The Future Energy Market

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August 11, 2012
Australia’s power market issues -

- Technology is moving the dial and empowering the end user
  - User control (the internet)
  - Smart Grid
  - Solar (distributed energy), puts the power under the user’s control
  - Solar storage at the household level is increasingly possible

- Environment
  - Electricity production is the single biggest contributor to global warming
  - Global warming is a big problem
  - Technology has answers

- Market structure doesn’t stand still
  - Vertical integration, likely to increase but may not matter
  - Network competition?

- The problem for policy makers- how to get out of the way.
  - Network Pricing regulation at the expense of policy and planning development?
  - Network Pricing regulation hasn’t worked anyway
  - Retail pricing regulation hasn’t done much good. Prices in NSW higher than Victoria, used to be lower

Source: Frontier Economics
Europe hints at the future

- Renewables to wipe out 50% of profits
  - Half to 2/3rds central European generation EBITDA may be wiped out

- German renewables have crashed spot price and spreads in just two years
  - Solar is eliminating mid-day peaks
  - Wind is crashing night time spot prices.

- Source: UBS research, 19 July 2012
It works: Europe’s Carbon output expected to fall

- Despite low carbon price. Carbon emissions forecast to fall faster than 1.74% target reduction rate
Global warming

- Coal is the main problem
- Renewables – looking more like an answer

Global thermal coal consumption

Source: BP

Cumulative carbon emissions

Source: BP

Weather catastrophes in Asia 1980-2011

Source: Munich Re

Annual carbon emissions

Source: BP
China – What are the limits?

- Coal remains dominant 56% by 2020.
- Nuclear, gas, wind, solar slowly gain share

Source: UBS e
An inventory of where we are -

- Adversarial network regulation that has lead to strong investment even in the face of flat volumes. Enquiries and reviews at every level of Government.
- Real electricity tariffs that in the past few years have reversed 50 years of real price declines
- A generation market with sub standard returns.
- A growing renewables market which struggles to keep a constant policy and incentive system for two years in a row
- A well designed Carbon “Tax” that should benefit Australians, since we learned from Europe’s mistakes, but which is used as a political weapon and likely to be scrapped at large cost to taxpayers
- An increasing vertically integrated electricity market which may see a decline in utility of the pool.
Solar seems like a good challenge for policy and technology

- 66% fall in installed cost in A$ in two years.
- 30% of daytime electricity in Germany
- European thermal generation ebitda forecast to halve by 2020!
- Grid parity encourages solar

Global annual solar installation to go to 40 GW

Source: UBSe
Solar – Empowers the consumer

- Has reached grid parity in NSW
  - Assumes all electricity can be consumed behind meter
  - Ignores STC benefit (2012 $4K)
  - Discount rate 7.8%
- Greatly empowers the consumer
- A typical “disruptive” technology like Itunes, Personal Computers, digital media
- Paybacks of around 6 years with solar credits and 10 years without
- Gap likely to increase over time
- User control of their system
  - Monitor use
  - Pay bills.
  - Control devices

Grid parity estimates – no subsidy, system cost $4K/Kw

Source: UBSe, based APVA

Grid Parity Gap grows

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2020</th>
<th>Compound</th>
</tr>
</thead>
<tbody>
<tr>
<td>NSW</td>
<td>300</td>
<td>380</td>
<td>3%</td>
</tr>
<tr>
<td>Solar (5KW)</td>
<td>270</td>
<td>195</td>
<td>-4%</td>
</tr>
<tr>
<td>Solar % of grid</td>
<td>90%</td>
<td>51%</td>
<td></td>
</tr>
</tbody>
</table>

PV solar system costs 2013 $KW

Source: UBSe
Solar – Subsidies planted the seed

Solar penetration top postcodes

<table>
<thead>
<tr>
<th>Location</th>
<th>State</th>
</tr>
</thead>
<tbody>
<tr>
<td>Banora Point</td>
<td>NSW</td>
</tr>
<tr>
<td>Chambers Flat</td>
<td>QLD</td>
</tr>
<tr>
<td>Mount Barker</td>
<td>QLD</td>
</tr>
<tr>
<td>Mawson Lakes</td>
<td>SA</td>
</tr>
<tr>
<td>Seaford</td>
<td>SA</td>
</tr>
<tr>
<td>Calamvale</td>
<td>QLD</td>
</tr>
<tr>
<td>Victoria Point</td>
<td>QLD</td>
</tr>
<tr>
<td>Alstonville</td>
<td>NSW</td>
</tr>
<tr>
<td>Bibra Island</td>
<td>QLD</td>
</tr>
<tr>
<td>Burpengary</td>
<td>QLD</td>
</tr>
<tr>
<td>Ormeau</td>
<td>QLD</td>
</tr>
<tr>
<td>Hallett Cove</td>
<td>SA</td>
</tr>
<tr>
<td>Ellenbrook</td>
<td>WA</td>
</tr>
<tr>
<td>Jimboomba</td>
<td>QLD</td>
</tr>
<tr>
<td>Aldinga</td>
<td>SA</td>
</tr>
<tr>
<td>Currency Creek</td>
<td>SA</td>
</tr>
<tr>
<td>Pinjarra</td>
<td>WA</td>
</tr>
<tr>
<td>Victor Harbor</td>
<td>SA</td>
</tr>
<tr>
<td>Caloundra</td>
<td>QLD</td>
</tr>
<tr>
<td>Dubbo</td>
<td>NSW</td>
</tr>
</tbody>
</table>

0% 5% 10% 15% 20% 25% 30%

Table 18: Payback time of rooftop solar if used to cut energy bills (no feed in profits)

<table>
<thead>
<tr>
<th>Country</th>
<th>Investment (€/kWh/year)</th>
<th>Residential tariff (€/cent/kWh)</th>
<th>Payback period (yr)</th>
<th>Commercial tariff (€/cent/kWh)</th>
<th>Payback period (yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spain</td>
<td>1.30</td>
<td>0.20</td>
<td>6.4</td>
<td>0.14</td>
<td>7.7</td>
</tr>
<tr>
<td>Italy</td>
<td>1.47</td>
<td>0.20</td>
<td>7.2</td>
<td>0.25</td>
<td>4.8</td>
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<tr>
<td>France</td>
<td>1.68</td>
<td>0.14</td>
<td>11.9</td>
<td>0.11</td>
<td>13.1</td>
</tr>
<tr>
<td>Germany</td>
<td>2.24</td>
<td>0.25</td>
<td>8.8</td>
<td>0.20</td>
<td>9.5</td>
</tr>
<tr>
<td>UK</td>
<td>2.29</td>
<td>0.15</td>
<td>15.2</td>
<td>0.12</td>
<td>16.2</td>
</tr>
<tr>
<td>Denmark</td>
<td>2.41</td>
<td>0.29</td>
<td>8.2</td>
<td>0.21</td>
<td>9.8</td>
</tr>
</tbody>
</table>

Source: Eurostat, BSW-Solar, UBS estimates

Source: Sunwiz
Commercial incentive also exists

- What about Government buildings?
  - Schools
    - Only require daytime electricity.
  - Lots of roof space
  - Armed forces?
  - Hospitals?

Commercial electricity – grid parity

Source: APVA 2012

Source: USA Dept of Energy EERE
Battery storage – economics are improving

- Peak demand typically around 7-8:00 PM
- Storage cost payback under 10 years already, assuming fast rate solar chargers exist and using Lithium based batteries

24 V 2.6KWh 100 Amp/Hour Lithium Battery

Source: Elite Power System

Source: NEM-Review

**NSW demand**

**NSW - median household**

<table>
<thead>
<tr>
<th>Unit</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual consumption MWh</td>
<td>7</td>
</tr>
<tr>
<td>Daily average KWh</td>
<td>19</td>
</tr>
<tr>
<td>Share of 4 pm - 9 PM 33%</td>
<td>UBSe</td>
</tr>
<tr>
<td>Storage required KWh</td>
<td>6.3</td>
</tr>
<tr>
<td>24 V 2.6KWh pack cost US$</td>
<td>1,725</td>
</tr>
<tr>
<td>Packs required</td>
<td>3</td>
</tr>
<tr>
<td>Cost of storing 200 Amphours $</td>
<td>5,175</td>
</tr>
<tr>
<td>Capacity per pack Amp Hours</td>
<td>100</td>
</tr>
<tr>
<td>Peak cost C KWh</td>
<td>52.5</td>
</tr>
<tr>
<td>Daily saving $</td>
<td>3.3</td>
</tr>
<tr>
<td>Annual saving $</td>
<td>1213</td>
</tr>
<tr>
<td>Payback Years</td>
<td>4.3</td>
</tr>
</tbody>
</table>

Source: UBSe
Wind cost has come down – Snowtown 2 $1.8 m MW

- Wind reduces carbon
- Modularity encourages investment flexibility
- Impacts thermal generation quite negatively
- Not a game changer from the consumer’s point of view.
Networks

- Peak demand is a network issue, not a generation issue mostly
- Solar – Network augmentation, reduces peak demand, but needs storage.
- Time of use pricing
- Load shedding – do we need a formal market?

Source: Integral presentation to IPART 2003

Load Profiles – Older Suburb (Greystanes)

Load Profiles – New Suburb (Glenmore Park)

Source: Integral presentation to IPART 2003
The grid in the hopefully near future

- Smart grid concept exists but progress is slow. No regulatory allowance
- Must start with time of use meters, roll out in NSW and QLD slow
  - Victoria mandated meters, NZ over 50% penetration
  - Can be achieved with modest incentive but still consumer choice
- Network efficiency and benchmarking lacking
- Network competition lacking
  - Last mile competition per UK model?
- NEM designed for central generation
  - No incentive to value distributed energy
- > $50B in network upgrades
  - could increased DE (PV, EE & DSM) provide a lower cost solution?
  - Could we end up with stranded assets if net zero energy / self-sufficiency increases?
Network issues

• What happens to current retail and network market structures if:
  – All buildings are net zero energy
  – Usage keeps dropping
  – Customers opt for on-site storage and purchase only in off-peak periods?

• Network tariffs where to?
  – Time of use tariffs that properly reflect marginal cost of peak consumption
  – Tariffs that can accommodate falling network utilization
  – Tariffs that incentivise distributed connections
Market structure

- Vertical integration is increasing
- Post NSW further privatisation, vertical integration could be much higher
- Raises question about usefulness of NEM

Self supply by majors today

Potential market share of majors post NSW privatisation, closure of Hazelwood, closure of Point Henry smelter

Source: Delta Electricity

Source: UBSe
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<table>
<thead>
<tr>
<th>UBS 12-Month Rating</th>
<th>Rating Category</th>
<th>Coverage</th>
<th>IB Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
<td>Buy</td>
<td>55%</td>
<td>33%</td>
</tr>
<tr>
<td>Neutral</td>
<td>Hold/Neutral</td>
<td>87%</td>
<td>31%</td>
</tr>
<tr>
<td>Sell</td>
<td>Sell</td>
<td>0%</td>
<td>15%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UBS Short-Term Rating</th>
<th>Rating Category</th>
<th>Coverage</th>
<th>IB Services</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
<td>Buy</td>
<td>less than 1%</td>
<td>0%</td>
</tr>
<tr>
<td>Sell</td>
<td>Sell</td>
<td>less than 1%</td>
<td>0%</td>
</tr>
</tbody>
</table>

1. Percentage of companies under coverage globally within the 12-month rating category.
2. Percentage of companies within the 12-month rating category for which investment banking (IB) services were provided within the past 12 months.
3. Percentage of companies under coverage globally within the Short-Term rating category.
4. Percentage of companies within the Short-Term rating category for which investment banking (IB) services were provided within the past 12 months.

Source: UBS. Rating allocations are as of 30 June 2012.

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<th>UBS 12-Month Rating</th>
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</thead>
<tbody>
<tr>
<td>Buy</td>
<td>FSR is &gt; 6% above the MRA</td>
</tr>
<tr>
<td>Neutral</td>
<td>FSR is between -5% and 6% of the MRA.</td>
</tr>
<tr>
<td>Sell</td>
<td>FSR is &gt; 6% below the MRA.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>UBS Short-Term Rating</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Buy</td>
<td>Stock price expected to rise within three months from the time the rating was assigned because of a specific catalyst or event.</td>
</tr>
<tr>
<td>Sell</td>
<td>Stock price expected to fall within three months from the time the rating was assigned because of a specific catalyst or event.</td>
</tr>
</tbody>
</table>
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