Smart meters provide real-time information on household energy use and estimated greenhouse gas emissions and could also advise, for example, half-hourly fluctuations in the price of energy to encourage low use during peaks. AMPY Email Metering

Smart approaches to electricity use

Forecast increases in electricity demand pose a dilemma for the electricity industry, which will need to cap or reduce its greenhouse gas emissions at the same time. A new approach, already proving successful, is to make consumers more aware of their hourly usage with smart metering and staggered pricing, to discourage usage peaks.

The International Energy Agency forecasts that if policies remain unchanged, world energy demand is set to increase by over 50 per cent between now and 2030.[1] In Australia, CSIRO has projected that demand for electricity will double by 2020.[2]

What is driving this increasing demand in Australia?

The answer is increased peak energy demands for cooling our poorly insulated and designed buildings in summer and heating them in winter.

The book *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*[3] discusses this phenomenon and cites the situation in Victoria, where summer peak energy demands in the 1970s and 1980s led the government to invest in more power stations. Consequently, there was little incentive for it to encourage efficient use of energy for the rest of the year as the excess capacity was sold to the market.

This created a 'vicious cycle' where the Victorian Government kept building more power stations to sell more power until it had incurred a $9 billion debt by the late 1980s. Privatisation of the sector was introduced in the early 1990s to reduce the debt, but still no incentives were in place for electricity providers to encourage more efficient energy use by its customers.

As a result, the Victorian energy grid is 20 per cent larger than it needs to be and Victorians pay higher bills for excess capacity to meet peak demand from heavy use of air conditioning during seasonal extremes.

The 'vicious cycle' has become an expensive exercise for both governments and taxpayers around Australia. Much of our electricity supply infrastructure is built to meet daily and seasonal peak loads, which only account for a small percentage of annual demand. About 10 per cent 'spare' capacity is required to meet the peak demand generated over 1 per cent of the year.[4]

Obviously, an effective way to reduce electricity consumption is to focus on reducing daily and seasonal peak electricity demand. But how can this be done? To begin with, governments could provide more incentives to encourage improved design of homes and commercial buildings to reduce their demand for air-conditioning.

Governments could also improve regulatory frameworks to reward utilities for encouraging customers to use electricity more efficiently, as was discussed in an earlier *Ecos* article, 'The first cuts must be the deepest'.[5] Currently there is little incentive for electricity utilities to do this.

Changing consumer behaviour

Another effective strategy for controlling peak consumption is smart metering combined with variable tariffs. This strategy, currently being followed in some national locations, could reduce seasonal and daily peak electricity load by providing customers with real-time information about consumption levels and costs during peak and off-peak periods.

Most people don't realise that the demand and price of electricity changes during the day, reaching a peak between 3 and 6 pm in OECD countries.

Consequently, they are not aware of the difference they could make through changing day-to-day usage behaviour and implementing efficiency measures. Conventional meters measure the total electricity used over a period of time, such as three months, whereupon customers receive a quarterly bill from their electricity provider. Smart meters, on the other hand, can provide customers with instant information (usually in a digital reading) about how much energy they are using, and the fluctuating price of energy every half hour.

Tariff-price reform would ensure that customer pricing more closely reflects the variable costs of producing electricity. Governments traditionally regulate pricing to ensure that retail electricity prices do not vary from day to day or even month to month. But to residential and commercial building customers, a fixed tariff suggests the cost of electricity remains roughly constant. It doesn't. So the current fixed price leads to customers over-consuming electricity during peak load, when it is at its most scarce. Small efficiency changes here could have big savings.

1 World Energy Outlook 2005. http://www.iea.org/Textbase/press/pressdetail.asp?PRESS_REL_ID=163
2 CSIRO (2006). Energy technology. www.det.csiro.au/PDF%20files/CET_Div_Brochure.pdf
3 Hargroves K and Smith M (2005). *The Natural Advantage of Nations: Business Opportunities, Innovation and Governance in the 21st Century*. (Earthscan) pp 53–55. www.thenaturaladvantage.info
4 IPART (Independent Pricing and Regulatory Tribunal of New South Wales) (1999). Regulation of network service providers: discussion paper DP-34, Sydney; IPART (2002). Inquiry into the role of demand management and other options in the provision of energy services: interim report, review report no. 02-1, Sydney.
5 Smith M and Hargrove K (2006). The first cuts must be the deepest. *Ecos* **128**, 8–11. www.publish.csiro.au/?act=view_file&file_id=Ec128p8.pdf

Demand response roadmap and smart agents

CSIRO is involved in an international effort to identify the value of demand response in national electricity markets through its participation in Australia's International Energy Agency (IEA) Demand Response Resources team, which recently released a roadmap for demand response in Australia. Demand response strategies encourage consumers to turn off appliances at times of peak demand or price in the electricity market. They are thought to be more cost-effective than building new power stations for meeting peak demands that occur for only short periods. CSIRO's Energy Transformed Flagship is also investigating the use of 'smart agents' (computer algorithms) that interact to monitor, predict and control appliance use across a network – for example, reducing power consumption in response to approaching 'spikes' in electricity price and demand.

CSIRO's Energy Transformed Flagship is investigating the use of 'smart agents' in a mini-grid connecting cool rooms, heating/air-conditioning systems, solar and wind generators and battery storage systems. In this instance, the smart agents monitoring temperature inside a cool room are able to respond to approaching 'spikes' in electricity price and demand to reduce power consumption. CSIRO Energy Technology

Momentum in Europe and the USA

In a number of countries, authorities have now accepted that instantaneous direct feedback through smart meters combined with frequent, accurate billing (electricity tariff reform) is an effective basis for sustained electricity-demand reduction in households and commercial buildings.

Smart meters are being rolled out in Italy and Sweden, and in California and Pennsylvania in the USA. Italy is in the process of rolling out smart meters to 30 million customers, while Sweden is embarking on a large rollout of smart meters nationally.

In the USA, Pennsylvania Power and Light (PPL) have installed 1.35 million smart meters. In Florida, electricity suppliers Georgia Power and Gulf Power have implemented smart meters and real-time pricing with remarkable results. Georgia Power's large customers reduced electricity demand by 20–30 per cent during peak load. Gulf Power achieved a 41 per cent reduction in load during peak times.

The USA's new 2005 Energy Bill contains a section entitled 'Smart Metering',[6] which includes a number of provisions creating new requirements for utilities, States, the Department of Energy (DOE) and the Federal Energy Regulatory Commission (FERC) in the areas of demand response and smart metering.

Australian initiatives

Australia is catching up with the smart meter movement in Europe and the USA. In 2006, for example, the Victorian Government announced its commitment to replace all old meters with smart meters over the next four to five years.

In New South Wales, as part of a large trial of smart metering and tariff reform, more than 160 000 manually read interval meters have been installed and a further 250 000 meters are to be installed over the next four years.[7]

Smart metering is also an integral part of the Federal Government's Solar Cities program. For instance, Townsville City Council will roll out 2500 smart meters and 1700 in-house energy display meters.[8]

In February 2006, the Council of Australian Government (COAG) announced its decision to 'Improve the price signals for energy investors and customers by: (a) committing to the progressive rollout of electricity smart meters to allow the introduction of time-of-day pricing and to allow users to respond to these prices and reduce demand for peak power; (b) requesting the Ministerial Council of Energy (MCE) to agree on common technical standards for smart meters and implement the rollout as may be practicable from 2007 in accordance with an implementation plan that has regard to costs and benefits, and takes account of different market circumstances in each State and Territory.'[9]

At a subsequent Ministerial Council on Energy meeting in Sydney, the State and Federal Government Energy Ministers reiterated this commitment to smart meter rollout subject to further cost–benefit analysis and consultation with stakeholders.[10]

Tangible benefits

To date, most cost–benefit analyses suggest that investment in smart meters is justified. In California, for example, where smart metering technology has been enthusiastically embraced, the results have exceeded even the optimists' hopes, with energy demand during peak periods lowered by 12–35 per cent.

With higher rates during peak times and a 'critical peak price' up to 15 times a year for short bursts when the grid really needs it, Californian consumers are benefiting. Most householders now have lower electricity bills, and a market survey showed that 90 per cent of participants support the use of smart meters and peak tariffs throughout the state.

● **Michael H. Smith** and **Karlson 'Charlie' Hargroves**, The Natural Edge Project.

More information:

Siderius HP and Dijkstra A (2006). Smart metering for households: cost and benefits for the Netherlands. SenterNovem. http://mail.mtprog.com/CD_Layout/Day_2_22.06.06/0900-1045/ID57_Siderius_final.pdf

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6 Section 1252 of the Electricity Title of the Energy Policy Act of 2005, USA
7 NEMMCO (2006). Metering and retail market development 2006 annual report. http://www.nemmco.com.au/meteringandretail/610-0112.htm
8 Townsville: Queensland's First Solar City. www.deh.gov.au/minister/env/2006/mr26sept06.html
9 COAG February 2006 – Decision 2.2. www.coag.gov.au/meetings/100206/attachment_b_ncp_review.pdf
10 Ministerial Council on Energy (2006). www.mce.gov.au/assets/documents/mceinternet/FINAL%20MCE%20Communique%20Oct%2006%20revised20061027125733.pdf