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Energy Conservation through Text Messages and Price Increases in Japan

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

Location: Japan

Sample: 691 households

Target group: Urban population

Outcome of interest: Climate change mitigation Energy conservation

Intervention type: Digital and mobile Nudges and reminders Energy efficiency Pricing and fees

AEA RCT registration number: AEARCTR-0001670

Data: Download datasets from Open ICPSR

Research Papers: Moral Suasion and Economic Incentives: Field Experimental Evidence from Energy ...

Partner organization(s): Mitsubishi Heavy Industries, Ltd., Kyoto Prefecture, Kansai Electric Power Company, The Stanford Institute for Economic Policy Research, Energy Institute at Haas, Japanese Ministry of Economy, Trade and Industry

Electricity customers may not be motivated to change their behaviors to conserve electricity during peak times. Researchers introduced two programs during peak consumption hours—text messages encouraging energy conservation for the benefit of society, or price increases—to evaluate the impact of social motivation and dynamic pricing on energy conservation. Both programs led to reductions in electricity use, but the impacts of the dynamic pricing were larger and persisted for longer than the impacts of the social motivation messages.

Policy issue

During peak demand hours, the cost to produce electricity can be significantly higher than during other times, leading policymakers to search for ways to reduce energy consumption during these hours. Various strategies may lower residential electricity consumption, including both internal forces (such as social pressure) and external forces (such as changes in price). Social motivation, or applying social pressure to conserve energy for the social good, has historically been a common strategy in many contexts. Moreover, there is little evidence on whether internal or external forces are more effective at encouraging sustained, long-term behavior changes such as decreased energy consumption. Are social motivation messages or price changes more effective at reducing household electricity use, both initially and over time?

Context of the evaluation

Kyoto is a prefecture of Japan in the Kansai region of the island of Honshu and has a population of 2.5 million. Kyoto was Japan's imperial capital for 1,100 years, until the Meiji Restoration in 1868. Its prefectural office is located in Kyoto City. Average temperatures in Kyoto range from 40°F (4°C) during the winter to 82°F (30°C) during the summer. Kansai Electric Power Company, one of the nation's 10 major electric utility companies, provides the prefecture of Kyoto with electricity. From April 2012 through March 2013 (roughly the time span covered by this evaluation), Kansai Electric Power supplied 142 billion kilowatt hours (kWh) of electricity.

To recruit participants for this evaluation, researchers contacted all residential electricity consumers in the Keihanna area of Kyoto (nearly 41,000 customers). Of these, researchers enrolled all customers who expressed interest in participating, except for students, customers who had devices that generated electricity at home, and those with no internet access. On average, participating households were comprised of three members with an average age of 40 to 42 years. The average household income was US$67,000. Importantly, households who participated in the study used similar amounts of electricity to households that did not volunteer to participate.

Example of electricity usage information provided by an in-home display. Photo: Fig A.1, Ito et al.

Details of the intervention

Researchers partnered with the Japanese Ministry of Economy, Trade, and Industry, the prefecture of Kyoto, Kansai Electric Power Company, and Mitsubishi Heavy Industries, Ltd. to conduct a randomized evaluation to determine the impact of social motivation messaging and pricing structures that correspond to demand (dynamic pricing) on energy conservation in Kyoto, Japan.

Researchers randomly assigned 691 households to one of two treatment groups or a comparison group (154 in the social motivation group, 384 in the dynamic pricing group, and 153 in the comparison group). All participating households received JPY¥24,000 (US$240 in 2012) and free installation of an advanced electricity meter. Peak demand hours, which are subject to high prices, were defined as weekdays between 1PM and 4PM in the summer in which the weather forecast predicted temperatures exceeding 88°F (31°C) or between 6PM and 9PM in the winter in which the weather forecast predicted temperatures below 57°F

(14°C).

For both treatment groups, households received encouragement to conserve electricity during peak hours via messages to their phones, computers, and in-home electricity displays. However, the messages differed by group. For the social motivation group, the text read, “Notice of Demand Response: In the following critical peak-demand hours, please reduce your electricity usage,” while the dynamic pricing group received a text reading, “Notice of Demand Response: In the following critical peak-demand hours, you will be charged a very high electricity price, so please reduce your electricity usage.” The dynamic pricing group also received information about how much the price would change. The price increases were randomly either JPY¥40, JPY¥60, or JPY¥80 (US$0.40, US$0.60, and US$0.80, respectively) higher than the typical price of JPY¥25 (US$0.25) per kWh. These price increases applied only to the peak demand hours.

Researchers collected meter readings at 30-minute intervals during the summer of 2012 and again in the winter of 2013, during which the weather reached peak demand temperatures on 36 days (15 days in summer and 21 days in winter). Additionally, researchers conducted three surveys to ask households about their energy use habits.

Results and policy lessons

In the short-term, both the social motivation and dynamic pricing strategies encouraged households to conserve electricity. However, only the dynamic pricing led to persistent conservation of energy throughout and after the evaluation.

Initial impacts:

Both the social motivation and dynamic pricing strategies led to initial reductions in electricity, but the impacts of the dynamic pricing were larger. During the first three peak periods in both summer and winter, the social motivation group reduced electricity usage by 8.3 percent. By comparison, the dynamic pricing group reduced usage by about 18.5 percent during the first three peak periods in both summer and winter.

Impacts throughout the evaluation:

Social motivation and dynamic pricing both produced sizable reactions in households in the short run. However, the effect of social motivation diminished quickly after repeated exposure to peak periods, as households became accustomed to the messages. By the fourth peak period, households receiving social motivation messaging stopped conserving during peak times, suggesting that households ignored the social message once accustomed to receiving it—a reaction referred to as “habituation.” However, although their reaction waned over the summer as they became habituated to the messages, their response recovered when they were given a break from the messaging—a counter-reaction referred to as “dishabituation.” After a three-month break, the social motivation group resumed conserving electricity to the same degree as the beginning of the summer peak periods, a reduction of 8.3 percent.

Meanwhile, the effects of dynamic pricing were sustained over time, suggesting that households are less likely to ignore this type of incentive after repeated exposure—in other words, households were less likely to habituate to dynamic pricing than to social motivation. Among the dynamic pricing group, consumption rates remained between 13 and 20 percent lower throughout the evaluation, suggesting higher prices continued to motivate electricity conservation. This continued decrease is an important example of consumers responding to marginal pricing when offered sufficient pricing information—an important contribution to growing literature examining the effects of marginal pricing.

Households with dynamic pricing also reduced energy use outside of peak periods, while households in the social motivation group did not. In the three hours before and after peak periods, energy use among dynamic pricing households fell by 4 to 6 percent. Moreover, in the summer, dynamic pricing households used 2 percent less electricity during all non-peak hours on peak period days.

Impacts after the evaluation:

Households that faced dynamic pricing continued to conserve after the messaging stopped and pricing changes ended, while the social motivation group returned to their typical energy use. During the three months following the evaluation, dynamic pricing households used eight to nine percent less electricity, suggesting that they had formed efficient energy habits.

Researchers surveyed households in order to understand what drove changes in energy use. Households in both groups reported buying more energy-efficient air conditioners but otherwise did not update their appliances. Households in the dynamic pricing group, but not the social motivation group, also reported using appliances in more energy-efficient ways. These findings suggest that the formation of more energy-efficient habits, rather than investment in new appliances, is what ultimately drove continued impacts after the evaluation for the dynamic pricing, but not the social motivation, group.

Overall, the results suggest that both dynamic pricing and social motivation may be effective policies for reducing energy use in the short term, but dynamic pricing may be a much more effective policy for sustained decreases in energy use over time.

Ito, Koichiro, Takanori Ida, and Makoto Tanaka. 2018. "Moral Suasion and Economic Incentives: Field Experimental Evidence from Energy Demand." American Economic Journal: Economic Policy 10(1): 240-267. https://doi.org/10.1257/pol.20160093