AURORA ENERGY RESEARCH

GB Market Summary March 2023

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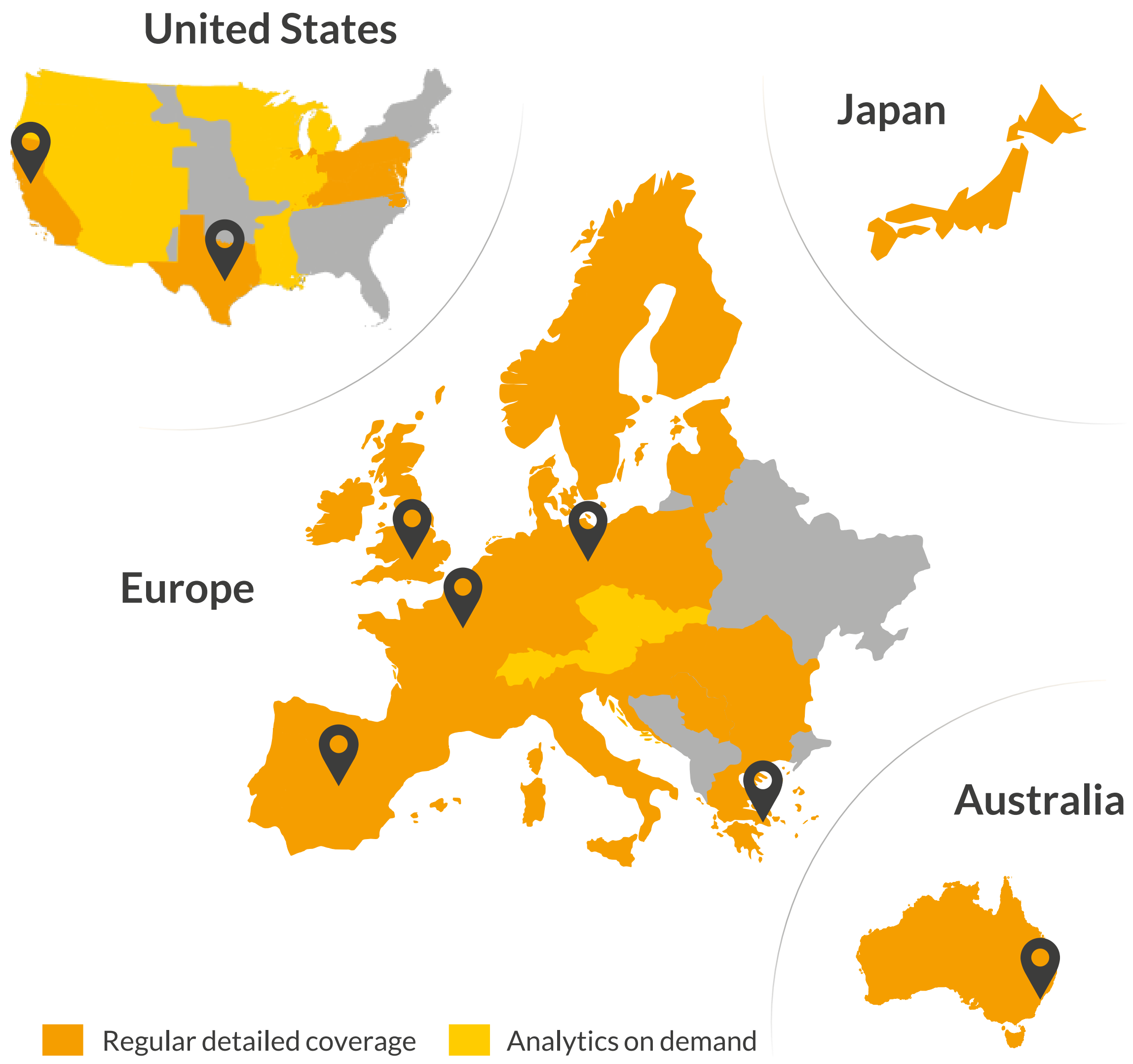
- Renewables
- Storage
- Electric vehicles
- Hydrogen (H_2)
- Carbon (CO_2)
- Natural gas



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Source: Aurora Energy Research

Executive Summary

- The average power price in March was £118.7/MWh, a 17.2% decrease since the average of £135.9/MWh in February
- This decrease in average power price was due to the carbon prices falling in March and the gas price continuing its steady decline since the beginning of the year
- The UK-ETS traded at an average of £74.08/tCO_2 in March, a £5.21/tCO_2 decrease relative to February
- Total demand in March was 22.91TWh, 9% higher relative to February and the same as total demand in March 2022
- Renewables output was up 3% in March month-on-month, led by offshore wind which increased by 0.6TWh

		Monthly value[1]	Month-on-month change	Year-on-year change	Slide reference(s)
System Performance	**Power prices,** *£/MWh*	118.7	-17.2 (12.6%)	-118.1 (49.9%)	5, 6
	Gas prices, *£/MWh*	37.8	-8.0 (17.5%)	-65.1 (63.3%)	8
	Carbon[2] prices, *£/tCO_2*	95.4	-5.7 (5.6%)	+1.3 (1.4%)	8
	Transmission demand, *TWh*	22.9	+1.9 (9.3%)	+0.0 (0.0%)	12
	Low carbon[3] generation, *TWh*	11.9	+0.7 (6.1%)	-1.2 (9.5%)	13, 14
	Thermal[4] generation, *TWh*	8.4	+0.8 (10.4%)	-1.3 (13.5%)	13, 14
	Grid carbon intensity, *gCO_2e/kWh*	174.0	-5.9 (3.3%)	-17.3 (9.0%)	16
Capture Prices	**Offshore wind,** *£/MWh*	105.5	-20.7 (16.4%)	-129.5 (55.1%)	20
	Onshore wind, *£/MWh*	105.5	-25.2 (19.3%)	-130.4 (55.3%)	20
	Solar PV, *£/MWh*	106.6	-23.9 (18.3%)	-107.9 (50.3%)	20

		Monthly value[1]	Variance to historical monthly average[3]	Slide reference(s)
Load Factors	**Offshore wind,** *%*	47.7	+2.2 p.p.	19
	Onshore wind, *%*	26.3	-7.0 p.p.	19
	Solar PV, *%*	7.4	-2.7 p.p.	19

1) Values averaged over the calendar month. 2) Includes CPS and EU ETS until 18th May 2021 and UK ETS from 19th May 2021 onwards; 3) Includes renewables and nuclear generation 4) Includes CCGTs, coal and other fossil plants; 5) Comparing to the average of same month in the previous 5 years.

Sources: Aurora Energy Research, Thomson Reuters, National Grid, Ofgem, Elexon

Agenda

I. **Wholesale market summary**

II. Renewable performance (redacted)

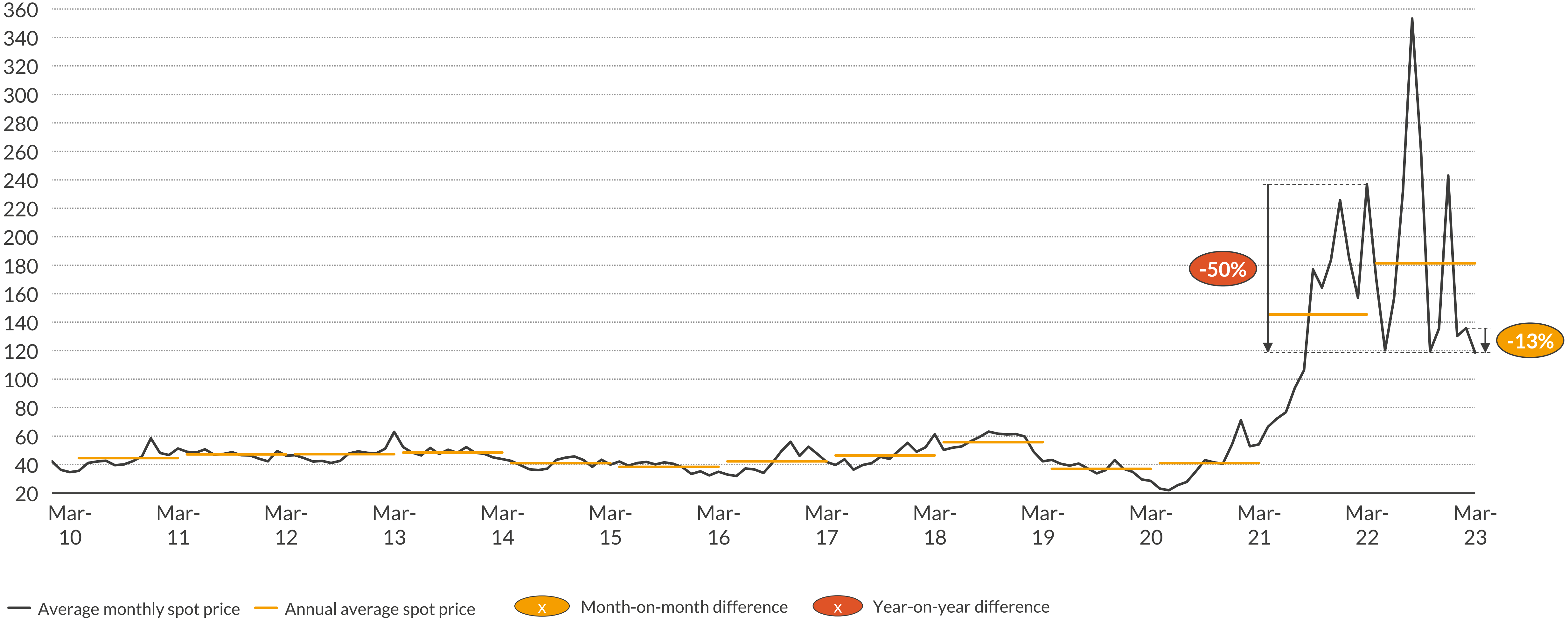
III. Company performance (subscriber only)

IV. Plant performance (redacted)

V. Balancing mechanism summary

Historic monthly average EPEX spot price

Average EPEX spot price[1]
£/MWh



1) Average monthly EPEX is the average over the month of the volume-weighted reference prices for each half-hour interval.

Sources: Aurora Energy Research, Thomson Reuters

Half-hourly EPEX spot price for March

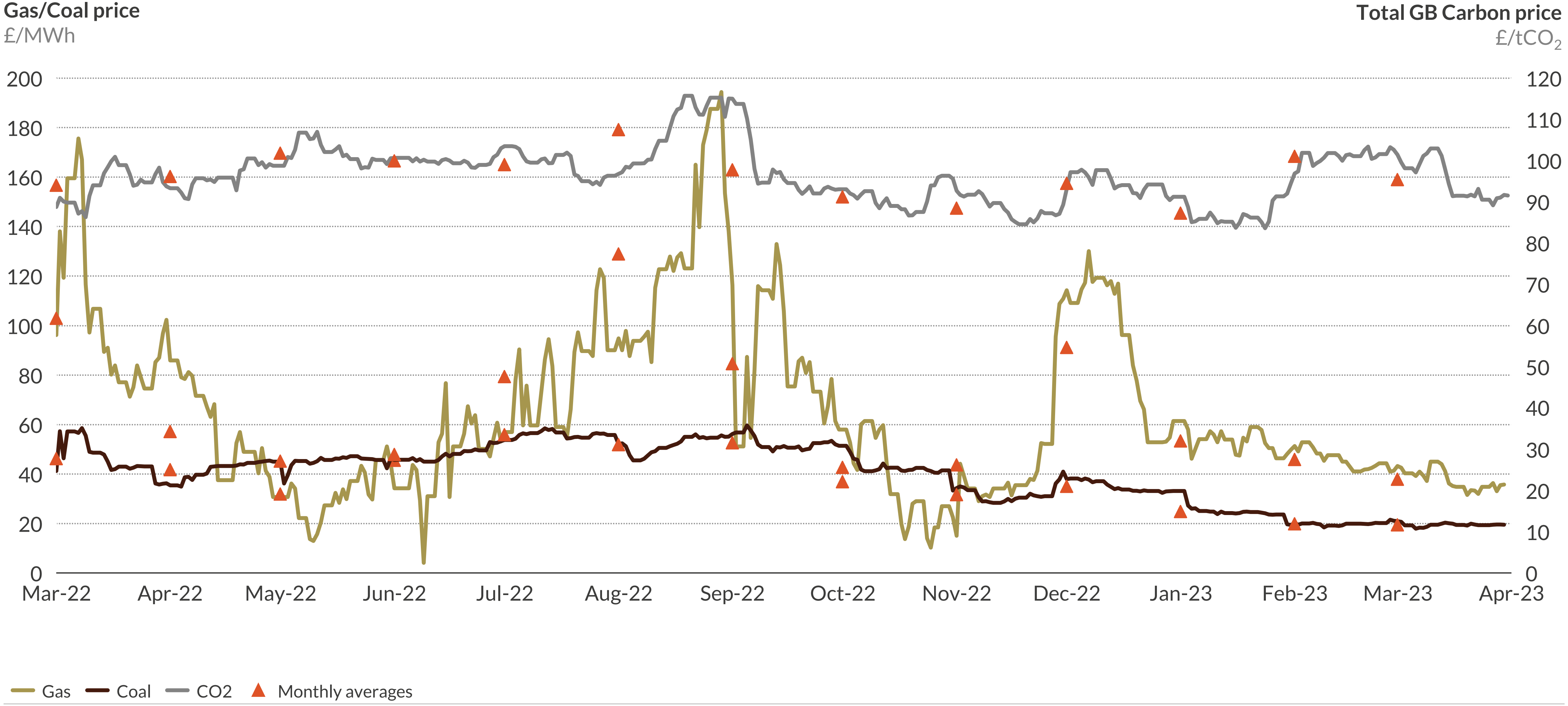
Monthly average price in March 2023: 118.70 £/MWh

EPEX spot price[1]
£/MWh

1) Half-hourly EPEX is the volume-weighted reference price over that half-hour interval, as provided by EPEX Spot

Sources: Aurora Energy Research, Thomson Reuters

Historic fuel prices
Gas, Coal and Carbon daily prices



Sources: Aurora Energy Research, Thomson Reuters

Historic weekly UK ETS and EU ETS Prices

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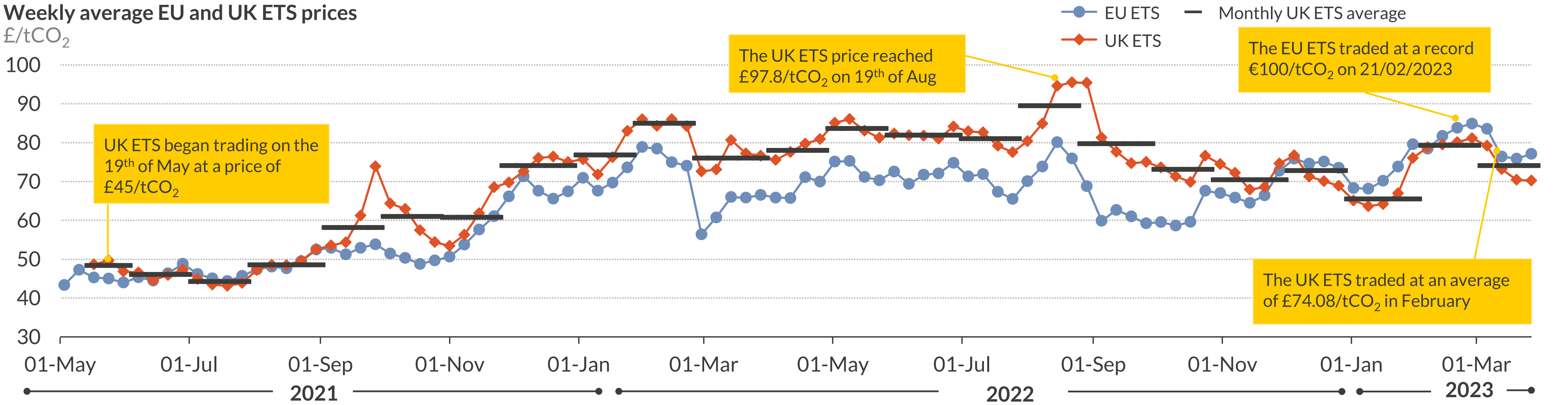

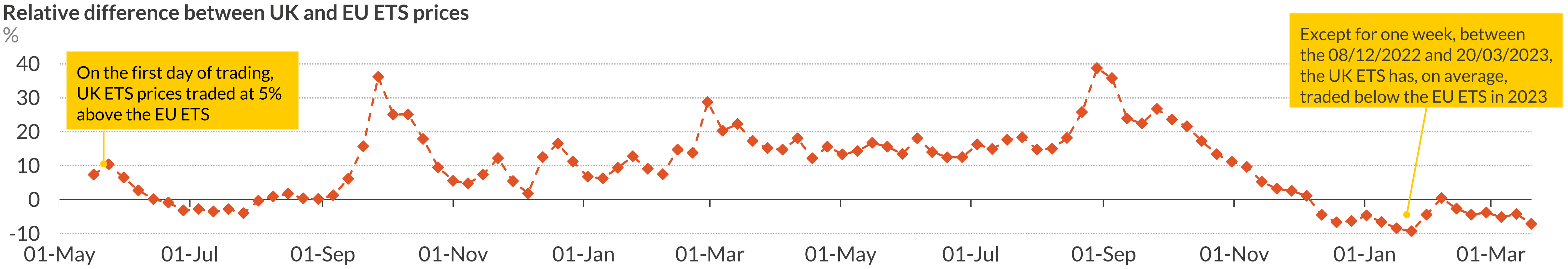

Sources: Aurora Energy Research, ICE Futures, Bank of England

Half-hourly spot prices against half-hourly system margins for March

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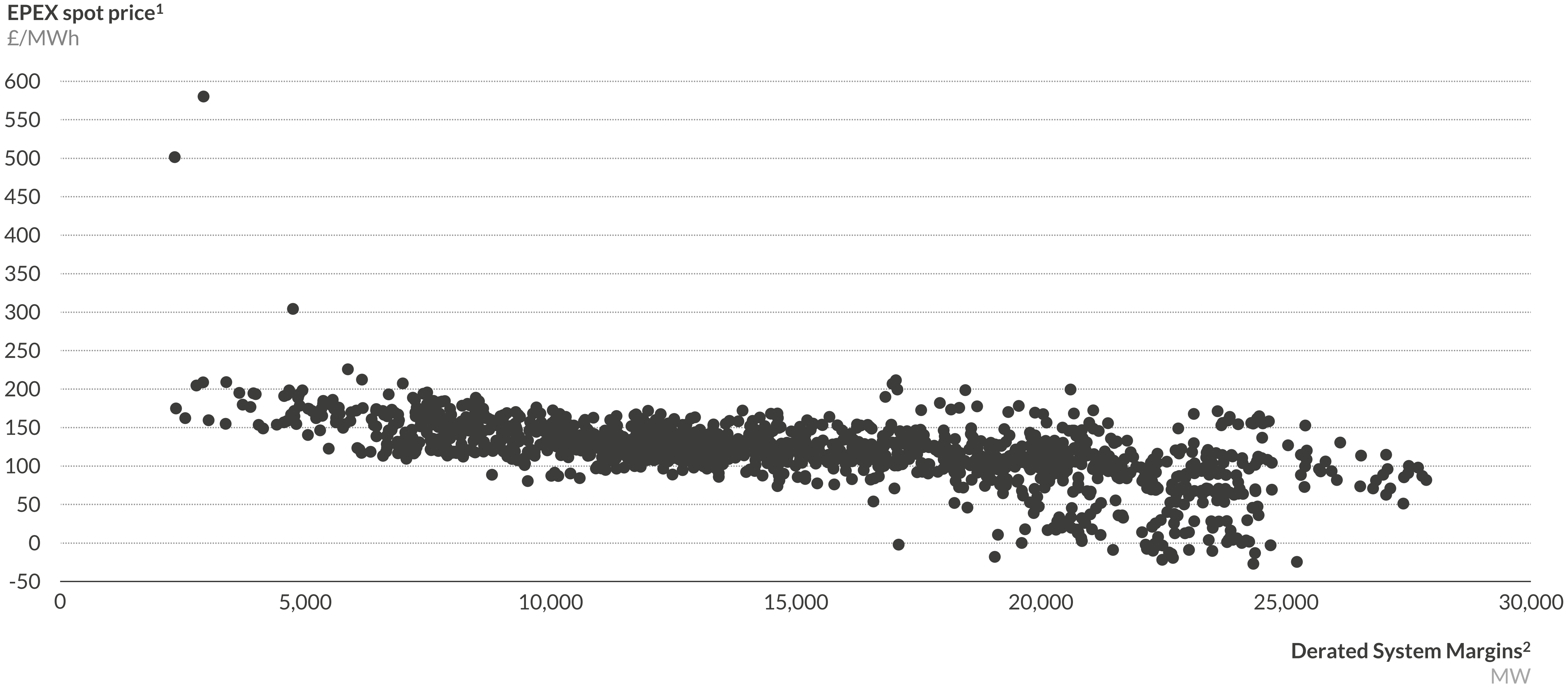
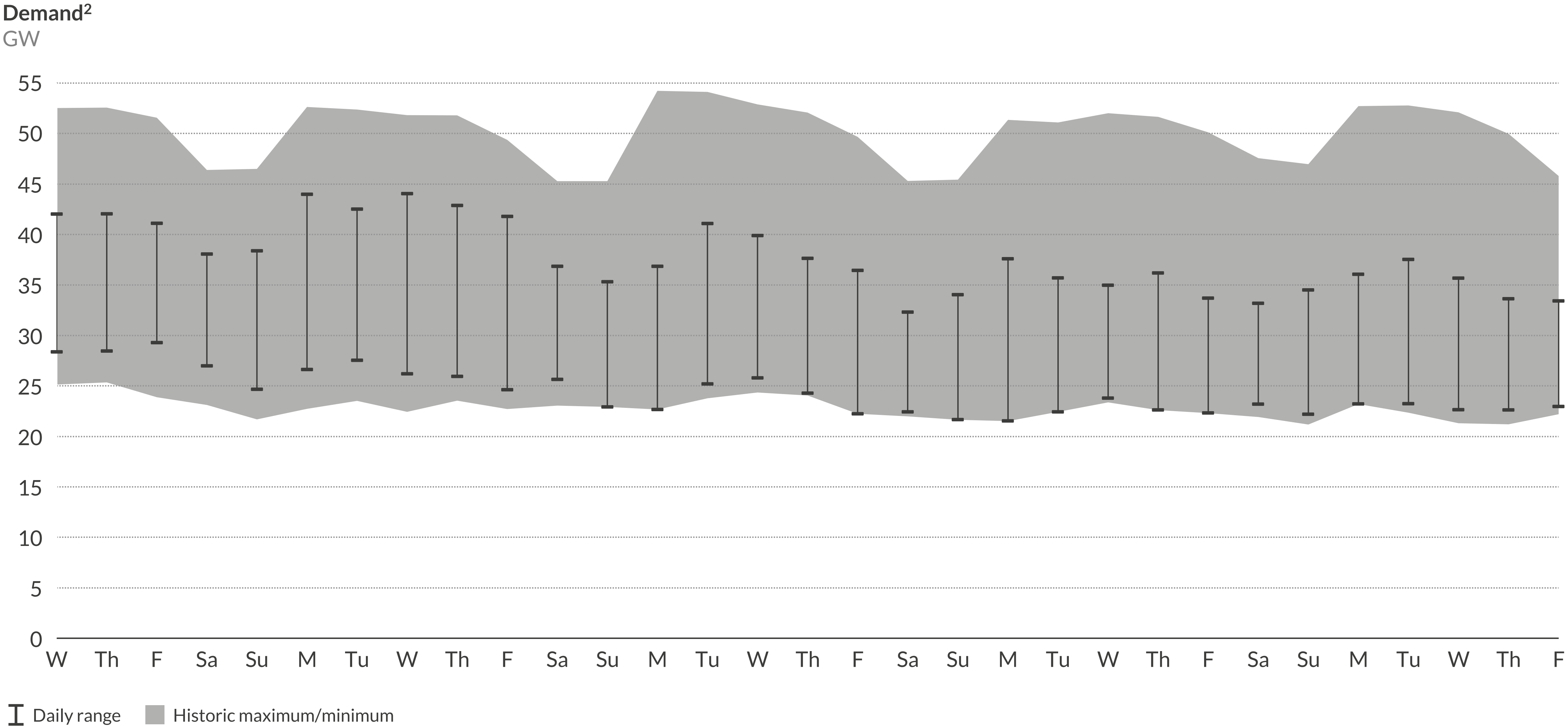


1) Half-hourly EPEX is the volume-weighted reference price over that half-hour interval, as provided by EPEX Spot. 2) De-Rated Margin Forecast calculated in accordance with the Loss of Load Probability Calculation Statement from Elexon.

Sources: Elexon, National Grid, Thomson Reuters, Aurora Energy Research

Daily March max and min demand

Relative to historic March max and min demand since 2010[1]

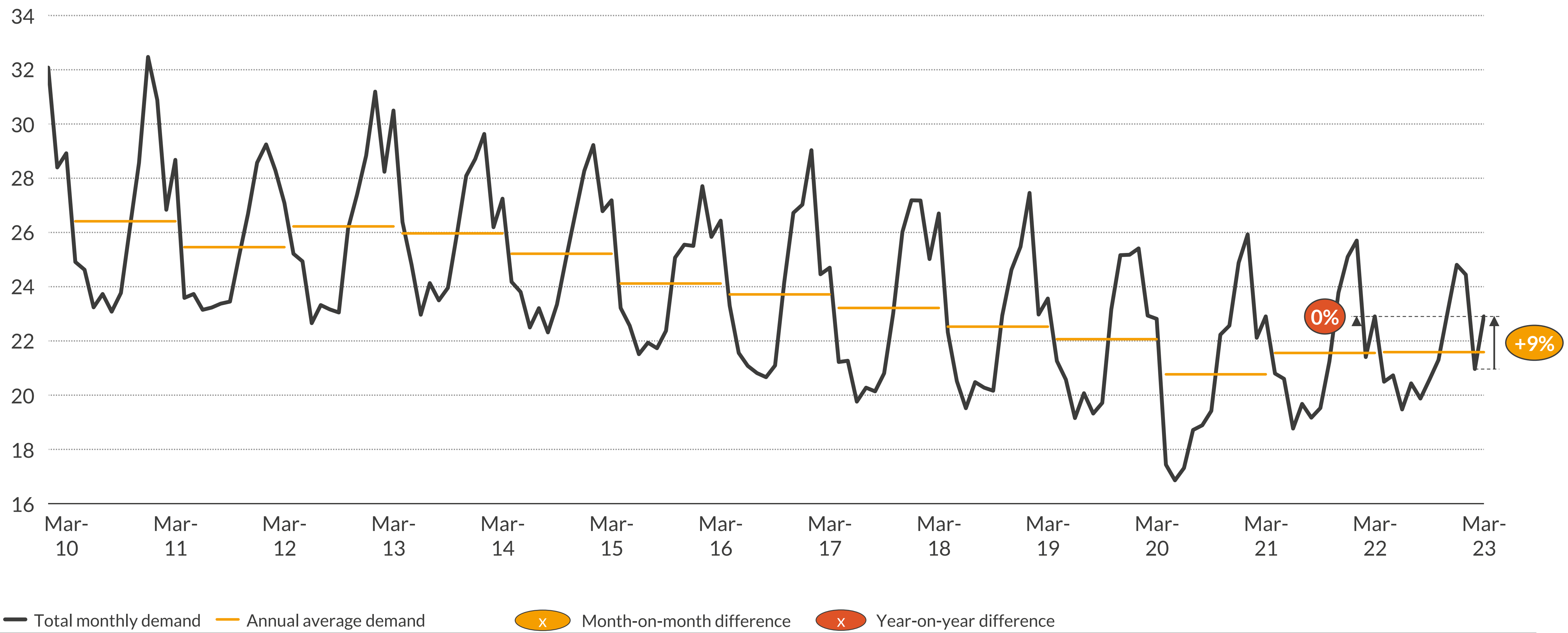


1) Data from previous years is matched to the nearest weekday within the current month, to maintain the weekly demand pattern. 2) Demand data presented here is Initial Transmission System Demand Out-Turn, and does not include embedded demand.

Sources: National Grid, Aurora Energy Research

Monthly historical demand on the transmission system

Total demand[1]
TWh

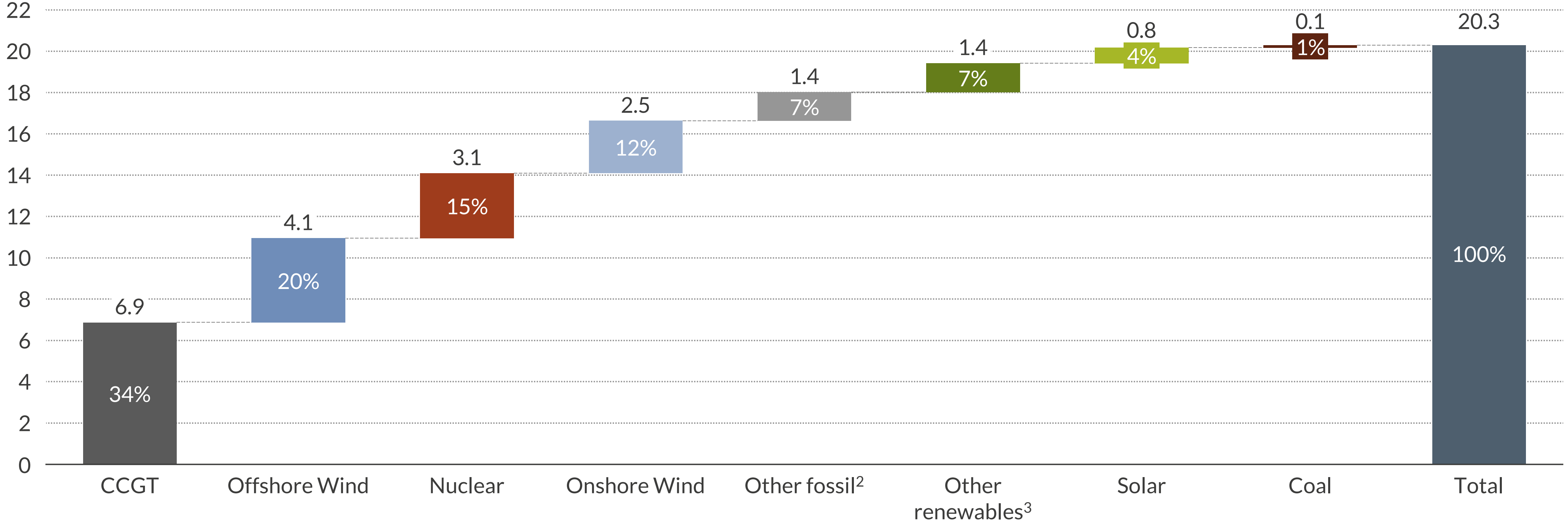


1) Demand data presented here is Initial Transmission System Demand Out-Turn, and includes station transformer load, pumped storage demand and interconnector demand, but does not include embedded demand.

Sources: National Grid, Aurora Energy Research

Monthly fuel mix breakdown

Output[1]
TWh



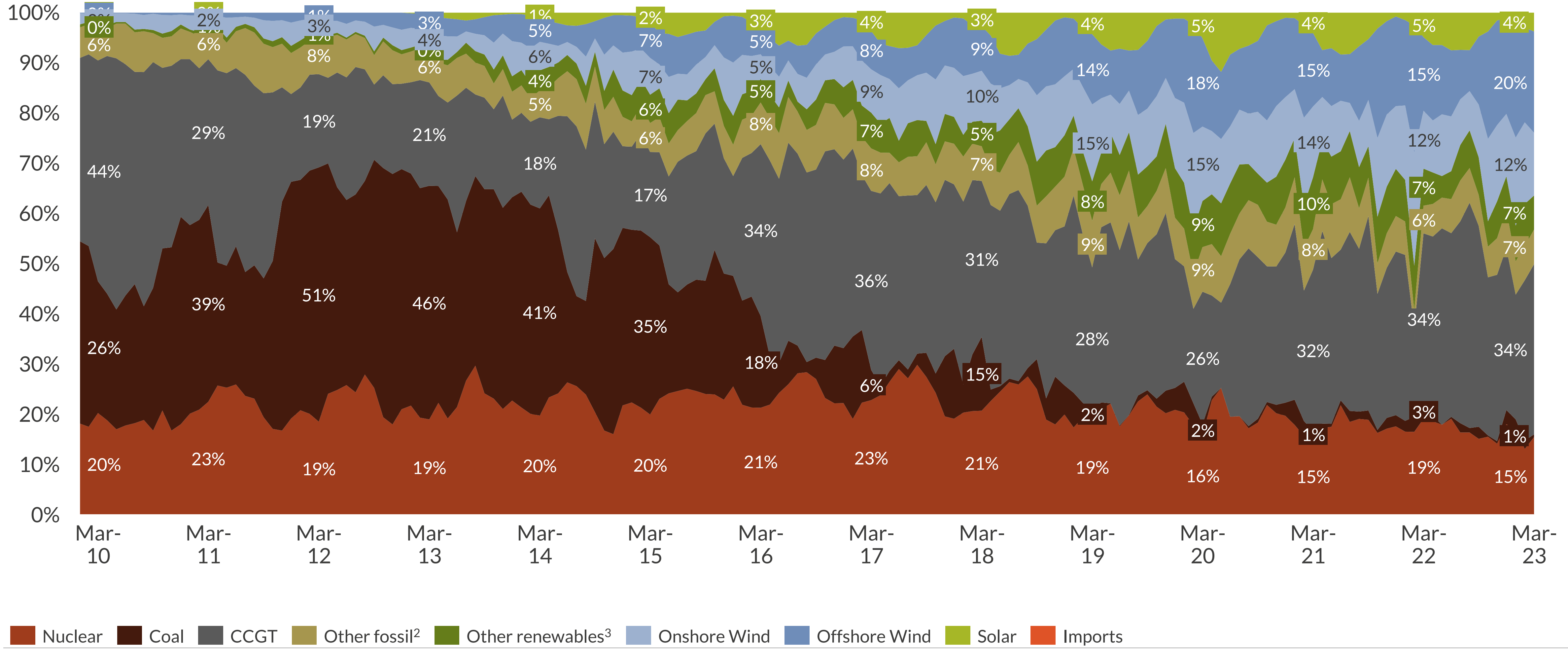
Load factor
%

CCGT	Offshore Wind	Nuclear	Onshore Wind	Other fossil	Other renewables	Solar	Coal
33	48	66	26	17	34	7	3

1) Includes outputs from generators registered as BM Units as well as embedded wind and solar PV assets. All numbers are rounded to 0.1 TWh which means that subtotals may not sum to total value. 2) Other fossil includes oil, CHP-CCGT and OCGT. 3) Other renewables includes biomass and hydro.
Sources: Elexon, Sheffield Solar, National Grid, Aurora Energy Research

Historical fuel mix breakdown

Output[1]
% of total



1) Includes outputs from generators registered as BM Units as well as embedded wind and solar PV. 2) Other fossil includes oil, CHP-CCGT and OCGT. 3) Other renewables includes biomass and hydro.

Sources: Elexon, Sheffield Solar, National Grid, Aurora Energy Research

Monthly interconnector flow duration curve
Flow in each half-hour for GB interconnectors

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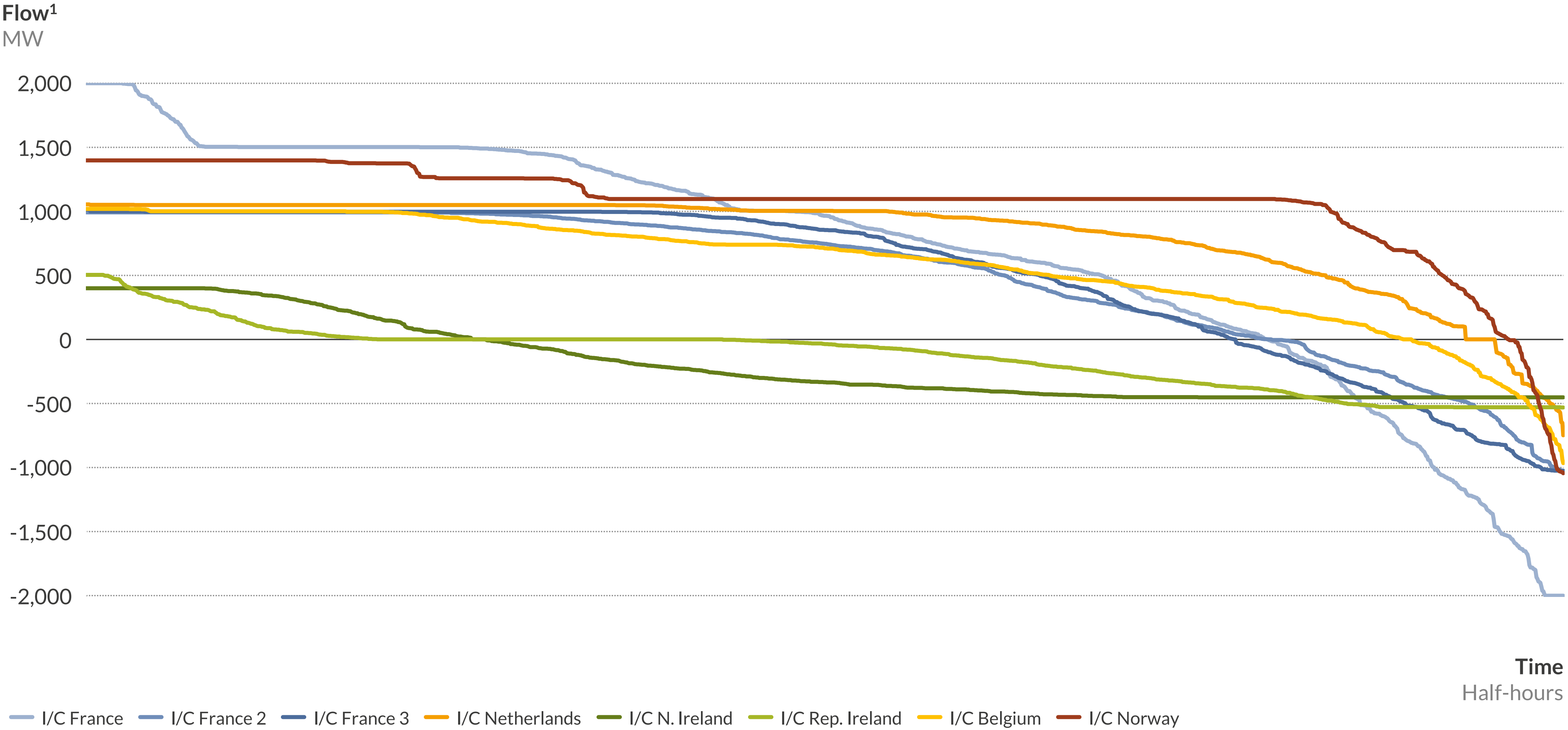

1) Positive flow is imports into GB, negative flow is exports.

Sources: Elexon, National Grid, Aurora Energy Research

Monthly emissions by technology

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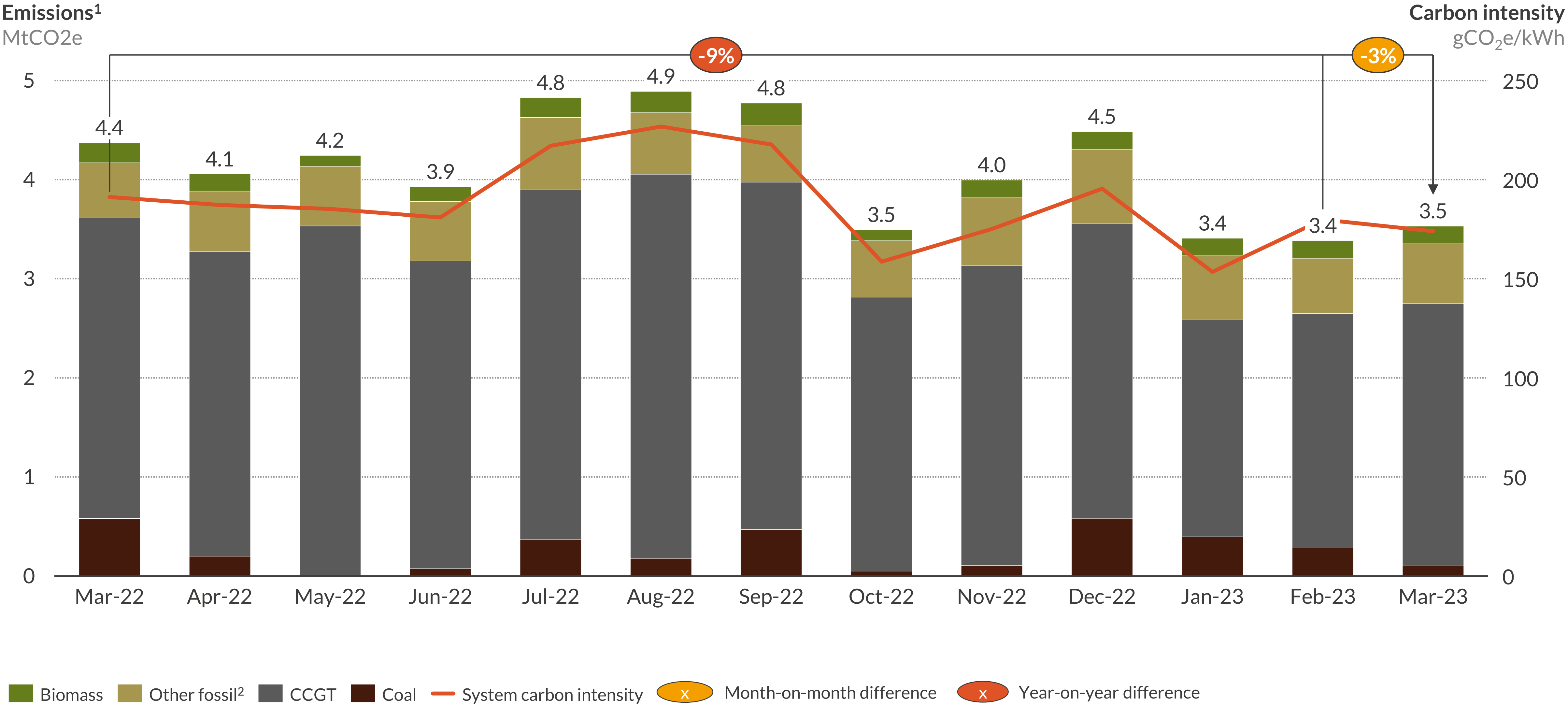

1) Please refer to Appendix for details of methodology employed to calculate emission amounts. Includes all Balancing Mechanism plants. 2) Other fossil includes oil, OCGT and gas CHP-CCGT.

Sources: Elexon, Ofgem, Aurora Energy Research

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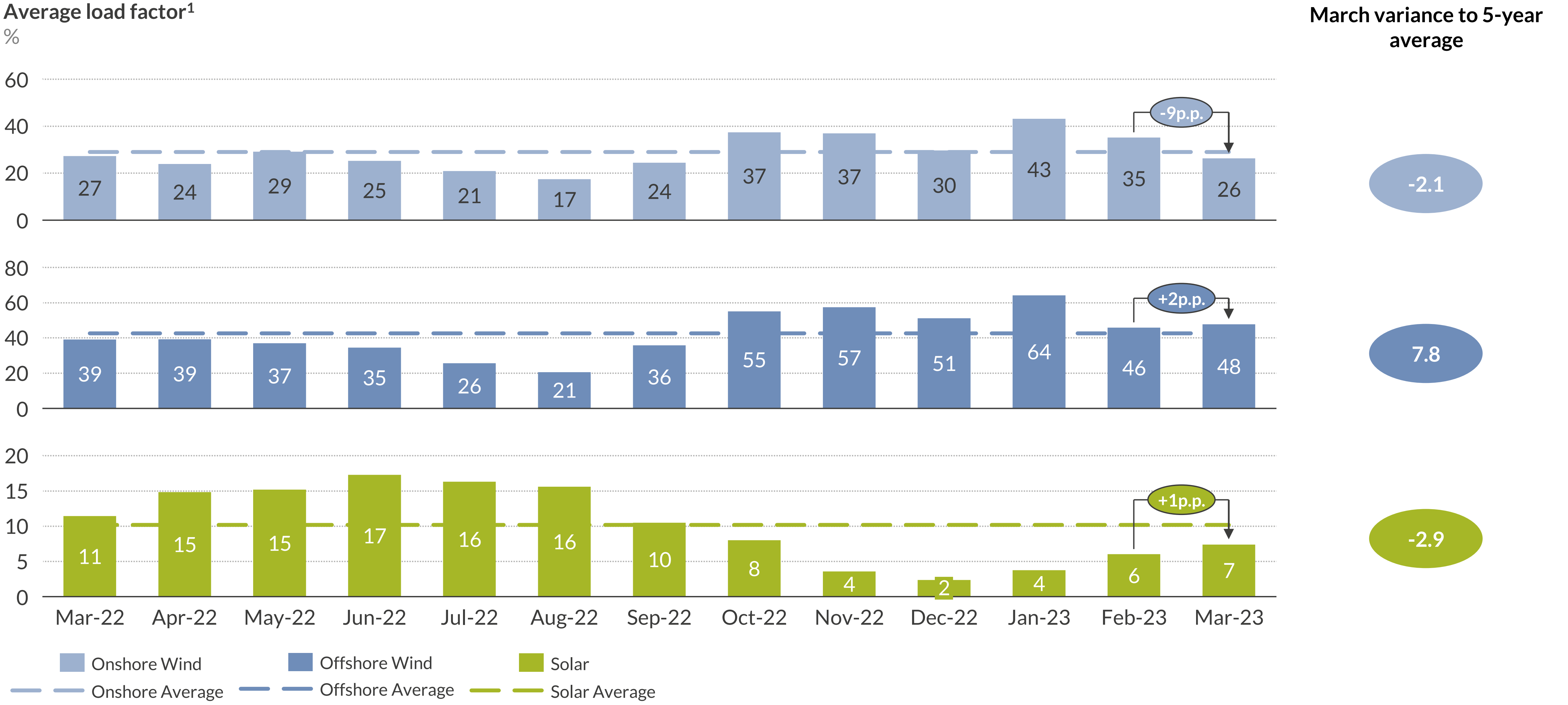
Monthly load factors by technology



1) Includes outputs from generators registered as BM Units as well as embedded wind and solar PV

Sources: Aurora Energy Research, Elexon

Capture price versus baseload APX price

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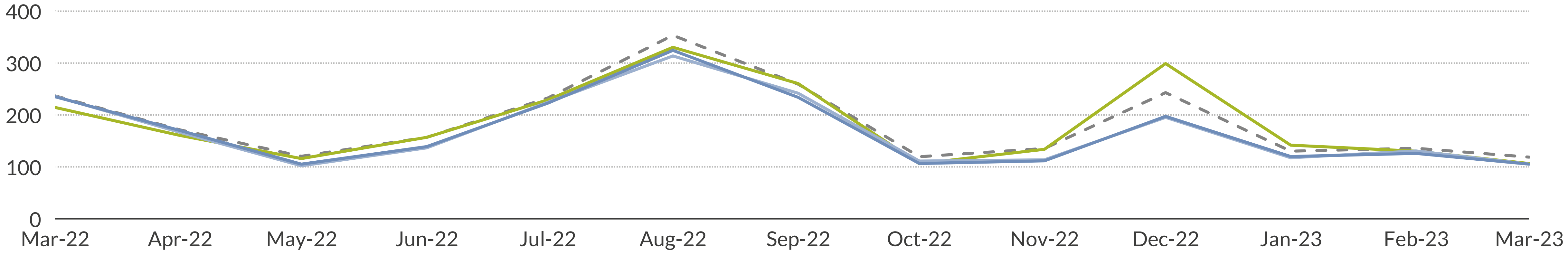
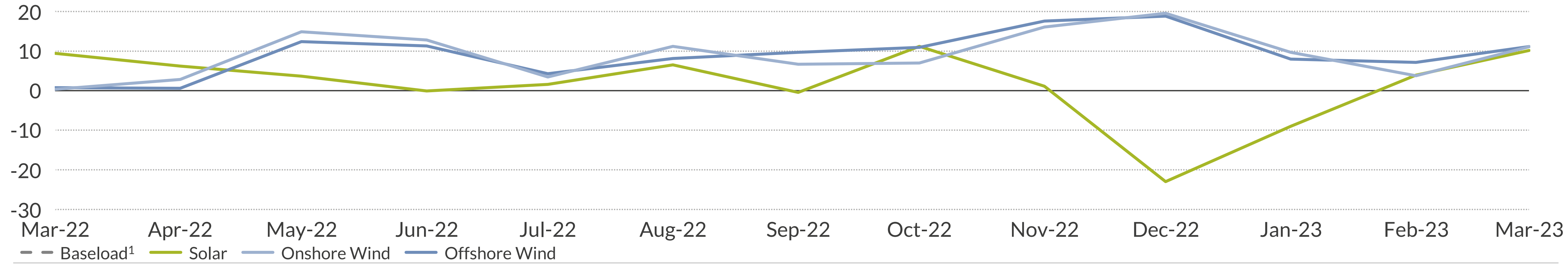
Intraday Price[1,2]
£/MWh



Technology capture discount[2] to baseload
%



1) The baseload price is the average monthly APX spot price. The capture price of a technology is the load-weighted monthly average APX price across all half-hourly periods; 2) Includes generators registered as BM Units as well as embedded wind

Sources: Aurora Energy Research, Elexon, EPEX Spot

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Plant utilisation – load factors by plant for March

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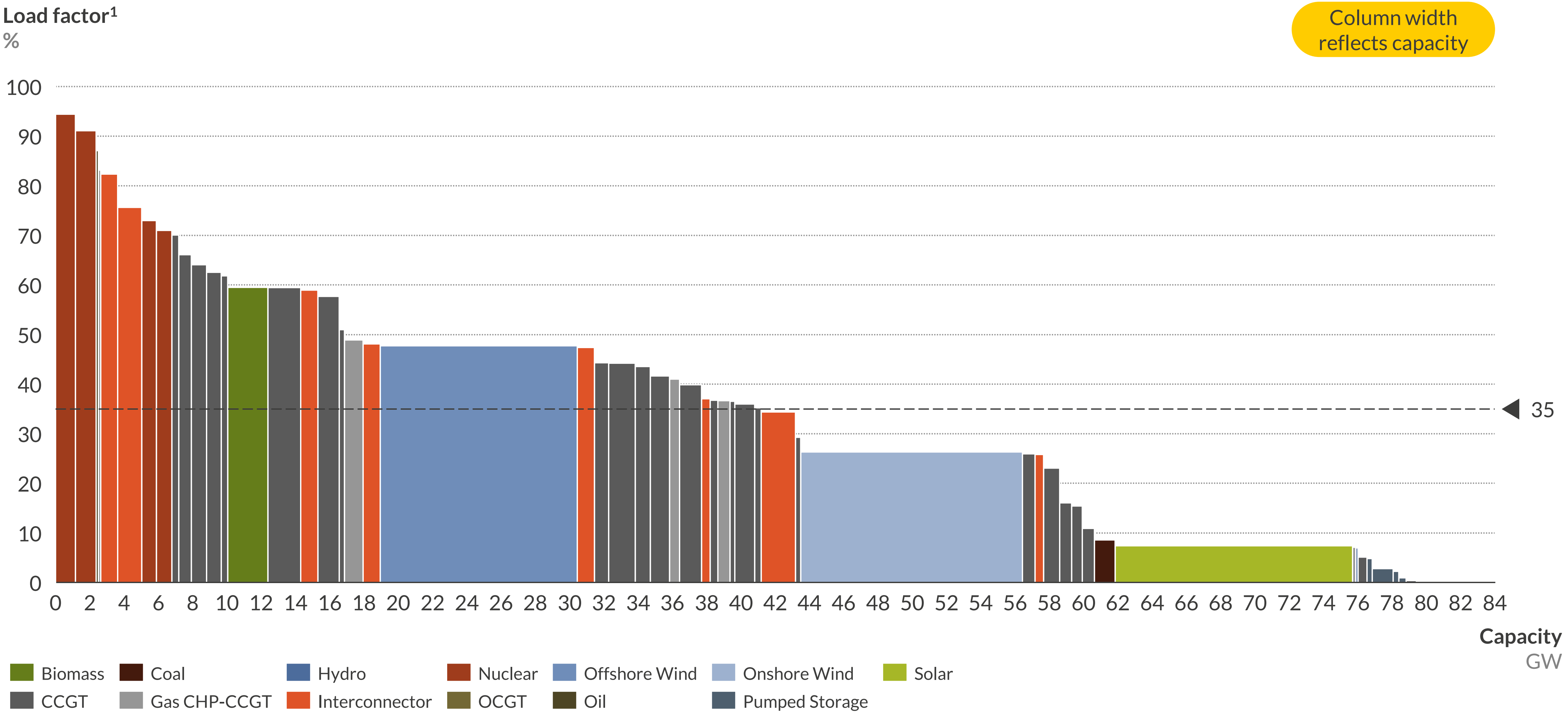

1) Represents 60 plants with highest capacity according to the Balancing Mechanism (BM) database, as well as aggregated data for wind and solar. Capacity of each plant represents the sum of capacities of all its generators that have been active at least once in the last three months. Please refer to Appendix for a detailed description of the data used and categories presented

Sources: Aurora Energy Research, Elexon, BEIS

CCGT plant utilisation – by plant for March

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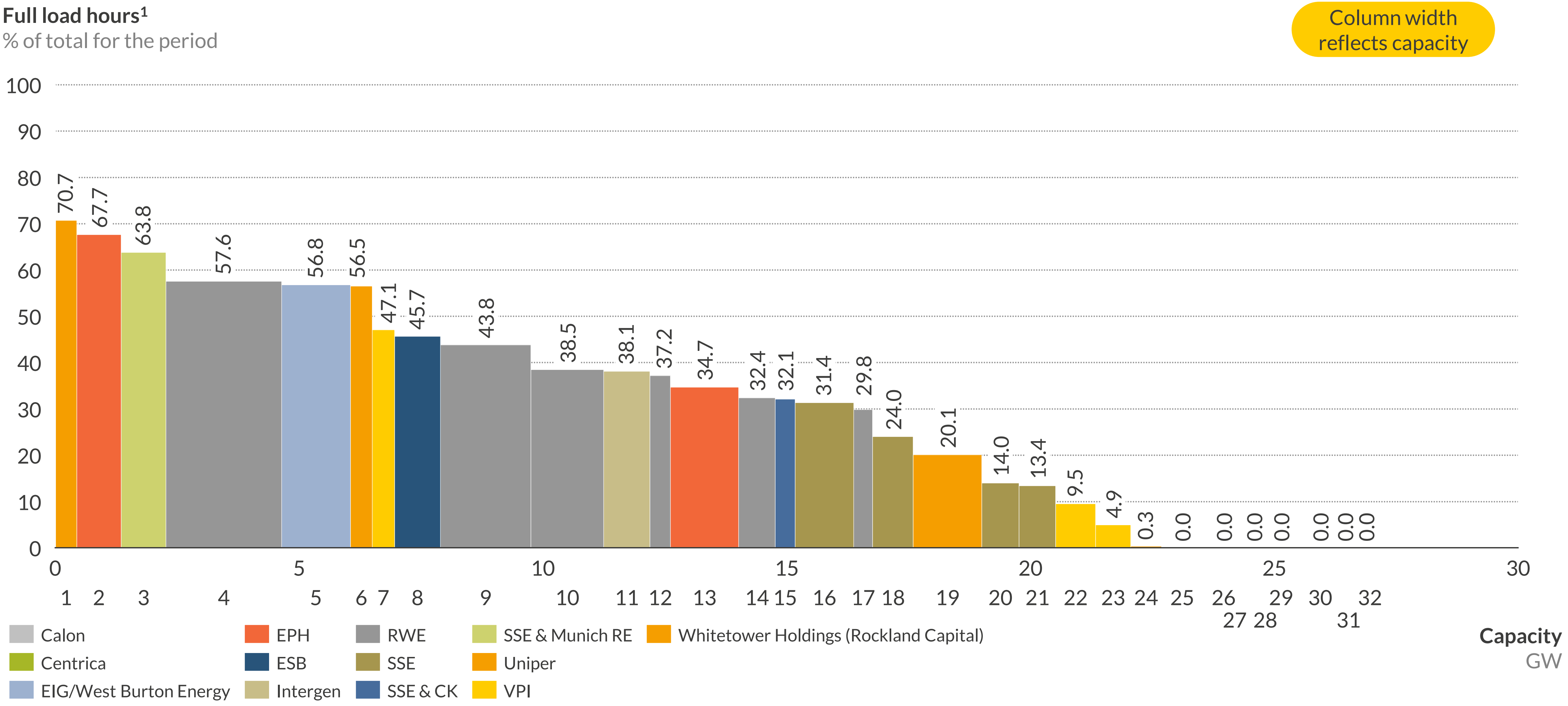

1) Includes all CCGT plants of the presented companies that report to the Balancing Mechanism. 2) Plant Names: 1. Enfield Energy, 2. Pembroke, 3. Cottam Dvpt Centre, 4. Marchwood, 5. Great Yarmouth, 6. West Burton B, 7. Staythorpe, 8. Carrington, 9. Didcot B, 10. Little Barford, 11. Kings Lynn, 12. South Humber Bank, 13. Langage, 14. Spalding, 15. Shoreham, 16. Medway, 17. Peterhead, 18. Seabank 2, 19. Seabank 1, 20. Connahs Quay, 21. Keadby, 22. Damhead Creek, 23. Rocksavage, 24. Rye House, 25. Corby, 26. Killingholme 2, 27. Sutton Bridge, 28. Glanford Brigg, 29. Severn, 30. Peterborough, 31. Coryton, 32. Killingholme 1.

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Monthly average system prices for the last 13 months

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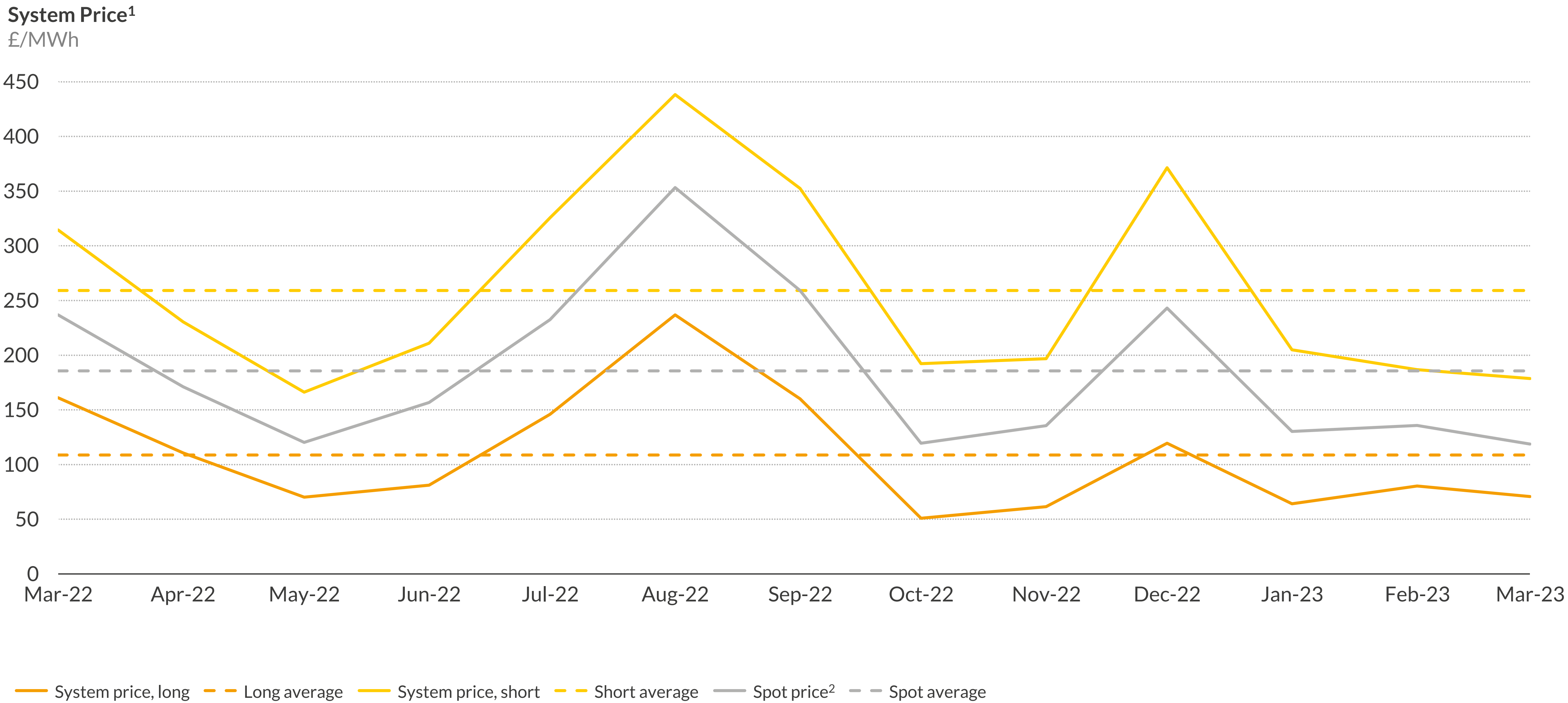

1) Monthly average; 2) Half-hourly wholesale spot price is the volume-weighted reference price over that half hour interval, as provided by APX Power UK

Sources: Aurora Energy Research, Elexon, EPEX Spot

Half-hourly System Price against Net Imbalance Volume for March

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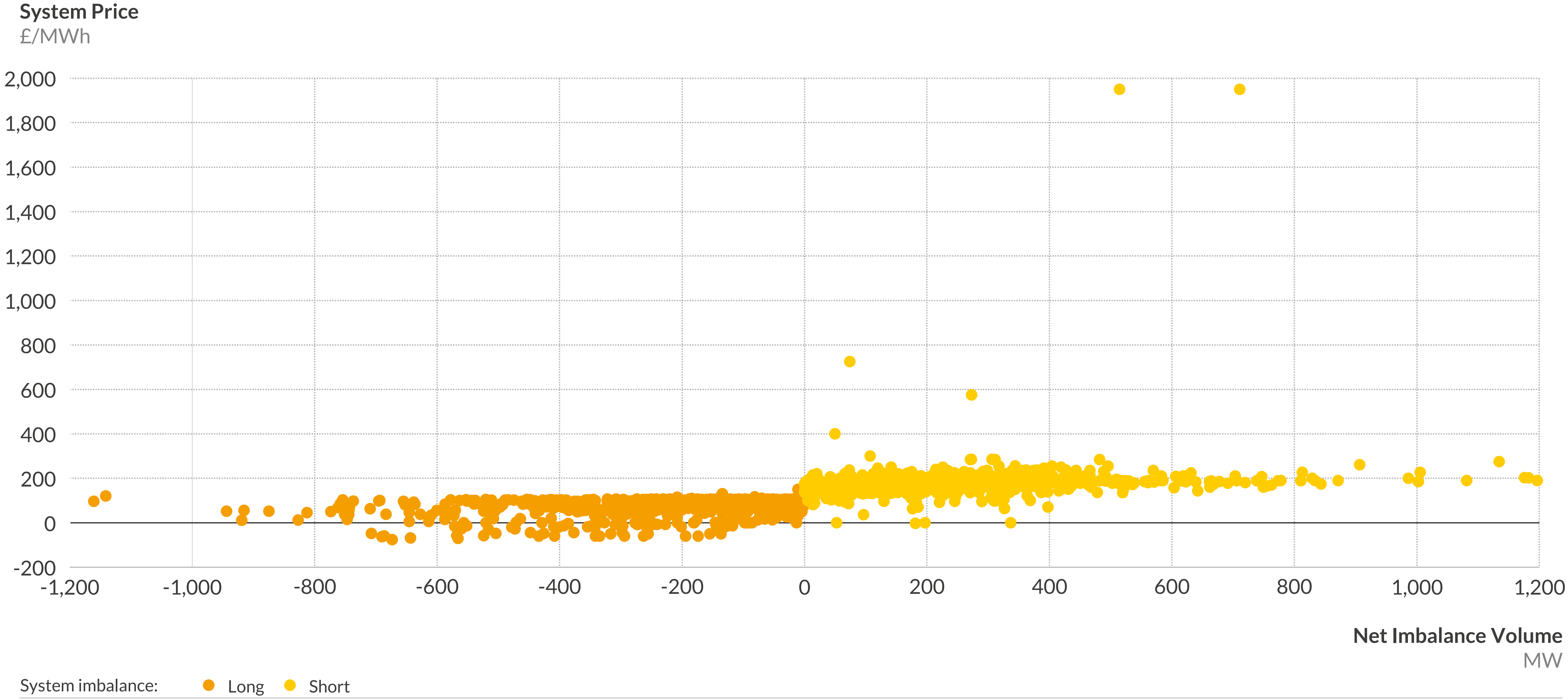
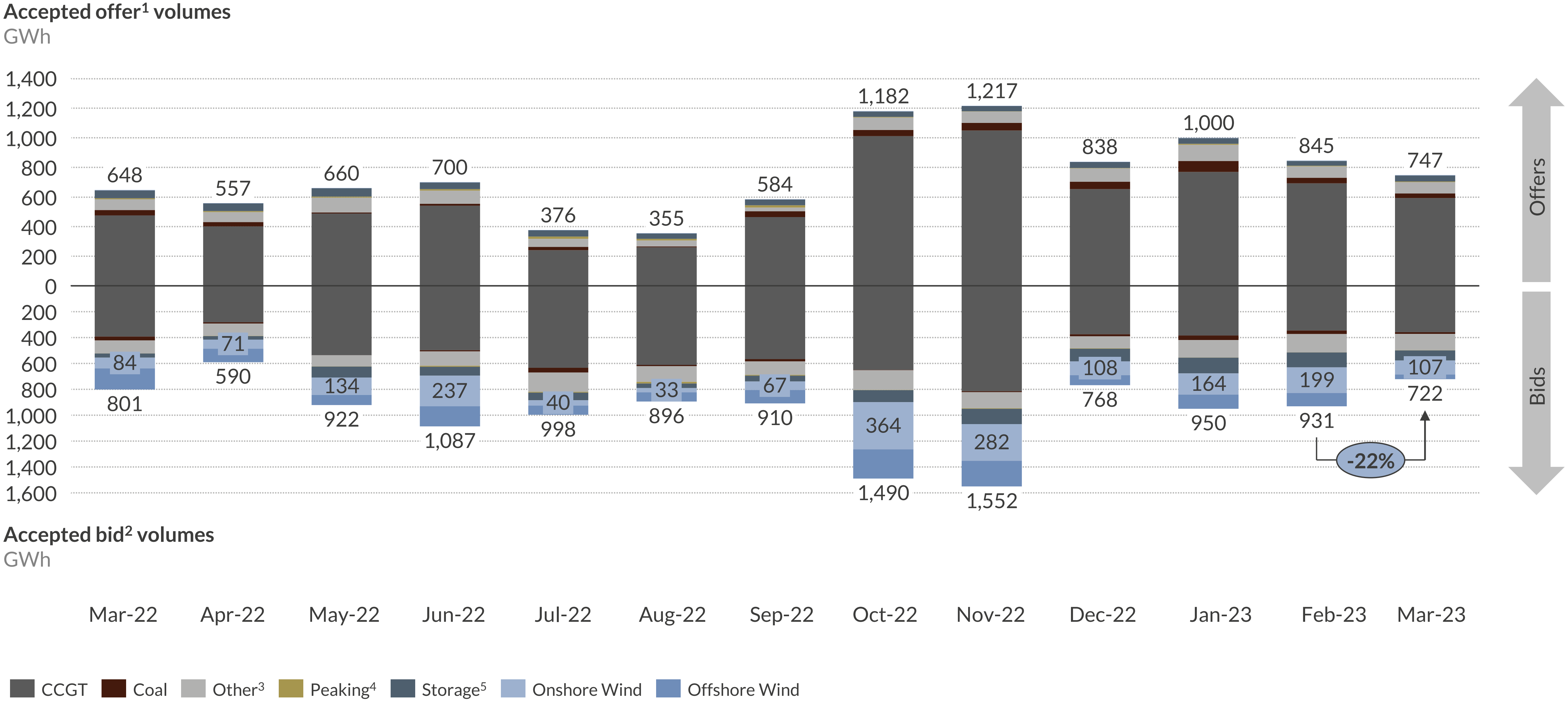


Sources: Aurora Energy Research, Elexon

Bid-offer acceptance volumes breakdown by technology for the last 13 months



1) Offers to increase generation or reduce demand; 2) Bids to reduce generation or increase demand; 3) Other includes oil, CHP-CCGT, biomass and hydro; 4) Peaking includes OCGT, reciprocating engines and DSR; 5) Storage includes batteries and pumped storage

Sources: Aurora Energy Research, Elexon

Bid-offer payments breakdown by technology for the last 13 months

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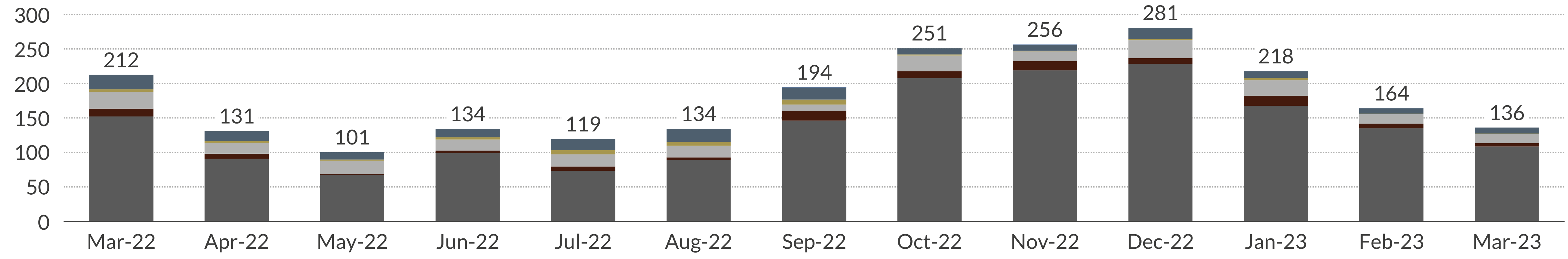
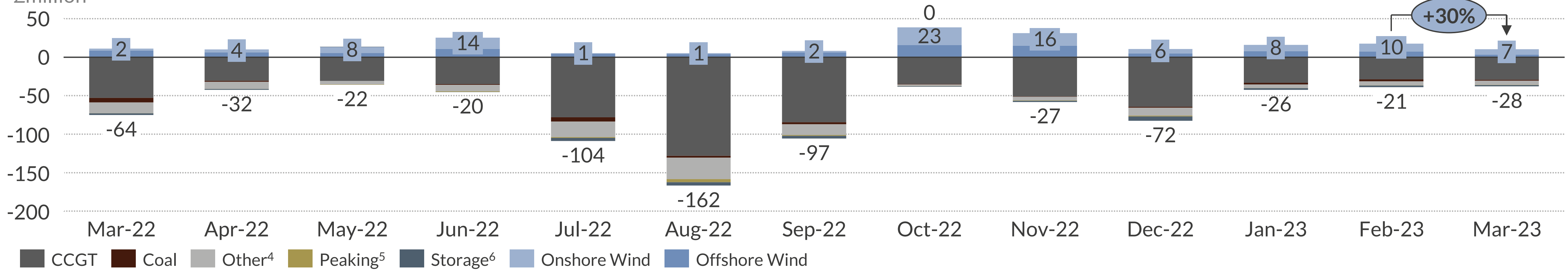
Accepted offer[1] payments[3]

£million



Accepted bid[2] payments[3]

£million



1) Offers to increase generation or reduce demand; 2) Bids to reduce generation or increase demand; 3) Positive cashflow means payment to generators, negative is payment to National Grid; 4) Other includes oil, CHP-CCGT, biomass and hydro; 5) Peaking includes OCGT, reciprocating engines and DSR; 6) Storage includes batteries and pumped storage

Sources: Aurora Energy Research, Elexon

Appendix

Data used

- Output values used in this summary reflect the sum of Final Physical Notifications (FPN) submitted by all BM Units of a given plant that have been active over the last three months.
- Capacity values used in this summary reflect the sum of capacities of individual BM Units, as reported to the Balancing Mechanism, that have been active over the last three months. They reflect long-term capacities and exclude temporary fluctuations due e.g. to plant failures or scheduled maintenance.
- Prices used in this summary are the EPEX half-hourly Reference Prices for half-hourly, two-hourly and four-hourly spot products.

Categories presented

- Full-load hours represent the plants' load factors, calculated as the ratio of the output produced in a given month to the maximum possible output given the plants' capacity.
- Running hours represent the proportion of time in a given month when a plant has been active, i.e. when at least one of its BM Units produced output greater than zero.
- Capture prices (or average output-weighted prices) are calculated as an average of EPEX half-hourly prices per MWh weighted by the plants' corresponding half-hourly outputs for all periods.
- Average gross margins are calculated as a sum of the uplift and inframarginal rent. Uplift is calculated as the difference between the EPEX price and the system marginal cost (SMC). SMC is the maximum marginal cost of all the plants with at least one generator producing above 80% of its installed capacity in a given half-hour.
- Emissions are calculated as plant output divided by electrical efficiency, multiplied by theoretical carbon content of the fuel input. The carbon content of fuel inputs is sourced from BEIS's Greenhouse gas reporting – Conversion factors 2016. System carbon intensity is calculated as the total emission divided by total electricity generated.

Source: Aurora Energy Research

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