STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

At a session of the Public Service Commission held in the City of Albany on August 18, 2011

COMMISSIONERS PRESENT:

Garry A. Brown, Chairman
Patricia L. Acampora
Maureen F. Harris
Robert E. Curry, Jr.
James L. Larocca

CASE 10–E–0285 - Proceeding on Motion of the Commission to Consider Regulatory Policies Regarding Smart Grid Systems and the Modernization of the Electric Grid.

SMART GRID POLICY STATEMENT

(Issued and Effective August 19, 2011)

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BY THE COMMISSION:

INTRODUCTION

Recent advancements in technology, as well as continuing increases in electricity demands, have led us to consider the smart grid and its role in the modernization of the electric grid. As part of the ongoing process of upgrading and replacing our aging transmission and distribution systems, utilities are increasingly employing smart grid technologies which, if utilized properly, have the potential to make electric power systems more reliable, robust, efficient and economical. Smart grid technologies can also enable integration of increased levels of renewable energy and increased energy efficiency and demand response.

In the order commencing this proceeding, we sought comments from interested parties in response to questions relating to various topic areas.[1] Responding parties include all of the State's investor-owned electric utilities,[2] telecommunication companies, hardware and software vendors, energy services companies (ESCOs), consumer representatives, not-for-profit organizations, and other governmental entities. Based on a thorough review and careful consideration of the parties' comments, we hereby provide policy guidelines for investor-owned electric utilities considering smart grid investments.

We believe the guidelines support important State energy policy goals and can advance New York's leadership in the 21st century clean energy economy. The promise of the smart grid is enormous and includes the potential for improved reliability, flexibility and power quality, reduction in peak demand, reduction in transmission congestion costs, environmental benefits gained by increased asset utilization, increased security, increased energy efficiency, and increased durability and ease of repair. Smart grid technologies further can aid in combating climate change by promoting utilization of renewable resources, as well as by helping to improve electric system reliability and efficiency.

The smart grid has also been envisioned as a means to spur technological innovation and serve as a catalyst for

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[1] Cases 10-E-0285, et al, Smart Grid Policy Consideration, Order Instituting Inquiry Into Smart Grid (issued July 16, 2010)(July 2010 Order).

[2] The investor-owned electric utilities consist of Consolidated Edison Company of New York, Inc. (Con Edison), Central Hudson Gas & Electric Corporation (Central Hudson), New York State Electric & Gas Corporation (NYSEG), Niagara Mohawk Power Corporation d/b/a National Grid (National Grid), Rochester Gas and Electric Corporation (RG&E), and Orange and Rockland Utilities, Inc. (Orange & Rockland).

economic development. It represents a long-anticipated convergence of energy and telecommunications, both in technology and policy. It has the potential not only to change the way electric utilities interact with their customers, but to allow other market actors to play a much greater role in providing energy services.

We therefore encourage electric utilities to develop smart grid systems that integrate new intelligent technologies, while optimizing the use of existing facilities and resources and maintaining just and reasonable rates for electric customers. These guidelines are designed to balance a careful approach while smart grid technology is still developing, with creating the conditions that will allow optimal technology solutions to flourish.

A brief summary of our conclusions follows:

- Vision: In general, our policy considers the smart grid as a developing set of solutions to a variety of needs and interests, rather than a final product or end-state to be achieved. As the technologies available, utility and customer needs, and available resources continue to evolve, the design of the smart grid must be capable of adapting to shifting conditions and priorities.

- Implementation Priorities/Timing: In the short term, we expect utilities to pursue established and reliable technologies that can provide a relatively certain return on investment. In the slightly longer term, the billions of dollars the federal government has provided for smart grid projects nationwide will generate a significant base of knowledge and experience which, along with further development of smart grid standards, will help identify those technologies that are most effective and efficient.

- Communications Technology: We expect that smart grid technologies will utilize a hybrid of both public and private networks. We urge the electric utilities and communication providers to work together to ensure the appropriate use of commercial facilities, and to limit utility capital investments in dedicated communications infrastructure to those functions where it is appropriate.

- Engaging Customers: Utilities must provide basic information on smart grid to customers who are largely unaware of this technology. Utilities further must provide a thoughtful and comprehensive customer education plan before commencing with implementation of technologies that require extensive customer engagement.

- Benefit/Cost Analysis: To ensure efficient investments, smart grid project proposals must be able to demonstrate benefits in excess of their costs. The type of project under consideration, along with the degree of novelty and scope involved, will dictate what type and level of analysis is appropriate.

- Cost Uncertainties/Cost Recovery: In the near term, for smart grid projects that provide a relatively certain return on investment, we will address rate recovery of those investments through traditional means. If a utility maintains that a novel or unproven technology will produce net benefits, we will consider risk sharing mechanisms in order to balance ratepayer and shareholder risks.

- Interoperability Standards: Utilities can start to develop smart grid plans and projects using the existing industry standards as building blocks. We will look to the standards as a guide in our review of project proposals, and utilities should use them as a reference case of best practices.

- Cyber-Security Standards: The utilities must develop the capability to build and maintain a knowledge base of existing and developing cyber security standards to help assure their appropriate implementation. Ultimately, however, utilities will bear the responsibility to ensure that cost-effective protection and preparedness measures are employed to deter, detect, and respond to cyber attacks, and to mitigate and recover from their effects. We will expect utilities making smart grid proposals to address these concerns, even as the security standards are evolving.

- Customer Data Privacy/Access: Utilities and third-party providers must take appropriate actions to protect customer privacy when proposing projects that involve the collection and use of customer data. Customer data should be made available in a timely manner to third parties who are

> authorized by the customer to receive it, and utilities should be compensated for their costs of providing such access.

BACKGROUND

Smart grid is a term that encompasses a wide variety of information, communication and automation technologies that have the potential to improve the operation of the electric system. Although a multitude of definitions exist for the smart grid, they all include the integration of information and the use of two-way communications technologies and advanced control capabilities in the electric grid system.

For example, the Federal Energy Independence and Security Act of 2007 (EISA)[3] defines "smart grid functions" as:

1. The ability to develop, store, send and receive digital information concerning electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations, to or from or by means of the electric utility system, through one or a combination of devices and technologies.

2. The ability to develop, store, send and receive digital information concerning electricity use, costs, prices, time of use, nature of use, storage, or other information relevant to device, grid, or utility operations to or from a computer or other control device.

3. The ability to measure or monitor electricity use as a function of time of day, power quality characteristics such as voltage level, current, cycles per second, or source or type of generation and to store, synthesize or report that information by digital means.

4. The ability to sense and localize disruptions or changes in power flows on the grid and communicate such information instantaneously and automatically for purposes of enabling automatic protective responses to sustain reliability and security of grid operations.

[3] 42 USC § 17386 (2007).

5. The ability to detect, prevent, communicate with regard to, respond to, or recover from system security threats, including cyber-security threats and terrorism, using digital information, media, and devices.

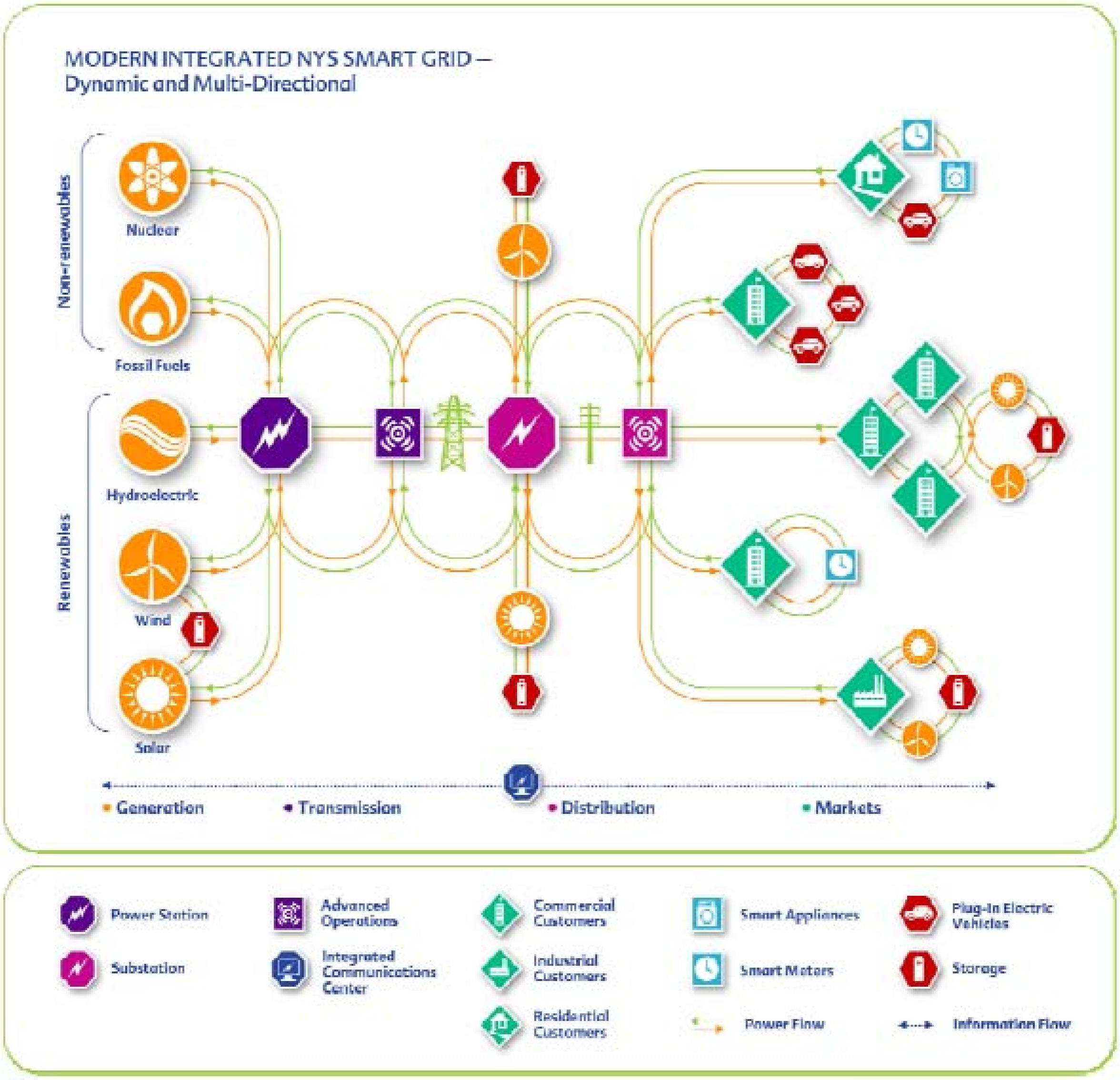
6. The ability of any appliance or machine to respond to such signals, measurements, or communications automatically or in a manner programmed by its owner or operator without independent human intervention.

7. The ability to use digital information to operate functionalities on the electric utility grid that were previously electro-mechanical or manual.

8. The ability to use digital controls to manage and modify electricity demand, enable congestion management, assist in voltage control, provide operating reserves, and provide frequency regulation.

9. Such other functions as the Secretary [of Energy] may identify as being necessary or useful to the operation of a smart grid.

To describe and explain the smart grid, entities such as the United States Department of Energy (DOE) and the Electric Power Research Institute (EPRI) have developed diagrams and visual depictions of the smart grid. The following diagram, which was provided by the New York Smart Grid Consortium (the Consortium) as part of its response to the July 2010 Order, was designed specifically for New York.



Based on our review, we find that no particular definition of smart grid is sufficiently precise or comprehensive for our formal adoption. For example, the definition within the EISA describes functions associated with metering and demand response, but does not refer to renewable resources or electric vehicles. Similarly, the diagram offered by the Consortium visually depicts many elements of a smart grid, but it also minimizes or omits important elements, such as cyber-security controls. We are also refraining from adopting a formal definition or graphical representation of the term smart grid to avoid suggesting a preference for a particular final product or end-state.

The advent of the smart grid concept has been attended by a degree of marketing and promotion not normally seen in the utility arena. According to an article appearing earlier this year in an industry journal, "the problem isn't just that 'smart grid' is a vague and over-applied term; the bigger problem is that it has morphed into a catch-all idea, stuffed full of promises that could smother the true potential."[4] We agree.

To some extent, this state of affairs reflects the prospect of new business opportunities and additional revenues utilities and other market participants see in the increased utility investments, increased information streams and closer interactions with customers generated by the smart grid. The prospect of utilities forging an intimate link with customers, from the collection of more granular customer usage data to the ability to reach through the meter and control customer appliances, undoubtedly has captured public attention – indeed, some smart grid marketing efforts have been directed at customers. We favor a dispassionate consideration of the smart grid, devoid of the marketing hype surrounding the term.

Given the lack of any precise definition, and the buzz surrounding smart grid, we considered dispensing with the term entirely, and instead utilizing the term "grid modernization." We recognize, however, that smart grid has become a commonly used term. We also acknowledge that grid modernization involves elements that are not necessarily smart – although smart grid technologies may strengthen transmission and distribution systems, they cannot by themselves deliver electricity from

[4] Steven Andersen, "Saving The Smart Grid," Public Utilities Fortnightly, January 2011, Volume 149, No. 11, p. 33.

generation sources to customers without the poles, wires, switches, transformers and the full spectrum of conventional infrastructure assets that must be upgraded or replaced as part of utility capital investment programs. Therefore, we will retain the use of the smart grid concept in addressing our smart grid policy. In addition, while we will not adopt a single or exclusive smart grid definition or diagram at this time, the EISA definition and the Consortium graphic aid in understanding the smart grid concept, and provide a basis for our further discussion.

We are also cognizant of federal efforts to implement a smart grid, which we have taken into consideration. EISA establishes a federal policy of supporting the modernization of the nation’s electricity transmission and distribution systems, including the deployment of the smart grid, to maintain a reliable and secure electricity infrastructure that can meet future demand growth. EISA requires states to consider adopting smart grid standards for electric utilities and authorizing smart grid expenditures. Specifically, states are required to consider adopting standards whereby, prior to undertaking investments in non-advanced grid technologies, an electric utility must demonstrate that the utility considered an investment in a qualified smart grid system based on appropriate factors, including: total costs, cost-effectiveness, improved reliability, security, system performance and societal benefit. In addition, states are to consider appropriate rate recovery mechanisms for smart grid investments, and any equipment rendered obsolete by the deployment of qualified smart grid systems.

The Commission, through its advanced metering infrastructure case and other proceedings, has addressed some of the federal requirements.[5] We have also required that utilities proposing capital investments identify and discuss alternative investments that could reasonably achieve the same or better results, similar to the kind of showing outlined in EISA; and we will further address the implementation of smart grid, under the policy guidelines we outline here, in the context of utility rate cases.

CURRENT UTILITY PROJECTS

In our July 2010 Order, we directed the utilities to provide a list and description of their recent projects involving smart grid technologies or equipment. The following summarizes the utilities' reports of their current efforts to modernize the grid.

National Grid states that it has been investing in smart grid projects related to system capacity and performance, asset condition, and line and substation reliability. National Grid believes these programs are necessary to ensure that the electric system is well positioned as the industry shifts to greater reliance on distributed generation, renewable technologies, and enhanced distribution automation schemes. Smart grid technology has also been built into National Grid's automation, capacity, reliability, and substation programs. Specific projects include investments in reclosers, energy management systems, and substation automation.

Central Hudson states it has invested in technologies that are fundamental to any smart grid design. Projects include

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[5] Case 09-M-0074, In the Matter of Advanced Metering Infrastructure, Order Adopting Minimum Functional Requirements for Advanced Metering Infrastructure Systems and Initiating an Inquiry Into Benefit-Cost Methodologies (issued February 13, 2009)(AMI Order).

advanced substation equipment, outage management systems, grid intelligence hardware, and improved supervisory control and data acquisition (SCADA) systems.[6] Through each of these projects, Central Hudson believes it has increased its knowledge and understanding of technology that is applicable to advancing the smart grid. Central Hudson reports it has also gained practical experience in the areas of automation, communications, cyber security, and interoperability.

NYSEG and RG&E in conjunction with their corporate parent, Iberdrola, S.A. (Iberdrola) declare their commitment to making energy networks more efficient and secure. Both companies plan to increase the number of remote terminal units (RTUs) connected to their SCADA systems.[7] The companies are also investing in upgrades to their outage management system, energy control system, and geographic information system. The companies further claim to benefit from Iberdrola’s wide variety of worldwide projects that are said to provide insight and experience related to the development and implementation of an effective smart grid.[8]

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[6] SCADA systems allow real time supervisory monitoring, status and control of transmission and substation equipment.

[7] A RTU is a device that collects, codes, and transmits operational data back to a central computer. RTUs can also collect information and implement processes that are directed by the SCADA. RTUs may be equipped with input channels for sensing or metering, output channels for controls and alarms, and a communications port.

[8] NYSEG and RG&E specifically reference Iberdrola's affiliate Central Maine Power’s $192 million investment for an AMI system to serve 600,000 customers, and suggest that a 5 year delay in AMI deployment in New York “would enable the completion of Iberdrola's AMI project in Maine that will provide further proof that New York can have full confidence in AMI as a value creation strategy for customers” (NYSEG/RG&E Comments, p. 13).

Con Edison and Orange & Rockland state that they have been updating and improving technology related to their transmission and distribution systems. They expect these system changes will create value for customers by reducing transmission and distribution system investments along with reducing the frequency and consequences of outages. The companies are concentrating on deployment of what they believe are proven solutions that deliver assured benefits with a low risk of becoming obsolete.

Con Edison and Orange & Rockland are pursuing several demonstration projects that will add smart grid functionalities, allowing the companies to gain experience before pursuing wide scale deployment. For example, smart grid technologies such as distribution automation, secondary monitoring, and machine learning[9] are being implemented in limited deployments and pilot and demonstration programs.

Such programs being undertaken by Con Edison include the Long Island City project, Con Edison's Smart Grid Investment Grant (SGIG) project and Con Edison's Smart Grid Demonstration Grant (SGDG) project. The latter two projects are being implemented with the assistance of funds provided pursuant to the American Recovery and Reinvestment Act of 2009 (ARRA), and were mentioned in our July 2010 Order.

The Con Edison Long Island City project will evaluate the benefits of an integrated smart grid in New York City. The objective is to gain insights regarding customer receptivity to in-home technologies and demand management solutions. Approximately 1,500 customers will receive smart meters, and

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[9] Machine learning involves the development of programs that allow a computer to improve its performance on a given task (e.g., recognize patterns in sensor data) based on experience.

approximately 300 of the group will also test web portals and in-home displays that can show energy usage by appliance. Other aspects of the project will study how solar and other renewable energy resources can be integrated into the electric grid, integration of intelligent distribution monitors and controls to improve reliability, and deployment of electric vehicles and charging stations.

The Con Edison SGIG project will deploy distribution technologies that provide benefits to customers by improving system reliability, reducing carbon emissions, and reducing costs by increasing system efficiency. The goal of the Con Edison SGDG project is to create a scalable prototype cyber secure control system, which integrates existing control systems with new control systems. This project will demonstrate monitoring and control capabilities, making use of controllable field assets to shift, balance, or reduce load in response to system contingencies or emergencies in a way that reduces demand where and when needed for system reasons.

Other smart grid demonstration projects being undertaken by Orange & Rockland include its integrated system model, and a joint project with the New York State Energy Research and Development Authority (NYSERDA). Orange & Rockland is developing an integrated system model for the electric delivery system and software that works with the model to provide centralized control logic. This modeling approach to real-time operations can provide a method of making actual and calculated parameters available for the entire system for analysis by other applications or for visualization. As part of the joint project with NYSERDA, Orange & Rockland is installing a dynamic rating system on one of its transmission lines to better utilize line capacity, and adding microprocessor-based relays at two substations to improve fault analysis and condition monitoring of system operations, as well as a secure backbone communications pathway.

The New York Independent System Operator, Inc. (NYISO) and the New York transmission owners received an ARRA award for two smart grid projects (these projects were also mentioned in our July 2010 Order). The first will integrate synchrophasor technology into the bulk power system by installing additional phasor measurement units (PMUs) and developing new analytical systems. This will improve the ability to detect bulk power system problems and avoid unplanned service losses. The second project will install additional controllable capacitors on the electric system to improve the control of reactive power and coordination of voltage on the bulk power system. The capacitors are expected to increase efficiency and reduce system power losses.

Finally, as a result of our orders regarding mandatory hourly pricing, all large use customers in the state have been converted to hourly meters, and mandatory hourly pricing.[10] Although the hourly meters used in these programs may lack the full functionality and two-way communication capability envisioned for smart meters, they accomplish the purpose of encouraging demand response by providing price signals to these customers that reflect the varying cost of producing electricity in each hour. Such meters are currently used for all of the state’s largest commercial and industrial customers, the threshold for which varies by utility, but typically is greater than 500 kW demand. These large use customers are billed based on day-ahead hourly prices. Participation represents

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[10] Case 03-E-0641, Mandatory Hourly Pricing, Order Denying Petitions For Rehearing And Clarification In Part And Adopting Mandatory Hourly Pricing Requirements (issued April 24, 2006).

approximately 5,000 customers and 6,900 MW of load -- over 20% of the NYISO's peak load, and most utilities are planning on moving to progressively smaller customers. Through the mandatory hourly pricing program, we are achieving a significant portion of our demand response goals, without requiring full implementation of smart meters.[11]

Taken together, the utilities' efforts to date demonstrate that New York State is already making strides to modernize the transmission and distribution infrastructure, accommodate greater integration of renewable resources, and expand the availability of demand response. While it will undoubtedly take years or even decades to fully modernize the electric grid, the process has begun.

COMMENTS OF THE PARTIES

In the July 2010 Order, we sought comments from interested parties on a series of questions organized into 10 broad areas of inquiry. The questions elicited responses from 32 parties, and 10 parties filed reply comments. The breadth of issues and highly technical nature of the subject matter undoubtedly challenged the parties to present their best thinking. We would like to thank all of the parties that submitted comments in this proceeding for their efforts. The strong responses reflect the high level of interest in smart grid, and we found all of them valuable in developing our policy. In this section, we briefly summarize the comments by

[11] In addition, the Commission is not authorized to mandate time-of-use rates for residential customers. Chapter 307 of the Laws of 1997 amended Public Service Law §66(27)(a) to delete a provision authorizing the Commission to mandate time-of-use rates for residential customers, in the public interest.

party; however, we also summarize comments by topic area in the sections that follow.

Our July 2010 Order directed all of the major investor-owned electric utilities to file responses. The responding investor-owned electric utilities included comments from Central Hudson, National Grid, a joint filing from NYSEG and RG&E, and a joint filing from Con Edison and Orange & Rockland.

Although the utilities’ opinions varied on specific issues, their comments were generally consistent with each other. They believe a discrete level of investment now will help utilities prepare for successful future deployments of cost-beneficial smart grid technology. They suggest starting with transmission and distribution upgrades and automation first and gradually working towards smart meters and customer related upgrades in the future. The utilities believe that this approach will allow them to upgrade their infrastructures while waiting for smart grid standards and procedures to further develop and mature. They also suggested that a good deal of information can be gathered from ARRA projects, many of which focus on customer-facing applications, that will benefit them in the future.

A substantial number of comments were received from various vendors of smart grid hardware and software, including CURRENT Group LLC (CURRENT), Elster Solutions, LLC (Elster), eMeter Corporation (eMeter), GE Energy, Grid Net, Honeywell, Intel, OPOWER, Inc. (OPOWER), Silver Spring Networks, Tendril Networks Inc. (Tendril), Viridity Energy Inc. (Viridity), and the Consumer Electronics Association (CEA), These vendors provide smart grid equipment for transmission and distribution systems as well as for residential applications, such as smart meters and smart sensors. Many provide software platforms for various smart grid applications, from utility networks to in-home residential networks. CEA is the principal U.S. trade association of the consumer electronics and information technology industries.

These parties generally support a rapid deployment of smart grid, in order to maximize the benefits these new technologies can offer. Topics of interest to these parties included policy priorities, regulatory action, open and interoperable standards, interchangeability, cyber-security, open market participation, customer education and engagement, demand response, and privacy. Many also contributed comments regarding specific technologies such as smart meters and home energy management systems.

We received numerous responses from telecommunication companies, including AT&T Communications of New York, Inc. (AT&T), CTIA – The Wireless Association (CTIA), Qualcomm, Inc. (Qualcomm), T-Mobile Northeast, LLC (T-Mobile), Trilliant, Inc. (Trilliant), and Verizon New York, Inc. (Verizon). Their comments were mainly focused on communication technology and security issues.

These parties sought to promote the benefits and resources they could provide in support of smart grid implementation. The telecommunication utilities generally recommended that the Commission encourage use of existing commercial networks and services. They believe this will keep costs down and speed implementation. They also stressed that security is of great importance to them, and that their networks are very secure.

We received comments from representatives of ESCOs and wholesale energy marketers, including the National Energy Marketers Association (NEM), Retail Energy Supply Association (RESA), and Small Customer Marketer Coalition (SCMC). These parties sought to highlight the role that ESCOs can play in educating consumers about smart grid-enabled demand response products and services and in providing customers with proper pricing signals to enable demand response solutions.

Consumer representative respondents included Multiple Intervenors (MI), the New York State Consumer Protection Board (DCP),[12] Galvin Electricity Initiative (Galvin), and Wal-Mart Stores, Inc. (Wal-Mart). These entities represent themselves or other consumers who will be affected by smart grid implementations.

MI represents large industrial, commercial, and institutional energy consumers in New York. It recommends that the Commission adopt a conservative approach to implementation of smart grid, in order to avoid unnecessary cost burdens for consumers. DCP urges the Commission to oversee deployment of smart grid technologies in a measured, careful and consistent manner that balances costs and benefits and takes into account less expensive alternatives that may accomplish the same goals. Galvin offers several specific policy reforms that it argues can empower consumers, maximize value, strengthen utilities and remove barriers to private investment. Wal-Mart advocates that the smart grid in New York be developed in a manner that eliminates technical obstacles for direct customer participation in managing energy use and improves demand response services and programs. Other topics important to this group of responders are consumer protections, consumer acceptance, cost allocation, and smart meters.

[12] Since this filing, the New York State Consumer Protection Board was merged with the New York State Department of State, and is now known as the Division of Consumer Protection.

Comments were received from several governmental and quasi-governmental agencies, including NYISO, the New York Power Authority (NYPA), and NYSERDA. Each of these organizations plays some role in the electric market within New York State. Each sees benefits that may come from the smart grid and offered guidance based on its particular area of expertise.

NYISO states that making the dynamic retail price of electricity available to consumers on a voluntary basis is a key aspect of the development of the smart grid. It attached a white paper on dynamic pricing to its comments. NYPA believes the combination of communications with electrical systems, control systems, equipment, and load control mechanisms can create a responsive and resilient electric power system that will optimize utilization of existing assets, increase reliability and allow a broader situational awareness environment for operations staff. While warning that the cost and time needed to develop a smart grid will be tremendous, NYPA believes this should not deter us from pursuing these innovations. NYSERDA respects the Commission’s caution in approaching deployment of smart grid, insisting on further contemplation of the readiness of the technologies, their relative cost and benefits, and the prospects for adoption by consumers who will be asked to use them. NYSERDA supports the use of pilot and demonstration projects to test the validity of technology and applications while controlling costs.

Other commenting parties included Environmental Defense Fund (EDF), the Consortium, and Utility Workers Union of America, AFL-CIO, Local 1-2, and Local 97 (Unions). EDF is a national non-profit organization that is interested in using smart grid technologies to hasten a transition to a clean, low carbon energy future. The Consortium is a unique public-private partnership of largely New York State utilities, authorities, universities, industrial companies, and institutions and research organizations, which came together in a collaborative manner to facilitate the development of a smart grid. The Consortium has developed, and submitted along with its comments, a "roadmap" to provide a framework for benefit-cost decision making and a methodology to prioritize smart grid investments. The Unions represent the utility workers for Consolidated Edison and National Grid. The parties discussed a wide variety of themes, including reliability, education, the environment, data access, and privacy, security, and price signals.

SMART GRID POLICY GUIDELINES

In this Policy Statement, we present, extend and refine our policies respecting grid modernization and provide further guidance to the utilities on how we will evaluate smart grid projects.

Vision for the Smart Grid Design

In the July 2010 Order, we requested parties' comments regarding their vision of the smart grid and its anticipated benefits. In particular, we sought parties' views on overarching features or attributes they feel should be part of smart grid development.

Party Comments

Most parties' comments addressed features of smart grid flexibility, accessibility, reliability, environmental attributes, or economic concerns. Parties generally agree that a smart grid must adapt to changes in technology, the environment, and business needs. The New York utilities generally all envision the smart grid as an interoperable system that better connects the utility with end users; however, they also agree that we should not rush into building an allencompassing system. Instead we should initially concentrate on transmission and distribution efficiencies, and gradually work toward customer-facing applications. Most of the utilities feel this staged approach will allow standards and current projects to mature and supply the industry with useful information for the future.

National Grid, on the other hand, recommends that the Commission not wait for the results on ARRA funded pilots, because the information gained from them may not be applicable for upstate New York utilities. It does believe, however, that further maturation of the standards is needed to pave the way for long term interoperability and create a stable environment for investment. NYSEG and RG&E point out that investment in smart grid technology is a necessity in order for New York to meet its carbon footprint goals.

Verizon suggests that the best smart grid design will be a standards-based framework that ensures interoperability, while accommodating technological advances and changes in the communications and control overlay network. Verizon also recommends that the design for the smart grid of the future not be utility specific.

Silver Spring Networks believes there is no pre-defined template for the smart grid and recommends utility specific smart grid designs. According to Grid Net, scalability is paramount if utility systems are to keep pace with the evolution of smart grid technologies. Grid Net also suggests that building smart grid systems on an industry-wide interoperability standard will allow utilities flexibility and choice among smart grid vendors, facilitate technology switching, ensure grid security, and subject ratepayers to less overall cost and risk.

Tendril believes that smart grid deployment should leverage opportunities to provide customers with both real-time and interval-based consumption information that can be used for energy conservation and demand management. Wal-Mart recommends that the smart grid be developed to facilitate direct customer participation. Because it believes smart grid deployment will occur on a state-by-state basis, CEA recommends coordination among the states and the federal government to ensure that data access, privacy, and security policies are consistent and do not impose unnecessary barriers to the creation of national markets for smart grid products and services.

A portion of the comments focused on improving reliability, security and quality of service. DCP and most other parties believe that the smart grid should allow transmission and distribution facility operators to know instantly about specific problems. DCP and the investor-owned utilities assert that the smart grid should lower customer bills through the reduction of operating cost. NYPA's vision includes a transmission system that improves the efficiency of all electrical equipment connected to it. In addition, NYPA believes that automating the system will reduce system losses, manage bi-directional power flows, and minimize outage durations.

EDF states that proper smart grid design will contribute to achieving important state policy goals related to reliability, cost, security, and environmental impacts of the energy industry. It also states that smart grid could improve energy independence, fuel diversity, and economic competitiveness. The Consortium believes that the smart grid will enable the state to meet its energy goals and spur economic development. The Consortium states that smart grid investment is sometimes difficult to cost justify because investments are often only marginally cost effective if viewed in terms of cost impacts on utility operations.

MI asks that the Commission refrain from approving an overly aggressive smart grid policy because of the potential cost burden on ratepayers. Con Edison and Orange & Rockland urge the Commission to focus on the bill impact of any proposed program and to approve those with a high potential to deliver cost savings.

Discussion

Major changes in the way electricity is produced, delivered and consumed are already underway. Given the ever increasing demands placed on the electric grid by new technologies, environmental concerns and increasing loads, the development of a smart grid is virtually inevitable. In our view, it has never been a question of if smart grid technology will be implemented, but when and at what pace.

Most parties agreed that some benefits could be obtained in just a few short years, and others may take a decade or more. In the end, precise time horizons may be irrelevant, because smart grid will likely remain a continuing work in progress. Available technologies, utility and customer needs, and resources available are all subject to change. Each of these factors will influence schedules, expectations, and possibilities.

The reality is that the smart grid will look less like a final product and more like a developing set of solutions to a variety of needs and interests. While the smart grid holds great potential, it involves many unknowns, such that there is also potential for waste or other inefficiencies if investments are not made wisely. Despite the potential for the smart grid, we must balance the relative costs and benefits of incremental smart grid capital expenditure budgets and increasing operations and maintenance costs, with other competing state energy and environmental initiatives. Therefore, our policy guidelines are established with the intent of encouraging smart grid investment in a reasoned, well-planned and properly coordinated fashion.

Our long-term vision for the electric system is, and will continue to be, the provision of energy services that meet the state's policy objectives, reliability standards, and environmental standards, at the lowest possible cost. Our policy must therefore balance the smart grid's costs against reasonably obtainable benefits in efficiency, security, reliability, and environmental quality, as well as other public interest benefits. The following list reasonably captures the overarching goals that were cited by the parties, with which we agree:

- Enhance reliability – anticipate, detect, and respond to system problems in order to maintain and generate enhancements to system reliability.
- Control costs – maximize the value of existing grid assets, and minimize capital and operational costs.
- Reduce environmental impacts – reduce the environmental impacts of electric generation, transmission and distribution systems in the state.
- Empower customers – provide customers with the tools and knowledge to better manage energy costs.
- Enable greater demand response – support an open marketplace where a variety of providers can offer energy management products and services to a wide range of customers.
- Accommodate new electric technologies – facilitate the interconnection of distributed generation, energy storage, and electric vehicles to the grid.

These are broad, high-level goals, and we hold no presumptions that any particular smart grid investment will lead directly to their achievement; however, utilities should consider them and be able to explain how the smart grid projects they propose for ratepayer funding are designed to achieve them. Furthermore, just as the smart grid will evolve over a period of many years, so will our vision. Given its evolutionary nature, it will be necessary for us to periodically revisit and re-examine our vision, goals and priorities for smart grid development.

To date, the utilities have been making smart grid investments that provide relatively certain benefits by installing components that improve system efficiency, advance the smart grid, and generate net benefits. This approach should continue. We also agree with those parties who argued that smart grid functions should be added first to core system operations in areas where they already make sense and technologies have been proven.

Transmission and distribution deployments are a practical starting point for the smart grid. Improvements to the delivery system should be based on availability and reliability of the technology, and should be designed to enhance system operability and flexibility, streamline business operations, and control costs. This can be achieved, for example, through such projects as the wider use of sensors and control devices on the transmission and distribution system, and automation of substations. We further discuss implementation priorities in the following section.

Given the variety of needs of the grid system today and the uncertainties associated with future evolution of new technologies, we see no reason to prescribe a “one size fits all” approach to grid modernization nor will we prescribe a particular planning process. Each utility needs to develop its own approach for modernizing its equipment and integrating its systems into the larger smart grid; however, some general considerations seem appropriate.

We agree with many commenting parties that there could be substantial benefits for utilities and their customers to conducting, and periodically updating, needs assessments with specific consideration of smart grid technologies. In order to maximize effectiveness, such a needs assessment should cross departmental "silos" to engage all areas of the company and consider how smart grid technologies could improve functions and processes.[13] Because smart grid technology is rapidly evolving, planning should also involve a dialogue with vendors, not only to determine what is available but also to communicate functional needs and objectives, so that vendors can design and develop products to meet system needs. Utilities may also benefit from collaborative planning and project execution, particularly for projects on the transmission system (e.g., the NYISO PMU and capacitor bank projects). Plans must be flexible and adaptable and be updated or revised as necessary when new technologies and standards emerge.

Although we will not require utilities to file separate smart grid plans for our consideration, we expect that utilities will incorporate new technologies into their regular infrastructure investment plan filings to take advantage of opportunities for increasing reliability, efficiency or otherwise improving the delivery and use of electrical power. During system planning and development, utilities should

[13] For example, meter data could be used not only for bill preparation, but as inputs to outage management and/or distribution management systems – but only if these systems are designed to share data with each other.

exercise care to avoid making investments in technologies that could become obsolete or otherwise stranded. Smart grid investments should be an integral part of a utility's overall capital spending plan and should harmonize with its overall investment strategy. We will generally consider smart grid proposals as part of the utility's overall capital spending plan during rate cases and/or other utility-specific proceedings, where the reasonableness of particular investments can be determined in an appropriate context.

The development of our smart grid policy of necessity reflects the state of the available technology at the present time. We have endeavored to ensure that our policy reflects what is technically and economically feasible in the marketplace; however, smart grid technologies are evolving at a rapid pace and will likely continue to do so. As the parameters of smart grid technology further develop, our vision may be subject to change. If this policy is regarded as a living document, that can be revised and updated as the state of smart grid technology progresses, we can proceed now and revisit the policy, including the holding of further proceedings as circumstances require.

To summarize, realization of the smart grid will be an evolutionary process. At this point in time, the most important smart grid attributes are flexibility, adaptability, and avoidance of full commitment to any particular technology while the most viable solution remains unclear. Significant expenditures are currently being made to modernize the grid and maintain grid reliability and functionality, and these should continue. In the near term, utilities should look for opportunities to accelerate current modernization efforts where they can be shown to be cost-effective and minimize ratepayer impact. While doing so, utilities should continue to evaluate smart grid strategies against the growing base of knowledge and experience in smart grid projects generated by ARRA, and the continuing emergence of national standards for smart grid technology.

Implementation Priorities/Timing

Smart grid technology must be deployed at a pace that makes sense based on availability and reliability of the technology, maximizing net benefits and meeting customer requirements. Moreover, limitations on available capital and utility resources will mean that many new technologies will have to be integrated into existing systems gradually over time. These constraints will force utilities to prioritize smart grid investments. The question of priorities is further complicated because of the interrelationships between different smart grid technologies -- some technologies may have features that can only be utilized when other technologies are also in place.

Given the complexities of planning a smart grid, the question of setting priorities can be difficult; however, it is imperative to set priorities for smart grid deployment that maximize potential benefits and minimize costs, obsolescence and lost opportunities. In the July 2010 Order, we sought input regarding what elements of the smart grid should receive priority in order to accomplish this.

Party Comments

Nearly all parties acknowledged the importance of a conservative approach to implementing the smart grid to ensure that smart grid investments benefit both the utility and the customer. Many of these comments recommend concentrating at the outset on smart grid components that improve core utility operations and reliability. Grid Net suggests an incremental or a phased approach, beginning with internal operations of the grid. The Consortium suggests prioritizing the deployment of proven products and services which provide value to the customer base.

The six investor-owned electric utilities generally support a phased approach to smart grid, concentrating initial smart grid investments in areas where the benefits are known, technology is mature, and the costs are well defined. Central Hudson views the smart grid as similar to any other capital investment and believes incremental changes to the grid promote predictability, reduce the risk of technological obsolescence, and increase the probability of achieving benefits. NYSEG and RG&E describe a staged approach designed to maximize benefits and minimize costs that would first focus on short-term investments, including the installation of basic network components that serve as the foundation for the future smart grid deployment. According to NYSEG and RG&E, longer-term investments would be made only when a specific business case is demonstrated.

Con Edison and Orange & Rockland urge that we promote a rapid, but phased, deployment of the most beneficial aspects of smart grid, based on certainty of benefits. They also support further evaluation of new technologies with less certain benefits and testing of dynamic rate designs. National Grid agrees with Con Edison and Orange & Rockland that many new technologies need to be thoroughly tested before mass deployment. National Grid suggests investing first in advanced transmission and distribution technologies, which it believes more easily show a proven value to customers. National Grid additionally is concerned that utilities have limited experience with the dynamics of grid operations when customer-side resources are involved or the impacts on loads from customer use of real-time data.

The parties generally agree that many of the presumed benefits of smart meters are unsettled areas that could benefit substantially from further study or testing, including customer acceptance of smart meters and the impacts of new rate structures on customer behavior as well as the interaction between smart meters, home area networks and home energy management systems. MI notes that the DOE's Smart Grid Information Clearinghouse will provide the Commission with information necessary to develop prudent smart meter policies for New York. Grid Net recommends that utilities engage in immediate and extensive project planning, including preparing their information technology infrastructure to accept the significant amounts of data that smart meters will produce. Honeywell, OPOWER, and Galvin suggest a voluntary smart meter rollout, allowing customers to opt-out of smart meter programs.

Various parties indicated that the penetration of electric vehicles, largely because of their high costs, is expected to be limited and geographically concentrated for the short-term. In the longer term, however, many parties expect electric vehicles will also create challenges on the electric distribution system. NYSERDA states that electric vehicle technology should be allowed to mature before broad-scale investments are made and recommends additional research into electric vehicles.

Discussion

Many new smart grid technologies are still expensive, and the risks associated with such technologies can be significant. We believe it is most appropriate to start with technology investments that can provide a relatively certain return, and continue to evaluate technologies whose potential benefits remain uncertain, particularly for technologies such as smart meters that are dependent on intensive customer engagement or behavior changes to produce those benefits.

Enhancing and maintaining the reliability and resilience of the electric system remains among our highest priorities. Installation of monitoring and control equipment that would allow utilities to identify system problems before they cause service disruptions and avoid outages or restore power more quickly can provide immediate and tangible benefits for all customers. Increased use of sensors in transmission and distribution networks and automation of substations can enhance system operability and flexibility, streamline business operations, and control costs. Utility grid measurement and sensory devices monitor various electrical factors such as current, voltage, phase angle, transformer state and a variety of other grid parameters. They are relatively easy to integrate into existing systems and their benefits are not dependent upon modifications to customer behavior. Upgrading these parts of the smart grid should receive priority attention.

Distribution automation technologies can provide such reliability improvements, but they also have the potential to provide efficiency gains, through more precise voltage control and new demand management tools, such as dynamic load distribution. These types of projects also have the potential to deliver tangible benefits in the short term and should receive priority consideration by the utilities.

Projects where the benefits are less tangible or rely on unproven technologies should receive lower priority. In particular, the benefits of technologies that involve considerable customer engagement or assumptions about customer behavior changes, such as smart meters, are much more difficult to gauge. Because overall customer reaction to these new technologies is largely unknown (and customer behavior is historically resistant to change), absent pilot projects or other field studies, actual benefits are difficult to reliably predict.

The recent history of smart meter deployment illustrates the difficulty of engaging customers. The California Public Utility Commission (CPUC) recently directed Pacific Gas & Electric Company to propose an opt-out for customers who object to the wireless technology used in the company's smart meters. The CPUC took action after a wave of protests, beginning in Bakersfield, CA and culminating in council votes in Fairfax, CA and other localities, banning smart meters. In Maine, the Public Utilities Commission has ordered that customers be allowed to opt out of Central Maine Power Company's smart-meter conversion, following similar customer complaints.[14]

Smart meters hold great potential to unlock many of the expected benefits of the smart grid. They can provide better price signals for customers to cut back in periods of high demand, facilitate interconnection with new technologies such as distributed generation and electric vehicles, furnish utilities with additional outage management tools, and enhance

[14] The Maine PUC required Central Maine Power Company to offer an opt-out program for customers who choose not to have a standard smart meter installed as part of the company's smart meter program. Customers will have two new opt-out options: the availability of the smart meter with its transmitter turned off and the ability to retain the existing analog meter. Each option would entail additional customer charges; however, low-income residents can qualify for subsidies. Pacific Gas & Electric Company proposes to disable smart meters for customers concerned about health and safety hazards from meter radio wave emissions, and to charge fees plus an additional monthly charge to cover the costs of manual meter readings and other costs. At this writing, the CPUC has not yet acted on the proposal.

the measurement and verification of energy efficiency gains. On the other hand, while utilities may derive operational benefits from implementation of smart meters (e.g., reduced costs from automation of the meter reading function), these benefits alone typically do not justify their costs, and it is not clear how many customers will make use of these technologies in a way that produces the other benefits.

One way to maximize the demand response benefits of smart meters while minimizing costs is to target implementation to customers with the largest loads and, consequently, the greatest capacity for load shifting. This is precisely the approach we have taken thus far in our Mandatory Hourly Pricing program.[15] Participation in that program was initially limited to customers with demands larger than 1,500 kW, and has progressively moved to customers in the 500 kW demand class, with most utilities planning to move down to 300 kW demand. When those plans are fully implemented – projected for 2013 – total participation will represent approximately 6,200 customers and over 7,600 MW of load. It is possible that, at some level of participation, further implementation of hourly metering to smaller customers, absent realization of collateral benefits, will not be cost-effective.[16]

In addition, through its Demand Response Proceeding, the Commission continues to aggressively pursue demand response

[15] Case 03-E-0641, supra.

[16] According to an analysis by the Brattle Group, even having a relatively small amount of load responding to price signals can realize significant efficiency benefits. See A. Faruqui, R. Hledik, J. Tsoukalis and J. Pfeifenberger, “The Power of Five Percent,” The Electricity Journal (October 2007).

in mass markets.[17] Rather than using meters, these programs utilize programmable communicating thermostats, pager-based systems, and other means of implementing direct load control.

While we continue to deploy smart meters strategically via mandatory hourly pricing, and further implement demand response, we seek opportunities to better understand the value proposition afforded by smart meters in the mass market. In the smart meter plans filed by the New York utilities in 2007, roughly two-thirds of the costs of installing advanced metering infrastructure (AMI) were offset by a reduction in traditional utility costs of operations or improved services, such as avoided meter-reading costs, faster outage detection and improved customer service.[18] In that case, we determined that "[a] projection of benefits from the demand response enabled by AMI systems must be included to bridge any benefit-cost gap based on what is recoverable from AMI-operational savings alone."[19] In addition, implementation of smart meters for mass market customers raises numerous rate design issues, as seen in the Commission's Order approving ARRA projects.[20]

In public comments, many New York customers have also raised concerns about radio frequency (RF) emissions from smart meters, similar to those raised by customers in California and

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[17] Case 09-E-0115, Proceeding on Motion of the Commission to Consider Demand Response Initiatives.

[18] AMI is generally comprised of smart meters as well as an associated meter data management system (MDMS), and a communications network linking the meters and the MDMS.

[19] Case 09-M-0074, AMI Order, supra.

[20] Cases 09-E-0310, et al., In the Matter of the American Recovery and Reinvestment Act of 2009, Order Authorizing Recovery Of Costs Associated With Stimulus Projects (issued July 27, 2009), pp. 43-56.

Maine. While the RF emission levels of these devices are exceedingly small relative to other commonly used devices (e.g., cellular telephones) -- and the authority for establishing standards for such emissions rests with the Federal Communications Commission (FCC), not us -- we note that the FCC's standards are developed and updated from time to time with input from independent professional sources, such as the United States Environmental Protection Agency and World Health Organization. As more data becomes available through ARRA projects and other studies, it is possible that the FCC will revise its standards related to RF emissions from smart meters.

Despite the public focus on smart meters, it appears that the majority of jurisdictions are taking a cautious approach to their implementation. A recent Federal Energy Regulatory Commission (FERC) report found only an 8.7% penetration of advanced meters, among all installed meters.[21] Much of that was concentrated in a few states, including Texas and California, and of the remainder, the bulk of the installations were in the service territories of cooperatives and public power districts. Outside of Texas and California, it appears that the penetration of advanced meters among investor-owned utilities remains very low.

Furthermore, those leading states now face challenges related to their early implementation of smart metering, as the National Institute of Standards and Technology (NIST) and other parties continue to grapple with the considerable task of producing standards that can accommodate their further development and implementation (we further discuss interoperability standards later in this document). According

[21] FERC, “2010 Assessment of Demand Response and Advanced Metering,” Staff Report (February 2011)(FERC Report).

to the FERC Report, "[e]arly adopters of AMI face interoperability issues as technology and standards evolve. Recently, utilities that installed meters that include integrated home area network (HAN) components have raised concerns that their meters may become obsolete if the industry adopts communication protocols for appliances and other components that are incompatible with their meters."[22]

Finally, we note that our preferred approach, i.e., initially focusing on transmission and distribution projects, would allow the majority of smart grid investments to move forward. A recent EPRI technical report estimates total investment needed to realize the smart grid nationwide is approximately $407 billion (a range of values between $338 and $476 billion is given; $407 billion is the median value). In EPRI's estimates (a range of values is also given for each cost component, the following figures and percentages refer to median values), about $64 billion, or 16%, is related to smart metering.[23] A cautious approach on metering therefore allows 84% of EPRI's projected smart grid investments to go forward without constraint or delay.

Given the enormous potential for customer engagement to contribute to achievement of our smart grid goals, however, the potential application of smart meter technologies to mass market customers cannot be ignored. Utilities must consider how smart meters and related technologies fit into their long term smart grid implementation plans, even if such projects do not

[22] FERC Report, p. 19.

[23] EPRI, "Estimating the Costs and Benefits of the Smart Grid: A Preliminary Estimate of the Investment Requirements and the Resultant Benefits of a Fully Functioning Smart Grid," Report 1022519 (2011).

receive priority in the near term. ARRA funding will support over $6 billion in smart meter and smart meter-related projects over the next few years. New York has the opportunity to learn from these projects in order to improve its decision making concerning large-scale smart meter investments so that uncertainty and costs are minimized. These and similar projects should narrow uncertainties and increase the likelihood of successful smart grid implementation in New York.

Through the Smart Grid Information Clearinghouse, DOE has provided an opportunity for sharing best practices and lessons learned through the ARRA programs.[24] Two categories of metrics will respectively measure progress building the smart grid, and its impacts related to operations and performance. We believe best practices and lessons learned resulting from ARRA projects will advance the smart grid implementation and reduce costs if they are well documented, analyzed, and sufficiently detailed.

A comprehensive research and development effort will likely be essential for advancing the technologies required to realize smart grid capabilities and benefits.[25] Utilities may also consider developing pilot projects or other small-scale deployments in order to fill in data gaps, address considerations unique to their service territories, or otherwise demonstrate the potential for new technologies. Those pilot

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[24] http://www.sgiclearinghouse.org

[25] A number of organizations could act in a coordinating role to assist in research and development, collaborative planning and evaluating best practices; including NYSERDA, the Consortium, and NYISO (as it has done for the PMU and capacitor bank projects). We urge the utilities to leverage these opportunities for collaboration and avoiding duplicative effort.

projects with the potential to provide relevant new information should receive priority consideration by utilities. Research and development, pilots, and demonstration projects may be necessary where the technology is not proven or ARRA project results are unlikely to produce results. For example, we see value in Con Edison and Orange & Rockland’s use of limited research and development projects and demonstration programs to prove technologies and narrow uncertainties regarding costs and benefits.

As the utilities establish plans for upgrading their systems, they must take into consideration the developing electric vehicle market. While the parties may be correct that electric vehicle penetration may be limited in the short term, we need to prepare for future electric vehicle consumption and the attendant reliability concerns that may arise. Well thought-out capital investment plans with conservative but realistic electric vehicle assumptions will help address these issues. We agree with NYSERDA, however, that further research is needed.

In sum, projects that provide relatively certain benefits should receive priority consideration over those with less certain or intangible benefits. Distribution monitoring, control and automation technologies are field-tested and are proven to enhance system efficiency and reliability, and therefore seem like a logical starting point for building the smart grid. We encourage the utilities and other entities to perform research and development and to conduct pilot programs in areas where new technologies are emerging. Such technologies should either be deployed on a small scale or, where ongoing studies exist, postponed until those studies are completed, in order to take full advantage of the learning opportunity. In particular, large-scale smart meter deployments should be postponed while ARRA projects are underway, or until uncertainties are otherwise narrowed sufficiently to justify expected costs.

Communications Technology

Deployment of technologies that allow the two-way flow of information is fundamental to almost every aspect of the smart grid. Two-way communications are necessary to support enhanced control of critical infrastructure and for providing access to the data necessary to better manage energy usage and efficiency.

Party Comments

Some electric utilities indicated a preference for a dedicated smart grid communications network, but generally, utility comments recognize that a hybrid network of both private (i.e., utility-built) and public (i.e., commercially available) elements will be required in a full smart grid deployment. National Grid acknowledged that a hybrid network will ultimately be used, but states that existing networks do not offer the control and reliability required to evaluate smart grid deployments and advocates for the use of private communications networks during pilot projects. National Grid also notes that mission critical smart grid operational applications and customer-facing systems have differing communications needs. Mission critical systems, such as protection and switching systems, need a communications platform that will provide high reliability, low latency, and high bandwidth capability.

Con Edison and Orange & Rockland recommend a flexible architecture for networking and security that may accommodate multiple communications solutions. They also believe that existing commercial networks fall short in delivering requirements for mission critical command and control functions.

They argue that a single-backbone communications architecture allows for lower overall cost, greater control of security, asset management, maintenance, troubleshooting and operational visibility.

NYSEG and RG&E believe that a private or a hybrid public/private network may be needed to fully implement a smart grid network. They note that other networks, such as synchronous optical networking (SONET), microwave, fiber, and radio, also utilize commercial network transport for aspects of the system such as backhaul or last mile. NYSEG and RG&E suggest constructing a broadband communications backbone as a foundational element of the smart grid. According to the companies, this would not only provide the two-way communication that underlies most smart grid functionality, but cost efficiencies would be achieved by avoiding a piecemeal approach to deployment.

Central Hudson suggests a statewide effort to request that the Federal Communications Commission (FCC) dedicate a low-frequency band for utility distribution automation in order to meet reliability, coverage, and latency criteria cost-effectively. Central Hudson believes that such a development would free up available public network capacity for lower priority smart grid data transmission and decrease the need to build private networks.

Conversely, communications companies' comments support the use of commercial (e.g., wireless or fiber) networks in broad segments of the smart grid. AT&T states that smart grid communications should utilize existing networks and services and augment existing systems where needed. It states that existing commercial wireless solutions are scalable, secure, and interoperable, and their use will lower the life cycle costs of smart grid communications deployments.

Qualcomm states that, other than cellular technology, no broadband communications technology can meet the unique combination of requirements for the smart grid, including reliability, security, full coverage, and global harmonization and interoperability. It also states that commercial cellular technologies offer broadband service to approximately 98% of all Americans. Qualcomm believes cellular technology should play a key role in the smart grid.

Verizon states that working with utilities to integrate utility-owned and communications service provider assets and capabilities, wherever commercial services can meet the grid's requirements, is the best possible model for cost-effective and robust solutions. Verizon states that communications service providers also have the incentive to invest in and upgrade their networks to meet evolving customer demands, and that they devote considerable resources to and have substantial expertise with cyber-security and emergency preparedness.

The NYISO sees potential value in the use of common carrier communications for smart grid applications, especially for communications to customers and end-use devices. Both the economics and ease of integration with customer technologies are attractive. The NYISO recommends investigation into the security, performance, and reliability aspects of these systems, when applied to different smart grid applications.

The Consortium believes the Commission should investigate the potential of using public networks for some smart grid applications, such as AMI. It argues that there are significant cost savings to be had, but policy and technical issues must be addressed. Galvin favors leveraging existing communications channels -– cable, dish, wireless, and telephone -- in order to maximize customer options.

Discussion

The smart grid, and the communications networks that serve it, must be accessible to appropriate parties, standards-based, and secure. Smart grid communications architectures must also be flexible and scalable, in order to accommodate the stages of smart grid development previously discussed. The customer-facing aspects of the network must also be customer friendly in their deployment and function. We recognize that there are several communications platforms and solutions that may be able to meet these requirements. Solutions for meeting cost-effective data communication requirements of the smart grid may include both wireline and wireless technologies and commercially available and proprietary networks.

The comments we received reflect a wide variety of opinion regarding the proper role of commercial networks in furnishing smart grid communications. Utilities favored greater use of dedicated systems while telecommunication companies advocate for increased reliance on existing commercial networks. For both economic and technical reasons, the smart grid will likely employ a hybrid public-private approach.

Dedicated or proprietary systems may provide certain benefits in functionality and other areas, but costs are likely to be significant. The existence of robust wired and wireless networks and broadband services present opportunities for cost-effective communications solutions. In particular, as many parties commented, use of existing commercial broadband services for HAN and other customer-sited technologies may facilitate innovation, empower customer control over energy consumption, and increase customer choice. Nevertheless, commercial communication systems may present their own limitations.

The lack of clarity regarding the proper balance of public and private facilities suggests to us that a significant investment in, or commitment to proprietary communications infrastructure at this time may limit future options or incur unnecessary costs. A unified network architecture must support the needs of multiple functions – requiring the network to have bandwidth sufficient to accommodate applications needing high throughput, low latency to support functions needing fast response, and high security and reliability to support mission-critical functions. Purpose-built systems can be selected and sized appropriately to specific applications. This avoids both overbuilding and “gold-plating.” In addition, the interconnection of control systems with other networks increases cyber-security risks. Physical separation of communication layers between smart grid applications reduces entry points for hackers and adds system redundancies, and may thus improve system reliability and security.

Utility proposals for long-term or large-scale investments in a unified communications infrastructure therefore should demonstrate both that such investments represent the best possible solution and that the utility has adequately considered a range of alternatives, including existing communications infrastructures. We further urge the electric utilities and communication providers to work together to ensure the appropriate use of commercial facilities and to limit utility capital investments in dedicated infrastructure to those functions where it is needed. Utilities must give fair consideration to use of commercial networks, and communications providers should be willing to offer services tailored to meet the utilities’ technical, coverage, reliability, security and cost requirements.

Engaging Customers

The transition to a smart grid involves more than technology; it also requires changes in customer behavior. Since a fully optimized smart grid is dependent on customer adoption and satisfaction, it is important for customers to have a full understanding of smart grid benefits. In the July 2010 Order, we asked for parties' input on specific needs and methods for engaging and educating customers.

Party Comments

Generally, parties agree that customers should be better engaged in smart grid topics. Most believe utilities should perform extensive customer education on smart grid, demand response, dynamic pricing, smart meters, and general energy consumption. EDF supports giving customers real-time pricing and usage data, providing information on the source of energy generation, and explaining to customers how to reduce their costs and environmental footprint. EDF notes successes in recent smart meter pilots in Washington, D.C. and Baltimore. Con Edison and Orange & Rockland recommend educating utility employees, as a source of information for other customers. The companies also recommend outreach plans, including the use of utility media resources, focus groups, and surveys. SCMC suggests "shadow billing" as a means to ease customers into dynamic pricing. This allows customers to see, without experiencing, what the bill impacts would be from dynamic pricing. OPOWER recommends that utilities offer analyses of customer data and actionable insight to assist customers. GE Energy suggests requiring utilities to take the lead in addressing customers' needs and concerns, which is essential in implementing smart grid technology. GE Energy notes that the failure to market smart grid properly can cause disastrous results, referring to real-time pricing programs in Texas, Maryland, and California as examples.

Many parties report that in pilot programs, customers have changed their consumption patterns based on the real-time feedback from smart meters, lowering their usage during expensive periods. Con Edison and Orange & Rockland state that customers will change behavior based on the more detailed consumption information enabled by smart meters, even without facing dynamic rates. Tendril recommends that smart grid deployment provide customers with opportunities to understand the technology, view their usage, and make changes in their behavior. National Grid contends that studying customer behavior is critical to maximizing smart grid technologies. National Grid believes that as people begin to adopt and integrate smart grid infrastructure, the cost of the technology will decrease for all customers, encouraging further adoption.

NYSERDA suggests that commercial and industrial customers are more likely to adopt and benefit from new technologies and capabilities and should be engaged first, while residential customers become educated about the smart grid. NEM recommends developing demand response capability now, allowing energy marketers to educate and prepare dynamic response customers for full smart grid implementation. Verizon recommends considering tax incentives to encourage potential users, as well as amending codes that restrict the attachment of energy sensors to circuits in homes and buildings.

Discussion

A large number of customers do not know how the smart grid works. An April 2011 survey conducted by EcoPinion found that only 35 percent of American consumers were aware of the term smart grid.[26] These survey findings reinforce the concerns we outlined in our July 2010 Order that lack of customer knowledge and understanding are potentially large barriers to the full potential of the smart grid. Customer education therefore must begin with basic information -– what is the smart grid, why is it important, and what are the customer benefits.

One benefit of early customer education may be to refocus the public dialogue about smart grid, which seems to be centered on smart meters. Some customer concerns may be alleviated if they understand that the smart grid is not just about meters. Utilities can make customers more aware of the steps they have already taken to develop the smart grid in their transmission and distribution networks.

At the appropriate time, customer education may also hold the key to successful dynamic pricing programs and smart meter implementation. Before commencing with large customer-centered smart grid programs, utilities must lay the groundwork with comprehensive customer education programs. Such educational efforts can increase acceptance, improve utilization, and ease implementation issues, as well as allowing utilities an opportunity to learn more about the services their customers want and are likely to utilize.

Customers participating in such programs need to understand their roles and responsibilities, as well as the role of the utility and any third parties. An important aspect of smart metering is its ability to enable active participation by customers, but customers must be equipped with the knowledge required to participate in a meaningful way. Customers will need to be actively supported in getting the right information to make informed decisions on their participation, and in

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[26] "Consumer Cents for Smart Grid," Survey Report, Issue 12, EcoPinion, May 2011, p. 2.

acquiring the necessary knowledge and skills to take advantage of smart meter-enabled programs.

The importance of customer education was demonstrated in recent experiences in California, Maine, Texas, and elsewhere. These experiences show that in order for smart meters or other customer engaging technologies to be successful, they must be marketed and promoted to gain customer participation.[27] In order to make an informed decision regarding participation, customers must have a clear understanding of the potential benefits, costs, and risks associated with their participation, or non-participation, in a dynamic rate program, in light of their personal electricity needs and usage profile.

Customer education programs must also deal candidly with the rate consequences of smart grid capital investments. If implemented properly, the smart grid can mitigate cost increases, as well as offer customers more reliable and more environmentally responsible service, but customers are wary of further rate increases and will have to be educated to have reasonable expectations regarding the potential of smart grid to lower electric bills.

We agree with the several parties who added that education of utility employees is also important. Effective implementation of the smart grid calls for specialized knowledge and new skills from the utilities' employees.[28] For example,

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[27] Several New York utilities have already begun revamping their voluntary residential time-of-use rate offerings to make them more attractive to customers.

[28] National Grid received an ARRA award of $2.2 million for workforce development. It plans to use the grant to train 4,900 employees in its New York and Massachusetts service territories and to broadly disseminate best practices and lessons learned to community colleges, universities, and energy industry associations.

line crews will need to be trained and qualified to manage a new array of sensory and communication devices.

Ultimately, the success of demand response depends on convincing people to change how and when they use electricity. Clear, concise, and relevant information in advance of a project involving new customer tools, information or interfaces is required to ease customer concerns and improve adoption. Influencing customer behavior requires that utilities and third party providers explain and demonstrate to customers the benefits of a proposed smart grid program. Therefore, if a smart grid technology relies on customer involvement in order to provide all or some of the anticipated benefits, any utility proposal to deploy such technology must include a plan for how customers will be engaged and should include an analysis on the expected level of customer participation.

Benefit-Cost Analysis

As is apparent, we need to have a clear understanding of both the magnitude and nature of potential costs and benefits of smart grid technology. Estimating future costs and the benefits of some smart grid technologies, e.g., smart meters, however, can be difficult because benefits may rely on customer behavioral changes, which are difficult to predict. In addition, the smart grid potentially holds benefits for numerous stakeholders, and many benefits, such as avoided environmental costs, are diffuse.

Party Comments

Con Edison and Orange & Rockland urge the Commission to take a holistic approach in identifying the value of the smart grid. They comment that the approach should be comprehensive and include benefits gained at generation, transmission, distribution, and customer levels.

National Grid comments that all benefits of each selected smart grid technology should be measured in terms of customer value and evaluated against the cost of implementation. National Grid also suggests that pilot projects are a good method to validate the business case assumptions for smart grid technologies.

NYSEG and RG&E explain that they expect each stage of smart grid implementation to provide costs and benefits both on an individual basis and on a complete integrated solution basis. The value of the various components of smart grid would be based on the benefits and costs associated with the various stages of development.

Central Hudson believes that, as in the case of other capital programs, there should be a demonstrable advantage to making the investment and an acceptable level of risk involved. Generally, Central Hudson states that smart grid investments should be held to the same standards as other capital investments, and if they meet those standards, the costs of smart grid investments should be recovered from customers as part of rate base.

Although the bulk of comments on this topic were received from utilities, other parties also suggested benefit-cost approaches. GE Energy warns the Commission against a narrow benefit-cost policy because benefits are delivered in combination, not simply as the sum of component parts. It also advocates that the Commission ensure that the direct beneficiaries of smart grid capital expenditures are the stakeholders carrying the cost burdens (e.g. customer class receiving smart meters should pay for their costs). Costs associated with technology that provides utility operational benefits, according to GE Energy, should be spread across all customer service classes. NYPA suggests that local benefits will be hard to measure for transmission projects and recommends that these costs should be socialized. Smart meters and other more directly attributable assets/benefits, according to NYPA, should be carried by the beneficiaries.

Discussion

Smart grid projects should always have a demonstrable benefit and acceptable costs and risks. Given the wide variety of potential technologies, functions and applications that may be incorporated into a smart grid project, there is no one benefit-cost analysis that will be appropriate for all smart grid investments, and the type of project under consideration, along with the degree of novelty and scope involved, will dictate what level of analysis is appropriate. Some investments will involve routine replacements or expansions of existing infrastructure with smarter components, and our analysis of such investments is likely to be performed in a manner similar to our standard review of similar capital expenditures. Projects that entail significant novelty or incremental expenditures, include unproven technologies or wide-scale expansion of existing programs, will require greater analysis.[29]

Projects that are designed to achieve a significant portion of benefits in the form of demand response or other resource savings should include a benefit-cost analysis performed according to the practices and procedures customarily utilized in the economic analysis of energy efficiency programs. This approach is consistent with what we have already required

[29] This is not intended to apply to the types of investments in research and development or pilot demonstration projects that we discussed earlier, whose purposes may include identification of benefits and/or substantiation of benefit-cost estimates.

for smart meter projects in our AMI case.[30] The Smart Grid Information Clearinghouse also has many documents on benefit-cost analysis of AMI and smart grid; this body of information will steadily increase as ARRA projects are deployed, and the process of estimating smart grid’s benefits and costs will continue to evolve as lessons learned from the many ARRA projects are shared.

Generally, utilities should exert their best efforts to assess all the costs and benefits associated with the implementation of smart grid technology. The appropriate costs to be used in a benefit-cost analysis are the incremental costs associated with the investment. Key assumptions, including the assumed baseline, should be clearly documented, as well as any stranded assets that would result from the investment. All incremental benefits should also be identified, including:

- benefits resulting from lower electric bills and better use of the electric infrastructure;
- other quantifiable economic benefits; and
- hard to quantify benefits, such as increased reliability of electric power, environmental benefits, and the safety of grid.

For benefits that are hard to quantify or that rely on uncertain assumptions, benefit-cost analyses must include sensitivity analyses that identify and examine variables that have a wide range of potential values. Utilities should use up to date and appropriate Commission-approved assumptions about wholesale energy and capacity prices, discount rate, and carbon price and other environmental externalities.

[30] Case 09-M-0074, supra.

Some smart grid projects may require other utility investments (e.g., billing system upgrades, customer education programs) in order for the full benefit of the investment to be realized. These costs must be recognized in the benefit-cost analysis. In addition, some projects may require customer investments (e.g., smart appliances). For programs featuring customer participation, benefits and costs should be examined from the participant perspective, to ensure that customers will receive an appropriate incentive to participate.

Many smart grid projects may be scalable. Given the uncertainty concerning returns from newer smart grid technologies, an analysis of the incremental benefits that arise from incremental expenditures would be useful in evaluating the appropriate total level of investment.

Our smart grid benefit-cost policy shall require that benefits and costs are reasonably quantified and generally help ensure that, in the end, those projects with the greatest value are implemented. We recognize that many parties are working to better define the cost and benefits of the smart grid. As a result, the process of estimating smart grid's benefits and costs will continue to evolve. In the interim, utilities should exert their best efforts to assess all the costs and benefits associated with the implementation of smart grid.

Cost Uncertainties/Cost Recovery

Smart grid technologies are undergoing rapid changes in capabilities and costs, which often make it difficult to estimate costs.[31] While some uncertainty in costs of new technologies can be expected, the current economic climate

[31] For example, in Boulder, Colorado, the "Smart City" project sponsored by Xcel energy has nearly tripled in cost, from $15 million to nearly $45 million, since it began.

leaves little room for miscalculation. Reasonable estimates of benefits and costs, and accountability for those estimates, will become increasingly crucial for smart grid projects going forward.

Party Comments

Some of the utilities suggest that cost overruns should generally be subject to the same mechanisms utilized for other utility capital expenditures. These utilities argue that the risks of smart grid cost overruns should be assigned to stakeholders in a manner consistent with any other capital cost overrun.

MI comments that the Commission should adopt an equitable cost allocation methodology firmly rooted in cost of service principles. MI believes if the Commission determines that approval of cost recovery related to the smart grid plans is appropriate at this time, the extent of such cost recovery should be limited to the highest-priority, lowest-cost proposed projects to ensure that immediate, demonstrable benefits are provided to electricity customers.

Verizon points out that change is needed to the current regulatory structure so utilities have the right incentives related to smart grid development, for example decoupling profits from consumption. Galvin suggests that the value of the smart grid should be monitored and tracked in terms of specific performance measures and outcomes. It also recommends that the Commission explore greater use of performance-based ratemaking whereby utility earnings are tied to specific performance outcomes. Galvin believes that utilities will behave more efficiently and innovatively if they can increase earnings by producing performance improvements and cost savings.

Silver Spring Networks recommends that utilities bear operational risks and customers be held accountable for realizing the benefits that result from their own actions. NYISO acknowledges that the utility is in the position of making an investment that will increase the regulated delivery rates, on the promise of reduced energy bills. While the benefits need to be accounted for in policymaking, NYISO argues that any uncertainties in the relative benefits are better left to individual investors and customers whenever it is possible and practical to do so.

Discussion

The statewide costs to establish full implementation of the smart grid, including smart meters, could well total in the billions of dollars, and would be a major undertaking for the State. Extracting the benefits of many smart grid projects further requires engagement from all areas of the utility and a multiplicity of functions and processes, including customer service, billing, outreach, and operations.

For any capital investment project, careful project planning, cost estimation, vendor selection, contracting, and program monitoring can reduce the risk of cost overruns. Over time, costs can be expected to vary from initial estimates due to both changes within the control of management and changes outside management’s control. Costs considered outside management’s direct control might include rates of inflation, cost of capital, interest rates, and commodity prices. Cost factors outside management’s control should be separately identified in project cost estimates so that ex-post evaluation can isolate and consider those changes separately from changes within management’s control.

Careful program monitoring can help ensure that departures from project estimates with respect to schedule or cost are noted early. For projects with uncertain benefits or costs, utilities should periodically evaluate if the projected costs and benefits associated with smart grid investments are being realized. With early warning, utility managers will have greater opportunity to determine when work should halt, when modifications are required, or when the project should be further reviewed. For smart grid projects, cost estimates should be informed, where practicable, by either ARRA results or actual experience achieved through small-scale implementations or pilot projects.

For many projects, however, such information may not provide adequate assurance. The scope, duration, and potential costs and benefits of many smart grid projects, such as smart meters, are not typical of utility capital budgeting. Last year the Maryland Public Service Commission initially rejected the proposal of Baltimore Gas and Electric to install 2 million smart meters, because the proposal asked "ratepayers to take significant financial and technological risks and adapt to categorical changes in rate design, all in exchange for savings that are largely indirect, highly contingent and a long way off."[32] The Maryland Commission ultimately approved an amended proposal, with additional conditions that it said would provide ratepayers "appropriate protection against bearing all of the project's technological and financial risks."[33]

Under typical ratemaking methods, utilities' capital budgeting requests generally consist of numerous individual traditional transmission and distribution projects, which are

[32] Maryland Public Service Commission, Order No. 83410 (June 21, 2010).

[33] Maryland Public Service Commission, Order No. 83531 (August 13, 2010).

reviewed in rate cases. Once an investment is reviewed in a rate case, utilities earn a return on the investment. Generally, utilities are allowed to recover the entire cost of the projects through depreciation and other expense allowances.[34]

This approach has worked well for traditional transmission and distribution projects; however, smart meters and other types of smart grid projects are different in nature from routine capital projects, in that they may pose significantly greater financial risks because expected benefits may not materialize or because cost estimates may be infirm. We recognize that tomorrow's benefits will always be less certain than today's costs, and new technology typically involves some risk. Given the state of the economy and the general upward pressures on rates, we will support smart grid projects where there is a reasonable basis to conclude that they will benefit customers. If a project involves large risks related to costs or benefits, then it may be appropriate in some circumstances for utilities and their ratepayers to share in the risks and the rewards.

Smart grid investments, such as smart meters, that ask ratepayers to take on significant costs or cost risks, or that produce largely indirect, highly uncertain, and mostly off-in-the-future benefits, may require cost recovery methods designed to meet the unique aspects of such investments or innovative rate structures that properly balance the risk and reward

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[34] In the short run (i.e., between rate cases) utilities absorb a small portion of capital project cost overruns (depreciation expenses and return associated with the additional investment).

between ratepayers and shareholders.[35] Consideration of shareholder/ratepayer risk sharing approaches may allow utilities to implement novel smart grid projects that otherwise might not go forward, if the utility is convinced that such projects are the best use of their capital budgets. New approaches could be developed to more equitably allocate risks and benefits between ratepayers and shareholders and ensure that the timing of recoveries is aligned with benefit streams to minimize bill impacts.

Utility rates are set to allow the utility to earn a return on its investment and collect depreciation expense along with related expenses, taxes and other costs. Under typical ratemaking methods, rate recovery of traditional capital projects commences when a project is placed in service. Traditional investments generally start providing benefits immediately upon being placed in service (for example, a transmission line brings additional capacity and supply into a load area the day it is energized), so in general this method reasonably aligns cost recovery with realization of benefits.

Certain smart grid investments may not provide a similar alignment of cost recovery and benefits. Generally, recovery of smart grid costs should be aligned with the time-period for the realization of benefits as closely as possible. If large portions of project benefits are uncertain or cannot be realized until a future date, it may be appropriate to defer cost recovery until the utility has delivered a cost-effective

[35] We are here referring only to general rate structures; issues relating to rate design and revenue allocation will be addressed on a case-by-case basis.

project, as the Maryland Commission did for Baltimore Gas and Electric.[36]

As with benefit-cost analyses, the novelty, scope and particulars of smart grid proposals will dictate the level, if any, of risk and reward sharing that is appropriate. Utilities proposing large scale deployments that involve high levels of uncertain costs or benefits are encouraged to include appropriate sharing of risk and reward between customers and investors as one mechanism for ensuring that potential benefits are balanced against costs.

Particularly in the near term, we would greatly prefer that utilities select smart grid projects that provide a relatively certain return on investment, and to address rate recovery of those investments through traditional means. If a utility is convinced that a given project produces net benefits, and those benefits are highly uncertain out into the future, risk sharing mechanisms can provide an option for utilities that want to proceed with such investments now.

Interoperability Standards

Smart grid implementation depends on numerous software, hardware, and communications applications operating in harmony. Such seamless interoperability depends on a common semantic framework for enabling effective communications at numerous interfaces, from legacy utility systems to customer equipment. We sought the parties' comments on how best to achieve this critical goal.

Party Comments

Utility comments on interoperability were fairly consistent. NYSEG and RG&E commented that interoperability is

[36] Maryland Public Service Commission, Order No. 83531, supra.

important to the performance of the smart grid at every level. National Grid endorses the establishment of common interoperability standards. In addition, National Grid suggests that products claiming interoperability go through a certification process to ensure it. Other commenting parties agreed the smart grid must have robust protocols and standards to ensure interoperability of smart grid devices and systems.

Honeywell believes development of the smart grid should consider interoperability during the design stage and that the system should be modular and scalable with upgradeable software features. In general, parties stated that the smart grid should be based on NIST standards and that implementation can start immediately based on the NIST work to date. According to GE Energy, the minimum set of standards necessary to implement the smart grid already exists. In many areas the individual standards needed to implement the smart grid are mature and relatively stable, and systems can be built upon these now with little risk of obsolescence in the short term. Conversely, GE Energy states that standards for in-home technologies are still developing.

Discussion

The electric grid has a tradition of using many proprietary customized systems, and until now, there has been a limited need for information systems on the utility side of the meter to interact with systems and devices on the customer side of the meter. Implementing the smart grid requires a movement away from proprietary systems to interoperable systems based on open standards.

As outlined in EISA, NIST has been given "primary responsibility to coordinate development of a framework that includes protocols and model standards for information management to achieve interoperability of smart grid devices and systems."[37] The NIST standard-setting process will include three phases. Phase 1 comprised a series of workshops with numerous parties and resulted in an action plan prioritizing the 25 most urgent standards necessary for creation of the smart grid. Phase 2 is ongoing and operates under an organizational structure called the Smart Grid Interoperability Panel (SGIP), which guides the development of the most urgent standards. Phase 3 will address testing and certification procedures.

The key to a successful smart grid will be to ensure a high level of interoperability between present and future devices and systems, however, the development of standards for the smart grid will be an ongoing process spanning many years and may eventually result in hundreds of standards. Existing standards are in varying stages of maturity.

While EISA directs FERC to institute a standards rulemaking proceeding, it did not authorize FERC to mandate compliance, and we conclude that the states are free to act within their jurisdiction on the standards, without specific federal statutory direction or constraint. Few, if any, interoperability standards have been adopted in regulations for infrastructures such as the legacy electric grid, the telecommunications system, or the internet. Generally, deployments of such technologies lead over the course of years or even decades to the emergence of de facto standards. Utilities have legitimate concerns that if smart grid standards are adopted in our regulations, the resulting regulations may not allow enough flexibility in applying the standards (e.g., to accommodate legacy equipment or transitional phases), and this may have unintended cost consequences. Therefore, it is reasonable to defer the consideration of the adoption of smart

[37] 42 USC § 1305 (2007).

grid standards and protocols at least until greater consensus on specific standards is reached. In fact, we note that FERC recently issued an order on smart grid interoperability standards, in which it concluded that there is insufficient consensus for the first set of standards sent to it by NIST. FERC therefore declined to institute a rulemaking proceeding with respect to these standards and terminated its docket. FERC encouraged stakeholders to actively participate in the NIST interoperability framework process to work on the development of interoperability standards and to refer to that process for guidance on smart grid standards.[38]

In the interim, as expressed in the comments received from the utilities and the other industry organizations, utilities can start to develop smart grid plans and projects using the existing industry standards as building blocks. We will look to the standards as a guide in our review of project proposals, and utilities should use them as a reference case of best practices. We will also require utilities making extensive smart grid proposals to show how the utility will minimize the risk of stranded costs, particularly in areas where standards are still evolving.

Cyber Security Standards

As the smart grid is built out, the number of accessible points on the grid that can potentially be breached will rise exponentially. Securing all of the grid's physical and cyber assets from tampering or attack will likely become a tremendous task for utilities.

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[38] Docket No. RM11-2-000, Order on Smart Grid Interoperability Standards (issued July 19, 2011).

Party Comments

All commenting parties agree on the importance of cyber security standards. Verizon states that security should be considered the cornerstone in constructing the smart grid and will minimize future costs if properly included in the design phase. Most parties believe that existing models such as the North American Electric Reliability Corporation’s (NERC’s) Critical Infrastructure Protection (CIP), and NIST standards provide a framework for implementing the smart grid in New York. Some parties believe the design of cyber security should go beyond these standards and reflect the work in other industries where securing information is essential to business success. These parties argue that utilities should take advantage of lessons learned in these industries and be committed to ongoing investments in security oversight, software upgrades, and process improvements.

Discussion

Grid security has always been a utility concern; however, on September 29, 2010, the Stuxnet Worm was reported in an Industrial Control Systems Cyber Emergency Response Team Advisory, and the potential vulnerability of an interconnected grid became a reality.[39] Utilities will need to move rapidly toward systems incorporating best current practices in cyber security.

Smart grid technologies will introduce a multitude of new intelligent components to the electric grid. With more pieces of the grid being interconnected, there is an urgent need to ensure that the utilities have appropriate security measures

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[39] The Stuxnet worm is a malware that targets industrial equipment through its programmable logic controllers and SCADA systems.

in place to ensure that smart grid technologies are not leveraged to commit physical and cyber threats or attacks. The NERC CIP specifications, which to date have been the only formal security specifications for utilities, are currently undergoing revision to address these changes.

The NIST "Guidelines for Smart Grid Cyber Security"[40] consists of three volumes and 537 pages, illustrating the complex and difficult task of establishing smart grid security guidelines. The NIST guidelines have already come under some criticism. In January 2011, the Government Accountability Office (GAO) issued a report finding, among other things, that the guidelines did not address important elements of cyber security and identifying gaps in the federal government’s ability to enforce compliance. The GAO report recommends that NIST update its security guidelines to incorporate missing elements and that FERC develop a coordinated approach to compliance oversight with state regulators.

We must ensure that the utilities have appropriate security measures in place to make certain that smart grid technologies are not leveraged to commit physical and cyber threats or attacks. Designing cyber security into the smart grid will reduce the vulnerability of the electric grid, as well as reduce the likely costs and problems associated with modifying smart grid components to address vulnerabilities. The developing NIST framework will likely address many security issues, and as with interoperability standards, utilities should use it as a reference case of best practices.

The utilities must develop the capability to build and maintain a knowledge base of existing and developing standards to help assure their appropriate implementation. Beyond

[40] NISTIR 7628 (September 2010).

standards compliance, however, utilities will bear the responsibility to ensure that cost-effective protection and preparedness measures are employed to deter, detect, and respond to cyber attacks, and to mitigate and recover from their effects. We will expect utilities making smart grid proposals to address these concerns, even as the security standards are evolving. Utilities making smart grid proposals will need to address security in their filings, demonstrating how their proposed projects will protect the security and integrity of the grid.

Because the smart grid will be built over time, cyber security must also grow over time to address threats and vulnerabilities in the short term as well as the longer term. As technology and threats to it evolve, security requirements will need to be revisited, perhaps frequently.

Customer Data Privacy/Access

The combination of technologies that will be employed in the smart grid, including smart meters, will generate an immense amount of data that utilities must be prepared to manage. Over time, data will originate from an increasing number of points along the entire electric grid. A comprehensive smart grid policy must allow for beneficial uses of smart grid data while addressing how that data will be collected, used, shared and protected. Moreover, because that data will have significant value to many, it is paramount that it be managed and utilized in a way that returns that value to customers.

Party Comments

A number of parties noted existing utility privacy policies and stated that these policies could expand as smart grid technologies develop. Some parties referenced examples of existing and well-established Fair Information Practice Principles (FIPPs) that could be adapted for use with the smart grid. NYSEG and RG&E believe energy consumption data should be treated in a manner consistent with past New York data practices -– the utility is responsible for keeping customer data confidential, but is also required to release the data to third parties upon customer request and approval.

Con Edison and Orange & Rockland also believe that usage information should be available to the customer and customer-authorized third parties. They also note that privacy standards are being developed by NIST. Con Edison and Orange & Rockland recommend that privacy issues be addressed in a manner that balances customers' need for privacy with the utilities' obligation to serve.

Verizon recommends that while the customer's utility should have full access to real-time energy use data and be able to disclose it as needed for operational purposes, customers should be able to control the circumstances in which utilities share the data for other reasons. Verizon contends that strong safeguards are necessary to help ensure that individuals' energy consumption and usage patterns are not obtained by inappropriate parties.

Several commenting parties believe that customers own their detailed consumption data and should therefore control it and be provided with direct access to it. Parties also believe that utilities should not use customer data for their own purposes or share customer specific data but that it could be used for research and development. Galvin encourages the Commission to consider providing general load profiles for use by market participants.

AT&T also believes that the customer holds an ownership interest in his usage data. The customer should have the option to grant data access to an application provider of his choice, without the involvement of the utility. The utility would retain the right to use customer information for business purposes such as billing, load management, and outage detection.

CEA contends the first step in making smart grid a successful customer experience is to make clear that customers own their energy consumption data, and customers should control access and use of this data. It contends that customers should have access to all information regarding their energy consumption and pricing, including real time usage information and rates, historical usage, and generation source. The association argues that the customer, not the utility, should control third-party access and distribution of energy consumption information.

According to DCP, privacy must play a central role in smart grid deployment and utilities need to ensure that customer data is safeguarded against human error, identity thieves, and hackers. Most parties agree with privacy protections for energy consumption information if it relates to personally identifiable information. Some parties support efforts to adopt nationally accepted privacy policies. CEA is concerned that the creation of multiple, state-specific privacy rules could hinder innovation and deployment.

Most parties support open access to the HAN market. Con Edison and Orange & Rockland, however, point out if utilities are to rely on HAN-produced data, the utilities should be involved in standards development and device testing. Central Hudson stated that its expertise does not lie beyond the meter and recommends that other third-party entities are better suited to provide these services. Intel suggests a home energy management system that sits behind a secure firewall. In this secure location, all the detailed information of the customer’s load specific energy use can, at the customer's discretion, be kept secure inside the system. The system would still be capable of receiving and acting upon data transmitted to it by the smart meter. At the same time, the customer's aggregate energy use data could still be transmitted back to the utility, thus meeting demand response goals of the utility.

Discussion

As smart grid technology is deployed, particularly smart meters, HANs, and other smart grid technologies beyond the meter, personally identifiable information -- generally defined as information that is capable of directly identifying an individual -- will increasingly become available to utilities and other entities. More detailed usage data has the potential to reveal details of home life and household activities that are traditionally protected from observation. The collection and management of such data raises important new privacy issues. The smart grid will face relatively greater customer resistance if these privacy concerns are not dealt with effectively.

A DOE report entitled "Data Access and Privacy Issues Related to Smart Grid Technologies," issued in October 2010, cautions that "because such data can also disclose fairly detailed information about the behavior and activities of a particular household," controls need to be implemented for ensuring the data is collected, used and shared in line with customers' privacy expectations.[41] According to the DOE report, studies conducted by utilities and consumer advocates have consistently shown that privacy issues are extremely important to utility customers. The DOE report also states that consumer

[41] Available at http://www.gc.energy.gov/documents/Broadband_Report_Data_Privacy_10_5.pdf

acceptance of the smart grid "depends upon the development of legal and regulatory regimes that respect consumer privacy, [and] promote consumer access to and choice regarding third-party use of their energy data."

The NIST Guidelines discussed above include an assessment of the impact on privacy that smart grid technology may have. NIST recommends that a privacy impact assessment should be conducted before deploying smart grid technologies and updated for all major changes in order to identify privacy risks. The report further recommends that formal privacy policies should be developed and documented.

Many parties also reference examples of existing and well-established FIPPs that could be adapted for use with customer energy usage data. FIPPs describe the manner in which entities should collect, use, and safeguard personal information to assure their practice is fair and provides adequate information privacy protection. Several versions of FIPPs have been developed through federal agencies, e.g., the Federal Trade Commission and Department of Homeland Security, professional associations, e.g., the American Institute of Certified Public Accountants, and international organizations, e.g., the Organization for Economic Cooperation and Development. These principles contain consistent and often complementary provisions.

A number of parties noted the existence of utility policies in New York for authorized access to and the privacy protection of customer information and stated that these policies could expand as smart grid technologies develop. For example, the Uniform Business Practices establish practices for authorizing the release of customer information by utilities to

ESCOs.[42] The practices require informed customer authorization prior to utility release of customer information to ESCOs. The practices also require that ESCOs inform customers of the information that will be obtained, to whom it will be given, how long it will be used, and how long authorization is valid.

In order to facilitate a competitive market for metering services, in 1999 the Commission established classifications for competitive Meter Service Providers (MSPs) and Meter Data Service Providers (MDSPs).[43] While MSPs are limited to provision of physical metering services (e.g., installation, maintenance and repair of meters), eligible MDSPs are able to perform meter reading; meter data translation; and customer association, validating, estimating and editing functions for an ESCO or utility. Although the competitive markets for MSP and MDSP services failed to flourish, many MDSPs are active in the implementation of NYISO demand response programs.

The Commission's recent order on behavioral modification energy efficiency programs administered by OPOWER also addressed customer data access and privacy concerns.[44] In that case, we authorized the OPOWER behavioral programs because the program design calls on OPOWER to perform a ratepayer funded utility function – inducing customers to use less energy by providing them with specific information about their energy

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[42] Case 98-M-1343, In the Matter of Retail Access Business Rules, Order Implementing Chapter 416 Of The Laws Of 2010 (issued December 17, 2010).

[43] Case 94-E-0952, Competitive Opportunities, Order Providing for Competitive Metering (issued June 16, 1999).

[44] Cases 07-M-0548, et al., Energy Efficiency Portfolio Standard, Order On Rehearing Granting Petition For Rehearing (issued December 3, 2010).

usage and how it compares to that of other similarly situated customers. In addition, the affected utilities were able to demonstrate a need to provide OPOWER access to the customer information in order to perform the utility function, and we had an opportunity to review the contract between the utility and the OPOWER and concluded that it offered sufficient privacy safeguards.

These cases provide a foundation for our consideration of data access and privacy principles regarding the smart grid. They are, however, limited in their applicability to the entities specifically identified, i.e., ESCOs, MDSPs or agents of the utility. The smart grid may open the door to other third parties offering a variety of energy products and services, including demand aggregation, and sophisticated energy management and device control provided through smart phones or web portals. In addition to demand aggregators and telephone and internet companies, smart appliances may bring appliance manufacturers into this arena, and electric vehicles may bring vehicle manufacturers and owners of charging stations. This would necessitate extending the principles embedded within the rules more generally over third party providers, including classes of providers that may not even exist today. In doing so, we would need to consider specific detailed protocols to facilitate third party access for various new technologies consistent with the need to maintain and ensure privacy protections.

Our customer data principles apply to the utility's provision of customer energy usage data to a third party on behalf of the customer. The rules constrain the utility's ability to share customer data with third parties absent customer authorization. Customers, however, are free to furnish their usage data to anyone they see fit, and to establish whatever terms and conditions on the provision of such data they deem appropriate. These principles apply to any use of customer energy usage data obtained from the utility, regardless of whether such data is sufficiently detailed to be classified as personally identifiable information.

With respect to third-party access to customer data held by the utility, our principles make such data available in a timely manner to third parties who are authorized by the customer to receive it, and utilities are compensated for the utility's costs of providing such access. We concur with DOE that authorization for such access must be given affirmatively, through an opt-in process that reflects and records the customer's informed consent. Such authorization must specify the purposes for which the third party is authorized to use the data, define the term during which the authorization will remain valid, and identify a means through which a customer can withdraw his/her authorizations.

Many FIPPs are designed to apply to entities using automated data systems and networks, and the Department of Homeland Security version pertains specifically to, and therefore is relevant for, personally identifiable information. It consists of several core principles pertaining to third party collection and use of customer data[45] that we fully support:

- Data policies and practices must be clear, transparent, and explained to customers.
- No customer data should be collected without the express consent of the customer.
- Only data relevant to the specific purpose should be collected.

[45] Utilities would continue to have full access to customer data for system planning purposes and other operational needs.

- Data acquired for one purpose should not to be used for others.
- All reasonable steps should be taken to prevent the loss, theft, or unauthorized modification of customer data.
- Customers should have the right to access, confirm, and demand correction of their personal data.
- All third-party entities handling customer data should be held responsible for complying with the same privacy principles.

We note that privacy concerns are greatly exacerbated by the implementation of smart meters and the collection of granular usage data that can function as personally identifiable information. Although the principles articulated above will generally apply to all customer data, as the data becomes more detailed and powerful, more detailed and specific procedures and safeguards may be needed to ensure appropriate privacy protections. Due to the early implementation of smart meters in other jurisdictions, many entities have already begun developing model business practices for the collection, use and disclosure of smart meter-based information, e.g., the National Energy Standards Board (NAESB). We will likely revisit this issue, perhaps conducting the privacy impact assessments recommended by NIST, as the proper management of smart meter and other granular customer data become more relevant, and may conduct further process to clarify our privacy policies respecting the smart grid before further deploying smart grid technologies that impact the collection and use of customer energy usage data.

One such issue that may need further development is whether electric customers in New York should be allowed to “opt-out” of a smart meter installation, as customers of Central Maine Power can, and customers of Pacific Gas & Electric may be able to do. Customers are likely to have very different expectations of privacy or tolerance for the gathering of more granular personally identifiable information. The proper balance between respecting reasonable expectations of privacy and facilitating operational efficiency will need to be established.

We recognize that privacy is a major issue across the nation, as well as for the customers in New York. Our long-term policy regarding privacy is that utilities and third-party providers must take great care to protect customer privacy when proposing projects that involve the collection and use of granular customer data. As different technologies and uses for the data they produce become apparent, we expect to work cooperatively with all interested parties to further develop detailed privacy procedures and controls.

CONCLUSION

In 2003, the National Academy of Engineering named the electric system the greatest engineering achievement of the 20th century. To meet our energy, environmental, and security needs for the 21st century, we must continue efforts to upgrade the electric grid. Given the reality of an aging grid, and the continuing need to invest in new infrastructure, there is an opportunity to upgrade the grid’s efficiency and effectiveness through investments in smart grid technology.

In adopting this policy, we recognize the smart grid’s potential to revolutionize the electric grid. We support the utilities’ implementation of smart grid technology because it can offer benefits to customers and society. We further consider the smart grid an essential element of New York’s future energy independence, job growth, and economic leadership.

With diverse needs, resources and legacy systems, the course and pace of smart grid deployment efforts will vary among utilities, and it is unlikely that a single solution will emerge as appropriate, cost-effective, and useful for all electric utilities and their customers. We further expect that building the smart grid is a process that will unfold over years and even decades. We therefore have not prescribed a particular end-state or deployment schedule for moving this effort forward. Rather, we have provided a policy framework to enable utilities to avail themselves of the opportunities available in this area, and to address the challenges that will emerge during the transition to a smart grid.

We believe the policy guidelines we have set forth here can advance New York’s leadership in the 21st century clean energy economy. While these policy guidelines represent important steps in this direction, we also recognize that there is still much to be done.

As the electric system undergoes this profound transformation, all parties, including the Commission, must utilize creativity and collaboration in order to allow this cultural and technological shift to occur more effectively and in a way that is more responsive to customer needs. We will continue to engage and collaborate with the utilities, other states, consumer advocates, and other stakeholders to ensure that the grid meets customer needs, operates with improved efficiency, security, and reliability, and sustains the growth of New York’s clean energy economy into the future. All stakeholders, particularly utilities, are strongly encouraged to be innovative and forward-thinking as we take the first steps toward establishing such a foundation for building the smart grid in New York.

By the Commission

Jaclyn A. Brilling
Digitally Signed by Secretary
New York Public Service Commission
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Secretary