

OPOWER, Inc. ("OPOWER") offers the following comments to the Smart Metering Implementation Programme: In-Home Display issued in July 2010:

Question 6: Do you agree with the proposed minimum functional requirements for the IHD?

OPOWER believes that the minimum functional requirements as currently proposed capture many of the building blocks needed to better inform consumers about their energy usage. In particular, we agree with the Government that displaying historical comparative information and usage information in pence and pounds will increase consumer understanding of their energy consumption patterns. However, we believe that there is one essential functional requirement missing from the Government's plan – proven, multi-channel, behavior-based messaging.

Behavior-based messaging gives customers a context in which to understand their energy use and is proven to motivate conservation. Information alone is not enough to change consumer behavior in a significant and sustainable way. For example, none of the current functional requirements proposed by the Government would tell individual customers what is *causing* them to use more energy (i.e. thermostat set too high, leaving the lights on, etc) and what they can and should do to use less. This is tantamount to a doctor telling a patient that he or she has an illness without explaining what caused the illness, how to treat it, and how to prevent it from coming back in the future. Furthermore, the current functional requirements do not provide a broader context to help consumers understand their energy usage relative to others (e.g., compared to individuals in similarly sized homes). Providing such context has proven to be more motivating to the consumer than concerns about cost.¹

Behavior-based messaging is further enhanced when delivered to customers through multiple communications channels. Messages can be communicated through paper-based reports sent in the mail, on a personalized web portal, via email, text-message to mobile phones, and/or through in-home displays. For some customers a website or email may be the best form of communication, while for many customers text-messaging a mobile or smart phone may be more useful. For example, while the broadband penetration rate in the UK is only about 30 percent, there are more mobile phone subscribers in the UK than people². In short, using multiple channels ensures that messages are reaching customers where they are already rather than delivering them to a technology or platform that they may not regularly use.

Furthermore, while OPOWER agrees with the stated goals of the Government's plan to "help consumers understand and change their energy usage,"³ we question whether IHDs by themselves are a cost-effective, verifiable, and sustainable means to achieve these goals. While several small-scale pilot studies have been conducted to measure the impact of IHDs on energy usage, the results are broadly inconclusive, suffer from sample sizes that are too small to produce statistically significant results at an acceptable confidence level, and timeframes that are too short to demonstrate sustainability, among other methodological shortcomings. It is possible that IHDs may be cost-effective in some cases, but

¹ Cialdini, Robert and Wesley Shultz. Understanding and Motivating Energy Conservation via Social Norms. 2004.

² Source: International Telecommunications Union. <http://www.itu.int>. October 28, 2010

³ Department of Energy and Climate Change and Office of the Regulator for Gas and Electricity Markets. *Smart Metering Implementation Programme: In-Home Display*. 27 July 2010. p. 1

this remains unproven to date. Moreover, some consumer advocacy groups are already criticizing the increasing cost estimates of smart meters⁴ with IHDs estimated to cost up to 30 pounds or more per household, not including installation and maintenance costs⁵. Therefore, OPOWER would recommend that the Government not limit its proposed functional requirements to IHDs or any other single technology. Instead, we would suggest that the Government pursue a portfolio approach where it develops requirements or goals, and then allows utilities to use the channels or technologies that can most effectively meet or achieve them.

To maximize benefits to the policymaker and the ratepayer, we propose that the Government considers one of two possible approaches to integrate multi-channel, behavior-based messaging into its program.

1. Include a supplementary requirement that the utility “use multiple channels to provide consumers with personalized behavior-based messaging based on their energy usage.”
2. Expand the current requirements and goals beyond IHDs so that multiple channels, including IHDs, can be used to achieve them based on their relative cost-effectiveness and sustainability.

Justification for Behavior-Based Messaging

The Government believes that smart meters can help it meet its ambitious energy reduction targets of between 1.5% and 4% for electricity and 1% and 3% for gas.⁶ Furthermore, the Government hopes that smart metering will lead to a 5% reduction in peak demand.⁷ In the *Smart Metering Implementation Programme Prospectus*, DECC and Ofgem state the expectation that changes in consumer behavior will be a key driver of energy savings and peak demand reduction.⁸ OPOWER applauds the Government’s ambitious goals and agrees that changing consumer behavior will be essential to achieve them. However, as OPOWER has learned in over three years working for 42 utilities in the United States, providing customers with more data is not enough to change their behavior with regard to energy consumption. Customers require personalized analysis, social context, and energy savings advice to motivate them to use less energy.

Behavior-based reporting is critical to customer engagement

Behavior-based programs have had strong success in the United States, producing results that are measurable, persistent, and independently verified. They can work either with data from existing meters or with smart meters. Several of the largest smart meter rollouts in the United States, including from Pacific Gas & Electric, American Electric Power, and Commonwealth Edison, have made home energy reports with behavioral messaging central to their customer engagement strategies.

⁴ Donoghue, Andrew. Experts Warn of High Cost of Smart Meter Rollout. eWeek Europe UK. July 2010.

<<http://www.eweekuk.co.uk/news/don%E2%80%99t-pass-smart-meter-costs-onto-public-warn-experts-8684>>

⁵ Colby, Ed. UK Energy White Paper: Meeting the Challenge. 2007. <<http://www.sentec.co.uk/assets/assets/UK-Smart-Metering.pdf>>

⁶ Smart Metering Implementation Programme: In-Home Display. 27 July 2010. p. 1

⁷ Ibid.

⁸ Department of Energy and Climate Change and Office of the regulator for Gas and Electricity Markets. Smart Metering Implementation Programme Prospectus. Page 28. <<http://www.decc.gov.uk/assets/decc/Consultations/smart-meter-imp-prospectus/221-ia-smart-roll-out-domestic.pdf>>

- Efficiency results: Behavior-based programs deliver predictable and consistent results

For example, OPOWER's Home Energy Reporting program – a multi-channel, behavior-based program -- has been consistently effective in each deployment to date. Every utility with at least six months of results has achieved energy savings between 1.5% and 3.5%. These results have been consistent across electric and gas utilities, as well as in winter-peaking, summer-peaking, and mild climates.

Figure 1 shows the consistency of savings that utilities have achieved through OPOWER's program:

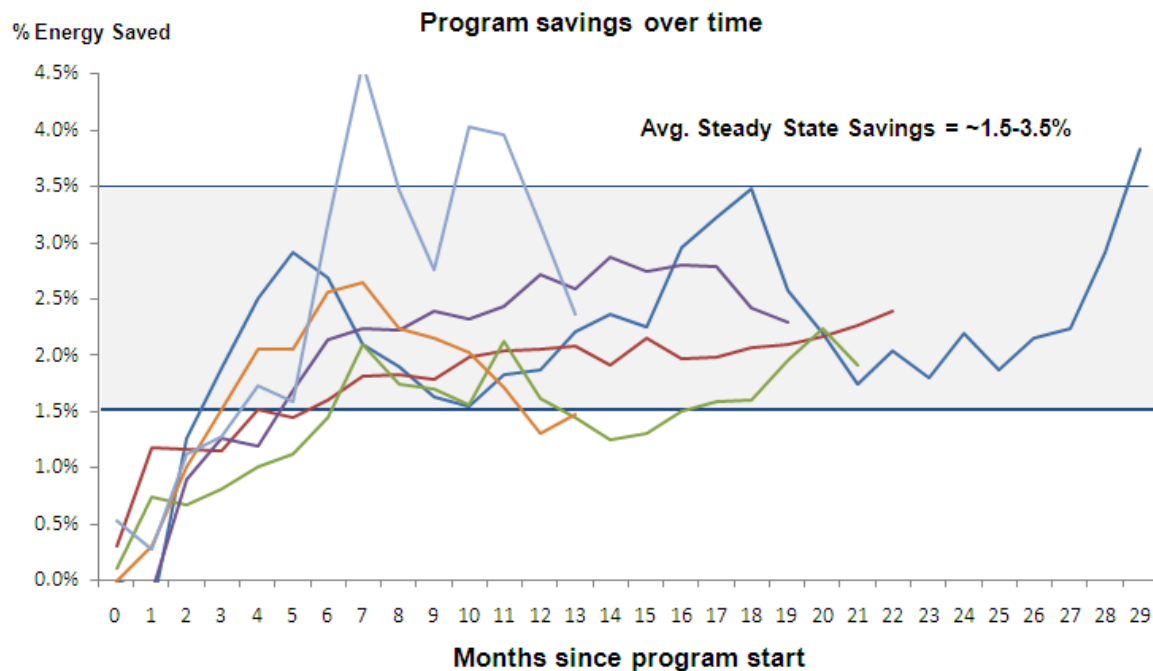


Figure 1: Results from Home Energy Reporting Program (OPOWER)

These results have been verified by several leading authorities. Summit Blue, an industry leading evaluation firm, has verified multi-channel behavior-based messaging's impact in Sacramento, California.⁹ Professor Ian Ayres, of Yale University, has verified its impact within Washington State.¹⁰ Professor Hunt Allcott, of the Massachusetts Institute of Technology, has verified its savings with Connexus Energy in Minnesota.¹¹ Moreover, Professor Allcott and Professor Sendhil Mullainathan, of Harvard University, published a discussion of multi-channel

⁹ Summit Blue. *Impact Evaluation of OPOWER SMUD Study*. September 2009.

<<http://www.opower.com/LinkClick.aspx?fileticket=naU7NN5-430%3d&tabid=72>>

¹⁰ Ayres, Ian. *Evidence from Two Large Field Experiments that Peer Comparison Feedback Can Reduce Residential Energy Usage*. July 2009. Available online at: <http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1434950>

¹¹ Allcott, Hunt. *Social Norms and Energy Conservation*. February 2010. Available online at:

<<http://web.mit.edu/allcott/www/Allcott%202010%20Social%20Norms%20and%20Energy%20Conservation.pdf>>

behavior-based messaging in *Science*.¹² In each case, the studies have not only verified the results of these programs, but have concluded that behavior-based programs are a simple and cost-effective source of energy savings.

- Behavior-based programs help consumers save energy during peak times

With better data about a household's usage provided through smart meters, OPOWER can generate stronger insights. While other platforms are still being developed and optimized in anticipation of smart meter installations at scale, the OPOWER platform is already at work—and delivering significant savings – to 2 million households in the United States and will be serving 10 million households in 2011.

Moreover, the OPOWER approach is fully compatible with—and, indeed, is enhanced by—smart meters. With traditional meters, OPOWER is able to tell customers the months in which they use the most; with smart meters, OPOWER can tell customers the hour of the day when they use the most. Furthermore, OPOWER will be able to help customers take advantage of the energy savings opportunities provided by smart-meter enabled initiatives such as dynamic pricing and demand response. For example, for customers who sign up for alerts, OPOWER can text message them the day before a critical peak pricing event or let them know they are on track for a high bill.

- Early results have proven behavioral messaging to be effective at reducing peak demand

Even in the absence of time-of-use or dynamic rates, behavioral messaging delivers energy efficiency savings that increase in tandem with load growth. Figure 2 illustrates the difference in kW savings between a test (receives behavioral messaging) and control (does not receive behavioral messaging) group by hour :

¹² Alcott, Hunt and and Sendhil Mullainathan. *Behavior and Energy Policy*. *Science*. March 2010. Available online at: <http://web.mit.edu/allcott/www/Allcott%20and%20Mullainathan%202010%20-%20Behavioral%20Science%20and%20Energy%20Policy.pdf>

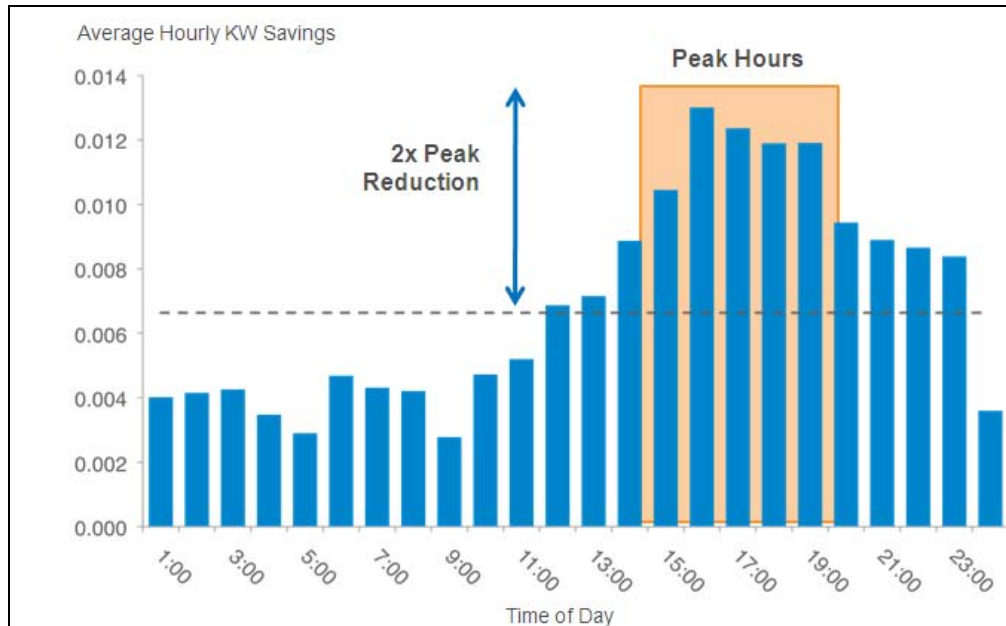


Figure 2: OPOWER's savings during peak hours

- Behavior-based Results Are Consistent Across Demographics

OPOWER's mailed reporting approach ensures that all populations—including vulnerable and elderly customers—have an opportunity to save. The consistency of OPOWER's results across demographics is illustrated below in Figure 3.

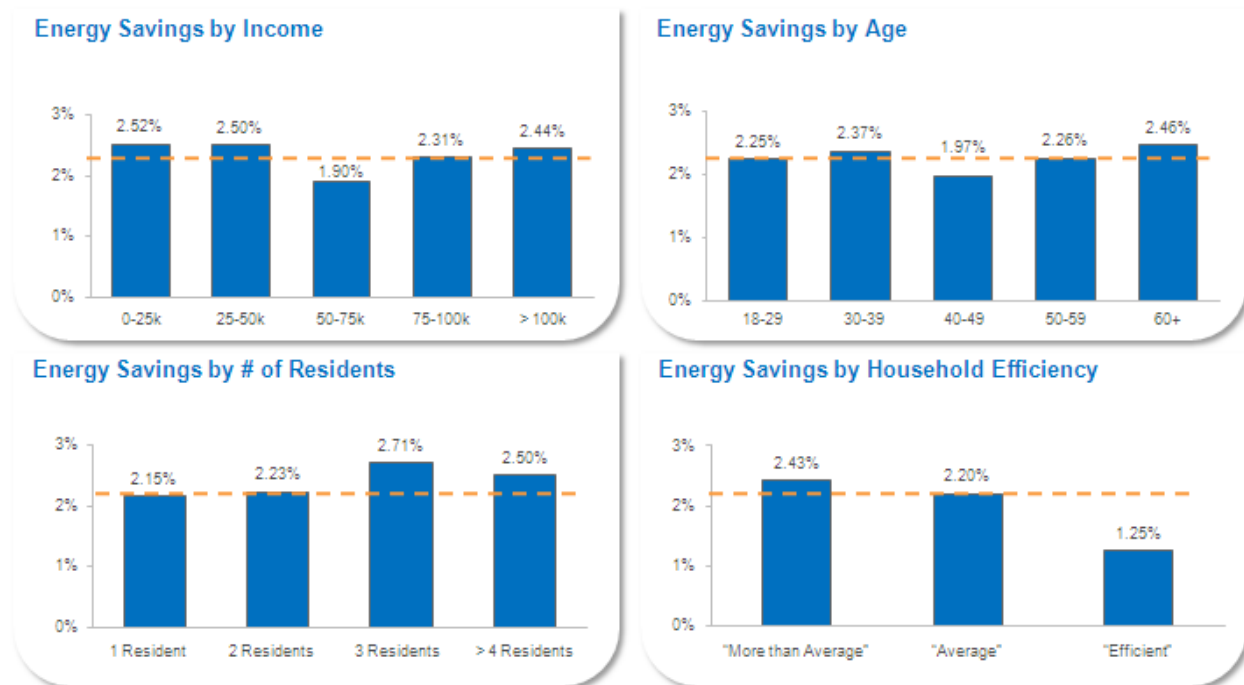


Figure 3: Consistency of OPOWER results

This reliable distribution of energy savings is critical to helping customers realize the value of smart meters. Effective engagement—and energy savings—across an entire customer base will ensure that customers of all demographics will have the chance to take advantage of the money savings opportunities afforded by smart meters.

- Behavior-based programs with an opt-out design cost-effectively generate large-scale savings

Critical to OPOWER's strategy is an "opt out" program design with an emphasis on mailed reporting. Mailed reports enable utilities in the United Kingdom to engage the majority of targeted customers and drive large-scale energy savings. By using mail, behavior-based messaging reaches all demographic groups, including low income and elderly populations. This means that utilities can engage up to 85% of participants - far more than other efficiency measures.¹³

This high participation rate means that small savings on a per household basis add up to significant savings in aggregate. Moreover, behavior-based messaging increases participation in other utility programs. By motivating customers to act and enabling them with information, OPOWER has demonstrated a 15% impact on utility-sponsored efficiency programs.

¹³ Summit Blue. *Impact Evaluation of OPOWER SMUD Study*. September 2009.

<<http://www.opower.com/LinkClick.aspx?fileticket=naU7NN5-430%3d&tabid=72>>

Finally, these efficiency changes are easily measured and verified and are generated cost effectively – on average, OPOWER's program costs \$.02-\$.03/kWh saved. The opt-out program design also allows for transparent and highly accurate measurement of savings, and avoids issues of bias and validity inherent to opt-in programs. This means that by using Home Energy Reports to engage customers around the smart grid, the Government can ensure that utilities are generating significant, large-scale energy savings at very low cost to the ratepayer.

No conclusive evidence on the efficacy of IHDs

While the Government's *Smart Metering Implementation Programme Prospectus* has proposed in-home displays as a potential way to reach customers and drive residential energy savings, the academic literature is currently inconclusive about whether or not IHDs can deliver cost-effective, persistent consumer energy savings. Deeper examination of several key studies reveals that IHDs, while promising in their potential and popular among customers in surveys, remain statistically unproven as a means to cost-effectively and sustainably reduce home energy use across a broad population. Studies conducted by Brattle Group, the Electric Power Research Institute (EPRI), Sarah Darby, and the Energy Trust of Oregon all report measurable energy savings in IHD pilots. However, these studies are generally too small to yield statistically significant results at either a 90 or 95 percent level of confidence, in most cases are subject to selection bias since the sample groups are not randomly selected, and are too short in tenure to demonstrate sustainability.

- In the **Brattle Group** report cited on p. 4 of the Government's paper on "Smart-Metering Implementation Programme: In-Home Display," the authors reference studies where only several hundred participants voluntarily chose to participate (California, San Diego), where savings was measured consumer perception through surveys rather than through reading the meter (Massachusetts), and where the conservation impact of the IHD was not separately measured from other programs (Canada/Woodstock). Many of the pilots reviewed in the paper are not even completed (Kentucky, Texas). Furthermore, as the authors conclude, "...given the time-constrained nature of these pilots, the impacts of IHDs have not tested for sustainability."
- In a report issued by the **Electric Power Research Institute (EPRI)** that assessed a number of studies on energy display devices, it was suggested that further studies of two years or longer were needed to draw statistically significant conclusions regarding the longevity of conservation gains from the use of energy display devices. The study also suggests that high cost, maintenance and battery-life issues may restrict an IHD's potential across a broader population.¹⁴
- The **Energy Trust of Oregon**, a respected nonprofit in the U.S. and state government-authorized efficiency administrator found in a survey of participants in its IHD pilot, customers perceived that the IHD was leading them to use less energy. However, their actual usage told a different story. As the study concludes, "while a decline in savings stemming from these devices [IHDs] could be expected over time, results of this study indicate that the monitors have no appreciable immediate impact as well." Like other studies, it also suffered from a small sample

¹⁴ Residential Electricity Use Feedback: A Research Synthesis and Economic Framework. EPRI, Palo Alto, CA: 2009. 1016844.

size so its results are inconclusive.¹⁵

- **Sarah Darby**, behavioral science and energy use expert at the University of Oxford, has estimated that the savings from direct display devices, such as IHDs, range from 5-15%.¹⁶ However, the studies that informed this assessment have only several hundred participants, which means that statistically they are of low confidence. Indeed, in an assessment of the potential of data displays in an AMI-enabled environment, Darby notes that there are few large-scale trials of direct energy feedback mechanisms carried out under rigorous conditions.¹⁷

Conclusion

As currently described in the Government's Smart Metering Implementation Programme: In-Home Display paper, there is an important functional requirement missing: Multi-channel, behavior-based messaging. OPOWER has demonstrated in the United States that multi-channel, behavior-based messaging provides cost-effective, persistent, and independently verifiable customer energy savings. Coupled with the smart meter technology that the Government plans to deploy, behavior-based messaging could have a powerful impact on energy usage in the United Kingdom.

While it is clear that customer engagement and behavior-change are important to the success of smart metering, it is less clear whether IHDs alone can engage customers and help meet the Government's energy reduction targets. IHDs can potentially be an important engagement tool, but are currently an experimental technology. The academic literature is not yet conclusive on whether IHDs cost effectively and sustainably lead to household energy savings. As such, if the Government chooses to proceed with the deployment of millions of IHDs, OPOWER would advise that they be used as part of a portfolio of energy efficiency solutions, including behavior messaging via the web, mobile applications and mailed reports.

Sincerely,

¹⁵ "The Net impact of Home Energy Feedback Devices," http://energytrust.org/library/reports/Home_Energy_Monitors.pdf

¹⁶ Darby, Sarah. The Effectiveness of Feedback on Energy Consumption. 2006.

<http://www.eci.ox.ac.uk/research/energy/downloads/smart-metering-report.pdf>

¹⁷ Darby, Sarah. Why, What When, How, Where, and Who? Developing UK Policy on Metering, Billing, and Energy Display Devices. 2008. <http://www.eci.ox.ac.uk/research/energy/downloads/darby08-aceee.pdf>

OPOWER Comments, 10/28/10

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