Dr Bruce Mountain
Director
CME Australia

Energy, carbon, finance: The business of markets

Sydney, Tuesday 17 October 2017
• Wholesale
• Networks
• Retail
• Distributed energy
Wholesale
Average spot prices ($/MWh): highly variable, now at record highs
Grid demand index: declining mostly
Average per capita demand (kW/person/hour): large declines

Per capita average hourly consumption demand: National Electricity Market

(kilowatts-per person per hour)

Trend changes in peak demand 2007 to 2017: generally declining
Networks
Total expenditure allowances in three regulatory periods: govt v private disparity
Change in asset value by asset type: mostly substations where govt owned
Change in substation capacity and peak demand per connection from 2006 to 2013: supply far exceeds demand, particularly where govt. owned.
Pecuniary benefit, regulated assets per connection and regulated revenue per connection for government distributors: profits proportion to RAB
Regulated asset value per connection ($’000 per connection) for electricity distributors in New Zealand, Great Britain, Australia and Ontario (2015 Australia dollars, PPP exchange rates)
Retail
Bill break-down residential – VIC: retail dominates

Figure 19: Residential bill disaggregation based on average bill from sample (4 MWh)

TOTAL $1,388

Source: Based on CME electricity analysis, Figure 30, p. 63
International comparison of retailers’ charge: Australian’s retailer charges much higher than in Europe

Figure 20 Interstate cross country comparison of retailer charges for their retail services, to residential customers (cents per kWh)

Source: Based on CME electricity analysis, Figure 35, p. 68
Break-down of fixed charges: retailer fixed charges disproportionately high

Figure 22 Annual fixed retail, fixed network and metering charges, bill data

Source: Based on CME electricity analysis, Figure 23, p. 50
Saving from switching: lots of money on the table. Why?

**Figure 24** Savings that could be achieved if consumers switched electricity offers

Source: Based on CME electricity analysis, Figure 42, p. 77
Saving from switching as percentage of bill: ditto

Figure 23: Distribution of savings by level of consumption

% as defined as reduction of the total bill

Savings $%

Savings $

Consumption class

Source: Based on CME electricity analysis, Figure 41, p. 76
Distributed energy
Behind-the-Meter (BtM) PV v Grid for households: PV installation now at record high can be no surprise

<table>
<thead>
<tr>
<th></th>
<th>VIC</th>
<th>NSW</th>
<th>SA</th>
<th>QLD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowest grid variable price</td>
<td>15</td>
<td>17</td>
<td>34</td>
<td>20</td>
</tr>
<tr>
<td>Typical grid variable price</td>
<td>27</td>
<td>29</td>
<td>41</td>
<td>27</td>
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<tr>
<td>Highest grid variable price</td>
<td>45</td>
<td>44</td>
<td>55</td>
<td>34</td>
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<tr>
<td>Average solar price</td>
<td>6.3</td>
<td>6.0</td>
<td>5.5</td>
<td>5.5</td>
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BtM PV 6 - 10x cheaper than grid variable price in SA

BtM PV 2.5 - 7x cheaper than grid variable price in VIC

- Installed price of PV dropped ~80% over last 7 years. Nationally 1/5 detached/semi-detached households now with PV (1/3 in SA and QLD).

- PV clearly much cheaper than grid, but PV typically only displaces ~ 30% of grid consumption for typical house. Surplus PV production exported to the grid, currently receives around 10 cents per kWh (~doubled in last year).

- Rooftop PV pays for itself in almost all cases with north or west facing roof. Rapid growth also in commercial sector

- Monthly installation rate at all-time high in August 2017 (100 MW, costing ~ $150m).

* Grid prices from MarkIntell on 13 September 2017. All prices inclusive of GST
Behind-the-meter battery economics for households: rapidly getting there for small customers

<table>
<thead>
<tr>
<th>The benefit</th>
<th>cents per kWh</th>
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<tbody>
<tr>
<td>Grid-only arbitrage (median peak minus off-peak prices)</td>
<td>17 24 40 18</td>
</tr>
<tr>
<td>Solar/grid arbitrage (lowest grid price minus avg. solar)</td>
<td>8 11 28 14</td>
</tr>
<tr>
<td>Solar/grid arbitrage (median grid price minus avg. solar)</td>
<td>21 23 35 21</td>
</tr>
<tr>
<td>Solar/grid arbitrage (highest grid price minus avg. solar)</td>
<td>39 38 50 28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>The cost</th>
<th>Cents per kWh stored and reproduced per day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tesla PW2**</td>
<td>28</td>
</tr>
<tr>
<td>Bloomberg capex estimate</td>
<td>25</td>
</tr>
</tbody>
</table>

* Grid prices from MarkIntell on 13 September 2017
** $11k annualised at 2% (real) over 10 years, zero residual, 90% round-trip efficiency

- For households in SA, benefits from grid-only arbitrage or grid/PV arbitrage comfortably exceed costs. Elsewhere, benefits exceed costs for expensive retail offers.
- PV + Battery allows grid-independence for 70-100% of consumption. Optimal battery/PV sizing for households depend on many factors.
Grid+PV+Battery dearer than grid-only for representative household in Victoria, but the gap is narrowing.
Policy issues arising

• Distributed energy technology development, and price/quality failure in the shared system driving decentralisation. Continued decentralised technology development certain but resolution of price failures in shared system remains unclear.

• Governments concerned about electricity prices should focus on ensuring households and businesses can take advantage of BtM PV, and increasingly also batteries.

• Grid still valuable as back-up/decentralised trading/ diversify risk. Continued decline in dependency on shared grid is certain. Incentives for grid by-pass are very strong in some places.

• Network asset values, particularly of government-owned distributors reflect historic write-ups, indexation at CPI and gold-plating. Asset write-down to bring regulatory values to economic value essential to ensure those dependent on the grid do not disproportionately bear burden of past policy failure & to avoid wasteful grid by-pass.

• For government distributors this is fiscal and political. For private distributors, legitimate concerns about political appropriation arise.
Annual Dinner

Dr Philip Lowe
Governor
Reserve Bank of Australia

Recent Developments in the Australian and Global Economy

Tuesday 21 November, Four Seasons Sydney

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