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Consumer preferences for electric service alternatives

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ABSTRACT

For a 'discrete choice experiment' to gauge consumer preferences for alternative electric service plans, surveys were administered to over 1000 residences in 12 electricity markets. The resulting estimated choice function parameters provide insights into the importance consumers place on individual features. Several demographic effects were identified that associate preferences with customers, providing powerful and actionable market segmentation tools.

1. Consumer-driven electric services

The electricity sector is undergoing profound changes as the result of technological developments such as advanced metering infrastructure (AMI), devices that simplify controlling and measuring electricity usage, increased engagement with customers such as providing feedback on electricity usage relative to neighbors, and customers supplying some of their power on-site. These developments create opportunities for electric utilities to improve the physical and cost performance of the electricity system by working with customers to encourage mutually beneficial changes in how they purchase and use electricity. These opportunities carry uncertainties because the timing, extent, and persistence of customer behaviors are hard to predict; therefore, so is the level of participation and net benefits.

This combination of new technologies and increased customer engagement is driving interest by electric utilities in expanding electricity service offerings. Electricity service plans (ESPs) that vary from traditional "flat" pricing provide a platform for leveraging new technologies and increased customer engagement. Existing research has documented how ESPs can be constructed from structural pricing building blocks to achieve specific load change effects and how these can be further differentiated based on what kinds of information and enabling technology are provided as part of the service (EPRI, 2012a,b).

ESPs offer immense possibilities for reducing costs and improving customer satisfaction; however, there are thousands of possible structural configurations. Identifying commercially and financially viable product mixtures that will generate sufficient subscriptions to warrant their development and maintenance costs in this situation can be a challenge. It requires sorting through the many new service configurations that are possible to determine which to offer.

Making such decisions requires an in-depth understanding of customer interests. An added complexity is that these needs may vary regionally or locally among customers that traditionally have been treated as having similar electricity demands, and they will evolve over time in response to forces that are not in the utility's control. Information to help utilities make informed decisions about investments in developing electricity services, that have prospective (but unproven) benefits in the absence of market experience data to verify customer acceptance and use, is critical to understanding customers' interests and needs.

2. Forecasting what consumers want and why

This article demonstrates how to address these needs and challenges by characterizing residential consumer preferences based on methods developed by behavioral scientists (EPRI, 2012a, b). The study employs an approach called "discrete choice experiment" (DCE) to characterize consumer preferences for ESPs. A review of methods employed by behaviorists (economists, sociologists, social psychologists, product developers, and market researchers) concluded that DCE was well suited for estimating ESP preferences (EPRI, 2012a,b). Previous applications of DCE to service

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Table 1
ESP Attributes and Levels.

ESP Type	Attributes	Description	Level
Flat Rate	Price	Plan where the price per kWh you pay does not change with volume or time	$0.10
Time-of-Use	Off-Peak Price	$ per kWh customer pays during off-peak hours	$0.03
			$0.06
			$0.09
	Peak Price	$ per kWh customer pays during peak hours	$0.12
			$0.25
			$0.35
			$0.45
	Peak Duration and Times	Set of hours that the peak price occurs over during the day	2 h 5–7 pm weekdays
			3 h 2–5 p.m. weekdays
			3–6 p.m. weekdays
			4–7 p.m. weekdays
			4 h 2–6 p.m. weekdays
			6 h 2–8 p.m. weekdays
	Season	Season in which peak prices, hours, and duration occurs	Summer
			Summer and Winter
Fixed Bill	Premium	Percentage increase to bill because you can use as much electricity as you want per month	2%
			5%
			15%
	Contract Length	Time period over which the monthly bill will be enforced	1 year
			2 years
			3 years

plan preferences suggest some consumers would enroll in alternative, diversified services, but did not report deep interactions, the influence of consumer characteristics on preference formation (Scott, 2011; Hiner Partners, 2013; Potter et al., 2014).

Discrete choice experiments provide a link between utility theory and an empirical expression of how product attributes influence consumer preferences (Louviere et al., 2010; Louviere et al., 2000). It provides a way to connect product and service features with their relative contribution to value (utility) and hence a way to quantify preferences for alternatives comprised of different levels of those attributes. Through specialized surveys, DCEs elicit information from consumers about their preferences by asking them to make choices among hypothetical alternatives. A choice model transforms the responses into a probability of acceptance to characterize how preferences change as product attributes vary.

Two pricing structures were selected for study, time-of-use (TOU) and fixed bill (FB), as alternatives to how consumers buy electricity today (most commonly, a uniform rate ($/kWh)). They provide enough diversity in attributes to test the applicability of a DCE approach.

TOU prices vary depending on when a good is consumed but typically follow an established schedule. TOU is common in a variety of purchase contexts. Examples include restaurants, theaters, and movies that may have a lower price in off-peak hours; hotels, rental cars, and airlines that may be cheaper on weekends; and cruises, theme parks, and resorts that often have off-season discounts. Similar to these situations, TOU electricity consumers pay a different price for electricity depending on when they consume it the price being higher during periods when electricity demand is high. Adopting a TOU pricing plan allows customers to save money by moving their consumption to off-peak periods. Electricity providers experience lower production costs due to lower peak loads.

The FB subscriber pays a predetermined dollar amount for electric service to the residence for the year, regardless of how much is consumed. Examples in other sectors are all-you-can-eat restaurant buffets, cell phone plans, and theme parks that charge for admission and all rides are free. For consumers, FB can reduce exposure to external factors that affect usage like weather and changes in household circumstances (more inhabitants, special needs, working from home). In exchange, providers receive a stable revenue stream.[1]

These options are examples of how electricity service can be differentiated to reflect the temporal and spatial nature of supply cost and acknowledge and leverage diversity in how consumers buy electric service. With this backdrop, project objectives were to:

- Develop, test, and document the findings of methods and processes for applying DCE to measure consumer preferences for two ESPs: TOU and FB.
- Quantify the contribution of ESP attributes to the formation of consumer preferences
- Quantify how consumer characteristics (deep interactions) contribute to ESP preference formation and to support market and customer segmentation.
- Demonstrate the viability and requirements of a DCE through applications in different utility markets, which may introduce cultural or regional factors that differentiate ESP preferences
- Map estimated preferences into a utility's market geography to support ESP implementation.

3. The DCE approach

TOU and FB attributes and levels were constructed to create product profiles that were then placed into choice sets presented to survey respondents.[2] Table 1 lists the attributes employed in the study and the levels used to construct the survey choice sets.

To maximize efficiency in the estimation of model parameters, the profiles and choice sets were incorporated into the discrete choice survey based on the principles of experimental design, a sub-specialty of statistical science. Experimental design seeks to maximize the statistical significance of econometrically estimated parameters given study constraints (i.e., experimental space and

[1] For example, Georgia Power (FlatBill®) and Oklahoma Gas and Electric (Guaranteed Flat Bill) have offered FB service to residences for several years. Both offer customers a one-year contract whose price is based on past usage, recalculated each year of subscription.

[2] A full account of methods and data employed are available in EPRI (2015).