

**MASSACHUSETTS' SMART GRID PILOT PROGRAM:
REAL-TIME ENERGY CONSUMPTION AND BEHAVIORAL
MODIFICATION**

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Most Americans are aware that they should decrease their energy consumption, but motivating individual households to modify their behavior can be challenging. Advancing Smart Grid technology may provide the key to long-term conservation and energy efficiency. Advancing Smart Grid refers to automated, consumer-interactive programs that enable ratepayers to choose their pattern of energy consumption by matching real-time electrical usage with associated costs.

On March 31, 2009, NSTAR, the largest Massachusetts-based, investor-owned electric and gas utility, launched an innovative Smart Grid Pilot Program (the “Pilot”).¹ Mandated by Section 85 of Chapter 169 of the Acts of 2008 (“Green Communities Act”), the Pilot promotes energy-conscious behavior by enabling two-way communications between a customer’s meter and NSTAR, providing real-time measurement and communication of energy consumption and pricing.² The goals of the Pilot are to reduce energy consumption overall, in addition to energy consumed during critical peak periods by a minimum of five percent.³ Reducing peak-period consumption will improve the reliability of the electrical grid and diminish the need to build additional power plants, which continue to degrade the environment.⁴

According to a report for the United States Department of Energy, “if the grid were just five percent more efficient, the energy savings would equate to permanently eliminating the fuel and greenhouse gas emissions from 53 million cars.”⁵ Although the nation’s electricity system is reliable, power outages cost Americans over \$150 billion each year, which equates to

¹ NSTAR, *NSTAR Unveils Innovative Smart Grid Program*, http://www.nstaronline.com/ss3/nstar_news/press_releases/2009/smart_grid.asp (March 31, 2009).

² Proposal Filing (March 31, 2009), p1, D.P.U. 09-31 NSTAR *Smart Grid Pilot Program*.

³ Direct Testimony of Peter Barsamian (March 31, 2009), D.P.U. 09-33: 4, *Exhibit NSTAR PAB*.

⁴ *Id.*

⁵ Sponsored by the United States Dept. of Energy, *The Smart Grid: An Introduction*, p11, [http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages\(1\).pdf](http://www.oe.energy.gov/DocumentsandMedia/DOE_SG_Book_Single_Pages(1).pdf) (April 1, 2009).

approximately \$500 for every person.⁶ In 2000, the average cost for the one-hour power interruption that hit the Chicago Board of Trade resulted in \$20 trillion in trade delays.⁷ The 2003 Northeast blackout cost the region an estimated \$6 billion in economic loss.⁸ Blackouts affecting Sun Microsystems, a software and systems provider, costs the company \$1 million every minute.⁹ In addition to the economic savings that Smart Grid technology may provide, the United States Environmental Protection Agency estimates that

Electric generation power plants produce: 67% of all emissions of sulfur dioxide, the leading component of acid rain and fine particulates; 40% of all man-made emissions of carbon dioxide, the leading greenhouse gas that contributes to global warming; 23% of nitrogen oxides, a key component of ground-level ozone (smog), acid rain, and fine particulates; and 40% of all emission of man-made mercury, a toxic heavy metal that is concentrated through the food chain.¹⁰

In an effort to combat the negative economic and environmental effects associated with an unreliable and overtaxed electrical grids, Massachusetts created components of a comprehensive energy reform bill known as the Green Communities Act (the “Act”) to address these concerns.¹¹ Massachusetts Governor Deval Patrick signed the Act into law on July 2, 2008.¹² The Act encourages energy conservation through reducing energy costs, fostering the development of renewable energy, and stimulating clean energy technology throughout Massachusetts.¹³

Section 116 of the Act establishes a goal to “meet at least 25 percent of the [C]ommonwealth’s electric load, including both capacity and energy, by the year 2020 with

⁶ *Id.* at 9.

⁷ *Id.* at 8.

⁸ *Id.*

⁹ *Id.*

¹⁰ Declaration of David B. Goldstein, 2006 WL 4980746 (S.D.N.Y.).

¹¹ MASS GEN LAWS, Ch. 169 §§ 1-124 (2008); see Governor Deval Patrick, *Governor Patrick Signs Energy Bill Promoting Cost Savings, Renewable and Clean Energy Technology*, http://www.mass.gov/?pageID=gov3pressrelease&L=1&L0=Home&sid=Agov3&b=pressrelease&f=080702_bill_energyclean&csid=Agov3 (July 2, 2008).

¹² *Id.*

¹³ *Id.*

demand side resources including: energy efficiency, load management, demand response and generation that is located behind a customer's meter . . .”¹⁴ In an effort to meet this goal, the proponents of the Act argue that customers must be able to see the actual cost of electricity resulting from their chosen pattern of consumption.¹⁵

Section 85 of the Act, requires each electric distribution company in Massachusetts to file a proposed plan establishing a Smart Grid Pilot Program with the Department of Public Utilities (the “Department”).¹⁶ NSTAR filed with the Department on March 31, 2009.¹⁷ Delivering electricity to approximately 1.1 million customers in Eastern and Central Massachusetts, NSTAR will enroll 3,000 customers in the Pilot, which represents 0.25% of NSTAR’s total customer population, as required by Section 85 of the Act.¹⁸ Additionally, to comply with the Act, the specific objection of the Pilot shall be to reduce the peak and average loads of Pilot participants by five percent.¹⁹ To reduce energy consumption for average and critical peak periods, Smart Grid technology extends communication capabilities to customers, alerting them of peak load demands, giving the customer the ability to monitor or remotely control their energy usage, and the opportunity to modify their consumption based on real-time information and pricing incentives.²⁰

In compliance with the statutory requirements set forth in Section 85 of the Act, the Pilot utilizes “advanced technology, by employing Home Area Network (“HAN”) which operates by

¹⁴ Commonwealth of Massachusetts. *Chapter 169 of the Acts of 2008: An Act Relative to Green Communities*. Boston: July 2008 (Mass-1).

¹⁵ Mass. H. 4365, *Green Communities Act*, Nov. 15, 2007; see Direct Testimony of Henry C. LaMontagne (March 31, 2009), D.P.U. 09-33: 3, *Exhibit NSTAR HCL*.

¹⁶ Commonwealth of Massachusetts. *Chapter 169 of the Acts of 2008: An Act Relative to Green Communities*. Boston: July 2008 (Mass-1).

¹⁷ Proposal Filing (March 31, 2009), p1, D.P.U. 09-31 NSTAR *Smart Grid Pilot Program*.

¹⁸ Direct Testimony of Lawrence J. Gelbien (March 31, 2009), D.P.U. 09-33: 5, *Exhibit NSTAR LJG*.

¹⁹ Commonwealth of Massachusetts. *Chapter 169 of the Acts of 2008: An Act Relative to Green Communities*. Boston: July 2008 (Mass-1).

²⁰ *Supra* note 18, at 14.

connecting to the customer's Broadband Internet and existing Automated Meter Reading ("AMR") meter via an internet Gateway/Electronic Receiver Transmitter ("ERT") bridge.²¹ As of 2007, Massachusetts was among the top five states in broadband penetration, with more than 90% of households having broadband service.²² In developing the Pilot, NSTAR sought to employ the existing broadband technology and AMR.²³ Having invested \$26 million since 2003 in the installation and modernization of AMR meters to residential and commercial customers throughout their service territory, NSTAR hopes to, "strike a balance between building on existing investments and testing newer technologies and platforms, while providing the customer an array of tools for monitoring, controlling and curtailing energy consumption in real time via a variety of applications."²⁴

The Pilot's two-way communication between ratepayer and NSTAR, updates every 15 seconds and will "provide real-time consumption and cost information, accommodate time-differential rates, and enable automated load control to reduce customer loads during periods of high system demand."²⁵ Customers will be able to access household energy cost per hour, household energy usage, the last hour consumption rate, billing period consumption, and current bill to date.²⁶ The equipment available to the Pilot participants will vary based upon system requirements, but may include communications through the "Gateway/meter interface", in-home energy displays, programmable communicating ("smart") thermostats or load control devices, and customer web portals via personal computer.²⁷

²¹ *Supra* note 18, at 4.

²² Massachusetts Institute of Technology, *Measurement and Assessment of Broadband Availability*, January 2009, pp 45,48.

²³ *Supra* note 18, at 10.

²⁴ Proposal Filing (March 31, 2009), p1, D.P.U. 09-31 NSTAR *Smart Grid Pilot Program*. ; *Supra* note 18, at 10 and 17.

²⁵ *Supra* note 18, at 4.

²⁶ *Supra* note 18, at 15.

²⁷ *Supra* note 18, at 12.

One of the many benefits of the in-home energy display is the audible alarm triggered by peak energy periods and pricing.²⁸ Customers with the smart thermostats, have the ability to program temperatures to meet household needs and reflect personal energy preferences.²⁹ The Internet communications enable remote temperature and use programming to account for times when the house is unoccupied.³⁰

As required by Section 85 of the Act, the Pilot's proposed technology platform enables NSTAR to offer time-of-use ("TOU") rates and automated load management, which are expected to reduce the peak and average load for Pilot participants by shifting energy consumption away from critical peak periods.³¹ TOU rates alert the customer of an energy cost increase due to a peak period via home energy display or web portal.³² The customer is provided the option of reducing their energy consumption during a critical peak in exchange for a rebate on their next energy bill.³³ Peak periods will be prevalent during the summer months from noon until 5:00 p.m. when energy consumption is at its peak due to the use of air conditioning.³⁴ The automated load management allows NSTAR to automatically reduce energy consumption during peak hours to substantially lower the participant's electric bill and provide stability to the grid.³⁵ Both TOU rates and automated load management are designed to motivate the participants to reduce their energy consumption during peak and average loads.³⁶

NSTAR predicts that if the Department approved the Pilot, a cost savings of approximately 50% to 65% would result from the widespread implementation of the Pilot

²⁸ *Supra* note 18, at 16.

²⁹ Direct Testimony of Peter Barsamian (March 31, 2009), D.P.U. 09-33: 4, *Exhibit NSTAR PAB*.

³⁰ *Id.*

³¹ Direct Testimony of Henry C. LaMontagne (March 31, 2009), D.P.U. 09-33: 4, *Exhibit NSTAR HCL*.

³² *Id.*

³³ *Id.*

³⁴ Direct Testimony of Lawrence J. Gelbien (March 31, 2009), D.P.U. 09-33: 5, *Exhibit NSTAR LJG*.

³⁵ *Supra* note 31, at 4.

³⁶ *Id.*

technology.³⁷ Section 85 provides that the Department will review the Pilot before August 1, 2010 and report to the legislature by September 2012.³⁸ However, NSTAR has requested a two-year trial period from 2010-2012 to allow the Pilot to cover two different summer periods of peak usage.³⁹ NSTAR has requested that the Department approve the Pilot by August 31, 2009 to begin rolling out the Pilot in 2010.⁴⁰

If approved, NSTAR may seek funding from the recently enacted American Recovery and Reinvestment Act of 2009 (the “Stimulus Act”), which includes possible funds for Smart Grid investments.⁴¹ Because the Pilot is designed to incorporate existing Distribution Automation systems such as AMR and relatively inexpensive Gateway devices, it is more cost effective than other platforms in the nation.

Despite the enthusiasm for Smart Grid technology, there are those who are skeptical regarding the intrusion into their private lives.⁴² Mark Farber, co-founder of Evergreen Solar, suggested that, “It turns out customers don’t actually want utilities to turn off their appliances,” when referring to Automated Load Control features.⁴³ However, some suggest that if the “Big Brother” effect is the most inconvenient factor to reduced energy bills, energy conservation for the benefit of the environment and more a stable grid, then perhaps it is worth the intrusion.⁴⁴

³⁷ Proposal Filing (March 31, 2009), p1, D.P.U. 09-31 NSTAR *Smart Grid Pilot Program*.

³⁸ Commonwealth of Massachusetts. *Chapter 169 of the Acts of 2008: An Act Relative to Green Communities*. Boston: July 2008 (Mass-1).

³⁹ *Supra* note 37.

⁴⁰ NSTAR, *NSTAR Unveils Innovative Smart Grid Program*, http://www.nstaronline.com/ss3/nstar_news/press_releases/2009/smart_grid.asp (March 31, 2009).

⁴¹ *Supra* note 18, at 21.

⁴² Josie Garthwaite, *The Smart Grid’s Next Step: Winning Over Consumers*, Business Week, http://www.businessweek.com/technology/content/apr2009/tc20090419_713545.htm?campaign_id=rss_daily (April 19, 2009).

⁴³ *Id.*

⁴⁴ *Id.*

In looking at other energy conservation techniques, Massachusetts's utilities provide many options for consumers to conserve and reduce energy costs in addition to Smart Grid.⁴⁵ For example, rebates, incentives, and loans associated with Energy Star Programs and MassSAVE, are a few of the available low-hanging fruits available to Massachusetts's residence who are aware of and choose to take advantage of these benefits.⁴⁶ However, Smart Grid technology provides a great deal of information and control to many customers at a real-time rate.⁴⁷ Each ratepayer may be alerted via home display or web portal regarding their current energy consumption, which allows the utility to influence customers to take advantage of energy saving incentives and empowers customers to choose to modify their electrical use patterns during critical peak hours, saving money and conserving energy.⁴⁸

Smart Grid technology provides a wide range of behavioral modification techniques which may be explored in the future, such as comparing the energy consumption of like households and using the communication platform as a method of promoting competition or "Keeping up with the Joneses."⁴⁹ The use of text messaging, emails, and communication via PDA will provide immediate responses to customers away from home who will then have the ability to adjust their energy consumption remotely. Additionally, the use of the aforementioned tools may allow for a real-time report card on energy consumption represented by red or green cues or something as simple as a smiley face or a frowny face.

Using behavioral modification in conjunction with Smart Grid technology may, in fact, provide the key to long-term conservation and energy efficiency through interactive programs

⁴⁵ NSTAR, *Electric Energy Efficient Programs*, http://www.nstaronline.com/residential/energy_efficiency/electric_programs/ (April 18, 2009).

⁴⁶ *Id.*

⁴⁷ Green Matters, *Smart Grid Infrastructures*, <http://greenmatters.csgeast.org/smart-grid/> (May, 2008).

⁴⁸ Direct Testimony of Peter Barsamian (March 31, 2009), D.P.U. 09-33: 4, *Exhibit NSTAR PAB*.

⁴⁹ Leslie Kaufman, *Utilities Turn Their Customers Green, with Envy*, *The New York Times*, January 31, 2009.

that alert customers to their energy consumption. If a person is not motivated by environmentalism, perhaps the matching of energy consumption and real-time electrical usage with the comparable pricing will entice people to reduce their energy consumption.