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Customer response to day-ahead market hourly pricing: Choices and performance

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Abstract

Real-time pricing (RTP) has been advocated to address extreme price volatility and market power in electricity markets. This study of Niagara Mohawk Power Corporation's largest customers analyzes their choices and performance in response to day-ahead, default-service RTP. Overall price response is modest: 119 customers are estimated to reduce their peak demand by about 10% at high prices. Manufacturing customers are most responsive with a price elasticity of 0.16, followed by government/education customers (0.11), while commercial/retail, healthcare and public works customers are, at present, relatively unresponsive. Within market segments, individual customer response varies significantly.

Keywords: Real-time pricing; Demand response; Default service

1. Introduction

In response to the problems of extreme price volatility and market power observed in some restructured electricity markets, policymakers and analysts are considering the relative roles of pricing and other regulatory and market interventions to improve their performance (Clarke, 2003; Flippen, 2003). Most agree that limited demand response (DR) at the retail level hampers the development of efficient wholesale markets. Relying on conceptual studies and anecdotal evidence, some have pointed to time-varying pricing, particularly real-time-pricing (RTP), as a mechanism to enable demand response (DR) and improve the linkage between wholesale and retail markets (Borenstein, 2002; Flippen, 2003; Horowitz and Woo, in press; Turvey, 2003).

Unfortunately, there is little publicly available information to help policymakers assess how well RTP actually works to elicit DR or to characterize its actual impacts on wholesale markets. Furthermore, in restructured electric markets, the new choices available to retail customers create a complex set of incentives. A few studies have examined industrial customer experience with RTP and found modest response (Boisvert et al., 2004; Herriges et al., 1993; Schwarz et al., 2002). California regulatory agencies and utilities recently sponsored a statewide pricing pilot for residential and small commercial customers and found load reductions ranging from 5 to 15% in response to high-price signals from a critical peak price tariff (Charles River Associates, 2005). However, all these studies examined *voluntary* RTP programs implemented in jurisdictions without retail choice.

This research sheds light on how well retail pricing strategies actually promote demand response in restructured electric markets with retail competition. It examines the experience of 149 large customers of Niagara Mohawk Power Corporation (NMPC), an upstate New York utility, that have been exposed to hourly prices indexed to day-ahead, wholesale spot market prices as the default service under retail competition since 1998. Their hourly load and price data over five summers (2000–2004) are supplemented by two phases of detailed customer survey and interview results to estimate demand models and to provide quantitative and qualitative context to model

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results.[1] Detailed information on data sources, survey administration and response and demand modeling methodology are available in Goldman et al. (2005).

Findings from this study are discussed in terms of customer *choices* in adapting to RTP as the default utility service in a competitive retail market environment, and customer *performance*, the actions customers undertook in response to hourly prices, their degree of price response and the aggregate impact on loads during high-price events.

2. Research questions

We conceptualized two distinct but interdependent aspects of customer RTP experience in the context of restructuring: *choice* and *performance*. Table 1 lists our specific research questions and the indicators used to assess them.

Customers' choices – of electricity supplier, of hedging products, of participation in NYISO DR programs – determine the magnitude of the incentives they face to respond to RTP signals. For example, choosing a competitive supply contract with a flat rate for all usage effectively removes a customer's incentive to respond to day-ahead hourly pricing signals.[2] Conversely, customers exposed to RTP and also participating in NYISO DR programs face additional incentives to respond at certain times relative to other customers. The choices afforded by retail competition and the coexistence of hourly electricity pricing with ISO reliability DR program incentives to adjust usage complicate the analysis of customer price response.

We define customer performance in terms of price response. This is characterized qualitatively, using customers' assessment of their own degree and type of response, and quantitatively, by estimating price elasticities for individual customers and summarizing the results by class, business sector and customer.[3]

Table 1
Research questions and indicators

Research question	Indicator
Customer choices: retail access and price risk mitigation	
Are customers satisfied with default RTP?	• Customers' overall satisfaction rating • Customers' self-reported access to information • Individual customers' comments
Does default RTP encourage customers to switch to competitive suppliers?	• Customer choice migration patterns • Individual customers' comments
To what extent do customers hedge against price volatility risks?	• Percent of customers taking hedged commodity service (NMPC Option 2 or alternative supply contracts) • Percent of customers taking financial hedges at various times
To what extent do customers on default-service RTP choose to participate in ISO DR programs?	• NYISO DR program enrollment
Customer performance: price response	
What is the overall price response by customer class and business sector?	• Load-weighted average elasticities of substitution
How do customers respond?	• Customers' self-reported load response strategies
How is price response distributed?	• Individual customer elasticities
What incentives do customers respond to?	• Customers' survey responses • Statistical influence of NYISO DR program enrollment on price elasticity
Do enabling technologies enhance price response?	• Statistical influence of enabling technologies on elasticity • Customers self-reported use of enabling technologies
What barriers do customers encounter in responding to prices?	• Barriers reported by customers • Customers' self-reported frequency of monitoring prices • Historic SC-3A prices

3. Tariff and retail market context

NMPC adopted RTP as the default tariff for its largest customers as part of its electricity restructuring plan implemented in the fall of 1998. At the time, promoting DR was not a motivation for RTP. NMPC had agreed to divest most of its generation assets and was interested in passing through wholesale hourly market prices to its largest customers as a way to manage its electricity supply price risk. The company's prior experience with a pilot RTP tariff, along with the generally accepted projection that wholesale market prices would be low in the foreseeable future contributed to initial customer acceptance of RTP. It was not until 2000, when substantial price spikes were first encountered in NYISO markets, that policymakers began to express major concerns about the lack of price-responsive load in New York.

The RTP tariff is the default supply option for the 149 NMPC customers that are served under the "SC-3A" service classification and do not contract with a competitive supplier; a subset of NMPC's customers with monthly peak demand in excess of two megawatts (MW).[4] It was designed to facilitate

[1] The two rounds of customer surveys and interviews were administered in August–October 2003 and October 2004–January 2005 to individuals responsible for 149 customer accounts. Altogether, 67% of eligible customers answered either the 2003 or the 2004 survey, with broad representation by all five business sectors included in the population.

[2] All hedged competitive supply arrangements reported to us were full-requirements, meaning that they applied to all of the customer's load. However, hedged pricing structures that do not fully insulate customers from price risk, have been offered in other jurisdictions (Barbose et al., 2005).

[3] See Goldman et al. (2005) for a detailed discussion of the customer demand models employed.

[4] NMPC has an additional 119 customers with peak demand in excess of 2 MW that are served under the SC-4, SC-11 and SC-12 rates, or have New York Power Authority allocations and take their residual power under SC-3A (see Goldman et al., 2004). We only had access to billing data and customer contact information for the 149 customers with full service under the SC-3A classification; these customers comprise our study population.