

2024

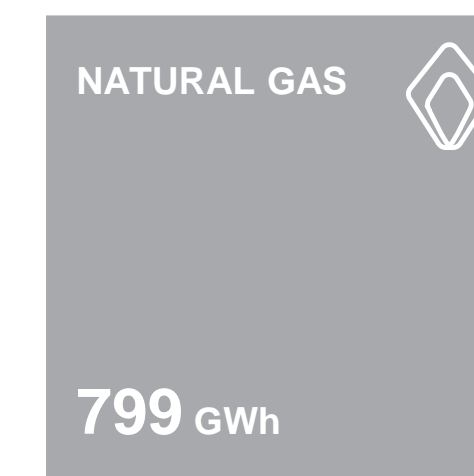
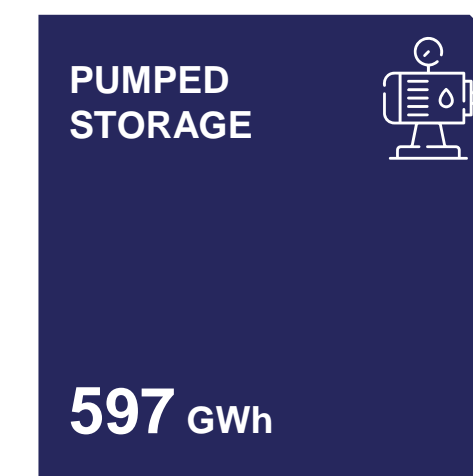
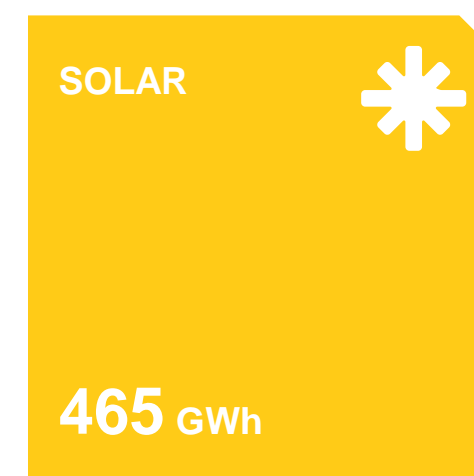
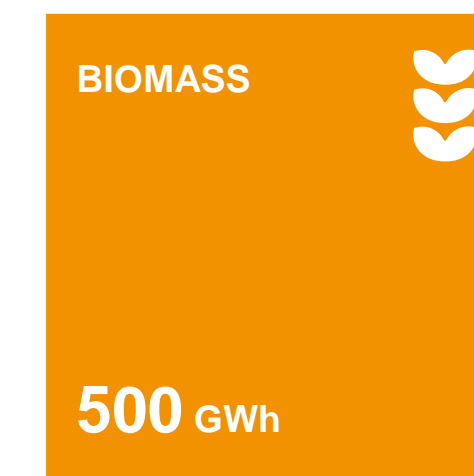
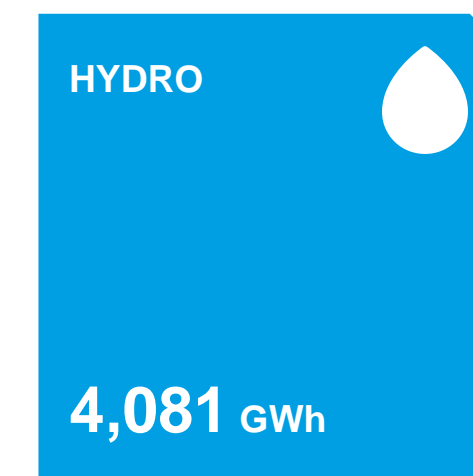
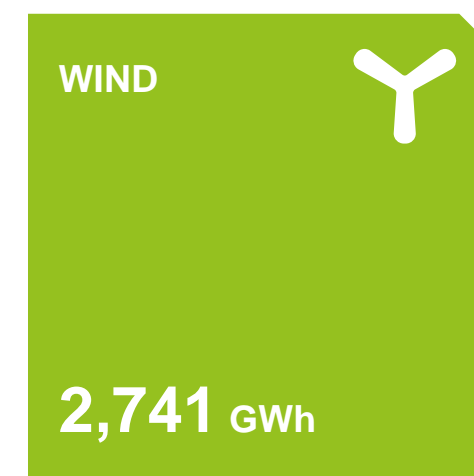
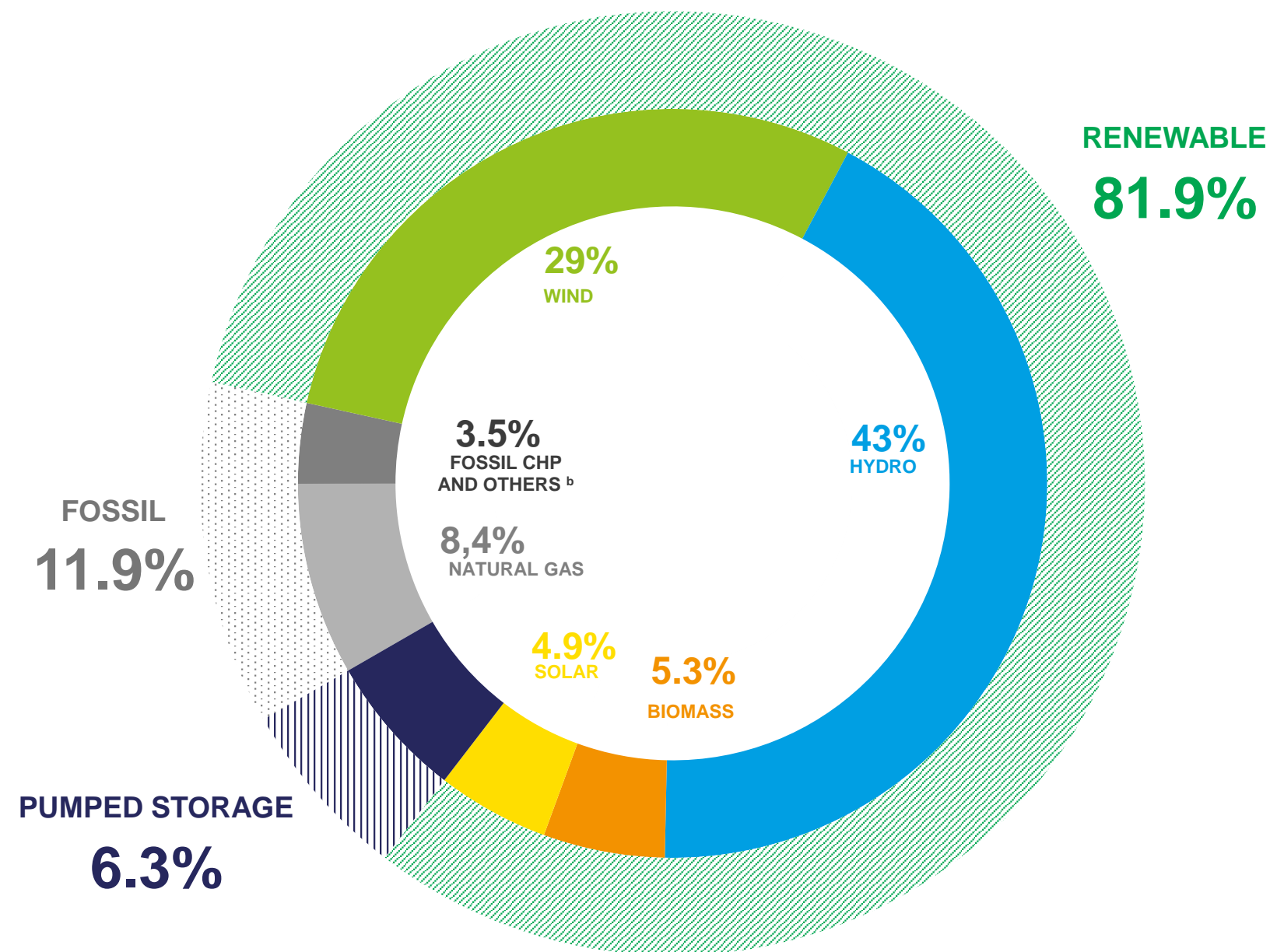
**RENEWABLE
ELECTRICITY
BULLETIN
FEBRUARY
2024**

**PORTUGAL NEEDS
OUR ENERGY**



EXECUTIVE SUMMARY

GENERATION (FEB)



MAIN INDICATORS (JAN-FEB)

GWh
9,512
Generation^a

€/ MWh
57.5
MIBEL PT Price

€/ tCO₂
60.4
CO₂ Price

MtCO₂ - eq
0.4
CO₂ Emissions

GWh
345
Import Balance

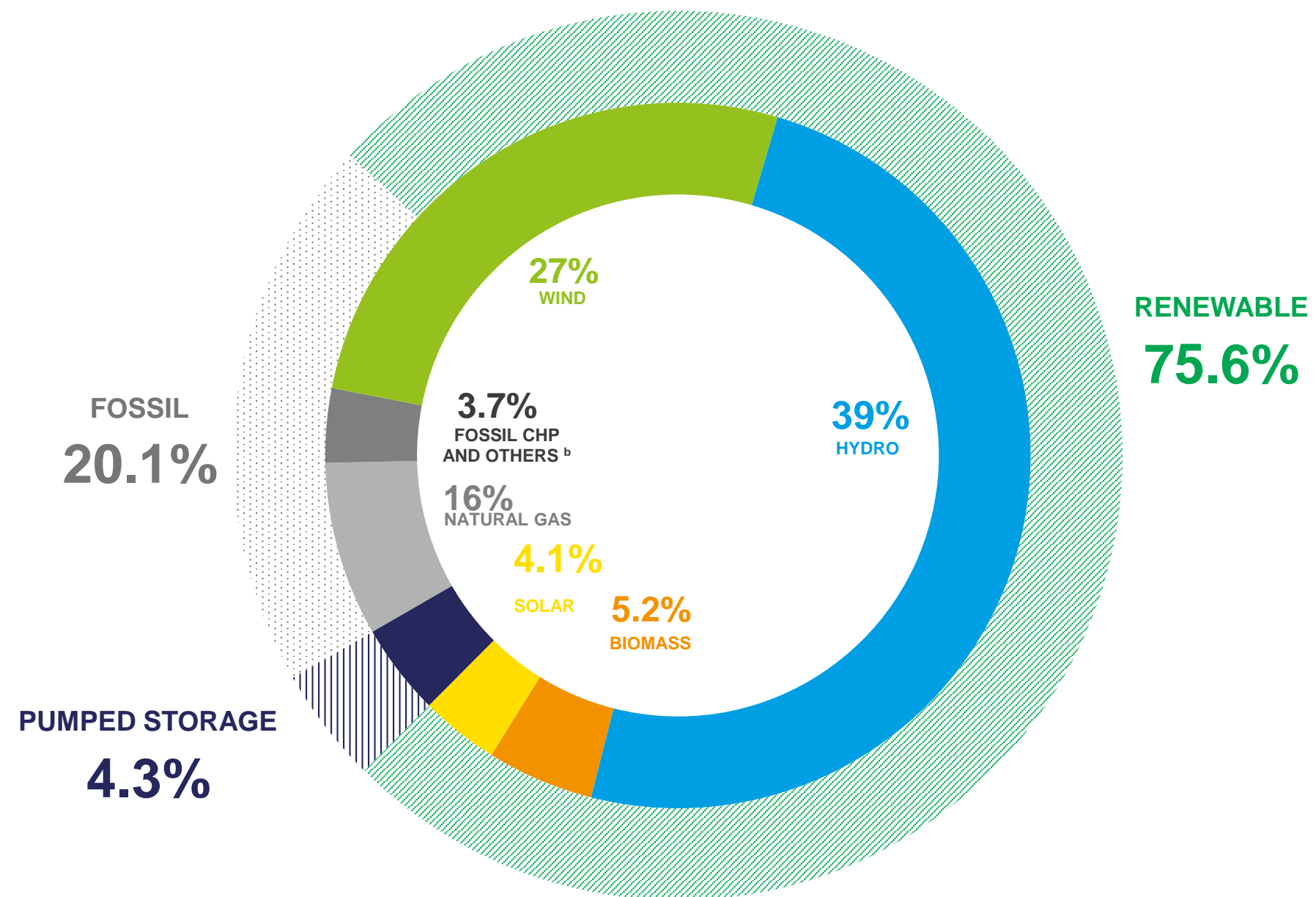
gCO₂ eq/kWh
42.5
CO₂ Specific Emissions

^a Generation refers to the net energy generation of the power stations, taking into account the pumping production recently disclosed by REN. Production from pumping is not included in the percentage of production from renewable sources.
Source: REN, APREN Analysis

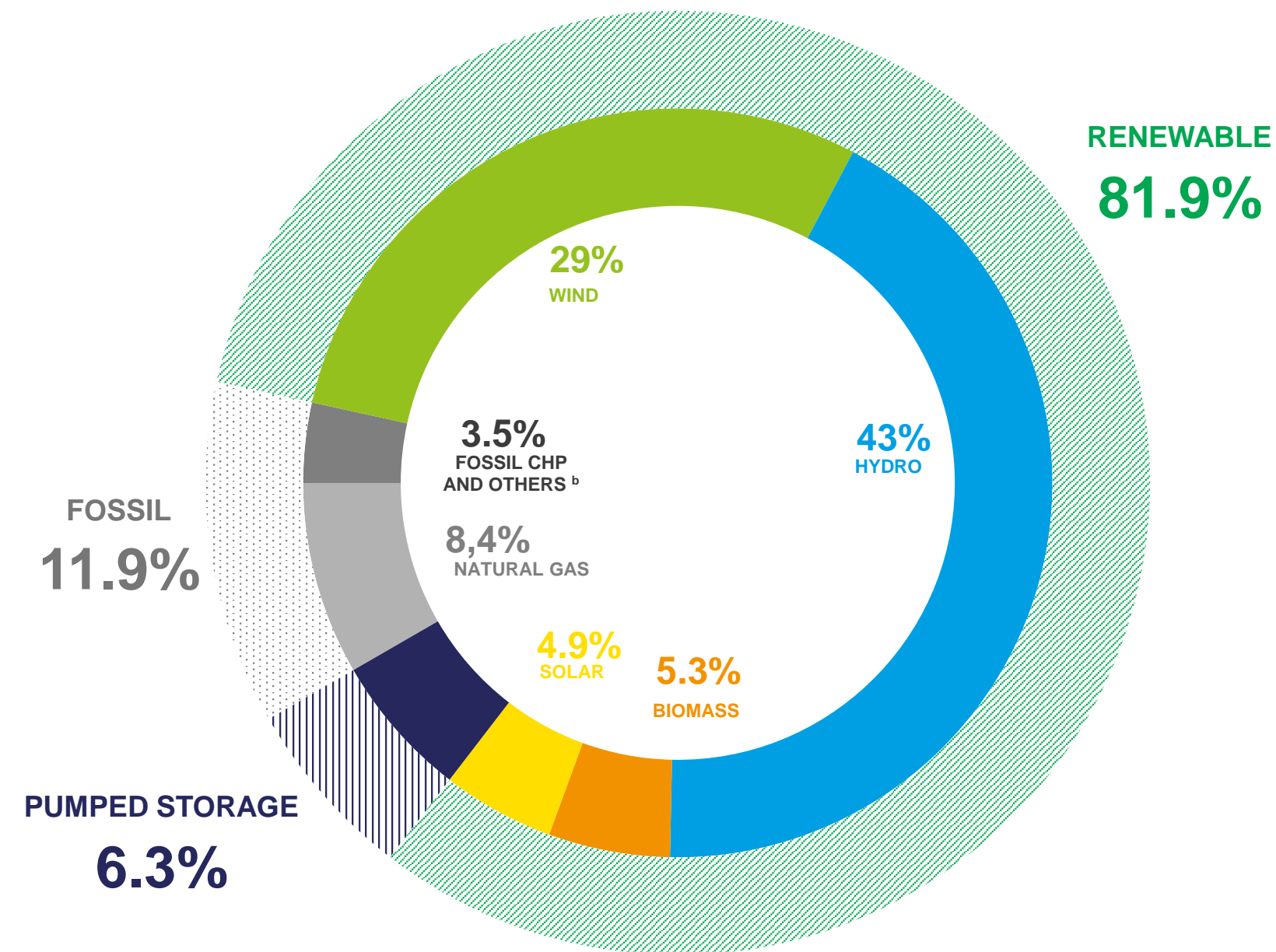
^b Includes fuel oil, diesel, the non-biodegradable fraction of MSW and new waste

EXECUTIVE SUMMARY

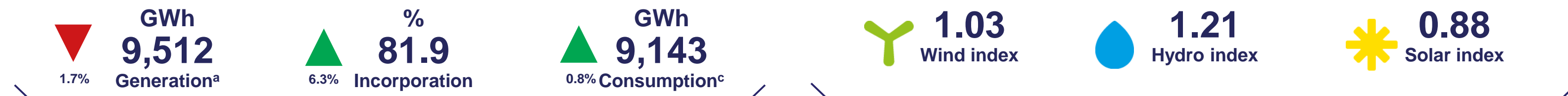
FEBRUARY'S GENERATION 2023



FEBRUARY'S GENERATION 2024



MAIN INDICATORS COMPARED WITH FEBRUARY 2023



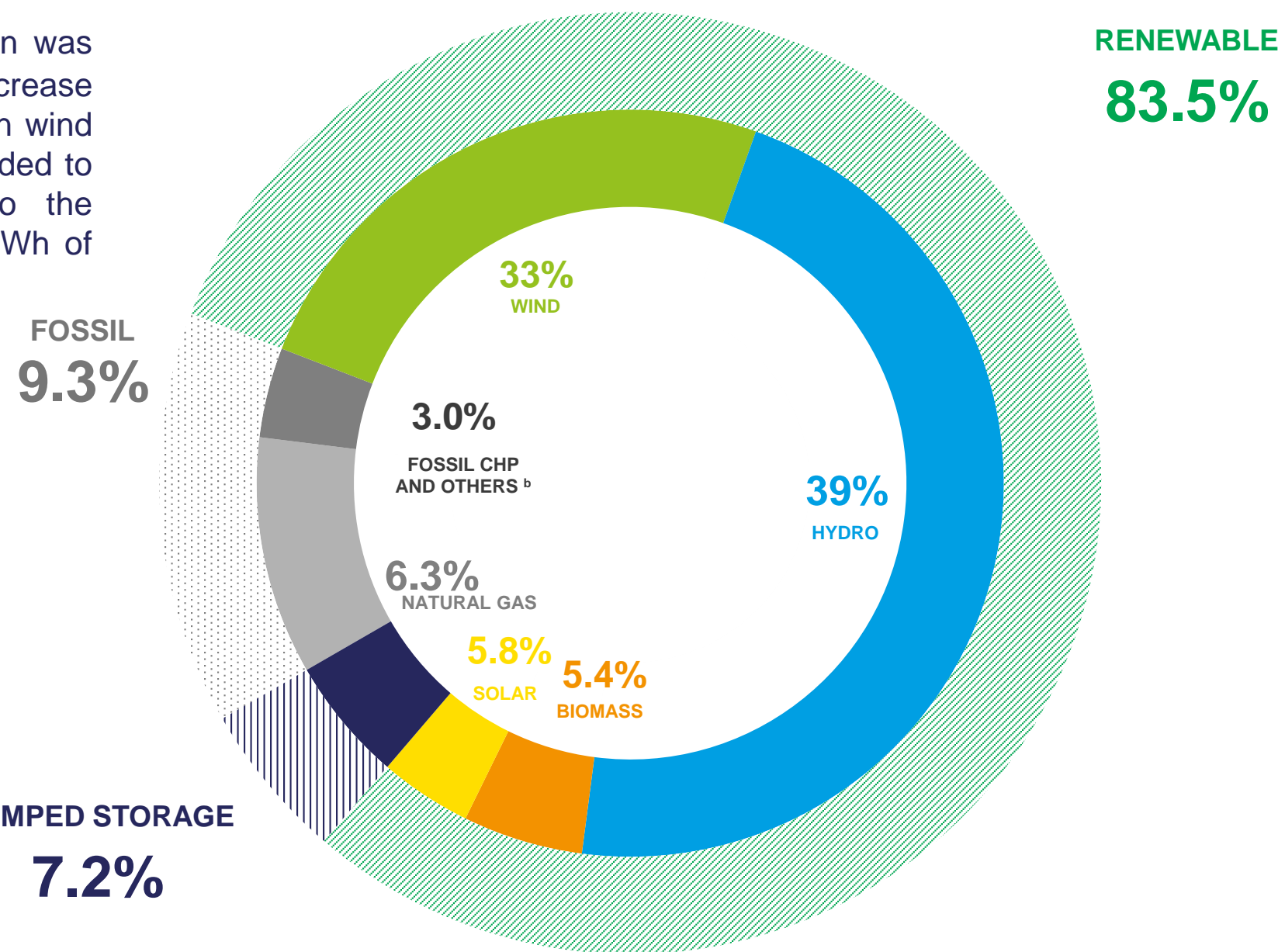
^a Generation refers to the net energy generation of the power stations, taking into account the pumping production recently disclosed by REN. Production from pumping is not included in the percentage of production from renewable sources.
Source: REN, APREN Analysis

^b Includes fuel oil, diesel, the non-biodegradable fraction of MSW and new waste

^c Consumption refers to the net generation of energy by power stations, taking into account the import-export balance.
Source: REN, APREN Analysis

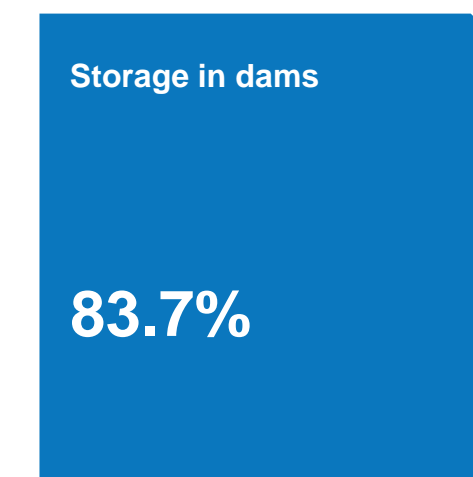
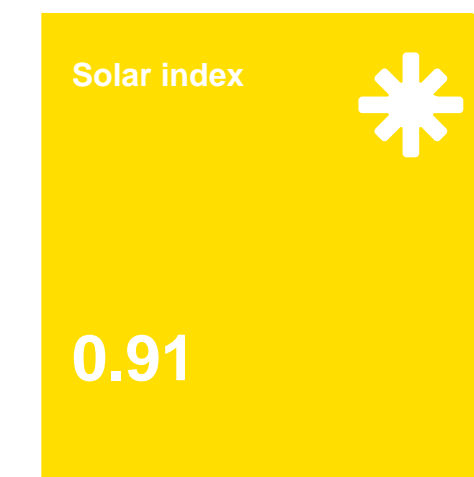
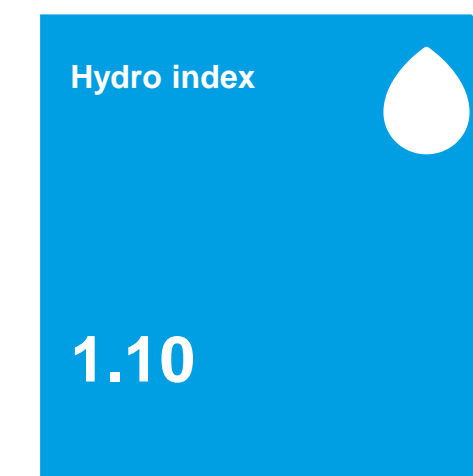
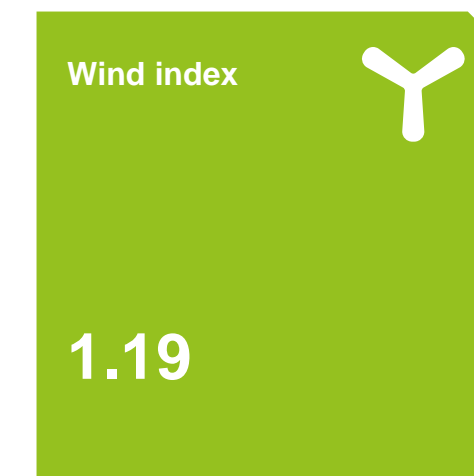
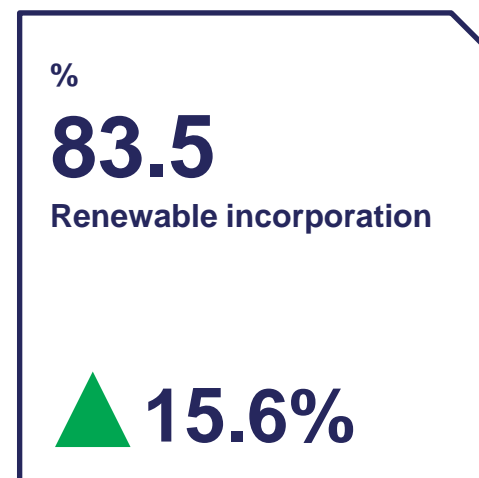
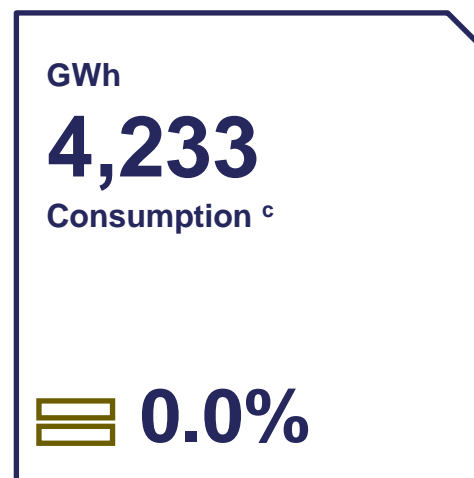
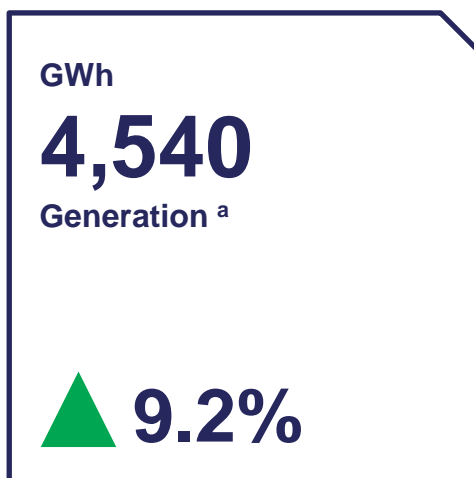
MONTHLY ANALYSIS IN PORTUGAL FEBRUARY

Between 1st and 29th February 2024, renewable incorporation was 83.5%, with a total of 3,789 GWh produced. The 15.6% increase compared to February 2023 is due to a substantial increase in wind and hydro power production in 5% and 11%, which corresponded to 1,520 GWh and 1,762 GWh, respectively, compared to the 1,176 GWh of wind power production and 1,181 GWh of hydroelectric production in February 2023.



RENEWABLE
83.5%

ELECTRICITY SECTOR INDICATORS (COMPARED TO FEBRUARY 2023)

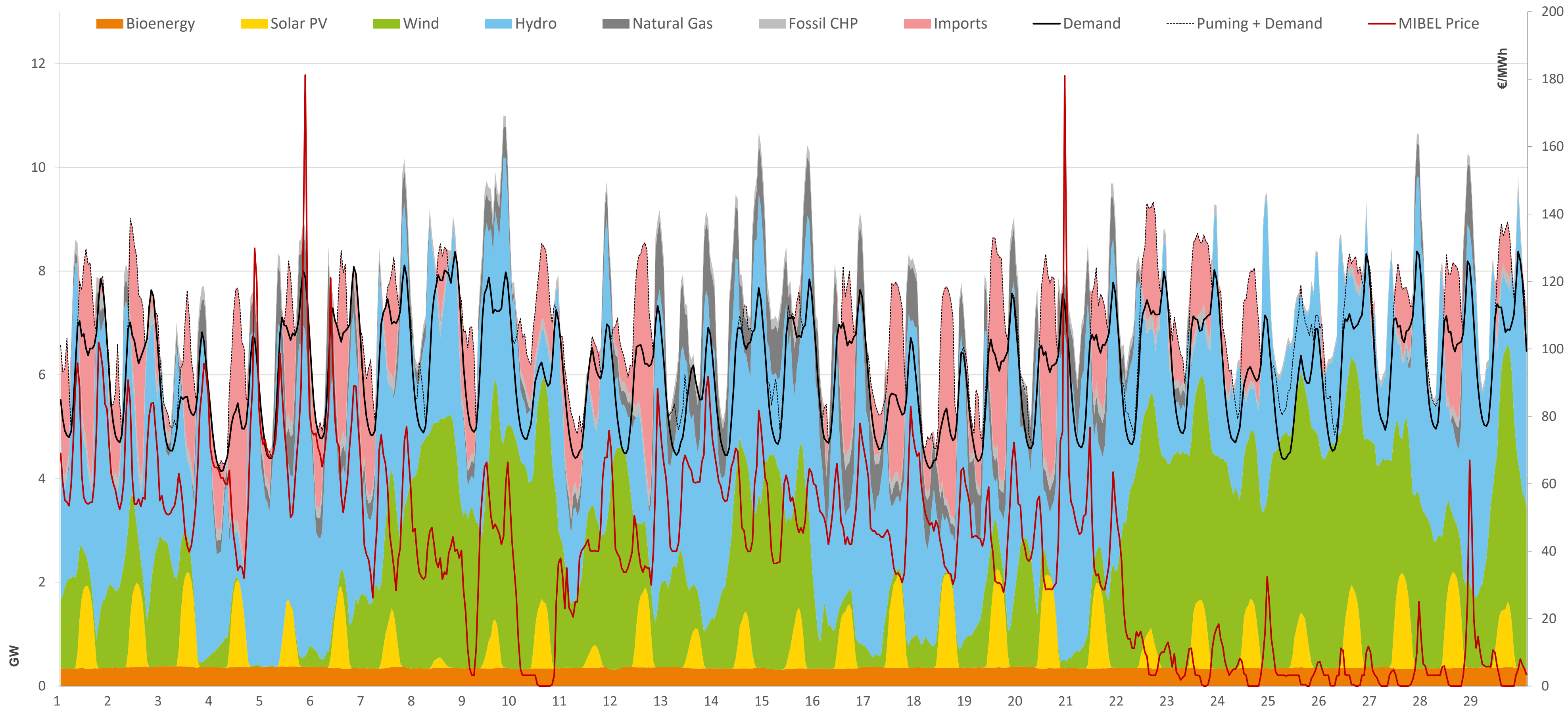


^a Generation refers to the net energy generation of the power stations, taking into account the pumping production recently disclosed by REN. Production from pumping is not included in the percentage of production from renewable sources.
Source: REN, APREN Analysis

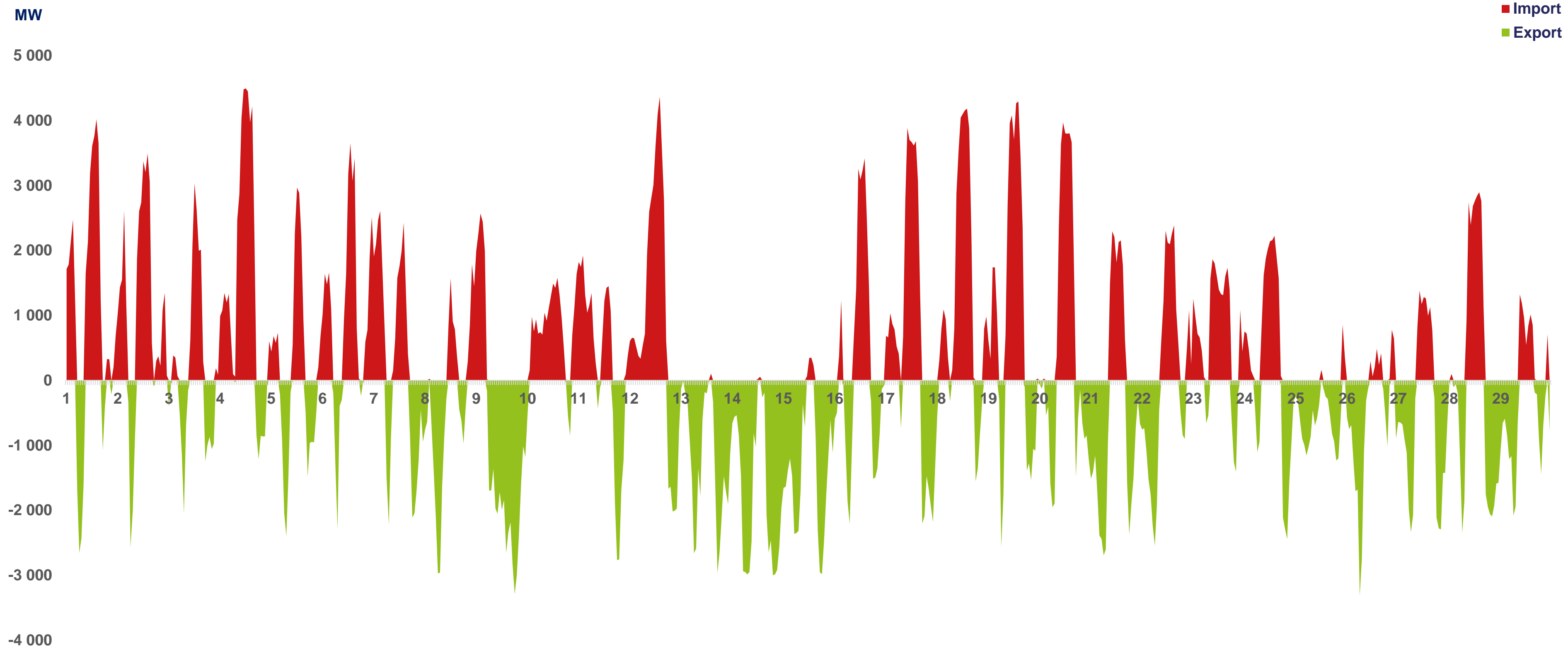
^b Includes fuel oil, diesel, the non-biodegradable fraction of MSW and new waste

^c Consumption refers to the net generation of energy by power stations, taking into account the import-export balance.
Source: REN, APREN Analysis

MONTHLY ANALYSIS IN PORTUGAL: FEBRUARY 2024 LOAD DIAGRAM



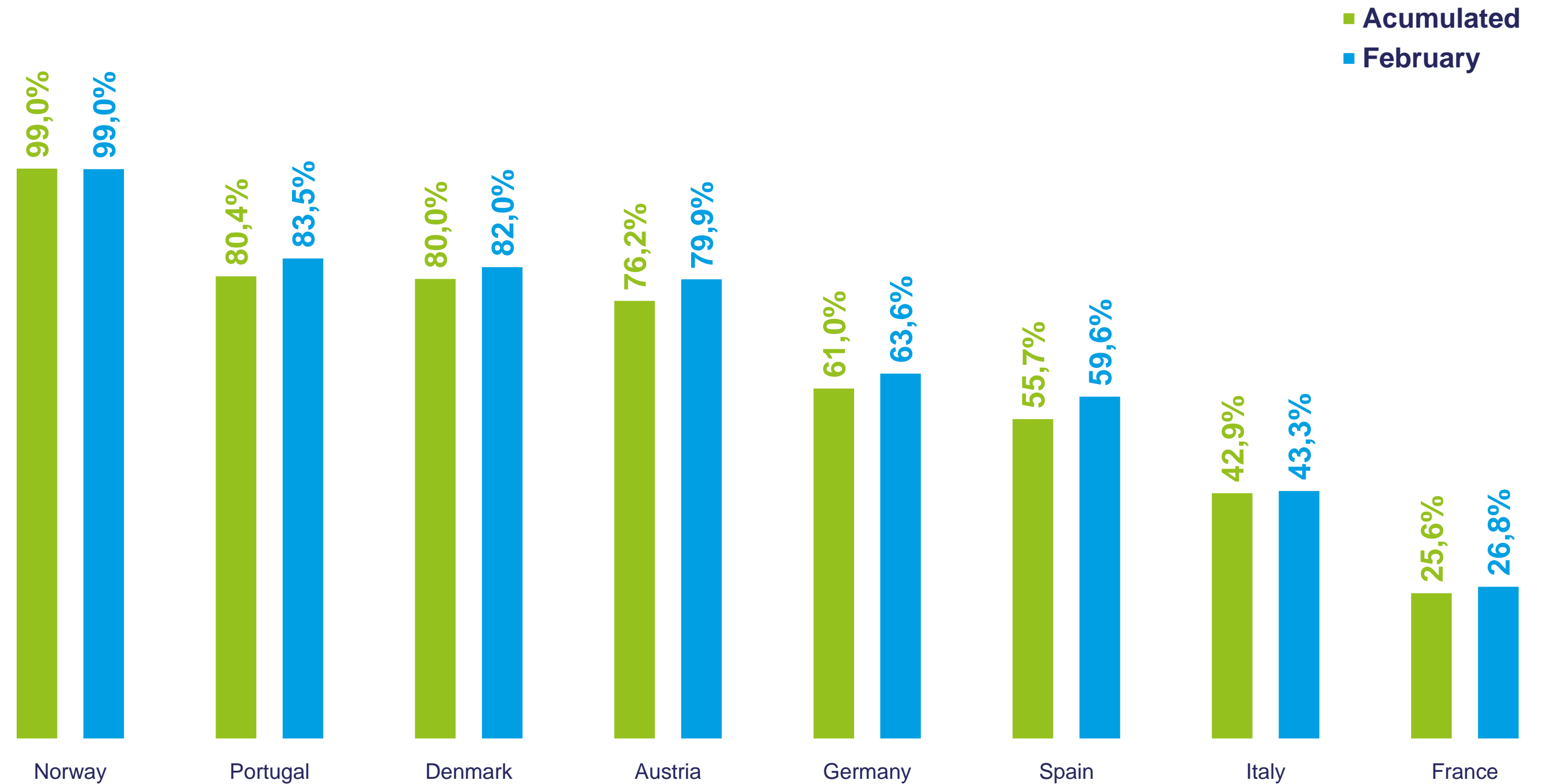
MONTHLY ANALYSIS IN PORTUGAL: DIAGRAM OF IMPORTS AND EXPORTS IN PORTUGAL



RENEWABLE ELECTRICITY EUROPA

In this analysis, only the main countries in the different European markets were considered, in order to obtain a representative panorama for comparison.

Between 1st of January and 29th of February 2024, Portugal was the country with the second highest share of renewable energy in electricity generation, behind Norway, which obtained 99.0% from RES. From February 1st to 29th, Portugal ranked second among the countries considered, with the highest renewable incorporation in Europe.



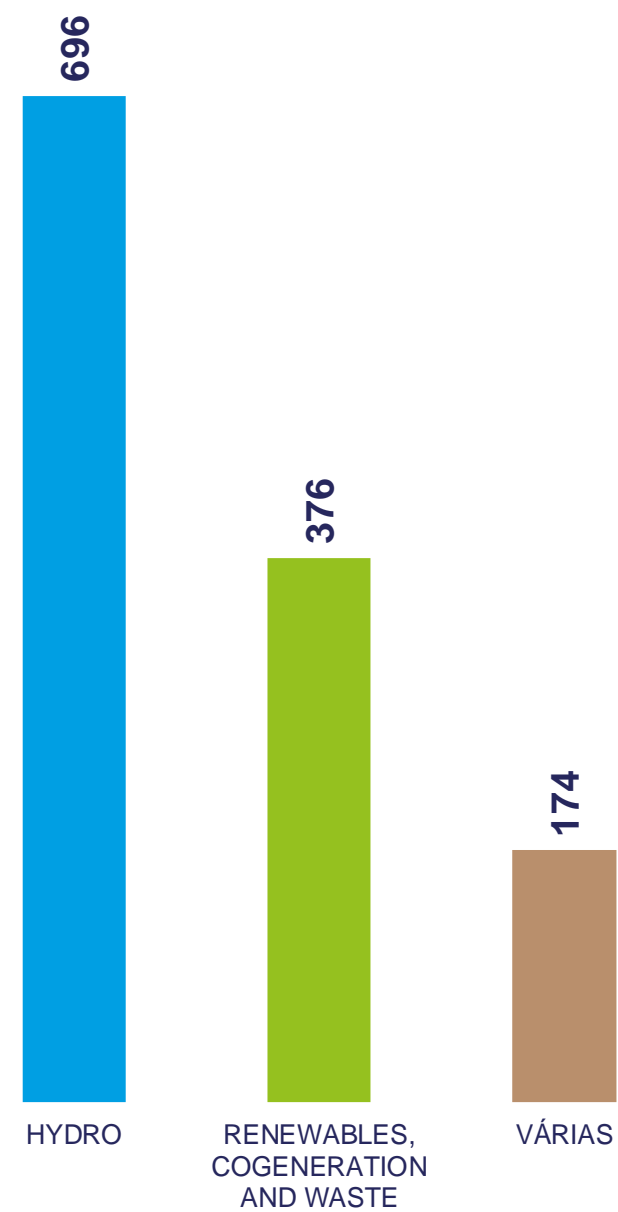
Renewable incorporation in monthly electricity generation (FEB).
Source: REN, Fraunhofer, REE, Terna, National Grid, ENTSO-E, APREN Analysis

MARKET PRICE SETTING PORTUGAL

Between 1st of January and 29th of February, the technology that closed the market for the most hours was hydro, with 696 non-consecutive hours, followed by renewables, cogeneration and waste with 376 hours, and pump 174 hours.

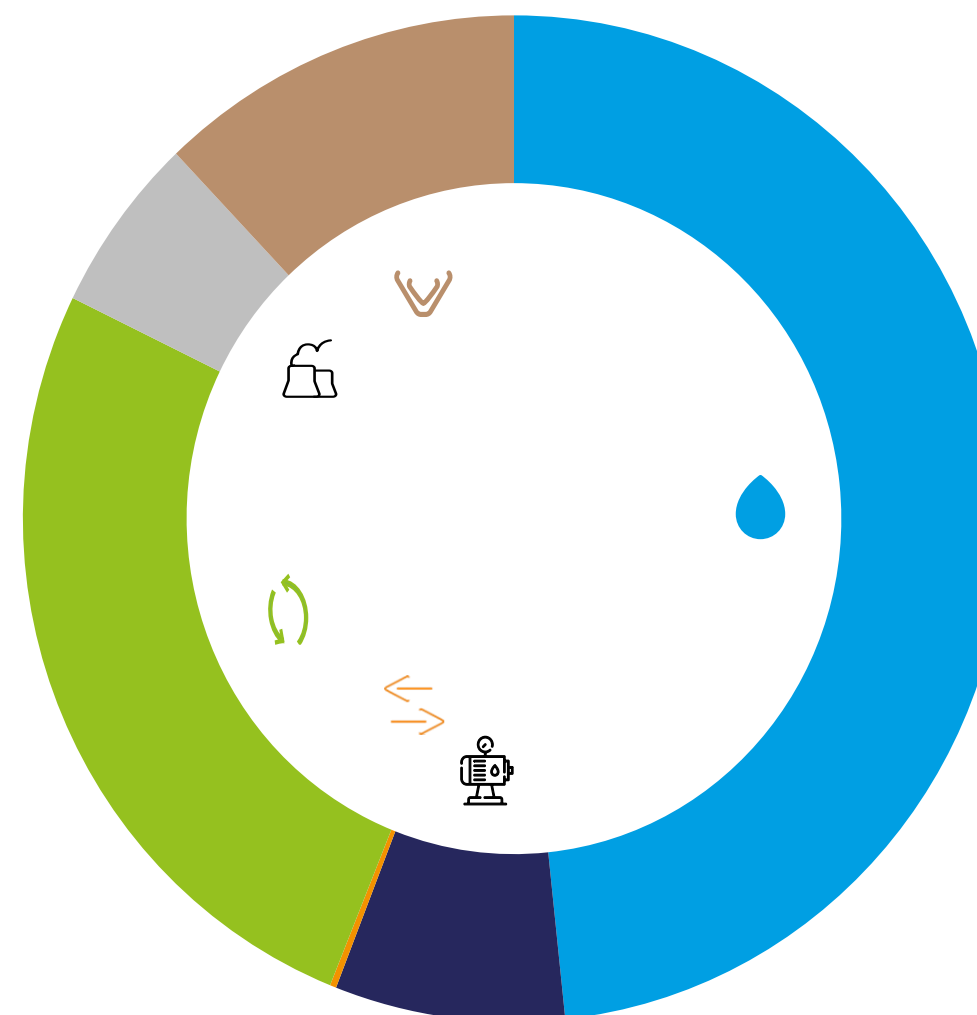


ACCUMULATED JANUARY - FEBRUARY 2024

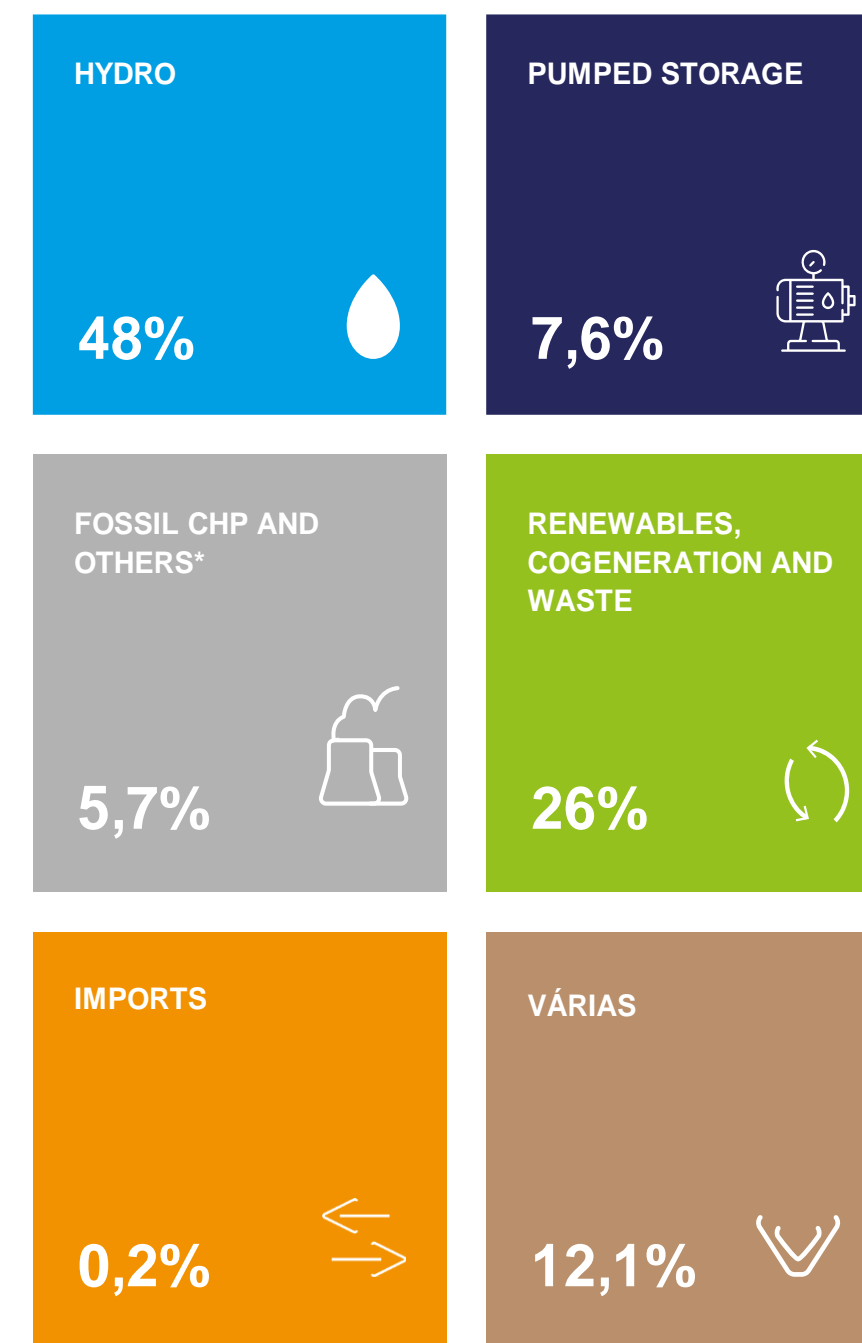


Number of market closing hours for the three main closing technologies (FEB).
Source: OMIE, APREN Analysis

FEBRUARY 2024



Percentage distribution of the number of hours of market closure for the various technologies, totalling 696 hours (FEB).
Source: OMIE, APREN Analysis



ELECTRICITY MARKET PORTUGAL

Between 1^s and 29th of February, the average hourly price recorded on MIBEL in Portugal (57.5 €/MWh) represented a decrease of 42.5% compared to the same period last year. In the same period, 539 non-consecutive hours were recorded in which renewable generation was sufficient to supply mainland Portugal's electricity consumption, with an average hourly price in MIBEL of 52.0 €/MWh.

539

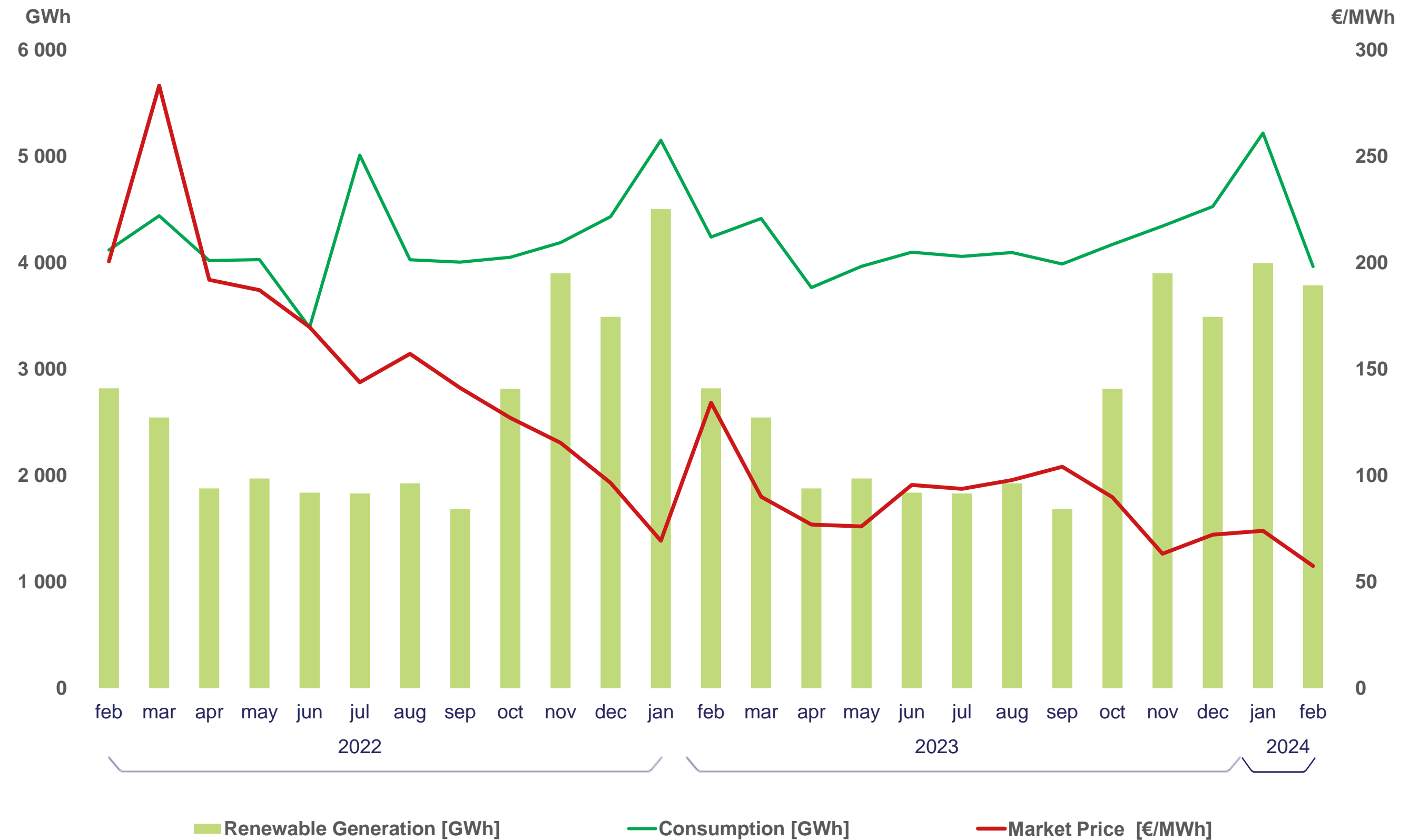
Hours

100% RENEWABLE HOURS

52.0

€/MWh

MIBEL'S AVERAGE PRICE (IN 100% RENEWABLE HOURS)



^d arithmetic average of MIBEL's prices. Source: OMIE

Specific emissions from the electricity sector in mainland Portugal, % use of coal and natural gas power stations (FEB-2022 to FEB-2024). Source: REN, DGEG, ERSE, APREN Analysis

ELECTRICITY MARKET SYSTEM SERVICES

Between January 1st and February 29th, 2024, 893 GWh of system services were transacted, which corresponds to 9.8% of consumption. There was an associated commercialization surcharge of €6.4/MWh, which corresponds to 14.5% of the price in the daily market of MIBEL.

The secondary bandwidth requirement was 446 GW, for which a capacity of 461 GW was contracted, of which 382 GW came from hydro technology, and 39 GW from thermal technology. The weighted price of the contracted bandwidth was €33.9/MW.



- Reserve Replacement - left axis
- Secondary Regulation - left axis
- Intraday Market Constraint Resolution - left axis
- Deviation - right axis

- Tertiary Reserve - left axis
- Daily Market Constraint Resolution - left axis
- Secondary Bandwidth - right axis
- Technical Restrictions and Other Costs - right axis

Source: REN

ELECTRICITY MARKET SYSTEM SERVICES –INFORMATIVE NOTE

The energy transacted in the system services market serves to ensure the balance between generation and consumption, always guaranteeing the stability of the national electrical system.

Reserve Replacement - aims to satisfy, before real-time, the differences between what is scheduled in the daily and intraday markets and the generation and consumption forecasts.

Secondary Regulation - aims to control the deviation of interconnection with Spain concerning the scheduled, collaborate in maintaining the joint frequency, or in the case of island operation, control the deviation of the system frequency from the nominal frequency.

Tertiary Reserve - corresponds to the maximum variation of power that can be made in a production unit.

Resolution of daily and intraday market constraints - is defined by restrictions on any limitations to the supply of electrical energy safely, with quality, and reliability.

The surcharge generated by this commercialization comes from the charges related to the regulation of the secondary bandwidth, reserves, deviations, and technical restrictions.



- Reserve Replacement - left axis
- Secondary Regulation - left axis
- Intraday Market Constraint Resolution - left axis
- Deviation - right axis
- Tertiary Reserve - left axis
- Daily Market Constraint Resolution - left axis
- Secondary Bandwidth - right axis
- Technical Restrictions and Other Costs - right axis

RENEWABLE ELECTRICITY EUROPE

During the month of February 2024, there was a minimum hourly price in MIBEL in Portugal of 0.0 €/MWh, where the market closed with various technologies. The maximum hourly price was 181.3 €/MWh, where the market closed with hydro.

MINIMUM PRICES (Feb)

1 ^o Germany	€/MWh -0.13
2 ^o Denmark Spain Italy Portugal	€/MWh 0.00
3 ^o Austria	€/MWh 1.25

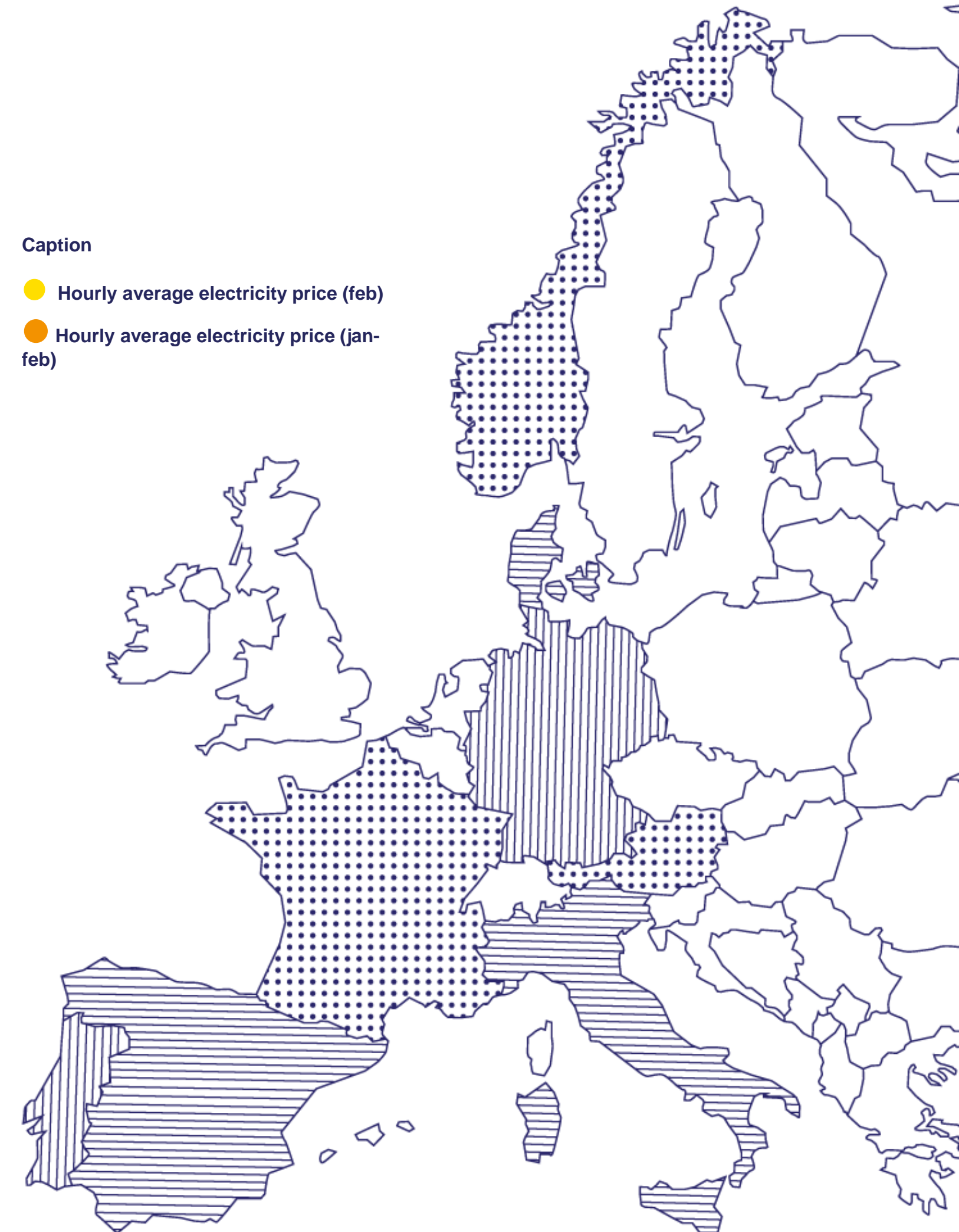
MAXIMUM PRICES (Feb)

1 ^o Italy Portugal Spain	€/MWh 181.26
2 ^o Denmark Germany	€/MWh 136.22
3 ^o Austria	€/MWh 128.05

Portugal €/MWh	39.9	57.5
Spain €/MWh	40.0	57.6
France €/MWh	58.4	67.8
Italy €/MWh	87.9	93.7
Germany €/MWh	61.3	69.2
Austria €/MWh	65.8	73.8
Denmark €/MWh	56.7	66.9
Norway €/MWh	51.5	59.3

Caption

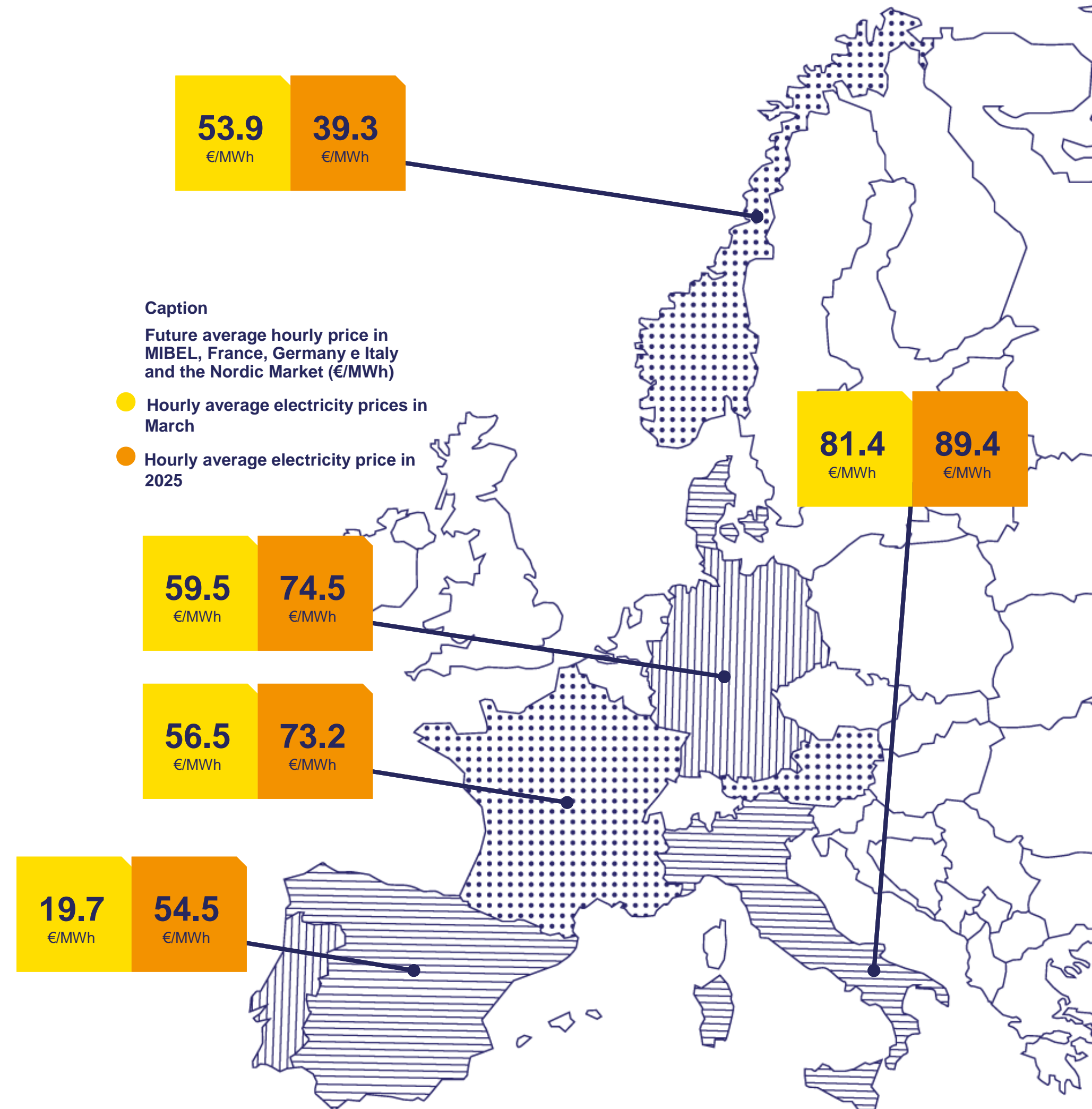
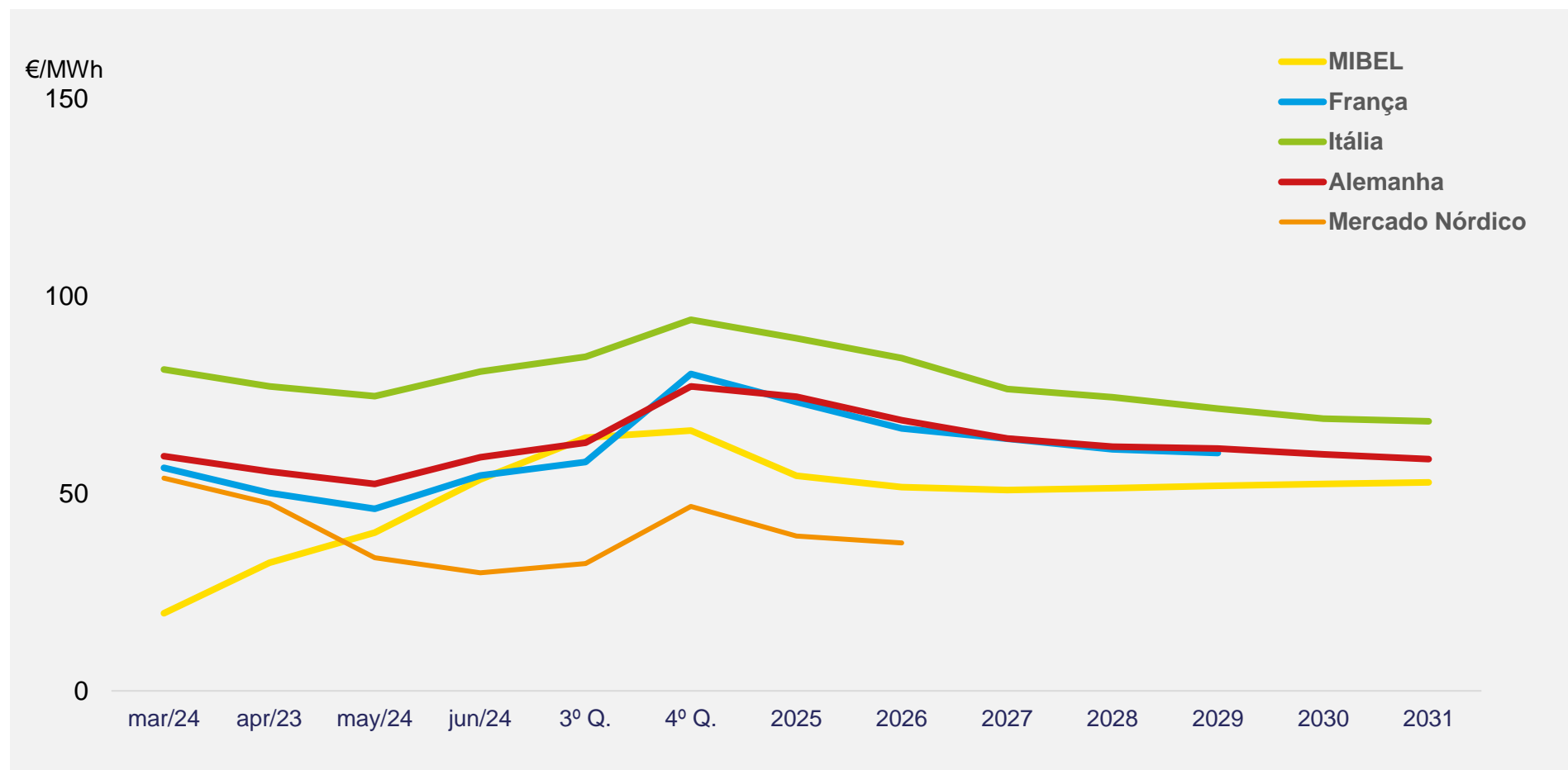
- Hourly average electricity price (feb)
- Hourly average electricity price (jan-feb)



ELECTRICITY MARKET FUTURES

The evolution of the average hourly future price shown is calculated on the basis of electricity^e purchase and sale contracts. The map on the right shows the price values for next month (March) and next year. In both cases, MIBEL and the Nordic Market have the lowest values, while the Italian market has the highest values in the analysis carried out.

MIBEL has the lowest values until 2031, due to investment in renewable production.



Caption
 Future average hourly price in MIBEL, France, Germany e Italy and the Nordic Market (€/MWh)

- Hourly average electricity prices in March
- Hourly average electricity price in 2025

^e Updated values in 8th of February.
 Source: OMIP, EEX, APREN Analysis

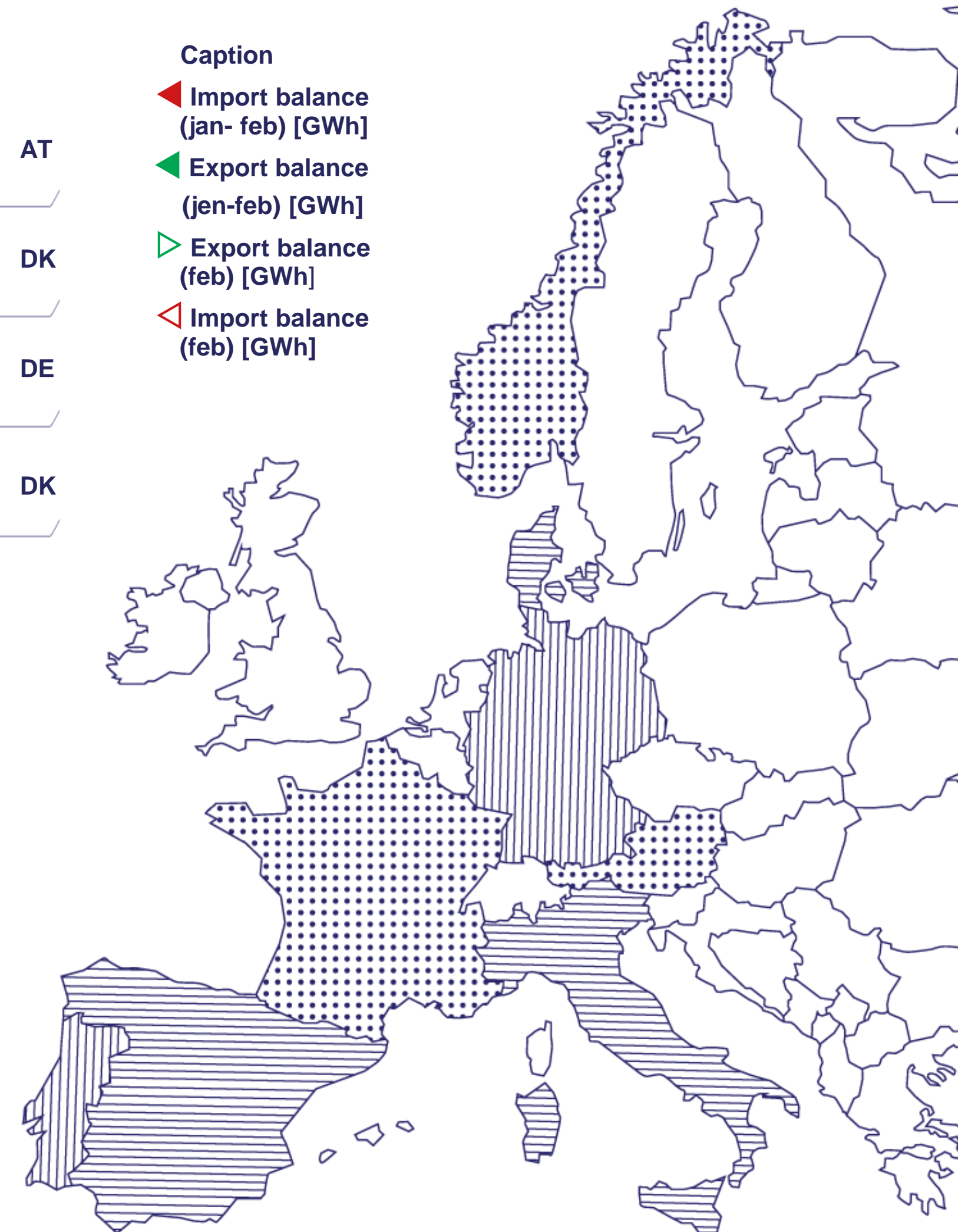
INTERNATIONAL EXCHANGES EUROPE

Between 1 and 29 of February 2024, mainland Portugal's electricity system registered electricity imports equivalent to 1,397 GWh and exports of 1,052 GWh, with Portugal being an importer with a balance of 345 GWh.

PT	345	97	ES	DE	1 118	593	AT
ES	118	80	MA	DE	50	276	DK
FR	1 074	907	ES	NO	424	254	DE
FR	3 530	1 872	IT	NO	100	190	DK
FR	2 984	1 560	DE				

Caption

- ◀ Import balance (jan-feb) [GWh]
- ▶ Export balance (jan-feb) [GWh]
- ▷ Export balance (feb) [GWh]
- ◁ Import balance (feb) [GWh]



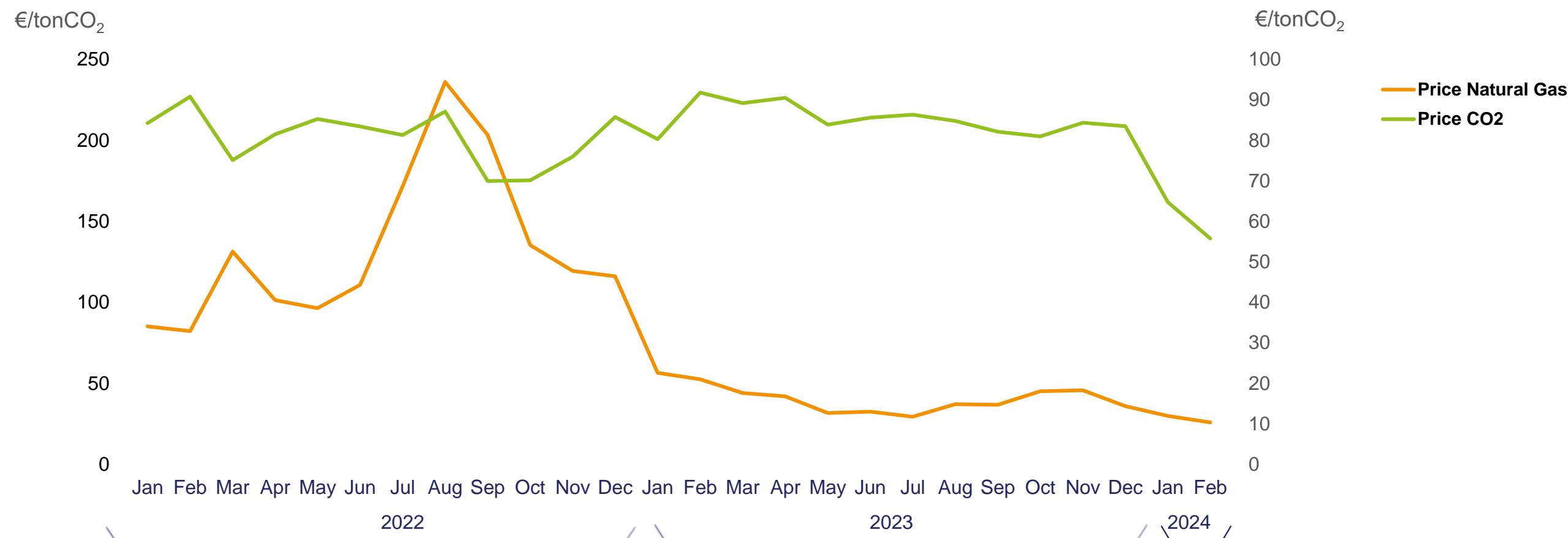
MAIN INDICATORS OF PT-ES INTECONNECTION

Usage	16.4% (feb) PT-ES	22.4% (jan-feb)	19.7% (feb) ES-PT	27.7% (jan-feb)
Congestion	1.9% (feb) PT-ES	2.9% (jan-feb)	0.1% (feb) ES-PT	1.9% (jan-feb)
Market Separation	2.0% (feb) PT-ES	3.5% (jan-feb)	74.4% (feb) MIBEL-FR	65.2% (jan-feb)

Source: ENTSO-E, OMIE, APREN Analysis

POWER SECTOR EMISSIONS

Between 1 and 29 of February 2024, specific emissions reached 42.5 gCO₂eq/kWh, making total emissions from the electricity generation sector 0.4 MtCO₂eq. The European CO₂ Emissions Trading Scheme (ETS) recorded a price of 60.4 €/tCO₂^d, a reduction of 70.5% compared to the same period in 2023



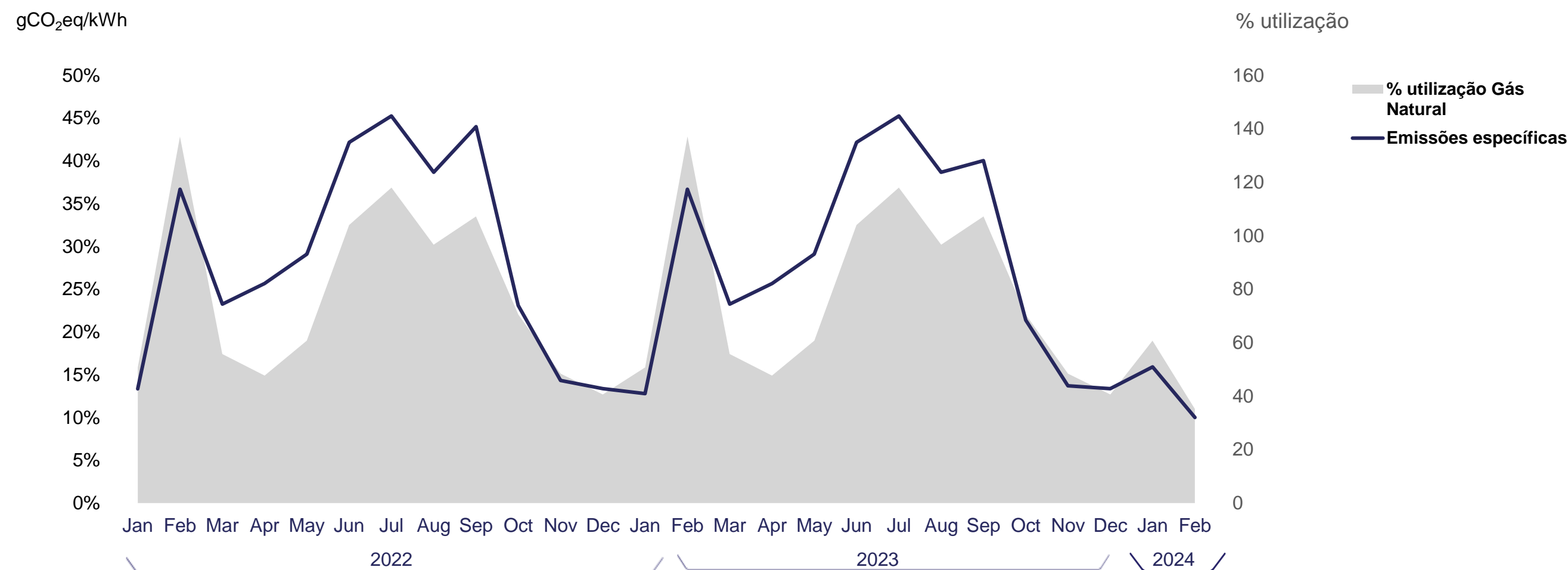
Price of CO2 allowances in the EU ETS and price of natural gas in Europe (FEB-2022 to FEB-2024)
Source: SendeCO2, WorldBank.

0.4
MTOCO₂eq
SECTOR EMISSIONS

60.4
€/tCO₂
AVERAGE LICENCES PRICES

42.8
%
IN COMPARISON TO FEB 2023

30
%
IN COMPARISON TO FEB 2023



Specific emissions from the electricity sector in mainland Portugal, % use of coal and natural gas power stations (FEB-2022 to FEB-2024).
Source: REN, DGEG, ERSE, APREN Analysis

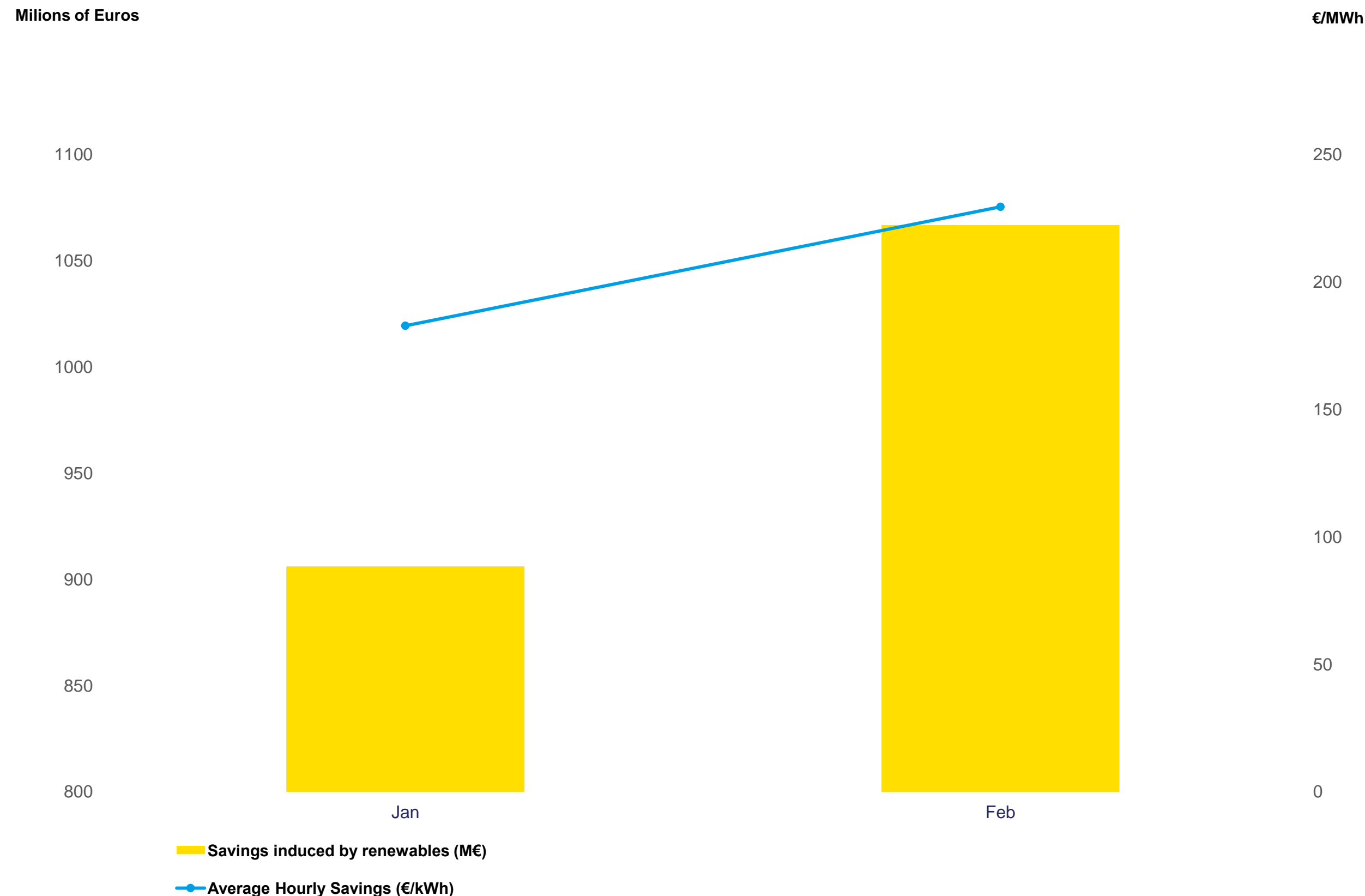
^darithmetic average of MIBEL's prices.
Source: OMIE, WorldBank.

SIMULATION OF PRICE FORMATION WITHOUT SRP

RENEWABLES HAVE AVOIDED:

The indicators below identify the savings achieved by the merit order between 1 and 31 February 2024 by the contribution of special regime production (SRP). This study is carried out for SRP, which includes all installed fossil cogeneration power. Bearing in mind that the capacity equivalent to this technology within SRP is fairly residual and that the other technologies are renewable, the figures are fairly close to the real savings generated by renewables.

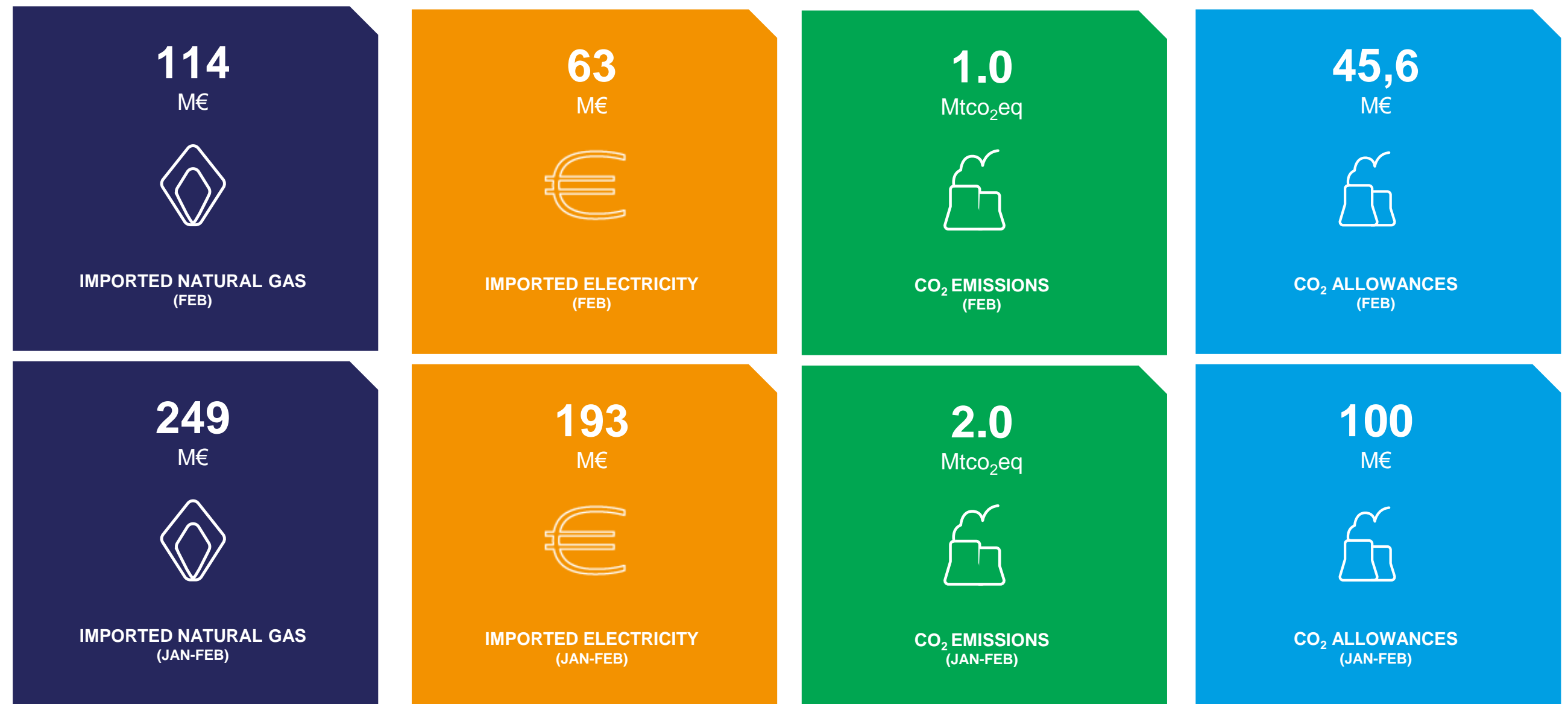
<p style="font-size: 24pt; font-weight: bold;">206.2</p> <p>€/MWh</p> <p style="font-size: 10pt; font-weight: bold;">AVERAGE HOURLY SAVING (JAN-FEB)</p>	<p style="font-size: 24pt; font-weight: bold;">1,971.2</p> <p>M€</p> <p style="font-size: 10pt; font-weight: bold;">CUMULATIVE SAVINGS (FEB)</p>
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ENVIRONMENTAL SERVICE

RENEWABLES HAVE AVOIDED:

The indicators below identify the savings achieved between 1st of January and 29th of February 2024 in natural gas, CO₂ emissions and CO₂ emission allowances, resulting from incorporating renewables into electricity generation. This analysis is based on the assumption that, in the absence of renewables, production would be ensured primarily by natural gas, followed by the use of imports.



Source: REN, REE, SendeCO2, WorldBank, DGEG, ERSE, APREN Analysis.
Disclaimer1: To estimate savings on imported natural gas, the WorldBank price for natural gas in Europe was used.
Disclaimer2: The average price on the MIBEL market was used to estimate savings on imported electricity.

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APREN
DEPARTAMENTO TÉCNICO
E COMUNICAÇÃO

Av. da República 59 – 2º andar
1050-189 Lisboa
(+351) 213 151 621

apren@apren.pt
apren.pt

