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Searching for best practices in smart metering

Governments across Europe have high hopes of smart metering as a means to improve energy efficiency. But smart metering is a complex business that is still under development and requires considerable investments.

by Annemiek Planting

Ideally, smart metering will mean: goodbye to estimated, and therefore inaccurate, bills. It will turn ignorant citizens who leave their televisions on stand-by or run their dishwashers during peak-hour into energy-aware end users who actively manage their domestic energy use. They will do their laundry during off-peak hours and when prices are low. They will either use electricity from microgeneration units in their own homes or feed it into to the grid. Not only will it result in domestic energy savings of 3% to 15% and CO_2 emission reductions, it will also enable utilities to reduce their costs and optimise power production and grid management.
In a more pessimistic scenario, smart metering will lead to massive asset stranding because millions of existing meters will be replaced before their end-of-life. This will result in increased energy usage and a situation where the primary beneficiaries are not the ones who are paying the bill. Moreover, if EU countries opt for different systems that are not interoperable, smart metering will become another obstacle to the formation of a well-functioning European energy market.

Smart metering is a phenomen that is still very much under development. The fact that there is no universally accepted definition of the term says enough. At its most basic, a smart meter electronically measures and displays how much energy is used. Customers can then view their real-time domestic energy consumption in terms of money rather than kilowatt hours. Although smart metering systems across Europe will share most of these characteristics, the starting point in each member state is different, says Howard Porter of the European Smart Metering Industry Group (ESMIG). 'With smart metering, meter communications can be either from the meters to devices inside the building, from the meters to the utility company or both. Local communications could allow the meters to talk to each other, perhaps to allow all of the meters to use a remote communications channel connected to the electricity meter. Another option is to install a separate meter hub that picks up and stores data from the meters and provides the remote link. Other devices could link into the local network, such as the washing machine and the solar panels on the roof.'

Regardless of the chosen direction, the information and communication systems should be flexible enough to make them future proof for at least the expected service life of 15 years. Porter: 'There are a number of communication technologies available, such as power line carrier, radio or GSM. In Italy, over 27 million identical smart meters have been installed and they all communicate through power line communication (PLC) to the nearest substation from where centralised control rooms collect the data through GSM. In Sweden, the government has stimulated the roll-out of smart metering by requiring accurate monthly meter readings in 2009.

As the Swedish market is deregulated, this has resulted in several different communication technologies. The market parties are looking for standardisation.
We obviously do not want to develop 20,000 different systems. This would delay the further development of smart metering in Europe and it would make us more vulnerable to competition from outside the EU. We would rather narrow it down to five or six ways, as part of a more or less standardised way of doing it.'
But although Porter advocates a certain level of standardisation, manufacturers will want to add different functionalities to distinguish themselves from the competition. This could drive up the costs and slow down the development of smart metering. Porter is not afraid of these risks. 'If the Energy Services Directive becomes a reality, there will be benefits across the board. Utilities have to become energy saving companies under this directive, completely changing their business models. They will do anything to reduce their costs. Smart metering provides them with the means to reduce energy consumption while reducing their costs through more effective billing and better access to customers' metering data. Building on that, they can provide their customers with new products and services, improving customer loyalty and satisfaction.'

Maximising opportunities

As far as Willem Strabbing, manager of KEMA's Intelligent Networks and Communications department, is concerned, communication protocols should be based on international standards. 'The Netherlands have already chosen a means of communication based on an open, international IEC standard. This will increase flexibility, reduce costs and risks and facilitate the future development of a smart grid and open markets. Many countries, such as France, Germany, Italy and Spain, are joining our initiative to create modular solutions and harmonise the different protocols used for meter communication. A modular approach, where the software and communication systems are interchangeable with other systems, should offer enough flexibility to support future services for as many market parties as possible. The ICT-infrastructure should also anticipate on the development of a digitised, "smart" grid where two-way communication between utilities and end users will lead to optimised grid and power production management.'

Most market parties seem to agree that standardisation is useful in order to reduce risks and implementation costs, while maximising opportunities to share best practices. What those standards should be has yet to be established. Some aspects of smart metering are simply not developed enough to be able to define standards, for example, in the case of customer feedback. In an effort to define and spread best practices, a number of key stakeholders launched a three-year project last year by the name of ESMA (European Smart Metering Alliance). ESMA now has over 80 members, including academics, utilities, consumer groups and energy agencies.

Article 13 of the Energy Services Directive states that information to final customers on their energy use may be delivered via bills, feedback from the energy company or directly from utility meters. In all cases, the solution should be 'cost-effective in relation to the estimated potential savings in the long term'. Whether this is the case is quite hard to determine, says ESMA coordinator John Parsons. 'As manufacturers are reluctant to give exact figures on long-term costs, it is very hard for governments and regulators to get reliable data. Governments are also cautious in their analyses. In the UK, for instance, the government has an optimism

Lower energy use

Studies in the US have shown that consumers can reduce their annual energy consumption by 10%. Peak demand on the grid could be reduced by 15%. The two studies, the Grid Friendly Appliance and the Olympic Peninsula Project, were published by Pacific Northwest National Laboratory (PNNL) earlier this year.
The 112 home owners who participated in the Olympic Peninsula Project received smart electricity meters, new thermostats, and new dryers and water heaters fitted with specially developed switches. All appliances were connected to the internet via software developed by IBM. Home owners used their PCs to set the amount of money they wanted to spend on electricity and the desired level of heating for their homes. The system automatically lowered their thermostats when electricity was relatively expensive because of high demand. The participants themselves could pre-set the desired minimum temperature. The participants also had a virtual bank account to see how much money they had saved.
The objective of the Grid Friendly Appliance Project was to reduce electricity consumption during periods of extreme stress on the grid. When special sensors detected the stress on the grid, the software automatically turned off heating elements in dryers and water heaters for minutes at a time. If this system were to be introduced on a much larger scale, the need to have outdated generators on stand-by to absorb peak demand could be reduced significantly. The consumers didn't notice any difference. When stress on the grid was reduced after a few minutes, the software switched the elements back on. Such events occurred once a day on average, each lasting for up to a few minutes. The system reduced peak power consumption by 15%. *(Remco de Jong)*

bias in the financial analysis of smart metering. So far, most trials have focused on testing the technical possibilities and performance of the equipment. Although the expectation is that smart metering will deliver significant energy reductions of 3 to 15% through reduced use and lower peak loads, there is limited specific evidence for this. If demand driven transportation tariffs are introduced, customers or utilities could programme their smart meters to switch off the air conditioner for a bit when prices or demand reach a certain level. Electricity tariff structures, such as real-time pricing or critical peak pricing, and load control are expected to lead to a reduction of energy consumption. This does not mean that energy end use will go down; this may even increase. The primary energy saving from demand response depends on what peak generation resources are not required. If less efficient power plants are required less often, this will result in lower total energy consumption.'

According to Parsons, governments are to some extent just making assumptions on percentages of possible energy savings. 'One of ESMA's main issues is the lack of reliable scientific data on the effect of consumption feedback to end users. Most evidence is based on small-scale trials and very few were longitudinal, which makes it hard to predict consumers' behaviour in the long run.'

Immediate effects

But new results from properly designed trials are underway across Europe, including major ones of 300,000 homes in France and 43,000 households in the UK. In Portugal, Energia de Portugal (EDP) is carrying out a pilot project (InovGrid) with IT-company Logica in 100,000 Portuguese homes. In Sweden, where all households will have digital meters next year, Logica and Växjö Energi have launched an energy saving web service for consumers. It includes a competition function that is currently being used by elementary schools to compete with each other in energy efficiency. 'A marvellous way of exploring the possibilities of smart metering while raising the awareness of children of their own consumption behaviour', says Ken Whittaker, leader of Logica's Smart Metering Practice unit.

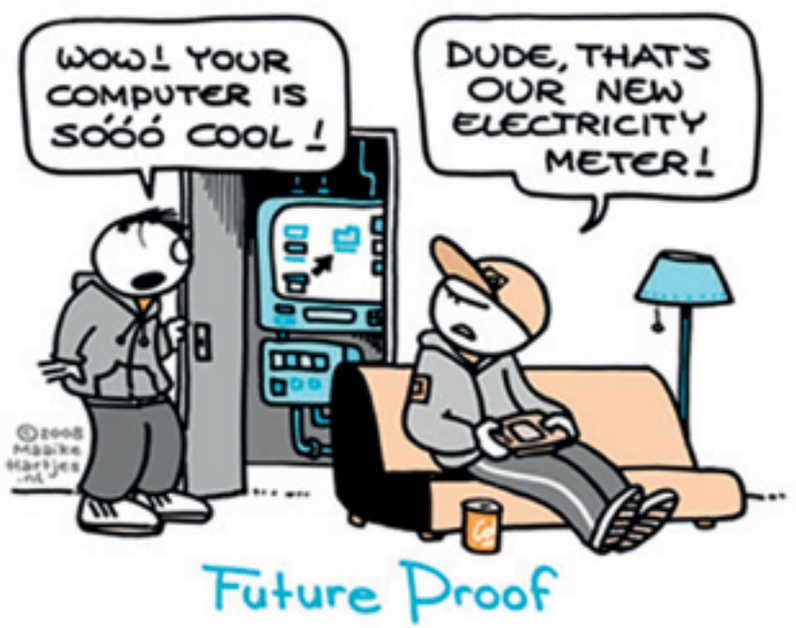

Illustration: Commissioned by TheSmartMeteringShop.com

According to Parsons, 'the one lesson learnt so far is that much of the success of smart metering as a means of reducing domestic energy consumption will depend on how the information is packaged and presented to the customers. A pan-European market research study in 2007 on the preferred communication technology for receiving smart metering feedback, found that there is a broad European preference for direct displays and more detailed billing. Customers want to see the immediate effects of their actions.'

One of the main concerns of the BEUC (European Consumer Organisation) is whether consumers should pay for smart metering. Levi Nietvelt of the BEUC says, 'Although some of our members are sceptical, the BEUC is generally in favour of smart metering. Clear information on their energy use can raise consumers' awareness of their energy consumption and how to reduce it. Moreover, accurate billing would get rid of an important source of customer complaints. But should customers have to pay? Beside the costs of a new meter while their traditional meter probably still works fine, the communication techniques of smart metering slightly increase energy consumption.'

The BEUC is currently defining its position, Nietvelt says. 'The question of how the costs can be shared in proportion to the benefits received by all stakeholders becomes harder to answer as energy markets are broken up and more parties are involved. We would definitely like to have a say in how feedback information is shared with the end users. We are investigating if it is in the customers' interest to make smart metering obligatory. And if smart meters are introduced, what the minimal requirements should be. Finally, we would also like to draw attention to the user friendliness of the different systems and on privacy issues.'

ESMA recommends that all countries should make an energy analysis, says Parsons, which should include not only the expected increases in energy efficiency but also the increase in energy consumption through the use of the smart metering system. 'If we manage to join forces and share best practices on a European level, we can maximise its undoubted benefits across the European Union.' ■