

# Energy Forecasting

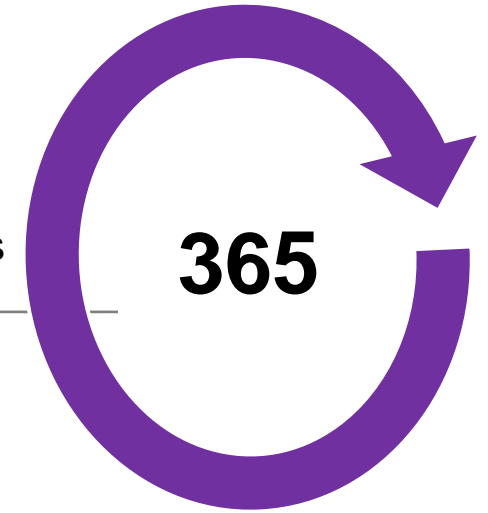
13 November 2024

John Walsh, Energy Forecasting Manager



# What do we do?

	Timescales	Frequency
<b>Demand</b>	<ul style="list-style-type: none"> <li>• Within day</li> <li>• Day ahead</li> <li>• 2DA &amp; 7DA</li> <li>• 13 Weeks ahead</li> <li>• 2-52 Weeks ahead</li> </ul>	<ul style="list-style-type: none"> <li>• 3 x daily</li> <li>• 3 x daily</li> <li>• Daily</li> <li>• Daily</li> <li>• Quarterly or as per needs</li> </ul>
<b>Wind Power</b> Metered & Non-metered	<ul style="list-style-type: none"> <li>• Within day – 14 days ahead</li> </ul>	<ul style="list-style-type: none"> <li>• 8 x daily</li> </ul>
<b>Solar Power</b> Embedded (Non-metered)	<ul style="list-style-type: none"> <li>• Within day – 14 days ahead</li> </ul>	<ul style="list-style-type: none"> <li>• 24 x daily</li> </ul>
<b>GSP Demand</b>	<ul style="list-style-type: none"> <li>• Within day – 14 days ahead</li> </ul>	<ul style="list-style-type: none"> <li>• 6 x daily</li> </ul>
<b>Reactive power (MVar)</b>	<ul style="list-style-type: none"> <li>• Within day – 13 days ahead</li> <li>• 2DA – 13 Weeks ahead</li> </ul>	<ul style="list-style-type: none"> <li>• Daily</li> <li>• Daily</li> </ul>
<b>Transmission Losses</b>	<ul style="list-style-type: none"> <li>• Retrospective</li> </ul>	<ul style="list-style-type: none"> <li>• Monthly</li> <li>• Yearly</li> </ul>



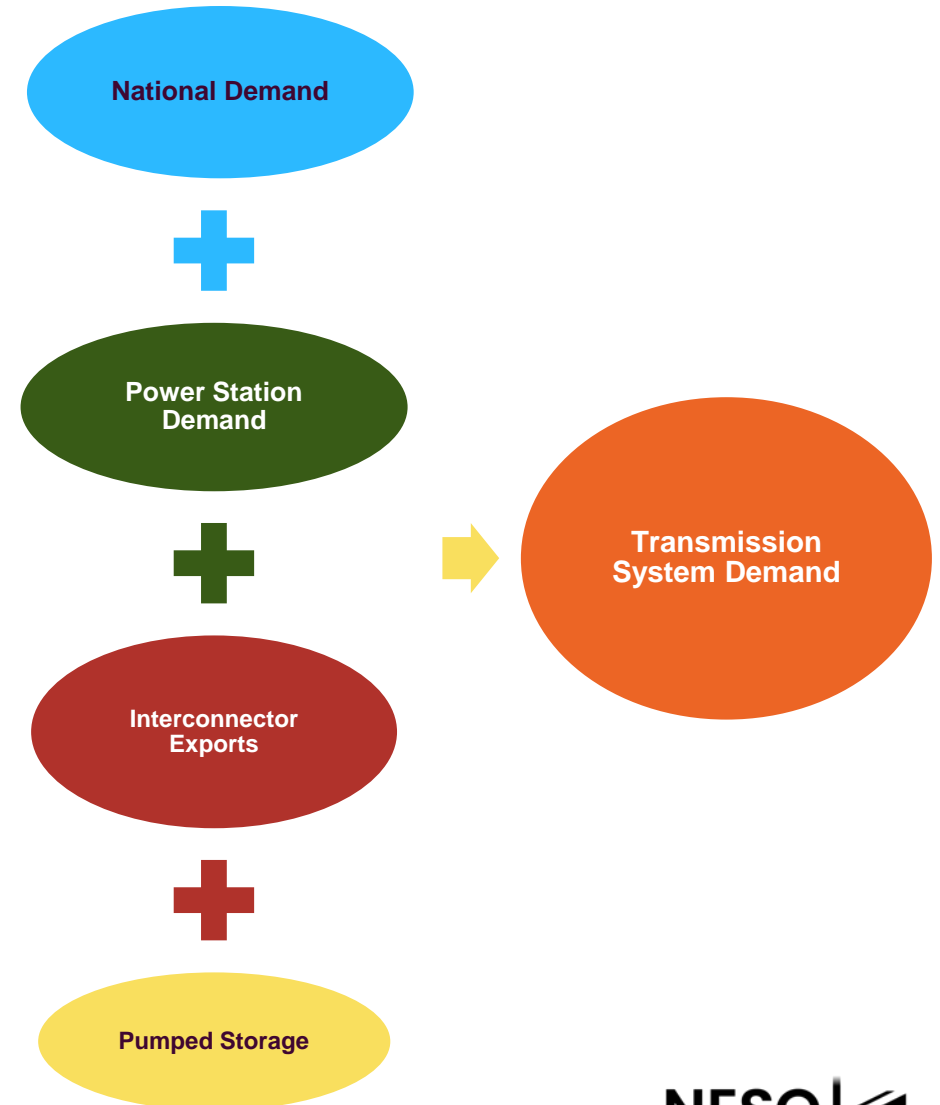
# Demand concept

## National Demand

- **Total GB generation requirement to supply the customer demand**
- Sum of metered generation, excludes station load, pump storage pumping and interconnector exports

## National Electricity Transmission System Demand

- **Total demand to be met by the transmission network**
- Meets the total GB customers demand plus the additional generation required to meet station load, pump storage pumping and interconnector exports

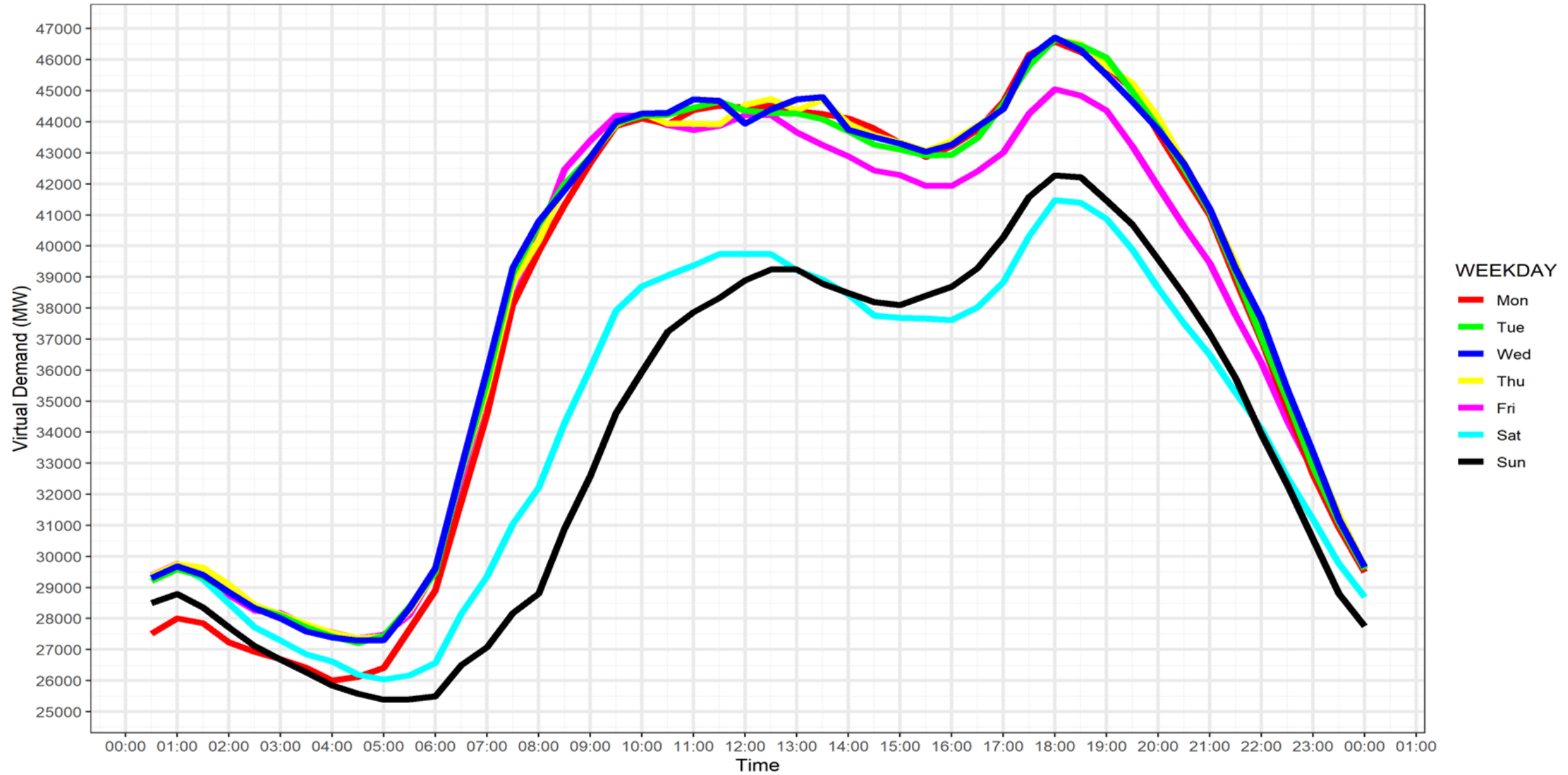


# Demand drivers

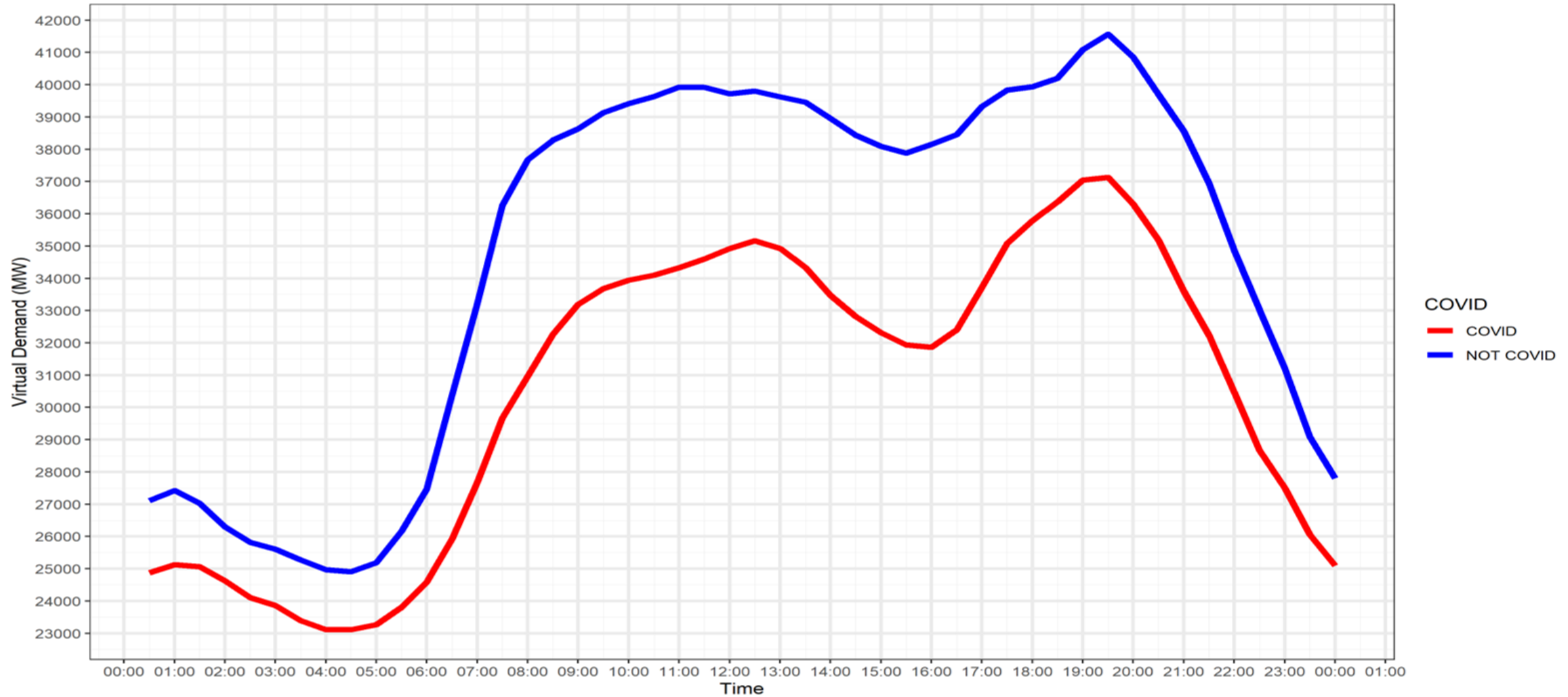
There are a significant number of drivers of uncertainty which are considered when forecasting demand:



# Insights



# Insights .....



# Weather

## One of the most significant drivers of uncertainty

Crucial input to demand and renewable generation forecasts

Weather driven generation capacity in GB:

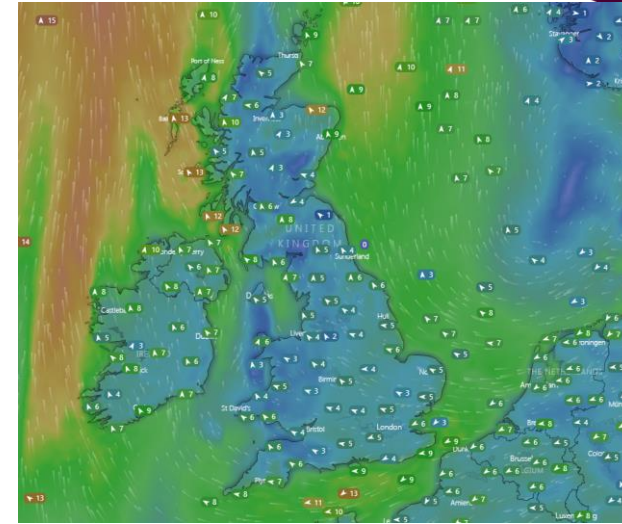
- 26.6 GW metered wind (Registered Capacity)
- 22.5 GW Operational Capacity of metered wind
- 6.6 GW of non-metered wind
- 17.2 GW of non-metered solar
- 0.3 GW of metered solar

Weather forecast used:

- D-0 to D-14: weather forecast
- D-15 and Beyond: seasonal average weather

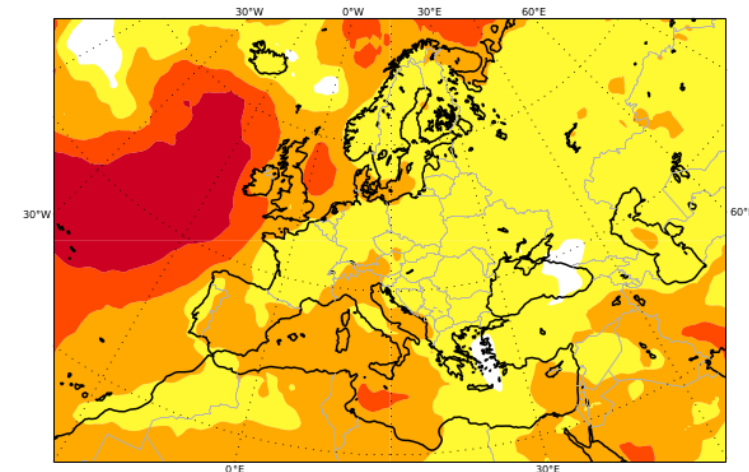
We receive weather forecasts: (one supplier)

- for >250 locations
- every 3 hours
- for the next 14 days
- at 1 hour resolution



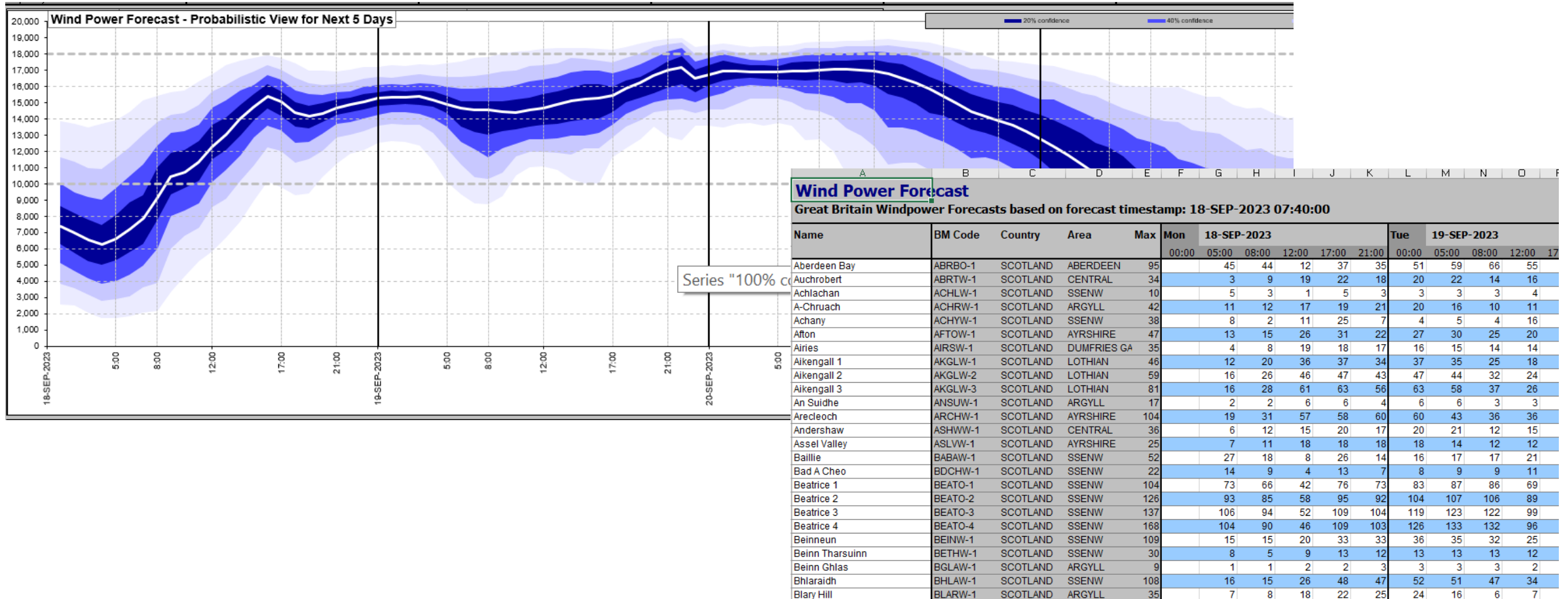
C3S multi-system seasonal forecast ECMWF/Met Office/Météo-France/CMCC/DWD/NCEP/JMA/ECCC  
Prob(2m temperature > median) NDJ 2022/23  
Nominal forecast start: 01/10/22  
Unweighted mean

0..10% 10..20% 20..30% 30..40% 40..60% 60..70% 70..80% 80..90% 90..100%



# Metered renewable generation

**Metered (BMU) Generation:** Metered generation connected to Distribution or Transmission Network (e.g. solar, wind), that has an operational relationship with ESO.



Note: Peak Metered Wind Outturn to date is 17.4GW, which includes the effects of operational actions (curtailment)



# Cut-off Modelling

## Mean Forecast (white line)

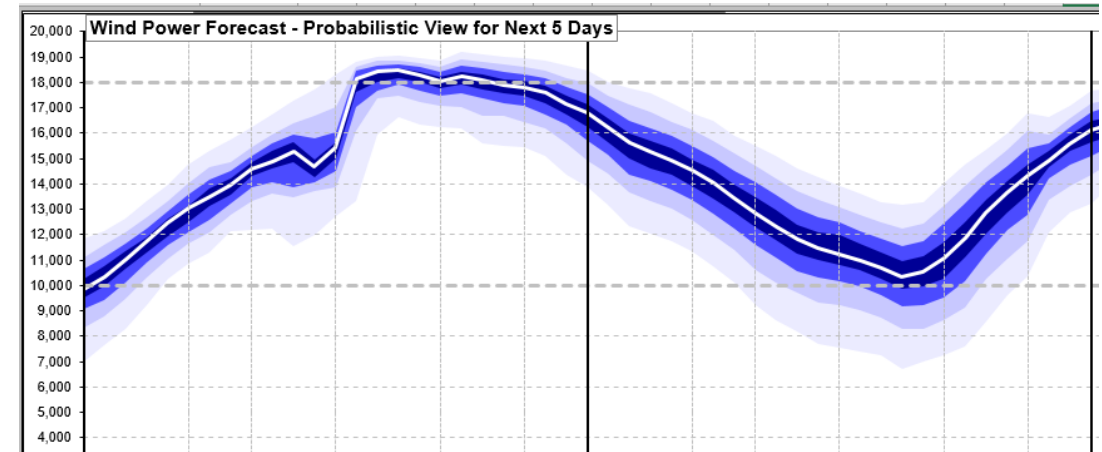
- Cut-off values are included in the forecast
- The upper and lower edges of the dark blue area, represents the 30th and 70th percentile
- These translate to the Max & Min values presented to ESO Balancing System

## Forecast Detail

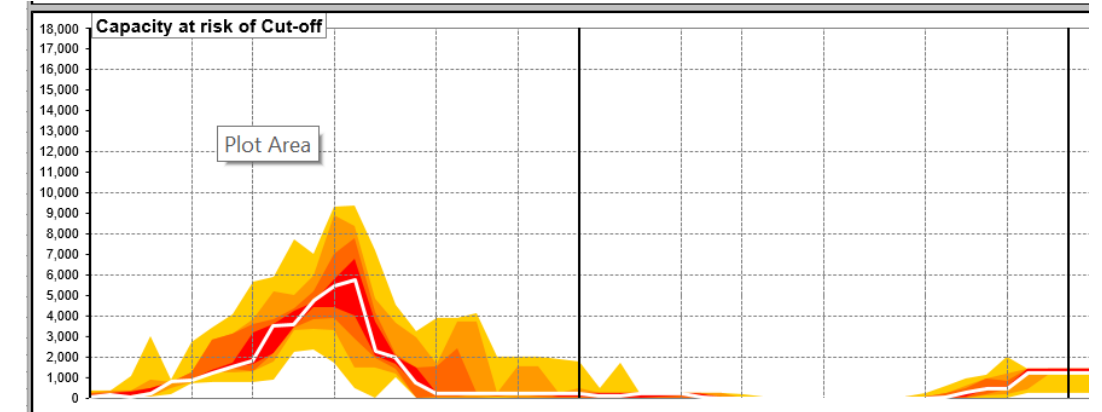
- Applied cut-off values are shown as red zeros

## Risk of cut-off (Work in progress)

- Working to give a more accurate certainty of cut-off conditions
- To avoid the “cry-wolf” condition
- Forecasting precise values will remaining challenging



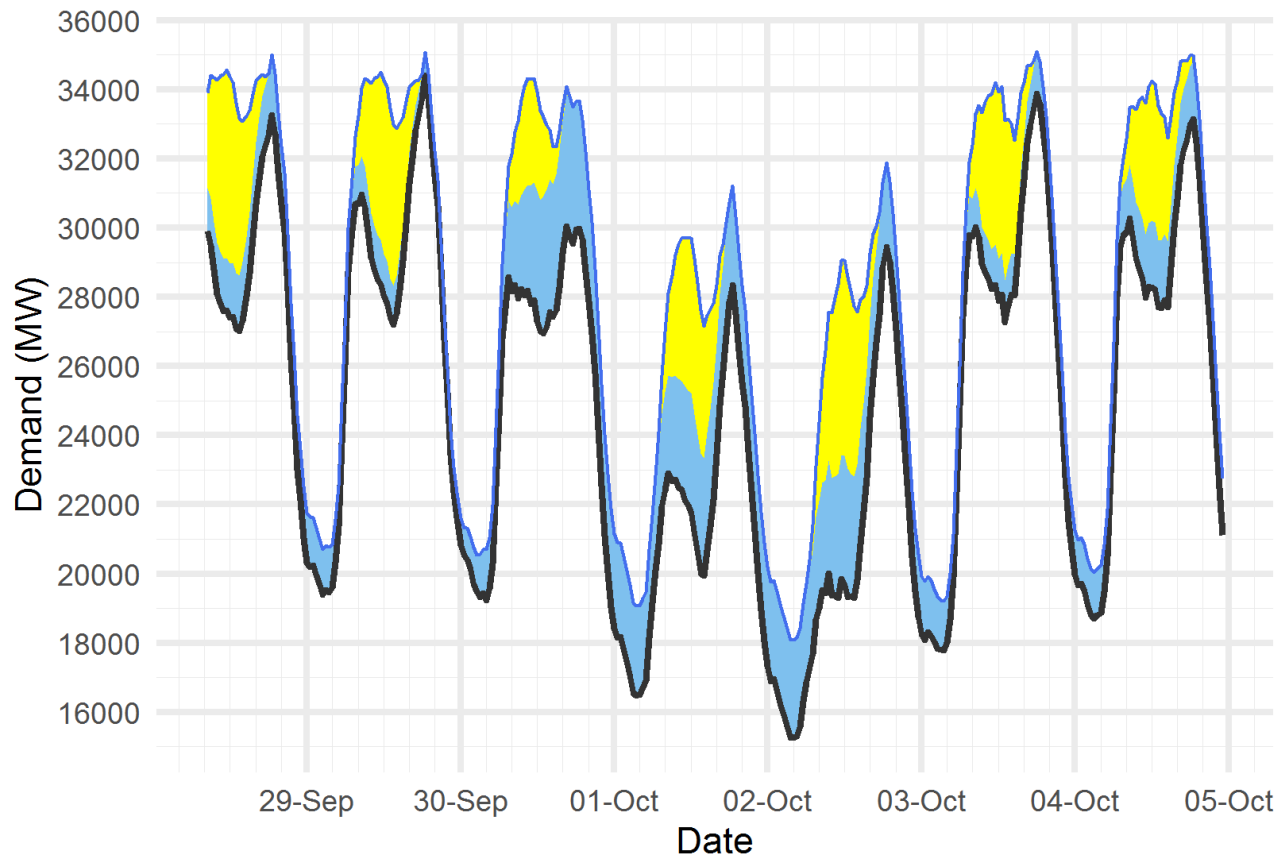
0	15	18	55	53	18	11	12	11	8	1	8	8
0	38	43	0	0	38	41	40	32	33	58	35	45
5	128	128	128	0	128	128	128	121	148	158	152	122
0	518	518	518	0	518	518	518	511	525	558	550	513
0	585	584	584	0	584	584	584	581	512	538	535	588
8	53	31	31	38	58	15	50	41	11	13	81	15





# Unmetered Renewable Generation

**Unmetered Generation:** Unmetered generation connected to Distribution Network (e.g. solar, wind)  
**Virtual Demand:** 'Total' energy demand in UK



ESO Demand forecast for 28 September-04 October 2022

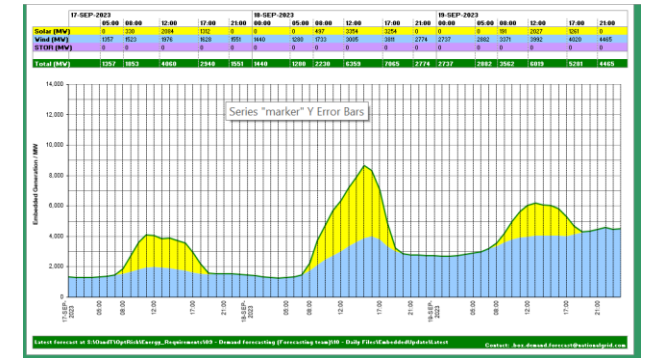


## Demand type

-  National Demand (ND) transmission connected generation requirement within GB
-  ND + est. of PV & wind at Distribution network

## Renewable type

-  Distributed\_PV
-  Distributed\_Wind

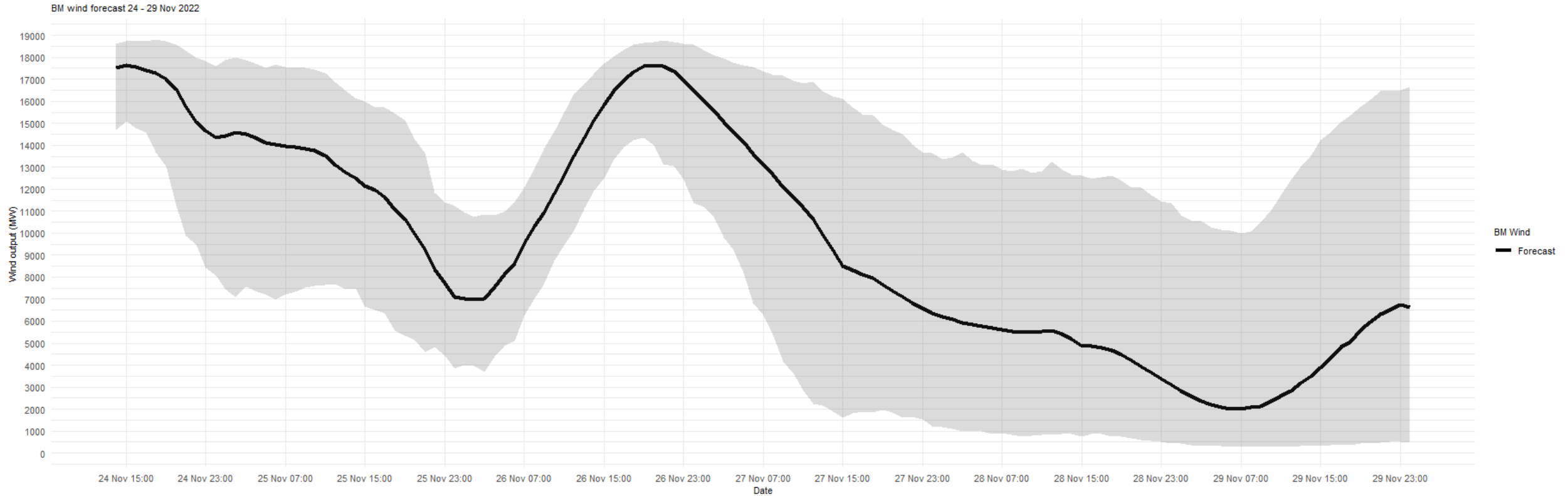


# Wind Availability

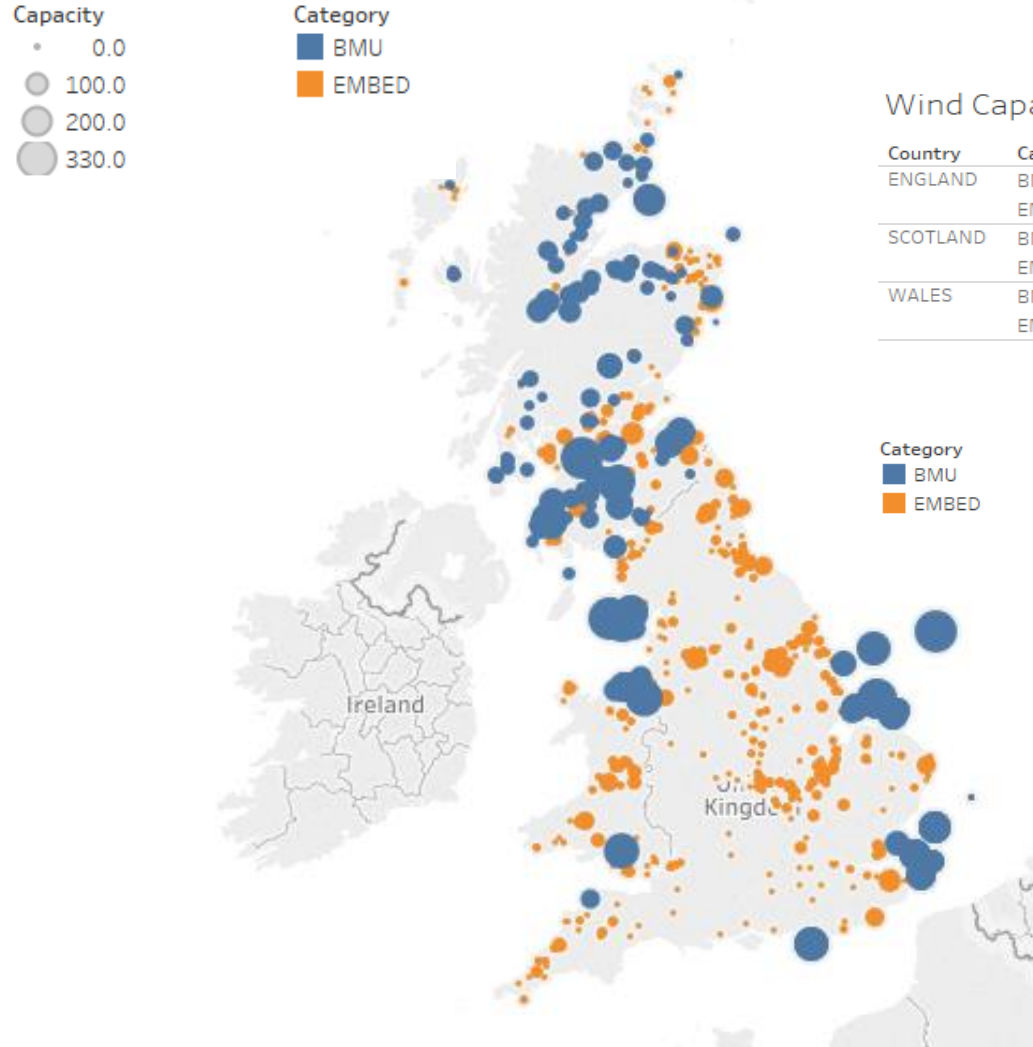
Wind availability could be between 0.5GW to 20GW.

Friday 8<sup>th</sup> Sept 2023 recorded only ~100MW across GB i.e. almost zero

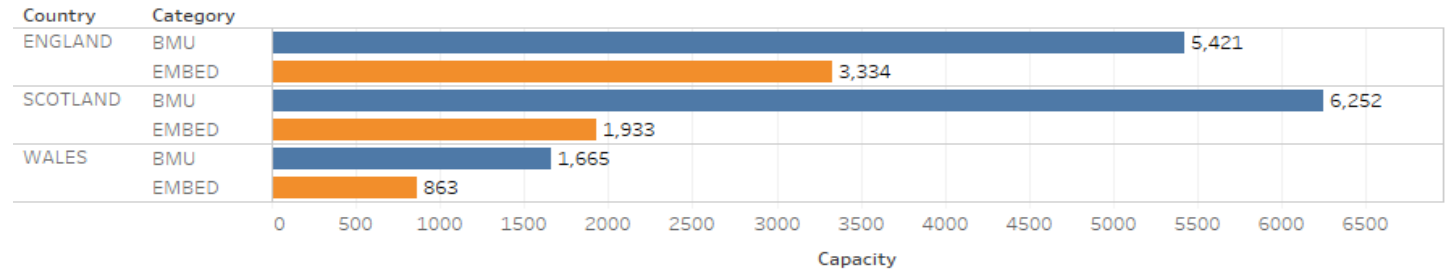
Average load factor of wind generation is around 40%



# Wind Generation Capacity



Wind Capacity Total in MW



**Current Wind Registered Capacity:**

Metered wind: 25.6 GW

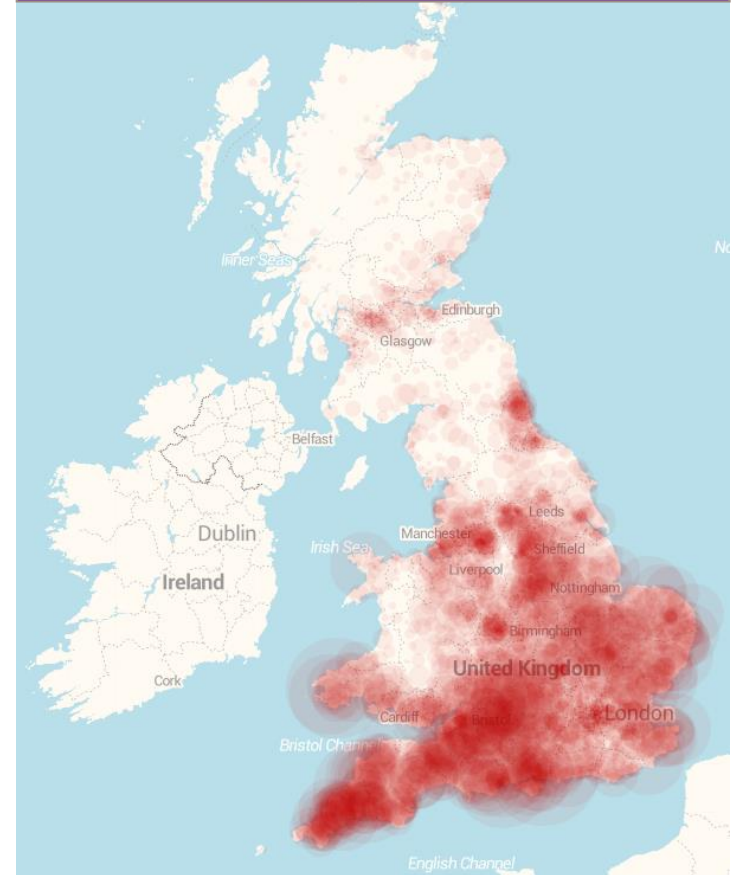
Unmetered wind: 6.6 GW



# Solar Generation Capacity

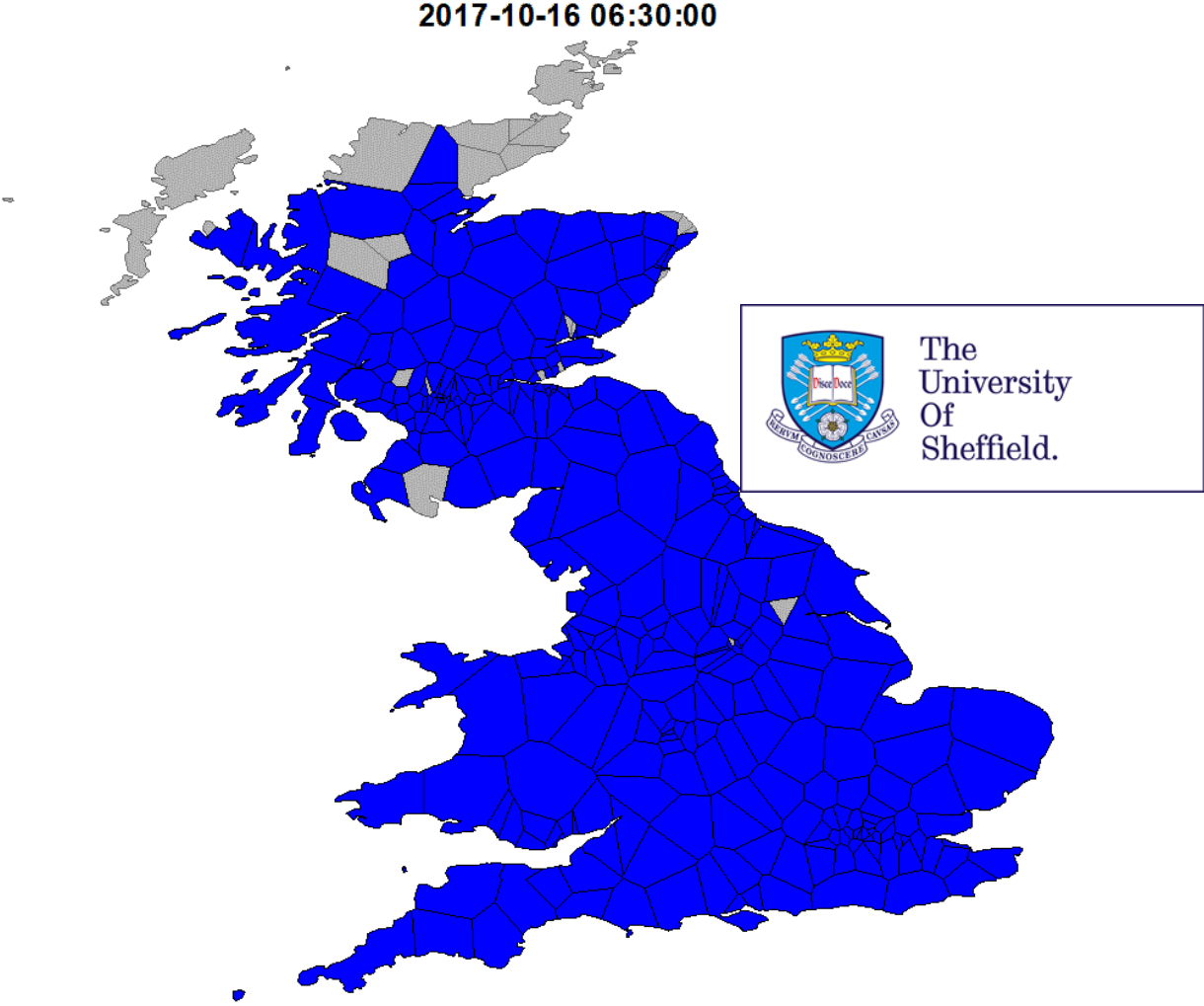
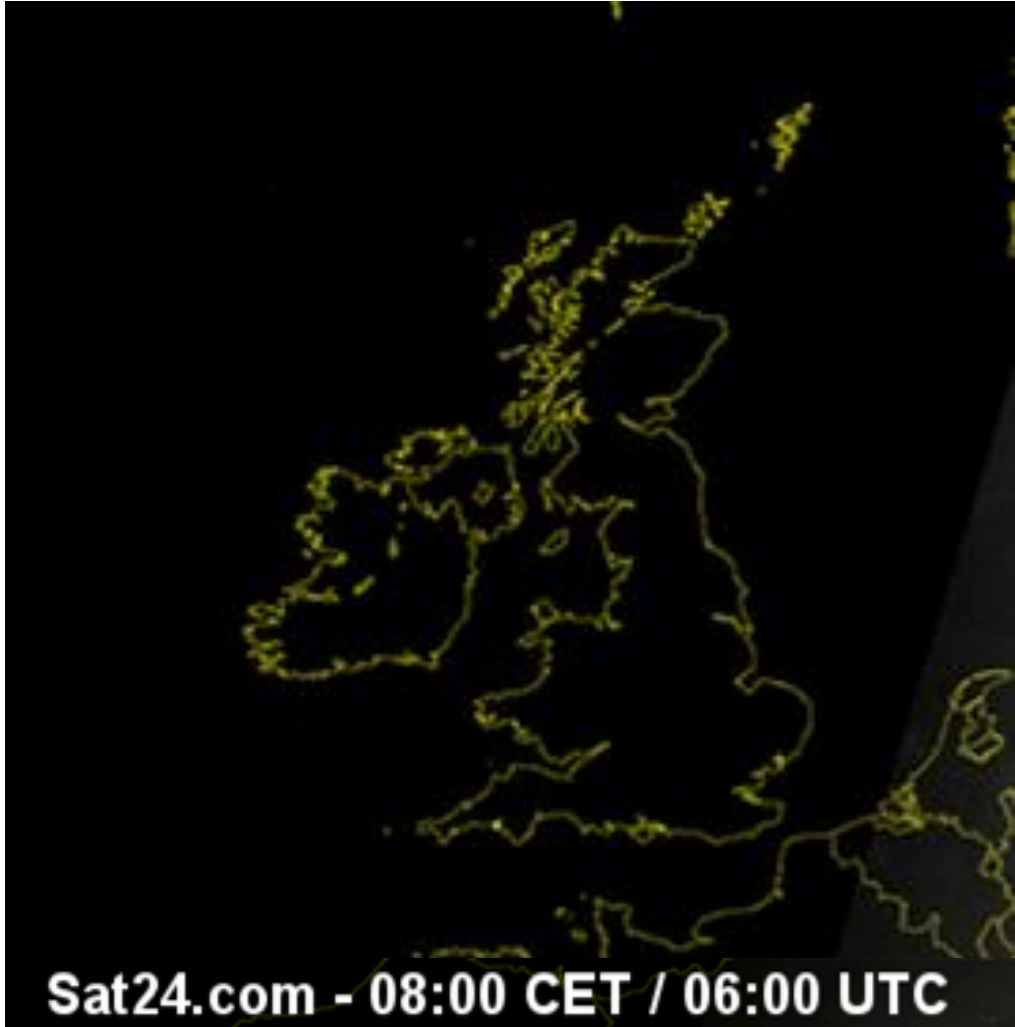
- Entire GB solar fleet is unmetered (almost), this means:
  - do not provide metering to the ESO;
  - do not participate in the BM.
  - variable generation, depending on local weather conditions
  - suppresses National Demand and network demands
- Capacities & locations found from DESNZ (BEIS) / Subsidy / Public databases. Approx. half is domestic solar!
- Solar output is an estimation, +/- 10% error, using data from PV Live/Sheffield University Collaboration

**Current Solar Capacity:**  
Unmetered solar: 17.2 GW  
Metered solar: 0.3 GW



Note: Ten industrial-scale solar farms (>50MW each) are now registered as BMUs ( $\Sigma$  600MW - metered), although only four currently operational.

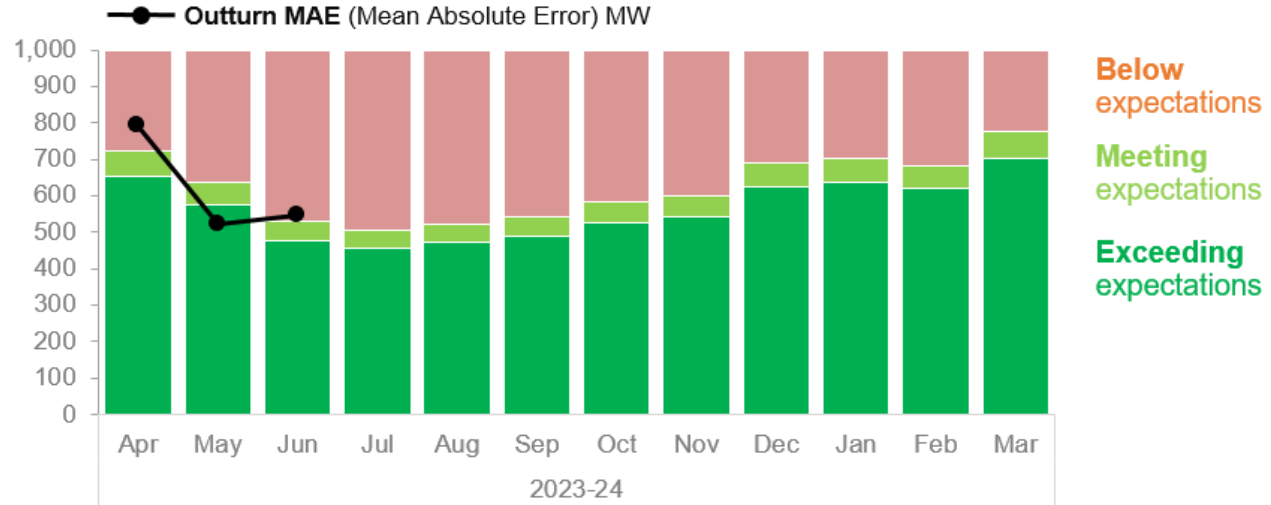
# Regional PV\_Live in action



# Regulatory Incentives

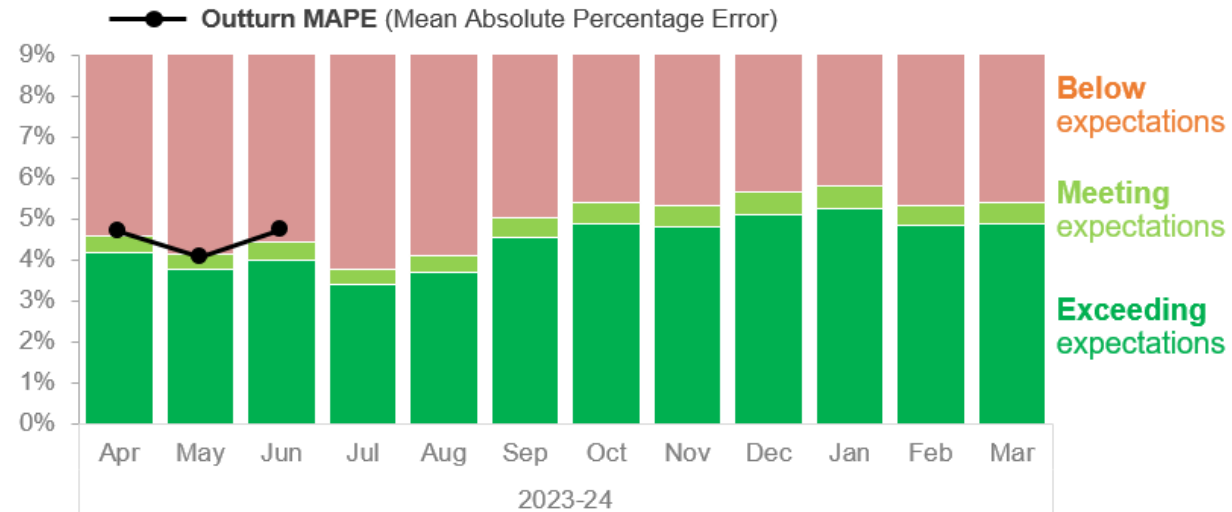
## Role 1b. Day-ahead Demand forecast

This metric measures the average absolute percentage error (APE) between day-ahead (DA) national demand forecast and outturn demand for each half hour period.



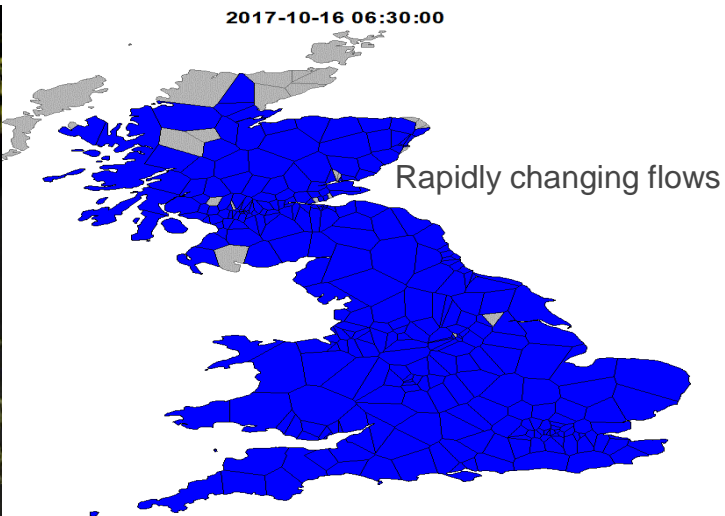
## Role 1c. Day-ahead metered wind forecast

This metric measures Average absolute % error in day ahead metered wind forecast (as % of total capacity)

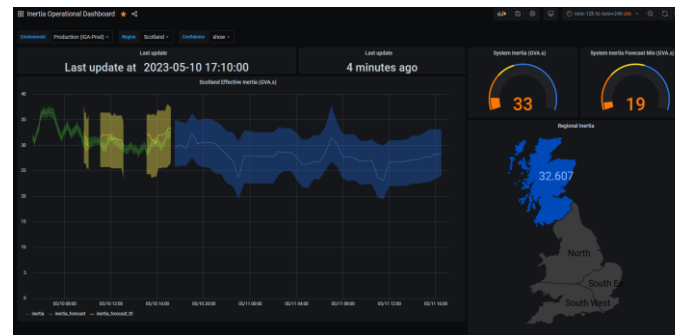


# Operational challenges with large renewable volumes

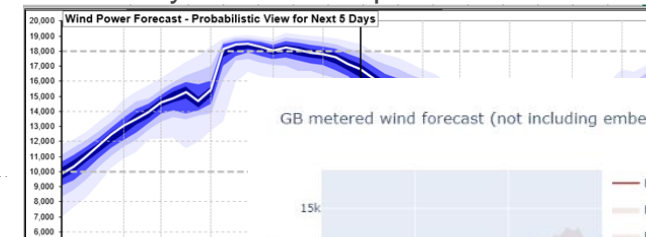
Weather forecast quality



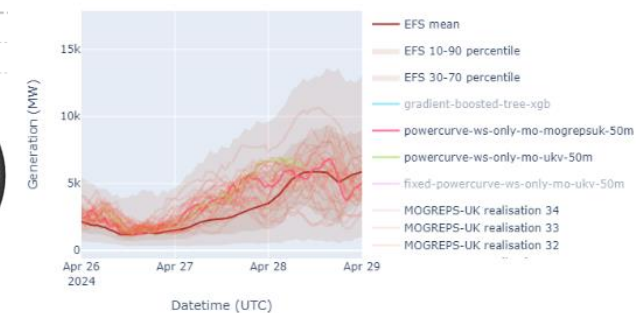
Reduced Inertia



Model & Systems development

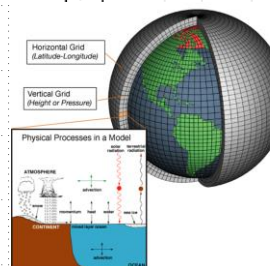
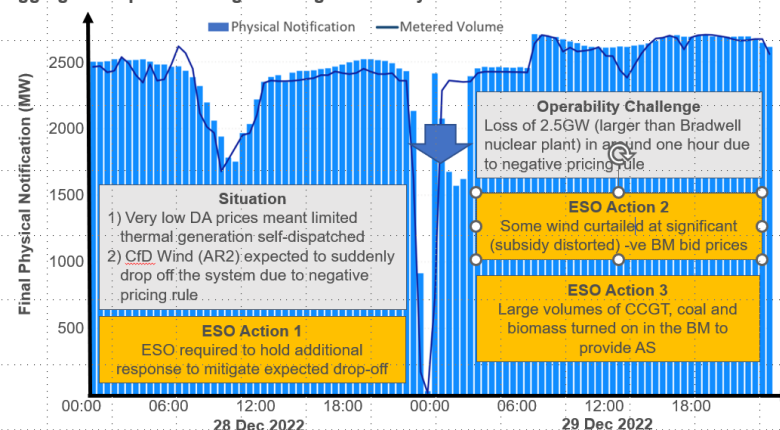


GB metered wind forecast (not including embedded)



Market influences (CfD)

Aggregate output of wind generating units de-synched over 28/ 29 December 2022 due to negative prices



High Speed Shutdown

