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A GUIDE TO Smart Metering

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INTRODUCTION

Smart thinking

We stand on the threshold of a revolution in the way that we consume energy. Smart metering is the key to unlocking savings for all, and may help to slow climate change

The UK is on the cusp of an energy revolution. North Sea oil and gas are running out, massive investment is needed to overhaul our energy storage, transmission and distribution infrastructure and a significant amount of the UK's traditional power generating capability is due to come off line in the next decade.

At the same time, climate change has come to the fore in our energy policy. The debate about whether climate change is real – and whether it is man-made – is effectively over. Governments are now introducing regulation to tackle carbon emissions.

The UK's Climate Change Bill, the world's first climate change legislation, is close to entering into law. It will demand an 80 per cent cut in carbon emissions by 2050 and introduce a Carbon Reduction Commitment that will make businesses and large public sector organisations buy carbon allowances based on the amount of energy they use. Meanwhile, at European Union level, more targets are in place, which mean that the UK must increase the amount of energy it generates from renewable sources to 15 per cent by 2020, from about 4 per cent now.

Home energy monitor at work

This means significant changes to the traditional way of generating and distributing energy. Currently, in a system that dates back to the advent of the electricity system, power is generated centrally in large power stations and sent down power lines to the end customer. It is also largely generated by burning fossil fuels, which are one of the main causes of global warming.

In future, the way we produce energy will be very different. The use of fossil fuels, particularly coal, will be phased out and if there is centralised energy production it will be nuclear power. But there will be far more decentralised energy produced either in individual homes and businesses or at community level. Some of this will be renewable energy from solar and wind power, ground source heat pumps and burning biomass. Larger scale renewable energy projects, particularly wind and marine energy, will also have to be incorporated into the system. By definition, many of these will be sited a long way from where the energy is needed, some of them several miles out into the ocean.
At the same time, there will be a greater focus on cutting the amount of energy we use, through energy efficiency measures ranging from installing loft insulation to demand management through "time-of-use" tariffs.

The focus on renewables, local generation and efficiency will go a long way to "decarbonising" our energy system, but this new energy landscape will present a number of challenges, including how to price electricity, gas and water; how to incorporate local and renewable sources of energy into the grid system and how to measure and manage that energy generation.

It is a massive challenge, but it starts with one small building block – the smart meter. The key characteristics of the smart meter that set it apart from what sits in your hallway or your office now are that it offers two-way communication and it offers real-time information. Put simply, it shines a light on the way energy is used for customers, suppliers and the companies that run the grid.

> "The smoothing of demand peaks provided by electric cars and other measures would mean energy suppliers would be able to avoid building costly new power plants"

This knowledge is important because it allows consumers to find out when and how they use energy – and how much they pay for it. It gives suppliers the information they need to offer new products and services more closely tailored to their customers' needs and it allows the grid operator to manage the system better. All of these benefits can result in energy and cost savings. Furthermore, this two-way communication is vital if you want to incorporate decentralised energy into the system.

Smart metering is an essential component of the "smart grid", which has the potential to transform the entire energy system. Not only does it make it easier to integrate renewable energy, it can transform their economic viability by, for example, enabling the use of electric cars as a form of energy storage. Wind energy generated at night when demand is low could be used to charge electric cars. These same cars could, under certain tariffs, also act as a source of energy at peak hours.

The smart grid would therefore be making renewable energy more viable and encouraging the spread of electric cars. On top of that, the smoothing of demand peaks provided by electric cars and other measures would mean energy suppliers would be able to avoid building costly new power plants.

However, a number of barriers remain to the widespread adoption of smart meters. For a start, while the benefits to "UK plc" are quite clear, it is difficult to build an individual business case for the separate elements of the energy system – this is especially tricky in the UK's deregulated market where energy retailers and the transmission system have been separated. "We need strong leadership from the government to accelerate implementation," says Steve Jennings, head of power and utilities at Ernst & Young. "Without it, the UK will fall behind in the roll-out of smart metering."

The view from Westminster

Mike O'Brien, minister of state at the Department of Energy and Climate Change, explains the government's policy on smart metering

Smart meters will transform the way we use gas and electricity. The Government has now announced that every home and business in the UK will have a smart meter and we want the rollout to be completed by 2020.

We are the first country to have a smart meter roll-out on this scale. It's a huge opportunity for the country as a whole, for energy customers and suppliers. It's also a huge opportunity for the businesses employed in designing and installing these new meters in a massive infrastructure project.. Smart meters will unlock a series of benefits for consumers as well as suppliers. Smart meters can be read remotely by energy companies leading to entirely accurate billing. No more estimated bills.

Smart meters will mean better customer service, tailored energy efficiency advice and the ability for the consumer to switch more quickly between suppliers.

Consumers will also be able to see how much energy they are using and when they are using it, which will help them cut their energy use, costs and carbon emissions.

Our commitment means that the big questions about smart meters are not "whether", but "how" and "when". These are the issues we're now finalising.

This is a big project affecting 25 million domestic electricity and 21 domestic gas customers, and, potentially, several million businesses. We have to get it right in organisational terms. And we have to get it right in terms of best value for customers.

A key piece of work that will help give us the best answers to these questions is our impact assessment.

This is looking at – and costing - all the aspects of a roll-out: what meters can and can't do; how the communication between the meter and the supplier works; what information the customer receives and what it looks like; and how the market is structured. We will be publishing this work in the New Year.

> "The big questions about smart meters are not 'whether', but 'how' and 'when'"

Attention has tended to focus on the domestic sector, but similar issues that arise for households also arise for business. They want entirely accurate bills, better information about their energy use and access to the measures that help them reduce it. So this week, we announced the new metering arrangements for larger non-domestic customers – around 170,000 electricity and 40,000 gas users – which will take effect from next April. Because businesses' needs and how businesses operate are different from domestic customers, we're ensuring that, by 2014, they will all have advanced metering.

This will allow them access to detailed information and help them to cut their energy use and costs. Usually, customers in this sector will wish to track energy use via internet accounts, but we're giving them as much choice as possible in the level of service and information they require.

Our proposals for larger businesses will join up with our initiatives in the business sector, such as the Carbon Reduction Commitment which has come out of the new Climate Change Act. This incentivises the early installation of more advanced metering by the biggest energy users. Earlier this year, we consulted on new metering for the remaining business customers – around 2.2 million electricity and more than 400,000 gas users. Our impact assessment showed a broadly positive case for providing smart or advanced metering for these customers. We're now working our way through the many responses we received to this consultation. We'll set out decisions on how to move forward for them when we determine the "how" and "when" for the domestic sector in the New Year.

Power point

IBM and EDF have signed a partnership agreement to carry out research on smart grids.

The French electricity provider will work with IBM to develop computing solutions to manage its power systems. EDF also hopes to improve the efficiency of its plants.

"Unlocking the answers to sustainable energy requires collaboration between the scientific and business communities," said John E. Kelly III, senior vice-president of IBM Research. "This initiative brings together the right expertise, exploring how to apply technologies with new intelligence, seeking improvements in efficiency and alternative energy."

IBM hopes the research will help improve its offering in the power generation and water management sectors.

Introducing the Smart Grid

The power of information is set to transform the way that we use and pay for power

"Smart metering by itself is of limited value," says Dave Ford, NPower head of metering. "The value comes out of what you do with the information."

Although smart metering on its own will produce significant savings, these will just come from identifying areas of inefficiency. But it has the potential to deliver much more. One of its main benefits is that it facilitates what is known as the Smart Grid. This is not a physical entity in the same way as the wires of the national grid system are – although it includes those wires. "The smart grid is a series of connecting devices that will allow the control of electricity flow," says Howard Mitchell, Smart Product Manager for E.ON. "Smart meters are the end point of the smart grid."

Oracle Utilities' Bastian Fischer agrees. "The smart meter is just at the very beginning of transforming the entire industry. It is a first step in a larger transformation of the entire network."
The information provided by smart meters at every level of the electricity system, from households to the transmission wires to wind farms to power stations, creates a powerful resource that is much more than the sum of its parts. "We will have much greater insight into what is happening," Mitchell says.

The current grid, which dates back to Thomas Edison, is essentially a star structure, with a large power station at its centre and end-users at the other end of the spokes of the star. Energy flows one way, from the power station to the household or business.. The two-way communication that is a key characteristic of the smart grid enables the delivery of energy to be transformed, so the system looks more like a web than a star. The knowledge gained from smart meters allows operators to identify power outages more quickly and smooth peak demand so less power is needed and they can more closely match production to demand. This sounds like a grey, technical issue, but studies have shown that it can save billions of pounds by avoiding the need to build new power stations or transmission infrastructure.

It also helps to reduce transmission losses – Europe lost the equivalent of 35 power stations' output in such losses last year.

> "There is a real opportunity to create a new system that will benefit the UK as a whole"

The grid also allows you to incorporate energy sources apart from power stations. These include local generation by households, businesses or communities and renewable sources of energy such as wind farms, wave and tidal power. "The smart grid allows you to be much more sophisticated in your energy management," says Mark England, CEO of energy management group Sentec.

For local generation to be viable there has to be a way to measure how much power devices such as solar panels or combined heat and power (CHP) boilers are feeding back into the grid and to enable people to be paid for that. "There will be a step change in the complexity of demand over the next 10 years as more homeowners adopt demand management, energy storage and microgeneration technologies," Mr England says.

In the long run, utilities or the energy management systems of so-called smart buildings – where energy management software is built in – will be able to communicate directly with appliances in your home such as fridges and air conditioners, instructing them to turn off for short periods at times of peak demand. In return, you will pay less for your power. Already, General Electric has launched a range of smart-enabled appliances, which will be able to receive a signal from their local utility and react based on the internal programming. The "smart" fridge has a defrost cycle that is started once the door has been opened a certain number of times, but if it kicks in at peak times, the power company can delay it. Other appliances include washing machines, dishwashers and microwaves, which will alert customers when peak tariffs are in operation.

The UK's grid infrastructure needs upgrading anyway, so there is a real opportunity to create a new system that will benefit the UK as a whole, the industry and consumers, says E.ON's Mitchell.

"There need to be some brave decisions – we have a chance to reinvent the system. But if we do not learn lessons from what has gone before, we will end up in a fight with a system that is already broken," he says.

SMART METERING – BUSINESSES

Doing the business

The benefits of smart metering for businesses can be summed up in one phrase: knowledge is power

Much of the focus on the benefits of smart metering has been on what improvements households will see, but commercial customers are likely to see even greater benefits.

The largest energy users already have meters that provide half-hourly readings and allow them to manage their energy consumption in a way that smaller enterprises currently cannot. The Carbon Trust, the government-backed organisation that aims to cut emissions from business, carried out a three-year field trial into the use of smart metering in small and medium-sized enterprises (SMEs).

The trial results suggest that by switching to advanced metering, on average SMEs can identify potential carbon savings of over 12 per cent, and they successfully implement savings of more than 5 per cent. On average, the companies who took part in the trial saved more than £1,000 a year on their energy bills.

The largest financial benefits were seen by multi-site businesses, such as retail and wholesale chains, and by high energy users, such as small manufacturing companies. Widespread adoption of advanced metering across the UK SME community would result in annual cost savings of £300 million for small businesses, the Carbon Trust says.

Bigger businesses will benefit even more. For those that are covered by the forthcoming Carbon Reduction Commitment, smart meters will be vital to enable them to track their energy usage and comply with the requirements of the CRC. Multi-site businesses may not have a big carbon footprint per site, but when added together, the total nationwide impact of say every Marks & Spencer store or Shell filling station will be considerable. Such companies will be able to aggregate their energy use and approach their energy supply to negotiate more favourable terms, says Dave Robinson, Market Development Director at meter maker Landis+Gyr.

Tom Delay, Chief Executive of the Carbon Trust, commented: "Our trial has shown that advanced meters can help businesses save money and also deliver significant carbon savings for the UK. To harness this potential there needs to be a structured and sustainable roll-out of this important technology to help the UK meet its commitment to cut carbon emissions by 80 per cent by 2050."

Smart meters allow businesses to manage their energy consumption and costs by identifying areas for potential savings, says Nick Wellington of energy management company Navetas. "It is like a fuel gauge on a car – you use it to understand what you are using and change your behaviour accordingly."

Businesses cannot make rational decisions about energy consumption if they cannot see the consequences of their actions, says Robinson. "If you are on a quarterly bill, by the time it arrives it is a bit late to do anything about it. Having the information there immediately allows customers to make informed choices, put them into practice and see the results." This allows managers to see the effect of energy efficiency measures or installing some kind of decentralised heat or electricity generation.

> "Advanced meters can help businesses save money and also deliver significant carbon savings for the UK"

Utility Partnership Ltd has installed 6,000 meters for telecoms group T-Mobile at its base stations around the country, as well as in its offices and retail sites. Gary Mawer, chief executive, says the new technology is essential for businesses in the current environment, with its combination of high energy prices, a squeeze on costs and a need to cut carbon emissions. "You cannot manage what you don't measure. Once you start measuring your energy consumption, you can do something about it," he says.

There are four key benefits to businesses from smart metering, he says.

The first is in procuring power – if you have proper data on your consumption profile, you can optimise tariff arrangements. Not knowing the full details of how, when and where you consume energy leads to uncertainty, which from the utility's point of view, is a risk that is priced in to your tariff.

Conversely, if you do know, it removes that risk. You may also identify possibilities in moving your consumption away from peak times, which gives you leverage with your supplier. Smart metering also makes it much easier to switch suppliers, too.

Next, the technology improves a company's financial controls, simply by letting you see what is going on. It is possible to discover errors earlier and because there is no need for estimated bills, you are not giving your money to the utility.

Smart metering also creates huge opportunities to improve energy efficiency, and to measure the effect of any efficiency measures once they have been implemented. This allows you to benchmark your performance against industry standards and even between sites.

Finally, it allows companies to reduce their environmental impacts from the use of electricity, gas and water – and to provide proof that they are doing so. With the advent of a range of environmental regulations such as energy performance certificates and the Carbon Reduction Commitment, this will become increasingly important.

"If you put smart meters in and make good use of the data – and that is crucial – you can cut your business's energy costs by 10-20 per cent," Mawer says.

The relationship with your energy supplier is also likely to change. Utilities, under pressure to comply with environmental targets, will approach customers with advice on the right tariffs and how to improve their energy efficiency.

Oracle Utilities Vice President and General Manager EMEA, Bastian Fischer, highlights the benefits to business of the increased visibility energy suppliers gain from advanced metering: "Customers can make more informed choices as utilities propose advanced products such as demand response programmes, energy consumption programmes or peak demand pricing."

As long as smart metering leads to more transparency in the energy market as a whole, it should also make the market more competitive. It will enable companies to differentiate their offerings more clearly in an attempt to win customers.

"Smart metering is one of the few things that can genuinely encourage competition," says Mark Powell, utilities partner at Fujitsu Services. However, significant structural changes to the market would be needed for genuine competition, he adds.

COMMERCIAL FEATURE

Time to get smart

Energy bills are a big issue for everyone, and politicians on all sides are calling for a more sensible approach to electricity and gas consumption. This is why E.ON is initiating revolutionary change, with benefits both to business and domestic customers.

> "Smart metering will provide valuable data on energy consumption which will enable customers to understand usage and save money"

It takes a forward-thinking company like E.ON to help business and domestic customers take control of their energy consumption in an accurate way.

E.ON believes that by putting customers at the heart of everything that they do, they can help all of us to understand our energy consumption more accurately: good news for businesses, householders and energy-conscious politicians.

Smart metering will provide valuable data on energy consumption which will help customers to understand usage and save money. The way forward, in both the commercial and domestic sectors, on this crucial topic depends on the implementation of smart metering technology, and E.ON is determined to be at the forefront as this exciting new technology comes on stream.

The government has announced that smart metering in homes and large and medium businesses is to become mandatory, and E.ON is looking forward to working with the country's leaders in the near future to ensure that their customers can quickly obtain the maximum benefit from this innovative new approach to the monitoring of energy consumption in the workplace and at home.

What does smart metering do?

• Consumers get accurate and automatic readings which gives accurate bills.

What is E.ON doing about it?

• E.ON is investing more than £12 million in smart metering technology

• E.ON recognises that smart metering is going to revolutionise the energy industry, giving control to the people that use it

CASE STUDY

Smart metering in business: The York House Hotel

A family-run, 16-suite hotel based in Whitley Bay, Tyne & Wear, is part of E.ON's smart metering trial. This boutique hotel, owned and run by Michael Ruddy offers all guests more than just a room: every visitor enjoys the benefit of an en-suite bathroom and kitchenette

Q: How was the installation of your smart meter?
Michael Ruddy: The process was very satisfactory, the appointment was made at a convenient time [to avoid the hotel's peak periods], the engineers were polite and courteous and explained how the smart meter works.

Q: How have you seen your billing improve?
MR: All my bills are now accurate. Before the meter was installed I had a lot of estimated bills which caused hassle and took time to resolve. Having this meter means we no longer need to check over our bills thoroughly.

Q: What has this meant to you as a business?
MR: The biggest improvement is on cash-flow and forecasting. In a seasonal business like mine, one of my major difficulties is knowing what I'm going to spend and when. This meter helps in two ways: firstly, we know we're paying the right amount, so we don't need to double check or confirm the reading is correct, and secondly, we can look at previous periods' consumption knowing they are correct, and then forecast how much we're likely to spend on electricity.
Generally, estimates got put on the to-do list, but as a small business we don't have someone dedicated to sorting out issues like this, so invariably it got left as other matters were more urgent. With the smart meter installed we don't have to worry about estimates and we know it's accurate.

Q: How important is energy efficiency to your business?
MR: We try where we can to reduce our consumption, which in turn reduces our costs and our impact on the environment. We are very interested in finding ways to become more energy efficient.

Q: Do you have any energy efficiency initiatives in your company?
MR: Most of our lights need to be kept on at all times for fire regulations, but where possible we have updated with more modern fittings which use less energy. When we refurbish, we always look to buy the most efficient fixtures and fittings so we can reduce consumption - not just energy but also water.

Q: Do you think having a smart meter will enable you to become more energy efficient?
MR: If you get the consumption usage then this would be a very useful tool in helping to reduce consumption as you'd be able to compare usages periods and like-for-like comparisons.

Q: Has having a smart meter changed your perception of E.ON in any way?
MR: My perceptions of E.ON have definitely changed for the better: having this smart meter means we no longer have to worry about our bill being estimated. If another business mentioned they were having problems with their supplier, I'd definitely recommend E.ON.

COMMERCIAL FEATURE

The home front

The advantages of smart metering for businesses are self-evident. But the government has moved to make smart meters mandatory for homes, which should allow people to spot energy wastage with more accuracy.

E.ON are working on smart meters for domestic customers, which in the future should enable residents to highlight energy wastage in their homes in the same way that businesses can identify inefficiencies. Mark Howe, E.ON's Commercial Marketing Director, commented: "We are really excited to be at the forefront of new smart meter technology, trialling it in homes and businesses across the UK.

"We support the Government decision to mandate the technology, and we feel this innovative technology empowers our customers to understand, control and manage their energy usage, both at work and at home."

E.ON's involvement in smart metering trials in both business and domestic contexts reflects the company's holistic approach to smart metering, which ensures that they are committed to exploring every way in which this technology could benefit consumers.

> "We feel this innovative technology empowers our customers to control and manage their energy usage, both at work and at home" Mark Howe, E.ON

The Energy Demand Research Project was commissioned by the Government in 2006, with the primary objective of testing whether certain interventions can influence customer demand, with a heavy emphasis on smart metering.

As part of the project, E.ON has installed smart meters in a number of households and will be collating consumption data over the next 2 years.

The British government has set challenging environmental targets. The UK needs to reduce emissions of CO2 by 60 per cent by 2050. At E.ON we are aiming to reduce CO2 emissions by around 20 per cent by 2020, by getting our customers in control of what they use and pay for. E.ON was investing in this field even before the government set the targets. The £12m that the company has already committed, as well as the valuable experience already gained from trails, ensures that E.ON is at the forefront of this important issue.

What does smart metering mean for the householder?

SMART METERS HAVE TWO MAIN BENEFITS

1. Accurate bills - E.ON will read the meter remotely. This removes the need for meter readers to come to your property and it puts a stop to estimated bills. This in turn leads to a better understanding of energy consumption.

2. Energy Control - By closely monitoring when the energy is used, you can start to implement initiatives which will help you reduce your energy consumption.

Research in action

Every responsible householder is aware of the necessity of reducing their energy consumption. It is an issue that the government is rightly emphasising, and which forward-looking companies like E.ON are constantly promoting

As part of its portfolio of smart metering trials, E.ON has joined forces with Kettering Borough Council as part of a one year smart metering trial for some households in Kettering. This is the first time that a local council and energy supplier have worked together in encouraging local residents to reduce their energy consumption.

Customers are currently being recruited to take part and smart meters are being installed with wireless links between meters and the Smart Energy Monitor. This displays electricity and gas usage by hour, day and month, shows CO2 emissions produced and gives an idea of cost.

Kettering Borough Council will be financially rewarding all households who take part in the trial and meet an energy saving goal.

Customers will be able to see their energy saving progress by logging on to their personalised online Smart Energy Tracker, and will also receive updates throughout the year. Although the trial runs for a year, customers should be able to make changes and see a difference to their energy usage and bills much sooner.

As the technology rolls out across the UK, some of our customers are already seeing the benefits. The first of these is simplicity, allowing for remote meter-reading that removes estimated bills and having to wait for the meter-reader to call.

E.ON understands that the future of energy saving may depend largely on educating and empowering the consumer. The more information that people are given about their own energy consumption, the more they will be inspired to change it; and smart metering gives people the power to control their own use of energy.

Nothing should go to waste

Greater co-operation and awareness can help businesses to become more frugal, productive and efficient

Think of microgeneration and the image that comes most readily to mind is of Tory Leader David Cameron's mini-wind turbine.

But the opportunities that will be created by the roll-out of smart metering are arguably greater for business than for households, not least because they enjoy benefits of scale not available to the domestic market.

And with the entering into force last week of the Energy Bill, the Planning Bill and the Climate Bill, which provide incentives to introduce renewable heating, a feed-in tariff for small-scale renewable energy and eases planning restrictions on such projects, the time has never been better.

Power point

A coalition of smart grid developers has handed Barack Obama a wish-list of policies that it wants addressed when he takes office in the White House.

Top of the list of 21 policy recommendations drawn up by the Demand Response Smart Grid Coalition, whose members include IBM and Tendril, is tax credits for companies investing in energy-saving technologies.

The group also wants the incoming President to offer higher credits for those using equipment that reduces power consumption, arguing that adopting energy-cutting technology is better for the environment than investing in renewables, because a kilowatt not consumed is better than one produced by solar power, for example.

As with households, location and the size of the business affect the viability of projects, but companies may also find they have opportunities to make use of their waste products. Food producers, farms and restaurants, for example, may be able to use their waste to produce biogas, which can be burnt to produce electricity.

There is scope to generate either electricity or heating, or both at the same time in a process known as combined heat and power (CHP). "CHP can make more sense for businesses because they often have a more appropriate heat demand than households," says Mark Williamson, of the Carbon Trust. The technology is particularly suitable for businesses that have a steady heat demand, such as care homes, leisure centres and hospitals. There is a mismatch between the amount of heat and the amount of electricity needed, so businesses can often use CHP to generate the heat they need and sell much of their surplus electricity.

There is also scope for co-operation between businesses – for example, a number of tomato growers have sited their greenhouses near power stations. The excess heat and CO2 from the power stations is piped into the greenhouses, boosting yields and increasing the efficiency of the power station. If the heat is captured and used, efficiency rises to about 80 per cent, compared to about 30 per cent if the heat is allowed to escape. If CHP is generated on site, efficiency increases to more than 90 per cent.

Where conditions suit the aggregation of several energy demands into a single Decentralised Generation Source, greater efficiencies can be achieved, says Chris Tanner, from DEKB.co.uk, the Decentralised Energy Knowledge Base. In other words, if businesses get together with each other, or with nearby housing developments and public institutions such as schools, universities and hospitals, CHP works to its potential. Heat produced during non-peak hours can be stored and used when demand is high. But the mix of different users also smoothes out demand peaks, with businesses and other organisations using the energy during the day and homes using it at either end of the day.

On an individual business basis, the most suitable technology is biomass heating, says Williamson. "Heating generates just under half of our emissions but we have not done well in decarbonising our heating systems."

Heating for medium size industrial and commercial applications is also the most effective use for biomass in terms of carbon reductions – much more useful than creating biofuels or generating electricity.

There is a range of incentives available to businesses looking to generate their own heat or electricity. These include Enhanced Capital Allowances, which enable businesses to claim 100 per cent tax relief in the first year on specific technology products, such as solar water heating, biomass boilers and heat pumps.

The Carbon Trust also offers loans to SMEs for energy efficiency projects, for which renewable energy installations may qualify when they displace grid electricity used on-site, or heat produced for use on-site by less efficient means. The government's Low Carbon Buildings Programme provides grants for microgeneration technologies to public, not-for-profit and commercial organisations. The technologies covered by the programme include solar PVs, wind turbines, small-scale hydro-electric power, solar thermal hot water, ground/water/air-source heat pumps and bioenergy, among others. The Energy Bill that entered into law last week provides for a Feed-in Tariff for renewable energy projects up to 5MW, which should boost the uptake of generation projects by businesses.

Ultimately, however, while there is scope for individual businesses to generate energy on their premises, decentralised energy is likely to be something that works best when it is done in partnership with other businesses or as part of a mixed use development involving buildings with different heat and electricity loads that combine to produce a stable and balanced energy demand.

CASE STUDY

Logica and Växjö

For the residents of the Swedish city of Växjö, monitoring and reducing their energy use has become something of a competitive sport.

Logica's new web-based technology is making it easy for homeowners to see how they can make savings – and compare results with their neighbours.

The 20,000 households that have a smart meter are making the most of EnergiKollen (which translates as energy control), an internet-based service created for customers of Swedish energy firm, Växjö Energi AB (VEAB). With ambitious plans to cut emissions by 50 per cent per head by 2010, the city – dubbed "the greenest in Europe" – needed a solution to encourage its people, both young and old, to tackle their energy consumption head on.

And EnergiKollen has delivered. Its easy-to-navigate graphics and functionality allow users to see just how their energy use varies, from day to day, hour to hour – encouraging them to pay more attention to their electricity, water and heating consumption and ultimately, to reduce it. VEAB customers can log on to the service over the internet, free of charge, and see how their energy figures measure up with their next-door neighbours, or others in similar sized properties. And customers are now competing with one another to see who can save the most energy. Logica and VEAB are offering up prizes, such as iPods, to the most committed consumers.

"Households that have engaged in the competition have really started to think about how they are using energy," says Rich Hampshire, a principal consultant with Logica. "They have made savings of between 20 and 30 per cent."

And it's a concept Hampshire believes has the potential to work here in the UK too. "Our challenge is to get more people engaged in it and the competition element encourages people to learn about energy use and to see the impact of their actions on their consumption.

The distribution solution

One of the main ways in which smart meters will change the UK's energy system is by allowing homeowners to generate their own electricity and sell it back to the power companies. This is how...

Until now, it has been very difficult to generate your own electricity and even more troublesome to sell any surplus you might have. With increased concerns over climate change and fuel prices going through the roof, it would be nice if you could get that roof to ease the burden a bit by hosting some solar panels or a solar-powered hot water tank.

Domestic emissions make up 28 per cent of the UK's total carbon emissions, so households are going to have to do their bit to meet the government's target of cutting emissions by 80 per cent by 2050. "The 80 per cent target will be very difficult without smart metering," says Steve Jennings, head of power and utilities at Ernst & Young.

According to Chris Tanner from DEKB.co.uk, the Decentralised Energy Knowledge Base, "Decentralised Energy can take many forms, including Combined Heat and Power, Biomass, Solar, Wind and Ground Source technologies. The energy which is produced can be heat, cooling, and electricity, or in some cases all three, collectively known as tri-generation."

One of the tricky issues with decentralised energy is that there is no "one size fits all" solution. The most suitable form of it depends on your location, the size of your house, the amount of land you have available and a range of other factors.

So, if you live on a farm in an isolated but windy area, a small wind turbine can produce electricity cheaper than grid power. On the other hand, many urban areas are entirely unsuitable for wind.

Solar photo-voltaic (PV) panels have more universal application – they can be placed on any roof, but they are still far more costly than fossil fuel generated electricity – the payback time on solar panels is still around 25 years, which is about how long they are expected to last, making them unviable at the moment.

However, the price is expected to fall significantly over the next few years as raw material prices fall and economies of scale come into play. But the less high-tech solar water heating is already economically viable and more widespread than PV. Combined heat and power (CHP) is another application that appears as if it should have universal application. CHP offers far greater efficiency than grid-delivered energy. But because new homes are relatively well insulated, CHP boilers turn out to be best suited for large, old homes such as the Victorian town houses you find in many cities, according to the Carbon Trust.

Because most houses use gas for heating, this is actually a bigger contributor to emissions than electricity, which means one of the most environmentally-friendly options is biomass heating.

Extensively used in Scandinavia, it is not yet widespread in the UK but a Carbon Trust study shows that there is potential to save 5.6m tonnes of carbon every year through the use of biomass heating.

While there remain cost issues with all of these technologies, smart metering at least makes it easier to realise the benefits, financial and environmental, of using these new technologies.

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Supply and demand

Smart metering will help not only consumers but utility suppliers, to the benefit of both

It is not just end users that will benefit from the introduction of smart metering. Utilities and transmission and distribution companies will see positive effects, too, in quite dramatic fashion. "It touches almost every aspect of our present utility structure," says Rich Hampshire, head of energy, utilities and telecoms at Logica.

The sector has welcomed government moves to mandate the roll-out of smart meters to businesses (within five years) and domestic customers (by 2020). "It gives the industry something to aim at," says Matt Beasley, a spokesman for Centrica, the owners of British Gas.

Most immediately, they will gain more visibility over what is happening to the power they supply. "It is of crucial importance to have transparency across the entire value chain," says Bastian Fischer, VP & General Manager EMEA, Oracle Utilities.

Utilities will get "a vast amount of extra data that will allow us to understand our customers better and improve our relations with them," says Howard Mitchell, Smart Product Manager for E.ON. Much of the guesswork that goes into scheduling and purchasing power will disappear because the data will be so much more comprehensive and clear, says Mitchell.

Estimated bills are just one bugbear for customers, according to Mitchell. "The process of billing a customer is very complex because of the way the industry has evolved. Lots of different processes have been bolted together." If smart metering is done right, a lot of the problems will simply not exist, he adds.

At the moment, many customers have their meters read four times a year at best, says Dave Ford, head of metering at NPower. Bills based on estimated readings "are just not a good relationship for us to have with our customers," he adds. It leads to inaccuracies and resources wasted in dealing with those inaccuracies.

The industry has tens of millions of pounds tied up in unreconciled billing, according to Ernst & Young's head of power and utilities, Steve Jennings.

Smart meters will mean the end of estimated bills, along with the need for meter readers, leading to significant cost savings. "Smart metering will allow companies to reduce their cost base," says Nick Wellington of energy management company Navetas. "They will not need call centres any more because everyone will know exactly what their usage is. Cutting their back office staff will save the utilities millions of pounds." More importantly, the technology will change the relationship of energy suppliers with their customers. "Better knowledge provides more insight into the way customers are using energy and allows for more complex but more consumer-focused tariffs that reflect customers' lifestyles and their ability to change their consumption patterns," says Logica's Hampshire. "It will allow, for the first time, real value-based competition based on services that meet customers' needs rather than just being about price."

Experience in markets such as the US shows that, as a result of better information about customers' use of electricity, smart meters can also play a big role in managing demand, which can be moved away from peak times, says Mark England, managing director of energy management group Sentec. "If a utility can dump demand instead of firing up a coal-fired 'peaker' power plant, it creates big carbon savings."

Florida Power & Light, a US utility, has managed to delay investing in 2GW of generating capacity by influencing consumption at peak times, while California's incentive mechanism for energy companies specifically encourages them to invest in energy efficiency measures, says Jennings.

The technology is not just relevant for electricity – smart metering for gas and water pays dividends too, although they differ significantly from electricity because they can both be stored in a way that electricity cannot. "The benefits are less obvious," says Jennings, "but it does show you what happens when you turn your thermostat down by 1oC or leave your tap running". Suppliers also gain valuable information about leakage and theft, which saves a lot of money, particularly in countries such as India.

Nonetheless, a smart meter roll-out will be expensive because there are 47m gas and electricity meters in the UK, all of which must be replaced, Wellington says.

While the overall benefits for the UK economy are clear, they are spread between customers, energy retailers, energy generators and the operators of the transmission and distribution network. Who pays for the installation of the meters is one of a number of issues that remain to be sorted out. Another problem is the issue of "interoperability". "We need meters that can be used by different suppliers," says Dave Robinson, market development director at meter maker Landis+Gyr.

Because consumers can switch suppliers, there must be "a requirement that metering systems and data is exchangeable efficiently between suppliers in the event of a change," says the Energy Retail Association (ERA).

The ERA says the government also needs to outline what market model will be used; what the meters will need to be able to do and a strategic vision for change.

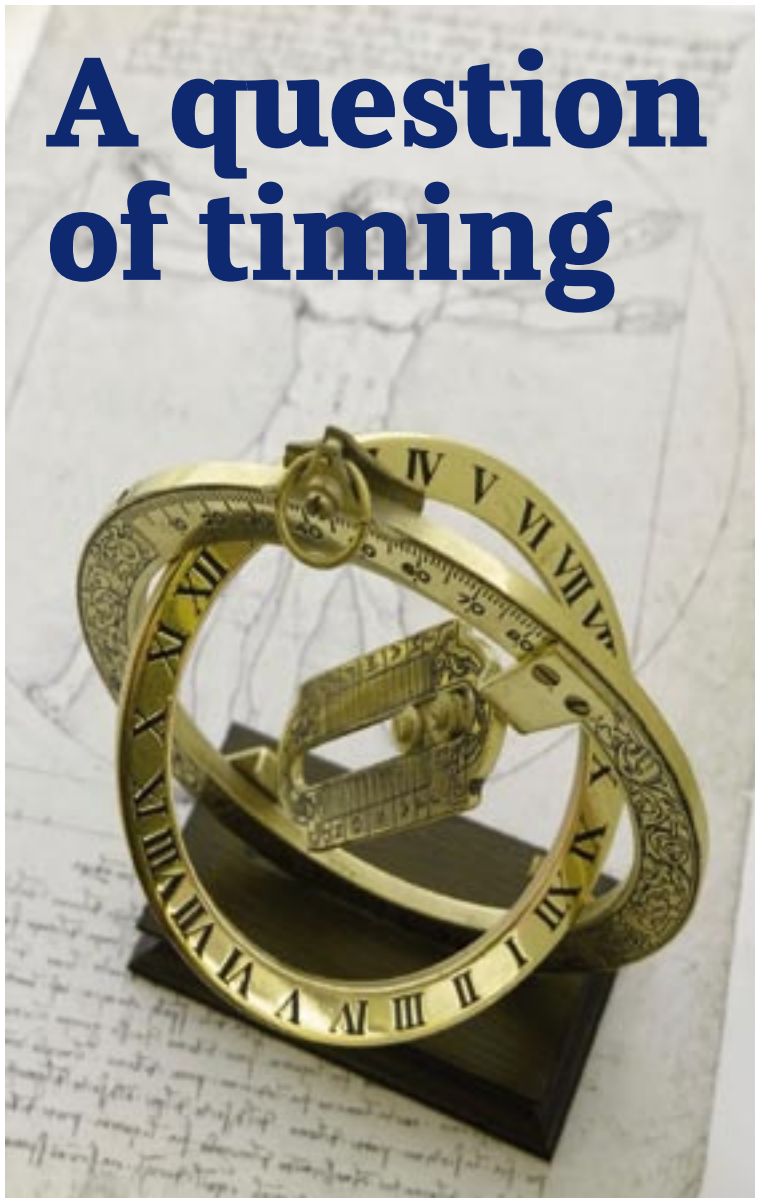
"We want to ensure no time is lost," says Jason Brogden from Engage Consulting, Programme Manager for the Energy Retail Association. "We are in a hiatus until someone shows some leadership."

Power point

Climate Change Capital Private Equity (CPE) has invested €10 million in Power PLUS Communications, a company that offers broadband services to speed up the development of smart grids.

The investment from the €200 million clean-tech fund will enable the German group to further develop its broadband power-line communication – a solution that transforms electricity networks into smart grids and allows utilities to communicate with their smart meters. CPE partner Bruno Derungs said: "In the future, we will see a transformation of the passive power grid. Broadband power-line communication will help to inform consumers about their power consumption on a real-time basis."

A question of timing



One of the effects of a nationwide smart meter roll-out is that it will enable the introduction of differentiated tariffs. What are they and why are they so important?

We see examples of differentiated tariffs every day – from mobile phone companies, train operators and low-cost airlines. They offer cheaper tickets or call rates at times when they have more capacity and more expensive usage at peak times.

The model works just the same for electricity providers, which have peak times around breakfast time (7am-9am) and then in the evening from about 6-8pm. Electricity is more expensive during these times and much cheaper in the middle of the night, according to Nick Wellington from energy management company Navetas. However, at the moment, the customer has no way of knowing the rate at which he is being charged and so has little incentive to change his behaviour.

Separately, there are also one-off peaks that come at the end of popular films or TV programmes – the classic example is the Super Bowl gridiron football final in the US, where the power network sees a massive surge in power use when it finishes, as people use the toilet (water flows use significant amounts of electricity) or make a cup of coffee.

Because electricity cannot be stored ready to be released at the times of highest demand, the system has different types of power plant, including those that just fire up to provide power at peak times. Often these are oil or coal-fired, so they produce a lot of pollution. On top of that, it is very inefficient to start up a plant and run it for a short time, so using these "peaker" plants is very expensive and very polluting, says Mark England of Sentec, an energy management group.

By pushing people away from using power at peak times, suppliers can avoid using these expensive plants and in the long run, they can avoid the massive capital costs of having to build new ones.

However, at the moment, customers know very little about what they pay at what time and they are given no indication of when is the best time to use appliances. "With the vast amount of data that we will gain, we will be able to understand our customers better and tailor products that suit people's individual circumstances," says Howard Mitchell, Smart Product Manager for Eon.

The visibility that smart meters provide to suppliers and customers about consumption and prices allows the energy companies to offer different tariffs to different customers to encourage them to change their consumption. So groups that have unusual demand profiles and a particular focus on value, such as students, could get cheaper power by signing up to an agreement not to use appliances at peak times.

There will also be the option for customers to add extra services, adds Mitchell. "These could include online access to information, allowing customers to monitor their energy use online; pay-as-you-go and paying in innovative ways, such as through your mobile. It will also transform prepayment from being something that is about your creditworthiness to a lifestyle choice that works as it does in the mobile phone sector."

UK ready for smart metering now

Navetas Chairman argues that consumers should benefit from smart metering without delay

We currently live in a period of high energy prices with a very real danger that the most vulnerable in society continue to fall into the trap of fuel poverty. Navetas Energy Management is an innovative company that helps consumers and businesses to reduce their energy costs and carbon footprint through the implementation of new smart metering technology.

Like budget airlines that 20 years ago took an established business model and changed it significantly so that more people could benefit from low cost air travel, Navetas believe that by thinking differently to the established players in the UK energy market, smart metering can be introduced quickly and economically into the UK without any regulatory changes and without additional charges to consumers.

In summer 2009, Navetas is launching a new and exciting low cost internet based metering data service provider, youhavethepower.com, to serve energy suppliers and consumers, providing accurate monthly billing and real time web based consumption data at a commensurate cost to existing basic metering and estimated billing services. youhavethepower.com will serve all consumers, without discrimination whether they are quarterly billed, direct debit or prepayment customers, through the same metering technology and on the same cost basis, thereby helping those in fuel poverty most by reducing their energy bills immediately upon the installation of these new smart meters.

Many in the energy supply industry and Government believe that the mass deployment of smart metering cannot be delivered in the short to medium term without significant change to the UK energy market or a solution being found to the problem of stranding assets.

However, Navetas consider that the market should determine that smart metering is a viable alternative to the current status quo, and thus no change to the regulatory regime is required.

In relation to the issue of stranding existing metering assets, it is clear that by definition replacing old technology with new will result in the obsolescence of the old. Navetas view is that such an issue should not hold back the deployment of new technology, particularly given the benefits that can be derived from smart meters to reduce fuel poverty. There has been and still is plenty of time for the large energy companies to make provision for obsolete stock, therefore this issue should be left to the market to resolve.

As for the stranding of future smart meters, Navetas is ready to invest in the mass deployment of smart meters in the UK through youhavethepower.com, for the following reasons:

- youhavethepower.com will serve all energy supply companies on an open, independent and transparent basis;
- youhavethepower.com will be independent of any individual energy supply company
- youhavethepower.com will provide smart metering to energy suppliers and consumers at a cost that is commensurate with existing basic metering

Our message to Government and the industry who are potentially delaying the introduction of smart metering through lengthy consultation and review of the regulatory environment for smart metering is a simple one.

Innovation in technology and commercial delivery of smart metering is happening now and any regulatory changes introduced should not restrict free and open competition in the market place to ensure the most cost effective and rapid deployment of smart metering in the UK.

There are already too many people in society, some the most vulnerable who are suffering because they do not understand what energy they are consuming and at what cost.

Navetas, with youhavethepower.com plans to use existing technology and introduce smart metering today and empower all consumers to control their energy consumption in a more cost efficient and environmentally friendly way.

Mike Mannering
Chairman
Navetas Energy Management

NAVETAS
Energy Management

Investing in the future

Smart energy networks offer an exciting opportunity for investors with an eye for a new market

The world stands on the brink of a new energy transmission future. Outdated power grids are about to undergo an information technology revolution.

They will be transformed from lumbering, inefficient delivery mechanisms into flexible, communicative, digital smart networks that will allow energy companies to carry out automated monitoring, have more control over power assets and buy in electricity from micro-generators. Driving this transformation are deep-seated concerns about energy security, quality of supply and carbon emissions: to reduce reliance on fossil fuels, new grids are needed to cope with the intermittent nature of renewable energy supplies. Existing grids are also woefully inefficient.

These factors indicate that smart grids will form an integral part of global energy infrastructure in years to come, which is why investors are increasingly taking an interest in the sector, keen to pick out the companies that will be at the forefront of a new enduring energy revolution. The trick is in choosing the areas in which to invest.

> "Investors are increasingly taking an interest in the sector, keen to pick out the companies that will be at the forefront of a new enduring energy revolution"

Smart grid technology encompasses a wide range of hardware and software products from major infrastructure to microchip scale and involving small start-ups to large established players. Dr Stephen Mahon, Chief Investment Officer at Low Carbon Accelerator, is keen on demand response companies – those that provide technology that turns off appliances/systems at peak times to prevent grid demand overload.

"The ability to reduce the peaks in energy consumption will prevent the need for large expenditure on new generating assets," he says.

"In this climate where the cost of capital is much higher, companies that can offer technology to do this are very attractive." He also highlights technologies that allow grids to integrate the variable energy supply from renewables more easily, increasingly important as green energy generation grows.

Heather Daniell, lead energy efficiency analyst at New Energy Finance, sees two main areas worth focusing on.

"Companies that provide hardware and software for metering and controls that work across multiple communication standards," she says. "The other will be those offering more of a service model — home energy management, for instance, where the electricity consumed by appliances is moderated by real-time pricing information."

Currently most investment opportunities are in the US where there are more incentives for companies to run energy delivery efficiently, but future prospects look good. UK and European markets will expand as regulations change, while in the longer term inefficient grids in emerging economies such as India and China will need to be upgraded. A recent report by Lux Research Growth predicts that smart grid software-related revenues will grow from $903m in 2008 to $3.1bn in 2013.

Despite the economic downturn, the conditions look promising for smart grid investment. Bruce Jenkyn-Jones, managing director of listed equities at Impax and portfolio manager of Impax Environmental Leaders (IEL), thinks that while there is some uncertainty at the moment about utility expenditure, spending on smart grid technology should be more resilient due to the lower capital expenditure requirement and short payback times. "This is good news for investors," he says.

Home is where the smart is

Smart metering will allow people to see exactly how much energy they are using, where and when

In an age of increased consumer choice, the purchase of energy is one area that consumer power has not yet fully penetrated. Despite the advent of a competitive energy market, customers feel powerless in the face of across-the-board price rises that have taken average household energy bills to above £1,000.

"At the moment, there is no option," says Mark England, CEO of energy management firm Sentec. "There are six companies offering a limited range of tariffs with no transparency. If you try to introduce energy saving measures, you have no way of knowing what good it is doing and there is no real mechanism to cater for people generating their own energy."

The central premise of the smart meter is: "Knowledge is Power." Currently, even if you take action to cut your energy consumption, you have no way of telling what effect that has had on your bill. The opacity of the system is demonstrated by research from the Energy Saving Trust (EST) that reveals eight out of 10 people do not know what tariff they are paying for their gas and electricity and that energy bills are the hardest to understand of all household bills. Philip Sellwood, chief executive of the EST, said: "Our study finds that energy bills are the most difficult to understand of any household bill: twice as hard as phone bills and four times as difficult as bank statements or credit card bills."

The advent of the smart meter, which should be installed in every home in the UK by 2020, promises to change all that. Trials in other countries show that simply having a smart meter in the home tends to cut energy bills by five to 10 per cent. A 5 per cent saving adds up to almost £1bn in cost savings and 6m tonnes of CO2, according to the EST.

Even if there was detailed consumption information on your bill – in the same way as your phone bill can be itemised – it is little use to you if it arrives three months after you turned your thermostat down by 1°C. Your smart meter will give you all the information you need – in real time – on what appliances you are using, how much that is costing you and how much you save by turning your thermostat down or not boiling your kettle at peak times.

Once you know how much you are being charged at any given time, your energy company can offer you different tariff packages based on your consumption needs. "The price of electricity varies every half hour, but at the moment the customer has no visibility on that," says Richard Barton, energy partner at Deloitte.

> "Simply having a smart meter in the home tends to cut energy bills by five to 10 per cent"

At the moment, the only real option is Economy 7, the night-time tariff, which around one in five households use, according to Eoin Lees, energy consultant.

This is "a surprisingly high figure given the inflexibility and limited attraction for most householders of a system primarily designed to reduce the costs of electrical heating using storage radiators".

Customers need to be able to see the benefits of saving energy, says Marian Spain, head of strategy at the Energy Saving Trust. "It is like food labeling – the information on food now allows people to make much more informed choices about what they eat."

"The customer will see a real range of tariff options depending on their tolerance for the energy company to control their operations and their flexibility," says England. Budget-conscious students could be offered cheaper tariffs in return for allowing their supplier to cut off some of their most energy-hungry appliances at peak time. It also offers great potential to reduce fuel poverty through innovative use of off-peak tariffs, says Rich Hampshire of IT group Logica.

But even customers with less flexibility, such as families who have to get ready for work and school at a certain time, should benefit. Energy companies will value certainty, so if they have a better idea of how many customers will be using energy at peak times, they can plan with greater precision how much power will need to be generated. "Ultimately, it should mean that we need to build fewer power stations and burn less expensive and polluting fuel to produce the electricity we need," says Barton.

For Steve James, Smart Metering Implementation Manager at E.ON UK, the potential of the smart meter was demonstrated when he returned from holiday in the Canary Islands to discover four inches of snow at the airport. "It would have been great to turn

the heating on remotely but in fact that wouldn't have worked because my heating system had failed and we had to wait to get the parts ordered and the system repaired. We also had to use expensive and wasteful bar fires to keep us warm. But with a smart meter, the failure could have been detected, parts ordered and I could have been notified, all on the beach in Tenerife."

As a participant in a dual fuel smart metering trial, he explains how he reacted when his meter was installed. "Like many people, I started by turning everything off and then turning appliances on one by one. We identified a rogue lighting circuit and have got even more into the habit of chasing the kids round switching off TVs and computers," Mr James said. "Another big saving was my fridge, which I kept for the beer after my wife finally persuaded me that our 20-year-old kitchen needed replacing. The fridge was old but I couldn't believe how much it was costing to run." A 10-year-old fridge uses four to five times the energy of the most energy efficient modern ones, according to the EST.

One of the most immediate and most welcome changes smart metering will bring is the end of the estimated bill, which is a major irritant for customers and a significant cost burden for the energy companies.

Once customers are used to having greater awareness about their consumption, all sorts of innovations are possible. As well as being able to monitor your energy use through your PC, TV or mobile phone, you may also be able to win prizes for saving energy, as happens in Växjö in Sweden.

Power point

In an unlikely partnership, Google has teamed up with General Electric, in a bid to promote the use of renewable energy in the US.

It is hoped the Washington lobbying muscle of the two companies might advance the use of renewable energy throughout the country.

GE has already committed to developing clean-tech solutions under its Ecomagination initiative, while Google has been involved in promoting greener data centres, as well as commissioning the largest private US solar power system for its Silicon Valley headquarters.

The new alliance will begin with joint lobbying for the creation of a smart grid – a more efficient national electricity system, using more IT.

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