Net Zero Market Design – Views from the Electricity System Operator

David Wildash
Acting Head of Markets
ESO’s Net Zero Market Reform programme is assessing how GB electricity markets should be redesigned to achieve net zero cost-efficiently

There is a need to invest at unprecedented scale and pace

There is a need to manage dramatic energy imbalances with flexible and firm technologies across both supply and demand

There is a need to incentivise assets to locate and dispatch where they can minimise whole system costs
Investment needs to be ramped up significantly across the electricity system.

- Massive scale up of investment in low carbon renewables needed.

- Market design and policy framework must also deliver optimal ratio of renewable and flexible/firm resources (on both supply and demand sides) if a cost-optimal power mix is to be achieved.

Most years have over 10GW of new build with the 2030-35 period seeing a sustained build out of 15GW pa. This presents a significant challenge for the market.
There is a need to manage dramatic imbalances with flexible and firm technologies across both supply and demand.

This chart shows the distribution of residual demand (and generation) for each year in hours.

The proportion of hours with excess generation will increase significantly by 2030 to c50% of hours. By 2050 this becomes more than 90%.

The proportion of excess demand hours become less frequent but more extreme.

Residual demand, GW – Leading the Way scenario

92% of hours in 2050 have negative residual demand.
Our deeper analysis of locational and flexibility issues show that the current market was not designed for net zero and left unchanged will impose excessive costs to consumers.

1. Constraint costs are **rising at a dramatic and accelerating rate**
2. **Balancing** the network is becoming **more challenging** and requires increasing levels of inefficient redispach
3. **Interconnectors and storage** are at times **exacerbating constraints**
4. Current market design does not **unlock the full potential of flexibility**

These issues are arising because the wholesale market price is missing a key component: dynamic real-time locational signals
Our most recent estimates show that constraint costs will continue to rise at a rapid rate, despite network reinforcement.
With higher renewables penetration, the need for ESO redispatch has markedly outgrown the residual balancer role originally envisaged.

**SO balancing as proportion of national demand** (%) vs renewable share of generation

1. SO role is residual, mostly repositioning market (~5%)

2. Increasingly wide variations in SO balancing requirement (~0 - 65%)

3. ...and increasing proportion of large interventions.

[Diagram showing trends over years]
The single national price is creating perverse incentives for flexible assets crucial to net zero

Interconnector flows under status quo national pricing

- Status quo market design is causing **storage** and **interconnector** behaviour that can aggravate grid constraints

- Projected capacity increase to 2035 (Leading the Way, FES 2021):
  - Interconnectors: 7.1 GW → 26.8 GW
  - Battery Storage: 4.6 GW → 23.4 GW
The single national price is also creating inaccurate signals for demand to respond

Demand is incentivised to reduce load to address scarcity… (although not as much as it could be)

….but low demand location is also incentivised to reduce demand despite no scarcity issue

….and at times exacerbates constraints
Nodal pricing would address critical issues in the current design, and sets up an enduring foundation for net zero

**Weaker locational signals**

**Single national price and locational network charges**
- Uniform price clears across entire market

**Zonal pricing**
- System divided into a small number of zones with individual prices

**Stronger locational signals**

**Nodal pricing**
- System divided into many “nodes” with individual prices

1. Efficient dispatch **reduces balancing costs**
2. Provides **correct signals** to interconnectors and storage
3. Delivers accurate locational price signals (dispatch and siting) needed to **realise demand side value**

*Boundaries for illustration only*