ENERGY DEMAND RESEARCH PROJECT

Review of progress for the period March 2009 – September 2009

March 2010

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Contents

1 Summary of report

This fourth report covers progress from March 2009 to September 2009 for the Energy Demand Research Project (EDRP). The EDRP is a large scale Great Britain-wide trial seeking to better understand how consumers react to improved information about their energy consumption. This project is designed to measure how consumers respond to such interventions over the long term. Ofgem oversees the EDRP on behalf of Government. Four suppliers are conducting trials under the EDRP; E.ON, EDF, Scottish Power and SSE. The EDRP is trialling a range of methods of providing customers with improved feedback on their energy consumption, known as interventions, these include energy consumption information through bills, energy efficiency information, clip on visual display units, smart meter related interventions, and community engagement.

In September, there were over 58,000 households taking part in trials and a further 16,000 households included in control groups. Over 17,000 households have had smart meters installed as part of the trial, many with both gas and electricity smart meters. The numbers of households involved in the trials and using smart meters are close to the target numbers set at the start of the trial.

The trials are generally progressing as planned. Some of those using innovative new technologies have experienced delays in delivery whereas other trials are almost reaching the completion of the data collection phase.

It is important to remember that, because the EDRP trials are still on-going and data is still being collected and analysed, it is too early to reach any conclusions on how individual combinations or combinations of interventions have influenced energy consumption long term. However, we can identify some emerging trends and themes.

Interim progress reports are published every six months throughout the trial. The first two reports were able to provide updates on progress in recruiting participants and installing interventions. The third and fourth reports refer to the middle parts of the trials, when the trials are already up and running, but before they have been gathering data for long enough to yield any statistically-robust conclusions. Some results of the EDRP should be available in the fifth progress report, due to be published in September 2010, and the final analysis and conclusion are likely to be completed in early 2011.

In the meantime, highlights of this fourth report are:

- The community trials have built on the progress that was reported previously, and are on course to meet their targets.
- Plans are in place for additional analysis of the EDRP to feed into the Smart Metering Implementation Programme and inform the Prospectus due this summer.
- We have been reviewing the practical and technical lessons emerging from the EDRP and alongside this document have published presentations from the suppliers on their experiences so far.

Additional questions on the EDRP can be directed to Ofgem via
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2 Background and context of the EDRP

2.1 Background of the EDRP

The Government allocated £9.75 million to part finance trials investigating consumer response to improved feedback on their energy use - the Energy Demand Research Project (EDRP). The EDRP was launched in July 2007 but partly due to technical issues with the new equipment being tested the majority of the trials began in late 2007/early 2008.

Ofgem agreed to manage the EDRP on behalf of Government, in terms of both drawing up recommendations for grant funding, and in overseeing the implementation and assessment of data arising out of the scheme.

The actual trials are being undertaken by four different energy companies, namely EDF Energy Customers plc (EDF), E.ON UK plc (E.ON), SSE Energy Supply Limited (SSE) and Scottish Power Energy Retail Limited (SP). They are required to submit reports at six-monthly intervals during the project.

The Centre for Sustainable Energy (CSE) support Ofgem in its evaluation and monitoring of the EDRP. CSE primarily ensures statistical reliability is maintained, interrogates the trends or conclusions in the Suppliers' reports, and cross analyse interventions across supplier trials.

2.2 Current context of the EDRP

In December 2009 the Government announced plans for the national roll-out of smart meters to all homes in Great Britain by the end of 2020. The EDRP will be an important source of information for the Smart Metering Implementation Programme, providing evidence to guide policy decisions, and also providing the opportunity to learn about the practical issues that may be encountered in a national roll-out.

The EDRP consists of 26 trial groups, across Great Britain, some of which are further divided into subgroups based on, for example, consumption level or type of meter. Each of the suppliers is conducting a series of trials involving a range of different interventions and combinations of interventions.

Due to the complex range of trials, care will have to be taken when any conclusions are drawn from the EDRP. Results from individual trials can be helpful but conclusions can best be reached by conducting cross-trial analysis. The EDRP trials appear to have already demonstrated certain effects, some of which have been reported in previous public reports. These can only be treated as preliminary observations because the analysis has been conducted on data collected over a limited period and data has yet to be compared from across the trials.

Additional analysis will be conducted over the next few months, taking a combined look at all of the EDRP data combined so far. Combining information across all the trials will involve some very detailed and complex analysis of the large data set. The analysis will seek to answer several key questions, primarily about which interventions, or combinations of interventions, would have the greatest impact on energy consumption if rolled out on a national level.

3 Interventions and trials

The trials are testing the effects of a variety of interventions that can be divided into six broad categories, as discussed in more detail in the following sections. The interventions are sometimes used in combinations, so it can be useful to consider themes, rather than trying to draw conclusions about individual interventions.

3.1 Billing and information

More than 13,000 households are now taking part in some form of billing trial, and nearly 26,000 are receiving energy efficiency information. However, it should be noted that some of these households will be receiving more than one intervention. For example, some households are receiving both historical bills and energy efficiency advice.

Technical delays and data quality issues have impacted on the rollout of these interventions in some trials. Since the last reporting period, these trials have seen an increase in the number of customers receiving 'better billing', although this has been partially counterbalanced by customers leaving the trials, so that, overall, therefore, these interventions are just under their target for the number of participants.

3.2 Clip- on energy monitors with visual display units

Clip-on energy monitors with visual display units (VDUs) have been given to around 8,000 customers. They enable the household to understand how much electricity they are consuming at any point of time through an electronic display in the house. In these systems, a sensor is attached (clipped on) to a conventional meter, and it then transmits information to a VDU which displays electricity consumption and load, as well as the cost of energy use. However, it is important to note that because these VDUs are connected to conventional meters, not smart meters, they do not communicate remotely with a supplier's billing system and may not show the same units as is being recorded by the customers' meter.

3.3 Smart meters

Smart meters have now been installed in about 17,000[1] homes. These are electricity and gas meters that collect meter values on a half hourly basis and transmit the data back to the supplier without the need for the consumer to read the meter manually. Several setups are being tested:

- Smart meters with a remote visual display of consumption and cost information of energy used for both electricity and gas.
- Smart meters with daily consumption information sent to the households' TV
- Smart meters with daily consumption information available on the internet
- Smart meters linked to heat control units which allows customers to control their boiler through a wall panel whilst having access to accurate electricity and gas consumption data
- Smart meters with an alarm which alerts the user to certain electricity consumption levels (load limiting alarm)
- Smart meters with a energy savings reward tariff which rewards the user for limiting their energy use

[1] Note that the actual number of smart meters is greater because some households will have received both gas and electricity smart meters.

- Smart meters with a time of day tariff which rewards the user if they move their consumption to 'off peak' hours (for example by running the dishwasher overnight).

3.4 Community engagement

The effects of engaging customers across a whole community, is also being trialled by one supplier. These trials include a metered local substation to monitor the community's energy consumption; a financial reward of £20,000 for a 10% reduction in consumption at the community level; fitting smart meters in participating households in the selected communities; energy efficiency advice; various community events and energy saving incentive schemes organised at a local level.

3.5 Consumer groups

As of September, around 58,000 households were involved in the trials, which is just above the suppliers' targets for recruitment . The overall number involved in the trials had reduced slightly from the previous report, March 2009, with nearly 800 or just over 1% of customers leaving the trials.

The EDRP trials involve a range of different domestic customer types, eg those likely to be in fuel poverty; and a range of different billing types, eg those using pre payment meters. Some trials are specifically targeted at particular groups, aiming to determine whether certain interventions are particularly effective for those groups. However, even in those trials that are not targeted at particular groups, information about income levels, payment methods, etc. is being gathered and will allow for studies of the effects of different interventions on different customer groups.

Control groups have been included to ensure the statistical robustness of the trials. The control groups consist of consumers that will not be provided with any information above their normal 'business as usual'. However, their energy consumption is recorded to enable comparisons with the households that are part of a trial. There are around 18,500 control households.

4 Obtaining results from the EDRP

4.1 Trial design

The EDRP consists of 26 trial groups, across Great Britain, some of which are further divided into subgroups based on, for example, consumption level or type of meter. The six main categories of trial interventions, discussed in more detail above, are:

- Better billing
- Energy efficiency information
- Clip-on energy monitors with visual display units
- Smart meters
- Community engagement
- Control groups

The interventions are being tested individually, to establish their individual effects, and also in combinations with each other, to test the total impact when a range of interventions is used. The aim of this is to determine whether the total effect on energy demand is greater than the sum of the effects of the components.

4.2 Data collection and analysis

The suppliers collect data from a number of different sources, the main source being metering data, obtained from every participating household. Household address information is removed before analysis. However, this large dataset would be of limited used without another important source, namely the customer survey data, obtained at the start, and again at the end, of the trials. This survey data provides important demographic information about each household that is then linked to the metering data. The results is that the datasets can be filtered so that they are included in only the relevant analysis, e.g. analysis of energy usage by a particular customer group with a particular intervention.

In all cases, the sample size has been selected to ensure the statistical robustness of the results. The supplier participants are responsible for their own trial structures, so the types of interventions being trialled and the means of achieving statistical reliability have been approached in a number of ways by the suppliers and their academic statistical experts. This has added to the richness of the EDRP, but there has also been the need to ensure that the results are comparable with one another. CSE has developed a Standard Reporting Framework (SRF) which is being used by suppliers to collate their information.

A two-pronged approach to data collection and analysis is being used:

1. The suppliers and their academic partners analyse the data from their trials and report it to Ofgem every six months
2. The supplier's data is being collected centrally and will be analysed to consider findings across the whole of the EDRP.

On the first point, the suppliers are working with academic partners to analyse their data and to draw interim conclusions. The formal reporting is made in six-monthly reports to CSE, using the SRF in order to try to achieve consistency between the suppliers' reported measures, even if their statistical methods differ. CSE then considers the overall results of the trials and collates them into a single report for Ofgem.

For the second approach, the large and complex metering data (and the associated, anonymised demographic data) are incorporated into the central database that is managed by CSE. This database will be cut into various datasets for use in answering specific questions pertinent to the Smart Metering implementation programme.

4.3 Themes for further analysis

There are specific questions that are of interest for the Smart Metering implementation programme, and that will be asked of the EDRP data over the next few months. If households are to realise potential reductions in energy consumption, there must be a cycle of learning and action. The desired output is customer action that saves energy, and it is assumed that this cycle has three inputs: feedback to customers about energy consumption, advice to customers about how make savings, and motivation for customers to implement that information. In the EDRP, these inputs have been provided in a variety of different combinations across a number of trials:

- Feedback to customers (sometimes based upon data from smart meters) has included the provision of:
    - more frequent billing (retrospective feedback);
    - more accurate billing (retrospective feedback);
    - additional information on past consumption, including graphs with bill providing a comparison of consumption with the same period in the previous months/year (retrospective feedback);
    - data displayed on visual display units (real-time feedback).

- Advice and information about energy efficiency have been provided:
    - on bills;
    - in conjunction with feedback about consumption;
    - through community schemes.

- Motivation to implement the advice can take a variety of forms, including:
    - informing householders of *potential* cost savings through reducing bills;
    - offering *guaranteed* cost savings or financial rewards;
    - generating community engagement by offering rewards for combined performance.

4.4 Preliminary observations

All of the observations in this section are based upon preliminary results, drawn from the data that was available at the time of writing the reports. As more data is collected and analysed, the picture might change. Also, the results are drawn from data for individual trials, and are not based upon analysis of the trials as a whole. Cross trial analysis will give a more complete picture of the effects of different interventions on demand.

Feedback to customers: More frequent billing

As was reported in the previous public report, survey results suggest that changes to the way in which customer are billed are noticed by the majority of customers. Increased frequency of billing was a factor that was noticed in particular, and monthly billing was particularly welcomed by customers. However while better billing, ie more frequent or accurate, can be an important first step in engaging customers on the topic of saving energy, the key question is whether or not these interventions actually result in changes that produce energy savings.

Increased frequency of billing has been trialled in various combinations and in conjunction with a variety of other interventions such as energy saving advice, smart metering or using other technology to display consumption. Therefore, further analysis is required in order to determine whether solely increasing the frequency of billing can affect consumption over the long term.

Feedback to customers: Smart meters and accurate bills

Smart meters are the key technology to generate accurate high-frequency data on household energy consumption. This is enabling the households in the trial to receive accurate bills. This is the immediate result of a smart meter upgrade and so forms the core benefit of any package of measures offered to householders by energy suppliers.

However, the new smart meter technology doesn't necessarily interact with the consumer in that household, and the more accurate bill, in some trials, may not look different to previous bills. Therefore the EDRP is trialling the installation of smart metering alone and with a range of other interventions that give information on consumption directly to the householder.

An accurate quarterly bill can give consumers greater confidence in the information they are receiving from their energy suppliers rather than receiving estimated bills. Analysis will seek to determine whether this provision of accurate information can help to prompt reductions in energy consumption, and whether there are different effects in certain customer groups.

One of the trials is exploring whether providing households with more sophisticated communications about energy consumption (based on web or television access to the data) produces any energy-saving outcome, beyond any achieved by smart meters and accurate bills. The use of such innovative technology encountered a number of technical issues as well as challenges in encouraging customer participation. This delayed the roll out of such devices and so insufficient data has been collected thus far to allow analysis at present.

Feedback to customers: Real-time feedback

The role of real-time feedback is different to that of retrospective feedback, i.e. bills, offering householders immediate, visible information. Within the EDRP, real-time feedback is principally being tested using in-home visual displays (VDUs), which are linked to either clip-on monitors or to smart meters. Feedback can be delivered by sound as well as by sight and it is likely that different customers may have reacted differently to each approach.

One of the trials involves a visual display that includes an alarm if daily cumulative electricity consumption goes over a threshold set at 6% above the household's typical consumption for the time of year. Another trial group has received the display without the alarm.

One trial investigates the impact of an energy feedback display that is incorporated into the household's heating thermostat/controller. This proved to be a difficult intervention to install, given the enormous variety of existing heating controllers and boilers. However, the preliminary findings suggest that there may be value in integrating energy feedback with existing devices with which people already use in the home.

Customer feedback on VDUs includes a dislike of alarms that sound too frequently, a welcome for a distinctive 'traffic light' indicator on displays, and preference for energy use to be expressed in money rather than in kilowatt-hours. However, it is clear that different individuals prefer different features. Therefore the effectiveness of these devices might be determined by the quality of the design and functionality.

Advice: information and energy saving tips

Those trials that have sent households information and tips about how to save energy at home, and no other intervention, have yet to identify any subsequent changes in the mean energy consumption of the households in the trial groups. There are two potential reasons for this, on the one hand, the information provided may not have been read or may not have been communicated clearly. Alternatively, the results so far could suggest that information about energy efficiency may not be enough in itself to trigger energy saving. The consequences of these two potential conclusions would be very different, so further analysis should be conducted on this topic.

Motivation: financial incentives

One trial combines energy-saving tips with a financial incentive to reduce energy consumption. Households were offered a £10 voucher if they managed to keep their energy consumption below a target defined by their historical consumption. The effect of this incentive was immediate and dramatic with a pronounced fall in the electricity consumption of the group receiving the intervention. However, once the households had received their reward, their energy savings began to decline and were entirely gone around seven months later.

It would appear that, in this trial the financial incentive was the primary driver of change, though this change was not sustained long term. What is not yet clear is whether the energy-saving tips helped the customers to reduce their consumption, or whether they acted on knowledge that they had already obtained from other sources. In order to determine the benefit that was realised through the provision of the tips, further analysis would be required.

The community trials also involve a financial incentive. If a community reduces their consumption by 10% for a three month period comparable to the previous year, the community will be awarded a cash bonus. Further detail on these trials is below.

Whilst it would seem that offering a predetermined financial reward in return for energy savings does encourage the realisation of those energy savings, one interesting question is how customers respond when informed of the potential cost savings that can be realised by simply reducing energy use.

Information and Motivation: community mobilisation

The community trials are being conducted in England, Scotland and Wales. The three rural communities targeted were each set a target to reduce their energy consumption by 10% with a substantial reward offered for success. In response, local people joined forces to develop and run energy-saving campaigns. These have included community events, newsletters, advice in local newspapers, ‘light bulb libraries’, insulation programmes, provide real-time feedback devices and on-to-one advice.

These trials could show how advice provision in a supportive community context could influence energy use. However, given the rural nature of these communities, any conclusions or lessons from these trials might not be entirely applicable to urban or sub-urban areas/communities.

When compared to geographically and demographically-matched controls, these communities have cut their electricity use significantly and are on course to receive their financial rewards. Also these trials have produced the biggest reductions in household energy consumption so far observed within the EDRP trials. Further analysis will be required, viewed in the context of the overall EDRP results to identify whether behavioural changes are sustained.

Results so far suggest that the involvement of entire communities can be helpful in realising energy savings, through informing and motivating people. However, the relative importance of information and motivation could be investigated as well as considering how different communities mobilise and whom they trust to provide them with such information.

5 Practical issues around smart meters

The EDRP will not only provide valuable data on consumers' responses to a range of sources of better information, it will also provide a useful insight into the practical and technical issues around delivering such interventions. The EDRP is trialling new approaches to engaging consumers and using new and innovative technology to do this. With any such trial, technical issues are likely when using new equipment and practical issues are likely in delivering and using that new equipment. The Suppliers have faced a number of different challenges along the supply chain of delivering smart meters but on the whole these have not been insurmountable. Such experience is invaluable for designing the national roll out of smart metering.

Below are some of the issues that suppliers have identified so far with installing and commissioning smart meters. Ofgem plans to do further work with the suppliers to identify the relative scale or impact of the different issues that have arisen so far, and how such challenges could be avoided or solved in a national roll out.

5.1 Selecting the right technology

Delivery of the trials so far has shown that one-size does not fit-all with regard to smart metering technology. Suppliers are having to consider a range of factors in selecting the appropriate technology for a customer. Different geographical locations experience different signal strengths which can affect the ability of the meter to send or receive information. The location of a smart meter within the property is also important, eg communications can be affected if the meter is in a metal box, in a basement, or is too far from the in-home display. The location or set up of a meter can mean that remedial work is required to move it, eg if it is on an asbestos board, or if the smart meter is larger than the original meter and does not fit into the meter box. Installing smart metering in basements, blocks of flats, or communal housing tends to be difficult with regards to gaining access, getting a signal and utilising the Home Area Network (HAN). Practical issues affecting installation are generally obvious and easy to spot in a property however, in some cases technical problems may not be recognised until the meters and interfaces have been installed in a property for some time.

5.2 Communications and management

Installing, commissioning and collecting data from smart meters involves a large volume of data transfer and collection. These processes need to be managed and tracked in an accurate and timely way, such as accurately recording which model numbers are installed where. As problems and faults arise they need to be logged so they can be dealt with quickly and accurately. Data synchronisation issues have occurred which have affected the quality of data supplied to the customer, or have caused problems between partners along the supplier chain. Accurate records can help a supplier to pin point where in the data transfer process a fault is occurring so that it can be rectified.

5.3 Skills

Delivering the trials has demanded a range of different skills from the Suppliers. Installers need the right technical skills to complete jobs and need additional training to be able to install both gas and electricity meters and to deal with any unforeseen safety or legacy issues. Suppliers are finding that softer skills are essential too, so that installers can clearly explain the new technology to customers. Customer advice lines linked to the trial are also having to build up their knowledge of this new technology to be able to answer consumer enquiries.

5.4 Consumers

Anecdotal evidence suggests that some consumers are seeking information about the new technology. The suppliers suggest that customers seem to respond better to terminology relating to money rather than energy with regard to their consumption information. Some suppliers have recognised the opportunity from the trials, and the provision of better and more frequent consumption information, to build a stronger relationship with their customers. It is fair to say that although the customers are relying on the suppliers for clear and accurate information, the suppliers also have to rely on their customers to keep appointments and not change their minds about accepting new technology. Such uncertainties can be evidenced by the number of customers who have left the trial mid way, which could in part be due to moving house or changing supplier. As part of Ofgem's Smart Metering Implementation Programme; Ofgem is commissioning primary research to gauge the current level of consumer awareness around smart metering.

6 Next steps

6.1 Future reports

The next EDRP supplier progress reports are due at the end of March 2010. These will then be considered by the EDRP evaluation team and a report will be submitted by Ofgem to Government. We would then expect the next update report to be published in September 2010.

EDRP is designed to test for sustained effects on energy demand over two years. Suppliers' trials will finish at different times from the present time onwards. These differences are due to the different complexities and attendant delays experienced in setting up the trials. A final report will follow data collection from the completed trials and is likely to be published in early 2011.

6.2 Interactions with the Smart Metering Implementation Programme

The management of the first phase of the smart metering programme is being carried out jointly between DECC and Ofgem's delivery arm, Ofgem-E Serve. DECC chairs an over-arching Strategic Programme Board. This Board provides the necessary strategic oversight and direction to the Programme during Phase 1. It provides a high-level forum for ensuring the Programme is aligned with Government policy objectives for smart metering and Ofgem's statutory duties, and consider interfaces with the Government's wider policies.

Ofgem E-Serve is managing the first phase of the Programme for DECC. Ofgem's detailed knowledge of the workings of the energy market, its strong relationships with industry players and consumer bodies and its regulatory role, mean it is ideally placed to help design the arrangements for introducing smart metering effectively into the complex structure of the energy industry.

The EDRP is an important source of information for the Smart Metering Implementation Programme, providing evidence to guide policy decisions, and also providing the opportunity to learn about the practical issues that may be encountered in a national roll-out. To this end, additional analysis will be conducted over the next few months, seeking to answer several key questions about which interventions, or combinations of interventions, have the greatest impact on energy consumption.

Alongside this, as mentioned above, we will be working closely with the suppliers in order to collate their practical experiences from the EDRP. Presentations from each of the suppliers showing their practical experiences so far have been published alongside this report.

6.3 Access to EDRP data for use in independent research

Through the EDRP, we are collating a database of half-hourly meter readings. We hope this will contain a valuable data set of domestic energy demand, with granularity covering a large range of situations. DECC is currently examining options for making subsets of the data available to researchers (for example for studies which require domestic energy consumption profile data) once the database being developed by CSE is in a suitable state of readiness. Whilst the primary value of the EDRP dataset is in the huge quantity of data that will be used to inform the Smart Metering Implementation Programme, the use of discrete sections of the data in independent research projects would ensure that the EDRP produces additional value in return for the public investment.