

2024

RENEWABLE ELECTRICITY BULLETIN

NOVEMBER
2024

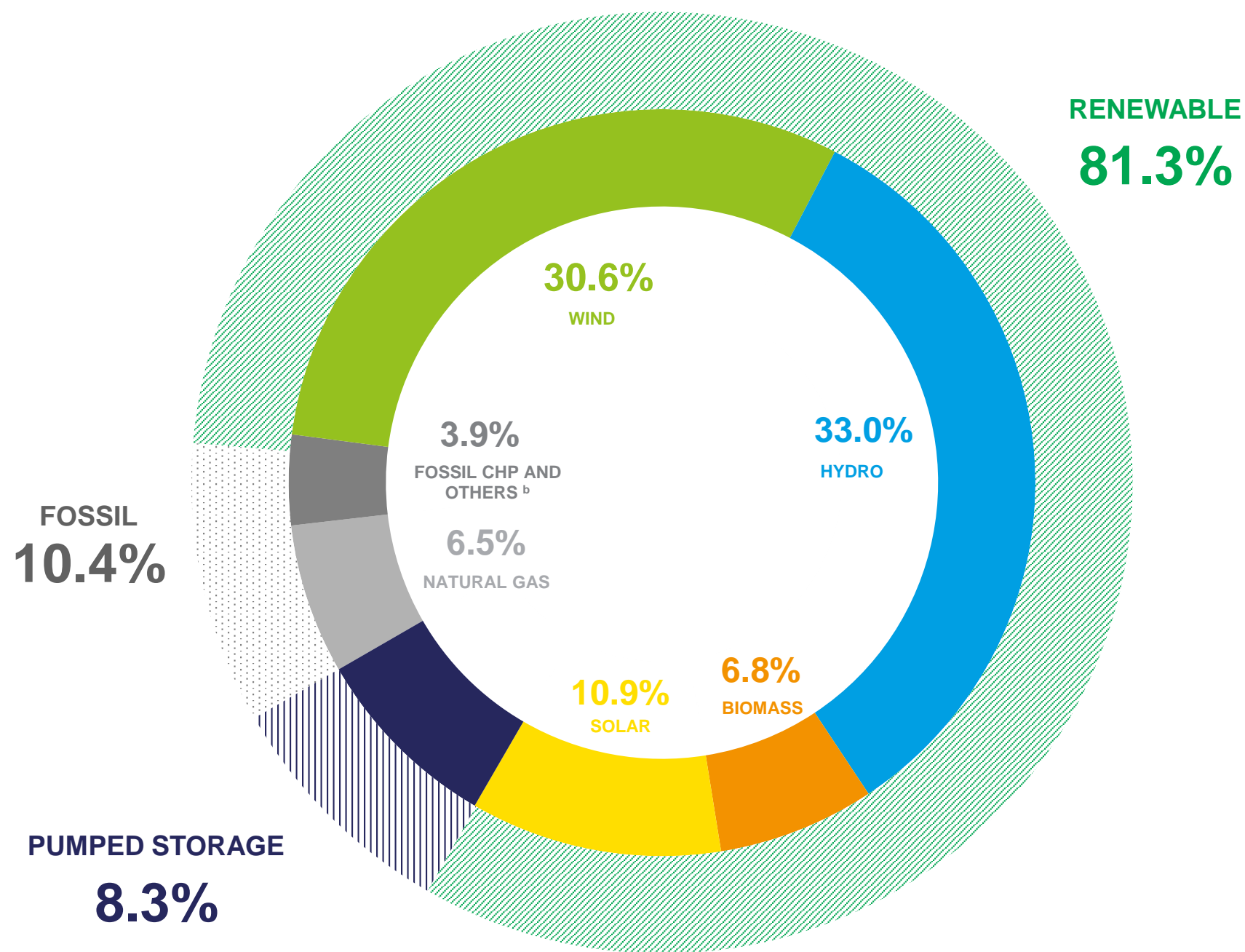
PORTUGAL NEEDS
OUR ENERGY



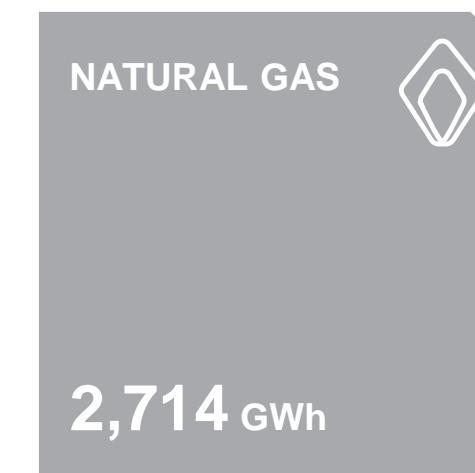
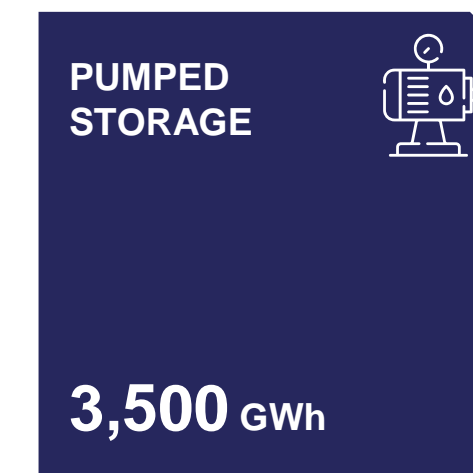
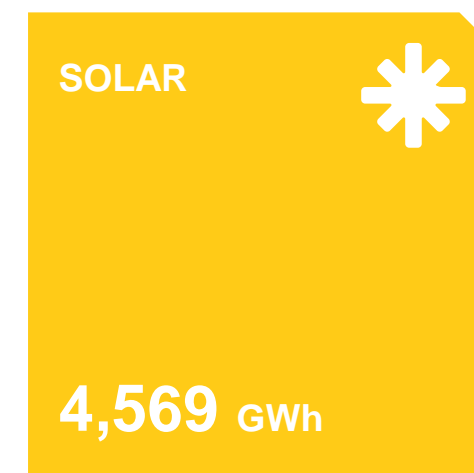
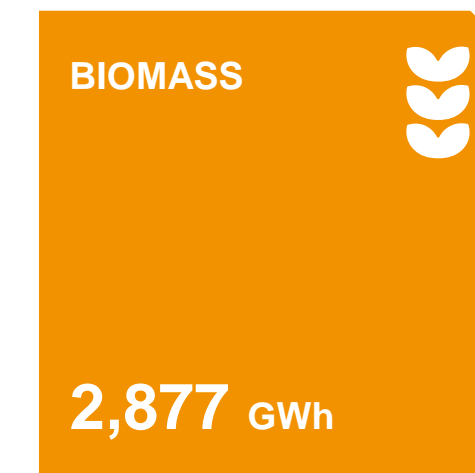
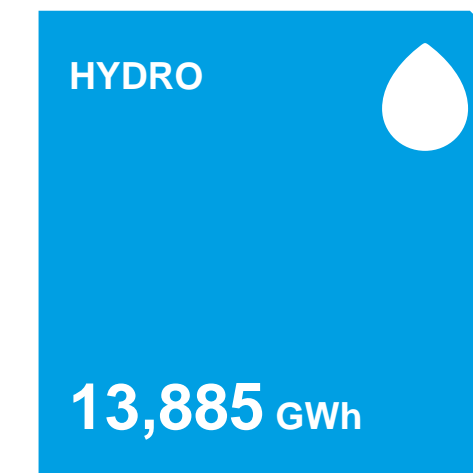
APREN Associação
de Energias
Renováveis

EXECUTIVE SUMMARY

GENERATION (JAN-NOV)



RENEWABLE
81.3%



MAIN INDICATORS (JAN-NOV)

GWh
42,065
Generation^a

€/ MWh
59.0
MIBEL PT Price

€/ tCO₂
65.0
CO₂ Price

MtCO₂ - eq
1.5
CO₂ Emissions

GWh
8,943
Import Balance

gCO₂ eq/kWh
36.7
CO₂ Specific Emissions

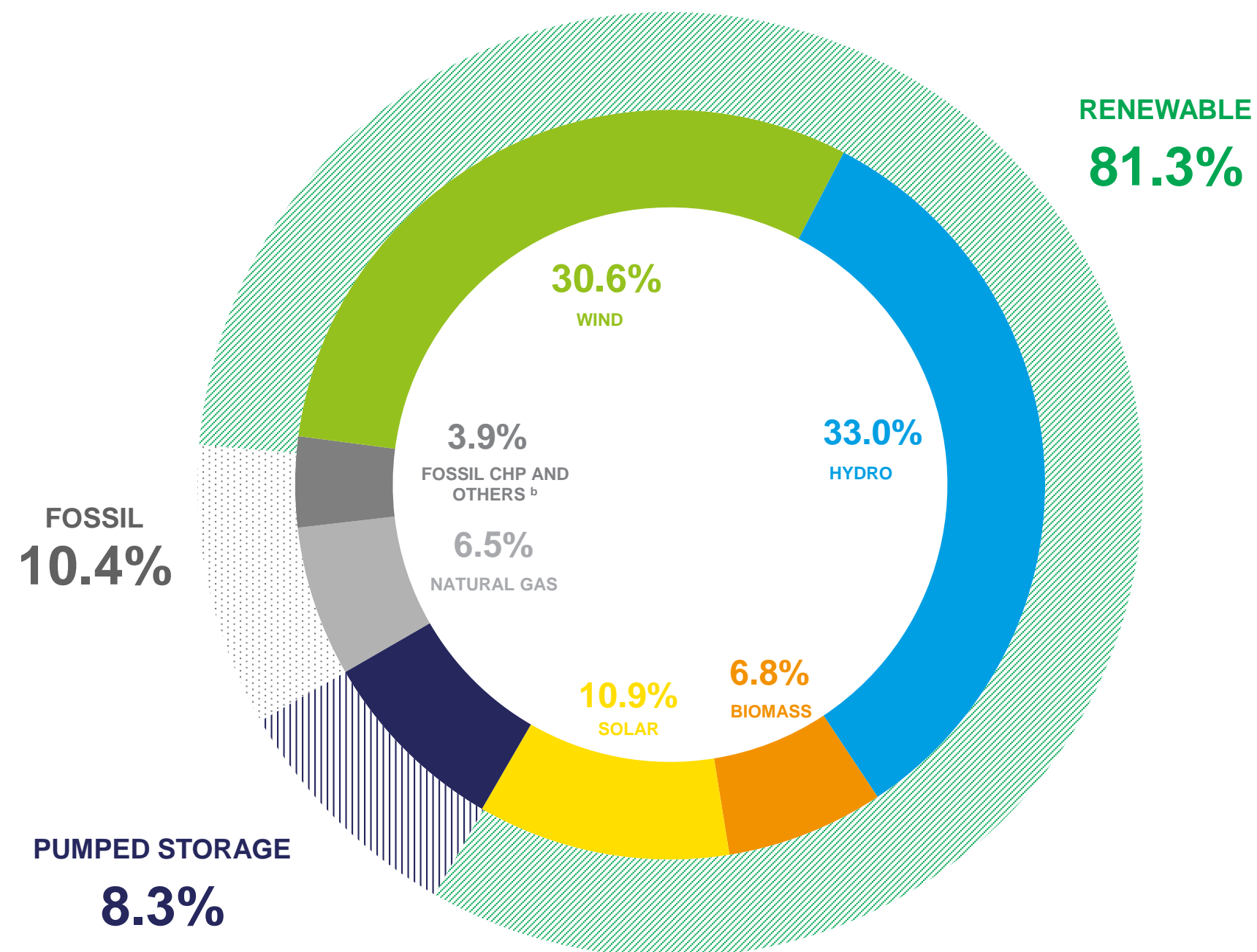
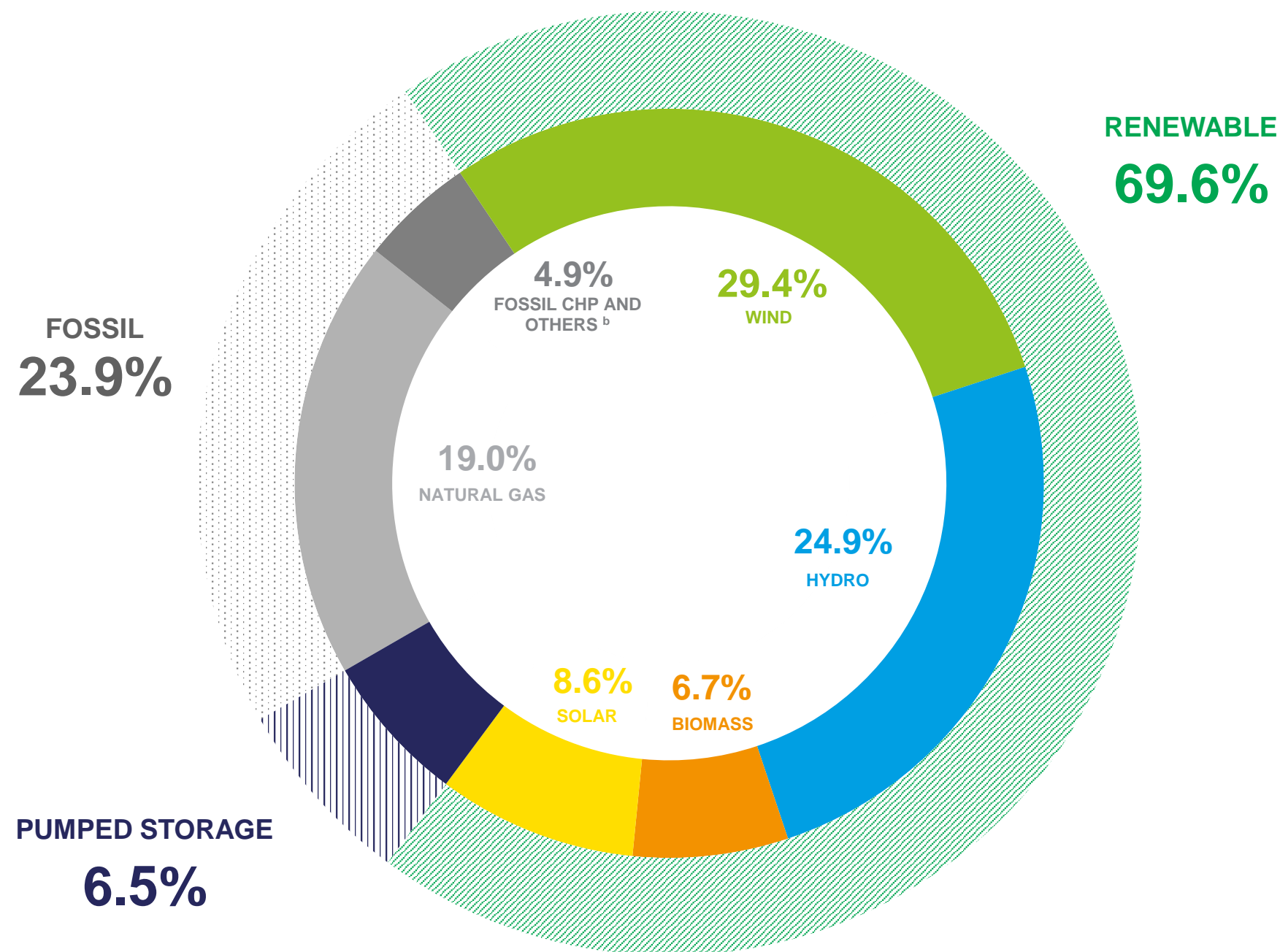
^a Generation refers to the net energy generation of the power stations, taking into account the pumping production recently disclosed by REN. Production from pumping is not included in the percentage of production from renewable sources

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

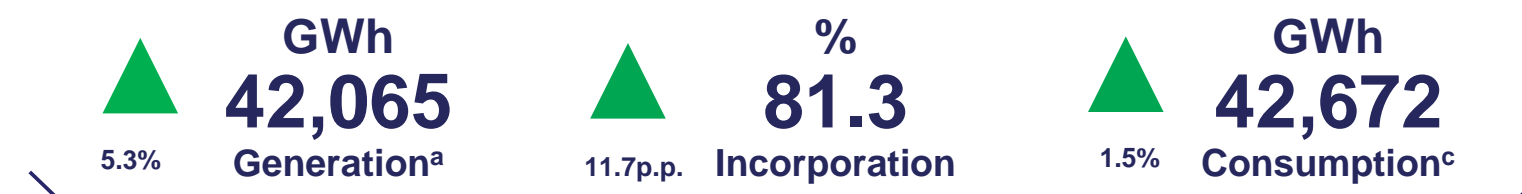
EXECUTIVE SUMMARY

NOVEMBER ACCUMULATED GENERATION 2023

NOVEMBER ACCUMULATED GENERATION 2024



MAIN INDICATORS COMPARED TO NOVEMBER 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

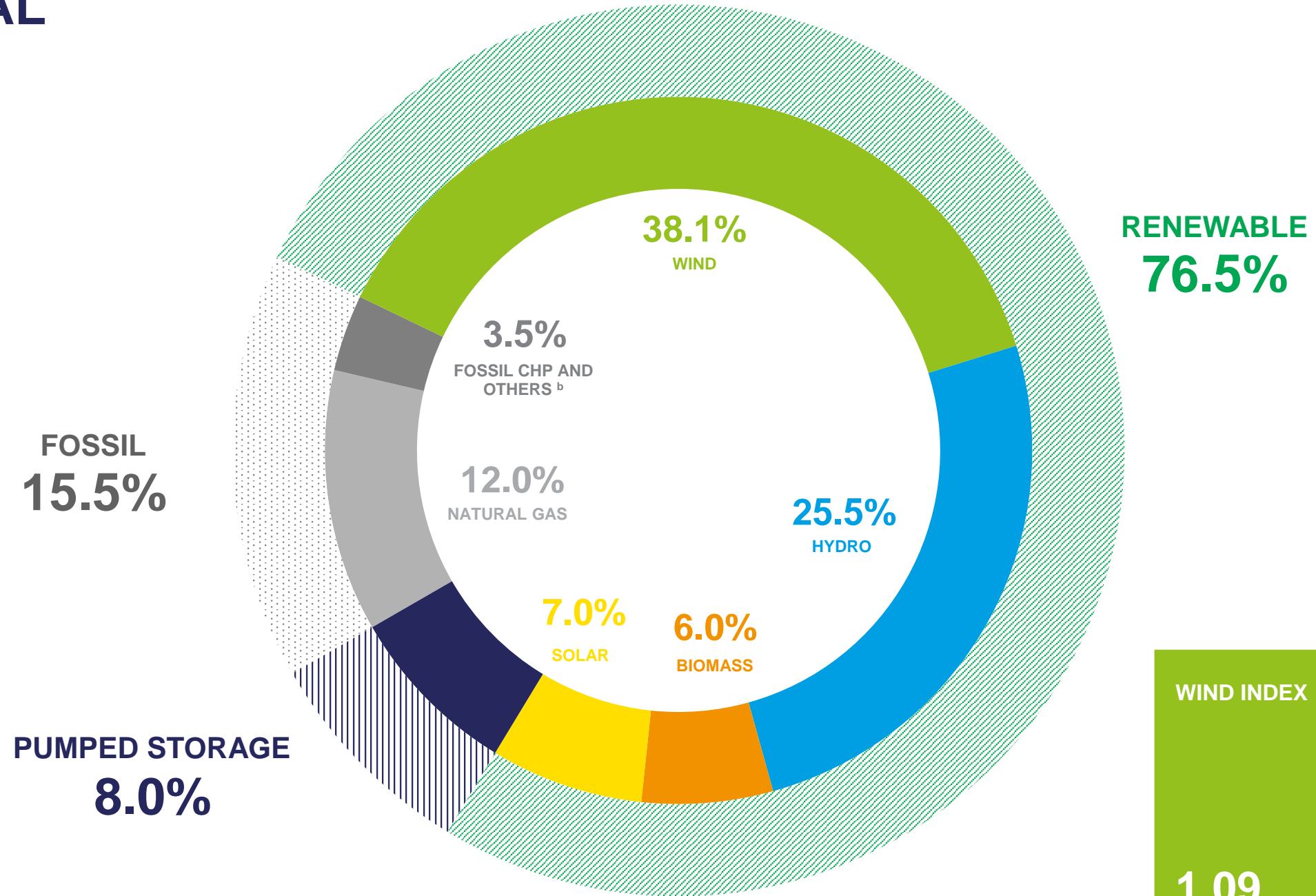
MONTHLY ANALYSIS IN PORTUGAL

NOVEMBER

Between 1 and 30 of November 2024, renewable incorporation was 76.5%, making up 2,936 GWh of the 3,836 GWh produced in the month under review.

The amount of energy generated compared to November 2023 is lower, mainly due to a reduction in hydro production from 45.4% to 25.5%.

In November 2024, imports totalled 18.9% of electricity consumption in mainland Portugal.



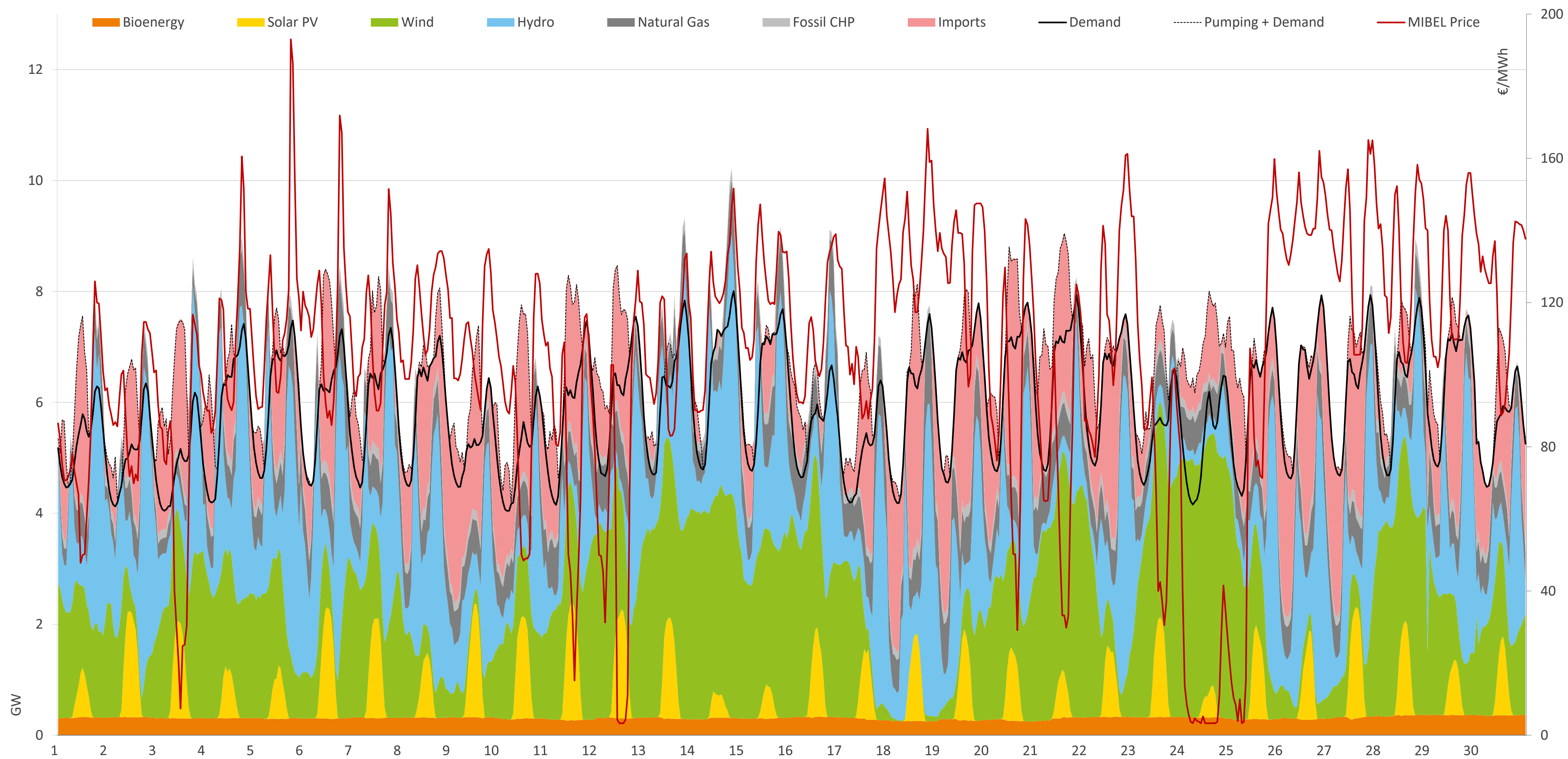
ELECTRICITY SECTOR'S INDICATORS (IN COMPARISON WITH NOVEMBER 2023)

<p>GWh</p> <p>3,836</p> <p>Generation^a</p> <p>▼ 18.0%</p>	<p>GWh</p> <p>4,252</p> <p>Consumption^c</p> <p>▼ 1.8%</p>	<p>%</p> <p>76.5</p> <p>Renewable incorporation</p> <p>▼ 6.8 p.p.</p>
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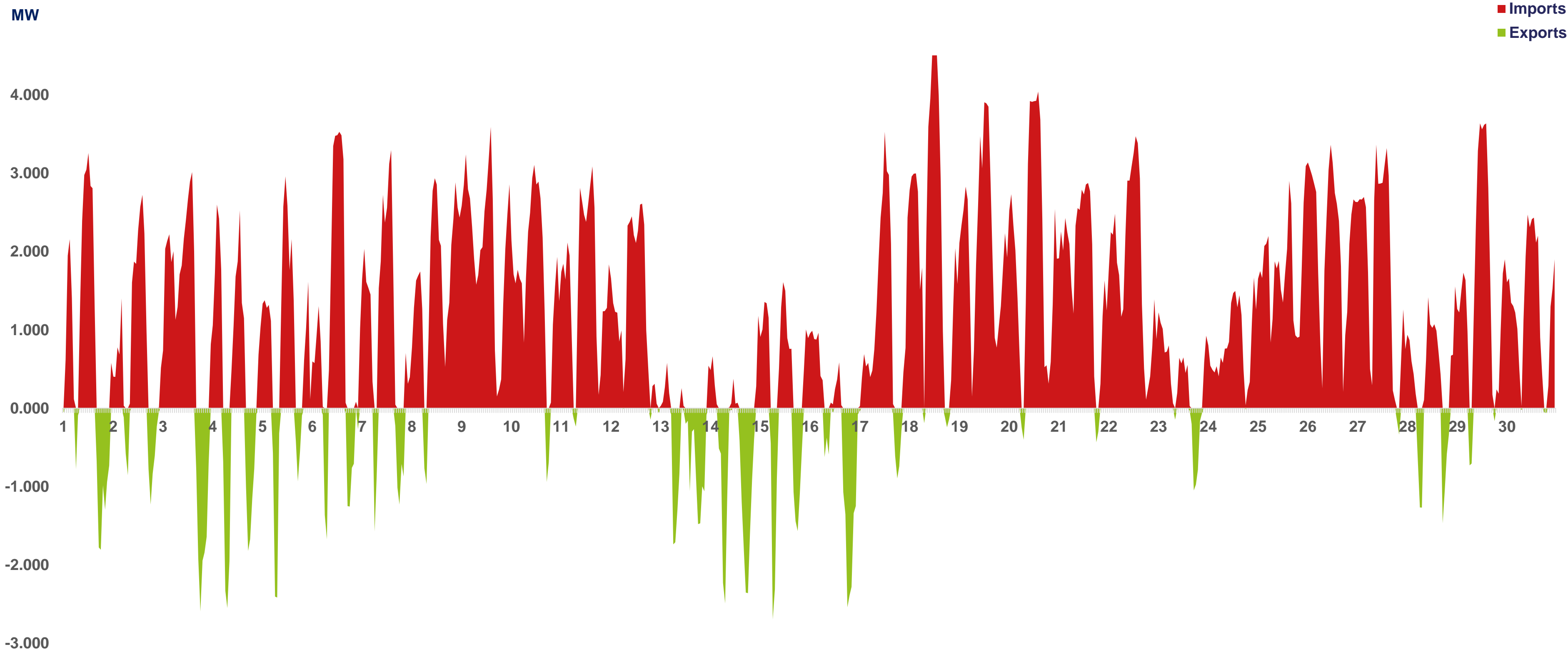
<p>WIND INDEX</p> <p>1.09</p>	<p>HYDRO INDEX</p> <p>0.72</p>
<p>SOLAR INDEX</p> <p>0.87</p>	<p>STORAGE IN DAMS</p> <p>59.0%</p>

^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: NOVEMBER 2024 LOAD DIAGRAM



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



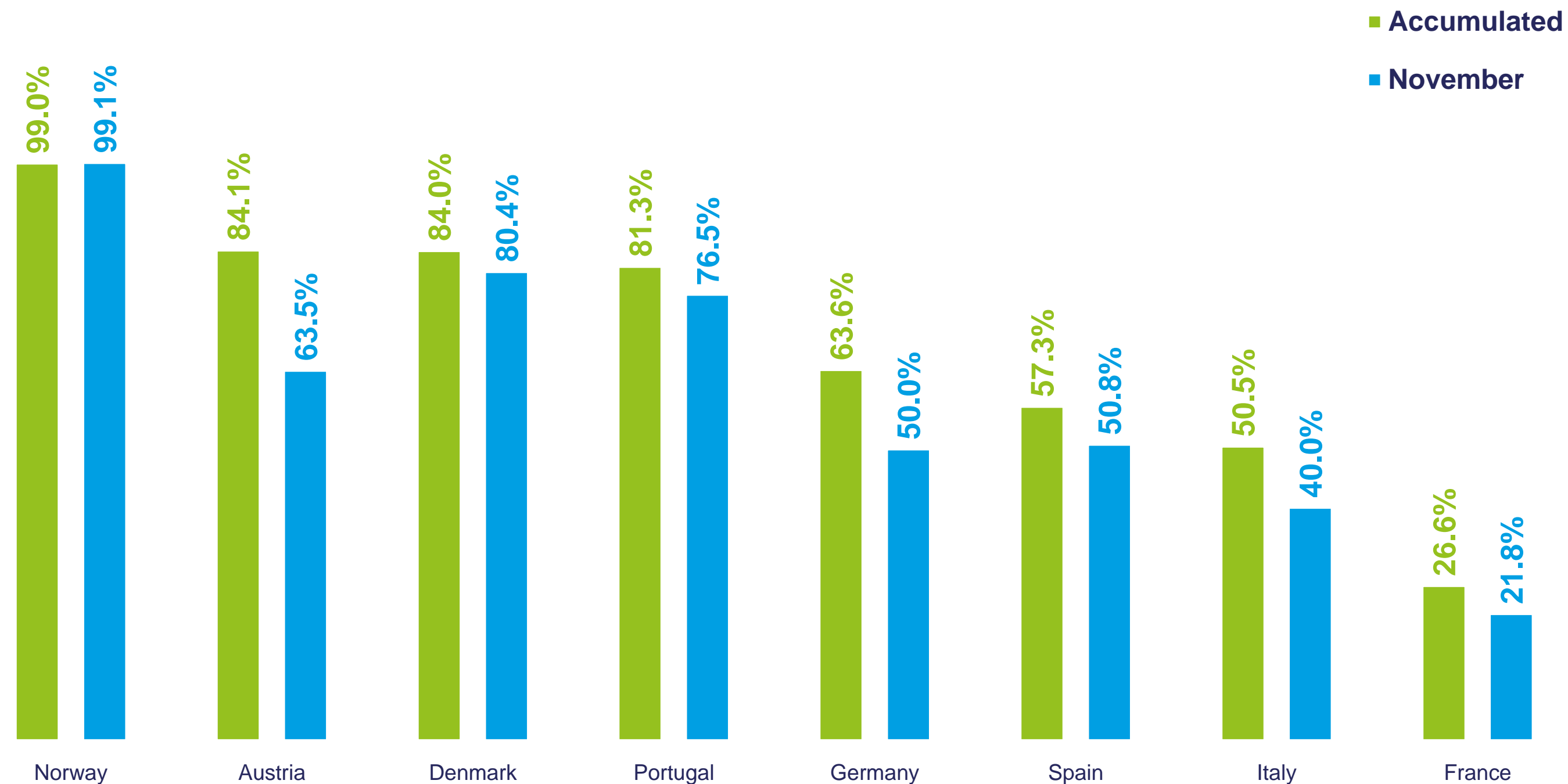
Source: REN, APREN Analysis

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 30 November 2024, Portugal was the fourth country with the highest share of renewable energy in electricity generation, with 81.3%, figuring behind Norway, Austria and Denmark, which respectively achieved 99.0%, 84.1% and 84.0%.

From 1 to 30 November, Portugal came fourth in the countries considered with the highest renewable incorporation in Europe, having reached 76.5%.



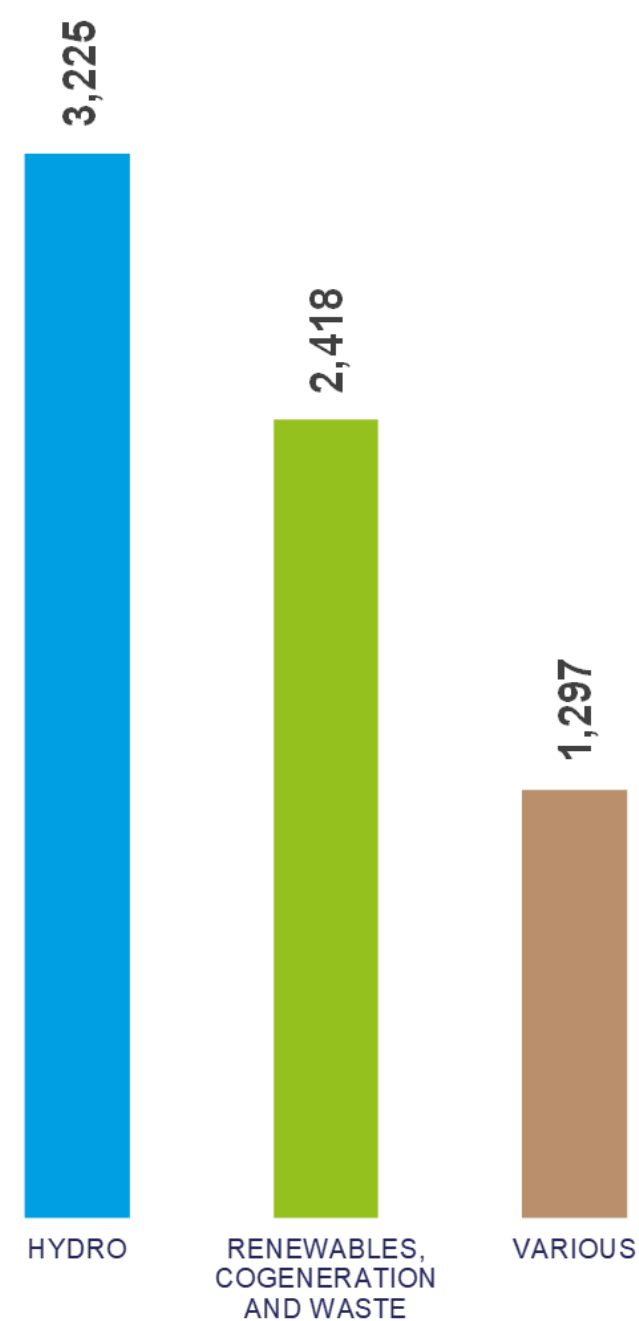
Renewable incorporation in cumulative (Jan-Nov) and monthly (Nov) electricity generation.
 Source: REN, Fraunhofer, REE, Terna, National Grid, ENTSO-E, APREN Analysis.

MARKET PRICE SETTING PORTUGAL

Between 1 January and 30 November, 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.

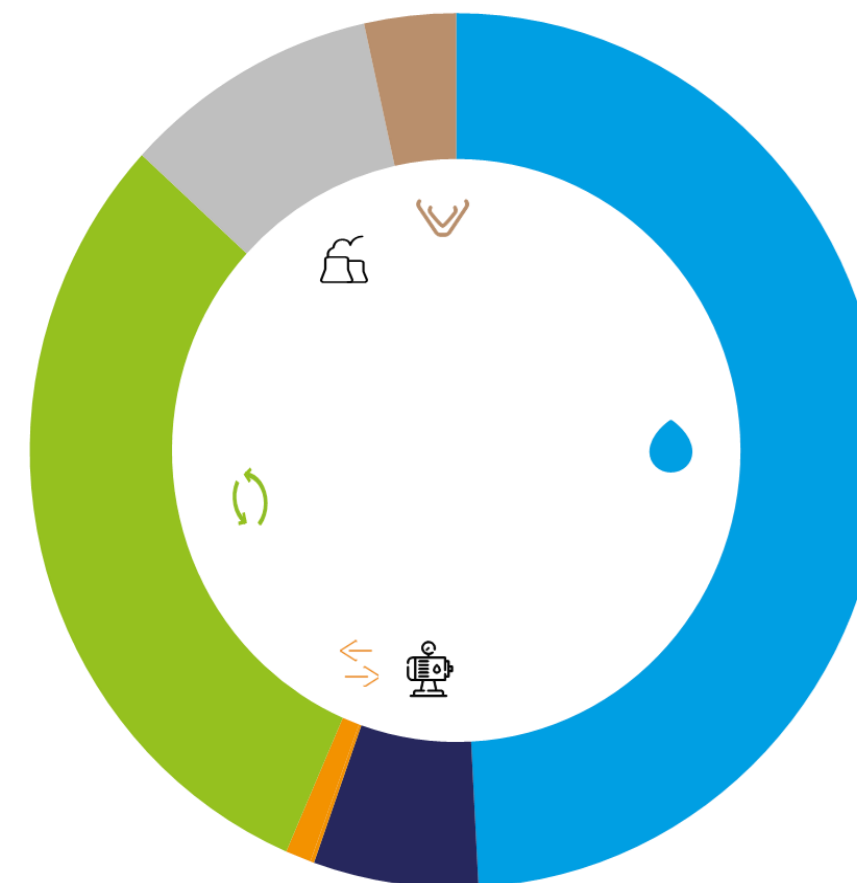


ACCUMULATED NOVEMBER 2024

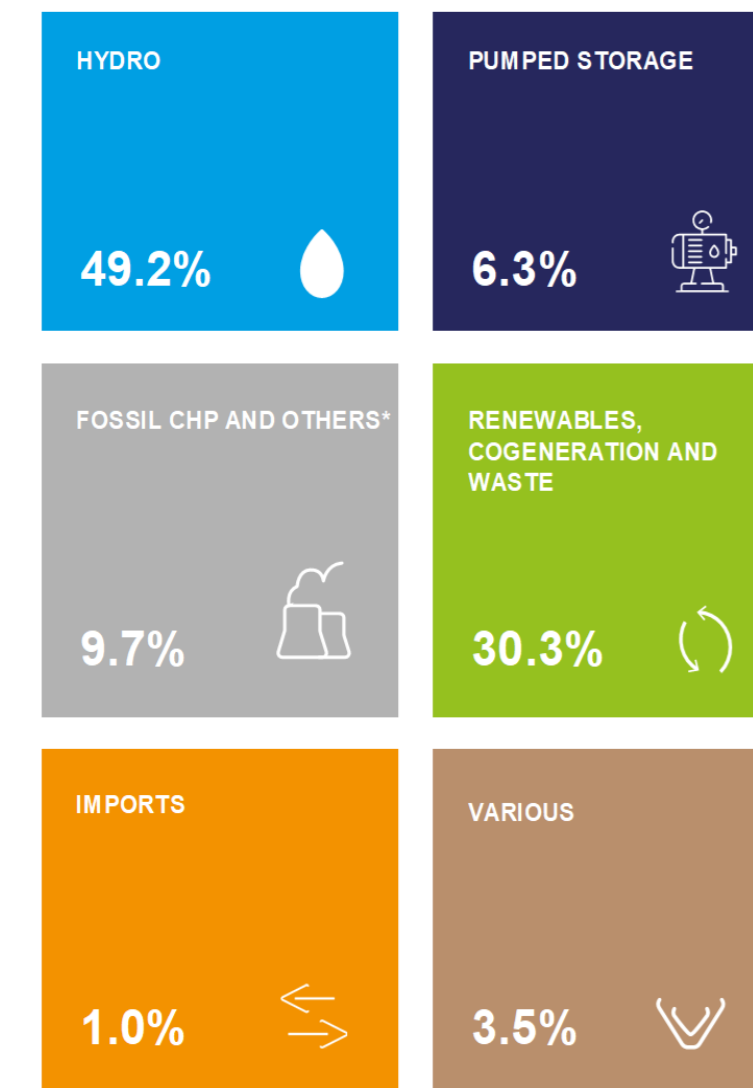


Number of market clearing hours (accumulated) for the three main closing technologies (Nov).
Source: OMIE, APREN Analysis

NOVEMBER 2024



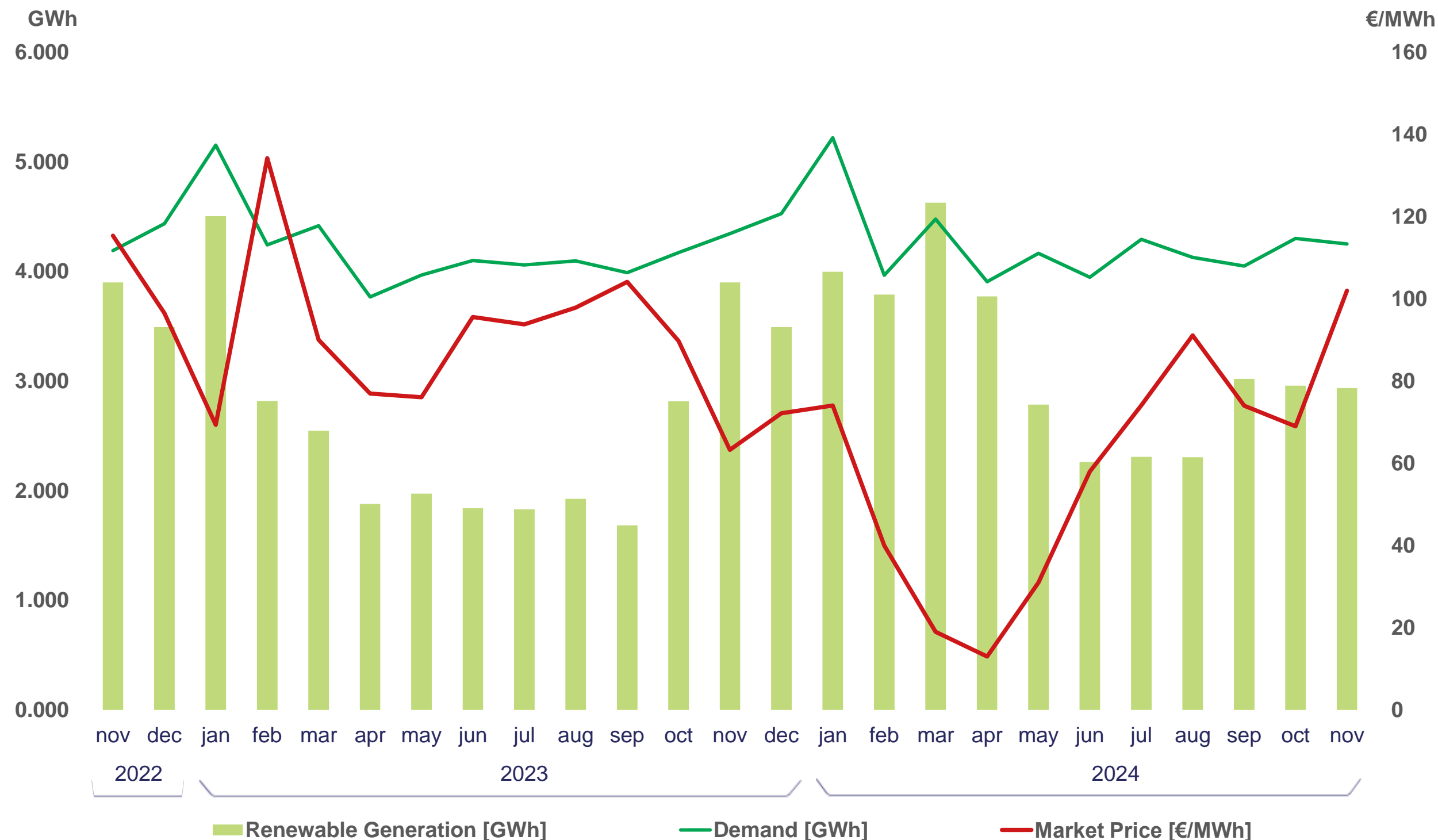
Percentage distribution of the number of hours of market clearing for the various technologies, totaling 720 hours (Nov).
Source: OMIE, APREN Analysis



ELECTRICITY MARKET PORTUGAL

Between 1 January and 30 November, the average hourly price recorded in MIBEL in Portugal (59.0 €/MWh^d) represents a 34% reduction compared to the same period last year. In the same period, there were 1,849 non-consecutive hours in which renewable generation was sufficient to supply mainland Portugal's electricity consumption, with an average hourly price in MIBEL of 47.9 €/MWh.

<p style="font-size: 24px; font-weight: bold;">1,849</p> <p>Hours</p> <p style="font-size: 12px; font-weight: bold;">100% RENEWABLE HOURS [Accumulated]</p>	<p style="font-size: 24px; font-weight: bold;">47.9</p> <p>€/MWh</p> <p style="font-size: 10px; font-weight: bold;">MIBEL'S AVERAGE PRICE (IN 100% RENEWABLE HOURS) [Accumulated]</p>
<p style="font-size: 24px; font-weight: bold;">100</p> <p>Hours</p> <p style="font-size: 12px; font-weight: bold;">100% RENEWABLE HOURS [November]</p>	<p style="font-size: 24px; font-weight: bold;">98.3</p> <p>€/MWh</p> <p style="font-size: 10px; font-weight: bold;">MIBEL'S AVERAGE PRICE (IN 100% RENEWABLE HOURS) [November]</p>



^d arithmetic average of MIBEL prices.
Source: OMIE

Electricity market analysis, renewable generation, consumption and market price (Nov-2022 a Nov-2024)
Source: OMIE, APREN analysis

RENEWABLE ELECTRICITY EUROPE

During the month of November 2024, there was a minimum hourly price in MIBEL in Portugal of 3.32€/MWh, where the market was cleared mainly by Renewables, Cogeneration and Waste. The maximum hourly price was 193.00 €/MWh, where the market was cleared by Hydro.

MINIMUM PRICES (NOV)

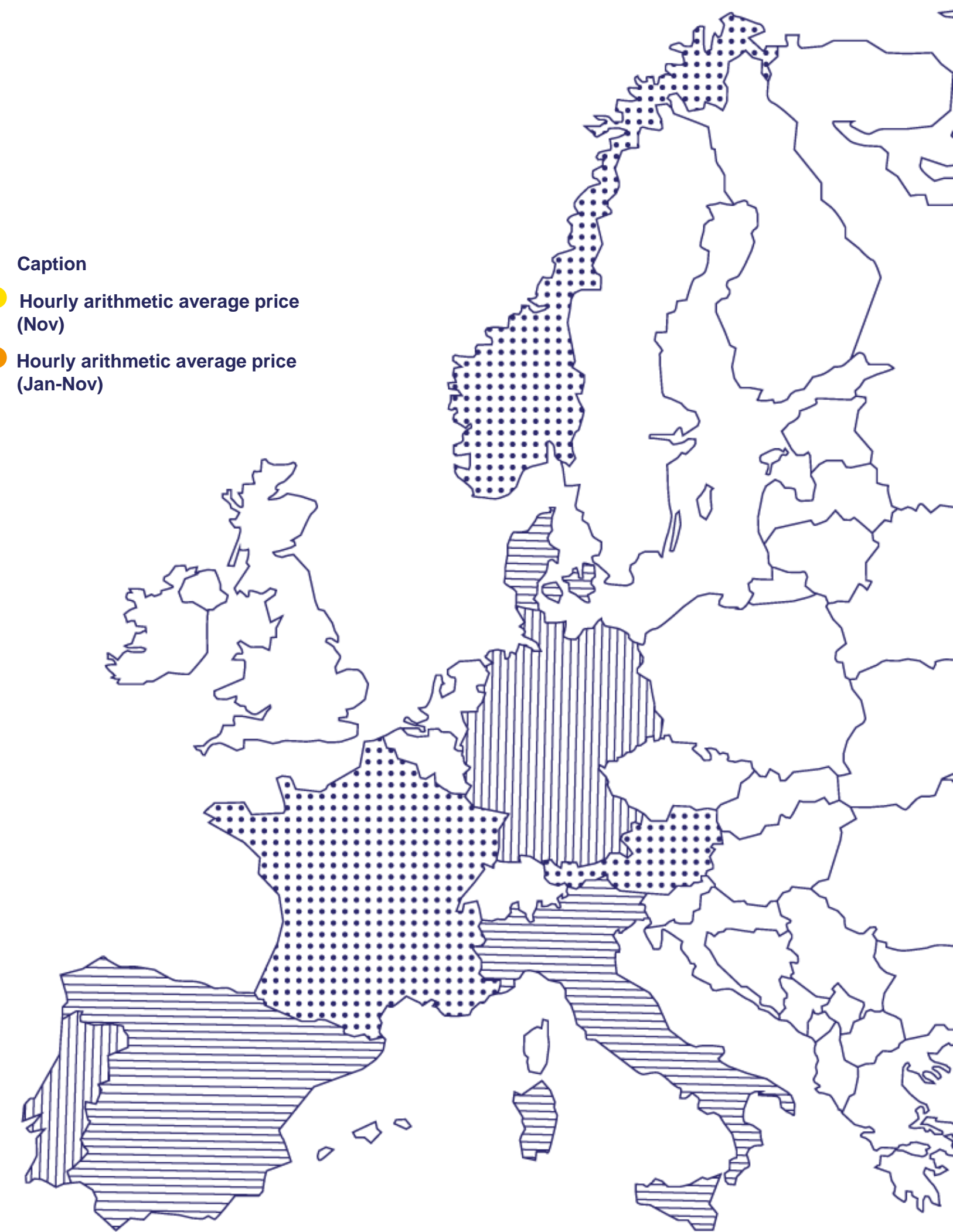
1 ^o	Germany	€/MWh	-1.86
2 ^o	France	€/MWh	2.79
3 ^o	Portugal Spain	€/MWh	3.32

MAXIMUM PRICES (NOV)

1 ^o	Germany	€/MWh	829.11
2 ^o	Austria	€/MWh	721.95
3 ^o	Spain Portugal France	€/MWh	193.00

Portugal €/MWh	101.9	59.0
Spain €/MWh	104.3	58.6
France €/MWh	100.5	54.3
Italy* €/MWh	-	-
Germany €/MWh	113.9	75.8
Austria €/MWh	130.8	77.1
Denmark* €/MWh	-	-
Norway* €/MWh	-	-

Caption
 ● Hourly arithmetic average price (Nov)
 ● Hourly arithmetic average price (Jan-Nov)

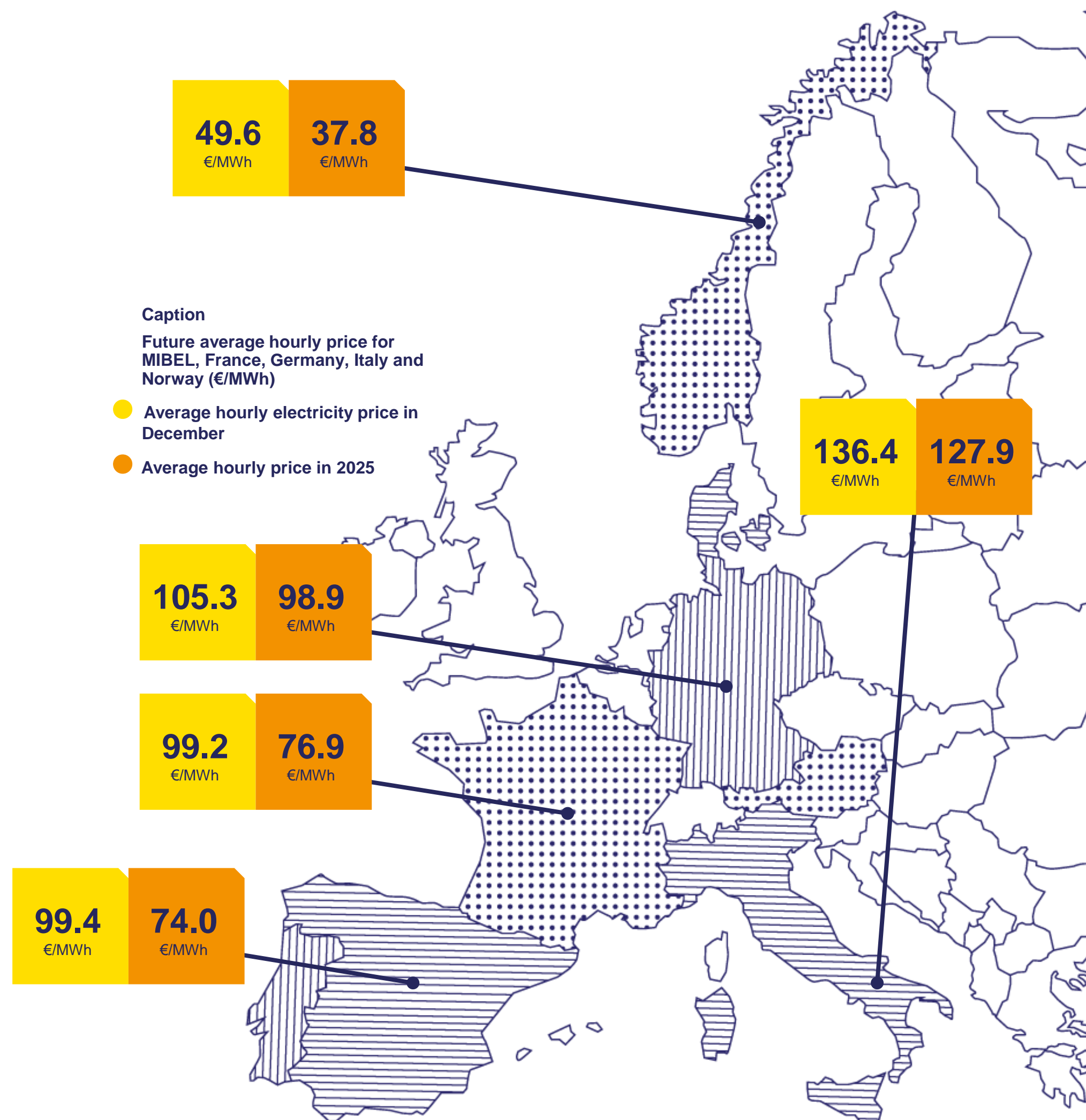
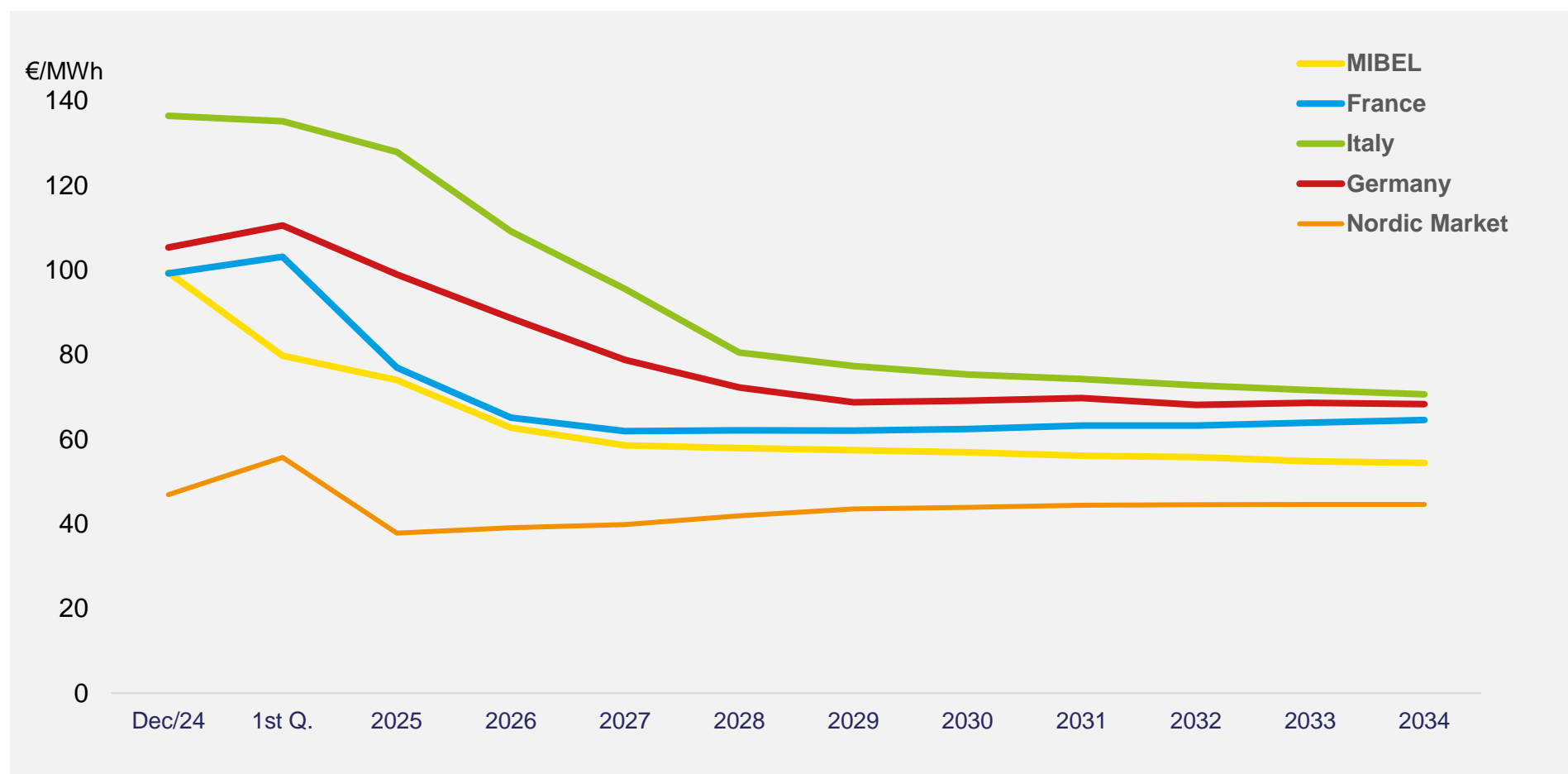


Source: ENTSO-E, OMIE, APREN Analysis
 * Given temporary constrains with the data sources used, it was impossible to present values in the current version of the Bulletin.

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.



Caption
 Future average hourly price for MIBEL, France, Germany, Italy and Norway (€/MWh)

- Average hourly electricity price in December
- Average hourly price in 2025

^eValues updated as of 2nd of December.
 Source: OMIP, EEX, APREN Analysis

INTERNATIONAL EXCHANGES EUROPE

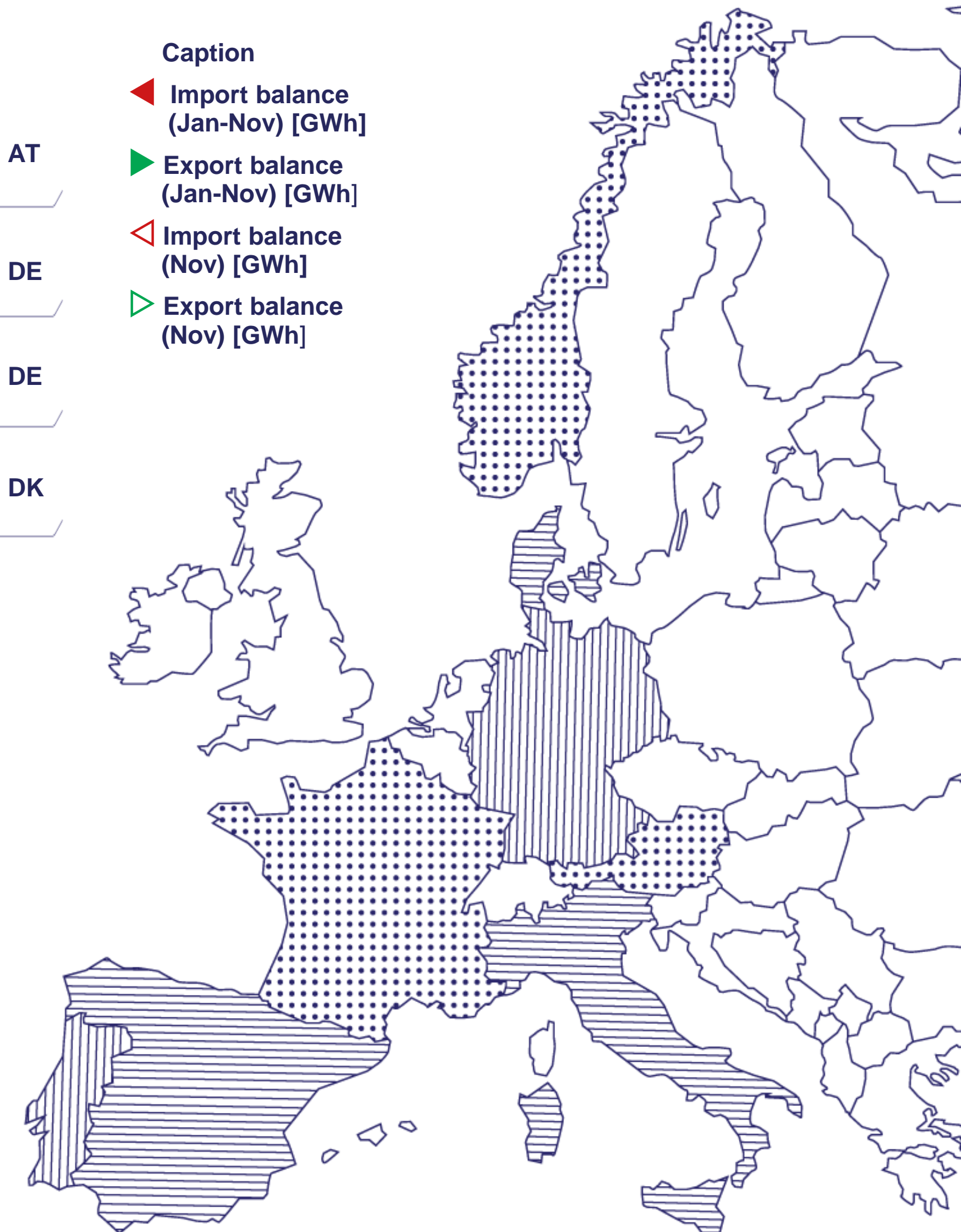
Between 1 January and 30 November 2024, mainland Portugal's electricity system registered electricity imports equivalent to 13,262 GWh and exports of 4,319 GWh, with Portugal being an importer with a balance of 8,943 GWh.

PT	8,943	802	ES	DE	1,325	686	AT
ES	2,555	264	MA	DK	6,477	847	DE
FR	2,793	661	ES	NO	5,144	587	DE
IT	18,039	1,662	FR	NO	5,771	724	DK
DE	18,243	1,760	FR				

Caption
 ▲ Import balance (Jan-Nov) [GWh]
 ▼ Export balance (Jan-Nov) [GWh]
 ▲ Import balance (Nov) [GWh]
 ▼ Export balance (Nov) [GWh]

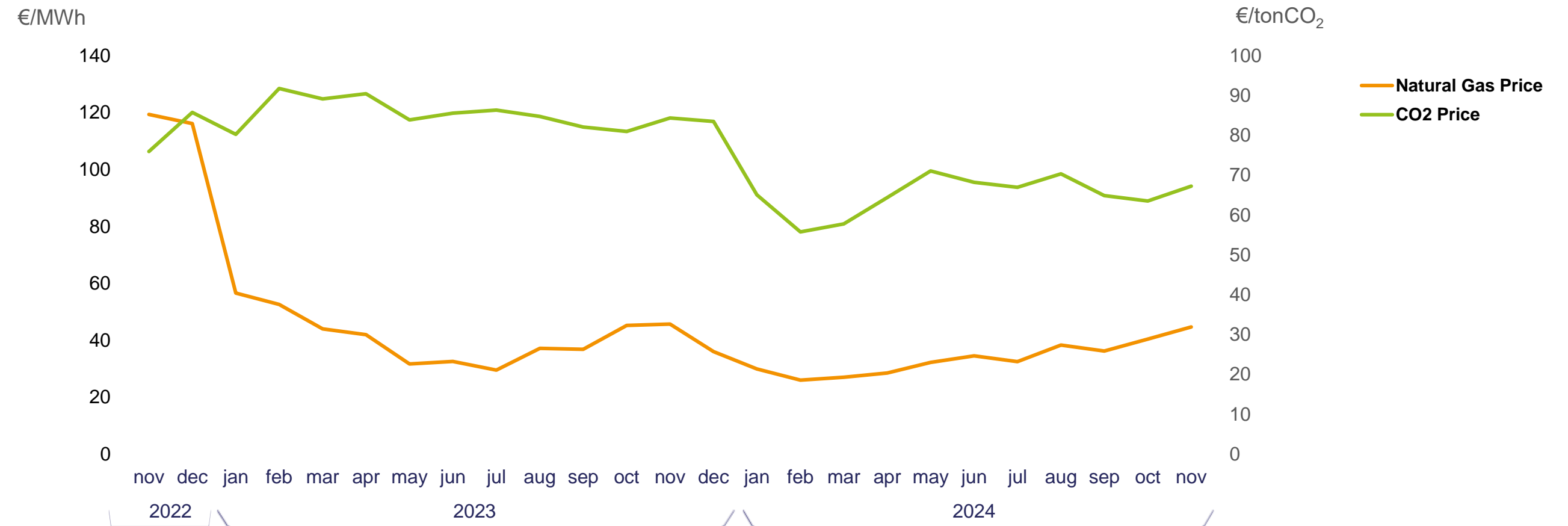
MAIN INDICATORS FOR PT-ES INTERCONNECTION

usage	7.9% (nov) PT-ES	10.3% (jan-nov)	33.4% (nov) ES-PT	39.3% (jan-nov)
congestion	0.4% (nov) PT-ES	1.4% (jan-nov)	1.5% (nov) ES-PT	5.7% (jan-nov)
market separation	1.9% (nov) PT-ES	6.5% (jan-nov)	55.4% (nov) MIBEL-FR	67.0% (jan-nov)



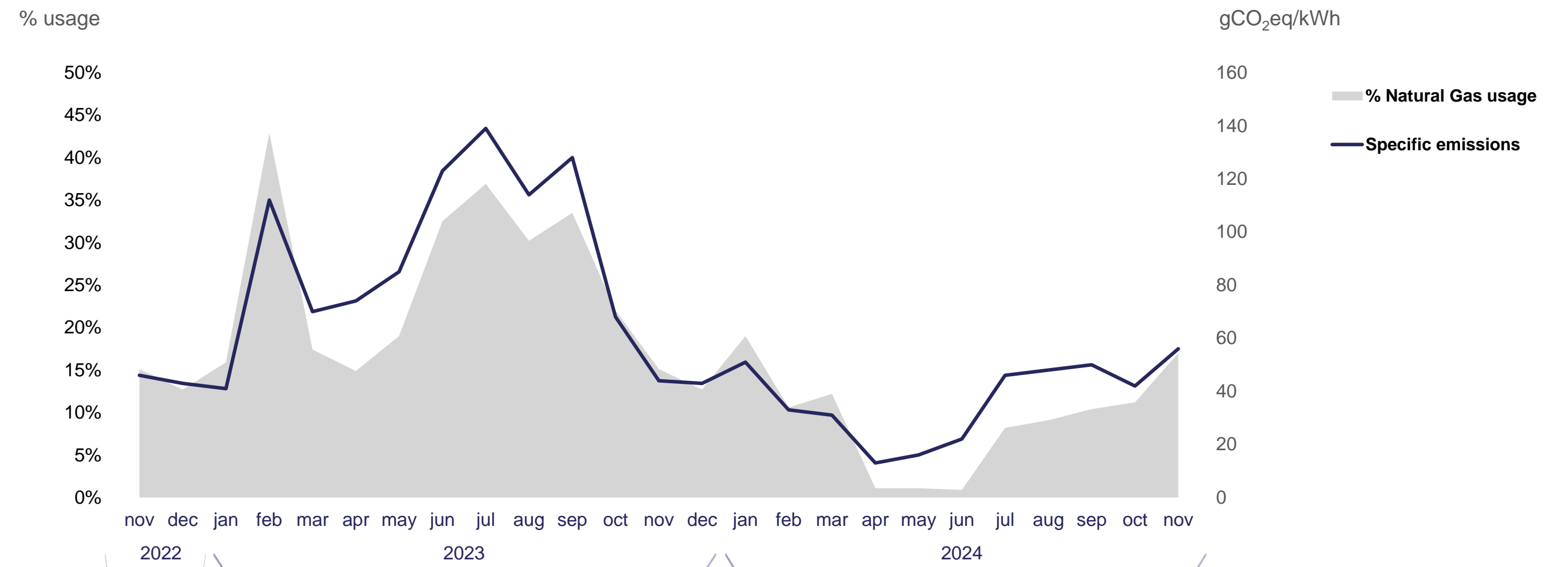
POWER PRODUCTION EMISSIONS

Between 1 January and 30 November 2024, specific emissions reached 36.7 gCO₂eq/kWh, giving total emissions from the electricity generation sector of 1.54 MtCO₂eq. The European CO₂ Emissions Trading Scheme (ETS) recorded a price of 65.0 €/tCO₂^d, a reduction of 55.2 per cent compared to the same period in 2023.



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

<p>1.54 MtCO₂eq</p> <p>SECTOR'S EMISSIONS</p>	<p>65.0 €/tCO₂</p> <p>AVERAGE PRICE OF LICENCES</p>
<p>23.9 %</p> <p>COMPARED TO NOVEMBER 2023 [ACCUMULATED]</p>	<p>55.2 %</p> <p>COMPARED TO NOVEMBER 2023 [ACCUMULATED]</p>



Specific emissions from the electricity sector in mainland Portugal, % use of coal and natural gas power stations (Nov-2022 to Nov-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 October* 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.

198.8

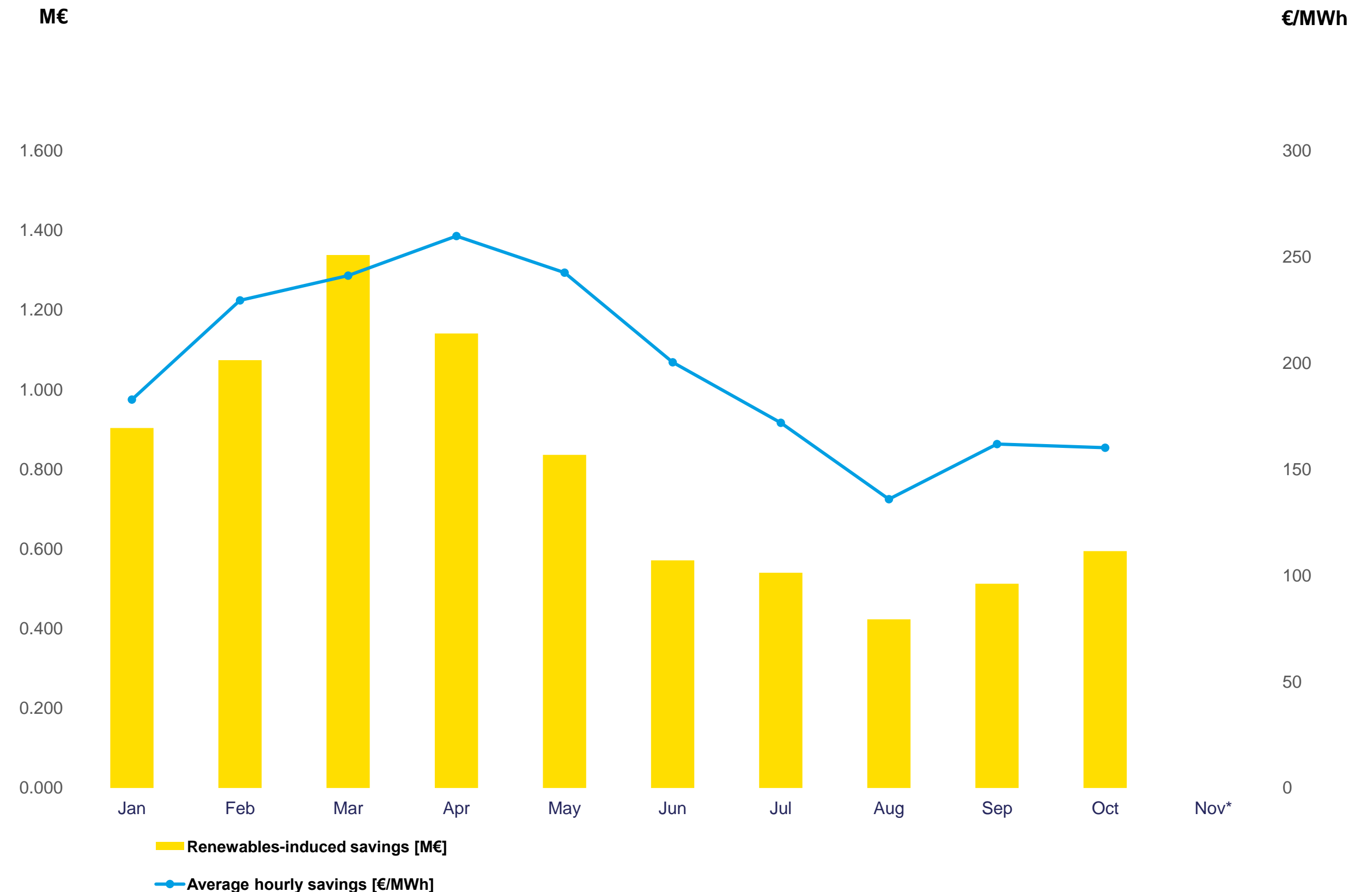
€/MWh

AVERAGE HOURLY SAVINGS (Jan-Oct*)

7,922

M€

CUMULATIVE SAVINGS (Jan-Oct*)

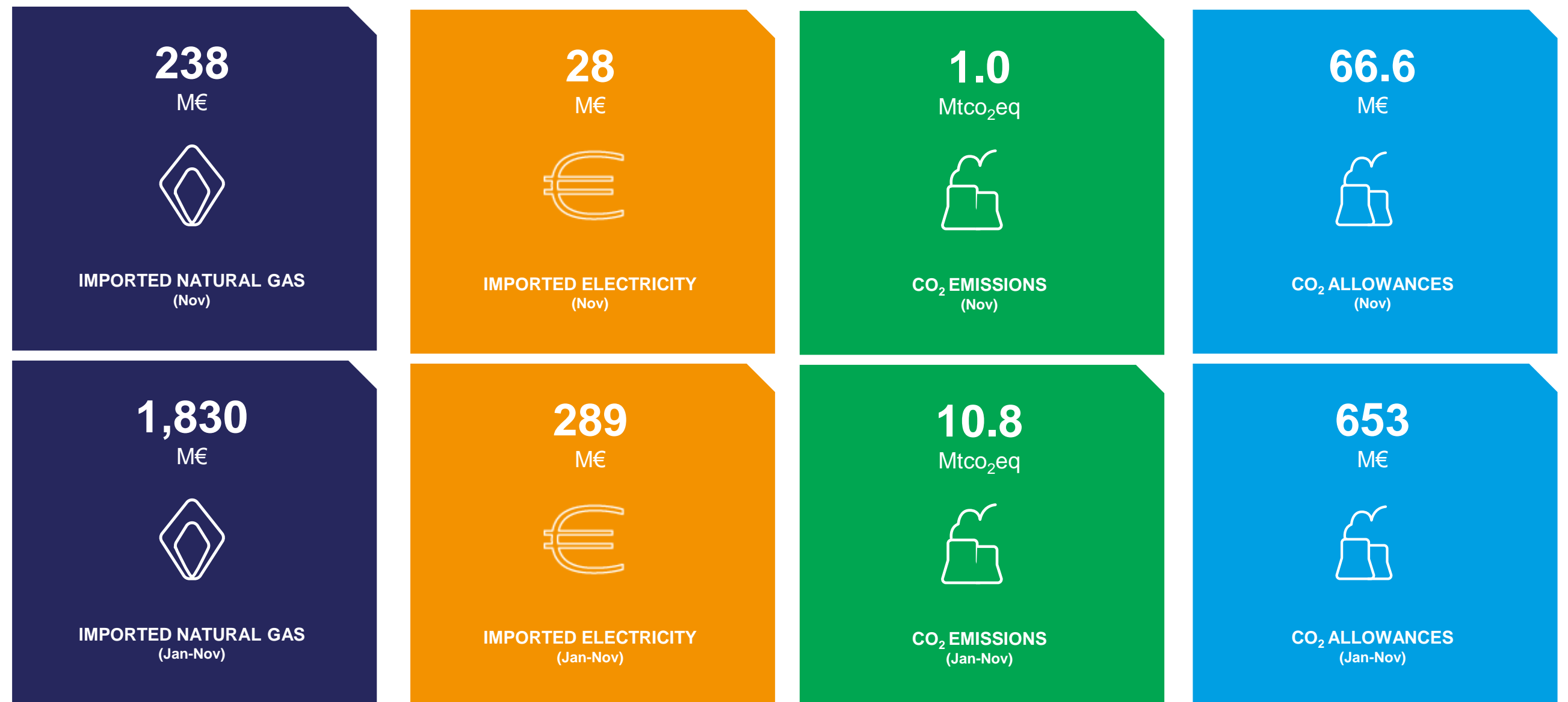


Disclaimer: This analysis is carried out using a program developed by APREN, based on the Deloitte calculation method.
 * Given temporary constrains with the data sources used, it was impossible to present values for the month of November in the current version of the Bulletin

ENVIRONMENTAL SERVICE

RENEWABLES AVOIDED:

The indicators below identify the savings achieved between 1 January and 30 November 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.

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