

Stakeholders and interested parties will have the opportunity to comment on the T&MD Operating Plan subsequent to NYSERDA's filing with the PSC on May 1, 2011. The Operating Plan will be noticed for initial and reply comments.

Stakeholder input and feedback will continue to be an important element of the implementation of the T&MD Program going forward.

Mission, Objectives, Priorities

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.

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

- Prove out emerging energy efficiency, renewable, and smart grid technologies/strategies and accelerate market readiness in NY.
- Move new/under-utilized technologies and services into marketplace to help achieve EEPS & Renewable Portfolio Standard goals.

- 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 proposed T&MD portfolio, NYSERDA is considering a number of factors and inputs, including the following: the major challenges to utility systems & ratepayers, technical and market opportunities and barriers to clean energy, areas where benefits to New York State could be great, experience in running the current SBC program, and input from ongoing interaction with market participants, stakeholder and DPS staff.

Criteria for prioritizing the T&MD program budget include the following:

Potential benefit to New York, over the near and long term, including

- increased reliability and/or safety;
- an improved environment;
- wholesale price suppression and mitigation of increases in delivery costs;
- reduction in energy cost to consumer;
- diversification of energy resources; and
- economic development and jobs.

- Level of resources needed to execute programs and make measurable progress on the objectives identified above.
- Availability of other sources of funding to address the problem/opportunity.
- Overall portfolio balance (sector, risk).

More detailed criteria for making specific project investments will be specified in the individual program solicitations. These criteria will be reviewed by DPS staff, external experts, and NYSERDA staff as part of our technical evaluation and competitive solicitation process.

Proposed Scope & Funding

NYSERDA is considering a portfolio of nine initiatives to address the T&MD mission. These programs fall in three major categories:

- Power Supply & Delivery
- Residential, Commercial and Industrial
- Clean Energy Infrastructure

Figure 1 identifies the programs and illustrates the objectives that will be pursued in each program. The attached program briefs identify the specific problem to be targeted, the preliminary strategies under consideration, potential benefits, and estimates of funding needed to address the problem. The program briefs also identify a number of outstanding issues for discussion and consideration.

NYSERDA estimates that approximately $79 to $105 million in program funds would be needed to address the nine target areas. These are *preliminary* estimates and will be refined as the program details are further resolved prior to submission of the proposal to the Public Service Commission. NYSERDA is keenly aware of the need to avoid increases in ratepayer charges for its combined SBC & EEPS programs. We will be looking for opportunities to balance and optimize across our SBC & EEPS portfolio to best address the Commission's clean energy goals and maximize benefits to New York ratepayers.

Overview

Figure 1. Linkage Between T&MD Objectives and Proposed Initiatives

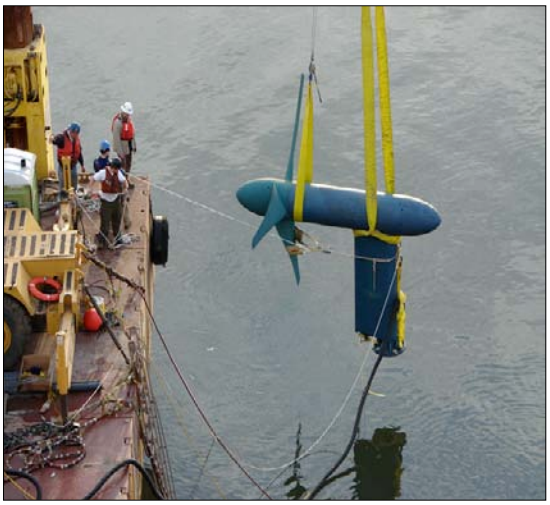
Technology & Market Development Objectives / ***Technology & Market Development Initiatives***	*Prove out emerging energy efficiency, renewable and smart grid technologies / strategies and accelerate market readiness in NY.*	*Move new/under-utilized technologies and services into marketplace to help achieve EEPS & RPS goals.*	*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.*
POWER SUPPLY & DELIVERY INITIATIVES				
Advanced Clean Power Generation	X	X	X	
Smart Grid and Electric Vehicle Infrastructure	X	X	X	
RESIDENTIAL, COMMERCIAL & INDUSTRIAL INITIATIVES				
Advanced Buildings	X	X	X	
Industrial Process & Information Technology		X	X	
Whole-Building Lower-Income		X		
Advanced Codes		X		X
CLEAN ENERGY INFRASTRUCTURE INITIATIVES				
Market Development		X		X
Clean Energy Business Development	X		X	
Environmental Monitoring, Evaluation and Protection (EMEP)				X

Power Supply and Delivery Initiatives

- Advanced Clean Power
- Smart Grid and Electric Vehicles Infrastructure

Advanced Clean Power

Targeted Problem



To address the combined threats of global warming and dependency on volatile fossil fuel markets, developing a pipeline of continuously-improving renewable resources and other clean and efficient energy options is essential and will require continued investment in technology and marketplace advancement. Improvements in the performance of renewable resources, the development and testing of power conversion systems and materials, and the development of technology that fosters integration with power systems and customer loads, offer opportunities to fully exploit the value of clean resources, improve grid utilization and lower energy costs.

Analysis of the performance of the national fleet of large wind turbines indicates that incremental improvement in turbine performance on the order of 3-8% annually may be achievable. These improvements and, ultimately, significant savings, can be achieved through investment in efforts such as development of performance-enhancing software and research on advanced turbine blade geometries. Similarly, technological advances in PV efficiency, hydro-kinetic and waste heat power generation can facilitate generation within load pockets. Fuel cell technology emerging from the auto industry could provide the cleanest possible fossil fuel generation in environmentally sensitive urban locations.

While the technologies and infrastructure needed to harvest the energy abundant in marine environments are not mature, New York could play a pivotal role in developing marine-based resources by exploiting its centralized location and existing port and transportation capacities, and using existing research laboratories and universities. All of these technologies have the potential to provide economic growth benefits while delivering clean energy directly to New York City, the State's largest load center.

Expanded customer acceptance and adoption of combined heat and power (CHP) can minimize costly investment in new electric central generation and distribution capacity needed for load growth. This can be particularly valuable in loan constrained urban areas. Utilization and integration of all sizes of CHP in the marketplace can be advanced. Medium to large scale CHP can provide much energy, environmental and economic benefit and be used to advance approaches to district energy systems to optimize the New York State power production and energy use portfolio. Custom-built CHP is the norm for large-scale projects but not cost-competitive for smaller-scale projects. In the one megawatt and smaller size range, several pre-engineered CHP systems are available on the market and more are in development, largely due to DOE's significant investment and work with manufacturers to get individual components matched into overall systems. These packaged systems span all types of prime movers, including: induction engines, inverter engines, synchronous engines, and micro-turbines. Continued support is needed to advance CHP in the market.

Preliminary Strategies

The Advanced Clean Power Generation program could focus on three areas:

Clean Power Technology—This focus area could support emerging technologies from inception through field testing and pre-commercial deployment. A "stage-gate" process could be employed to fund projects in phases with each project required to successfully achieve certain milestones on the path from feasibility to commercial sales. NYSERDA funding that does not exceed 50% of development costs will ensure that a contractor has a significant stake in each project's success. Once a product has achieved all necessary certifications such as Underwriters' Laboratory approval, and offers a commercial warranty, continued support may be available through other means including NYSERDA's Clean Energy Business Development programs.

The product development cycle typically takes more than five years from inception to commercial sales. Developing products that make this transition is a fundamental goal of the clean power technology innovation effort. This program would build on the portfolio of collaborative renewable technology development projects established during the predecessor program (e.g., 10 wind, 13 solar, 6 hydroelectric, 27 fuel cell, 31 biomass, and waste heat recovery) that reaped 13 product commercialization successes.

***Resource Development*—**This focus area could develop an inventory of sites, renewable fuel supplies, and technologies that collectively can build the capacity to produce clean energy across several frontiers (e.g., offshore wind, bio-fuel, hydro). Considerable emphasis could be given to developing offshore wind energy in the later part of this decade, similar to the approach used for land-based wind development in the upstate region. This program would be designed to share risk and leverage funds from others – including the private-sector – associated with characterizing operating environments, developing sustainable fuel growth and management practices, conducting various site and resource-specific assessments (e.g., geophysical, meteorological, biological, energy production), assessing project engineering and economic viability, and conducting assessments associated with the manufacturing/supply chain and serviceability for kinetic hydro and offshore components. Funding could also support participation in federal and state stakeholder organizations and consortia to ensure proper program focus, and that New York-centric interests are considered.

***Combined Heat & Power and District Energy*—**There are two components of this focus area: (1) accelerated marketplace acceptance and adoption of high-performing *standardized,* pre-engineered/pre-packaged "plug-and-play" CHP systems; and (2) supporting performance-based installations of efficient, environmentally and economically-beneficial CHP and district energy systems.

- ***"Plug-and-play" CHP***—Activities could include: (1) demonstration of advanced packaged CHP systems via cost-sharing of projects that induce customers and vendors to embrace a catalog approach, and (2) support of other market development activities, including but not limited to: critical marketplace "barrier busting" activities, working with early adopters serving as test cases, retro-commissioning of projects, and conducting technology transfer efforts. The goal is to develop "appliance-like" CHP systems that can be covered by warrantee to ensure that the equipment is free from manufacturer defect and that each system component will work properly with all other components. This program is the next evolution of NYSERDA's CHP Demonstration Program that supported 97 projects to collectively provide 115 MW of new generation capacity and received a 2010 "States Stepping Forward Program Award" from The American Council for an Energy-Efficient Economy.
- ***CHP and District Energy Performance*—**This effort could fund installations of CHP using performance-based payments and explore integrating district energy systems. The program can initially focus on clean, efficient, cost-effective gas-fired CHP systems that provide ratepayer benefit, by requiring a 60% fuel conversion efficiency and including incentive reductions for non-performance. CHP and district energy systems are complex projects with long lead times. Project viability is affected by numerous external variables including the difference between electric and fuel prices ("spark spread"), 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 based on a performance-based design that can reliably deliver persistent energy, economic and environmental performance.

Benefits

The proposed Advanced Clean Power programs could significantly improve the performance of current technologies, support an expansion of the resource base, and lead to the development of advanced next generation technologies. The "commercialization pipeline" would flow through the term of this SBC program, accelerating the market readiness of new options and validating performance benefits with testing and demonstrations. These activities could confirm technical and economic readiness and ready the market for private sector investment and robust deployment. The proposed CHP program could accelerate market uptake by pushing markets to achieve improved levels of financial, efficiency and environmental performance. Customer-sited CHP systems are capable of providing both system and customer benefits including higher energy efficiency; permanent demand reduction; avoided line losses; deferred transmission and distribution upgrades; reliability and security; flexible energy scheduling; emergency shelter options; faster and easier siting than central station power plants; and improved system-wide environmental performance. These are particularly relevant to peak-load emissions, as higher efficiencies that reduce emissions and conserve limited fossil fuel resources contribute to the State's energy self-sufficiency.

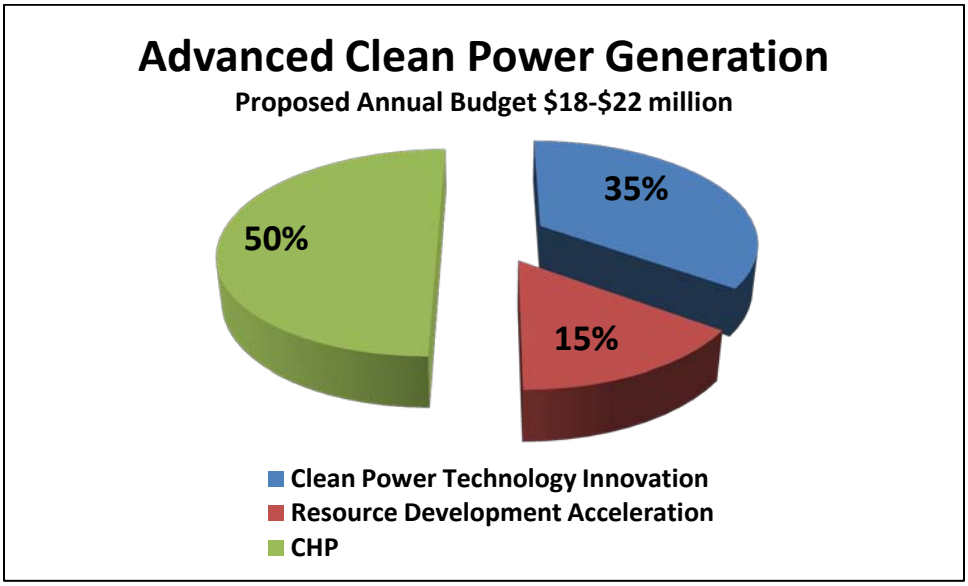
Long-term environmental benefits would accrue through the large-scale use of these advanced products and services and the development and demonstration of clean energy systems. Economic benefits would include leveraged investment into the State, creation of new businesses and products, sales and employment, and energy cost savings for host and user sites. Energy benefits would include peak load reduction, improved energy efficiency, improved reliability/power quality, reduction in the consumer's cost of clean energy, suppressed wholesale prices, and increased utilization of power system assets. The types of program outcomes anticipated include:

- Advances in electric storage at the distribution voltage level;
- Advanced material/components for PV cells;
- Design/application of advanced condition monitoring processes and intelligent diagnostics;
- Pre-screened/near shovel-ready project site areas and project configurations;
- Advances in airfoil technology that reduce dynamic loading/stress on turbine blades and increase efficiency;
- Demonstrated capacity to exploit available tidal/current and ocean energy;
- Increased market uptake of CHP with reduced costs and increased performance;
- Market advancement by improving and increasing installed resources of medium-to-large CHP and developing small-scale, and district-energy-related CHP; and
- Positioning for New York to have a prominent role in the development and manufacturing of marine-based technologies and energy storage devices.

Advanced Clean Power

Funding

$18-$22 million dollars in annual funding could support the Advanced Clean Power programs with 35% invested in the Clean Power Technology area, 15% in Resource Development and a combined 50% in Plug-and-Play and District Energy Performance CHP.



Issues to Consider

- What activities are needed in the marketplace to stimulate CHP?
- What role should the SBC T&MD program pursue for CHP?
- What magnitude of funding is needed for CHP?
- How might other potential funding sources (e.g., EEPS2, modified RPS) influence SBC T&MD activities for CHP?
- How should funding be allocated between resource/project development and technology demonstration/development?
- How can the T&MD program meaningfully catalyze the development of off-shore wind, given the scale of effort/resources that are likely necessary?

Smart Grid and Electric Vehicles Infrastructure

Targeted Problem

Systematic grid modernization offers an opportunity for improved asset utilization, improved efficiency and lower costs while lowering the carbon intensity of the electric-power sector. Grid modernization is essential to most economy-wide, low-carbon strategies, as electrification is likely to be a long-term requirement for reduced carbon intensity in the transportation, buildings and industrial sectors.

Electric vehicles are entering the market at an accelerating pace and every major vehicle manufacturer will have an electric Grid Powered Vehicle (GPV) model within the next year. Although the load growth will be gradual, the electric grid requires modernization to handle this new load and to support trends such as increased penetration of intermittent renewable power generation. Hundreds of millions of dollars of investment together with new regulations are required to enable the grid to evolve in an efficient manner that provides maximum benefit to all consumers..

Preliminary Strategies

The overriding goal of the Smart Grid and Electric Vehicle Infrastructure Program is to accelerate the market readiness of new and emerging smart grid and GPV infrastructure technologies and strategies resulting in cost effective performance, reliability and environmental improvement. Initiatives that could be undertaken include engineering studies, product development, demonstration projects and pilot programs that: 1) promote a diverse supply of low-carbon electric-power generation; 2) enhance transmission and distribution reliability, efficiency, control and interoperability; 3) enable end-users to reduce energy consumption and cost; and 4) support business models and rate structures that can facilitate a reasoned transition to a transportation sector primarily powered by electricity.

Program implementation would be through competitive solicitations issued by NYSERDA and 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;
- Prepare the grid for the upcoming increase in electric vehicle charging load;
- Qualify and validate the cost/ benefits of new products that improve power delivery reliability and efficiency;
- Provide statewide benefits through technology transfer studies, analysis and “lessons learned” from pilot programs and demonstrations;
- Develop and demonstrate innovations that improve grid reliability; and
- Demonstrate and validate the smart grid value proposition for end-use consumers.

Smart Grid and Electric Vehicles Infrastructure

Program priorities and overall program design would be informed by the New York State Smart Grid Consortium, with guidance and rulings ultimately provided by the Public Service Commission. In addition, the New York Battery and Energy Storage Technology Consortium (NY-BEST) would also provide input regarding the energy storage components of the program. Over the multi-year program specific areas of focus would evolve as smart grid and electric vehicle technology develop and as public policy and consumer preferences change. By the end of the five-year SBC funding cycle, the program could support the following activities:

- Establishing uniform, statewide diagnostics to assess T&D system reliability;
- Integrating advanced communication, control, and monitoring technologies, power electronics, and innovative T&D technologies;
- Deploying and validating the value of remote sensing devices for continuous monitoring of T&D infrastructure with real-time monitoring of real and reactive power;
- Facilitating the delivery of electricity from both large-scale and distributed renewable generation resources including wind and solar;
- Supporting enabling technologies such as energy storage, flow batteries, flywheels, stationary batteries and compressed air energy storage to reduce the intermittency of renewable resources;
- Demonstrating advanced distribution management systems;
- Demonstrating and validating technology and business models that minimize negative grid impacts from GPV charging;
- Documenting and disseminating lessons learned and best practices from smart grid programs worldwide;
- Research studies to evaluate new technologies, design methodologies, policies and other barriers to implementation of a New York smart grid; and
- Demonstrating and documenting the grid impact of various GPV infrastructure technical approaches and business scenarios.

Potential Benefits

The Smart Grid program could provide numerous near-term benefits including: development and use of grid visualization tools, advanced system modeling, and a communication infrastructure utilizing information gathered in real-time for improved grid use and reliability. These technologies will provide grid operators with the tools needed for system efficiency optimization (e.g.: phase balancing, VAR control and voltage conservation), modeling and advanced fault prediction and location. Such tools could reduce the likelihood of cascading outages. Other potential near-term benefits include standardizing communication protocols and device interoperability in order to maximize efficiency benefits from appliances, electric vehicles and other electric loads and facilitating seamless integration of renewable energy sources with the grid. The program will yield additional benefits by demonstrating how energy storage systems can promote greater market penetration of renewable resources and by improving the capability of advanced buildings to achieve deep reductions in energy demand and peak load.

Research into electric vehicles and batteries, consumer and vehicle load profiling, and smart charging and storage technologies at the distribution voltage level could provide information needed for decision making related to the timing of broad-scale investment into grid modernization. Research could also support planning to maximize the potential benefits of electric vehicle charging and storage including: improved grid load shape, asset utilization and reliability; ratepayer cost reductions; and reduced greenhouse gas emissions.

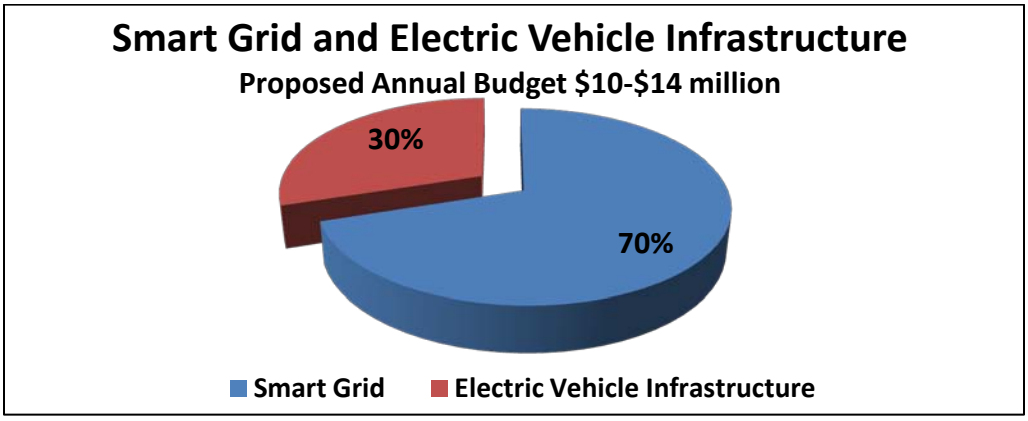
Smart Grid and Electric Vehicles Infrastructure

A successful smart grid and electric vehicle infrastructure program could yield the following additional benefits:

- *Lower energy prices*: A smart charging-smart grid can shift a significant new electric load to off-peak times when the grid transmission and distribution asset are underutilized. The generation of additional revenue from the same capital asset can lower the capital amortization and O&M cost per unit of electricity to all customers.
- *Improved grid performance-reliability*: Grid integration of energy storage can provide superior performance of frequency regulation and other ancillary services critical to grid reliability. Innovation in power system devices is expected to drive reductions in system losses approaching 10% for the power system while improving power factor.
- *Reduced environmental impact*: 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 electric transportation that will reduce greenhouse gases from the transportation sector, responsible for the single largest percentage of combustion generated CO2.
- *Opportunities for economic development*: To develop and demonstrate products, services and business models, NYSERDA will coordinate with New York businesses, incubators, universities and organizations such as NY-BEST and the New York State Smart Grid Consortium.
- *Contribution to Commission's Clean Energy Goals*: Achieving the Public Service Commission's Clean Energy goals requires integration of increasing quantities of intermittent renewable power with the grid and increased efficiencies in load management and performance. Smart-charging and grid-connected energy storage can enable the utilization of off-peak renewable power generation and load shifting. Development and demonstration of communication protocols and technologies enabling and empowering consumer energy management could also contribute to the achievement of New York's clean energy goals.

Funding

$10-$14 million in annual funding could support the Smart Grid and Electric Vehicle Infrastructure program, with approximately 70% invested in Smart Grid activities and 30% invested in electric vehicle infrastructure activities.



Smart Grid and Electric Vehicles Infrastructure

Issues to Consider

- What is the best approach & mechanism for obtaining and incorporating utility input?
- How do we best represent the "voice of the consumer" and identify projects that provide maximum value to rate-payers?
- What specific metrics should be measured to determine programmatic success?
- How do we ensure that program investments in one area don't negatively impact other areas?
- What is the best way to support a "systems approach" to program implementation?
- How can we improve the level of communication between all smart grid stakeholders?
- Utilities already invest significant amounts annually in their electric systems. How can this SBC program help make new utility investments "smart-grid ready"?
- Given the multiyear (perhaps even decadal year) efforts required to transform to a modern/smart grid, how can the success of individual investments within the 2012-2016 timeframe be best evaluated?

Residential, Commercial and Industrial Initiatives

- Advanced Building Technologies
- Industrial Process Innovation and IT Productivity
- Whole Building Lower-Income Initiative
- Advanced Energy Codes and Standards

Advanced Building Technologies

Targeted Problem

Buildings represent a large and dynamic portion of electricity requirements for New York. They are responsible for more than 62% of the State's total energy consumption and 50% of greenhouse gas emissions. Reducing energy intensity in buildings is necessary to realize the Public Service Commission's clean energy and smart grid policy goals and to deliver system efficiency and cost-savings to ratepayers. Buildings are long-lived assets that are relatively inflexible to, but dependent on, changing energy supply and delivery infrastructure conditions. Buildings are also a large source of the peak/off-peak swing that must be accommodated by supply, transmission and distribution systems. Costs during these excursions from steady-state operations are disproportionally high because of increased use of inefficient peaking units, transmission congestion, and the result of load pockets.

The building sector does not take full advantage of available technology that can reduce energy intensity, exploit renewable resources or utilize onsite power generation that make 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 impacts the timing and magnitude of Smart Grid investments. Increasing building load flexibility through expanded load management and DR resources would enable utilities, system operators and third party load curtailers to facilitate more efficient dispatch, but this would also require 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 to owners remain inadequate. Moreover, energy costs as a percentage of overall budgets remain relatively small and the cost of performance-enhancing technologies high. This gap is exacerbated by actual and perceived reliability, component compatibility, impact on end users' lifestyles and business practices, and uncertainty through the delivery chain associated with marketing, warranty, installer capabilities and post-installation support. Finally, the unfamiliarity and complexity of transactions associated with selling negative load to a supplier, and challenges of modeling energy savings cash flows to facilitate financing, are barriers that must be overcome.

Preliminary Strategies

The Advanced Buildings program proposes the following strategies to accelerate the market introduction of new and emerging high-performance building technologies and practices, and to develop new and improved building technologies and systems.

Emerging Technology/Accelerated Commercialization (ETAC)—Buildings. A new, systematic and deliberate approach to accelerate commercial introduction of emerging or underutilized building technologies and strategies can be constructed on lessons learned from program precedents including Bonneville Power Administration's Energy Efficiency Emerging Technologies (E3T) and California's Emerging Technologies Coordinating Council (ETCC). This initiative could serve as a "feeder" program to support EEPS and other clean energy programs. The initiative could be comprised of the following:

- ***Stakeholder Engagement*** —A systematic and formalized process based on stakeholder engagement could be developed to identify and rank promising technologies and strategies. In targeted market segments, stakeholders will regularly convene to discuss emergent and underutilized technologies and strategies. Stakeholders could 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. This process can identify stakeholder/market needs and emerging solutions, technologies ready for multi site demonstration, and efforts required to address various commercialization impediments. Similar efforts in other states have largely focused on feeding the pipeline for incentive based energy efficiency programs. In contrast, this program will also support promising technologies and strategies that can succeed without incentives and innovative approaches to nonfinancial barriers.
- ***Large-Scale Demonstrations and Market Acceleration***—Customized approaches to address market sector need and to accelerate the most promising technologies and practices will be developed. Activities could include coordination with existing R&D and deployment programs and utilities, and application of strategies such as targeted market research, large-scale demonstrations and integration into existing programs. Highly visible, large-scale reference projects could demonstrate opportunities, performance economics and impediments (e.g., savings validation, cost factors, regulatory obstacles). Candidate markets could include under-served building types (e.g. mixed use or low-rise multifamily), large commercial buildings, or residential developments. Coordination with other Emerging Technology/Accelerated Commercialization (ETAC) programs around the country could 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.
- ***Performance Economics and Knowledge Transfer***—A strategy to communicate the performance economics of emerging technology and practices could be implemented. Knowledge transfer could target a broad cadre of interested market actors and direct market actors (buyers and sellers) with specific interests in delivering the technology or service. Interested market actors could be involved via colloquia, webcasts and enhanced web access, and supported through market-ready project summaries, primers and case studies. General outreach and coordination can occur with other programs and providers including utilities, contractors, laboratories, innovators, universities, and developers. Key actors in the marketing chain can be identified through NYSERDA's existing networks, and efforts could be coordinated through existing workforce development activities.

Technology Development: To stimulate the development of new and improved technology and reduce the cost of clean energy technologies, NYSERDA can employ a rigorous stage gate process [discovery (scoping/analysis), business case, development, testing, and launch] for granting support for new product development from idea to commercialization. At each gateway between stages of the product development process, progress will be evaluated to determine if the effort should advance to the next stage. Use of the stage gate process can 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 discipline.

Technologies that the Advanced Buildings initiative could support include:

- Building envelope materials and systems that reduce thermal and infiltration losses in buildings;
- Discrete end use equipment including heating, air conditioning, lighting and other plug loads to reduce absolute loads;
- Compressor less and other air conditioning cycles that reduce summer peaking loads;
- Low- and self-powered heating systems that address ancillary electric loads (blowers, pumps) and improve reliability during outages;

- Lighting technologies based on solid state lighting that accelerate the integration of renewable energy: these may be directly powered by photovoltaic DC output;
- Daylighting systems leveraging the dimming capabilities of LEDs;
- Automation technology to enable load flexibility and smarter background operations;
- Integrated design practices emphasizing g deeper load reduction, energy recovery and onsite renewable energy harvesting and power production; and
- Informatics to present energy information to users in a convenient manner that simplifies management.

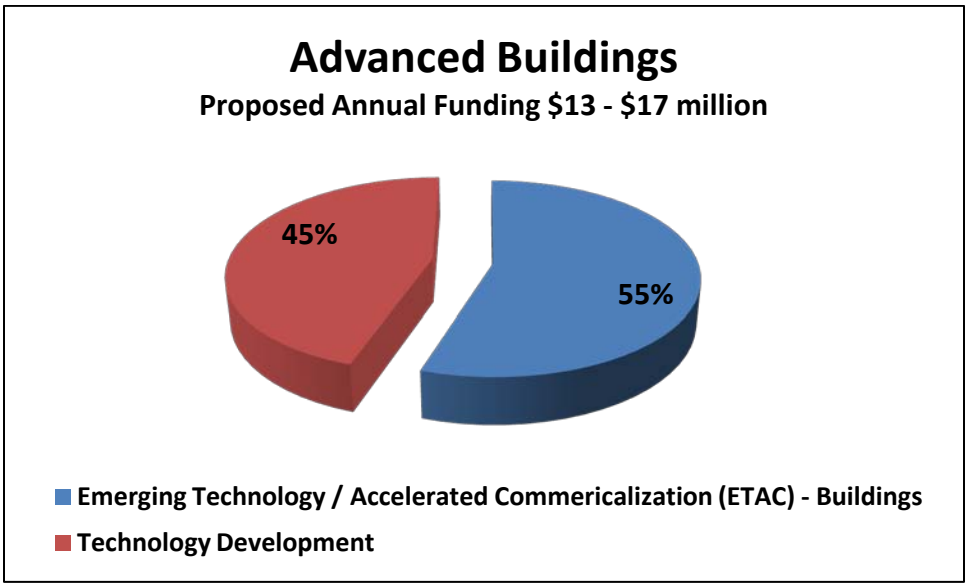
The above strategies could be pursued through creation of an Advanced Buildings Consortium charged with bringing critical players in the technology innovation and commercialization process—the developer, the end user, the financial community, the utility, and the service provider.

Potential Benefits

The program could accelerate adoption of new and underutilized building technologies that achieve load reduction and increase load flexibility through a combined technology innovation and market development strategy. Within the near-term, several new and existing underutilized product technologies could feed into EEPS programs or directly penetrate markets without incentives. Residential sector efforts could increase adoption of deep retrofit technologies and practices for existing homes and multi-family buildings, with a potential of reducing energy use up to 70%. In new construction, new technologies and demonstrations could enable market adoption of smarter and more energy efficient buildings that are potentially 50% better than Energy Star and could approach net zero when combined with the use of renewable energy. Enabling automated load flexibility and improvements to the energy performance of commercial buildings can optimize energy use, take advantage of time sensitive rates, and offer resources to increase the reliability of the utility system. Economic development and job creation can occur through the development and commercialization of new technologies and building upgrades. An infrastructure of contractors, installers, and maintenance personnel could be certified to deploy advanced buildings and ancillary technologies.

Funding

$13-$17 million of proposed annual funding can support the Advanced Buildings Initiative, with approximately 55% invested in emerging technology/accelerated commercialization and 45% dedicated to technology development.



Issues to Consider

- What strategies should be pursued within the advanced buildings feeder program to ensure that some wide-scale benefits can be realized prior to 2015?
- Should the TM&D program support a focused buildings research consortium to accelerate energy innovation in NYS? Will there be adequate funds/critical mass to launch an effective consortium within the TM&D program?
- Should the TM&D program provide financial incentives for load management and control technology to enable participation in DR programs or should the TM&D program focus on demonstrating & developing new DR-enabling technology?
- If the T&MD programs discontinue incentives for load management and DR, will this create a significant gap and/ or reduction in participation in NYISO or utility DR programs?

Industrial Process Innovation and IT Productivity

Targeted Problem

New York's industrial sector is a diverse, energy-intensive component of the State's economy. The industrial sector, can be slow to adopt commercially available energy efficiency technology and manufacturing processes.

Innovation to support the technology development activity associated with the growing demand for clean energy and development of new clean energy products can trigger improvements in specialized manufacturing techniques. Innovations in manufacturing is a core element of the "innovation economy," as noted in The Public Policy Institute of New York State, Inc.'s 2010 report, titled, *Transcending the Hamster Cage: Unfettering New York's Static Innovation Economy*, which recommends, "We should place an emphasis on financial and technical assistance to existing New York State manufacturing base *to implement advanced manufacturing technologies with an emphasis on helping them to grow through innovation* rather than spending money trying to attract out of state manufacturers to relocate here through large financial incentives" [emphasis added]. As the renewable energy industry strives to reduce cost and increase efficiency, innovations in manufacturing of clean energy system components are essential.

New York's information technology sector is another critical and growing component of our economy. New York has the second highest concentration of data centers in the nation. These centers consume 3% of New York State's electric energy, a usage projected by the EPA to double every three to five years. New York's IT sector includes stand-alone data centers and data closets within buildings that operate 24-hours a day. The centers' extremely large concentrations of load per square foot are comprised of significant cooling and data processing operations; data centers are a source of rapid base load growth for the entire electric grid and individual buildings.

Despite the industrial and IT sectors' sensitivity to power interruption and power quality issues, penetration of commercially available energy efficiency opportunities and adoption of improved manufacturing processes have had limited success. Penetration has been hindered by the sectors' business requirements, risk aversion and capital costs associated with equipment and process changes. Preliminary Strategies

The Industrial Process and Information Technology Initiative includes two components:

Manufacturing & Information Technology "Feeder" Component. This component could support market development for a select group of efficient emerging and/or underutilized technologies, and establish market conditions to increase compatibility with EEPS programs and/or direct market uptake without incentives. To develop critical mass with limited funding, feeder activities could focus on a few technologies selected through a rigorous vetting process. Examples of technologies meriting consideration are the following:

- Use of optical sensors linked to automation controls for electric-motor-driven mixing of ingredients in various manufacturing sectors such as food processing/chemical processing/cosmetics/pharmaceutical companies;
- Application of LEAN principles, commonly used in the manufacturing sector, to the IT sector to reduce computing waste. Areas of focus may address superfluous redundancy, zombie (unproductive) and underused servers, data duplication, dead applications, downtime, and overcooling.

Feeder activities could be custom-tailored to each technology selected through the vetting process. One concept under consideration is deployment of consulting engineers as "commissioning agents" on a batch of demonstration projects involving the selected technology. The consulting engineer following a project from start to finish can help reduce costs and schedule overruns while gaining in-depth knowledge applicable to other projects. Regularly scheduled roundtables involving all commissioning agents could facilitate sharing of lessons learned, culminating in the compilation of a "best practice" manual to guide the transition of the technology to EEPS programs or direct market uptake. Demonstration efforts, combined with this aggressive technology transfer component, could support the installation of energy efficient equipment at host sites while maximizing the potential for replication.

Clean Energy Manufacturing "Innovator" Component. This component could assist inventors and support technology development of new manufacturing methods and machine tools in order to enable the efficient mass production of clean energy technologies. The effort would address the manufacturability challenge that faces every new technology once proven successful at the "proof-of-concept" stage. Furthering the manufacturability of innovative products is an essential link in the Innovation Chain for moving the technology closer to market.

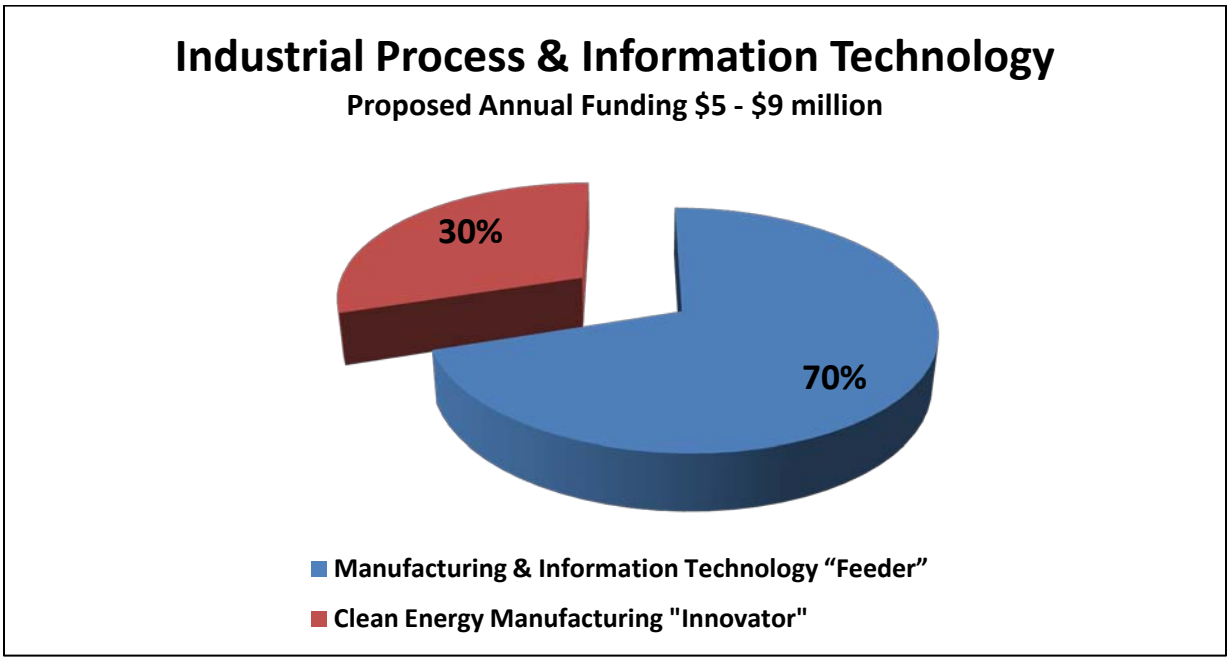
Benefits

In addition to host site benefits, the "Feeder" component provides a step to transition the technology to EEPS programs or direct market uptake and to facilitate deeper penetration of energy efficient equipment with concomitant reductions in energy use and demand. The Clean Energy Manufacturing Innovator component could leverage clean energy technologies developed throughout NYSERDA by enabling their efficient manufacture. This expansion of manufacturing could stimulate economic development and job creation and deliver two additional benefits that can accelerate marketplace uptake: the more efficient factory with improved productivity per unit of energy use, and the cost-effective clean energy product itself.

Industrial Process Innovation and IT Productivity

Funding

$5-$9 million in annual funding could support the Industrial Process and Information Technology Initiative, with 70% invested in the Manufacturing & Information Technology "Feeder" component, and 30% in the Clean Energy Manufacturing "Innovator" component.



Issues to Consider

- What is the right balance of EEPS vs. SBC initiatives for this sector?
- What technology transfer strategies can be used to maximize impact of industrial programs?
- How best to integrate "Feeder" program and large-scale deployment efforts?

Whole Building Lower-Income Initiative

Targeted Problem

Many of New York's lower-income residents live in inexpensively constructed and inadequately maintained housing, resulting in poor building performance and other energy-related health and safety issues. Approximately 30 percent of the State's households heat with fuels other than electricity or natural gas. On average, costs associated with space and water heating represent 54 percent of each household's total annual energy cost. The energy burden for the lower-income population is particularly severe. Efficiency programs targeted at reducing this energy cost burden must address measures that reduce the costs of space and water heating.

Additionally, households often use portable electric space heaters in place of, or to supplement, the primary heating source. Without the benefit of energy efficiency services targeting the primary heating fuel (oil or propane), lower-income households will continue to use supplementary appliances. The results are higher electric bills; potential health and safety issues associated with exposure to indoor, unvented kerosene heaters; and increased fire hazards.

Approximately 2.9 million households, representing approximately 35% of the population in New York, have incomes at or below 80 percent of the State Median Income (SMI). The federally-funded Weatherization Assistance Program (WAP) administered by New York State Housing and Community Renewal (HCR) targets low-income households at or below 60 percent of SMI. The American Recovery and Reinvestment Act provided one-time supplemental funding for WAP, but it is unlikely that this level of funding will continue. NYSERDA's lower-income initiatives have traditionally served households up to 80 percent of the SMI. The estimated 700,000 households with incomes between 60 percent and 80 percent SMI are vulnerable due to high energy burdens, coupled with limited publicly-funded programs available at this income threshold.

Funding for comprehensive, whole-building programs for the lower-income sector has been the purview of SBC. Through EEPS, incentives for lower-income households are limited to cost-effective electric and gas measures. EEPS' gas funding for affordable multifamily buildings is offered for firm gas customers only. Since larger buildings typically use #6 oil or dual fuel, firm gas customers represent only 2.3 percent of NYSERDA's historically-assisted multifamily buildings with more than 75 residential units. While NYSERDA has some Regional Greenhouse Gas Initiative proceeds for non-electric/non-firm gas measures, these funds are limited and the future funding source extremely volatile. Green Jobs – Green New York provides free comprehensive energy audits to lower-income households ineligible for WAP or EmPower New York and financing for installation of energy-saving measures, but does not cover any program incentives (for example, the cost of measures installed through EmPower New York℠ or the 50% cost-share by the program through Assisted Home Performance with ENERGY STAR®).

Preliminary Strategies

The SBC funds could be used to provide direct consumer incentives and to support a proportional share of implementation and quality assurance costs related to non-electric/non-firm-gas measures. To ensure whole building needs are addressed, the SBC funding stream could be fully integrated with the EEPS-funded energy efficiency programs targeting the lower-income sector (EmPower New York, Assisted Home Performance with ENERGY STAR®, New York ENERGY STAR HOMES®, and the Assisted Multifamily Performance Program).

A concerted effort to explore partnerships and cooperative strategies with the oil and propane industries to establish a new dedicated funding stream could be pursued. Discussions with oil industry representatives are ongoing and discussions with the propane industry are expected to follow. In the near term, however, SBC funds could fund the incentives. As collaborations with the oil and propane industry advance, the SBC incentives could leverage additional funds and ultimately be phased out.

Oil and propane vendors have not yet participated in large numbers in the Assisted Home Performance with ENERGY STAR® program. Most of the work conducted in oil and propane-heated households has been implemented by a few full-service vendors or contractors specializing in gas and oil-fired systems. Industry training curriculum and BPI certifications have focused primarily on gas-fired heating equipment. Workforce development activities through Green Jobs – Green New York currently support curriculum development for oil-fired systems and NYSERDA continues to work with BPI to ensure certifications address the requirements of oil-fired systems. Increased and expanded industry participation could be an important goal of the Initiative.

The Initiative could target specific underserved populations—including seniors and others on limited incomes—not reached by federally-funded weatherization services. Local community agencies and organizations could be tasked to deliver education on energy efficiency and energy use management. Home performance and business model seminars could be provided for oil vendors in collaboration with industry training activities, and, to encourage participation, and partnership incentives could be available to oil vendors and HVAC contractors. Funds could be used to provide consumer education materials specific to the oil industry structure and to encourage on-bill financing models meeting the needs of oil and propane customers.

Potential Benefits

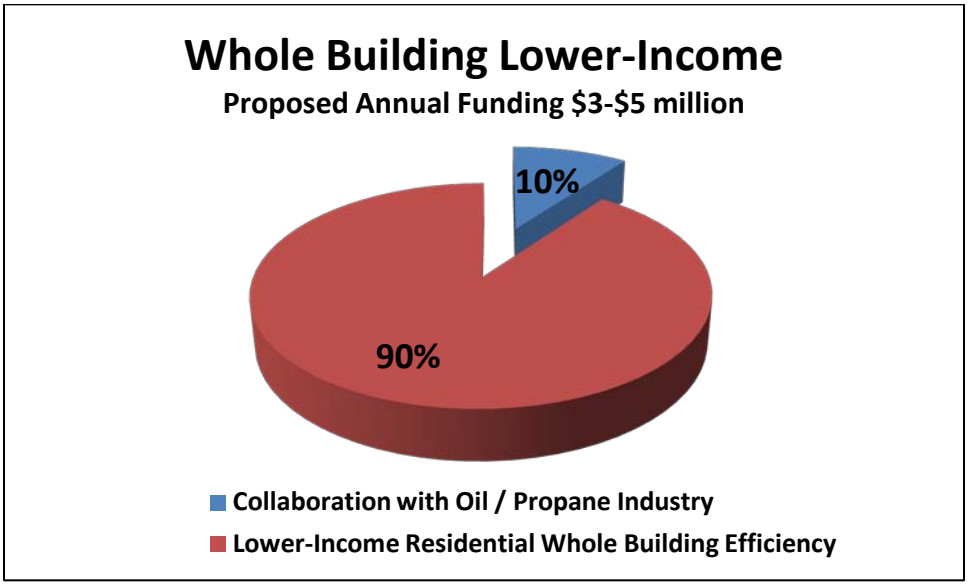
The proposed Whole Building Lower-Income Initiative could provide a comprehensive approach for these lower-income customers and fill critical gaps by targeting fuels not adequately addressed by other sources. In the near term, the Initiative could serve as last-resort funding to ensure that lower-income households and multifamily buildings participating in the EEPS programs receive comprehensive energy conservation measures that can maximize energy bill reductions. Approximately 36,000 households could be served.

Investment in whole-building residential energy efficiency reduces carbon site emissions and other pollutants in urban areas by assuring more efficient use of fossil fuels. Average bill savings for lower-income single family households achieved through the whole building approach can range from $600–$900 per year, as contrasted with savings of only $200 per year on average if only electric savings are achieved. Households receiving comprehensive services, and therefore greater bill savings, are better able to pay their household bills, including their energy bills. Installation of comprehensive heating measures eliminates the need for electric or kerosene space heating. Approximately $1.6 million in annual total bill savings is estimated for the 36,000 households which could be served through the proposed Whole Building Lower-Income Initiative. Collaboration with the oil and propane industries could lay the groundwork for a future funding stream that will help meet the State's aggressive clean energy goals.

Whole Building Lower-Income Initiative

Funding

Annual funding of $3-$5 million is proposed with the expectation that this amount can leverage other funds. While NYSERDA estimates the need to be much greater ($14 million per year based on projected participation rates), a more modest budget is proposed in recognition that these oil and propane measures would be funded from electric and gas ratepayers.



Issues to Consider

- This level of funding ($4-$5 million per year) may not be adequate to serve oil/propane heat customers based on typical participation rates of low-income households in NYSERDA programs. What is the societal impact of potentially reducing the number of households served with heating efficiency measures if funds to support non-electric/non-gas heat households are not identified?
- Is there a better or additional funding source for this work?
- Is there sufficient support for the development of oil and propane energy efficiency funds?
- How do we best coordinate services to the low income sector to reduce confusion and improve outreach?
- Are there specific research needs regarding the potential for energy savings related to oil and propane in the residential sector, and to characterize other aspects of benefits/issues of various programs targeting the low-income sector?

Advanced Energy Codes and Standards

Targeted Problem

Implementation of codes and standards is among the most cost-effective means to achieve energy and resultant emissions savings, but the opportunity is not being fully realized. There is a substantial energy savings gap between the targeted rate of code compliance, where 100% of the code requirements are met through project design and construction, and the actual rate of code compliance, i.e., the measurable performance of the completed building.[1] With aggressive requirements for increased energy performance in buildings anticipated over the next 5 years,[2] the gap between targeted and actual energy savings could be exacerbated by many barriers, including: lack of knowledge of the codes among the construction and enforcement community; lack of skills in reviewing building plans and specifications; unfamiliarity with the application of new technologies; poor building commissioning, operation and maintenance; and the slow translation of new concepts and greater stringency into design and construction practices.

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 25 products ripe for new standards or updates to existing federal standards. New York's involvement in standards development (through public rulemaking comments and letters to DOE on proposed federal standards and adoption of State Standards) has been essential to progress made and will continue to be essential to future progress. With the overall increase in appliance and equipment standards development activity, NYSERDA will not be able to participate in key appliance and equipment standards product areas without additional funding.

As a condition of receiving ARRA funding, New York agreed to implement a plan to achieve 90% compliance with the Energy Code by 2017. The plan is required to include active training and enforcement programs and annual measurement of the rate of compliance. While ARRA funds were used to initiate training and project support and compliance assessment efforts, there is no ongoing funding source available to meet ongoing DOE obligations or to build upon the progressive efforts developed under the ARRA program. There is also no ongoing funding source to achieve the very cost-effective energy and emission savings that an effective New York codes and standards initiative can deliver.

Preliminary Strategies

Four primary strategies are under consideration to advance codes and standards in New York. A Code Support Advisory Group could be established with representatives from the utilities, real estate, low-income housing, code enforcement, design and construction, historic preservation, and other communities to guide the development and application of these strategies. Additionally, NYSERDA would continue to work closely with DOS on implementing the Advanced Energy Codes & Standards Initiative.

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1. "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 possible, recent studies have identified 80%-90% compliance as more realistic.
2. The US Department of Energy's (DOE) goal is that building energy performance increase an additional 25% over the next 5 years.

Annual Statewide Compliance Assessments—NYSERDA could complete annual statewide compliance assessment studies—as required by ARRA—to track trends as codes and standards continue to increase in stringency. Using ARRA funds, NYSERDA has competitively selected a contractor to complete a comprehensive statewide baseline compliance study. This first baseline study will be completed in June 2011 and will identify areas of low compliance and energy savings gaps. Lessons learned through the initial study could be leveraged to design future assessments, which will in turn continue to inform future allocation of NYSERDA resources.

For appliance and equipment standards, retailers and vendors could be surveyed to assess conformance to selected state or federal product standards. Products with higher energy impacts and greater likelihood of non-compliance would receive the greatest focus in annual 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. Improving upon training efforts developed using ARRA funds, new or expanded training modules could be developed by competitively-selected contractors. The modules could focus on code requirements in the context of: building science and building systems; enforcement options, including third party personnel; beyond-code designs; lighting; renewables; advanced inspection; and green planning. Training could be a mix of in-person and on-line sessions of introductory to expert-level courses tailored for their intended audiences, and could include site-specific and hands-on training.

Educational tools that further support increased compliance with energy codes and standards could be developed by competitively selected contractors. These tools could help improve compliance and enforcement by improving access to energy-code related information and facilitating submission or review of compliance documentation. Examples include: updates to the (ARRA-funded) User's Guide to the Energy Code; Volume 2 of the (ARRA-funded) contractor's Field Guide to be targeted to mid-size residential and commercial buildings; an advanced Energy Code compliance support model; and an Auto-CAD-compatible library of energy-related construction details.

For appliance and equipment standards, NYSERDA could work to ensure that recent tools, including the online MultiState Compliance Database developed to certify products, are updated and New York-appropriate. NYSERDA participated in development of this tool using SBC funds.

Technical Support, Studies, and Resources—Technical consulting and market research firms could be competitively selected to provide support and the objective review necessary for considering codes and standards changes and to implement new codes and standards strategies. This could permit New York to more proactively respond to federal standard proposals and national energy code proposals. Potential topics of study include, but are not limited to: analyzing available products and costs to determine the economics of proposed code and equipment standards and other considerations associated with implementation; creation and assessment of a database of New York-specific building types and associated modeling to determine greatest opportunities for energy savings; and evaluation and development of policy strategies on topics such as full integration of renewable technologies or the impact of code-mandated commissioning requirements. Comprehensive evaluations of the cost-effectiveness of advanced codes that achieve 30% and 50% more energy savings than ASHRAE 90.1-2004, and a study demonstrating the State-required 10-year payback period of Energy Code enhancements, could also be undertaken. Products undergoing market research for codes and standards are different from those being researched for market development. For codes and standards, products are generally mature, whereas for market development, products are generally emerging.

To influence and assure the benefit to New York on national development of building code requirements, and appliance and equipment standards, NYSERDA and Department of State could participate in national and regional development efforts. Participation could include travel to events such as meetings and rulemakings, code development hearings, and codes and standards development workshops.

Pilots and Expanded Implementation Assistance— Several pilots designed to test new implementation and business models for appliance and equipment standards, improved code compliance, and stretch code efforts using green growth policies could be competitively selected. Pilots might include: approaches to reaching new markets; opportunities to increase the efficacy of energy-related efforts at local and State agencies; implementation strategies for adoption of stretch codes or standards; alternate approaches to local enforcement; integration of stretch codes and standards into green growth and local planning initiatives; and partnerships with municipalities designed to advance energy savings.

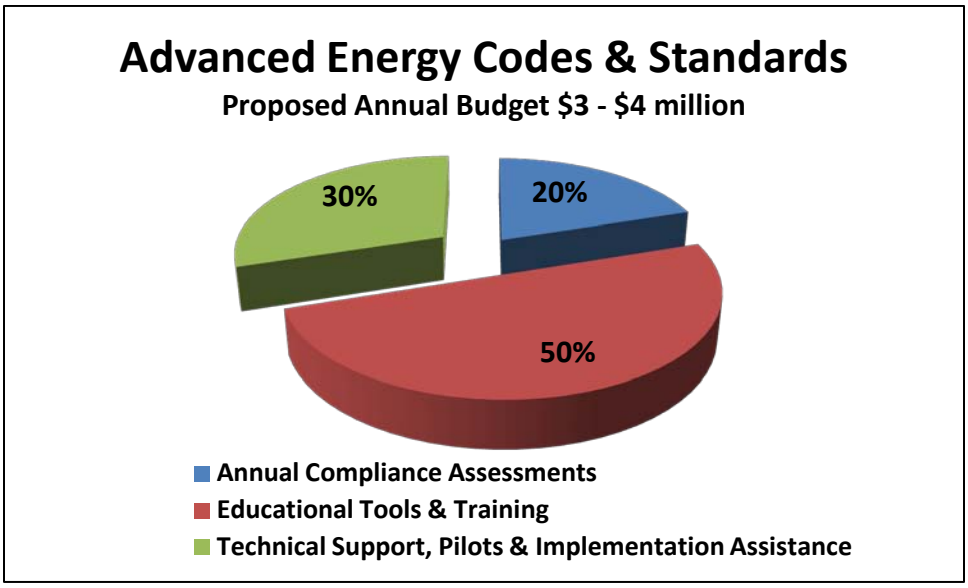
Potential Benefits

These preliminary Initiative activities could spur advances in energy codes and standards that would change the baseline for the entire marketplace, providing far broader savings than available through the incentive-based programs. These suggested activities also could increase compliance with codes and standards and deliver otherwise lost savings broadly across the market, including improving the savings being delivered through incentive programs. Proposed activities could be instrumental in cost-effectively achieving New York's "15 by 15" goal. Initiative activities could also test new codes, standards, and compliance strategies and use the lessons learned to prepare the market for future, widespread adoption.

In the near-term, these Initiative activities could improve and develop the strengths of all individuals involved with building enforcement and implementation; test new compliance and enforcement systems, and advance the marketplace via greater and appropriate use of energy-savings technologies and construction materials. Code compliance could be increased to the Federally-mandated 90% compliance rate; energy-saving approaches extended to more existing buildings; compatibility of energy-related improvements to building science and construction practices evaluated; and stretch codes better promoted for localities as a means to "push the envelope." Over the long-term these Initiative activities could ready the building marketplace for advances associated with future code enhancements, lead to the adoption of alternative compliance and enforcement systems, and improve the technical viability and durability of energy-related improvements.

Funding

Proposed annual funding to support the Advanced Codes and Standards opportunity is in the range of $3 to $4 million with approximately 50% invested in developing educational tools and providing training, 30% dedicated to technical support, pilots and implementation assistance, and 20% spent conducting annual statewide compliance assessments.



Issues to Consider

- What is the best balance amongst activities in this area?
- What is the best strategy for coordination with DOS and local entities?
- How can best practices be disseminated throughout NYS?
- How can we monitor and assess the energy impacts of this technical assistance?

Clean Energy Infrastructure Initiatives

- Market Development
- Clean Energy Business Development
- Environmental Monitoring, Evaluation and Protection

Market Development

Targeted Problem

Despite progress in increasing the efficiency of New York's buildings and processes, lasting improvements in energy consumption patterns require changes in consumer understanding and behavior towards energy. Individual device or project incentives do not ensure replication of choices in, or continued demand for, energy efficient products or construction practices. The supply chain is inconsistent in recognizing, adopting, and communicating the benefits of new cost-effective technologies and strategies that achieve greater energy efficiency. As a complement to EEPS and RPS, expanded supply chain capacity and information for energy consumers must be provided to understand the value, implications and benefits of purchasing and operational decisions.

High first cost, often cited as a barrier to implementation, is one of several impediments affecting the adoption of energy efficiency and distributed energy resources (DER). Many other factors–tenant/landlord agreements, sunk costs, complex retail and wholesale markets, energy price volatility, unfamiliarity with new technologies and strategies, perceived issues such as cash flows and investment risk–also challenge energy efficiency programs. Facilities, end users, contractors and suppliers face numerous institutional, attitudinal and behavioral barriers that also prevent widespread adoption of energy efficiency and DER improvements. Because midstream market suppliers may be unaware of the rapidly changing energy efficiency and DER markets, they are often reluctant to risk incorporating new strategies and technologies into their business models.

As new products and strategies become available through the accelerated commercialization efforts of NYSERDA and others, midmarket product and service suppliers and supply chain partners must be knowledgeable about appropriate use, operations and opportunities. Information on current and emerging products is fundamental to the competitive marketplace and for suppliers and partners offering customers education and cost-saving opportunities.

Technical advances and emerging fields require curriculum, third-party certifications, and professional development and degree programs via a broad training network. A steadfast commitment to training initiatives that brings new businesses to New York and retrains and hires unemployed workers can ensure that trained workers are ready and able to fill the emerging clean energy jobs. Ongoing collection and analysis of market intelligence data can ensure a stream of long-lasting clean energy benefits and advance EEPS and RPS program goals. Focused market research that identifies emerging opportunities can increase the efficiency and effectiveness of program implementation.

Preliminary Strategies

Market development initiatives prepare the supply chain for adoption of emerging technologies and strategies into business models; increase the number of qualified service providers; conduct market characterization, research, and data analysis to identify barriers, new technologies, and energy consumption patterns; and build demand through education, targeted outreach, and behavioral change. Accordingly, this initiative could be comprised of four components:

Market Pathways. Working across the supply chain and all sectors, this component can promote stocking, specification, installation, maintenance, and use of energy efficient and DER products and strategies. Primary factors affecting operations, business models, customer behavior, and the supply chain can be addressed, in addition to the study of opportunities and gaps in the financial markets. This includes identifying and communicating the value of integrating strategies that go beyond first-cost into operations and capital decisions.

- *Energy Smart Products* –To assist businesses supplying emerging technologies and higher efficiency products in developing markets, efforts with manufacturers, distributors and retailers can be expanded to ensure ready availability of quality products. Examples include solid-state lighting and lighting design, load management and emerging technologies that will anticipate Smart Grid options, informational displays, super-efficient HVAC, appliances, and electronics. Sales-related education, cooperative promotions, and stocking or market share incentives can reduce first cost and increase market share. Emphasis can be placed on products emerging from R&D projects to ensure these become well-established in the supply chain.
- *Midstream Partner Support* – Efforts targeting designers, energy consultants, specifiers, distributors, manufacturers' representatives, contractors and installers can address the primary factors affecting operations, business models, and customer choices. Supplier business models encourage load management, network-enabled energy information systems, proper sizing, quality lighting and HVAC installations, and both systems-based and whole building approaches can be introduced to midmarket partners across all sectors.
- Innovative interventions aimed at increasing the value of energy efficiency in the financial sector can be explored. Such interventions are required in underwriting standards, energy aligned leasing arrangements, assessment practices, and value-added selling approaches for real estate professionals and ESCOs. Innovative financing models can be investigated, catalogued, and communicated.

Workforce Development and Training (WFD) and Career Pathways. This component can support penetration of advanced energy efficiency and DER technologies into the New York economy. Contractors and technicians who install, operate, and maintain clean energy technologies can be mentored and career pathways developed for professionals through disadvantaged and underserved populations. Leveraging of federal and other third party resources and funding can be sought.

- The *Renewable Energy* training network can be expanded and new technology curriculum added to existing programs. Career pathways, including basic skill, technical, and on-the-job training, can be supported and aligned with career pathways created under EEPS. Support can include development of certification and standards, curriculum, and acquisition of needed training tools.
- *Advanced Technology Training* can target advanced building controls, lighting products and design strategies, operational strategies leading to NetZero buildings, electric vehicles, and other innovative strategies. Training for the trades can be developed and integrated with certificate and degree programs, with certifications developed in coordination with professional certifying organizations. Opportunities to support upward mobility within the clean energy sector can be identified.

An *Education to Change Behavior and Influence Choices* component can focus on consumer understanding, attitudes and behavior regarding energy related choices.

- *Behavioral Pilots* can demonstrate at the community level new technologies including plug-in displays, web portals, social media, and targeted communications identifying low/no-cost energy options. Examples of cost-effective approaches to large scale adoption of energy efficient behavior for various targeted consumer groups can be demonstrated.
- *Energy Workshops and Community Forums* demonstrating low- and no-cost energy saving measures can be conducted for homeowners, renters, business managers, and others. Workshops targeting low income and under-served neighborhoods, but open to others, can teach participants to read and understand energy bills, develop good energy habits and control energy costs.
- *Community Partnerships* supporting efforts to adopt energy efficiency and renewable energy resources as core community values can be coordinated and supported.

To *Educate Future Consumers*, clean energy curricula and training for K-12 teachers can continue to be offered. Hands-on, project based lessons will align with the New York State Learning standards for math, technology, language arts, science, and social studies. Working with guidance counselors and educators to shift program emphasis to grades 7-12 can prepare students for clean energy career pathways.

- The *Low-Income Forum on Energy (LIFE),* the longest running statewide low-income energy policy dialogue in the US, can continue to convene those committed to providing low-income New Yorkers access to safe, affordable and reliable energy, and as a venue for policy makers to learn from those at the front end of program delivery.

A *Market Research* component can complement ongoing market characterizations, assessments and baseline studies by focusing analysis on specific market sectors and identifying opportunities for new technologies. Market and institutional barriers to technology and product adoption must be overcome to achieve broader program participation. Critical early stage insights to guide future program investments can be identified. Market research conducted by independent contractors and involving both primary and secondary data collection and analysis could examine:

- Where further data on energy use, saturation, decision making and opportunities is needed for specific subsectors or customer populations;
- Energy market issues and trends (e.g., load profiles/growth, economics, distributed energy resources) affecting behavior and decision making and with significant system cost impact or benefit opportunities;
- Potential benefits of strategies designed to deliver a broader array of services (e.g., analyzing the added value associated with whole building approaches); and
- Potential barriers to technology development and commercialization processes in order to optimize the transition of early stage and underutilized technologies to market readiness.

Data available from sources such as building performance benchmarking efforts and the home performance database could be compiled to provide market intelligence on building characteristics, energy use, demand, cost, and end use energy consumption. Analysis of these data sets could be an important tool for examining trends and focusing future resources to targeted marketing efforts.

Benefits

The Market Development Initiative could accelerate the adoption of clean energy technologies and practices through the following:

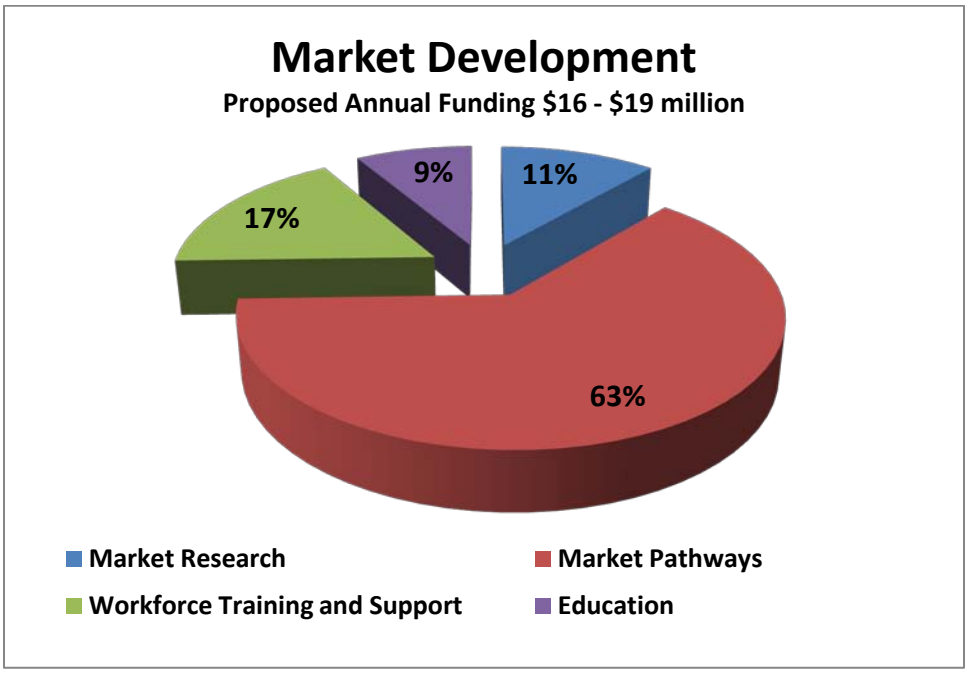
- Partnerships across the supply chain to ensure the knowledge, support, and availability of products and services leading to an increased market share of same;
- Expanded business models for midstream and upstream market partners that bring the most efficient equipment into the market;
- Identification and demonstration of strategies for greater penetration of energy efficiency and load management capabilities;
- Increased investment in energy efficiency and DER projects as financial and behavioral barriers are addressed;
- Adoption of strategies that address owner/tenant split incentives and guide decisions regarding energy efficiency investments;
- Increasing the quality, operations and maintenance of installations and systems and incorporation of new technologies through a trained and qualified workforce;
- Entry of disadvantaged and emerging workers into the clean energy job market; and
- Education of future energy users.

Market Development

Data and information from the Market Research program can further existing energy programs, support policy decisions on future initiatives, support system planning relative to changes in markets and loads, and examine ongoing issues and opportunities.

Funding

Annual funding in the range of $16-19 million is proposed for this Initiative.



Issues to Consider

- How does NYSERDA ensure that efforts to develop a clean energy workforce do not substantially outpace market demand for such labor?
- How can the many different outreach and education efforts in NYS (Cleaner, Greener Communities, climate smart communities, energy smart communities, BEAM, etc) integrated to effectively deliver a consistent message and avoid confusion in the market place?
- How can owner/tenant arrangements that inhibit energy saving operations and projects be addressed?
- Has energy efficiency's value proposition been sufficiently demonstrated to property owners?
- Has access to financing been identified or made available?
- Has the supply chain been sufficiently educated so that energy efficiency strategies using underutilized and emerging technologies are part of their business model?
- Is the upstream market prepared to meet the demand for the higher efficiency products?
- Are current end-user education efforts sufficient to support market transformation?

Clean Energy Business Development

Targeted Problem

Innovation in the energy sector is necessary to respond to the challenges of climate change, energy independence, and New York's goals for a clean energy economy. To reduce the costs of reliable renewable energy, and increase the efficiency with which scarce energy resources are used, successful and continual market introduction of new clean energy products and services is essential. Entrepreneurial business startups that are less than five years old have great potential for innovation and have been the source of much of the nation's net job generation. Without these startups, overall net job change may have been negative for most years since 1980. In the clean technology sector, only eleven of the top 100 most promising international companies existed in 2000.

Entrepreneurs face significant challenges in transforming a new technology into a viable business, in particular at very early stages in a product's life cycle when the financial risk is greatest. Public investment at this stage is critical, as is the knowledge and guidance of energy market dynamics. Successful outcomes from product innovation benefit ratepayers through an increase of product options and the cascading effects of economic development activity.

New York's powerful research and development base is a source of innovation that can propel the creation of high growth ventures. The potential is limited only by the funding sources available through the state's research programs. While New York's 20 research institutions and universities are second among those states attracting federal R&D funding, our universities lag in incubating new companies. The lack of adequate venture-backed funding sources results in a disproportionately low number of fast-growth companies. In 2010, Silicon Valley was the top region for venture capital. The metropolitan New York region was a distant third with only 8 % of the US investment, and upstate New York, with only one-half percent, ranks extremely low. Many views of innovation in New York concur with the need for a more entrepreneurial environment, increased earlystage capital for startups, more networking and connection opportunities among innovation actors, and, overall, an innovation-friendly legal and regulatory environment.

Preliminary Strategies

The Clean Energy Business Development Initiative could catalyze innovation and foster an entrepreneurial climate for business creation and for the growth of early stage companies that bring new clean energy technologies to market. The Initiative could build a long-lasting capacity for innovation and entrepreneurship and spur action and investments benefitting ratepayers without long-term public investment. Improving the entrepreneurial environment can translate innovative ideas into investment-worthy and commercially-viable business enterprises. This goal requires capitalizing on New York's inherent strengths, capturing the attention and imagination of the investment and venture community, and providing focused business mentoring to companies with creative solutions to the state's energy needs. The Initiative would entail an integrated approach to capacity building for entrepreneurship and innovation in the clean energy market.

Innovation/Entrepreneurial Capacity. This component is the core of the Initiative and represents the majority of the proposed funding. Innovation/Entrepreneurial Capacity building can provide an environment that supports rapid innovation and the growth of companies that bring these technologies to market. Such activities will stimulate and support institutions and infrastructure meeting the needs of clean energy innovators. The existing Clean Energy incubator program would be continued and four new activities supporting the incubators added:

- Proof-of-Concept Centers established to accelerate the commercialization of university innovations and move these to market;
- An Emerging Business Investment Program for early stage clean energy companies with high growth potential would increase access to capital that is generally difficult to receive from private investors;
- Cluster Development activity could promote networks of interrelated clean energy firms and convene multidisciplinary market participants to accelerate development of new product and services and create new business models. Clustering can drive productivity and innovation as well as promote regional competitiveness;
- A Clean Energy Innovation and Entrepreneurial Network could enable statewide collaborations and partnerships by linking geographically-diverse entrepreneurs, established companies, universities, and other innovation stakeholders.

Market Intelligence. Innovation responds to market signals. The Market Intelligence component could track, analyze and distribute business and financial information relevant to clean energy activities. This component can promote investment opportunities and provide feedback that benchmark New York relative to other states and similar initiatives.

Direct Support for Business Acceleration. The Direct Support for Business Acceleration component could address gaps in NYSERDA's other technology development and commercialization programs. Examples include support to early stage companies for independent technology validation. During the last five years of the SBC, NYSERDA provided support for the business development activities of companies seeking to bring innovative clean energy products to market. Under the future SBC, such activities would be integrated into product development programs to increase the likelihood of commercialization of clean energy technologies. This component would provide a transitional program to support these business development activities until they are fully integrated into product development efforts.

Potential Benefits

The Clean Energy Business Development Initiative could achieve the following:

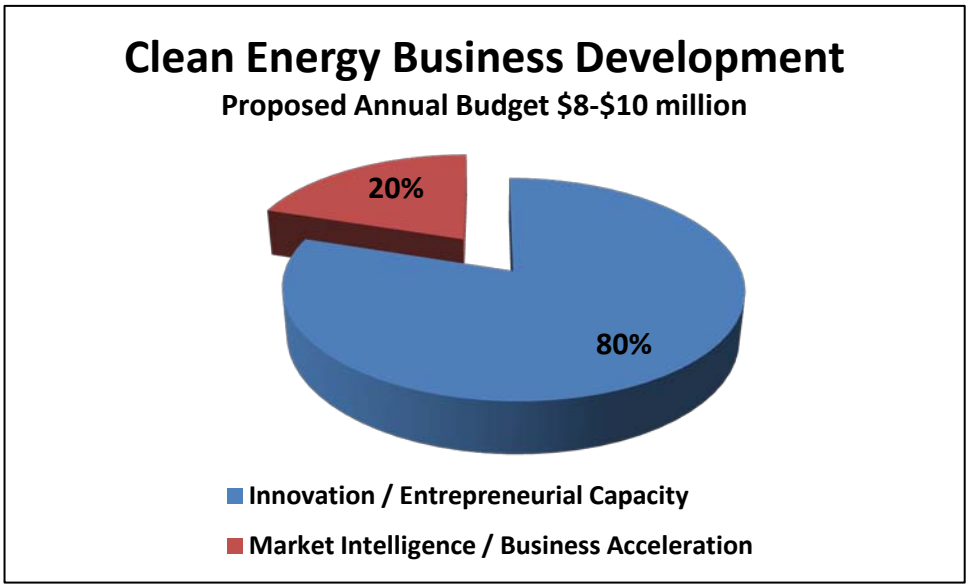
- Create a risk capital climate that increases the availability early stage investment for clean-energy technology start-up companies;
- Establish a sustainable initiative to translate university research into a pipeline of opportunities for clean energy technology companies;
- Form a network of business mentoring incubators and initiatives to increase the probability of innovative clean energy technologies achieving commercial success and serving the needs of the New York market;
- Facilitate research and business clusters around areas of energy technology where state resources can be combined to improve the rate of innovation, technology commercialization and deployment; and
- Create more than 100 new enterprises commercializing technology for New York energy markets and introduce more than 100 new clean energy products.

Clean Energy Business Development

The establishment of an energy innovation ecosystem in New York could increase the success rate and quicken the commercialization of new energy technologies that generate clean electric power or offer more efficient use of electric power. This will enhance our ability to achieve the Commission's clean energy goals. The state will benefit from the economic activity and job generated, in particular through the work of early stage companies. Many of the clean technology businesses supported through the Initiative will continue to serve the market after the completion of funding.

Funding

Annual funding of $8-10 million to support technology commercialization in early stage companies is expected to leverage more than $4 in private capital for every SBC dollar expended.



Issues to Consider

- What are the best strategies for supporting early-stage clean energy companies in NYS?
- How can NYSERDA:
  - provide more non-financial assistance to help clean energy companies?
  - facilitate networking and creation of a clean energy ecosystem that will foster innovation?
  - best use its limited funds to leverage private capital and to better position NYS companies to bring in private capital: either angel investors, VCs, strategic partners?
  - integrate the Clean Energy Business program with the new regional economic development councils in an effective manner?

Environmental Monitoring, Evaluation and Protection

Targeted Problem

The Environmental Monitoring, Evaluation, and Monitoring Program (EMEP) provides the environmental foundation for all of NYSERDA's Clean Energy initiatives. Environmental stewardship and sustainability practices through EMEP provide the opportunity to reduce the adverse impacts associated with the generation of electricity that damage New York's ecosystems and the health of its citizens.

The byproducts of electricity generation are responsible for adverse economic impacts through the degradation of lakes, streams, forests and buildings from acid deposition; widespread fish consumption advisories due to mercury pollution; and morbidity and mortality caused by poor air quality related to ozone and particulate matter. Additional threats associated with a changing climate exacerbate the impacts from electricity production's primary pollutants. The State also faces new environmental risks associated with the potential development of the vast natural gas reserves in the Marcellus shale –cited as a potential major fuel source for electric generation in New York. Moreover, while emission reduction efforts have had limited success, sensitive ecosystems and the State's vulnerable populations continue to be adversely impacted.

To this end, EMEP's primary mission is to increase the understanding and awareness of the environmental impacts of energy choices and emerging energy options and to provide a scientific foundation for formulating effective and equitable energy-related environmental policies and practices. In addition to reduced energy consumption and increased energy reliability, major goals include improved environmental quality and reduced energy-related impacts on ecosystems and human health.

New York State has invested hundreds of millions of dollars in clean energy initiatives through the RPS, EEPS, SBC programs, and RGGI. Robust environmental monitoring and evaluation and protection initiatives, conducted in association with clean energy programs, are essential to the knowledge and accountability necessary to assess progress and guide new policies. Additionally, the clean energy technology industry must be actively engaged in discussions related to life-cycle environmental impacts to minimize unanticipated, negative environmental impacts, and document the energy and environmental attributes of investments in clean energy.

Preliminary Strategies

Five strategic objectives are proposed:

1. Enhance the understanding of the environmental impacts of emerging technologies, energy systems, and energy-related pollution control technology.
2. Support environmental accountability through analysis of monitoring data and modeling:
    a. Provide the necessary research to assess environmental changes, specifically relative to changes in emissions and energy technology.
    b. Support research evaluating 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 in New York State.

c. Where strategic opportunities exist, support efforts to augment compliance monitoring that provides scientifically-robust information that advances an understanding of the fate and transport of energy-related pollution in New York and the region.

3. Support research to enhance understanding of the source types, source regions, and specific pollution components contributing to major environmental problems in the New York State:

   d. Provide insight on the relative contribution of the combustion of fossil fuel in the various sectors (e.g., electricity production, heating, transportation).

   e. Prioritize opportunities for mitigation and encourage cross-sector, market based pollution control strategies.

4. Evaluate the individual and combined impacts of energy-related pollution sources. Support efforts to examine the health and ecological co-benefits of alternative energy and technology solutions.

5. Support an energy-related environmental research capability to better address the critical problems facing the State and its diverse regions, and to create opportunities for innovation.

A Program Advisory Group and a Science Advisory Committee currently assist EMEP in its focus on policy and scientific relevance. This advisory structure could be enhanced by periodic assessment of each group's composition. Based on a stakeholder-driven framework, the EMEP research agenda can continue to develop and integrate an evolving energy/environmental landscape and to identify information gaps and research needs. For example, the program could consider the following issues related to 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 the ongoing need to address greenhouse gases, other climate-forcing agents, and conventional combustion-related pollutants.

Consideration in a broader and evolving environmental policy context could also include the following:

- 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-spots and environmental justice;
- Scarcity of resources for adequate long-term monitoring programs;
- Recognition of the lack of coherent multi-pollutant policies and programs.

Most EMEP projects would be selected through competitive solicitation. Project results will be distributed to multiple audiences in a variety of formats – from peer-reviewed scientific journal articles to concise project summaries targeting decision makers.

Environmental Monitoring, Evaluation and Protection

Potential Benefits

EMEP is a state and national leader recognized for supporting sound scientific research that informs policies and decision making. EMEP investments have informed mercury control policies affecting energy production, fine particle pollution standards, acid deposition control policy, and greenhouse gas emission policies – all topics with a major impact on energy production and use. The continuation of EMEP can improve environmental quality by helping to reduce the environmental impacts of existing and emerging energy technologies and by informing energy-related environmental policies and goals. While the majority of initiatives supporting the Public Service Commission's *Clean Energy* goals target energy efficiency and renewable energy strategies, EMEP focuses on the "*Clean*" component of the goal by adding an environmental perspective to monitoring and evaluating energy options and by promoting technologies with reduced environmental footprints.

Funding

A minimum annual investment of $3-5 million would be needed to support energy-related environmental research and will provide an improved understanding of the environmental impacts of emerging energy technologies and required mitigations.

Issues to Consider

- What share of the resources available for EMEP should be allocated to assessing the environmental impacts of new, emerging technologies vs. assessing the impacts of the current fossil-fuel based energy system?
- How can the limited EMEP funds address energy-related public health issues in a meaningful way?
- Is the proposed funding level of $3-5M/yr adequate to address critical NYS needs, especially in light of declining resources from other sources?

Evaluating Success

The proposed Technology and Market Development (TM&D) 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 could be identified to best measure program progress and success in terms of realized and potential benefits along the energy innovation chain. Evaluation techniques can be designed to address T&MD Program efficiency, effectiveness, outcomes and impacts related to achievement of the following programmatic objectives:

- Prove out emerging energy efficiency, renewable, and smart grid technologies/strategies and accelerate market readiness in the State;
- Move new and under-utilized technologies and services into the marketplace to help achieve EEPS and RPS goals;
- Stimulate technology and business innovation to provide more clean energy options and lower cost solutions, while growing the New York's clean energy economy; and
- Spur actions and investments to achieve results distinct from incentive-based programs.

In order to best assess these objectives, key metrics and indicators are expected to focus on market progress and technology innovation milestones. However, metrics and evaluation techniques can also be designed to capture the near-term energy and economic benefits from early deployment "feeder" programs, as well as the potential longer-term energy and economic benefits from business, market and technology development and demonstration activities.

The evaluation approach for these "next generation" TM&D programs could be informed by strategies developed by best-practice resources, such as the U.S. Department of Energy Office of Energy Efficiency and Renewable Energy,[1] as well as by the expert input of third-party evaluation contractors. Evaluation objectives and approaches are expected to be designed based on the nature of the program and developed at the onset of the evaluation. At this stage, some key questions that the market and impact evaluation effort could seek to answer in terms of the TM&D portfolio's near- and potential long-term effects are outlined in Table 1 for each major type of program.

In addition to market and impact evaluation, formative process evaluations could be conducted on all major programs during the early stages of implementation, and repeated periodically, to examine program efficiency and effectiveness in light of the program's stated outcomes and impacts. The goal of process evaluation is to inform real time adjustments and maximize program efficiency and effectiveness through actionable recommendations. Process evaluation and periodic review of program performance will enable NYSERDA to assess the TM&D portfolio's progress and redeploy funds as necessary to best meet the overarching program objectives.

1. 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 1. TM&D Program Outcome Indicators and Impacts

Program Type	Key Evaluation Questions to Assess Program Outcomes and Impacts
Technology Development and Demonstration	**Near Term Outcome Indicators** • 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? • 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? **Longer Term Impacts** • To what extent has commercialization been achieved? • What evidence is there of spillover or replication from the funded technologies/projects? • How long does it take to generate the technology's first sales? What are the annual revenues? What are the related employment effects? • What are the overall macroeconomic effects on NY's economy? • 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? • Did the project influence subsequent investment in utility infrastructure?
Early Deployment "Feeder" Programs	**Near Term Outcome Indicators** • 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? **Longer Term Impacts** • 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?
Business and Market Development	**Near Term Outcome Indicators** • Has the program increased the knowledge base of energy efficiency, renewable energy, and smart grid opportunities in the 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 manufacturing and installation businesses in NY? • To what extent has the program played a role in leveraging private capital and other investments in clean energy businesses? **Longer Term Impacts** • Has the program increased the overall extent of energy efficiency, renewable energy, and smart grid development and investment in the State? • To what extent has the program supported energy efficiency actions, investments and savings separate and apart from incentive programs (e.g., through increased Code compliance)?
Policy Research and Market Analysis Programs	**Near Term Outcome Indicators** • 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? **Longer Term Impacts** • Have additional project relationships developed among researchers, commercializers, 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?

Evaluation Implementation and Funding

Evaluation work could 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.

It is expected that the evaluation contractors could assist with further planning evaluation strategies and metrics most appropriate for the proposed 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.

The majority of the evaluation budget could support the work of independent contractors. Of the total budget spent on evaluation studies, approximately 30 percent could be allocated to process evaluation and 70 percent to impact and market evaluation. It is expected that a separate Evaluation Plan would be filed with the DPS, reflecting the portfolio of T&MD activities ultimately approved by the PSC.