

# 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

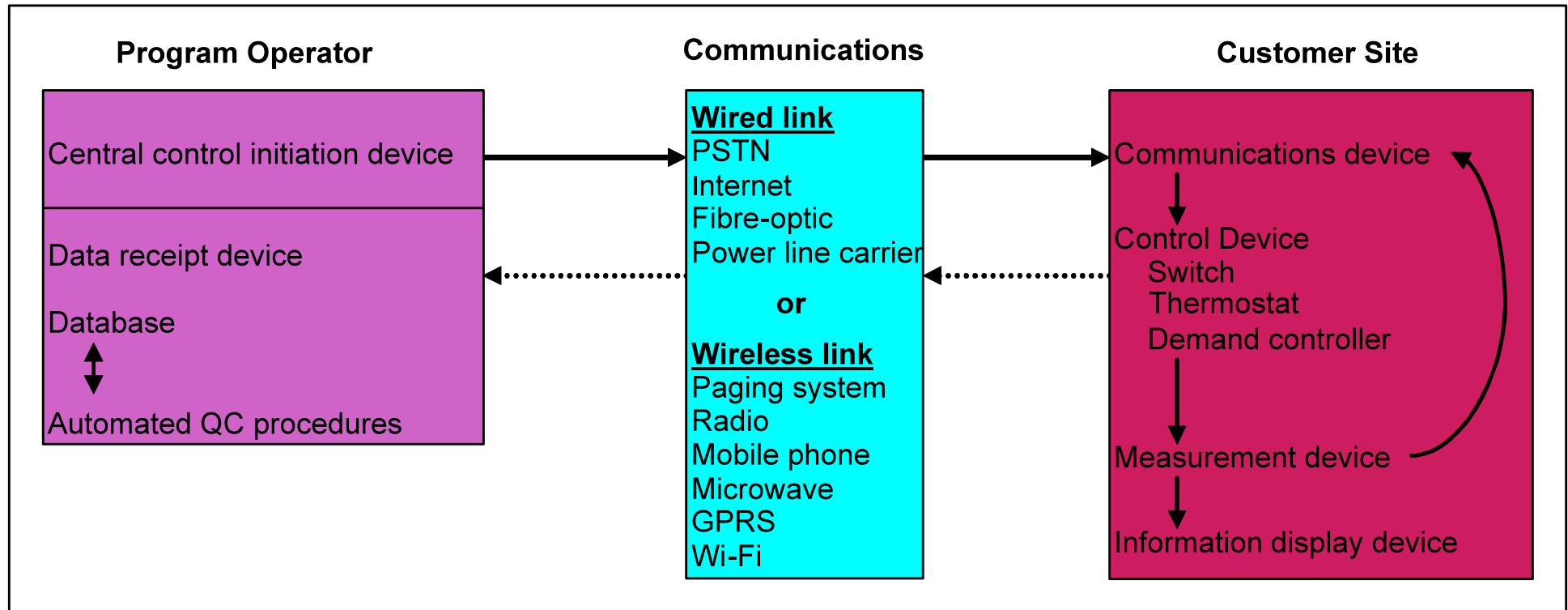
- Price-based demand response programs are implemented to reduce or shape customer demand, particularly to reduce loads at peak times
- The effectiveness of these programs depends on customers changing their behaviour in response to price signals
- Customers may change their behaviour for a period of 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](mailto:crossley@efa.com.au)
- Energy Futures Australia, my company's website: [www.efa.com.au](http://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](http://www.ieadsm.org/ViewTask.aspx?ID=16&Task=15&Sort=0)