Before the
Public Utility Commission
Commonwealth of Pennsylvania

Energy Efficiency and Conservation	**)**	
Program and EDC Plans	**)**	
Reply to Comments on the Staff's	**)**	**Docket No. M-2008-2069887**
Implementation Plan for the EE&C	**)**	
Program of November 26, 2008	**)**	

Reply Comment of the Federal Trade Commission

December 17, 2008

I. Summary

The Federal Trade Commission ("Commission" or "FTC") appreciates this opportunity to comment on efforts by the Pennsylvania Public Utility Commission ("PA PUC") to increase energy efficiency, conservation, and demand response. In part, this comment is a reply to comments on the November 26, 2008, PA PUC staff proposals for an implementation plan for the Energy Efficiency and Conservation Program (and to the plan itself).[1] It also replies to the November 18, 2008, presentation by the Retail Energy Supply Association ("RESA") at the PA PUC *en banc* hearing.[2] The PA PUC's efforts to increase energy efficiency, conservation, and

[1] Commonwealth of Pennsylvania, Pennsylvania Public Utility Commission, Energy Efficiency and Conservation Program and EDC Plans, Docket No. M-2008-2069887 (Nov. 14, 2008), *available at* http://www.puc.state.pa.us/PCDOCS/1026558.doc.

[2] Richard J. Hudson, Jr., testimony on behalf of the Retail Energy Supply Association, before the Pennsylvania Public Utility Commission, *En Banc* Hearing on "Alternative Energy,

demand response have the potential to enhance consumer welfare and increase economic efficiency at both the wholesale and retail levels. More efficient pricing, advanced metering, and improvements in the technology used to determine when (and how much) energy is consumed are all critical to the future performance of the power industry in Pennsylvania and in the United States as a whole. We commend the Pennsylvania Legislature and the PA PUC for taking initiatives on these important topics.

Although many of the specific questions posed by the PA PUC at the *en banc* hearing pertained to Conservation Service Providers, we agree with RESA that these questions must be framed in the context of empowering customers to manage their peak and overall loads. We encourage the PA PUC to center the Energy Efficiency and Conservation Program around providing customers with incentives and opportunities to better manage those loads. This comment describes several aspects of encouraging energy efficiency and conservation as a means to deliver consumer benefits. We believe that addressing the topics covered in this comment, either in the short term or during subsequent policy reviews, will benefit Pennsylvania's electric power customers and U.S. power customers in general.

The FTC encourages the PA PUC to employ dynamic electric power pricing and demand response to involve customers in addressing the power systems' most pressing problems. Well-designed dynamic pricing and demand response programs can enlist customers to help meet important challenges facing the power system by, for example:

- managing peak load;

Energy Conservation and Efficiency, and Demand Side Response" (Nov. 18, 2008), *available at* http://www.puc.state.pa.us/electric/pdf/EnBanc-DSR/Ttmy-RESA111908.pdf.

- ensuring that load never exceeds generation;
- keeping system costs down;
- reducing the need for ratepayers to pay to build, maintain, and operate peak-load generating facilities;
- pricing pollution into the time-varying cost of power, thereby encouraging customers to shift power demand to periods when the marginal plant is a low-cost, low-emissions generator (and away from periods when a less attractive plant is on the margin);
- making good use of the wind and solar generators being installed in response to environmental concerns, market forces, and Pennsylvania's renewable portfolio standard;
- complementing unpredictable, intermittent wind and solar generators with flexible demand rather than flexible supply, when flexible demand is more cost-effective; and
- facilitating the appropriate investment in and use of technologies by end-users, generators, and utilities, including plug-in vehicles and onsite generation when they are cost-effective.

Automation, feedback, and incentives can enable consumers to become partners in addressing all of these problems. The PA PUC has an important opportunity to give every customer the option to sign up for real-time or critical peak pricing. The PA PUC also has an opportunity to give utilities and Conservation Service Providers the incentives and mandate to develop programs that are attractive to customers and that benefit customers who participate in the programs, non-participating customers, utilities and the electric system. This requires firms to develop communication strategies that help customers to make good choices about whether to enroll and to respond appropriately to sound economic incentives. These programs can benefit participating and non-participating customers if the programs have effective marketing, user-friendly implementation, and structures that better align customers' incentives to use power with its cost to the grid. Early experience with dynamic pricing programs suggests that recruitment of customers requires careful design and marketing; once enrolled, however, customers respond to the new incentives and are pleased to save money and to gain a sense of better understanding and controlling their energy use.

Developments in metering, feedback, and control technologies are creating new, cost-effective opportunities for consumers to participate in managing load. At the same time, the growing use of wind, solar, and nuclear generation is increasing the proportion of generators over which dispatchers have limited control. These parallel developments in demand and supply technology create significant additional opportunities to empower consumers to improve the efficiency of the electric power system.

We encourage the PA PUC to continue to make a concerted, ongoing effort to support programs that empower consumers to manage their loads and address the challenges facing Pennsylvania's electric system. The PA PUC's role may involve encouraging firms to take innovative approaches to empowering consumers, mitigating risks to firms during the transformation, and updating regulations that stand in the way of progress. Dynamic pricing is a compelling economic idea, but it requires an ongoing commitment to make it work for regulators, utilities, and customers.

II. Interest of the Federal Trade Commission

The FTC is an independent agency of the federal government responsible for maintaining competition and safeguarding the interests of consumers through enforcement of the antitrust and consumer protection laws and through competition policy research and advocacy. The FTC often analyzes regulatory or legislative proposals that may affect electric industry competition or allocative efficiency. It reviews proposed mergers that involve electric and gas utility companies. In the course of this work, as well as in antitrust and consumer protection research, investigation, and litigation, the FTC applies established legal and economic principles and recent developments in economic theory and empirical analysis.

The energy sector, including electric power, has been an important focus of the FTC's antitrust enforcement and competition advocacy.[3] The FTC's competition advocacy program has produced two staff reports on electric power industry restructuring issues at the wholesale and retail levels,[4] and FTC staff also contributed to the work of the Electric Energy Market

---

[3] *See*, *e.g.*, Deborah Platt Majoras, Chairman, Federal Trade Commission, Opening Remarks at the FTC Conference on *Energy Markets in the 21st Century: Competition Policy in Perspective* (Apr. 10, 2007), *available at* http://www.ftc.gov/speeches/majoras/070410energyconferenceremarks.pdf. FTC merger cases involving electric power markets have included *DTE Energy/MCN Energy* (2001) (consent order), *available at* http://www.ftc.gov/os/2001/05/dtemcndo.pdf; and *PacifiCorp/Peabody Holding* (1998) (consent agreement), *available at* http://www.ftc.gov/os/1998/02/9710091.agr.htm. (The FTC subsequently withdrew the *PacifiCorp* settlement when the seller accepted an alternative acquisition offer that did not pose a threat to competition.)

[4] FTC Staff Report, *Competition and Consumer Protection Perspectives on Electric Power Regulatory Reform: Focus on Retail Competition* (Sept. 2001), *available at* http://www.ftc.gov/reports/elec/electricityreport.pdf; FTC Staff Report, *Competition and Consumer Protection Perspectives on Electric Power Regulatory Reform* (July 2000), *available at* http://www.ftc.gov/be/v000009.htm (compiling previous comments that the FTC staff provided to various state and federal agencies).

Competition Task Force, which issued a report to Congress in spring 2007.[5] The Commission also has held public conferences on energy topics.[6] The FTC and its staff have filed numerous competition advocacy comments with FERC and the states concerning electricity restructuring initiatives.[7] The FTC staff also participates in preparing United States Government filings before international competition organizations regarding energy policy matters.[8]

---

[5] Electric Energy Market Competition Task Force, *Report to Congress on Competition in Wholesale and Retail Markets for Electric Energy* (2007), *available at* http://www.ferc.gov/legal/fed-sta/ene-pol-act/epact-final-rpt.pdf.

[6] The most recent FTC conference on energy issues was *Energy Markets in the 21st Century: Competition Policy in Perspective*, held on April 10-12, 2007 (conference materials *available at* http://www.ftc.gov/bcp/workshops/energymarkets/index.shtml). *See also* the FTC's public workshop on *Market Power and Consumer Protection Policies Issues Involved with Encouraging Competition in the U.S. Electric Industry*, held on September 13-14, 1999 (workshop materials *available at* http://www.ftc.gov/bcp/elecworks/index.shtm); and the Department of Justice and FTC Electricity Workshop, held on April 23, 1996.

[7] *See*, *e.g.*, Fed. Trade Comm'n, *Comment Before the Federal Energy Regulatory Commission on Wholesale Competition in Regions with Organized Electric Markets* (Apr. 17, 2008), *available at* http://www.ftc.gov/be/v070014b.pdf.

FTC competition advocacy filings after mid-1994 are available in reverse chronological order at http://www.ftc.gov/opp/advocacy_date.shtm. FTC competition advocacy efforts regarding the electric power sector began in 1994 with a Comment of the Staff of the FTC Bureau of Economics to the South Carolina Legislative Audit Council on the Statutes and Regulations Covering the South Carolina Public Service Commission (Feb. 28, 1994).

[8] The FTC and the Department of Justice participate as United States delegates in a number of international organizations, such as the Organisation for Economic Co-operation and Development. As part of this process, the FTC staff contributes to the United States' "country reports" on competition topics. *See*, *e.g.*, United States Department of Justice and Federal Trade Commission, "Note by the US Department of Justice and US Federal Trade Commission," OECD Roundtable on Energy Security and Competition Policy (Feb. 21-22, 2007), *available at* http://www.ftc.gov/os/2007/02/WD200725OilGasUnited%20States.pdf. When requested by the Department of State, the FTC staff also contributes to comments by the United States on proposed regulatory reforms in other nations.

III. Facilitating Demand Response and Dynamic Pricing, and Ending Regulatory Practices That Can Inhibit Demand Response

By facilitating the implementation of demand response and dynamic pricing in Pennsylvania, the PA PUC has an opportunity to reduce costs to ratepayers, increase reliability, and ease the integration of intermittent wind and solar resources. We encourage the PA PUC to seize this opportunity. Utilities may want to roll out dynamic pricing first as an attractive opt-in program. Once such a program has been reviewed and refined, and after it has satisfied thousands of customers for a few years, dynamic pricing could become the default option for all new accounts (and perhaps could serve as an opt-out rate for existing customers of provider-of-last-resort service). The widespread availability of advanced meters facilitates the low-cost expansion of dynamic pricing programs.

The PA PUC may wish to coordinate with other regulators and market operators about how the expansion of dynamic pricing and demand response should affect policies in the PJM Interconnection and Midwest ISO wholesale power markets that supply Pennsylvania's power. This conversation might explore the future of market power mitigation and capacity market policies that currently are used as substitutes for consumer participation.

A. Background

Traditional retail electric prices do not change contemporaneously when higher demand leads to higher wholesale prices.[9] This problem is particularly acute when generation or

[9] Traditional retail rates generally are time-invariant, *i.e.*, the rates do not depend on when the customer uses power, regardless of scarcity conditions and wholesale prices. Some traditional utility systems, however, include seasonal differences in rates that otherwise are time-invariant. Over time, changes in average wholesale prices can (and do) lead to adjustments in traditional retail rates. Such adjustments, however, involve substantial lags, and do not contemporaneously track the daily cycles in generation and transmission costs that produce fluctuations in wholesale prices.

transmission equipment problems and extreme weather conditions lead to excess demand for electricity that cannot be supplied by the system, and also to far higher costs to produce, transmit, and deliver electricity than normal. With time-invariant retail prices, customers pay the same price to run their air conditioners and dryers during low-demand periods and high-demand periods – two situations during which the real cost of having the marginal generator available and operating, plus the cost of transmitting that power to the customer, may differ by a factor of 50 or more.[10] Fixed retail prices lead to a serious waste of resources. People who pay time-invariant prices buy and use peak-period power that they might not be willing to purchase if they had to pay the marginal cost of generating and transmitting that power. Moreover, the fact that large increases in wholesale prices during high-demand periods do not lead to increases in retail prices raises the likelihood of market power problems in wholesale electricity markets. If retail prices – and therefore consumption – do not respond in real time to increases in wholesale prices, generators are more likely to have market power, and to exercise it by raising wholesale prices, than would be the case if retail prices increased (and trimmed consumption) when wholesale prices increased.

[10] During critical peak periods, wholesale prices sometimes reach $1000/MWh or more. During off-peak periods, wholesale prices in some areas are as low as $20/MWh (or lower). For example, the California Independent System Operator is seeking authority to institute a price ceiling of $2500/MWh and a price floor of -$2500/MWh during the initial period of its revised nodal pricing system. Simulations suggest that nodal prices may fall below the proposed floor or exceed the proposed ceiling during extreme operating conditions. California Independent System Operator, Market Redesign and Technical Upgrade Tariff Amendment to Adopt Price Cap and Floor (filed Nov. 3, 2008), *available at* http://www.caiso.com/2074/2074da39205e0.pdf.

Traditional, fixed retail pricing also increases the volatility of wholesale prices, increases the risk of blackouts and brownouts, and raises the average costs of the electric power system. For example, during an unusual heat wave that drove temperatures above 100 degrees in Southern California in early September 2007, Southern California Edison reported that approximately 20,000 customers were subject to extended blackouts. It was estimated that 90 percent of those blackouts were due to peak demand that exceeded the capacity of local distribution equipment under such extreme temperatures. If retail prices had adjusted to reflect wholesale prices in real time, people would not have used power that they valued at less than its social cost.[11] As a result, there would have been a more efficient allocation of the limited amount of electricity in the short term, and power system suppliers would have had stronger incentives to build the efficient amount of generation, transmission, and distribution capacity.

Reliance on fixed retail prices poses major threats connected with two major new technologies. One of these technologies is electric vehicles, of either the plug-in hybrid or the all-electric variety. Time-invariant retail pricing does nothing to encourage plug-in hybrid customers to recharge during off-peak hours. If large numbers of plug-in vehicles recharge during peak demand periods, the power system will require the costly construction, maintenance, and operation of peakers and additional transmission and distribution capacity in order to maintain system reliability.[12]

---

[11] Electric power's social (opportunity) cost is the lesser of (1) the cost of building and running an electricity system large enough to prevent the blackout or (2) the cost at which other customers will reduce their consumption of electric power enough to prevent the blackout.

[12] Dynamic pricing encourages owners of plug-in hybrid and all-electric vehicles to shift the charging of their vehicles to periods in which low-cost power plants are on the margin.

The second major technology consists of wind and solar power and other forms of intermittent renewable generation. Many states have prescribed a "renewable portfolio standard" that requires a portion of generation to be from renewable energy sources. Pennsylvania's renewable portfolio standard requires that 18 percent of the state's energy come from renewable sources by 2020, including 0.5 percent from solar photovoltaic generation.[13] Once a technology such as wind or solar photovoltaic is in place, it is likely to be dispatched whenever it is available because the marginal cost of wind and solar photovoltaic is close to zero. With fixed retail prices, customers have no incentive to curtail their consumption when the wind dies down or clouds roll in. A lack of demand response forces fossil-fuel generators with higher marginal costs to produce more electricity. Without customer demand response, the costs of integrating intermittent, albeit environmentally attractive, power sources into the power system may be higher, as will the costs of reducing adverse environmental effects to mandated levels. Unpredictable, intermittent wind and solar generators require flexible complements to balance generation and load minute-by-minute. Dynamic pricing and demand response programs may offer a flexible demand complement that is more cost-effective than flexible supply.

Dynamic pricing is a collection of approaches, including real-time pricing and critical peak pricing, that allow retail prices to change on short notice in response to fluctuations in wholesale prices. Real-time pricing sets one retail price for each hour (or a smaller unit of time, such as quarter-hour or a five-minute segment) as a function of the spot market wholesale price.

---

[13] Database of State Incentives for Renewables & Efficiency, *Pennsylvania Incentives for Renewable Energy*, *available at* http://www.dsireusa.org/library/includes/incentive2.cfm?Incentive_Code=PA06R&state=PA&CurrentPageID=1.

Critical peak pricing is a simpler, dynamic (time-varying) pricing system. Typical critical peak pricing programs define peak and off-peak periods and specify a peak price that is higher than the off-peak price. These programs also allow utilities to designate about 1 percent of all hours as critical scarcity periods, during which the price is significantly higher than during other (non-critical) peak periods.[14] This comment advocates dynamic pricing programs that increase economic efficiency by making retail prices significantly better reflect the marginal cost of power as it fluctuates over time.

---

[14] Critical peak pricing schedules predetermined price periods and permits retail suppliers to declare a limited number of critical periods that invoke the critical price. Utilities choose to designate critical events when forecasted conditions are likely to cause electricity scarcity, system unreliability, or high wholesale prices. Under the program, customers are notified about critical events through automated phone calls, e-mails, or notification of a programmable communicating thermostat. Although critical peak pricing notification policies vary, typically customers are notified the day before the event that they need to adjust their thermostats by hand. Shorter notice is possible if a customer has a programmable communicating thermostat or a "gateway" system that automatically reduces his or her electricity consumption during critical periods.

Utilities commit in advance to the number of critical hours or events. This limit typically is about 1 percent of all hours, or about 15 events per year. Sometimes utilities commit to limits on the timing of critical events. For example, California's Statewide Pricing Pilot program called critical events only between 2:00 pm and 7:00 pm on weekdays. Sometimes critical peak pricing programs set forth conditions that will suffice to call a critical event. For instance, temperatures below freezing or exceeding 95 degrees Fahrenheit suffice for Gulf Power to trigger a critical event, while the California Statewide Pricing Pilot announced that any Stage 1 power emergency would trigger a critical event. Regarding the Gulf Power situation, *see* Gulf Power Co., "GoodCents Select: Advanced Energy Management Program," *available at* http://www.ewh.ieee.org/r3/nwflorida/presentations/01_19_06.ppt; regarding California, *see* Charles River Associates, "Impact Evaluation of the California Statewide Pricing Pilot" (Mar. 16, 2005), *available at* http://www.energy.ca.gov/demandresponse/documents/group3_final_reports/2005-03-24_SPP_FINAL_REP.PDF. In general, utilities also retain the flexibility to declare a critical event on any day on which they forecast high power costs or low system reliability, so long as such a declaration would not exceed the annual limit on the number of critical events they can call.

Five types of regulations are particularly likely to prevent or undermine demand response, efficient pricing, and conservation.[15] The first type includes regulations that forbid time-varying retail pricing. Time-invariant pricing subsidizes consumption when power is most costly and when increases in consumption are most likely to cause blackouts or other reliability problems. A second type of unproductive regulatory action is approval of perfunctory dynamic pricing schemes and implementation, which can lack measures to reduce the cost and risk of participation and also can suffer from inadequate design, testing, and implementation of communications, education, and marketing. These plans can be ineffective because they are based on an oversimplified view of customers' needs or suffer from underinvestment in marketing. A third type comprises regulations and ratemaking systems that penalize utilities financially if demand response increases between rate cases. The fourth type consists of regulations that allow utilities to discourage efficient customer investment in onsite generation by charging inefficiently high prices for standby service.[16] The fifth type includes regulation that deprives customers who want to offer demand response of the opportunity to customize their offers.

[15] The FERC Staff Report, *Assessment of Demand Response and Advanced Metering*, FERC Docket AD-06-2-000 (Aug. 2006), *available at* http://www.ferc.gov/legal/staff-reports/demand-response.pdf, also discussed a variety of regulatory barriers to demand response. Experience and research have continued to develop in this area since the release of this FERC Staff Report.

[16] Owning an onsite generator can increase a customer's responsiveness to prices by enabling the customer to substitute self-generated power for power from the grid when the costs of the latter exceed the costs of the former.

B. Removing Regulations that Prevent Retail Real-Time, Marginal-Cost Pricing of Electric Power

The most direct way to increase the elasticity of wholesale demand with respect to wholesale prices is to redesign retail rates to ensure that those rates better reflect the marginal costs of supplying electricity to retail customers from the grid. These costs vary with changes in aggregate and local demand and supply conditions, such as weather-driven demand for air conditioning or generation and transmission equipment failures. A first step toward developing retail prices that reflect marginal cost is to remove regulations that prohibit dynamic prices. One way to achieve marginal-cost pricing of electric power is to base real-time retail prices on wholesale market-clearing prices.[17] Retail pricing that tracks wholesale prices reduces or eliminates the waste of resources that time-invariant pricing encourages, including generation of electricity at a marginal cost that exceeds the value of the electricity to some of those who

[17] State regulators, utilities, and researchers have gathered evidence about demand response programs that are effective and consequently tend to reduce the need to buy power when it is most expensive. Some demand response approaches, however, can entail significant costs that must be compared to their benefits in any evaluation of their effectiveness. For example, real-time prices encourage customers to reduce consumption during peak demand periods and to invest in ways to respond efficiently to price fluctuations. Real-time pricing, however, requires advanced meters that can be expensive. "Experiences in New York, Georgia, California, and other states and pricing experiments have demonstrated that customers do take actions to adjust their consumption, and are responsive to price (*i.e.*, they have a nonzero price elasticity of demand). Georgia Power Company's successful real-time pricing tariff option has demonstrated that industrial customers who receive real-time prices based on an hour-ahead market are relatively price-responsive (price elasticities ranging from approximately -0.2 at moderate price levels, to -0.28 at prices of $1/kWh or more) given the short-time period in which to act. Among day-ahead real-time pricing customers, price elasticities range from approximately -0.04 when prices are at moderate levels to -0.13 when customers are exposed to higher prices. A critical peak-pricing experiment in California in 2004 determined that small residential and commercial customers are price responsive and will produce significant reductions. Participants reduced load 13 percent on average, and as much as 27 percent, when price signals were coupled with automated controls such as controllable thermostats." FERC Staff Report, *supra* note 15, at 13-14 (footnotes omitted).

consume it during peak periods. Such retail pricing also would reduce the frequency and extent of blackouts and brownouts, as well as required operating reserves.[18] In deciding which approach to take to retail pricing, state regulators should consider the implementation and transaction costs. Dynamic pricing's transaction costs include the cost of having people monitor and respond to price changes or the cost of computerized thermostats or appliance controllers to do so. Implementation costs appear to be declining in the wake of technical advances in metering and billing.[19]

With dynamic pricing, some customers could see an increase in the variability of their electric bills from month to month. Utilities, however, can offer billing plans under which customers pay a constant amount each month in order to smooth out payments. Also with dynamic pricing, customers may face a risk that their electric bills will increase unexpectedly

---

[18] Numerous power system simulations show that demand response lowers wholesale prices during peak-demand periods. *See, e.g.*, Severin Borenstein, "The Long-Run Efficiency of Real-Time Electricity Pricing," 26:3 Energy J. 93 (2005). Regarding reliability, ERCOT (the system operator in most of Texas) reported that demand response avoided a blackout and restored a frequency decline when a rapid, unanticipated decline in wind speeds caused an associated decline in wind generation. This example illustrates that demand response can substitute for generation-based reserves. Electric Reliability Council of Texas, "ERCOT Demand Response Program Helps Restore Frequency Following Tuesday Evening Grid Event," ERCOT Press Release (Feb. 27, 2008), *available at* http://www.ercot.com/news/press_releases/2008/pr_print_1_174210_174210.

[19] Real-time metering already is extensively deployed for large commercial and industrial customers in several states that allow customers to select their own electricity supplier. Several pilot projects for residential customers have been completed or are underway, but mass deployment of advanced meters for residential customers is rare in the United States. After an extensive analysis of costs and benefits, the three major investor-owned utilities in California have undertaken programs to deploy advanced meters for all classes of customers. Mass deployments lower the average costs of the meters, reduce average installation costs, and yield significant labor savings because the new meters report usage electronically and do not require human meter readers to go door to door.

because of an unusual increase in market-wide demand or an unusual decrease in supply. In theory, customers may be able to hedge (or buy insurance) against this in financial markets. Regulators should consider whether customers are able to buy such insurance if they are willing to pay its costs. For example, utilities could allow customers to have the option to buy blocks of power in advance at prices that reflect the utilities' costs of purchasing power in wholesale markets; simultaneously, the utilities could purchase blocks of power in advance in wholesale futures markets or enter into financial hedging contracts.[20] A single program can both mitigate bill volatility and offer good marginal incentives. Letting people prepay for a power consumption schedule at its expected cost and any applicable risk premium reduces bill volatility from transient, unexpected price changes. The pricing of deviations from the prepaid consumption schedule at the dynamic price offers good marginal incentives.

So long as the social benefits of dynamic pricing exceed the costs of its implementation, dynamic pricing should be the basic (or default) service option.

C. Successful Dynamic Pricing Implementation Requires Attention to Detail

Customers who opt for dynamic pricing programs – such as Gulf Power's GoodCents Select or Illinois' EnergySmart Pricing – generally reduce their power consumption during peak periods, save money, indicate satisfaction with the program, and continue participation.[21]

[20] For a more extensive discussion of this subject, *see* Severin Borenstein, Center for the Study of Energy Markets, Univ. of Cal. Energy Inst., Working Paper #155, "Customer Risk from Real-Time Retail Electricity Pricing: Bill Volatility and Hedgability" (2006) (also published at 28:2 Energy J. 111 (2007)).

[21] Gulf Power Company, "GoodCents Select: Advanced Energy Management Program," *available at* http://www.ewh.ieee.org/r3/nwflorida/presentations/01_19_06.ppt; Dan York and Martin Kushler, "Exploring the Relationship Between Demand Response and Energy Efficiency: A Review of Experience and Discussion of Key Issues," American Council for an Energy-Efficient Economy, Report No. U052 (Mar. 2005), *available at* http://www.aceee.org/pubs/u052.pdf; Dan Merilatt (V.P. Program Development, GoodCents),

Customers reported similar reactions in pilot programs – such as California's Statewide Pricing Pilot – that offered a new rate, paid customers to participate, and appealed to their sense of civic responsibility. Customers perceived that they had greater control over their electric bills and better understood when and how they use power.[22] Likewise, for several years Georgia Power's real-time pricing program for commercial and industrial customers has been viewed as successful for both the utility and customers.[23]

Although dynamic pricing can have compelling benefits for both consumers and grid operators, the merits of dynamic pricing may not be apparent to customers who have always been on traditional, time-invariant rates.[24] Getting customers to opt into these programs can be difficult and requires attention to:

- strategies to inform customers about price changes and ways to respond to them;

"Demand Response Programs: New Considerations, Choices & Opportunities" (Jan. 2004), *available at* http://www.enertouch.com/info/Demand%20Response%20Programs.pdf; Kathryn Tholin, "Real-time Pricing for Illinois Consumers," Center for Neighborhood Technology/Community Energy Cooperative (Nov. 8, 2006), *available at* http://peaklma.com/new%20folder/documents/tholin.ppt#256,1,Real-time Pricing for Illinois Consumers.

[22] Charles River Associates, "Impact Evaluation of the California Statewide Pricing Pilot" (Mar. 16, 2005), *available at* http://www.energy.ca.gov/demandresponse/documents/group3_final_reports/2005-03-24_SPP_FINAL_REP.PDF; Ahmad Faruqui and Stephen George, "Quantifying Customer Response to Dynamic Pricing," 18:4 Electricity J. 53 (May 2005), *available at* http://www.enertouch.com/info/Quantifying%20Customer%20Response.pdf.

[23] Galen Barbose, Charles Goldman, and Bernie Neenan, "A Survey of Utility Experience with Real Time Pricing," Lawrence Berkeley Nat'l Lab., Paper LBNL-54238 (Dec. 1, 2004), *available at* http://repositories.cdlib.org/lbnl/LBNL-54238.

[24] We recognize, of course, that no practical new pricing system is likely to improve every customer's situation. Some users now pay less over the year than the marginal cost of supplying their power. Heavy users of peak-time power that cannot easily change the time of their electricity use will not switch voluntarily. But they should not be subsidized forever.

- the way customers think about risks and price changes;
- program implementation; and
- marketing.

Although utilities' carefully implemented commercial programs have succeeded, others have failed to attract customers. One-third of available, commercial real-time pricing programs have zero participants.[25] Low participation often reflects inadequate implementation or promotion. Dynamic pricing programs tend to fail when they stem from a regulatory edict that the utility opposes and consequently implements with little attention to marketing, user friendliness, or other details crucial to attracting and retaining customers. Programs that exist only on paper squander opportunities to temper market power, to reduce distortionary regulation, and to save billions of dollars for customers. Thus, regulators need to look for ways to give utilities (and other firms offering these programs) the incentives and flexibility to devote resources to program implementation and refinement. Moving to dynamic pricing can benefit utilities, customers who choose dynamic pricing, and even customers who remain on time-invariant pricing.[26] Offering utilities a share of the benefits from dynamic pricing programs may be an appropriate way to offer them a stake in the programs' success.

Experience shows that many customers will not take action to change away from whatever rate the regulator establishes as the default. Regulators and utilities may wish to

[25] Barbose *et al.*, "A Survey of Utility Experience with Real Time Pricing," *supra* note 23.

[26] *See* Severin Borenstein and Stephen Holland, Center for the Study of Energy Markets, Univ. of Cal. Energy Inst., Working Paper #106R, "Investment Efficiency in Competitive Electricity Markets With and Without Time-Varying Retail Prices" (revised July 2003); Severin Borenstein, "The Long-Run Efficiency of Real-Time Electricity Pricing," *supra* note 18.

consider making dynamic pricing the default rate, as several states have already done with respect to large commercial and industrial customers.[27]

Residential and Small Commercial and Industrial Customers: The FTC staff researches how individual consumers understand marketing materials and mandatory disclosures. This research – as well as our experience with disclosure regulation – shows that people with legal, engineering, or policy analytic expertise often write materials that consumers have difficulty understanding.[28] Communications expertise, testing, and revision can improve dynamic pricing materials' effectiveness at attracting customers and equipping them to respond to dynamic prices.

Careful and innovative design of programs and marketing efforts are important. Well-designed residential dynamic pricing programs have gotten low sign-up rates, often on the order of 1 percent. Identifiable flaws in simplified customer decision-making patterns may bias customers against signing up for dynamic pricing programs described in straightforward but ill-chosen ways. Letzler describes these decision patterns and suggests the use of incentive-

---

[27] *See, e.g.*, Lisa Wood, "The New Vanilla: Why Making Time-of-Use the Default Rate for Residential Customers Makes Sense," Energy Customer Mgmt. (July/Aug. 2002); John Beshears, James J. Choi, David Laibson, and Brigitte C. Madrian, "The Importance of Default Options for Retirement Savings Outcomes: Evidence from the United States," in *Lessons from Pension Reform in the Americas* (2008).

[28] *See, e.g.*, James M. Lacko and Janis K. Pappalardo, Bureau of Econ., Fed. Trade Comm'n, "Improving Consumer Mortgage Disclosures: An Empirical Assessment of Current and Prototype Disclosure Forms" (June 2007), *available at* http://www.ftc.gov/os/2007/06/P025505MortgageDisclosureReport.pdf; James M. Lacko and Janis K. Pappalardo, Bureau of Econ., Fed. Trade Comm'n, "The Effect of Mortgage Broker Compensation Disclosures on Consumers and Competition: A Controlled Experiment" (Feb. 2004), *available at* http://www.ftc.gov/os/2004/01/030123mortgagefullrpt.pdf.

preserving rebates to present critical peak pricing in a more appealing manner without changing incentives, total annual bills, or the opportunity cost of power.[29]

Care also must be taken in designing dynamic rate demand response programs to prevent some customers from manipulating reward levels. For example, there is a longstanding argument about the relative merits of dynamic pricing and baseline-rebate programs. Baseline-rebate cases calculate a personalized "baseline" demand level from each customer's consumption history and then pay customers rebates when they consume less than their baseline amount during a critical period. Many customers in an Anaheim, California, baseline-rebate field experiment exploited these flawed incentives to raise their own baselines and earn larger rebates at the expense of other ratepayers.[30] Consuming more power during the baseline-setting period allows customers to earn a larger rebate without reducing their critical period consumption. Thus, baseline-rebate programs present dynamic pricing well, but can create flawed incentives. By contrast, conventional dynamic pricing can amount to a poor marketing presentation of good incentives. Letzler summarizes evidence that both incentives and presentation matter, and suggests the use of incentive-preserving rebates that achieve an appealing rebate-based presentation of critical peak pricing incentives.

Large Commercial and Industrial Customers: The challenges of getting larger enterprises to participate in dynamic pricing are different but no less important. Dynamic

[29] Robert Letzler, Center for the Study of Energy Markets, Univ. of Cal. Energy Inst., Working Paper #162, "Applying Psychology to Economic Incentive Design: Using Incentive Preserving Rebates to Increase Acceptance of Critical Peak Pricing" (Nov. 2006).

[30] Frank A. Wolak, "Residential Customer Response to Real-Time Pricing: The Anaheim Critical-Peak Pricing Experiment" (May 24, 2006), *available at* ftp://zia.stanford.edu/pub/papers/anaheim_cpp.pdf.

pricing can significantly lower the cost of some accounts' consumption patterns, letting them save even if they exhibit little price sensitivity in the timing of their consumption. It can raise the cost of other consumption patterns, meaning that those customers would have to respond significantly to prices before they saw any net savings. For example, offering customers the right to buy power at the time-invariant price – and then billing only deviations from this prepaid power consumption schedule at the dynamic price – can keep bill levels stable while offering a more accurate price for deviations.[31] Further, dynamic pricing increases bill volatility, but simple hedges can reduce this risk.[32] Moreover, large customers may be more likely to participate if they have access to infrastructure to reduce the transaction cost of realizing savings, such as consulting and documentation of practices that have saved similar customers money.

D. Removing Financial Penalties Against Utilities that Allow or Foster Increased Price Sensitivity of Demand

Dynamic electricity pricing has the potential to generate billions of dollars in social savings that customers and utilities or power marketers can share. Regulators should work with utilities and power marketers to seek out deals that benefit both customers and suppliers. Regulators should commit to the principle that rational customer response to a well-designed dynamic pricing program approved by the regulator should not financially penalize the utility.[33] Regulators may need to commit to frequent rate adjustments during the first few years of the

[31] Severin Borenstein, "Wealth Transfers Among Large Customers from Implementing Real-Time Retail Electricity Pricing," 28:2 Energy J. 131 (2007).

[32] *See* Borenstein, "Customer Risk from Real-Time Retail Electricity Pricing: Bill Volatility and Hedgability," *supra* note 20.

[33] If the dynamic pricing design reduces revenues but has no effect on consumption patterns, the regulatory body may wish to consider adopting a different design with greater demand response.

implementation of dynamic pricing to ensure that, in the event the program leads to unanticipated changes in consumption patterns, there are not prolonged, important deviations from the rate of return and incentive scheme that the regulators set for the utility.

Unfortunately, many ratemaking systems make it unprofitable or risky for utilities to offer dynamic pricing.[34] Utilities that operate regulated, natural monopoly distribution systems for electric power often have been reluctant to offer dynamic pricing for electric power because they fear financial losses if consumption declines below the level for which they have planned[35] (and on which the regulated rates are based).[36] The restructuring of utilities' financial incentives

[34] In "The Long-Run Efficiency of Real-Time Electricity Pricing," *supra* note 18, Severin Borenstein estimates that universal implementation of real-time pricing could reduce the cost of operating the electric system by 5 to 10 percent. Total U.S. purchases of electricity were $342 billion in 2007 (*see* http://www.eia.doe.gov/cneaf/electricity/epm/table5_2.html), so universal deployment of real-time pricing could save between $17 billion and $34 billion. Those estimates do not take into account the potentially large benefits of making the system robust to unexpected events, such as the combination of poor hydroelectric conditions, natural gas supply problems, and a thriving economy that set the stage for California's crisis in the summer of 2000. Further, Borenstein and Holland show that putting some customers on real-time pricing benefits those customers who remain on time-invariant pricing, and that the first customers who switch to dynamic pricing have the greatest impact. *See* Borenstein and Holland, "Investment Efficiency in Competitive Electricity Markets With and Without Time-Varying Retail Prices," *supra* note 26.

[35] A similar revenue shortfall could occur if customers who are currently using an above-average proportion of their power during inexpensive periods – and are thus paying a cross-subsidy to other customers – were to flock to dynamic pricing but not change their consumption patterns. That dynamic pricing program would lower their bills by offering them a lower price for their off-peak consumption, which could reduce the utility's revenue. Utility executives who are worried about this problem may seek to set inefficient dynamic rates that recover their costs off-peak or may be inclined to oppose meaningful dynamic pricing. Decoupling can solve this problem by ensuring that the utility earns its regulated rate of return regardless of the quantity of power it sells during any time period.

[36] A switch from traditional, fixed retail prices to real-time retail prices can be engineered to cause or prevent shifts in costs among customer classes (*i.e.*, residential, commercial, industrial) because it does not facilitate arbitrage among classes or make it more difficult to determine the class to which a customer belongs. A move to real-time pricing typically will reduce cross-subsidies from customers with flat demand to those with "peaky" demand. For

to which we refer can increase the feasibility of quickly implementing real-time (or other time-varying) retail pricing arrangements.

Traditional utility price regulation typically sets a price based on the total of fixed and variable costs at the time of the previous rate case, divided by the quantity of electricity (or natural gas) consumed at that point in time. If the volume declines after the rate case, the revenue will fall by more than the decline in costs (because only the variable, but not the fixed, costs will decline). The resulting revenue may not be sufficient for a normal rate of return on the utility's investment until an adjustment is made in the volume data used in setting rates.[37] Hence, in comparison to utilities that do nothing or even discourage conservation, utilities that foster conservation could be penalized by traditional, fixed retail rates. The PA PUC may wish to investigate whether existing rates and regulations maintain disincentives for suppliers to promote demand response and conservation by their customers.

Regulators might use one or more of a number of methods to avoid this result (and thus avoid creating a disincentive to pursue energy conservation and efficient price signals). "Decoupling" – one method used in several states, with differing specific elements – adjusts prices to cover fixed costs. Another way is to separate the portion of customer charges for fixed costs from the portion designed to recover variable costs. Several states – including Idaho and

---

example, Ramsey pricing principles (minimizing deadweight loss by charging higher prices to customers with less elastic demand) could be used in conjunction with either pricing system to allocate joint and common costs among customer classes.

[37] Sheryl Carter, "Breaking the Consumption Habit: Ratemaking for Efficient Resource Decisions," 14:10 Electricity J. 66 (Dec. 2001).

New York – are considering or seeking proposals designed to encourage utilities to work with consumers to conserve energy through variations on these two methods.[38]

E. Reforming Standby Electric Power Service Regulations

Technical improvements in small-scale electricity generators have made it increasingly attractive for some commercial (and even some residential) electricity customers to consider investing in onsite generation – *i.e.,* building their own electric generation facilities on the site of an industrial manufacturing facility or at home.[39] Onsite generation (also known as "distributed generation") represents a form of competition – a substitute for power from the grid. Because onsite generation can result in reduced (or more price-sensitive) demand for incumbent utilities, utilities can have incentives to prevent customers from making such investments.[40] In the FTC investigation of the DTE/MichCon merger, for example, the staff obtained documents indicating

[38] Dovra Bachrach, Sheryl Carter, and Sarah Jaffe, "Do Portfolio Managers Have an Inherent Conflict of Interest with Energy Efficiency?," 17:8 Electricity J. 52 (Oct. 2004).

[39] Residential onsite electric power generation (other than backup generators) currently consists primarily of solar cell arrays installed on rooftops. Hot water solar panels also are relevant to the extent that they displace the use of electricity to heat water. Small-scale wind generators are being developed for residential use, and residential-scale fuel cells may attract considerable interest as prices of these generators decline and their reliability is established. The considerable research and development regarding small-scale fuel cells for use in the transportation sector could be transferable to onsite generation products.

[40] At the same time, onsite generation can benefit the customer/investor, the distribution utility, and other ratepayers – especially in transmission-constrained areas – by increasing supply and easing reliability concerns inside the constraint. The Massachusetts Department of Telecommunications and Energy opened an inquiry into policies affecting onsite generation, including incentives to exclude onsite generation, recovery of potential stranded costs of utilities caused by onsite generation, and whether utilities should offer more than one type of standby service. *See* Commonwealth of Massachusetts, Dep't of Telecomm. and Energy, *Investigation of Standby Rates and Alternative Rate Structures that Will Promote Efficient Deployment of Distributed Generation*, D.T.E. 7-06 (Mar. 23, 2007), *available at* http://masstech.org/2007-03-23-DG-DTE-07-6-Order.pdf.

that the incumbent electric utility considered onsite generation to be a competitive threat.[41] A potential policy concern in this situation is that a utility not covered by a revenue-decoupling arrangement may manipulate regulatory policies to impede socially efficient onsite generation to avoid financial losses by the utility. Environmental concerns and technological developments are transforming the characteristics of cost-effective generation technologies, making it particularly important to design technologically neutral regulatory approaches that enable emerging technologies to enter based on their merits.[42]

1. Nondiscriminatory Onsite Generation Policies

One scenario of concern involves onsite generators that are able to, and often do, operate full-time. Onsite gas turbines (*e.g.*, microturbines) and other technologies that typically run essentially nonstop are vulnerable to regulatory flaws that can differ from those that would discriminate against intermittent technologies, such as wind or solar onsite generation. The scenario starts with the recognition that customer interest in onsite generation depends on a variety of factors, such as fuel and equipment costs relative to the price of power obtained from the grid. Reliability preferences also are likely to be a factor. One potential problem for a

[41] Fed. Trade Comm'n, Analysis of the Proposed Consent Order and Draft Complaint to Aid Public Comment in *DTE Energy Company and MCN Energy Group Inc.*, File No. 001 0067, *available at* http://www.ftc.gov/os/2001/03/dteanalysis.htm. For an example of government modeling the penetration of onsite generation, *see* Erin Boedecker, John Cymbalsky, and Steven Wade, "Modeling Distributed Electricity Generation in the NEMS Buildings Models" (2002), *available at* http://www.eia.doe.gov/oiaf/analysispaper/electricity_generation.html.

[42] Dynamic (ideally, real-time) pricing is a particularly important tool to create incentives for efficient investment in intermittent generation technologies (*e.g.*, wind and solar) and in technologies that store power or change load shapes. Real-time prices capture changing patterns of electricity scarcity or abundance and also harness market forces to help integrate technologies such as wind turbines, solar generation, plug-in hybrid vehicles, and other energy storage devices into the grid.

customer considering an onsite generation investment is that the customer occasionally may need to receive "standby" power from the utility (if, for example, the onsite generator has a mechanical breakdown or needs maintenance).[43] Utilities, which generally are allowed to charge special rates to such intermittent customers, can frustrate competitive inroads of onsite generation by charging inefficiently high prices for standby service. Supracompetitive standby rates exceed opportunity costs (including a market-based risk premium) and may provide utilities with a rate of return above the competitive level, or even above the short-term profit-maximizing price.[44] For example, the utility might set standby service charges so high that they offset any savings the customer might expect from generating power onsite. If the price of standby service exceeds the efficient price, some customers are likely to be deterred from undertaking efficient onsite generation projects and competing.

There may be a number of ways in which an incumbent utility could persuade the regulatory body to authorize a price for standby service that exceeds the efficient price and thus deters the entry of non-intermittent onsite generation. One key way to do so is to posit an unrealistic scenario in estimating the costs of providing such service – e.g., a situation in which all onsite generators simultaneously break down when demand from other utility customers is at its peak.[45] A utility should not be allowed to block the efficient entry of onsite generation by

[43] Most customers who invest in intermittent generation technologies such as wind and solar generation will need power from the grid on a regular basis.

[44] Such a strategy on the utility's part would be profit-maximizing solely by dint of its effect in preventing entry by competing onsite generators.

[45] Under this approach, the utility would claim the need to retain more generation capacity than necessary to maintain an acceptable level of reliability and would blame the excess costs on customers with onsite generation. In reality, the utility could reduce capacity reserves with an acceptable level of reliability, because it is extremely unlikely that onsite generators would simultaneously suffer mechanical breakdowns. James Mulligan, "The Economies of

positing an unrealistic scenario as the basis for setting the price of standby service.[46] Instead, the pricing of standby service should reflect calculations – such as those of reliability organizations – that relate reserve levels to the probability of blackouts or other reliability incidents.

In the case of intermittent forms of onsite generation (or of onsite generation that could generate full-time but nonetheless operates intermittently depending on the relative costs of making or buying power), a utility without decoupling protection could seek to block entry of onsite generation by applying excessive standby rates to all power purchases by customers with onsite generators. This scenario could be inappropriate for solar generators in power systems where peak loads occur in the summer and demand response is well developed. Solar generators operate during afternoon peak demand periods but not overnight. Hence, onsite solar generators could flatten the load profile of the customer and the system. This kind of onsite solar generation, combined with demand response programs that reduce load during morning, evening, and cloudy peak periods, could allow the power system to increase capacity utilization and reduce the need to build and operate costly peakers.

Even if a utility does not establish a standby service price in excess of the efficient level, it might be able to block competition and increased demand response from onsite generators by offering only an "unlimited" form of standby service. This strategy in and of itself can

---

Massed Reserves," 73 Am. Econ. Rev. 725 (1983); Walter Y. Oi, "Productivity in the Distributive Trades: The Shopper and Economies of Massed Reserves," in Zvi Griliches (ed.), *Output Measurement in the Service Sectors* 161 (U. of Chicago Press, 1992), *available at* http://nber15.nber.org/bookcv_chicago/9780226308852_web.pdf.

[46] By contrast, if a utility were unable to manipulate government regulatory proceedings in order to block entry by onsite generators, its only recourse in responding to the challenge of onsite generation might be to improve its service and reduce its costs and prices, just as incumbent suppliers respond to increased competition in other markets. Such improvements in economic performance would redound to the benefit of all electricity consumers.

discourage entry by onsite generation, because some onsite generation investments may be financially viable only if standby service is available in a limited form that costs less than unlimited standby service.[47] If the utility persuades the regulatory body to allow it to offer only "unlimited" – and thus more expensive – standby service, then competition from onsite generators that require nothing beyond limited (and less expensive) standby service might not develop.[48,49] One solution worth considering would be to put standby customers on the

[47] For example, "as-available" standby service could be conditioned on whether power is readily available to serve the standby power customer at or below a pre-set wholesale price. Another variation on the theme would offer power at the real-time wholesale price plus a distribution charge (unless power was so scarce that the system was in an emergency status and running with reduced reserves). Another alternative to unlimited standby service could be standby service that is capped at a specific quantity. (A cooperative utility in Hawaii allows customers to specify the amount of standby service for which they are willing to pay. Under this tariff, the utility operates a circuit breaker (paid for by the customer) to ensure that the customer draws no more than the specified amount. *See* http://www.kiuc.coop/anne/IRP_public_site/Tariff/Rate_Rider%20S.pdf.) Both of these alternatives would involve lower costs for the utility – and presumably lower prices to the onsite generator – than unlimited standby service.

More generally, customers with onsite generation, like other customers, may have varying preferences for the reliability of their electric service. Many utilities offer lower prices to customers who will accept a lower level of reliability (known as "interruptible service"). The same range of reliability and price tradeoffs could apply to standby service.

[48] One form of alternative standby service involves the utility's supply of the additional power only if generation and transmission capacity are readily available. Some states require utilities to offer this type of contingent standby service, and to price it below the price of unlimited standby service. Contingent standby service is conceptually very similar to the "interruptible service" (referenced in note 47, *supra*) that is routinely offered to industrial and commercial customers at a rate lower than the rate for standard service. Under interruptible service, customers get a discount on all of their power in return for an agreement to waive their right to demand as much power as they want at the predetermined price.

[49] If the concern is limited to utilities' decisions to offer only one form of standby service, regulators may wish to evaluate the benefits and costs of requiring utilities to offer a choice among levels of standby service.

wholesale, real-time price plus the same, appropriately chosen distribution and connection charges applicable to other, similarly-situated, real-time pricing customers.

One method to ensure that utilities do not use distortions in standby service to impede onsite generation is to allow the entry of alternative standby service providers.[50] For example, one or more owners of onsite generating capacity could function as sources of standby service for other onsite generators if they are linked. This linking of onsite generators in order to provide alternative standby services into what is known as a "micro-grid"[51] is likely to be most practical when onsite generators are clustered in an industrial park or another type of commercial development area. In order for micro-grids to be formed, state or federal regulations may need

[50] So long as competition in the supply of standby service is feasible, maintaining such competition is a potentially attractive solution. If customers wanted (and were permitted) to buy standby capacity, presumably they could enter into arrangements under which other parties would build generators for this purpose, attach the new generators to the existing network (or a new network), and sell standby capacity under long-term contracts to willing buyers.

In light of the severity of the regulatory challenges, allowing entry and competition in the provision of standby service may well benefit customers more than attempts to regulate the price while blocking entry. If competition in the supply of standby service is not allowed, then a market power problem may be present that may be difficult to address with price regulation. Clearly the price has to be high enough for the seller to anticipate earning a normal rate of return. If there are economies of scale in the provision of standby capacity, however, marginal-cost pricing alone will not raise enough revenue. Moreover, a regulator that mandates standby service at a price that is set *ex ante* is forcing the utility to assume risks, which raises the problem of determining what the compensation should be for assuming such risks. An alternative would be to shift the risk to customers, by charging prices determined *ex post* to raise the right amount of revenue. But this raises the concern among standby service customers that the risk premium will be set above the market level as part of the utility's strategy to protect itself from competition. In short, this is not an easy matter for regulation to remedy efficiently or effectively.

[51] Jay Apt, M. Granger Morgan, and Carnegie Mellon Electricity Industry Center staff, *Critical Electric Power Issues in Pennsylvania: Transmission, Distributed Generation and Continuing Services When the Grid Fails* (2005), at 33 *et seq.*, *available at* http://wpweb2.tepper.cmu.edu/ceic/pdfs_other/Critical_Electric_Power_Issues_in_Pennsylvania.pdf. A micro-grid can improve reliability for member customers by providing power even if the utility grid is not functioning and the customer's onsite generator is not operable.

to be amended to allow the currently prohibited entry of competing transmission facilities ("overbuilds").[52]

2. Sunk Costs Complicate the Analysis of Onsite Generation Policy

The question for regulators about expanding onsite generation – aside from removing regulatory barriers that exist for purely anticompetitive reasons – becomes more complex if the opportunity to avoid paying markups that cover the utility's sunk costs (*i.e.*, its irreversibly expended fixed costs) drives the interest in onsite generation.[53] Most facility construction costs are sunk, as are the yet-to-be-recovered losses from past wholesale purchases of expensive power that then was resold at lower, regulated retail rates. When regulators guarantee utilities' ability to recover costs, the purchase of onsite generators often lets a customer shift the responsibility to pay to other customers who continue to buy all of their power from the utility. When such markups make onsite generation attractive, regulators should consider how their onsite generation policies affect the distribution of sunk costs.

Customer actions to avoid paying sunk costs can create costs to society that fully or partially offset the benefits. For example, consider a situation in which an onsite generator's marginal cost is greater than the grid's marginal cost, but the utility's fixed-cost-recovery markups make grid power more expensive than onsite power. The customer comes out ahead by

---

[52] If the concern is limited to utilities' decisions to offer only one form of standby service, regulators may wish to evaluate the benefits and costs of requiring utilities to offer a choice among levels of standby service.

[53] The challenge for regulators becomes complicated when a significant fraction of rates goes to pay costs that onsite generation does not affect. Onsite generation reduces fuel costs and variable operating and maintenance costs. Onsite generation can reduce fixed operating and maintenance costs by allowing facilities to be retired or by avoiding construction. When onsite generation avoids construction, it also avoids such facilities' fixed costs.

using the onsite generator, but only because he or she shifted to someone else the responsibility to pay an amount greater than his or her savings. This result is socially wasteful. If a rate allows ratepayers to benefit by making socially wasteful choices about onsite generation, then changing the rate's allocation of fixed costs may improve onsite generation investment and facility siting choices.[54,55]

If utilities were purely profit-maximizing firms providing a product in the marketplace, consumer choice about whether to make or buy power would be beneficial. If utilities were purely public service entities that taxed electricity to cover sunk costs, however, then customers' substitution of untaxed electricity for taxed electricity to make other customers pay their share of the sunk costs could be unfair and unproductive free riding. Regulated utilities with substantial sunk costs can create a situation that is a mix of the two.

F. Facilitating the Participation of Customers as "Suppliers" in Wholesale Markets

An increase in demand response participation can produce a number of beneficial results: it increases ratepayer savings, can be an effective substitute for distortionary market power mitigation policies, reduces the risk of exercise of generators' market power, and improves system reliability. As with designing an appealing dynamic pricing rate structure, attracting participation in demand response aggregations is a task that deserves careful attention. The PA PUC, PJM Interconnection, and Midwest ISO may wish to consider whether letting customers

---

[54] If customers can come out ahead by building their own generator, other customer choices are likely to be distorted. For example, they are likely to site their production facilities in less convenient places than they would if the price of power were closer to its marginal cost.

[55] Onsite generation entry combined with slow regulatory action to adjust rates can reduce utility profits, as noted above. The threat of such a result may provide utilities with an incentive to avoid investment cost overruns.

customize their demand response offers can increase participation rates because some potential participants face constraints on how quickly and for how long they can cut back their power consumption.[56] Some useful insights about this design task may be garnered from efforts to encourage generators to provide capacity reserves.

A key concept in attracting generators to supply reserves is to recognize that different generators face different technological constraints. A good example is ramping speed. Some generation technologies can be ramped up from low power levels to full power levels in a relatively short period, while others require a longer time. Rather than setting a single price and a single requirement for ramping speed, market designers and operators encourage participation by more generators by customizing contracts to supply reserves. Generally, system operators pay more for reserve capacity that can ramp up quickly than for slower-ramping reserves.

Generators that cannot ramp up output quickly require the ability to specify a minimum run time during which the system operator dispatches the unit. Some retail customers contemplating offering demand response may have the opposite concern. For example, a grocery store may be willing to reduce electric load temporarily by postponing refrigerator operation for a few minutes, so long as this does not risk exposing the food to unsafe

[56] For a general discussion and framework for considering customization of demand response offers, *see* Electric Power Research Inst., *New Principles for Demand Response Planning* (Mar. 2002), EP-P6035/C3047, *available at* http://www.goodcents.com/info/New%20Principles%20for%20Demand%20Response.pdf.

temperatures.[57] Absent an ability to specify a maximum duration of refrigeration curtailment, however, the food store is unlikely to offer to postpone its cooling load.

A manufacturer with an energy-intensive batch process may be willing to offer demand response so long as it is given enough notice to complete safely the processing of the current batch or to postpone processing the next batch in an orderly manner.[58] Similarly, a manufacturer or retailer may be willing to consider bidding to supply demand response only if it is assured that there will be sufficient spacing between the instances when the system operator asks the firm to trim its consumption – spacing that may be necessary to meet the firm's existing obligations to supply its own customers or to maintain adequate inventories.

In the case of large commercial buildings, the magnitude of demand response offers may be contingent on the time of day when dispatch occurs, or on how early notice was provided of a pending dispatch of the building's offer to reduce power consumption.[59] During the early

[57] Not all load from refrigeration equipment is necessarily devoted to cooling of food. For example, display cases may also have heating elements that keep the doors from collecting condensation when the air is moist. Hence, demand response may involve no change in cooling of the food, but instead may involve turning off the anti-condensation heating elements for a period of time. The store might wish to avoid leaving condensation at higher levels for an extended period, but this would be less likely to raise health and safety concerns than decreasing refrigeration. Cal. Energy Comm'n, "Enhanced Automation Case Study 7: Lighting and Equipment Controls/Grocery Store" (2005), *available at* http://www.energy.ca.gov/enhancedautomation/case_studies/CS07_Albertsons_w2.pdf.

[58] Charles Goldman, Nicole Hopper, and Ranjit Bharvirkar (Lawrence Berkeley Nat'l Lab.) and Bernie Neenan and Peter Cappers (Utilipoint Int'l), "Estimating Demand Response Market Potential Among Large Commercial and Industrial Customers: A Scoping Study," Paper LBNL-61498, § 3.4.3 (Jan. 2007), *available at* http://www.energetics.com/electricity_forum_2007/pdfs/61498.pdf.

[59] Sila Kiliccote and Mary Ann Piette (Lawrence Berkeley Nat'l Lab.) and David Hansen (U.S. Dep't of Energy), "Advanced Controls and Communications for Demand Response and Energy Efficiency in Commercial Buildings" (Jan. 2006), paper for the *Second Carnegie Mellon Conference in Electric Power Systems: Monitoring, Sensing, Software and Its Valuation for the Changing Electric Power Industry*, *available at*

evening, residential demand rises for cooking, climate control, and lighting, while commercial flexibility also increases. Dispatch of demand response near the end of the business day could be larger and longer because occupancy of office buildings will be low at the time of the dispatch and natural cooling will help bring interior temperatures within acceptable limits before the next morning. Demand response by office buildings could be even larger and longer if the dispatch occurred just before a weekend. Early notice can facilitate larger dispatch at a subsequent time if the building is pre-cooled to the low end of the acceptable interior temperature range prior to the expected dispatch period, because pre-cooling reduces the need to air condition the building to stay within the acceptable zone during the dispatch period.

In general, the PA PUC, Conservation Service Providers, PJM Interconnection, and Midwest ISO may wish to consider a wide range of customized demand response specifications, so long as the benefits are likely to exceed the costs of administering the customized offers. The PA PUC also may wish to urge FERC, PJM Interconnection, and Midwest ISO to consider ways to ensure that wholesale markets can accommodate the range of innovative, customer-friendly varieties of demand response that Conservation Service Providers may develop.

IV. Conclusion

We commend the PA PUC for seeking to increase demand response and energy efficiency. Dynamic pricing and demand response programs can be powerful tools to empower customers to help manage peak and overall load. Good programs can empower customers to manage load shapes to enhance reliability, reduce peaking costs, and complement unpredictable, intermittent generators with a combination of flexible demand and flexible supply. Advanced metering that both provides energy consumption data to customers and allows dynamic pricing is

http://www.osti.gov/energycitations/servlets/purl/889248-7DjwKn/889248.PDF.

a key facilitating technology. This comment has recommended that the PA PUC: (1) encourage real-time or other dynamic pricing programs that increase economic efficiency; (2) urge utilities to design and market dynamic pricing programs that appeal to customers; (3) eliminate regulatory provisions that financially penalize power suppliers if they facilitate efficient dynamic pricing; (4) offer fair standby pricing policies for customers with onsite generation investments; and (5) advocate for demand response bid flexibility.