# *Investigation of Efficient Operation of Price Signals in the Electricity Market*

Stakeholder Reference Group Meeting

October 2011

pwc

# *Outline*

## Overview of our task

The purpose of this presentation is to provide some preliminary findings to the AEMC's Stakeholder Reference Group for the Power of Choice Review on the analysis of the efficient operation of price signals in the NEM.

Based on the terms of reference provided by the AEMC, the presentation will address the following questions:

- What is an economically efficient electricity price?
- Would existing prices be expected to encourage economically efficient outcomes?
- What market conditions influence the efficiency of prices and the proposed response by consumers?

# *Our task*

PwC has been engaged by the AEMC to provide advice on the efficient operation of price signals in the NEM, including:

- The costs incurred in the provision of electricity services and the implications for efficient pricing
- The extent prices retailers charge to consumers reflect the costs they face
- Whether increasing the cost-reflectivity of prices would result in overall efficiency gains

In doing so, we are to have regard to market conditions that may impact on the ability to set efficient prices, and for consumers to respond

# *What is an efficient electricity price? (1)*

## An efficient price should achieve two outcomes

1. Allow a business to recover at least the cost of providing a good or service, and
2. Provide a signal to consumers about the costs of consumption

The costs that are most relevant for encouraging efficient demand-side participation are the marginal costs of supply

- These are the costs that vary as consumption varies

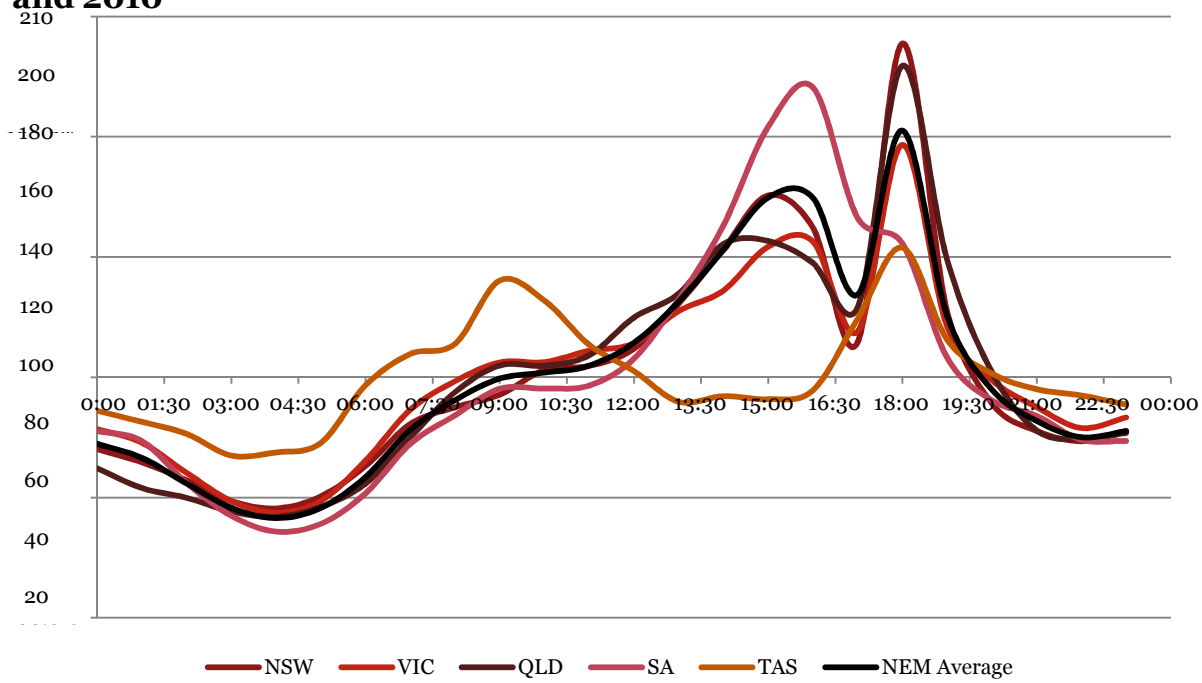
Where costs are properly signalled to consumers, and consumers are aware of the price and practicably able to respond, consumption should be efficient

# *What is an efficient electricity price? (2)*

## Wholesale costs

Rationale exists for energy component of prices to vary throughout the day

**Relative average hourly prices in the NEM by jurisdiction between 1999 and 2010**

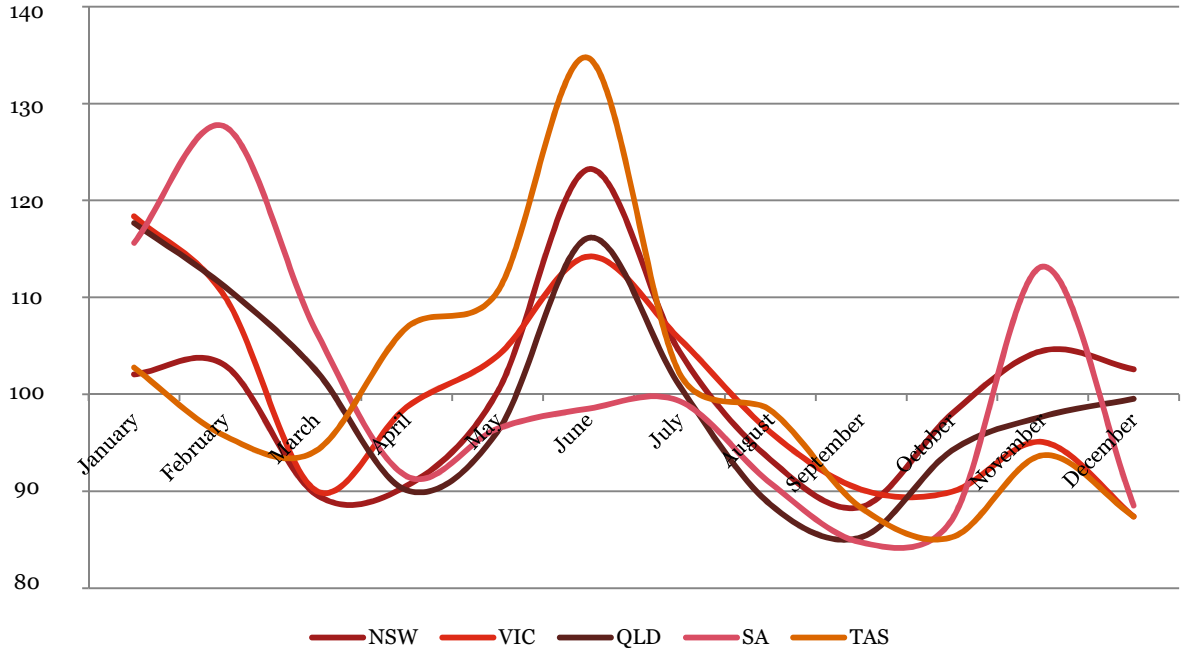


# *What is an efficient electricity price (3)*

## Wholesale costs

Rationale also exists for energy component of prices to vary throughout the year

**Relative average monthly prices in the NEM by jurisdiction between 1999 and 2010**



# *What is an efficient electricity price (4)*

## Wholesale costs

Rationale for higher price when higher pool price occurs e.g. critical peak pricing

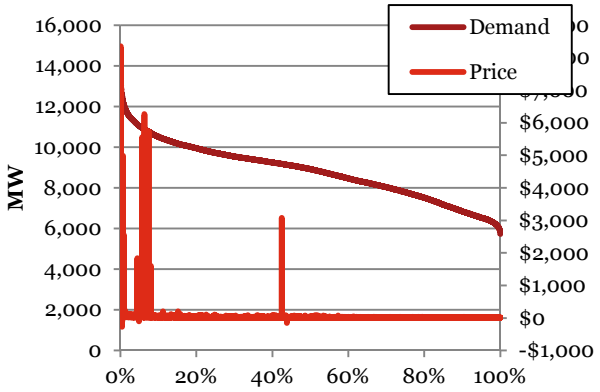
Note, high prices are not always driven by demand – therefore may occur at unpredictable times

**Table 1: Impact of peak prices on the average wholesale price 2010**

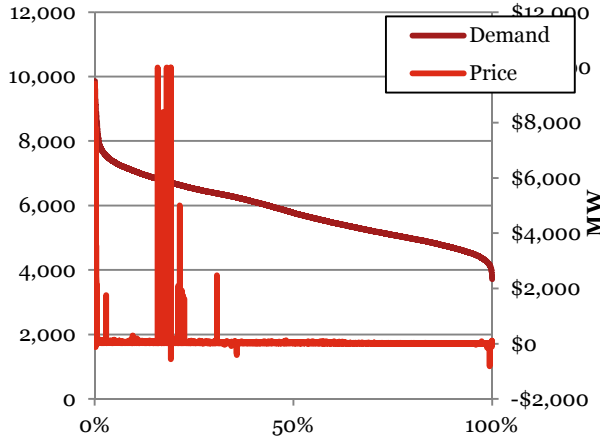
| | NSW | VIC | QLD | SA |
|---|---|---|---|---|
| ***Average Price (all data)*** | $30.89 | $34.44 | $25.53 | $40.28 |
| ***Average price (with top and bottom one percent of prices removed)*** | **$25.13** | **$23.95** | **$21.60** | **$25.42** |

# What is an efficient electricity price (5)

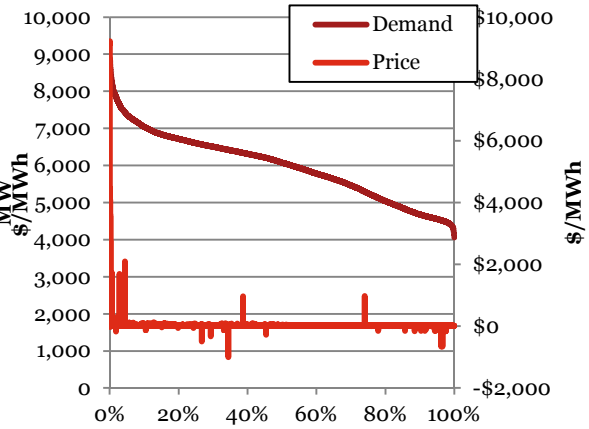
**Correlation demand and price - New South Wales**



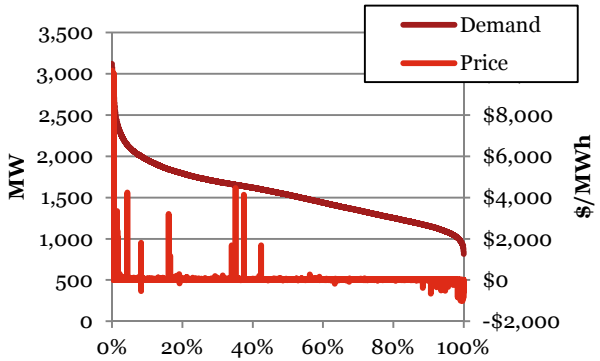

**Correlations demand and price - Victoria**



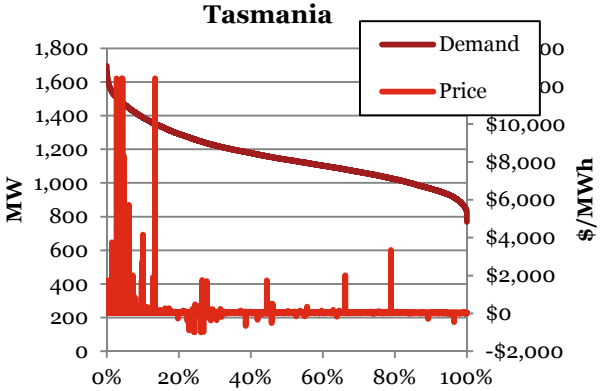

**Correlations demand and price - Queensland**




**Correlations demand and price - South Australia**




**Correlation demand and price - Tasmania**



# *What is an efficient electricity price? (6)*

## Network costs

Network costs are predominately driven by peak demand (with contingency to deal with uncertain events), therefore, marginal costs for usage at all other times are very low

Network prices could be expected to be efficient when:

- They are highest at times of peak demand,
- Particularly high where an event threatens supply (network outage, unexpected demand)
- Lower at all other times

Due to economies of scale LRMC pricing may not allow for recovery of all costs (LRMC below average costs)

- Economic theory suggests that any residual costs should be recovered through fixed charges so to maintain efficient signals for consumption

# *What is an efficient electricity price? (7)*

## Retail operating costs

Retail operating costs include:

- Consumer acquisition costs
- Billing and IT systems
- Consumer management (e.g. call centres), and
- Meeting government policy objectives (e.g. feed-in schemes etc)

Costs are driven by consumer numbers rather than electricity consumed

Implies that retail operating costs should be predominately recovered through fixed per consumer charges

# *Do existing electricity prices reflect efficient outcomes? (1)*

Broad range of pricing offers are available for retail and network

## Accumulation meter prices

- **Flat tariffs** – do not vary by the time of day or the year
- **Inclining block tariffs** – prices increases as certain consumption thresholds are met

## Interval meter prices

- **Time of use -** prices vary based on time of day, the week, or weekend (typically include peak, shoulder, off-peak)
- **Critical peak prices** – prices set to reflect expected costs of meeting high cost events (unique demand conditions, outage etc)
- **Peak time rebate** – provide a payment for a limited number of hours or days where energy costs are high should consumers reduce demand
- **Wholesale cost pass-through** – actual wholesale prices passed through to consumers

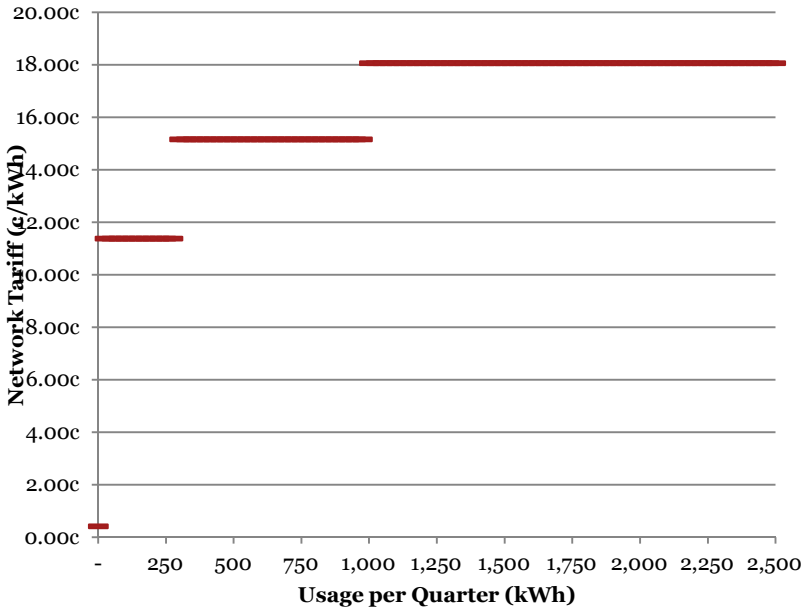
# *Do existing electricity prices reflect efficient outcomes? (2)*

## Network tariffs

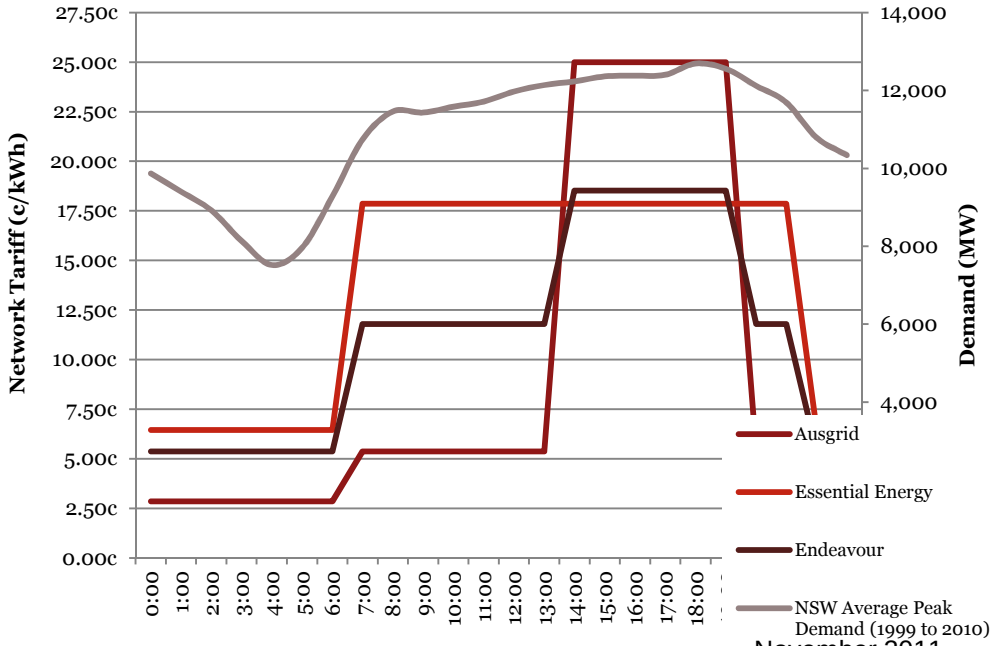
Inclining block tariffs may not be effective in signalling costs of network services as they are independent of the timing of consumption

Some consistency between demand profile and TOU tariffs

**Inclining block network tariff for South Australia**



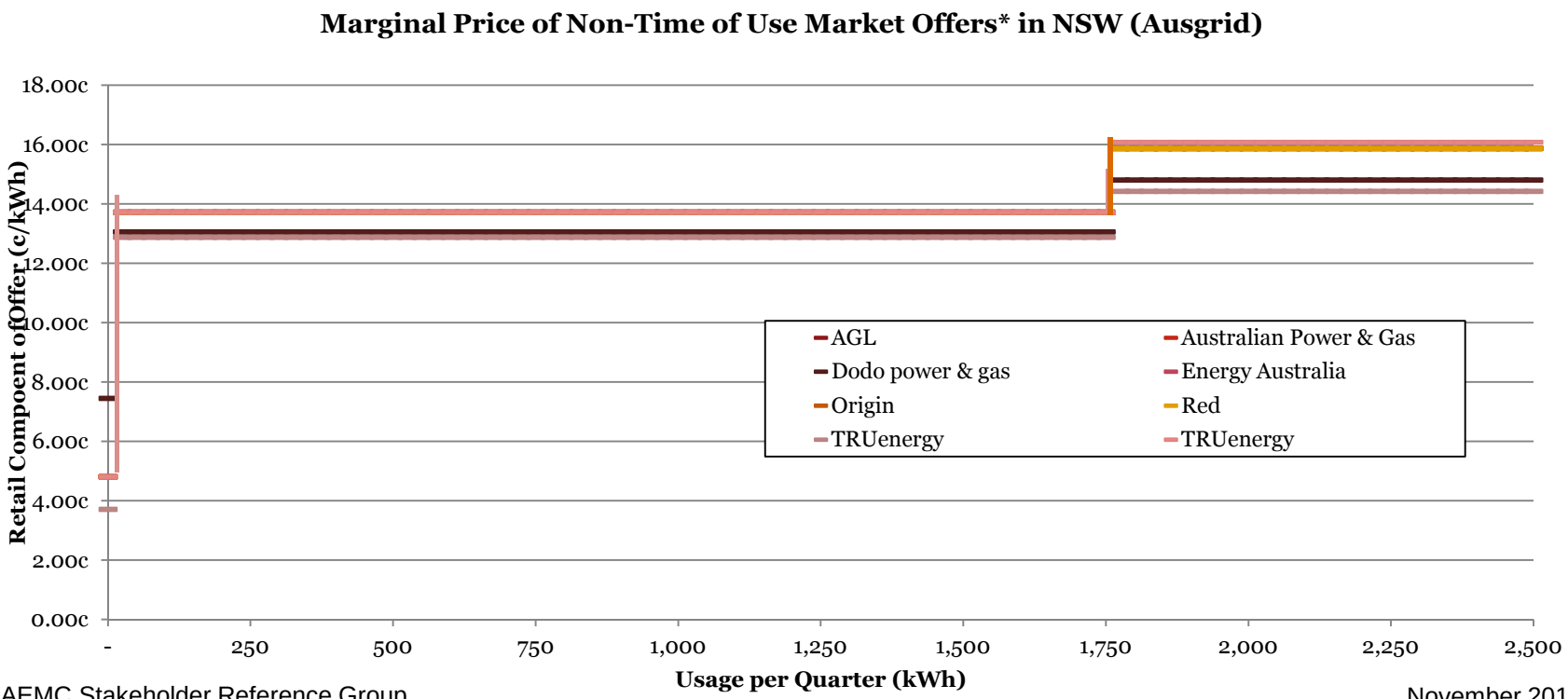

**Time of use network tariffs for NSW**



# *Do existing electricity prices reflect efficient outcomes? (3)*

## Retail components of tariffs

Most retail tariffs do not vary by time of day – instead marginal prices dependent on volume per quarter (inclining block)



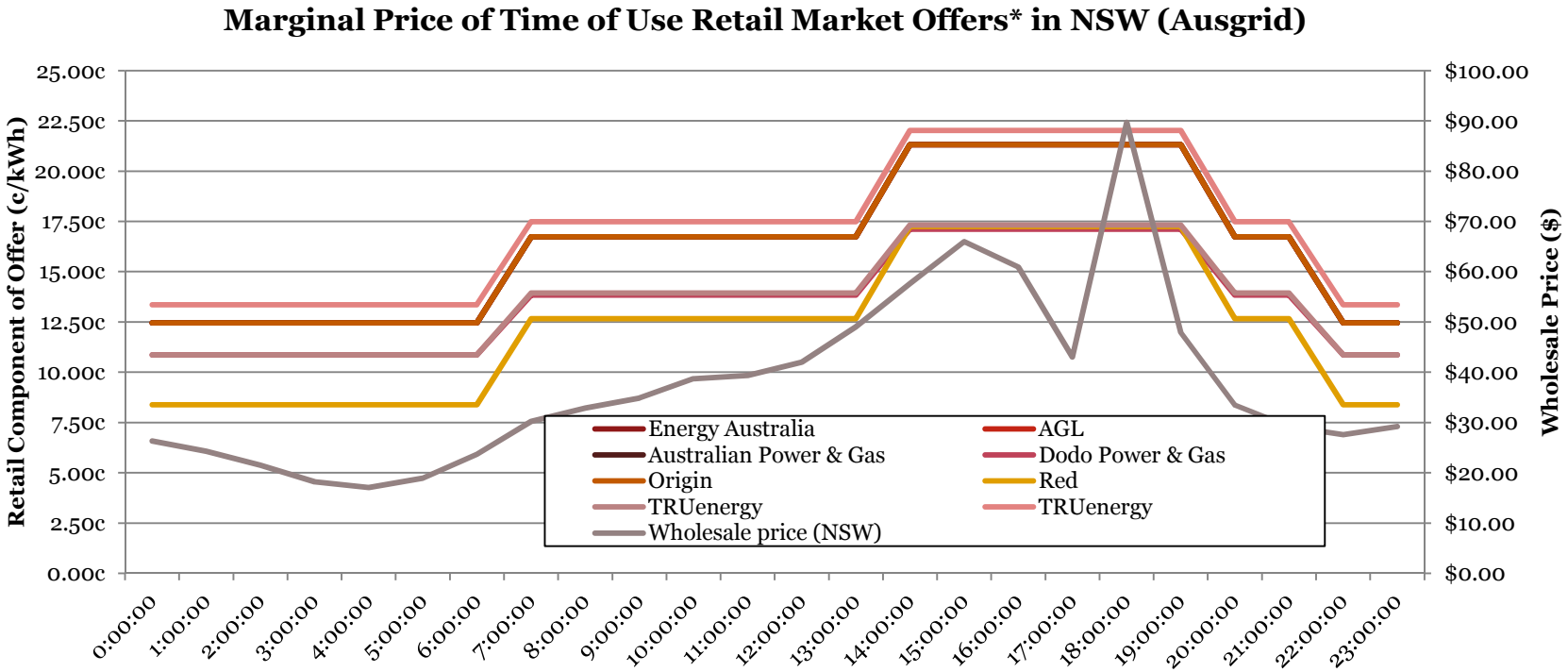

* Network tariff component relating to Ausgrid has been removed from the total retail offer

# *Do existing electricity prices reflect efficient outcomes? (4)*

## Retail components of tariffs

Time of Use tariffs do a better job of aligning with wholesale prices in some jurisdictions

Whether they are above or below the wholesale price curve depends on whether fixed costs are recovered fully through the fixed retail charge

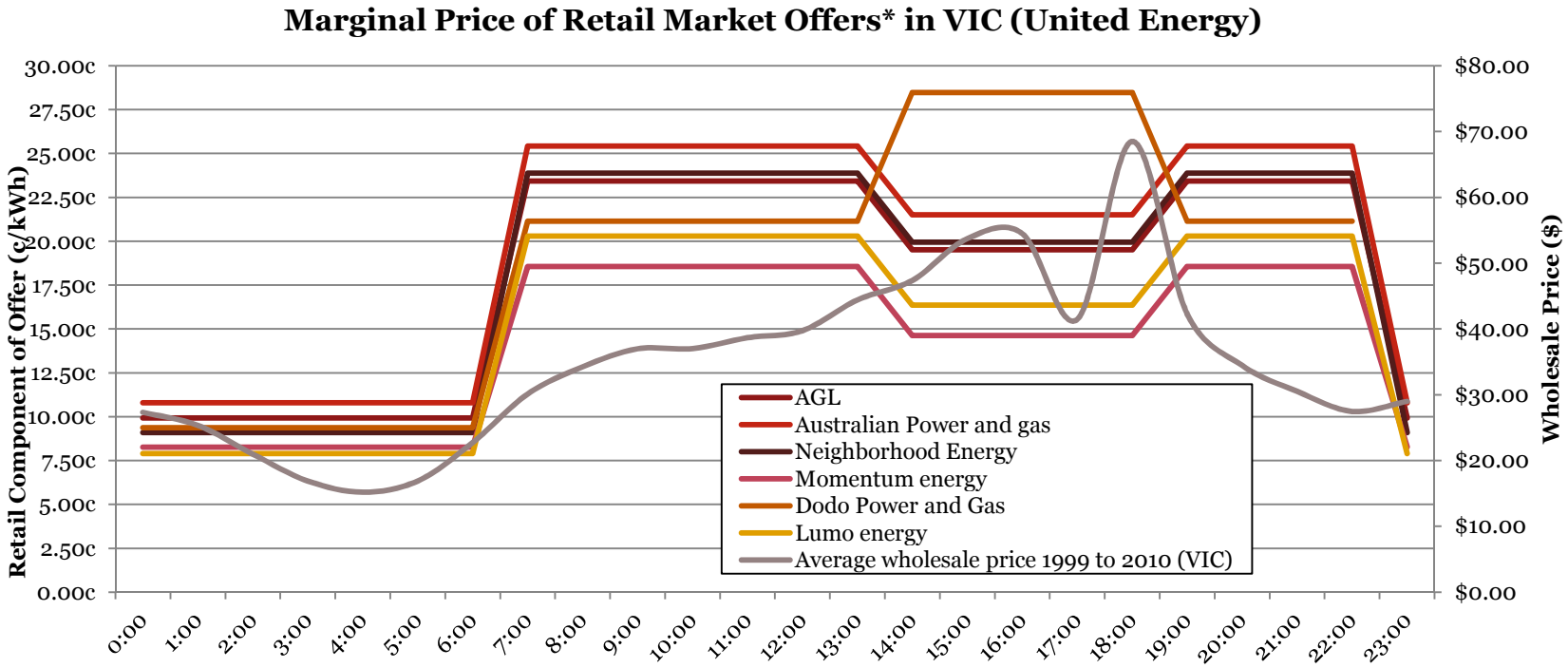



*Network tariff component relating to Ausgrid has been removed from the total retail offer

# *Do existing electricity prices reflect efficient outcomes? (5)*

## Retail components of tariffs

However, not all jurisdictions have effective time of use tariff structures for retail component




*Network tariff component for United Energy has been removed from the total retail offer

# *Do existing electricity prices reflect efficient outcomes? (6)*

## Retail components of tariffs

If prices are efficient expectation would be similar variable charges in a jurisdiction given one wholesale price set for a region (ignoring network losses)

- Similarity in variable component may just reflect relativity to regulated tariff
- Difference in fixed component may reflect higher cost to serve in regional areas – e.g. higher door-to-door marketing costs

**Table 2: Comparison of fixed and variable rates for retail component (i.e. network component removed) of tariffs in NSW (non ToU)**

| | Daily Service Charge (c/day) | Average Energy Usage Rate (c/kWh) |
|---|---|---|
| *Ausgrid Area* | 16.818 | 10.094* |
| *Essential Area* | 27.331 | 11.155 |
| *Endeavour Area* | 31.43 | 15.41 |

# *Do existing electricity prices reflect efficient outcomes? (7)*

## Retail components of tariffs

There are very different patterns in variable component of time-of-use tariffs between distribution regions

**Table 3: Comparison of fixed and variable rates for retail component (i.e . network component removed) of tariffs in NSW (ToU Tariffs)**

| | Daily Service Charge (c/day) | Peak (c/kWh) | Shoulder (c/kWh) | Off Peak (c/kWh) |
|---|---|---|---|---|
| *Ausgrid Area* | 43.240 | 24.459 | 4.840 | 2.320 |
| *Essential Area* | 55.474 | 10.780 | 10.123 | 8.565 |
| *Difference* | **-12.234** | **13.679** | **-5.283** | **-6.245** |

# *Market conditions – Consumer drivers (1)*

## Electricity as a consumable good – but it's different to other consumables

- Electricity itself is intangible, although its benefits are not
- Supply of electricity is continuous and needs to meet peak demand - it is difficult for consumers to understand the cost of using electricity
- There are no, or at least limited, alternatives to electricity in most circumstances
- Electricity suppliers cannot differentiate their product - they can compete on price and customer service

## What are the decisions faced by customers for electricity?

1. The choice of electricity supplier or retailer
2. The choice of when and how much electricity to consume
3. The choice of what electricity dependent appliances to purchase

## Factors that may influence the decisions of consumers

| | | | | | |
|---|---|---|---|---|---|
| **income** | **level of education** | **norms and expectations** | **size of household** | **whether they are tenants or owners** | **available information** |

Can be influenced by retailers

# *Market conditions – Consumer drivers (2)*

## How are consumers making decisions?

Long run decisions:

- Choice of retailer and the choice of appliance

Short run decisions

- How much electricity to consume at a particular point in time

Consumers are more sensitive to longer term price rises

If consumers behave rationally they should:

- Choose the retailer with the best price
- Choose appliances that minimise the total cost of its use over its life (upfront cost + energy cost)
- Consume electricity when the value they obtain is greater than the price they pay

However, there are likely to be a number of behavioural factors that inhibit rational decision making by consumers

# *Market Conditions – Consumer Drivers (3)*

| | Searching | Obtaining | Acting |
|---|---|---|---|
| Limited consumer capacity | Awareness of challenges means that consumers do not search at all | Consumers adopt pre-existing 'rules of thumb' or shortcuts to navigate and sort information | Consumers may switch to an option that is 'better' but may not be best for them |
| Status quo bias | Consumers do not search for alternatives | Consumers over-emphasise knowledge and benefit of existing provider or package | Consumers do not switch away from current provider or package |
| Loss aversion | Consumers are less inclined to search when prices fall than when they rise | Consumers place more weight on potential losses relative to potential gains | Consumers postpone making a decision |
| Time inconsistency | Consumers do not search for alternative energy deals or pursue energy efficient appliances | More emphasis on short term discounts or less emphasis on long term savings | Consumers do not make a decision or choose a sub-optimal option |
| Comparative norms | Consumers rely on information presented by other consumers | Consumers place a high weight on actions of others | Consumers choose the option that, although popular, may not be best for them |

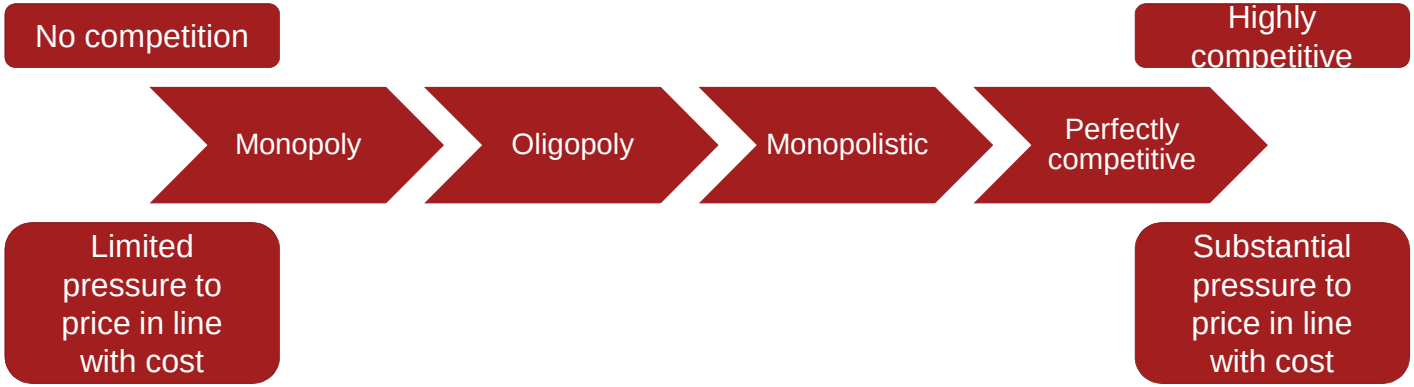
# *Market conditions – Business drivers (1)*

## Competition is important for efficient pricing

Rivalry between businesses provides a discipline, and incentive, to price close to cost

- That is, at a retailer's own marginal costs, e.g. wholesale costs, customer acquisition costs and billing, and
- Retailers should have incentive to pass through the structure of network tariffs

The size of the incentive to price at cost depends on the effectiveness of competition



# *Market conditions – Business drivers (2)*

## Regulated tariffs likely to influence competitive outcomes

Regulated tariffs seek to protect customers from inefficient pricing until competition becomes effective. However, regulated tariffs may act as a focal point around which companies compete.

- May provide a reference point to competitors that encourages coordinated behaviour
- Constrains structure of competitive offers

## Incentives to set efficient prices

Retail:

- Efficient price setting protects retailers against risk
- If the variable component of tariffs is set too high there will be an undue reliance on throughput
- Settlement based on net system load profile reduces incentive to encourage load reduction

Network:

- The Rules framework directs NSPs to set prices on the basis of long-run marginal costs
- Existence of side constraints may limit the capacity for NSPs to set cost reflective prices

# *Market Conditions – Technology drivers (1)*

Interval meters are a pre-condition to:

- Setting efficient prices, and
- Assuming the meter is used in wholesale settlement, for providing incentives for retailers in a competitive market to utilise non-price options to encourage efficient behaviour (as settlement no longer occurs on deemed profile and retailers face the marginal costs of a customer's use)

Technology can assist consumers' response to prices by:

- Conveying information about the cost of electricity and their use
- Helping them to make a physical response (e.g. direct load control)

Interval meters come at a cost, therefore, the benefits of their use dependent on the benefits that can be derived from improved price and non-price activities

# *Market Conditions – Technology drivers (2)*

## Supply-side functions required to facilitate efficient pricing

| Function | Enabling technology | Availability of technology | Cost of technology | Potential for enhancing efficient price signals |
|---|---|---|---|---|
| Provision of electricity usage information | Accumulation meters / pre-pay meters | Already common | Low | Limited |
| | Interval meters (local read) | Common for large users | Medium | Moderate (depending upon load predictability) |
| | Smart meters (remote read) | Many options available | Medium - high | High |

# *Market Conditions – Technology drivers (3)*

## Demand side functions required to facilitate efficient response to price

| Function | Enabling technology | Availability of technology | Cost of technology | Potential for enhancing efficient price signals |
|---|---|---|---|---|
| Provision of electricity usage information | Accumulation meters / pre-pay meters | Already common | Very low | Very limited |
| | Interval meters (local read) | Common for large users | Low | Very limited |
| | Smart meters (remote read) | Available – but not widely marketed | Medium - high | Very limited |
| | In home displays – energy usage only (either aggregate usage or dis-aggregated by equipment) | Available – but not widely marketed | Medium | Limited - Medium |
| Provision of electricity cost information | Electronic information via computers / mobile devices | Available – but not widely marketed | Medium | Medium |
| | In home displays - energy usage and cost (either aggregate cost or dis-aggregated by equipment) | Available – but not widely marketed | Medium - high | Medium |
| Ability to reduce and/or shift demand (load control) | 'Dumb' controls on individual equipment (start time programming or delay functions) | Already common | Low | Medium (better when combined with an in-home display) |
| | Remote control (via contracts that enable the utility to control equipment remotely) | Not widespread | Medium | Medium |
| | Smart controls that can communicate with various equipment (e.g. Home Area Networks) | Not widespread | High | High |

- Although smart controls / home area networks and in-home displays do not necessarily require smart meters instead they could operate via a hard-wire link to a standard interval meter, or utilise the internet

# *Market Conditions – Technology drivers (4)*

## Technologies that are likely to best facilitate efficient response to price signals

- **Smart controls that enable users to automatically optimise their operating profile** based on price data and operator programmed constraints – may have the potential to be highly effective but are unproven
- **Remote control of appliances** – that enable users to provide the energy service provider with (limited) control over when certain appliances are operated – have the potential to be moderately effective overall and may be highly effective during the highest price periods.
- **In home displays** – especially those that display cost information, – have the potential to be effective so long as users actively engage.

## Links between behavioural aspects and technology

- Given the limited consumer capacity to assess benefits and costs automation of the process of load control/shifting may be necessary
- However, status quo bias and risk aversion means consumers may only cede limited control of equipment to utility companies – opt out schemes may be an option
- Consumer education and acceptance is likely to be the biggest challenge encountering technologies that can assist with efficient response to price signals. The rate of acceptance is likely to be linked to perceptions over the magnitude of cost savings available (which in turn will be linked to perceptions over the cost of electricity).