Case 07-M-0548

Energy Efficiency Portfolio Standards Proceeding

Final Report

WORKING GROUP IV

December 5, 2007

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I. EXECUTIVE SUMMARIES

A. Overview of Working Group IV's Charge

On September 17, 2007, Working Group #4 was formed as one of four (4) vehicles for public participation in NYS Public Service Commission Proceeding Case: 07-M-0548, Energy Efficiency Portfolio Standard. Open to all through voluntary participation, and rising to a membership of over 60 volunteers, Working Group #4 convened six (6) times from 9/17/2007 through 11/29/2007.

Working Group #4 produced a report, submitted on 12/5/2007 in the Energy Efficiency Portfolio Standard Proceeding. The report is a consensus document, except in a few areas where a dissenting opinion is noted, or where noted in the form of certain attachments which have not been thoroughly vetted due to time constraints. There are some gaps in the report; most gaps are associated with placeholders for forthcoming recommendations, and assessments of the need for funds to accomplish such recommendations. Working Group #4 expects to finish addressing such gaps around mid-February 2008.

The focus of Working Group #4 is as follows:

- Emerging Technologies, Demand Response and Peak Load Reduction, and Transmission and Distribution Efficiencies.
- Electricity, Natural Gas, and District Steam (energy forms within the purview of NYSPSC).
- End-User Sector, Energy Delivery Infrastructure (T&D, Natural Gas Delivery Systems, and District Steam Systems), and Central Power Plant Generators.
- Energy Usage (e.g., kWh), and Demand (e.g., kW), where reduction of Energy Usage is highest priority.

Working Group #4 managed the participatory process so as to establish a report covering a broad format (not exclusive to any one company or market sector), and sought consensus but noted the existence of diverse opinions by expressing majority and minority viewpoints. Working Group #4 began by compiling a catalog of market activity for both emerging technologies and demand response, then identified gaps and possible barriers or hurdles for usage or continued growth in NY. Working Group #4 has compiled some recommendations, while other recommendations may still be forthcoming (recommendations have been/will be established with sensitivity to the integration of proposed efforts with existing programs). Working Group #4 expects to finish around mid-February 2008 by assessing, for the compilation of recommendations, estimates of costs to the extent possible, benefits, and beneficiaries.

In addition to this Brief Overview of Working Group 4's Charge and Executive Summary, the report contains chapters on Emerging Technologies, Demand Response and Peak Load Reduction, and Transmission and Distribution Efficiencies; a collection of attachments; and a Glossary. Executive summary highlights of the chapters on Emerging Technologies, Demand Response and Peak Load Reduction, and Transmission and Distribution Efficiencies follow.

B. Emerging Technologies

What: Emerging technologies represent a broad category of energy-efficient items and practices which are generally considered to have not yet reached commercial maturity in the marketplace (i.e., pre-commercial), are not yet generally cost-effective, or have entered the market but have a minimal percentage of current market share. Emerging technologies are characterized by their various stages of readiness, ranging from early stages (e.g., "breadboard"/bench-top partial prototype not yet involved with field trials) to later stages (e.g., initial adoption by niche markets but minimal penetration with mainstream consumers). Earlier-stage emerging technology companies, often championed by inventors and entrepreneurs, can face a particular hardship trying to build a working prototype and conduct field trials without the benefit of a steady income stream (since the product is not yet available for sale). Later-stage emerging technologies must compete against the incumbent technology that is commonplace in the field, and must overcome consumer uncertainty regarding relative attributes (benefits/drawbacks) and consumer inertia (e.g., comfort with the current system, aversion to risk, and focus of attention on other interest areas).

Why: Society will continually need new and improved technologies if we are to reduce our impact on natural resources compared to our impact based on use of currently-available technologies, and if we are to obtain new amenities and greater benefits. Each year, as society adopts the best technologies available, there is an ongoing need to "re-stock the shelves" with the next-generation of newer and better technologies. Acceleration of the rate at which an emerging technology reaches commercial maturity can often be achieved through field demonstration trial and early-adoption fleet programs, during which time equipment is placed in service and the associated energy efficiency benefits materialize and accrue, sometimes at quite significant levels. One can surmise that 15x15 is built on a premise that although there exist energy efficiency deployment programs (e.g., System Benefits Charge Program, Con Edison Systemwide Program and Targeted Program), more still needs to be done and can be done. This premise also holds true for emerging technologies – although there are programs more still needs to be done and can be done. It is critical that New York State not be left behind in the race to prosper from the businesses that will invent and manufacture clean energy emerging technologies (the Innovation Economy) and that New York consumers quickly gain access to emerging technologies. The use of a traditional Total Resource Cost (TRC) test does not appear to be compatible with an intention to support emerging technologies.

How: Promoters of emerging technologies offer long lists of their virtues. The virtue of any one particular emerging technology, or the relative virtue of one emerging technology compared to another emerging technology, is not in question here. A set of recommendations to address hurdles faced by emerging technologies has been crafted in a fashion to "fix the problem so all can benefit". This set of recommendations is compatible with an "options" approach (i.e., a portfolio management approach that finds winners by allowing them to reveal themselves, as opposed to guessing based on preconceived notions -- the approach suggests the benefits of maintaining a broad portfolio of technologies at various stages of market readiness [seeds, sprouts, and blossoms], and giving ever-increasing nurturing as technologies ripen). This set of recommendations consists of seven (7) overarching themes, as follows:

- Continue and expand existing funding programs.

- Leverage allies (CATs, TDOs/TDCs, venture capital funds, Comptroller investment portfolio, federal funds such as SBIR, insurance companies, volunteer executive mentors, business schools and MBA programs, etc.).
- Bundle incentives so as to be simple to acquire and of sufficient magnitude to inspire action.
- Create a new program with sufficient funding to engage in clean energy emerging technologies "mega" demonstration projects (for example, field trial of one large/costly item such as utility-scale flywheel energy storage, or field trial of a mega fleet of dispersed small modular items such as grid-integrated systems with two-directional flow of electricity [e.g., batteries] as a means to investigate the tolerable saturation point of the grid).
- Promote data collection, display, analysis, and communication mechanisms, such as real-time monitoring and display, and common communication protocols and platforms.
- Perform/update studies and develop/update protocols to assist with public policy (such as market potential studies, review/update of the Standard Interconnection Requirement, and review of codes and standards).
- Create a technology transfer clearinghouse for clean energy emerging technologies to raise consumer awareness and inform the design/specify/build trades-people, expand technology transfer efforts (conferences, workshops, outreach, site tours, etc.), expand training and certification programs for clean energy installation and service technicians.

C. Demand Response and Peak Load Reduction

Peak demand reduction programs provide numerous benefits to New York electric customers. Benefits of these programs include both customer financial benefits and societal benefits such as increased reliability, reduced reliance on power plants, and the resulting cost avoidance and environmental benefits associated with displaced power generation.

FERC adopted the definition of "Demand Response" (DR) that the U.S. Department of Energy (DOE) submitted to Congress:

> "Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized." [1]

Over the longer term, sustained and targeted demand response and peak load reduction lowers the need to build new generating, transmission, and distribution capacity. In addition,

[1] " U.S Department of Energy, Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005." February 2006.

reliability benefits accrue because demand response lowers the likelihood and consequences of forced outages on the electric grid.

Aggressive DR programs are necessary to save millions of dollars by deferring some of the expensive additions to generation, transmission and distribution resources. Delay in proceeding with an effort to increase activity in demand response programs will result in the forfeit of benefits that could otherwise accrue to New York customers.

Working Group IV has identified several recommendations of how New York State can achieve significantly increased levels of DR and peak load reduction. Below is a summary of the working groups' recommendations.

Advanced Metering Infrastructure (AMI) and Smart Grid

With the growing maturity and success of New York's demand response programs, many of the most demand responsive customers have already been recruited into demand response programs. Since much of this "low hanging fruit" has been harvested, we must look for tools that allow us to better reach the higher hanging fruit. Full scale AMI deployment is a tool that can greatly expand New York's pool of demand response customers, by allowing for automated load control and detailed energy usage and price information that is critical for time variant rates.

A broad range of demand response technologies are available and continue to evolve with a number of new and enhanced technologies appearing on the market or in development. Included among the options are smart thermostats capable of responding to tiered time-of-use (TOU) pricing and remotely initiated curtailment events, remote appliance controllers, energy management systems with automatic demand control, computer-controlled load management systems, improved communications technologies (both customer premise and wide-area networks), improved metering technologies with built-in demand-response functionality, and integration with on-site generation and/or renewable energy sources. These technologies can all be considered part of a robust AMI system that enables better source to site grid management within a "Smart Grid".

A "Smart Grid" is the integration of power systems on both sides of the customer meter operating in a coordinated, efficient and reliable manner. A Smart Grid power system handles emergency conditions with 'self-healing' actions and is responsive to energy-market and utility business-enterprise needs. A Smart Grid deploys intelligent sensors throughout the electric distribution network, providing continuous monitoring and analytics to create a real-time, two-way, diagnostic monitoring and control system. A Smart Grid enables utilities to monitor and manage virtually every piece of equipment on the electric distribution network in real-time. A well planned Smart Grid will allow for many utility and transmission and distribution improvements and efficiencies, in addition to the behind the meter benefits.

A fully functional Smart Grid will also include end use devices such as air conditioners, refrigerators, dishwashers and dryers that can receive and respond to curtailment signals or increased energy prices. With the backbone of a carefully planned AMI, these demand responsive devices can be made to communicate with AMI systems so that they can be easily and widely deployed into a large number of AMI equipped homes. It is recommended that demand responsive devices be given a label such as "green grid", and marketed and subsidized.

This will empower customers to choose to install reduced cost, high efficiency appliances, in exchange for their commitment to allow the appliance to be controlled by a curtailment signal.

A carefully planned system will harvest many benefits in both utility operational efficiencies and changes in customer behavior, both voluntarily and through curtailment signals.

It is recommended that a careful and consistent cost benefit analysis be done by each utility to capture all quantifiable benefits of a robust AMI and/or Smart Grid system. If it is determined to be cost effective within a utility, full scale deployment of an AMI, AMI and Smart Grid or Smart Grid system is recommended. It is further recommended that technology choices be carefully vetted by a panel of experts to ensure that the most functional and socially beneficial equipment is installed. There are many interactive nuances to be considered within the technology package that should be thoroughly reviewed to ensure that the most comprehensive, timeless, and cost effective technology package is implemented.

<u>Continued and Increased Deployment of Current Programs</u>

With the lofty objectives of EPS, it is anticipated that success will require both a scale up of existing programs, and the creation of new programs. In the creation of new programs, it should be recognized that New York currently has some of the most successful programs in the world. Care should be given in developing new programs to ensure that they don't compromise the highly successful programs that exist today. If competing programs are introduced, it could result in customer confusion and may not achieve a net increase in resources if the new program's success comes from decreased participation in the incumbent program.

It is recommended that existing programs be modified, where needed to maximize participation, while new programs are carefully developed to minimize customer confusion and overlap in programs.

<u>Increased Price Stability for Demand Response</u>

New York's demand curve has sent much needed price signals by valuing capacity beyond the reserve margin, while also reflecting supply and demand fluctuations with corresponding price fluctuations. One downside to the demand curve is that the rapid fluctuations in price don't necessarily represent the longer term need for capacity. For example, upstate capacity prices went from a high price in 2003 of over $2/kW-mo to a price of less than $1.50/kW-mo in 2004. In 2007, prices topped out at over $3/kW-mo. These rapid price fluctuations represent immediate market conditions, whereas business planning is typically done on a medium to long term basis. Likewise, it is possible that New York City capacity prices could soon be significantly reduced based on market changes under discussion at the NYISO.

It is recommended that longer term price signals be sent to the market. Two examples of mechanisms for longer term price signals are RFPs for demand response, or a forward capacity market. In both cases, care should be given to not enter into extremely long term contracts that years from now, no longer represent current market conditions. A contract term of roughly three years may be a reasonable compromise to preserve supply and demand signals, while offering some price stability to the market.

Expanded Use for DR Resources

Given the large pool of existing DR customers, New York should continually analyze how to best deploy these resources, and compensate them appropriately based on the value they provide for each deployment. Two examples of alternative deployments are for use as synchronous reserves, and for emissions reductions on high ozone days.

DR as Synchronous Reserves

Many of the DR resources existing today have the ability to respond very quickly, making them an attractive candidate to be used as synchronous reserves. This is a high value market that will make participation attractive for potential participants and will significantly help improve the social benefit of these resources. The NYISO is currently finalizing a Demand Side Ancillary Services Program for just this purpose, however, it will initially be offered only to the largest customers. The current metering requirements are modeled off those that would apply to a synchronous reserves generator, which makes participation cost prohibitive to all but the largest customers.

It is recommended that the NYISO design a way for smaller resources (under 1 MW) to supply ancillary services as soon as the Demand Side Ancillary Services Program has been implemented.

DR for Emissions Reduction on High Ozone Days

There is a strong correlation between high electric use days and high ozone days. This presents an opportunity for demand response to be called on to reduce peak electric use on projected high ozone days, thereby improving air quality on the worst days. Of course, only non generation based resources will be called on for this, since on site generation will only exacerbate the ozone problem.

It is recommended that a study be conducted to determine the feasibility and value of such a program. If determined feasible and cost effective, a program should be developed to pay for demand response to be called on for emissions reductions on projected high ozone days.

Integrating Demand Response, Peak Load Reduction and Energy Efficiency

One characteristic that all demand response customers have in common is that they are willing to reduce their energy use in exchange for payment. Moreover, demand response customers have interval meters, and often building management systems. Obviously this is an attractive market segment for energy efficiency and peak load reduction measures. It is recommended that as a forward capacity market is considered, an energy efficiency component be considered to help providers offer packaged demand response and efficiency opportunities.

Another way to capitalize on synergies between DR, peak load reduction, and energy efficiency is the development of monitoring based commissioning program. The interval meters installed for demand response can be used to identify commissioning opportunities. If the commissioning measures are taken, interval meters can track the savings, which can then be funded by an incentive program. It should be recognized that many of the measures taken will be operational in nature and will have a shorter life span than capital improvements such as lighting and cooling.

It is recommended that a Monitoring Based Commissioning program be investigated, and if determined feasible and cost effective, a program be implemented.

D. *Transmission and Distribution*

By viewing the grid in its entirety, and by understanding and applying the laws of physics[2] which govern how electricity is generated, transmitted, distributed and consumed, decision-makers are better equipped to compare, evaluate and decide among the competing interests, alternative and recommendations of representatives from each of these interest groups. This holistic approach provides decision-makers with a tool to evaluate and compare the economic and environmental costs and benefits when considering efficiency improvement options or when making recommendations on how to systematically pursue the quest for grid intelligence. Simply put, an efficiency framework governed by the laws of physics and chemistry will be sensitive to the unique operational behaviors of the electric grid as a whole and should be used to score, prioritize and select the order in which limited resources should be deployed.

Reductions in transmission and distribution (T&D) system losses offer significant energy savings potential for New York State. These savings are attainable by re-emphasizing long-standing good utility practices and through effective management of electric capacity. Two to three percent of New York's electricity is consumed by transmission system losses before the energy is ever converted into useful work at the consumer level. Similarly, an additional four to eight percent is consumed by losses in the distribution system. The precise amount of avoided energy production savings available from ameliorating transmission and distribution system losses for each utility will depend on the characteristics of each utility's system; therefore, it is important to note that the cost-effectiveness of any efforts will need to be carefully scrutinized so that all benefits are properly monetized and distributed fairly with all entities involved. The majority of T&D system losses are attributable to a basic component of electric energy called reactive power.

The effects of reactive power are not bounded by the points of demarcation between the transmission (i.e., bulk power grid), sub-transmission, and distribution systems. Measures to counteract the effect of reactive power are most effective when applied at the points where the reactive load is located. If reactive power is managed at the distribution system level, there is less of a need for power factor corrections at the sub-transmission and bulk transmission system levels, where the costs and complexity of the corrective measures increase exponentially and their effectiveness is relatively limited. Additional generation is required to supply the energy that is consumed by T&D losses. This means that more fuel is consumed to generate the added power, which in all likelihood, would come from the less efficient generating unit available at any given time. The impact is more fuel consumed and greater emissions levels. Reactive

[2] The Laws of Physics, especially electric and magnetic theory manifest themselves in the operating characteristics of the equipment used.

power also has an effect upon system voltage, affecting transfer capability of certain bulk transmission interfaces.

If reactive power is better managed at the point where the energy is consumed, the actions undertaken by end-use customers may offer meaningful solutions to power factor correction. Some utilities have used rate structures that encourage customers to maintain power factors within acceptable ranges. BC Hydro, for example, imposes a penalty charge for poor power factor if customers refuse to implement corrective measures to maintain power factors of 90% or better. The penalties range from 2% for power factors between 88% & 90% to 80% for power factors below 50%[3]. Unless a rate structure is developed and implemented that emphasizes power factor correction, it is unlikely that customers would consider taking the steps to improve their individual power factor problem. Should studies show that such steps would provide appreciable benefits, appropriate rate structures that place reasonable emphasis upon maintaining acceptable power factors, and educational and utility support programs are two approaches which could be developed to encourage effective reactive power management at the end-user level.

In New York's deregulated wholesale energy marketplace, the matters of who benefits from investments in reactive power management and the cost recovery for such investments are issues that are being discussed by the NYISO's stakeholders. As previously stated, measures that are undertaken at the bulk transmission system level to support bulk power grid transfer capability are impacted by the reactive power characteristics of the underlying sub-transmission and distribution systems. Methodologies for studying and identifying the effect upon the bulk power system from lower voltage systems, as well as the shared benefits across the bulk power system, need to be developed. Further, the impact of establishing minimum interconnection standards for interfaces comprising the points of demarcation between transmission, sub-transmission, and distribution systems could be studied to determine potential benefits for managing system power factors within reasonably acceptable levels.

Reducing system losses would benefit consumers to the extent that they or the load serving entities that serve them will need to procure less energy and capacity to meet their electricity needs. Such savings would help offset the capital and other costs of making local distribution system improvements. Quantifying the exact amount of savings that could be achieved is complex, as it involves consideration of each utility and load serving entities capacity and energy requirements, a forecast market prices that each would have to pay for capacity and energy. Nevertheless, given the potential magnitude of the savings associated with reducing energy losses, as well as capacity savings for LSE's load, quantifying potential improvements and costs associated with alternative solutions would be a part of any study. Moreover, beyond cost savings, reducing system losses could have environmental benefits, due to reductions in SO_2, NO_x, and CO_2 emissions.

In much the same way that good utility practices cannot be assumed, consumers must be encouraged to use electricity more efficiently. The PSC should require the development of utility rate structures that place sufficient emphasis upon maintaining minimum power factors, consuming energy during off-peak periods, purchasing energy-efficient equipment & appliances, and making informed energy efficiency improvements if benefits of these alternatives are

[3] BC Hydro Electric Tariff Eff. 1 August 1997, p. B-30 Effective 1 May 1980

compelling. A common theme to every aspect of attaining New York's energy goal is technology. Much like the proposed efficiency standards for utility equipment, the PSC should establish minimum efficiency standards for all electrical equipment installed in New York.

II. EMERGING TECHNOLOGIES

1. Introduction

<u>What</u>: Emerging technologies represent a broad category of energy-efficient items and practices which are generally considered to have not yet reached commercial maturity in the marketplace (i.e., pre-commercial), are not yet generally cost-effective, or have entered the market but have a minimal percentage of current market share. Emerging technologies are characterized by their various stages of readiness, ranging from early stages (e.g., "breadboard"/benchtop partial prototype not yet involved with field trials) to later stages (e.g., initial adoption by niche markets but minimal penetration with mainstream consumers). Earlier-stage emerging technology companies, often championed by inventors and entrepreneurs, can face a particular hardship trying to build a working prototype and conduct field trials without the benefit of a steady income stream (since the product is not yet available for sale). Later-stage emerging technologies must compete against the incumbent technology that is commonplace in the field, and must overcome consumer uncertainty regarding relative attributes (benefits/drawbacks) and consumer inertia (e.g., comfort with the current system, aversion to risk, and focus of attention on other interest areas).

<u>Why</u>: Society will continually need new and improved technologies if we are to reduce our impact on natural resources compared to our impact based on use of currently-available technologies, and if we are to obtain new amenities and greater benefits. Each year, as society adopts the best technologies available, there is an ongoing need to "re-stock the shelves" with the next-generation of newer and better technologies. Acceleration of the rate at which an emerging technology reaches commercial maturity can often be achieved through field demonstration trial and early-adoption fleet programs, during which time equipment is placed in service and the associated energy efficiency benefits materialize and accrue, sometimes at quite significant levels. One can surmise that 15x15 is built on a premise that although there exist energy efficiency deployment programs (e.g., System Benefits Charge Program, Con Edison Systemwide Program and Targeted Program), more still needs to be done and can be done. This premise also holds true for emerging technologies – although there are programs more still needs to be done and can be done. It is critical that New York State not be left behind in the race to prosper from the businesses that will invent and manufacture clean energy emerging technologies (the Innovation Economy) and that New York consumers quickly gain access to emerging technologies. The use of a traditional Total Resource Cost (TRC) test does not appear to be compatible with an intention to support emerging technologies.

<u>How</u>: Promoters of emerging technologies offer long lists of their virtues. The virtue of any one particular emerging technology, or the relative virtue of one emerging technology compared to another emerging technology, is not in question here. A set of recommendations to address hurdles faced by emerging technologies has been crafted in a fashion to "fix the problem so all can benefit". This set of recommendations is compatible with an "options" approach (i.e., a portfolio management approach that finds winners by allowing them to reveal themselves, as opposed to guessing based on preconceived notions -- the approach suggests the benefits of maintaining a broad portfolio of technologies at various stages of market readiness [seeds, sprouts, and blossoms], and giving ever-increasing nurturing as technologies ripen). This set of recommendations consists of seven (7) overarching themes, as follows:

- Continue and expand existing funding programs.
- Leverage allies (CATs, TDOs/TDCs, venture capital funds, Comptroller investment portfolio, federal funds such as SBIR, insurance companies, volunteer executive mentors, business schools and MBA programs, etc.).
- Bundle incentives so as to be simple to acquire and of sufficient magnitude to inspire action.
- Create a new program with sufficient funding to engage in clean energy emerging technologies "mega" demonstration projects (for example, field trial of one large/costly item such as utility-scale flywheel energy storage, or field trial of a mega fleet of dispersed small modular items such as grid-integrated systems with two-directional flow of electricity [e.g., batteries] as a means to investigate the tolerable saturation point of the grid).
- Promote data collection, display, analysis, and communication mechanisms, such as real-time monitoring and display, and common communication protocols and platforms.
- Perform/update studies and develop/update protocols to assist with public policy (such as market potential studies, review/update of the Standard Interconnection Requirement, and review of codes and standards).
- Create a technology transfer clearinghouse for clean energy emerging technologies to raise consumer awareness and inform the design/specify/build tradespeople, expand technology transfer efforts (conferences, workshops, outreach, site tours, etc.), expand training and certification programs for clean energy installation and service technicians.

2. Background/Context

a) Define emerging technologies/outline major characteristics

Emerging technologies represent a broad category of energy-efficient items and practices which are generally considered to have not yet reached commercial maturity in the marketplace (i.e., pre-commercial), are not yet generally cost-effective, or have entered the market but have a minimal percentage of current market share (perhaps less than 2 or 5 percent)[4]. Emerging technologies face considerable technical, business, and market risks (for example – technical risks: can the product be made to work reliably? business risks: can a start-up company remain afloat financially throughout the time needed for the technology to become successful? and market risks: will a competitor be first to achieve customer/brand loyalty?).

Energy-efficient emerging technologies addressed within the scope of Working Group 4's purview include technologies impacting electricity, natural gas, and steam.

Emerging technologies include research and development outcomes now occurring at universities in New York (See Appendix A) and also items which can be purchased by an energy consumer, as well as practices[5] which can be self-implemented or obtained by procurement of a

[4] American Council for an Energy-Efficient Economy (ACEEE), *Emerging Energy-Saving Technologies and Practices for the Buildings Sector as of 2004*, October 2004, Report Number A042, and *Emerging Energy-Efficient Industrial Technologies*, March 2001, Report Number IE012, both co-sponsored by NYSERDA and others.

[5] ibid.

service. For example, retro-commissioning is a practice that can be performed to ensure that energy-consuming appliances are functioning as intended and thus minimize wasted energy; however, retro-commissioning has a minimal percentage of current market share at present.

Emerging technologies can be applied at end-user facilities (e.g., residences, businesses, factories) to produce heating and cooling, lighting, and other functions in an energy-efficient manner, to produce electrical power on-site in an energy-efficient manner, or to assist with decisionmaking and enable control of energy-related activities. Emerging technologies can also be applied within the energy delivery infrastructure (e.g., electric transmission and distribution cables, substations; natural gas pipelines; district steam pressure regulators) to help deliver energy where and when it is needed while minimizing losses along the path to the ultimate consumer. Emerging technologies can be applied at central station power generators to produce electricity using minimal fuel and/or with minimal emissions.

Policymakers may seek to promote emerging technologies due to their energy-efficiency attributes. It should be recognized that many emerging technologies have additional "non-energy" benefits (e.g., improved comfort, improved safety, improved productivity, reduced environmental impact), and these benefits may be as important in influencing the purchaser's decision on whether to adopt.

Promoters of emerging technologies offer long lists of their virtues. The virtue of any one particular emerging technology, or the relative virtue of one emerging technology compared to another emerging technology, is not in question here.

Recap:

- EPS Working Group #4 defines "Emerging Technologies" based on their "state of market readiness" characteristics (as opposed to compiling a stagnant list).
- Emerging Technologies are generally considered to have not yet reached commercial maturity in the marketplace (i.e., pre-commercial), are not yet generally cost-effective, or have entered the market but have a minimal percentage of current market share.
- Emerging technologies can be risky.
- Emerging technologies include items as well as practices.
- Emerging technologies can be applied at end-user facilities as well as within the energy distribution infrastructure or at central station power generators.
- Emerging Technologies have energy-efficiency attributes as well as "non-energy" benefits.
- Energy-efficient emerging technologies addressed within the scope of Working Group 4's purview include technologies impacting electricity, natural gas, and steam.

b) Explain why emerging technologies need support

Emerging technologies are characterized by their various stages of readiness, ranging from early stages (e.g., "breadboard"/benchtop partial prototype not yet involved with field trials) to later stages (e.g., initial adoption by niche markets but minimal penetration with mainstream consumers).

Earlier-stage emerging technology companies, often championed by inventors and entrepreneurs, can face a particular hardship trying to build a working prototype and conduct field trials without the benefit of a steady income stream (since the product is not yet available for sale). A major challenge is gaining access to personnel with expertise in a variety of technical disciplines as well as business management and finance, since their services may be needed only sporadically, or a limited operating budget does not provide sufficient payroll funds to attract the needed caliber of talent. Another major challenge faced by emerging technology companies with budget constraints is gaining timely access to high-quality/precision instruments with which to conduct experiments and measure results.

Later-stage emerging technologies must compete against the incumbent technology that is commonplace in the field, and must overcome consumer uncertainty regarding relative attributes (benefits/drawbacks) and consumer inertia (e.g., comfort with the current system, aversion to risk, and focus of attention on other interest areas). Champions of later-stage emerging technology companies can include the original inventors and their entrepreneurial partners, and may also include investors (such as angels, philanthropic foundations, and venture capitalists – all of which can help increase the level of private capital investment in NYS) and franchisees licensed to deploy a given product. Later-stage energy-efficient emerging technologies often participate in field demonstration trial and early-adoption fleet programs, during which time equipment is placed in service and the associated energy efficiency benefits materialize and accrue, sometimes at quite significant levels.

Society will continually need new and improved technologies if we are to reduce our impact on natural resources compared to our impact based on use of currently-available technologies, and if we are to obtain new amenities and greater benefits. Each year, as society adopts the best technologies available, there is an ongoing need to “re-stock the shelves” with the next-generation of newer and better technologies. Although state and federal support for research and development of emerging technologies at universities is greatly helping to address this concern, more will be needed. In addition, the traditionally long timeline to move an emerging technology from concept to commercialization can be an insurmountable obstacle for some[6], and retards the rate at which those good ideas “on the drawing board” can make it into the hands of consumers – the sooner an emerging technology reaches maturity the sooner society can harness its benefits. Public/private partnerships can be a successful vehicle to spur innovation[7], and reflects the large public interest in successful commercialization of clean energy emerging technologies.

Emerging technologies can help avoid “lost opportunities” for energy efficiency, particularly for the new construction market, where initial implementation is much more cost-effective than later retrofitting. Important features, such as low-energy design, and advanced construction practices, if not implemented at the time of initial construction may be prohibitively expensive to address through retrofit.

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[6] “If you have a technology or the idea for a product that you want to market profitably, you confront a long, vexing journey across tough terrain littered with the hulks of abandoned ideas, many of them good ideas. Some new products, however, do survive the trip. Dozens of them reach the market every year, sustaining the energy of the American economy and enriching their creators---at least sometimes.” (US Department of Energy, *From Invention to Innovation*, August 1999, page 4).

[7] Organisation for Economic Co-operation and Development, *Sectoral Case Studies in Innovation: Energy – Innovation in Energy Technology: Comparing National Innovation Systems at the Sectoral Level,* February 2, 2006 (executive summary available at http://www.oecd.org/dataoecd/38/41/36193502.pdf).

Quality of life, economic development/job creation, and innovation are inextricably linked. Governor Spitzer's January 2007 State of State Address emphasized "… we must first adapt to the Innovation Economy. This is the knowledge-based economy of new business and new ideas that has become the driving force of job creation in the world today …". This linkage was further emphasized, especially relating to clean energy technologies, in Governor Spitzer's 15x15 speech[8], and incorporated as a component of the NYSPSC Order which set in motion the Energy Efficiency Portfolio Standard Proceedings[9]. The quest for clean energy technologies is global[10], and is currently dramatically underfunded[11]. It is critical that New York State not be left behind in the race to prosper from the businesses that will invent and manufacture clean energy emerging technologies and that New York consumers quickly gain access to emerging technologies; a comprehensive and integrated support system is vital to success[12].

One can surmise that 15x15 is built on a premise that although there exist energy efficiency deployment programs (e.g., System Benefits Charge Program, Con Edison Systemwide Program and Targeted Program), more still needs to be done and can be done. This premise also holds true for emerging technologies – although there are programs more still needs to be done and can be done. Historically, New York allocates ##% of energy funds to deployment programs, and the remaining ##% to emerging technologies programs[13]. For comparison, California allocates ##% of energy funds to deployment programs, and the remaining ##% to emerging technologies programs[14] -- Additional details will be forthcoming in mid-February 2008. Also, programmatic gaps exist where the developmental needs of emerging technologies are not addressed (for example, while there are programs to demonstrate a few installations of a

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[8] "15 by 15 will address the rising tide of young people leaving New York by fueling a job-rich clean power industry that is driven by the race to meet our target. Think of all the high-paying jobs that will be needed to retrofit power plants, homes and office buildings so they can be more efficient; the jobs that will be needed to develop innovative efficiency and clean energy technologies" (Governor Eliot Spitzer, *"15 by 15" A Clean Energy Strategy for New York*, April 19, 2007, page 6), underline added for emphasis.

[9] "… more efficient use of energy has the potential to foster economic development and job growth by encouraging in-state technology advances to deliver energy efficiency programs to consumers… An EPS should be designed ultimately to reduce customer bills, stimulate State economic development, and create jobs for New Yorkers... Consider and prioritize end-user efficiency programs, market transformation approaches, research and development" (Case 07-M-0548, *Proceeding on Motion of the Commission Regarding an Energy Efficiency Portfolio Standard*, Order Instituting Proceeding, Issued and Effective May 16, 2007, pages 3, 6, 7), underline added for emphasis.

[10] "Ensure that the United States is the premier place in the world to innovate; invest in downstream activities such as manufacturing and marketing; create high-paying jobs based on innovation" (National Academy of Sciences, *Rising Above the Storm, Energizing and Employing America for a Brighter Economic Future*, 2006).

[11] "Increase investments and cooperation in energy-technology innovation to develop the new systems and practices that are needed to avoid the most damaging consequences of climate change. Current levels of public and private investment in energy technology research, development, demonstration, and pre-commercial deployment are not even close to commensurate with the size of the challenge and the extent of the opportunities" (United Nations Foundation and The Scientific Research Society, *Confronting Climate Change: Full Report*, February 27, 2007, page xvii), underline added for emphasis.

[12] "In general, successful market adoption of breakthrough innovations result from complex interactions among the private sector, the Federal Government, State government, universities, and the marketplace" (The President's Council of Advisors on Science and Technology, *The Energy Imperative, Technology and the Role of Emerging Companies*, 2006).

[13] Analysis of New York budgets for SBC 1, 2, 3, RPS, NYSERDA statutory program, DHCR WAP, gas utility Utilization Technology Development consortium, and Con Edison Systemwide and Targeted programs indicates (TBD)

[14] Analysis of California budgets (TBD)

particular item, there aren't any programs which support mega-fleet demonstration of grid-integrated systems with two-directional flow of electricity such as battery storage, micro CHP, plug-in hybrid-electric vehicles with vehicle-to-grid capability, etc., with focus on determining the grid-response aspects that can only be assessed under mega-fleet conditions).

Recap:

- Similar to the notion that there are existing energy efficiency deployment programs but they are underfunded, likewise there are existing emerging technology advancement programs but they too are also underfunded.
- Emerging technologies provide a pathway to better quality of life, economic development, and job creation.
- Support for emerging technologies is needed to "re-stock the shelves" with the next-generation of newer and better technologies.
- Emerging technologies can help avoid "lost opportunities" for energy efficiency, particularly for the new construction market.
- Earlier-stage emerging technology companies can face particular hardships trying to build a working prototype and conduct field trials, gaining access to personnel with expertise, or gaining access to high-quality/precision instruments, without the benefit of a steady income stream.
- Later-stage emerging technologies must compete against the incumbent technology that is commonplace in the field, and must overcome consumer uncertainty and consumer inertia.
- Energy efficiency benefits materialize and accrue during field trials and early adoption of emerging technologies.

3. Framework for Discussion

a) Outline major categories of emerging technologies

Any listing of emerging technologies will only be a snapshot in time, and could quickly become obsolete for a variety of reasons (e.g., some technologies on the list will reach maturity and should be taken off the list, some technologies on the list will be eclipsed by other/better technologies and will disappear from the marketplace, and some technologies will be newly conceived after the list is made)[15].

The following partial listing of emerging technologies is provided only as a reference to help frame the discussions in the remainder of this report, it is not intended to serve as an endorsement of any particular item or product as being more or less important to society, more or less at a state of readiness, or more or less deserving of government support. Compilation of the following partial listing in a format showing various groupings has been useful for focusing discussions to identify commonalities (such as stage of market readiness, targeted customers, and hurdles to technology maturity). EPS Working Group #4 has discussed the benefits of pursuing an approach that will help all emerging technologies, not merely those on an initial list. This approach is adopted as a way to avoid disenfranchising purveyors of meritorious technologies in response to lessons-learned through experiences under the NYS Renewable Portfolio Standard

[15] ACEEE studies, ibid.

Customer Sited Tier (RPS CST), where the initial list included only Photovoltaics (PV), Small Wind, and Fuel Cells (significant subsequent efforts were needed to expand the list to also include Anaerobic Digester Gas).

Advanced Lighting	On-Site Generation	Heating & Cooling	Energy Storage, Distribution & Voltage Regulation	Sensors, Controls, Data Management	Improved Combustion & Heat Transfer
■ LEDs ■ Daylighting ■ others	■ PV ■ MicroCHP ■ Microturbine ■ Fuel Cell ■ others	■ Solar heat and/or HW ■ Groundsource Heat Pump ■ Residential condensing water heater for DHW ■ Solid State Cooling ■ Advanced steam system management ■ others	■ Advanced Batteries ■ Flywheel ■ Ultracapacitor ■ Point of Consumption Voltage Regulators ■ High-temperature super-conductors ■ others	■ Advanced Meters ■ Load shed ballast ■ Occupancy sensors ■ Advanced data displays ■ others	■ Superboiler ■ Partial oxidation gas turbine ■ Ultra-low NOx supplemental firing ■ Metal forging advanced heat transfer ■ Advanced glass melting ■ others

As an example, one of the commonalties that became apparent as a result of the above list is with regard to on-site generation and also energy storage: hurdles affecting two-directional flow of electricity (from the grid to the site, and occasionally from the site to the grid) have been cataloged and suitable recommendations will be explored.

Recap:

- Any listing of emerging technologies will only be a snapshot in time, and could quickly become obsolete.
- Compilation of a partial listing of emerging technologies is provided only as a reference to help frame discussions.
- Compilation of groupings has been useful for focusing discussions to identify commonalities (such as stage of market readiness, targeted customers, and hurdles to technology maturity).
- EPS Working Group #4 has discussed the benefits of pursuing an approach that will help all emerging technologies, not merely those on an initial list, as a way to avoid disenfranchising purveyors of meritorious technologies.

b) Define pathway taken by emerging technologies from concept to commercialization, including concept of "options" approach

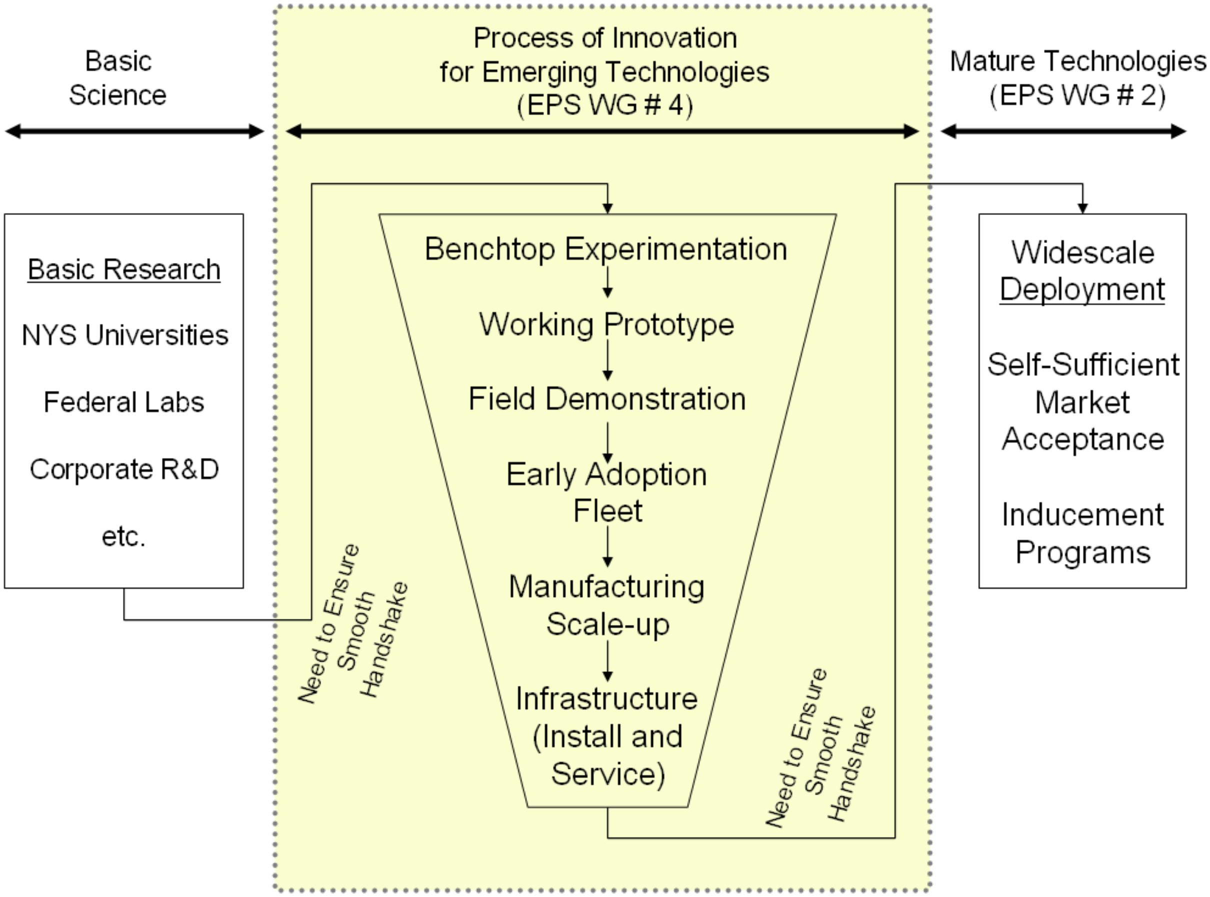
The following is a condensed schematic representation of the pathway of the critical sequential steps necessary to bring a new technology from concept to commercialization.

For the purposes of discussion, Basic Research (the birthplace of great ideas), is critical to the success of any venture to bring new technologies to market, and should receive proper funding and support (including opportunities for academic openness and a free exchange of pre-commercial ideas among and between institutions of higher learning throughout the world)[16]. However, due to the tenuousness of any linkage between basic research and an expectation for tangible outcomes by 2015 in the New York State marketplace, within EPS Working Group #4 it has been widely agreed that activities conducted as Basic Research are outside the purview of 15x15.

Widescale Deployment, through programs aimed at increasing penetration of mature technologies into the mainstream marketplace, is a concern that falls within the domain of EPS Working Group #2.

Therefore, the center box shown below represents the realm of Emerging Technologies concerns to be addressed by EPS Working Group #4. Smooth handshaking interactions between new ideas transferring from Basic Research into the realm of Emerging Technologies, and between products reaching maturity and transferring from the realm of Emerging Technologies into the realm of Widescale Deployment are also concerns to be addressed by EPS Working Group #4. Assisting Emerging Technologies to reach maturity so they can "re-stock the shelves" is not geared exclusively to funneling products into a Deployment Program. In fact, the ideal but elusive scenario is that an Emerging Technology will reach maturity and rapidly merge into the marketplace due to self-sufficient Marketplace Acceptance and will not need a Deployment subsidy.

[16] The support, integration, and application of research and development at universities and high technology training occurring at community colleges in NY State must be an integral part of any proposed energy solution. There are now projects underway that can, among other things, ultimately lead to transformational changes in energy supply and delivery, while other activities offer a more-immediate contribution to energy goals. The potential of research and development energy projects now occurring at the State's academic institutions must be aggressively identified and the commercialization process accelerated. In addition, there especially must be an increased commitment by the State to focus funding at universities on research and development that have the greatest potential to achieve specific energy goals. The investment on the front end will clearly reap energy and cost-saving benefits in the end. A partial listing of energy-related research occurring at NYS institutions of higher learning is presented at Appendix A.



The individual stages comprising the process of innovation for emerging technologies may have fuzzy boundaries. The following descriptions are provided in order to facilitate discussion:

Benchtop Experimentation: When focusing on a particular product this is also known as Applied Research. It may involve laboratory verification testing and construction of a proof-of-principle partial prototype. Team members may consist of a champion in the form of a local company which has a focus on achieving commercial sales and attaining profitability, and a company internal research division or an academic partner. Typical challenges faced at this time often include acquiring technology rights, gaining access to lab equipment, and attracting operating funds.

Working Prototype: Fabricating a working prototype, also known as Development, may involve efforts for application- and product-engineering, fabrication and testing of a full-scale working prototype, and development of enhancements to existing products. Team members may expand to include entrepreneurs. Typical challenges faced at this time often include integrating all prototype parts into a comprehensive device, formalizing a management team and creating a business plan.

Field Demonstration: Launch of first-generation product with in-field trials may involve intensive monitoring with an objective to validate the technology, its application, and value proposition. Field trials may involve removal of the item from the field followed by a "post mortem" disassembly to determine wear & tear and failure modes. Engineering efforts may include emphasis on design for ease of manufacture and scale-up. Typical challenges faced at this time often include obtaining Underwriters Laboratory (UL) listing or other industry-standard certification, and contracting for third-party testing to validate claims.

Early Adoption Fleet: Commercial introduction of a second-generation "hardened" design with refinements, sales to early adopters in niche markets, equipment warrantees, product publicity. Typical challenges faced at this time often include improving the marketing sales pitch and identifying receptive niche markets.

Manufacturing Scale-up: Typically encounter the Chicken/Egg Conundrum: Need to achieve a large sales-volume in order to justify (and finance) production scale-up, but, need production scale-up to leverage economies of scale to achieve product price reductions in order to attract a large number of customers. Typical challenges faced at this time include attracting very large capital investors, and/or establishing contracts with component suppliers and job-shop manufacturing facilities (the "supply chain").

Infrastructure Expansion (Installation and Servicing): During early commercial growth need to gain adequate market share to support business, pursuing sales to pragmatists and mass market. Typical challenges faced at this time often include training of sales force and installation/maintenance technicians, and overcoming regulatory and codes-and-standards constraints. If further support is needed to prosper in the marketplace, prepare for handoff to Deployment Programs.

While the pathway of the critical sequential steps necessary to bring a new technology from concept to commercialization is used as a framework for discussion, the degree of difficulty encountered at each step may vary based on the technology, the nature of the innovation, and the resources available to the development team. For example, invention of a new product that is built from commercially-mature and readily-available sub-components may encounter a milder challenge during the scale-up of manufacturing (in this case, scale-up of assembly), compared to other inventions.

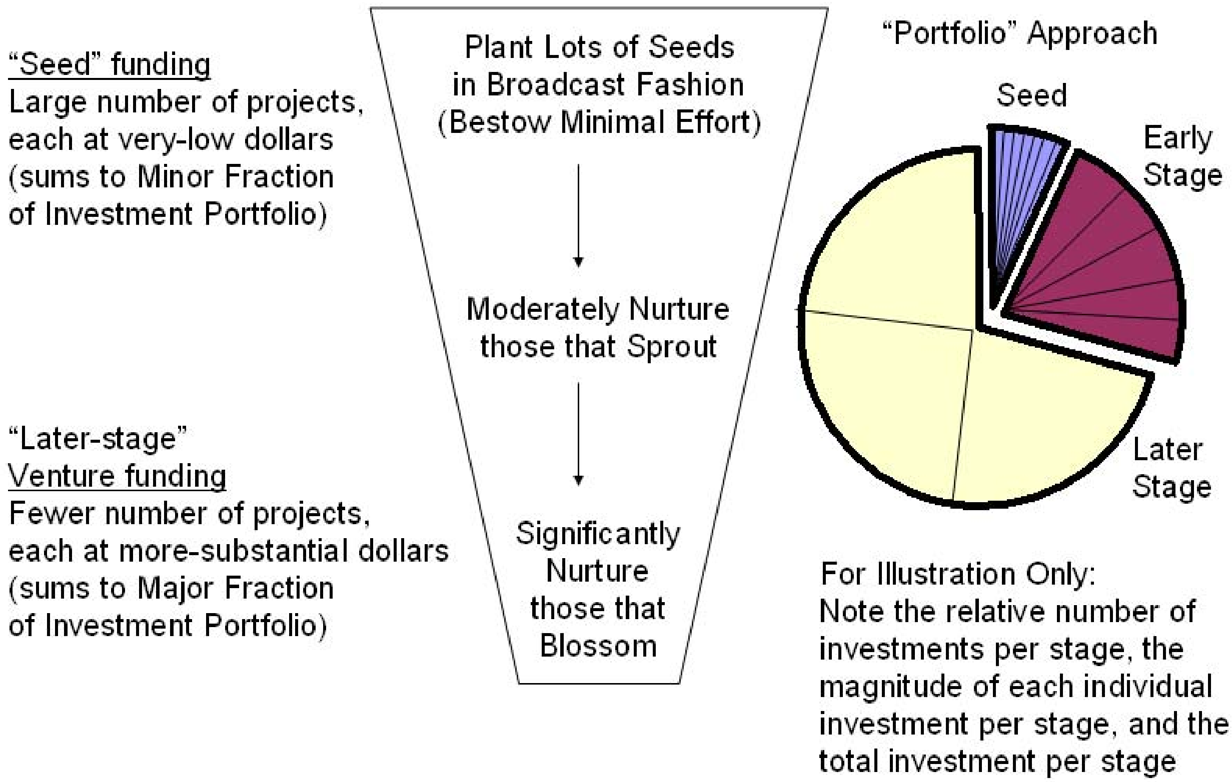
As businesspeople endeavor to move their emerging technologies along the pathway from concept to commercialization, they will likely progress sequentially through these stages. A jumble of government programs exist to assist with the challenges encountered along the way. These government programs may be thought of as a series of conveyor belts, each intended to move the state of readiness of the technology from one stage to the next. Unfortunately, there may be gaps between the conveyor belts, that is to say, a program may not help advance the technology all the way to the next stage. Furthermore, the various conveyor belts may not run at a synchronized speed, such that progressing through a particular stage of development may become a bottleneck in the overall effort.

It is the intent of EPS Working Group #4 to provide recommendations to improve the *infrastructure of support* to developers of emerging technologies 1) to align the conveyor belts to provide full coverage throughout the entire pathway, 2) to synchronize the speed of the conveyor belts to eliminate bottlenecks, and 3) to speed-up the conveyor belts to expedite the process and thus increase the chances that a new technology will make it to maturity before support for it fizzles out. Recommendations presented in this format will be able to withstand the test of time; they will provide assistance to developers of emerging technologies regardless of their state of readiness, and will be applicable to support an ever-changing list of emerging technologies, including those that have not yet been conceived. Once the necessary conveyor belts are all in place and properly tuned, program implementation structures (such as competitive solicitations, eligibility criteria guided by an advisory process, assigning proper valuation to products manufactured in New York State, etc.) could be used to ensure that the greatest support is made available to the most-promising technologies and most-influential economic development aspects.

"Options" approach is a portfolio management approach that finds winners by allowing them to reveal themselves, as opposed to guessing based on preconceived notions (guessing can lead to unintended consequences – for example, if society were to guess that compact fluorescent lightbulbs should be favored to the exclusion of incandescent bulbs, and then outlaw incandescent bulbs, some unintended consequences would arise during relamping of refrigerators and ovens, where compact fluorescent bulbs might be inappropriate given the temperature regimes of those locations). In a British white paper entitled "Europe's Deficit in Clean Energy Innovation"[17] the author encourages a concerted effort to breakdown barriers to innovation and entrepreneurship in the clean energy sector by using the public sector to create markets, not to pick winners.

Applied to emerging technologies, the approach suggests the benefits of maintaining a broad portfolio of technologies at various stages of market readiness, further described below as seeds, sprouts, and blossoms. Every farmer knows it is unsustainable to simply harvest blossoming crops; they must also routinely plant seeds, and nurture young sprouts. Options approach suggests that the degree of nurturing should be proportional to the magnitude of anticipated benefits (as characterized by a number of features including proximity to maturity).

[17] Liebreich, Michael Europe's Deficit in Clean Energy Innovation, April 28, 2005, New Energy Finance of London (available at http://www.newenergyfinance.com/NEF/HTML/Press/NEF-Innovation-White-Paper.pdf).



The benefits of a broad portfolio are supported in an article by the president of the American Association for the Advancement of Science John P. Holdren[18] where he indicates "A further implication of the characteristics of today's energy challenges is that society will do better to pursue a broad portfolio of improved energy-supply and end-use options, rather than putting its eggs in too few baskets. ... by combining the growth of multiple new or improved options – each drawing on different types of material resources, skills, and firms – it can replace the status quo technologies more rapidly than would be possible by one or two new options alone."

[18] Holdren, John, P., *The Energy Innovation Imperative: Addressing Oil Dependence, Climate Change, and Other 21st Century Energy Challenges*, the MIT journal Innovations, spring 2006 (available at http://www.policyinnovations.org/ideas/policy_library/data/energy_innovation/_res/id=sa_File1/INNOV0102_p3-23_holdren.pdf).

Recap:

- There is a pathway along critical sequential steps necessary to bring a new technology from concept to commercialization; movement from step to step comprises the process of innovation.
- The critical sequential steps include: Benchtop Experimentation; Working Prototype; Field Demonstration; Early Adoption Fleet; Manufacturing Scale-up; and Infrastructure Expansion (training of Installation and Service technicians).
- EPS Working Group #4 addresses smooth handshaking interactions between new ideas transferring from Basic Research into the realm of Emerging Technologies, progression through the realm of Emerging Technologies, and smooth handshaking interactions between products reaching maturity and transferring from the realm of Emerging Technologies into the realm of Widescale Deployment (WG #2).
- A jumble of government programs exist to assist with the challenges encountered along the pathway; improvements and expansions are possible.
- EPS Working Group #4 will provide recommendations to improve the *infrastructure of support* to developers of emerging technologies to provide full coverage throughout the entire pathway, to eliminate bottlenecks, and to expedite the process.
- "Options" approach is a portfolio management approach that finds winners by allowing them to reveal themselves, as opposed to guessing based on preconceived notions; it suggests the benefits of maintaining a broad portfolio of technologies at various stages of market readiness (seeds, sprouts, and blossoms).

c) List hurdles faced by energy-efficient emerging technologies, and recommendations

The following hurdles (and their corresponding recommendations) are grouped sequential by "state of market readiness" (e.g., hurdles encountered when attempting to move an emerging technology through the "benchtop experimentation" stage, or through the "field demonstration" stage). These hurdles and recommendations are phrased so as to be independent of any particular product or service, and are intended to highlight that when an emerging technology progresses to a particular state of market readiness its further progress could be retarded due to a hurdle which is characteristically associated with that particular state of market readiness.

Hurdles encountered during **Benchtop Experimentation stage**	**Corresponding Recommendations**
Hurdle #01: Difficulty attracting operating funds (investments) at this stage (often because investors are looking for quick returns instead of building a long-term relationship).	Recommendation #01: The Small Business Technology Investment Fund (SBTIF) is one potential source of venture capital, and should be highlighted to entrepreneurs (this existing State resource could possibly assist start-up companies with truly innovative high-tech energy products). In addition, the State Comptroller, which also distributes venture

Hurdles encountered during Benchtop Experimentation stage	**Corresponding Recommendations**
	capital funding, might be encouraged to direct a greater portion of investment resources toward energy companies.
Hurdle #02: Difficulties obtaining wise counsel regarding technical and business risks and potential rewards before too much is irretrievably invested.	Recommendation #02a: Generally, incubators foster new company growth without regard to the business or technological focus; an energy incubator is likely to need specialized facilities. Could promote clean energy incubators, perhaps based at the universities now engaged in energy research and development. Recommendation #02b: Promote availability of Executive Volunteers as mentors (including active and retired personnel), and referrals via Technology Development Orgs/Technology Development Corps (TDOs/TDCs).
Hurdle #03: Gaining access to high-caliber talent for short-duration project-focused effort (could be difficult to justify hiring a permanent employee for a short-duration assignment, could be difficult to recruit a high-caliber individual for a short-duration assignment).	Recommendation #03: Some infrastructure components currently exist to guide energy alternative and conservation ideas from drawing board to commercialized product. Two existing programs: Centers for Advanced Technology (CATs) and the Technology Transfer Incentive Program (TTIP) could possibly direct greater amounts of their attention toward the encouragement of energy research and development at universities in the State. CATs support university-industry collaborative research and technology transfers. The intent of the program is to facilitate the transfer of technology from New York’s top research universities into commercially viable products produced in the private sector. Similarly, TTIP is specifically designed to help businesses make the rapid transfer of new ideas and new technology from the research lab to the marketplace. Regional Technology Development Centers (RTDCs) work with hundreds of small manufacturers each year. Many RTDCs, with support from ESD and NYSERDA, have

Hurdles encountered during Benchtop Experimentation stage	**Corresponding Recommendations**
	helped clients with energy audits and installing energy efficient manufacturing equipment. RTDCs could be used as a mechanism to reach existing manufacturers to help reduce energy usage and costs through efficiency and new equipment.
Hurdle #04: Balancing the need to divulge some information and/or partner with external groups when seeking subsidy funding (in order to convince fund administrators of the viability of the concept) compared to the inherent need to protect intellectual property, can be an impediment to obtaining funding.	Recommendation #04: A recommendation will be forthcoming in mid-February 2008.
Hurdle #05: Acquiring technology rights (intellectual property) if all necessary pieces are not within one's holding.	Recommendation #05: A recommendation will be forthcoming in mid-February 2008.
Hurdle #06: Gaining periodic access to lab equipment if purchase cannot be justified or afforded.	Recommendation #06: See recommendation #03.
Hurdle #07: Lack of information regarding availability and performance of emerging technologies, which could be bundled into an integrated energy solution, where the bundled product becomes more economical than the individual components.	Recommendation #07: A technology transfer clearinghouse regarding clean energy emerging technologies should be established.

Hurdles encountered during Working Prototype stage	**Corresponding Recommendations**
Hurdle #08: Integrating all prototype parts into a comprehensive device, which will be readily manufacturable at a competitive price, simple to operate and maintain, reliable, and properly sized with dimensions and weight appropriate for its typical use at customer sites.	Recommendation #08: Continue and expand existing funding programs, continue and expand outreach efforts which promote partnerships with the NYS CATs.
Hurdle #09: Selection of cost-effective components may be hampered by needs to meet and/or duplicate other pre-existing in-field components, such as utility-grade	Recommendation #09: A recommendation will be forthcoming in mid-February 2008.

Hurdles encountered during Working Prototype stage	**Corresponding Recommendations**
revenue meters.	
Hurdle #10: There is a lack of common protocols for bi-directional communication between and among appliances and energy curtailment administrators, and this has retarded the number of communicable appliances being fielded.	Recommendation #10: Promote a consortium approach to establish a consensus protocol.
Hurdle #11: Formalizing a management team.	Recommendation #11: See recommendation #02b.
Hurdle #12: Creating a business plan.	Recommendation #12: Promote access to SUNY Small Business Center, and referrals to business schools.

Hurdles encountered during Field Demonstration stage	**Corresponding Recommendations**
Hurdle #13: Obtaining Underwriters Laboratory (UL) listing or other industry-standard certification.	Recommendation #13: Continue and expand existing funding programs.
Hurdle #14: Contracting for third-party testing to validate claims.	Recommendation #14: Continue and expand existing funding programs.
Hurdle #15: Subsidies to support field trials typically do not provide enough funds to enable "mega" projects. Two types of mega projects are envisioned: either field trial of one large/costly item (e.g., utility-scale flywheel energy storage); or field trial of a mega fleet of dispersed small modular items - while there are programs to demonstrate a few installations of a particular item, there aren't any programs which support mega-fleet demonstration of grid-integrated systems with two-directional flow of electricity such as battery storage, microCHP, plug-in hybrid-electric vehicles with vehicle-to-grid capability, etc., with focus on determining the grid-response aspects that can only be assessed under mega-fleet conditions).	Recommendation #15: Create a new program with sufficient funding to engage in clean energy emerging technologies "mega" demonstration projects.
Hurdle #16: Introduction of new technologies into an industrial facility's manufacturing	Recommendation #16a: Showcase NYS's emerging technologies at appropriate trade

Hurdles encountered during Field Demonstration stage	**Corresponding Recommendations**
process may disrupt normal production patterns, and may encounter strong resistance to change.	conferences and trade media (e.g., alert product developers of upcoming conferences, submit case studies to trade journals). Program implementers should consider creating Tech Transfer Manager positions for each end-use sector. Recommendation #16b: Do a better job of quantifying energy benefits and non-energy benefits to emphasize bottom-line impact. Recommendation #16c: Work with NYS business schools to focus on/research acceleration of getting energy-efficient emerging technologies to the marketplace. Perhaps create fellowships to team academia with emerging technology developers to accelerate the conveyor belts. Recommendation #16d: Emphasize that this is not just about (controversial) global warming. Using energy efficiently: saves money, keeps more US money in the US, reduces the reasons to go to war over oil dependency, reduces air-quality-related illnesses (e.g., asthma), thus reducing medical/insurance costs, provides an opportunity for NYS and the US to use its technology development expertise to be the leader in inventing energy-efficient products that we can sell all over the world. Recommendation #16e: Get insurance companies involved since they stand to reap significant benefits from cleaner air. Recommendation #16f: Continue and expand existing funding programs with improved "risk sharing".

Hurdles encountered during Field Demonstration stage	**Corresponding Recommendations**
Hurdle #17: Customers are often either unclear that the field trial is an "experiment" or unaware of the magnitude of the risks associated with failure of the experiment, and therefore not properly equipped to pursue "plan B" if the experiment fails.	Recommendation #17: Innovative programs aimed specifically at reducing the risk to early adopters should be looked at in preference to outright subsidies as viable technologies should be able to offer good return based on performance and initial cost assessments, but long term performance and reliability to achieve the projected life-cycle cost is the unknown that neither the manufacturer nor the customer can easily address.
Hurdle #18: Commercial financing of field trials can be difficult to obtain when lenders rightly understand the risks involved in an "experiment".	Recommendation #18: See recommendation #17.
Hurdle #19: Continued dependence on analog information (as opposed to digital data) retards data sharing, data analysis, and timely decision making. Lack of real-time monitoring reduces the ability to demonstrate the effectiveness of advanced energy management strategies.	Recommendation #19: Real-Time Monitoring of energy (electricity, district steam) consumption/generation provides load profile data and is an indicator of operating efficiency. All generators and district steam boiler plants should monitor their consumption to indicate efficiency and operating trends. Sub-metering should also be considered for critical equipment. Once historical reference data is collected, immediate action can be taken when usage varies beyond acceptable limits. Installation of accurate meters could be beneficial. A variety of monitoring platforms, including web-based, could be considered. Advanced metering infrastructure could be helpful.

Hurdles encountered during Early Adoption Fleet stage	**Corresponding Recommendations**
Hurdle #20: It may be challenging to identify receptive niche markets.	Recommendation #20: A recommendation will be forthcoming in mid-February 2008.
Hurdle #21: There is a lack of performance certification regarding some emerging technologies.	Recommendation #21a: Continue and expand existing funding programs. Recommendation #21b: See recommendation

Hurdles encountered during Early Adoption Fleet stage	**Corresponding Recommendations**
	#07.
Hurdle #22: Benefits may be perceived as diffuse and uncertain, thus limiting private sector involvement.	Recommendation #22: A recommendation will be forthcoming in mid-February 2008.
Hurdle #23: Technologies which have achieved wide acceptance elsewhere in the world, but have limited experience in NYS, encounter hurdles associated with lack of public awareness regarding the availability, reliability, and mode of integration with pre-existing systems.	Recommendation #23a: Conduct a statewide effort to assess market potential and hurdles regarding clean energy emerging technologies. Recommendation #23b: NYS should create a statewide marketing campaign similar to promote clean energy emerging technologies. A NYS campaign would raise public awareness of the technologies and their impacts. This could be done through implementation programs which could pay for performance (sales and/or kWh/therm savings) for both residential and commercial applications. Recommendation #23c: Expand programs to sponsor demonstration of emerging technologies, ensure the demonstration events include independent evaluation of the technology performance, the markets where it can be used, its costs and value proposition. Also, high importance should be given to user/customer assessments and feedback. Conduct widespread technology transfer through multiple media outlets and through numerous channels with trade allies. Recommendation #23d: NYS could create a focused educational effort that would reach out to Builders, Architects, Engineers and Contractors. Recommendation #23e: Expand existing training programs at the many institutions

Hurdles encountered during Early Adoption Fleet stage	Corresponding Recommendations
	around the state, from Career & Technical Education high schools to SUNY and CUNY campuses. Nurture and fully maximize the training programs going on at New York State's community colleges to educate anew generation of high technology energy employees (these schools offer a key opportunity to develop labs and clinics to train students). Create partnerships with stakeholders in the emerging market for green construction and materials, energy efficiency, efficient appliances, manufacturer's representatives, etc. Market these programs to attract students and professionals, emphasizing the growing sector of green-collar jobs and the wide array of talents needed, from math and science to engineering to sales and communication skills. Provide funding via public and private sectors, including SUNY/CUNY budgets, building, construction, energy, renewable industries, and trade unions. Create incentive programs to stimulate the creation of internship programs and in-house training. Partner with the Workforce Development Institute to create installation certification programs. Recommendation #23f: Offer more-comprehensive energy audits which are expanded to include assessment of non-traditional features (such as point-of-consumption voltage regulation, etc.). Recommendation #23g: NY State (agencies, authorities, etc.) should initiate clean energy emerging technologies projects (where ever feasible) on NYS buildings and in transportation systems (such as electrified rail, hybrid electric vehicles, compressed natural gas vehicles, etc.), and showcase the technologies as case studies on the state

Hurdles encountered during Early Adoption Fleet stage	**Corresponding Recommendations**
	website. Recommendation #23h: Establish programs to assist with block-purchasing (by government, private sector, others) of clean energy emerging technologies. Recommendation #23i: See recommendations #07 and #16a.
Hurdle #24: There may be a lack of information to assist the bundling of benefits so emerging technology vendors can emphasize the value proposition of their wares.	Recommendation #24a: Bundle subsidies via a variety of mechanisms (e.g., rebates, tax credits, government purchasing contracts, net metering, etc.) as best streamlined, and at a sufficient level to bring the cost of the technology in line with consumer spending habits. Increase the availability and level of subsidies to be effective in the marketplace (establish the appropriate mechanism of bundling for the desired outcome). Recommendation #24b: Builders should be given high-enough incentives (so as to inspire action) to include clean energy emerging technologies as part of their construction. Recommendation #24c: Promote performance contracting programs to reduce the risk that insufficient savings might be realized. Recommendation #24d: Provide long term, low interest financing so customer's monthly payment is the same as or less than what it would be if they didn't make the change to the clean energy emerging technologies. Recommendation #24e: Provide a low-income solution for those people who would benefit from a change to a clean energy

Hurdles encountered during Early Adoption Fleet stage	**Corresponding Recommendations**
	emerging technology but don't have money to put toward capital equipment (a "pay as you save" approach could be considered). Recommendation #24f: See recommendations #07 and #16c.
Hurdle #25: Previous launches of premature products, when problems were encountered, have tainted consumers' perceptions; difficult to get beyond remembrances of these "ghosts".	Recommendation #25: See recommendation #38b.
Hurdle #26: Engineering assessments may be needed to entice a site to consider participating in an emerging technology deployment program.	Recommendation #26: Continue and expand existing funding programs.
Hurdle #27: There may be a lack of familiarity among authorities having jurisdiction (e.g., the multitude of building inspectors, fire marshals, etc.) regarding emerging technologies.	Recommendation #27: Provide training and site tours to educate code compliance officials regarding the attributes of a wide variety of clean energy emerging technologies.
Hurdle #28: There may be a need to involve marketing professionals in order to improve the marketing sales pitch.	Recommendation #28: A recommendation will be forthcoming in mid-February 2008.
Hurdle #29: There may be a lack of data-rich studies regarding the potential impacts of emerging technologies (as driver for public policies).	Recommendation #29: See recommendation #23a.
Hurdle #30: Utility infrastructure limitations which exist and are awaiting scheduled improvement, such as grid network protectors at or beyond their fault current duty ratings, impose limitations on customer choice and/or configuration of certain emerging technologies (such as on-site generation).	Recommendation #30: Instruct utilities to expedite upgrades to systems.
Hurdle #31: There may be a lack of contracting options whereby emerging technologies could be used to complement intermittent generators (e.g., solar, wind) in order to establish a reliable energy pattern.	Recommendation #31: A recommendation will be forthcoming in mid-February 2008.

Hurdles encountered during **Early Adoption Fleet stage**	**Corresponding Recommendations**
Hurdle #32: Voluntary residential customer time-variant rates provide insufficient savings potential to encourage meaningful actions and widescale participation.	Recommendation #32: The NYSPSC should review the statue which prohibits mandatory time-variant pricing residential rates, and consider recommending legislative changes if benefits are found to outweigh costs (as noted in the "Demand Response" portion of this report).

Hurdles encountered during **Manufacturing Scale-up stage**	**Corresponding Recommendations**
Hurdle #33: Chicken/Egg Conundrum: need to achieve a large sales-volume in order to justify (and finance) production scale-up, but, need production scale-up to leverage economies of scale to achieve product price reductions (in order to attract a large number of customers).	Recommendation #33: See recommendation #23h.
Hurdle #34: Difficulty attracting very large capital investors without giving away too much company value.	Recommendation #34: Establish "introduction/match making" programs to bring together potential investors and those seeking capital.
Hurdle #35: May be difficult to establish a suitable contract with a job-shop manufacturing facility to perform contract manufacturing on an as-needed basis.	Recommendation #35: Establish "introduction/match making" programs to bring together potential job-shop manufacturers and those seeking to outsource some manufacturing activities.

Hurdles encountered during **Infrastructure Expansion stage**	**Corresponding Recommendations**
Hurdle #36: There is a lack of training available to expand the cadre of installation and service technicians capable of dealing with emerging technologies.	Recommendation #36: See recommendation #23e.
Hurdle #37: There may be challenges to overcoming regulatory and codes-and-standards constraints.	Recommendation #37: Establish an ad hoc mediation team.

Hurdles encountered during transition to Mature Technology	**Corresponding Recommendations**
Hurdle #38: There is a lack of awareness of energy inefficiency problems and energy-saving opportunities.	Recommendation #38: See recommendations #23b, #23f, and #23g.
Hurdle #39: There is a lack of information available to the public to support purchasing decisions regarding emerging technologies. Conflicting or inaccurate information in the marketplace which harms the ability of emerging technologies to attract customers is difficult to overcome.	Recommendation #39: See recommendations #07 and #23c.
Hurdle #40: Emerging technologies often have first-cost premiums and there is a pervasiveness of "first cost" mentality and lack of appreciation of "life cycle cost" consideration. Individuals do not readily embrace the complex quantitative analyses which are often a good selling point for emerging technologies.	Recommendation #40: See recommendations #24d and #24e.
Hurdle #41: Subsidies are needed to bring the cost of the technology in line with consumer spending habits (such as the typically expected payback period for each various end-use sector – e.g., industries typically require a shorter payback period than institutions). Existing mechanisms of subsidies (rebates, tax credits, government purchasing contracts, net metering, etc.) are insufficient and/or convoluted/cumbersome (and might not be available to all potential customers – for example, tax incentives are not readily available to non-profit enterprises).	Recommendation #41: See recommendation #24a.
Hurdle #42: There is a lack of familiarity among specifying engineers and architects regarding emerging technologies.	Recommendation #42a: The systems of NYS codes and local permits should be modified to encourage new construction project to include clean energy emerging technologies. Recommendation #42b: Energy Star criteria currently do not recognize buildings that go beyond the base requirements and achieve superior performance. Program administrators

Hurdles encountered during transition to Mature Technology	**Corresponding Recommendations**
	should create Energy Star Silver, Gold and Platinum categories for buildings and recognize builders/owners who build beyond Energy Star minimum criteria. Recommendation #42c: See recommendations #07, #23d and #24b.
Hurdle #43: Inertia – there is a reluctance among builders and developers to try new approaches which may involve emerging technologies.	Recommendation #43: Continue and expand existing funding programs.
Hurdle #44: There may be competition between various emerging technologies for "set aside" incentive funds resulting in "in-fighting" instead of directing the focus toward comparison/contrast of emerging technologies versus mature technologies.	Recommendation #44: A recommendation will be forthcoming in mid-February 2008.
Hurdle #45: Existing pilot programs which have proved successful at deploying emerging technologies are limited in scope and duration.	Recommendation #45: Continue and expand existing funding programs.
Hurdle #46: New product may not fit into existing product markets or business models.	Recommendation #46: A recommendation will be forthcoming in mid-February 2008.
Hurdle #47: There may be a lack of fuel flexibility with combustion devices as offerings to customers with natural gas or propane or other fuel.	Recommendation #47: A recommendation will be forthcoming in mid-February 2008.
Hurdle #48: Commissioning and retro-commissioning efforts, including comprehensive or targeted annual audits, are difficult to sell based on the presumption that the amount of waste that will be found and eliminated will sufficiently exceed the cost of the effort.	Recommendation #48: See recommendation #24c.
Hurdle #49: There may be duplicative regulatory requirements, such as the need for "type testing" of inverters that have already undergone Underwriters Laboratory (UL) listing or other equivalent testing and	Recommendation #49: Review codes and standards and recommend elimination of duplicative requirements.

Hurdles encountered during transition to Mature Technology	Corresponding Recommendations
certification.	
Hurdle #50: Regulatory uncertainty can cause paralysis – a "wait and see" mentality appears under certain circumstances (as the deadline for exemption from standby tariffs approached, CHP projects underway with significant investment but uncertain if they would meet the deadline are reported to have considered abandoning any further action). Regulatory uncertainty can also inspire awkwardly designed systems that are far from optimum (as has typically been the case with CHP systems that are designed based on current tariffs with little appreciation for potential tariff structures that will occur upon the scheduled sunset of Competitive Transition Charges [CTCs] even though such systems will be governed by such future tariffs for the majority of their operating lifetimes).	Recommendation #50: A recommendation will be forthcoming in mid-February 2008.
Hurdle #51: Regulations may not have kept up with advances in technology (e.g., the Standard Interconnection Requirement [SIR] may need updating).	Recommendation #51: The NYS Standard Interconnection Requirements (SIR) should be reviewed and updated as necessary to take into account new developments and systems which may have alleviated many earlier safety concerns.

4. Recommendations and Forecasted Benefits

a) Discuss recommendations to address hurdles

Recommendations to address hurdles are shown in the tables in the previous section, where 51 specific hurdles are keyed to their corresponding recommendations, and 40 distinct recommendations have been compiled so far. These 40 recommendations can be consolidated within seven (7) overarching themes, as follows:

Recommendation Overarching Theme #1: Continue and expand existing funding programs.

Recommendation Overarching Theme #2: Leverage allies (CATs, TDOs/TDCs, venture capital funds, Comptroller investment portfolio, federal funds such as SBIR, insurance companies, volunteer executive mentors, business schools and MBA programs, etc.).

Recommendation Overarching Theme #3: Bundle incentives so as to be simple to acquire and of sufficient magnitude to inspire action.

Recommendation Overarching Theme #4: Create a new program with sufficient funding to engage in clean energy emerging technologies "mega" demonstration projects (for example, field trial of one large/costly item such as utility-scale flywheel energy storage, or field trial of a mega fleet of dispersed small modular items such as grid-integrated systems with two-directional flow of electricity [e.g., batteries] as a means to investigate the tolerable saturation point of the grid).

Recommendation Overarching Theme #5: Promote data collection, display, analysis, and communication mechanisms, such as real-time monitoring and display, and common communication protocols and platforms.

Recommendation Overarching Theme #6: Perform/update studies and develop/update protocols to assist with public policy (such as market potential studies, review/update of the Standard Interconnection Requirement, and review of codes and standards).

Recommendation Overarching Theme #7: Create a technology transfer clearinghouse for clean energy emerging technologies to raise consumer awareness and inform the design/specify/build tradespeople, expand technology transfer efforts (conferences, workshops, outreach, site tours, etc.), expand training and certification programs for clean energy installation and service technicians.

b) Recommendations on funding allocations and flexibility

Emerging Technologies are generally considered to have not yet reached commercial maturity in the marketplace (i.e., pre-commercial), are not yet generally cost-effective, and can be risky. Therefore, the use of a traditional Total Resource Cost (TRC) test does not appear to be compatible with an intention to support emerging technologies.

Ultimately, realistic projections of costs to bring an emerging technology to maturity, and its forecasted commercial price once it reaches maturity, should be considered during the design of program implementation structures (such as competitive solicitations, or eligibility criteria guided by an advisory process), in order to ensure that the greatest support is made available to the most-promising technologies.

Additional details will be forthcoming in mid-February 2008.

c) Expected benefits, beneficiaries, and timeframes

Additional details will be forthcoming in mid-February 2008.

d) Identify linkages to other parts of the report

Additional details will be forthcoming in mid-February 2008.

5. APPENDIX A: A Partial Listing of Energy-related Research occurring at NYS Institutions of Higher Learning

Business, academic, and government partnerships need to take a leading role in meeting the short and long term energy projects and objectives of Governor Eliot Spitzer.

The Empire State's academic institutions are engaged in energy Research and Development that will meet the goals of the Energy Efficiency Portfolio Standard (EEPS). Many of these involve projects which could possibly lead to transformational changes in energy supply and delivery. Others offer more of an immediate contribution to energy goals in such areas as building efficiency.

It will be useful to incorporate these activities in Work Group IV's final recommendations to the EEPS Plenary.

Highlights of energy Research and Development at several leading State universities follows. Note that a myriad of other educational institutions in NYS, including Polytechnic University, Columbia University, Long Island University, Manhattan College, NYU, and others, have programs which involve clean energy emerging technologies.

Alfred University is engaged in research at its Center for Environmental and Energy Research (CEER) that includes nanoscale layered photocatalysts, recycling of silicon-wafers production wastes, emissions reduction of commercial glassmaking, and recovery and purification of hydrogen from mixed gas streams. In 2006, Alfred won a Center for Advanced Technology (CAT) Development award to work with the RPI Energy CAT on Fuel Cells.

Clarkson University is improving fuel cell design, developing dairy waste-to-energy, making advances in blade and turbine wind energy technology, and investing in research that improves motor design and truck efficiency.

Cornell University is working on projects to convert lignocellulosic materials to ethanol, it is engaged in conversion research for waste vegetable oil to biodiesel, and the conversion of dairy-manure derived biogas to liquid fuels. Cornell is also the northeast SunGrant Initiative Center to further industrial biotechnology, agricultural biotechnology, and to develop biobased green products.

Rensselaer Polytechnic Institute is working in the area of energy-efficient solid-state lighting at its Lighting Research Center. Working with OSRAM SYLVANIA the Center has demonstrated a new lighting control system that allows electricity customers to reduce monthly utility bills by controlling their own peak electricity demand. RPI also is engaged in finding sustainable energy alternatives at its Center for Future Energy Systems (CFES). Current research areas at CFES include smart lighting, smart displays, renewable energy, and fuel cells and hydrogen. In 2006, RPI won a Center for Advanced Technology (CAT) Development award for "Distributed Generation" (DG) regarding small scale electrical generation at the utility grid level.

Syracuse University is developing industrial and residential cogeneration, supercritical diesel fuel combustion systems, and CHP unit using biodiesel from soybean oil via supercritical oxidation. The Syracuse Center of Excellence continues to work on sustainable design fuels with an energy strategy of efficiency and re-use.

SUNY Albany is engaged in research that includes solar, biodiesel, hydrogen sensors, anaerobic methane digester, and hydrogen from mixed gas streams. It's Energy and Environmental Technology Applications Center (E2TAC) works toward the integration of microelectronics and nanotechnology in advanced energy and environmental applications. In 2006, Albany won a CAT Development award to create a test farm that will allow demonstration and continuous operation of prototype alternate energy products which incorporate nanomaterials and nanoelectronic components developed by the school.

SUNY's Center for Suitable and Clean Energy is conducting research in photovoltaic power generation, solar-fueled hydrogen generation, renewable carbonate fuel cell operations, biomass gasification for synthetic gas, and biomass combined heat and power sole-firing and co-firing with fossil fuels energy production.

SUNY Stony Brook announced in October 2007 that it broke ground for The Advanced Energy Research and Technology Center to develop new and efficient sources of energy. The Center also will build alliances among universities, laboratories, and companies. Basic energy research initiatives at the Center include solar, wind, hydrogen, methane hydrates, solid state and polyelectrolyte membranes and conventional fuels like coal, shale and fossil.

Suggested Links for the EEPS Plenary to review and perhaps cite in its report:

- www.syracusecoe.org/main/energy.aspx
- www.cnse.albany.edu/business_resources/centers_programs.html
- www.cornell.edu/landgrant/rural/energy.cfm
- www.aertc.org
- www.clarkson.edu/research/env_energy.html
- www.ceer.alfred.edu
- www.lrc.rpi.edu
- www.rpi.edu/cfes/
- www.e2tac.org

The links and highlights above are a modest reflection of the activities occurring throughout New York. Not surprisingly, there are many private-academic-government energy partnerships occurring in other states.

In February 2007, the federal government called for a 22% increase in federal grant money. The National Renewable Energy Laboratory, a component of the National Bioenergy Center, helps advance the U.S. Department of Energy's goals to find alternative energy sources. It has set up a Technology Transfer Office to assist scientists and engineers "in the practical application of their discoveries." One beneficiary has and will be the Brookhaven National Lab in Upton, New York which is a leader in biofuel field testing, wind-energy design, and battery-material development, among other things.

Keeping the above considerations in mind the Plenary should be encouraged to include the following as part of its final report: the need for i) increased targeting of State funds toward research areas having the greatest potential to specific energy goals; ii) aggressively applying current technologies developed at research institutions; iii) encouraging Angel Investors to allocate seed money for energy alternatives; iv) exploring the creation of incubators focused exclusively on alternative energies and commercialization; and v) creating or fostering the infrastructure that enables a free exchange of ideas among and between institutions of higher learning throughout the world.

III. DEMAND RESPONSE, PEAK LOAD REDUCTION, AND OTHER LOAD AND DISTRIBUTION MANAGEMENT TECHNIQUES

A. Advanced Metering and Advanced Metering Infrastructure (AMI)

1. Demand Response & AMI Explained

To begin with a discussion about advanced metering without first discussing Demand Response as an introduction would be pointless.

Peak demand reduction programs (demand response) will provide numerous benefits to New York electric customers. These program benefits will include substantial customer financial benefits and electric reliability benefits.

Some customers have the potential to receive substantial savings on their energy bills and incentive payments by adjusting their electric demand in response to time-sensitive electric rates and incentive-based programs. In addition, demand response programs may serve to reduce wholesale capacity and/or energy market prices because such programs may avert the need to use the most costly-to-run power plants during periods of otherwise high demand – driving generation costs and prices down for competitive wholesale electricity purchasers.

Over the longer term, sustained and targeted demand response lowers the need to build new generating, transmission, and distribution capacity. In addition, reliability benefits accrue because demand response lowers the likelihood and consequences of forced outages on the electric grid.

Regional, state, and utility demand response programs are all needed to achieve effective Demand Response. Programs at all three levels are needed to derive maximum current and future benefits. While participation in NYISO programs can reduce wholesale power costs for all consumers, State and utility programs are necessary to save millions of dollars by deferring some of the expensive additions to generation, transmission and distribution resources.

Support for and promotion of Smart Metering and the creation and deployment of an Advanced Metering Infrastructure (AMI) will facilitate further development of demand response programs that will provide opportunities for ratepayers and operational efficiencies for the utilities. [19]

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[19] The National Association of Regulatory Commissioners (NARUC) has been active in their efforts to promote advanced metering and the creation of an Advanced Metering Infrastructure (AMI) throughout the country. The NARUC Board of Directors, at their Winter Committee Meetings in February of 2007, approved a resolution that offered recommendations for

2. Advanced Metering and AMI

The Federal Energy Regulatory Commission (FERC) defines Advanced Metering in the following manner:

> *"Advanced metering is a metering system that records customer consumption [and possibly other parameters] hourly or more frequently and that provides for daily or more frequent transmittal of measurements over a communication network to a central collection point."*[20]

In general, the primary benefit of creating an AMI is the ability to quickly process large amounts of pricing and usage data and make such data available to customers, the utility and other interested parties. AMI not only offers opportunities for sophisticated load management measures behind the meter, but it also provides a platform for potential benefits for utility operations in areas such as remote service connects/disconnects, outage management, theft detection and remote load control

A critical "emerging technology" for enabling demand side management is based on the use of advanced meters and the development of an Advanced Metering Infrastructure (AMI). AMI is not a specific technology, but rather an infrastructure that has, at its core, a bi-directional network with advanced meters. The Federal Energy Regulatory Commission (FERC) defines AMI as:

> *"The communication hardware & software and associated system and data management software that creates a network between advanced meters and utility business systems and which allows collection and distribution of information to customers, retail providers and the utility."*

AMI's most basic functions involve reading and recording customer electric (and/or gas or water) usage at programmed hourly intervals (or shorter term intervals or on-demand), and then storing and forwarding that information over fixed networks for use by customers and customer-based systems, grid operators, and utilities. Among the most valuable capabilities of AMI in terms of providing operational efficiencies and cost savings are automated remote meter readings and remote outage detection, diagnosis, and restoration. AMI is an enabler of Demand Response as it has the capability to provide time variant pricing information, which is needed to provide time-based rates to customers.

Time-based rates, such as Time of Use (TOU) rates, Critical Peak Pricing (CPP) rates and Real-Time Pricing (RTP), allow customers to be charged rates that vary dynamically over some period, e.g., hourly, based on the underlying wholesale cost of electricity in the day-ahead (or real-time market). AMI can also allow customers to see their usage and the corresponding price for that usage, and to modify their usage in response to the price. AMI can also provide utilities and grid operators the capability to monitor electric usage by an individual customer as well as by groups of customers, and to perform automated or manual load control and distribution system operations and maintenance.

States that are facilitating cost-effective AMI technologies. The Board adopted the "Resolution to Remove Regulatory Barriers to the Broad Implementation of Advanced Metering Infrastructure".[19]

[20] Definition is taken from the 2007 Assessment of Demand Response and Advanced Metering Report submitted by the FERC.

A broad range of demand response technologies are available and continue to evolve with a number of new and enhanced technologies appearing on the market or in development. Included among the options are smart thermostats capable of responding to tiered time-of-use (TOU) pricing and remotely initiated curtailment events, remote appliance controllers, energy management systems with automatic demand control, computer-controlled load management systems, improved communications technologies (both customer premise and wide-area networks), improved metering technologies with built-in demand-response functionality, Internet-controlled systems and integration of other subsystems with on-site generation and/or renewable energy sources.

AMI can be viewed as a foundation for demand response initiatives, providing enhanced capabilities for communicating prices to customers in real or near-real time, accelerating measurement and verification of demand changes, and facilitating faster data processing and settlement. One day, AMI may become part of a "Smart Grid" -- a network tying together and coordinating supply-side resources with customer processes to enhance the overall operation of the distribution network.

When developing a demand response program, it should be flexible enough to accommodate a number of approaches and technologies appropriate for a variety of customers and their needs and electrical configurations. An effective program should take advantage of developing technologies and should be as broadly compatible across devices and systems as possible to maximize the useful life of equipment and to maintain options for expanding the scale of existing programs.

In some cases, the actual meter may not need to be replaced. If another communication pathway is available to get remote meter readings on a timely basis, this could be used if it proves to be more cost effective. This could be an interim step while further integration between systems occurs.

The design for the next generation of demand response programs should include a thorough evaluation of AMI capabilities relative to other alternatives and should take advantage of the range of technologies available to the extent that they can be integrated into an overall coordinated program and are designed to be cost-effective. Interoperability among devices should be one of the focal points of such an evaluation, as this is important to ensure that the utility retains the flexibility to use multiple technology suppliers during their AMI deployment.

3. Advanced Metering Functionality

Advanced meters can provide up-to-the-minute information on customer usage. In addition, they may incorporate a number of added functions. For example, current meter technology companies offer some, if not all of the following advanced meter functionality via two way communications. They provide Time of Use (TOU) capability for use with TOU rates. They are capable of remote connectability and disconnect capability services for instances when people are moving in to a neighborhood and when they are moving out.

Advanced meters can support the collection of interval data, be it hourly or sub-hourly meter data. They can accommodate coincident and off cycle demand reads and Move-In and Move-Out meter readings. Advanced meters combined with AMI may support multi-utility (e.g., water and gas) solutions, meaning AMI systems can provide meter reads for electric and natural gas or electric, natural gas and water together.

With two way AMI functionality, advanced meters support the ability to do remote administration, such as upgrading of meter software without ever leaving the utility offices. They provide for outage/restoration management and can also support tamper and theft detection as well. Advanced meters are capable of Plug-and-Play meter deployment, so if anything goes wrong with the meter itself, it can be popped out and a replacement popped in.

Advanced meters can support reverse energy monitoring, load research, and voltage quality monitoring at the meter. As mentioned previously this does not pre-suppose replacement of the current meter if these other features can be incorporated cost–effectively.

4. Interoperability and Open Standards Based Architecture

Advanced metering and the creation of an Advanced Metering Infrastructure will only provide real value if there are ways for different technology to work with each other and if there are standards promoted in the development of the metering technology that provide for a level playing field for all capabilities.

The ability of two or more systems or components exchanging information and using the information that has been exchanged is known as "Interoperability". There are numerous examples of interoperable systems operating on an open standards based platform with a notable one being the Global Telecommunications Cellular network. As an example, a consumer with a GSM phone cannot take that phone to a CDMA supplier and join their network. They are required to purchase a new phone. However, that same consumer can safely and securely place a phone call to a CDMA phone and be connected, demonstrating the goal of an interoperable network.

The ultimate goal of any Advanced Metering Infrastructure (AMI) is the ability to leverage the infrastructure investment to the fullest extent possible.

A primary capability for an AMI solution that should be evaluated when considering a purchase is the breadth of end-point devices that are supported. Consideration should be given to both the number of different device types and manufacturers supported (meter, smart thermostat, in-home display, etc.). The AMI solution should also support an open architecture at the head-end application, both providing robust advanced metering and demand management applications as well as providing for standards based integration to other systems such as customer information system (CIS) or outage management system (OMS).

The distinction between "open standards based" architecture and proprietary meter technology is a very important one and needs to be understood. The meter technology company's network infrastructure, from back office software to the meters (and into the home), should be designed to leverage existing communications standards and open standards based protocols. This however does not necessarily result in a single open architecture system where meters from vendor A and vendor B are interchangeable. While the metering industry may employ meter standards, there is not a single end-to-end solution in the industry today that is *not* proprietary in some manner.

5. Hurdles and Barriers to Entry for Advanced Metering and AMI

There is continuing development in the advanced metering technology business in order to keep up with the operational requirements requested by utilities.

6. Regulatory Hurdles

- The need to create rules and regulations that set forth minimum functionality criteria supportable across all utilities are being addressed in the Commission's AMI proceeding
- The need to look at cost/benefit analyses that include addressing the operational needs and requirements of the utilities in the AMI proceeding
- Rules and Regulations of the Public Service Commission, contained in 16 NYCRR, Chapter II, Electric Utilities, Subchapter A, Service – Part 92 - Regulations Applicable to Electricity Meter Testing and Reporting, need to be revisited by this Commission. The necessity for such a process with the advent of advanced meters that are ANSI compliant is questionable.
- There are unique NYS requirements for listing of meters and this causes delays in introducing new meters.

7. Recommendations and Forecasted Benefits

- Make possible modifications to existing demand response programs and seek to create new programs that leverage the Advanced Metering Infrastructure technology being deployed today and tomorrow to handle customer requirements for time variant rates and utility operational system requirements.
- Fund technology that fits broad, state-wide, utility programs and demand response goals as well as efforts that support specialized markets that are key for DR and EE success.
- It is recommended that the unique New York State requirement for listing meters be reviewed with requirements to meet the current version of the American National Standards Institute C12 (electric metering) series standards. Texas, for example, uses this as the state requirement. Specifically, these unique requirements consist of Public Service Law Section 67 and 89, and Commission regulations require new meters and ancillary devices used for revenue purposes require Commission approval. The approval process comprises of testing and determining functionality of meters to meet accuracy and safety standards as determined by Commission regulations, and requires a Staff recommendation to be made to the Commission regarding its use for revenue service.
- In the AMI proceeding, cost recovery for utilities and potential incentives for full scale AMI deployment and smaller pilot opportunities should be addressed and potentially Included in future cost recovery requirements in NY PSC regulations.

8. Expected Benefits, Beneficiaries and Time Frames

- Utilities and Customers alike will benefit from Advanced Metering and AMI deployment and DR programming that is installed to support such meter functionality and time-variant rate options.
- The Benefits include: –

- Timely Access to Meter Data
- Increased Price Transparency
- Demand response through both price elasticity and curtailment signals
- Accurate and recoverable data
- Provision of operational efficiencies for the utility
- Financial benefits for the ratepayer
- Systems defined by functionality not methodology, thereby leveling the playing field for all meter technologies
- Improved safety and reliability

- The Beneficiaries include –
  - All Ratepayers
  - Utilities and other LSEs
  - NYISO
  - The State of New York
  - Smart Meter and AMI Technology Providers
  - Demand response providers
- The Time Frame when this technology implementation is possible is now.

B. Maximize DR Potential from Existing Investment in Advanced Metering

There is a need to maximize DR potential from existing investment in advanced metering and learn lessons to develop more effective time-based pricing programs prior to implementing AMI/Smart Grid or AMI/Smart Grid pilot programs.

1. Discussion

Unleashing the demand response (system peak-shaving) potential of customers beyond what might be obtained through simple energy efficiency measures requires several pre-conditions. At minimum, some type of interval metering and time based financial incentive (through utility or ESCO commodity service or enrollment in NYISO DR Program) is required. Realizing this DR potential may also require web presentment of hourly energy cost data, additional equipment at the customer facility and/or customer access to other type of remote load control services.

Installing the metering technology and creating time-based rates alone is costly. Based on the utility AMI filings, we see costs of $150-to $400 per metered point which translates into billions of dollars for ratepayers state-wide. To be sure, AMI systems also have the potential to generate substantial benefits for customers and operational benefits for some utilities.[21] For some utilities, AMI or Smart Grid pilot projects will be required to validate these benefits and whether the benefit of AMI ultimately justifies the cost. For other utilities, the business case for AMI is stronger and AMI pilot programs won't be required.

In either case, the more we can learn about what it takes to unleash the DR potential of different classes of customers across the state that already have interval meters, time based rates and/or who already participates in direct load control or NYISO DR programs, the better. The lessons learned from these customers can be used to generate either more valid AMI pilot results or to enable the utilities who are implementing AMI to do so more effectively. Moreover, working more intensively with these customers will hopefully have the added benefit of increasing the amount of DR in the near term.

Major categories of Customers Affected:

- Large C & I Customers (2200 new MHP customers since 2006, 700 take commodity service from utility default)
- Customers who participate in NYISO DR programs
- Residential customers on time-based rates and/or who participate in direct load control programs

2. Hurdles/Barriers

(i) Regulatory: None

(ii) Other--Some Time Based Rate and NYISO participants take commodity service from ESCOs and many NYISO participants take service from Curtailment Service Providers.

(iii) Financial- Utilities need to recover incremental program cost.

3. Recommendations and Forecasted Benefits

(i) Demand response audits should be offered to all customers who are currently enrolled in the MHP programs state-wide to provide customers with an action plan to respond to events/or available in this rate class. Once the extent of this load shed is known with this group of customers, tests need to be conducted to determine how much is actually done in a facility to understand the customer's acceptance to the proposed load shed plan. Automating certain aspects of operation is highly recommended as a means to provide load management without human intervention. In addition, other DSM opportunities may be identified in the audit for future follow-up.

(ii) It is also recommended that some additional outreach and support for mass market customers who are already on time based rates across the State —especially those with large amounts of time-discretionary load. This could include a DR audit and

[21] The incremental operational savings of AMI for utilities who have already installed drive-by AMR systems are significantly lower than for utilities who have not installed AMR.

a pilot study to evaluate the potential benefit of enabling DR technologies designed for mass market customers, and also evaluate whether or not to modify the financial incentives for mass market customers who currently participate in direct load control programs.

(iii) PSC Review of State statutes that prohibits mandatory time variant rates with an eye towards recommending legislative change if benefits are found to outweigh costs.

(iv) Lastly, we also recommend that the utilities re-evaluate the rate designs in the voluntary time-based rates programs for mass market customers to determine whether or not the designs might be modified so as to augment the level of DR

4. Funding Allocations

(i) Demand Response Audits are typically in the $2,500 to $4,000 range for most facilities. Additional Allocation will be necessary to fund more intensive Outreach to mass market customers.

5. Expected Benefits

(i) Most audits performed show 2-5% load shed is possible for most facilities, and in fact can approach over 10% for some facilities.

6. Time Frame- Next 12 months

C. Smart Grid/Controllable Technology Development and Deployment

1. Smart Grid Introduction

A "Smart Grid" is: (a) the integration of power systems operating in a coordinated, efficient and reliable manner; (b) a power system that handles emergency conditions with 'self-healing' actions and is responsive to energy-market and utility business-enterprise needs, and (c) a power system that serves millions of customers and has an intelligent communications infrastructure enabling the timely, secure and adaptable information flow needed to provide reliable and economic power to the evolving digital economy.[22]

To achieve the full potential of Smart Grid, a communications network must be in place to allow the existing power distribution grid to monitor and measure usage in real time, visualize network performance, and create an enablement platform that engages everyone from system operators to customers very differently.[23]

The key to a Smart Grid deployment is the underlying utility infrastructure must be robust enough to allow the amount of automation and control Smart Grid architecture allows. The

[22] Intelligrid – The Integrated Energy and Communication Systems Architecture- Volume 1 : User guidelines and Recommendations EPRI. Page v.

[23] Utility Products, Volume: 4, Issue: 11, November 2007 : Touch, Reach, Digitize: Are utilities looking hard enough at Smart Grid's communications backbone? By Robert Robinson & Mark Hoffman

billions of dollars NYS utilities currently spend on capital investments and operating and maintenance costs will still have to be spent when enabling Smart Grid technology. Once a Smart Grid technology is in place with a robust distribution system, then there should be ample opportunity to squeeze additional economies out the existing system.

Smart Grid is a proven technology that exists today. Many utilities in the country have deployed various components of Smart Grid including AMI and Demand Response including Duke, SCE, FPL, PGE, and Oncor Electric Delivery (formerly known as TXU Electric Delivery). Further, The Smart Grid Facilitation Act of 2007 passed by the House of Representatives on August 4, 2007[24] is awaiting action in the U.S. Senate as part of a larger energy policy package.

A Smart Grid deploys intelligent sensors throughout the electric distribution network, providing continuous monitoring and analytics to create a real-time, two-way, diagnostic monitoring and control system. A Smart Grid enables utilities to monitor and manage virtually every piece of equipment on the electric distribution network in real-time, including transformers, digital fault recorders, power quality monitors, tap changer monitors, substation batteries, circuit breakers, feeder reclosers, feeder switch controllers, feeder sectionalizer controllers, feeder capacitor controllers, and feeder regulator controllers. A Smart Grid optimizes efficiency of the network, and performs real-time power outage avoidance as well as real time, pin-point outage and restoration detection. In addition, a Smart Grid monitors substation functionality, such as breaker performance, faults analysis, outage/sag history, power quality, waveform analysis, energy cost analysis, fault location, incipient cable faults, high impedance faults and other critical infrastructure and functions.

In addition to benefits such as those above, Smart Grid systems also perform AMI functions – reading meters (electric, gas, and water) and controlling "smart" appliances and home devices. Broader Smart Grid transformations leverage AMI and seek one or more distribution-centric advancements including grid reliability & security, demand response, distributed energy resource integration, distribution automation, energy efficiency and home automation. These advances trigger some incredibly information-intensive innovations:

- Access to real demand elasticity;
- Automation of grid operations to the point of true self-healing;
- Economic enablement of "beyond the meter" loads and distributed generation resources that will respond intuitively to the grid; and
- Optimization of upstream resources that contribute to energy security, emissions reductions, and power quality.[25]

A Smart Grid's high bandwidth, low latency communications capabilities enable real-time demand response, load shaping, load management, and time-of-use pricing in virtually real time intervals. Smart Grid- enabled demand response and real-time pricing programs gather and

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[24] **H.R. 3221: New Direction for Energy Independence, National Security, and Consumer Protection Act, http://www.govtrack.us/congress/bill.xpd?bill=h110-3221&tab=summary**

[25] Utility Products, Volume: 4, Issue: 11, November 2007 : Touch, Reach, Digitize: Are utilities looking hard enough at Smart Grid's communications backbone? By Robert Robinson & Mark Hoffman

deliver interval data and "on-demand" meter, smart appliance, and demand equipment reads, confirmations, data aggregation and reporting. Crucially, Smart Grid control of demand functions is not limited to a central control node, (i.e., a meter) and is protocol agnostic. Through a dynamic open architecture, a Smart Grid can manage multiple end points through various protocols including ZigBee, Home Plug, and others. Smart Grid enabled Demand Response/Demand Side Management (DR/DSM) enables control of millions of users, or can control with pinpoint accuracy down to individual meters. Smart Grid flexibility would allow for wider participation of DR/DSM.

A Smart Grid also delivers virtually real-time measurement and verification of voltage, voltage reduction, program acceptance, and program participation, data aggregation and reporting. The capabilities of a high bandwidth system allow for virtually instantaneous confirmation of signal receipt, acceptance, and aggregated grid impact, permitting voltage monitoring from the substation beyond the meter to the individual electrical outlets in a home or business.

Measurement and Verification (M&V) is always a key program component that consumes time and resources. Traditional M&V does not allow for real time decisions and severely limits a utilities' ability to make instantaneous decisions that impact energy use and emissions. Smart Grid data aggregation and reporting in almost real time, removes the need for costly, time lagged, and frequently inaccurate extrapolated measurement and verification processes. A Smart Grid delivers real time aggregated data (from the substation to the plug) which allows the utility to make decisions and take actions immediately. Most importantly, Smart Grid M&V data is verifiable and can be used to model scenarios to develop new programs and decision metrics for future programs.

A 2004 EPRI analysis of 11 peer-reviewed studies found that widespread adoption of Smart Grid devices such as an "intelligent air conditioning unit with embedded software and hardware capable of two-way interacting with the power system" could produce a median achievable savings of 24% of total U.S. electricity demand.[26] There is also a rapidly accumulating body of evidence suggesting that providing customers with real-time information about their energy usage and its costs serves, in itself, to reduce consumption.[27] EPRI projects that Smart Grid-enabled electrical distribution could reduce electrical energy consumption by 5 percent to 10 percent and carbon dioxide emissions by 13 percent to 25 percent.[28]

A Smart Grid is also crucial to take full advantage of distributed generation and renewable energy sources. "According to the European Wind Energy Association (EWEA), integrating wind or solar power into the grid at levels higher than 20% will require advanced energy management techniques."[29] Through Smart Grid-based positive and negative load analysis, a utility can monitor, forecast, and manage distributed energy resources allowing for

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[26] Michael W. Howard, SVP, Electric Power Research Institute, *Facilitating the Transition to a Smart Electric Grid*, House Energy & Commerce Subcommittee on Energy and Air Quality, May 3, 2007.

[27] *See, e.g., New Ways to Monitor Your Energy Use --- Utilities Test Prepaid Smart Cards and High-Tech Meters To Help Consumers Keep Tabs on Cost and Consumption*¸ Wall St. Journal, June 19, 2007.

[28] *See* Electric Power Research Institute, *Electricity Sector Framework for the Future: Achieving the 21st Century Transformation* (Aug. 2003), page 42 (*"EPRI Report"*), available at: http://www.globalregulatorynetwork.org/PDFs/ESFF_volume1.pdf.

[29] Zhang, *Smart Grid Environmental Benefits*.

better load management and, more importantly, tapping efficient non-traditional peak generation. Smart Grid's net metering capability allows for Plug-In Hybrid Vehicles (PHEV),[30] solar, and distributed generation to become net generation resources while crediting customers for supplied/generated power.

While Smart Grid consumer programs will have a profound affect on energy use, resulting efficiencies, and Green House Gas (GHG) emissions reduction, perhaps the most significant energy efficiency opportunity is Smart Grid's enablement of efficient use and control of already generated electricity. Following the adage that… "the most efficient kilowatt saved is the kilowatt not generated," a Smart Grid enables a utility to manage and control the significant transmissions and distribution losses that occur moment by moment on the nation's aging grids. Smart Grid allows utilities to visualize and manage transmission & distribution inefficiencies and electrical losses. As FERC Commissioner Kelliher recently observed, "If we could make the electric grid even 5 percent more efficient, we would save more than 42 gigawatts of energy: the equivalent of production from 42 large coal-fired power plants. Those are plants that we would not need to build and emissions that we would not produce.[31]" A Smart Grid will enable efficiency savings of this magnitude and more. EPRI projects that Smart Grid enabled electrical distribution systems could reduce electrical energy consumption by 5 percent to 10 percent and carbon dioxide emissions by 13 percent to 25 percent.[32]

"The Delivery of power from the generating station to the end use customer results in a, loss of energy throughout the T&D network. Minimizing these resistive energy losses will reduce electric power costs for all ratepayers. "Although electric delivery losses – on a per unit basis – have substantially declined over the years, New York State must continue to further reduce these overall system losses. In the US the average electric power system electric delivery losses from a central power plant to an end use consumer is approximately 6%. ….. Total electric consumption for all sectors in New York is approximately 140,000 GHh – 6% of this value is the equivalent to a nominal 1,000 MW central power plant operating all year long".[33]

2. Need

As Judge Stein and Judge Stegemoeller formulate a New York Energy Efficiency Portfolio Standard (NYS PSC Case 07-M-0548) to maximize energy efficiency and conservation, the Judges, and later, the Commission, should consider additional mechanisms to encourage the deployment of Smart Grid systems.

Development of traditional energy efficiency programs such as demand response, improved weatherization and more stringent appliance standards are important means to achieving the State's conservation goals, but new technologies, including Smart Grid, are essential if New York is to meet Governor Spitzer's 15/15 target and achieve the full potential of energy efficiency programs. Simply doing "more of the same" will not ensure the State's energy

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[30] *See ibid.* ("The Smart Grid is a necessity for enabling the next generation of automotive vehicles.").

[31] (Commissioner Wellinghof, U.S. Federal Energy Regulatory Commission testifying to U.S. Congress, May 2007).

[32] *See* Electric Power Research Institute, *Electricity Sector Framework for the Future: Achieving the 21st Century Transformation* (Aug. 2003), page 42 (*"EPRI Report"*), available at: http://www.globalregulatorynetwork.org/PDFs/ESFF_volume1.pdf.

[33] NYSERDA Electric Power Transmission and Distribution (EPTD) Program, http://www.nyserda.org/includes/funding_content_pop.asp?i=PON%201102

security. Smart Grid is a "future proof," advanced technology that can help achieve the Portfolio's overarching goals:

- Promoting the most efficient use of society's resources
- Lower customer bills through increased end-use efficiency
- Enhancing the price-responsiveness of wholesale electricity markets
- Mitigating the risks associated with climate change
- Minimizing the environmental impacts of energy production, transportation, and use

3. Hurdles/Barriers

Smart Grid exists today. The largest barrier to Smart Grid adoption is a lack of education. The utility marketplace, New York included, is slow to adopt and recognize new technologies. For example, AMI, which is one component of a Smart Grid, has taken more than fifteen years to be understood and is only beginning to be implemented. Smart Grid has a significant investment component. Adoption will impact ratepayers. The state must also create incentives or a recovery mechanism removing the strong economic incentives that utilities now have to increase sales rather than employ greater efficiency which a Smart Grid will deliver. Utilities need regulatory certainty / assurance that they can recover prudent investments in Smart Grid. The state should also consider incentives for Smart Grid deployment, such as allowing utilities to retain a substantial portion of savings created by Smart Grid systems, accelerated depreciation for Smart Grid investments, and continued use of unrealized depreciation allowances for systems that are replaced.

a) Ways to Overcome Regulatory Hurdles

It is important to note that a Smart Grid can be deployed in such a way that ratepayers do not have to pay for the entire cost of deployment. Instead, utilities can retain a third party to build and operate the Smart Grid communications network (at the third party's cost) and provide the utility automated meter reading, outage detection and other Smart Grid services. The network operator can then use the same network for other commercial applications, such as broadband Internet service, thereby defraying substantial network costs away from electric rate payers. The net result is that the utility and ratepayers may get these advanced services at a lower cost.

Permitting utilities to deploy Smart Grid systems in this manner reduces costs to ratepayers. In fact, deploying such a system can actually be a significant source of revenue for a utility, because the network operator pays for pole attachments, electric power and other goods and services. Although no single financial structure will necessarily be appropriate for all utilities or all deployments, this does illustrate how a future-proof Smart Grid can be attained without requiring that ratepayers front all related costs.

This Proceeding and the Commission should also consider the additional incentive of allowing a utility to retain a portion of the efficiency savings created through use of a Smart Grid. For example, regulations could allow a utility deploying Smart Grid to retain a portion of the savings that result from deployment and use of a Smart Grid.

Many energy-using, handling and measuring technologies, including a vast population of utility meters and controls on appliances, space heating and cooling, lighting, and other items remain analog and are generally not sensitive to grid conditions beyond the point of coupling, e.g. normally the meter. The dependence on analog information remains a significant barrier to intensify energy efficiency.

"Natural" turnover or unit replacement is gradual at its most rapid and cannot be relied upon as sufficient to achieve early diffusion of end-use technology that can interface with smart grid technology.

Rapidly diffusing end-use technology that is capable of two-way communication via a Smart Grid, capturing meaningful stimuli/sensing will be necessary. The State should encourage policies to accelerate deployment of existing technology and mobilization of R&D. Interoperability protocols and model standards for information management should also be developed, along with incentives and programs for large-scale deployment. Additionally rate incentives for end-users need to be refined.

The role of early adopters, whether end-users, third-party providers, and/or utility providers capable of offering technologies and services that utilize smart grid resources should be clarified. The State should ensure that all potential players have equal access to markets.

R&D is needed to develop and standardize end-use technologies that are controllable (lighting, air conditioners, household appliances, etc.)

- Review the extent of and forms by which digital technology and infrastructure can penetrate analog technology and infrastructure. (This can be illustrated with relevant examples, e.g. micro-CHP technology that replace residential furnaces with heating and generating systems that can interface digitally with the grid, could be aggregated within load zones, and be utilized at 50% higher output at times when the grid needs support.)
- Identify priorities for accessing digital technology already being deployed and establishing guidelines for retro-fitting smart grid technology to the existing fleet of digital appliances, air conditioning, furnaces, and lighting.
- Identify issues relating to overlaying digital information infrastructure over analog information infrastructure going forward with interconnection facilitated with open architecture permitting multiple applications to emerge.

b) Ways to Overcome Financial Hurdles

(a) Incentives, programs and recognition for large scale deployment of controllable end use technology.

- Identify guidelines for defining large scale deployment programs.
- Identify priorities for labeling as a "15 by 2015 EE" pilot or "guiding light".
- Establish "Smart Green Grid" Label and criteria for large scale deployment endeavors.

(b) Rates and/or programs to encourage the use of these technologies and properly monetize the benefit of them

- Cost and revenue recovery for expenditures incurred by regulated entities.
- Allow recovery of unrealized depreciation for equipment replaced.
- Incentive rate making to induce changed utility investment.
- Tax incentives for installation of smart grid technologies, including State personal and corporate income taxes and other taxes, including State sales taxes in certain situations.
- Remove barriers and streamline implementation.
- Education and marketing programs to encourage usage.
- Modernize our electric infrastructure across the State, and use revenue decoupling, which would help provide incentives for utilities on energy efficiency projects such as a Smart Grid system. The recommendation of the "green grid" labeling program is also an important tool for education and awareness about end-use digital appliance technologies.

c) Pathway to Commercialization

Smart Grid development will only be accelerated as more utilities embrace the technology and software and hardware manufacturers focus on development of Smart Grid enhancements. Smart Grid is a proven technology that exists today. Many utilities in the country have deployed various components of Smart Grid including AMI and Demand Response such as Duke, SCE, FPL, Gulf Power, and PGE.

4. Recommendations and Funding Allocations

Conduct a thorough analysis of Smart Grid and, if feasible, explore the following funding options:

- Rate based funding
- Private/Public funding partnerships
- Private funding

5. Expected beneficiaries and timeframes

<u>Beneficiaries:</u>

- Utilities
- Ratepayers
- State economy
- The environment

Timeframes:

If deployment began January, 2008, full benefit could be reached by 2011.

Linkages to Technologies to Other Parts of the Report

- Demand Response
- AMI/Smart Metering

6. Dissent Opinions

Not all agree with II A above - Paragraph 1 which states that [34] "A 'Smart Grid' is a "future proofed" infrastructure and complementary services enabled by a high bandwidth, low latency, "open flexible architecture"[35] communications system and sensors that both serves as a demand resource and enables electric utilities to provide energy more efficiently, reliably and securely than is possible with the existing electric grid."

D. Continued and Increased Deployment of current NYISO Demand Response Programs

1. Summary

New York's demand response programs have provided opportunities for retail consumers to participate in the wholesale market to maintain reliability. Demand response resources who have demonstrated their ability to curtail load for reliability may be willing to accept additional deployment instructions from either the system operator or the local transmission utility for local reliability. Expanding market offerings beyond NYISO-administered programs, through innovative rate structures and market-based programs offered by utilities and competitive entities, can reach customer segments that are not participating in NYISO-administered programs.

ESCOs and load aggregators (also known as Curtailment Service Providers) who interface directly with retail customers play an important role in helping transform and educate the market about demand response and energy efficiency. It is essential that utilities, regulators, and competitive entities work to break down barriers to consistent and timely transactions to promote the competitive market environment in New York.

2. Need

Identify additional ways to increase participation in existing demand response programs and provide more opportunities for demand response to participate in the electricity market.

[34] This was called out as a dissent as it is an EPRI statement (see cite). EPRI most would agree is a non biased organization that has done significant work on Smart Grid. After all they call it Intelligrid.

[35] Intelligrid[SM] - *http://www.epri-intelligrid.com/intelligrid/docs/1012028_Consumer_Portal_7.05.pdf*

3. Discussion

New York has some of the most mature demand response programs in the country. Demand response programs administered by the NYISO have proven their effectiveness in improving reliability. The benefits of demand response go beyond the payments to the participants in the program, they include in improved reliability, lower wholesale market prices, improved load factor, and reduced aggregate system capacity requirements.

Deployment of demand response for reliability is currently limited to times of reserve shortages. A program under development by the NYISO, the Demand-Side Ancillary Services Program (DSASP) will offer additional opportunities to resources who can control their load in real-time. Demand response resources who have demonstrated their ability to curtail load for reliability may be willing to accept additional deployment instructions from either the system operator or the local transmission utility for local reliability. A recent example of this is the Targeted Demand Response Program in the New York City zone where Special Case Resources (SCR) and Emergency Demand Response Program (EDRP) resources are activated by the NYISO at the request of Con Ed to provide load relief in subzones of zone J.

Load reductions offered into the Day-Ahead Demand Response Program (DADRP) contribute to lower wholesale market prices, but very few resources currently participate in this program. Although loads may be aggregated to reach the one MW minimum reduction required to bid, there are no aggregations in this program at the time of this report. This is another area of opportunity for resources to receive payments for load reduction offered into the wholesale market. Unlike NYISO’s reliability programs, where the NYISO controls when the resources are needed and pays the higher of the hourly market price or $500 for load reductions during an activation, DADRP resources are required to put a value on the load reduction they offer into the market and specify when they are willing to curtail. These additional requirements have been identified as barriers to participation.

While New York’s demand response programs have been successful since their inception, there is room for improvement to increase participation in existing programs, expand market offerings for demand response beyond NYISO-administered programs, increase the customer segments that face market price signals, and take advantage of technology to facilitate demand response, where appropriate.

The success of demand response efforts in New York will require a collaborative effort by all stakeholders to ensure that programs are coordinated to meet New York’s goal of 15 by 15. ESCOs and load aggregators (also known as Curtailment Service Providers) who interface directly with retail customers play an important role in helping transform and educate the market. Improvement is needed in areas of interaction between regulated and non-regulated entities to simplify the transactions between these entities. The increased cooperation and collaboration would benefit the market and the retail customers.

A specific area of coordination is access to meter data which is discussed in another section of this document.

4. Recommendations and Forecasted Benefits

- Customer Education Collaboration: Utilities that have not partnered with CSPs and ESCOs should be encouraged to partner so they can enhance their service offering to customers by partnering with CSPs and ESCOs. This holds true for educating customers on NYISO programs as well as other DR and energy efficiency opportunities. Utilities have unhampered access to their customers, long term relationships, and know the load patterns of each customer. CSPs and ESCOs are experts at educating customers on demand response and permanent load reductions, as their businesses inherently depend on it. When the two sides work together the customer wins.

- Implementation Collaboration: Demand Response market participants should continue working together to streamline demand response implementation. One example of such collaboration is the current effort to address meter access in New York.
- Valuation: Curtailment-based demand response (i.e. load reduction achieved without behind the meter generator) is better for the environment than any generation source, period. Reducing load at peak times eliminates the need to build new peaking generation. Reducing load through curtailment is even better than building a solar power plant, and curtailment should be valued, and focused on, accordingly.
- Include peak demand reduction goals to reduce the environmental impact of inefficient peaking capacity.
- Increase participation in existing programs. Enrollment in existing demand response programs appears to have stabilized, indicating possible saturation. The barriers to participation should be discussed by the stakeholders to identify ways to increase participation.
- Expand market offerings for demand response beyond NYISO-administered programs. Demand response involves more than NYISO-administered programs. Load reductions can be achieved through interruptible programs and direct load control on various equipment and appliances. Through innovative rate structures and market-based programs offered by utilities and competitive load-serving entities, additional types of demand response can reach customer segments that are not participating in NYISO-administered programs.
- Increase customer segments that face market price signals. Although Mandatory Hourly Pricing has been in place for the largest electricity consumers, the vast majority of consumers do not see time-varying prices for the electricity they use. While it may not be practical for all customers to face hour-by-hour pricing, rate structures that are more closely aligned with the diurnal nature of market prices would provide signals about the value of electricity. Rate structures such as flexible time-of-use and residential hourly pricing have been implemented in other markets around the country to increase awareness of the value of electricity at various times of the day.
- Take advantage of technology to facilitate demand response and demand management, where appropriate. Proposed deployments of advanced metering infrastructure (AMI) will enable more automated control of appliances and other end uses, either through response to price signals or via direct control. This market

transformation will take some time as the metering equipment gets installed and end-use equipment is adapted to accept control signals.

E. Further Opportunities for End Users to Participate in Demand Response Programs

1. Need

Demand response has proven itself as a reliable component of an electric grid's supply and demand toolbox. Further opportunities for end-users to participate in wholesale markets should be created, expanded, and streamlined. Demand Response could be expanded in the following ways:

- Include as a Key Component in Integrated Resource Planning
- Allow the Capacity Market Inclusion of Bilateral Agreements
- Develop Localized Demand Response Programs

2. Hurdles/Barriers

- Limited Inclusion of Demand Response in Integrated Resource Planning
- Limited Localized Opportunities for Demand Response
- Financial
- Out-of-Market Capacity Contracts Deflate Market Price of Capacity

3. Recommendations and Forecasted Benefits

- Demand Response, as a dynamic resource, should be a key component of Integrated Resource Planning as it is a dependable and proven resource.
- Localized demand response opportunities should be created and expanded to enhance the impact of demand response on the grid.

F. Continued and Increased Deployment of Existing Incentive Programs

1. Need

With recent economic growth, the widespread adoption of electronic office and entertainment equipment, and increasing saturation of low cost air conditioners, New York's demand for electricity has increased. The need for load factor improvement is evident by the fact that New York's peak demand has grown faster in recent years than its annual consumption.

This increased need for power, particularly at peak times has begun to, and can continue to be met by demand side options. Demand response and peak load reduction measures have proven to be a cost effective and environmentally friendly alternative to increased reliance on peaking power plants.

2. Discussion

The NYSERDA System Benefit programs currently in place have been carefully developed and refined into the successful programs that they are today. It is the recommendation of this group that these programs continue to be implemented with modifications intended to increase participation. Among other recommendations of working group IV are new program areas. It should be clear that these are recommended in addition to the current system benefit programs, not in place of them. It is anticipated through this and the other working groups that utilities will also administer incentive programs. It is recommended that these be coordinated carefully with existing programs to prevent overlap and customer confusion.

3. Current Program Areas to be Continued and Expanded

- Peak Load Reduction
  - Permanent Demand Reduction (targets reductions that occur during system peak)
  - Demand Response (provides incentives for technologies such as interval meters and automated control systems that enable participation in demand response programs)
  - Real Time Pricing (provides incentives for load control technologies that allow customers on real time pricing to be price responsive)
- Demand Response Audits (Incentives are provided to DR Providers to conduct demand response audits and develop curtailment plans for customers)
- Technical Assistance to help real time pricing customers minimize electric costs by identifying price elastic behavior. Cost shared studies are performed to identify capital or operational opportunities that minimize energy costs.
- Research, development and demonstration of new technologies and strategies to reduce peak demand through both demand response and permanent load factor improvements.

4. Barriers and Recommendations

As with most new ventures, a large majority of the barriers present themselves in the early years. Since New York's system benefit programs have been in place for many years, many of the barriers have already presented themselves and been overcome. We must recognize though, that the set of barriers is fluid and must be evaluated on a continuous basis, as new challenges will always present themselves. It should further be recognized that like the set of barriers, the set of solutions must be continuously evaluated, with an open mind to new ideas. Some barriers and proposed solutions are identified below.

a) Growth of Energy Professionals in New York State

In the early years of New York's System Benefit programs, it was identified that the infrastructure of Energy Service Companies (ESCOs) and Demand Response Providers (DRPs) needed to be developed. Programs specifically targeted the growth of energy professionals as an outcome, and as a result the industry has grown substantially. However, with the recent rise in energy costs and high awareness of energy and environmental issues, demand for energy services has also grown substantially. New York must continue to work to increase the number of energy professionals that serve this state by working with academic institutions. We must also recognize that these services are in high demand nationally and internationally, and work to make New York a leading market for energy professionals.

It is extremely important to recognize the valuable role that ESCOs and DRPs play in marketing, customer relationships, and a bundling of services that is difficult to achieve by any program administrator. If New York becomes a leading market for energy professionals, it will also likely be a national leader in energy efficiency and demand response. Below are some recommendations on how to further increase the infrastructure of ESCOs and DR Providers that is necessary to achieve the goals of EPS.

- Structure incentives to foster relationships between ESCOs or DRPs and end use customers. This can be accomplished by providing incentives directly to ESCOs or DRPs and by carefully structuring programs to work with their business models, rather than requiring that they work outside of their core competencies and areas of profitability.
- Set incentives that are, at a minimum, competitive with other leading states. As with any free market, a tight supply, relative to demand will result in increased prices. We must recognize that in this time of high demand for energy professionals, we must increase program incentives to attract a higher supply of energy professionals to New York.

b) Upstream Market Transformation

New York has worked with manufacturers and vendors to increase the availability and economic viability of high efficiency products. This effort should be increased and broadened to target chillers and other cooling measures. Large, aging chillers represent a large, on peak load in New York State. Even with incentives to drive customers to the highest efficiencies available, we have seen missed opportunities. Energy is often not given the priority it deserves in the complicated, capital intensive process of a chiller plant replacement. There are many entities involved, including the customer, design engineer, and equipment vendor. It is easy for complications to put the project over budget and efficiency may be sacrificed in value engineering to reign in capital costs. Furthermore, buildings in New York, particularly New York City are often bought and sold on short timeframes. This leaves the owner focused on reducing capital costs at the expense of energy savings, knowing that he may not own the building long enough to realize a payback from energy conservation projects.

We believe that this common lack of consideration of efficiency in chiller plants can be overcome with upstream incentives targeted to manufacturers. If incentives for high efficiency chillers can buy down the higher capital cost before it gets to the end user, this may marry the customers desire to minimize capital costs with the states desire to reduce peak demand and annual energy consumption. This approach is likely transferable to other technologies and sectors.

- Customer Confusion Caused by Competing Incentive Program Options

  As the system benefit programs have grown and filled different market needs, some overlap in programs has emerged. While the overlap helps to fill certain market niches, it also causes confusion among end users. The market has identified that current programs would benefit from a more streamlined process. The system benefit programs are moving towards a more common sense approach to minimize customer confusion. The approach is to consolidate like programs to form a logical decision tree based approach to program choice. Additionally, with the rollout of targeted programs such as Con Ed's Rider U Program and NYSERDA's system wide programs, we have experienced customer confusion. As future programs are created and implemented by multiple program administrators, great care should be given to ensure that customers are not confused and overwhelmed by competing approaches to a like outcome.

5. Summary

To summarize, the current system benefit programs have been a tremendous success. They have been refined and have gained momentum since there inception in 1998. These programs present the opportunity to contribute significantly to the goals of EPS. As additional programs are developed care should be given to ensure that they achieve additional resources, rather then compete with existing programs. The addition of competing programs introduces the risk that projects will be transferred from one program to another, with little increase in overall activity in the sum of the programs.

Changes to improve existing programs should begin as soon as possible. Many of the system benefit programs expire in the spring of 2008, making that a logical timeframe to implement some of the changes listed above. Much of the increased outreach and recruiting to energy professionals nationwide can begin immediately.

As we move toward the goals presented in EPS, we should recognize that while an aggressive approach is required, thoughtful, long term planning must not be compromised by the need to accomplish lofty goals in a short period of time. Efforts from various groups should be carefully coordinated, approaches should be carefully considered, and programs should be guided by cost effectiveness, not only based on total resource cost tests, but also based on incentive dollars per kW and kWh achieved.

To be concise, our recommendations are as follows:

a) Continue to administer existing programs, in an expanded and simplified fashion.

b) Streamline current NYSERDA application and payment processes.

c) Develop new programs carefully to not compete with existing programs.

d) Grow the infrastructure of energy professionals in New York.

e) Expand efforts in working with equipment manufacturers and vendors to increase the efficiency of equipment before it gets to the customer (upstream market transformation).

G. Price Stability for Demand Response

1. Need

There is significant need to provide price stability for demand response providers and customers. Stability in the dollar value of demand responsive kWs will assist in sending adequate price signals and will further the development and growth of New York State's demand response market.

2. Discussion

Current market conditions have little longer-term price security for demand response providers. For example, the current "In-City Market Mitigation" proceeding before the FERC could potentially significantly reduce the value of capacity in New York, and therefore the dollar value of demand response.

One way to stabilize capacity prices in New York State is to implement a Forward Capacity Market. This option will be explored in more detail below.

A second way to stabilize prices for demand response is through the use of Requests for Proposals (RFPs). Use of RFPs in addition to the current NYISO programs will enhance demand response in New York. In other states, such as California, major utilities contracted for significant demand response. This process can facilitate an open and competitive process, and furthers growth and development of demand response. An additional benefit can be derived through the RFP process by bringing several types of demand response resources to the market. The RFP process would seek to bring a diverse class of demand response resources, such as day-of and day-ahead curtailment resources. Issuance of RFPs can facilitate a broader class of demand response, which gives greater flexibility to both local utilities and the wholesale market during emergency events. RFPs typically result in long-term contracts which provide price signals and long-term incentives for demand response. An RFP process provides market stability and the commitment that New York State considers demand response as a long-term resource.

Categories of Demand Response

- Installed Capacity Market (NYISO ICAP Market) and/or Forward Capacity Market (FCM)
- NYSERDA Programs
- Utility Programs

3. Hurdles/Barriers -

- Regulatory / Financial
    - i. Lack of price security for demand response
    - ii. Lack of long-term capacity market

4. Recommendations

- Explore means of providing longer-term price security for demand response resources through:
    - i. Establishment of a Forward Capacity Market such as in New England and PJM.

ii. Issuance of long-term contracts for additional demand response beyond the wholesale market. Contracts could be issued by NYSERDA, the utilities, or other entities.

5. Funding Allocations

- Development and implementation of a Forward Capacity Market would be handled and funded through the NYISO.
- Funding for RFP's could be obtained through the System Benefit Charge (SBC)

6. Expected Benefits

- Significant additional MW's of peak load reductions throughout the state
- Several types of demand response resources (day-of, day-ahead, 30-minute response)

7. Time Frame

- Short Term -- The RFP process and awarding of contracts would take less time to implement than implementation of a Forward Capacity Market. Typically an RFP process takes six months to arrive at an awarded contract.
- Long-term – Establish a Forward Capacity Market, similar to those in New England and PJM.

8. Dissenting Remarks

- Regarding long-term demand response contracts, care should be taken to ensure that new demand response and/or load reduction contracts do not disadvantage similar contracts already in place.

Discussion – RFP's that are structured as long term contracts (LTCs) of any sort (energy, capacity, ancillary services, etc.) are counter-productive to a vibrant competitive market in energy products. In a non vertically-integrated utility marketplace, LTCs will invariably distort market signals to all consumers. LTCs are just as likely to end up being a stranded asset with higher than market costs as a benefit with lower than market costs in the future. The state learned this lesson with the infamous six-cent rule for QFs in the 80s and 90s. The QFs all built upstate, nearly bankrupting the old Niagara Mohawk Power Company with the legislative requirement to pay all output at six cents instead of the then market costs which were substantially lower than six cents. The six-cent rule was for all intents and purposes an LTC. Setting up LTCs again will likely have similar effect in the future.

H. Provide an Opportunity for Aggregations of Small Resources to Participate in the Demand-Side Ancillary Service Program (DSASP)

1. Discussion

The NYISO is developing a program to accommodate demand-side resources that have at least one MW of load reduction capability to provide ancillary services: regulation, and/or synchronized or non-synchronized reserves. The initial implementation does not include a provision to allow aggregations of smaller resources to participate as a single resource in the ancillary services market through DSASP due to several issues, summarized as:

- Operational Visibility
- Secure Network Operations
- Reliability Organization Rules

2. Hurdles/Barriers

Operational visibility requires demand-side resources participating in the ancillary services market to have continuous two-way communication with the NYISO for control and real-time verification of response. Unlike other NYISO demand response programs which have a notification period of at least two hours before they are expected to respond, a DSASP resource must be able to respond to six-second instructions from the NYISO and transmit real-time consumption and performance back to NYISO. A significant investment in metering equipment is required to insure that the demand-side resource knows when they are scheduled in real-time and that the operator can see that the resource is providing the service at the dispatched level.

From a reliability perspective, NYISO is responsible for ensuring that network operations remain secure. The NYISO operates by controlling resources on a six-second and five-minute basis. Aggregations could prevent the NYISO from using this operating protocol for certain DSASP resources. This would make it difficult for the NYISO to determine aggregated load impact on network operation. With real-time control required for ancillary services, zonal aggregations may not provide the level of acceptable granularity of control within a portion of the zone. Additional investigation is required to determine the minimum level of control granularity that meets network operation standards.

The NYISO is bound by rules that reliability organizations such as North American Electricity Reliability Corporation (NERC), New York State Reliability Council (NYSRC) and Northeast Power Coordinating Council (NPCC) have developed regarding how demand-side resources can participate in wholesale market operations. Until recently demand-side resources were not permitted to provide synchronized reserves. As with the initial demand response programs introduced several years ago, there are questions about how well demand-side resources will perform when called upon for ancillary services.

There is no doubt that demand-side resources provide quick response when called upon to help maintain reliability in New York State. Aggregations in the Special Case Resource (SCR) and Emergency Demand Response Programs (EDRP) have provided access to the market for smaller customers. While these programs provide relief during reserve shortages, the real-time nature of providing ancillary services requires a higher level of real-time resource visibility and coordination.

3. Recommendations

The NYISO plans to implement the Demand-Side Ancillary Service Program in 2008. Once the initial implementation is complete, the NYISO will investigate the requirements to incorporate aggregations into the ancillary service market.

I. Deployment of non-generation DR Resources for emissions reduction on high ozone days Emissions Reduction on high Ozone days

1. Need

New York's air quality has a strong relationship to electric demand, due to emissions caused by electric generation. Demand Response resources that do not rely on distributed generation have the potential to mitigate the polluting effects of peaking power plants on high ozone days.

2. Discussion

In addition to responding to reliability events, non generation based demand response could be dispatched on high ozone days to achieve emissions reductions. These resources could potentially improve air quality through reduced reliance on electric generation. A portion of the existing pool of non generation based demand response resources may be willing to respond the additional hours required to reduce high ozone days, provided appropriate compensation is provided.

The New York State Department of Environmental Conservation (NYSDEC), in conjunction with the New York State Department of Health, issues ozone advisories when the ozone concentrations are expected to exceed an Air Quality Index (AQI) value of 100. The NYSDEC posts ozone and fine particulate forecasts on its website at http://www.dec.ny.gov/cfmx/extapps/aqi/aqi_forecast.cfm.

3. Recommendations

A study should be conducted to determine the monetary value of reduced emissions on high ozone days. This and other benefits, such as wholesale price reductions, should be quantified to determine an appropriate incentive. The determined value and incentive level should then be vetted to the demand response community. If the incentive is sufficient to justify the additional event hours, a program should be developed. This study should also investigate technical environmental and meteorological issues surrounding electric generation emissions and ozone conditions. This will help to better inform program development. It should also be determined the appropriate program administrator, funding source, and budget.

J. Landlord/Tenant Barriers to DR and EE

1. Need

Improve incentives for commercial and multi-family residential building owners and tenants to participate in DR and EE programs.

2. Discussion

One of the most widely recognized, but most intractable barriers that faces proponents of improved energy efficiency and demand responsiveness in the commercial and multi-family residential spaces is the misalignment of incentives between those who own and operate the buildings and those who live and/or work in them. This is often cited as the single largest barrier to the participation of these sectors in demand response and energy efficiency programs. This is an especially critical consideration in New York City.

One version of this issue pertains to commercial properties in which owners profit from tenant electric use. Many commercial buildings are master metered and receive only a single bill from the utility or electric supplier. The owner then distributes the charges to the tenants based on submeters or square footage. In so doing, the owner adds a surcharge to the tenant costs, established in the lease. Because of this revenue stream, owners are frequently loath to pursue any efficiency measures in tenant space. Unless the tenant and owner contract to split energy savings, either through a lease addendum or other mechanism, owners routinely block efficiency projects that affect electric consumption in tenant use.

In other instances, including that of multifamily properties, the split incentive problem arises whenever the entity paying for the electric (or gas or oil) usage, is not the one who is responsible for paying for energy efficiency upgrades. For example, when the tenant pays the EL1 rate for apartment usage but the landlord owns the refrigerator and is responsible for installing in-unit hard-wired lighting fixtures, the building owner does not directly benefit from installing more energy efficient appliances and lighting in such apartments. And when the building is master metered for electricity (without submetering) the residential tenant has no direct economic incentive to conserve, or to pay for energy efficiency upgrades. These split incentive situations require program policies and incentive structures that support a "whole building" perspective.

An additional consideration that reinforces this behavior is the fact that unbundled billing and rate data is not generally made available to landlords or tenants. The result of this reduced transparency of bill impacts is that tenants have lower awareness of energy components and thus less incentive to change their behavior in other ways, which might reduce costs and possibly impact demand.

3. Recommendations and Forecasted Benefits

(i) Incentives for landlords and their tenants need to be aligned so that both can support the participation of their buildings in DR and EE programs.

(ii) Assemble a Task Force – Governor Spitzer and Mayor Bloomberg should convene a multi-disciplinary Blue-Ribbon Task Force to:

- Recommend appropriate regulatory, legislative, or other initiatives that will lead to a better alignment of the incentives between landlords and tenants regarding the participation of both in demand response and energy efficiency initiatives.
- The focus of such a Task Force should be on addressing this split incentive issue in both the multifamily and commercial sectors.

- This is an effort that should require little funding to achieve; but it will require a coordinated commitment by many stakeholders to address this complex issue effectively.
- The task force should explore the potential benefits of landlords providing tenants with unbundled billing and rate information.

4. Expected Benefits

- Potentially, greatly expanded participation (100s of MW) by commercial and multi-family residential properties in DR and EE programs.

5. Time Frame

- The Task Force should be convened in early 2008 and be charged with submitting its recommendations by January 1, 2009.

K. Develop and Deploy Technologies that are Both Efficient and Demand Responsive

1. Need

There is a significant opportunity to integrate demand response and energy efficiency efforts given the close relationship of EE and DR, particularly regarding customer education and implementation.

2. Discussion: Capturing Synergies between Demand Response and Energy Efficiency

An integrated energy management solution would cover different facets of energy strategies which might include an aggressive transient demand reduction strategy based on reliability-based demand response and also long term energy efficiency solutions for the same equipment.

One key barrier to maximizing this synergy is the lack of capacity valuation for energy efficiency projects in New York. Providing the opportunity for energy efficiency projects to earn capacity credits for the load they avoid would provide a highly effective market based funding source.

3. Hurdles/Barriers Regulatory

- Lack of Capacity Valuation of Energy Efficiency
- Ownership of Energy Efficiency Credits
- Integration of DR and EE Programs, Customer Education, and Outreach Efforts

4. Recommendations and Forecasted Benefits

a) Energy Efficiency project funders should own the Energy Efficiency Credits of EE projects.

b) Demand Response and Energy Efficiency programs, and customer education and outreach efforts should be integrated.

c) One relatively simple way for energy efficiency projects to obtain capacity credits would be for the NYISO to offer an “Energy Efficiency Capacity Program” (ECAP). This could function similar to the NYISO’s Demand Response Programs. After verifying permanent load reductions through energy efficiency, participants could bid the reductions into the capacity market and earn the market clearing price. While this seems similar to the ISO-NE Forward Capacity Market’s inclusion of demand side management in its “Other Demand Resource” category, the proposed ECAP program would avoid the complications of the NYISO having to create its own FCM, as well as the challenges of creating a White Tag (EEC) market. Further, the ECAP program could be implemented quickly by leveraging the ISO-NE’s extensive work in developing M&V standards for demand side management projects.

d) The Energy Efficiency Credits of EE projects should be owned by the parties funding the EE projects. A key factor in promoting linkages between demand response and energy efficiency is the issue of ownership of the Energy Efficiency Credits (EECs). Demand response participants “own” the capacity credits of their demand reductions, and thereby earn market-based revenues. Similarly, to the extent that end-users fund energy efficiency projects, end-users implementing permanent demand reductions must be the owners of the EECs associated with those reductions.

e) Energy Efficiency Credits, or White Tags, are an emerging market mechanism that has the potential to help companies finance energy efficiency projects with private sector capital. The idea behind White Tags is to allow energy efficiency to trade like a commodity -- a company wanting green marketing rights or a utility desiring to comply with mandatory efficiency standards could purchase White Tags, or the rights to the energy conserved by an efficiency project. White Tags could potentially provide robust market incentives promoting efficiency, but there are four key pitfalls that must be avoided to ensure market participation is not prohibited due to fears of illegitimate practice.

   First, third party certification and measurement and verification is necessary to ensure fictitious credits are not created by companies involved in selling them. Standard SBC and SWP program M&V practices could easily be used for this. Second, the White Tags market must be transparent and auditable, ensuring credits are not double counted or sold. Third, White Tags should not offset any other renewable or kW based targets included in the RPS or EPS. Fourth, strict environmental consideration needs be taken into account when certifying White Tags. White Tags have the great potential to promote market-based efficiency, but if the market is seen as illegitimate in any way, participation in this nascent practice will plummet and White Tags may not provide any meaningful aid to energy efficiency or the EPS.

f) Demand Response and Energy Efficiency programs, and customer education and outreach efforts should be integrated. From the perspective of an energy efficiency provider, demand response should be a routine part of the offerings. Typically in EE, homeowners are offered a comprehensive array of devices and treatments that improve energy efficiency, everything from low-flow showerheads to CFLs, along with all the building performance improvements like insulation, air sealing, duct sealing, HVAC options, etc.

Similarly, utility customers should not be contacted separately for energy efficiency and demand response efforts. The benefits and implementation logistics (engineering, M&V, etc.) of EE and DR are so similar that separate efforts are frequently duplicative.

In-home energy display devices or other mechanisms that provide customers with real time information about energy costs could be required elements of the mix. Combining energy efficiency, real time pricing information, and load control will enhance our ability to deliver all possible energy savings.

L. Capture Synergies between Energy Efficiency and Demand Response in the Mass Market

1. Need

Increase efficiency by capturing synergies between demand response and energy efficiency. Develop and deploy technologies that are both efficient and demand responsive (dimming ballasts, controllable appliances, etc.)

2. Discussion

An integrated energy management solution would cover different facets of energy strategies which might include an aggressive transient demand reduction strategy based on reliability-based demand response and also long term energy efficiency solutions for the same equipment.

A key factor in promoting linkages between demand response and energy efficiency, is the issue of ownership of the Energy Efficiency Credits (EECs). Demand response participants "own" the capacity credits of their demand reductions, and thereby earn market-based revenues. Similarly for energy efficiency, end-users implementing permanent demand reductions must be the owners of the EECs associated with those reductions.

For companies that concentrate on small, residential energy efficiency work, demand response should be a routine part of the offerings. Typically in EE, homeowners are offered a comprehensive array of devices and treatments that improve energy efficiency, everything from low-flow showerheads to CFLs, along with all the building performance improvements like insulation, air sealing, duct sealing, HVAC options, etc.

Devices that provide customers with real time information about energy costs, or load control devices that raise central AC thermostats or cycle pool pumps, could be required elements of the mix. Combining energy efficiency, real time pricing information, and load control will enhance our ability to deliver all possible energy savings.

3. Hurdles/Barriers -

- Require that EE offerings to residential/mass market customers include demand responsive components

- Additional funding through SBC to offset additional costs of adding DR components to offerings

4. Recommendations and Forecasted Benefits

Synergies exist between DR and EE for the mass market. Incremental cost of adding DR capability during EE installs may be very low.

- Require EE Outreach to include, or at least asses the merits of including, a DR component as well
- Funding Allocations – Incremental funds should allocated as other mass market EE costs are allocated
- Expected Benefits – Low cost incremental demand response. Possibly highly flexible and reliable due to the large numbers of small participants
- Time Frame – (undefined)

M. Enhanced DR and Monitoring-Based Commissioning (MBCx)

1. Need

Leverage Demand Response capacity to produce incremental and permanent energy efficiency.

2. Discussion

There is a close and direct relationship between demand response (DR) and energy efficiency derived from MBCx by virtue of the fact that ISO demand response programs require the installation of the very interval metering that is a prerequisite to implementing MBCx. ESCOs can use the advanced meters required by DR program rules to obtain a continuous record of load and energy consumption on a near-real-time basis. This data is analyzed either manually, or electronically using and trending software ESCOs are then able to discern opportunities for ongoing energy efficiency savings that might otherwise go unnoticed. Further, these efficiencies may be available at very low cost as they may entail simple operational changes to building management systems.

Monitoring-based commissioning (MBCx) employs remote energy system metering with trend log capability to identify previously unrecognized inefficiencies in energy system operations, facilitate the application of diagnostic protocols, document energy savings from operational improvements, and ensure persistence of savings through ongoing re-commissioning.

These efficiency efforts differ from traditional commissioning or retro-commissioning efforts in that they may require continuous monitoring and adjustment in order to be persistent. However, with continuous attention, these measures can be as permanent as other energy efficiency measures. Yet these tangible, verifiable, and economic efficiency resources will never be seen if the essential metering is not introduced in response to a demand response opportunity.

3. Hurdles/Barriers -

Regulatory

- PSC and NYSERDA must first recognize MBCx as a permanent energy efficiency measure eligible for funding

Financial

- Include kW target in proceeding to incentivize additional demand response
- Provide additional financial support for incremental kWh savings enabled by that DR
- Provide support for advanced metering and communications infrastructure necessary to enable customers for DR and MBCx

4. Recommendations and Forecasted Benefits

- Leverage existing and incremental demand response to achieve significant, permanent, low-cost energy savings
- Adopt kW targets for 15 by 15 to enhance DR participation
- support advanced metering/AMI
- certify MBCx as an eligible EE measure
- Expected Benefits – 5-10% energy savings
- Time Frame – Available immediately

IV. TRANSMISSION AND DISTRIBUTION SYSTEM EFFICIENCY

1. Transmission and Distribution System Losses

Losses occur as a result of the operation of the delivery system itself (i.e., the operation of the T&D system results in reactive power losses at high transfer levels as well as thermal losses at all transfer levels), and as a result of reactive losses placed on the system by end-users.

Reductions in transmission and distribution (T&D) system losses offer significant energy savings potential for New York State. These savings are attainable by re-emphasizing long-standing good utility practices and through effective management of electric capacity. Two to three percent of New York's electricity is consumed by transmission system losses before the energy is ever converted into useful work at the consumer level. Similarly, an additional four to eight percent is consumed by losses in the distribution system. The precise amount of avoided energy production savings available from ameliorating transmission and distribution system losses for each utility will depend on the characteristics of each utility's system; therefore, it is important to note that the cost-effectiveness of any efforts will need to be carefully scrutinized so that all benefits are properly monetized and distributed fairly with all entities involved. The majority of T&D system losses are attributable to reactive power losses.

Ratepayers ultimately pay for the additional energy consumed by transmission system losses. Of the 173,000,000 MWh of electricity supplied to the State's transmission system in 2006, approximately 2.4% (4,000,000 MWh) of this energy was consumed by transmission system losses. Of the remaining 169,000,000 MWh supplied to wholesale consumers, a conservative estimate of 6% (10,000,000 MWh) was likely consumed by distribution system losses. In total, approximately 14,000,000 MWh of New York's energy supply was consumed by T&D losses in 2006.

Reducing system losses would benefit consumers to the extent that they or the load serving entities that serve them will need to procure less energy and capacity to meet their electricity needs. Such savings would help offset the capital and other costs of making local distribution system improvements. Quantifying the exact amount of savings that could be achieved is complex, as it involves consideration of each utility's and load serving entities capacity and energy requirements and a forecast of market prices that each would have to pay for capacity and energy. Nevertheless, given the potential magnitude of the savings associated with reducing energy losses, as well as capacity savings for LSE's load, quantifying potential improvements and costs associated with alternative solutions would be a part of any study to increase energy delivery efficiency. Moreover, beyond cost savings, reducing system losses could have environmental benefits, due to reductions in SO_2, NO_x, and CO_2 emissions.

a) Reactive Load Losses

Electricity consists of two components: real power (kW) and reactive power (KVAr). Both are vital to the transmission and consumption of electric energy. Real power is often referred to as useful energy while reactive power is often referred to as "imaginary power". Customer meters measure real power usage for billing purposes, but generally not reactive power at the enduser level. Reactive power is, however, measured at higher voltage levels for the purpose of operating and controlling the bulk electric power system but is rarely, if ever measured at distribution levels. Different measures are needed to efficiently compensate for reactive losses occurring on the bulk power system vs. those created at the customer load level.

Reactive power consists of the energy needed to sustain the 60 cycles per second frequency of voltage and current in an AC power system. As long as voltage and current are in phase with each other, the maximum amount of power (referred to as apparent power) will be transferred to or consumed by load(s). When voltage and current are not in phase, the power delivered will be reduced in proportion to the mismatch. This reduction in electric delivery capacity is inefficient and can become a problem when load levels are high.

To achieve the most efficient energy transfer, the electric system must balance reactive loads caused by all capacitive and inductive loads, at any given time. When reactive load balancing is maintained, power factor[36] is equal to unity ("one"), and usable electric energy

[36] The term power factor is used to quantify the effect of reactive power on an electric system. Power factor (%) is computed as the quotient of active power (KW) divided by apparent power (KVA). In the absence or reactive power requirements, real power and apparent power would be equal and the amount of power flowing on the electric system would be optimized. Higher reactive power levels manifest themselves as higher apparent power flows, which result in higher electric inefficiencies (losses) manifested in the form or higher heat lost from generators, transformers, cables and motors, lights, etc.

transfer is maximized. It is often most efficient to balance reactive loads by adding either capacitive or inductive reactance as close to the load (i.e., right on the motor itself) as possible.

Whether inductive or capacitive, all reactive loads manifest themselves in the production of heat released by the load, generator or circuits in between. Reactive power losses are inefficiencies which have not been systematically addressed in the United States. Reactive loads can become a significant problem if they cause a component to approach its thermal operating limit. For example, during peak-load periods power flows into load pockets often are limited by transmission or distribution system constraints, creating a need for relatively inefficient generators within the load pocket to operate in order to satisfy load requirements. Operation of these units contributes to high electric prices and high emissions levels. A continuous program of measuring and correcting power factor either at the load itself or at the lowest voltage levels of the AC network will mitigate the impact of enduse reactive loads when power flows are highest.

What Are the Implications of Reactive Power Losses?

Transmission and distribution circuits, as well as total supply requirements, are sized according to apparent power (KVA) requirements. The effects of reactive power are not bounded by the points of demarcation between the transmission (i.e., bulk power grid), sub-transmission, and distribution systems. Measures to counteract the effect of reactive power introduced by endusers are most effective when applied at the points where the reactive load is located. Typically, reactive power is managed through the use of capacitors.

Consider the example of a typical industrial customer with an 8 MVA (i.e., 8,000 KVA) load, a power factor of 80 percent and a load factor of 60 percent. Of the 8,000 KVA of apparent power consumed by this customer, only 6,400 KW (8,000 KVA X 0.80 power factor) of active or real power is provided to do work. However, this customer also consumes 4,800 KVAR of reactive power to support the 60 cycle per second field changes; this power performs no useful work and must ultimately be either compensated for or dissipated as heat losses. With these operating characteristics, the customer loses 2,331,580 KWh of energy annually to distribution system losses. The customer can mitigate these losses by improving the power factor and using energy more efficiently at this site. If the customer were to install 3,000 KVAr of capacitors, the amount of reactive power would be reduced to 1,800 KVAR, resulting in a 721,330 KWh (31%) reduction in system losses, annually. The effect of the addition of the capacitors is reflected as an improvement of the customer's power factor to ~96% from its pre-correction state of 80%.[37]

If reactive power is managed at the distribution system level, there is less of a need for power factor corrections at the sub-transmission and bulk transmission system levels, where the costs and complexity of the corrective measures increase exponentially and their effectiveness is relatively limited. As mentioned previously, additional generation is often required to supply the energy that is consumed by T&D losses. This means that more fuel is consumed to generate the added power, which in all likelihood, would come from the less efficient generating unit available at any given time. The impact is more fuel consumed and greater emissions levels. Reactive power also has an effect upon system voltage, affecting transfer capability of certain bulk transmission interfaces.

[37] The above is an idealized situation; additional losses and over-voltages could occur during low loads.

2. Distribution Transformer Efficiency

Power transformers are generally very efficient, however, because all electricity goes through at least one transformer (and typically several) before the energy is delivered to the end user, increases in energy efficiency can result in significant energy and life cycle cost savings.

The National Energy Policy Act of 1992 directed the US Department of Energy (DOE) to consider energy efficiency standards for distribution transformers. The national Energy Policy Act of 2005 established standards for low-voltage (600 Volts or less) dry type distribution transformers at the National Electrical Manufacturers Association TP-1-2002 standard's levels for all units manufactured on or after January 1, 2007. These units are typically used for commercial buildings. Field studies have shown this efficiency level provides about 50% energy savings for real world loads.

A DOE final rule published in October 2007 established efficiency standards for liquid-filled distribution transformers (the type used by utilities) and for medium voltage dry type distribution transformers (typically used for factory loads) at levels more efficient than TP-1 for all units manufactured on or after January 1, 2010. The efficiencies chosen were the highest that would not have serious consequences for small manufacturers.

Many distribution transformers are at or near the nominal end of life. As new units replace old units there will be significant energy and life cycle cost savings. However, as the new DOE requirements do not cover refurbished units, there will be a temptation to refurbish rather than buy new transformers as the capital cost of refurbishment would be less than the capital cost of replacement with a more efficient transformer. It is recommended that the PSC encourage the replacement of older less efficient transformers at the end of their useful life, rather than refurbishment of those old units.

3. Approaches to Managing System Losses

Reactive power management is a long-standing, good utility practice; however, its focus is typically to manage system voltage and the ability to transmit energy across the transmission grid. The measures to correct power factor applied by utilities are not usually dynamic. Rather such measures involve capacitor banks that apply a fixed amount of capacitive reactance to maintain system voltages or switched capacitor banks that are brought on-line when system limits are exceeded. It should be noted that underground cable systems are a large source of lagging reactive power and distribution loads are typically sinks of lagging reactive power. Such complexities would be incorporated into each utility's study of system losses.

In New York's deregulated wholesale energy marketplace, the matters of who benefits from investments in reactive power management and the cost recovery for such investments are issues that are being discussed by the NYISO's stakeholders. As previously stated, measures that are undertaken at the bulk transmission system level to support bulk power grid transfer capability are impacted by the reactive power characteristics of the underlying sub-transmission and distribution systems. Methodologies for studying and identifying the effect upon the bulk power system from lower voltage systems, as well as the shared benefits across the bulk power system, need to be developed. Further, the impact of establishing minimum interconnection standards for interfaces comprising the points of demarcation between transmission, sub-transmission, and distribution systems could be studied to determine potential benefits for managing system power factors within reasonably acceptable levels.

While the devices that utilities can employ to manage reactive power are commonly known and readily available, the studies required to determine where and when corrections are needed are performed on a periodic basis; many years often elapse between studies. With the advent of SmartGrid technologies, described further under the demand response/peak load reduction section of this report, utilities could benefit from near real-time information available through advanced metering systems to identify changes in system characteristics warranting power factor correction, allowing a more dynamic, continuous management of system power factor. Further, automation could be introduced through SmartGrid applications that responds dynamically to changes in system power factor in a real time manner. Current practices rely on the management of capacitor banks to correct power factor on a seasonal basis in support of system voltages.

If reactive power is better managed at the point where the energy is consumed, the actions undertaken by end-use customers may offer meaningful and least cost solutions to power factor correction. Some utilities have used rate structures that encourage customers to maintain power factors within acceptable ranges. BC Hydro, for example, imposes a penalty charge for poor power factor if customers refuse to implement corrective measures to maintain power factors of 90% or better. Large customers with power factors between 88% and 90% are assessed a penalty charge computed as 2% of their pre-penalty energy costs. The penalties range from 2% for power factors between 88% & 90% to and 80% for power factors below 50%. In the example described earlier in this section, the large industrial customer with an 80% power factor would be charged a 9% penalty under BC Hydro's rate structure[38].

Unless a rate structure is developed and implemented that emphasizes power factor correction, it is unlikely that customers would consider taking steps necessary to improve their individual power factor problem. Should studies show that such steps would provide appreciable benefits, appropriate rate structures that place reasonable emphasis upon maintaining acceptable power factors, and educational and utility support programs are two approaches which could be developed to encourage effective reactive power management at the end-user level. Any rate structure(s) developed needs to assure cost-effectiveness for all entities involved.

SmartGrid technologies, such as advanced metering, could be further leveraged to measure and monitor large customers' power factor and provide the data needed to implement power factor-based billing. The minimum functionality standards for advanced metering infrastructure that are being developed through the Commission's Advanced Metering Infrastructure Proceeding [Ref Cases: 94-E-0952; 00-E-0165; 02-M-0514] should contain provisions for power factor measurement for metering systems typically deployed for customers that typically have significant inductive loads.

<u>Improving T&D Efficiencies Through Load Factor Improvement</u>

Load factor is a measure of how energy is consumed, relative to consumption during peak periods. Daily system demand patterns exhibit low evening loads which spike upward to an afternoon peak each day. The large average-to-peak fluctuation provides an opportunity to improve the operating efficiency of the electric system by "flattening" loads over the 24-hour

[38] Reference British Columbia Hydro & Power Authority Electric Tariff Original Page B-29, located at: http://www.bchydro.com/rx_files/policies/policies1459.pdf

period each day. Measures that either store energy or shift loads to off-peak periods will improve system load factor and efficiency.

Utilities must provide infrastructure that is capable of supplying energy during periods of peak consumption. For example, transformers that reduce system voltages to levels that are required by end-use consumers must also be sized to support customers' load during peak periods. Load factor improvement is accomplished by managing the way customers use electricity, whether in industrial processes or in the home; hence the term Demand-Side Management (DSM).

Technologies such as thermal storage, battery storage, pump storage, fly-wheels, and compressed air storage allow energy to be "stored" during off-peak periods and drawn upon during periods when energy consumption generally increases, having a leveling effect upon customers' usage and reducing peak demand. While overall energy consumption may be increased due to the need to "charge" these devices, reducing the variability in power plant output by the shifting of the consumption to off-peak periods allows power plants to be operated in a more efficient, steady state manner. A power system that consistently operates at high load factors allows more efficient management of supply-side resources, emissions, and grid infrastructure.

Improving Generation Efficiency

Generation efficiency improvements (of which there are many) are one of the numerous options available to generating plant managers to acquire a competitive edge in the market and hold market share in the face of increasing use of DG/CHP where greater energy conversion and therefore environmental efficiencies can be achieved. The Public Service Commission has promoted markets in order to incent generator owners to pursue these efficiency improvements to their generation fleets.

If generation efficiencies are achieved through actions that would likely not be considered as cost effective responses to electric market signals, for instance capital intensive generator re-powering, these efficiencies should be applied toward the Statewide 15 by 15 goal.

End-use Electrical Equipment Efficiency

While there are numerous was that end-use application efficiency can be improved (as discussed in other parts of the Working Group 4 report, we are focusing on motor efficiencies here because of the high impact of electric motor use on the electric system.

Electric motors consume 64 percent of the electricity produced in this country. Although they are generally efficient, motors are often run at lowered efficiency because the motor size is not matched to the horsepower requirements of the task. Motors frequently drive variable loads such as pumps, hydraulic systems and fans. In these applications, motor efficiency is often poor due to operation at low loads. While the operating cost of a motor, over its lifetime, is many times its purchase price many consumers would rather incur the higher operating costs than finance the higher capital costs, especially when the higher operating costs can be recovered by increasing the price of the product proportionately over time. When environmental effects are considered, the price paid by society for a motor that is no longer efficient is much higher. Small improvements in efficiency can therefore generate significant savings in energy costs and environmental impacts.

Since motors run most efficiently near their designed power rating, it is good practice to operate between 75 percent and 100 percent of full load rating. The National Association of Electrical Manufacturers (NEMA) publishes guides for selecting motor design types for particular tasks.

Proper power supply is essential for achieving rated performance of a motor. Unbalanced three-phase voltage affects a motor's current, speed, torque and causes its temperature to rise. Equal loads on all three phases of electric service will help assure voltage balance while minimizing voltage losses. Motors powered by a single AC phase operate less efficiently as the power quality deteriorates. Therefore, it is important for utilities to maintain line voltages at established levels and with reasonable power factors so that electric power consumers are not forced to accept an inferior product.

Regular maintenance helps minimize loss from friction and heat and extends motor life. Lubrication and cleaning should be performed periodically. Motors should also be checked for proper ventilation, mounting bolt security and load change application. Motor manufacturers can improve efficiency from three to eight percent. Heavier copper wire, higher core-steel grade, thinner core laminations, better bearings and reduced windage designs add up to improved efficiency. Even though the initial cost of a more efficient motor may be higher, its payback can be very short, especially for motors that are in constant use.

Electronic Variable Speed Drives (EVSDs) control the speed and torque of an AC electric motor by varying the frequency and voltage of the electricity supplied to the motor. By using an EVSD, only the electric energy needed by a motor to perform its intended function, at the time, is supplied. Therefore, EVSDs can reduce the power consumed by most motors. EVSDs replace inefficient, energy robbing speed controllers such as belts and pulleys, throttle valves, fan dampers and magnetic clutches.

EVSDs have been applied successfully in pumping applications such as in municipal water systems, chemical and petrochemical industries, pulp and paper industries and food industries; in air handling applications such as, conditioning and ventilation systems; in applications where efficient speed control is called for such as conveyor systems used in the food, paper, automotive and consumer goods industries and are well suited for use in crushers, grinding mills, rotary kilns, presses, rolling mills, textile machinery, escalators and elevators which operate intermittently experiencing hundred if not thousands of starts and stops each working day.

Electronic VSDs have many advantages, such as:

- No friction loss because there are no moving parts.
- Instant and precise control of equipment speed - one VSD can control multiple motors.
- Gentle startups and gradual slowdowns to reduce motor stress.
- Small size makes them ideal for retrofit.
- Energy savings up to 20 percent.

4. Recommendations

- Potential reductions in delivery losses need be studied, but they must be studied by each utility for its service territory, and the study should include both transmission and distribution losses as individual components, to the extent practicable and possible, because they can be interrelated. A potential scope of work for the studies should be developed. If it is desired that the studies be done on a more accelerated basis, a mechanism for utility cost recovery needs to be implemented. [39]
- Programs that come from WG 2 should address increased deployment of energy efficient motors because of their significant contribution to load.
- The PSC should explore the development of utility rate structures that place sufficient emphasis upon maintaining minimum power factors and consuming energy during off-peak periods, if benefits of these alternatives are compelling.
- The PSC should explore the establishment of minimum efficiency standards for all electrical equipment installed in New York.

5. Attachment A: The Modern Electric Grid

At any instant in time the modern electric grid consists of generation, transmission, distribution, and load equipment operating in balance, or as close to it, as possible, since all components “synchronize” themselves to the grid. This lock-step cadence pervades the entire grid and all components linked to the grid reflect the same lock-step behavior. The 60 cycle per second frequency is a common characteristic of both voltage (V) and current (I) waveforms in AC systems. It begins with electric generators which strive to generate the power needed to supply all customer loads, at any given instant. Because it is not possible to store AC electric energy (in its AC form[40]), the need to balance power supplies with all load(s) occurs every instant in electrical space (where the laws of physics apply), but is measured (metered) much less frequently in both the operation of the equipment, and, when metering the flow of power where the laws of economics generally prevail. Unfortunately, in some cases, especially at lower distribution voltage levels, the quality (i.e., voltage and power factor, etc.) of power provided by that portion of the AC power system was, and may not be measured at all.

The cyclic nature of AC current was the reason that, in 1888, Nicola Tesla and George Westinghouse were triumphant when they harnessed Niagara Falls and transmitted its power

[39] WG IV supports the Staff’s T&D Recommendation in its Revised Proposal for Energy Efficiency dated November 26, 2007. Studying and identifying the potential incremental gain available for reducing losses on the electric generation, transmission and distributions systems is complex and any theoretical model would be a simplification based on certain assumptions. Such a theoretical study would have to recognize that there is wide variation in the circuitry that exists not only across utilities but even within each utility. For example, the extensive and largely underground transmission and distribution systems that comprise the Con Ed system make it unique and therefore different than other AC electric power systems. Such a study would have to include the evaluation of the costs of electrical losses in terms that can be compared with the costs of means to reduce those losses.

[40] In the DC system, chemical laws related to oxidation-reduction reactions allow energy to be stored chemically in batteries. While batteries could store power generated by an AC system, that would require the power to first be converted from AC power to DC power, stored in a rather large battery and then be converted once more from DC power and then to AC power in order to be useful.

much longer distances than DC power systems could, at that time. The use of AC power however required system electrical engineers, at that time, to expand the principles of physics which drive direct current (DC) power systems to accommodate the effects of creating and collapsing an electric field sixty times every second as seen in domestic AC power systems. The magnitude and nature of the resistive forces in AC power systems depends on the manner in which the electric power is consumed and is not avoidable. Regardless of whether the resistance is caused by a motor which introduces an inductive resistance or reactance or a capacitor which introduces a capacitive reactance, the net effect is the same; the production of excessive heat. This heat is produced as reactive electric currents circulate over the entire grid. At any instant in time, the heat due to reactive power losses can either be stored or dissipated either by the generator, the loads (i.e., motors and lights, etc.), or the T&D equipment in between. The costs of power quality defects on the electric system, which can approach 20 percent (and be as high as 50 percent), means that more than 20 percent (and as much as 50 percent) more power is generated, transmitted and distributed to serve all customers. This added generation is usually produced by the least efficient, highest cost and most polluting generation available at the time of the imbalance. It also means that components, like motors, operate at points other that the most efficient operating points introducing inefficiencies across the grid. We also understand that the best and most effective place to correct power factor problems is as close to the loads as possible, thereby limiting the power factor impact on other loads served by the same distribution network(s).

Early electric component manufacturers dealt with the reactive forces of AC power by building their equipment in a manner that provided the greatest ability to dissipate the heat. When we visit museums, we marvel at the old motor stator cores and large windings of the first generators and motors. Unfortunately and unintentionally, another trade-off was made as efficiency was sacrificed. As we strive for increased electric generator, transformer or motor efficiencies we reduce the effective operating ranges of these components. Heretofore, we allowed equipment designers to determine the trade-offs between component sizes which ultimately add up in the cost of equipment.

In the first half of the 20th century equipment manufacturers placed most interest on marketing products capable of performing acceptably over a wide range of power quality and loading conditions without noticeably affecting performance. Higher efficiency motors have generally involved optimizing such competing alternatives such as voltage levels and wire and core sizes. Manufacturers prefer to limit their product lines in favor of broader product applications with wider operating bands (i.e., fewer motor sizes for a given voltage). For AC electric motors and generators, efficiency translates into more product lines as narrower operating ranges are conducive to more efficient motor operations.

By viewing the grid in its entirety, and by understanding and applying the laws of physics which govern how electricity is generated, transmitted, distributed and consumed, decision-makers are better equipped to compare, evaluate and decide among the competing interests, alternatives and recommendations of representatives from each of these interest groups. This holistic approach provides decision-makers with a tool to evaluate and compare the economic and environmental costs and benefits when considering efficiency improvement options or when making recommendations on how to systematically pursue the quest for grid intelligence. Simply put, an efficiency framework governed by the laws of physics and chemistry will be sensitive to the unique operational behaviors of the electric grid as a whole and should be used, along with other factors, to score, prioritize and select the order in which limited resources should be deployed.

A common framework will enable decision-makers to select the most efficient and effective distribution of limited resources to capture the most cost-effective options first and determine which higher-cost options should be pursued with priority over the medium- and longer terms. It must also be recognized that the perception of the terms medium- and long-term have taken on new meaning in New York's competitive electricity marketplace. The concept of long-term has historically carried a ten to twenty-year horizon, while today two to five years might be more appropriate. For example, is greater societal value delivered by working with transmission owners to correct power quality issues (i.e., voltage sags and lagging power factor issues) or does society benefit more by dealing with the end-users whose loads create the inefficiencies in the first place? At another level, to what degree is the grid made "smarter," when instruments are installed to measure and correct voltage and power factor at transmission and/or distribution levels or on the customers' side of the meter? At what levels of deteriorated electric performance should measures be taken to reduce losses or even measure them? And which party should be held accountable for electric efficiency losses, T&D owners or customers? At what levels of deteriorated power quality should electric rates be proportionately adjusted so that customers can understand the full impacts of their individual loads and pay the fair share of the costs of dealing (or not dealing) with power quality issues they might create? Which options provide the greatest environmental benefit(s)? To what extent and under what circumstances do environmental interests prevail?

V. LATE ATTACHMENTS

A. Late Attachment 1: LIPA Energy Efficiency Programs

This item was moved to an attachment because it was submitted late and not subject to discussion.

LIPA Energy Efficiency Programs

1. Need

In May 1999, the LIPA Board of Trustees approved the Clean Energy Initiative ("CEI"), a five year, $160 million effort targeted at achieving energy and capacity savings for LIPA, delivering electric bill savings to customers and providing environmental benefits to society. In 2001, the overall commitment through 2003 was increased by $10 million to a new total of $170 million. In 2003, LIPA earmarked $185 million for the CEI form 2004 through 2008. Currently, the CEI is a 10-year, $355 million commitment to promote clean electric technologies through the end of 2008.

LIPA is facing the decision to extend its commitment to energy efficiency, renewable energy, demand reduction and RD&D over the next year or so. At the same time, it is recognized that greater levels of energy efficiency may be achievable, capturing a larger percentage of the economically feasible potential for energy efficiency. As LIPA looks to the future of its energy efficiency programs, it will be seeking newer and more effective ways to increase penetration into the existing (retrofit) markets, and place a greater focus on demand savings than in the past.

2. Discussion

The CEI portfolio contains 11 programs that pursued investments in energy efficiency, renewable energy, peak load reduction and a variety of research, development and demonstration (RD&D) projects. During its first six years (1999 through 2005), the CEI has produced significant savings for Long Island. During this period, the programs are estimated to have saved customers over $275 million and generated significant reductions in energy and capacity needs. Along with the reduction in energy use comes a variety of benefits from the pollutants that were not generated. Over its first six years, the CEI has resulted in a total of 1,348 GWH of energy saved and/or produced to date, which resulted in reduced emissions of 937,402 tons of CO_2, 1,334 tons of NO_x and 4,298 tons of SO_2. These energy savings translate into fuel savings of more than 2.17 million barrels of oil, or more than 13.48 million dekatherms of gas. In 2005, the CEI (excluding RD&D efforts) has reduced LIPA's peak demand by 269 MW and reduced the annual energy requirements by 385 GWh.

The eleven programs in CEI (not including RD&D) are:

- Residential Lighting and Appliances – Energy Star lighting fixtures and bulbs, and Energy Star refrigerators, dishwashers and clothes washers in existing residential homes.
- Cool Homes (HVAC) – energy efficient air conditioners and heat pumps.
- Residential Energy Affordability Partnership (REAP) – improves energy affordability for LIPA's lower income households through free installation of a comprehensive set of cost effective energy efficiency measures and extensive energy information and counseling.
- Solar Pioneer (Photovoltaics) – promotes sustained and orderly development of the PV market on Long Island.
- Residential Information and Education – provides valuable energy saving information to customers, including free home energy audits.
- Energy Star Labeled Homes – seeks improved energy efficiency in the residential new construction market.
- Home Performance with EnergyStar – seeks to transform the way energy efficiency services are delivered to existing homes, using a "house as a system" approach to home improvement contracting.
- Commercial Construction – promotes the application of a broad range of energy efficient electric technologies and design opportunities, comprised of three components: Prescriptive, Customer and Whole Building.
- Retrofit Energy and Capacity (RECAP) – contracts with third party providers to deliver energy savings to LIPA customers by working directly with the commercial and industrial marketplace.
- LIPA Edge – direct load control, using a two-way communications system, of residential and small commercial air conditioning systems on critical peak days.
- Customer-Driven Efficiency (CDE) – provides assistance to both residential and commercial customers not covered by any other of LIPA programs, including technical analyses, energy audits and financial assistance for energy efficiency where cost effective.

- Current Program Areas to be Continued and Expanded -
- LIPA has identified several key areas where energy efficiency can be achieved at greater than historic levels. Each area needs to be investigated in more detail, and validated through comprehensive cost-benefit analyses, critical review of program design and delivery plans, and focused market research.
- Existing Customers, Buildings and Appliances
- Most of the economic potential for energy efficiency involves the early replacement of functioning appliances, equipment and building envelopes with state of the art, highest efficiency alternatives. Reaching these customers and opportunities likely requires a change in focus in the existing energy efficiency programs, and potentially greater incentives to motivate customers to act sooner to replace their functionally adequate resources.
- Continued Market Transformation
- To be more effective in the future, the energy efficiency programs need to focus on: (1) manufacturers, distributors and retailers; (2) architect, engineers, contractors and installers; and (3) other advisors and contributors to the decision process, as well as the customers/owner.
- Technical Assistance and Coordination

  Achieving higher levels of energy savings will require providing more assistance to customers, in order to capture more of the latent opportunities that are economically feasible. Two roles will likely take on more importance as deeper penetrations of energy efficiency into the retrofit market:

  - Solution Providers: experts that identify and evaluate technical solutions to customer energy efficiency needs.
  - Market Channel Coordinators: experts that coordinate among the various technical experts to assemble the appropriate types of services and solutions to meet the customer's requirements.
- Demand Reduction Opportunities

  While demand side management programs that reduce the use of energy (such as lighting programs) contribute to the reduction of fuel use and environmental emissions, it is more cost effective to reduce peak demand requirements since this creates an opportunity to eliminate or defer the need to construct more generating capacity. The increased focus on demand reductions includes greater attention to air conditioning efficiencies, building envelope improvements, and efficiency measures that tend to operate on summer weekdays such as office lighting and equipment, pool pumps and

3. Barriers and Recommendations

- Cost Recovery and Bill Impact Considerations

  Achieving greater levels of cost-effective energy efficiency will require the commitment of significant amounts of financial resources that will have multiple impacts on the utilities and their customers. Larger commitments to fund energy efficiency will likely have an impact on customer bills, even if there are savings over the long term. Additionally, there will be shift between the unbundled portions of the customer's bill, as delivery charges increase to support reductions in power supply costs. If utilities are going to commit the financial resources to pay for the increased energy efficiency programs, then a true consensus needs to be developed between customers and their delivery service companies that the tradeoffs are reasonable and appropriate. Achieving that consensus will likely involve specific recommendations and solutions between each utility and its unique set of customers, and the process should be designed to reflect the necessary factors, decisions and compromises appropriate for each service territory and mix of customers.

- Measurement and Verification

  M&V is particularly important for demand side resources like energy efficiency because the benefits are not directly observable by customers. It is hard to know what the customer's bill would have been, absent the energy efficiency program, particularly for customers. Programs of this magnitude will need to instill a high level of confidence among the supporting constituents. Key to establishing this confidence will be an aggressive program of measurement and verification, tied into a communications program that demonstrates to all parties that the savings which have been targeted and paid for are being realized.

4. Summary

LIPA has been a leader in energy efficiency for the past ten years. It now has an opportunity to expand on that leadership role, by sharing its methods and approaches with the rest of the State, and considering ways to expand the amount of energy efficiency that it can achieve for its customers. Among the ways in which LIPA can achieve greater penetration of its energy efficiency programs are:

- Increase the focus on the replacement of existing appliances and equipment.
- Utilize solution providers and market channel coordinators to better integrate the available energy efficiency measures into the customers operations and/or construction alternatives.
- Increase funding to sponsor a greater level of cost-effective energy efficiency.
- Pursue more peak load reduction opportunities to improve system load factor and avoid the construction of new power plants.

B. Late Attachment 2: Reduce barriers to DR by improving access to usage data.

This Item was not fully discussed and agreed to by the Working Group.

1. Need - More timely access to customer usage information

Delays in obtaining access to customer usage information from utility meters forces delays and/or the installation of redundant metering, resulting in delayed enrollments and increased costs or decreased benefits. The NYISO requires that DR participants to have interval meter data in order to participate and demonstrate performance. Where such customers are already equipped with revenue-grade interval meters, those meters will be sufficient to enable participation, although meter data may only be available from the utility some time after the fact. However, where the customer does not have interval metering, it is necessary for the DR Provider (DRP) to obtain interval meter data through one of three approaches:

- Utility-supplied pulses or data obtained from the existing meter
- A new meter installed in parallel with the existing meter
- “Shadow” metering such as “Veris” meters

Neither of the latter options are preferred as they are wasteful of both time and dollars. In addition, the installation of shadow metering can be hazardous as such meters are usually installed on live busses.

A far preferable option is to obtain the meter data from the existing meter; however doing so requires a visit by utility personnel. Pulses provided through a utility-supplied pulse “block” on the existing meter are the most common means of obtaining such data, however, delays involved can be significant, averaging two months upstate and four months in New York City and on Long Island due to significant other work at the utility.

The revenue impact of this issue is significant; if a DR provider enables 100 new MW in 2008 at an average of $7/kW-month and can get each asset to market one month earlier on average by having quicker access to data at the meter providers and customers will realize an additional $700,000 in revenues on these sales. The result is that many DR providers are forced to install redundant metering, despite the cost in order to preserve revenues that would otherwise be lost.Fortunately, there are several options available to address this problem, including:

Pulses through a utility-supplied pulse “block” on the existing meter;

Pulses through another electrical or mechanical device attached to the existing meter;

Actual kW and kWh readings obtained from the existing meter through an Ethernet, Optical, or other type of connection;

Pulses or actual readings through a new meter installed in parallel with the existing meter (either through a second meter socket or socket “adaptor”)

2. Recommendations

- PSC should establish reasonable deadlines for providing meter data via pulse or other acceptable approaches and direct utilities to have enough inventory on hand at all work locations would allow these requests for pulses by DR providers to be done quickly.
- Timely installation of pulses. In many cases pulses installations take less than ½ hour and a regulatory or management requirement that providing pulses for a DR request would be attended to quickly

3. Hurdles/Barriers

Regulatory

- Lack of established tagets/benchmarks for what constitutes a reasonable time for utilities to provide meter data access to DRPs

Financial

- Possibly little to none. Installations of pulse initiators for DR represents a small minority of existing utility work orders, however, having enough of the proper meters in stock could be a cause of the delay. Allowing utilities to have enough inventory on hand at all work locations would alleviate this.

Funding Allocations

- Additional costs are not expected if reprioritization is sufficient to meet deadlines, otherwise additional costs to expand inventories should be recovered along with other metering costs

Expected Benefits

- Shortened DR implementation cycle
- Decreased expenditures on "shadow" meters by RIPs and NYSERDA
- Decreased financial and administrative burden on NYSERDA

Time Frame

- Immediate upon implementation

C. Late Attachment 3: Energy Storage for New York's Energy Future[41]

This Item was not fully discussed and agreed to by the Working Group.

1. Need

Modular Distributed Electricity Resources, including modular electricity storage that are geographically targeted, are needed to enhance energy efficiency, demand response, and distributed generation, including both renewables and conventional fuels. These important options are increasingly warranted on both sides of the point of common coupling (between the load and the grid) for meeting operational requirements such as voltage regulation, providing electric energy and capacity at alternative times and places.

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[41] See **Guide to Estimating Benefits and Market Potential for Electricity Storage in New York (With Emphasis on New York City)** For New York State Energy Research and Development Authority, Agreement 8723, March, 2007. See Technical Reports – electric power delivery. http://nyserda.org/publications/default.asp

a. Since divestiture of central generation plants distribution companies cannot rely upon generators within the proximity of need to provide voltage support if and as needed.

b. Among the options available are advanced batteries, fly wheels, ultracapacitors, point of consumption voltage regulators. In short, they can complement the regional electricity supply, transmission and distribution facilities.

c. If the value of the T&D I^2R energy losses that are avoided can be monetized for entities to invest in and operate electricity storage devices, it can help justify the expense.

d. Electricity Storage Provides Unique Capabilities; Unique Opportunities

a. Enhance off-peak wholesale electric energy value
b. Enhance value of renewable electric *energy*
c. Enhance value of renewable electric *capacity*
d. Improve operation and environmental performance of the electric generation fleet
    1. Reduces: generation startups, ramping, part load operation
e. Provide clean, high value ancillary services
    1. Especially regulation, reserves, black start
f. Increases electricity price hedging opportunities
g. May improve fuel diversity
h. Can manage effects from renewables' intermittency

Electricity Storage to Reduce Statewide Energy Use

"Dynamic Operating Benefits"

- storage providing reserves, "regulation"
- reduce generation startups
- reduce generation ramping
- reduce generation partial load operation to;
    - reduce fuel use
    - reduce emissions
    - reduce generation wear and tear

"Wind Intermittency Management"

- Storage used to "manage" intermittent output
- Reduce thermal generation ramping
- Reduce need for make-up/import energy
- Includes reduced i^2r losses to:
- Reduce fuel use
- Reduce emissions
- Reduce generation wear and tear

"Time-of-demand Shift"

- Charge off-peak; energy from efficient gen.
- Discharge on-peak; displace less efficient gen.

Optimize CHP

- Storage used to "manage" discontinuities between thermal and electric demand

Manage localized power flows

- Storage used to "manage" local power flows
- Increasingly important as dg proliferates
- Avoid heavy or over loading of d equipment

Reduce i^2r losses

2. Hurdles/Barriers

Regulatory Hurdles are reflective of the costs of development and deployment. Monetization of benefits is crucial. Authorization for same is a regulatory choice. Demonstrations are called for within the PSC jurisdictional utilities, and the non-jurisdictional authorities. Funding approval is warranted inside the EPS process and the budgets of non-jurisdictional entities. The involvement of the NYISO will perforce bring the regulatory jurisdiction of the FERC.

Ways to Overcome

a. Start with a review of the Storage Benefits Report and identify the regulatory hurdles.

b. Design regulatory strategies in conjunction with the EPS process and the NYISO process.

The ability to aggregate benefits is crucial and an extended inventory of alternative and complementary have been identified in the NYSERDA report identified in the first footnote of this section. In order to overcome financial hurdles:

Pooling of initiatives will be important, e.g. the proposal for utility grade demonstration of plug-in hybrid electric vehicles as a grid resource could be done in conjunction with proposals to develop utility grade demonstrations in the mid-Atlantic states in conjunction with PJM, PEPCO-Holdings, and Google.

- Work to monetarize values at NYISO.

3. Recommendations and Forecasted Benefits

The EPS process provides an opportunity for NY Storage Opportunities to more rapidly receive attention and to mobilize pilot and utility scale demonstrations. This includes flywheels, advanced batteries, ultracapacitors, point of consumption voltage regulators and other devices. Five major action steps are identified and recommended.

a. Deploy fly-wheel technology for frequency regulation and other purposes.
    1. Create utility scale demonstration (20 MW) within 2 years.
b. Characterize synergies between grid and plug-in hybrid vehicle storage.
    1. Create utility scale (1 - 3 MW) demonstration within 2 years
c. Optimize photovoltaics for on-peak power *and* energy, plus voltage support, with modest amounts of storage.
    1. Create 15 demos. By NYSERDA, NYPA, LIPA within 2 years
d. Use upstate, off-peak wind generation (per GE wind study) for power *and* energy in NYC and LI.
    1. Conduct Feasibility review by NYSERDA, New York City, LIPA in 2 yrs, demo in 3 yrs, deploy in 4 yrs
    2. Develop storage and contracting options
e. Use storage to serve demand from low capacity factor, small a/c
    1. Deploy with direct load control initiatives and independently
    2. Deploy utility-scale programs for 10,000 units year 1, 30,000 units year 2, 60,000 year 3.
f. Provide rapid response local voltage support.
    1. Aggregate as part of a value proposition with 2 or more benefits
    2. Get 10 pilots into the field anticipating broader deployment in years 3 to 5.
g. Defer T&D upgrades, extend T&D life
    1. For distribution system: create scoping study and one demonstration in NY and LI, participation by NYSERDA, LIPA, NYPA
    2. Stimulate RD&D initiatives by TOs, participation by NYSERDA
h. Identify and characterize the most viable and attractive *near term* value propositions.
    1. Promote savvy “benefits aggregation” similar to demand response, supplementing with other possible benefits wherever possible
    2. Promote storage as “hub” for integrated energy solutions that are otherwise uneconomic

D. Late Attachment 4: Gas – Demand Response

This Item was not fully discussed and agreed to by the Working Group.

1. Need -

On May 16, 2007, the Commission issued its *Order Establishing Gas Efficiency Program for 2007-2008 Heating Season*. The Order directs the Con Edison and the New York State Energy Research and Development Authority (NYSERDA) to immediately begin to implement a gas efficiency program in Con Edison’s service territory for the 2007-2008 heating season. The

Commission's Order includes a requirement that NYSERDA file a plan for the gas program on June 1, 2007. The Gas Program will improve the efficient use of gas through the use of comprehensive, effective incentive and financing packages. This includes providing technical and financial assistance to both residential and commercial customers. The Gas Program will maximize current resource acquisition while continuing development of a viable energy services industry and supporting the transformation of markets to higher levels of energy efficiency.

2. Discussion

a) Pursuant to the Con Ed Joint Proposal dated June 1, 2007, the Gas Energy Efficiency Program was divided between a transitional year (Rate Year 1 (RY1), 10/1/07 through 9/30/08, and the balance of the Gas Rate Plan). During the transitional year NYSERDA is the program administrator of a $14 million program. [42] Con Edison may spend $300,000 on customer outreach and education.

b) The details of the Gas Efficiency program for rate years two and three of the gas rate plan will be determined by a collaborative that begins meeting in September. The collaborative will work continuously through the completion of the April 2008 filing of its recommendations to the PSC for rate years two and three.

3. Barriers

a) Barriers - Regulatory

i. During the course of RY1, Con Edison's earning threshold under the gas rate plan can be affected by the gas efficiency program. The earnings sharing threshold of 10.9% can be reduced by ten basis points if Con Edison does not demonstrate support of the RY1 program and NYSERDA's administration of that program. The threshold can also be reduced by ten basis points if NYSERDA does not encumber at least 75% ($ 9 million) of the $12 million of program funds.[43]

b) Financial

i. Pursuant to the Order, the Gas Program will be funded at $14 million; eligible customers will include all firm gas customers (including transportation customers). The Gas Program continues the allocation of program benefits of 50% to low-income residential customers, 25% to other residential customers, and 25% to commercial and industrial customers as was directed by the Pilot Order. The previous Gas Program (Pilot), administered by NYSERDA pursuant to the Commission's Pilot Order, will form the basis of the Gas Program through September 30, 2008.

ii. On September 27, 2004 as part of the Order Adopting Terms of a Joint Proposal (Gas Rate Order) Case 03-6-167 the PSC approved a $5million gas efficiency pilot program through September 30, 2007. Additional funding ($200,000) was included to fund a gas energy efficiency potential study in the Con Edison service area.

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[42] Each quarterly payment is recoverable through the MRA during the three months following each payment. Reconciliation of MRA is based on actual sales compared to forecasted sales.

[43] Efficiency programs are funded at $12million. Total budget of $14million includes approximately $2million of NYSERDA administration costs and are not included when calculating 75% of program budget to be encumbered.

4. Recommendations

The Gas Program Plan's portfolio of programs and individual initiatives will ensure that:

- natural gas customers in the Company's service territory continue to receive needed and enhanced value-added gas services;
- the environmental quality of New York's air, land, and water resources is maintained or enhanced;
- system-wide gas reliability is strengthened; and
- work is integrated with electric efficiency programs and federal energy efficiency programs. Building on the progress and success of the **New York Energy $mart,K** Power Saving Partners, and Pilot programs, the Gas Program will provide an expanded portfolio of programs that address the public policy goals of the Gas Program. In sum, those goals are primarily to effectuate energy efficiency improvements and to address the specific gas energy efficiency needs of lower income consumers.

5. Time Frame

The Gas Program timeline, listing milestones through September 30, 2008, and includes information for both the ongoing Pilot Program and anticipated dates and milestones associated with the Gas Program for 2007-2008.

Date	Milestone
June 1, 2007	NYSERDA files Gas Plan for 2007-2008 Gas Program
	Approval triggers allowable start of 2007-08 Gas Program
August 27, 2007	NYSERDA to file Quarterly Report for Pilot Program
September 27, 2008	Pilot Program under Case 03-G-1671 ends
November 30, 2007	NYSERDA to file final Quarterly Report for Pilot Program
	NYSERDA to file first Quarterly Report for 2007-08 Program, if warranted
January 30, 2008[a]	NYSERDA to file Comprehensive Report Evaluating Pilot Program
February 29, 2008	NYSERDA to file second Quarterly Report for 2007-08 Pilot Program
May 30, 2008	NYSERDA to file third Quarterly Report for 2007-08 Pilot Program
August 29, 2008	NYSERDA to file fourth Quarterly Report for 2007-08 Program
September 30, 2008	2007-08 Heating Season Gas Program Ends
March 31, 2009[b]	NYSERDA to file Comprehensive Report Evaluating 2007-08 Program

[a] NYSERDA will file the Comprehensive Report earlier if evaluation results show that a significant amount of measures have been implemented under the Pilot at an earlier date.

[b] NYSERDA will file the Comprehensive Report earlier if evaluation results show that a significant amount of measures have been implemented.

Excerpted and Adapted from NYSERDA's Natural Gas Efficiency Program for the Service Territory of Consolidated Edison Company of New York, Inc. Program Plan.

E. Late Attachment 5: Solar Thermal Technology

This Item was not fully discussed and agreed to by the Working Group.

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EarthKind Energy is providing this "un vetted" addition to the Working Group IV report.

1. Introduction

We submitted similar comments, but the way they were changed to "be generic for all possible emerging technology" changed the meaning so much that they became unrecognizable and ineffective.

We believe solar thermal has unique characteristics that require it to be a specifically named technology, ready for mass implementation - but requiring explicit focus and incentives.

Judge Stein unambiguously charged Working Group IV with the following mission:

> "• *Working Group IV – Emerging technologies: next generation resources for network management, customer load management, solar heat/hot water technology."*

This charge for WG IV included:

> *"5. For emerging technologies that could contribute to energy efficiency, identify regulatory and market barriers.*
>
> *6. Identify, describe, and inventory emerging technologies that could contribute to energy efficiency."*

Earthkind provided in-person participation at every Working Group IV session to bring up solar thermal and provide precise information on solar thermal's efficiency contributions. The results of WG4's efforts show much more emphasis on the specifics of emerging technologies that reduce demand, than those focused primarily on reducing energy use.

While we agree these are important discussions which address the concerns of the many working group members, the report could have benefited from reviewing and including more on noteworthy technologies such as solar thermal (which the group was also specifically charged to address). Solar Thermal technology is readily available to reduce energy use, and is quickly able to be deployed for mass market commercialization.

Below is the information that was originally submitted to the group. While our recommendations were incorporated into the emerging technology section, that document became too generic to provide a clear discussion and pathway.

2. Discussion

EarthKind believes the work product of the group could have been improved if specific technologies at various stages (mature, process of innovation etc.) had been illustrated to develop a more detailed identification of hurdles, recommendations and associated costs.

Solar Thermal technologies are an example of an emerging technology that is ready for widespread application in the state, but has not done so. This is an excellent technology to demonstrate how to create a smooth handshake to full market acceptance, since these products have wide acceptance other markets such as Germany (which has an inferior solar resource). **This concept is substantiated by the fact that California recently approved a $250 million initiative to install 200,000 solar hot water systems.**

The technology has already had field demonstrations and is ready for early adoption. Solar Thermal already has a manufacturing base in Canada and Europe that is ready to be utilized for NYS sales and installations. Increased sales in NY can result in widespread deployment with mass market acceptance and create NYS manufacturing to service the entire Northeast U.S. within 3 to 5 years.

The technology has TRC of greater than 1. Payback occurs in 5 to 10 years for a product with a life of 20 to 25 years.

3. Barriers and Recommendations

HURDLE 1. There is a lack of public awareness of Solar Thermal products.

RECOMMENDATION 1. NYS should create a statewide marketing campaign similar to Germany's "Solar Na Klar" – "Solar Is the Clear Choice" - that created a market which installed 140,000 solar thermal installations in 2006 with $1.6 Billion in sales and 18000 jobs, and has reduced energy consumption by over 4.3 Million MWhs per year. A NYS campaign would raise public awareness of the technologies and their impacts. This could be done through NYSERDA PONs which could pay for performance (sales and/or kwh/therm savings) for both residential and commercial applications.

RECOMMENDATION 1a. NYS should create deep enough rebates (initially 25% to 50%, up to $4,000 per residential system, scaling down over 7 years) that would incentivize solar thermal results by offsetting enough costs to overcome the initial marketing expenses.

RECOMMENDATION 1b. NY State should initiate solar thermal projects (where ever feasible) on NYS buildings, with 20 year contracts to showcase the technologies as case studies on the state website. Twenty year pay-for-performance State contracts would demonstrate the technology, contribute to the 15x15 goals, create long term stability for manufacturers and installers, and would reduce energy costs for NYS taxpayers.

HURDLE 2. Home builders, Architects, Engineers, and BPI Contractors are not aware of Solar Thermal products.

RECOMMENDATION 2. Builders should be given higher incentives (up to 50% of the installed cost) to include Solar Thermal as part of their construction. This would give builders a clear incentive to provide a southern orientation for their buildings, consider solar thermal for every new building, and create customer awareness as customers or potential customers begin to see many new homes and commercial buildings being built with solar thermal as the new standard.

RECOMMENDATION 2a. NYS could create a focused educational effort would reach out to Builders, Architects, Engineers and Contractors. This could be included as part of either Recommendation 1 or 1a's efforts, but should recognize the fact that this impact will not be realized for at least a year after the effort is initiated.

RECOMMENDATION 2b. NYS codes and local permits should specify that every new construction project should have to include solar thermal as a percentage of their new construction.

RECOMMENDATION 2c. Energy Star criteria currently do not recognize buildings that go beyond the base requirements and achieve superior performance. NYSERDA should create Energy Star Silver, Gold and Platinum categories for buildings and recognize builders/owners who build beyond EnergyStar minimum criteria.

HURDLE 3. Initial cash outlay is too high, customer are unlikely to make outlay.

RECOMMENDATION 3. Provide long term, low interest financing so customer's monthly payment is the same as or less than what it would be if they didn't make the change.

HURDLE 4. Paybacks are not fast enough for customers who are not yet familiar enough with the advantages of the product.

RECOMMENDATION 4. Follow Recommendation 1a.

RECOMMENDATION 4a. Provide statewide underwriting that would create 20 year financing for solar thermal projects. This would create a positive savings from day one for all potential customers.

HURDLE 5. Plumbing and HVAC Contractors who install hot water heaters have not embraced efficiency technologies.

RECOMMENDATION 5. Create a Statewide Training Program where manufacturer's representatives, the plumbing & HVAC trades, and the Workforce Development Institute create installation certification programs.

HURDLE 6. Customers think they need to replace their current hot water system and depend totally on the sun.

RECOMMENDATION 6. This could be included as part of Recommendation 1 and 1a, If the state pays 25% – 50% per system, customers would have a financial interest to listen to a message.

HURDLE 7. When people think solar, they think PV.

RECOMMENDATION 7. Include this educational effort as part of Recommendation 1 and 1a.

HURDLE 8. Some customers and installers remember the premature products from the 1980's.

RECOMMENDATION 8. Include this educational effort as part of Recommendation 1 and 1a.

RECOMMENDATION 8a. Same as Recommendation 4: Create a Statewide Training Program where manufacturer's representatives, the plumbing & HVAC trades, and the Workforce Development Institute create installation certification programs.

HURDLE 9. Non-profits do not get tax incentives.

RECOMMENDATION 9. Provide additional funding for non-profits so they have an incentive to move forward.

HURDLE 10. Solar thermal systems are different from other energy efficiency measures as it produces energy in the form of heat. One method to promote customer acceptance of the technology is for the customer to pay for the system based on the output of the system. BTU meters can be utilized to measure the output of the system. No BTU Meters are currently certified as utility grade. Utilities would not be able to bill based on the current meter standards.

RECOMMENDATION 10. Allow utilities to provide billing for 3rd parties.

HURDLE 11. 900,000 residential homes still heat their hot water with electricity, which is both costly and increases KW peak demand loads.

RECOMMENDATION 11. Conduct a statewide effort specifically focused on residential customers who used electricity to heat their hot water, including controls that automatically reduce load during on-peak time periods. In addition to reducing kWh energy, this would also lower peak demand.

VI. CONTENTIOUS ATTACHMENTS

A. Contentious Attachment 1: Communication with NYISO

This Item was called out as Contentious among some curtailment service providers. The first and last paragraphs were acceptable; the two middle paragraphs are the contentious portion.

COMMUNICATION WITH NYISO

The Demand Response programs offered by the New York Independent System Operator (NYISO) have had a positive impact on helping to ensure there is a reliable supply of electric energy to New York state consumers. These programs have also provided a source of income for program participants that have helped encourage participants take actions beneficial to all end users in the state. As valuable as these programs have been, however, some feel there may exist some barriers that have served to limit participation. While we of course recognize that the Commission has no authority over the programs and activities of the NYISO, it is important for the Commission to be aware of potential issues that could have an impact on the success of any programs or actions that it does have authority over, as the NYISO clearly values the Commission's perspectives.

One such issue, about which some participants have expressed concern, is the relatively unsophisticated way in which the NYISO communicates event activation information to, and receives performance information from DR providers. These participants are concerned that the lack of a stable communication infrastructure results in garbled communication of event information and unreasonable settlement delays. They also worry that the NYISO reliance on manual processing can lead to inaccurate reporting of data.

Given the close relationship between the NYISO DR programs and those sponsored by the Transmission Owners, including the jurisdictional utilities, NYPA, LIPA, some believe that the Commission should urge the NYISO to adopt more robust communication requirements. For example, Con Ed raised the lack of a NYISO requirement for more advanced communication as the principal reason for not adopting such a requirement for its Rider U DLRP program.

The NYISO has a vigorous Working Group structure that deals with such matters and in fact, is currently debating these issues now. As a result, it is the considered opinion of the many in this Working Group that any issues related to this area should be addressed in that forum alone. However, all of the parties agree that the Commission should be aware of and actively participate in those discussions.

The following sections B, C, D, and E were all part of one sub-group encompassing Distribution Generation. The entire section was moved to an attachment because there was not complete agreement on the wording and recommendations.

B. Contentious Attachment 2: Distributed Generation

1. The Need for Distributed Generation

Distributed generation (DG) in the United States was recently studied pursuant To Section 1817 Of The Energy Policy Act Of 2005. [44] A key argument of the report to Congress is as follows:

> The enhanced efficiencies gleaned from the "free" fuels of solar or wind energy, and the recycled energy of CHP, are central to the DG proposition.[45]

[44] U.S. Department of Energy, The Potential Benefits of Distributed Generation and Rate-Related Issues That May Impede Their Expansion: **A** Study Pursuant To Section 1817 Of The Energy Policy Act Of 2005 (February 2007).

The same proposition applies to the importance of DG for the development and implementation of New York's Efficiency Portfolio Standard (EPS).[46]

Each of the DG technologies has its' own distinct set of advantages and disadvantages – environmental and otherwise. Projects of three basic kinds of DG are identified in the DOE Report to Congress: on-site DG, emergency power, and direct energy. [47] This report will focus on the first category (on-site DG) and will separately consider DG in general, Clean DG, and Renewable DG.

New York has a substantial existing base of on-site DG –especially Clean DG and Renewable DG [48] and a significant additional technical potential, especially given the prospects of concerted efforts to promote new activity in the context of EPS implementation. However, it is difficult to quantify this additional potential For example, with respect to Clean DG, in 2002 NYSERDA found that the additional technical potential of Combined Heat and Power's technical potential was 8,500 MW over and above the 8,000 already installed.[49] With respect to PV the existing installations reportedly total about 12 MW with a remaining technical potential of 2,000 MW under various cost and technical scenarios. Updates have not been obtained of existing installations and technical potential for on-site wind, bio-mass, small hydro, compressed air, and other technologies.

Clean DG not connected to the grid may be considered "dispersed DG." DG connected to the grid may be considered "distributed DG." In either form DG offers numerous advantages compared to traditional central station generation in today's energy world and could play a significant role in helping New York achieve Governor Spitzer's ambitious goal of reducing New York State's electricity consumption by 15% by the year 2015. These advantages can be categorized in terms of economics, improved grid reliability, reduced emissions and reduced siting issues.[50] Existing central power station efficiencies are limited to less than 40% at higher

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[45] Ibid, p. 1-7

[46] Over 99% of the 12,000,000 DG units reported by DOE are under 200 kW in size and include small PV systems, small reciprocating generators that do not directly feed electricity into the distribution grid. From 200 to 60,000 kW nationally there are over 122,000 installations. In aggregate this is only a fraction of the installed electrical capacity in the U.S. Similar reasoning applies to New York State's DG resources.

[47] The DOE DG Report to Congress identifies DG installations as including (page 1-7):

- *On-site DG* includes photovoltaic solar arrays, micro-turbines, and fuel cells, as well as CHP, which are installed on-site, and owned and operated by customers themselves to reduce energy costs, boost on-site power reliability, and improve power quality.
- *Emergency power units* are installed, owned, and operated by customers themselves in the event of emergency power loss or outages. These units are normally diesel generation units that operate for a small number of hours per year, and have access to fuel supplies that are meant to last hours, not days.
- *District energy* systems are installed, owned, and operated by third parties, utility companies, or customers. These systems are often used in municipal areas or on college campuses. They provide electricity and thermal energy (heat/hot water) to groups of closely located buildings.

[48] It should be recognized that New York State has a substantial emergency generator base and potential to mobilize clean emergency generators in the context of demand response initiatives addressed elsewhere in the WG4 report. Hundreds of MW of EG have been participating in NYISO demand resource programs

[49] NYSERDA Technical Report 02-12, Market Potential for Combined Heat and Power in New York, October 2002. http://www.nyserda.org/Programs/dgchp.asp

[50] These advantages can be categorized in terms of economics (http://www.epa.gov/chp/basic/economics.html), improved grid reliability (http://www.epa.gov/chp/basic/reliability.html), reduced emissions (http://www.epa.gov/chp/basic/environmental.html) and reduced siting issues, reductions in peak power requirements,

theoretical levels. Combined heat and power DG can raise these efficiencies into the range 65 to 85% or more.

However, while New York's energy consumers are increasingly attracted to DG for these and many other reasons, there are numerous barriers to the widespread adoption of DG technologies across the state. The attractiveness of participating in measures to increase the efficiency of energy consumption and in measures to reduce greenhouse gases will help motivate action by New York's energy users to consider, invest in, and deploy clean DG and renewable DG.

The higher efficiencies of CHP can translate into a substantial reduction in emissions. On December 1st, 2007 the U.S. Greenhouse Gas Abatement Mapping Initiative, issued its Executive Report prepared by McKinsey and Company and reviewed by the Conference Board. The report's title indicates the importance of the findings to the current endeavors in New York State: Reducing U.S. Greenhouse Gas Emissions: How Much and at What Costs?[51] It indicates that a wide array of abatement measures[52], if society in the U.S. is strongly committed, can achieve reductions in emissions at a marginal cost of less than $50 per ton. [53].

The Study also finds that "CHP is projected to provide abatement at negative cost, but it faces significant implementation challenges, including costly interconnections with the power grid, lengthy process for environmental approvals, local zoning restrictions, as well as site infrastructure, such as adequate space and compatible distribution systems." [54]

On average, if costs continue to drop as in recent past, the full levelized cost for electricity from solar PV would be compressed from the range of $300 to $350 per megawatt-hour in 2005 to $90 per megawatt-hour by 2030.[55].

Each of the DG technologies has its' own distinct set of advantages and disadvantages – environmental and otherwise. The generic considerations for DG will be addressed first, then for Clean DG (other than renewables), and then for renewable DG.

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provision of ancillary services, including reactive power, improvements in power quality, reduction in vulnerability to terrorism and improvements in infrastructure resilience (www.ferc.gov/legal/fed-sta/exp-study.pdf).

[51] Reducing U.S. Greenhouse Gas Emissions: How Much and at What Costs The report is available at http://www.mckinsey.com and was produced in association with National Grid, DTE Energy, Environmental Defense, Honeywell, Natural Resources Defense Council, PG&E, and Shell.

[52] "Solar power and distributed generation with solar photovoltaics represent considerable abatement potential. In total, distributed solar PV could achieve nearly 50 gigawatts of capacity by 2030, yielding some 50 megatons of abatement. At this level of penetration, nearly 5 million residences would have solar panels on their roofs (~3 percent of houses nationwide) and 150,000 businesses would have commercial systems installed." Ibid, p 62

[53] A U.S. mid-range abatement curve for 2030 is displayed in Exhibit 11 on page 20. Exhibit 26 on page 59 compares abatement options in the power cluster that are less than $50/ton CO2e with solar PV with 50 Megatons of CO2e potential at a levelized cost $29 (2005 real)/per ton CO2e, Wind with 120 Megatons at $20. In comparison, combined heat and power applications in commercial settings are estimated to yield 70 megatons of abatement by 2030 at a negative cost of -$36 per ton of CO2

[54] "The abatement potential derives from the use of waste heat given off by on-site natural gas combustion. The waste heat displaces additional fuel needed for heating or cooling purposes. When transmission losses associated with electricity from the grid are included, a conventional approach to heat and power for a building would use significantly more energy than a properly sized CHP system….." (Ibid, p. 39). (Economics and tons of relief cited appear in chart on p. 36).

[55] Ibid, p. 63.

2. Discussion - The Barriers

As noted in the McKinsey Study, numerous barriers exist to the widespread adoption of DG technologies across the state.

The first-order barrier to DG utilization is the technical and economic feasibility in a given situation. Lack of feasibility at the specific project level screens out many projects and barriers of various kinds decrease feasibility and cause many projects to not come to fruition.[56]

The introduction of the Standardized Interconnection Requirements (SIRs) has addressed the vast majority of the engineering issues that used to exist in interconnecting DG to the grid have been addressed. However, the very nature of such systems means that there will likely always be site-specific issues that cannot be completely addressed in such a document. This situation is especially acute when projects are proposed in utility territories that have not experienced much demand for DG previously. As a result, at times utilities do not have the specific institutional knowledge within the customer service organization to deal with such situations.

While the Con Edison and Orange & Rockland Companies raised the SIR application process timeline to 5 MW in 2005 while technical standardization has remained at 2 MW since 2002 for all the jurisdictional utilities. One option for consideration is whether all should be standardized at the higher level. While the SIR mandated standardization of interconnection to network situations, in fact few facilities have been able to work out interconnection arrangements with a host utility, given the issue of fault currents, which limits the type of DG that can be connected. Given the technical issues involved, network interconnection is subject to continuing IEEE committee development of standards. However, several projects have been able after extensive process to work out arrangements to interconnect to networks. The difficulty of doing this remains a barrier, especially in the core cities.

A parallel issue deals with the lack of standardized interconnection guidelines for interconnecting DG projects that want to sell thermal output to district energy systems, e.g. Consolidated Edison's steam system below 96th Street in Manhattan. Lastly, since the SIRs were approved there has not been any formalized periodic process for information exchange regarding interconnection issues.

Local building and fire codes can serve as additional barriers. In both cases these barriers exist in large part because the local municipalities wrote their codes long before DG entered the market as a viable energy alternative for end users. In many cases municipal building inspectors (electrical and others) and local fire department inspectors are not yet familiar with DG technology and therefore, have limited ability to judge the integrity of these systems. This represents a training opportunity.

New York State's electric utilities are supportive of DG as long as customers are subject to cost-based standby rates. Some utilities have concern over the operational impact that large amounts of such systems may have on the grid and also for safety concerns.

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[56] In the second DOE DG category, emergency generators that meet evolving Department of Environmental Conservation Guidelines are creating additional efficiency values as they interface with the grid and utilize underemployed resources. In the third DOE DG category, NYS has one of the largest district heating systems in the world. The feasibility of maintaining its efficiency, increasing it, or adding or refurbishing other district heating systems in the State remain difficult asset-driven decisions.

New York State utilities also support the potential for DG to address the need for T&D system constraints. New York utility experiences implementing Case 00-E-0005 pilot procurements in 2001 showed that DG solutions for selected localized distribution system constraints were uneconomic when compared to augmenting the T&D system in those areas. [57] However, after two pilot rounds Con Edison is implementing (2005-2008) a 150 MW targeted T&D program open to energy efficiency and clean DG. There is a procurement requirement that DG projects would have to be grid-isolated and have full back-up available. As one result, while it is anticipated that approximately 80 MW of projects will be under contract by March 31, 2008, Con Edison indicates no DG project has been contracted. In short, the program as designed is not mobilizing Clean DG projects.

Still it is notable that a simulation study of over 800 busses in Santa Clara, California employing Silicon Valley Power System data which indicated that hundreds of distributed power generation locations, especially near the ends of radial feeders, reduced reap power losses by increasing network efficiency, eliminated low- and high voltage buses and improved network voltage profiles, and they reduce the amount of real power stress in the system.[58] This excerpt is as quoted in the DOE Report to Congress referenced earlier. Such detailed options have yet to be explored in New York

Beneficial tax treatment for installing some energy efficient technologies is made available to homeowners and other taxpayers.

Another barrier involves limitations on net metering for DG. Net metering for different technologies, starting at residential levels and just recently broadening to commercial and industrial levels, exists in about three-fourths of the States. All these States allow a mix of renewable technologies. Smaller CHP systems can also net meter in about one-quarter of the States, although there has been limited uptake at the residential level due to the absence of appropriate technology. Technology and economics are changing for both renewable and CHP systems making net metering a more feasible option. The ability to receive payments for sending excess electricity back through the electric meter to the utility/grid is important to the economic viability of many DG systems. For some systems, simply being able to trickle out some electricity is a technically necessity at certain times. Net metering is discussed separately in the sections on Clean DG and Renewable DG.

Another barrier is the perception that DG systems only benefit the host. However, in the February 2007 DOE report cited previously, DG systems are demonstrated to provide various benefits among them being increased system reliability and improved power quality. Therefore, an argument can be made that compensation to the host for those benefits would be fair and reasonable.

Recognizing only transmission losses in the T&D system is also a barrier to the adoption of DG solutions. Distributed net electricity generation avoids both distribution losses and transmission losses. Temporal and locational differentiation (and costs) for transmission losses are now an established part of New York’s wholesale locational marginal pricing system

[57] Utility Analyses Performed in response to NYPSC Opinion 015 in Case 00-E-0005; Proceeding on Motion of Commission to Examine Costs, Benefits and Rates related to DG, October 26, 2001

[58] Evans, P.B., 2005. “Optimal Portfolio Methodology for Assessing Distributed Energy Resources Benefits for the Energynet,” CEC-500-2005-096, prepared by New Power Technologies for the California Energy Commission, March

(LMP).[59] However, the only losses recognized and differentiated in the LMP energy prices are transmission losses. The distribution losses avoided should be made transparent to end-users as part of unbundling and the operation of the electricity market system.

The inability of utility distribution systems to accommodate the addition of certain types of DG due to the potential for fault currents is another barrier. As a result, in these areas only induction and inverter based systems and not synchronous systems can be installed. Since induction type systems can not operate independently from the grid, this barrier removes one of the chief incentives for organizations to install DG – back-up in times of interrupted supply from the grid.

Another barrier is PSC directed "type" testing of inverters used in net-metered systems (solar and others). The type testing performed in order to be accepted as "type-tested" was developed to show that the tested inverter and firmware performed the necessary interconnection functions adequately and the need for additional review by the utility engineer could be minimized. While this is not a standard type-testing protocol for the Underwriters Laboratory or other appropriate national testing laboratory there is concern there is sufficient redundancy that may occur and that this is a duplication of effort that no longer provides any benefit to the ratepayers of the state.

The utilities and DPS Staff believe that the Commission's Guidelines and Orders establishing electric standby rates for the utilities reaffirm that the Utilities current Standby Rates applicable to customers who operating DG are just and reasonable pursuant to Public Service Law. They further believe that the Commission Orders views the current standby rates as properly designed to reflect the costs that such customers impose on the electric system; i.e., they are cost based. In addition, they believe that the exemptions and/or discounts from Standby Rates that will be available to Clean and Renewable DG for most of the current decade, that are borne directly by utilities and other customers, are amply sufficient to help develop the market for these technologies.[60]

Some other parties believe that the standby service rates charged by electric utilities to provide back-up service to customers who install distributed generation continue to act as a barrier to wider deployment of DG. The sheer costs are a barrier and the lack of transparency in the rates complicates DG investment and operating decisions. These parties believe that the NYPSC should re-examine the guidelines that it has already established for the Design of Standby Rates and its approval of Utility Standby Tariffs based on those design parameters. See discussion below on Clean DG.

It is important to note that the Pace Law School Energy Project has developed a Stand By Rate estimator to help businesses analyze the energy bill impacts of deploying onsite generation.

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[59] Transmission losses have been addressed in greater detail in a separate section of the WG 4 report.

60 The Commission's Orders establishing electric standby rates mitigated any adverse impact to pre-existing customers (as of 2003) by offering an eight-year phase-in of the standby rates for most utilities. Niagara Mohawk has exempted pre-existing customers from standby rates until 2011. Eligible customers using small, efficient Combined Heat & Power (CHP), NYSERDA-funded DG or technologies existing of fuel cell, wind, solar thermal, photovoltaics, sustainably-managed biomass, tidal, geothermal or methane waste have the option of a five-year phase-in (starting in 2004) or a permanent exemption (originally offered until 2006, extended to 2009) from the standby rates. Small off-site generators may also qualify for permanent exemption to standby rates. Niagara Mohawk continues to exempt environmentally advantageous DG technologies from stand by rates and offer substantial discounts off Standby Rates for CHP DG that meet NYSERDA qualifications.

However, while useful in many respects, given the number of assumptions that must be made in determining the data that is used in calculating the results, the end product is at best an educated guess as to what the actual bill impact will be. Given that the result is uncertain some see this as therefore increasing the risk factor of such projects, which in effect turns it into a barrier. It should also be pointed out that the calculator can only analyze the rates of two utilities.

3. Recommendations and Forecasted Benefits

a) High Level Summary

Clean DG and renewable DG provide many potential benefits (technical, economic, improved grid reliability, reduced emissions and reduced siting issues compared to central stations)[61] to the citizens of New York State, yet it faces many barriers of various sorts that have limited its deployment in the State. In order to help ensure the advantages of DG are properly taken advantage of and can fully contribute to achieving the Governor's ambitious goal of 15 by 15 we offer the following recommendations.

b) Recommendations

a. New York State should create and maintain an annual summation of DG resources in existence and remaining potential to provide a useful base for policy-making during the EPS process and such information should become an objective of EPS implementation (may overlap with other workgroup recommendations.)

Combined with that, however, there needs to be recognition of the operational benefits that DG systems can offer. These benefits include, among many other benefits as identified in the DOE Report to Congress, line and equipment losses avoided and voltage support as identified in a DG collaborative report in 2006 to Massachusetts regulators (see DTE 02-38-C Mass. DG Collaborative Report June 30, 2006 – Attachment "H").

Lack of tax credits for clean DG is a barrier to deployment. Tax incentives for initial and/or continuing tax costs for DG installations for homeowners and other taxpayers could be made available for income and sales or use taxes. A sub-group of WG 4, and other interested parties,

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[61] Additional potential benefits of DG include:

- Relief capacity to constrained transmission load pockets (SW Connecticut, NEMA/Boston in the Massachusetts DG collaborative report – but Southeastern New York in this instance), by reducing transmission and distribution (T&D) losses and potentially reducing reserve capacity needs.
- Reduction in energy price volatility. Reductions in regional energy demand should result in lower market clearing prices that benefit all customers.
- Economic benefits to the customer and to the larger economy.

This is supported by the Navigant Economic Analysis in Attachment G to the Massachusetts DG collaborative report in 2006. Page 38 of their report also states that the use of natural gas fired CHP would not only lead to reduced fuel use at central plants but also lead to an overall net reduction in natural gas use. They also state that the "elasticity of demand for electricity supply increases with more DG". They go on to state that as a result increased demand elasticity can lead to reduced electric prices for all. Finally, among other benefits they state that DG can provide high quality power to high tech industries (see also NYSERDA report "The Role of DG in Power Quality and Reliability", Dec. 2005, for additional power quality benefits) and also provide local jobs for installers, operators and maintainers. The Navigant Report (attachment G) also demonstrates numerous other benefits offered by DG. For example on page 18 of their report Navigant details the net present value savings various projects could achieve via the deferment of T&D upgrades.

should be created to work on identifying measures that could become candidates for tax incentives, e.g. states sales tax relief on original installation or significant upgrade, and state sales tax relief on continuing inputs to a DG facility, such as fuel if applicable which occurs in Empire Development zones. Further discussion occurs in the discussions on Clean DG and Renewable DG.

The narrow purview of net metering limits its effectiveness. Study expanding the purview of net metering, eligible sizes, and aggregate quantities allowed. (See further discussions in both the sections on Clean DG and Renewable DG.) If moves are made to emphasize commercial net metering, make an effort to preserve residential options.

With respect to safety concerns, the uniform interconnection guidelines put in place by the PSC should be reviewed and updated as necessary to take into account new developments and systems.

In addition, if after reviewing appropriate "type" testing requirements, they are found to be redundant, some or all could be eliminated and replaced by a simple standard that calls for the use of only UL or similar approved devices.

In order to address the fault current issue that exists in certain utility systems we urge that the affected utilities be directed to implement accelerated programs to upgrade their local networks by installing higher capacity breakers so that synchronous DG/CHP systems can be installed by end-users.[62]

Propose that a study be conducted to determine the feasibility of unbundling distribution and transmission losses avoided information by a DG endeavor to the extent that providing such information is cost effective and technically possible and recognizing in values streams available to DG the losses avoided.

We would also like to see greater deployment of non-polluting back up power options such as fuel cells and electricity storage which comply with the NY RPS or grid tied PV systems with battery back up systems. With the anticipated use of advanced meters such as TOU, the option of utilizing backup power to reduce peak-loads could be very useful and cost-effective. This issue should be analyzed more closely as deployment of these backup systems increases.

Model codes (that facilitate DG) should be collected, reviewed and provided to local government for their consideration and adoption. The State's training institutions should be mobilized to train for DG deployment and technology development.

The State may also want to consider the creation of explicit incentives/subsidies to support the expanded use of DG to the extent that such a result is deemed to be socially advantageous or supportive of the Governor's goal of 15 by 15.

With the potential growth in DG related to the EPS implementation, it would be appropriate to consider a California-style Rule 21 collaborative process to smooth out unique interconnection difficulties.

[62] Consolidated Edison has an aggressive program already in place approved and monitored by the Department of Public Service.

There is a dissent to remove the following sentence from the DG Group. It is here as a placeholder.

In **addition, the implementation** of more moderate standby rates, if not the elimination of them, would greatly benefit the deployment of DG. At the very least, the exemptions that currently exist should be made permanent and available to all.

c) ***Expected Benefits - to be determined.***

d) ***Funding Allocations – To be determined.***

e) ***Time Frame – Immediate to five years.***

C. Contentious Attachment #3: Clean DG and Waste Heat Utilization to Improve Efficiency

1. Need

Waste heat utilization related to distributed generation has become a goal of public policy recently in California[63] and in Connecticut[64]. New York State should consider the opportunity seriously.[65]

Waste heat utilization can be used to meet thermal needs for heating and/or cooling. It can also be used to supplement direct use of electricity at or near the generating site and thus increase efficiency of net electricity generation by reducing/modifying conversion losses into value added and by eliminating or reducing line losses, which in the United States average nine percent (9%)[66] and at times of peak stress can reach over twenty percent (20%) in the secondary distribution system. This is true whether the prime mover is powered by a renewable resource, a fossil resource or by waste heat. Waste heat utilization is not feasible in all situations, but offers promise in many situations.

Both California and in Connecticut have legislated measures to improve energy efficiency by deploying combined heat and power. California provides a mandate that CHP by 2010 must track thermal loads, but offers a number of breaks, including two-way meters, and other measures. Connecticut recognizes CHP that enhances waste heat recovery (and EE as well) as a Class III Renewable resource earning tradable credits. Connecticut provides other incentives

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[63] Assembly Bill No. 1613, CHAPTER 713, An act to add Chapter 8 (commencing with Section 2840) to Part 2 of Division 1 of the Public Utilities Code, relating to energy. [Approved by Governor October14, 2007. Filed with Secretary of State October14, 2007.]

[64] Amendments to Connecticut's ***ACT CONCERNING ENERGY INDEPENDENCE,*** Enacted on June 5, 2007: [emphases added] Sec. 41. Subsection (a) of section 16-245n of the general statutes is repealed and the following is substituted in lieu thereof (Effective October 1, 2007): ftp://ftp.cga.ct.gov/2007/tob/h/2007HB-07098-R04-HB.htm

[65] Each State Government establishes emission standards via its own processes.

[66] Energy Information Administration's Monthly Energy Report, October 2007, page 62. Note 2:http://www.eia.doe.gov/mer/

"Overall, approximately 67 percent of total energy input is lost in conversion; of electricity generated, approximately 5 percent is lost in plant use and 9 percent is lost in transmission and distribution."

including a waiver of gas delivery costs, with the costs transferred from the gas delivery companies to the electric utilities.

In addition, Connecticut specifically created and funded rapidly successful programs to deploy combined heat and power units and emergency generators to meet reliability needs in conjunction with ISO-New England needs and programs.[67] In 2006 and 2007 the ISO-NE has developed and the FERC has approved procedures so that distributed energy resource modules, such as combined heat and power and other dispersed resources at industrial, commercial, institutional, and residential levels can participate in the capacity markets and advance efficiency by lowering the coincident peak reserve coverage requirements. Other recommendations of WG4 address some of these issues. A limiting factor on utilizing waste heat to produce electricity and for other heating and cooling purposes is that the heating availability or load may be seasonal, for example in the space heating season. This should not be viewed as deal-breaker, but only as a factor to be addressed in optimizing efficiency savings.

Historically, distributed generation was dispersed and operated at smaller sizes at industrial, commercial, and municipal sites across New York State before generation was gradually centralized into larger more remote installations first owned and operated by investor owned utilities, public authorities, municipalities and rural cooperatives (few rural cooperatives occurred in New York.). Many smaller installations that utilized waste heat and that often used renewable resources were gradually phased out, e.g. smaller paper mills were closed that co-generated[68] producing both electricity and thermal simultaneously or sequentially with black liquor or wood waste.[69] The EIA now employs the term combined-heat-and-power for such installations.

Since 1978 distributed generation has seen a resurgence across New York State and the mobilization of dispersed generators to participate in demand response programs of both the NYISO, the authorities and the distribution utilities have encouraged a renaissance in the use of generators. Various legislative and regulatory incentives have been conceived, negotiated, litigated, implemented, evaluated in the field, revised or eliminated (for example six cent law). It is all too easy to say that "we have been there and done that", when in fact we have not recently. Modifying the stand-by rate structure in the 2001-3 was a step, but was geared to trying to keep facilities on the grid, rather than optimizing their thermal recovery.

Technology is now available that can economically and cleanly service smaller loads, including small family residences (1-4 family) of which there are more than 3,500,000 in all parts of the State. Microturbines and fuel cells also can readily work with heat recovery.

Waste heat recovery sized for thermal load has tremendous potential for the right applications with great economical benefits throughout the State of NY. The economics for

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[67]On November 2, 2007 the current posted status report on achievements since May 2006 indicates that 224 MW of CHP applications were mobilized, 202.2 MW awarded at a level of $95.3 million or $471/kW leveraging four-fold investments and that 84 MW of emergency generator applications were mobilized, 78 MW awarded at a level of $17.0 million or $216/kW also leveraging four-fold investments. Therefore, at ratepayer expense of $112.3 million 280.2 MW of on-site generation has been mobilized. All of it participates in ISO-NE capacity programs. http://www.dpuc.state.ct.us/electric.nsf

[68] A co-generation facility as defined in subdivision 2-a of section 2 of the NY Public Service Law is one "which simultaneously or sequentially produces either electricity or shaft horsepower and useful thermal energy which is used solely for industrial and/or commercial purposes.

[69] See glossary for revised definition of CHP now employed by Energy Information Administration.

waste heat recovery cogeneration are better downstate than in the rest of the State in most qualified applications due to higher electric cost and better spark spread. However, the industrial and institutional base upstate offers substantial potential as well in appropriate situations, albeit with lower electric costs and tighter spark spreads.

2. Barriers to Waste Heat Utilization and the Application of Combined Heat & Power (CHP) Systems

Interconnection issues with regard to installation have been or are being streamlined to reduce barriers to market entry. For example, Con Edison has recently relaxed some requirements for installing CHP systems in its network. The Company's website has become much more user-friendly for potential applicants considering projects that will also interconnect electrically. More needs to be done to alleviate interconnection difficulties. Successful award programs at NYSERDA have promoted much waste heat utilization via CHP, however, at present incentives available for participation in various NYSERDA programs for cogeneration are limited to systems that are 500 kW in size or larger.

There is a tremendous growth opportunity for small waste heat utilization cogeneration systems (30 kW to 500 kW range) sized for year round thermal loads for multifamily residential and small commercial customers (if the incentive levels are streamlined and the due diligence requirements for projects is proportional to the incentive dollars and project cost). One to ten kW systems for residential and small commercial applications are now available, cost effective, and clean as discussed in the July 19-20th EPS symposium and in technology submissions by the Gas Technology Institute participant in WG4.

3. Hurdles/Barriers in Summary

a. Regulatory – A significant hurdle to deployment is the lack of recognition by policymakers that waste heat utilization is key to improving energy efficiency at the nexus between the electricity and the natural gas utilization systems in New York State.

b. Financial – The inability to aggregate multiple benefits is a barrier. For example, some monetary awards prevent receiving others. An extended inventory of alternative and complementary benefits has been identified in multiple NYSERDA reports and State Energy Plan documents but unfortunately projects are often restricted to tapping only one or a few benefit streams, incentives (or subsidies).

c. Scale and siting – Historically every time a CHP initiative has taken off in New York State, the pressures to scale up have tended to drive projects to larger and larger sizes, thus neglecting smaller projects. The indications in Work Group 4 are that multiple entities are capable of providing smaller residential and commercial scale CHP systems, including 1-5 kW options for the household.

4. Recommendations and Forecasted Benefits

Co-generation has repeatedly appeared on NY's agenda, but waste heat utilization has not specifically appeared as a public policy objective. Given the focus now on energy efficiency, then waste heat utilization offers substantial promise.

a. Establish a Blue Ribbon Task Force to address Waste Heat Utilization in New York as a part of the effort to enhance energy efficiency.

- Review the recent reforms in California and Connecticut as well as other states.
- Propose recommended policies and practices to set a goal and unleash 600-1200 MW of CHP installations in New York State between 2008 and 2015.

Posit alternatives that can be implemented generically in the context of the EPS process or separately, or in the context of individual utility/authority rate proceedings.

- Begin a study to determine if a rule-making and/or legislative reform agenda is appropriate to allow net metering for clean efficient CHP (per NYSERDA guidelines) for **ALL** customer classes (residential, commercial, industrial), especially at residential and commercial levels under 200 kW.
- Consider not setting any limits on the total allowable load of such systems. At the very least, they must be based upon current peak load data. In addition, if caps are created a specific carve-out for residential systems of all types should be created so that a few large clean DG systems do not eliminate the opportunity for small residential systems,
- For example, in Washington State70 and in Washington, DC71 all customer classes can net meter facilities to 100 kW in size across a range of technologies. This is a valid option for New York State to consider. This is true in many jurisdictions.
- In both Washington State and in Washington, DC net excess generation is compensated at the customer's retail rate on the next monthly bill.
- With regards to payments to net metered customers, as stated earlier, currently under NYS law there are a variety of payment calculations. PV Systems under 10 kW receive the utility retail rate each month plus the avoided utility cost for any excess over usage on an annual basis, while systems over that size receive the avoided utility cost.
- Utility participants in WG 4 feel that the PSC should ensure that customers with on-site generation are not over-compensated for excess generation to avoid subsidization of these generators by other customers. Any expansion should include a strict requirement that excess net-metered generation in a particular billing period be compensated (through a payment or a forward bill credit) at the utility's avoided energy cost. Such a compensatory rate would properly reflect the cost that the net-metered generation permits the utility to avoid. It is unlikely that net metered generation permits the utility to avoid certain costs that are embedded

[70] Washington's net-metering law applies to systems up to 100 kilowatts (kW) in capacity that generate electricity using solar, wind, hydro, biogas from animal waste, or combined heat and power technologies (including fuel cells). All customer classes are eligible, and all utilities -- including municipal utilities and electric cooperatives -- must offer net metering.

[71] Washington, D.C.'s net metering law applies to Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Fuel Cells, CHP/Cogeneration, Anaerobic Digestion, Tidal Energy, Microturbines: Applicable Sectors: Commercial, Industrial, Residential--Limit on System Size: 100 kW

in the full retail rate (transmission, distribution, administrative and general) and, therefore, setting the credit/payment rate at the utility's full retail rate will overcompensate the net-metered customer. That overcompensation will essentially effect a subsidy by customers without the ability or means to undertake net-metering because the utility will need to recover from those customers the revenue short-fall associated with a retail rate credit.

- DG interests seek to have all factors determined to be of benefit considered in establishing the price for net excess generation. This may lead to pricing in the mid-range between commodity energy prices and full retail rate equivalents, e.g. based on the local utility's monthly supply charge, (as it is known in Con Edison's service territory).

Review and highlight the CHP initiatives as they relate to waste heat utilization "occurring" in response to the Con Ed 2005-2008 rate case implementation. Evaluate the waste heat utilization potential and implications for CHP as one driver for such allocated initiatives whether by NYSERDA, the utility, the City of New York, the NYC Housing Authority, the NYPA and other entities.

Explore creating waste heat utilization/CHP initiatives (2-3 year horizon) involving all utilities, authorities, and municipalities that service end-use electric customers in the State.

Earmark a significant waste heat utilization initiative involving CHP for the NYPA and the MTA that do not directly service end-user electric customers in the State. Encourage NYPA and MTA to launch two projects within 2 years.

Consider the monetary grant models employed in Connecticut which are leveraging four-fold investment levels and which have triggered CHP and EG initiatives involving more than 280 MW in nineteen months.

Study the waste heat available for recovery in New York State to identify targets of opportunity at the residential, commercial, institutional, and industrial levels immediately and within the term of the 15 X 15 initiatives.

Mobilize a portion of funding of the efficiency programs at the Authorities of the State.

- Work to monetize values for waste heat at NYISO.

Explore the use of waste heat utilization upgrades as a rationale for providing additional incentives, as in the CT model if waste heat utilization is increased ten percent and if total heat utilization is over fifty percent.

Conduct a study on the cost-effectiveness of smaller CHP technologies and then consider launching a large-scale pilot to deploy smaller residential CHP systems (year 1 – 500 units, year 2 – 1000 units, year 3 – 2000 units, year 4, 5000 units, year 5 10,000 units) utilizing a mix of incentives, tax breaks and other devices, including Twenty percent per year in low income housing situations.

Launch a technical collaborative and a PSC proceeding to develop guidelines for unbundling variable distribution loss and cost information as a component in value recognition for CHP and other EPS measures, including line items on bills.

Every effort should be made at this time to insure that smaller size technologies can be deployed and persist.

Location inside buildings is important in many situations, and local fire and building codes written before CHP was viable option are creating some barriers to entry. Codes that affect siting inside structures should be reviewed for appropriate modification.

It should be noted that the Real Estate Board of New York in its written comments in this proceeding specifically requested help mobilizing the opportunity for microturbines in buildings. Recommend setting an agenda to promote deployment (roll-out) of efficient microturbines, fuel cells and clean reciprocating technology in CHP configurations.

Investigate any potential synergies between district energy/steam systems and distributed waste heat systems.

On the taxation front, initial and continuing tax relief for Clean and Renewable DG installations for homeowners should be evaluated along with tax incentives for other energy efficiency measures. A work group should be created to work on identifying measures that could become candidates for tax incentives, e.g. states sales tax relief on original installation or significant upgrade, and state sales tax relief on continuing inputs to a DG facility, such as fuel if applicable.

5. Funding Allocations – To be determined

6. Expected Benefits – To be determined.

7. Time Frame – Immediate to 7 years

D. Attachment #4: Renewable DG

1. Need –

Renewable distributed generation, such as photovoltaic and wind based systems, are increasingly being explored and in many cases implemented as New Yorkers look for sound energy generation alternatives to traditional generation technologies. While they offer many potential benefits as is discussed below, they also face very specific challenges. Given that such systems produce zero emissions and therefore the greatest environmental benefit possible today, we believe they should be encouraged to as great an extent as is practical.

2. Barriers

a) Regulatory

Chief among the challenges they face is the fact that while New York State offers various economic and regulatory incentives for such systems these incentives are for the most part restricted to only residential or small -scale deployment. For example, as referred to in the New York State Energy Plan of 2002, the law regarding net metering (for solar PV systems) is as follows: Net Metering Law. New York's net metering law (The Solar Choice Act of 1997, L. 1997, Ch. 339), allows residential electricity customers to offset their electricity use with power they send into the grid using PV equipment owned by the customer. New York's net metering legislation includes a 25% tax credit for the purchase and installation cost of a qualifying PV system, not to exceed $3,750. The maximum capacity allowed per customer is limited to 10 kW. The law requires each utility to connect residentially-operated PV facilities until such connected power equals at least 0.1% of that utility's 1996 peak demand.

Since these credits and incentives are not offered to commercial installations, many commercial interests who have explored or expressed interest in using renewable technologies, have not pursued them.

Furthermore, as also mentioned above, there are caps on the total percentage that such systems can be of a utility's peak demand which further limits the amount of renewable systems that can be deployed in the state, (e.g.1% of a utility's 1996 peak demand in the case of solar systems).

b) Financial

The pricing structure for typical residential PV systems is typically $8 to $9 per DC watt installed for smaller systems. Accordingly, a typical residential 3W system, (before incentives) can cost anywhere between $24,000 and $27,000, which can be cost prohibitive. This structure is a significant barrier from a financial standpoint because PV systems become much more attractive from a cost recovery standpoint when system sizes increase (well over 10kW) and benefits of economies of scale can be taken advantage of, particularly by commercial and industrial customers. Yet the incentives referenced above that would further assist in reducing the financial barrier such systems face are not currently available to them.

Stand-by Charges: A PSC proceeding described within the 2002 state energy plan states that:

> "The PSC proceeding to investigate generic principles for designing equitable stand-by service delivery rates for customers with interconnected generation facilities has recently concluded. The decision approved a protocol for special "standby rates." Such rates will apply to distributed generation customers who remain connected to their local utility system for backup power. The guidelines rely on a more cost-based approach to charging for delivery service than rates that had previously applied to standby customers."

At present there are four financial incentives for residential customers for on-site generation of electricity through installation of a PV system. A brief description of the incentives, which follows will provide context to the financial barriers and their removal.

a. The first incentive is through net metering, this allows the owner of the PV system to send excess electricity back through the electric meter to the utility and the utility credits the excess power produced at the same rate paid for the electricity purchased.

The second financial incentive is the NYSERDA rebate (typically for about 40% of the system cost) is only applicable to residential customers of utilities, which pay into the System Benefit Charge (SBC.) LIPA, NYPA, cooperatives and a few other entities are exempt from the SBC charge.

The third financial incentive is the New York State tax credit referenced within the net metering law.

The fourth financial incentive is the federal tax credit for 30% (for those who qualify) of the installed cost of the system, with no limit. Therefore, with the current structure, commercial and industrial customers cannot receive the benefits of net metering or the state tax credits.

3. Recommendations and Forecasted Benefits

a. All types of clean DG systems offer a range of benefits to the citizens of New York State, including health and environmental and, economic benefits. However, the amount and type of benefits offered varies with the type of DG system involved. For example, renewable DG systems such as photovoltaic and wind based both offer significant environmental and health benefits. According to the Clean Energy Estimator, 2,000 MW of solar electricity in New York State, versus the ~ 12 MW currently installed, would improve air quality, reduce respiratory illnesses, and reduce global warming emissions by removing: 2 million tons of CO2, 1,800 tons of NOX and 5,300 tons of SO2,[72] goals which are clearly in line with the 15 x 15 initiative.

b. Net Metering In New Jersey and California they are providing output based credits as a way of backing away from up-front incentives. Such a methodology should be explored further here in New York as well. For example, there is now in place in New Jersey a rather robust market for Solar Renewable Energy Credits (SREC), which are created and traded by aggregators and other entities. At present each SREC is currently priced at approximately $220 per MW hour of PV created electricity.[73] This is the price that PV system owners can be paid for each MW hour of electricity produced by their PV system. Also, PV system installations within the state have jumped to a cumulative total of approximately 2,300 with an installed capacity of approximately 40.8 MW DC[74]. This compares to New York, which has approximately 900 cumulative PV systems (participating in subsidized programs of NYSERDA) with installed capacity of approximately 5.5 MW[75]

c. Raising the net metering limit and expanding net metering to ALL customer classes (commercial, industrial) would help make it possible for New York to enjoy the benefits of a robust renewable generation sector as it strives to achieves the Governor's 15 x15 goal.[76]

    For example, in Washington State[77] and in Washington, DC[78] all customer classes can net meter facilities to 100 kW in size across a range of

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[72] http://www.clean-power.com/nyserdaweb/ (Clean Power Estimator)

73 Current SREC Trading Statistics, Through August 2007, New Jersey Clean Energy Program, http://www.njcleanenergy.com/renewable-energy/programs/solar-renewable-energy-certificates-srec/public-reports/public-reports

[74] http://www.njcleanenergy.com/renewable-energy/program-updates/core-activity/solar-installation-projects/solar-installation-projec

[75] NYSERDA http://clean-power.com/PowerNaturally

[76] Con Edison indicates that it cannot agree to this.

[77] Washington's net-metering law applies to systems up to 100 kilowatts (kW) in capacity that generate electricity using solar, wind, hydro, biogas from animal waste, or combined heat and power technologies (including fuel cells). All customer classes are eligible, and all utilities -- including municipal utilities and electric cooperatives -- must offer net metering.

technologies. This is a valid option for New York State to consider. This is true in many jurisdictions. (See further discussions under Clean DG and Renewable DG which address size considerations.).

In both Washington State and in Washington, DC net excess generation is compensated at the customer's retail rate on the next monthly bill.

With regards to payments to net metered customers, as stated earlier, currently under NYS law there are a variety of payment calculations. Systems under 10 kW receive the utility retail rate each month plus the avoided utility cost for any excess over usage on an annual basis, while systems over that size receive the avoided utility cost.

Utility participants in WG 4 feel that the PSC should ensure that customers with on-site generation are not over-compensated for excess generation to avoid subsidization of these generators by other customers. Any expansion should include a strict requirement that excess net-metered generation in a particular billing period be compensated (through a payment or a forward bill credit) at the utility's avoided energy cost. Such a compensatory rate would properly reflect the cost that the net-metered generation permits the utility to avoid. It is unlikely that net metered generation permits the utility to avoid certain costs that are embedded in the full retail rate (transmission, distribution, administrative and general) and, therefore, setting the credit/payment rate at the utility's full retail rate will overcompensate the net-metered customer. That overcompensation will essentially effect a subsidy by customers without the ability or means to undertake net-metering because the utility will need to recover from those customers the revenue short-fall associated with a retail rate credit.

DG interests seek to have all factors determined to be of benefit considered in establishing the price for net excess generation. This may lead to pricing in the mid-range between commodity energy prices and full retail rate equivalents, e.g. based on the local utility's monthly supply charge, (as it is known in Con Edison's service territory).

d. Furthermore, any limits on the total allowable load of such systems should be eliminated. At the very least, they must be raised to more realistic levels and be based on current peak load data, not data that is over a decade old (1996 peaks). In addition, a specific carve out for residential systems of all types should be created so that a few large DG systems do not eliminate the opportunity for small residential systems, (if caps are not eliminated). Voltage support as identified in a DG collaborative report in 2006 to Massachusetts regulators (see DTE 02-38-C Mass. DG Collaborative Report June 30, 2006 – Attachment "H").

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[78] Washington, D.C.'s net metering law applies to Solar Thermal Electric, Photovoltaics, Wind, Biomass, Hydroelectric, Geothermal Electric, Fuel Cells, CHP/Cogeneration, Anaerobic Digestion, Tidal Energy, Microturbines: Applicable Sectors: Commercial, Industrial, Residential--Limit on System Size: 100 kW

E. Attachment #5:Environment Considerations

The New York State Department of Environmental Conservation (NYSDEC) plans to promulgate a regulation (6 NYCRR Part 222) to establish emission standards for new and existing distributed generation sources. In addition, emission testing and record keeping requirements will be established. The rule is subject to public review and comment before it can take effect. As a result, the content of the draft rule as it exists as of the date of this report may be different than the content final rule. Therefore, it is premature to discuss the rule in any detail at this time. The NYSDEC anticipates that Part 222 will take effect in the Fall of 2008.[79]

VII. LETTERS OF COMMENT

This section contains……

A. Letter 1: NYSEG RGE Perspective on DG

An equal opportunity employer

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1. Distributed Generation – Alternate Perspective

Certain parties in Working Group IV have perceived barriers of various sorts to the further deployment of Distributed Generation ("DG").[80] Recommendations have been proposed to potentially remove such barriers in order to make DG more economically feasible. In order to provide the proper perspective on these recommendations, New York State Electric & Gas ("NYSEG") and Rochester Gas and Electric ("RG&E") (collectively, the "Companies") offer the following on the proposed recommendations.

a) Standby rates should not be eliminated for DG and no further exemptions from standby rates should be given to DG customers.

The elimination of standby rates, as has been suggested by others in this proceeding, would undo numerous orders issued by the New York State Public Service Commission establishing

[79] Each State Government establishes emission standards via its own processes. It is anticipated that NYSDEC will reflect on the actions of other States in determining its proposals.

[80] Also know as On-Site Generation (OSG).

just and reasonable stand-by rates. On-site Generation (“OSG”) is installed in accordance with utilities’ Commission-approved tariffs; approved Joint Proposals consistent with the Guidelines for the Design of Standby Rates adopted in Opinion 0104[81]; and standardized interconnection requirements established in Case 02-E-1282.[82] The Commission’s Orders establishing electric standby rates[83] for the utilities concluded that the rates applicable to customers operating OSG are just and reasonable pursuant to Public Service Law, properly designed to reflect the costs that such customers impose on the electric system; i.e., they are cost based. Standby rates reflect the costs that OSG imposes on the system. OSG customers should be responsible for their fair share of system costs. Costs to provide standby service are real and should therefore be charged to OSG customers to avoid subsidization by other customers.

The DG market appears to have had sufficient time to develop. The Commission’s Orders establishing electric standby rates mitigated any adverse impact to pre-existing customers (as of 2003) by offering an eight-year phase-in of the standby rates. Eligible customers using small, efficient Combined Heat & Power (CHP), NYSERDA-funded DG or technologies existing of fuel cell, wind, solar thermal, photovoltaics, sustainably-managed biomass, tidal, geothermal or methane waste have the option of a five-year phase-in (starting in 2004) or a permanent exemption (originally offered until 2006, extended to 2009) from the standby rates. Small off-site generators may also qualify for permanent exemption to standby rates.

b) Net metering should not be expanded and payment for net metered energy should be based on the utility’s avoided energy cost.

The net metering programs that are currently being implemented in New York meet the PURPA net metering standard. Implementation experience should be realized before expanding the range of available net metering programs in New York Important operational and metering issues need to be examined (ideally, through actual operation of facilities) with respect to the customers and technologies that already benefit from net metering.

The existing net metering requirements extend to a variety of customers, including all residential customers, and across a broad spectrum of renewable OSG technologies, including solar, farm-waste and wind. Related PSC policies and requirements (e.g., interconnection standards) have sought to simplify and standardize the rules and procedures for interconnecting such facilities, thereby facilitating their expansion and development.

If the Commission decides to expand the existing net metering programs, they should ensure that customers with on-site generation are not over-compensated for excess generation to avoid subsidization of these generators by other customers. The statutory impetus for any PSC expansion of existing programs is PURPA, which defines net metering service as the off-setting of "energy" production and delivery. Any expansion should include a strict requirement that excess net-metered generation in a particular billing period be compensated (through a payment

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[81] Case 99-E-1470, Electric Standby Service, Opinion 01-4, issued October 26, 2001.

[82] Case 02-E-1282, Order Modifying Standard Interconnection Requirements, issued November 17, 2004.

[83] Case 02-E-0551 – Rochester Gas and Electric Corporation and Case 02-E-0779 – New York State Electric & Gas Corporation – Orders Establishing Electric Standby Rates, Proceeding on Motion of the Commission as to the Electric Tariff Filings to Establish New StandbyServices in Accordance with Commission Order Issued October 26, 2001 in Case 99-E-1470. Similar Orders exist for the other NYS electric utilities.

or a forward bill credit) at the utility's avoided energy cost. Such a feature would adhere to the PURPA definition of net metering service and the related reference to "energy" offsets. Such a compensatory rate would properly reflect the cost that the net-metered generation permits the utility to avoid. Net metered generation, rarely, if ever, permits the utility to avoid certain costs that are embedded in the full retail rate (transmission, distribution, administrative and general) and, therefore, setting the credit/payment rate at the utility's full retail rate will overcompensate the net-metered customer. That overcompensation will essentially effect a subsidy by customers without the ability or means to undertake net-metering because the utility will need to recover from those customers the revenue short-fall associated with a retail rate credit.

c) ***All subsidies extended to DG for purposes of the EPS should be treated as program costs.***

Exempting OSG from standby rates or extending net metering to OSG at a compensation greater than the utility ’ s actual avoided cost constitute OSG subsidies. If a policy decision is made to allow these, or any other, subsidies to encourage OSG for EPS purposes, the cost of these subsidies should be funded by the EPS program. Utilities should not be expected to absorb these costs. These subsidy costs should also be taken into account in any benefit/cost tests applied to this option.

Similarly, the potential for subsidies received through both the Renewable Portfolio Standard (“ RPS ”) customer tier and the EPS should be taken into consideration in any benefit/cost analysis. If it appears that supporting OSG through both the RPS and the EPS would result in double-counting benefits, or cause any other design, implementation, or measurement problems for either or both programs, then consideration should be given to either transferring the RPS customer tier to the EPS program, or exempting OSG from one of the two sources of funding.

Conclusion Standby rates and net metering are not barriers to the further development of DG. The barrier is the uneconomic nature of much DG at this time. If the EPS proceeding concludes that DG should be subsidized using EPS funds, then this will help overcome the fact that DG is currently too costly for widespread use. If such a policy is deemed desirable, then a discussion should ensue on the best form that subsidy should take, and how utilities can recover its costs due to that subsidy.

B. Letter 2: Sierra Club

SIERRA CLUB
FOUNDED 1892

Sierra Club Atlantic Chapter 353 Hamilton Ave. Albany, NY 12207 www.sierraclub.org

December 3, 2007

New York State Public Service Commission Three Empire State Plaza Albany, NY 12223

ATTN: Honorable Eleanor Stein, Administrative Law Judge

RE: Explanation of Dissent and Presentation of Position

Dear Judge Stein:

The Sierra Club Atlantic Chapter is anxious to begin implementation of the recommendations being put forth in this proceeding. However, we believe that a brief explanation of dissent regarding the proposed combined presentation (with Ruben Brown/E Cubed Co., LLC) on Demand Side/Peak Load Reduction – part of Working Group IV is necessary. The following pages contain our statement as originally submitted to Mr. Brown which we believe fairly and accurately reflected the issues in both renewable distributed generation (DG) as well as DG in the form of combined heat and power/micro-combined heat and power (CHP/micro-CHP) which Mr. Brown and E Cubed Co., LLC support.

The major reason for our dissent is in Mr. Brown's insistence to combine renewable energy DG (chiefly solar photovoltaics and wind power) with CHP. The problem is that CHP is not considered a renewable energy and therefore should not be combined with renewable energy. According to standards established within the NYS Renewable Portfolio Standards (RPS), renewable energy in the Main Tier consist of biogas, biomass, liquied biofuels, fuel cells, hydroelectric, photovoltaics, ocean or tidal power and wind. Renewables for the Customer-Sited Tier includes fuel cells, photovoltaics, and wind resources.[84] Furthermore, we are certain that NYSERDA does not consider CHP as a renewable resource either.

Two examples underscore this point. First, the technical issues which Mr. Brown stated that confront CHP do not relate to renewable energy. Secondly, the legislative support and constituencies necessary to overcome the legal and institutional barriers explained within the report are much different for renewable energy and CHP. To combine them blurs the clear distinctions between renewable technology and CHP.

In closing, we certainly appreciate staff's untiring efforts in providing this forum and ensuring that all parties are provided meaningful input. Please do not hesitate to contact us if you need any additional information or have any questions.

Sincerely,

Annie Wilson
Chair, Atlantic Chapter Energy Committee

Peter Sheehan
Member, Atlantic Chapter Energy Committee

[84] State of New York Public Service Commission; Proceeding on Motion of the Commission Regarding a Retail Portfolio Standard, Case 03-E-0188, p.9.

DEMAND SIDE/PEAK LOAD REDUCTION

1. HURDLES TO ON-SITE GENERATION

The Need

On-site generation, also known as distributed generation (DG), includes a variety of renewable and other technologies, each with their own environmental benefits and issues. Chief among the renewable options are photovoltaic (solar PV), wind and low impact hydropower. Some of the other DG options options are combined heat and power/micro-combined heat and power (CHP/micro-CHP), with CHP systems being powered by any number of sources such as fuel cells and micro-turbines, among others. In general, DG offers numerous advantages compared to central station generation in today's energy world and should be allowed to play a significant role in helping New York achieve Governor Spitzer's ambitious goal of reducing New York State's energy consumption by 15% by the year 2015. These advantages can be categorized in terms of economics, improved grid reliability, reduced emissions and reduced siting issues. However, while New York's energy consumers are increasingly attracted to DG for these and many other reasons, there are numerous barriers to the widespread adoption of renewable and other DG technologies across the state.

Discussion - The Barriers

The barriers faced by DG range from institutional to legislative to regulatory barriers and have resulted in a significant stunting of the growth of DG in the state. Turning first to institutional barriers, these barriers involve utilities but also, local building and related codes.

Most electric utilities are reluctant to embrace DG for two reasons. First, since utility income has historically been based on throughput – the amount of electric energy they deliver – the more DG there is the less income they receive. Second, some utilities object to DG because of their concerns over the operational impact such systems may have on the grid and also for safety concerns. As will be addressed in more detail later in this narrative, economic concerns can be addressed via decoupling mechanisms, which would remove the financial disincentive from utilities. With respect to the impact on the grid, properly sited DG can, in fact, increase grid reliability particularly in areas where there is congestion at peak times by reducing load on the grid. Safety concerns can and have been addressed via the use of various means and measures including special switchgear and inverters, among other measures.

Additional institutional barriers involve local building and fire code issues, to name a couple. In both cases these barriers exist in large part because the local municipalities wrote their codes long before DG entered the market as a viable energy alternative for end users. In line with this barrier is the fact that in many municipalities, building inspectors (electrical and others) and local fire department inspectors are not yet familiar with the technology and therefore have limited ability to judge the integrity of these systems.

Legislative and regulatory barriers encompass a number of different areas and issues. For example, one significant area involves the concept of net metering. The law regarding net metering (for solar PV systems) is as follows: *New York's net metering law (The Solar Choice Act of 1997, L. 1997, Ch. 339), allows residential electricity customers to offset their electricity use with power they send into the grid using PV equipment owned by the customer*. The ability to receive payments for sending excess electricity back through the electric meter to the utility/grid is critically important to the economic viability of many DG systems. End-users generally argue for the full rate they otherwise would have paid while some utilities argue for the avoided cost. Current NYS law calls for payment to be based on the utility retail rate and/or avoided utility cost depending on the size or the type of system involved – Public Service Law Section 66-J – see further discussion in “Recommendations” below.) New York State currently has legislation in place that creates and incentivizes, or at least does not discourage, certain types of DG for small-scale residential use. Specifically, it only allows net metering for small-scale solar PV (up to 10kW) and wind DG (up to 25 kW depending on the system) along with CHP systems located on farms and powered by farm waste - up to 400 kW.

In addition, NY legislation also caps DG to no more than 0.1% of the local utility’s peak demand (based on 1996 levels!) See the Central Hudson and Gas rate case below for the exception.

Another barrier is PSC directed “type” testing of inverters used in net-metered solar PV systems. Since all commercially available inverters must first be approved by Underwriters Laboratory (“UL”) or other appropriate national testing laboratory, this is simply a duplication of effort that no longer provides any benefit to the rate-payers of the state.

Standby rates, which utilities have put into effect in order to recover revenue as a result of the increasing use of DG, have also acted as a barrier to wider deployment of DG. Such rates have been justified on the grounds that should a DG system fail, the utilities would be required to provide back-up power to the customer in question and so they must have the systems in place to be able to provide such power. While that is true to some extent, in many cases these rates increase the costs to end-users who wish to adopt DG to such an extent that such systems may be no longer economic to install and so, in such cases they represent a barrier to deployment. Connecticut has eliminated stand-by rates.

Recommendations

1. The most important issue with respect to the barriers related to local utilities is the elimination of the disincentive they have as a result of the current rate structure they operate under. The implementation of a structure that would decouple revenue from throughput would eliminate the financial disincentive that utilities currently face.
2. The existing cap on renewable energy systems should be raised to 2MW per meter, to encourage renewable system deployment as has been done in neighboring states. The raising of the solar PV net metering cap of 10 kW cap will require legislative action as has been successfully realized in neighboring states such as New Jersey. The net metering cap at the utility level referenced above can be overcome through orders issued by the PSC as was done in its recently-released order regarding the expansion of the ceiling on PV net metering for Central Hudson Gas and Electric[85]. Expanding net metering to **ALL**

[85] State of New York, Public Service Commission, Case 07-E-0437: New York Solar Energy Industries Association and Sustainable Hudson Valley – *Joint Petition to Expand the Ceiling on the Photovoltaic Net Metering Load for Central Hudson Gas and Electric Corporation from 1.2 MW to 3.0 MW*

customer classes (residential, commercial, industrial) is critical if New York is going to enjoy the benefits of renewable and other clean technologies.

3. CHP systems (which meet strict efficiency and emissions guidelines) effectively double the efficiency of conventional power plants since one fuel input is used to generate two outputs – electricity and heat. In addition they result in reduced emissions compared to the average electrical generating facility. The CHP industry supports expanding net metering laws to include CHP throughput.
4. In addition, redundant "type" testing requirements should be removed through PSC regulations and permit U.L. or other nationally-recognized standards to be the sole requirement.
5. Regarding payments to net metered customers, as stated earlier, currently under NYS law there are a variety of payment calculations. Systems under 10 kW receive the utility retail rate each month plus the avoided utility cost for any excess over usage on an annual basis, while systems over that size receive the avoided utility cost. In order to encourage deployment of such systems, especially in the residential market, we urge the adoption of the utility retail rate methodology for net-metered customers up to 100 kW in size (as is the case in Washington State and Washington D.C.). For net-metered customers over 100 kW we suggest payment be based on the local utility's monthly supply charge, (as it is known in Con Edison's service territory).
6. Utilities need to recognize the operational benefits that DG systems can offer and implement more realistic, if not eliminate entirely, stand-by rates.
7. Lastly, it is recommended that the NY PSC produce a report which would examine the safety and interconnect issues and how they relate to the electrical grid. This report would have enormous benefits as more renewable and other DG systems are integrated into the grid.

Expected Benefits:

1. **Raising the Net Metering Cap:** (No. 2 recommendation.) In New Jersey, raising the cap has spawned a number of market incentives and significantly increased PV installations. Accordingly, there is now in place in New Jersey a rather robust market for Solar Renewable Energy Credits (SREC) created by the program which are created and traded by aggregators and other entities. At present each SREC is currently priced at approximately $220 per MW hour of PV created electricity.[86] This is the price that PV system owners can be paid for each MW hour of electricity produced by their PV system. Also, PV system installations within the state have jumped to a cumulative total of approximately 2,300 with an installed capacity of approximately 40.8 MW DC[4][87]. This

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[86] Current SREC Trading Statistics, Through August 2007, New Jersey Clean Energy Program, http://www.njcleanenergy.com/renewable-energy/programs/solar-renewable-energy-certificates-srec/public-reports/public-reports

[87] http://www.njcleanenergy.com/renewable-energy/program-updates/core-activity/solar-installation-projects/solar-installation-project

compares to New York which has approximately 900 cumulative PV systems (participating on the SBC) with installed capacity of approximately 5.5 MW.[88]

2. **Raising the Limits of DG Far Beyond 0.1% of the Local Utility's Peak Demand (based on 1996 levels.):** By raising the current limits, administrative and financial hurdles can be reduced significantly. This will occur by removing the need to file each time the current DG ceiling is reached as more renewable and other DG sources are installed.
3. **Environmental and Health Benefits**: In terms of the environment, according to the Clean Energy Estimator, 2,000 MW of solar electricity in New York State (there is currently ~ 12 MW– including non-SBC installed systems), would improve air quality, reduce respiratory illnesses such as asthma and bronchitis, and reduce global warming emissions by removing: 2 million tons of CO_2, 1,800 tons of NO_X and 5,300 tons of SO_2,[89] goals which are clearly in line with the 15 x 15 initiative.
4. **Economic Benefits**: Based on survey data, 1MW of installed PV relies upon 69,650 hours of labor throughout the entire manufacturing, distribution and installation chain.[7][90] At present, only a portion of these jobs (i.e., installation/integration, sales), will be jobs within the state. As New York hopefully becomes an appealing market place for silicon refiners, PV and balance of system component manufacturers and others along the PV chain, more economic benefits should accrue to and within New York State.

VIII. GLOSSARY

Note: Many of the following terms are used throughout the document prepared by Working Group IV, "*Demand Response/Peak Load Reduction and Emerging Technologies*". However, some of these definitions are in the form of an interpretation of a term or technology due to the lack of a general consensus of a definition. Other terms may not yet represent the final, industry accepted definition due to the changing nature of the technology or other factors.

AC power: Power is defined as the rate of flow of energy past a given point. In alternating current (AC) circuits, energy storage elements such as inductors and capacitors cause periodic reversals of energy flow. The portion of power flow averaged over a complete cycle of the AC waveform that results in net transfer of energy in one direction is known as active or "real" power. (See below)The portion of power flow due to stored energy which returns to the source in each cycle is known as reactive power. (See below)

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[88] New York State Energy Research and Development Authority, http://www.clean-power.com/PowerNaturally [7]

[89] http://www.clean-power.com/nyserdaweb/ (Clean Power Estimator)

[90] Survey conducted by Workforce Development Institute, in conjunction with industry partners. Formal release pending.

Advanced meter: a metering systems that records customer consumption [and possibly other parameters] hourly or more frequently and that provides for daily or more frequent transmittal of measurements over a communications network to a central location point.

Advanced metering infrastructure (AMI): The communication hardware and software and associated system and data management software that creates a network between advanced meters and utility business systems and which allows collection and distribution of information to customers, retail providers and the utility.

Aggregator: Any marketer, broker, public agency, city, county, or special district, that combines the loads of multiple end-use customers in facilitating the sale and purchase of electric energy, transmission, and other services on behalf of these customers.

Apparent power: The combination of real and reactive power, given in units of volt-amperes (VA). Apparent power is conventionally expressed in volt-amperes (VA) since it is the simple product of RMS voltage and current

Applied research: A deliberate, focused effort to answer a specific question of economic importance.

Automated meter reading (AMR): The retrieval of meter consumption data from a centralized location or drive-by vehicle. Via a common communications channel (telephone lines, radio frequency, power lines, cable lines or a combination of such.

Avoided cost: The cost of generating power that a utility avoids by purchasing the same amount of power from another source. A commonly used form consists of a forecast of future avoided costs, known as a long range avoided cost (LRAC) projection.

Basic research: an exploratory effort to investigate scientific principles and broaden understanding.

Biomass is any organic matter that can be used as a fuel to generate energy. Wood and waste wood are common examples of biomass fuel, but biomass also includes such matter as municipal solid waste, agricultural waste, lawn and yard waste, and animal waste--all of which can be converted to energy-producing fuels using available technologies.

Breadboard/Bench top Partial Prototype: A device built from conveniently-handle able parts intended to demonstrate the viability of one important feature – at this stage the individual parts and their relative positioning typically not to scale with envisioned final product (e.g., neither miniaturized not densely-packed).

British thermal unit (BTU): is a measurement of energy. BTU is commonly used to measure the energy content of various fuels and steam. One BTU is the amount of heat required to raise the temperature of one pound of water one degree Fahrenheit. [?]

Capacitive, inductive or resistive loads: Most loads in an AC electric distribution system fall into one of three categories: resistive, inductive or capacitive. In most circuits, the most common loads are likely to be the inductive loads. Examples of inductive loads include transformers, fluorescent lighting and AC induction motors. Most inductive loads use a conductive wire formed into a coil to produce an electromagnetic field allowing the transformer, light or motor to operate. The AC power from a distribution system is consists of both real (kW) and reactive (kVA) power. The active power performs useful work in driving the motor while the reactive power only supports the alternating magnetic field.

Capacitors: Capacitors can be installed at any point in an electrical system and will improve the power factor between the power source and end use application. Capacitors are most effective and efficient when added just before the end-use application which is causing the deterioration in power factor. Capacitors improve power factor because the effects of capacitance are exactly opposite those of inductance. The VARr (or KVAR) rating of a capacitor shows how much reactive power the capacitor will supply. Since this kind of reactive power cancels out the reactive power caused by inductance, each KVAR of capacitance decreases the net reactive power demand by the same amount. A 15 KVAR capacitor, for example, will cancel out 15 KVA of inductive reactive power.

Capacity (Electric Capacity): The load for which a generating unit is rated by its manufacturer. For an electric system, the total load rating for all generating units.

Capacity factor (load factor): The ratio of actual output for a specific time period to the maximum output possible during that period.

Central power: The generation of electricity in large power plants with distribution through a network of transmission lines (grid) for sale to a number of users. Note: It is the opposite of distributed power.

Clean DG: The generation of electricity at or near the energy end-user. Clean energy technologies include renewable energy sources such as solar, wind, geothermal, biomass, biogas, and low-impact hydroelectric, as well as CHP (the simultaneous or sequential generation of electric and thermal energy from a single source).

Cogeneration: The simultaneous production of two or more forms of useable energy from the combustion of a single fuel source. Because cogeneration uses the waste energy, which is vented in a traditional power plant, the process is 50 to 70 percent more efficient. Most cogeneration systems are designed to simultaneously produce electric power (to be used on site or sold back to an investor-owned utility or both) and thermal heat for industrial processes or the heating and cooling of buildings. Cogeneration projects can be any size, from 10 kilowatts to 1,000 megawatts or more.

Combined cycle generation: is a high-efficiency power production process. In a typical combined cycle power plant, combustion turbines (essentially large jet engines) burn natural gas or oil to generate electricity in the first cycle. In the second cycle, the exhaust heat is captured, rather than vented into the atmosphere, and is used to generate steam, which drives steam turbines to supply additional electric power. By using heat that otherwise would have been wasted to generate additional power, the combined cycle unit can produce cost savings as well as increased operating efficiency.

Combined heat and power (CHP): A plant designed to produce both heat and electricity from a single heat source. Note: This term is being used in place of the term "cogenerator" that was used by the Energy Information Agency in the past. CHP more accurately describes the facilities because some of the plants included do not produce heat and power in a sequential fashion and, as a result, do not meet the legal definition of cogeneration specified in the Public Utility Regulatory Policies Act (PURPA.)

Consumer inertia: a lack of willingness of consumers to act, due to ccomfort with the current system, aversion to risk, and focus of attention on other interest areas.

Critical peak pricing (CPP): A dynamic pricing tariff for commodity service under which customers face time-variant prices that reflect the inherent uncertainty for commodity supply/demand conditions. Customers face a much higher price (critical price) on system peak days which may be announced on relatively short notice and a traditional time-of-use rate on non-critical days.

Curtailment service provider (CSP): A company authorized to act as an interface party between the independent system operator (ISO) and end use customers to deliver demand response capacity.

Day-ahead demand response program (DADRP): A New York ISO program which allows energy users to bid their load reductions, or "negawatts", into the Day-Ahead energy market as generators do. Offers determined to be economic are paid at the market clearing price. DADRP allows flexible loads to effectively increase the amount of supply in the market and moderate prices.

Demand response (DR): Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.[91]

Demand response provider (DRP): See Curtailment Service Provider

Demand side management (DSM): Refers to utility programs intended to affect the timing or amount of customer electricity use. These include energy efficiency programs aimed at reducing the energy required to serve customer needs and programs that shift electricity demand to reduce peak loads or to make more economic use of utility resources.

Deployment programs: market intervention programs offering a consistent inducement and seeking a repetitive outcome (such as a rebate program).

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[91] " U.S Department of Energy, Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them: A report to the United States Congress Pursuant to Section 1252 of the Energy Policy Act of 2005." February 2006.

Direct load control: a DSM program where the utility pays the customer to install a switch that allows the utility to control the customers' equipment (air conditioners, water heaters, pool pumps, etc.) as a way of reducing demand during peak periods.

Dispatched generation: A generator that has been requested to increase or decrease generation, or to be brought on line or shut down by the system operator.

Dispersed generation: A small generating system that creates electrical power near point of consumption and is not connected to the grid.

Distributed generation (DG): A system in which many smaller power-generating systems create electrical power near the point of consumption and is connected to the grid.

Distributed power: Generic term for any power supply located near the point where the power is used. Note: It is the opposite of central power.

Distribution line: A circuit in a distribution system operating at relatively low voltage.

Distribution system: The circuits that deliver power directly to the customer. These are operated at relatively low voltages.

Electric capacity is the ability of a power plant to produce a given output of electric energy at an instant in time, measured in kilowatts or megawatts (1,000 kilowatts). The load for which a generating unit is rated by its manufacturer. For an electric system, the total load rating for all generating units.

Electric revenue adjustment mechanism (ERAM): A device intended to insulate a utility's margin (non-fuel related revenues) from variations from electric sales forecasts used to establish a utility's revenue requirement in rate proceedings.

Emerging technologies: technologies generally considered to have not yet reached commercial maturity in the marketplace (i.e., pre-commercial), are not yet generally cost-effective, or have entered the market but have a minimal percentage of current market share, include items as well as practices, and can be applied at end-user facilities as well as within the energy delivery infrastructure or at central station power generators, and include technologies impacting electricity, natural gas, and district steam (Source ACEE).

Emergency demand response program (EDRP): A program of the New York ISO designed to reduce power usage through the voluntary shutting down of businesses and large power users. Companies, mostly industrial and commercial, sign up to take part in the EDRP. The companies are paid by the NYISO for reducing energy consumption when asked to do so by the NYISO.

Energy audit: Either a cursory or detailed analysis of energy end-uses within a facility performed to identify savings opportunities on energy consumption either on overall use or during a specific time frame.

Energy service company (ESCO): A business entity which sells energy commodity and other energy related services to customers in New York State. These entities are also referred to as competitive load servicing entities (LSEs)

Environmental externalities: The environmental costs to society of electricity generation which are not reflected in the utility's cost of producing electricity or the price paid by customers to consume electricity

Field demonstration: a learning approach for improving the durability and performance of a product, involving placement and use in a "real world" setting. The field demonstration may run until the product fails of its own volition, or the field demonstration may be adjourned after a pre-set period of time so the product can be returned to a laboratory setting for disassembly and internal inspection. The primary objectives of a field demonstration include acquisition by the product manufacturer of important information to guide further product refinement, and collection of performance/reliability data to assuage consumer skepticism.

Forced (unplanned) outage: The emergency shut down of a generating plant because of unexpected problems.

Fuel cell: An electrochemical device that uses hydrogen and oxygen to produce DC electricity, with water and heat as byproducts.

Gigawatt Hour (gWh): One billion watt hours, or one million kilowatt hours of energy.

Generators: Those entities which will design, construct, own, operate, and maintain generation assets to supply energy and ancillary services to the competitive market.

Grid is a network of high voltage transmission lines along which power moves. In the United States, there are three distinct electric power grids: the Eastern Interconnection, of which New York State is a part; the Texas Interconnection; and the Western Systems Coordinating Council. In addition, certain regions of the U.S. import electric power from the Canadian grid. Many New York utilities and the Power Authority import electricity generated in Canada. **Heat rate**: A measure of generating plant heat efficiency, generally expressed in Btu per net kilowatt hour.

Heating, ventilation and air conditioning system (HVAC): Generally refers to those used by large commercial/industrial customers.

Innovation: a process to gather and harness knowledge with the intention of creating a new or improved product.

Independent power producer (IPP): A private entrepreneur, who develops, owns or operates electric power plants fueled by diversified energy sources such as biomass, cogeneration, coal, small hydro, waste-to-energy and wind facilities.

I**ndependent System Operator (ISO)** is the entity charged with reliable operation of the Grid and provision of open Transmission Access to all market participants on a non-discriminatory basis, (i.e., NYISO)

Integrated resource planning_(IRP): A planning process for electric utilities that evaluates many different options for meeting future electricity demands and selects the optimal mix of resources that minimizes the cost of electricity supply while meeting reliability needs and other objectives.

Installation and servicing infrastructure: a support system for customer-acquired products, including a cadre for trained and qualified installation and maintenance technicians, the availability of an inventory of spare parts, mechanisms to collect data and track product failures (to support next-generation improvements, to establish standardized repair procedures, and to facilitate recalls)

Inverter: A device that converts direct current (DC) power to alternating current (AC) power.

Investor-Owned Utility (IOU) is a form of electric utility owned by a group of investors. Shares of IOUs are traded on public stock markets.

Kilowatt (kW) is a measurement of electric power equal to one thousand watts. Electric power capacity of one kW is sufficient to power 10 100-watt light bulbs, or about one average home.

Kilowatt hour (kWh) is a measurement of energy and is equal to the energy produced by a one kilowatt plant in one hour. (Note: A typical electric consumer in New York State uses 500 kWh per month of electricity.)

Least-cost planning: The balancing of supply-side and demand-side alternatives to meet energy needs at least cost (often called Integrated Resource Planning).

Load: The amount of electric power delivered or required at any specific point or points on a system. The requirement originates at the energy-consuming equipment of the consumers.

Load factor (or Capacity factor): The ratio of the amount of electricity used during a specific time period to the maximum possible use during that period.

Load forecast: Estimate of the level of energy likely to be needed in the future.

Load management: Utility activities designed to influence the timing and magnitude of customer use of electricity. Traditional load management objectives include peak clipping, valley filling and load shifting.

Load shifting: A form of load management that involves shifting from peak to off-peak periods. Examples are information programs that encourage customers to use storage water heating and storage space heating.

Long run avoided cost (LRAC): A projection of the forecasted avoided cost for each year up to 20 years in the future.

Loss of load probability: A calculation of the probability that system demand will exceed system capacity in a given period, often expressed as number of incidents per year.

Lost Opportunities for energy efficiency, particularly for the new construction market, where initial implementation is much more cost-effective than later retrofitting. Important features, such as low-energy design, and advanced construction practices, if not implemented at the time of initial construction may be prohibitively expensive to address through retrofit.

Manufacturing scale-up: development of the ability to produce a significantly-larger number of items per day compared to the production rate associated with the production methods initially used to produce a product during sales to a limited number of early adopters, may involve a change from manual-assembly processes to automated assembly line format.

Mandatory Hourly Pricing (MHP): Customers are billed for their actual hourly commodity usage at an hourly market-based price. Currently large non-residential customers who choose to take commodity service from utilities are subject to this type of billing in New York State.

Mega-fleet Demonstration: the field demonstration of a very large number of dispersed small modular items arranged in such a way as to support an investigation and assessment which could not otherwise be performed with just a few of these items – for example, field demonstration of a very large number of grid-integrated systems with two-directional flow of electricity [e.g., batteries] as a means to investigate the tolerable saturation point of the grid (where such a determination could not be made using only a few batteries).

Megawatt (MW) is a unit of electric power equal to one million watts, or 1,000 kilowatts.

Monitoring-based commissioning (MBCx): A system which employs remote energy system metering with trend log capability to identify previously unrecognized inefficiencies in energy system operations, facilitate the application of diagnostic protocols, document energy savings from operational improvements, and ensure persistence of savings through ongoing re-commissioning.

Niche markets: interest in a product expressed by a well-defined small fraction of the marketplace as opposed to the general public.

Non-energy Benefits: motivations for, or collateral benefits obtained, associated with the adoption of an energy-efficient technology, and may include improved comfort, improved safety, improved productivity, and reduced environmental impact.

Off-peak: Period of relatively low demand on a utility's generating system.

On-peak: Period of relatively high system demand on a utility's generating system, season and time-of-day specific for each utility.

Options approach: a portfolio management approach that finds winners by allowing them to reveal themselves, as opposed to guessing based on preconceived notions. Applied to emerging technologies, the approach suggests the benefits of maintaining a broad portfolio of technologies at various stages of market readiness (seeds, sprouts, and blossoms), and giving ever-increasing nurturing as technologies ripen.

Payback period: The ratio of the estimated annual savings of a conservation measure or renewable energy (RE) system to its estimated cost, expressed in years, used to determine whether the conservation measure or RE system is cost-effective.

Peaking unit: A generating unit used to meet the portion of peak load that cannot be met by base load units. Generally, these are higher energy cost units, such as gas turbines.

Power factor: Power factor (PF) is a measure of how effectively electricity is used. Power factor is the phase relationship between alternating current and voltage waveforms in AC electrical distribution systems. Power Factor can be expressed as the ratio between real power and apparent power or the formula PF = kW / kVA. When current and voltage are "in phase" and the power factor is "unity" or 1 (or 100 percent). When reactive loads (i.e., either inductive or capacitive loads) are present, power factor will be less than unity (typically 80 to 90 % power factors can occur). Low power factors, electrically speaking, cause heavier currents to flow in power distribution lines in order to deliver a given number of kilowatts to an electrical load. A high PF benefits both the electric consumer and utility, while a low PF indicates poor utilization of electrical power. To illustrate this principle consider a steel stamping operation which runs at 100 kW (real power) and the apparent power meter records 125kVA. To find the PF, divide 100 kW by 125 kVA to yield a PF of 80 percent. This means that only 80 percent of the incoming current does useful work. Because electric utilities must supply both the real (kW) and reactive (kVA) needs of all customers, the higher PF is maintained, the more efficient our distribution system becomes. Conversely, when power factor is allowed to deteriorate, electric power usage becomes inefficient. Improving the PF can maximize current-carrying capacity, improve voltage to equipment, reduce power losses, and lower electric bills.

Power quality: The measure of how closely the power on an electrical circuit matches the nominal values for parameters such as voltage, current, harmonics and power factor.

Primary (and secondary) lines: The electric lines delivering power from the substation to the customer are primary and secondary lines.

Proof-of-principle: evaluation for confirmation of viability of an important sub-component of a product (such as when developing a robotic hand, the proof-of-principle of a workable knuckle which can serve as a building block).

Public Utilities Regulatory Policy Act of l978 (PURPA): This law requires utilities to purchase power from qualifying cogeneration, small hydro or waste-fueled facilities, under contracts priced at the utilities avoided cost; i.e., the incremental cost to the utility of electricity it would generate itself, if it did not purchase that electricity from a qualifying facility.

Qualifying facility (QF): A non-utility electric generator, such as a cogenerator of any size which meets specified efficiency standards and renewables under 80 MW, and which qualifies for certain benefits under federal statutes, (i.e., engaging in wholesale power sales without FERC regulation of their profits.)

Rate base: The base investment on which the utility is authorized to earn a cash return. It includes the original cost of facilities, minus depreciation, an allowance for working capital and other accounts.

Ratepayer is a retail consumer of the electricity distributed by an electric utility. This includes residential, commercial and industrial users of electricity.

Reactive power: The product of out-of-phase voltage and current waveforms, which results in no net power flow. Since reactive power flow transfers no net energy to the load, it is sometimes called "wattless" or “imaginary” power. An inductive load, like a motor, compressor or ballast, also requires reactive power to generate and sustain a magnetic field in order to operate. The unit for reactive power is "VAR", which stands for volt-amperes reactive. In industry usage it is referred to as non-working power KVAR’s or kilovolt-amperes-reactive.

Real power: The portion of power flow averaged over a complete cycle of the AC waveform that results in net transfer of energy in one direction**.** Real power refers to the “true” or “working” power used in all electrical appliances to perform the work of heating, lighting, motion, etc.

Real-time pricing (RTP): Customers are billed for commodity based on hourly usage and an hourly price that reflects supply/demand conditions in the real time or day ahead market.

Rebates: Payments made to customers who install a specific option, either as original equipment or as a replacement for an existing device. Rebate levels are generally set in proportion to the relative benefits to the utility of having the customer install the option. Rebates are often provided for insulation and energy-efficient equipment (motors, water heaters, lamps and lighting systems, etc.).

Renewable Energy Certificate (REC): A tradable commodity that represents a certain amount of electricity generated from renewable resources.

Renewable resource: A sustainable energy resource such as solar, wind, water (hydro), geothermal, biomass or the like, rather than non- renewable oil, gas, or coal, to produce electricity.

Retailer: An electric service provider who enters into a direct access transaction with an end-use customer, i.e., aggregators, brokers, and marketers or ESCos.

Retro-commissioning: a practice that can be performed to ensure that energy-consuming appliances are functioning as intended and thus minimize wasted energy. Retro-commissioning may provide corrections for sensor drift (re-calibration), previously undetected component failures (e.g., stuck flow diverters in air handling ductwork), or changes in site activities compared to “design conditions” (such as introduction of summer programs at a school).

Revenue decoupling: Utility rate mechanism designed to sever the link between the recovery of utility fixed costs, including profits to the volume of actual sales. It is designed to remove both the incentive to sell more electricity to maintain earnings and the disincentive for conservation and renewable energy.

Revenue decoupling mechanism (RDM): Typically a multi-year ratemaking arrangement which sets rates each year based on three main features; a revenue reconciliation, certain expense recovery rules (i.e., index factors) and incentives.

Six Cent Law: Public Service Law, Section 66-c, which provided that utilities shall enter into contracts with qualifying cogeneration, small hydro and alternate energy facilities priced at a minimum rate of six cents per kWh. The minimum rate provision was repealed in l992, but existing contracts were grand fathered against the repeal.

Small Hydro: A generating system that converts the mechanical energy of running water into electric energy much the same as any larger traditional hydroelectric system. Small is defined in state and federal law to be less than 80 megawatts.

Smart Grid: The integration of power systems operating in a coordinated, efficient and reliable manner. It deploys intelligent sensors throughout the electric distribution network, providing continuous monitoring and analytics to create a real-time, two-way, diagnostic monitoring and control system.

Solar Photovoltaic (PV) System: An electrical system consisting of an array of one or more PV modules, conductors, electrical components, and one or more loads.

Solar Renewable Energy Certificate (SREC): A tradable commodity that represents a certain amount of electricity generated from solar photovoltaics.

Solar Thermal Energy Systems: A system which converts solar radiation into heat energy, typically used to pre-heat a water supply or heat a living space.

Special Case Resources (SCR) A program of the New York ISO designed to reduce power usage through the shutting down of businesses and large power users. Companies, mostly industrial and commercial, sign up to become SCRs. The companies must, as part of their agreement, curtail power usage, usually by shutting down when asked by the NYISO. In exchange, they are paid in advance for agreeing to cut power usage upon request

Standard Interconnection Requirement (SIR): Standardized procedures to interconnect DG less than 2 MW established by the NYPCS through collaborative process.

State of Market Readiness: the stage at which an emerging technology exists, typically somewhere along the continuum from being in the midst of building a working prototype, to conducting a first round of field demonstration trials, to selling product to early adopters, and beyond.

Sub-metering: The measurement and billing of electric use in individual apartment units in a master-metered multi-family building**.**

Substation: The location for equipment that makes up the interface from transmission to distribution. This includes transformers and various protection devices.

Switched capacitors: Customers whose electric loads consist of very large, intermittent inductive loads, such as large motors, compressors, etc., may require switched capacitors or capacitors that are connected to individual motors or groups of motors. Such capacitors are only energized when the motor load is turned on. Where installation of capacitors along side a motor is not practical, capacitors may be added and controlled at the substation, depending on measured power factor. The switching feature is only required if the capacitors needed are so large that they cause an undesirable leading power factor during times when large motors are turned off.

Systems Benefits Charge is a per-customer charge intended to recover the costs of public benefit demand-side management, research and development.

Total resource Cost (TRC) test: an economic calculation method sometimes used to determine if a given government subsidy will inspire private investments in cost-effective technologies**.**

Time of Use (TOU) pricing/rates: The establishment of rates that vary by season or by time of day to reflect changes in a utility's cost of providing service.

Transformer: A device that changes electricity from one voltage to another, for example, from transmission voltage to distribution voltage.

Transmission: The transportation of electric energy in bulk at high voltages, generally from a generating unit to a substation or for transfer between utility systems.

Voluntary Time of Use (VTOU): A time of use rate structure which a customer can elect.

Waste-to-energy: A technology that uses refuse to generate electricity. In mass burn plants, untreated waste is burned to produce steam, which is used to drive a steam turbine generator. In refuse-derived fuel (RDF) plants, refuse is pre-treated, partially to enhance its energy content prior to burning.

White tags: A tradable commodity that represents a certain amount of energy conserved (or rights) by an efficiency project.

Wind power: a renewable energy source used to generate electricity by converting wind energy into useful mechanical energy. This mechanical energy is then converted into electricity by the use of an electric generator located within each individual wind machine.

Working prototype: a device intended to demonstrate the viability of the integration of all essential features – in a “first generation” working prototype typically the individual parts and their relative positioning not to scale with envisioned final product (e.g., neither miniaturized not densely-packed), however, a refined working prototype may very closely resemble in size and shape the envisioned final product.