New Topics in Electricity Market Design

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Market design, like all facets of energy policy, is being influenced by the “trilemma”

- For some years, EU policy debates on market design have needed to consider the “trilemma”
- In fact, all these policy aims can be supported by designing market arrangements to promote *economic efficiency*
- Primarily, this means sending price signals to market participants that reflect marginal cost
Sharpening Price Signals in the Energy Market
Electricity is limited in its capacity to traverse time and space!

Even in low carbon power systems, efficient markets are powerful tools for revealing information on how the value of energy varies over time and across different locations.

Source: http://cardifflocalguide.co.uk/dr-who-experience/
Market arrangements should encourage efficient trade-offs between:

- Locational variation in generators’ own costs (wind speeds, access to fuel, etc)
- Locational variation in power system costs and benefits, such as variation in T&D costs, and/or the value of the energy produced

Theory provides a solution: locational marginal pricing of energy (LMP)

Setting pricing zones delineated by points of persistent congestion, as per the EU Target Model, would be a step in the right direction.
(1) **Space:** In the meantime, transmission charges could, in theory, convey the same efficient signals as LMP

- If the network is built efficiently, it is possible to set infrastructure charges that send signals, on average over the year, equivalent to LMP

\[
\Sigma_{\text{hours}} \frac{\text{LMP}}{8760} \\
\Rightarrow \text{LRMC of Transmission} \\
\Rightarrow \text{Efficient Transmission Access Price}
\]

- Ofgem’s Project TransmiT sought to move transmission charges closer to this theoretical ideal, by pricing the infrastructure required to efficiently trade-off constraints and investment

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**LRMC of Transmission to Efficiently Accommodate Wind, vs TNUoS Charges**

Source: NERA and Imperial College London (Feb 2014)

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TNUoS charges for wind understate the true variation in the LRMC of transmission across the country.
Windy systems rely heavily on flexible plant to ramp up and down as wind speeds change, and to provide back-up capacity when it is not available.

Efficient peak pricing can signal that there is not enough capacity, or that it is responding too slowly. Some reforms are working towards this (e.g. Balancing Services SCR making prices “more marginal”).

Some evolution in market design may further enhance efficiency:
- Shorter trading intervals
- Real time pricing of ancillary services

Illustrative Hourly Production Mix in GB – 7 Days During April 2025

Source: NERA Modelling
Making market price signals more efficient adds most value if subsidy schemes make use of them

- Across many EU jurisdictions, subsidised low carbon generation is taken out of the market
- A lack of exposure to market price signals, as well as energy-based subsidies can lead to perverse outcomes – see negative German power prices

<table>
<thead>
<tr>
<th>Support scheme</th>
<th>Balancing responsibility</th>
<th>Exemptions for RES-E</th>
<th>Level of balancing responsibility</th>
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0: no balancing responsibility for RES-E; if there is no balancing responsibility, the column “Exemptions for RES” typically does not apply.
1: RES-E are not fully exempted, but there is a specific balancing regimes for RES-E or there is a balancing responsibility only under certain support schemes; 2: Full balancing responsibility for RES-E.
Source: European Commission

Source: Platts Powervision
Capacity Remuneration Mechanisms (CRMs)
CRMs are interventions to protect security of supply

The CRMs being rolled out across Europe run the risk of being like Baldrick’s bath

Source: http://blackadder.wikia.com/wiki/English_Civil_War_Baldrick

Source: http://www.tc.nationwide-bathrooms.co.uk/baths/cromwell-freestanding-double-skinned-acrylic-bath-on-feet.html
CRMs are a response to concerns that markets will fail to deliver.

Possible Market Failures:

- **Explicit** price caps
- **Implicit** price caps
  - Credibility of volatile prices
  - Uncertain government policy
- ... exacerbated by greater investment in intermittent capacity.

**CRMs attempt to replace (non-credible?) volatile peak prices with a more credible, stable signal**

*Source: ACER (2013), Capacity Remuneration Mechanisms and the Internal Market for Electricity, 30 July 2013, page 8*
In principle, a security of supply intervention could target price or quantity

### Sharper Peak Prices
- Expose participants to marginal costs of their actions
- Fixes *explicit* price caps but may not deal with potential credibility problem
- Favoured by Commission

### Capacity Payment
- Payment available to any market participant providing capacity (LOLP-related)
- Replaces missing money
- Commission staff working document favours procurement auctions

### Targeted Mechanism
- Smaller apparent intervention
- Undermines peak prices and investment incentives for all non-contracted participants
- Commission staff working document favours over market wide schemes

### Market-Wide Mechanism
- Competitive auction available to all market participants (in the UK excepting renewables)
- US heritage as a response to explicit price caps (e.g. $1,000/MWh)
- GB model

National authorities are increasingly favouring capacity *markets* over *payments* to provide stable, market-led signals for investment

Prices in capacity markets depend on the *rules* as well as fundamentals.

The (admittedly short) history of the British Capacity Market has already shown that rules may come under pressure.

**15-year contracts**

**Demand Side Response**

**Interconnectors and zoning**

**Arbitrage between T-4 and T-1**

If the rules themselves are volatile, the capacity mechanism will not be credible.
Conclusions
Conclusions

- Power market design should aim to promote economic efficiency through efficient pricing

- Policy measures to bring prices closer to marginal cost can help, but there may be limits on what they can achieve

- Capacity mechanisms can only solve any security of supply problem if they can provide a more stable and credible signal than the energy price signals they replace
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Back-up Material
Efficient peak pricing is especially important in RES-dominated power systems.

Windy systems require more peaking plant, making a higher proportion of generation reliant on peak price signals.

Renewables production in off peak periods drives down the residual demand to be met by other technologies.
Recent reforms have improved efficiency of peak pricing

Recent changes to the calculation of bid/offer prices will sharpen signals

In merit plants, hour ahead

Out of merit plants, hour ahead

Single Cash Out Price

SBP

SSP

Capacity

£