Integrating Public Health and Environmental Protection into Demand Response Programs

Anna Garcia, Tracey Bailer, Miles Keogh and Brian Castelli
Center for Energy and Climate Solutions

ABSTRACT

Electric system reliability has taken center stage recently due to high levels of electricity supply uncertainty, with power interruptions, brownouts, and requests for voluntary curtailment more prevalent. Reliability concerns and electricity prices have led to the development of several demand response programs, particularly in the Northeast, Mid-Atlantic and California.

These programs have realized some success in reducing peak electricity load and providing reliability; however, most of them have lacked much needed policies to reduce public health effects and environmental impacts from the proliferation of high-emitting back-up generation. Future demand response programs must incorporate a public health/environmental component into program designs in an attempt to encourage energy efficiency and reliability consistent with air quality goals.

A more comprehensive version of this paper was prepared for the Ozone Transport Commission (OTC), the National Association of State Energy Officials, (NASEO) and the National Association of Regulatory Utility Commissioners (NARUC). It lays the groundwork for investigating and developing a more environmentally-friendly design for demand response programs. It reviews recent demand response programs in the northeastern states and California that incorporated different kinds of load and demand strategies to enhance reliability, yet have not focused on environmental impacts. It further proposes to create a new demand response model through a state pilot project to develop an environmentally-friendly program that emphasizes energy efficiency and innovative, clean distributed generation that will benefit the electricity provider and consumer in today's markets, and can be replicated in states inside and outside of the northeast region.

Introduction

Demand response can be defined as what a consumer does or how a consumer responds with respect to electricity load, or the power-providing requirements of an energy producing system. It also applies to the energy consumption or electrical requirements of a piece or group of equipment. Load is similar to demand, but while demand describes how much electricity the consumers "ask for," load is seen from the suppliers' side as how much power is "sent to" consumers.

In recent years, it has become more evident that electricity demand is growing at a faster rate than the current capacity is able to handle. As consumers and businesses intensify their use of air conditioners in response to high summer temperatures and increase their use of electrical devices in homes and offices, electricity loads climb and the power grid becomes increasingly stressed. For example, the North American Electric Reliability Council (comprised of most of the power generating and distribution companies in the United States) predicts that peak demand will grow an average of 1.8% annually over the next 9 years. A March 2000 reliability study on the Northwest power system predicts that the probability of a power generation shortfall will reach approximately 24% by 2003 (Nadel et.al., 2000). Demand response programs allow consumers to respond to electricity prices directly, offering mechanisms to help manage the electricity load in times of peak electricity demand in order to increase reliability and relieve grid congestion. This has the added benefit of providing increased market efficiency and more efficient transmission and distribution. Significant consumer benefits also accrue from demand response programs, chiefly in the form of cost savings due to lower peak electricity prices, less opportunity for market manipulation by electricity providers, and additional financial incentives to induce their participation in these programs (Johnston, 2001). To achieve this consumers must be provided with the opportunity as well as the necessary tools and information to choose when and how to curtail power consumption.

Certain types of demand response mechanisms, including energy efficiency and clean distributed generation technologies, can help to reduce air pollutant emissions, leading to improvements in public health and air quality. Other types of mechanisms can increase air pollutant loadings and exacerbate poor air quality and its associated health problems. The benefit of reduced emissions from central generation resulting from some demand response mechanisms can potentially be more than offset by the increase in air pollution coming from high-emitting distributed or on-site generation used as alternative peak power sources. All these factors must be taken into consideration when designing demand response programs. The goal is to provide greater power and system reliability while simultaneously mitigating detrimental environmental and public health impacts.

Elements of Typical Demand Response Programs

Two key elements comprise a typical demand response program: (1) the set of mechanisms that are being made available to consumers to modify power usage; and (2) the incentives and tools that motivate consumers to participate in the program.

Mechanisms for modifying power usage give electricity consumers the ability to respond to outside indicators by changing their grid electricity usage and providing them with the knowledge and necessary tools for why and how this can be done. The outside indicators that influence electricity consumers are economic impacts, including bills, prices, payments and shared savings, and power system conditions, such as reliability (Johnston, 2001). Demand response mechanisms that utilize these indicators and modify power usage include load management, demand management and distributed/on-site generation.

Load management mechanisms include price signals, curtailment, demand-side and day-ahead bidding, emergency measures (e.g., switching to back up generators), and load shifting (e.g., changing consumption to non-peak hours). *Demand management* includes options such as energy efficiency and conservation, which encourage overall reductions in electricity consumption during base and peak periods of load generation. In 1997, the U.S. Department of Energy's (DOE) five National Energy Laboratories concluded that cost-effective energy efficiency investments could displace 15 percent of the nation's total electrical demand by 2010 (Cowart, 2001). *Distributed/on-site generation* include technologies that can serve as alternatives to central station power, including not only back up generators and internal combustion engines, but also renewable energy technologies, fuel cells, microturbines and biomass technologies. They also include combined heat and power applications, which generate thermal and electrical energy in a single system that can deliver energy at efficiencies of 70 percent or greater.

Incentives and tools for persuading consumers to adopt demand response mechanisms for modifying power usage are critical to achieving a more reliable power supply. They include financial incentive programs/tools, federal and state programs, communication tools, and technology tools. *Financial incentives* include real time pricing, explicit bonuses or rebates, tax incentives, buy-back programs, and low-cost financing for energy efficiency or clean power technology investments. *Federal and state programs* such as Energy Star, Rebuild America, the New York State Energy Research and Development Authority's (NYSERDA) air conditioner buy-back program, state energy codes and smart growth policies encourage base and peak load shaving by promoting greater adoption of cleaner and more efficient technologies and best practices. *Communication tools* include educational programs and information/marketing campaigns that explain what demand response is and how consumers can participate, and software tools and devices that communicate information to consumers throughout the day to actively engage them in reducing demand. *Technology tools* provide for the use of automatic controls to assist consumers in managing electrical usage, including load curtailment software and metering technology as two examples.

Building Public Health and Environment into Demand Response

While demand response programs can help to provide a more stable and reliable power supply, some technologies deployed in these programs can have serious adverse impacts on public health and the environment. Load response mechanisms, such as curtailment, that reduce demand on central station generation without the use of back-up generation do not increase air pollutant emissions that cause health and environmental problems. Demand response mechanisms, such as energy efficiency and conservation, and many forms of on-site, renewable energy, such as solar and wind power, have positive public health and environmental benefits because they have no air pollutant emissions associated with them. The more of the nation's power needs that are met by energy efficiency and clean, renewable energy technologies, the greater the benefits to the public.

The Environmental Implications of Demand Response

Certain types of on-site generation that may be used to supplement or substitute for central generation can increase air pollution, including nitrogen oxides (NOx), ground-level ozone, sulfur dioxides (SO_2), particulate matter (PM), carbon monoxide (CO), carbon dioxide (CO_2), and other air toxics. These pollutants can cause serious respiratory and pulmonary health ailments, including premature mortality, as well as ecosystem and agricultural damage due to acid deposition, high ozone levels, visibility impairment and climate change (EPA, 2001). Polluting on-site generation technologies include uncontrolled diesel generators, microturbines, and some forms of biomass. Even some natural gas-fueled generation technologies can produce emissions (Greene and Hammerschlag, 2000).

Emissions from small, on-site sources are of great concern because they are, in large part, currently unregulated, often occur in densely populated areas, have low stacks, and have short distances to property lines. Their use often coincides with air pollution episodes, thus adding to the environmental burden at the most sensitive times. Non-utility generators smaller than 1 MW in size are not generally covered by federal emissions regulations, except perhaps for the most polluting small generators located in areas with the most severe air quality problems. Some states have adopted stricter regulations for small generators, including California, New York and Texas. The coverage is not consistent from one state to another, and some sources are not covered due to size or indication that, in the past, emissions from this category were not sufficient to warrant specific regulation (Greene and Hammerschlag, 2001). Reliability induced curtailments due to lack of generation, mostly occurring in the summer months, unfortunately tend to occur at the time of maximum ozone related problems. The use of less clean distributed generation during these periods exacerbates the problem.

Without regulations or restrictions on the uses of these sources in demand response programs, their increased use to provide alternative and reliable power will significantly increase air pollutant emissions, and result in serious public health, environmental, and economic impacts. The Regulatory Assistance Project (RAP) has recently developed a draft model rule for the output of specified air emissions from smaller-scale electric generation resources. The purpose of the rule is to regulate the emissions of certain air pollutants from smaller-scale electric generating units and reduce the regulatory and administrative requirements for siting units that are affected by this rule (RAP, 2001). In 2001, the Ozone Transport Commission developed a distributed generation model rule suggesting limits that states can use within the context of their permitting programs (OTC, 2001).

Integrating Public Health and Environment into Demand Response

A number of significant public health and environmental impacts are associated with some of the technologies currently used in demand response programs. However, with awareness and planning, it is possible to avoid or mitigate these impacts. The key is to design a demand response program with an appropriate mix of load management, demand management and load shifting/on-site generation strategies and technologies that are targeted to reduce the most polluting components of the peak power curve. These need to be accompanied by the right types of incentives and tools to encourage participation and achieve success. An environmentally-friendly demand response program integrates public health and environmental considerations up front, and allows states or regions to realize significant public health, environmental and societal benefits.

In deploying any of these strategies, focusing on displacing peak power loads with little additional generation or clean generation will yield greater benefits, not only for power and system reliability, but also for the public health, the environment and society. A goal is to reduce peak load as well as ensure that emissions do not get displaced to another time.

Examples of Demand Response Programs and Environmental Impacts

Before examining how to develop more environmentally-friendly demand response programs, it is helpful to review those programs recently implemented by the Independent System Operators (ISOs) in terms of their reliability and environmental outcomes. The ISOs are responsible for matching the electricity dispatched within the regional electric grid to the customer demand for electricity in order to ensure customers receive uninterrupted power.

Four ISOs in the United States – New England, New York, PJM, and California – implemented demand response programs in 2000 and 2001. These programs were intended to balance supply-side resources with demand-side resources that would increase system reliability and hold down prices, but were not designed with public health and environmental concerns as key considerations.

At its core, each ISO's demand response strategy has two parts: an emergency response program and an economic response program. The emergency response programs in 2000 and 2001 were designed to increase available demand resources in a short period of time, through load curtailments, when the gap between available supply and system demand became small enough to threaten system reliability. The economic programs in 2000 and 2001 were designed to motivate demand reductions during times of high demand, when generators began to dispatch their more expensive units. In some of the ISOs the emergency and economic elements of demand response were augmented with other programs, such as installed capacity and day-ahead programs.

While headlines during this period brought a lot of attention to high energy prices and reliability problems, this did not encourage more than modest participation in the ISO-sponsored programs during the summers of 2000 and 2001. From a reliability perspective, the most successful ISO program was that of the New York ISO (NYISO), which realized several hundred megawatts of available reductions. Other programs were much less successful, or have not yet published their data. While there was limited data and a small number of participants, ISO New England (ISO-NE), which achieved a reduction of 2,134 kWh, was the only ISO to analyze environmental impacts, which yielded discouraging results. Good levels of electricity demand reductions were achieved, however, in California through the state-sponsored energy efficiency and conservation programs which supplemented the California ISO (Cal ISO) program, as is illustrated later in this paper. The results of the ISO-NE, NYISO, PJM Interconnection, and Cal ISO demand response programs are discussed in more detail below. Differences in the structures of these and other demand response programs, and the lessons learned from implementing them, could point the way forward toward increasing reliability and reducing the environmental impacts of future demand response programs.

ISO New England

ISO New England's Load Response Program was the only one of the four demand response programs to monitor and report the effect of its program on air emissions. As established in late 2000, the program was internet-based and allowed customer load response to occur through curtailment, load-shifting, or on-site generation. There were two elements of this program: Class 1 Demand Response, in which participants committed to mandatory energy reductions after 30 minutes' notice; and Class 2 Price Response, in which participants could choose to reduce consumption during periods of high wholesale energy prices. End-use customers in all of these programs had to participate through load serving entities (LSEs) or aggregators, rather than being able to join directly (Babula, 2001).

The Class 1 Demand Response program compensates participants at the 30-Minute Operating Reserve price for any mandatory curtailments it experienced; in this sense it was a typical emergency response program. Those who wished to participate did so by curtailing their electric use or by switching to another power source, typically by using on-site back-up generators. The Class 2 Price Response program was available to participants only when the forecasted energy price was above $100/MW. Customers who reduced load as part of the Class 2 price response program were compensated based on the energy clearing price being paid during the hours which the reduction occur (ISO-NE, 2001).

The program debuted during the summer of 2001, and 5 commercial and industrial users participated, reducing load during 7 peak load events during June and July, totaling 70.5 peaking hours. Three of these customers reduced their load using on-site diesel generation, and 2 curtailed their demand. Although the participants who curtailed load reduced it by 2,134 kWh, the participants who switched to on-site diesel power as part of the demand response program increased on-site electricity consumption by 534,035 kWh, and the program resulted in a net increase in total electricity consumed of 531,901 kWh.

A similar net increase in air emissions resulted from the use of on-site diesel generation. Despite reductions in emissions from the participants who reduced their load, the use of on-site diesel resulted in a net increase of 1,058 lbs of NOx emissions, 3,671 lbs of SO2 emissions, and 531,533 lbs of CO2 emissions (Babula, 2001).

The New England program must be renewed for 2002, and the ISO is already preparing market rule changes for the 2002 program. Currently enrollments for 2002 include 18 sites totaling 6.8 MW for the Class 1 Demand Response program, and 106 sites totaling 58.8 MW for the Class 2 Price Response program (Gilligan, 2001).

New York ISO

The New York ISO's 2001 program, like the other ISO demand response programs, was aimed at the wholesale electricity market. The NYISO's program consisted of three elements: an Emergency Demand Response program, and Installed Capacity (ICAP) Special Case Resources program, and a Day-Ahead Demand response program (Lawrence, 2001).

The Emergency Response Program was activated whenever a deficiency in operating reserves was forecasted. This program was open to both interruptible loads and to emergency backup generators. End-use customers in this program were eligible to participate through LSEs or aggregators, or by joining directly. Participants were paid a fee for their consent to curtail load or engage on-site generation with a minimum of 4 hours notice. The ICAP Special Case Resources program was open to loads or backup generation greater than 100 KW. Under the rules of the NYISO in 2001, businesses that could cut back or transfer at least 100-kilowatts to a backup generator could sell these kilowatts under the Installed Capacity Program (ICAP). When the NYISO needed additional generating supplies to maintain reliability, the NYISO called on participating ICAP businesses to switch on their generators and reduce the demand on the regional electric grid. In New York City, the value of installed capacity during the past year was approximately $100 per kW (Martinsen, 2001).

The price-based Day-Ahead Demand Response program became open to LSEs in 2001 and opens to other providers and aggregators in 2002; the use of diesel back-up generators was excluded. Participants in 2001 were able to bid demand reductions in a day-ahead market, and were paid a location-based marginal price. These bids were usually accepted by the NYISO when day-ahead electricity prices were forecasted to be high.

Registered participants in all of the NYISO programs for 2001 combined included 13 LSEs, 9 aggregators, and 7 industrial end-users, representing 275 resources with 679 MW of demand, including both interruptible load and on-site generation. NYISO estimated that from August 8 – 10, 2001, the highest peak of the summer season, between 433 MW and 476 MW were shaved from the peak by the Emergency Demand Response program. A further 400 MW reduction from 14 bids occurred on August 8, 2001. The bulk of these reductions were accomplished through load reductions, rather than through on-site generation

Although the NYISO did not measure the emissions effects of their program, there is reason to believe that the program had a more positive effect on air quality. In the NYISO's Emergency and ICAP Special Case programs, load curtailments comprised at least 85% of the load reductions achieved, with the remainder of the reductions resulting from on-site generation or a combination of load reduction and on-site generation. In this respect it was quite different from the ISO-NE program, where 3 of 5 participants turned to on-site diesel generation. Also unlike the ISO-NE program, the Day-Ahead Demand Response program did not allow the use of diesel generators as sources of on-site power. This should have resulted in a more positive emissions outcome from the program.

Furthermore, the NYISO's 2001 demand response program was augmented by a program sponsored by Governor Pataki's administration, which provided approximately $5 million for the retail substitution of about 38,000 older air conditioners with new, more energy-efficient ones, substantially reducing demand during peak summer events.

For 2002, the NYISO will attempt to maximize participation in the Emergency and ICAP Special Case programs, and plans to expand the Day-Ahead Demand response program beyond LSEs to incorporate other entities (Lawrence, 2001).

PJM Interconnection

PJM launched a pilot program in the summer of 2000 to use a range of demand resources, including curtailment, on-site generation, and economic incentives, to ensure system reliability. The pilot was to be implemented only as an emergency action, and involved 43 sites, between 120 kW and 15 MW, for a total of 80 MW. The program was not put into effect in 2000, however, because no emergency procedures were required during that summer. Consequently a new program was introduced in 2001, which, like the ISO-NE and NYISO programs, had an Emergency Option and an Economic Option (Kormos, 2001).

LSEs participating in the 2001 PJM program could engage in the Emergency Option only through pre-arrangement with the ISO. Eligible participants supplied required central station load reductions via alternative on-site generation or through measurable and verifiable load curtailments, with a minimum demand reduction of 100 kW within one hour. Participants were also subject to very specific metering requirement. These customers were reimbursed at the location-based marginal price for the hours during which they curtailed or displaced use (Gilligan, 2001).

Any of the LSEs and other electricity providers in PJM could sign up their customers for the Economic Option, which allowed consumers to bid load reductions at wholesale rates. It offered incentives for participants to reduce demand on the PJM system and share the savings. This option can be engaged at any time, and customers usually bid when wholesale prices are higher than retail rates, causing curtailment to be economically attractive. No restrictions were placed on the use of diesel back-up generators. Billing and settlement was made directly between PJM and the participants; payments were based on actual spot market prices (Kormos, 2001). PJM reported four days of activity in late July/early August, but has not published information about participation, kWh reduced, or net emissions.

California ISO

The California ISO (Cal ISO) began developing demand response programs for the summer of 2001 as a response to the infamous "rolling blackouts" of the previous year. In order to minimize or eliminate the need for involuntary rotating blackouts, Cal ISO established three demand response programs to complement its existing Participating Load Program: the Demand Relief Program, to act as an emergency measure; the Discretionary Load Curtailment Program, allowing loads to bid on day-ahead and day-of load reductions; and the Voluntary Load Curtailment Program, a consumer demand-side bidding program.

The Participating Load Program for 2001 was organized as an open bidding process for participants who bid load reductions. Loads accepted into the program were dispatched just like generators, but their bids were not included in setting the market clearing price. To participate, loads had to offer at least 1 MW of curtailment, but this could be an aggregation of customers (Goldman, 2001).

Consumers were eligible to participate directly in the Demand Relief Program if they had at least one megawatt of demand reductions or worked through a Load Aggregator (e.g., utility, retail energy service provider). The ISO paid customers a monthly reservation payment of $20,000 per megawatt each month to be available to curtail load at the Cal ISO request whether or not they were asked to curtail. Customers were also paid $500 per megawatt hour for the actual demand that they curtailed. Curtailments were limited to 24 hours per month and customers had to have an hourly interval meter.

The Discretionary Load Curtailment program was intended to operate year-round and was designed to attract voluntary curtailments prior to emergency conditions from Load Aggregators. The Cal ISO requested curtailments and paid participants between $250 and $500 per megawatt hour for demand reductions (Cal ISO, 2001).

The Voluntary Load Curtailment program was designed as a demand-side bidding program for consumers. When the Cal ISO notified the utility of the need for demand relief, customers made kW reduction offers of 100 kW or more for specified periods of two to four hours. Accepted bids paid the customer $0.35 per kWh reduced. Newcomers received interval meters and communication equipment free of charge with a 1-year enrollment.

The Cal ISO demand response program was invoked for two days in early July, 2001. The emergency demand response program - the Demand Relief Program - resulted in a maximum peak reduction of 50 MW, and the economic program – the Discretionary Load Curtailment program - resulted in a maximum peak reduction of 16 MW. No information was available on the success of the Voluntary Load Curtailment program or the Participating Load Program (Gilligan, 2001).

The Demand Relief Program for 2001 used a tiered program which gave preference to non-diesel backup generation but which did not exclude diesel generation from the program. The Cal ISO states that each of its demand response programs were designed with the environment in mind, however it did not publish any information regarding the effects of its programs on air emissions. Given the available information regarding low participation and the possibility of diesel backup use, it is difficult to infer whether the Cal ISO 2001 demand response program resulted in a net benefit or net loss for air quality (Cal ISO, 2001).

Like New York, Cal ISO's demand response program was augmented by Governor Davis' $800 million energy efficiency and conservation programs for residential and business customers, and the "20/20 Program," which allowed customers to earn a 20 percent discount on their energy bills for reducing their electricity use by 20 percent during the hot summer months. Through these programs California realized a total reduction in electricity use of 8.9 percent during peak hours in 2001 as compared to use in 2000. The state also experienced a 6.7 percent decline in overall energy use in 2001 (CEC, 2002). Many of the reductions from the energy efficiency/conservation programs reflect permanent changes in energy demand.

Overall Program Performance

Cal ISO and ISO-NE saw only modest participation in their demand response programs, and there were no data available from the PJM program. The NYISO's demand response program achieved the greatest success in terms of demand reduction, with over 400 MW reduced through its emergency option and 400 MW peak reduced though its economic option. Although the data is based on limited experience, only New England has made available any air quality data stemming from its demand response program; the data indicated a negative net environmental effect. However, it can be inferred that, by excluding on-site diesel generation from its program, the NYISO's program was not as likely to have the same negative air quality effects as ISO-NE's program. And the success of the supplementary energy efficiency programs in New York, operated by NYSERDA, and in California, operated by the California Energy Commission, provided not only significant reductions in energy demand, but also substantial avoided air emissions.

The information that is *not* available from the ISO-sponsored programs makes its own important point: that the air quality impacts of the first ISO demand response programs were not tracked with the same rigor that the system reliability elements were. The re-evaluation and redesign of these programs to improve their impact on system reliability provides an opportunity to track and improve the air quality effects of these programs.

Environmentally-Friendly Demand Response Programs: A Pilot Project

While the most recent ISO demand response programs undertaken in the Northeast/Mid-Atlantic states and California have demonstrated some significant successes in reducing peak demand, none of them has either measured or demonstrated good environmental performance. The NYISO and Cal ISO demand response programs were augmented with significant energy efficiency programs, operated by the states, and while both included restrictions on diesel generators, neither program analyzed environmental impacts. Only the ISO-NE monitored and reported on the effect of its program (albeit a small one) on air emissions; it experienced an overall increase in emissions due to running on-site diesel generation.

As currently designed, the above ISO-operated programs would likely increase the number and severity of air pollutant-related health conditions and further degrade air quality and the environment. By overlooking the significant public health and environmental improvements that energy efficiency, clean distributed generation and combined heat and power have to offer, they are also missing out on the substantial economic and societal benefits these types of strategies can provide. Most demand response programs do not include a component to measure the extent of their public health and environmental impacts, because the ISOs and energy agencies developing and deploying demand response programs do not generally have public health or environmental responsibilities within their purview.

The gap in program design for environmental impacts was explored in detail during a November 2001 meeting of state energy, environmental and public utility officials in Philadelphia. At this meeting, Northeast and Mid-Atlantic states' members of OTC, NARUC and NASEO, along with the State and Territorial Air Pollution Program Administrators/ Association of Local Air Pollution Control Officials (STAPPA/ALAPCO) discussed how demand response programs could be designed to encourage energy efficiency and reliability while being consistent with air quality goals. The three ISOs for the region attended and were open to suggestions on improving their programs.

Meeting participants stressed the need for a pilot project that would build load/demand response programs that address reliability concerns in more environmentally beneficial ways, and could serve as a replicable model for the New England and Mid-Atlantic states as well as outside the Ozone Transport Region. The foundation of such a pilot project would be developing and demonstrating examples of "cleaner" demand response programs for the summers of 2002 and 2003 through an integrated process between energy, environment and public utility officials, working cooperatively with the ISOs, in one or more states.

A Proposed Approach

Participation in the pilot project would be voluntary, and the number of participating states would depend upon the type and amount of funding available to support these efforts from federal and state agencies, foundations and other sources. A requirement for any state interested in participating in a pilot would be the involvement of representatives from key state agencies, including the state energy agencies, state environmental agencies, the public utility commission, and other agencies deemed to be integral to the policy decision-making process in developing a demand response program.

Because the pilot project would examine opportunities for new program designs in 2002 and 2003, a two-phase approach would be necessary. Phase I would focus on developing near term energy efficiency, renewable energy, low- and no-emitting distributed generation and other environmentally beneficial mechanisms that would be feasible to implement as soon as the summer of 2002. Phase II would have a longer term focus, examining similar and additional options that would be ready for implementation in a summer 2003 program. The pilot project would be designed to achieve a number of overarching goals and objectives, including: (1) improving power system reliability and relieving grid congestion, and (2) ensuring that air quality and public health concerns are integrated into DR program design by determining mechanisms, including siting and criteria, to help further integrate demand response programs with energy efficiency and renewable energy opportunities, and assisting in developing and deploying clean distributed generation.

During working group sessions the policymakers would investigate, design, and then implement environmentally-friendly demand response options, focusing first on the summer of 2002 and then looking ahead to 2003. Through these sessions and periodic collaboration with key stakeholders the state would select a set of options that could be implemented for each respective summer season, identify potential partners and financing opportunities and strategies for each option, and facilitate the implementation of the options.

In addition, the pilot would coordinate appropriately with the newly formed New England Demand Response Initiative (NEDRI) to ensure that all efforts for clean demand response programs in the New England states support one another. The NEDRI project will engage stakeholders throughout New England in a year-long process to develop recommendations for a comprehensive demand response that addresses both wholesale and retail related issues in the New England electricity market.

Tracking and Replicating Results

As different environmentally-friendly demand response options are implemented, their progress would be tracked and evaluated. Information about energy and emissions performance would be analyzed to determine the penetration and success of the options.

The final product of the pilot would consist of a case study report on the pilot, including an outline of the environmentally-friendly options in the form of a program model, results tracked and evaluated in the pilot, lessons learned, and recommendations for improving on the options developed in the pilot. The program model and the accompanying documentation would provide readable and easy-to-follow guidance to other states interested in replicating the environmentally–friendly demand response program developed in the pilot.

Conclusion

ISO-sponsored demand response programs have demonstrated some success in reducing peak electricity load and providing greater power system reliability; yet they have not demonstrated particularly good environmental performance. Developing one or more prototypes for load/demand response programs that address reliability concerns in more environmentally beneficial ways will provide states with an innovative tool for meeting critical power, public health, and environmental needs. The next steps are to identify energy, environment, public utility and ISO officials interested in participating in such pilot projects that will provide states with a replicable demand response program model that incorporates consideration for public health and the environment.

References

Babula, Mark. 2001. *ISO New England's Load Response Program 2001 Summer Options*. A presentation at the Defining Priority Actions for Demand Responsiveness and Energy Efficiency Conference in Philadelphia, PA, November 14-15, 2001.

California Energy Commission (CEC). 2002. "Governor Davis to Announce 2001 Electricity Use Down Nearly 9 Percent from 2000," Press Release, January 17, 2002. http://www.energy.ca.gove/releases/2002_releases/2002-01-17_governor.html.

California Independent System Operator (Cal ISO). 2001. *Demand Response Program Overview/Processes*. A presentation by the California ISO.

Cowart, Richard. 2001 "Efficient Reliability: The Critical Role of Demand-Side Resources in Power Systems and Markets," a report prepared by the Regulatory Assistance Project for the National Association of Regulatory Utility Commissioners.

Environmental Protection Agency (EPA). 2001. *Latest Findings on National Air Quality: 2000 Status and Trends*. Washington, DC.: U.S. Environmental Protection Agency.

Gilligan, Donald. 2001. "Grading 2001's ISO Demand Response Programs." In *Energy User News*, October 31 2001

Goldman, Charles. 2001. *Demand Response Programs: An Emerging Resource for Electricity Markets - Opportunities for Federal Customers*. A presentation for the FUPWG Meeting in Oklahoma City, OK. October 11, 2001.

Greene, Nathanael and Hammerschlag, Roel. 2000. "Small and Clean is Beautiful: Exploring the Emissions of Distributed Generation and Pollution Prevention Policies." In *The Electricity Journal*, *June 2000*.

Independent System Operator – New England (ISO-NE). 2001. *ISO New England Inc. Post Summer 2001 Briefing*. September 14, 2001.

Johnston, Lucy. 2001. *Load Response and Environmental Impact*. A presentation prepared by Synapse Energy Economics. November 15, 2001.

Kormos, Mike. 2001. *Distributed Generation and Demand Side Response*. Presented at the Peak Load Management Alliance Spring Conference, April 30, 2001.

Lawrence, David J. 2001. *NY ISO Demand Response Programs – 2001 Performance*. A presentation by NY ISO, November 14, 2001.

Martinsen, Kevin. 2001. "Using Energy Price Volatility to Improve Your Bottom Line," Conedison Solutions," March 26, 2001.

Nadel, Steve, Gorton. Fred, and Neme, Chris. 2000. *Using Targeted Energy Efficiency Programs to Reduce Peak Electrical Demand and Address Electric System Reliability Problems*. Washington, DC.: American Council for an Energy-Efficient Economy, November 2000.

Ozone Transport Commission (OTC). 2001. *Model Rule for Additional Nitrogen Oxides (NOx) Control Measures*. http://www.sso.org/otc/Publications/pub2.htm.

Regulatory Assistance Project. 2001. *Model Regulations for the Output of Specified Air Emissions from Smaller-Scale Electric Generation Resources*.