

Smart Metering, Load Control and Customer Behaviour

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Presentation Topics

- Changing customer behaviour
- Smart metering and behaviour change
- Load control technology and behaviour change
- Conclusions
- Information resources

Changing Customer Behaviour

Why Behaviour Change?

- A challenge facing developed countries is to achieve changes in the **quantities** of energy we use and the **timing** of when we use it
- We need to significantly increase the **efficiency** with which we use energy to combat climate change
- We need to change the **time** at which we use energy to reduce the massive expenditure required to expand electricity networks to handle peak loads
- Achieving both these goals requires significant behaviour change in the ways in which we currently use energy

Role of Technology

- Technology is a (relatively) new factor that can greatly assist in achieving changes in energy-using behaviour
- Two types of technology have the potential to achieve behaviour change:
 - ▶ smart metering; and
 - ▶ load control technology

Smart Metering and Behaviour Change

Types of Metering

- **Accumulation meters** simply record energy consumption progressively over time
- **Interval meters** record the quantities of energy consumed over set, frequent time intervals
- Typically, the minimum time interval set for recording energy consumption is every 15 minutes and the maximum interval is every hour
- **Smart meters** are interval meters with one-way or two-way communications between the energy supplier and the meter

Capabilities of Smart Metering

- Interval meters enable implementation of time-varying energy pricing in which the energy price varies during the day, eg high prices can be set during peak periods when the energy system may be constrained
- 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

Customer Response to Time-Varying Prices

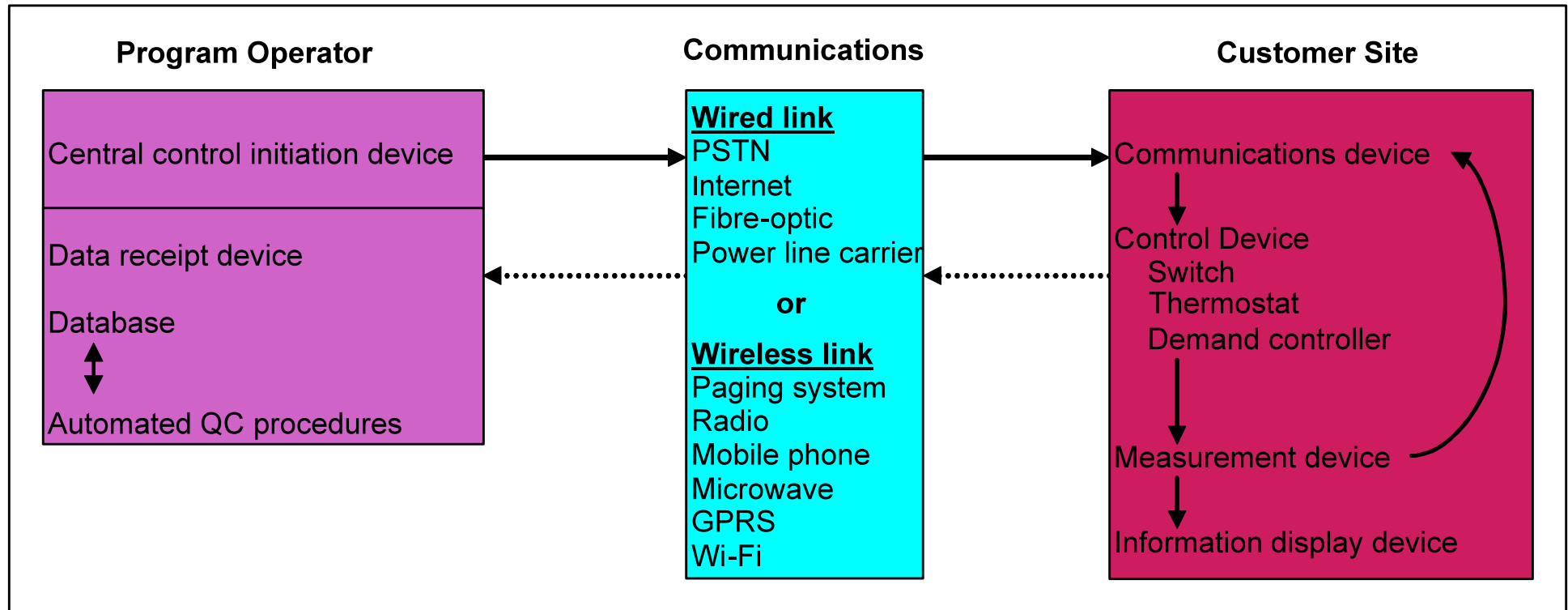
- Price-based demand response programs are implemented to reduce or shape customer demand, particularly to reduce loads at peak times
- The effectiveness of these programs depends on customers changing their behaviour in response to price signals
- Customers may change their behaviour for a period of time (months?) after time-varying prices are introduced
- However, this response usually decays over time as customers find that their financial savings are minimal and the effort required to respond to price changes is large

Load Control Technology and Behaviour Change

What is Load Control?

- 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
- 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 System



Components of a Load Control System

Capabilities of Load Control Technology (1)

- Load control technology now exists that enables switching of end-use loads to be carried out:
 - ▶ **automatically**, in response to a signal linked to a particular event, eg high energy prices or network constraints
 - ▶ **manually**, also in response to an event (the initiator of the switching requires information about the event)
- Switching may be carried out **locally** by the end-user, or **remotely** by a signal sent by a load control program operator

Capabilities of Load Control Technology (2)

- 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
- Load control technology provides energy suppliers and network operators with flexible methods to influence the quantity and timing of energy use
- Smart meters are **not** necessary to carry out load control; switching signals do not necessarily have to pass through the meter

Customer Response to Load Control Programs

- Load control technology enables a single “set and forget” decision by facility operators and householders in relation to energy use
- Customers can set a price level above which selected appliances or equipment will be automatically controlled
- The effort required by customers to respond to time-varying prices is greatly reduced and customers generally respond by changing their behaviour with little decay in their response over time
- The most successful load control programs enable customers to override any automated settings, eg for special events

Conclusions

Metering and Load Control (1)

- **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

Metering and Load Control (2)

- **Two-way communication** is not essential to carry out remote switching of loads but it can provide valuable information to the program operator about the results of the switching
- **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
- Some studies suggest that rolling out smart meters to all electricity consumers in a country may achieve savings of between **4% and 10%** in total national electricity use
- However, energy savings 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

Information Resources

- David Crossley: crossley@efa.com.au
- Energy Futures Australia, my company's website: www.efa.com.au
- In 2009, the IEA DSM Programme completed 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