Smart meter implementation programme: Response to selected questions on data access and privacy

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About Green Alliance

Green Alliance is an environmental think tank working to ensure UK political leaders deliver ambitious solutions to global environmental issues. While not a formal alliance, we work closely with partners in the third sector, business and other spheres to advocate proposals salient across the political spectrum. Our activities include research, advocacy and convening high-profile events with senior politicians and key influencers.

Green Alliance has carried out extensive policy research on energy efficiency and how knowledge about human behaviour should be incorporated into policy design. We have been looking at the smart meter roll-out since its inception, and have been consistently pushing for the design to maximise energy efficiency.

Overview

The prize of reducing energy use is one of the prime motivators for the introduction of smart meters. Indeed, as stated in the roll-out strategy document, over 40% of the benefits of the scheme are expected to come from a reduction in household energy demand.

However, as DECC has acknowledged, smart meters alone do not save energy; people do. So "delivering the benefits of smart metering *depends* on consumers changing their energy consumption behaviour"[i].

Numerous studies have shown that information provision alone rarely leads to a change in behaviour[ii] and it is unlikely that the provision of information through in-home displays alone will produce the kind of behaviour change required to realise the scheme's benefits.

In fact, the provision of information is merely the pre-condition that will enable a range of potential energy savings interventions to be introduced. These savings will only be realised if people *know how* to respond to the information they receive and *are encouraged* to do so.

The current plans don't oblige energy companies to do much more than show people how to use their In-home Display device. Various studies have shown that interest in the information[iii] these displays provide (and resulting action) is likely to wane after a period of time.

It is therefore essential that the components are put in place for stakeholders to encourage and enable consumers to change their behaviour on a regular basis. For example through providing them with regular tips on energy savings based on their usage patterns, such as how to use their hot water heating more effectively if they are running it on the top temperature all day long.

It is essential that this support is given to all consumers regardless of their economic circumstances and the only way that we can see this happening is if it is either mandated or a mechanism is introduced that helps put a value on energy savings, such as an Energy Efficiency Feed in Tariff (see below and in a forthcoming Green Alliance briefing).

We believe that the current proposed plans will severely limit the ability of stakeholders to help customers reduce energy use and that substantial changes need to be made to ensure we do not hinder this one in a generation opportunity to deliver energy efficiency programmes into the future.

Our key recommendations are that:

- The use of personalised energy efficiency advice through billing and customer support should not only be permissible under regulated duties, but should be mandated.
- At least half-hourly records of household energy use should be provided on an 'opt-out' basis.

Responses to select consultation questions

Energy services market

Question 2: To what extent would different rules for access to data between suppliers and third parties be expected to impact on the development of an energy services market (in terms of product and tariff innovation and / or entry to the energy market by third parties)? What are the particular data uses to which these concerns apply?

Green Alliance is keen to see a healthy energy services market and the introduction of new entrants, whom we believe are likely to drive innovation in this sector. We are also mindful that households are likely to take advice on energy savings from people that they trust, and energy suppliers currently have a low score on that basis.

It is therefore essential that third parties can access data on energy use, for the provision of energy efficiency advice only. There are two potential models that allow efficiency providers to access this type of household data. One model allows third parties to access data by partnering directly with a supplier, while the other model allows third parties to partner directly with the customer.[iv] While each model has its own benefits and drawbacks, we recommend that the government implements policies that allow *both* business models to thrive in the UK's energy efficiency markets.

Granularity of data

Our response covers questions 3 and 4.

Question 3: Are there any data uses, apart from those set out below, where the arrangements for access to data could have an impact on the benefits of the programme. How does this analysis differ for the gas market?

Question 4: What types of energy services and energy advice could be provided by the market (by suppliers and / or ESCOs / potential new entrants) that require access to specific levels of data? What level of data granularity (frequency, time-lag) are needed to provide such services and what is the potential impact of these services in terms of percentage energy savings? Please provide empirical examples and explain the basis of any assumptions and distinguish between gas and electricity

The provision of energy services and energy advice are absolutely central to smart meters delivering energy savings. It is well documented[v] that the provision of information alone is unlikely to lead to any substantial changes in behaviour unless accompanied by other services that show people how they can save energy and encourage and enable them to do so.

Results from the Energy Demand Research Programme[vi] (EDRP) and analysis by the National Audit Office[vii] show that unless smart meters are deployed intelligently, with complimentary programmes alongside them, they are not guaranteed to bring about any reduction in energy demand.

These findings are supported by a 12-month pilot study involving thousands of families at the University of East Anglia[viii], which found that any initial enthusiasm among householders about cutting energy use with smart meters quickly wore off. In the absence of meaningful, ongoing support about the changes they could make, householders were left feeling frustrated and despondent that the changes they made were very small, rather than feeling motivated to save more energy and money.

The EDRP also showed that the trials where householders were supported by complimentary advice from companies, as a part of a continuous process, had the best results. The more personalised and granular data that was used, the more useful advice was for households.

Our response below sets out the different types of services that increasing granularity of data enables.

Here we reference evidence from Opower, a behavioural energy efficiency and smart grid software company. Opower has shown what different levels of granularity can provide in terms of advice to households. All graphs are theirs. What is clear from the information is that as the granularity of data increases, so does the potential for services and energy savings: profiles can be more particularised, usage can be disaggregated, and tips can be more targeted. Importantly, access to detailed data also enables companies like Opower to target behaviour and drive savings during critical peak periods, when the load on the entire grid is the greatest.

<u>Monthly Intervals</u>

At monthly intervals customers can be provided with the aggregate amount of energy used by their household in a given month. They can be advised on how their energy use compares to their

neighbours and varies over seasons. Opower, or a similar company, could therefore provide advice based on progress month-by-month and targeted tips on reducing energy based on demographic data.

The majority of Opower's programs in the US have operated with monthly data and have delivered savings of 1.5%-3.5%.

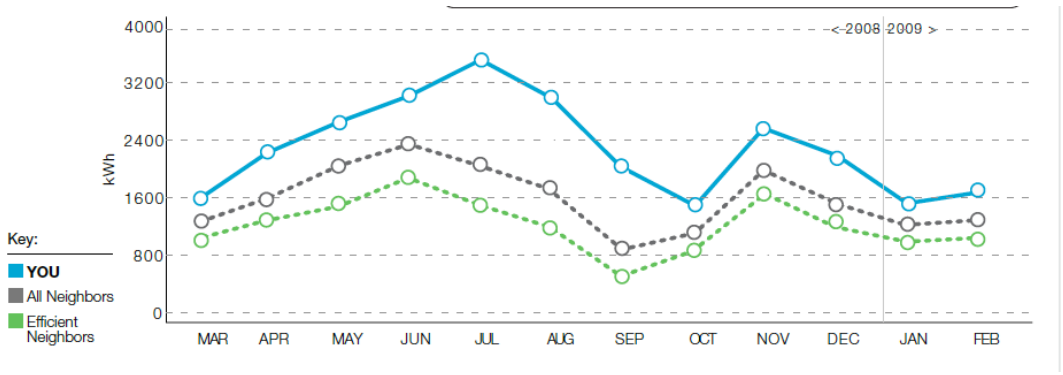


Figure 1: Household comparison of energy use at monthly intervals. Source: Opower

Daily Intervals

At daily intervals, it is possible to disaggregate to some degree the amount of energy use dedicated to heating and cooling, and to offer consumers useful information about the ways they can save energy by modifying their behaviour (e.g. turning the thermostat down a few degrees). Insight can also be provided on weekday versus weekend usage and how weather and behaviour are interacting.

Figure 2: Household energy use mapped daily showing daily patterns of usage. Source: Opower

30-minute Intervals

With Smart Meter data at a 30 minute intervals companies can present customers with insights on the ways they use energy at different times of day, enabling them to adjust their usage and lessen strain on the grid during peak times. **To provide dynamic pricing, interval data of at least this level of specificity, if not greater, is essential.** This level of data enables far more accurate heating and cooling disaggregation and the construction of profiles identifying classes of usage. For most appliances, device disaggregation and identification is not possible with 30-minute data, although sometimes a refrigerator, because of its regular and predictable cooling cycle, might be detectable at this interval.

Though true device disaggregation remains difficult at the kinds of intervals available from most installed smart meters (30-minute, 15-minute), the benefits of such granularity are still dramatic compared to less detailed daily intervals.

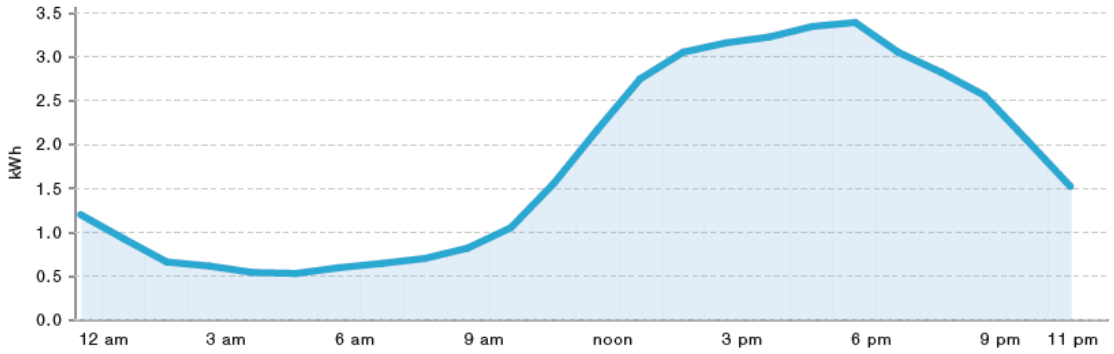


Figure 3: Household energy use in 30 minute intervals showing pattern of energy use throughout the day. Source: Opower

15 minute intervals or less

With meter reads at 15 minutes or less, patterns of appliance energy use become evident. The fifteen minute read (zoomed in below) shows the pattern a compressor cycle of a refrigerator. At these levels of granularity it becomes possible to disaggregate many particular appliances based on algorithmic analysis of load signature such as a refrigerator or an electric hot water heater.

Some of the most dramatic potential of the Smart Grid become possible when true real-time data is available. When customers are able to identify how much energy their refrigerator, air conditioner or television is using – and how much it is costing them – at any given moment in time, the potential for energy-saving behaviour change is greatly increased.

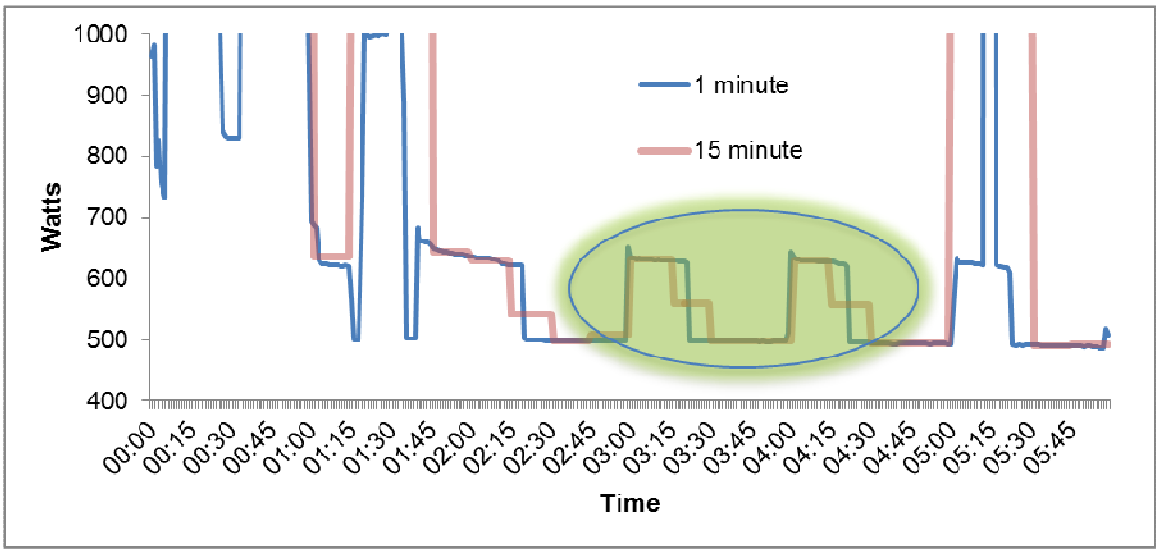


Figure 4: Household energy use at one minute and 15minute intervals showing detailed energy use and capable of recognising the energy use pattern of a refrigerator. Source: Opower

Studies that have pinpointed the load signatures of specific appliances from use data are often using data intervals of less than a minute. Indeed, the most dramatic illustrations of disaggregation based on load signatures use data collected at sub-second intervals.[ix] While researchers have begun to focus on strategies for disaggregating devices based on lower resolution smart meter data,[x] these efforts have not been as successful as techniques utilising more frequent interval measurements.

Incentives to provide the energy efficiency advice that high granularity of data provides

The advice we described above would be beneficial to householders. But we remain concerned that energy suppliers, or any profit-based third parties for that matter, currently have no real incentive to provide it.

There are incentives to support customers in making one-off energy saving behaviours, as they tend to involve purchases that an energy supplier, or other third party, could potentially profit from. This is the kind of behaviour that we expect energy suppliers to be keen to promote.

DECC's challenge is to get round the issue that it is fundamentally not in the supplier's interest to encourage *habitual* behaviour change (actions such as turning off lights or turning down thermostats) to reduce energy consumption where there is no hope of profit. Supporting habitual behaviour change is fundamental to realising the energy efficiency benefits of smart meters, but these actions would reduce the suppliers income from the household in question so they have little incentive to promote them.

Consumer groups are therefore rightly concerned that customers may be providing extensive data to their supplier but that they will get little service back in response. And/or that any advice provided will be concentrated on the richer segment of the market who can better afford to make these one-off purchasing decisions.

There are two ways we believe this could be overcome:

One is through the introduction of an Energy Efficiency Feed in Tariff, or any similar mechanism that actually creates a market for energy demand, which could provide a payment for advice that reduces energy use. We can provide more information, if required, on how such a Feed in Tariff would operate.

The second is by requiring suppliers to provide regular energy efficiency advice to all their customers based on their use, as part of their regulated duties. The suppliers are currently developing a Privacy Charter which focuses on what smart meter data *cannot* be used for. However, there are no requirements on what it *should* be used for. In the United States, California has recently enacted legislation that includes energy efficiency under the primary purposes under which suppliers may use smart meter data and share it with contracted agents subject to appropriate privacy safeguards.

Suppliers should be obliged to use the data provided through smart meters to provide advice to all customers. Options might include:

- Provision of easy to understand comparative billing;
- Alerts to high energy use or consumption patterns that reveal wastage;
- Analysing energy data to provide tailored advice;
- Working with and providing support and resources to community groups.

Consumer choice

Below we respond to question 16 and 17 together.

Question 16: Are there any alternatives to a basic opt-in or opt-out approach to consumer choice such as some form of prompted choice? What are the practical and consumer protection considerations in relation to different options (for example when and how)? From a consumer perspective what alternative approaches and vehicles (for example letter, email, phone) to seek customer consent are there?

Question 17: What evidence is there of likely take-up rates that could be achieved through different approaches to consumer choice?

As well as exploring the consumer protection impacts of opt-in and opt-out approaches to sharing data, it is **essential** to consider the impacts that the approach to consumer choice will have on the ability of the smart meter programme to deliver the expected and necessary energy savings.

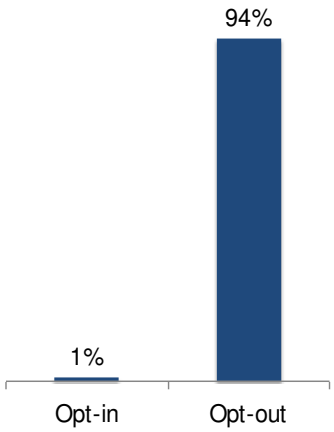
DECC acknowledges the restrictions that an 'opt-in' requirement creates in relation to the amount of consumers that will share their data and the fact that most customers do not have concerns about[xi] sharing their consumption data, yet it has still indicated its intention to go down the 'opt-in' route.

This decision seriously undermines the ability of the smart meter programme to deliver energy efficiency. We have set out above how essential the provision of customer data is to enabling the maximising of energy efficiency gains from smart meters. Below, we set out the vital importance of taking an 'opt-out' approach to securing this data from customers.

'Opt-in' energy savings services can help people reduce their energy consumption, but this potential is rarely realised because people don't 'opt-in' to them.

This is evidenced by the previous failure of web-based information services that customers have to choose to access. No energy-savings were found from web-based interventions in the EDRP, whilst Google and Microsoft have both recently scrapped their online metering tools that can connect with smart meters, because of an "inability to scale". This is likely to be because voluntarily engaging with a web tool requires a lot of initiative from people, so only a few are likely to do it.

Figure 5:Opt-out lifts participation in German green power programs



By adopting an 'opt-out' approach the potential savings and proportion of households reached will increase by several magnitudes. Without permitting default approaches (which require customers to 'opt-out'), we question whether DECC will be able to realize its ambitious energy efficiency goals.[xii]

A German study on green power pricing programmes demonstrates the dramatic value of opt-out design. An initiative in the German town of Schönau, in which customers had to 'opt-out' of programmes that saw them receive electricity that is generated from a larger share of renewables had 94% participation. This programme is comparable to UK consumers choosing green energy tariffs from their suppliers, which they have to 'opt-in' to. Average take up of such tariffs is a dramatically lower 1% in the UK. [xiii]

The Cabinet Office's Behavioural Insights Team has recognized the benefit of programmes that have to be 'opted-out' of in the context of pension schemes, health care, and energy policy. [xiv,xv] Changing pension schemes from opt-in to opt-out increased participation from 40% to 90% in the UK.[xvi] The UK government has also pursued changing the default settings for heating and lighting systems with the ambitious goal of realising a reduction in emissions of 25% by 2015.[xvii]

Opower's model has effectively used 'opt-outs'/defaults to engage over 85% of customers in US supplier service territories with energy use. With this high level of participation, the small behaviour changes that lead to Opower's average 1.5 – 3.5% savings result in a large aggregate impact. When projecting a relatively generous opt-in rate of 5% for a full UK deployment, Opower still estimates the UK would lose 15,000 GWh in energy and over £1.3 billion in bill savings over three years. **Figure 6** compares these estimated benefits of opt-out versus opt-in Opower programmes if fully deployed in the United Kingdom.

Figure 6: Benefits of opt-out for UK full deployment. Source: Opower

Benefits of an OPOWER program:	Opt-out*	Opt-in**	Loss
❑ % of customers who take action	85%	< 5%	~80%
❑ Energy savings	> 20,900 GWh	< 5,900 GWh	15,000 GWh
❑ Gross savings for customers	> £1,700m	< £350m	~1,350m
❑ Measurable and verifiable results	✓	✗	ransparency
❑ Savings across each customer class	✓	✗	Equality

*Assumptions include deployment to 21.3m UK households over 3 years and access to sub-interval data
**Assumptions include averages of 5% of customers opting in and 10% savings rate for 21.3m UK households over 3 years

An opt-out approach is also necessary for establishing unbiased experimental design, including randomisation, statistically equivalent control and treatment groups, and ex-*post* measurement. An opt-out approach allows for the creation of treatment and control groups that are demographically equivalent so that the effect of a programme on the treatment group's energy usage can be measured with statistical confidence. By contrast, an opt-in programme would be difficult to measure with certainty.

Future proofing

As DECC have acknowledged, the design that is put in place now will need to be able evolve over time as new innovations come forward. We cannot predict what new innovations might come forward and following an opt-in approach which means we cannot access granular data from the vast majority of households in the UK could come back to haunt the government when that data is required for progress and they need to ask all households again to provide it.

Green Alliance
October 2011

Endnotes

[i] DECC, March 2011, *Response to Prospectus Consultation* http://www.decc.gov.uk/assets/decc/Consultations/smart-meter-imp-prospectus/1477-data-access-privacy.pdf

[iiii] For example Douglas Mackenzie-Mohr, 2007, *Fostering Sustainable Behaviour: An Introduction to Community-based Social Marketing.* More information available at: http://www.cbsm.com/public/world.lasso

[iii] For example Tom Hargreaves, "When practices strike back…: a longitudinal study of the impact of smart energy monitors on domestic energy-use practices" presented on Friday 02 September 2011 at the *Royal Geographical Society annual International Conference*, London; and OFGEM, June 2011, *Energy Demand Research Project: Final Analysis*

[iv] The proposed central data and communications body ("DCC") in the UK could potentially create a third access point, which would operate similarly to the supplier access point.

[v] Douglas Mackenzie-Mohr, 2007, *Fostering Sustainable Behaviour: An Introduction to Community-based Social Marketing*. More information available at: http://www.cbsm.com/public/world.lasso

[vi] OFGEM, June 2011, *Energy Demand Research Project: Final Analysis,* available here: http://www.ofgem.gov.uk/sustainability/edrp/Documents1/Energy%20Demand%20Research%20Project%20Final%20Analysis.pdf

[vii] National Audit Office, June 2011, *Preparations for the Roll Out of Smart Meters*, available here: http://www.nao.org.uk/publications/press_notice_home/1012/10121091.aspx

[viii] Tom Hargreaves, "When practices strike back…: a longitudinal study of the impact of smart energy monitors on domestic energy-use practices" presented on Friday 02 September 2011 at the *Royal Geographical Society annual International Conference*, London. More information: http://www.rgs.org/NR/rdonlyres/51DA9557-F06B-43A3-B2CB-3910D2F4CB74/0/110902Smartmeters.pdf

[ix] by Carrie Armel, Precourt Energy Efficiency Center, Stanford University, June 2011 ,"*The Value of Energy Sensors: Will It Be Realized?"* presentation delivered, p. 11. Available at: http://greensvlg.org/wp-content/uploads/2011/07/2C-Smart-Meters-Slide.pdf

[x] J. Zico Kolter, Siddharth Batra, and Andrew Y. Ng., 2010, *"Energy Disaggregation via Discriminative Sparse Coding,"* In Neural Information Processing Systems (NIPS)

[xi] P10 of *A call for Evidence on Data Access and Privacy* says "most customers are not unduly concerned about suppliers of network companies having access to their consumption data but are concerned this could lead to more unwelcome contact through sales and marketing and do not want the data to be used to sell them new products without their explicit consent."

[xii] Moxham, Ben and Gila Sacks, 5 September 2010, "Advisers' letter to David Cameron on energy and climate policies," in Daily Telegraph, available here: http://www.telegraph.co.uk/earth/greenpolitics/8741779/Advisers-letter-to-David-Cameron-on-energy-and-climate-policies.html

[xiii] Pichert, Daniel, and Konstantinos Katsikopoulos, October 2007, "Green Defaults: Information presentation and pro-environmental behaviour," in *Journal of Environmental Psychology*, available here: ftp://papers.econ.mpg.de/IMPRS/SumSchool2009/priv/Katsikopoulos/ABC%20Read%205.2.pdf

[xiv] Cabinet Office, June 2011, *Behaviour Change and Energy Use,* available here: http://www.cabinetoffice.gov.uk/sites/default/files/resources/behaviour-change-and-energy-use.pdf

[xv] Cabinet Office, 31 December 2010, *Applying behavioural insight to health*, available here: https://update.cabinetoffice.gov.uk/sites/default/files/resources/403936_BehaviouralInsight_acc.pdf

[xvi] Cabinet Office, 31 December 2010, *Applying behavioural insight to health*, available here: https://update.cabinetoffice.gov.uk/sites/default/files/resources/403936_BehaviouralInsight_acc.pdf

[xvii] Cabinet Office, June 2011, *Behaviour Change and Energy Use,* available here: http://www.cabinetoffice.gov.uk/sites/default/files/resources/behaviour-change-and-energy-use.pdf