RTP as an Optional Service: It's Alive, But Is It Well?

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I. Introduction

Economists have advocated for real-time pricing (RTP) of electricity on the basis of the gains in economic efficiency that would result from charging customers the contemporaneous marginal cost of supplying electricity instead of the average cost.[1] In recent years, RTP has also become the subject of interest in a variety of policy contexts, including integrated resource planning initiatives, ongoing efforts to improve efficiency and reliability in competitive electricity markets, and implementation of default service in states with retail choice.

Most experience with RTP has been as an *optional* service, that is, a self-selecting alternative to the standard utility service. By our count, approximately 70 utilities in the U.S. offered an optional RTP program at some point over the past 20 years. However, many programs are now defunct. In 2003, 47 utilities in the U.S. were still offering an optional RTP program, on either a pilot or permanent basis (see Figure 1). In addition, 10 utilities in states with retail choice currently offer RTP as the *default* service for large customers that are not under contract with a competitive supplier. Another two utilities have received regulatory approval to do so in the next few years.[2]

Although the results of a few optional RTP programs have been publicized, the vast majority of programs have operated in relative obscurity.[3] To provide a wider perspective on utility and customer experience with RTP, we surveyed 43 optional RTP programs offered in 2003.[4, 5] We interviewed RTP program managers and other utility staff, and reviewed publicly available sources, including key regulatory documents and program evaluations. Based on this research, we identified trends related to RTP program history and outlook, program design and implementation, customer participation, and participant price response. The results are both surprising and instructive. We conclude that RTP is indeed alive but is not prospering as well it could. Thus, we offer a number of recommendations for policymakers and utilities that are considering optional RTP as a strategy for developing price responsive demand.

II. A Brief History of RTP

A. RTP programs have been introduced in response to a range of market and regulatory conditions.

The RTP programs in our survey were introduced over a 20-year period spanning three semi-distinct eras (see Figure 2). The first wave of RTP programs emerged in the mid-to-late-1980s, when several utilities developed RTP pilots to test its viability and potential impact as a novel demand side management (DSM) strategy.[6] The second wave came in the mid-1990s, when many utilities, primarily located in the Southeast and Midwest, introduced RTP programs. It coincided with a period of heightened concerns about uneconomic bypass from on-site generation, and anxiety about the competitive consequences of what appeared to be impending retail market restructuring. Responding to these pressures, utilities saw RTP as a way to retain and recruit large customers by offering them: early access to market prices, the opportunity to expand their loads without incurring additional demand charges, and more control over their

costs. And as we discuss below, RTP also provided a means for offering selective discounts at a time when utilities perceived threats to large loads. The proliferation of new RTP programs subsided in the late-1990s as attention in many states shifted to restructuring-related issues.[7] However, beginning in 2001, a resurgence of interest in RTP occurred, with several new programs introduced in New York and California, as state policymakers and utilities sought to address concerns about inadequate reliability, price volatility, and market power.

B. Inducing peak demand reductions was not the primary goal for many RTP programs.

The motivations for offering RTP, as reported by program managers, reflect the regulatory and market context characteristic of the three eras described above (see Figure 3). Over half of the RTP tariffs were expressly introduced to build satisfaction and loyalty among large customers. These RTP programs accomplished this objective by providing customers with low cost power for incremental load and the opportunity to reduce their energy costs through load management. Load shape objectives were also a key utility motivation for introducing RTP: one-third of the programs were reportedly developed specifically to induce peak demand reductions and one-quarter were developed primarily to encourage load growth. One quarter of the programs, including those offered by utilities in Illinois and New York, were implemented specifically to comply with a legislative mandate or regulatory order. Finally, one fifth of the programs were introduced expressly to gain experience with market-based pricing or to reduce the utility's exposure to wholesale market price risk.

C. Most utilities do not plan to promote their RTP tariff aggressively in the future.

Only one-third of the utilities in our survey expect to maintain some form of active commitment to optional RTP, as reported by program managers. This includes those that are planning to continue actively marketing a recently-introduced RTP program (15%) or a 1990s-era program (11%), or are planning to replace their existing program with a new optional RTP program (8%). The remaining utilities are either continuing to offer their existing program but without actively promoting it (38%) or are in the process of phasing it out with no plans to introduce a new program in its place (28%).

This trend reflects a number of factors. With many states having moved either resolutely toward or away from retail competition, some utility's original rationale for offering RTP may no longer be as relevant as it once was. In some states with retail competition, utilities or regulators no longer see a utility role in offering "experimental" retail supply tariffs, rather the focus is on RTP as a default service tariff. In other cases, utilities are reportedly waiting to see how the regulatory environment and/or retail market develops before committing further resources to RTP program marketing or development. Finally, some programs have evidently not performed as well as originally expected and no longer have the support of the utility or state regulators.

III. Trends in RTP Program Design and Implementation

A. The two-part, CBL-based RTP tariff became the *de facto* tariff design adopted during the mid-1990s, but that design has found less application more recently in states with retail competition.

The RTP programs introduced in California in the mid-1980s were based on a tariff design that collected both fixed and variable costs through a single, hourly-varying price applied to all energy consumed. The hourly price included a time-varying component that reflected hourly marginal costs and one or more adders or multipliers to recover fixed costs. The adders were designed to be revenue neutral over average climatic conditions, for the class of customers deemed likely to participate. However, because many eligible customers had loads that differed substantially from the class average, utilities faced the possibility of revenue erosion. Moreover, this type of RTP tariff design was risky for the customer, as it exposed its entire load to uncertain prices.[8]

The two-part, CBL-based RTP tariff design, first offered by Niagara Mohawk Power Company in 1988, was widely adopted during the RTP heyday of the mid-1990s.[9] This tariff design had a number of favorable attributes. First, it addressed the shortcomings of the early design associated with utility revenue erosion and customer bill stability. Second, it provided the means for communicating an efficient price signal, as the customer's marginal usage could be charged at marginal cost. Third, because each customer's revenue obligation is determined by its CBL, the two-part RTP tariff design provided a means for engaging in selective pricing practices that standard rates would not allow. Many utilities allowed customers to add new load after enrolling in RTP without making upwards adjustments to their CBL. Several utilities also offered certain types of customers the opportunity to receive an initial CBL less than their actual or projected load. Customers would thereby receive a discount on the portion of their load above their CBL, as long as the average marginal prices remained below the standard tariff rate.

RTP programs introduced since the late 1990s have tended to diverge from the CBL-based design, particularly those adopted in states with retail competition and unbundled electricity rates. Many of these RTP programs are based on an unbundled tariff design with a one-part commodity charge, calculated by applying hourly energy prices to the customer's entire load in each hour, plus unbundled T&D charges.[10]

The departure from the CBL-based RTP rate design in restructured markets likely reflects a combination of factors. First, the advantage of the CBL-based design to the utility in terms of revenue stability is less relevant in restructured markets, given that T&D costs have been unbundled and, often, the utility has divested its generation resources. Second, policymakers and competitive suppliers may view it as inappropriate for the utility to offer a CBL-based RTP tariff on the grounds that hedged RTP tariffs and other "innovative" pricing arrangement should only be provided by competitive suppliers.

B. RTP programs, for the most part, have not been broadly and pro-actively marketed.

About 40% of the programs in our survey reportedly have not been "pro-actively" marketed.[11] Many of the programs in this group were mandated by legislation or regulatory order, and the utilities were not under any explicit obligation to market the program or otherwise promote participation. Moreover, some utilities are restricted by restructuring-related rules from

engaging in aggressive marketing activities. Of the 60% of RTP programs that were pro-actively marketed, very few were marketed broadly across the base of eligible customers. Instead, most were targeted to relatively narrow sub-sets of the eligible customers, such as industrial customers interested in expanding production or customers with an established ability to shed load, as indicated by prior participation in an interruptible service rate or the presence of on-site generation.

C. Most utilities have undertaken few activities to help customers improve their price response capabilities.

A variety of services or programs could potentially be provided by utilities in conjunction with RTP, to help customers identify, analyze, or implement load response strategies. These could include offering facility audits, web-based access to hourly load data, or financial assistance with enabling technologies. About one-third of the programs in our review offered customers some form of technical assistance to help assess their price response capabilities. Half of the programs provide customers with web-based access to their hourly load data on a day-after or near real-time basis; the remaining programs provide access less frequently (e.g., weekly or at the end of the billing period) or not at all. Access to load data on a near real-time basis, when offered, is typically an upgrade to the standard service and is available for a fee.

IV. The Impact of Optional RTP on the Development of Demand Response

The extent to which optional RTP programs constitute a significant source of demand response depends on the number of customers that choose to enroll and their price responsiveness.

A. With a few notable exceptions, most optional RTP programs have attracted limited participation.

Of the 43 RTP programs in our survey, only three (Georgia Power, Tennessee Valley Authority, and Duke Power) had more than 100 non-residential participants or more than 500 MW enrolled in 2003 (see Figure 4 and Figure 5). Together, these three programs represent 80% of the 11,000 MW of total retail load enrolled in optional RTP programs in that year. In contrast, one-third of the programs in our study had no participants in 2003, and another third had fewer than 25 participants and less than 50 MW enrolled. Although many RTP programs have an enrollment cap and/or a relatively high minimum customer size threshold (e.g., the program is limited to customers 1 MW and above), participation in most programs is well below the enrollment cap or eligible customer population.

B. Participation in most optional RTP programs has declined in recent years.

Half of all programs offered prior to 2000 lost 25% or more of their participants from 2000-2003, while only two programs reported an increase in participation. Many program managers attributed the decline in participation to an increase in price volatility or average RTP prices during or immediately prior to that period, thereby eroding or even reversing many customers' expected bill savings relative to the standard tariff rate. According to several

program managers, this trend was exacerbated by the fact that many customers had apparently enrolled in RTP expecting to realize bill savings without responding to hourly prices.

C. Participation in most RTP programs is dominated by large industrial customers, followed by large institutional customers.

Program managers generally agree on what types of customers appear to be most amenable to RTP. Chief among these are large industrial customers, particularly those with electrically intensive batch processes that can accommodate occasional rescheduling (e.g., steel mills with arc furnaces). Program managers also pointed to other attributes of large industrial customers that contribute to their propensity for RTP participation, such as flat load profiles (which are beneficial in the case of one-part RTP programs designed around class-level revenue neutrality), high electricity expenditures, relatively high levels of sophistication and technical capability, and options for facility expansion. Customers with onsite generation, including large institutional customers with backup generators, such as universities and military bases, were also perceived as capable of responding to RTP prices. Based on program managers' characterizations, commercial buildings represent a very small fraction of RTP participants.

D. Quantitative information on participants' price responsiveness is relatively sparse.

Most program managers indicated that RTP participants' price response had not been formally evaluated, for a number of reasons. First, many programs have had too few participants, operated for too short a duration, or did not exhibit enough price volatility to warrant undertaking a rigorous assessment of price response. Second, because most programs are not integrated into the utility's system scheduling or planning operations (in part, a consequence of the small amount of load enrolled), detailed information about price response is not required for operational purposes. Finally, because many programs were motivated primarily for purposes other than load management, utilities have had little reason to devote resources to measuring and quantifying customers' price response.

E. Many RTP participants reportedly do not respond to hourly prices.

Published evaluations of individual RTP programs have generally found that most of the load reduction induced during high price periods is attributable to a relatively small fraction of participants. Consistent with these findings, most managers of programs with 10 or more participants indicated that between 20% and 60% of RTP participants are price responsive (see Figure 6). One program manager reported that this percentage has increased significantly in recent years, because non-responsive participants have dropped off of RTP following periods of heightened price volatility.

A variety of factors were offered to explain why many RTP participants apparently do not respond to hourly prices. In accordance with the marketing strategy and program goals characteristic of many RTP programs, some customers may have enrolled in RTP without any intent of monitoring or responding to prices on a daily or hourly basis. Program managers also pointed to a number of specific operational and institutional factors that, in their view, limit many participants' price responsiveness, including: a lack of flexibility or technical expertise;

employee turnover; and a tendency for customers simply to forget about electricity prices if they remain low and stable for prolonged periods.

F. RTP programs have achieved load reductions equal to 12-33% of participants' combined load.

Eight program managers whose RTP program had more than 20 participants provided data on the maximum load reduction generated by the program as a percentage of participants' combined (non-coincident) peak load (see Figure 7). Most programs reportedly generated load reductions in the range of 12-22% of participants' total load. However, two programs claim load reductions of approximately 33%. These load reductions occurred across a wide range of hourly prices, from $0.12/kWh to $6.50/kWh. Several RTP programs obtained relatively large percentage load reductions at less extreme prices than other programs, highlighting the importance of factors other than price.

Program managers generally indicated that customers respond with rather low-tech strategies. In particular, most attributed the price response from their RTP program primarily to large industrial customers that reschedule discrete, electrically-intensive process loads (e.g., arc furnaces at steel mills) and to customers that run on-site generation. Consistent with this characterization, interviews with RTP participants have also found that most customers on RTP respond to high prices using relatively simple processes implemented manually or by using existing control equipment.[12]

G. Load reductions generated by RTP programs have generally constituted a rather negligible percentage of the utility's total system peak.

Data on the maximum load reduction was provided for ten programs. Only two (Georgia Power and Duke Power) were reported to have generated load reductions greater than 100 MW, and only one (Georgia Power) has generated load reductions greater than 1% of the utility's system peak (see Figure 8). For most programs, the modest load response reflects the small amount of participating load; only four programs had more than 5% of the utility's system peak enrolled. Some program managers also attributed the modest load reductions to the fact that RTP participants had not yet faced particularly high prices, that few participants were price responsive, or both.

V. Policy Implications and Recommendations

It is clear from our review that, while several programs have been a resounding success, a variety of issues must be addressed if optional RTP is to more widely serve as a significant source of price responsive demand. Below, we discuss these issues and possible strategies for addressing them.

A. Basic information-related barriers must be addressed if RTP is to attract and retain a large number of participants.

The modest participation in most RTP programs likely reflects a lack of awareness among eligible customers that RTP was available, an inadequate understanding of the potential

benefits among those that were contacted, or both. It is imperative that sufficient resources are devoted to developing and implementing an aggressive customer education program to build customer awareness and acceptance of RTP. Such efforts should seek to introduce the program to a wide population of customers and offer information and tools to allow customers to assess the potential benefits, costs, and risks. To sustain participation and price responsiveness over time, program participants should be provided with market information to help them develop a market view on the level and volatility of prices. Periodic re-training is also essential to accommodate employee turnover and the fact that customers may tend to forget about RTP if prices remain low for extended periods.

B. Optional RTP tariffs that offer customers a substantial and fairly predictable financial benefit and that allow customers to financially hedge their exposure to price risk have attracted a large number of participants.

Based on RTP experience to date, many customers may conclude that the expected bill savings from participating in a revenue-neutral RTP are insufficient compensation for the risks and additional costs. To attract a wide and diverse base of participants, an optional RTP tariff must offer an attractive risk-reward proposition compared to the standard, fixed-price rate. Two basic RTP tariff design attributes are essential to achieving this end. First, the RTP tariff should provide a quantifiable and plausible financial benefit relative to the standard fixed price tariff. Second, customers must be afforded an opportunity to financially hedge their exposure to price volatility.

Competitive retail suppliers widely offer pricing arrangements with these attributes, particularly in regions with a transparent and liquid spot market.[13] Many competitive retailers offer customers the option to purchase some or all of their load at prices indexed to the real-time or day-ahead spot market. Customers receive a discount relative to a fixed-price, full-requirements service by avoiding the market-based risk premium they would otherwise be charged to compensate the retail supplier for bearing price and load shape risk. Customers can potentially quantify that benefit by comparing the expected cost under RTP with purchasing their supply at a fixed price from the same or another retail supplier. A variety of options for financially hedging exposure to hourly price risk are becoming prevalent in competitive markets, which fulfills the second requirement.

Creating RTP tariff designs that are attractive to a wide range of customers is more challenging in regulated retail markets. The two-part RTP tariff design offers participants several types of financial benefits. First, customers can earn bill credits by responding to high prices by shifting load, reducing discretionary usage, or operating on-site generation. Second, participants can purchase low load factor usage without ratcheting up their demand charge. This can be a large benefit to customers that have constrained their usage pattern to limit their maximum demand, as well as to customers with idle plant or business capacity that have episodic opportunities to increase their output. Third, many programs do not require that participants adjust the CBL upward if they expand their facility while on RTP.[14] Customers thereby earn bill savings by avoiding demand charges on their additional load, as long as average RTP prices remain below the standard usage rate.

The benefits associated with load growth can be eroded or even reversed if hourly prices spike and the customer does not respond. To provide customers with an opportunity to shield this load from hourly price risk, several utilities, including Georgia Power and Duke Power, offer

RTP participants a range of supplemental financial risk management products for their incremental load. However, providing a supplemental financial hedge in a regulated environment does pose a fundamental issue. The entity that sets the prices also sets the hedge premiums, which makes setting the premium difficult: too low and the utility loses money; too high, and the utility has an incentive to raise RTP prices.

The financial benefits outlined above that customers accrue from participating in a two-part RTP program may be sufficient to motivate high participation rates among certain classes of customers, e.g., customers with on-site generation or load growth opportunities. However, the limited participation rates observed among most optional RTP programs raise some question about whether these benefits, by themselves, are sufficient to achieve high market penetration rates among a broad group of C&I customers. The fundamental policy question for regulators in regulated retail markets who want to encourage participation in RTP is: are these implicit benefits from two-part RTP sufficient to induce widespread customer participation, or are additional explicit benefits required? Can the benefits of RTP programs to all other ratepayers be quantified? And, can the re-allocation of any RTP program costs to other customers be justified (e.g., by showing the extent to which all ratepayers benefit from RTP participants' price response)?

C. Regulators and utilities should consider implementing programs to provide RTP participants with technical assistance and programs to facilitate the adoption of DR enabling technologies.

Customers on RTP can physically manage their exposure to price volatility by reducing their usage during high-price periods. However, many customers currently do not have well-developed price response capabilities, because traditional tariffs have not rewarded such behavior. One way to promote participation in RTP and price responsiveness is to offer customers assistance in developing these capabilities. Facility audits can help identify and assess operational strategies and/or technologies for responding to prices. Rebates or other forms of financial incentives to encourage the adoption of enabling technologies for price response (e.g., energy information systems and load control equipment) may also be warranted. By integrating these efforts into the marketing and delivery of energy efficiency programs, utilities can capitalize on existing implementation infrastructure and can potentially improve RTP participation among commercial and institutional customers, which have historically been the mainstays of energy efficiency programs.

D. Policymakers and program designers must consider what role on-site generation will or should play in customers' price response.

Experience with RTP thus far indicates that customers with on-site generation (e.g., cogeneration or back-up generators) are among those most receptive to RTP and often the most price-responsive.[15] The availability of on-site generation for price response may vary considerably across regions, given differences in industries local to the region and differences in air quality regulations governing the use of back-up generators. Policymakers that are considering RTP therefore need to consider the stock of on-site generation installed in the region and the fact that RTP may provide customers with an incentive to increase the use of existing, or install additional, on-site generation. Depending on the emissions characteristics and location of

on-site generators relative to bulk power generation, the health and environmental consequences of increased operation of on-site generators may be negative or positive.

E. Evaluation and analysis of customer price responsiveness is needed to support RTP implementation and related policy and planning activities.

Only a handful of the RTP programs have conducted a comprehensive, independent analysis of participants' price response, and relatively few of those results have made their way into the public domain. Yet, many utilities, policymakers, and customers are reluctant to fully embrace RTP, partly because the benefits are highly uncertain. If non-participant benefits in particular are not well understood, funding for supplemental programs to build customer acceptance of RTP and price responsiveness may also be difficult to justify. It is therefore critical that RTP pilots be rigorously evaluated, and the results made available to the broader policy community. Evaluation initiatives should focus on resolving key uncertainties regarding costs and benefits, so that RTP programs can be standardized and widely marketed, similar to the process that has been utilized in a number of states for energy efficiency programs.

F. Implementing RTP as part of a portfolio of demand response programs and dynamic pricing options may be the most effective strategy for developing greater levels of DR.

RTP may be able to attract relatively high participation rates among specific types of customers without requiring any substantial efforts to build customer acceptance. However, to penetrate beyond these first adopters, additional resources may be required in the form of marketing, customer education, technical assistance, and incentives for RTP participation and/or adoption of enabling technologies. It is therefore important that policymakers not only compare the costs of these inducements to the benefits associated with any associated incremental gains in RTP participation, but also that they compare the cost-effectiveness of these activities to other types of programs and pricing mechanisms for stimulating DR. Given the heterogeneity of retail customers, a portfolio of RTP and "reliability-based" demand response programs ultimately may be the most effective strategy for generating the level of DR required to achieve the underlying policy objectives

VI. Conclusion

A small number of programs have demonstrated that RTP, offered as an optional tariff, is capable of attracting a substantial number of participants and that at least some of these customers are able and willing to respond when hourly prices rise. However, for the vast majority of programs, modest participation rates have limited the significance of their demand response impacts. Policymakers must therefore be realistic about the likely reception of RTP among customers that have become accustomed to fixed retail rates. If RTP is to be offered as an optional service, as opposed to being made mandatory for certain customer classes, a concerted effort must be made to overcome customers' entrenched habits and expectations, for such programs to have a meaningful impact on market performance or utility operations and planning. This will require a long-term commitment by policymakers and utilities on several fronts: cultivating customer acceptance of RTP; revising ratemaking policies and practices to explicitly account for the value to shareholders and ratepayers of the risk transfer to customers

on RTP and their price response; and developing a range of dynamic pricing and DR programs that reflect the heterogeneity of customer preferences and capabilities.

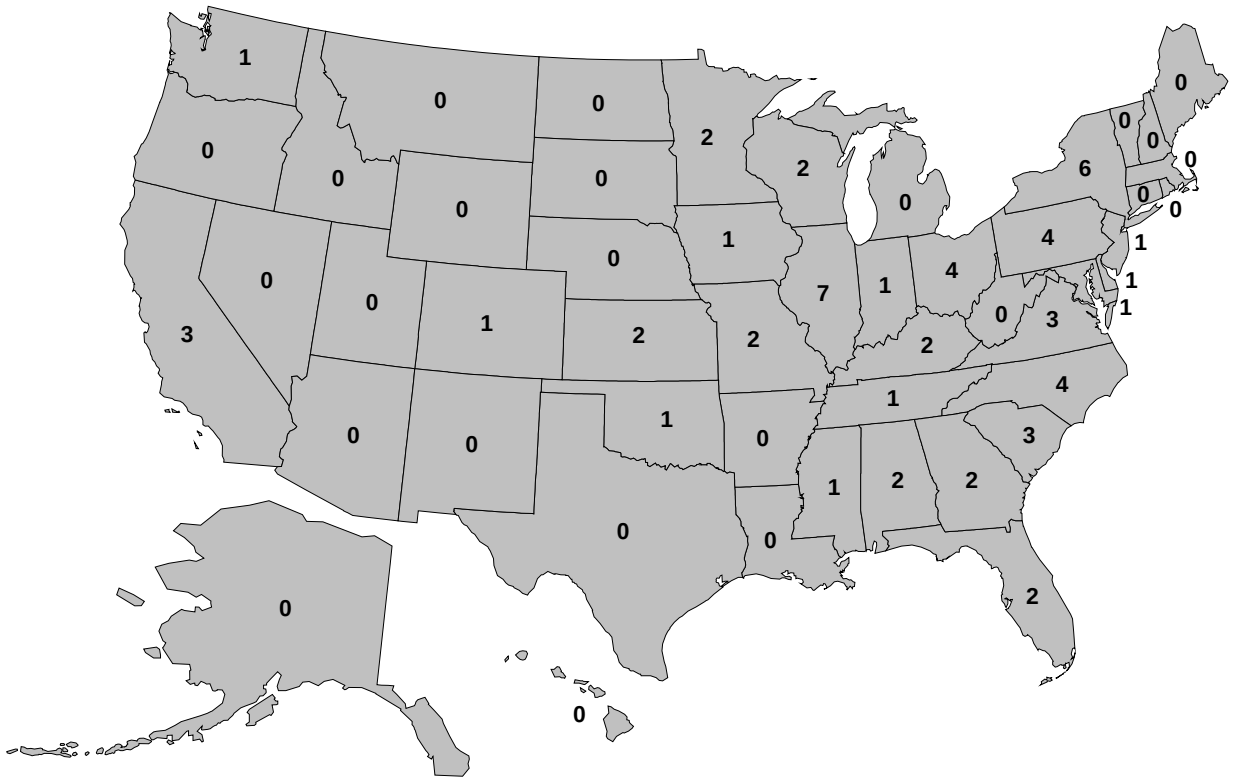

Figure 1. Number of utilities in each state offering an optional RTP program in 2003

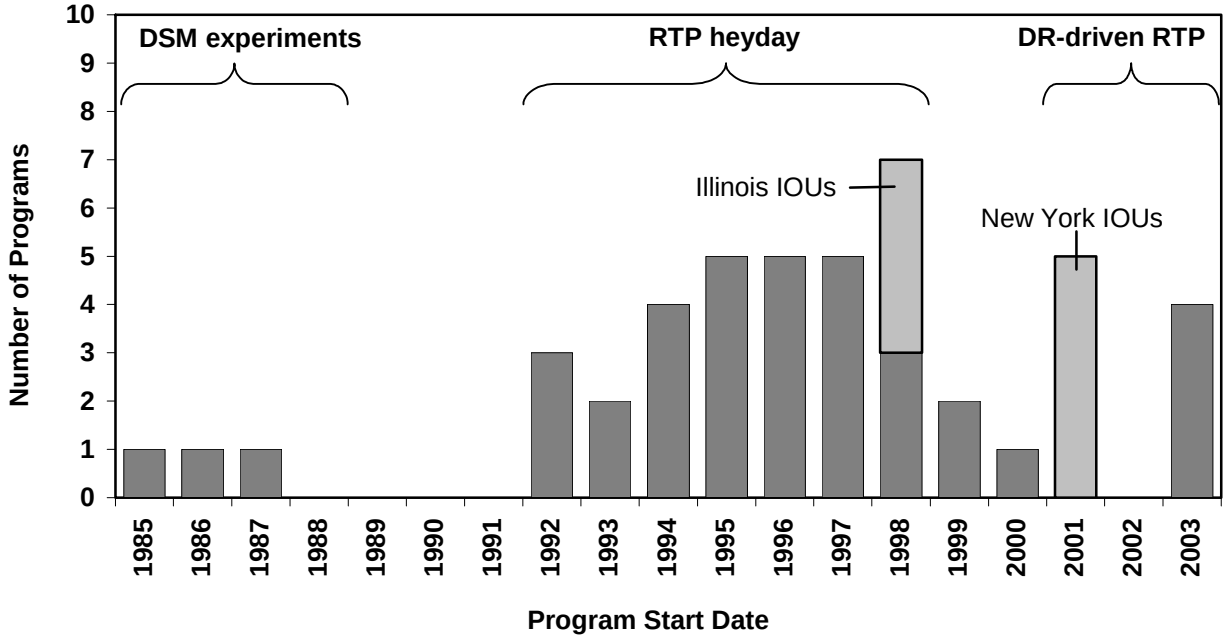

Figure 2. Start date of optional RTP tariffs offered in 2003

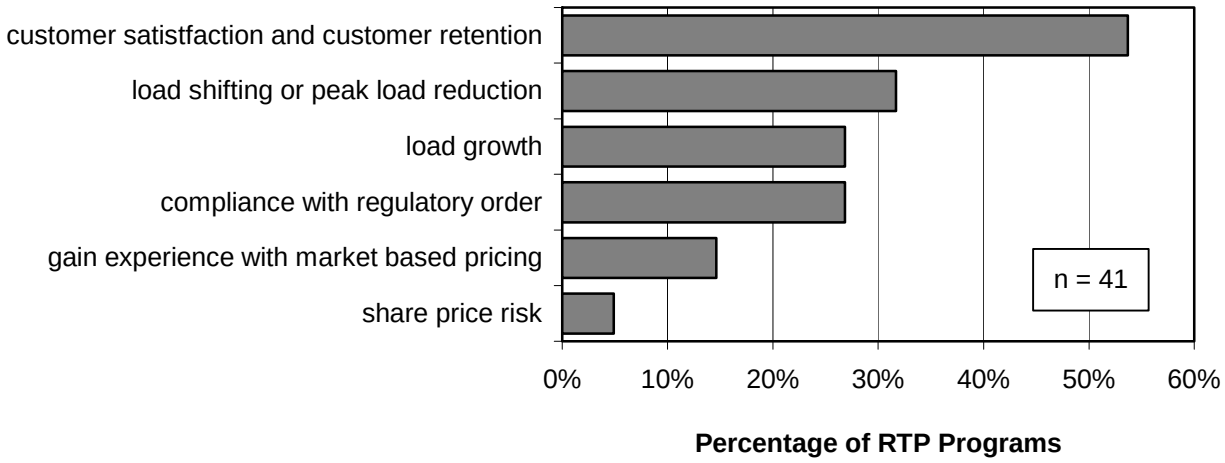

Figure 3. Primary utility motivations for offering RTP[16]

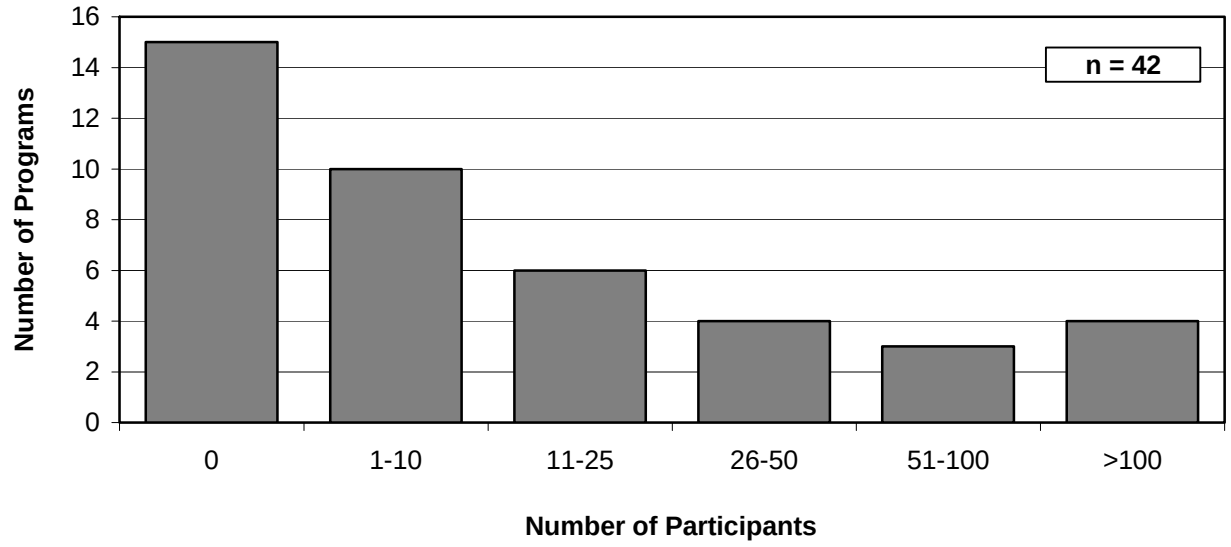

Figure 4. Number of customers enrolled in optional RTP programs in 2003

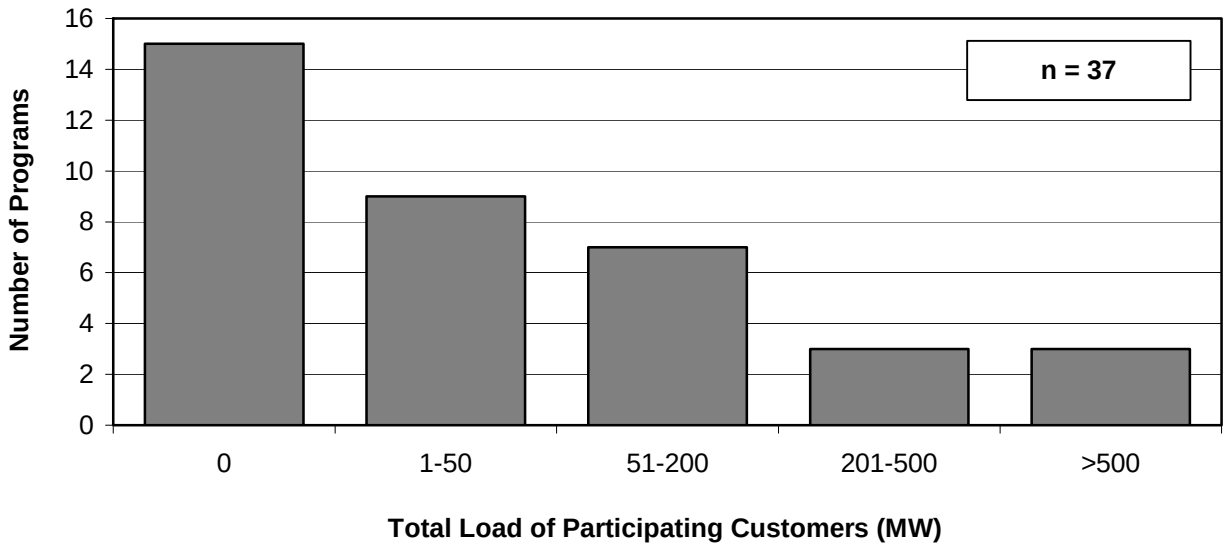

Figure 5. Total load of customers enrolled in optional RTP programs in 2003

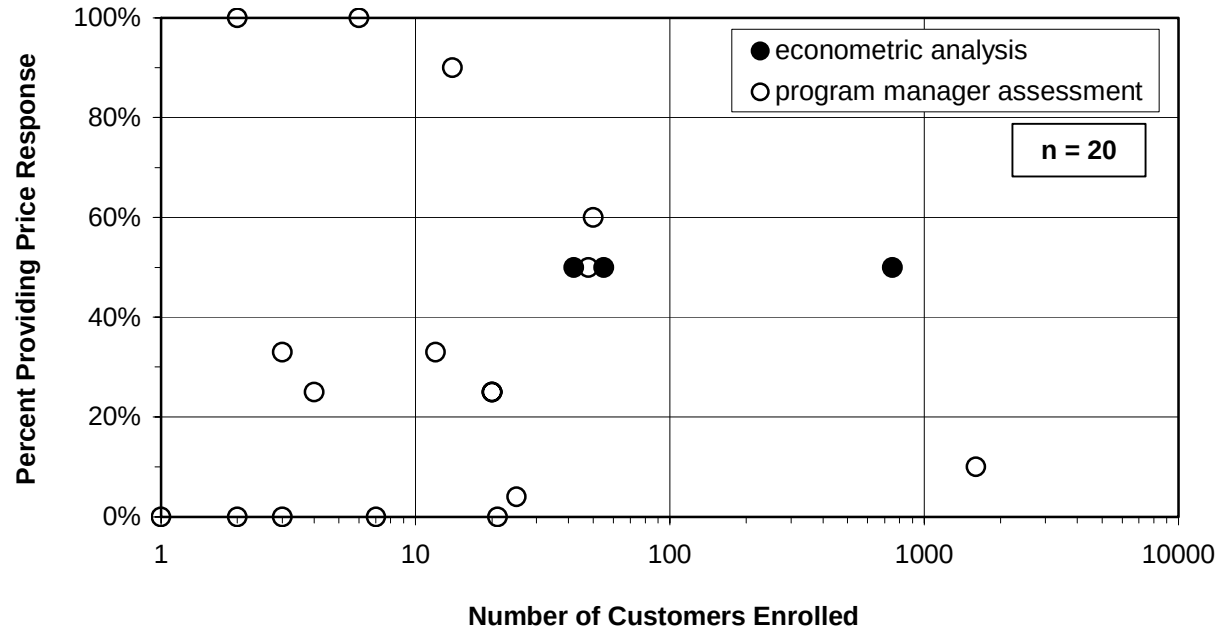

Figure 6. Percentage of participants in each RTP program reported to be price responsive

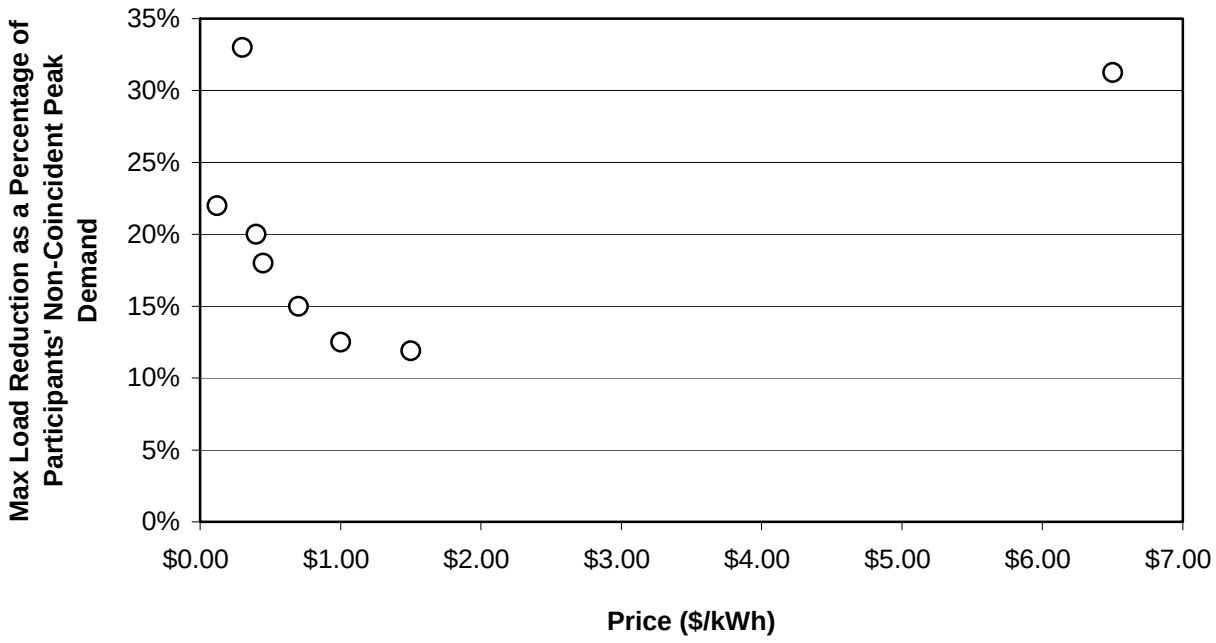

Figure 7. Maximum percentage load reduction from RTP programs

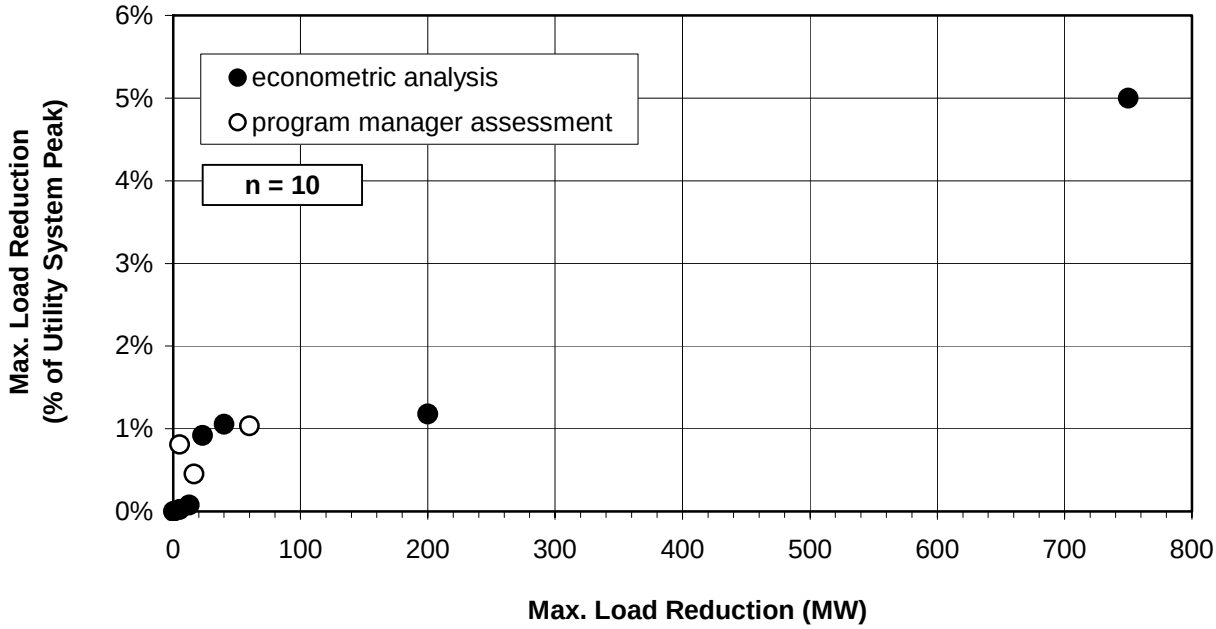

Figure 8. Maximum load reductions from RTP programs

[1] William Vickrey, *Responsive Pricing of Public Utility Services*, Bell J. of Econ., Spring 1971. Fred C. Schweppe, Michael C. Caramanis, Richard D. Tabors and Roger E. Bohn, Spot pricing of electricity (Boston MA: Kluwer Academic Publishers, 1987).

[2] For a comparative analysis of experiences with default service RTP, see Galen Barbose, Charles Goldman, Ranjit Bharvirkar, Nicole Hopper, Michael Ting, and Bernie Neenan, *Real Time Pricing as a Default or Optional Service for Large Customers: A Comparative Analysis of Eight Case Studies*, Lawrence Berkeley National Laboratory,

LBNL-57661, August 2005. For a detailed case study analysis of Niagara Mohawk's experience with default service RTP, see Charles Goldman, Nicole Hopper, Ranjit Bharvirkar, Bernie Neenan, Richard Boisvert, Peter Cappers, Donna Pratt, and Kim Butkins, "Customer Strategies for Responding to Day-Ahead Market Hourly Electricity Pricing," Lawrence Berkeley National Laboratory, LBNL-57128, August 2005.

[3] For example, see Michael O'Sheasy, *How to Buy Low and Sell High*, Elec. J. Jan/Feb 1998.

[4] For a complete discussion of the research results, refer to Galen Barbose, Charles Goldman, and Bernie Neenan, *A Survey of Utility Experience with Real Time Pricing*, Lawrence Berkeley National Laboratory: LBNL-54238, December 2004.

[5] Some of the utilities offering RTP are subsidiaries of a common holding company and offer identical, or nearly identical, RTP programs that are administered essentially as a single program and which, therefore, we treated as a single program for the purpose of reporting summary statistics and characterizing utilities' experiences.

[6] For a discussion of some of the earliest RTP programs, see Juliet Mak and Bruce Chapman, *A Survey of Current Real-time Pricing Programs*, Elec. J. Aug/Sept 1993.

[7] The exception to this trend was that all Illinois utilities were required to begin offering RTP to non-residential customers in 1998 to comply with the state's restructuring law.

[8] For a discussion of the drawbacks of the one-part RTP tariff design, see Michael O'Sheasy, *Is Real-Time Pricing a Panacea? If So, Why Isn't It More Widespread?*, Elec. J. Dec. 2002.

[9] This type of RTP tariff involves establishing a unique customer baseline load (CBL) profile for each participant, typically based on its historical load data. RTP participants are billed for their CBL usage based on the billing determinants of their otherwise applicable tariff, and are assessed hourly prices only on the difference between their actual usage and their CBL in each hour.

[10] Unbundled T&D charges may include some combination of demand and volumetric charges, possibly differentiated by time of use period.

[11] We define "pro-active" marketing to include activities such as holding workshops or meetings with customers to discuss the program, issuing program brochures or other informational material, or conducting analyses to identify customers likely to be amenable to RTP.

[12] The results of customer interviews are reported in Goldman et al., 2005.

[13] Experience with these types of dynamic pricing arrangements in competitive retail markets is discussed in Barbose et al., 2005 (see chapter 5).

[14] Some other utilities that have two-part RTP have adopted a similar protocol, while others have made provisions to adjust customers' CBL over time to reflect permanent changes in usage.

[15] See Peter M. Schwarz, Tom N. Taylor, Matthew Birmingham, and Shana L. Darden, *Industrial Response to Electricity Real-Time Prices: Short Run and Long Run*, Economic Inquiry, October 2002.

[16] Some respondents identified more than one primary factor, thus the sum of responses across all categories of responses is greater than 41.