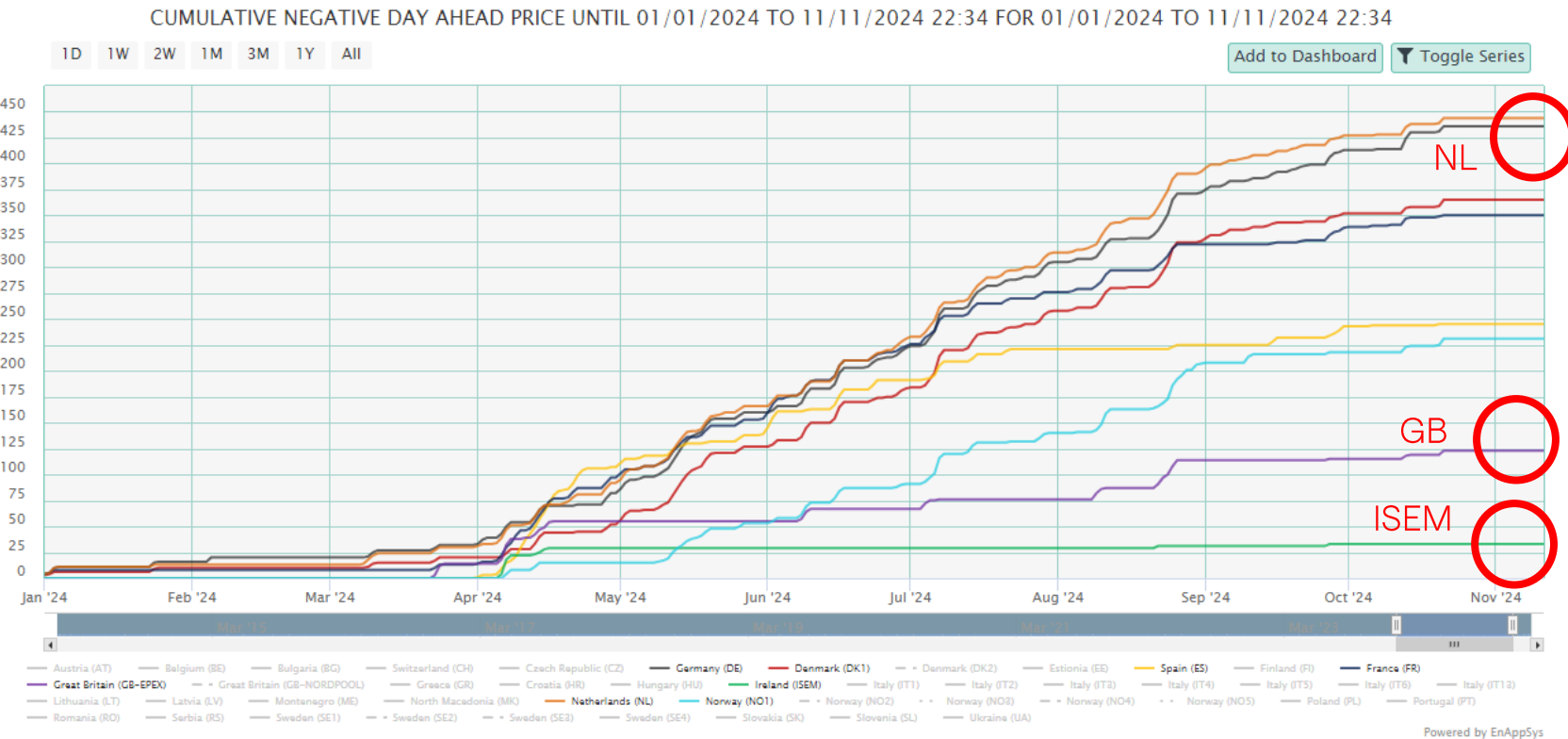


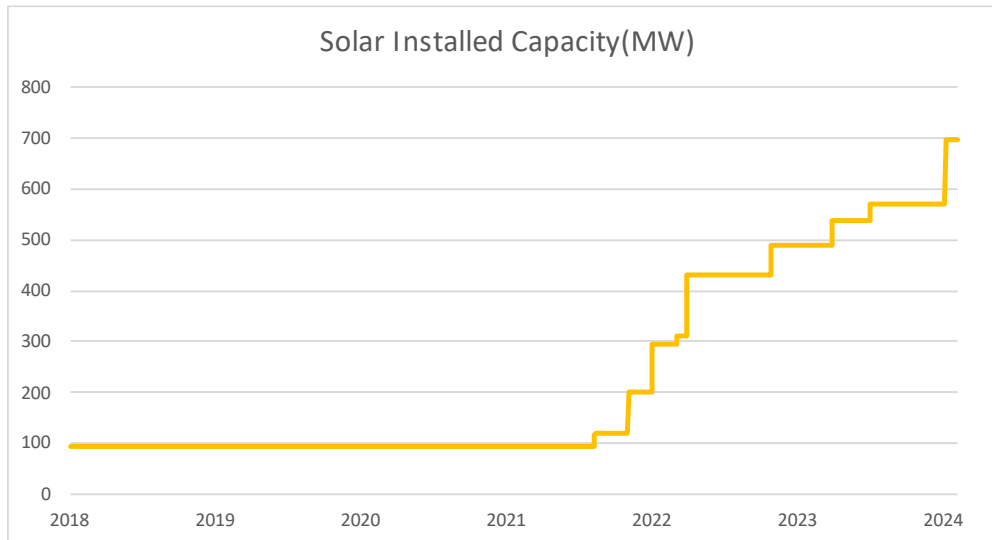
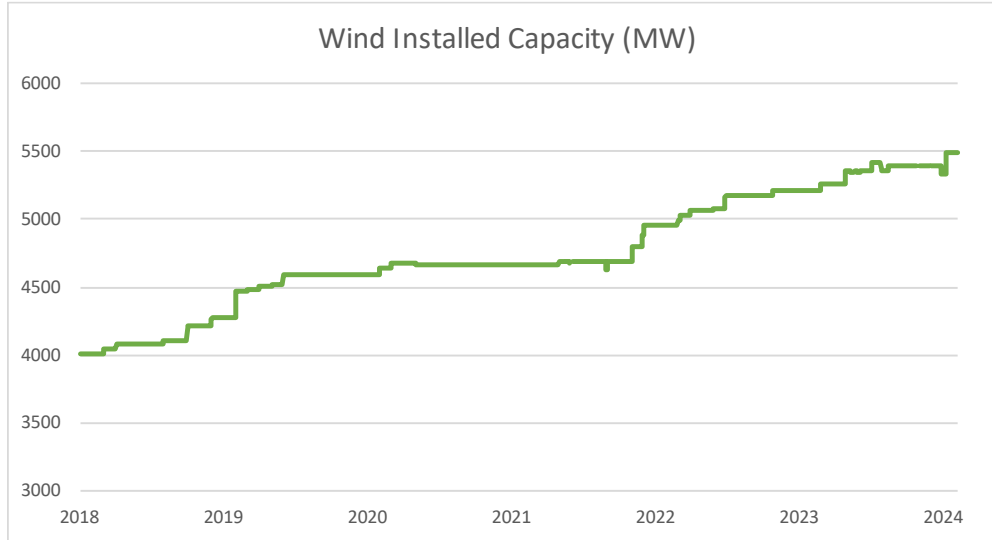
I-SEM: Expanding renewable buildout, but why so few negative prices?

- I-SEM is at the bottom of the stack when it comes to periods of negative pricing in Europe
- Only 31 hourly periods of negative day-ahead pricing since the start of 2024
- To what extent is this driven by fundamentals versus policy?

Market	Total Number of Negative-Priced Hours
Netherlands	418
Germany	399
France	326
Spain	232
GB	114
I-SEM	31



The State of the Market



Renewables Buildout

- Steady increase in wind buildout with ~5.5GW installed currently
- Rise in wind capacity of ~30% since 2018
- Solar buildout rapidly increasing since mid-2021
- Peak demand ~7GW, average ~4-5GW
- In 2022, SNSP threshold increased to 75% to allow more non-synchronous generation sources online

Renewable subsidy auctions have been less successful than hoped

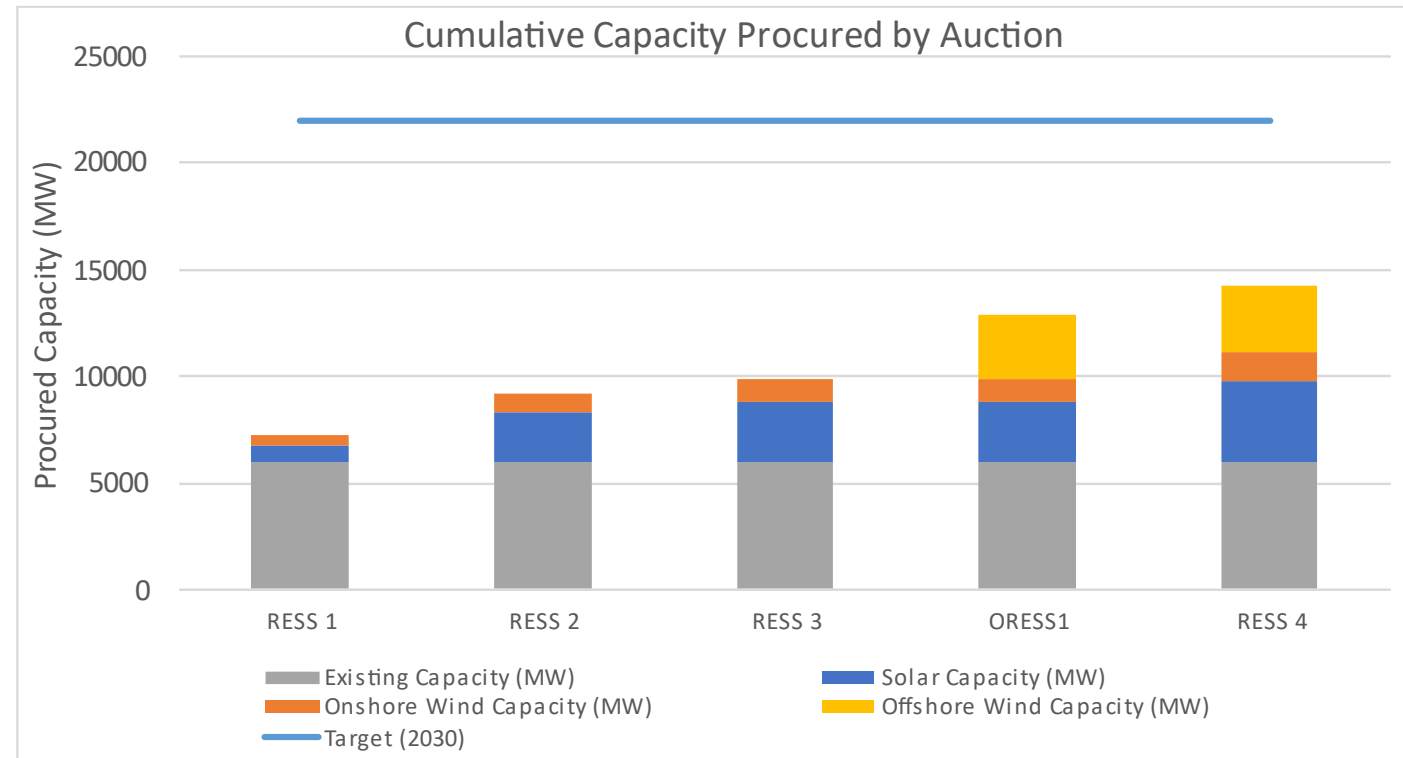
- Renewable Electricity Support Scheme (RESS) auctions have procured less renewable capacity than expected when compared against government targets for 2030
- Total capacity (including existing and all planned from RESS auctions) is still beneath 2030 targets
- Development process can be long, taking several years for grid connections and planning permissions

	Solar Capacity (MW)	Onshore Wind Capacity (MW)	Offshore Wind Capacity (MW)
RESS 1	796	479	0
RESS 2	1534	414	0
RESS 3	498	148	0
ORESS1	0	0	3074
RESS 4	960	374	0
Total RESS Capacity			
	3788	1416	3074
Existing Capacity (2024)			
	571	5368	25
Total Planned			
	4359	6784	3099
Target Capacity (2030)			
	8000	9000	5000



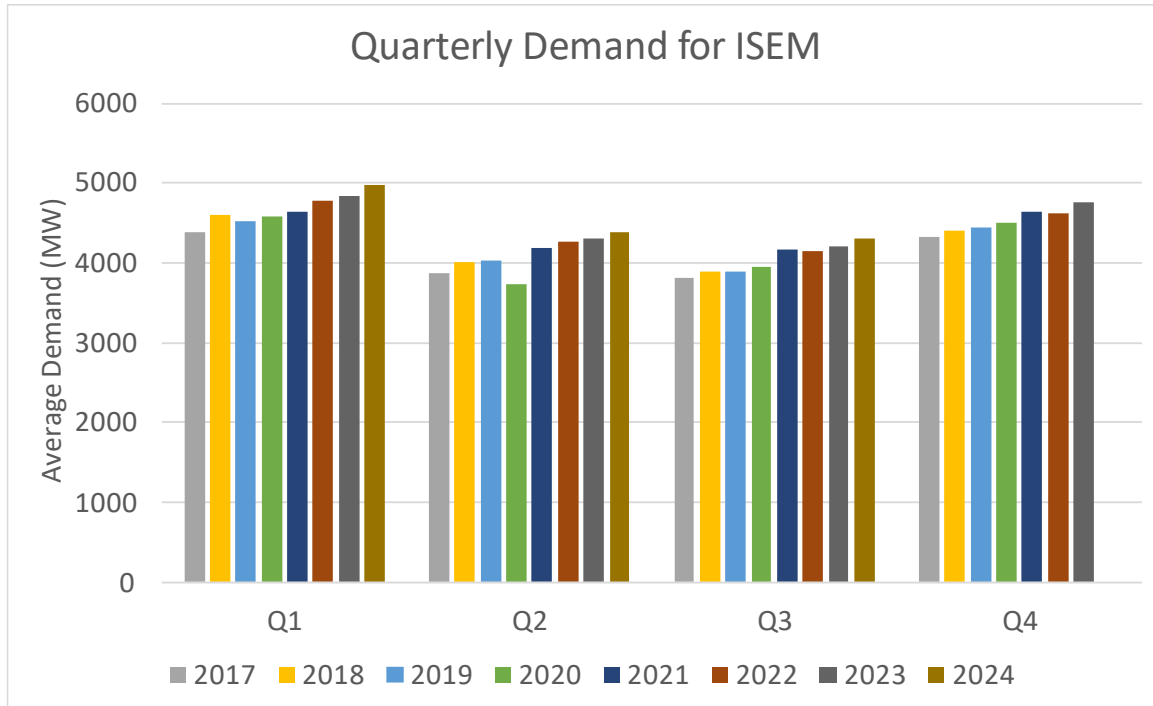
Total Contracted Capacity Behind Government Targets

- Almost 8GW of further renewable capacity is required to meet target above what has already secured RESS contracts
- This far ~8.2GW of RESS contracts have been secured





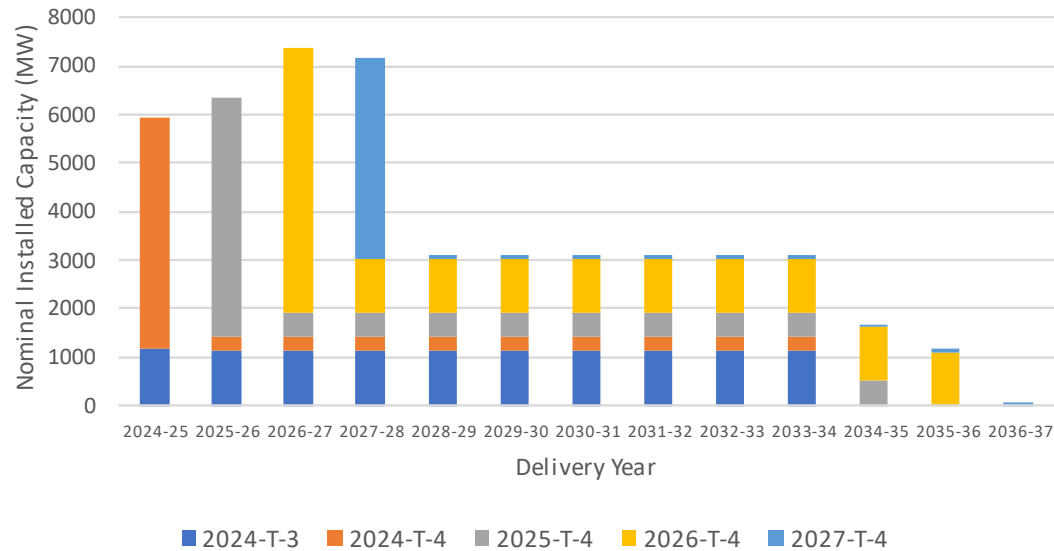
Demand on the Rise



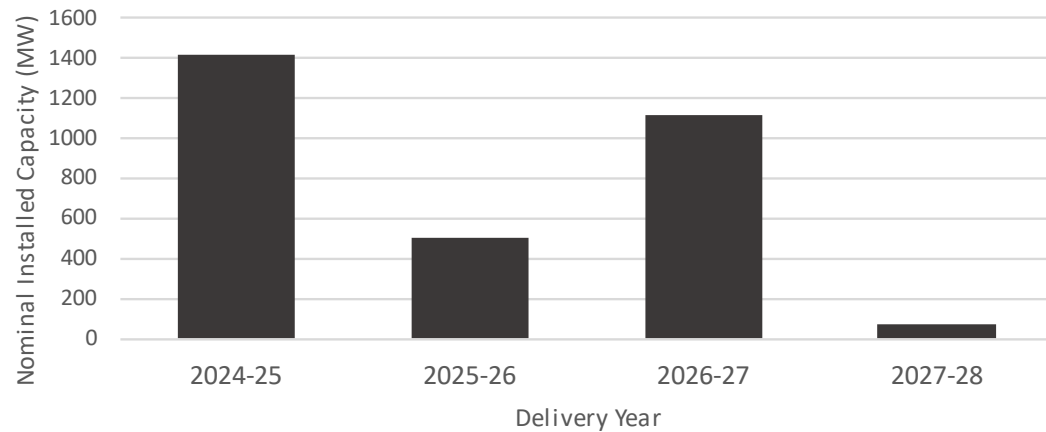
- Low corporation tax rate of 12.5% has attracted global technology companies to base their European operations in Ireland
- For reference, US corporation tax is at 21%, with Trump proposing a cut to 15%
- Over 80 datacentres have been built, with tech giants Google, Amazon and Meta planning further expansion
- Datacentres now make up more of national demand than all residential homes
- Internal constraints worsening as gap between areas of high and low demand widens



Gas Turbine Contracted Capacity By Auction



New-Build Gas Turbine Capacity in Capacity Market with 10-Year Contracts By Delivery Year

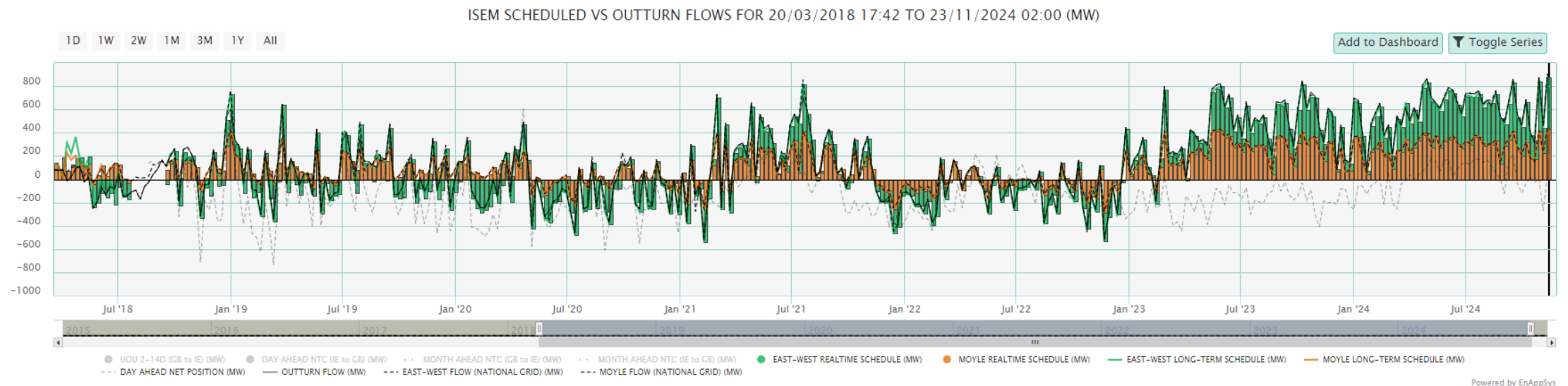


Capacity Mechanism Not Keeping Up

- Capacity Market dominated by Gas Turbine assets
- Fewer new-build Gas Turbine assets being contracted long-term (10 year) contracts
- This is despite the rising demand due to datacentre buildout
- Only three new-build gas assets procured contracts in most recent auction for delivery year 2027-28. Two of them in Northern Ireland

Limited Interconnection Capacity

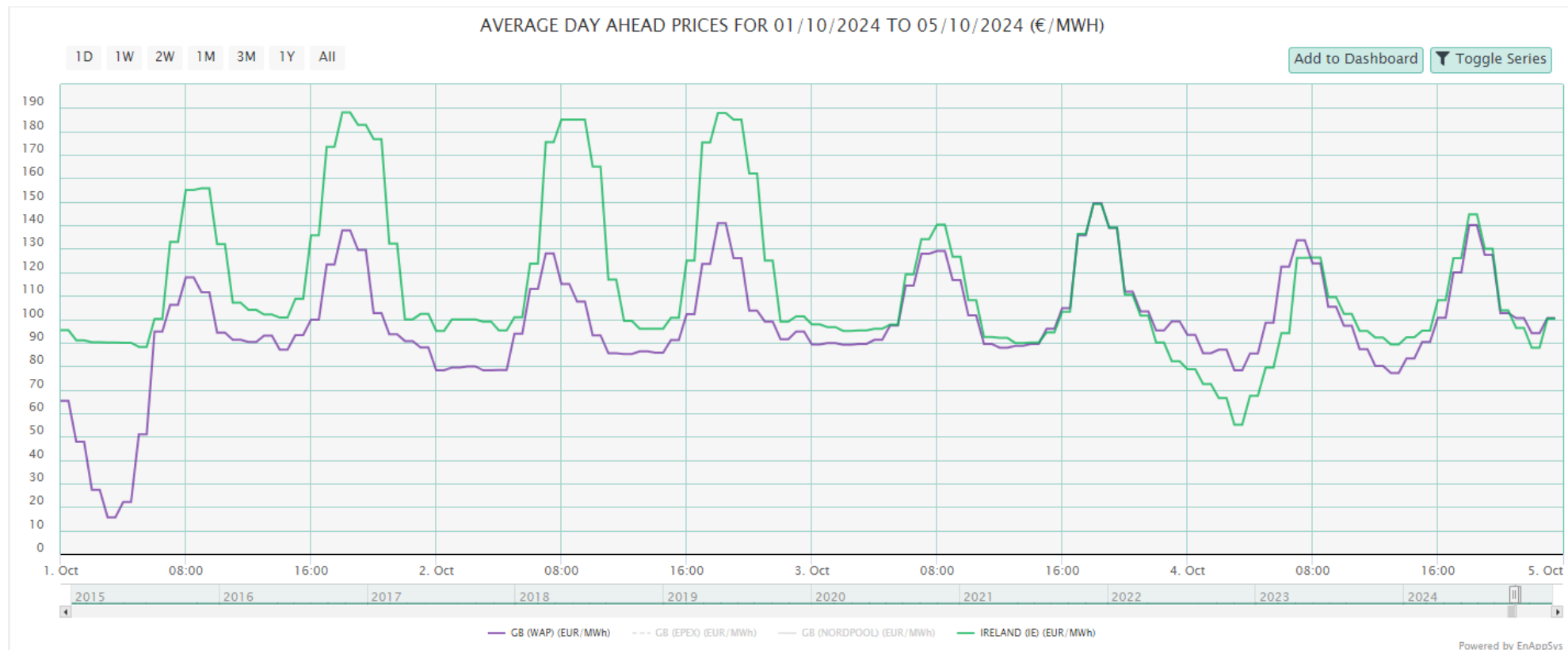
- Moyle and East-West Interconnector are the only cables linking the SEM to other markets
- Both connect to GB giving a total of 1GW capacity
- Originally intended to allow excess Irish renewables to flow into GB, more recently it is regularly in a net import position
- Total interconnection capacity represents 22% of peak GB demand, whereas it is only 14% for I-SEM, so more reliance on conventional generation for demand peaks in I-SEM



Explaining the Price Differential

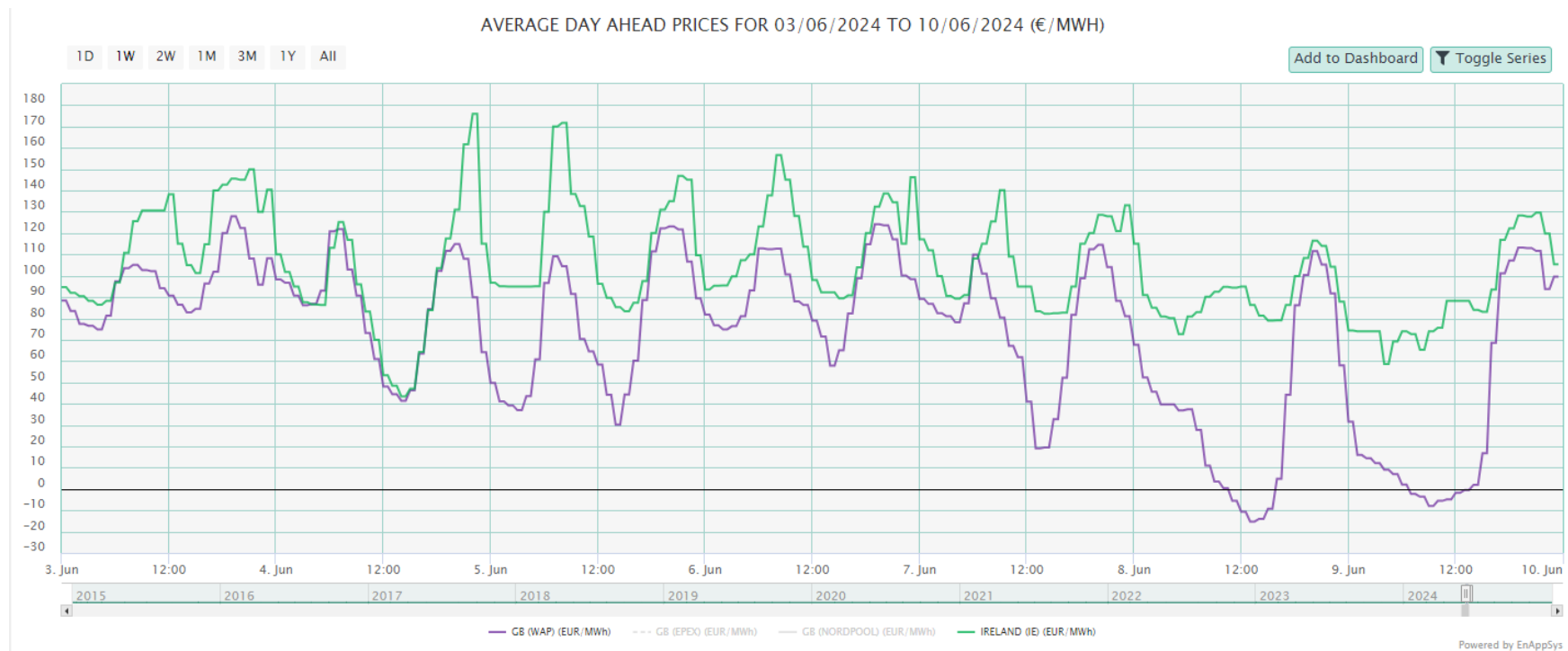
GB – I-SEM Day-Ahead Price Differentials

- Day-ahead power prices in the SEM frequently decouple from those in GB, particularly when renewables are low



GB – I-SEM Day-Ahead Price Differentials

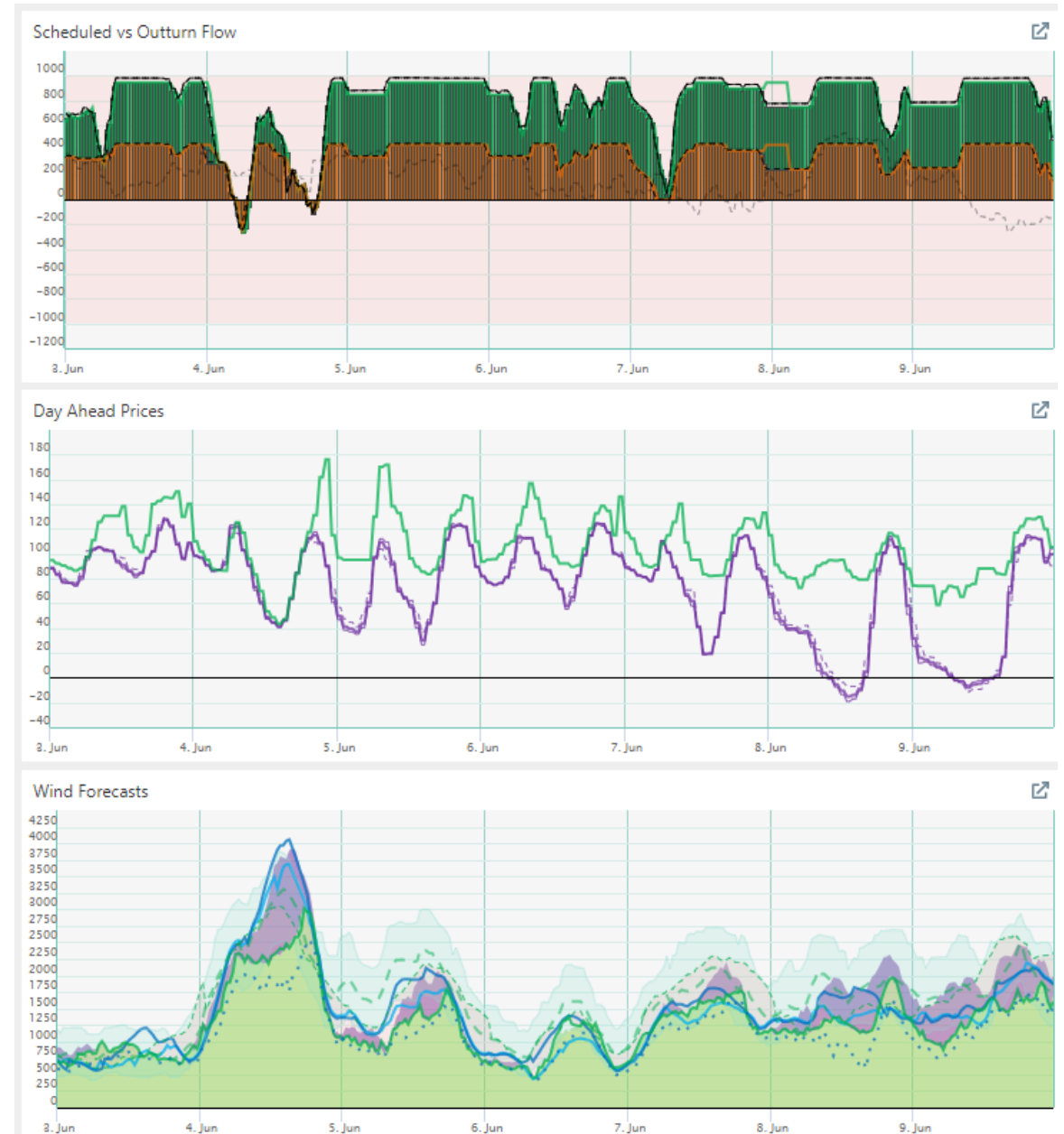
- When GB prices drop to negative levels, prices in the SEM do not follow
- Instead, Irish prices remain high, and the interconnectors shift to a full importing position to bring as much cheap power from GB into the SEM as possible





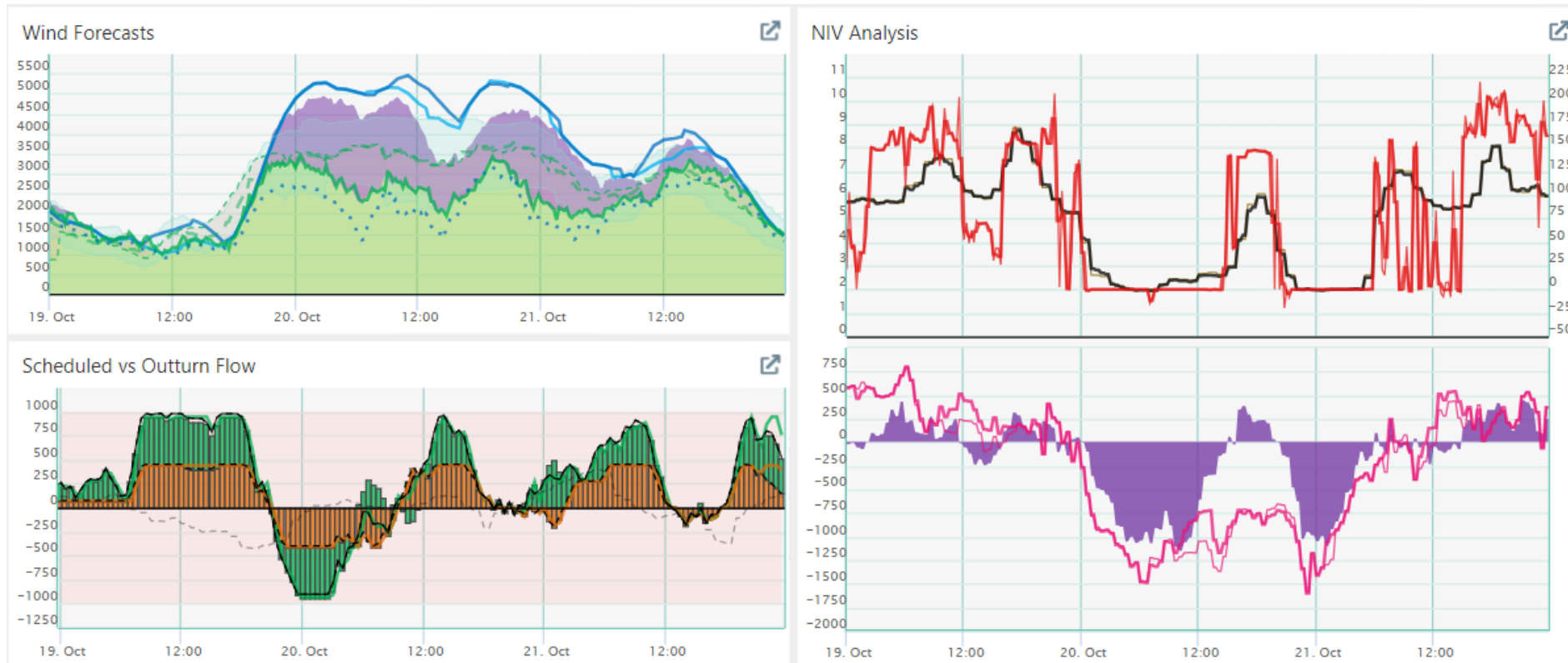
The Canary in the Coal Mine

- Cheap power flowing in from the continent brings GB prices negative
- Interconnectors flow power from GB into the SEM at full capacity
- Cheap imports mean that local renewables must be bid down in the balancing mechanism in order to balance supply and demand
- Why are Irish renewables being displaced by imports from GB?



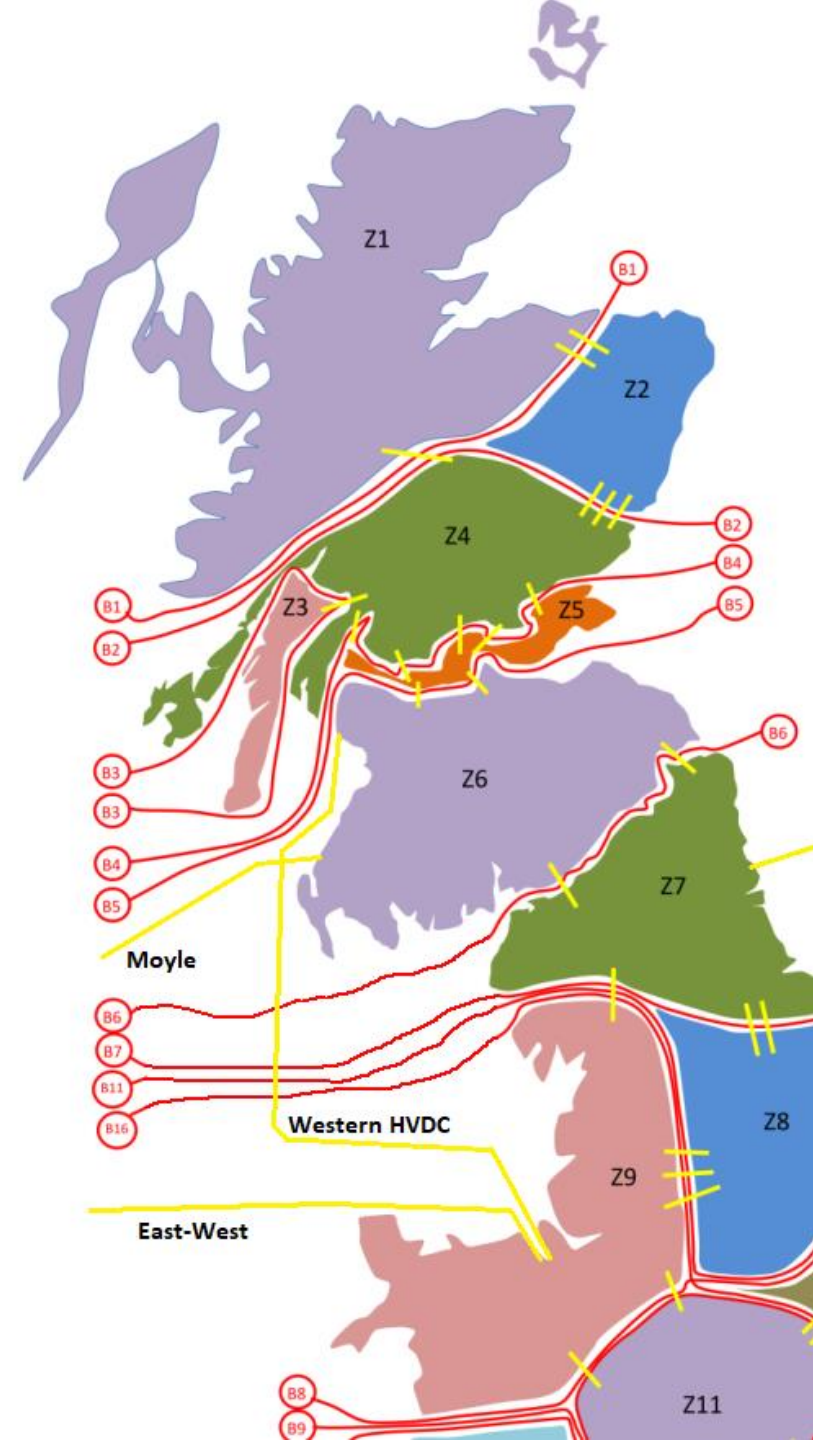
Balancing Prices

- Wind assets priced into the BM at €0/MWh
- In order for balancing prices to go negative, all available downward wind volumes must be taken first and then negative dispatchable bids can be taken



GB B6 Boundary Constraint

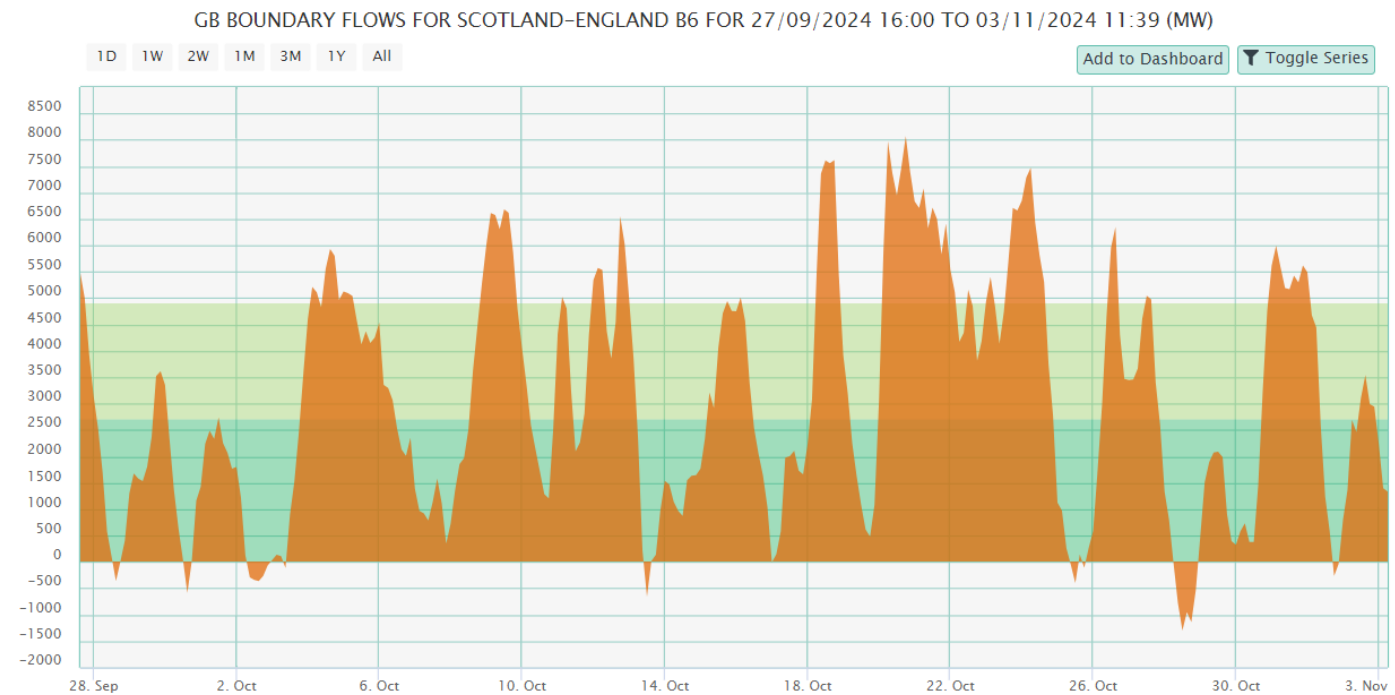
- Moyle lands in Zone 6 in Scotland
- The B6 Boundary is a bottleneck in GB
- If Moyle flows were rebalanced to flow into Scotland, it could worsen the bottleneck at the B6 boundary





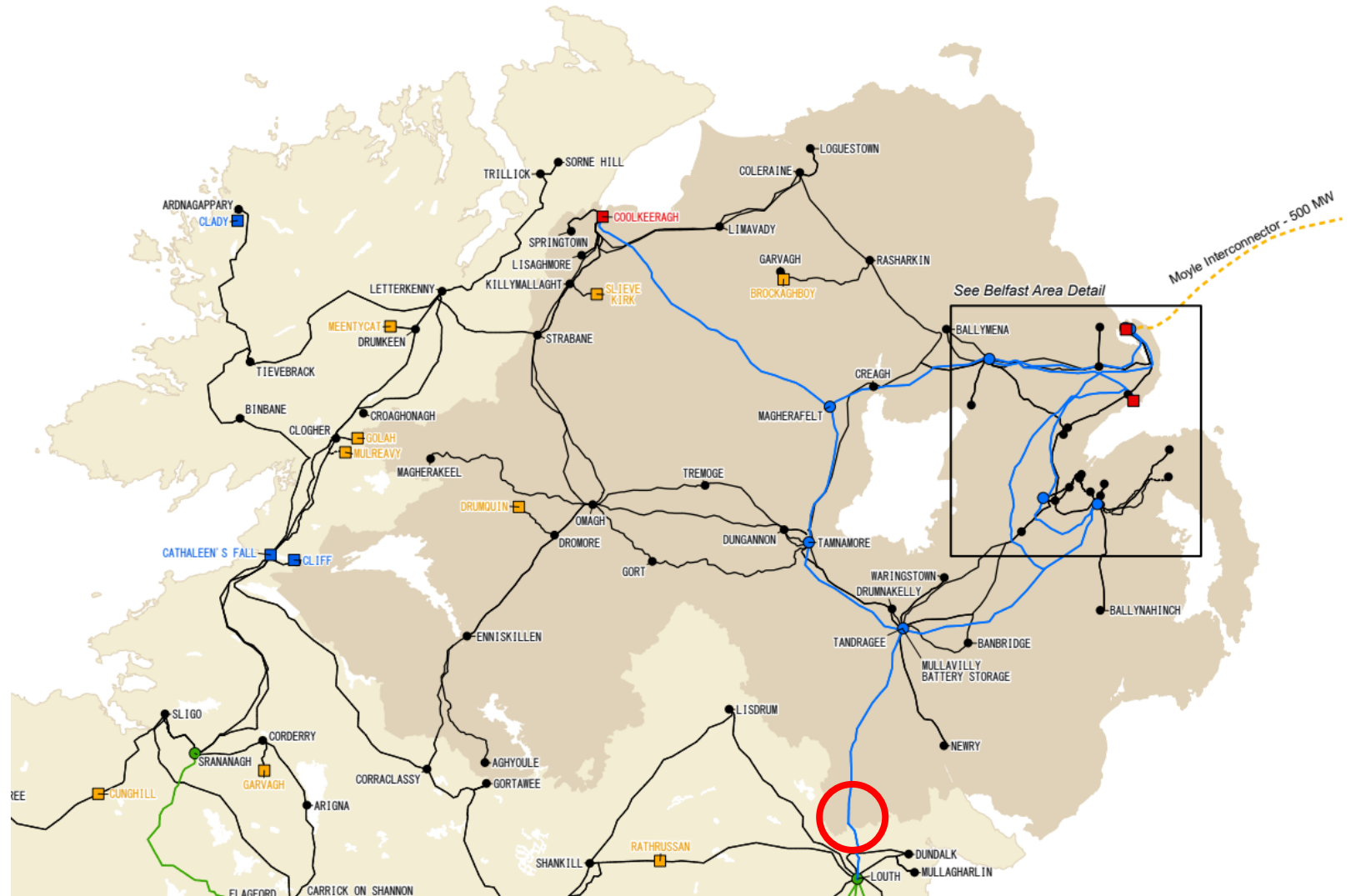
GB B6 Boundary Constraint

- Exports through the B6 boundary often exceed transfer capacity when it is windy in Scotland
- Exporting additional power into Scotland would potentially make this worse and increase overall balancing costs in GB



Limited flows on North-South line

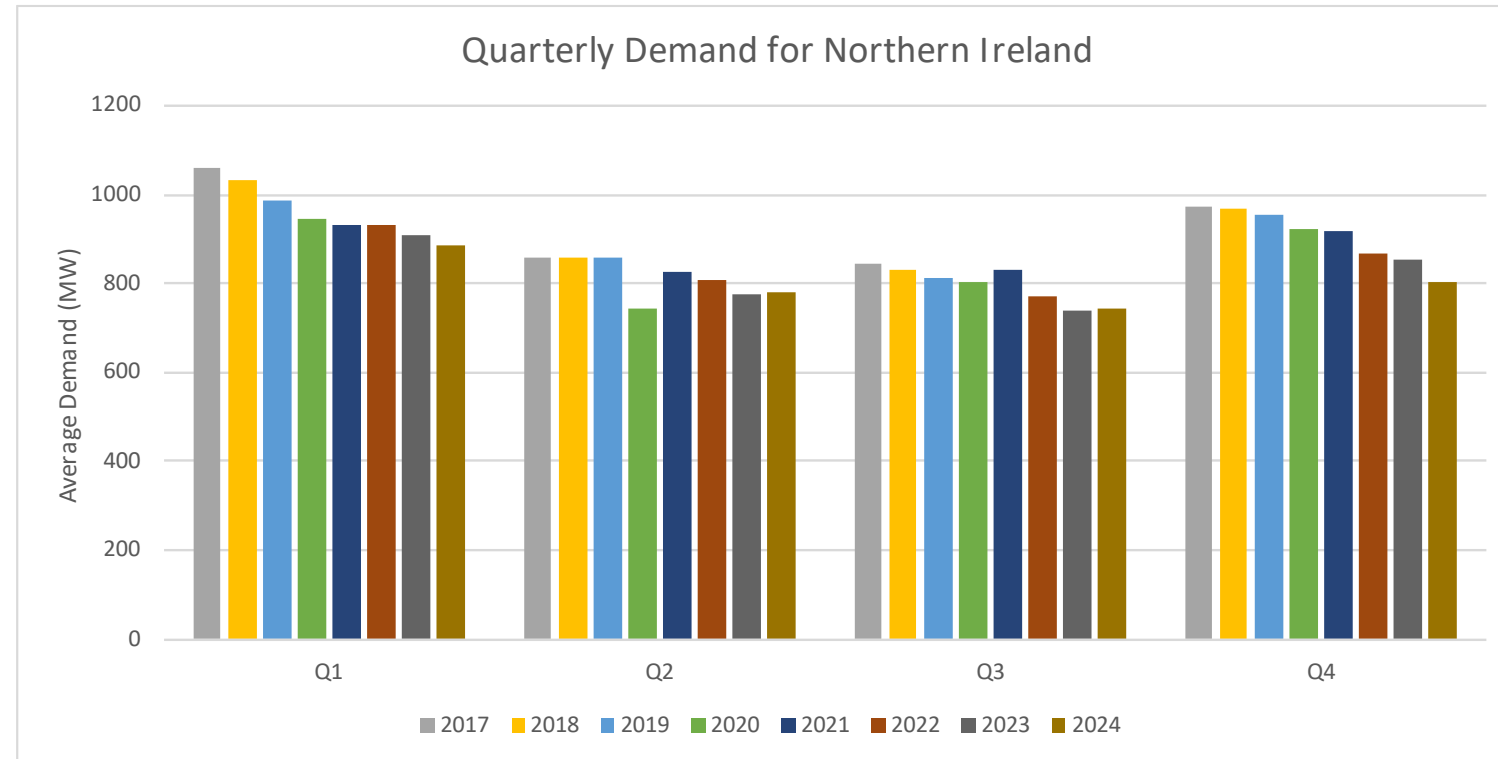
- Only one primary cable (275kV) connects Northern Ireland to the Republic
- Two other auxiliary cables exist but they cannot operate without the primary cable
- Capacity of 1.5GW, but only 450MW permitted to flow through from NI to RoI due technical reasons





Demand Decreasing in Northern Ireland

- Datacentre buildout primarily in the Republic
- Peak demand in Northern Ireland ~1.4GW last winter
- During times of full import, over one third of Northern Ireland Demand is covered by Moyle





Northern Ireland Constraints

- Certain generating units are required to be on load due to system constraints

Name	TC G Type	Limit Type	Limit	Resources	Description
System Stability (S_NBMIN_MINNIU)	NB	N:>=	3 Units at all times	B10, B31, B32, C30, KGT6	There must be at least 3 machines on-load at all times in Northern Ireland. Required for dynamic stability.

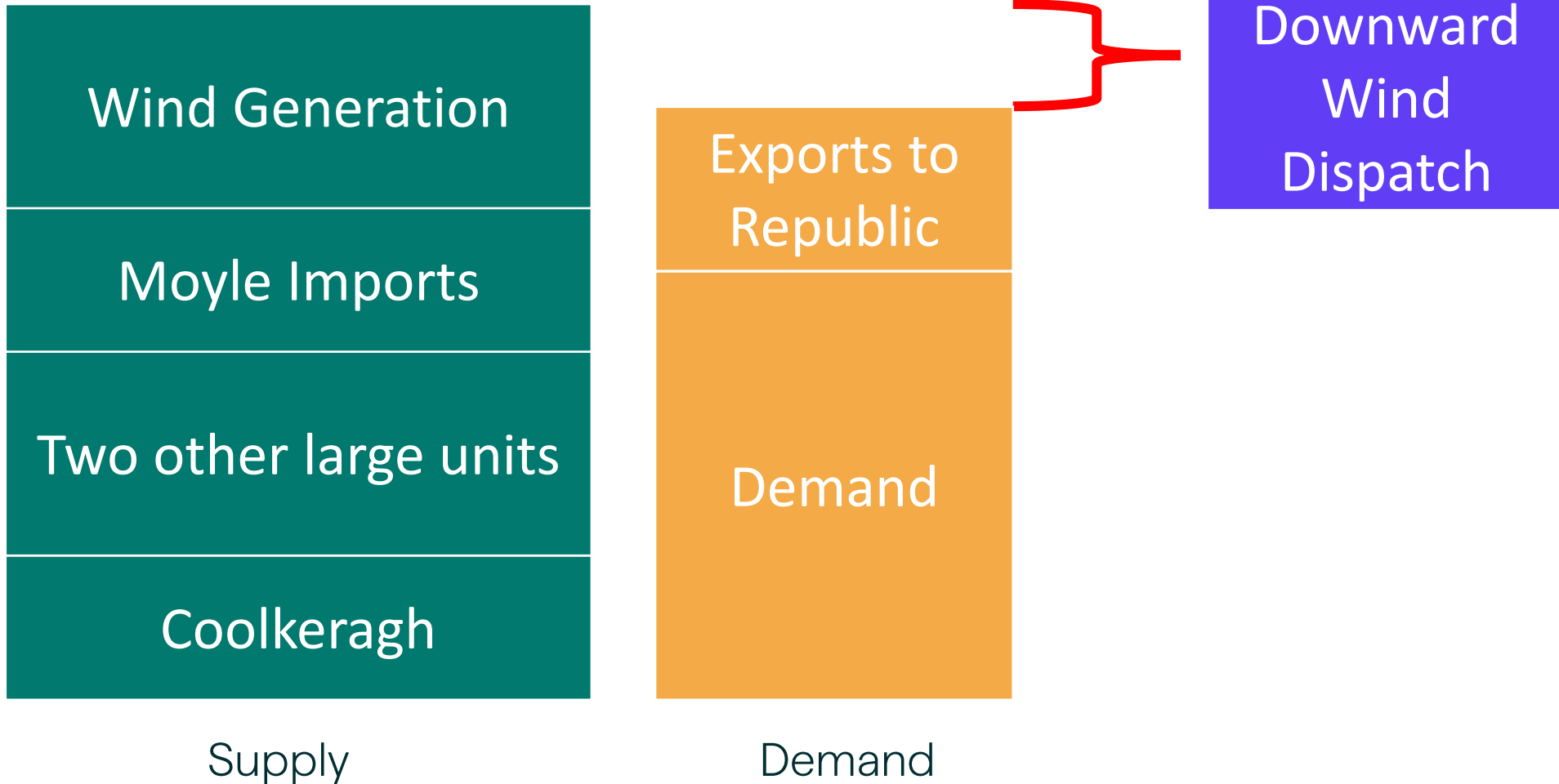


Northern Ireland Constraints

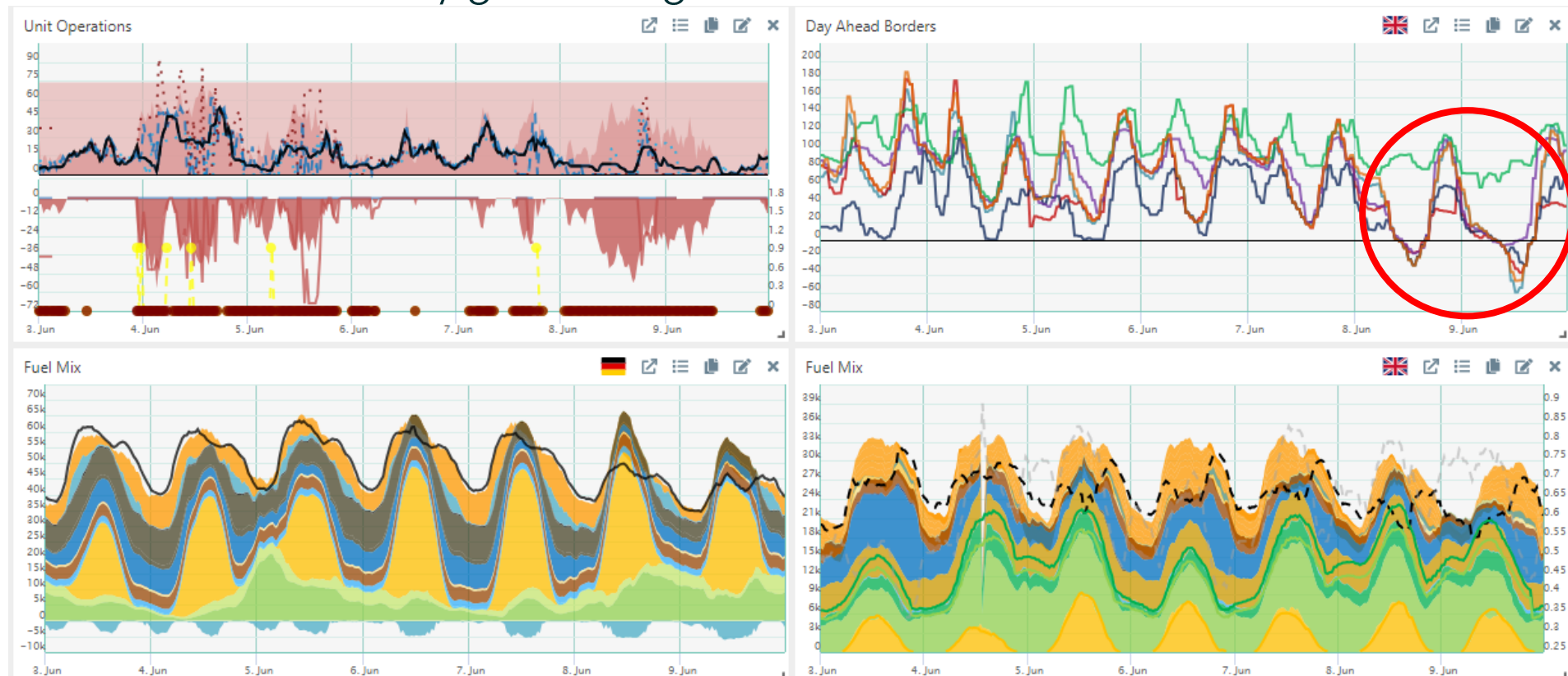
- Certain generating units are required to be on load due to system constraints
- Coolkeeragh CCGT often required to be running at all times

Name	TC G Type	Limit Type	Limit	Resources	Description
System Stability (S_NBMIN_MINNIU)	NB	N:>=	3 Units at all times	B10, B31, B32, C30, KGT6	There must be at least 3 machines on-load at all times in Northern Ireland. Required for dynamic stability.
System Stability (S_NBMIN_MINNI3)	NB	N: >=	Minimum 1 at all times	C30	Security of supply.

Determining Balancing Actions



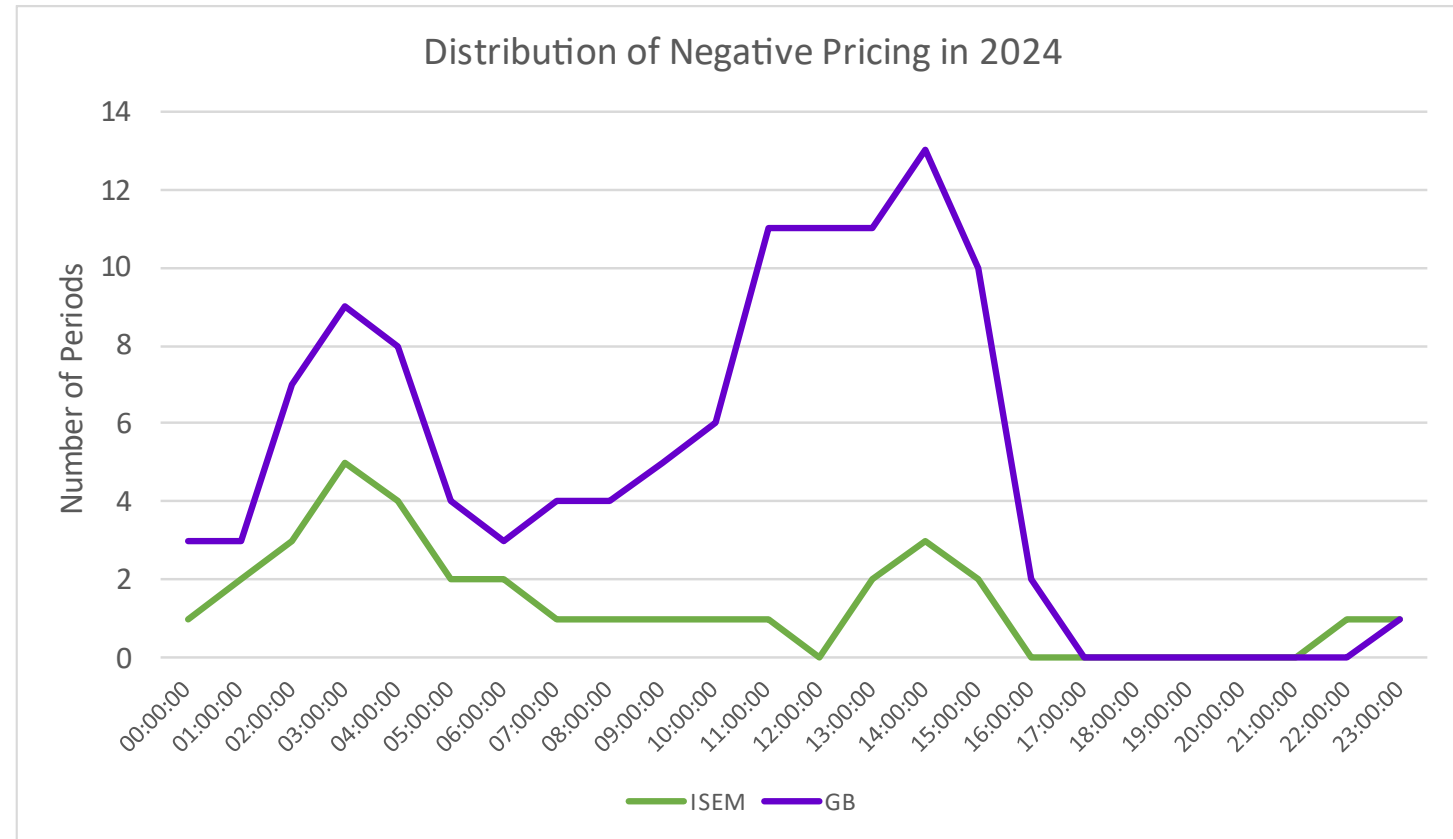
- As an example, Slieve Kirk Wind Farm, the largest in Northern Ireland, is turned down
- Renewables dominate fuel mixes of GB and Germany, with day-ahead prices dropping to negative levels
- I-SEM imports as much as it can, but still requires a large proportional component of its demand to be met by gas-fired generation



Negative Pricing Events

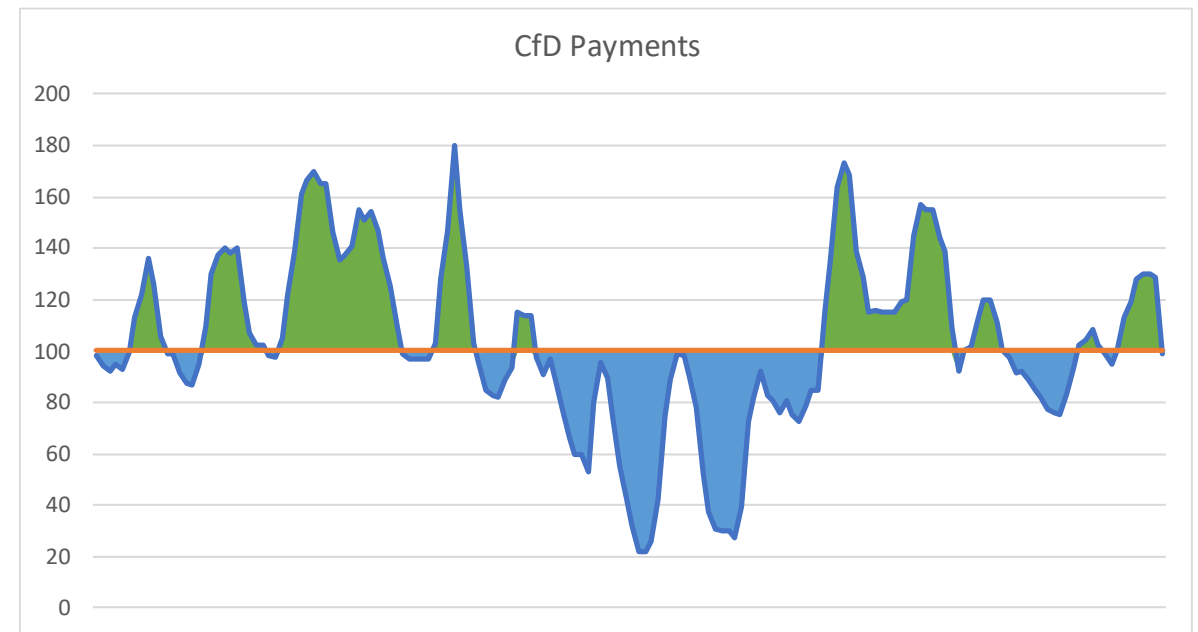
Overnight Negative Pricing Events

- Negative pricing events tend to occur overnight in ISEM, unlike in other European markets where negative pricing is driven by solar generation
- Solar generation not covered under REFIT subsidy scheme, only newer RESS scheme



CfD Mechanism under RESS

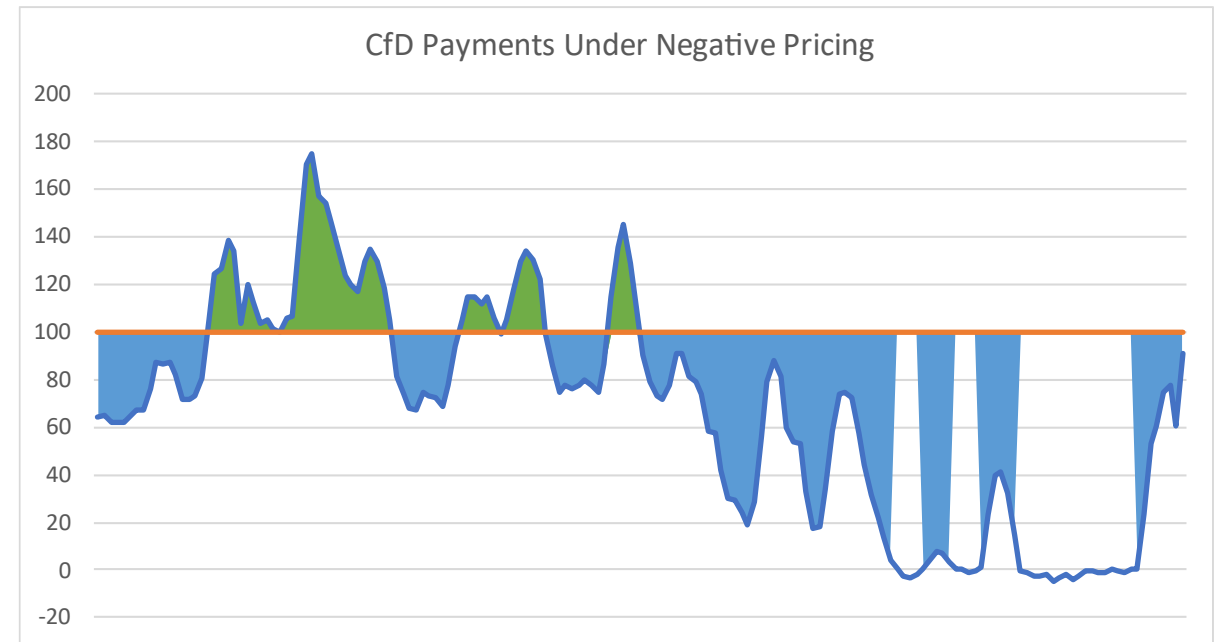
- RESS operates using a CfD mechanism
- Mechanism pays each asset the difference between the market price and the strike price set when it procured its contract
- That means assets will pay back to the mechanism when the market price is the higher of the two





No Payout at Negative Prices

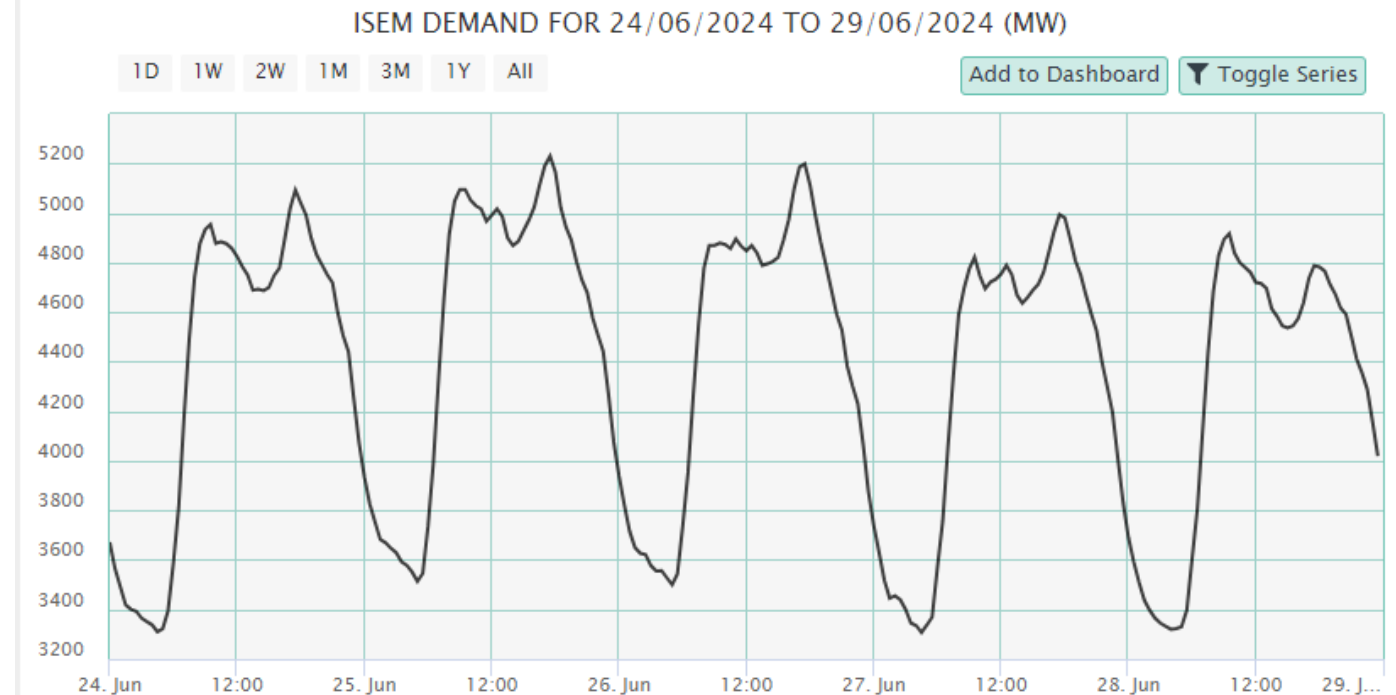
- RESS CfD mechanism does not pay out when prices are negative
- This means that renewables assets will not price themselves into the day-ahead market with negative prices
- Such legislation does not exist in other key markets such as GB, Germany and the Netherlands
- European power can end up being cheaper than domestic renewable generation, hence the wind bid volumes





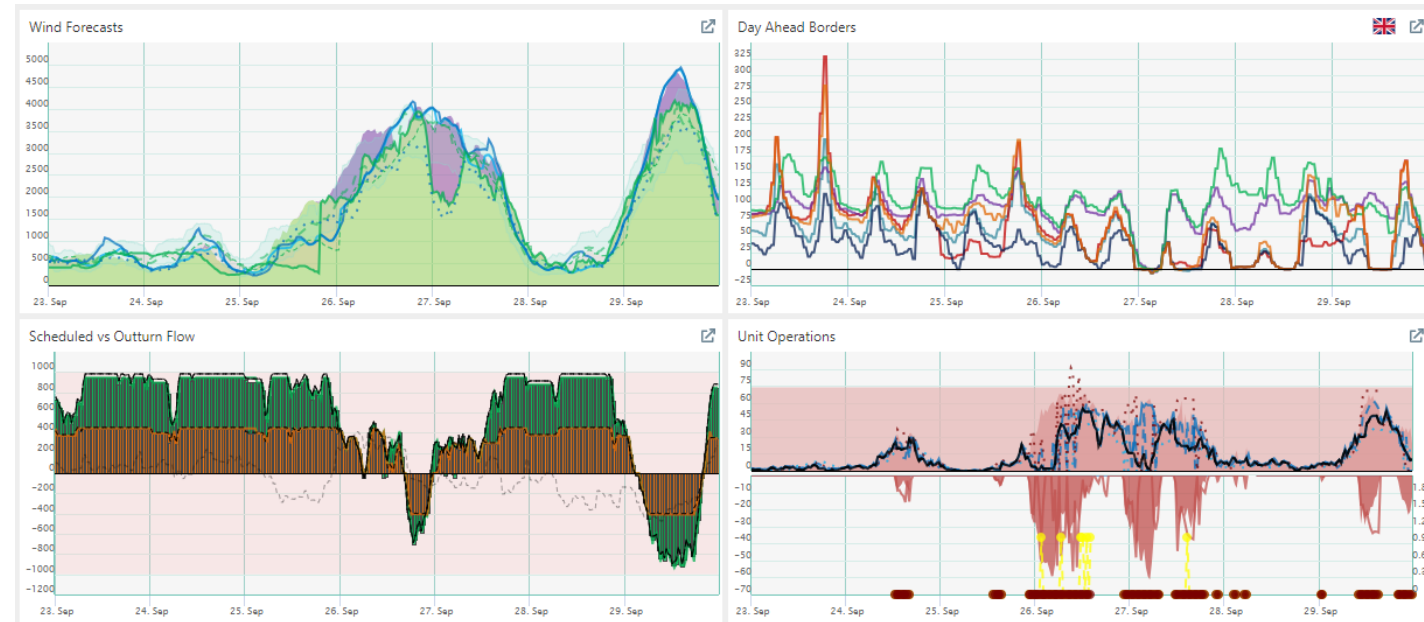
Overnight Negative Pricing Events

- Demand swings from overnight to morning peak are high (~4GW -> 6GW) without a midday drop on the scale of other markets due to limited behind-the-meter solar
- Datacentre demand isn't baseload, so large swings can be expected with low overnight demand



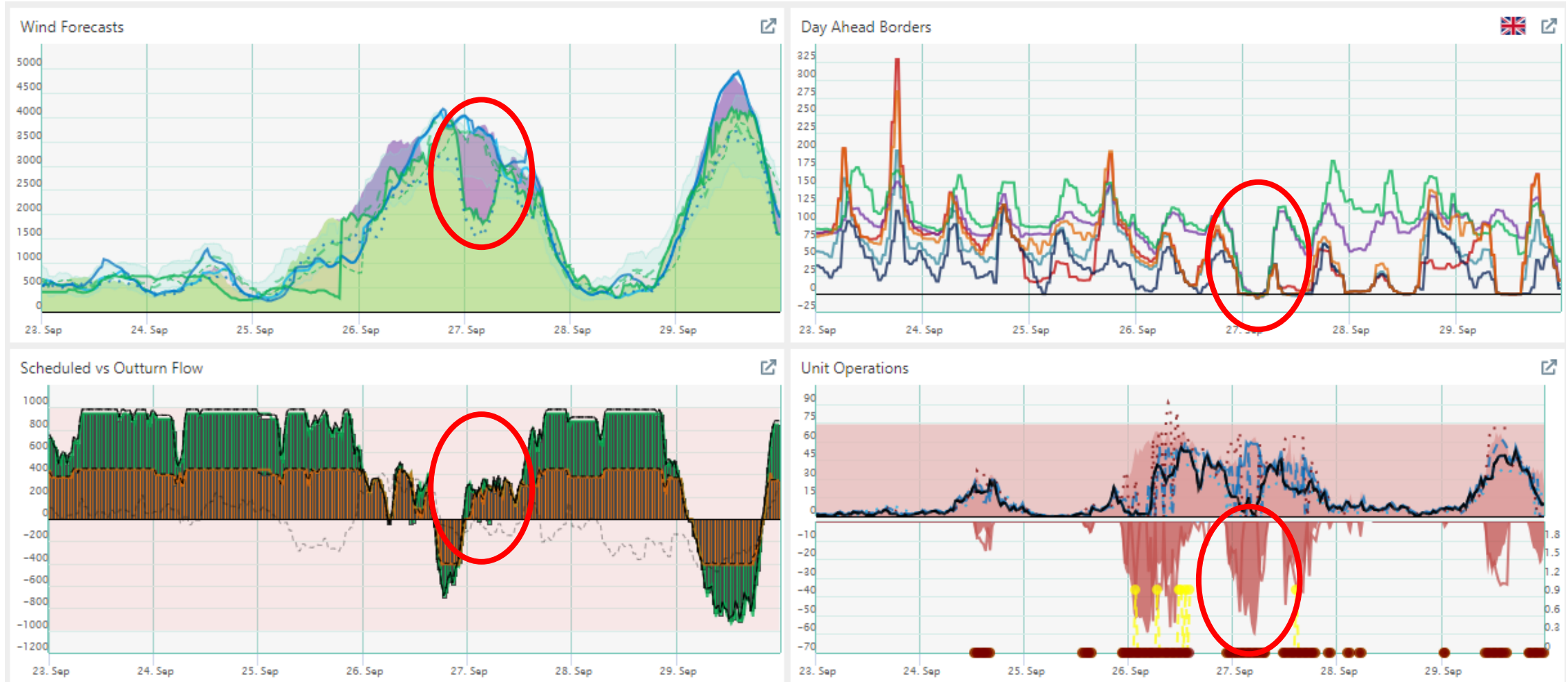
Overnight Negative Pricing Events

- Wind assets setting the price
- REFIT scheme operates as a two-way Feed-in-Tariff, meaning that it pays out at negative prices, so negative pricing more likely
- Curtailment payments mean that there is lower risk of running overnight





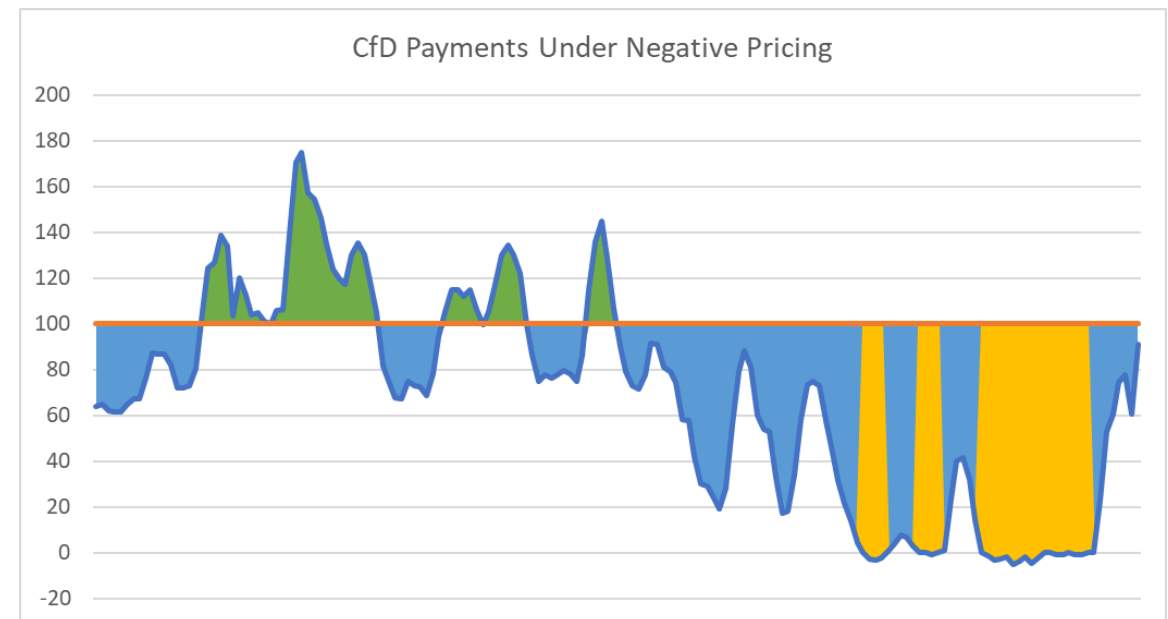
Overnight Negative Pricing Events

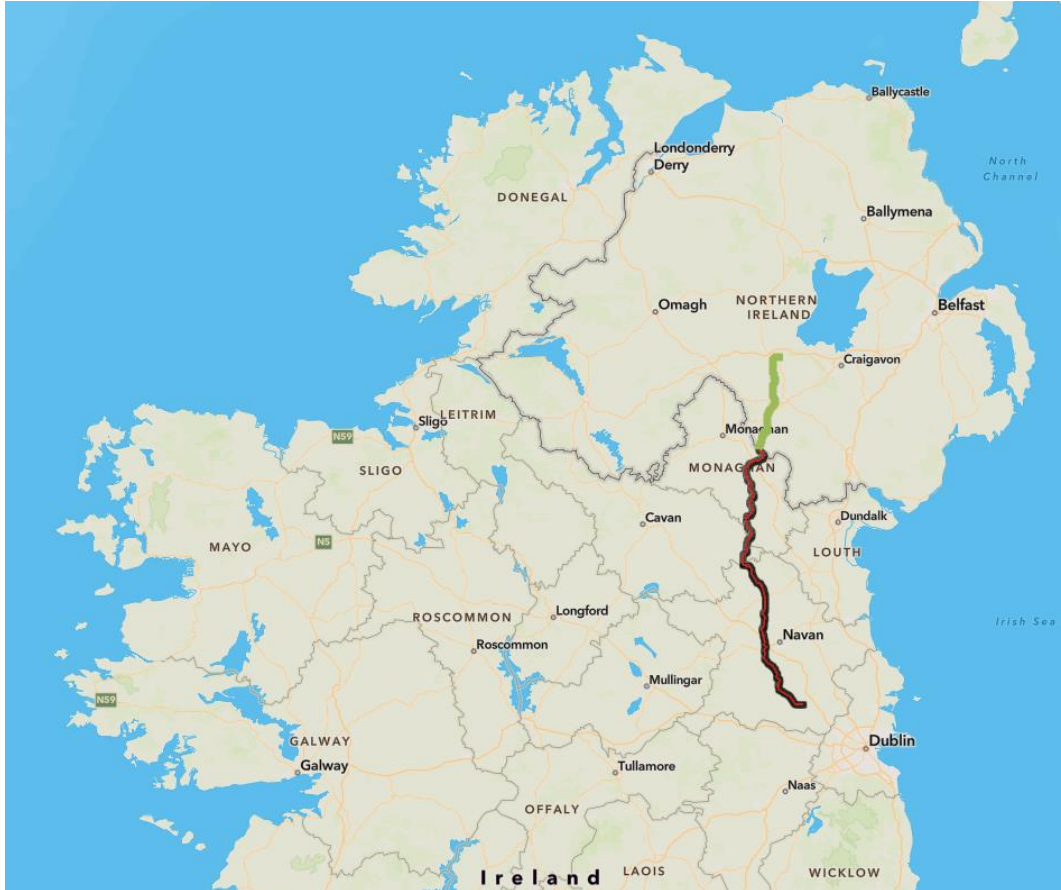


What Does the Future Look Like?

Unrealised Available Energy Compensation

- Mechanism under RESS 3 and 4 that still pays out to renewable assets when they are turned down
- Payment is dependent on the reason for the turn down
- For energy that was not realised due to curtailment or oversupply, the asset gets paid
- For energy that was not realized due to constraints, the asset receives no compensation





North-South Interconnector

- A new line connecting Northern Ireland to the Republic is in development
- 400kV AC overhead line between County Tyrone and County Meath
- Likely to decrease constraint volumes, allowing power to flow more freely between Northern Ireland and Republic
- Expected go-live 2026

[North-South Interconnector Interactive Web Map \(arcgis.com\)](https://arcgis.com)

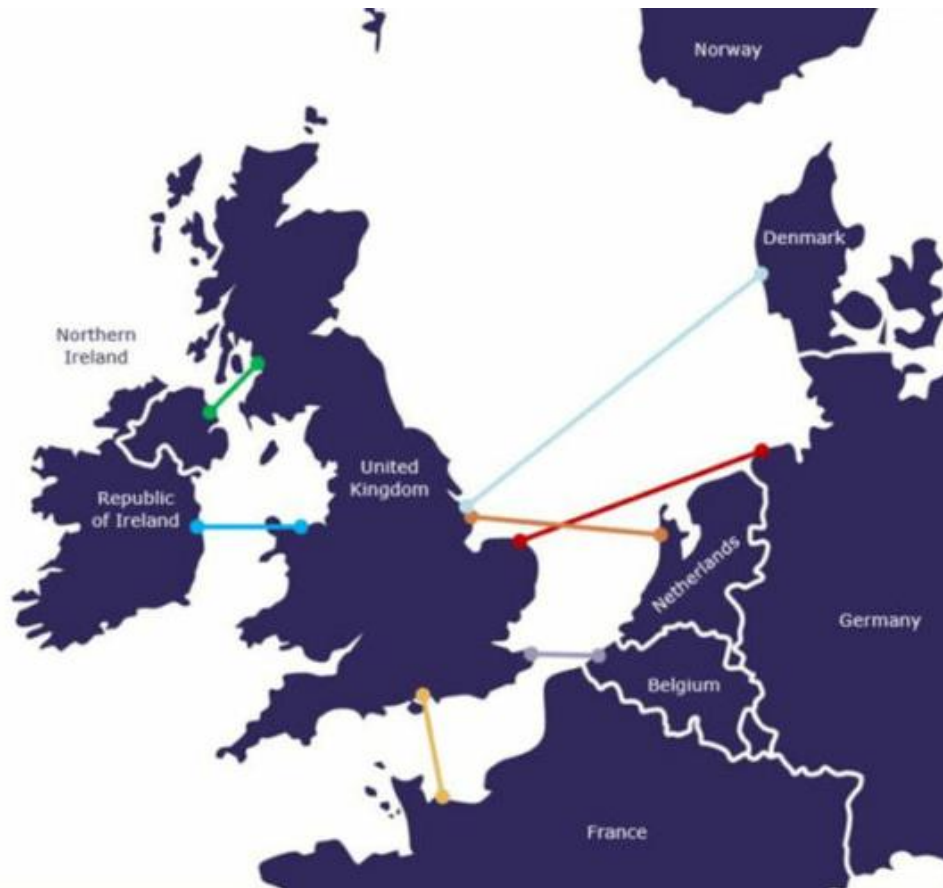
Increased Interconnector Capacity

- Interconnector capacity is set to increase
- Greenlink will increase connection capacity with GB by 500MW, due to go live late this year
- Celtic Interconnector (700MW) will connect the SEM to France, integrating it within the SDAC system. Go live planned for 2026
- In total, that's more than doubling the current total interconnector capacity



Increased Interconnector Capacity

- After Ofgem's review, three interconnectors that were previously not granted cap and floor regimes have now had their decisions overturned
- This will result in two interconnectors, LirIC (0.7GW) and MaresConnect (0.75GW), connecting to Northern Ireland and the Republic, respectively



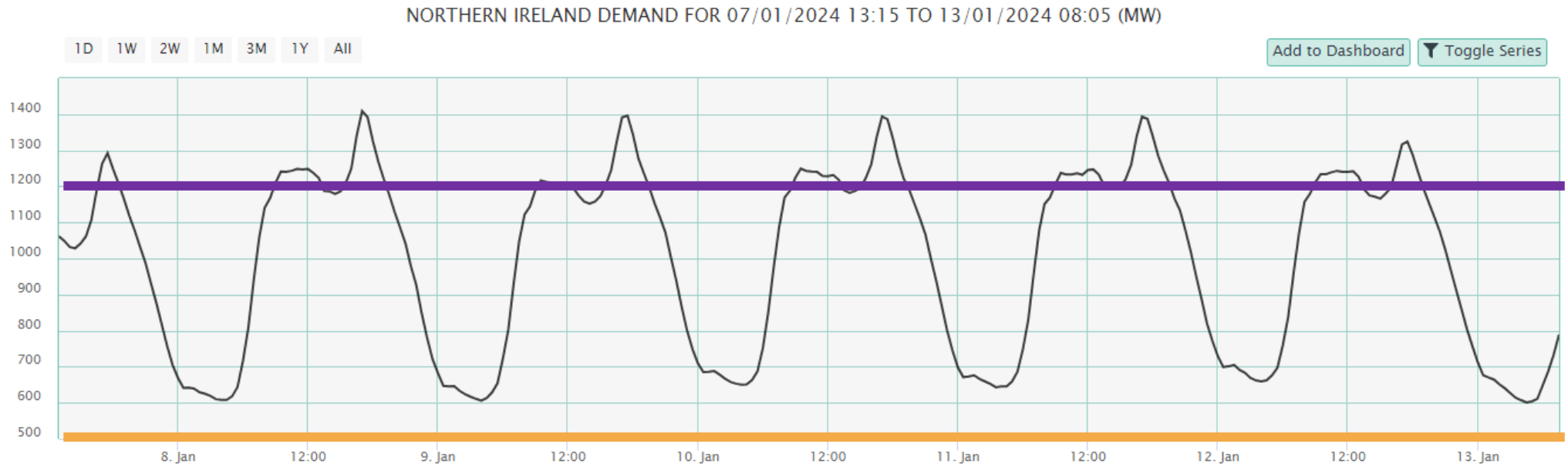


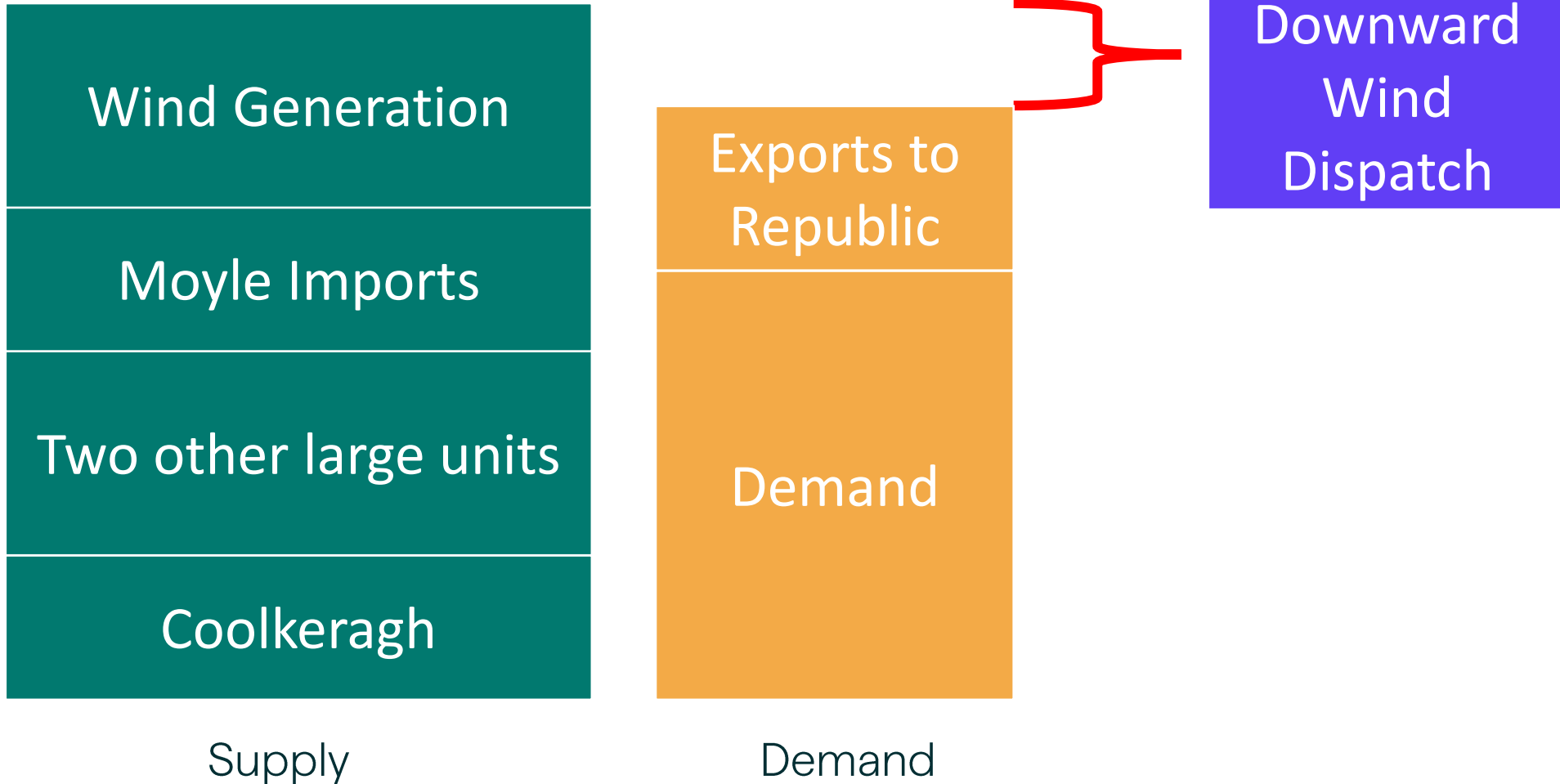
Northern Ireland's High Interconnection Capacity with GB

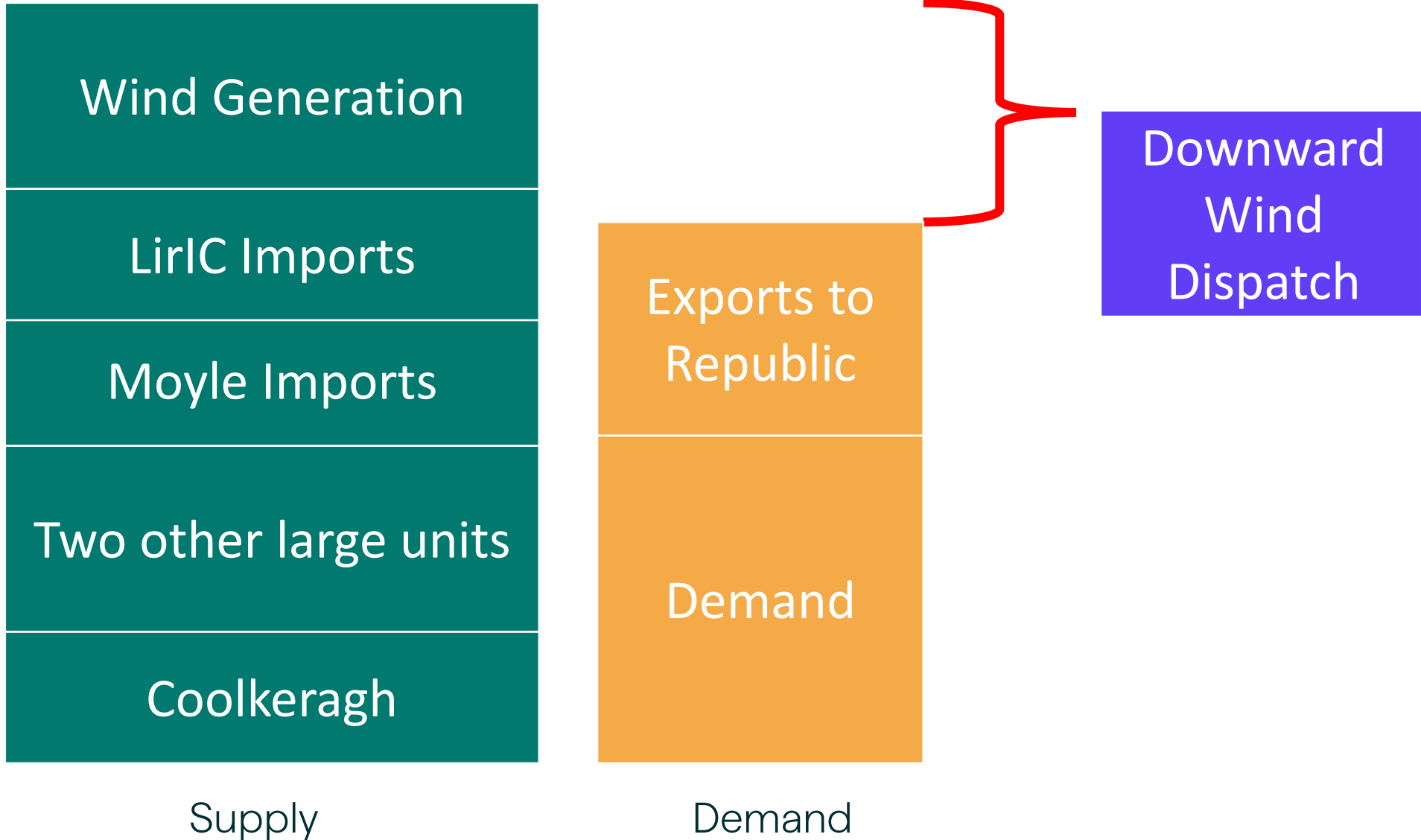
- Winter peak demand for Northern Ireland was ~1.4GW, though this is decreasing year-on-year
- With LirIC, total interconnection capacity between GB and Northern Ireland will be 1.2GW

Moyle + LirIC

Moyle









Future Market Design

- The total number of ex-ante markets set to increase from 5 to 7 once Celtic goes live
- IDA1 and IDA2 markets remain coupled with GB and will dispatch the interconnectors

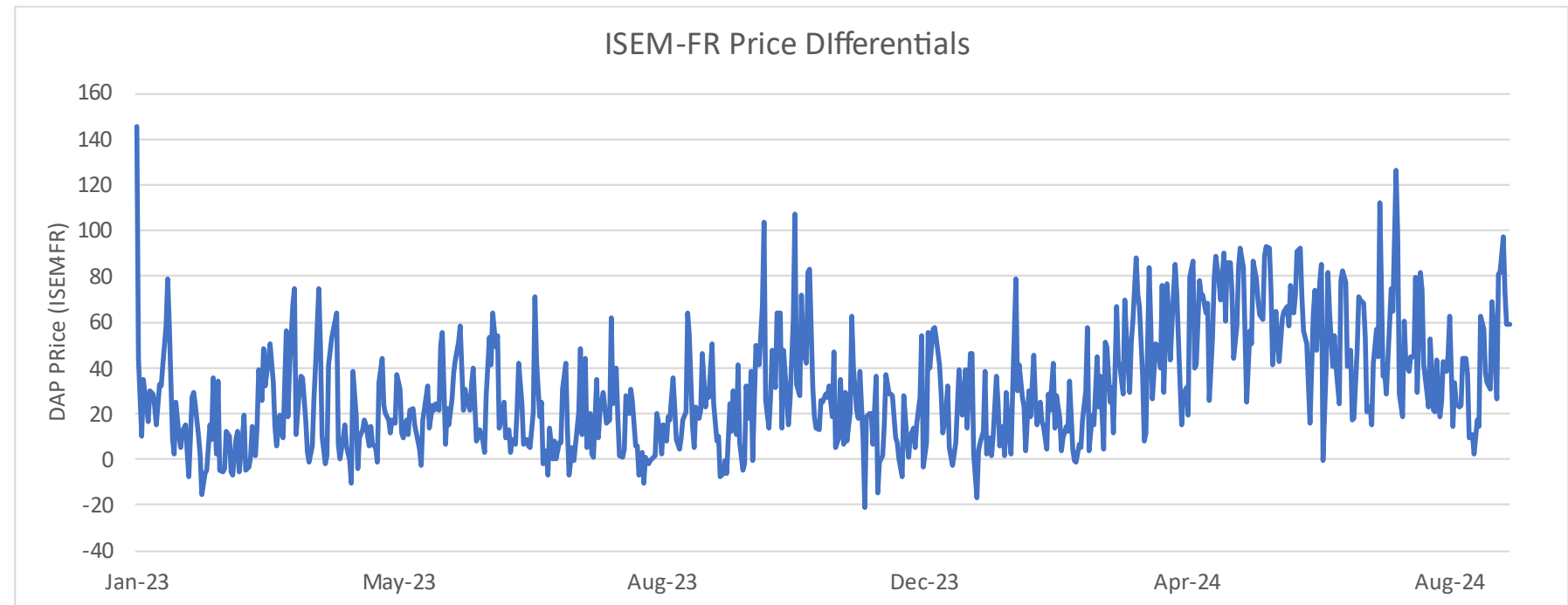
Coupled Market		
SEM-GB	SEM-FR	Local
	SDAC	SDAC
	EUIDA1	
IDA1		
	EUIDA2	
IDA2		
	EUIDA3	IDA3
	SIDC	IDC





I-SEM/FR Price Spreads Rising

- Spreads between I-SEM and France have consistently increased since France recovered from its extended nuclear outages in 2022
- Summer 2024 showed very consistent spreads with I-SEM generally seeing premium prices



Depth of Negative Pricing May Decrease Across Europe

- Germany switching to similar renewable subsidy legislation as RESS 1 and 2, meaning no payouts below zero
- Large scale storage assets will decrease price spreads between daily high and lows
- Longer-duration storage assets could even reduce the spreads across several days



In Summary

- Rising demand, high constraint volumes, low interconnection capacity and renewable buildout that is behind targets is causing a requirement for gas-fired generation which is setting the price
- Negative prices from the continent can't feed through to the SEM since they have to come through GB and the GB-SEM interconnector bottleneck
- Local renewables are being turned down in favour of imports, giving balancing prices of €0/MWh when renewable balancing actions set the price
- Future connection with Europe and more strict subsidy rules on the continent may bridge the gap between prices in I-SEM and elsewhere in Europe