

Analytical history of renewable support schemes in Britain

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Stephen Littlechild Festschrift Seminar

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Outline

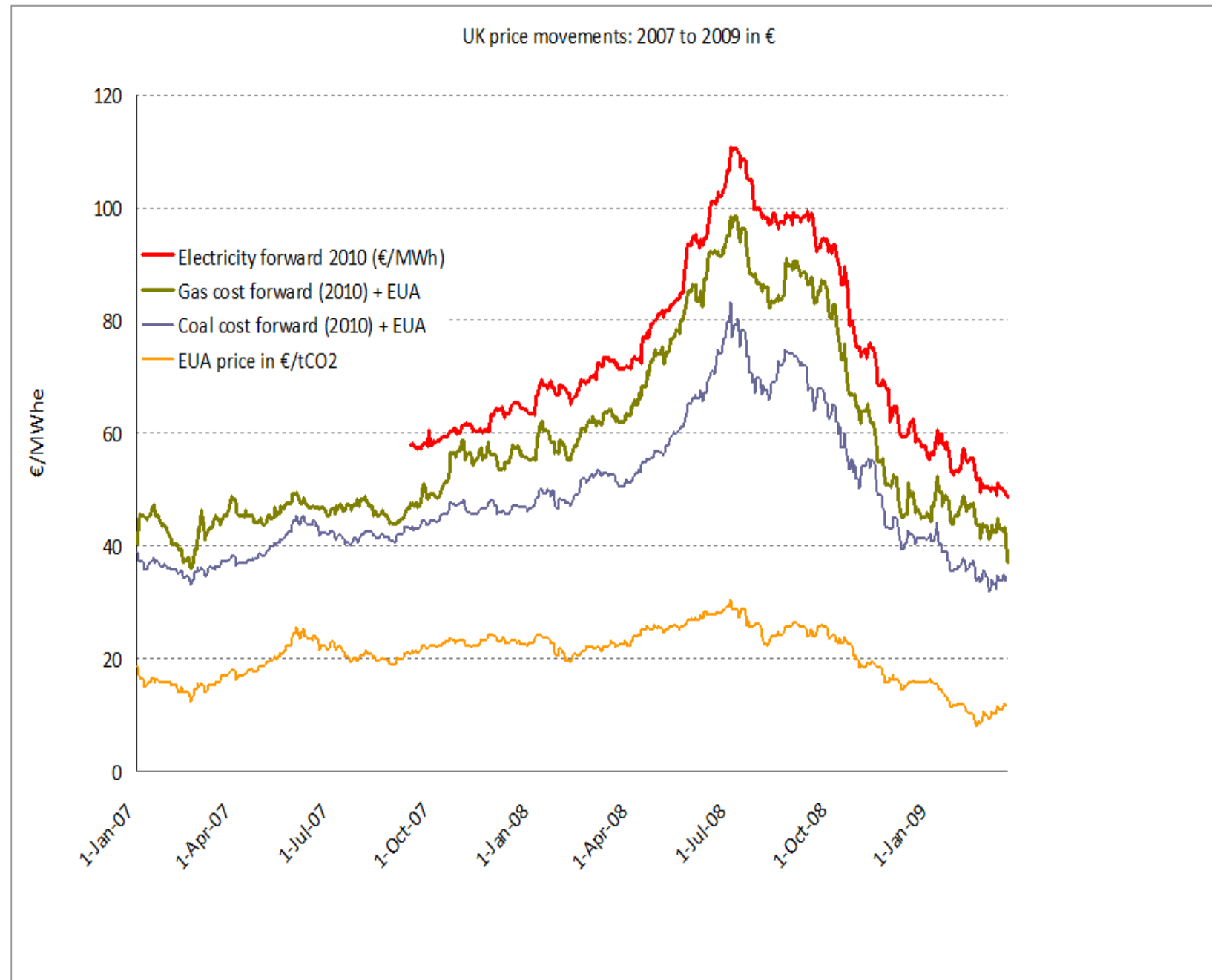
- Supporting renewable electricity:
 - from NOFFO auctions to **ROCs** and then **CfDs**
- Problems:
 - **ROCs**: Windfall profits, lack of hedge, volatile revenues=> high WAC
 - **Negative prices and inefficient dispatch**
 - **Rising curtailment rates**
- Reforms:
 - **2-way CfDs, no subsidy with negative prices => efficient dispatch?**
 - **Transmission charges to improve locational guidance**
- Conclusions

Four types of renewable support scheme

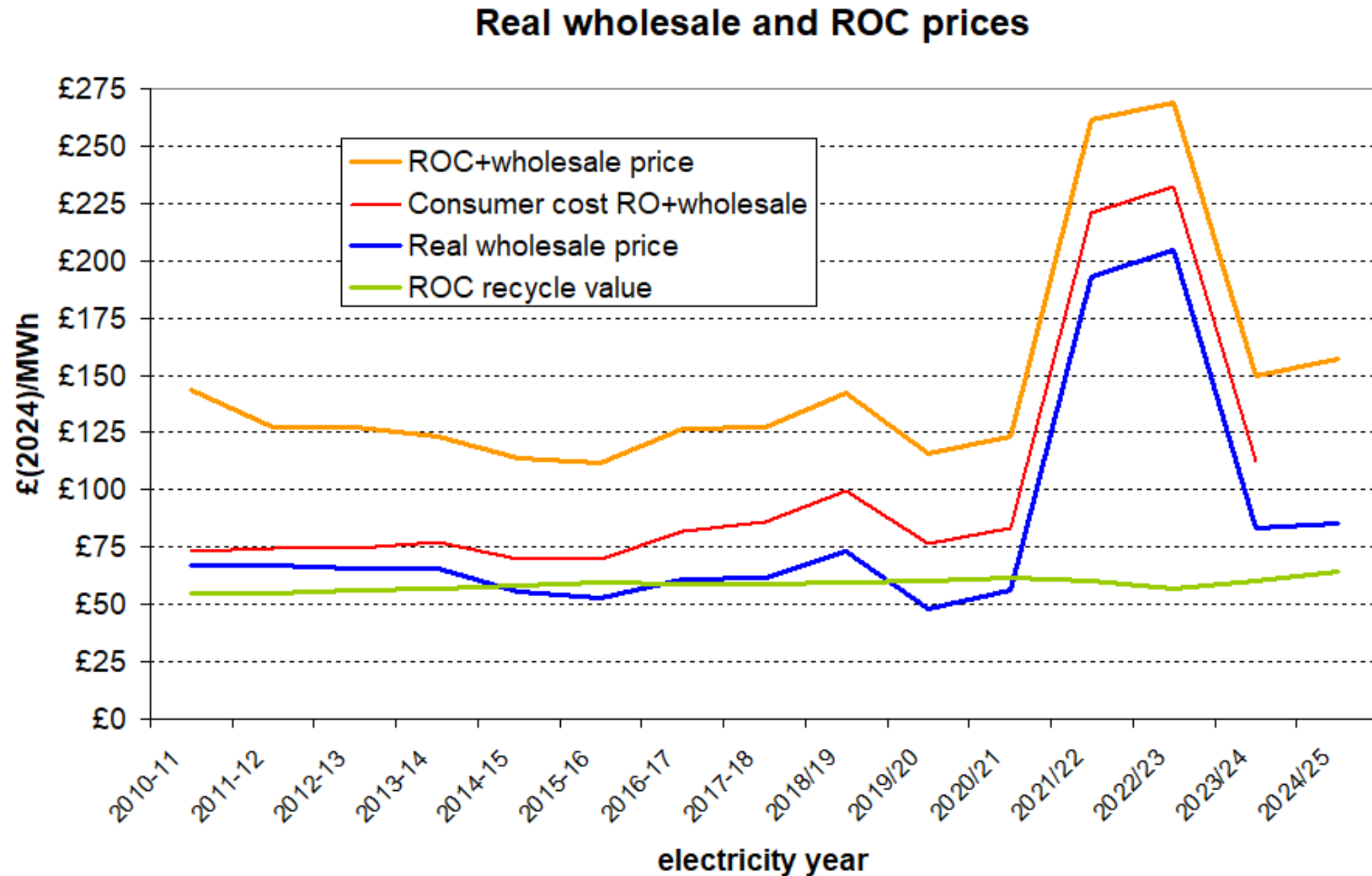
- 1990s: Non-Fossil Fuel Obligation auctions: competition for the market
 - Five auctions from 1991 to 1998, many schemes not delivered
 - Stephen advised the secretary of state on which schemes to support
- 2002-11: Renewables Obligation: competition in the market
 - Tradable Green Certificates; initially 1 ROC per MWh for all technologies
 - Banding introduced to reflect relative costs

Fossil generators are naturally hedged against fuel and carbon cost movements

Renewables with ROCs are exposed to volatile market prices



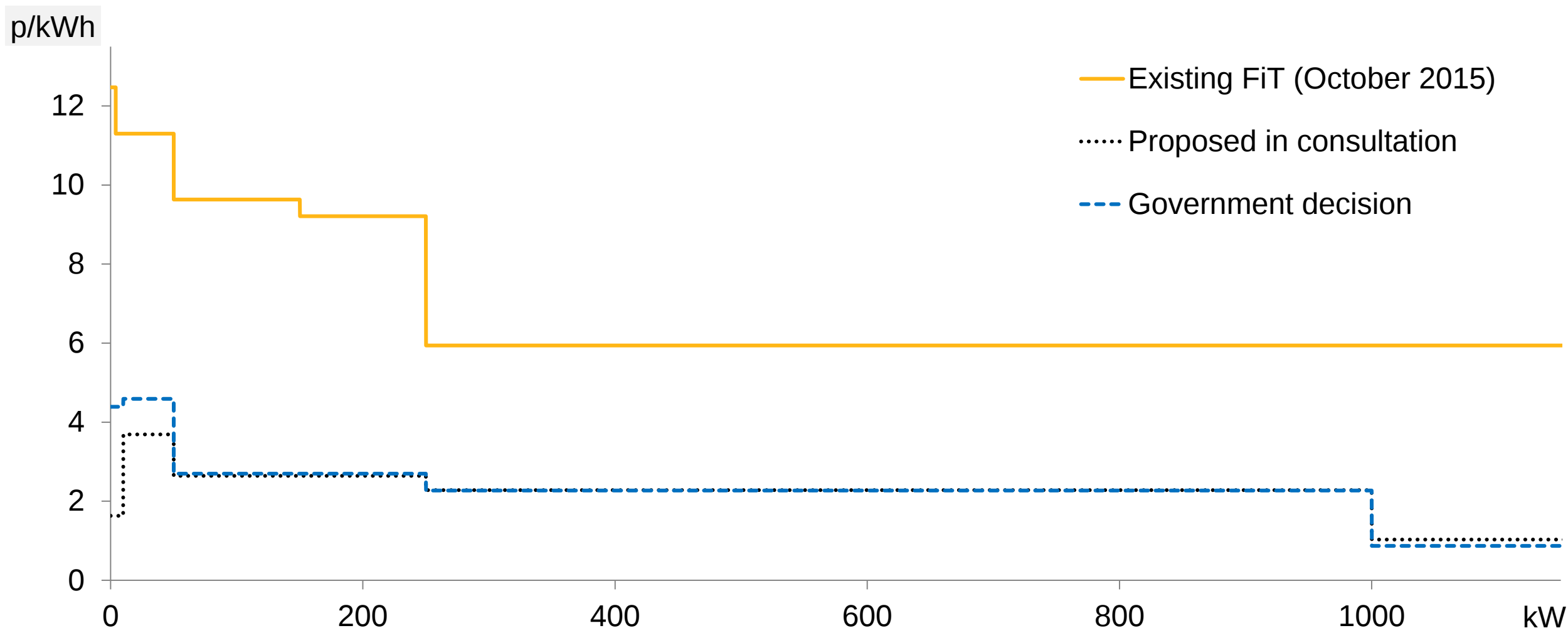
Renewable Obligation scheme = unstable producer prices, high price risk for consumers



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Feed-in Tariffs for Solar PV

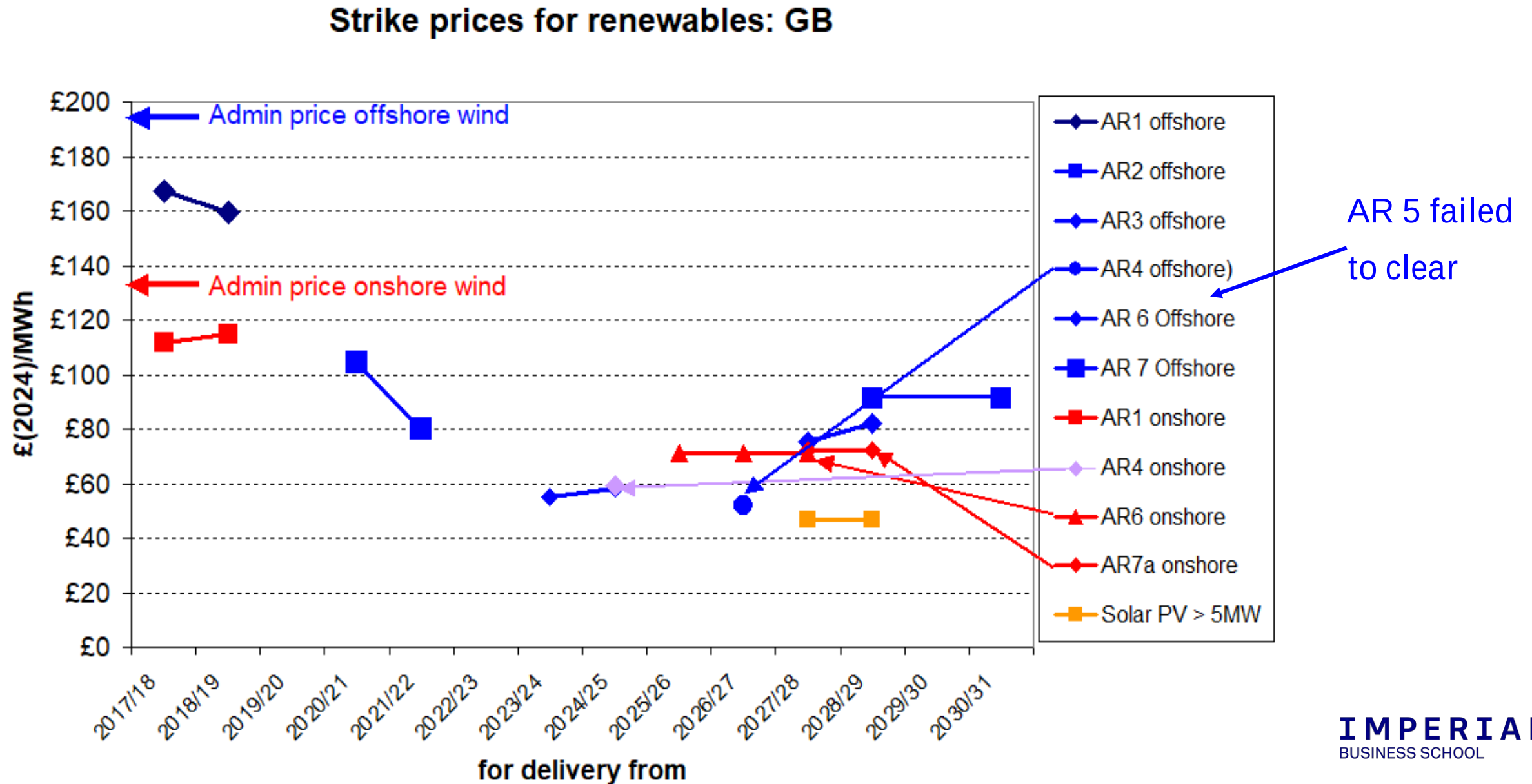


Installation size

Four types of renewable support scheme

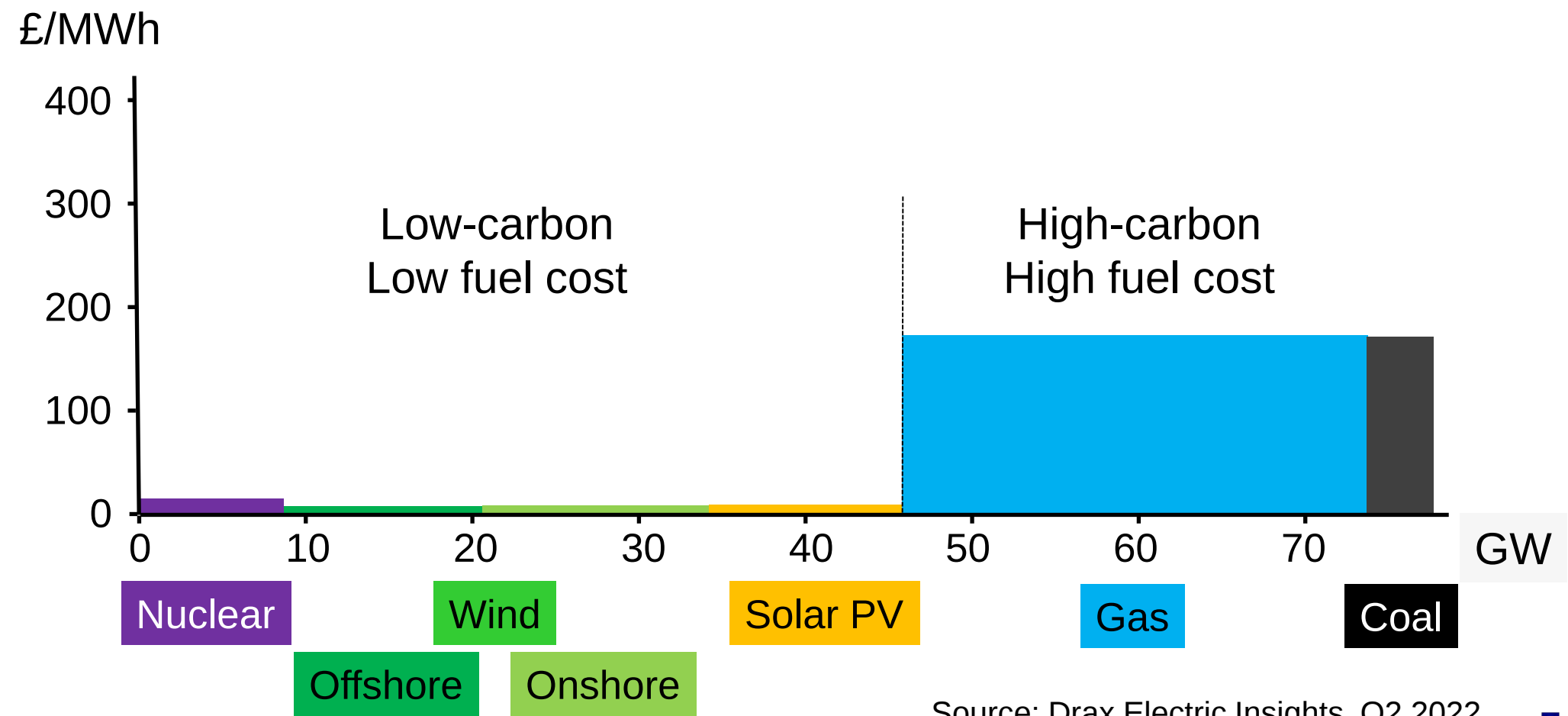
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 - Initial administered prices higher than subsequent auction results

Auctions for CfDs have delivered substantial cost savings



Generator Variable Costs

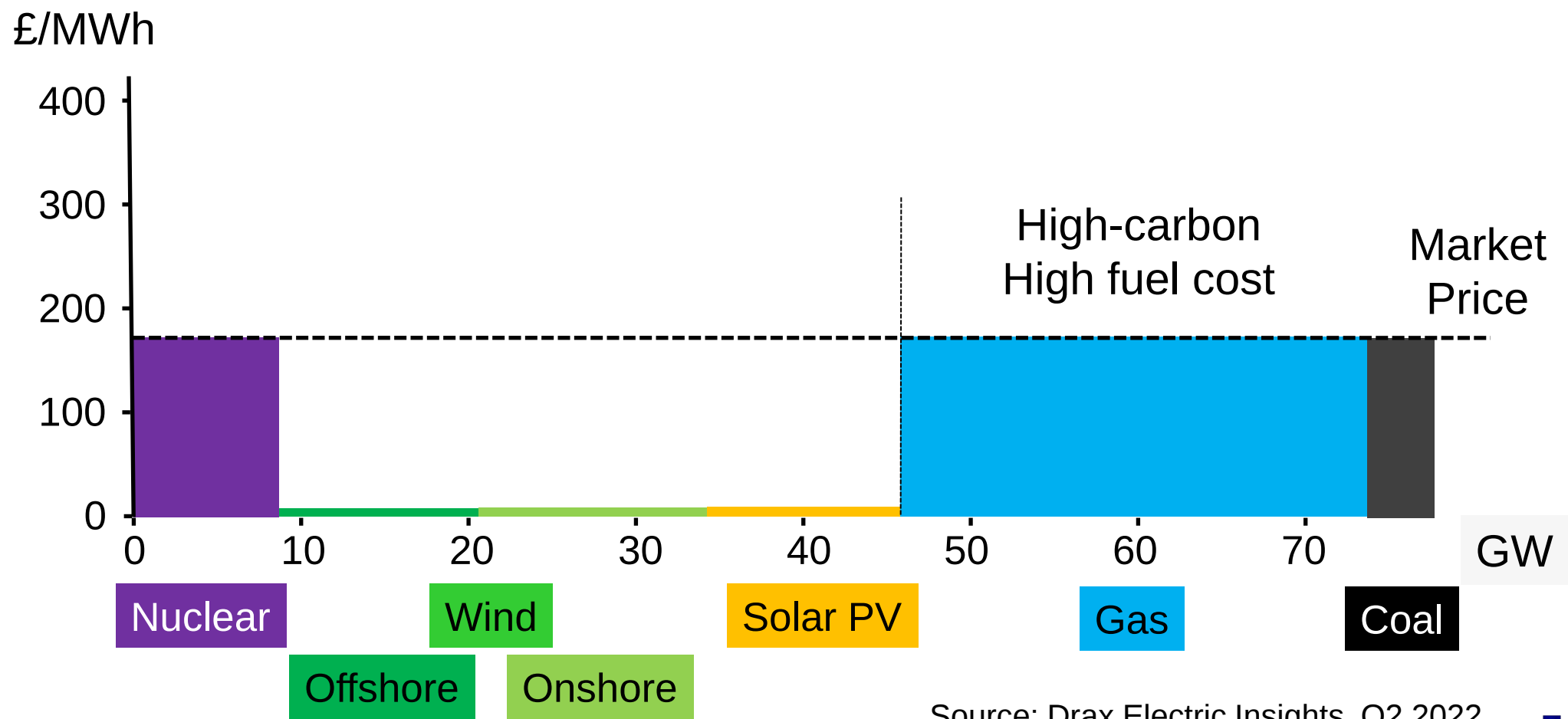
(approximate 2022 levels)



Source: Drax Electric Insights, Q2 2022

Generator Revenues

Great Britain, Jan-Jun 2022



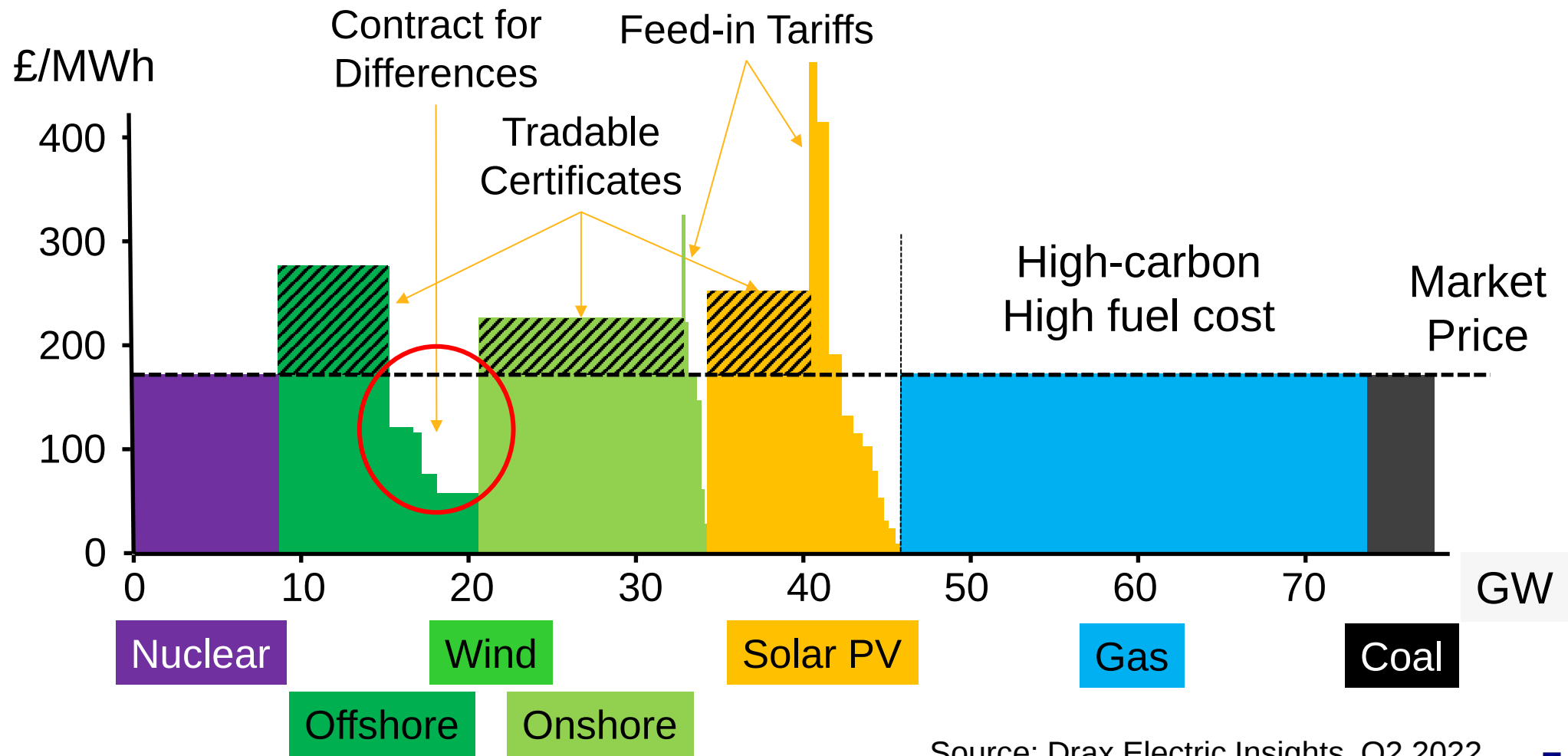
Source: Drax Electric Insights, Q2 2022

Estimates are not adjusted for timing of output or old renewables no longer receiving ROCs

https://reports.electricinsights.co.uk/wp-content/uploads/2022/09/Drax_Electric_Insights_Report_2022_Q2.pdf

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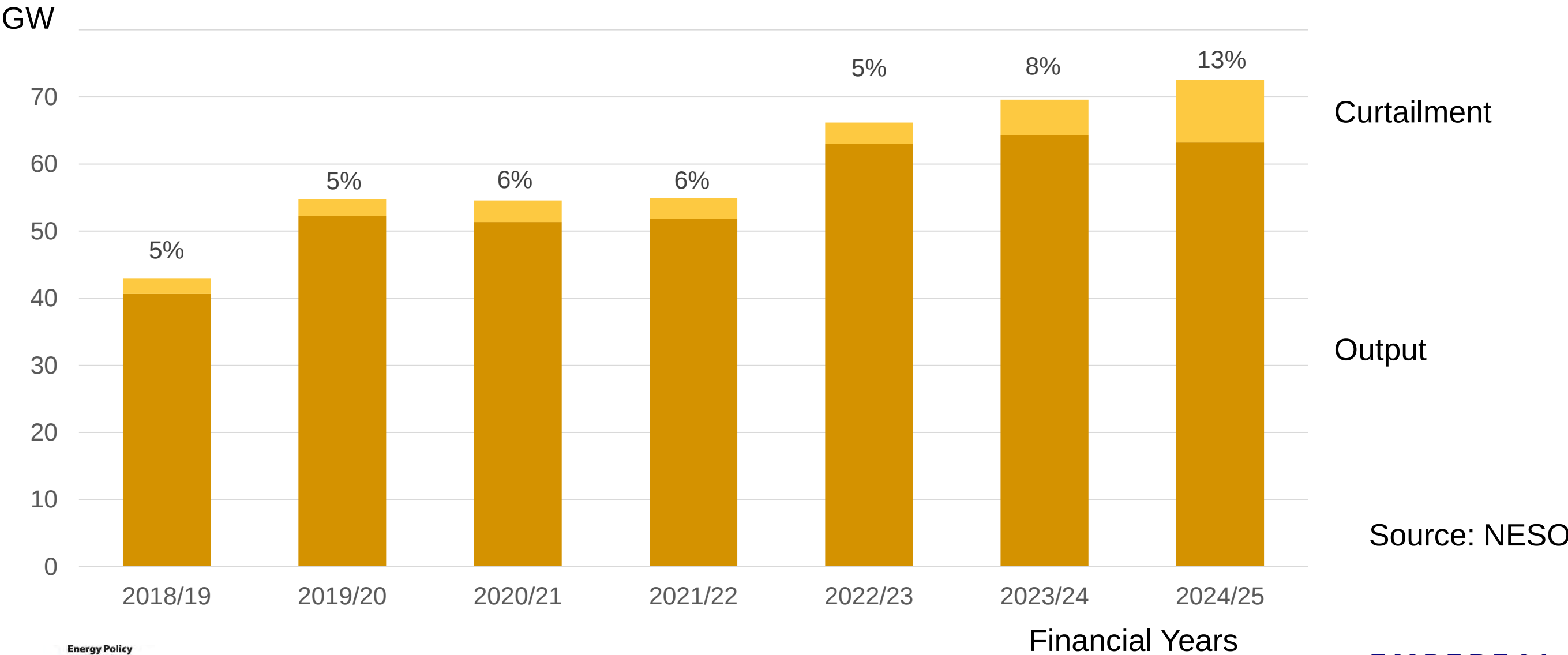


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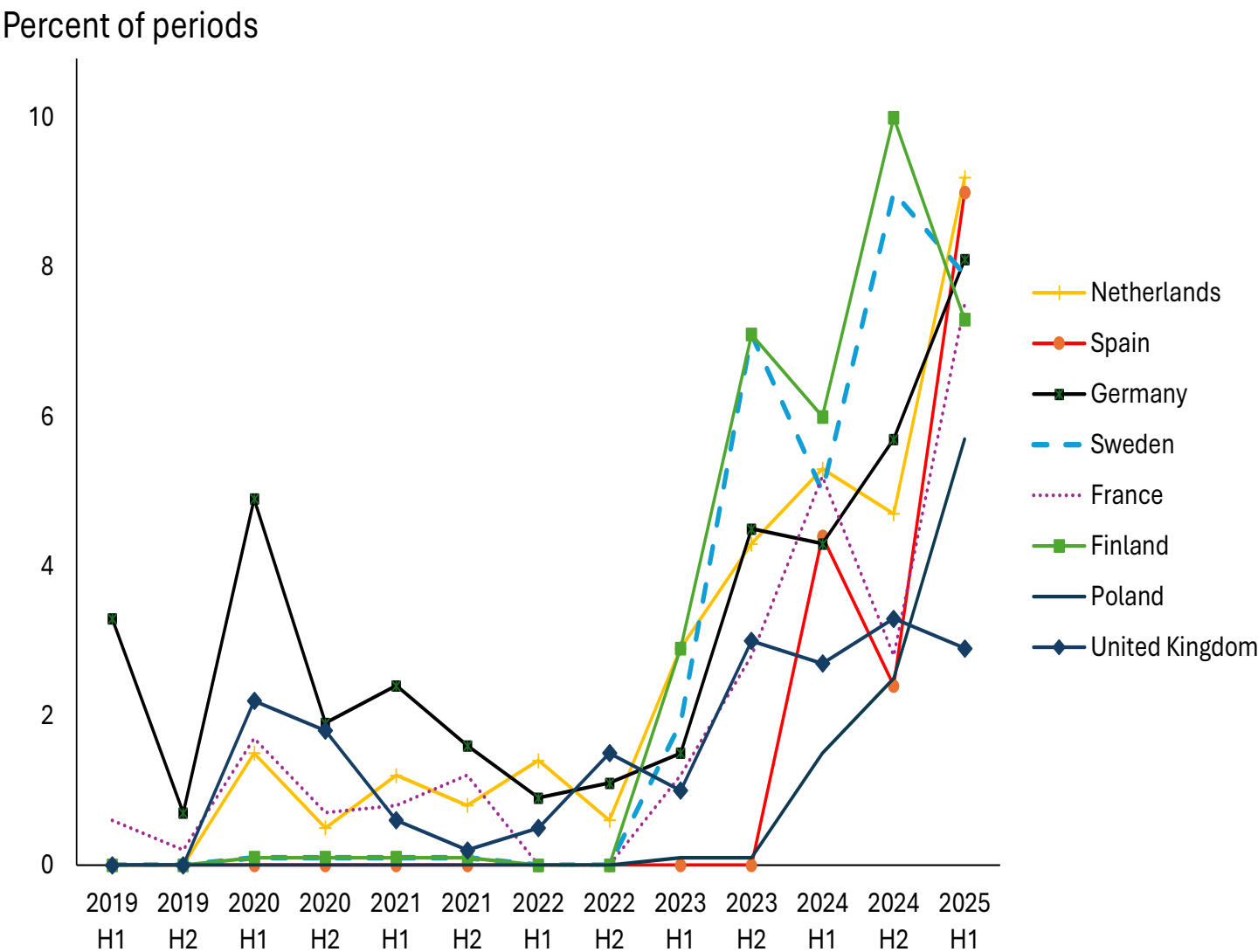
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 - Weak signals (at best) for efficient operation

Wind Output and Curtailment in GB



Spain and Netherlands experienced more than 800 hours of negative prices

Negative wholesale prices in Europe

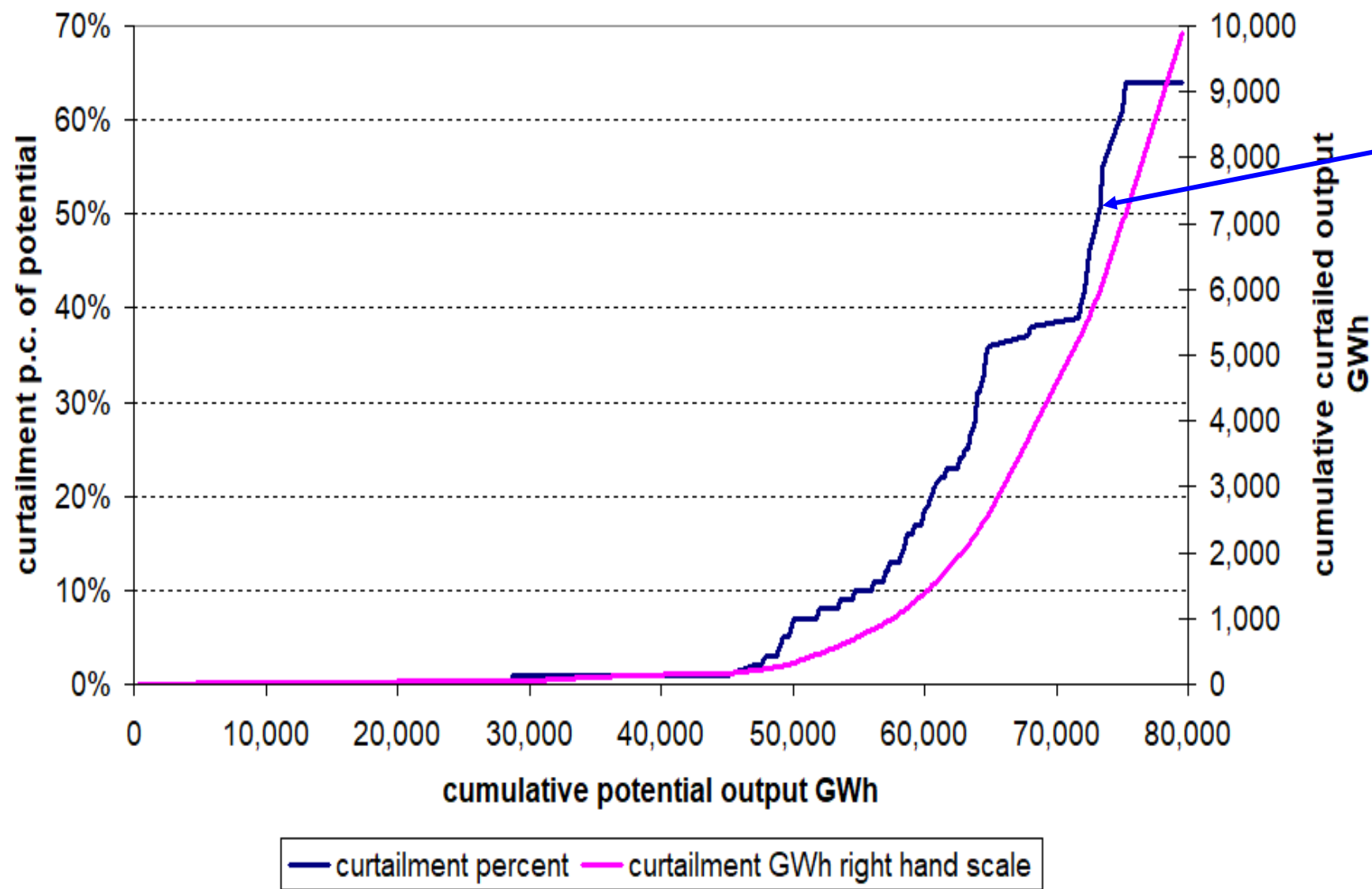


Ensuring Renewable Support leads to efficient dispatch

- EU **Regulation 2024/1747** and **EC guidance (C/2025/6701)** require support to be
 1. two-way CfDs (rules out windfall gains)
 2. should participate efficiently in the electricity markets
 3. Receive no support payments when market price falls to zero
- GB CfDs since 2020 not paid when Intermittent Market Reference Price is negative
- Remaining reform: no payment if local balancing price is negative
- These ensure **efficient dispatch order** as variable cost roughly zero
 - ⇒ should not be dispatched if price negative
 - ⇒ **Discourages locating behind congested export boundaries**

British (mainly Scottish) wind farms are facing rising curtailment

British Wind Curtailment Rates and Volumes 2024



The cost of delivered power is more than twice its nominal cost for these wind farms

Transmission charges give strong locational signals

TNUoS Tariffs 2021-22

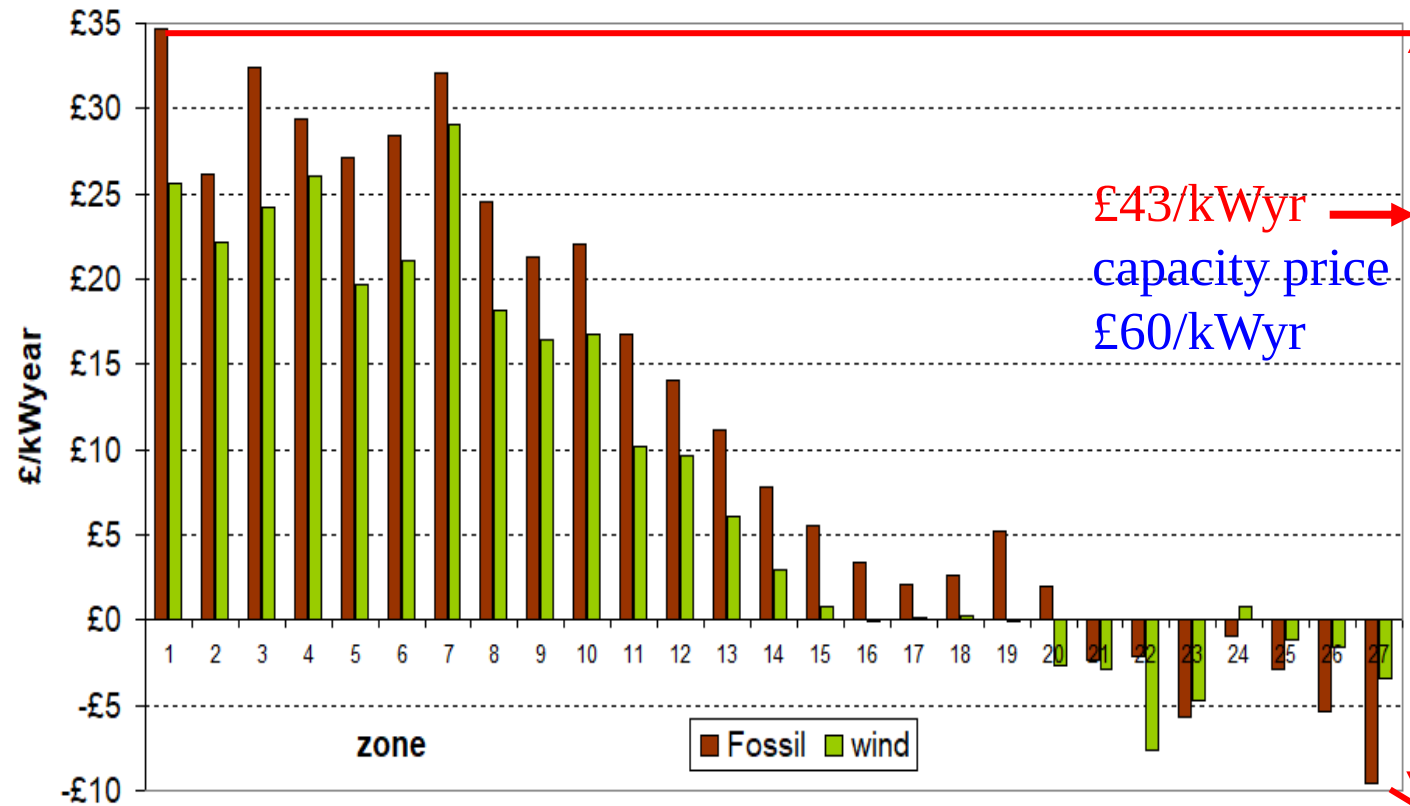
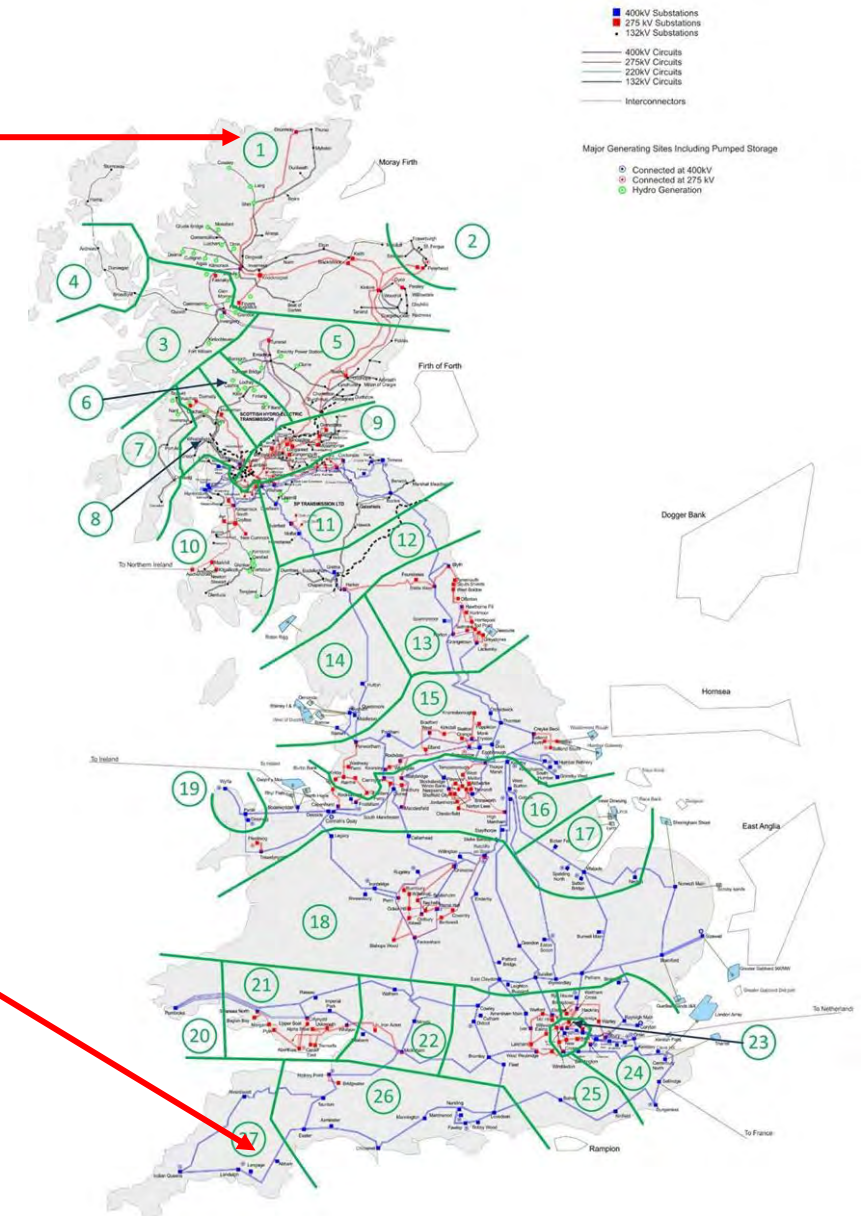


Figure A2: GB Existing Transmission System



But **new transmission** is needed
to export wind from Scotland

Improving location decisions of new Variable Renewable Electricity

- Current G-TNUoS charges give quite strong locational signals
- **Windfarm** located in Argyll (SW Scotland – windy) pays **£23.71/kWyr**
= **£7.76/MWh** at **34% capacity factor (CF)**
- **Windfarm** in East Anglia pays zero
- **Feb 2026 Auction Round 7a** cleared at **£72.24/MWh** for **onshore wind**
= gross profit in Argyll (CF=34%) is **£63.28/MWh**; in E Anglia **£72.24/MWh**
⇒ Argyll windfarm needs **CF of 39%** to earn same gross profit
⇒ Feasible as Argyll windier

BUT exports from Scotland are constrained (perhaps 50%)
Current grid charges give incorrect locational signal

Plan to export wind from Scotland involve expensive offshore links

The **Western Bootstrap** is already commissioned

Next up are **Scotland to England Green Links**

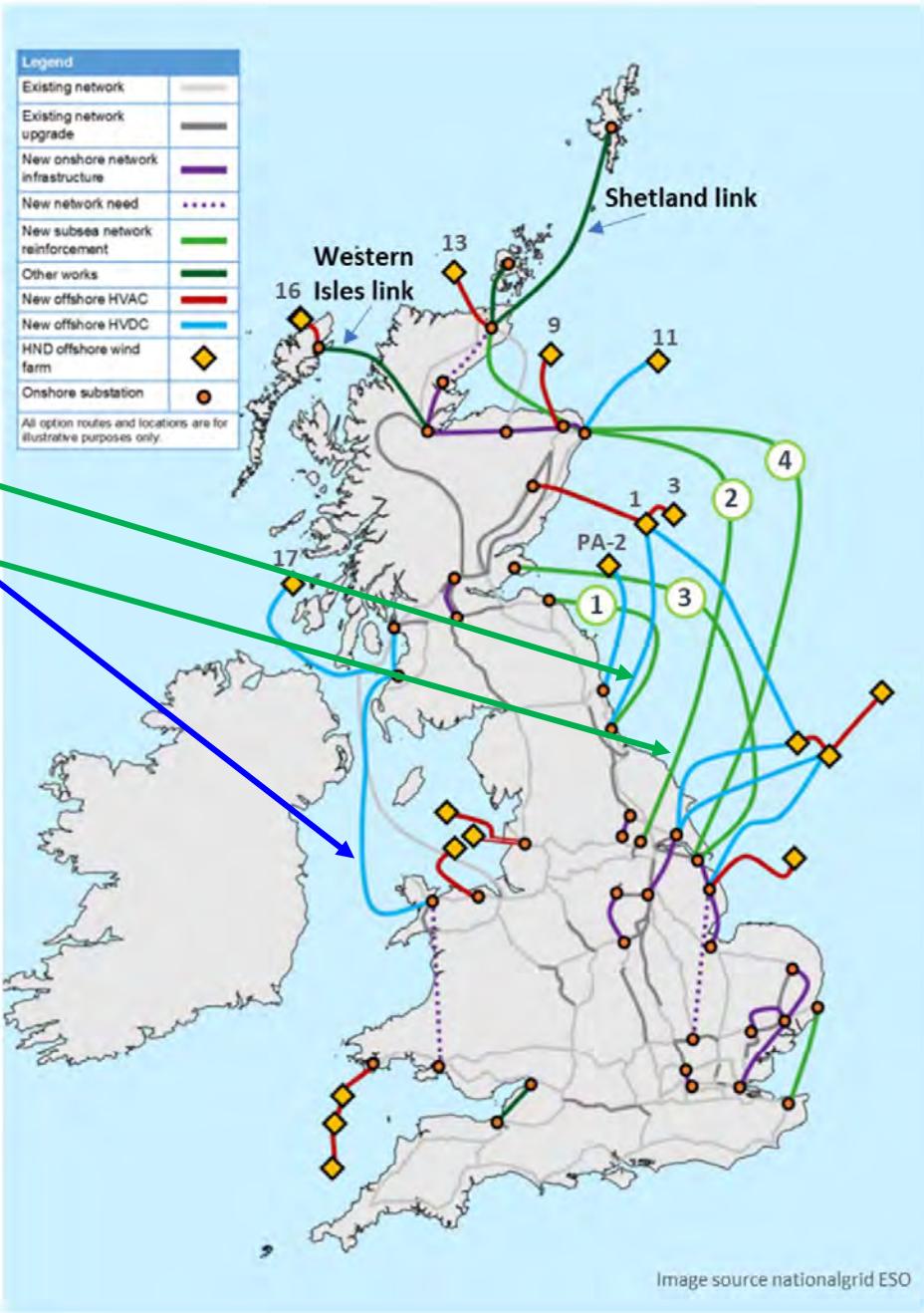
SEGL 1 £2.5 billion

SEGL 2 £4.3 billion

Item	WB	SEGL 1	SEGL 2
Length km	420	176	440
capital cost £/kW	1032	647	2150
annuitized cost £/kWyr.	£86.69	£54.35	£180.60
TNUoS	£23.99	£7.82	£27.58
ratio subsea/TNUoS	3.6	6.95	6.2

=> Marginal forward looking cost of SEGL 2

= £29.22/MWh in Scotland: needs CF=57% vs. 34% E Anglia



Conclusions

- Renewable support has evolved from auctions, to costly ROCs and finally to CfDs
- After administered **CfD strike prices** now set in **last price auctions**
⇒ **impressive price falls**
- Recent reforms now **remove subsidies if reference price negative**
 - Ensure that this is interpreted as **nodal balancing price for efficient dispatch**
- Grid charges are locational but backward-looking, ignore congestion
- **Solution**: **grandfather** existing connections
- Offer **20-year G-TUoS contracts** (like OFTO) based on **marginal expansion cost**
- Offer **non-firm connections** until expansion is available – last-in first curtailed