



postnote

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SMART METERING OF ELECTRICITY AND GAS

Smart metering enables accurate measuring of energy usage and the provision of improved information to consumers, suppliers and the market. The 2007 White Paper on Energy identified smart metering as a possible energy saving measure. It also outlined the expectation that smart meters will be installed in all of the UK's 25 million homes over the next ten years. This POSTnote examines the potential benefits, costs and policy considerations involved.

Background

Using energy more efficiently is a cost effective way of cutting greenhouse gas emissions. Collectively, individuals are responsible for over 40% of the UK's energy use and carbon dioxide emissions. It is estimated that over £900 million is wasted every year by leaving domestic appliances on when not in use. Lack of information and motivation are barriers to saving energy.¹

Domestic energy users currently receive energy consumption information only through traditional metering and billing systems. Nearly 90% of domestic customers receive at least one bill based on an actual meter reading each year, but other bills may be estimated. In addition, bills may be ignored if paid via direct debit. If energy users had more options to monitor their usage, it would potentially enable them to change their behaviour.

Metering

All electricity and gas consumers in the UK are required to be provided with a meter that is read periodically. Although metering technology has evolved, most UK domestic meters are still of a basic design and usually located out of sight of the user. They are a low-cost and reliable way of measuring the cumulative amount of energy used. Energy suppliers are required to take an actual reading every 14 months for settlement reasons and to inspect the meter at least every two years. Most

companies are now aiming to take 4 actual readings a year.

Energy Information

One of the barriers to informing users about their consumption is the fact that most energy use is not readily apparent to users. Therefore, a major challenge is to make energy use more visible and more amenable to understanding and control. The statutory independent consumer watchdog Energywatch commissioned research with Ipsos MORI in 2007 and found:

- respondents had a general lack of understanding regarding their energy use;
- the information provided to consumers through bills and traditional meters is not sufficient to adequately inform consumers adequately;
- respondents agreed that having more information about their energy use would allow them to make more informed decisions as consumers.²

Smart meters

Definitions of smart meters vary, but typical features include:

- display and recording of real time information on electricity and gas consumption that is available immediately or remotely to energy suppliers and consumers
- two way communication between energy suppliers and the meter to make it possible to switch tariffs, or to alter pay as you go (pre-payment) provisions remotely.
- the possibility of flexible tariffs, which may be higher at peak-demand times of the day and lower for off-peak.
- the ability to meter exports from micro-generators. These are small generator systems such as solar panels, and the export metering capability facilitates the sale of excess electricity back to the grid.
- provision of information on patterns of use to help to improve forecasting and wholesale purchase.

- inactivity monitoring and, with gas, real time monitoring of gas leaks and carbon monoxide emissions. The gas can then be turned off remotely.³ It is technically possible for smart meters to measure water consumption as well as energy usage, but this note is concerned with latter only

To provide useful and understandable information to consumers, smart meters can have prominent display units (or alternative means of display such as digital television). These can give details on cost of energy consumption, an indication of high/medium/low use and comparisons with historic and average consumption patterns. Displays can be stand-alone devices or additionally can be accessed via personal computers or mobile devices / phones. In conjunction with energy use details, smart meter displays (or other display means) could be used to give targeted advice on efficiency measures to energy consumers.

Smart meters need a mechanism to enable two way communication between the supplier and the meter / consumer. The two main communication options are: fixed communications, such as telephone lines or electricity distribution wires; or wireless communications, such as mobile phone technologies or low power radio.

Box 1: The benefits of smart meters

For the consumer, a smart meter can provide two main benefits. With a real time display, energy consumption and cost data are easily visible, and can allow the consumer to make energy savings.⁴ In addition, billing will be accurate and no longer require a meter reader to visit the house. Estimated meter readings for billing would be eliminated.

Benefits for energy suppliers include:

- elimination of manual meter reading costs (estimated to cost £150 million per year)
- reduction of costs to service customers. For example, debt management, prepayment / credit payment changes are cheaper to implement with a smart meter;
- extension of the range of products and services into the home
- remote disconnection and connection of supply, (although existing regulatory procedures for customer disconnection will still have to be followed)
- on-demand meter readings
- remote tariff management
- enhancement of capabilities to detect fraud and the stealing of electricity.

Network operators own the infrastructure that energy is transported along, such as the electricity transmission grid.

Benefits of smart meters for network operators include:

- more accurate data on energy consumption on the network
- greater control of small scale generation / micro-generation
- rapid detection of outages and verification of restoration of services
- Improvement in network investment and asset management decisions.⁵

Real-time electricity display units

A smart meter system can incorporate a real time display which shows both electricity and gas usage, although as there is no set definition of a smart meter this will not always be a feature. An alternative product, but with limited features, is a 'clip-on' real-time electricity display unit. This is a 'Do it Yourself' device

which indicates the electricity used in a home or office. A sensor transmits electricity consumption information wirelessly to a portable display unit, but with no remote link to the supplier. This can display approximately (with up to 98% accuracy) how much electricity is being consumed. There are currently many brands of electricity display units on the market, with different features, ranging in price from around £30 to £150 (see Issues).

Adaptation of basic meters

Meter manufacturers have also highlighted that technically it would be possible to insert a communication chip into a basic meter to give accurate real time consumption data. Such devices could communicate with a central domestic 'smart box' that acts as a hub for all the domestic metered services (including water). This could be remotely interrogated by suppliers. There is considerable innovation in the area of smart box technologies and how they could provide a range of smart home services beyond metering.⁶

Policy context

The European Union Directive

The EU Energy Services Directive came into force on 17 May 2006, and member states have until 17 May 2008 to implement it. The Directive requires them to adopt an overall national indicative energy savings target of 9% by 2017. In the UK, the Department for Environment, Food and Rural Affairs (Defra) has the lead responsibility to implement the directive. In response to it, the UK Energy Efficiency Action Plan 2007 was published in June 2007. This contained plans to deliver energy efficiency savings of 18% by 2017.

Article 13 of the directive outlines various requirements for metering and informative billing of energy consumption. In so far as it is technically possible, financially reasonable and proportionate in relation to the potential energy savings, energy suppliers must provide customers with:

- individual meters that reflect actual consumption and provide information on time-of-use
- billing that reflects actual consumption and occurring often enough to enable customers to regulate consumption
- where appropriate, a range of information in or with bills, for example, comparative information from the customer's previous periods of energy consumption.

The Energy White Paper

The Energy White Paper *Meeting the Energy Challenge*, published in May 2007, outlined government proposals for metering. It stated the expectation that smart meters would be provided to all gas and electricity customers over the next decade. Following this, the government published a consultation in August 2007. This invited views on a full roll-out of smart meters over the next five years for business customers above a certain energy usage threshold, where it was cost effective to do so.

The government also consulted on proposals for:

- provision of comparative historical consumption data on gas and electricity bills
- electricity suppliers to provide (where technically possible) free of charge a real-time display unit when a basic electricity meter is replaced or newly installed in

domestic premises from May 2008 onwards (currently electricity meters are replaced at a rate of about 1.5 million per year)

- electricity suppliers to provide a real-time display unit to all electricity consumers who request one for a period of two years from as early as possible in 2008 and no later than May 2008.

With regards to policy options for a full roll-out of smart meters, the consultation gave a number of illustrative possible policy options, including:

- taking no further action beyond mandating smart meters for business, providing policy certainty and relying on suppliers to take forward the roll-out
- requiring all new and replacement domestic meters to be smart
- requiring all meters to be smart within 10 years.⁷

The government has yet to complete a full-cost benefit analysis of the range of policy options available, or to make a decision on implementation. It aims to respond early in 2008.

The consumer watchdog Energywatch commissioned its own analysis, which concluded that once the full range of supplier and consumer benefits is taken into account, an accelerated roll-out of smart meters over ten years would provide a net benefit of £8.8 billion. It has called for a government mandate to ensure a universal smart meter programme is completed. However, it should be noted that at present there is no evidence base to show the cost effectiveness of smart meters (Box 2).

Box 2: Trialing smart meters

The Energy Demand Research Project involves around 40,000 households across Great Britain. The project, which began in stages from July 2007 and continues until 2010, will evaluate consumers' responses to different metering and billing options, including combinations of some or all of the following:

- improved billing (with and without smart meters)
- energy efficiency information
- community engagement
- visual display units
- smart meters
- time of use tariffs.

The results of the trial will provide data on consumer behaviour and inform any roll-out of smart meters.

The implication in the government's consultation is that energy suppliers will have responsibility for rolling out smart meters. The Energy Retail Association (ERA), which represents Great Britain's domestic electricity and gas suppliers, proposes that the government introduces a universal legal requirement for energy suppliers to install smart metering within a specified time period. It believes that the benefits to suppliers of universal smart metering do not meet the overall costs, but that taking into account benefits to consumers and network providers the business case can be made for Great Britain as a whole.⁸

Issues

Governments around the world have either facilitated or mandated the roll-out of smart meters (Box 3).

Pros and cons of real-time electricity displays

There is disagreement within the UK industry on the government's requirements for the provision of real-time

electricity display units. Retailers of real-time electricity display units argue that:

- the devices work in achieving monetary and carbon savings
- the provision of smart meters is expensive, at least three years away, and will take at least 10 years for complete roll-out
- in contrast, 'clip-on' real-time display units can be distributed at between 3.75% and 20% of the cost of installing smart meters, and that most homes in Great Britain could have one within 30 months, leading to immediate savings in carbon emissions.⁹ It is estimated that on a wholesale basis energy suppliers could obtain 'clip-on' units for as little as £15.

Box 3: International Experience

Case studies of international experiences can help to demonstrate some of the benefits of smart metering.

Northern Ireland

A prepayment electricity smart meter was introduced after concerns about security and fraud, customer dissatisfaction and pressure from the regulator to find an alternative prepayment solution. Smart meters were trialled in 200 homes and full deployment of new meters began in 2000.

Ontario, Canada

The government of Ontario established targets for the implementation of 800,000 smart electricity meters by December 2007, and for all Ontario consumers by the end of 2010. An implementation plan released in January 2005 identified mandatory technical requirements for the smart meters, priorities for implementation, cost recovery methods and the market competitiveness of meter provision and support. The Ontario Electricity Coalition is campaigning for the plan to be abandoned over fears of increased costs to consumers.

Italy

From 2001 to 2005, the dominant electricity company in Italy (Enel) replaced all of their 27 million residential meters with smart meters. The main drivers for smart meters were serious problems with fraud, preparation for a competitive market in 2007 and peak demand problems resulting in blackouts.

The cost of the programme was €2.1 billion, with annual savings from revenue protection estimated at €500 million. With the introduction of multi-tariff rates in 2005, consumers could also save up to €80 each year. However, there have been a number of technical issues with the metering technology.

California, USA

A major driver for smart metering in California is reduction of summer peak demand, mainly from air conditioning. The Californian utility companies have applied to their regulatory authority to seek deployment of smart meters for all of their customers.¹⁰

Netherlands

The company Oxxio introduced the first smart meter for both electricity and gas in 2005. In September 2007, the Dutch government proposed that all seven million households in the Netherlands should have a smart meter by 2013, as part of a national energy reduction plan.

The Association for the Conservation of Energy and the Green Alliance agree broadly with the government's proposals in this area, as long as 'clip-on' real time display devices do not come at the expense of smart meters. Government modelling suggests that the implementation of their real-time electricity display

requirements will produce a total net benefit to society in the range of £205 million to £1.1 billion. In contrast, the Energy Retail Association (ERA) argues against the provision of electrical real-time displays. Instead it believes the focus should be on the roll-out of smart meters. It argues that:

- smart meters should handle both gas and electricity
- real time displays are not a meter and can provide only approximate indications of electricity consumption (independent analysis shows accuracy within 2.5%)
- with a smart meter, electricity suppliers can reinforce energy saving measures with propositions, price prompts and messages.¹¹

Energywatch, the Energy Saving Trust and the Office of Gas and Electricity Markets (Ofgem) agree with the ERA position, and argue that the government should abandon its proposals on real-time electricity displays and focus on smart meters.

Logistics of the roll-out of smart meters

If the government mandates the roll-out of smart meters across the UK, it would be the largest home visit programme ever seen in the country, as up to 45 million meters may need to be replaced or upgraded. Many issues arise from such an undertaking, and determining the most efficient and cost-effective way to do this is under consideration. For instance, whether

- gas and electricity meters be replaced at the same time
- all meters in a geographical area should be replaced at the same time, regardless of supplier.

Ofgem considers that it is the political uncertainty surrounding smart meters that has blocked their widespread delivery to date, as well as the absence of an industry business case. It has called on the government to make early decisions to clarify the method of smart meter rollout. The ERA believes that an independent industry body should be established to agree the market design, the ownership of the assets, necessary infrastructure and all necessary elements to facilitate the roll-out.

A competitive meter market

Ofgem considers that it is essential that, in any rollout of smart meters, a competitive meter market be maintained. Key principles underlying such a market include:

- individual suppliers should make their own commercial decisions on metering
- suppliers' interest in providing customers with services they want, including the necessary metering for those services, should drive those decisions
- customers should remain free to switch suppliers. For example, switch to those who offer innovative metering, good service and competitive prices
- individual suppliers, not customers, should bear the risk of poor decisions by suppliers on the wrong technology in metering and cost overruns.¹²

On the grounds that in the absence of an industry business the costs of smart meters will need to be passed onto consumers, suppliers have requested a non-competitive rollout of meters. The required increase in energy prices would result in any supplier initiating the implementation of smart metering alone being at a

competitive disadvantage. In addition, they claim it would be more cost-effective if suppliers could co-operate on a street by street implementation of smart metering. The suppliers would therefore prefer a time limited mandate for the implementation of smart metering with an opt out from competition law.

Interoperability of different meters

Interoperability is generally considered crucial to the success of smart metering. Common standards are needed to ensure that customers with smart meters can switch supplier without having to change their meter. It also means that suppliers will not face technical barriers to interact with smart meters installed by their competitors. Interoperability can be brought about by voluntary agreements on standards or proposing supplier licence changes. The Energy Retail Association strongly opposes voluntary standards, on the basis that they will not guarantee interoperability for all customers. The Association has proposed a Smart Metering Operational Framework, to help ensure interoperability, and Ofgem has established a metering interoperability steering group.

Overview

- Lack of energy consumption information and motivation are barriers to domestic energy efficiency;
- Smart meters are an advanced metering system which provides enhanced energy consumption information and services to both customers and suppliers;
- A two year trial of smart meters and other interventions, part funded by Government, is being led by four energy suppliers.
- The Government's expectation is that all consumers will have a smart meter installed over the next decade.

Endnotes

- ¹ DBERR, 2007. Meeting the Energy Challenge. A White Paper on Energy.
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The Parliamentary Office of Science and Technology, 7 Millbank, London, SW1P 3JA; Tel: 020 7219 2840; email: post@parliament.uk

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