

2024

RENEWABLE ELECTRICITY BULLETIN

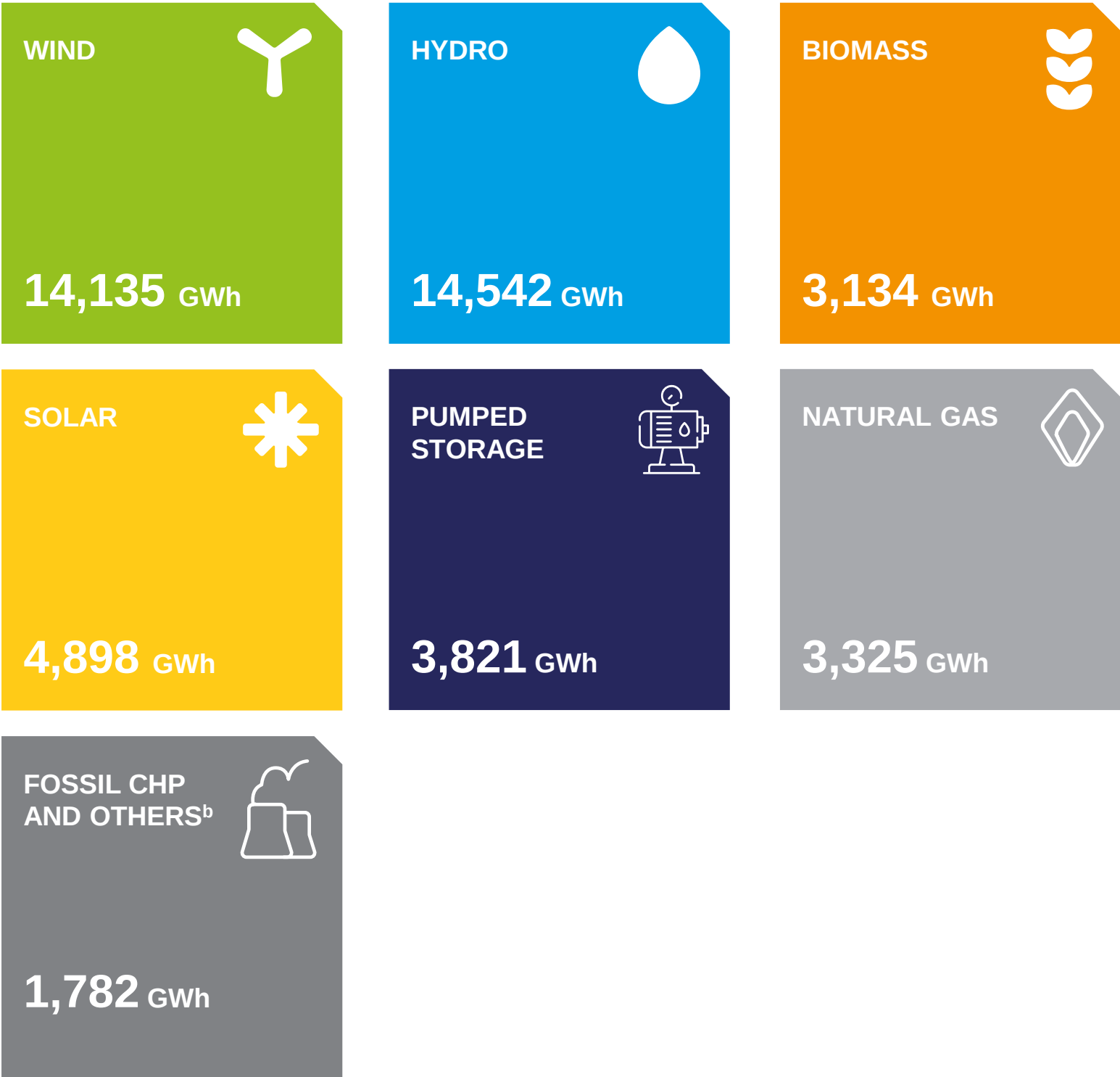
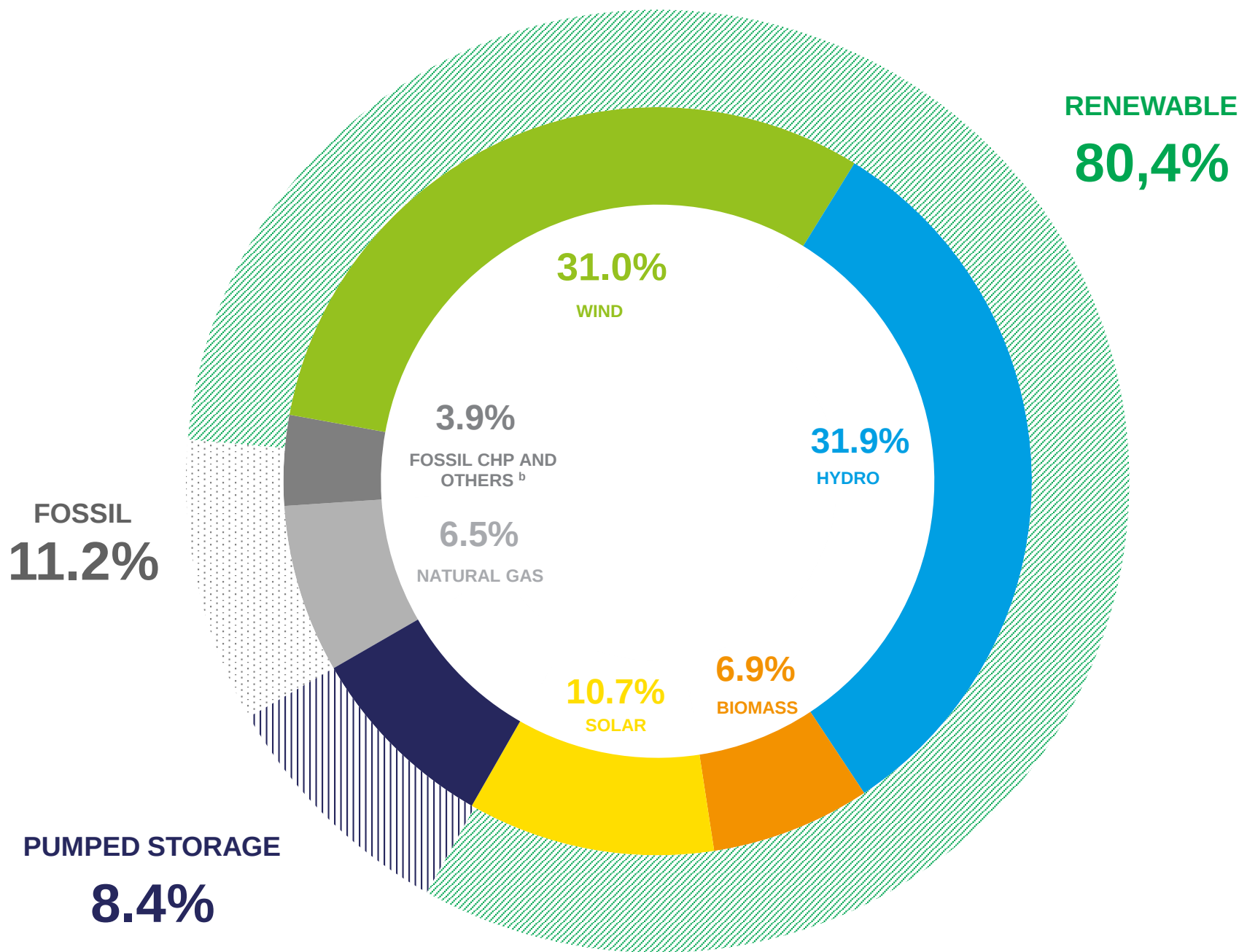
DECEMBER
2024

PORTUGAL NEEDS
OUR ENERGY



APREN Associação
de Energias
Renováveis

EXECUTIVE SUMMARY
GENERATION (JAN-DEC)



MAIN INDICATORS
(JAN-DEC)

GWh
45,637
Generation^a

€/ MWh
63,5
MIBEL PT Price

€/ tCO₂
67.0
CO₂ Price

MtCO₂ - eq
11.4
CO₂ Emissions

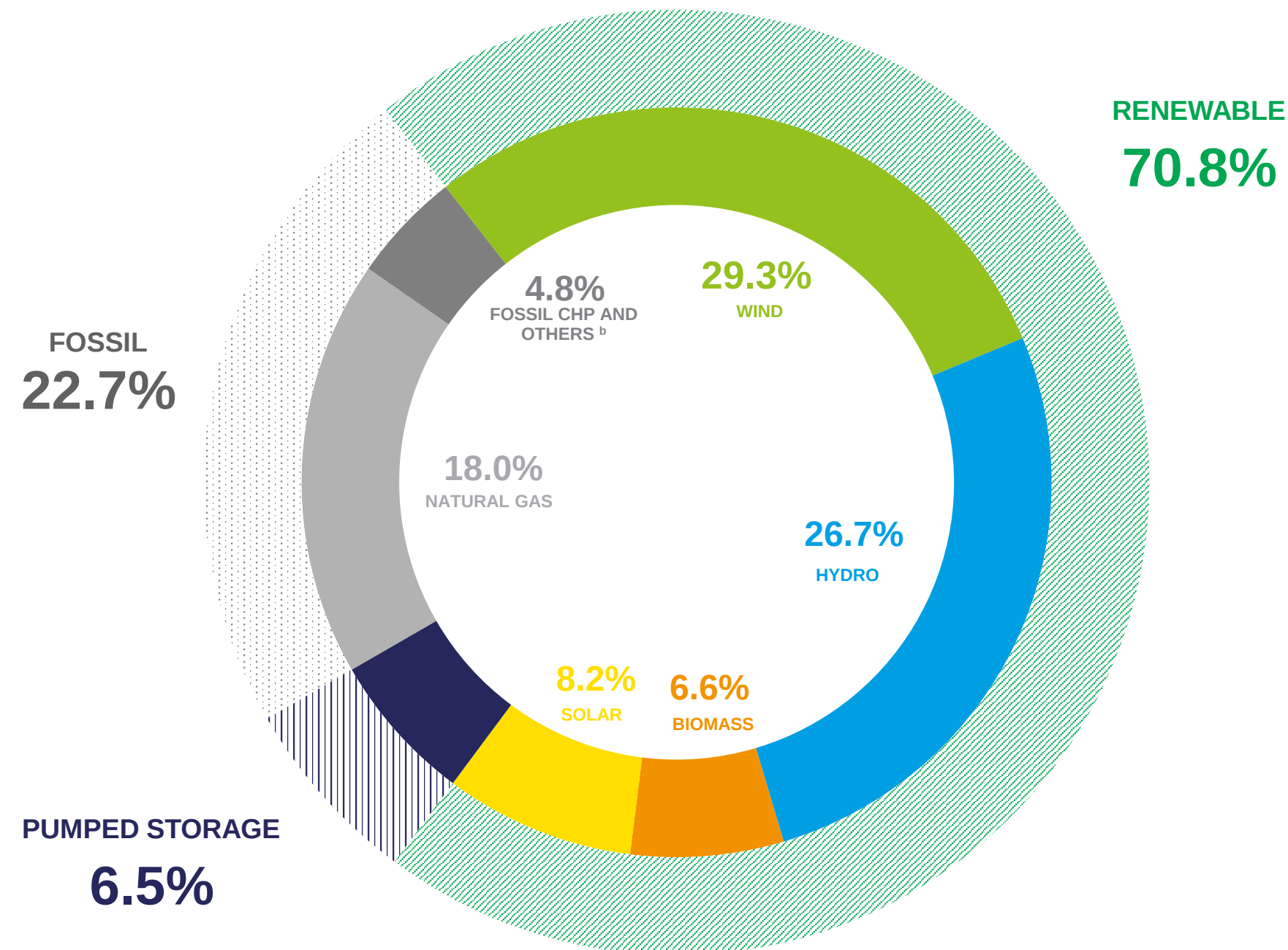
GWh
10,442
Import Balance

gCO₂ eq/kWh
39.8
CO₂ Specific Emissions

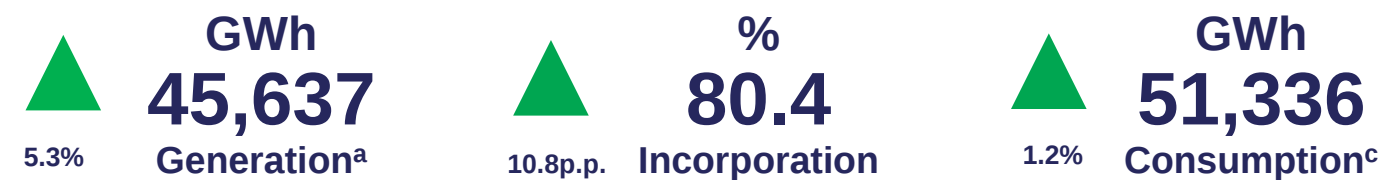
^a Generation refers to the net energy generation of the power stations, taking into account the pumping production recently disclosed by REN. Production from pumping is not included in the percentage of production from renewable sources
^b Includes fuel oil, diesel, the non-biodegradable fraction of MSW and new waste

EXECUTIVE SUMMARY

DECEMBER ACCUMULATED GENERATION 2023

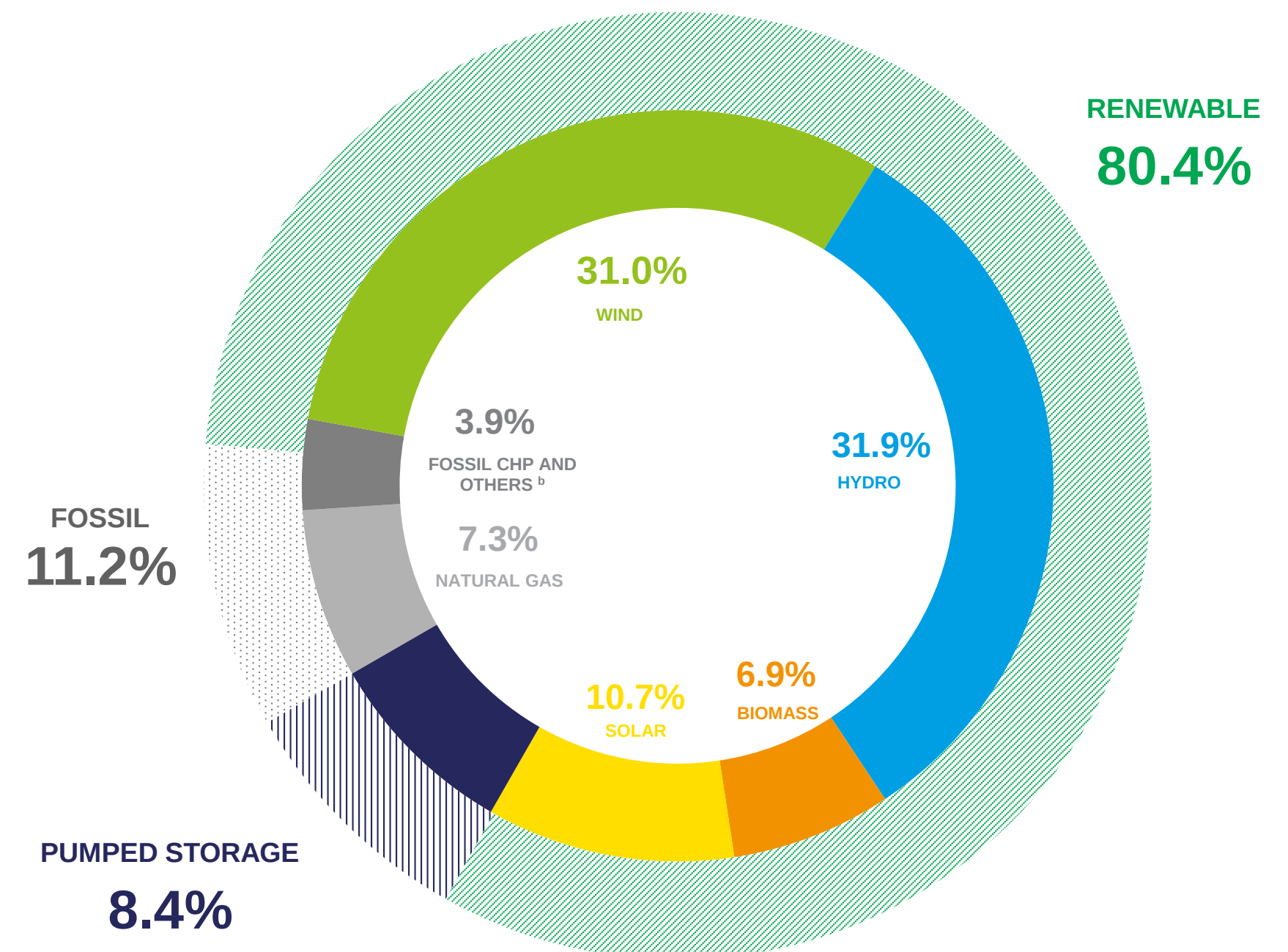


MAIN INDICATORS COMPARED TO DECEMBER 2023



^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

DECEMBER ACCUMULATED GENERATION 2024



^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

DECEMBER

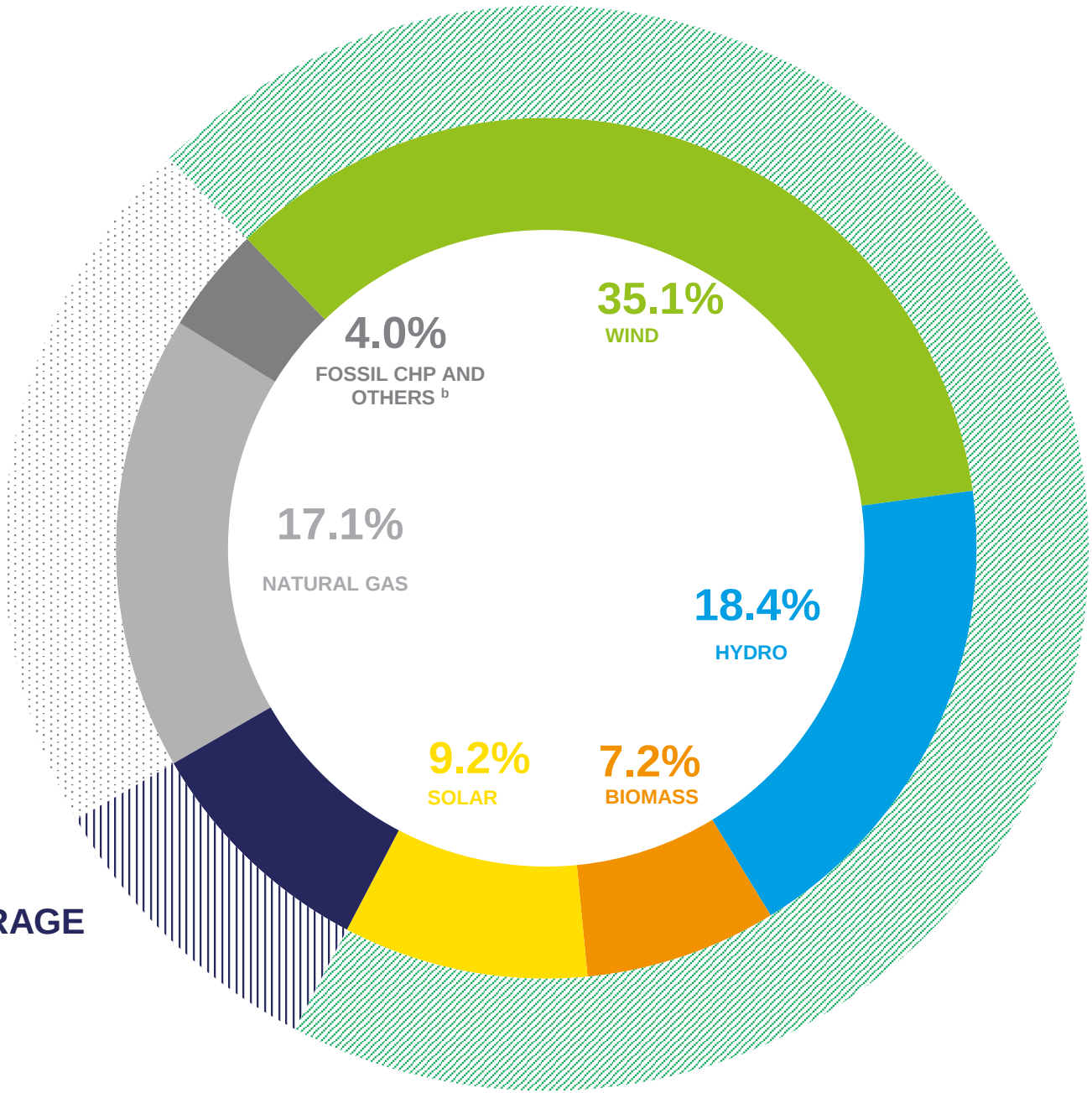
Between 1 and 31 of December 2024, renewable incorporation was 69.9%, making up 2,498 GWh of the 3,572 GWh produced in the month under review.

The amount of energy generated compared to December 2023 is lower, mainly due to a reduction in hydro production of 24.6 percentage points, from 1,848 GWh to 657 GWh

In December 2024, imports totalled 32.1% of electricity consumption in mainland Portugal.

FOSSIL
21.1%

PUMPED STORAGE
9.0%



RENEWABLE
69.9%

ELECTRICITY SECTOR'S INDICATORS (IN COMPARISON WITH DECEMBER 2023)

GWh
3,572
Generation^a

▼ **16.9%**

GWh
4,664
Consumption^c

▼ **1.2%**

%
69.9
Renewable incorporation

▼ **11.3 p.p.**

WIND INDEX

0.86

HYDRO INDEX

0.36

SOLAR INDEX

1.08

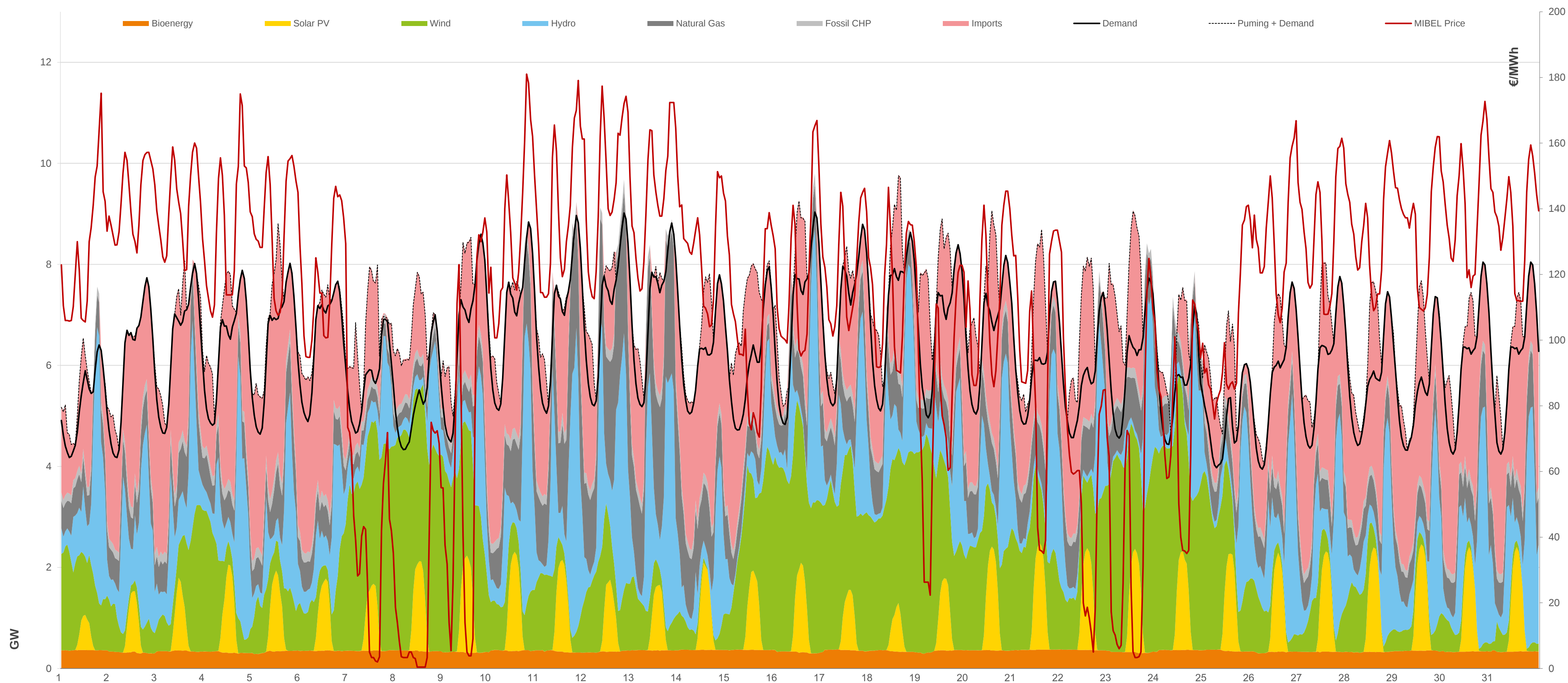
STORAGE IN DAMS

57.7%

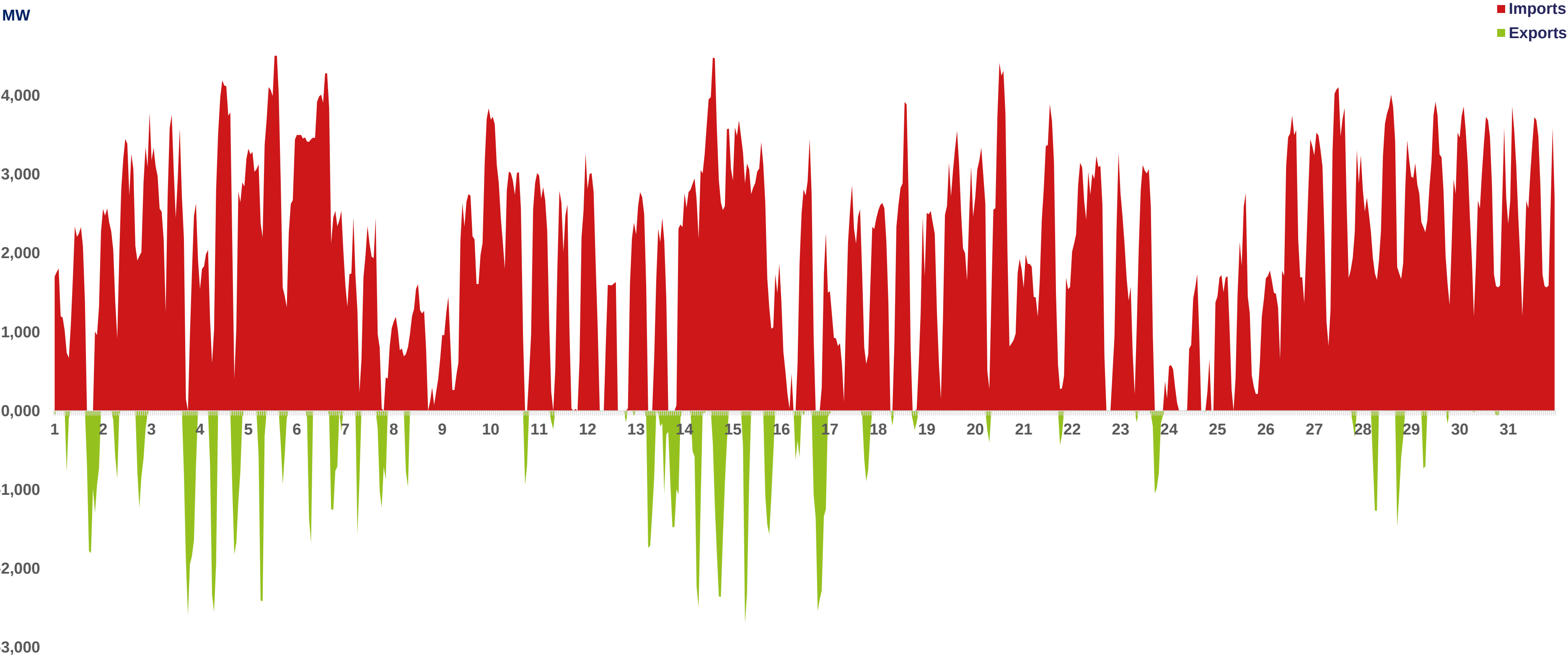
^a Generation refers to the net energy generation of the power stations, taking into account the pumping production recently disclosed by REN. Production from pumping is not included in the percentage of production from renewable sources.
^b Includes fuel oil, diesel, the non-biodegradable fraction of 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:

DECEMBER 2024 LOAD DIAGRAM



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



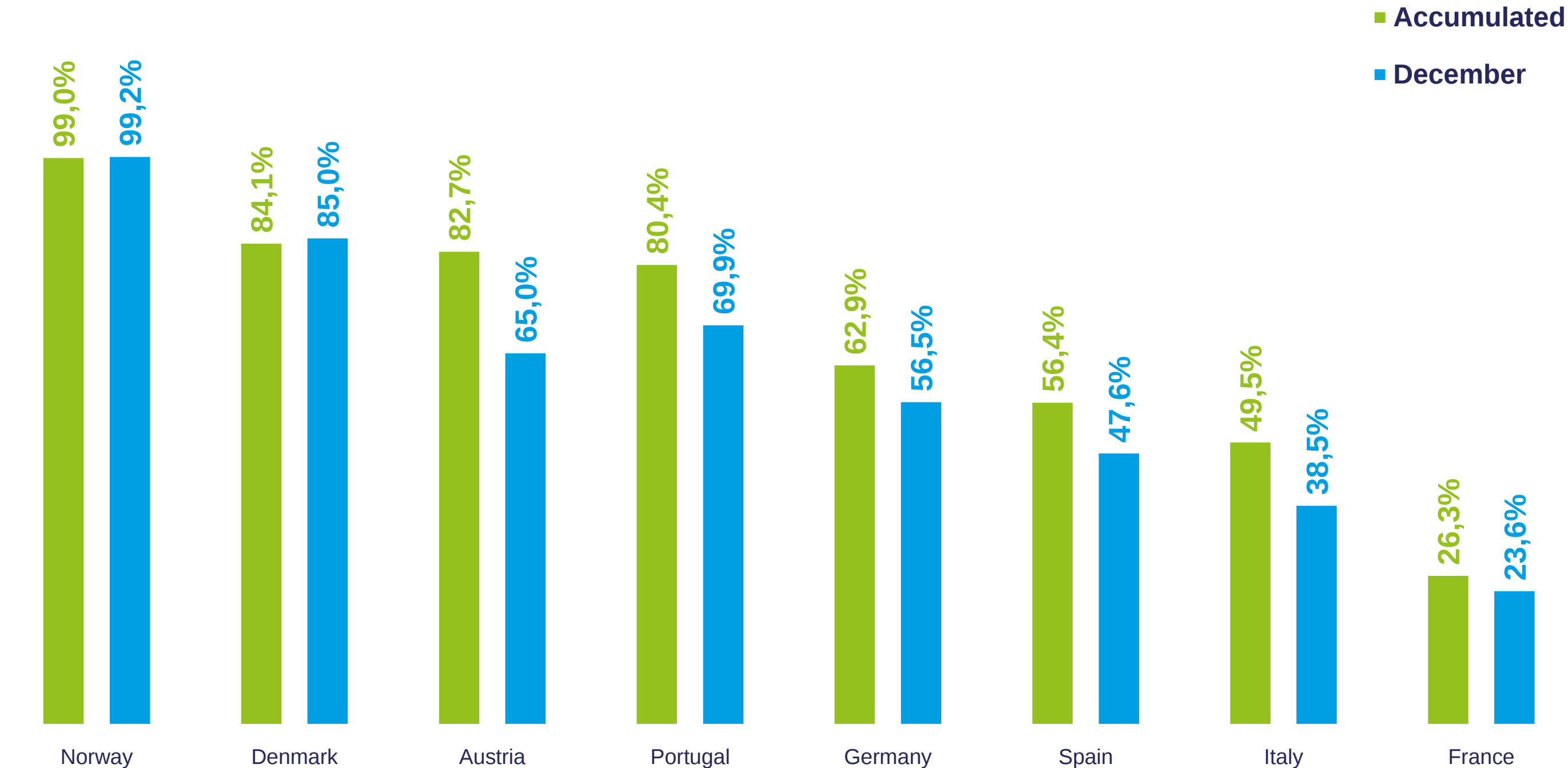
Source: REN, APREN Analysis

RENEWABLE ELECTRICITY EUROPE

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

Between 1 January and 31 December 2024, Portugal was the fourth country with the highest share of renewable energy in electricity generation, with 80.4%, figuring behind Norway, Denmark and Austria, which respectively achieved 99.0%, 84.1% and 82.7%.

From 1 to 31 December, Portugal came third in the countries considered with the highest renewable incorporation in Europe, having reached 69.9%.

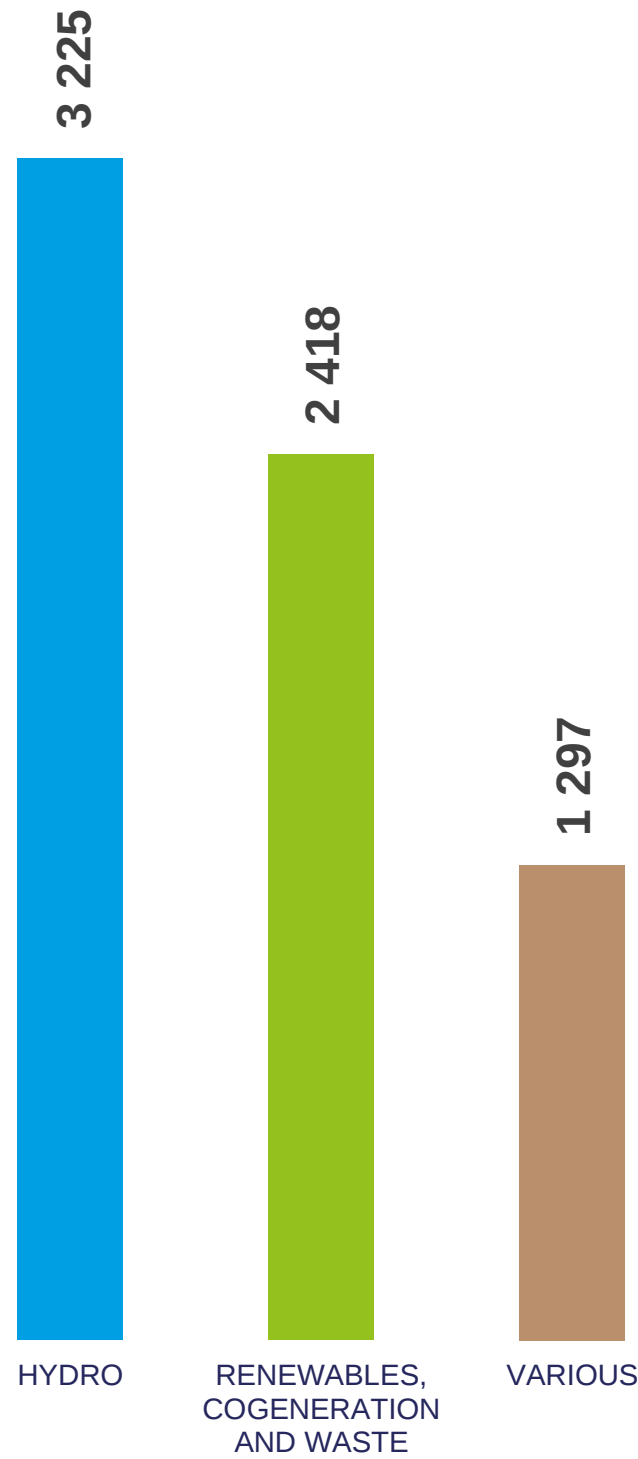


MARKET PRICE SETTING PORTUGAL

Between 1 January and 31 December, the technology that cleared the market with the most hours was hydro, with 3,225 non-consecutive hours, followed by other renewables, cogeneration and waste with 2,418 hours, and various technologies with 1,297 hours.

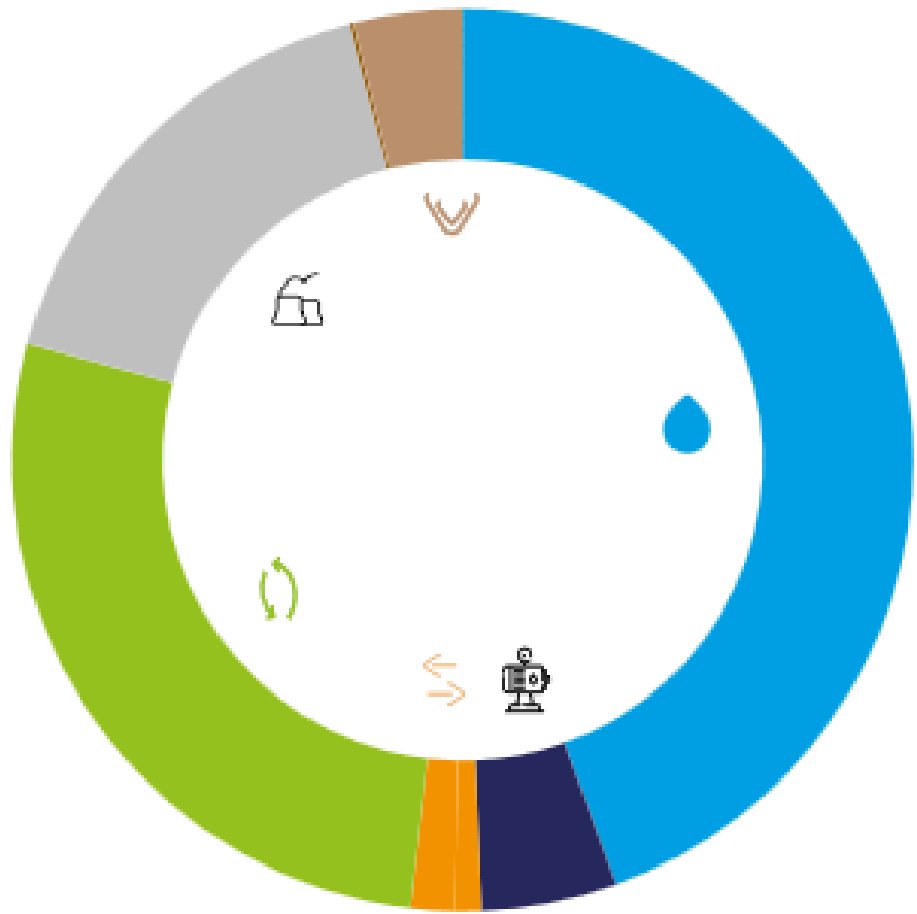


ACCUMULATED DECEMBER 2024



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

DECEMBER 2024



Percentage distribution of the number of hours of market clearing for the various technologies, totaling 744 hours (Dec).
Source: OMIE, APREN Analysis

ELECTRICITY MARKET

PORTUGAL

Between 1 January and 31 December, the average hourly price recorded in MIBEL in Portugal (63.5 €/MWh^d) represents a 32.9% reduction compared to the same period last year. In the same period, there were 1,867 non-consecutive hours in which renewable generation was sufficient to supply mainland Portugal's electricity consumption, with an average hourly price in MIBEL of 43.5 €/MWh.

1,867
Hours

100% RENEWABLE HOURS
[Accumulated]

43.5
€/MWh

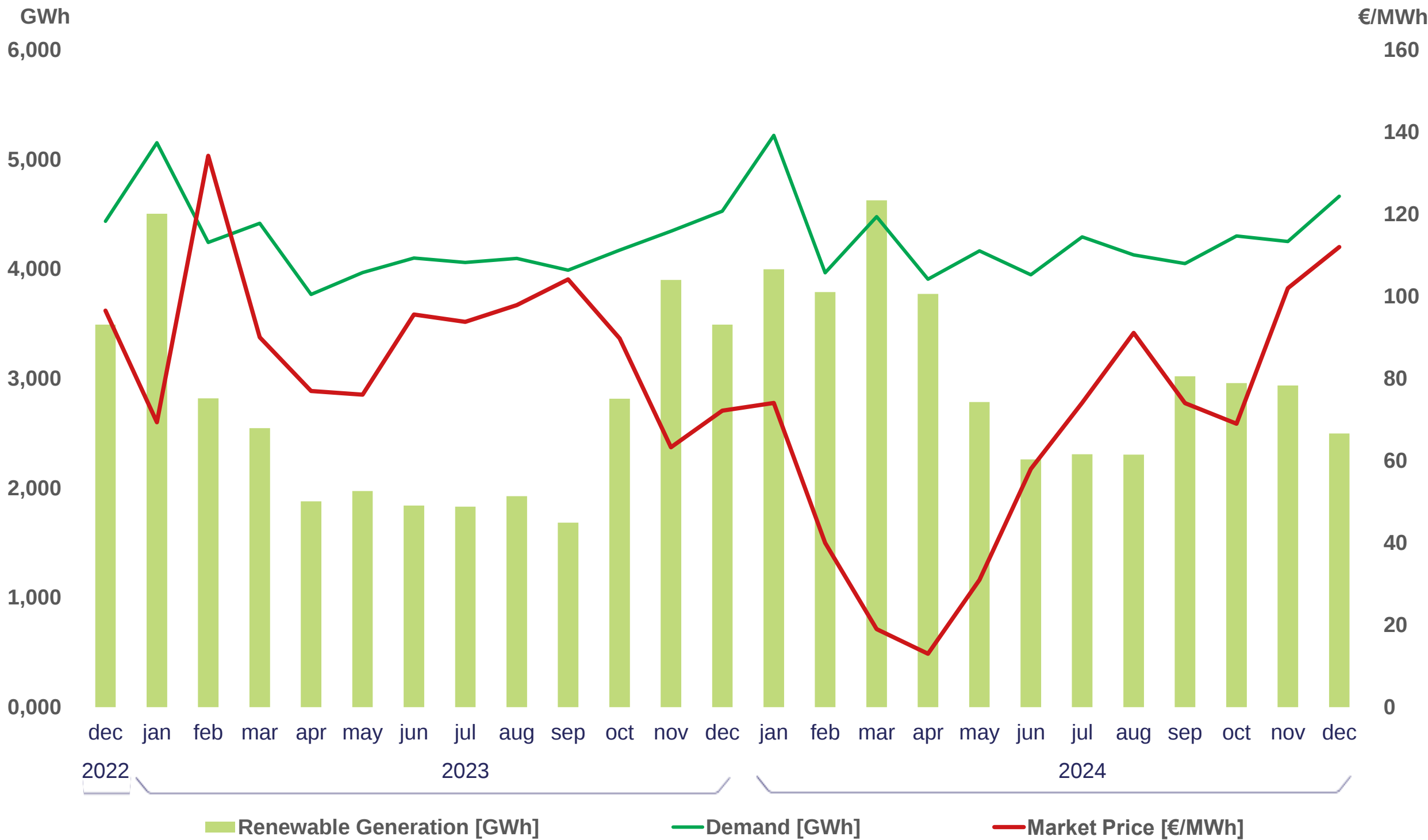
MIBEL'S AVERAGE PRICE (IN 100% RENEWABLE HOURS)
[Accumulated]

31
Hours

100% RENEWABLE HOURS
[DECEMBER]

53.4
€/MWh

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



^d arithmetic average of MIBEL prices.
Source: OMIE

RENEWABLE ELECTRICITY

EUROPE

During the month of December 2024, there was a minimum hourly price in MIBEL in Portugal of 0.44€/MWh, where the market was cleared mainly by Renewables, Cogeneration and Waste. The maximum hourly price was 181.00 €/MWh, where the market was cleared by Hydro.

MINIMUM PRICES (DEC)

1° Germany	€/MWh -2.06
2° France	€/MWh 0.77
3° Norway (NO2)	€/MWh 0.0

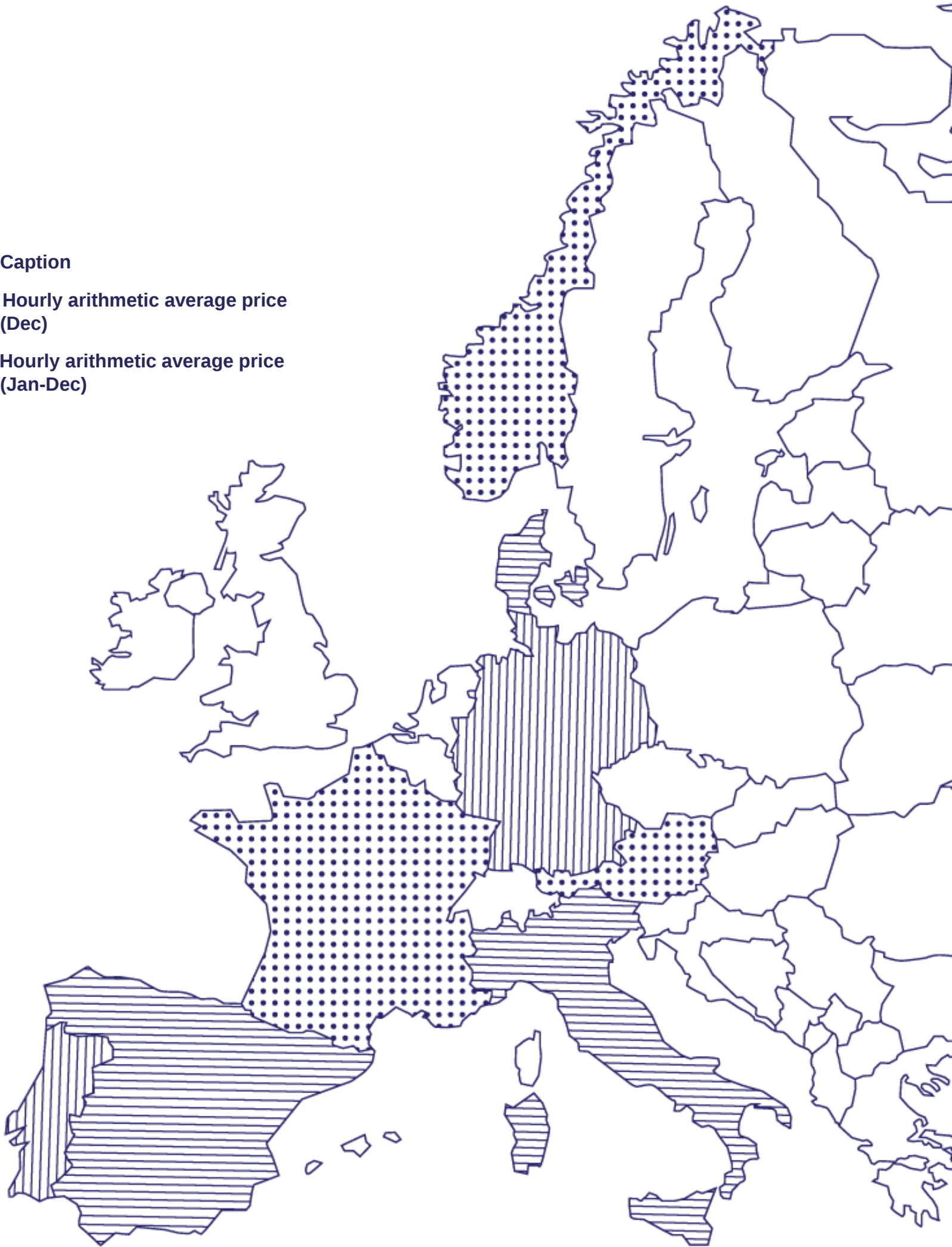
MAXIMUM PRICES (DEC)

1° Denmark (DK2)	€/MWh 936.31
2° Germany Denmark (DK1)	€/MWh 936.28
3° Austria	€/MWh 850.0

Portugal €/MWh	111.5	63.5
Spain €/MWh	111.2	63.0
France €/MWh	98.2	58.0
Italy (IT-NORD) €/MWh	135.3	107.4
Germany €/MWh	108.3	78.5
Austria €/MWh	129.7	81.5
Denmark (DK1) €/MWh	91.8	70.6
Denmark (DK2) €/MWh	92.7	70.9
Norway (NO2) €/MWh	63.5	50.1

Caption

- Hourly arithmetic average price (Dec)
- Hourly arithmetic average price (Jan-Dec)

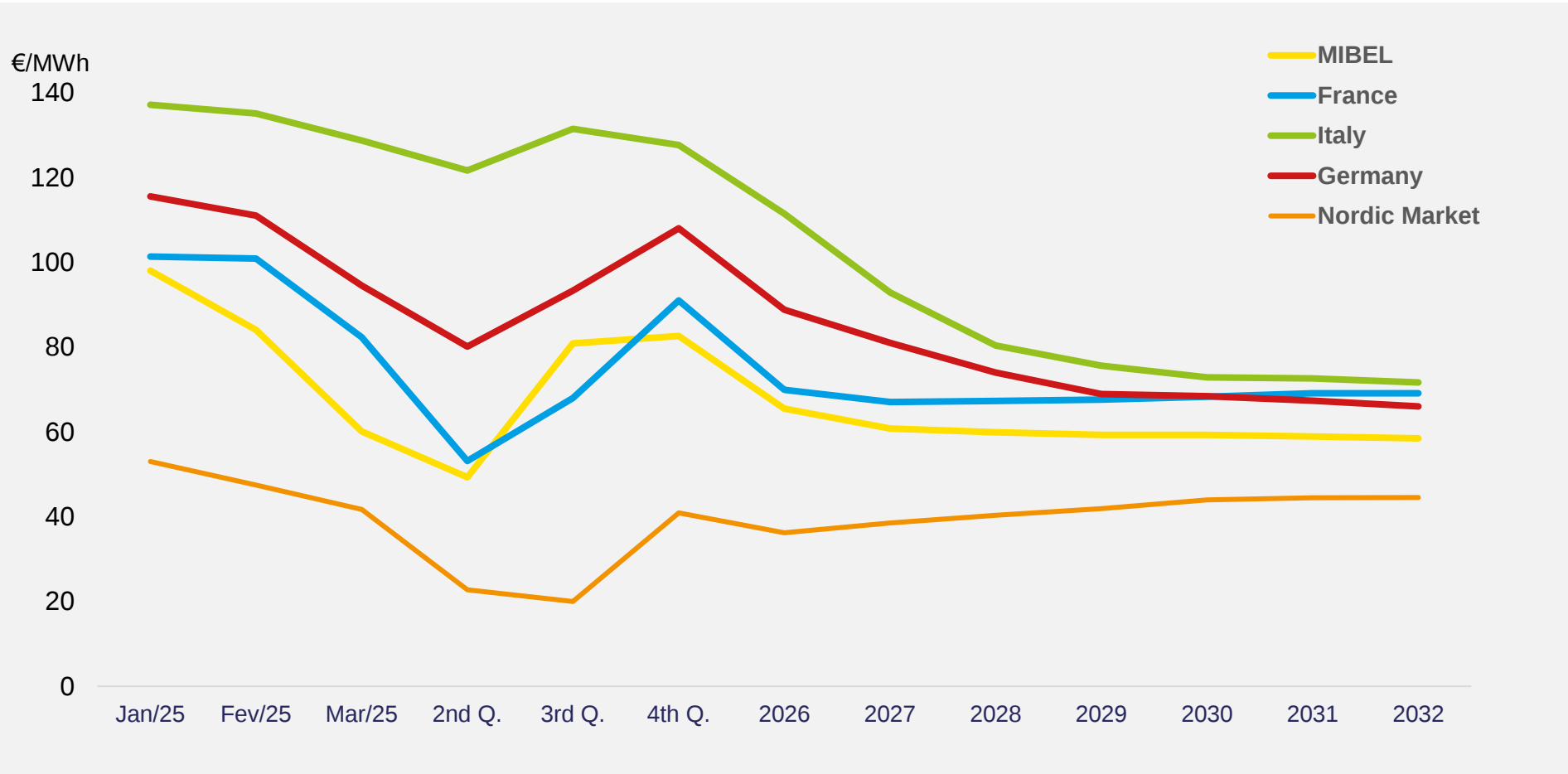


Source: ENTSO-E, OMIE, APREN Analysis
Disclaimer: due to changes in the ENTSO-e reporting format, the price values have been changed to those of the bidding zones, where applicable. In this edition, only bidding zones with interconnections with other countries have been considered.

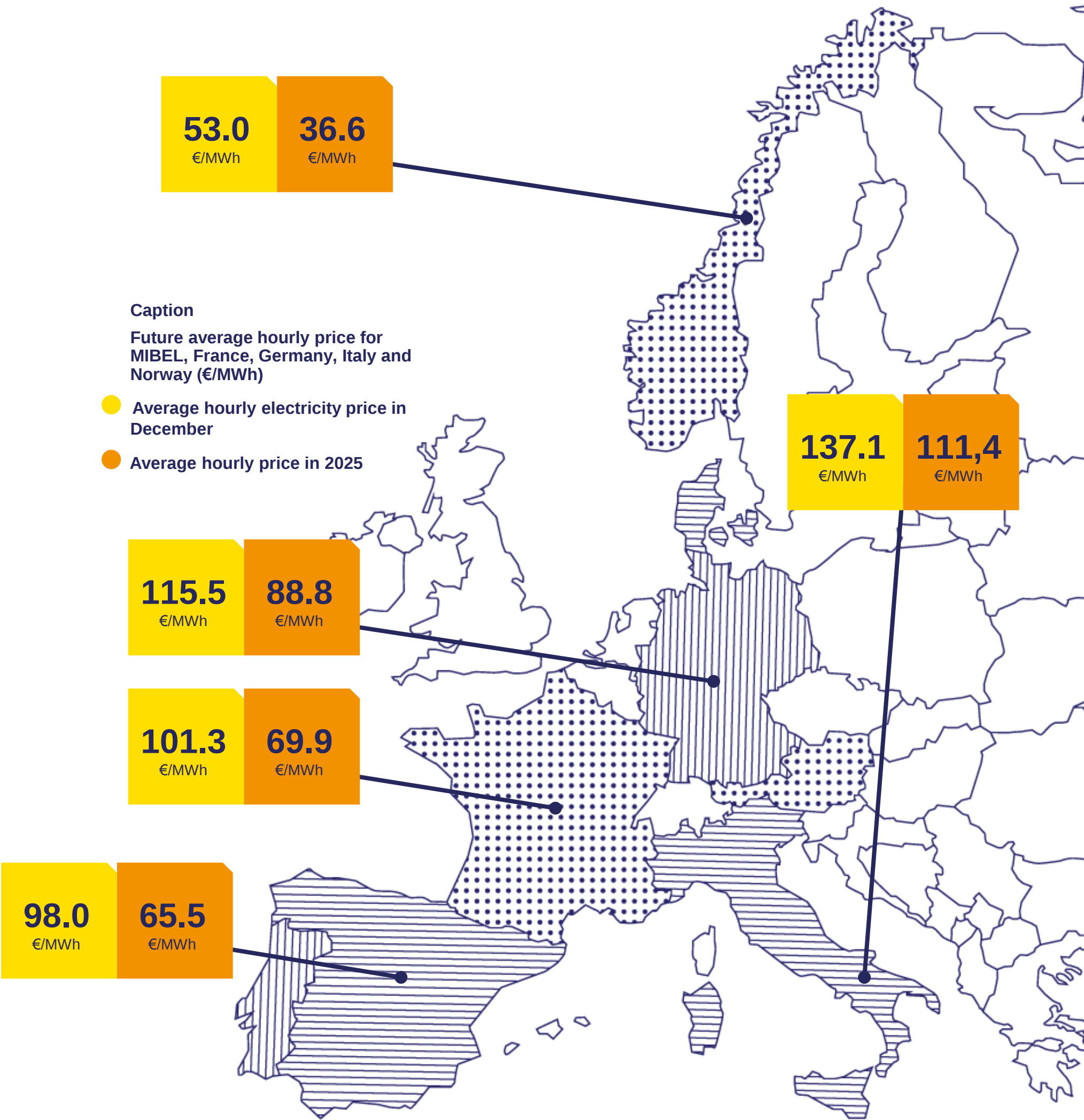
ELECTRICITY MARKET FUTURES

The evolution of the average hourly future price shown is calculated on the basis of electricity purchase and sale contracts. The map on the right shows the price values for next month (December) and next year. For next month, MIBEL is the second market with the lowest values, while for next year it is the Nordic Market that has the lowest values.

MIBEL has the second lowest values until 2034, due to investment in renewable production.



^eValues updated as of 6th of December.
Source: OMIP, EEX, APREN Analysis



INTERNATIONAL EXCHANGES

EUROPE

Between 1 January and 31 December 2024, mainland Portugal's electricity system registered electricity imports equivalent to 14,943 GWh and exports of 4,501 GWh, with Portugal being an importer with a balance of 10,442 GWh.

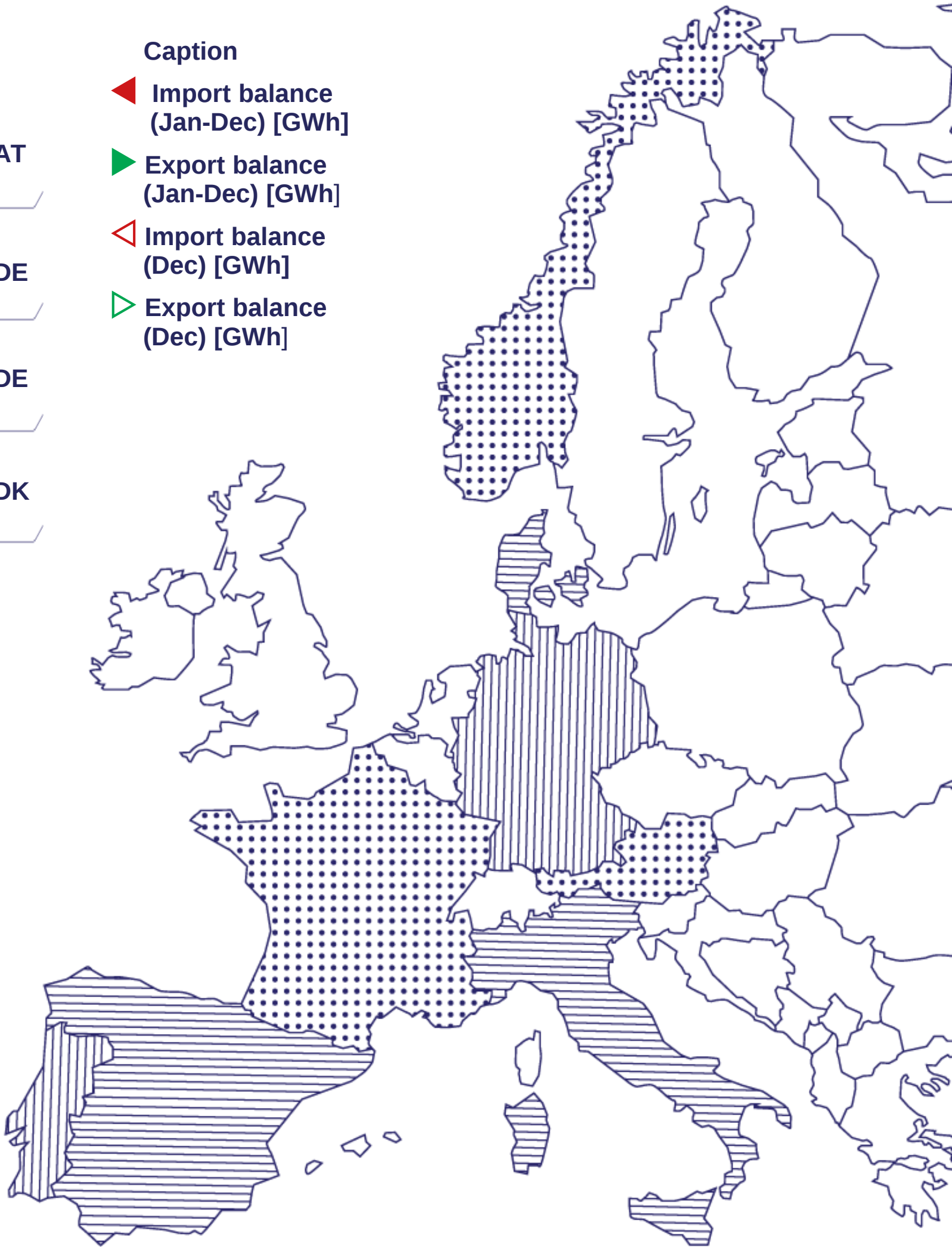
PT	10,442	1,499	ES	DE	2,392	689	AT
ES	2,534	253	MA	DK	7,431	684	DE
FR	1,894	900	ES	NO	5,778	616	DE
IT	19,843	1,766	FR	NO	6,466	690	DK
DE	19,774	1,517	FR				

Caption

- Import balance (Jan-Dec) [GWh]
- Export balance (Jan-Dec) [GWh]
- Import balance (Dec) [GWh]
- Export balance (Dec) [GWh]

MAIN INDICATORS FOR PT-ES INTERCONNECTION

usage	23,3% (dec)	36.3% (jan-dec)	53.9% (dec)	49.5% (jan-dec)
congestion	0.0% (dec)	5.6% (jan-dec)	3.1% (dec)	7.8% (jan-dec)
market separation	3.1% (dec)	6.8% (jan-dec)	72.7% (dec)	73.7% (jan-dec)



Source: ENTSO-E, OMIE, APREN Analysis
Disclaimer: due to changes in the ENTSO-e reporting format, the crossborder flow values have been changed to those of the bidding zones, where applicable. In this edition, only bidding zones with interconnections with other countries have been considered

POWER PRODUCTION EMISSIONS

Between 1 January and 31 December 2024, specific emissions reached 39.8 gCO₂eq/kWh, giving total emissions from the electricity generation sector of 1.82 MtCO₂eq. The European CO₂ Emissions Trading Scheme (ETS) recorded a price of 65.2 €/tCO₂^d, a reduction of 50 per cent compared to the same period in 2023.

1.82
MtCO₂eq

SECTOR'S EMISSIONS

65.2
€/tCO₂

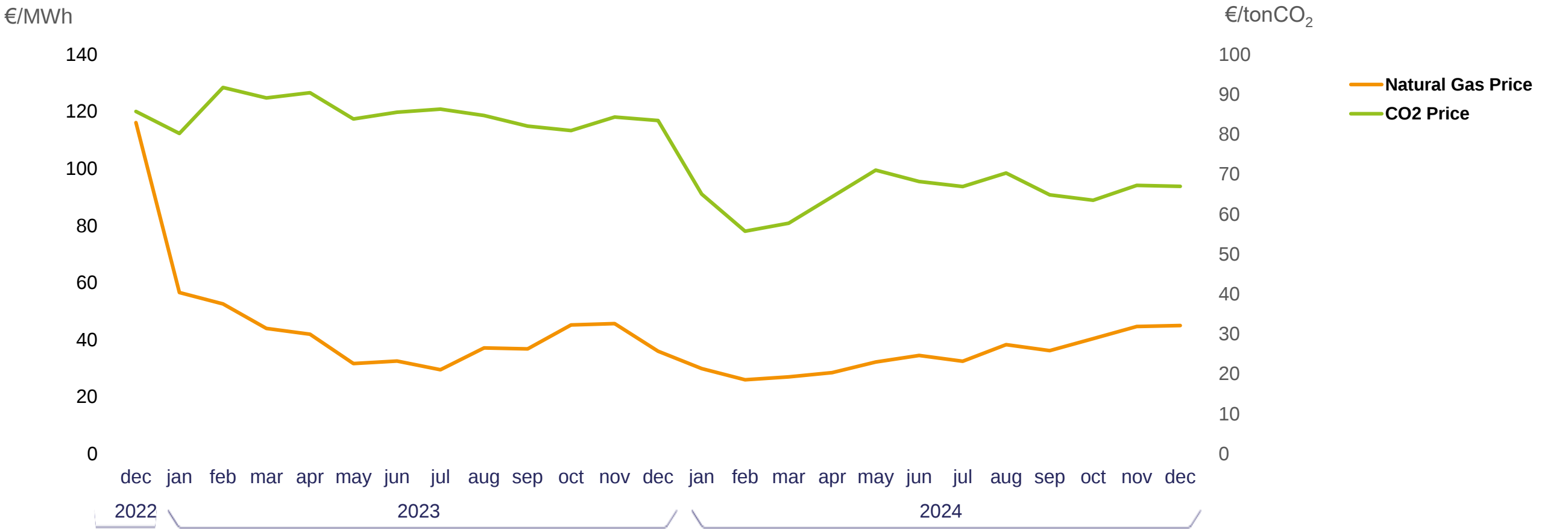
AVERAGE PRICE OF LICENCES

50
%

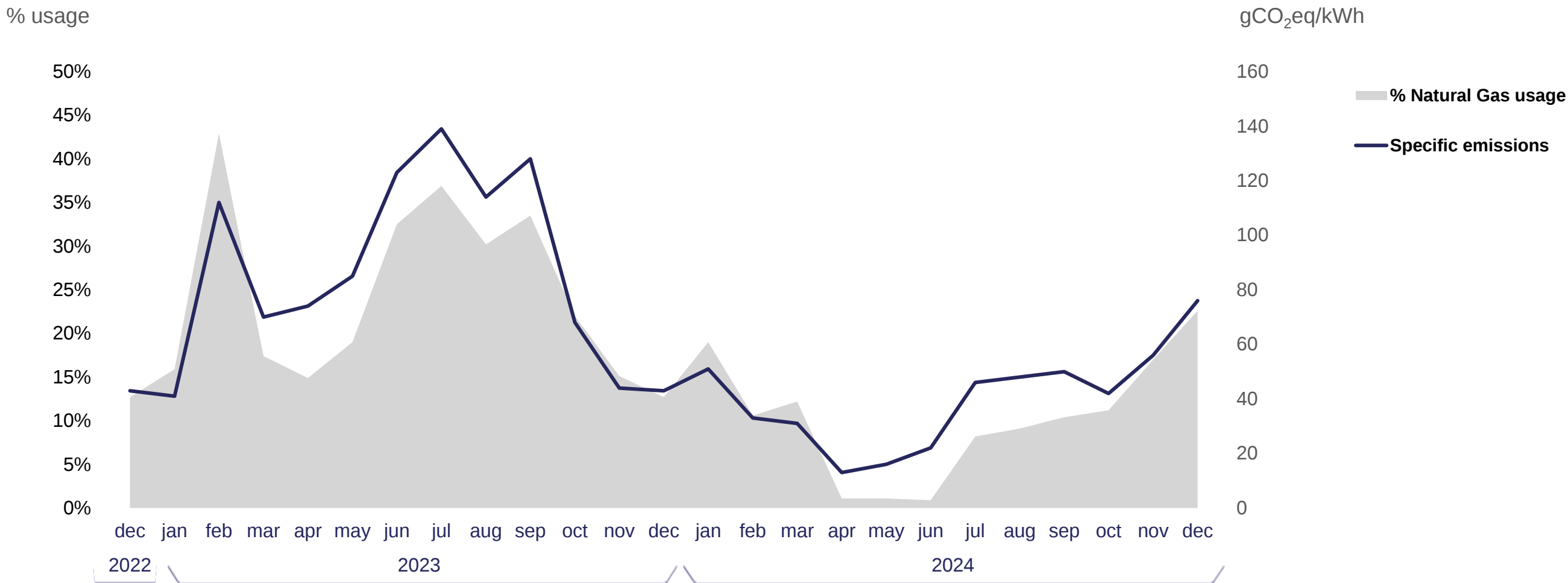
COMPARED TO DECEMBER 2023 [ACCUMULATED]

23.5
%

COMPARED TO DECEMBER 2023 [ACCUMULATED]



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



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

^d arithmetic average of hourly prices
Source: OMIE, WorldBank.

SIMULATION OF PRICE FORMATION WITHOUT SRP

RENEWABLES AVOIDED:

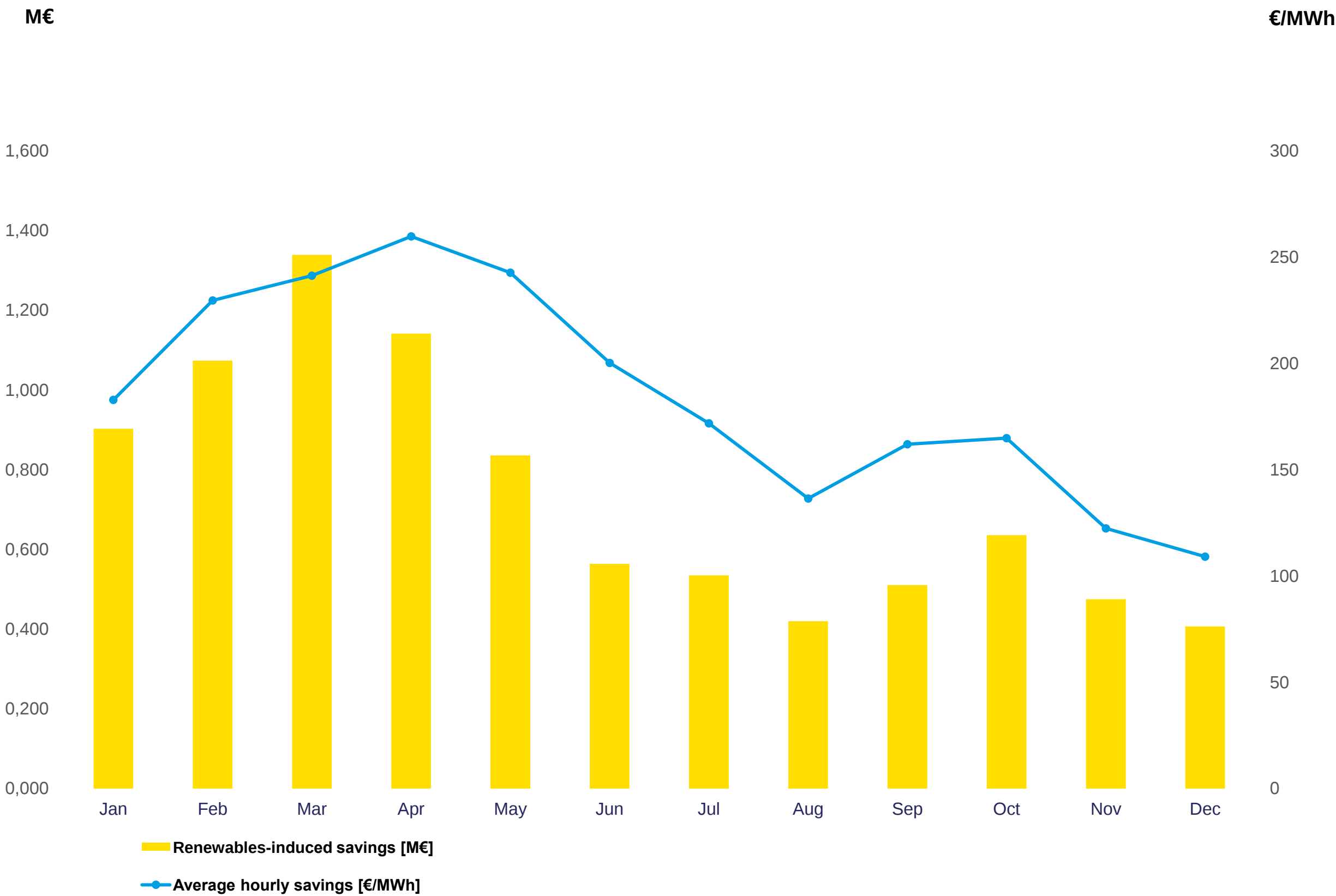
The indicators below identify the savings achieved by the merit order between 1 January and 31 December 2024 by the contribution of special regime production (PRE). This study is carried out for PRE, which includes all installed fossil cogeneration power. Bearing in mind that the capacity equivalent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

185.3
€/MWh

AVERAGE HOURLY SAVINGS
(Jan-Oct*)

8,844
M€

CUMULATIVE SAVINGS
(Jan-Oct*)

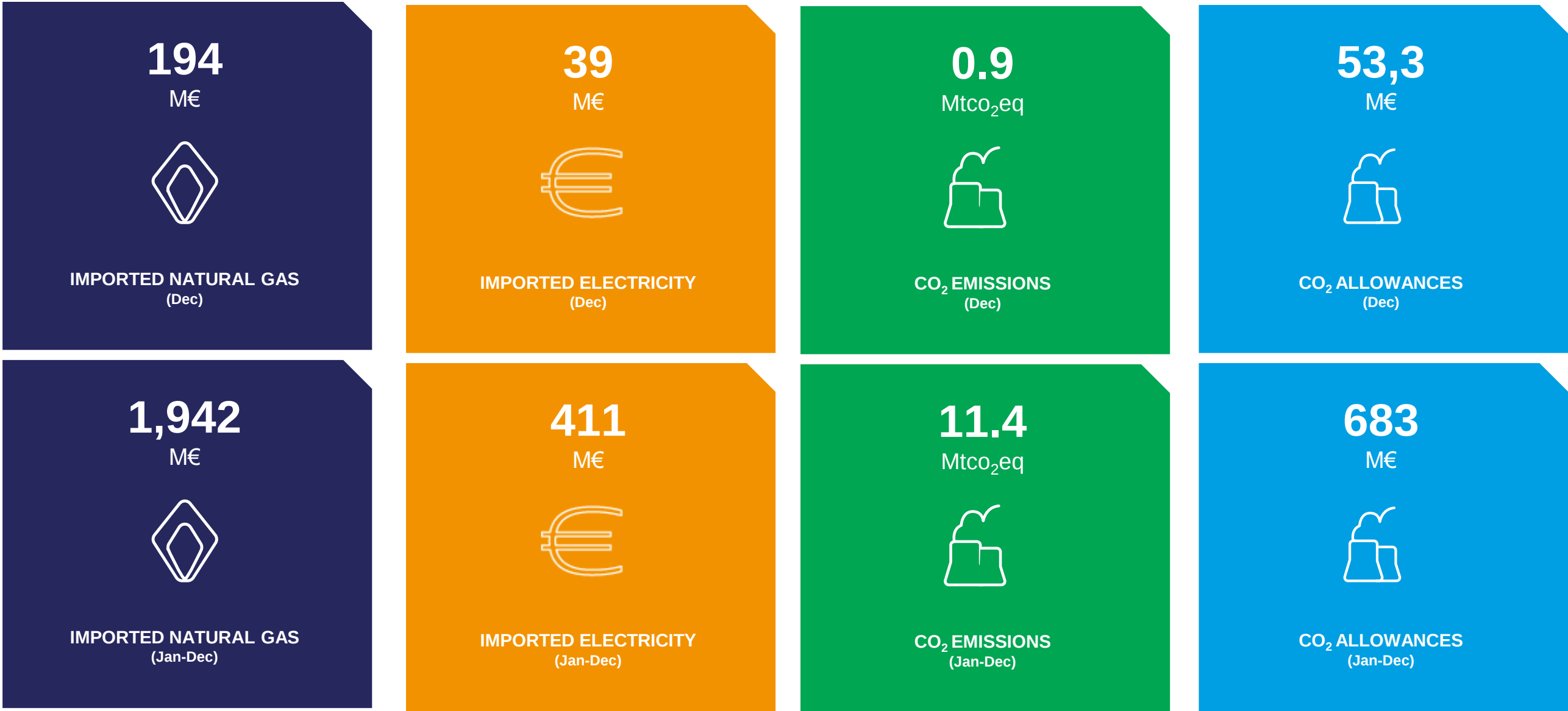


Disclaimer: This analysis is carried out using a program developed by APREN, based on the Deloitte calculation method.

ENVIRONMENTAL SERVICE

RENEWABLES AVOIDED:

The indicators below identify the savings achieved between 1 January and 31 December 2024 in natural gas, CO₂ emissions and CO2 emission allowances, as a result of 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: OMIE, APREN Analysis.

20
24

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