

# Estimating the Impact of Time-of-Use Pricing on Irish Electricity Demand

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Electricity demand traditionally exhibits a substantial peak during a small number of hours each day. Policymakers are aware of the potential benefits that may be generated from a shift in energy consumption away from peak times. Smart meters, in conjunction with time-of-use (TOU) pricing, can facilitate an improvement in energy efficiency by providing consumers with enhanced information about electricity consumption and costs, and thereby encourage a shift away from consumption during peak hours.

In the EU, a number of recent pieces of legislation have promoted the use of smart metering, including the Electricity Directive 2009/72/EC, which requires Member States to ensure the implementation of intelligent metering systems and to carry out a cost-benefit analysis of the system by September 2012. In Ireland in May 2009 the first National Energy Efficiency Action Plan (NEEAP) was adopted in line with EU requirements, and included a commitment to encourage more energy efficient behaviour by households through the introduction of smart meters.

In 2007, the Irish Commission for Energy Regulation (CER) announced their intention to introduce a trial smart metering experiment in the Irish residential and small-to-medium enterprise (SME) electricity markets. Smart meters, which replaced the existing mechanical meter

readers, were introduced in approximately 5,000 households and 650 SMEs. In this paper, we focus on the behavior of households during the trial. While participating households self-selected into the trial, and therefore our results cannot be generalised to the overall population, participants were randomly assigned to control and treatment groups. Treatment groups were exposed to a variety of time-of-use (TOU) tariffs and information stimuli (in-home display (IHD) units, monthly billing, *etc.*). Data was collected over the period 14 July 2009 to 31 December 2010, and as the experiment began on 1 January 2010, six months of pre-trial data are available for both the control and treatment groups.

We use the data collected from the Irish smart metering trial to address the following research questions: (i) what are the effects of different TOU tariffs (peak, day and night) and stimuli on residential electricity consumption during different times of the day? (ii) what are the determinants of electricity consumption? (iii) does the socio-economic position of the household influence their response to the tariffs and information stimuli?

Our results show that different information stimuli lead to differences in household responses during different times of the day. In particular, the quality of the information given to the consumer about their electricity consumption is positively linked to the contraction in the electricity demand. Moreover, the magnitude of the contraction increases as the ratio of peak to off-peak prices increases. However, the extent of the additional reduction in peak demand due to a steepening tariff schedule is very small in absolute terms. Other stimuli, such as a bi-monthly or monthly billing, which provide the consumers with less information than the in-home display, also give rise to reductions in peak demand when TOU tariffs are employed, but for these stimuli there is little evidence of further reductions as the ratio of peak to off-peak prices rises further. This suggests that consumers in this experiment respond on the basis of a simple heuristic: they

know peak prices are now higher than at other times of the day and they change their behaviour to reflect this, but further increases in the differential are either not fully perceived or evoke only a weak response for some other reason.

Our results also show that controlling for day of the week, public holidays, climatic conditions and household appliance ownership, the presence of different TOU tariffs affects household electricity consumption during the peak hours, but does not lead to a significant change in electricity usage during the day and night periods. Finally, we find that households with higher education levels respond to TOU tariffs during the peak period (consistent with the overall results noted above), but that households with low education levels are less responsive to TOU tariffs.