

SMART METERING, LOAD CONTROL AND ENERGY-USING BEHAVIOUR

Dr David Crossley

Managing Director Task XV Operating Agent
Energy Futures Australia IEA DSM Programme

CHANGING ENERGY USING BEHAVIOUR

Three approaches have typically been used to encourage people to change their energy-using behaviour:

- **information**, eg publications, websites, energy information centres, energy audits, energy labelling of appliances, equipment and buildings;
- **pricing**, eg inclining block tariffs and time-varying pricing, such as time of use (TOU), critical peak pricing (CPP), real-time pricing (RTP);
- **regulation**, eg minimum energy efficiency performance standards (MEPS) for appliances, equipment and buildings.

The effectiveness of the three approaches has been variable. Information alone has generally been not very effective. The effectiveness of pricing is variable: better results are achieved when combined with an information campaign and if end-use customers recognise some sort of “energy crisis”. The behavioural response to pricing often reduces over time, particularly if an “energy crisis” is seen to be resolved. Regulation has been quite effective, but it forces behaviour change rather than encouraging long-term attitudinal change. For maximum effect, regulation must achieve complete market transformation.

Technology is a (relatively) new factor that can greatly assist in achieving changes in energy-using behaviour. Two types of technology can be used to achieve behaviour change:

- advanced metering; and
- load control technology.

ADVANCED METERING

Types of Metering

Currently, recording the quantities of energy consumed by end-users is mostly carried out by using *accumulation meters* which simply record energy consumption progressively over time. However, more advanced meters are increasingly being used. *Interval meters* record the quantities of energy consumed over set, frequent time intervals. **Smart meters** include, in addition to the interval metering capability, one-way or two-way communications between the energy supplier and the meter. *Advanced Metering Infrastructure (AMI)* refers to the full measurement and collection system, and includes customer meters (usually smart meters), communication networks, and data management systems.



Capabilities of Advanced Meters

Advanced meters enable the implementation of time-varying pricing under which the price per unit of energy varies according to the time of the day. Seasonal variation in prices is also possible. Time-varying tariffs send price signals to customers that reflect the underlying costs of generating, transporting and supplying electricity, enabling resources to be allocated more efficiently. Furthermore, price-based demand response programs can reduce or shape customer demand, particularly to reduce loads at peak times on the electricity system.

LOAD CONTROL TECHNOLOGY

Components

Load control comprises a system or program that enables end-use loads to be changed in response to particular events, eg high electricity prices or problems on the electricity network.

Load control technology products can be classified as follows:

- metering and information display devices;
- appliance and equipment controllers;
- integrated load control systems.

Capabilities

The operator of the load control system may be:

- an electricity supplier or network operator;
- a market or system operator;
- a demand side response service provider; or
- the end-user themselves.

Load control technology now exists that:

- automates many energy-using activities;
- enables a single “set and forget” decision by facility operators and householders in relation to energy use;
- provides energy suppliers and network operators with flexible methods to influence the quantity and timing of energy use.

Switching of end-use loads can be carried out automatically, in response to a signal linked to a particular event (eg high energy prices or network constraints); or manually, also in response to an event. In the latter case, the local operator requires information about the event to be able to carry out the switching. Switching may be carried out locally by the end-user, or remotely by a signal sent by a load control program operator. Switching of loads may involve:

- cycling loads on and off according to pre-set timing schedules;
- reducing loads to pre-set levels; or
- switching off loads completely.

Advantage

The advantage of direct load control implemented by energy suppliers and/or system operators is that the end-use customer can simply make a one-time “set and forget” decision about changing their behaviour. This is much more convenient than having to continually make decisions about switching energy-using appliances and equipment.

METERING AND LOAD CONTROL

Metering and load control interact as follows:

- **interval metering** is necessary to implement time-varying pricing;
- **interval metering** is *not* necessary to carry out load control functions – available technology can remotely switch loads without requiring connection to a meter;
- **one-way communication** (not necessarily through a meter) is essential to carry out remote switching of loads;
- **two-way communication** is not essential to carry out remote switching of loads; and
- **metering** in some form is required for settlement of the financial transactions associated with load control programs.

SMART METERING AND SAVING ENERGY

Installing smart meters will, by itself, do nothing to save energy. Energy savings will only be achieved if installing the meters results in changing people’s behaviour so that they use less energy in total. Overseas studies suggest that rolling out advanced meters to all electricity consumers in a country may achieve, in a best case situation, savings of between four and 10 percent in total national electricity use, with corresponding savings in greenhouse gas emissions. However, energy savings at any level can only be achieved if the installation of the meters is accompanied by supporting technology and programs, such as information displays, time-varying pricing, energy audits and particularly some form of load control.

INFORMATION RESOURCES

David Crossley: crossley@efa.com.au

Energy Futures Australia, my company’s website: www.efa.com.au

The International Energy Agency DSM Programme carries out multi-national research projects on demand side management. Website for information about the IEA DSM Programme: www.ieadsm.org

The IEA DSM Programme is currently undertaking a research project on using advanced metering and load control to support electricity networks. Website for information about this project:

www.ieadsm.org/ViewTask.aspx?ID=16&Task=15&Sort=0