An electricity market design for a 21st century electricity system

Thomas Pownall
University of Exeter
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Contents

• Background on the UK’s current electricity market design
• The changing electricity system
• How the current electricity market design is not outdated
• Issues that are arising as a consequence
• My proposed design
Background on the UK’s current electricity market design

• Post privatisation 1989-1998
  – Pool market mechanism
  – Scheduled the day-ahead
  – Majority of trades struck in ‘forward markets’
  – Market manipulation

• NETA -1998
  – Bilateral trading (~85%)
  – Remainder traded on the SPOT market or through the other markets: Capacity, Ancillary and the Balancing market
Timeline of events

'GB Trading Arrangements'

We will discuss trading tomorrow

Forwards and Futures Markets

Contracts struck up between a variety of traders

'Closing Period'

Trading Period

Developed by market. Not centrally prescribed.

Mandatory

We will discuss trading tomorrow.

‘GB Trading Arrangements’

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Mandatory
The characteristics of this new electricity system

• The GB’s electricity system is undergoing fundamental changes.
• Thus, the institutions which govern the electricity system need to evolve in parallel.
• The electricity market design is one of these.

<table>
<thead>
<tr>
<th>Traditional Electricity System Characteristics</th>
<th>Emerging Electricity System Characteristics</th>
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</thead>
<tbody>
<tr>
<td>Centralised</td>
<td>More Decentralised</td>
</tr>
<tr>
<td>Fossil and nuclear based, large scale</td>
<td>Decarbonised, multiple scales</td>
</tr>
<tr>
<td>Supply based, load following</td>
<td>Supply and demand</td>
</tr>
<tr>
<td>Firm power</td>
<td>Smart and flexible</td>
</tr>
<tr>
<td>Linear, top-down system operation</td>
<td>Two way, dynamic, digitalised system operation</td>
</tr>
<tr>
<td>Passive consumers</td>
<td>Spectrum of consumer behaviour</td>
</tr>
<tr>
<td>Clear lines between power, heat and mobility sectors,</td>
<td>Breaking down of decarbonisation lines and</td>
</tr>
<tr>
<td>supply chain activities and business models</td>
<td>re-allocating at distribution level, and particularly domestic level</td>
</tr>
<tr>
<td>Distant from use</td>
<td>Often local</td>
</tr>
<tr>
<td>Energy focused stakeholders</td>
<td>Multiple stakeholders – data / IT, car manufacturers etc</td>
</tr>
</tbody>
</table>
The Electricity Market Design: Clarification of terms

• What is an *Electricity Market Design*?

  The formal and informal rules which guide the buying and selling of electricity, providing stability for all members involved

• The importance of clarification
Importance of the electricity market design

- Determines access to value
- This ‘access’ will shape the future electricity system
- To decarbonise, the electricity market design needs to provide value to specific technologies
  – i.e. Flexibility, DSR, Storage etc.
Why does our electricity market design need to evolve?

• Market design no longer reflects the electricity system
  • Leading to many issues
    – Price depression
    – Price cannibalisation
    – Missing money
    – Lacking necessary flexibility
Many calls for a new electricity market design

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</tbody>
</table>
My proposal: Goals

• An energy efficient system based primarily on renewable generation requires an electricity market design which values, and incorporates, their characteristics.

• Assets should be able to trade with whomever they wish, be this in their local neighbourhood or into national markets

• Reduction of overall GHG emissions stemming from the electricity system (to include heat or mobility when via electricity) should be delivered i.e. to meet decarbonisation targets

• Consumer protection should be in place, whether prices, security of supply, equity or data.

• All assets – transmission or distribution / supply, demand and storage / energy or system - should have their value revealed
My proposal: methodology

• Reviewing current electricity market design proposals
• Creating a design based on the ‘features’ of these proposals
• Proposing this design to key electricity market design experts in Great Britain
Sub-Grid Supply Point
Distributed Service Provider (DSP)
Timeline

**Dx:**
Long-term contracts set up between parties. i.e. energy suppliers, P2P, prosumers and consumer

**Tx:**
Assets contract into the wholesale market

**Dx:**
Forecasts sent to DSP. DSP considers if actions are needed. P2P, aggregators, consumers etc. strike contracts. All info sent to DSP.

**Tx:**
Renewable forecasts to the market operating body. Firm market participants make preparations as necessary.

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Years/Months ahead
Previous day
Delivery day
Balancing Markets

Real time

Gate Closure 1*
Gate Closure 2**
Tak!

Thank you for listening

Questions?

Please contact me at t.pownall@exeter.ac.uk to discuss this further