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ENERGY RESEARCH

ERCOT Market Summary Feb-23

Published Mar-23

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Executive Summary

1. Day-Ahead and Real-Time prices fell for the second consecutive month, dropping to $20.8/MWh and $18.0/MWh, respectively. $18.0/MWh is the lowest monthly average Real-Time price since June 2020, when prices were supressed by a pandemic induced economic slowdown
2. Transmission demand fell for a second straight month, dropping to 30.3TWh. Peak demand also remained low and system-wide margins never dropped below 8GW

1. System Performance	Monthly value	Month-on-month change	Year-on-year change	Slide reference(s)
Day-Ahead prices[1] *$/MWh*	20.8	- 3.3 - 13.6%	- 16.6 - 44.3%	8, 9
Real-Time prices[1] *$/MWh*	18.0	- 4.2 - 18.8%	- 28.2 - 61.0%	10, 11
ORDC Adder Value *$/MWh*	0.3	+ 0.1 + 119.4%	- 10.7 - 97.5%	13, 15
Reliability Adder Value *$/MWh*	0.6	0.3 + 137.6%	- 8.2 - 93.3%	13, 16
Natural gas prices[2] *$/MMBtu*	2.0	- 0.5 - 20.9%	- 2.4 - 55.1%	17
Transmission demand *TWh*	30.3	- 1.9 - 6.0%	- 1.0 - 3.0%	18, 19

2a. Technology Performance	Monthly value	Month-on-month change	Year-on-year change	Slide reference(s)
Low carbon[3] **generation** *TWh*	15.1	- 1.1 - 7.1%	+ 1.9 + 14.7%	22, 23
Thermal[4] **generation** *TWh*	15.2	- 0.9 - 5.3%	- 2.8 - 15.5%	22, 23

1) Hub average data 2) Gas prices are a Texas average 3) Includes Nuclear, Solar PV and Onshore wind 4) Includes Gas and Coal

Sources: ERCOT, Aurora Energy Research

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Executive Summary

3. Renewables GWAs fell in line with wholesale prices, dropping to $16.8/MWh and $16.9/MWh for solar and wind, respectively. Solar capture prices were the lowest since December 2020; the few high price hours in February occurred in the late evening or early morning when solar generation was zero or near zero
4. Regulation Down prices nearly doubled from January, reaching $8.9/MW. The increase in price was the result of higher procurement values, which reached their highest level in over five years (405.5MW/hour)

2b. Technology Performance	Monthly value	Month-on-month change	Year-on-year change	Slide reference(s)
Solar capacity factors[1] *%*	18.4	+ 1 p.p.	- 4 p.p.	24
Solar GWA price[2] *$/MWh*	16.8	- 3.3 -16.2%	- 11.8 -41.1%	25
Wind capacity factors[1] *%*	43.1	+ 2 p.p.	+ 7 p.p.	24
Wind GWA price[2] *$/MWh*	16.9	- 3.3 -16.5%	+ 3.2 23.2%	25

3. Ancillary Services Performance	Monthly value	Month-on-month change	Year-on-year change	Slide reference(s)
RRS Price *$/MW*	3.7	- 0.3 - 8.0%	- 9.3 - 71.6%	28
Non-Spin Price *$/MW*	5.3	+ 0.9 + 21.1%	- 9.2 - 63.4%	28
Regulation Up Price *$/MW*	5.5	+ 0.4 + 7.4%	- 9.2 - 62.5%	28
Regulation Down Price *$/MW*	8.9	+ 4.4 + 97.4%	+ 0.1 + 0.7%	28

1) Based on ERCOT daily balancing report 2) Based on Day-Ahead prices

Sources: ERCOT, Aurora Energy Research

Aurora provides market leading forecasts & data-driven intelligence for the global energy transition

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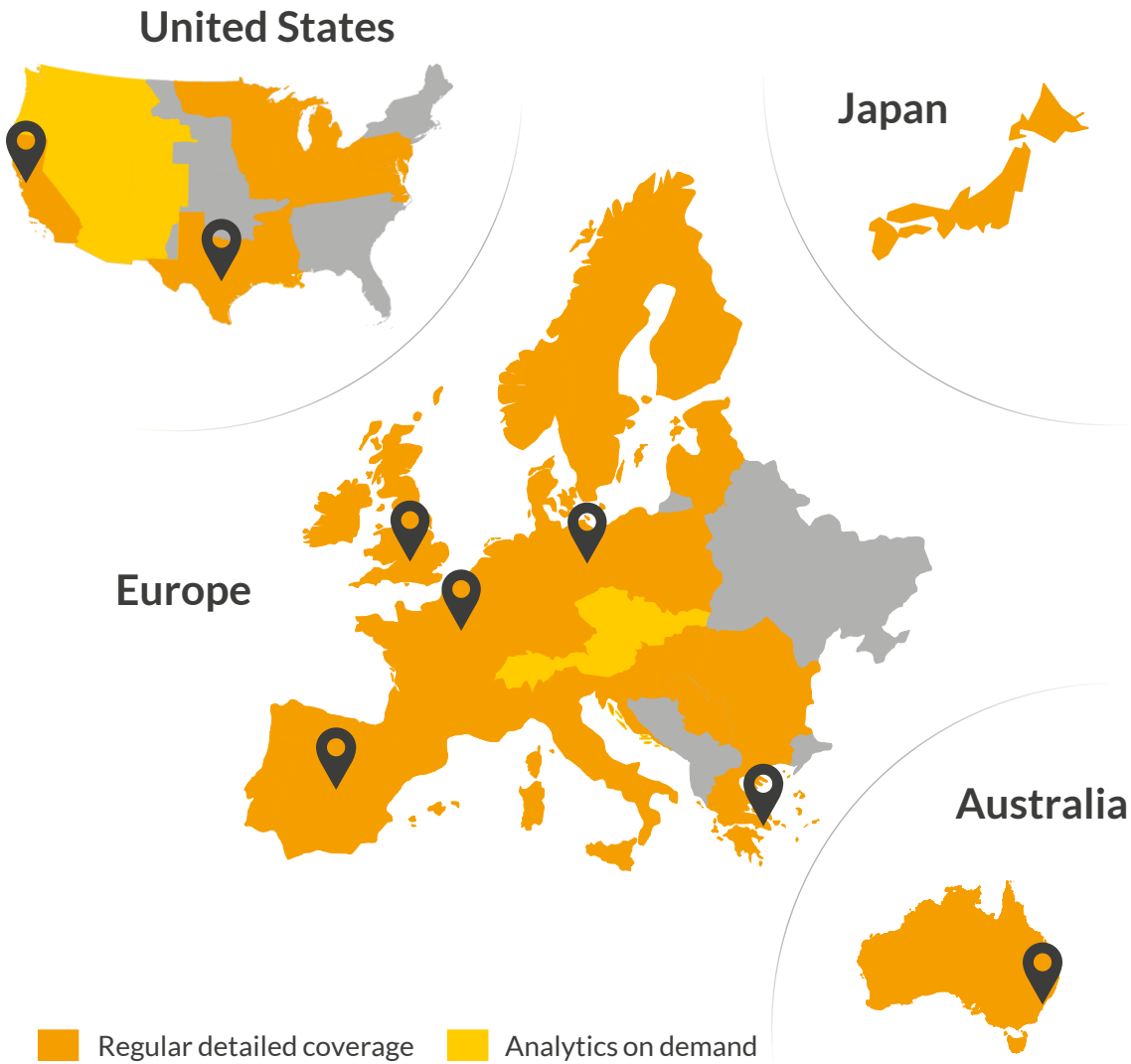
- Power markets
- Renewables
- Storage
- Electric vehicles
- Hydrogen H_2
- Carbon CO_2
- Natural gas



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Oxford | Berlin | Madrid | Athens
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300+
market experts, 35+ in the US

600+
subscribing companies

120+
transactions supported in 2021

Source: Aurora Energy Research

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Historical monthly average ERCOT wide Day-Ahead and Real-Time wholesale prices

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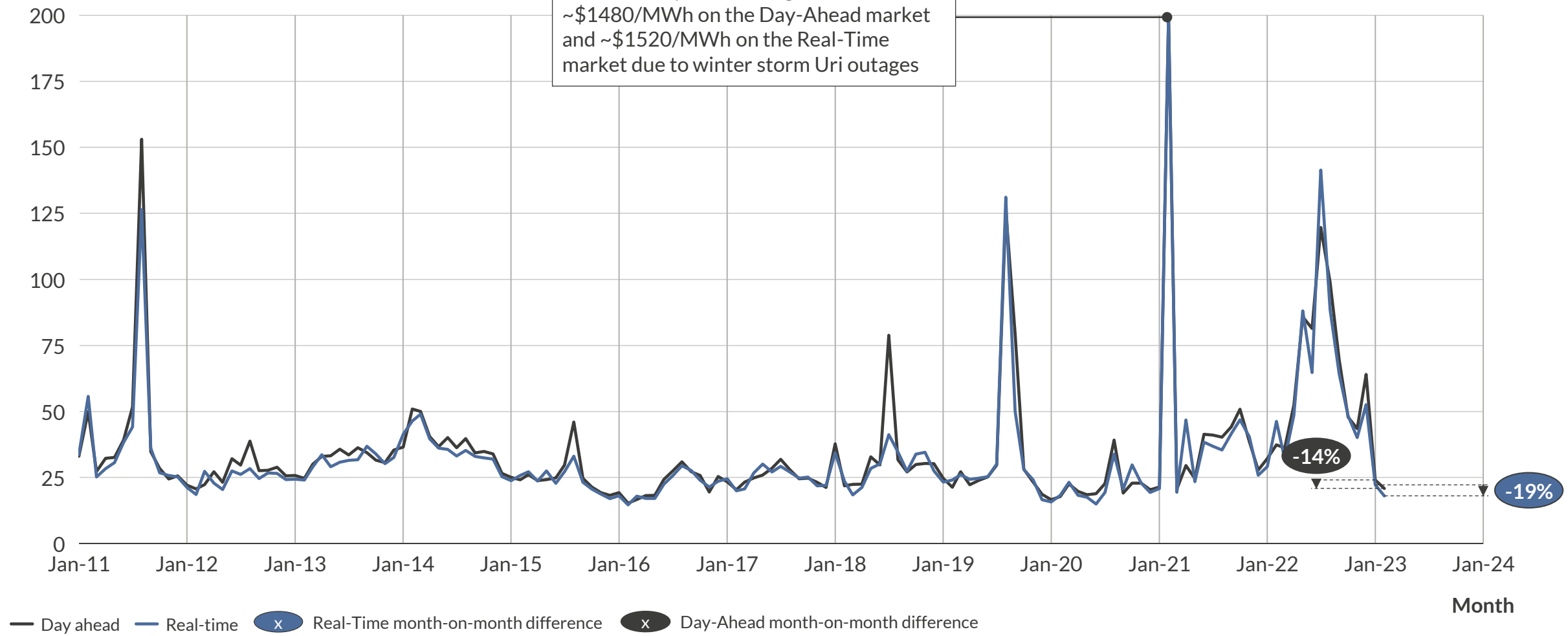
Monthly average ERCOT wide ATC price[1,2]

$/MWh



1) ATC = Around the clock wholesale price, ERCOT wide is equivalent to the Hub Average 2) Feb 2021 capped at $200/MWh

Sources: ERCOT, Aurora Energy Research

Comparison of regional hub Day-Ahead and Real-Time prices

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	Current month avg.	Previous month avg.	Month-on-month change	Year-on-year change	Avg. daily 1hr price spread[1]	Hours of negative prices
Day–Ahead hub prices	*$/MWh*	*$/MWh*	*$/MWh*	*$/MWh*	*$/MWh*	*Hours*
Hub Average	20.8	24.1	- 3.3 - 13.6%	- 16.6 - 44.3%	31.9	1
Houston	22.0	24.8	- 2.8 - 11.4%	- 18.4 - 45.5%	32.0	0
North	21.3	24.7	- 3.4 - 13.9%	- 18.1 - 46.1%	31.8	0
South	20.3	23.9	- 3.6 - 15.2%	- 15.6 - 43.5%	31.1	7
West	19.7	22.8	- 3.1 - 13.8%	- 14.1 - 41.8%	37.4	26
Real–Time hub prices	*$/MWh*	*$/MWh*	*$/MWh*	*$/MWh*	*$/MWh*	*Hours*[2]
Hub Average	18.0	22.2	- 4.2 - 18.8%	- 28.2 - 61.0%	53.4	41
Houston	18.9	22.8	- 3.9 - 17.1%	- 30.6 - 61.9%	53.2	33
North	18.1	23.2	- 5.1 - 22.2%	- 29.8 - 62.2%	53.3	37.75
South	17.5	22.3	- 4.8 - 21.6%	- 26.8 - 60.6%	65.8	49.75
West	17.6	20.5	- 2.9 - 14.0%	- 25.5 - 59.1%	65.3	141

1) For Day-Ahead the difference between top 1 hour price and bottom 1 hour, for Real-Time the average of the four highest settlement prices within a day minus the average of the four lowest settlement prices in that day

Sources: ERCOT, Aurora Energy Research

Hourly Day-Ahead hub prices for February 2023

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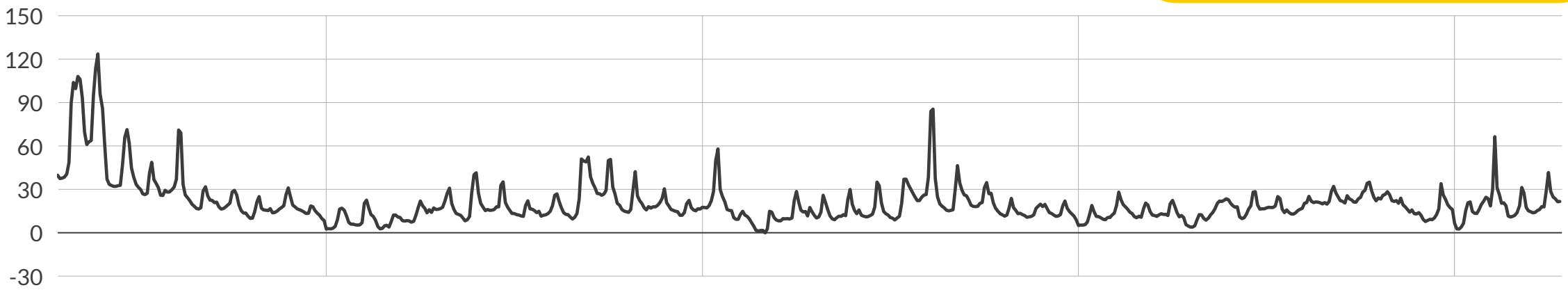
Day-Ahead hub average price

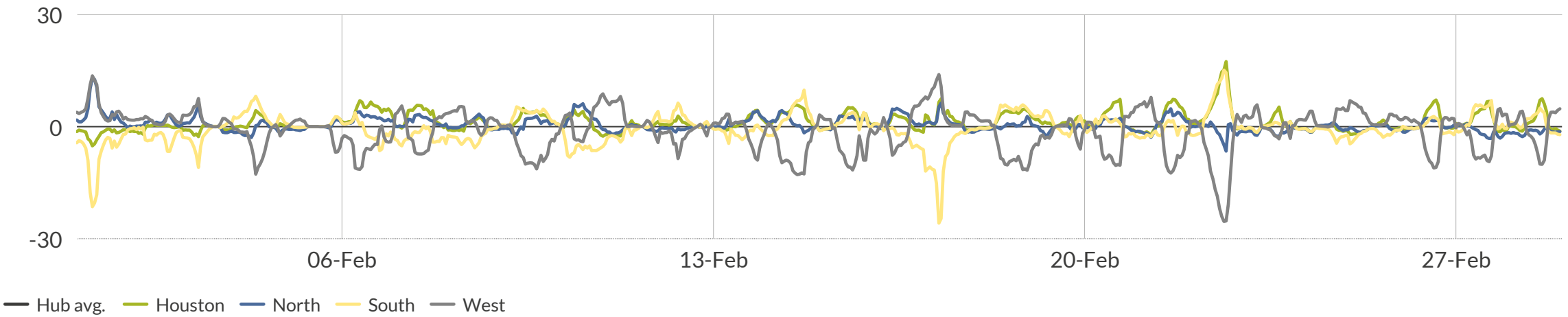
$/MWh

Monthly average price in February 2023: $20.8/MWh



Day-Ahead price delta to hub average

$/MWh



Sources: ERCOT, Aurora Energy Research

Historical monthly average Day-Ahead price by hub

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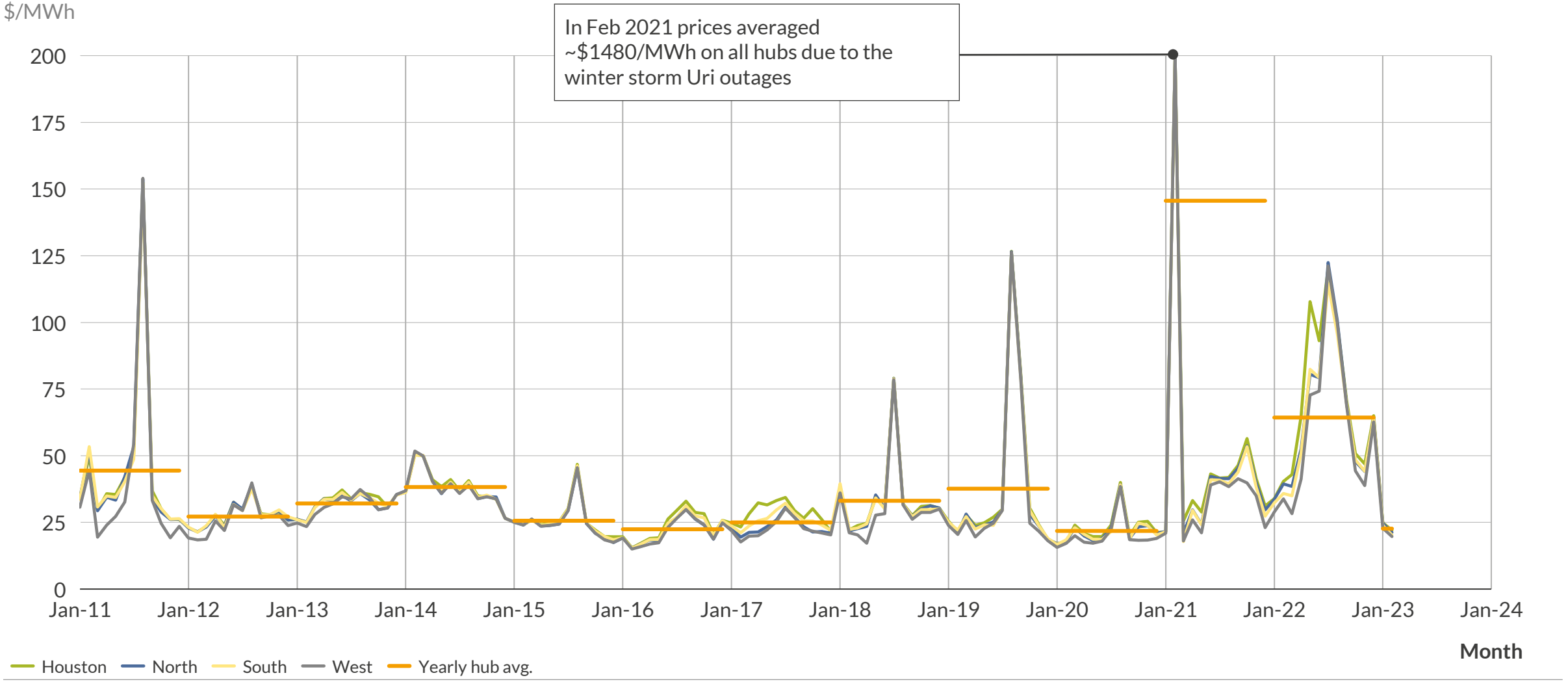
Monthly average Day-Ahead ATC price[1,2]

$/MWh



1) ATC = Around the clock wholesale price 2) Feb 2021 capped at $200/MWh

Sources: ERCOT, Aurora Energy Research

15 minutely Real-Time hub prices for February 2023

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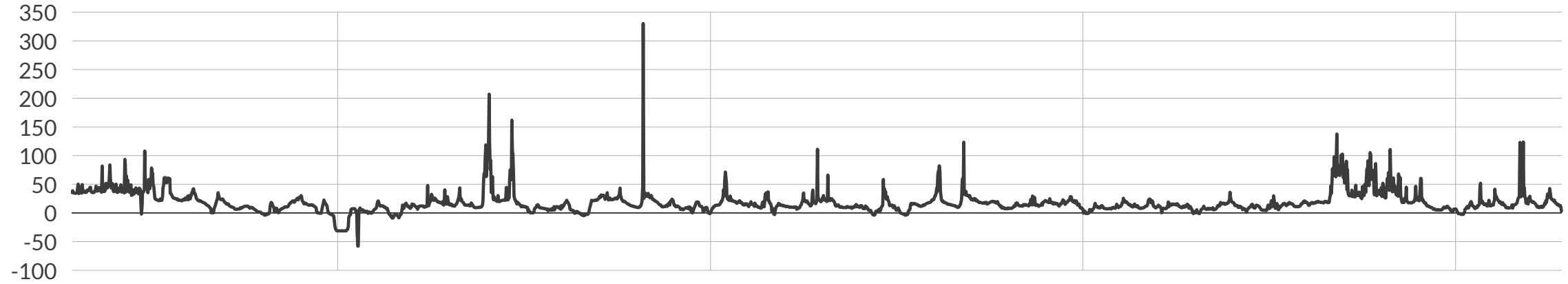
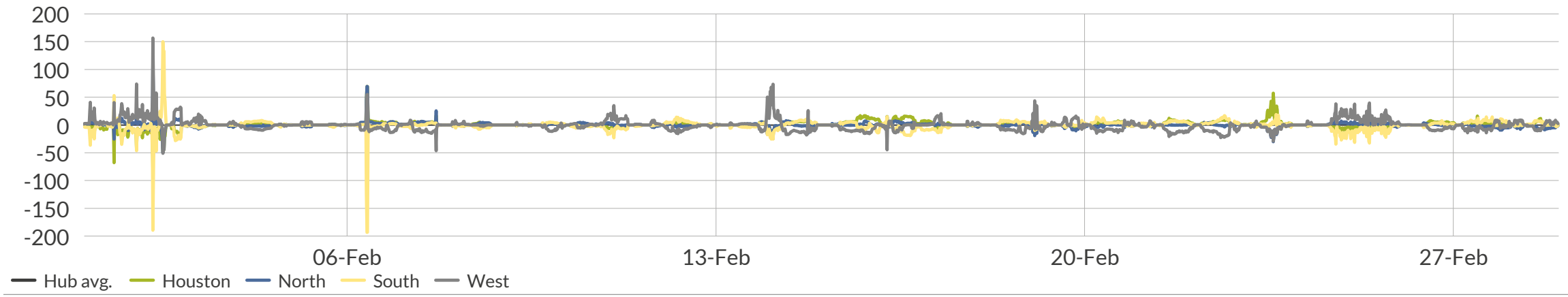
Monthly average price in February 2023: $18.0/MWh

Real-Time hub average price
$/MWh



Real-Time price delta to hub average
$/MWh



Sources: ERCOT, Aurora Energy Research

Historical monthly average Real-Time price by hub

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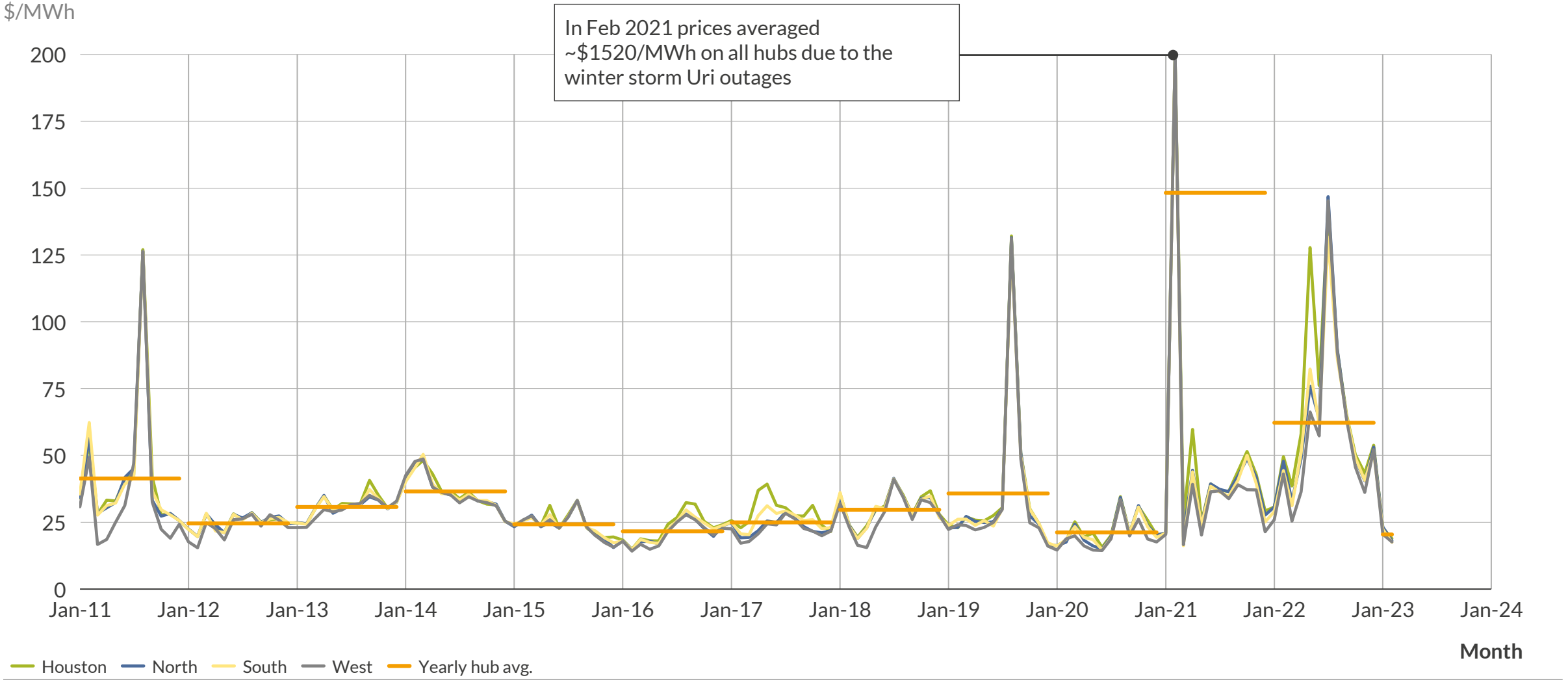
Monthly average Real-Time ATC price[1,2]

$/MWh



1) ATC = Around the clock wholesale price 2) Feb 2021 capped at $200/MWh

Sources: ERCOT, Aurora Energy Research

Monthly average Day-Ahead to Real-Time delta and average hourly delta for February 2023

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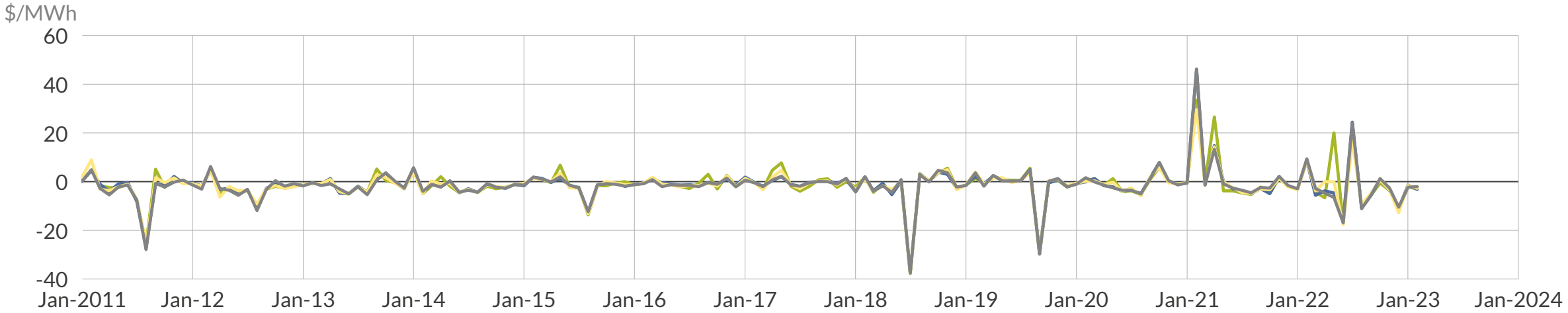
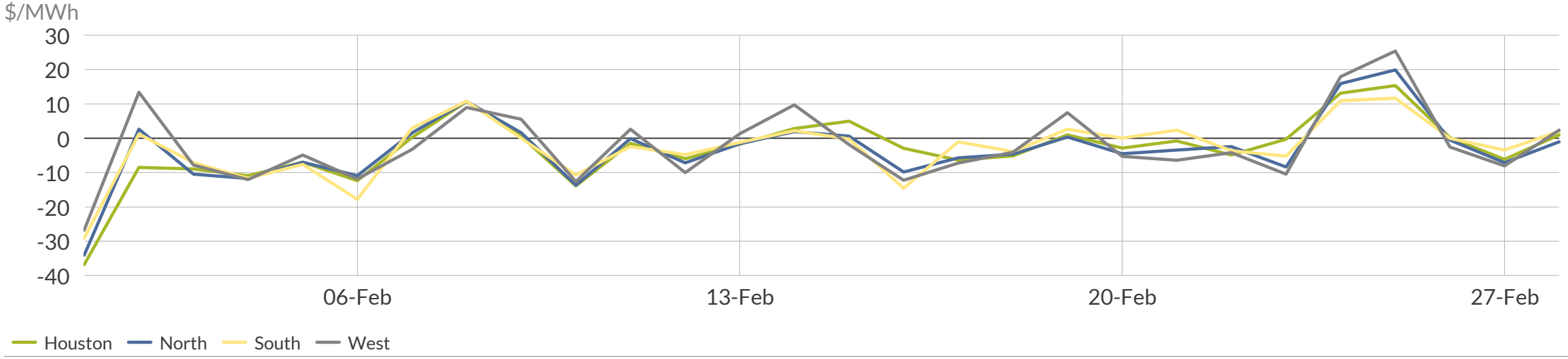
Monthly average delta from Day-Ahead to Real-Time ATC price[1]



Daily average delta from day ahead to Real-Time ATC price[1,2]



1) ATC = Around the clock wholesale price, 2) RTM price is averaged at the hourly level

Sources: ERCOT, Aurora Energy Research

Historical Real-Time price breakdown

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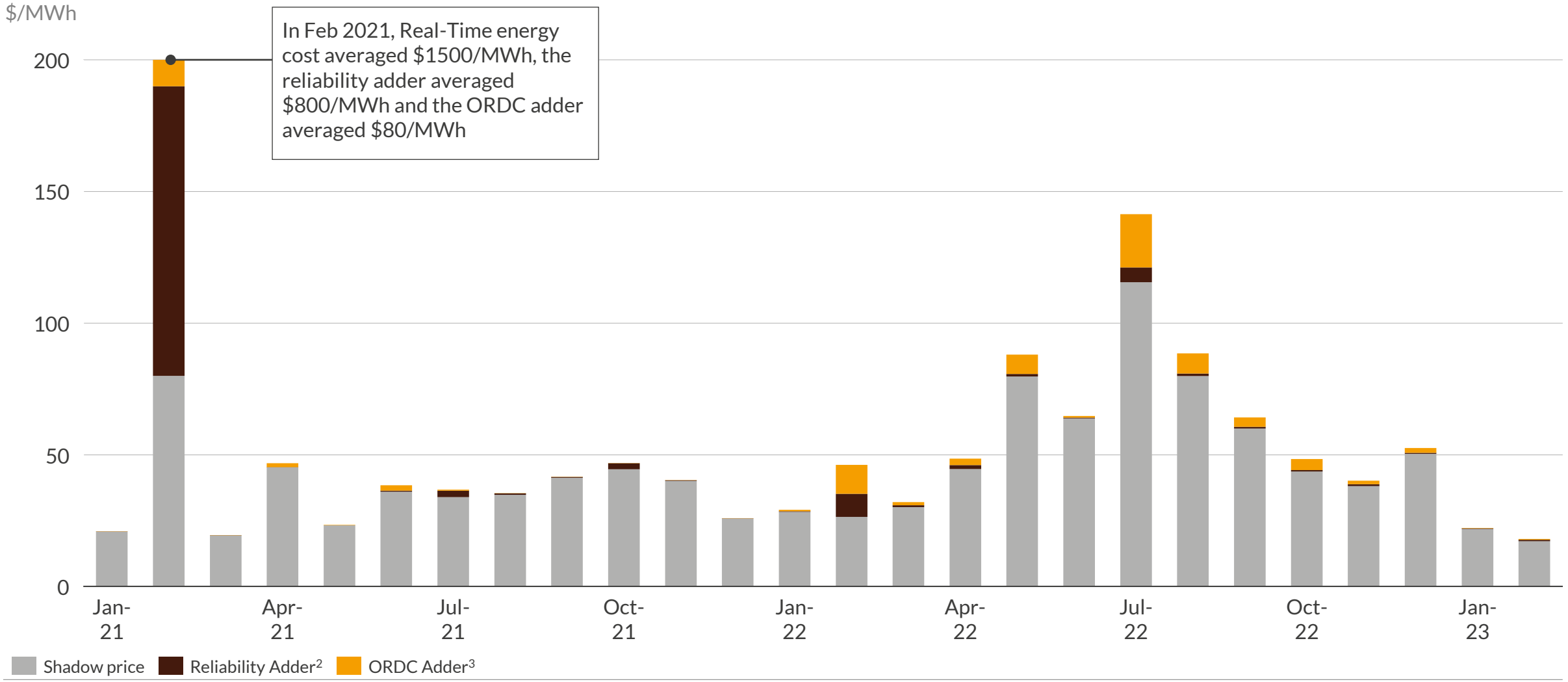
Average Real-Time price[1] breakdown by month



1) Hub average price 2) Marginal cost of generation in ERCOT (equivalent to the cost of providing an extra MWh of energy) 3) Operating Reserves Demand Curve, determines the value of scarcity (low reserves) in the ERCOT market 4) Reliability Adder offsets price depression from out-of-market reliability actions taken by ERCOT

Sources: ERCOT, Aurora Energy Research

Real-Time prices against system margins for February 2023

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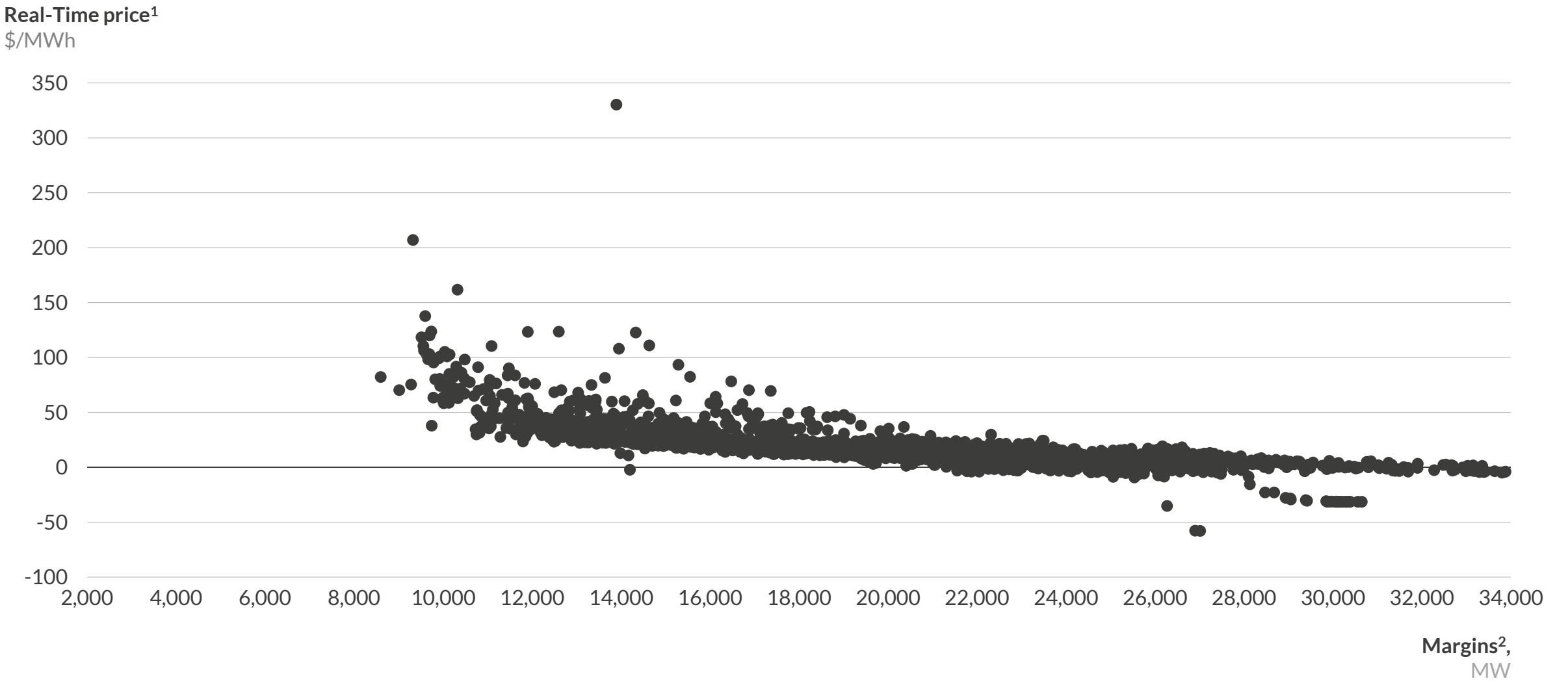

1) Hub average 2) Sum of online and offline reserve capacity

Sources: ERCOT, Aurora Energy Research

15 minutely value of ORDC Adder for February 2023

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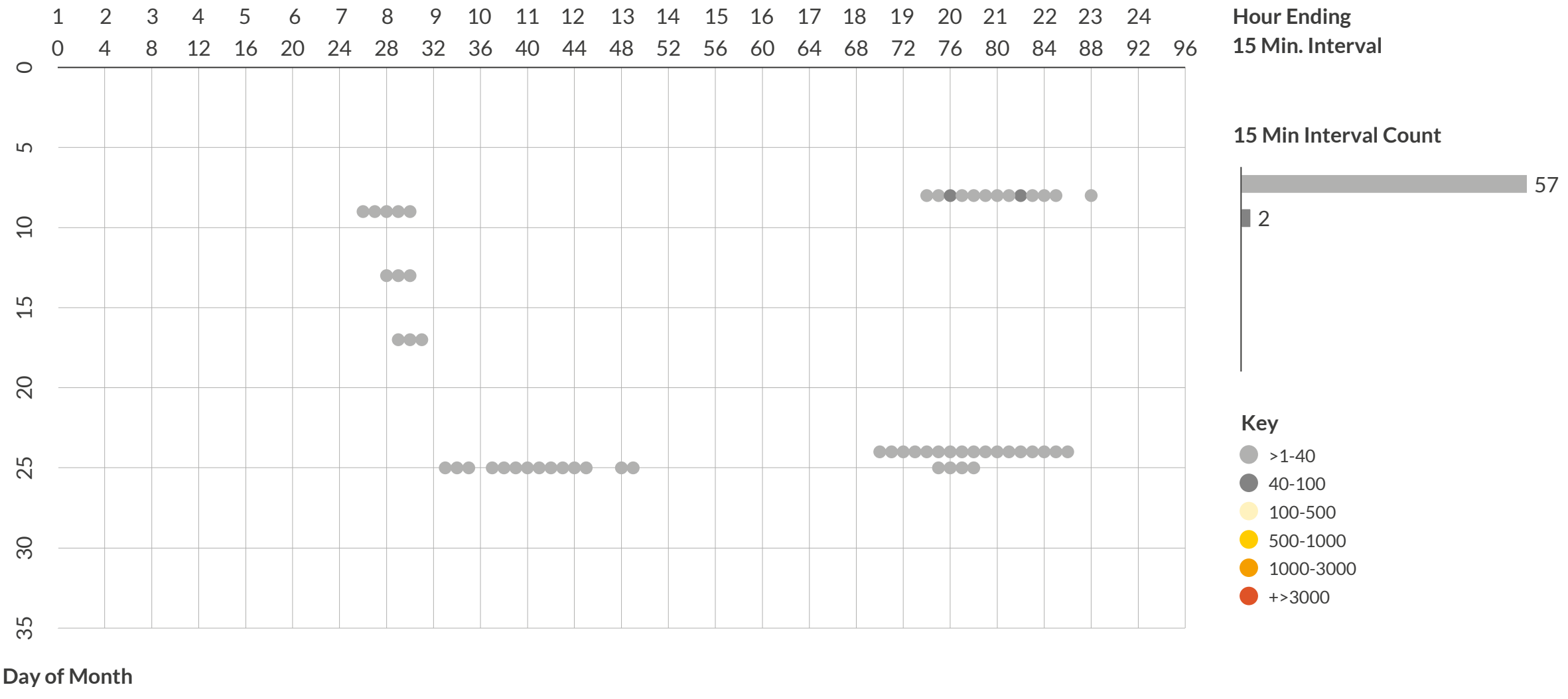

Sources: ERCOT, Aurora Energy Research

15 minutely value of Reliability Adder for February 2023

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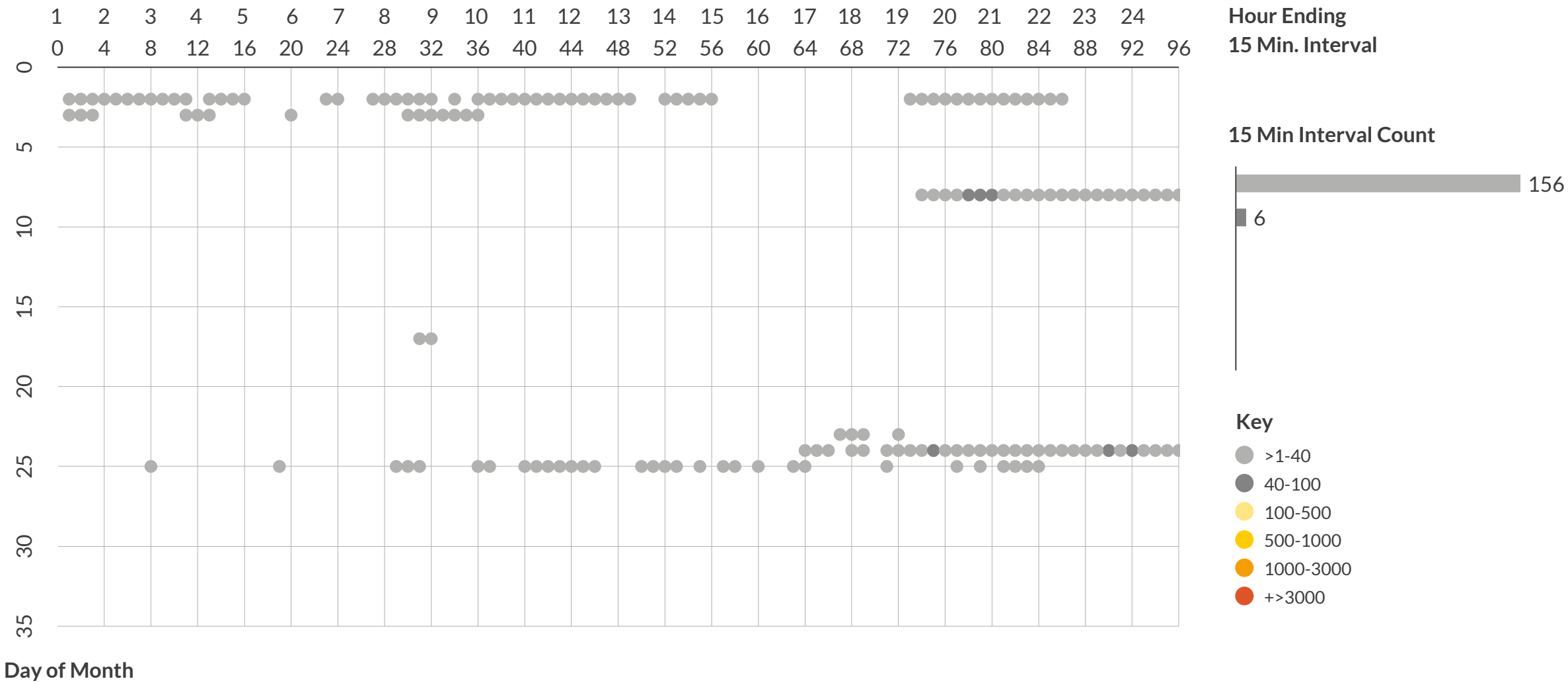

Sources: ERCOT, Aurora Energy Research

Historical natural gas prices for relevant trading hubs

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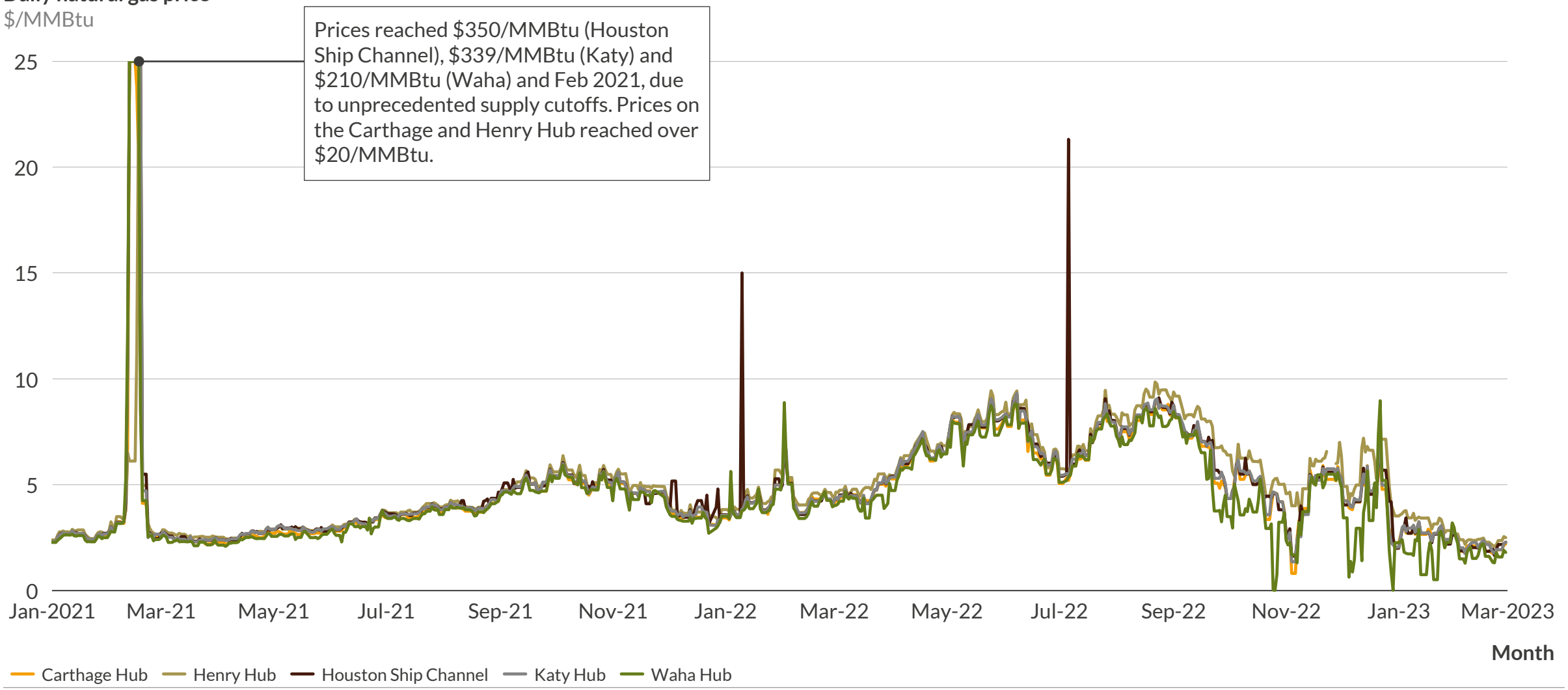
Daily natural gas price[1]

$/MMBtu



1) Feb 2021 values capped at $25/MMBtu for display purposes

Sources: Thomson Reuters, Aurora Energy Research

Daily February 2023 max and min load

Relative to historical daily min/max load for February [1]

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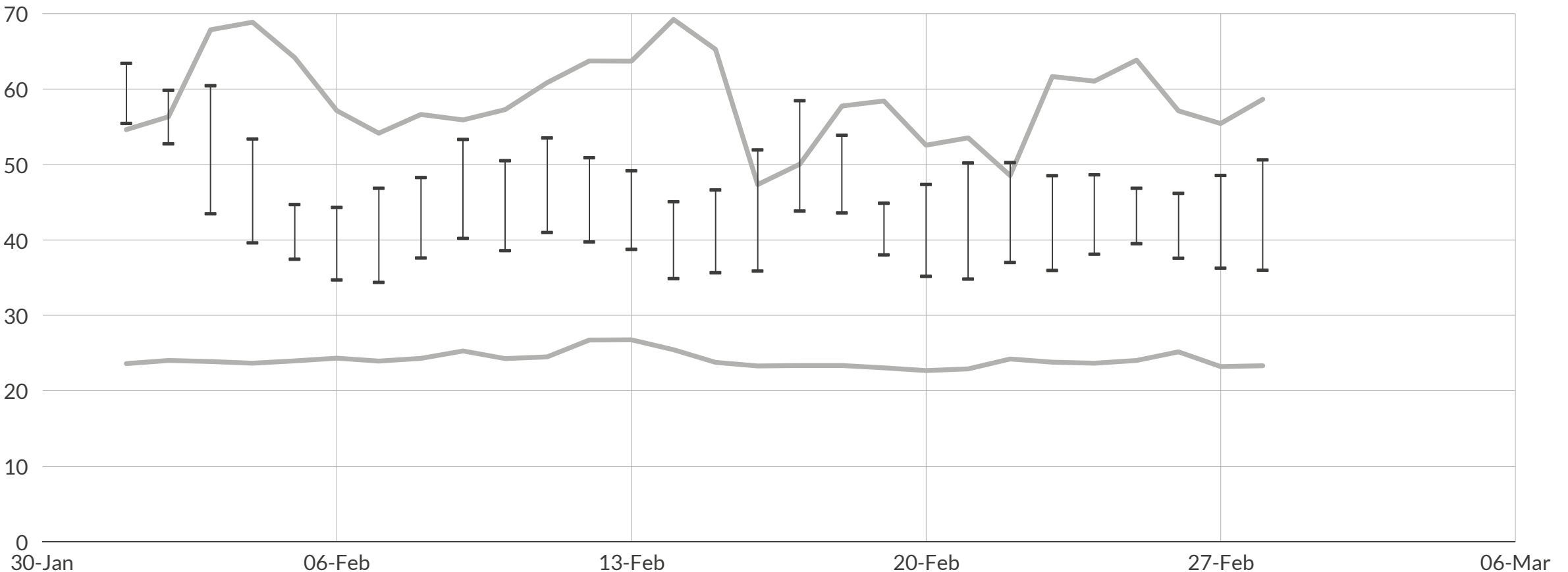
Total ERCOT load

GW



1) Including years since 2010

Sources: ERCOT, Aurora Energy Research

Monthly historical load on the transmission system

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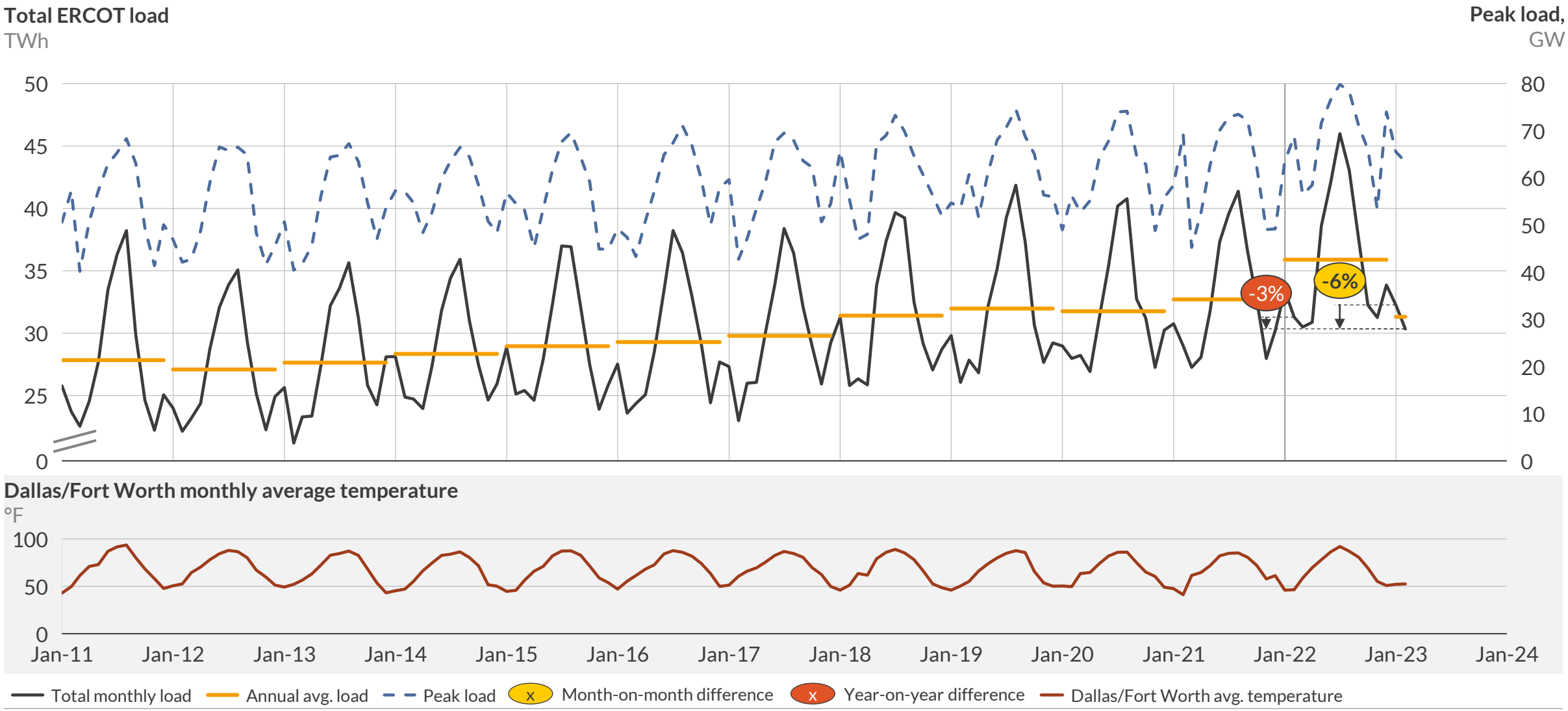

Sources: ERCOT, Aurora Energy Research, NOAA

Monthly flow duration curve and total monthly imports/exports for ERCOT DC Ties

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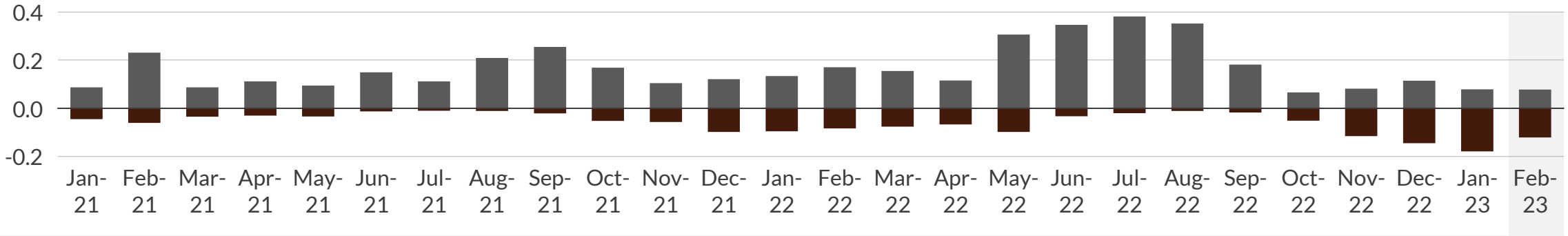
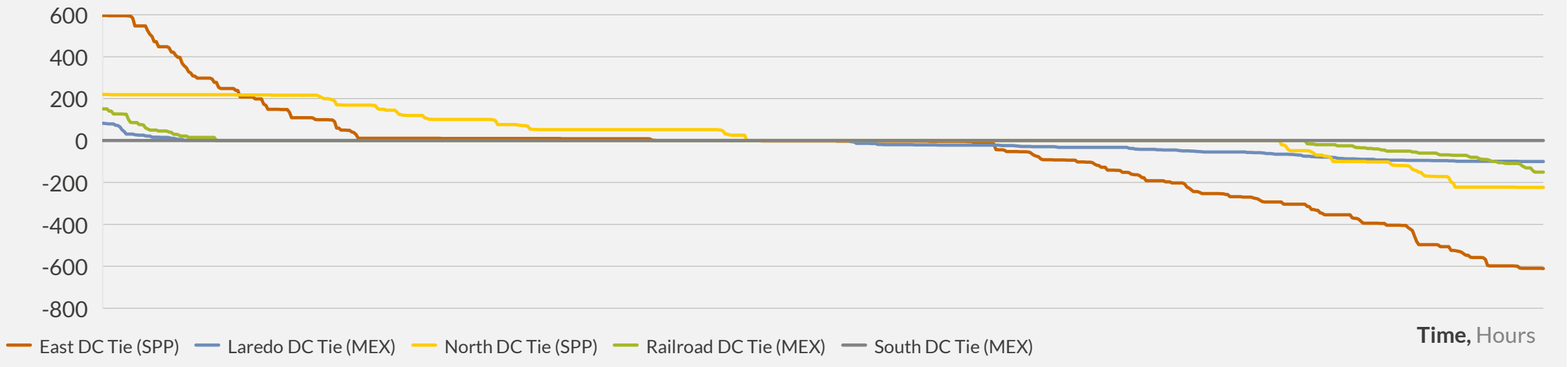
Total monthly imports and exports

TWh



Hourly flow by interconnector for February 2023[1]

MW



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

Sources: ERCOT, Aurora Energy Research

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February 2023 generation breakdown by fuel

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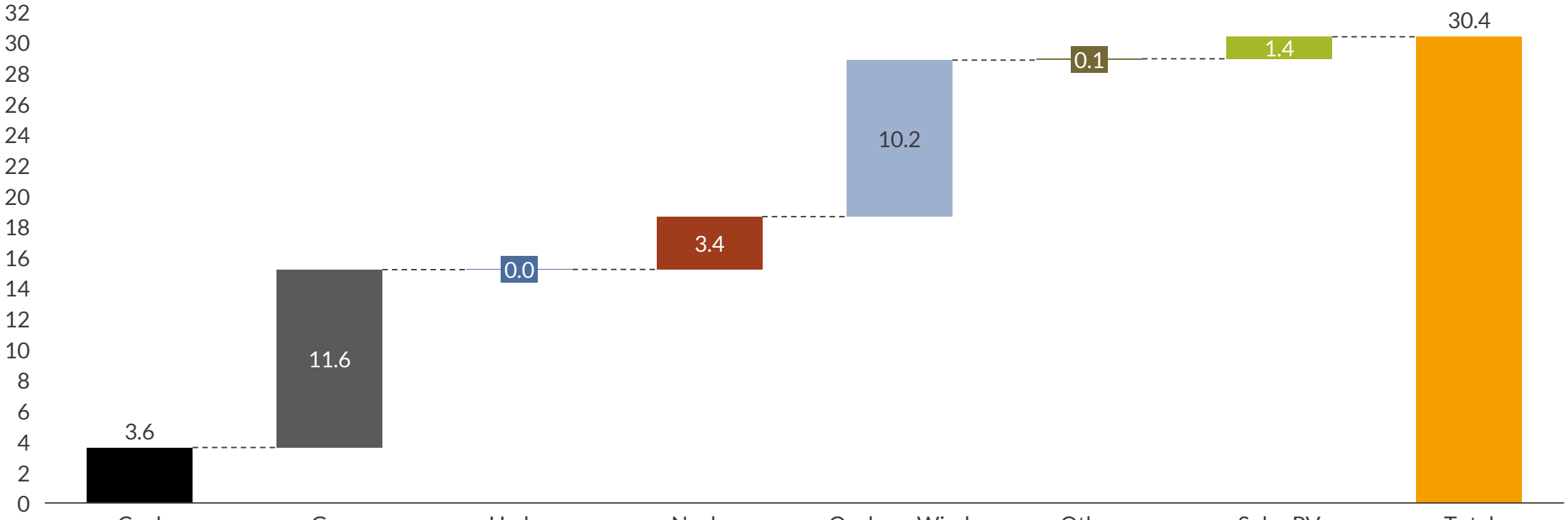
Output
TWh



Capacity factor[1,2],
%

Coal	Gas	Hydro	Nuclear	Onshore Wind	Other	Solar PV
40	28	4	99	43	11	18

1) Preliminary based on ERCOT daily balancing authority report 2) Includes PUN and synchronised capacity

Sources: ERCOT, Aurora Energy Research

Historical ERCOT generation breakdown

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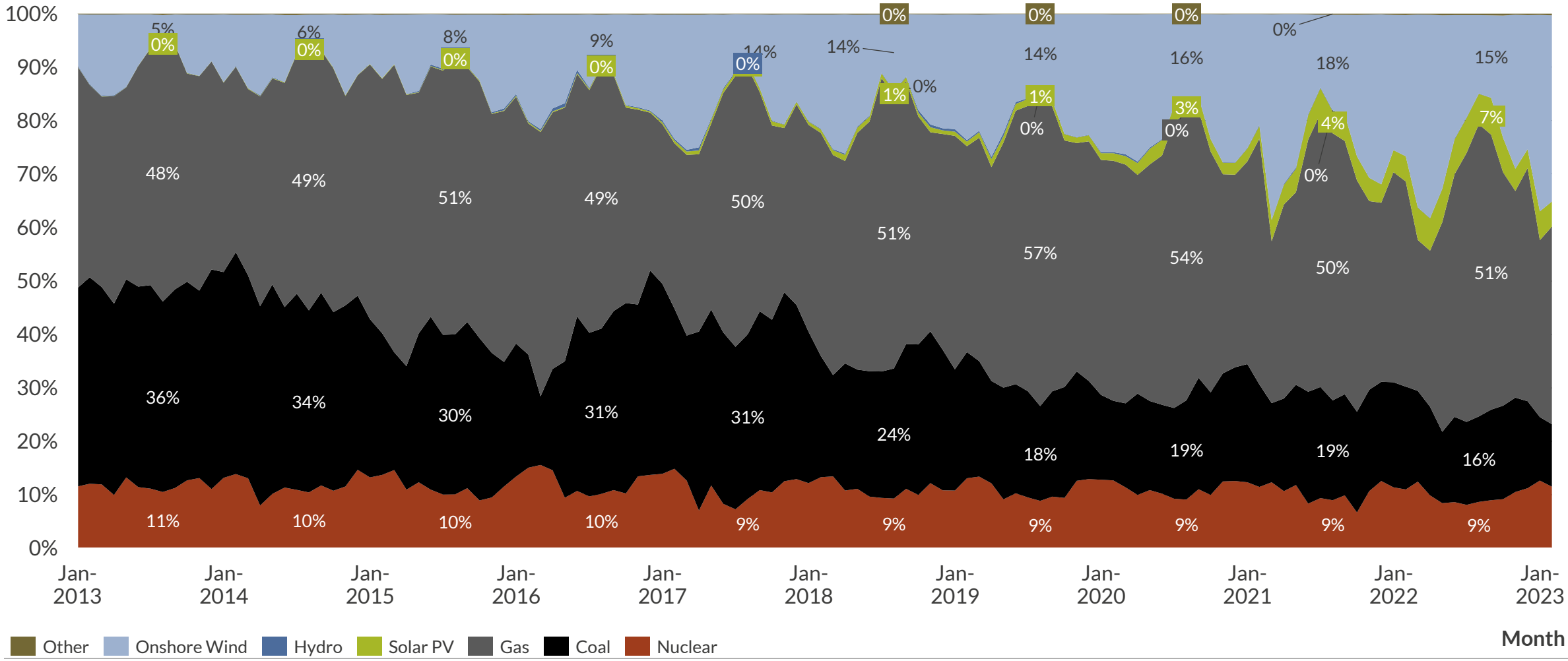
ERCOT wide generation by technology[1]

% of total



1) Based on daily balancing authority report for the last two months, SCED disclosure data for all prior months

Sources: ERCOT, Aurora Energy Research

Thermal output against system margins for February 2023

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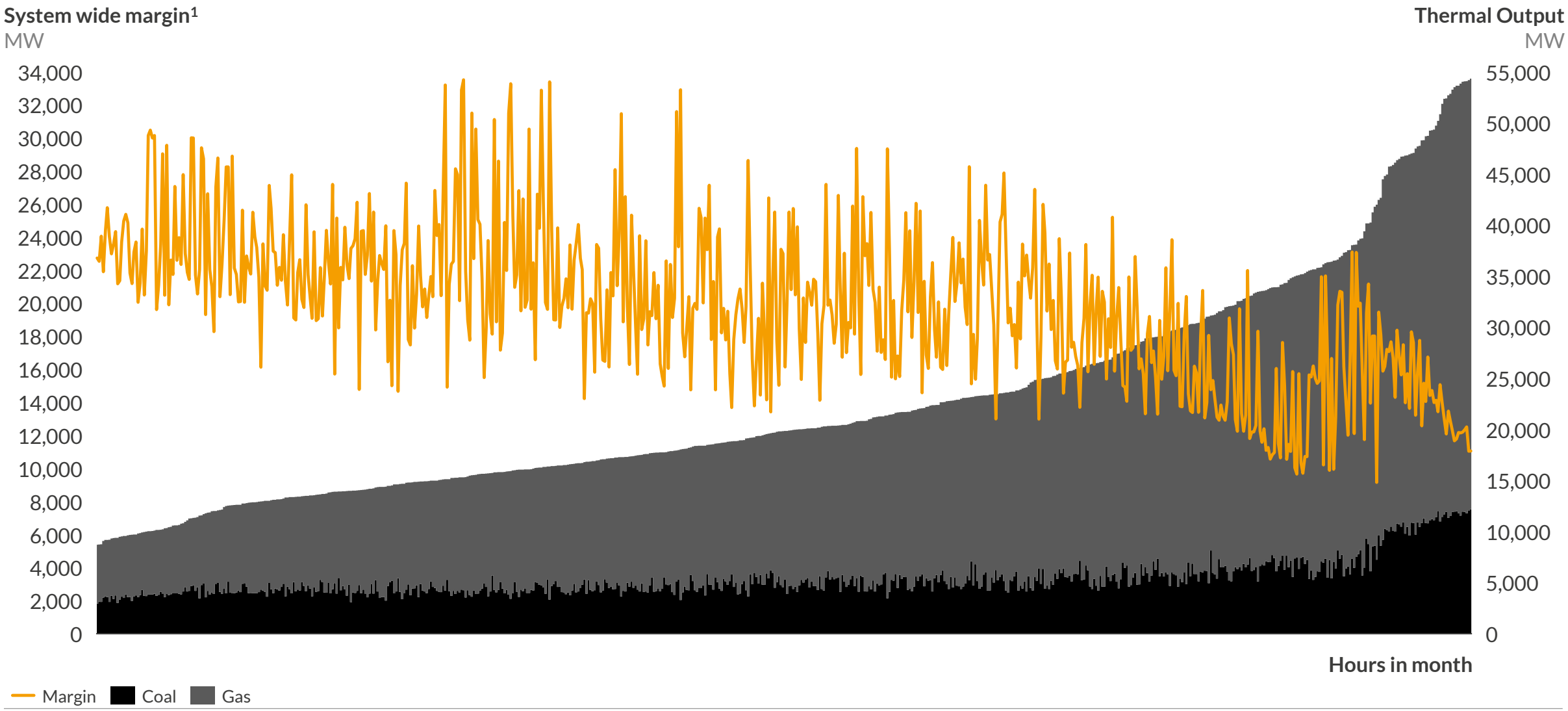

1) Sum of online + offline reserve capacity

Sources: ERCOT, Aurora Energy Research

Monthly capacity factors for renewable technologies

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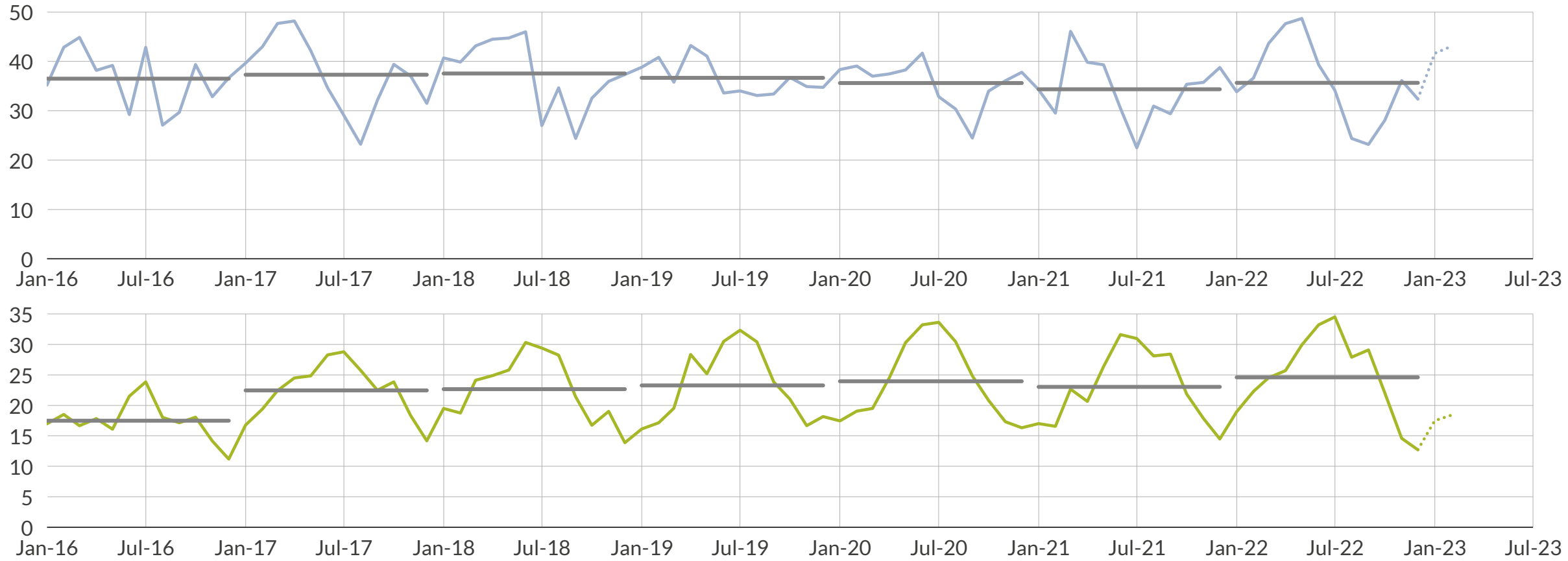
Average capacity factor[1,2]

%



1) Capacity includes synchronised units 2) Preliminary results from Daily Balancing Authority Report

Sources: ERCOT, Aurora Energy Research

Monthly generation weighted average prices for renewable technologies

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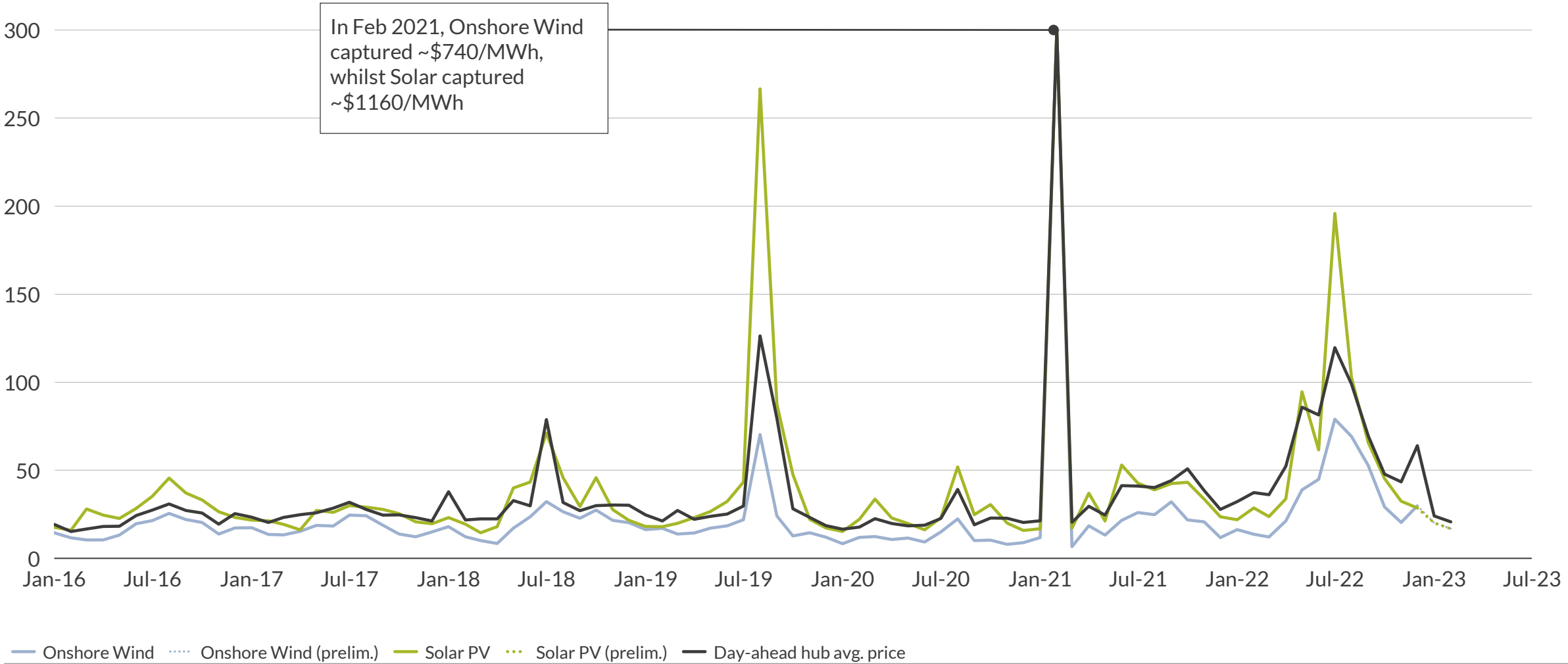
Average GWA price[1,2,3]
$/MWh



1) Based on hub average prices for past two months, based on regional hub prices for all other months 2) Preliminary results from Daily Balancing Authority Report and hub average prices 3) Feb 2021 prices capped at $300/MWh

Sources: Aurora Energy Research, ERCOT

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Historical average Ancillary Service prices

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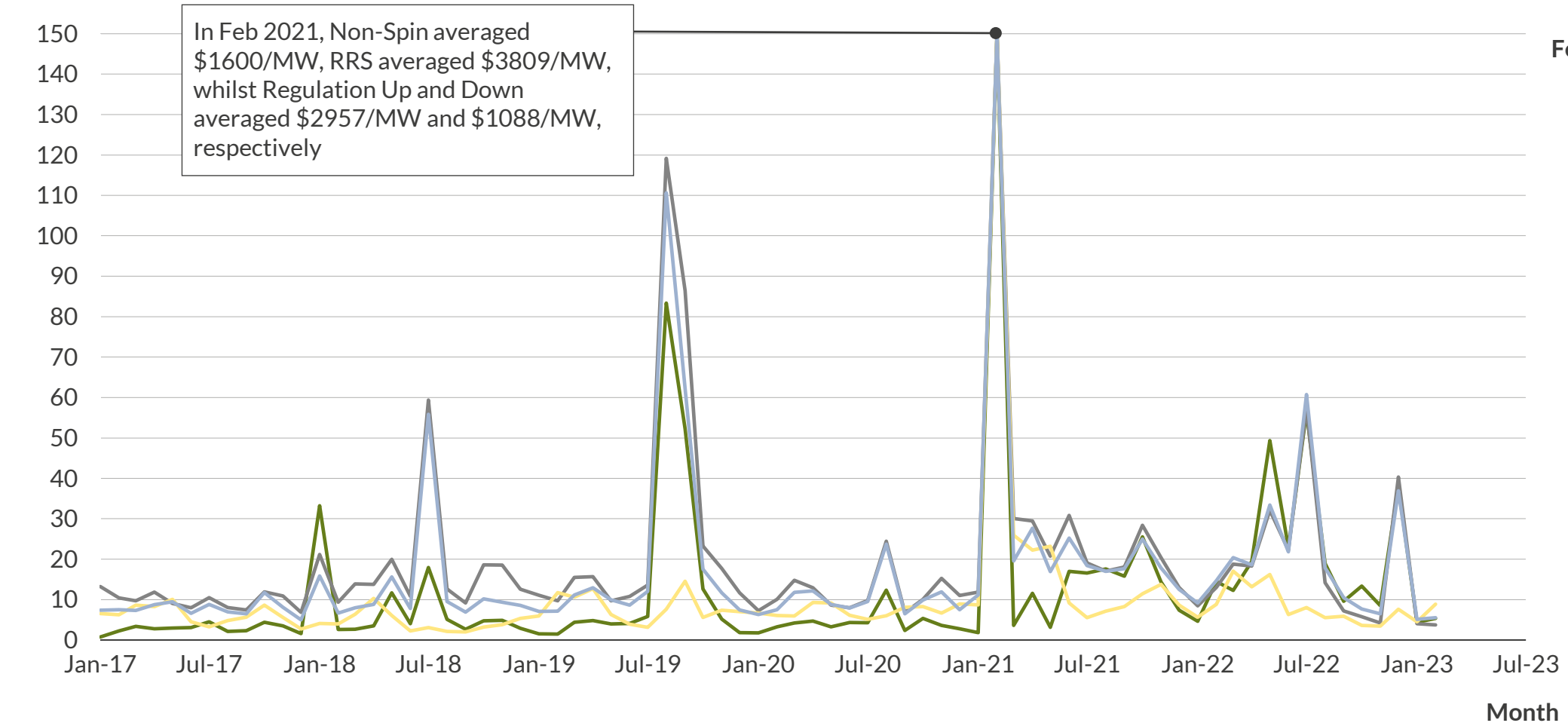
Market Clearing Price for Capacity (MCPC)

$/MW



February 2023 average price by service

$/MW

Non-Spin
5.3

RRS
3.7

Regulation Up
5.5

Regulation Down
8.9

1) Feb 2021 prices capped at $300/MWh

Sources: Aurora Energy Research, ERCOT

Historical Ancillary Service awards by service[1]

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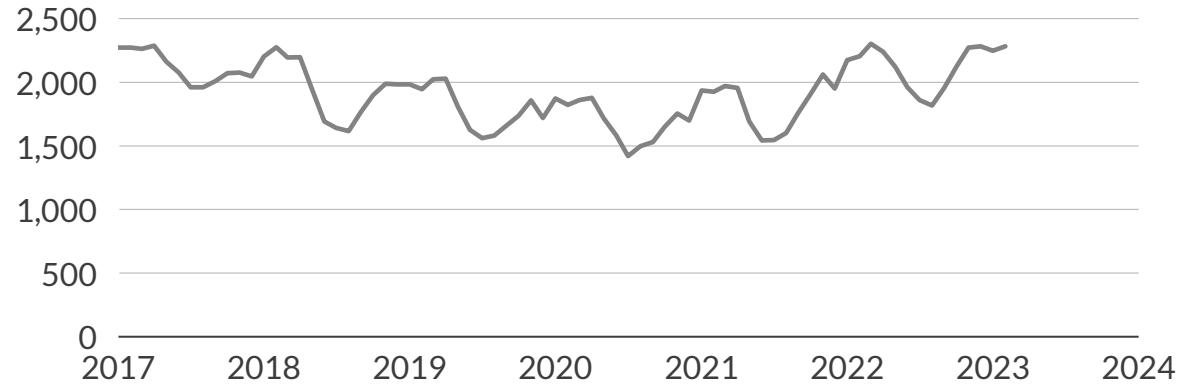
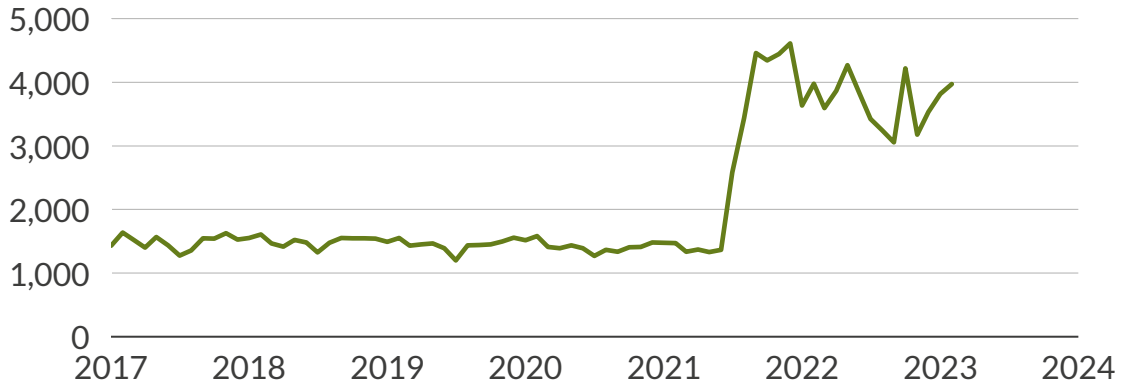
Average volume awarded for RRS

MW/hour



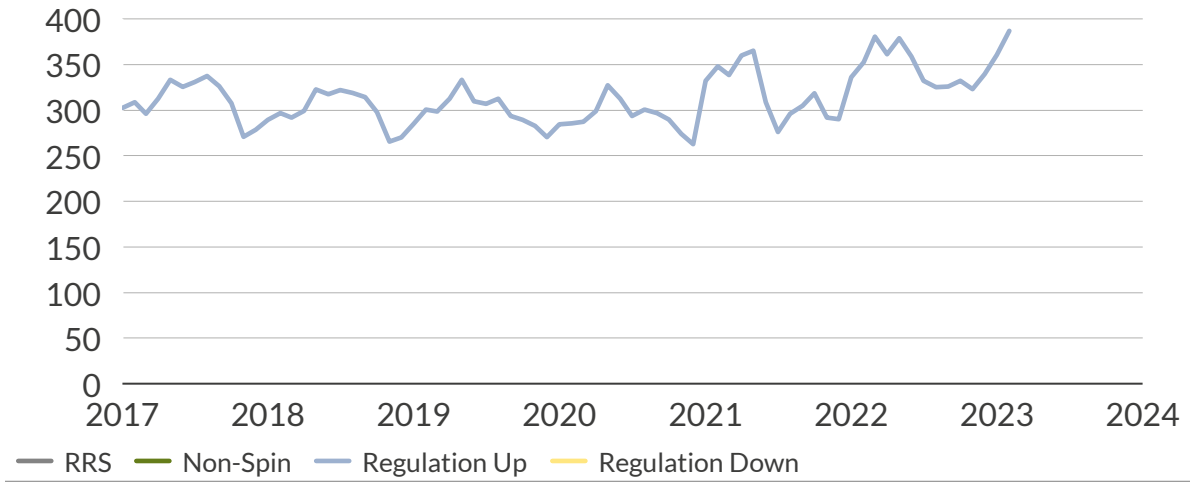
Average volume awarded for Non-Spin

MW/hour



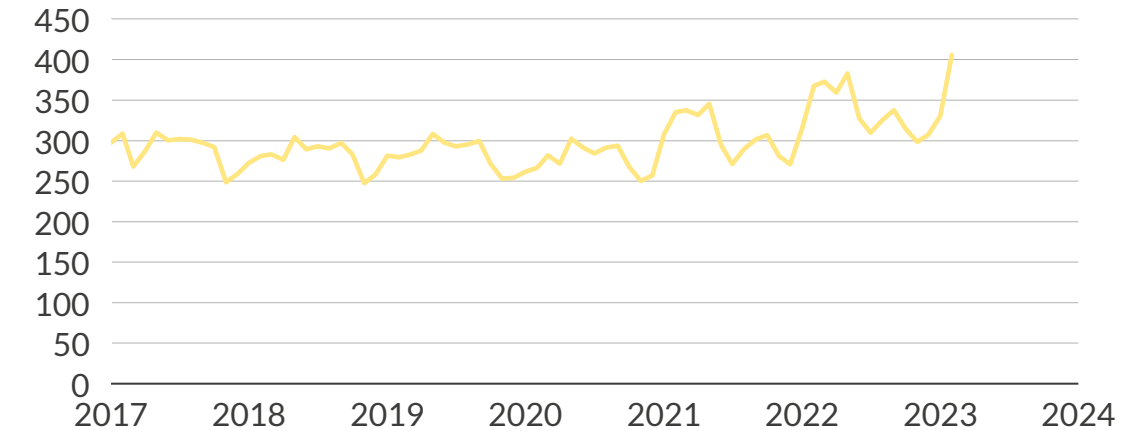
Average volume awarded for Regulation Up

MW/hour



Average volume awarded for Regulation Down

MW/hour



1) Data for previous two months from ERCOT 2-day ancillary disclosure. Data for all other months from 60-day disclosure reports

Sources: Aurora Energy Research, ERCOT

Historical RRS awards by technology to December 2022

Does not include the previous two months[1]

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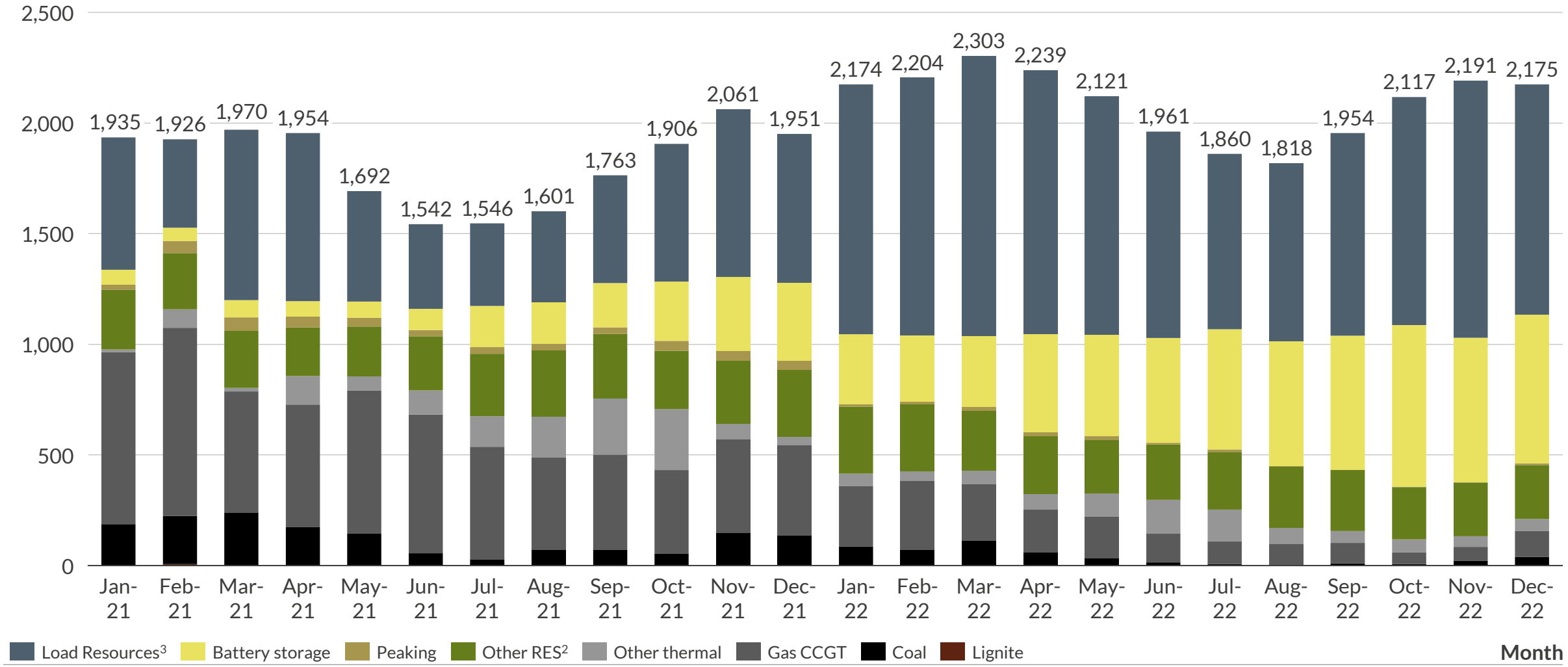
Average RRS volume awarded

MW/hour



1) Due to confidentiality of ERCOT plant level disclosure data 2) Includes Hydro 3) Includes some battery resource on the load side

Sources: Aurora Energy Research, ERCOT 60-day DAM Disclosure report

Historical Non-Spin awards by technology to December 2022

Does not include the previous two months[1]

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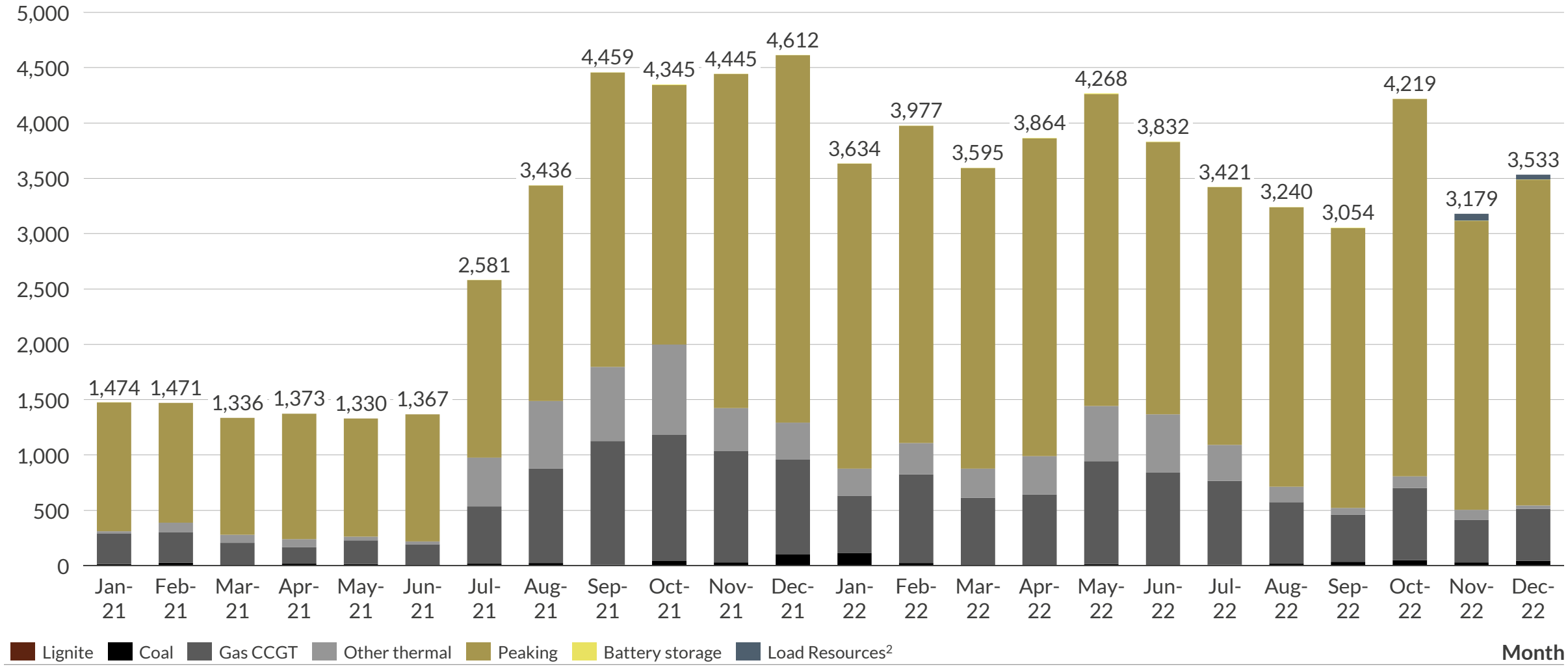
Average Non-Spin volume awarded

MW/hour



1) Due to confidentiality of ERCOT plant level disclosure data. 2) Includes some battery resource on the load side.

Sources: Aurora Energy Research, ERCOT 60-day DAM Disclosure report

Historical Regulation Up awards by technology to December 2022

Does not include the previous two months[1]

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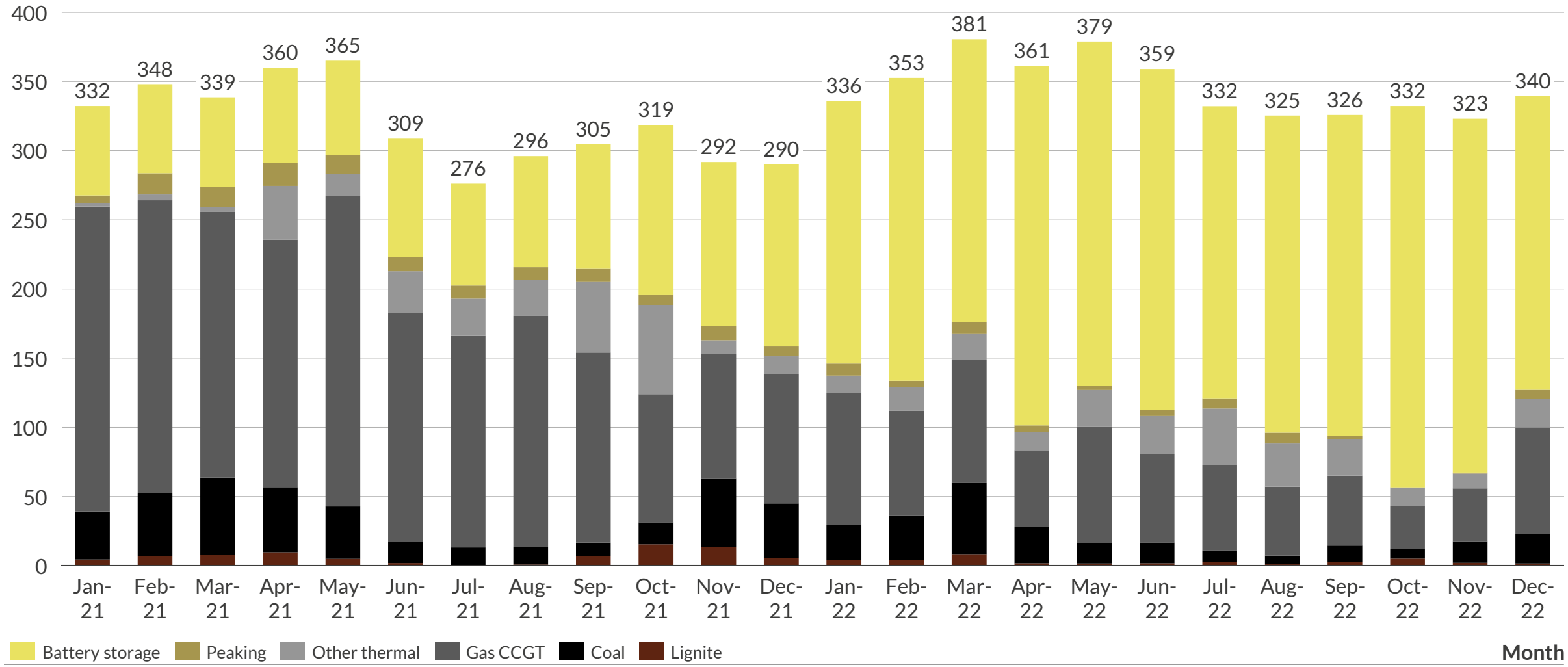
Average Regulation Up volume awarded

MW/hour



1) Due to confidentiality of ERCOT plant level disclosure data

Sources: Aurora Energy Research, ERCOT 60-day DAM Disclosure report

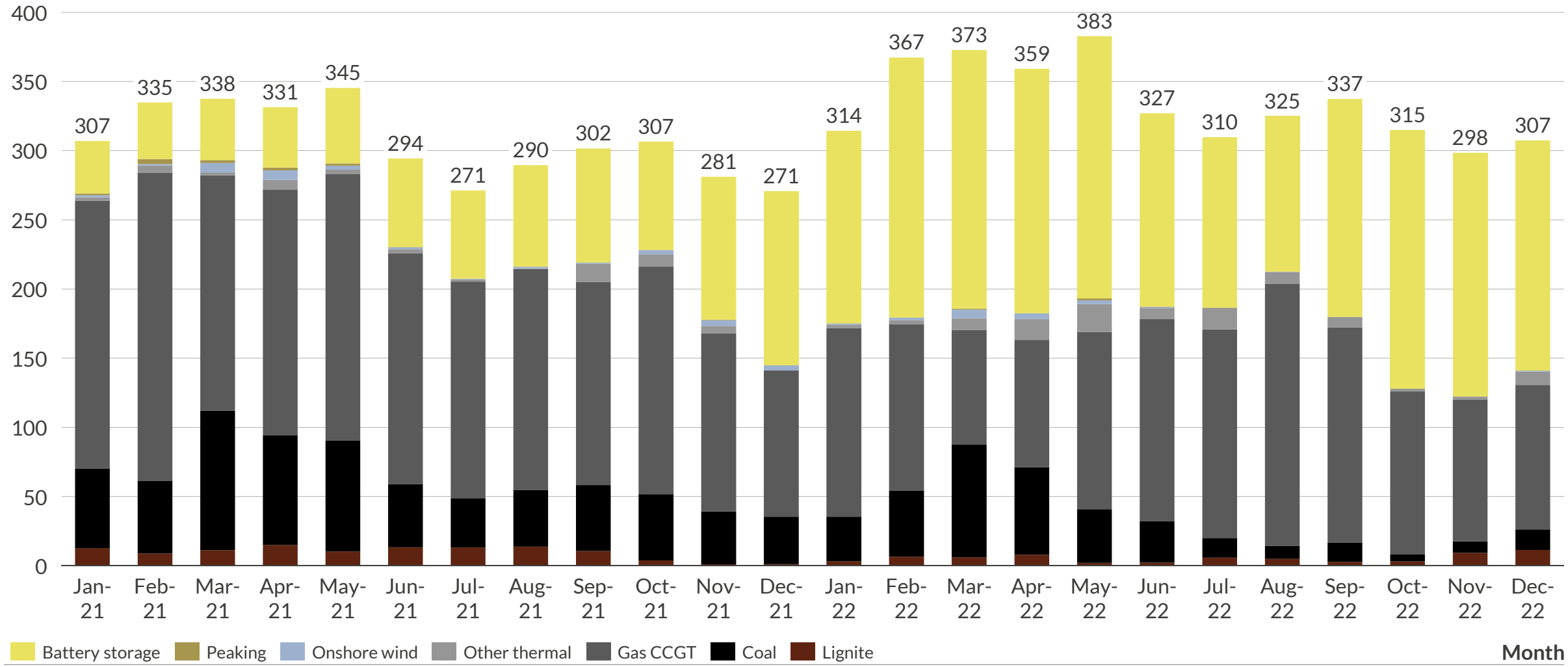
Historical Regulation Down awards by technology to December 2022

Does not include the previous two months[1]

AURORA

Average Regulation Down volume awarded

MW/hour



1) Due to confidentiality of ERCOT plant level disclosure data

Sources: Aurora Energy Research, ERCOT 60-day DAM Disclosure report

Agenda

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Distribution of Real-Time nodal basis risk

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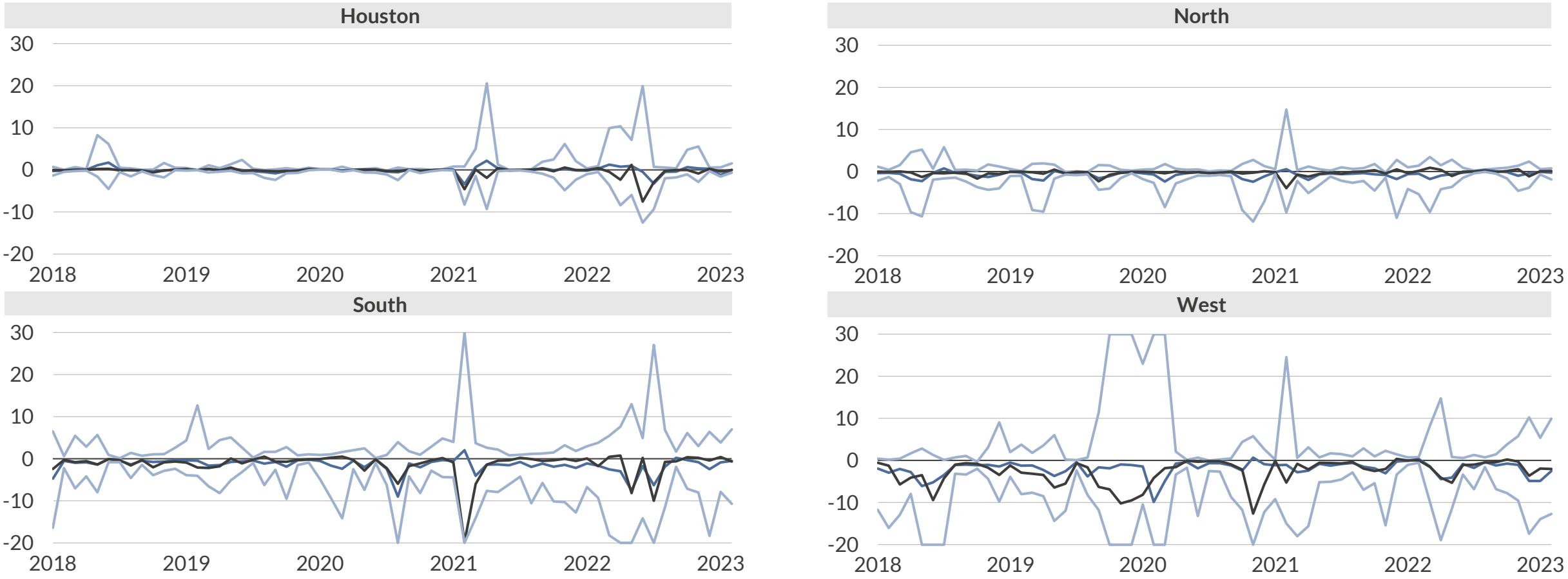
Average nodal basis risk [1] across nodes by hub

$/MWh [4]



1) The nodal basis risk takes the difference between the nodal SPP and its relevant hub price. 2) Top 95th percentile of nodes for the average daily price spread in the given month. 3) Bottom 5th percentile of nodes for the average daily price spread in the given month. 4) Scale floored at -$20/MWh and capped at $30/MWh.

Sources: ERCOT, Aurora Energy Research

Distribution of Real-Time nodal daily price spreads

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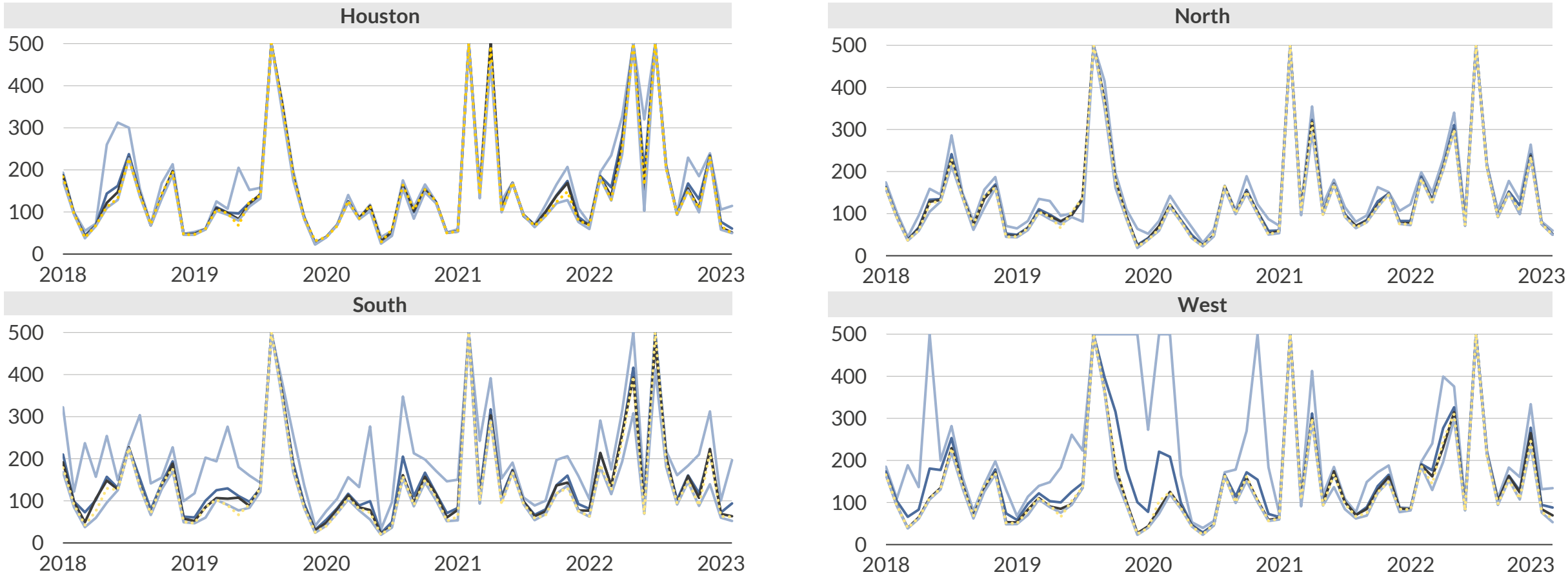
Average daily price spread[1] across nodes by hub

$/MWh [4]



1) The daily price spread takes the average of the four highest settlement prices within a day and minuses the average of the four lowest settlement prices in that day. 2) Top 95th percentile of nodes for the average daily price spread in the given month. 3) Bottom 5th percentile of nodes for the average daily price spread in the given month. 4) Values capped at $500/MWh.

Sources: ERCOT, Aurora Energy Research

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