

Measuring Demand Response to Market Prices



INCREASE THE ACCURACY OF REVENUE FORECASTING

If you are developing new pricing designs without accounting for demand response, you are setting yourself up for a 4–10% error in revenue forecast, and that's under normal conditions. Your margin of error is likely to jump to 100% when prices are volatile. This project provides knowledge of customers' demand response profiles, with special attention to curtailable rate options, as a stable foundation for retail pricing, resource procurement, resource planning, and system operations.

WHY MEASURE DEMAND RESPONSE?

If your responsibility is *retail pricing*, you need good data on customers' ability and willingness to respond to prices. For example, what demand response can you expect during a period of price spikes from customers enrolled in real-time pricing, spot pricing, or buy-back programs? Or, if you are an energy supplier *procuring* resources on the wholesale market, you need accurate forecasts of daily loads for customers under market price contracts so that you can meet those loads. Estimates of likely demand response are also essential if you are a government *planning* or *regulatory* agency that must assess the adequacy of regional capacity to meet demand on critical high-cost days. Or, if your organization is responsible for *scheduling* loads and *dispatching* generating units, you need the ability to anticipate demand response on days of wholesale price spikes.

Gain knowledge of customer demand response profiles to improve retail pricing, resource procurement, resource planning, and system operations

SELECT PROJECT OPTIONS TO FIT YOUR NEEDS

Your specific needs and the data you have available determine the direction of research under this project. You may be a utility with hourly load data on a group of customers operating under hourly market prices, or a utility or energy service provider with no such historical hourly data but an interest in developing price response measures and demand response forecasting capabilities. Or, you may represent a government or other organization that wants to develop demand response data and capabilities. We will design a project to fit.

The following descriptions summarize the types of research activities you might select for this project:

Estimate price responsiveness to hourly pricing plans.

Members of the EPRI retail pricing team have helped design and evaluate numerous real-time pricing (RTP) programs in the United States and abroad. In the course of these projects, we have used hourly price and usage data for RTP customers to develop statistical methods for estimating the parameters of customer demand models. The parameter values developed in these projects are summarized in EPRI's current *StatsBank* (Customer Profile) database, and can be applied to EPRI's *Product Mix* pricing design software.

If your goal is to estimate price responsive parameters for your RTP customers, EPRI would:

- Acquire hourly load and price data (including weather data) for all or a sample of the target customers for a recent historical period
- Conduct econometric analysis to estimate model parameters
- Summarize patterns in the resulting price response parameters

We would analyze these data at either the individual customer level (resulting in a distribution of individual price response parameters) or at the customer segment level, depending on your preference.

Infer price responsiveness from traditional demand-charge tariffs. We can investigate customer price responsiveness for customers still purchasing services under standard retail tariffs. Many common tariffs, particularly for larger customers, imply varying hourly prices to customers. For example, consider customers are charged a flat energy price and a summer on-peak demand charge. The effect on the customer's bill of a 1 kWh increase in consumption depends on the season and hour of day. During summer on-peak hours, a load increase could increase the customer's maximum demand, thus raising the demand charge payment and the effective price for the customer during that hour. The EPRI retail price team has developed methods for inferring effective hourly prices for a wide range of traditional tariffs. Combining these inferred prices with hourly load data (and appropriate weather data) yields estimates of customers' demand response. The resulting parameters are indicators of both the likelihood that customers of different types would accept an hourly pricing product, and of the extent to which they would respond to hourly prices.

Develop demand response models to forecast load response to hourly prices. Estimating price response parameters in either of the project activities just described involves developing statistical estimates of the parameters of a demand response equation. The resulting equation allows simulation of customer load response under a variety of price and weather conditions. In this project activity, the EPRI retail pricing team would develop spreadsheet software that implements the estimated demand response models.

Estimate overall customer class price elasticities from control area or regional data. Measures of customer price response are key elements of the marketing management process in all competitive industries. The energy and economics literature abounds with estimates of price elasticities for all forms of energy, by broad customer class.

Many of these estimates, however, are quite dated, applying generally to periods of increasing energy prices. Some individual utilities have developed price elasticity estimates as part of traditional long-term load forecasting activities. Studies of this type are infrequent in today's competitive market, and are often plagued by problems such as insufficient price variation over time. Members of the EPRI retail pricing team have recently explored the potential for combining sales and revenue data from a number of control areas and regions in the United States to develop market forecasting models and customer class price elasticities.

THE PROJECT PROCESS

A customized project would unfold in three stages: design, data collection, and parameter estimation. In the *design* phase, we will focus on the particular customer classes and regions of interest and identify available data, both public and proprietary. In the *data collection* phase, we will locate and acquire historical data on electricity sales (and natural gas, if it is of interest) and revenues (or prices), measures of income and economic activity, and weather. In the *estimation* phase, we will create appropriate variables to represent sales by consistent customer class, determine appropriate measures of the effective prices faced by the target customers, and identify other factors (e.g., weather and economic activity) designed to control for influences other than price. With these data, we will develop demand models that provide the capability to estimate market size by region, and to account for the effect of changes in electricity prices as market restructuring and competition unfolds.

PROJECT COST

The project cost is \$100,000.

CONTACT INFORMATION

For more information, contact the EPRI Customer Assistance Center (EPRICAC) at 800/313-3774 or askepri@epri.com

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