Net Zero Market Design – Views from the Electricity System Operator

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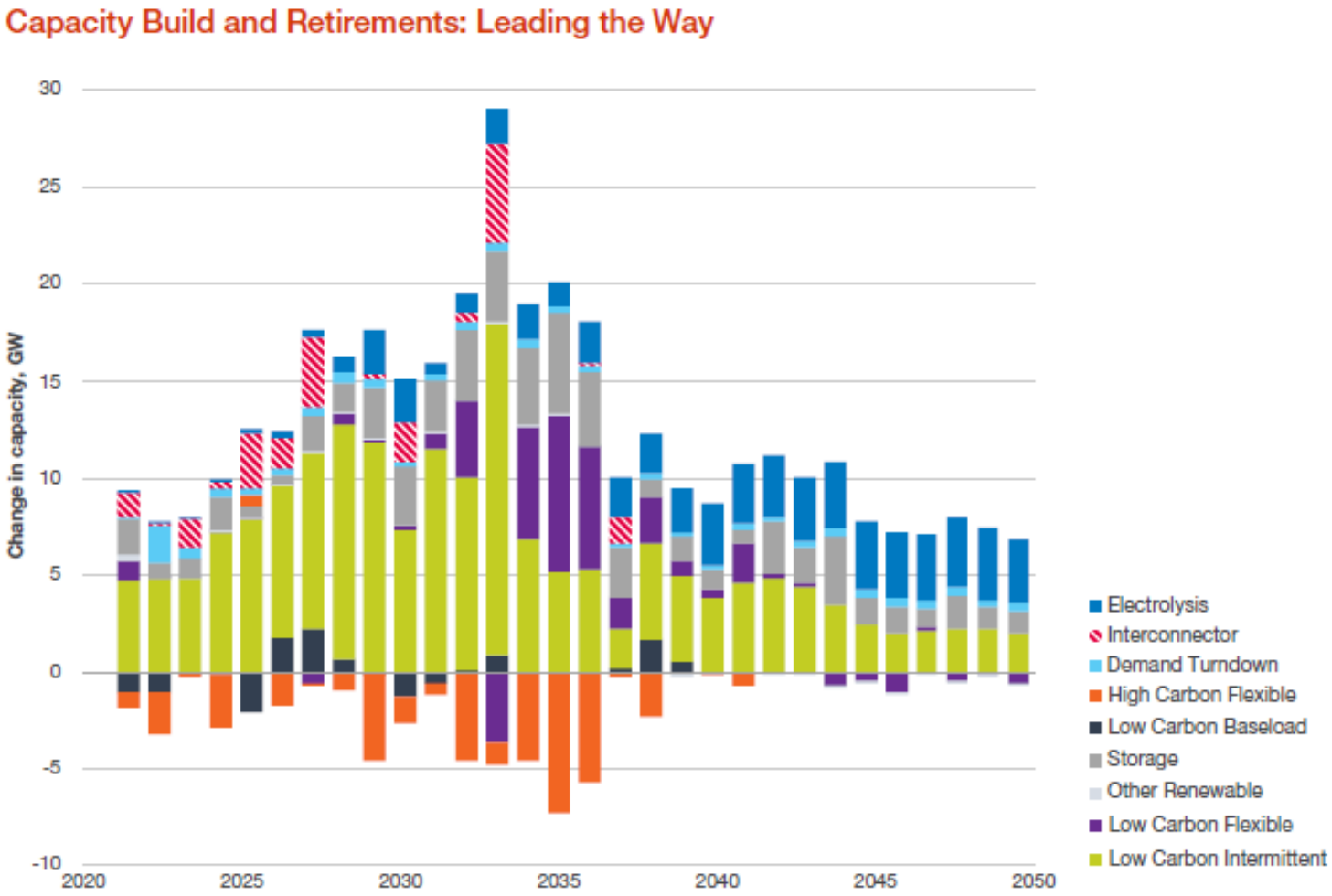
ESO's Net Zero Market Reform programme is assessing how GB electricity markets should be redesigned to achieve net zero cost-efficiently

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



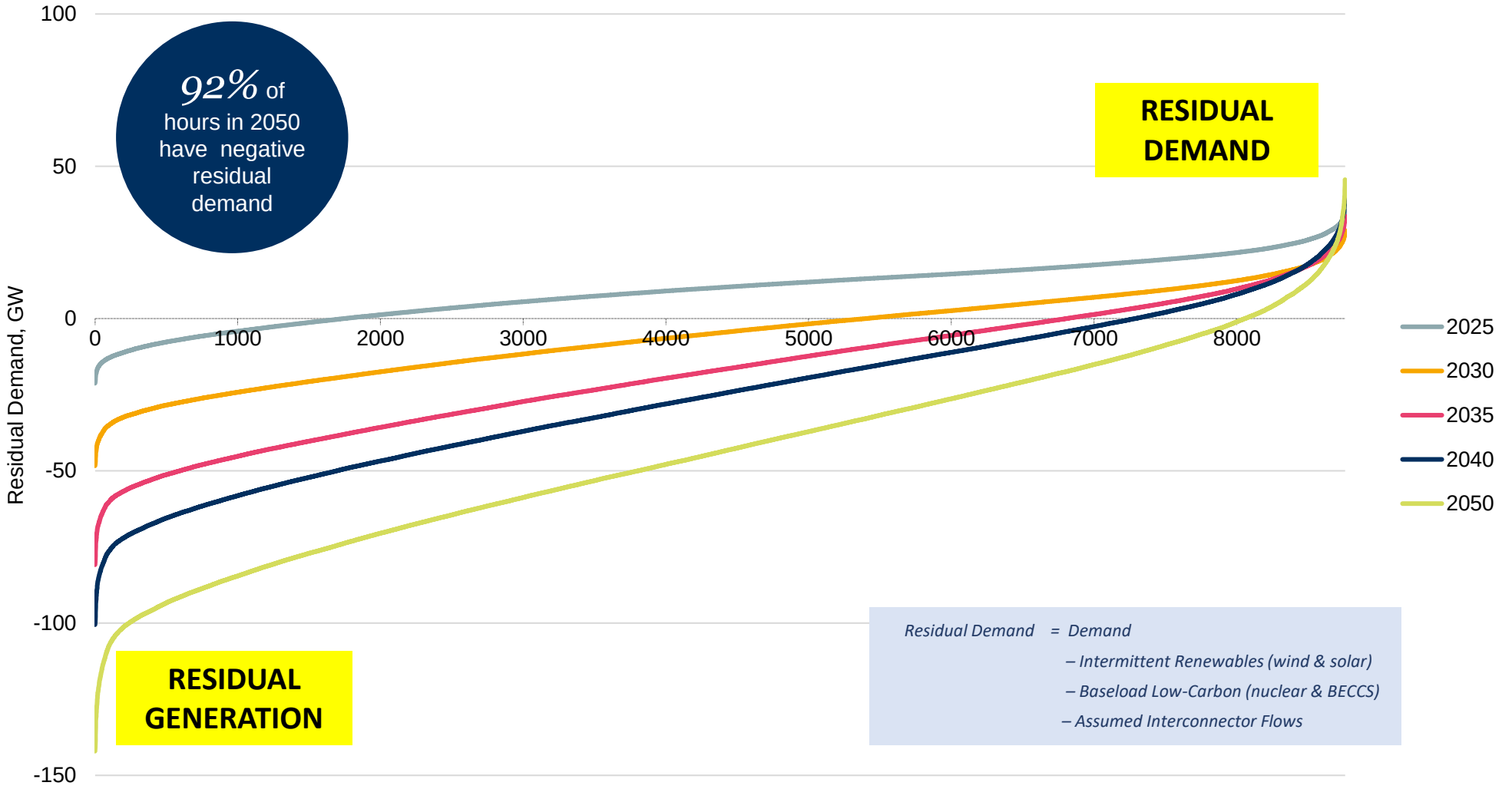
Most years have over 10GW of new build with the 2030-35 period seeing a sustained build out of 15GW pa. This presents a significant challenge for the market.

- 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.

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

Residual demand, GW – Leading the Way scenario



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%.

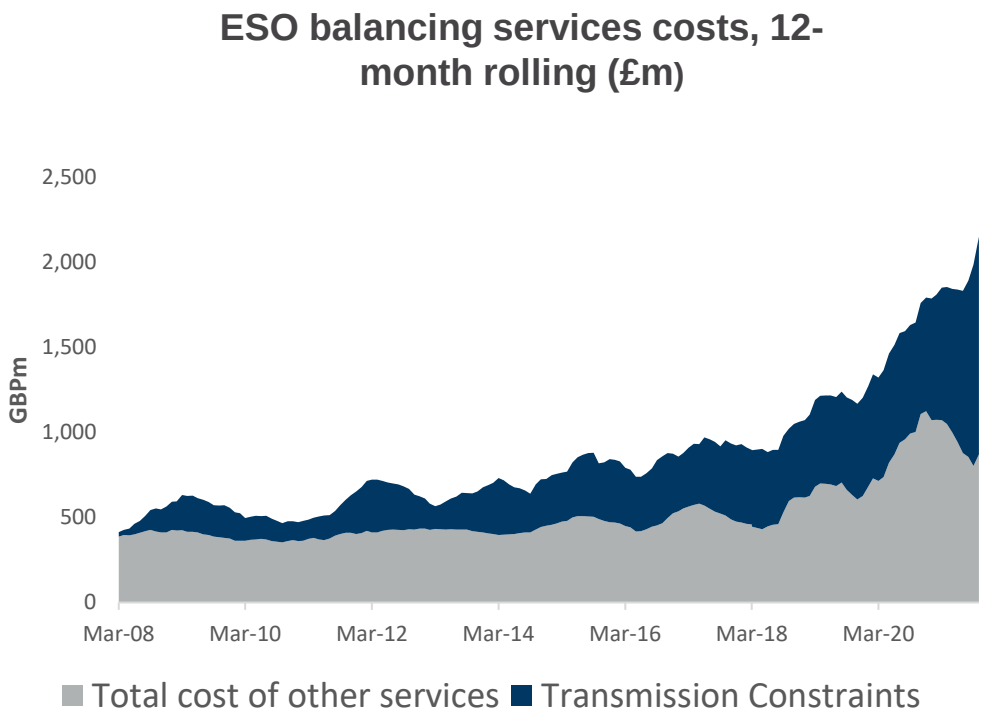
The proportion of excess demand hours become less frequent but more extreme.

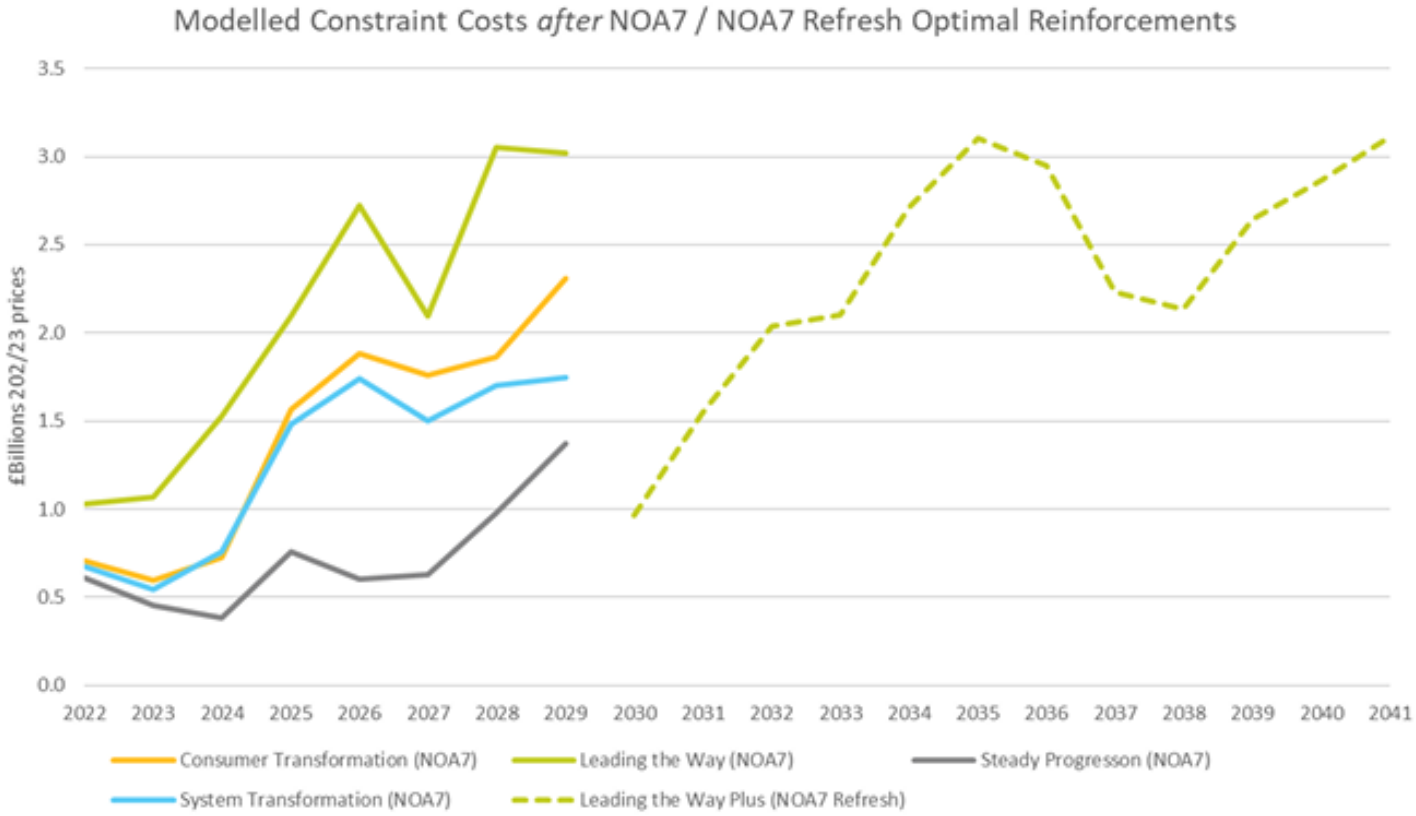
Our deeper analysis of locational and flexibility issues show that the current market was not designed for net zero and left unchanged will impose excessive costs to consumers.

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 redispatch
3. **Interconnectors and storage** are at times **exacerbating constraints**
4. Current market design does not **unlock the full potential of flexibility**

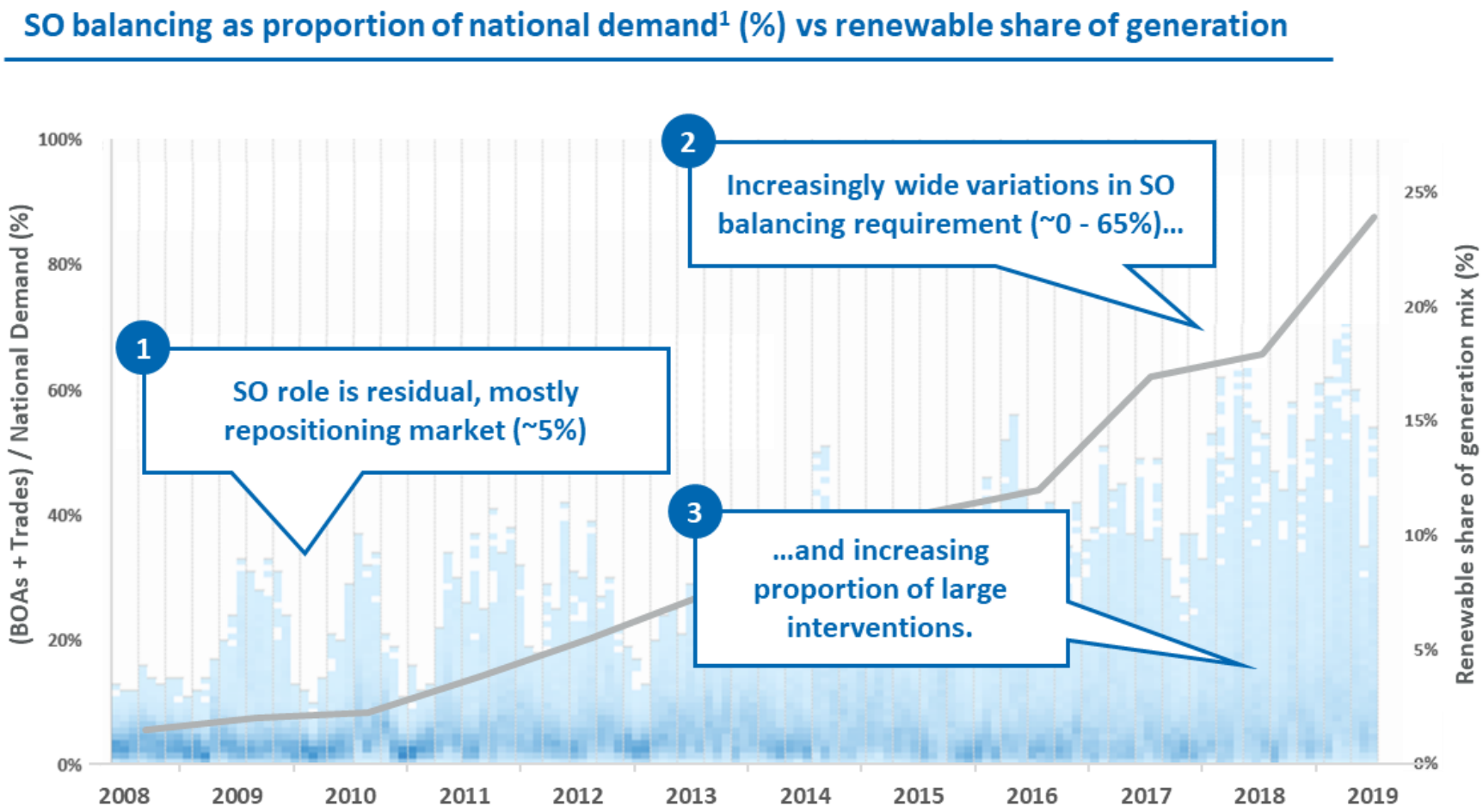
These issues are arising because the wholesale market price is missing a key component: dynamic real-time locational signals

Our most recent estimates show that constraint costs will continue to rise at a rapid rate, despite network reinforcement



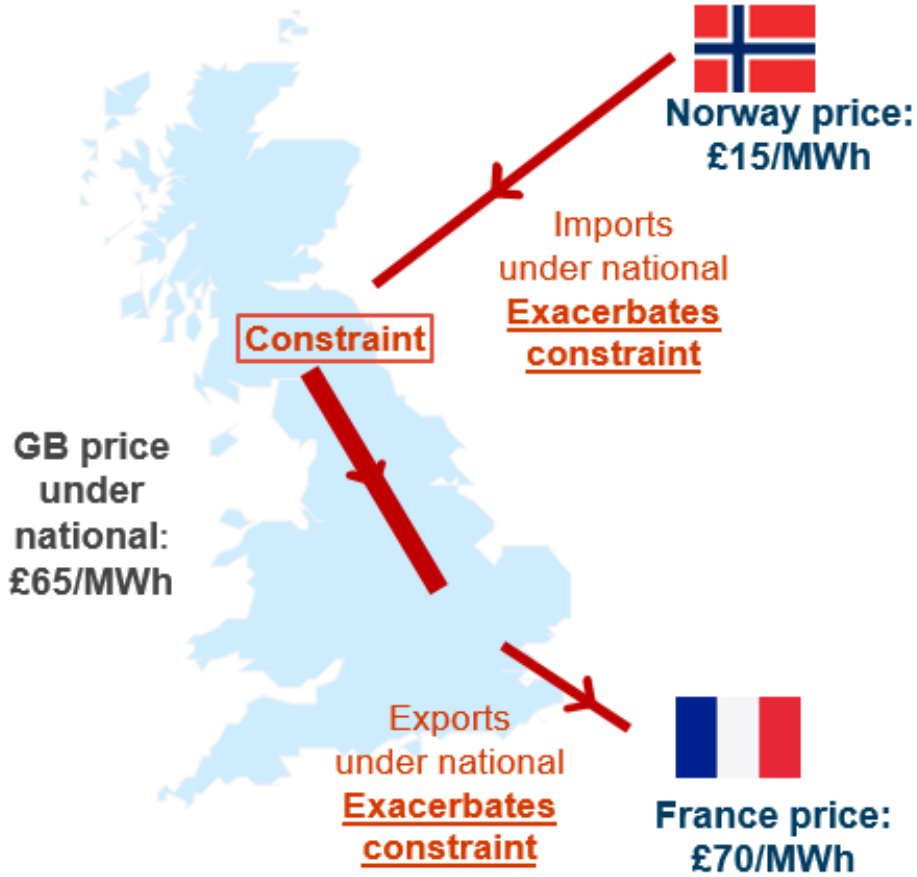


With higher renewables penetration, the need for ESO redispatch has markedly outgrown the residual balancer role originally envisaged



The single national price is creating perverse incentives for flexible assets crucial to net zero

Interconnector flows under status quo national pricing

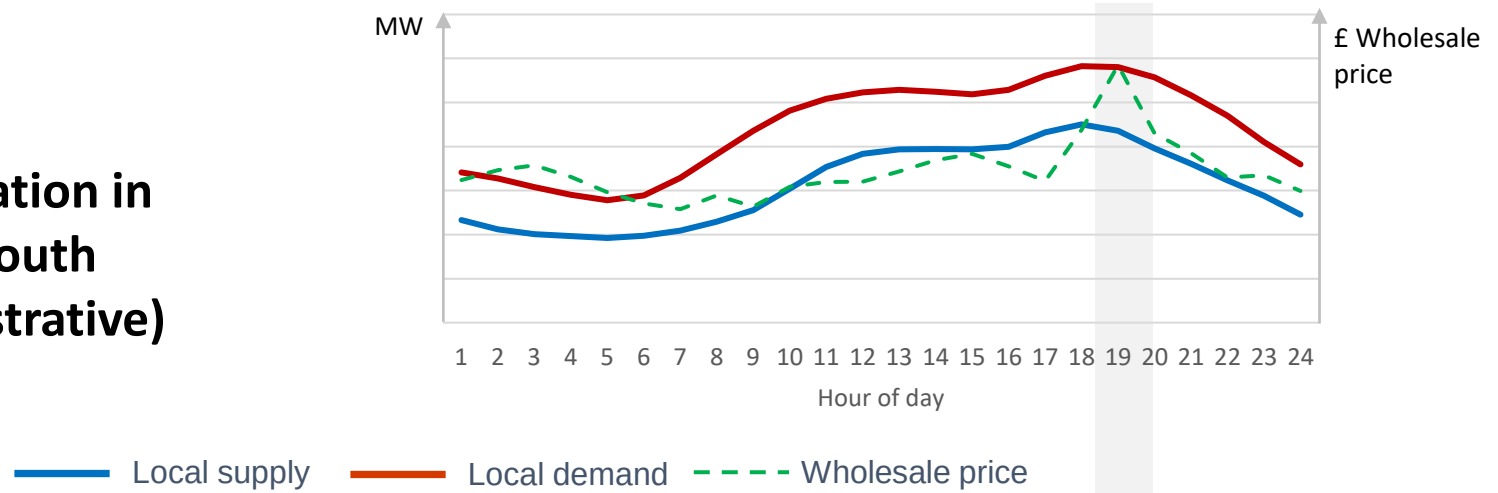


- Status quo market design is causing **storage** and **interconnector** behaviour that can aggravate grid constraints

- 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

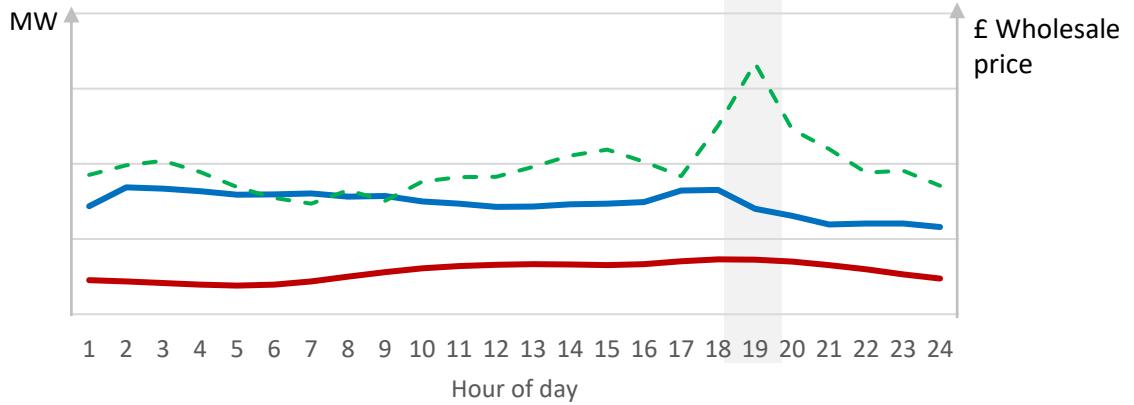
The single national price is also creating inaccurate signals for demand to respond

Location in South (illustrative)



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

Location in North (illustrative)



….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

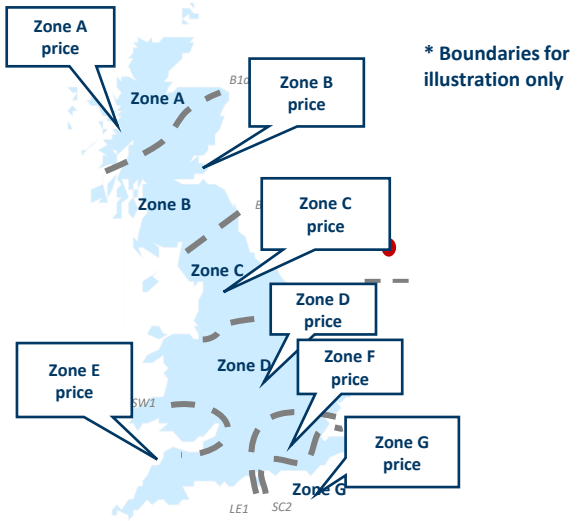
Weaker locational signals → *Stronger locational signals*

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



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**