

Time-of-Use electricity pricing and residential low-carbon energy technology adoption

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Executive summary

Despite of various types of costly policy instruments such as tax credits and direct rebates, the penetration of energy efficiency and solar energy is still relatively low. Many organizational, behavioral, and market factors have been analyzed in existing literature to explain the low adoption level. Yet, the impact of one particular factor (electricity rate structure) on energy efficiency investment and solar panel adoption is often overlooked in empirical studies. In this paper, we show empirically that consumers facing Time-of-use pricing (TOU) are positively correlated with the adoption of solar energy, compared to consumers on non-dynamic pricing plans.

TOU, one of the most widely adopted dynamic pricing programs, charges different electricity prices depending on the time of the day, i.e. higher prices during peak hours (e.g. late afternoon in summer months) and lower prices during non-peak hours. We compare adoption decisions in energy efficient appliances and solar panels between consumers on non-dynamic rates (marginal electricity prices are constant throughout the day) and those on TOU rates. We use household-level data in Phoenix, Arizona from an appliance saturation survey of 16,035 customers conducted by a major electric utility in 2014 for empirical verification. Probit model and statistical matching methods are employed, and robustness checks are conducted using multinomial logit model, bi-variate probit model, and machine learning matching method.

Our empirical evidence suggests that TOU consumers are associated with 27% higher likelihood to install solar panels, but not more likely to adopt energy efficient AC. Our results have important implications for policy makers to promote the adoption of solar panels and TOU pricing. Our finding of the correlation between TOU and solar adoption suggests that TOU is associated with the same magnitude of impact as financial instruments such as rebates or tax credits of \$2,070~\$10,472, about 85% of current size of financial incentives for solar panels. The result that TOU is positively correlated with solar panel adoption implies that utilities could provide more information for their customers regarding the benefit of TOU for solar adopters. When government or utilities implement educational or informational programs to electric customers, they could bundle the information about the benefits from both solar and TOU, which potentially increases the adoption of both TOU and solar panels. From the cost-effectiveness perspective, combining TOU and solar in policy programs can also achieve a lower cost per additional adoption of TOU and solar.

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