Default Effects and Follow-On Behavior: Evidence From An Electricity Pricing Program

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Sector(s): Environment, Energy, and Climate Change

Fieldwork: Sacramento Municipal Utility District (SMUD)

Location: Sacramento, CA, United States of America

Sample: 71,017 households

Target group: Urban population Families and households

Outcome of interest: Technology adoption Energy conservation

Intervention type: Pricing and fees

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Partner organization(s): Office of Electricity Delivery and Energy Reliability of the U.S. Department of Energy

Paying the same price for electricity regardless of season and time of the day can lead to inefficiencies in responding to electricity demand. Time-varying electricity pricing—a system in which electricity rates vary depending on the time of day and increase during hours of high demand—can smoothen out such inefficiencies. Researchers found that households which were enrolled in time-varying pricing plans by default tended to stick to their default enrollment with only few households choosing to opt-out, suggesting the presence of strong default effects, meaning that people lean toward the course of action requiring the least effort by sticking with a pre-set default option. In addition, electricity consumption decreased under time-varying plans.

Policy issue

Paying the same price for electricity regardless of season and time of the day can lead to inefficiencies in responding to electricity demand. For example, while there is often low electricity demand during the night [1], consumption in many contexts peaks during after-work hours, leading to stressed electricity grids during peak times and an oversupply of electricity during the night. Time-varying electricity pricing—a system in which electricity rates vary depending on the time of day and increase during hours of high demand—can lower electricity system operating costs, lower the cost of integrating renewable energy sources, and lead to a more resilient electricity infrastructure. Time-varying electricity prices are thought to smooth out inefficiencies, such as times of day with very low or very high electricity demand created under time-invariant pricing. One approach to adopting time-varying electricity pricing is to default consumers into a time-varying pricing plan, providing the option of opting out of the plan. However, evidence is needed on whether defaulting consumers into time-varying plans has long-term effects on household electricity

consumption.

Context of the evaluation

In the United States, aging electricity and power infrastructures, system reliability concerns, and the integration of new renewable energy sources into the electricity system pose a challenge to policymakers. One way to address some of these challenges is to improve the system's response to demand for electricity by employing time-varying pricing plans or other policies to increase efficiency.

Historically, the vast majority of U.S. residential customers (over 95 percent in 2012) faced time-invariant electricity prices, for which providers set fixed electricity prices independently from the season or time of day. Recent investments in smart-grid infrastructure, including smart meters in individual households, make larger-scale enrollment of households in time-varying electricity plans technologically feasible.

A technician reads a meter.

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Details of the intervention

Researchers partnered with the Sacramento Municipal Utility District in California to evaluate the effects of a variety of enrollment schemes in time-varying pricing plans on electricity consumption. In collaboration with the municipality district, researchers randomly assigned 71,017 households to one of five groups:

Time-of-use (TOU) opt-in group: Researchers mailed informational material to households informing them about the new TOU pricing plan and gave households the opportunity to opt-in to the plan. Households also received phone calls that encouraged them to enroll. On the TOU plan, customers paid a US$10 monthly fixed charge and US$0.27 per kWh of electricity consumed during 'peak times' in which district-wide electricity demand was high which occurred from 4-7 pm on non-holiday weekends. During 'off-peak' hours, customers paid US$0.08 per kWh for electricity consumption below 700 kWh per month and paid US$0.17 for consumption above 700 kWh.

Critical peak (CPP) opt-in group: Researchers mailed informational material to households informing them about the new CPP pricing plan and gave households the opportunity to opt-in to the plan. Households also received phone calls that encouraged them to enroll. On the CPP plan, customers were charged a high rate of US$0.75 per kWh for electricity consumption between 4pm and 7pm on several 'event days' which they were notified of at least one day in advance. However, customers did not face the fixed monthly charge paid by other groups. Outside of event days, customers were charged US$0.09 per kWh up to 700 kWh per month and US$0.17 per kWh beyond.

TOU opt-out group: Households were automatically enrolled in the TOU pricing plan. After receiving informational material about the plans, they were given the opportunity to opt-out and return to the standard pricing plan.

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Comparison group: Households remained on the standard pricing plan and did not receive any information about the TOU or CPP plans. On the standard pricing plan, they paid a US$10 monthly fixed charge, US$0.09 per kWh for the first 700 kWh of consumption, and US$0.18 per kWh consumed above 700 kWh within the monthly billing period.

Four groups were encouraged to participate in the new pricing program while one group received no encouragement and thus served as the comparison group. All groups faced a tiered pricing structure, meaning that the price for the first block ('tier') of electricity consumed was lower than the price for a higher tier above a certain consumption threshold.

From 2011 to 2013, researchers collected administrative data on energy use and electricity plan enrollment on the 71,017 households to measure the impact of the different schemes on adoption of the plans and on energy consumption.

Results and policy lessons

Customers in each pricing plan tended to accept whatever program they were enrolled in automatically. Taken together, default enrollment into more efficient pricing plans offers a powerful means to improve the way the electricity grid responds to varying demand for electricity and improve overall efficiency. Relatively few households opted-out of the plan that they were assigned to by default. Reductions in electricity consumption were seen both when looking at all households that received opt-in encouragement as well as households that ended up participating in the new pricing plans.

Impact of Opt-Out Schemes on Household Electricity Consumption: In the opt-out groups, 4 percent of customers chose to opt-out of the CPP plan while 2.1 percent of customers chose to opt-out of the TOU plan. This shows that defaulting customers to the more efficient and sustainable time-varying pricing plan could increase the adoption of such plans with low opt-out rates when opting out requires an action.

The households that were automatically enrolled in the CPP plan but given the option to opt-out reduced their average household consumption by 0.31 kWh during event days and by 0.09 kWh during non-peak times.

Households in the TOU opt-out group reduced their daily peak consumption by 0.13 kWh and reduced average consumption during non-peak times by 0.10 kWh.

Impact of Opt-In Schemes on Household Electricity Consumption: Roughly 20 percent of households opted-in to the CPP plan when encouraged to do so, while for the TOU plan, 19.3 percent of households encouraged to join enrolled. Encouraging households to opt-in to the CPP pricing plan lead to a reduction in hourly electricity consumption of 0.13 kWh per household (equivalent to powering a 100 watt lightbulb for an hour and twenty minutes) during peak hours on event days.

Smaller reductions in electricity consumption are also visible for CPP opt-in households on non-event days, with hourly consumption per household decreasing by 0.03 kWh on average. For households encouraged to opt-in to the TOU pricing plan, researchers observed a reduction in daily peak consumption of 0.09 kWh per household. These households decreased their average hourly consumption by 0.05 kWh per household during non-peak times.

When looking at only households that ended up participating in the CPP and TOU plans, reductions in electricity consumption are also visible. Households opting-in to the CPP plan reduced their average peak consumption by 0.66 kWh while those opting-in to the TOU plan reduced peak consumption by 0.48 kWh.

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1. Environmental Defense Fund, 2015. https://www.edf.org/sites/default/files/time-variant_pricing_fact_sheet_-_april_2015.pdf