Smart meters and remote reading of meters

There are significant differences between the two proposed automated ways of checking electricity and gas (and potentially other utility use) usage more accurately.

Remote reading of meters

Remote reading of electricity meters occurs only occasionally, though the time scales may vary; some daily, some weekly, and some only when interrogated by a radio vehicle driving up the street on a quarterly basis. It is intended to minimise meter reading costs and fraud, dispensing with the need to gain entry to homes. This is especially useful for multi-occupancy properties, which can mean many call-backs, due to the number of people being out when the meter reader calls. The meters transmit readings using RF, but does so relatively rarely.

Smart meters

There are already about 50,000 households which have the meter as part of trials. First Utility, a new energy company with 30,000 customers, offers each household a smart meter. But most of us will not start getting the meters until 2012.

The smart meters currently on trial in the UK all use WiFi inside the house and a mobile phone network card for contact back to the electricity company, mostly GSM, but one may be using 3G. In South Africa the electricity network is using TETRA for the meters as the signal travels through walls and buildings better due to its lower carrier frequency (436 MHz).

By 2020 every one of the 26 million households in the country will have their old gas and electricity meters ripped out and replaced, with the cost expected to run to between £7 billion and £9 billion. The cost will initially be swallowed by the energy companies, who over time will pass it onto consumers. The Government insists, however, that even with this cost consumers could benefit by as much as £100 a year because the smart meters will allow them to cut down on their energy usage. You will not get a direct bill from your energy company for the meter, but inevitably you will have to pay something towards the £7 billion cost of installing the meters, which cost up to £100 each. This could cost around £5 a year. But taking into account the energy you will be saving by having the meter, some analysts reckon we will be better off by about £40 a year, though this figure is strongly disputed, and many experts say the figure would be far lower.

The installation cost will be approximately £340, but the government believe that customers will save this (and more) in the long term, and reduce carbon emissions, by seeing their costs and usage on a daily basis, and therefore be encouraged to cut back to reduce bills. This has been hailed as a forward-looking 'green' initiative, which appeals to those who do not want the production of electricity using nuclear power, or a reduction in need for power.

Mr Miliband's department admitted to the Daily Telegraph (November 2009) that the official estimates of savings from the new meters were lower than had previously been thought, possibly £28 per year per household. Most of the savings will be made by the utility companies as they will not be employing meter readers.

'Smart' metering, which will always include the remote reading capability mentioned in the first section, is much more complex. It is primarily intended to enable electricity demand to be affected by altering the price per unit over a wide cost range (like large industrial users have had for many years – their price can vary from a few pence per unit to over £10 per unit if they exceed

their approved demand at peak times!). Smart metering is an automated and advanced version of 'off peak' or 'economy 7' off-peak electricity.

Instead of having fixed times which are cheaper, the companies will set the electricity price from minute to minute depending on demand and surplus load availability. The smart meters are told the current price (by RF/microwave or by signals on the wires) and depending how they have been set up, they either turn circuits on/off or use a WiFi type system to talk to your washing machine, electrical heating systems (like storage heaters) and other high-power electrical equipment so that the equipment (depending how you have set it) can decide when to 'run'.

This would mean that your washing machine would cost a great deal if you use it at 8 a.m. or 6 p.m. or between 11.00 a.m and 3.00 p.m. on Sunday (for example), but if you had pre-loaded it the previous night and allowed it to start automatically when the price was best (say 4 a.m.) then it would cost maybe one-hundredth of the unit cost than if it were on at the peak times mentioned. Even fridges and freezers would turn off during the most expensive periods unless their temperature was too high for safety at the time. This is because the UK (and most European) electricity systems can often be working at almost maximum capacity, especially during cold periods, and there have been some almost complete automated protective shut-downs. If that happened it would take at least 12 hours to get everyone back on an electricity supply.

The meters could be used to ration supplies across the network or cap electricity use for certain households. Households generating their own electricity through rooftop windmills, etc. could sell it back into the National Grid via the meters. Smart meters will also be to monitor the electricity you can create at your home through wind turbines or solar panels. And it will enable you to sell this energy when you do not need it. They could also communicate with electric cars that are parked and fully charged enabling the cars' batteries to provide power to the grid when electricity supply is low.

However, we believe that at the so-called "smart meters" launch that Ed Balls announced in November 2009, "smart" is only smart for one thing - the electricity industry's profits. Energy suppliers will save billions by doing away with meter readers and call centre staff, and it will mean estimated bills are a thing of the past.

What the UK Government is now announcing seems to be nothing more than "remote meter reading" (almost certainly by installing at least one mobile phone connection in every home's electricity and gas meter) which allows the industry to lay off the 1000s of meter readers and thus increases the electrical industry's profits, without any of the positive tariff-led demand control that "Smart Metering" properly means. It will also effectively put a mobile phone in every electricity and gas meter. This is really bad news for electrosensitive people.

As far as we can find out, the major energy companies have failed so far to agree the best method, despite the scheme being years in the planning. This is mainly because (very sensibly!) most of the suppliers and generators want the meters to be able to control electricity demand as well as just be able to be read remotely.

The problem here is that there are at least five significantly competing but incompatible schemes (e.g. Zigbee, Z-wave, etc) for communication and control of appliances in the home. We are extremely concerned that this current Government's initiative will result in billions of GBP being spent on remote-reading meters that will be anything but truly "smart". The choice of communications protocol inside the house cannot be left to market forces or large numbers of appliances and meters will end up not being able to talk to each other.

We almost certainly will have to have 'intelligent' metering and control for future electricity use, and sustainability. Mobile phone technology will be used to transmit information on each

family's energy consumption to a central 'hub'. It is expected that the Department of Energy and Climate Change (Decc) will call for a "central hub" model, kick-starting one of the biggest IT projects the country has ever seen. The meters will need to send accurate readings to a central office via SMS or GPRS technology. The office will be run by a communications and IT specialist and it is understood companies such as Vodafone and O2 are negotiating to be involved. This company will then pass the data onto the individual energy companies.

The likelihood now is that industry will go for MESH networked meters, probably at 800 to 900 MHz, which will chat to each other (with a different signal format from anything else) and pass data onwards and eventually get to/from an Area Access Point which will be 3G/UMTS based for ongoing communications. This greatly reduces infrastructure casts and most large scale implementations in Canada and the USA are currently using this method.

This saves the companies erecting lots of Smart meter Access Points (base stations) or having to pay for a 3G/UMTS or GSM mobile phone network connection. Remote houses will be OK-ish but if you are close to the Access Point, then your house meter may be 'communicating' with others most of the time.

The Wiki definition of MESH networking is a type of networking wherein each node in the network may act as an independent router, regardless of whether it is connected to another network or not. It allows for continuous connections and reconfiguration around broken or blocked paths by 'hopping' from node to node until the destination is reached.

A test on a HydroOne smart meter showed that it was transmitting every few seconds as part of the 'mesh network'. A report by Richard Tell Associates (2008) states that at 0.3 metres the 2.45 GHz mesh network transmitters fitted in homes will emit about 6 V/m. This is higher than the BioInitiative recommendation of 0.6 V/m outdoors and 0.2 V/m indoors.



As well as the meter under the stairs, it is hoped householders will have a small screen – the size of a small paperback – which they can keep in the kitchen, or sitting room. This will allow companies to send messages to families about their bills, special offers or warnings about when their energy usage is unusually high. Which?, the consumer watchdog, has warned that without these screens householders could save as little as £1 a year off their bills, because they will not be able to tell how much energy they are using on an hour-by-hour basis. Which? also fears that Decc will not make these screens mandatory. Information from the meters will be sent, usually through the mobile phone network, to the supplier via the energy hub. This will show household consumption and end disputes over bills.

The meters will also show how much carbon is being used and allow consumers to identify exactly where energy is being used throughout the house.

Unfortunately, it will increase people's exposure to the already ubiquitous electrosmog, and those who are already sensitised to RF radiation may find their symptoms increase or worsen. People in the UK fitted with pacemakers are not required to have smart meters. There could be other exemptions, but there are financial consequences. It would be useful if the ability to monitor use of electricity were a function that could be disabled, leaving the occasional RF transmission for the purposes of billing the only function left working. This would mean very little exposure to those who are sensitive. This would avoid the problems created in transmission by those who decide to screen the RF from the meter, thus disabling its ability to transmit at all. When measurements were taken in Germany in March 2009, the details were transmitted every 30 seconds. According to the firm that manufactures the meters, the intervals between readings are shorter when the figures are needed for bill calculations and longer during the rest of the time.

Because of this, a fully wired (non-wireless) option **must**, in our opinion, be designed into the system that is finally authorised for use so that we do not all have to have yet another source of microwave pollution inside our homes. Technically there should be no problem at all in allowing for that option. However, one email correspondent, in December 2009, said *"I have contacted British Gas asking if they had non-wireless versions and they do not"*. For ES people, they should be able to take regular meter readings and call or mail these to the supply company, with a company employee checking the meter annually or semi-annually to ensure accuracy.

There are systems that could be implemented that would mean that virtually no microwaves need to be used. For example, most 'off-peak' meters in current use pick up a long-wave radio signal (just like a long-wave/medium-wave radio – at tiny levels in most homes) and use that to switch between normal and low rate charge modes. This type of system could be used to transmit the prices and then either a dLAN (along the house wiring) or a fully signal-wired (like a very simple Ethernet type system, e.g. CAN-bus which is now used in most motor vehicles) system used to communicate with your electrical appliances.

There have been trialled ways of reading the meters using RF signals transmitted down the mains, rather than wirelessly. However, there have been problems including getting the signal inside houses and interference has been reported by amateur radio enthusiasts. It would also add considerably towards the amount of 'dirty electricity' that would be measurable in people's homes. It may be an alternative, though for multi occupancy buildings, such as flats.

It will be possible for people to opt out completely, but their electricity bills will usually end up being several times as expensive as people who fully utilise the smart metering and control functions. It has been suggested that there will be a dearer 'standing charge' for everybody (maybe about £50 per year, mostly to pay for some real people meter readers) and that this charge will be heavily discounted (and maybe credited in full) to families who have smart meters.

It may be that smart meters could also be used in the future as a way to monitor and control water usage, especially in areas where the water supply is becoming increasingly problematical.

It has been suggested smart metering may be possible using optic fibres, which would eliminate added RF exposure. For individual homes fibre optic cabling is relatively high in cost because of technological limitations, possibly in the order of £600 per household in cities, towns and village streets with lots of houses. The price would be greater for rural areas where there are fewer connections, when the main cabling cost would have to be shared by fewer people.

A combination of communications networks could be possible. The data could be transmitted down a telephone line, the infrastructure for which already exists, and almost all telephone exchanges are now connected by optical fibre, and have acceptable bandwidth speeds. Rural exceptions, such as the Scottish Highlands and Islands, where the fibre optic cabling has not been laid, often use microwave links for their main connection anyway.

So, a good way would be to incorporate a telephone line based ADSL router (or modem/+ firewall) in every smart meter with an additional Ethernet socket(s) to attach an Ethernet switch for home broadband and for wired appliance control. Such a wired system would allow BT (etc.) to supply subsidised wired broadband to every house, give them the income to extend and improve their long-distance fibre-optic infrastructure, and allow us to reduce our microwave exposure.

Instead, the mobile phone companies are looking for new ways of making money, now the phone market is becoming saturated; people like Sir John Bond, the chairman of Vodafone, is a business adviser to the Government; so a new wireless metering company will be set up, that will be then

sold off at a vast profit in the future. I don't suppose the British tax-payer will see any of the profits made.

It would be good to ensure that, inside our houses, we can have the option not to use RF/microwaves to communicate between the meter and various appliances, without suffering financial consequences. This will need a considerable amount of lobbying by a lot of people.

Experiences of smart meters in other countries

In **Denmark** and the **Netherlands**, energy savings fell below 5% after the meters had been in place for about 6 months. People in the **United States**, who already have smart meters, complain of unexplained high bills and in some cases they are having to keep the old meters in place alongside the smart meters!

Since smart meters have been rolled out in San Francisco, thousands of people have reported ill health symptoms, including headaches, nausea, heart palpitations and tinnitus, as a result of the powerful bursts of radiation from the meters approximately once every 4 seconds, 24 hours a day. Independent measurements reveal radiation spikes that are far more powerful than any commonly used household wireless devices, potentially more than 100 times the level of mobile phone exposure. 42 local governments have demanded a halt to the smart meter program because of experienced health effects and fears over long-term cumulative exposure.

Marin County board of supervisors is to consider a moratorium on PG&E smart meters, partly because of health concerns. More than 22 cities and 3 counties in **California** have already launched formal objections to the mandatory deployment of smart meters, since many people are concerned about the likely long-term health effects. **Fairfax** has passed an ordinance allowing the town's police to physically prevent contractors from installing radiation meters.

Solar storms may affect smart meters

NASA is expecting magnetic storms in 2013 when two solar cycles (11-year and 22-year) coincide. Magnetic storms can play havoc with many types of electronic wireless equipment. At the moment it is unclear whether smart meters would be able to continue to function if exposed to such an electromagnetic pulse, thus reducing the availability of power to the majority of homes, businesses, etc.

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