COMMONWEALTH OF MASSACHUSETTS
DEPARTMENT OF TELECOMMUNCATIONS AND ENERGY

PETITION OF THE MASSACHUSETTS DIVISION OF ENERGY RESOURCES FOR AN INVESTIGATION INTO DYNAMIC PRICING FOR BASIC SERVICE	)	DTE 06-______

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Executive Summary

The Division of Energy Resources (DOER) hereby petitions the Department of Telecommunications and Energy (the Department), pursuant to its authority under G.L. c. 164, to open an investigation into whether the current pricing structure for basic service fulfills the requirement of the Restructuring Act to provide electricity buyers and sellers with appropriate price signals. This petition argues that consumers would be better served by a dynamic pricing structure more closely aligned with the wholesale price of electricity. In particular, DOER proposes a change in the structure of basic service to provide Time Of Use rates, or the equivalent, for residential and small commercial & industrial (C&I) customers, and Real Time Pricing for large C&I customers.

The current structure of basic service for electricity customers in Massachusetts provides consumers with same rate for every hour of the month (in the case of large commercial and industrial customers) or every hour of a six month period (for all other customers). There is no variation in those rates depending on the hours of day or days of the week when the electricity is consumed. Yet electricity prices at the wholesale level vary dramatically hour to hour and day to day and season to season. As a result, during peak demand periods consumers are encouraged to consume more than they would if they were aware of the real cost to provide the electricity. In off-peak periods, consumers are charged more than the underlying cost of electricity and might choose to consume more if they were able to purchase it at its real, underlying cost.

This petition argues that a closer correlation between retail prices and wholesale prices, through a system of dynamic pricing for basic service, could help rectify these inefficiencies. With more accurate price signals, consumers would make more efficient use of generation resources, more use of demand resources, better utilize the distribution system and minimize the use of natural resources consumed by electricity production. For example, a recent study of the potential benefits of real time pricing for large commercial and industrial customers estimated that in Massachusetts these customers would save between $9 million and $24 million per year.

With the advent of an investigation of dynamic pricing of basic service by the Department, DOER would immediately undertake the analyses required to evaluate the costs and benefits of alternative pricing regimes for basic service. In the course of such an investigation, DOER would be prepared to present develop detailed, quantifiable findings and pricing proposals that would:

- Identify customers' ability and inclination to respond to price changes;
- Quantify the benefits of price response by consumers;
- Identify necessary and appropriate metering and other infrastructure requirements;
- Quantify the costs of metering and other necessary infrastructure;
- Identify methods for procuring basic service to deliver dynamic prices; and
- Identify necessary and appropriate mechanisms to maintain low-income discounts and avoid harm to vulnerable customer groups.

The 1997 Electric Industry Restructuring Act gave the Department the authority to set the terms and conditions for basic service. St. 1997, Ch. 164, § 1(g) While the Department has investigated the structure of basic service on several occasions, and recognized the need for accurate price signals, it has never fully analyzed the potential benefits and costs of using dynamic pricing for basic service. DOER believes that such an investigation would lead the Department to conclude that accurate price signals for basic service would provide significant savings to electricity customers, increase the reliability of the electricity system and strengthen our economy.

I. INTRODUCTION

The Division of Energy Resources (DOER) hereby petitions the Department of Telecommunications and Energy (the Department) to open an investigation into whether the current pricing structure for basic service fulfills the requirement of the Restructuring Act to provide electricity buyers and sellers with appropriate price signals or whether consumers would be better served by a dynamic pricing structure more closely aligned with the whole sale price of electricity. In particular, DOER proposes a change in the structure of basic service to provide Time Of Use rates for residential and small commercial & industrial (C&I) customers, and Real Time Pricing for large C&I customers.

Basic service electricity consumers in Massachusetts pay for their electricity using a pricing structure that promotes wasteful behavior. They pay a single rate for usage during every hour of the day and month. These rates mask the significant variability that characterizes hourly marginal supply costs, as represented by locational marginal prices (LMPs) at the wholesale level. Because they do not see these supply cost variations, customers can not and do not adjust their usage to reflect the value they realize from electricity, something they routinely undertake in markets for other goods and services where prices reflect the marginal cost of supply.

The absence of "price response" (defined as customers adjusting usage to reflect changes in the prices they pay) renders the electricity market unbalanced. It is missing an essential ingredient that ensures competitive efficiency. The consequences include financial costs such as: less than optimal investment in generation to provide installed capacity and operating reserves, the use of more expensive fuels to operate marginal generating units, and excessive expenditures on transmission and distribution.

As a result, consumers collectively pay more than the value they realize from the electricity they consume. This does not comport with a robustly competitive electricity market. No amount of tinkering with market price-setting rules or more intensive oversight can substitute for the absence of price response. Until a critical threshold of price response is realized, the New England electricity market will operate at a needlessly sub-par level of performance and Massachusetts consumers will bear additional cost. Accordingly, a paramount issue in the ongoing design of the state's electricity market is how to foster price response.

This petition begins with a review of the current structure of Basic Service and the economic flaws and harm to ratepayers caused by its disconnection from dynamic electricity prices. It then describes the substantial net benefits, even after accounting for incremental metering and data processing costs, that can be anticipated from using dynamic pricing for basic service. This petition reviews the options for modifying the current pricing structure for basic service to remedy its flaws and concludes by presenting two basic service pricing proposals. For large C&I customers, basic service would be based on the hourly LMP's for their delivery zone; for all other C&I customers as well as all residential customers, basic service would be a two-period rate design with a higher single rate for peak consumption periods and a lower single rate for off-peak consumption periods.

Dynamic pricing of basic service would encourage consumers to utilize electricity more efficiently, in better alignment with its true cost and value. These pricing regimes would enable them to save money by shifting consumption to off-peak periods, be more productive by using more electricity during those off-peak periods, reduce the overall cost of electricity to all consumers during peak periods and reduce the cost to society of maintaining large amounts of resources in reserve to be used only rarely at peak consumption periods. Dynamic pricing would reduce or delay the need for new generation resources, especially peaking resources, foster more efficient use of existing generation resources, increase the proportion of demand resources competing economically in the marketplace, and foster the use of new technologies that would allow consumers to automate adjustments to their consumption so that it occurs when its actual value more closely aligns with their willingness to pay for it. In short, these pricing structures would create a more efficient and more productive electricity system for all ratepayers and for society.

II. THE CURRENT STRUCTURE OF BASIC SERVICE

Basic Service Reveals Only Average Supply Costs

Basic service for electricity customers in Massachusetts consists of a single rate for each kWh consumed, no matter when it is consumed during the monthly billing period. However, hourly electricity supply costs vary within each day, across days of the week and seasons of the year. The discrepancy between the average basic service rate and the hourly marginal supply cost results in squandered resources. The greater this discrepancy, the greater will be the cost to consumers and society.

Currently, basic service provides consumers a choice between prices that vary monthly or a fixed rate. Basic service prices in Massachusetts are set periodically through a procurement process conducted by the utilities. Each distribution company procures 50 percent of its default service supply for smaller customers semi-annually, for 12-month terms. As a result, default service prices for these smaller customers (for both the monthly and the six-month pricing options) are now based on an average of the results of two separate procurements (D.T.E. 02-40-B). Basic service prices change with trends in the market outlook, but they do not reflect the hourly and daily topology of projected or actual Locational Marginal Prices (LMPs).

For medium and large commercial and industrial customers, each distribution company procures its entire default service supply requirement quarterly. This allows for the average energy price to adjust more frequently to changes in the overall forward supply outlook, thereby establishing a closer link between usage prices and supply costs. But this design still uses the average price that masks the underlying LMP volatility, resulting in inefficiencies and excessive costs.

Basic Service Electricity Prices Diverge From The Cost Of Supplying Energy

While retail customers pay prices that are constant over the hours of the day, LMPs, which reflect marginal supply costs, fluctuate. The discrepancy between these prices is what results in higher costs to consumers and inefficiencies in the sector. As

Table 1

Hours per Year (September 2005-August 2006) in Which LMPs Achieve Different Price Levels							
Zone	$0 - $50	$50 - $100	$100 - $150	$150 - $200	$200 - $250	$250 - $500	$500+
WCMA	1,867	5,228	1,437	200	16	4	8
SEMA	2,053	5,255	1,272	158	11	3	8
NEMA	2,012	5,180	1,329	186	17	19	17

Table 1 demonstrates, hourly prices can be higher, sometimes considerably higher, than the average price of about $73/MWh. LMPs exceed the $100/MWh level approximately 1,500 hours per year, the majority of which corresponds to summer or winter afternoon hours. Prices in WCMA and NEMA exceed $150/MWh, almost twice the basic service rate, over 200 hours per year, and the number of such hours in SEMA are almost as high.

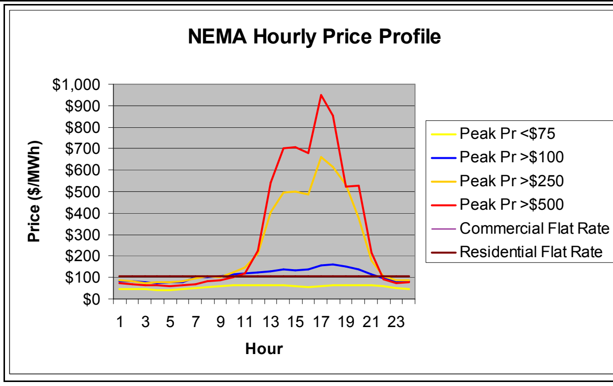

Figure 1 NEMA Hourly Price Profile

The discrepancy between the cost of supply and consumer pay prices is most dramatic on the highest priced days, and those are the days that contribute the most to higher consumer costs. Figure 1 illustrates the variance between residential basic service and commercial single-price basic service rate and the corresponding hourly LMP for NEMA for days with different hourly price regimes, ranging from days where the high price is $75/MWh to days when the price is $500/MWh or above.

The histogram depicted in Figure 2 illustrates the distribution of NEMA prices that exceed $200/MWh. The histogram exhibits two clusters of high prices, one in the $300-400/MWh range and another at highly elevated prices, those above $800/MWh. This is yet another indication of how supply prices diverge from basic service prices as they are currently designed. The prices illustrated are for the period September 2005 to August 2006, which was characterized by an extremely hot period in late July and early August. They demonstrate how changes in demand can result in a large spread between the cost of supply and basic service prices based on average costs. Highly volatile and elevated LMPs also are the result of conditions where supply availability relative to demand is low, resulting in scarcity conditions that can be episodic or, in the case of a shortfall in the level of installed capacity, chronic.

NEMA – LMP Histogram (LMP>$200)

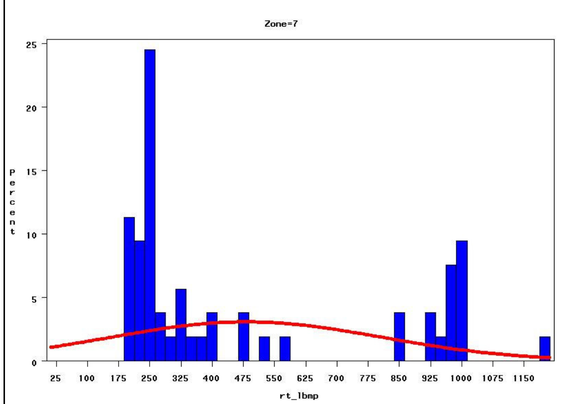

Figure 2 NEMA Price Histogram

Services Currently Offered By Competitive Suppliers Do Not Fill The Void

When Massachusetts customers switch to a competitive supplier, there is no formal reporting requirement to document which pricing plan they elect. DOER's informal inquires indicate that very few customers that have switched are electing a pricing plan that would foster price response. A study by LBNL that surveyed New England suppliers found that few offer and promote time-base pricing plans.[1] The low incidence of time-differentiated alternatives in New England likely reflects competitive entities unwillingness to expend the time and effort to educate customers on the advantages of price responsive behaviors, or to provide incentives, like enabling

[1] Barbose, G., Goldman, C., Neenan, B. December 2004. *A Survey of Utility Experience with Real-Time Pricing*. Lawrence Berkeley National Laboratory Report No. LBNL-54238. Available at http://www.lbl.gov/

technology, to improve price response. Clearly, fostering demand response requires an initiative to introduce customers to the advantages and costs of price responsive behaviors over hedged service. The experience to date in New England indicates that regulatory initiatives are needed to implement dynamic pricing.

The ISO-New England Demand Response Programs Are Instructive

ISO-NE implemented demand response programs beginning in 2001. It offers consumers a variety of ways to participate directly in the capacity market by offering load curtailments as resources that ISO-NE could dispatch. Almost immediately, a variety of business entities came forth to recruit participants in anticipation of being able to provide value to customers in which they could share. That value is realized by providing customers with a more accessible explanation of the program and its benefits and risks, by helping customers devise response plans to make participation possible or to participate at a higher level, and by providing control or measurement technology to accomplish a higher rate of participation. An additional motivation for some was the opportunity to induce customers to sign up for competitive generation service.

At the start of the summer of 2006, there were over 500 MW of load subscribed to the ISO-NE programs by over 1,000 customers, a remarkable achievement in a five-year period. This demand response program indicates how quickly competitive forces come into play to take advantage of an opportunity that offers potential benefits to both them and their customers. A similar inducement is needed to jump-start the proliferation of pricing plans that link usage prices to market LMPs. The benefits of such programs for customers and their providers are potentially larger than the ISO-NE demand response programs.

Demand Response Programs are Beneficial, But Not Enough

ISO-NE implemented demand response programs are designed and deployed to maintain system reliability. These programs can only be effectively administered by ISO-

NE, which has been delegated responsibility for maintaining system security and reliability. However, this requires consideration of the system-level (societal) consequences of supply circumstances, and not the consequences for individual customers. These demand response programs provided approximately 500 MW of load reduction this summer which contributed to protecting the power supply during critical periods this summer. CEO Gordon Van Welie emphasized the need to foster demand response as part of creating a reliable and robust power system:

> "One of the next key initiatives is to fully integrate the wholesale and retail markets so consumers can "see" the true price of electricity and can choose to shift their electricity use according to their sensitivity to price. Consumers are unlikely to conserve at times of peak demand when prices are highest without a more direct connection between wholesale and retail prices. State retail rates should be adjusted to allow customers to see these costs and how they vary with the time of consumption. We applaud Massachusetts for proposing such a plan. Implementing dynamic retail pricing would also enable us to broaden the scope of the current Demand Response programs."[2]

ISO-NE has also implemented programs specifically to foster and realize the benefits of price response. These programs were necessitated by the lack of price response induced by the retail rates offered to consumers in the region. While having customers bid curtailable loads as resources can influence LMP and help abate price volatility, it is not the most effective and efficient way to accomplish that result, as some market designers have pointed out.[3] Many of the inducements that have been adopted to encourage active bidding and response, which has been very low in most day-ahead bidding programs, compromise the efficiency goal of the program.[4] Economic efficiency is best served when customers face and routinely make consumption decisions based on price changes

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[2] Van Welie, Gordon. September 25, 2006. Lights, Power, Action. Solutions to New England's Energy Future. Keynote addresses to: Boston, MA. Available at: http://www.iso-ne.com/pubs/pubcpmm/pres_spchs/2006/gordon_van_welie_remarks_092506.pdf.

[3] Ruff, L. December 2002. *Demand Response: Reality versus Resource*. Energy Journal, Vol. 15, No. 10, pp. 10-23.

[4] For a review of participation rates see: Goldman, C. April 28, 2006. *Customer Experience with Real-Time Pricing as Default Service*. Presented at ISO-NE 2006 Demand Response Summit, Sturbridge, MA. The adverse consequences of such programs are described in: New England ISO, NEPOOL. February 18, 2005. *Compliance Filing of the New England Power Pool Participants Committee and ISO New England, Inc.* FERC Docket No. ER04-1255.

that reflect the marginal cost of supply, which is the compelling reason for implementing time-varying basic service.

The Absence Of Dynamic Pricing Raises Costs For Consumers[5]

In a robust market, the forces of competition drive consumption prices to a level that equates the marginal cost of supply to the marginal consumer value. Lacking the active expression of consumer preferences to ensure that supply costs do not rise above the value of the good, prices are free to rise to levels not justified by the marginal value of consumption. The cost to consumers rises as result of distorted signals because resources are not judiciously utilized. The optimal amount and composition of generation assets is not realized because investors base decisions on trends in usage that do not reflect the true value of electricity. Daily dispatch is sub-optimal as a result of demand fluctuations that are driven by weather and other factors and not tempered by the resulting higher supply costs. Fuel is consumed to serve loads, which if priced at the actual cost of supply, might not materialize. Finally, inefficiency in the electricity sector has an unavoidable ripple effect causing inefficient resource use in other sectors that suffer from the distortion in resource valuations, due to inefficient pricing, in the electricity sector.

III. BENEFITS OF DYNAMIC PRICING

Efficient Pricing Contributes To Lower Capacity Costs

Efficient pricing equates the marginal value of consumption to the marginal cost of supply. Price response based on efficient prices serves to alter consumer behavior over time reflecting how customers value electricity. The result is that observed daily and weekly trends in loads reflect consumers' willingness to pay on a sustained basis, and therefore provide investors with reliable signals as to the value of investments in generation, transmission and distribution. The reduction in price volatility clarifies for

[5] Appendix A contains a more detailed discussion of the economics of price response.

investors what customers will pay for electricity, and identifies trends in overall consumption of electricity and patterns of usage.

Planners are then able to identify future generation, transmission, and distribution needs with a lower margin of error, which in turn reduces the perceived risks to investors. New plant additions can be sized more effectively and profitably, which attracts and rewards investments and abates economic losses that result from unrealized demand and reduces the chance that capacity will be short of what is needed to reliably serve demand.

Dynamic Pricing Promotes Reliability

Inefficient retail pricing can lead to fluctuations in demand that range from less than optimal use of available generation to stretching reserves to the point that system reliability is endangered. If customers respond to high day-ahead LMP-based prices, generation units otherwise scheduled to serve load could be freed up in real-time to provide ancillary services. Price response to upwardly trending real-time prices could avert the need to undertake a reserve pickup (whereby the short-notice generation is dispatched) which would result in a shortfall of the reserves needed to meet primary contingencies. In this role, price response serves as self-dispatched ancillary service.

Consumption May Rise in Some Periods With Dynamic Pricing

When consumers pay prices that are below what they are used to paying as a flat rate, they have an incentive to increase usage. This is a natural, symmetric behavior and one that comports with achieving efficiency. When the flat, average cost rate was too high relative to supply costs, consumption in those periods was sub-optimally low. The dynamic price corrects that misdirection of resources and the customer's consumption will increase to equate the marginal value of electricity to its prevailing marginal cost. The benefit to the price responsive customers is the value of the added goods produced and services rendered, which now exceed the cost. Clarify next sentence or remove:

Society benefits also because deadweight losses are generated by suboptimal consumption, just as they are if consumption exceeds the social optimum.

A Recent Study Indicates Benefits for Massachusetts Consumers

A recent study commissioned by ISO-NE estimated the benefits that could be derived from of the adoption of alternative time-differentiated rates as basic service for New England electricity customers over 500 kW. [6] The study reported results on a zonal basis, which provides a preliminary assessment of the level of benefits that might result if Massachusetts were to adopt time-differentiated basic service, keeping in mind that the study only looked at larger customers. A complete study would need to include smaller commercial and residential customers, but perhaps would need to include only some of the same service plans.

The study found that time-differentiated basic service for customers over 500 kW could produce bill savings benefits to Massachusetts consumers of between $9 million and $24 million per year from reduced LMP volatility. Capacity benefits were not included in this study's benefit calculations. The study illustrates the insurance value of demand response. In years when supply or demand conditions, or a confluence of both, are such that price volatility or levels are extraordinarily high, price response produces relatively larger benefits, a substantial portion of which accrues to all customers, even those that elect a hedged service.

Since the ISO-NE study was conducted in the summer of 2005, the level and volatility of LMPs have risen. A relatively short stretch of unusual weather revealed how vulnerable the system is to the confluence of elevated demand and the loss of a small part of the generation capability. Congestion has become a major concern, and while

[6] Appendix B contains a more detailed discussion of the results of the ISO-NE study of the benefits of price response as the default service for customers over 500 kW. B. Neenan, Cappers, P., Pratt, D., Anderson, J. December 2005. *Improving Linkages between Wholesale and Retail Markets through Dynamic Retail Pricing: Preliminary Results*. Report prepared for New England ISO. Available at www.ISO-NE.com

initiatives are underway that will mitigate the impact in the long run, for the near term LMPs volatility may be higher than the study considered. These factors can result in higher LMPs that can trigger more load changes by price-responsive customers than the study suggests are likely, resulting in benefits to both those that respond and to all consumers. The adoption of the Forward Capacity Market will clarify the value of reduced loads at times when the system peaks, another source of benefits. As customers shift load away from peak periods, they will also benefit from reduced capacity requirements. An update to the ISO-NE study that focus on Massachusetts and its market circumstances will clarify the expected benefits associated with fostering price response through structure of basic service.

IV. DESIGN CHARACTERISTICS OF DYNAMIC PRICING STRUCTURES

Time-Differentiated Prices Can Be Crafted To Meet Consumer Needs

A variety of pricing plans are available to better link consumer prices to the cost of supplying energy. Each plan sets usage prices to track the time-varying nature of supply costs. They are often referred to as price response plans because they specify the usage prices and let customers decide based on the value they would derive how much to use at those prices. Price response plans can be categorized as follows:

1. **Real-time Pricing (RTP).** Usage prices are set every hour to reflect either the corresponding hourly ISO day-ahead market LMP or the real-time market LMP. RTP achieves the highest level of efficiency because prices always reflect contemporaneous marginal supply costs.

2. **Critical Peak Pricing (CPP).** A TOU schedule defines usage prices except under ‘critical’ circumstances, during which the TOU schedule’s peak price is replaced by another, much higher (and often times predetermined) critical peak price. As the name suggests, the high price is invoked to signal that supply costs are out of line with the TOU schedule peak price. Typically, the price change is made with short notice, one day or less. CPP is most efficient when the high peak

price corresponds closely to the actual supply costs when it is invoked, or to reduce peak demand to avoid capacity costs.

3. **Variable Peak Pricing (VPP).** Like TOU, the day (or just weekdays) is divided into a peak and off-peak period. The off-peak price is set in advance. The peak period price is set each day equal to the average of the corresponding ISO day-ahead market hourly LMPs. Like TOU, there is one price for all usage during the peak period, but that price changes daily. The peak period price is posted the afternoon of the day before it goes into effect. VPP is most efficient in cases where price volatility is predominantly confined to consecutive afternoon hours that constitute a peak period in the traditional TOU sense.

4. **Time-of-Use (TOU).** Consumption (energy) prices are set in advance, for a specified period of time, for different periods of the day (usually just weekdays) typically defined as peak and off-peak to reflect the underlying system demand circumstances. However, in some cases the day is further divided by designating a shoulder peak period that separates the peak and off-peak periods. The daily schedule may apply only to one or more seasons, or to the entire year. These plans are most efficient (achieve high utilization of resources) when supply costs follow a definitive and unwavering pattern where high LMPs are associated with the peak period. They are most effective in inducing customers to adjust usage, when the peak time periods include only a few hours of the day, and the price differential is high.

When demand intersects the supply curve at its steepest segment, a relatively small amount of demand response results in a substantial reduction in LMP, which triggers direct and indirect savings to consumers and enhances the sector's economic efficiency. For example, when the supply curve is especially steep, the supply flexibility, which measures the change in LMP for a one percent change in load, can be 20 or greater; that is, a one percent change in load results in a 20% change in LMP. The ISO-NE supply curve has in the past exhibited supply responsiveness.

Pricing plans that link usage prices directly to prevailing spot market LMPs are a very effective means for abating price volatility. In the short run, consumption prices reflect supply costs. In the long run, the consumption levels and patterns that efficient pricing reveals serve to guide resource decisions toward the socially optimal level. If consumers were inclined to take on such risks, then the electricity sector would become balanced in that supply and demand forces together determine how resources are used, and determine efficient prices. However, some consumers, and perhaps a substantial majority of residential customers, are not inclined to take on the price risks associated with hourly prices linked directly to LMPs.

A recent study by DOE summarized what has been learned from pilots and experiments involving time-varying pricing over the past 35 years.[7] The results are summarized in Figure 3. The salient findings are as follows:[8]

- The estimates of price elasticity from RTP programs for commercial and industrial customers range from very low (approximately 0.02) to quite high (about 0.28).
- Residential RTP elasticities are encouraging in their relative intensity, but represent only a relatively small number of customers in the pilots compared to the other customer segment experience.
- CPP , which has been promoted as an easier to implement, but just as effective means of achieving response to high prices, exhibits a tighter range of estimated values, which would indicate that the response varies less among customers or different circumstances.
- TOU elasticities are distinguished by the fact that they compare quite well with RTP.

[7] U.S Department of Energy. February 2006. *The Benefits of Demand Response in Electricity Markets and Recommendations for Achieving Them. A Report to U.S. Congress Pursuant to Section 1252 of the Energy Policy Act of 2005*. The figures accompanying the text were also adapted from the DOE study.

[8] Price elasticities are stated in absolute terms because in some cases the estimated demand curve produces an own-price elasticity of demand, which is negative in sign, and in others the estimated demand curve yields a substitution elasticity, which is positive design. Both can be interpreted as a relative measure of the intensity of how load is adjusted in response to price changes. For a discussion of these elasticity estimates and their interpretation, see DOE, February 2006, op cit.

The experience to date with TOU suggests that it can induce price response quite effectively. Because TOU involves a price schedule, the actual level of load change depends on the peak and off-peak prices that comprise that schedule. The greater the price spread for a given level of elasticity, the larger the load change, which in the case of TOU, predominantly involves shifting usage from the peak to the off-peak period. In

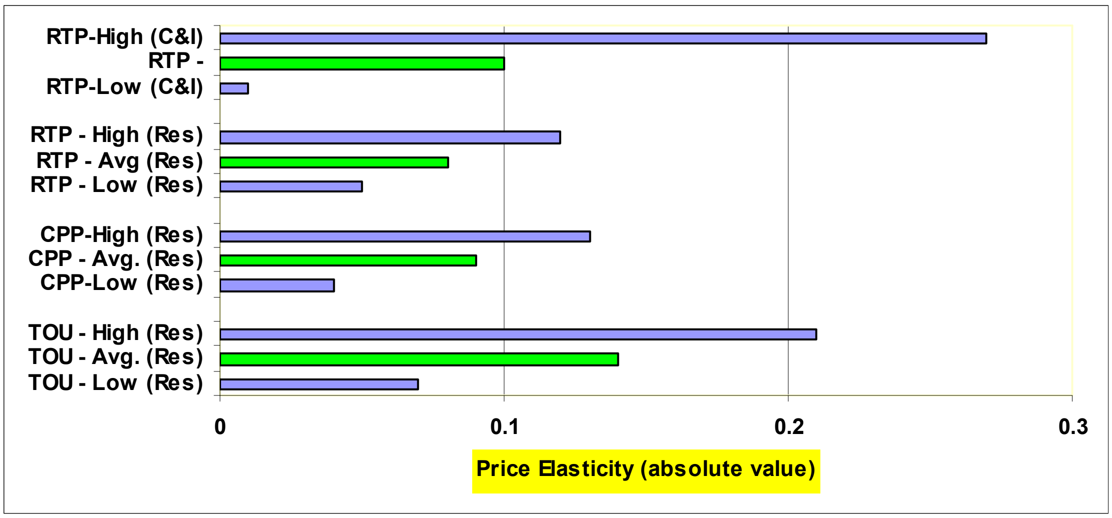


Figure 3. Range of Price Elasticity Estimates from Pricing Pilots and Experiments in the U.S.

other words, unlike RTP response that is transient in that it is induced by episodic LPM changes, TOU results in a sustained change in the pattern of consumption. This is especially valuable in reshaping the system load curve in ways that reduce the cost of supply in the long run.

The fact that price response can be realized under both RTP and TOU means that choice is not between adopting one or the other for all customer classes. The challenge is to find the right match between customer inclination to respond and a pricing plan's inducement to respond:

- TOU is likely best suited to residential and smaller commercial customers because responding involves changes in behavior that can be permanently integrated into business or lifestyle routines. The growing availability of monitoring and control devices for a wide range of appliances and machinery make these adjustments more easy to adopt and expand the extent to which customers can adjust load and realize savings.

- RTP comports with many larger customers' ability and inclination to manage energy usage to lower costs. Many are familiar with making commodity purchasing decisions and all businesses have to manage costs closely and creatively to survive. Electricity price volatility has some unique characteristics, but the requirements to save money are not as complicated as it might seem.
- LMPs tend to follow repeated patterns driven by market circumstances. The onset of hot weather, caused by a passing front, causes loads to go up in large part because customers activate air conditioning equipment. The higher loads causes prices to rise fairly predictably, higher the second and subsequent days of the business week, but falling off either as the front passes, or the weekend arrives. The level LMPs reach depends also on supply circumstances. If capacity is sufficient, then LMPs may rise to two or more times the average level. If shortfalls arise, or especially if congestion becomes a factor, then they rise to even higher levels. Saving money under RTP involves anticipating events that cause prices to rise systematically and having made provision to respond by reducing loads when prices are high and making up for lost activity at other times.
- Commercial customers operate under very diverse circumstances that defy generalizations. Some are suited for RTP, and others will find TOU more commodious. An important part of devising basic service is to determine how to make the demarcation of pricing regimes: by size (peak demand), which is the historical means of differentiating customers, by consumption volumes, by rate class (for billing purposes) or by other criteria (metering availability, anticipated elasticity, competitive alternatives, etc.).

Price Stability And Efficiency Can Be Jointly Realized

Because many customers, especially residential customers, are likely to elect basic service, at least for the immediate future, it is important that the design of basic service not maximize efficiency at the expense of price stability. Fortunately, efficiency and stability can be accomplished jointly by matching the design of time-varying basic service with customers' ability to benefit from it, and the need to achieve both short-term and long-term efficiency.

RTP offers an immediate way to abate price volatility because usage prices are linked directly to LMPs. This will improve allocative efficiency, which measures how well the available set of resources, both physical assets and fuel, are utilized. TOU provides customers with incentives to adjust usage on a permanent basis. The relative peak and off-peak prices reflect trends in the level and character of LMPs and the character of their volatility, thereby inducing lasting adjustments in usage that result in dynamic efficiency, the long-term optimization of societal resources.

The design of basic service, and its predecessor default rates, has been shaped by concerns about ensuring price stability. Rightfully so. When the wholesale generation market was first opened to competition, predicting the pattern and level of LMPs was fraught with uncertainties about the supply circumstances, how suppliers would bid services, and how the LMP creation process would divulge the relationship between supply and demand conditions. Moreover, the extent and availability of hedged alternatives from competitive suppliers was uncertain. A simple, highly averaged price for basic service served to ensure a substantial degree of price stability so the consumers would not be ravaged by price shocks of a magnitude that defied responding to. Efficiency was a consideration, as was the timeliness of the procurement process, which involves frequent supply bidding to reflect trends in supply costs.

By now, LMPs have become more predictable. As a result it is now possible to give greater weight to efficiency concerns in setting basic service prices.

- Customers are better able to conduct analyses to determine the extent to which they can respond to prices, and can estimate the savings from doing so.
- A time-of-use rate can employ a relatively fixed peak period to capture the highest LMPs using only a few afternoon hours in the summer and winter months. Since the same hours define the peak, basic service prices will change to reflect

trends in the market. As a result, the fixed TOU peak period results in price stability that rewards customers for permanent changes in load patterns.

- Customers can get help in devising and carrying out response plans from the growing number of firms that have made it their business to help customers understand the benefits of demand and price response.
- There is a growing inventory of technologies to help customers monitor and manage their electricity usage, enabling customers to save money through price response, and achieve other productivity and efficiency benefits.
- The availability of competitive alternatives to basic service is developing steadily, especially now that residential basic service rates more closely reflect the cost of supplying hedge service.

The time is right to give proper attention to the role of basic service pricing in the development of a sustainable competitive electricity market in Massachusetts.

Customers Want Choices In How They Purchase Electricity

A study conducted several years ago provides valuable insight into how customers would like to be able to buy electricity.[9] A comprehensive survey was administered to residential customers, and nonresidential customers with demands under one megawatt, to determine preferences for alternative pricing plans. The results, illustrated in Figures 4 and 5, confirm what many have said for years: many customers want greater time-differentiation in electricity pricing. Some important insights for the design of basic serve are as follows:

- Over half of the survey respondents indicated that they preferred a time-varying rate. The survey's residential customers paid inverted rates, with inclining block

[9] Public Service of Oklahoma, July 11, 2000. *ValueChoice (SM) Portfolio of New Pricing Products: Market Acceptance Testing Among Public Service of Oklahoma Residential Customers*. Available at www.utilipoint.com Public Service of Oklahoma, May 2, 2000. *ValueChoice (SM) Portfolio of New Pricing Products: Market Acceptance Testing Among Public Service of Oklahoma Non- Residential Customers*. Available at www.utilipoint.com

rates in the summer and declining block rates in the winter. Commercial customers paid hours-use rates.

- Preference for RTP was virtually the same among residential (7%) and non-residential (8%) customers.
- Residential customer indicated a strong preference for TOU; 37% said that it was their first choice, almost as high as that for the existing block rate and a flat rate alternative combined.
- Commercial customers indicated a lower preference for TOU and a higher preference for the block and swing rate that allows them to commit some load to the TOU rate schedule and then pay for additional load at the RTP rate.

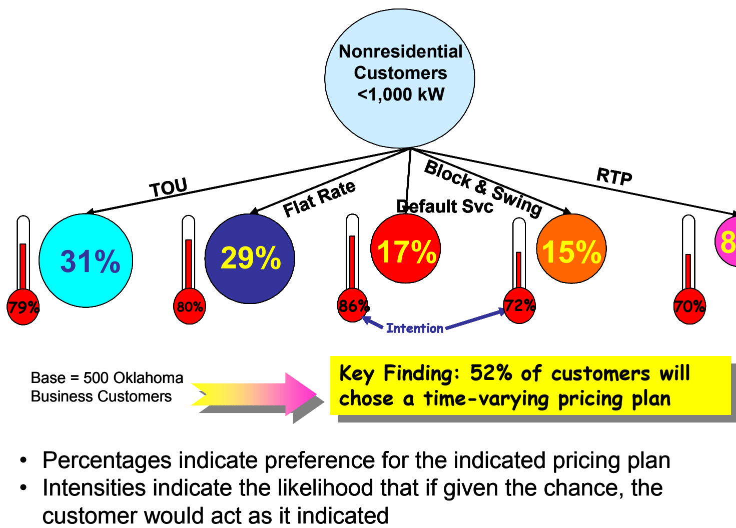


Figure 4 Non-Residential Customer Pricing Plan Preferences

Unfortunately, a comparable study has never been done to solicit Massachusetts' customer preferences for alternative pricing plans. But, such a study would in all likelihood reveal that a substantial number of Massachusetts customers want to be able to buy electricity under a plan that properly rewards them for taking control of when and how they use electricity.

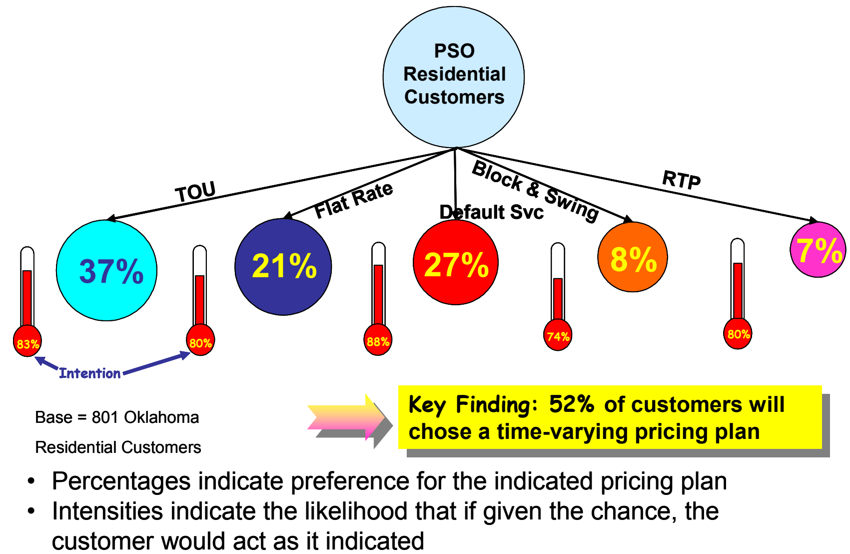


Figure 5 Residential Customer Pricing Plan Preferences

For Large C&I Customers, Prices Should Be Linked To Hourly Market Prices

DOER recommends that real-time pricing be limited to C&I customer classes that currently possess interval metering technology and are over a certain size threshold. The exact size threshold may differ among utility companies, depending on their specific rate classes. Customers subject to RTP are sophisticated in their purchasing and procurement decisions and are already subject to some form of time-of-use pricing in their distribution rates. In addition, because they already have the metering technology and are billed under TOU distribution rates, incremental data processing and metering costs are minimized. Finally, customers with limited ability to shift load off peak would have ample opportunities to switch from basic service to a competitive supply option. The most recent DOER customer migration data for September 2006 show that 65% of customers in the large C&I customer group as classified by DOER, which consists of utility customer classes with interval metering, have migrated to competitive supply. An investigation by the Department should examine the costs and benefits of different size thresholds for basic-service customer participation in RTP and whether to utilize day-ahead or real-time prices.

Case studies of the performance of RTP-based default service offer encouraging results. The NGrid New York Study revealed that many customers that have elected a competitive service chose a pricing plan similar to NGrid's RTP-based default service. They reported that they switched from basic service for several reasons: to take advantage of a shopping credit built into the default RTP service; because a lower cost day-ahead RTP service was offered; because a competitive supplier allowed the customer to designate part of its load to a fixed rate schedule and pay the day-ahead RTP for additional load; or a competitive supplier allowed the customer to switch from RTP to fixed price service at its election, on relatively short notice.[10] The proliferation of variations on the RTP basic service design to accommodate customer's individual needs is a sign that the market is maturing.

A study of the performance of default RTP service in other states reports similar findings, which are illustrated in Table 2 and Figure 6, as follows. [11]

[10] Goldman, C., Hopper, N., Bharvirkar, R., Neenan, B., Boisvert, R., Cappers, P., Pratt, D., Butkins, K. 2005. *Customer Strategies for Responding to Day-Ahead Hourly Electricity Prices*. Demand Response Research Center. Lawrence Berkeley National Laboratory Report No. LBNL-57128. Available at http://www.lbl.gov/.

[11] Goldman, C. April 28, 2006. *Customer Experience with Real-Time Pricing as Default Service*. Presented at ISO-NE 2006 Demand Response Summit, Sturbridge, MA: Barbose, G., Goldman, C., Bharvirkar, R., Hoper, N., Neenan, B. Forthcoming 2005. *Real-Time Pricing as a Default or Optional Service for C&I Customers: A Comparative Analysis of Eight Case Studies*. Ernest Orlando Lawrence Berkeley National Laboratory, Demand Response Research Center. Report No. LBNL-56661.

- Load representing from almost 10% (New York, Niagara Mohawk (NMPC)) to about 18% of system peak load are exposed to hourly prices.
- The proportion of those that exhibit price response, which means that they adjust usage to changes in the hourly prices, is two-thirds in New York (NMPC), about half in New Jersey, and under a quarter in Maryland. The NY results may reflect the maturity of that market; RTP has been the default service since 1998. Maryland customers exposed to RTP tend to be smaller is size, and more commercial or service oriented, than those in New Jersey, which may account for the lower price response.

Case Studies of Default RTP in the U.S.

State	Utilities	Year of Implementation	Applicable Customers
New Jersey	Statewide	2003	>1.25 MW
Maryland	Statewide	2005	>600 kW
Pennsylvania	Duquesne Statewide	2005 2007 (proposed)	>300 kW >500 kW
New York	Niagara Mohawk Central Hudson Statewide	1998 2005 2006/07	>2 MW >500 kW Differs by utility
Illinois	ComEd	2007 (planned)	>3 MW
Ohio	Cinergy/CG&E	2005	Returning C&I >100 kW

Table 2. RTP as Default Service for Larger Customers

- Price response comes equally from default RTP service and a competitive supplier equivalent in New York and Maryland, but in New Jersey almost two-thirds of the price response comes from competitive suppliers. The latter result may reflect the use of real-time prices in NJ for default service, which would provide customers with a strong incentive to switch to a competitive supplier in order to hedge some its load, or have the option to switch away from RTP at its discretion.
- The proportion of customers that pay prices tied to LMPs and do not respond is from one-third (NY) to over 75% (MD). Interviews with NY customers and competitive retailers reveal that many of these customers chose RTP because they believe that the hedging premiums available from competitive retailers are too high relative to the expected level of hourly LMPs. Some retailer in NY report that customers are asking to pay real-time LMPs, recognizing that on average they are 5% less than the day-ahead equivalents, despite the fact that doing so

constitutes greater risks, since the real-time hourly LMPs are posted by the NYISO after the fact.

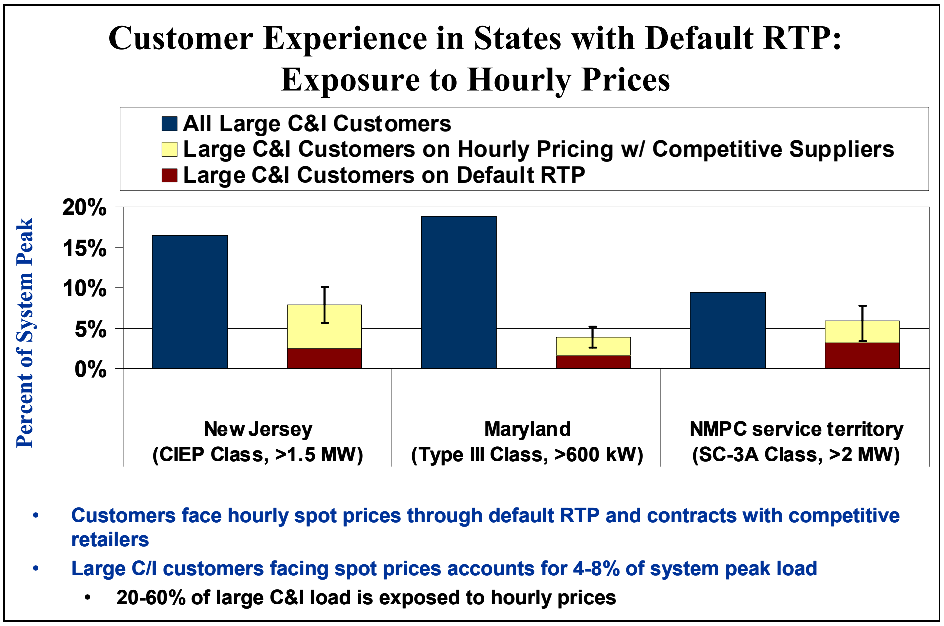


Figure 6. Customer Experience with RTP as Default Service

For Residential and Smaller C&I Customers, Basic Service Should Reflect Peak and Off-Peak Prices

Residential and smaller C&I customers should be charged a time-of-use rate that consists of a two-part tariff with separate prices for peak and off-peak periods during the summer and winter months. Peak periods would be defined as some portion of the afternoon during weekdays and would differ based on winter and summer months.

While perfect efficiency would be sacrificed with this approach compared to an application of real-time pricing to all customers, there are two important considerations in providing time-differentiated service to this customer segment. First, almost all of these customers do not possess the necessary metering for real-time pricing, and metering cost is an important factor in the cost-benefit calculus when considering implementation to smaller customers. Second, many of these customers may not possess the necessary sophistication and ability to shift loads or simply may not desire to manage their loads to the degree necessary to maximize efficiency gains under real-time pricing. An investigation by the Department should examine the costs and benefits of different variants of TOU pricing. The proceeding should also be designed to develop the specific delineations of peak and off-peak periods.

V. THE DEPARTMENT SHOULD OPEN A NEW INVESTIGATION INTO DYNAMIC PRICING FOR BASIC SERVICE

The Department Should Order Dynamic Pricing for All Customers on Basic Service

DOER hereby petitions the Department to conduct a comprehensive inquiry or series of inquires into the potential benefits of implementing time-based basic electric service in Massachusetts. The existing pricing of basic service, by design, protects customers from the price volatility that characterizes the New England electricity market; yet, it is a primary contributor to rising electricity prices. Until customer demand is more adequately represented, price volatility can only be abated by administrative measures like price caps, that are contrary to an efficient market where sellers bid prices that reflect market conditions as they see them and customers respond by altering consumption in response to those prices. Because customers have misleading price signals on which they base consumption decisions, administrative measures that seek to improve market efficiency turn out to be an expensive and ineffective way to achieve competitive market-like results.

If the Department grants DOER's petition, DOER would immediately undertake the analyses required to evaluate the costs and benefits of alternative pricing regimes for basic service. DOER would retain UtiliPoint International, Inc. to conduct that study.

This firm's principles produced the study of the impacts of default service in New England released by ISO-NE. The substantial effort undertaken to develop the basic modeling platform used in that study would provide the basis for conducting a study directed at the Massachusetts marketplace.

The study would include the following tasks:

- Update the supply and demand models that were developed for the ISO-NE study. The supply model will be updated to reflect recent LMP history. In addition, the capacity impacts model will be revised to conform with the approved (albeit still evolving) Forward Capacity Market (FCM). The demand model will be refined to provide greater resolution to the characterization of Massachusetts customers, and to incorporate current basic service rates.

- The study will utilize forward market views to establish the benefits of price response. These forward views consist of hourly LMPs and corresponding FCM market-clearing capacity prices. The consultant will work with DOER, ISO-NE and other stakeholders to develop credible forward market characterizations.

- The consultant will evaluate the impact of several basic service pricing regimes.

- Simulations will be conducted by the consultant to quantify the benefits of the alternative basic service plans using the modeling platform. The results will be categorized and summarize to facilitate determining the consequences of alternative basic service pricing plans.

- The consultant will identify the implementation requirements associated with each pricing plan that is evaluated and develop a cost model that provides a first-order estimate of the one-time and ongoing costs for each basic service plan.

- The consultant will develop a benefit/cost analysis of each pricing regime.

DOER is prepared to present its case to the Department, including the study and findings described above and expert testimony in support of its particular pricing recommendations within three months of a decision by the Department's to open a docket.

Time-Based Metering And Data Processing Systems Are Essential

The introduction of time-differentiated rates is hindered by the fact that the metering required is not currently in use by most customers. Utility billing systems that could effectively and efficiently bill customers for time-varying rates is also not universally available. While most customers with a maximum demand over 500 kW already have interval metering sufficient to implement most of the basis service options needed to foster demand response, full deployment of pricing plans such as RTP may require additional upstream investments in data collection and processing systems. However, if more complex pricing plans, such as RTP, are limited to the largest customers, the added requirements should be manageable at costs that are considerably below the resulting benefits. Clearly, a careful and thoughtful study is required to fully specify the requirements and ratify the costs. DOER anticipates that the incremental costs of new metering and billing systems would be additive to metering and data-processing system costs that are currently included in rate base and collected through existing rates.

It will be important for the proceeding to take account of other benefits that flow from adopting more modern and flexible metering and data management systems. These include the benefits of lower meter reading and meter-to-revenue processing costs, value-added services for customers that improve their ability to alter how they use electricity, and the creation of new opportunities for investment in technologies that improve energy efficiency and manage usage based on prevailing prices.

Proposed Issues To Be Addressed And Resolved In The Proceeding

- Matching basic service design to customers' ability and inclination to respond to price changes. The full range of potential pricing plans would be evaluated, including:
    - Real-time pricing, using both day-ahead and real-time LMP
    - Time-of-use schedules that reflect daily and seasonal patterns in hourly LMPs
    - Hybrids such as critical peak pricing and variable peak pricing that capture many of the benefits of RTP but are more customer accommodating, like time-of-use.
    - New pricing plans that are proposed by stakeholders
- Quantifying the benefits of price response. It is vital to quantify, to the extent possible, the level and distribution of benefits associated with alternative basic service pricing plans to be able to assess trade-offs between efficiency gains and the costs to implement, and to evaluate customer acceptance. The analyses should consider explicitly the benefits of price response under a variety of market conditions to reveal the extent to which price response results in avoided costs, and provides a form of insurance against adverse market circumstances.
- Assuring compatibility of basic service with ISO-NE demand response programs. Basic service should complement programs implemented by the ISO that integrate customer load changes directly into market operations. In order for price response to be fully effective, its affect must be anticipated by market participants, both from a planning perspective, and on a daily basis. Another important design consideration is the treatment of demand response as a capacity resource in Forward Capacity Market auctions.
- Establishing the appropriate metering requirements and how the costs involved will be recovered.
- Establishing mechanisms for procuring basic service. Other jurisdictions have adopted time-varying rates and procure basic service using an auction mechanism, in particular RTP is in use in New Jersey and Maryland, Illinois recently conducted it first successful auction to procure a supplier for RTP-based default

service for customers over three megawatts, and residential RTP program participants.

- The proper structure of basic service for low income customers. A discount for low income customers can be realized within a time-varying basic service rate that promotes the efficiency use of electricity. The low income discount could be maintained under a TOU plan, while still providing energy prices that would offer these customers opportunities to shift consumption to off-peak times and realize additional bill savings.
- Setting a time table for implementation. The benefits of price response start as soon as customers face prices that reflect LMPs. But, developing the infrastructures takes time, and there may be important scope and scale aspects to its development, and to educating customers and supporting their development and deployment of price responsive behaviors.

DOER believes that the first step in the Department's investigation should in implementing Basic Service that is priced on a real time dynamic basis in the area of larger Commercial and Industrial customers where sophisticated customers are already far more active in the use of electricity from Retail Suppliers and there is already significant use of more advanced meters. Modifying Basic Service for Residential and smaller Commercial and Industrial customers will require a different approach and could be undertaken separately as a later step.

VI. LEGAL BASIS FOR OPENING THIS INVESTIGATION

Under the Restructuring Act, the Department has the legal authority to investigate how basic service can be better crafted to meet the requirement that it "provide electricity buyers and sellers with appropriate price signals." St. 1997, Ch. 164, §1(g). Dynamic pricing presents a unique opportunity to meet the challenges of the Restructuring Act by enabling electricity suppliers to operate more efficiently and provide clear price signals for basic service customers.

"The Department has broad authority to investigate and rule on the rates, prices, and charges of an electric company." Mass. Electric Co. v. DPU, 419 Mass. 239 (1994) (citing G.L. c. 164, § 94). In D.T.E. 99-60-A at 4, the Department stated that default service should function as a basic service that provides consumers with the appropriate incentives to turn to the competitive market for more sophisticated or advantageous service offerings. The Department has also acknowledged that "In order to function as a basic service, default service should provide customers with efficient price signals. However, extended periods of price certainty for what is, after all, last resort service, serves to undermine retail competition." DTE 02-40-B, at 37.

While the Department has investigated the structure of basic service on numerous occasions, and recognized the need for appropriate price signals, it has never fully analyzed the actual benefits, and costs, of using dynamic pricing for this service. DOER proposes to provide evidence that dynamic pricing can meet the statutory requirements for basic service, provide both suppliers and consumers with efficient price signals, and provide capacity and reliability benefits for the entire region.

The legislature has stated that default service "shall not exceed the average monthly market price of electricity" and "shall include payment options with rates that remain uniform for periods of up to six months." G.L. c. 64, §1B(d). There is nothing in that legislative mandate that prohibits dynamic pricing, nor is there a requirement for a single rate structure or price. Indeed, the Department has previously approved the pricing and procurement of basic service in ways that provide different rates on a month-to-month basis. In an investigation pursuant to this petition, the Department would have the opportunity to explore various dynamic pricing structures that could meet the legislative criteria for basic service. To cite but one example, time-of-use pricing with a peak and off-peak rate, procured for periods of six months at a time, would remain "uniform" for that period and produce a rate that does not exceed the "average monthly market price" of electricity.

The Department has already recognized the need to shift from a minimum six month procurement period to a six month maximum. D.T.E. 02-40-B, at 39, fn 18. Likewise, the Department anticipated further investigation into the length of procurement periods by stating "A persuasive, though not yet convincing case can be made for the proposition that a procurement term of one month would (1) provide efficient price signals to customers because the resulting prices would track wholesale market price on a monthly basis; (2) provide customers with an appropriate level of price certainty and (3) provide appropriate protection from spot market price volatility." Id. at 39. DOER proposes to now provide the convincing case that the Department has been seeking.

Electricity restructuring in Massachusetts seeks to achieve competitive markets in generation that (i) provide electricity suppliers with the incentive to operate efficiently, (ii) open markets for new and improved technologies, (iii) provide electricity buyers and sellers with appropriate price signals, and (iv) improve public confidence in the electric utility industry. St. 1997, Ch. 164, §1(g). The investigation requested here would present the Department with sufficient evidence to determine that Massachusetts electricity buyers and suppliers will benefit from a basic service structure based on dynamic pricing.

VII. CONCLUSION

For the reasons state above, DOER respectfully requests the Department to open an investigation into the benefits of dynamic pricing for basic service.

DIVISION OF ENERGY RESOURCES

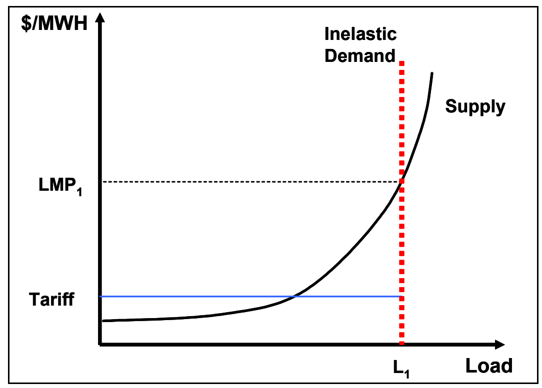
Rachel Graham Evans
Legal Counsel

<ins>Appendix A</ins>

Appendix A

The Economics of Price Response

Direct Effect of Price Response. Wholesale spot markets with no demand response treat demand as inelastic. The intersection of that vertical demand and the supply curve established the LMP. When high loads coincide with a sharply upward sloping supply curve, LMPs can achieve very high levels. Panel A depicts this situation, where LMP_1 is the market-clearing price. The deviation of LMP from the tariff rate is important, as it represents inefficient usage of societal resources and results in higher customer bills, compared to a market that exhibits price response.

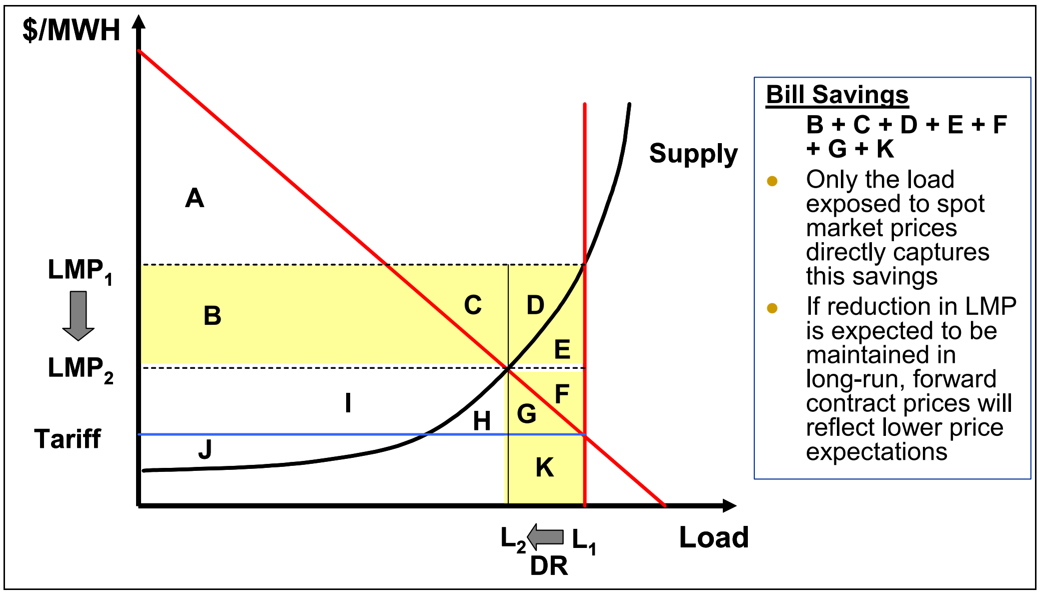


Panel A. LMPs when Demand is Inelastic

If customers, or at least some customers, are price responsive, and they pay prices that reflect the hourly LMPs, then the demand curve is downward sloping over at least some range of loads. The result is that the market clearing LMP is lower, as depicted in Panel B by LMP_2, because customers reduced usage from L_1 to L_2. The supply curve is the same, but price falls due to price response.

In Panel B, the areas labeled by capital letters represent bill savings to customers, either directly or indirectly, that are attributable to price response. The customers that responded to the high LMP (L_2) realize savings equal to the areas labeled D, E, F, G and K, which is the load reduction times the difference between LMP_1 and LMP_2. Savings to other customers come about because the LMP is lower. If all load was transacted in the spot markets, the savings would be measured by shaded areas B and C. However, typically 60% or more, of load is sold under bilateral contracts the provisions of which are not affected by LMPs, at least not directly. As a result, the direct savings of price response is the portion of the shaded area B plus C represented by load settled in the spot market.

Indirect Effect of Price Response. Bilateral contracts are also impacted by price response. In developing bilateral contracts that offer a flat price for energy, suppliers build in a hedging premium to reflect their risks, which are that actual LMPs deviate from the average level of the forward price forecast used to develop the contract, and that actual usage varies from the level used to set the load weighted average prices. The first element is salient to measuring the affects of price response, because if LMPs are less



Panel B LMPs When Demand is Elastic

volatile, then price risks are lower and so are hedge premiums. Additional consumer savings accrue to customers that are not price responsive, and in fact do not face price volatility at all, in the form of reduced hedging costs. These savings are defined by the amount of load transacted through fixed price bilateral contacts multiplied by the impact of price response on the level and volatility or LMPs.

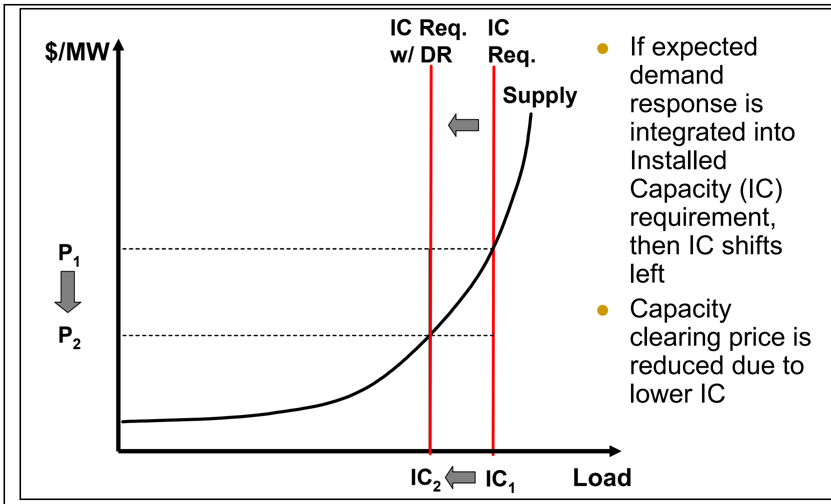
Societal Benefits. In economic terms, optimum economic efficiency is achieved when consumption prices are equated to the marginal cost of supply because resources are allocated efficiently. Consequently, when usage prices diverge from the cost to supply electricity, resource efficiency is less than optimal. For example, if the cost of supply is well above the price the consumer pays for energy, then the consumer makes its consumption decisions without proper regard for the resource costs involved. The result is that consumers use too much electricity when marginal supply costs are high relative to the average price they pay. These additional, inefficient expenditures on electricity are at the expense of those for other goods and services that are priced (properly) at marginal costs: their consumption is below the efficient level. As a result, resources in many sectors of the economy are not allocated efficiently. If some retail consumers pay electricity prices that reflect the marginal cost of supply, as an RTP program would accomplish, the change in electricity consumption results in efficiency improvements throughout the economy of Massachusetts.

Panel B also depicts the consequences of this inefficiency. The price indicated by the letter T is the average tariff prices. The LMP is the actual market-clearing price. Load, represented by the letter L is higher than the social optimum in the absence of price response. The area above the demand curve and below the supply curve which is to the right of the equilibrium (LMP_2 in Panel B), where supply and demand intersect, measures the resource or societal losses, referred to as deadweight losses. This is the area labeled E and F in Panel B

Market efficiency is improved if customers pay prices that reflect contemporaneous LMPs and make hourly consumption decisions that are tied directly to the prevailing marginal cost of supply. The usage adjustments they make, relative to what they would have consumed under an average rate, result in reduced deadweight losses; in other words, a welfare improvement. Load drops and welfare losses are reduced, and enough load responds so that supply and demand are equated, then deadweight losses are fully abated. The greater the disparity between the average prices paid by flat rate, non-RTP customers and the RTP price, the more efficiency society gains from price response induced by an RTP program.

Price response can result avoided capacity costs.

Price response can influence the prices that clear the capacity market. To the extent that high LMPs are coincident with system peak demand, as measured for the purposes of setting capacity requirements, price response reduces those requirements by shifting the



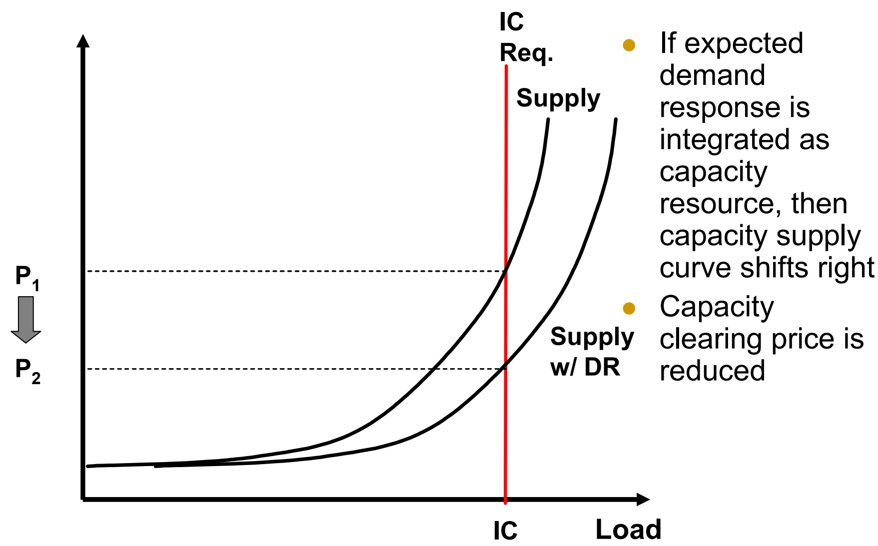
Panel C. Impact of Peak Load Reduction due to Price Response on Capacity Costs

demand curve for capacity so it intersects capacity supply at a lower level. Panel C illustrates this effect. The initial capacity requirement, the vertical line labeled as *IC Req.* is shifted leftward to that illustrated by IC Req.w/DR, because system peak demand is reduced, causing the market-clearing price of capacity to decline from P_1 to P_2.

Alternatively, if a peak load reduction that results from demand response is treated as a capacity resource, so that customers, or their agents, can offer the capacity equivalent into the market, for example as a capacity resources in the ISO-NE Forward Capacity Market, then the demand for capacity by LSEs remains constant, but the supply curve is shifted leftward, resulting in a lower market-clearing capacity prices, as depicted in Panel E.

The implicit benefits of peak-hour coincident load reductions accrue to the customer, if it pays an unbundled rate with its ISO-NE capacity requirement separately calculated based on its coincident peak. Alternatively, if the capacity costs are incorporated into basic service energy prices, then the benefit accrues to the customer's supplier. However, the

ISO-NE has not yet determined if peak reductions that arise from price response will be allowed to be declared as capacity resources, and if so, how the obligation would be fulfilled under its FCM provisions regarding seasonal peak hours and critical peak hours.



Appendix B

Benefits of Adopting Time-Differentiated Basic Service

for MA Customer over 500 kW

A recent study commissioned by ISO-NE evaluated the benefits of the adoption of alternative time-differentiated rates as basic service for New England electricity customers over 500 kW.[12] The study reported results on a zonal basis, which provides a preliminary assessment of the level of benefits that might result if Massachusetts were to adopt time-differentiated basic service, keeping in mind that the study only looked at larger customers. A complete study would include smaller commercial and residential customers, but perhaps would include only some of the same service plans.
study, which was commissioned by ISO-NE, is entitled:

A statistical supply model was developed for each ISO-NE pricing zones to quantify the impact of changes in load on zonal LMPs. **Base** model supply (zonal load) model parameters (the factors that determine LMP in any hour) were estimated using historical data. They include the hourly LMP, available capacity, operating reserve levels, a measure of congestion, weather conditions, and import and export levels. For any hour in that year, the impact on LMP is simulated by adjusting the load from the observed to some new (lower) level, and calculating the changing LMP that results.

Future supply conditions were constructed to reflect **High** and **Extreme** years to provide the means for establishing the value of demand response to mitigate factors that otherwise would result in high price volatility and higher customer bills. Expected benefits were developed from these cases by weighting them by the likelihood of this occurring (57 % Base, 29 % High and 14 % Extreme).

Demand was represented by developing hourly load shapes by customer class and business activity, and assigning to each a price elasticity value. The price elasticities are

[12] Neenan, 2006, op cit.

the corresponding price elasticity estimates, by business activity, for customers of NGrid in New York based on observed price response over the period 2000-2005, during which they paid hourly energy prices directly linked to the NYISO day-ahead prices. The elasticity represents that exhibited by the most price responsive customers (those with an elasticity over 0.05), which are the ones that are likely to choose basic service under the pricing plans evaluated. The price elasticities used are as follows:

- Manufacturing = 0.34
- Commercial/Retail 0.21
- Government/Education 0.21
- Public Works 0.09
- Heath Care 0.07

For purposes of simulating the impacts, these customers are assumed to be served under the default service pricing. But, the responses and benefits would be substantially the same if they were served under an equivalent pricing plan by a competitive supplier.

In conducting the simulations, participation in base services, was set to correspond to the percentage of customers that are the most responsive, based on the NGrid New York Study, which result in the following level of base service participation:

- Manufacturing = 43%
- Commercial/Retail 24%
- Government/Education 45%
- Public Works 11%
- Heath Care 40%

Five different default service options were evaluated, by comparing the impacts to a tow-period TOU rate the structure of which comported with that of the default service at the time priced at a market-equivalent rate. Several alternative structures were evaluated, as follows:

1) a three-part time-of-use (TOU) rate that is comprised of a price schedule, set in advance, that specified the prices for off-peak, shoulder peak and peak prices;

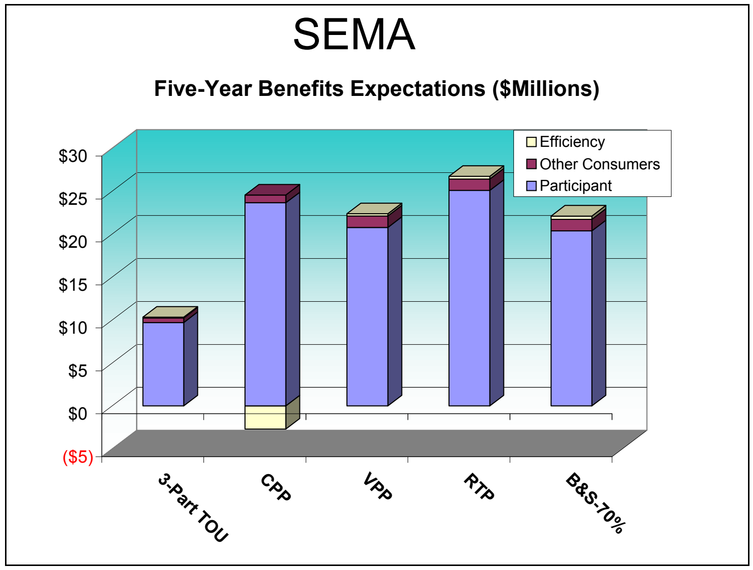
2) a critical peak pricing (CPP) rate that employs the same TOU rate schedule except on days when zonal loads were expected to establish the summer monthly peak, in which case a much higher peak rate is substituted for that of the TOU schedule;
3) variable peak pricing (VPP) rate, which also uses the TOU rate schedule of off-peak and shoulder peak prices, but sets the peak hours' price each day equal to the average of the corresponding day-ahead LMPs:
4) real-time pricing (RTP) rate whereby customers receive a new hourly rate schedule each day applicable to the next days usage; and
5) and a block and swing rate whereby the customer nominates peak and off-peak load to the TOU schedule and all remaining load in any hour is charged the RTP price.

The price response benefits are characterized as those that accrue to 1) **participants**, customers that pay the default prices or their equivalent, 2) benefits that accrue to **other customers** due to lower LMPs or hedging premiums, and 3) **societal** benefits (reductions in deadweight losses).

The study projects expected benefits over a five year period by benefit category for each of the pricing options. They are depicted in Panels E (NEMA), F (SEMA), and G (WCMA). These benefits reflect to LMP impacts only: at the time of the study, uncertainty about the structure of the capacity market precluded estimating the benefits of capacity savings. The results can be summarized as follows:

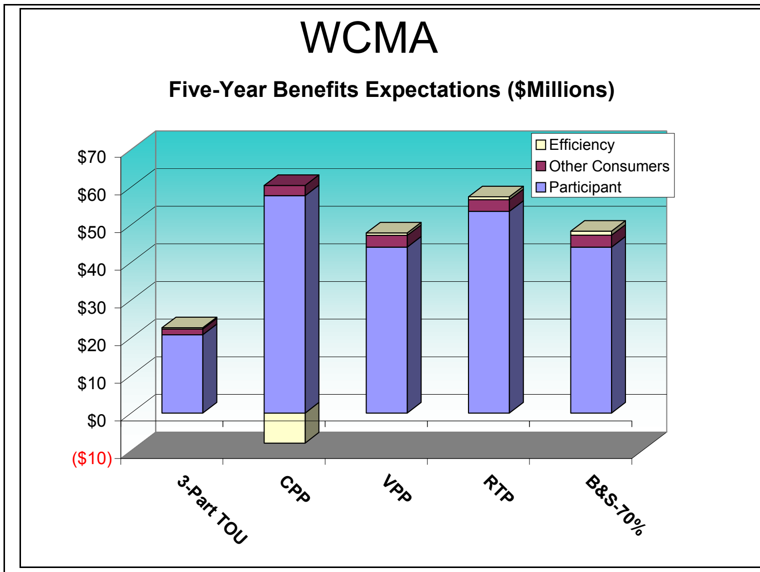
- The five-year benefits of time-based basic service in Massachusetts range from \$46 million to over \$120 million (\$9million to \$24 million per year). This analysis includes only customers 500 kW and above, and only some of which are assumed to be price responsive.
- RTP produces the highest expected benefits, over \$50 million per year in NEMA and WCMA and \$25 million in SEMA. The benefits are predominately realized by participants.
- VPP achieves at least 80% of the benefits associated with RTP. However, this result is due to the absence of the measurement of capacity benefits, which may accrue more widely.

- CPP achieves total benefits nearly equal to those of RTP in SEMA and WCMA. However, CPP exhibits negative societal benefits, which means that the CPP plan modeled results in lower efficiency than a two-part TOU. This is because CPP's very high peak price is triggered by expectations of setting the monthly peak prices using the day-ahead prices and weather to develop the expectation. When real-time LMPs turn out to be low, the CPP imposes a price that is too high relative to the marginal supply cost, resulting in reductions in electricity usage that are not warranted based on supply costs, and substantial welfare losses result. CPP presents a challenge to implement as a basic service rate. It would require that the supplier chosen to serve this load propose how it would implement the provision for replacing the TOU peak prices with the much higher CPP price. The protocols adopted and the CPP price itself would likely vary considerably among bidders, which would compound comparing bids as their inherent benefits to participants, and to the suppliers, would differ.

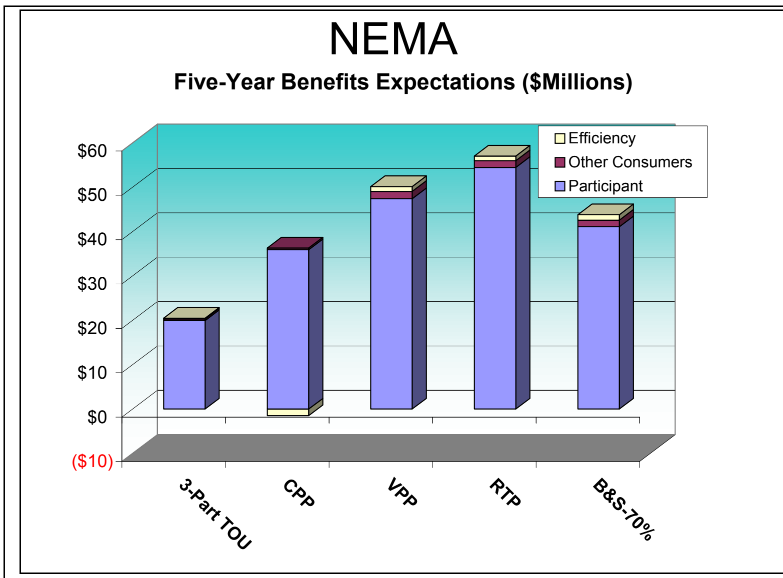


Panel F. Benefits of Price Response in SEMA

- Block and Swing (B&S) pricing compares favorably with VPP, although less so in NEMA. B&S also is challenging to implement as a basic service, since it allows customers to decide how much to commit to each TOU block, the remainder priced at RTP. This complicates bidding by competitive suppliers, and may result in larger premiums than TOU because of perceived risks, at least initially.



Panel G. Benefits of Price Response in WCMA



Panel H. Benefits of Price Response in NEMA

Appendix C

Customer Experience with Default RTP

A study conducted by Lawrence Berkeley National Laboratory examined the extent to which RTP-based default service in retail choice markets has fostered price responsive behaviors. Panel I summarizes theses initiatives. The study looked at default service in six states with a considerable span of experience. Default RTP was introduced in New York at Niagara Mohawk (now National Grid New York) in 1998 for customers over 2 MW. New Jersey and Maryland followed suit in 2003 for customers over 1.25 MW and 600 kW, respectively. One Pennsylvania utility (Duquesne) adopted RTP for customers over 300 kW in 2005, the same year another NY utility (Central Hudson) adopted it for customers over 500 kW, and Ohio adopted it for customer over 100 kW that return default service. Illinois (customers over 3 MW) and the rest of Pennsylvania (customers over 500 kW) are scheduled to adopt default RTP in 2007, and the other New York utilities have been ordered to introduce or expand default RTP beginning in 2006.

Case Studies of Default RTP in the U.S.

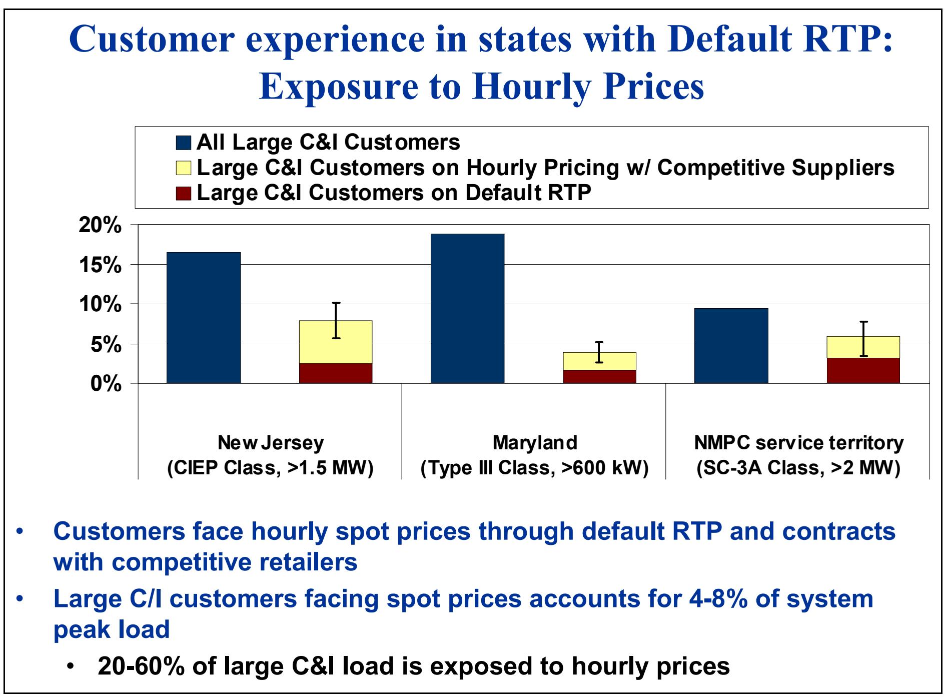
State	Utilities	Year of Implementation	Applicable Customers
New Jersey	Statewide	2003	>1.25 MW
Maryland	Statewide	2005	>600 kW
Pennsylvania	Duquesne Statewide	2005 2007 (proposed)	>300 kW >500 kW
New York	Niagara Mohawk Central Hudson Statewide	1998 2005 2006/07	>2 MW >500 kW Differs by utility
Illinois	ComEd	2007 (planned)	>3 MW
Ohio	Cinergy/CG&E	2005	Returning C&I >100 kW

Panel I. Case Studies in RTP as the Default Service

The study used interviews with utilities and suppliers to estimate the percentage of the default service customers that paid RTP prices or an equivalent thereof, and as a result could be price responsive. The findings for NY, NJ and MD, for which sufficient information was provided to construct estimates, and which are depicted in Panel J, are as follows:

5. Load representing from almost 10% (New York, Niagara Mohawk (NMPC)) to about 18% of system peak load are exposed to hourly prices.

6. The proportion of those that exhibit price response, which means that they adjust usage to changes in the hourly prices, is two-thirds in New York (NMPC) about half in New Jersey, and under a quarter in Maryland. The NY results may reflect the maturity of that markets; RTP has been the default service since 1998. Maryland customers exposed to RTP tend to be smaller is size, and more commercial or service oriented, than those win New Jersey, which may account for the lower price response.
7. Price response comes equally from default RTP service and a competitive supplier equivalent in New York and Maryland, but constitutes almost two-thirds for the price response in New Jersey. The latter result may reflect the use of real-time prices in NJ for default, which would provide customers with an inceptive to switch to a competitive supplier in order to hedge some its load, or have the option to switch from RTP at its discretion.



8. The proportion of customers that pay prices tied to LMPs and do not respond is from one-third (NY) to over 75% (MD). Interviews with NY customers and competitive retailers reveal that many of these customers chose, and assumed price risks that do not take action to abate, RTP because they believe that the

hedging premiums available from competitive retailers are too high relative to the expected level of hourly LMPs. Some retailer in NY report that customers are asking to pay real-time LMPs, recognizing that on average they are 5% less than the day-ahead equivalents, despite the fact that that do so constitutes greater risks, since the real-time hourly LMPs are posted by the NYISO after the fact.