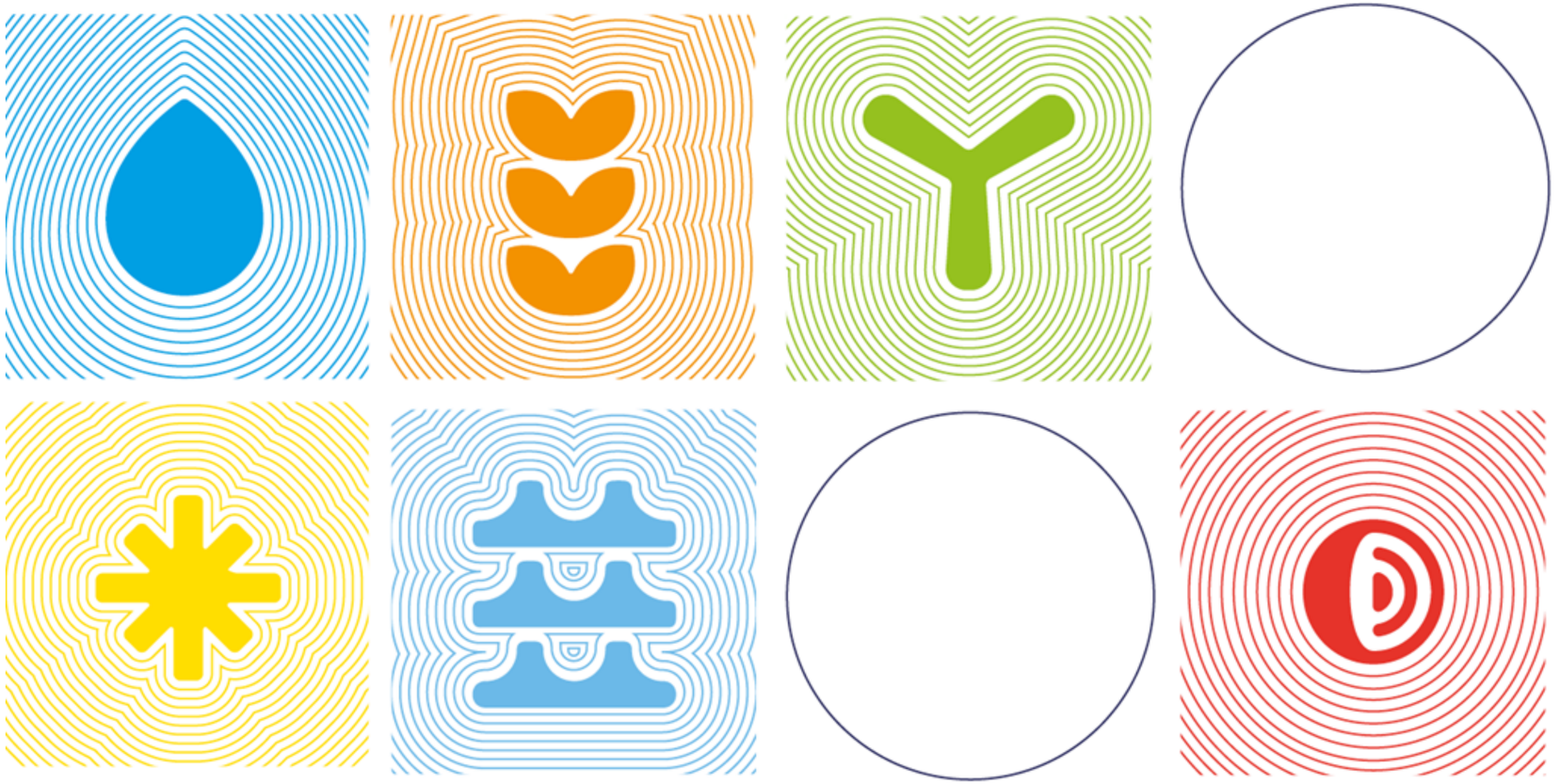
Renewable Electricity Bulletin
September 2023



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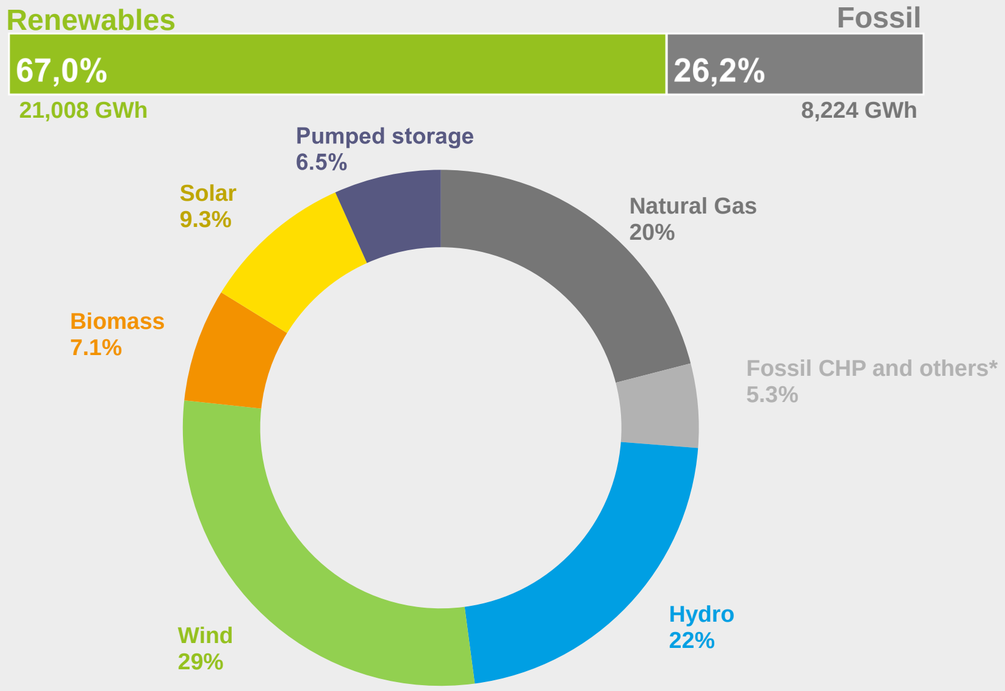
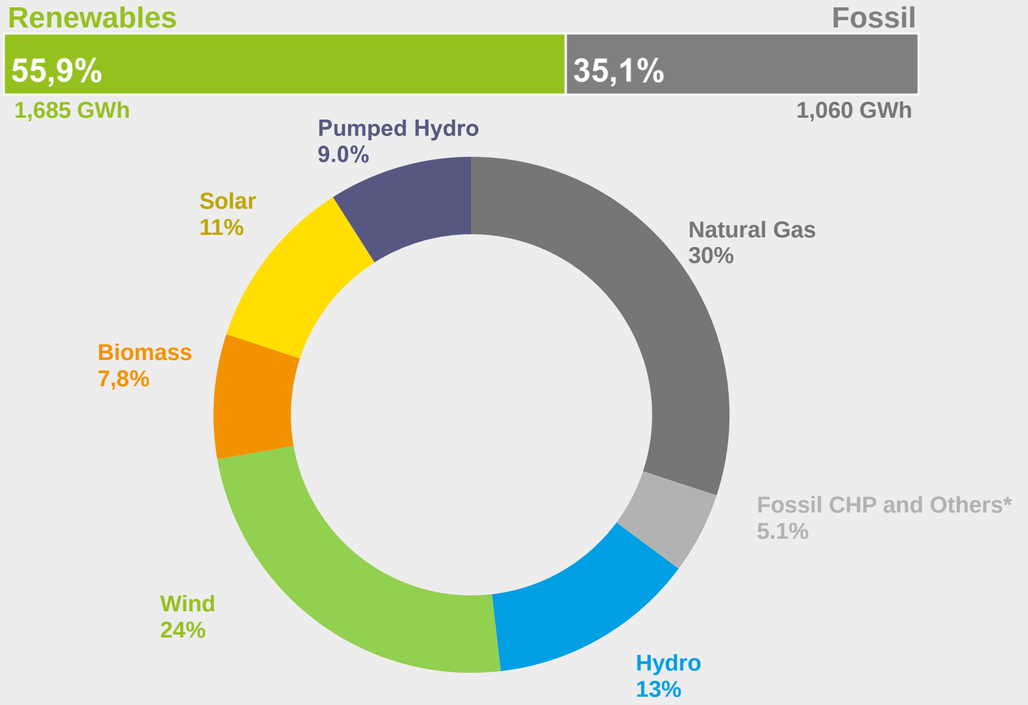
Executive Summary

Accumulated Generation (Jan-Sep)



Monthly Generation (Sep)



Electricity sector indicators (Jan-Sep)

GWh	tCO_2	MWh	$MtCO_2eq$	GWh	gCO_2eq/kWh
31,333	€86.1	€92.7	3,0	8.833	95.1
Generation[a]	Price CO_2	MIBEL Price PT	CO_2 Emissions	Import balance	CO_2 specific emissions

[a]Generation refers to the net power generation of the power plants, considering the production by pumping recently disclosed by REN. Pumping production is not accounted for in the percentage of production from renewable sources.
Source: REN, Analysis APREN.

* Includes fuel oil, diesel, the non-biodegradable fraction of urban solid waste and other waste.

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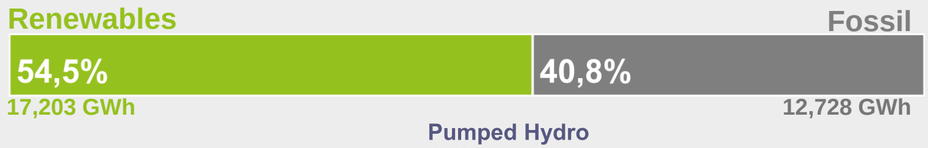
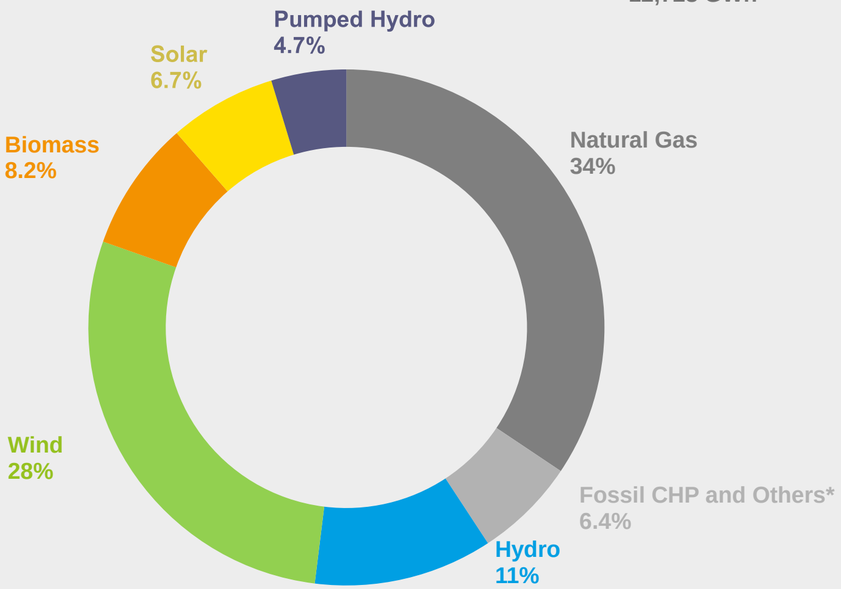
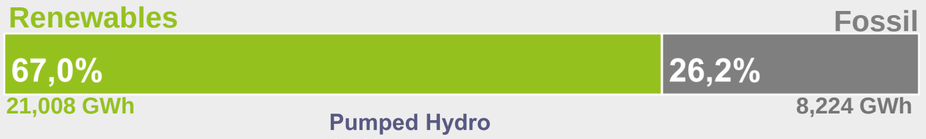
Executive Summary

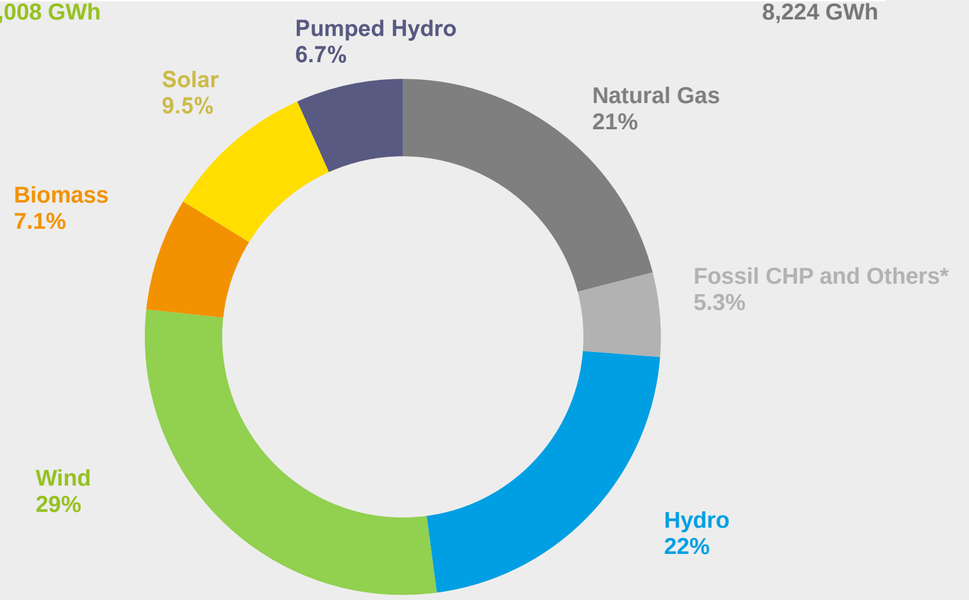
Accumulated September 2022 (Jan-Sep)





Accumulated Sep 2023 (Jan-Sep)





Main indicators

In comparison to September 2022

0.3 % ▲	12.5% ▲	-0.6% ▼	0.96	0.79	1.04
GWh	%	GWh	Wind index	Hydro index	Solar index
31,333	67.0	37,476			
Generation[a]	Incorporation	Consumption[b]			

[a] Generation refers to the net power generation of the power plants, considering the production by pumped storage recently disclosed by REN. Pumping production is not accounted for in the percentage of production from renewable sources.
Source: REN, Analysis APREN

[b] Consumption refers to the liquid generation of power of the plants, considering the import-export balance.
Source: REN, Analysis APREN

* Includes fuel oil, diesel, the non-biodegradable fraction of urban solid waste and other waste.

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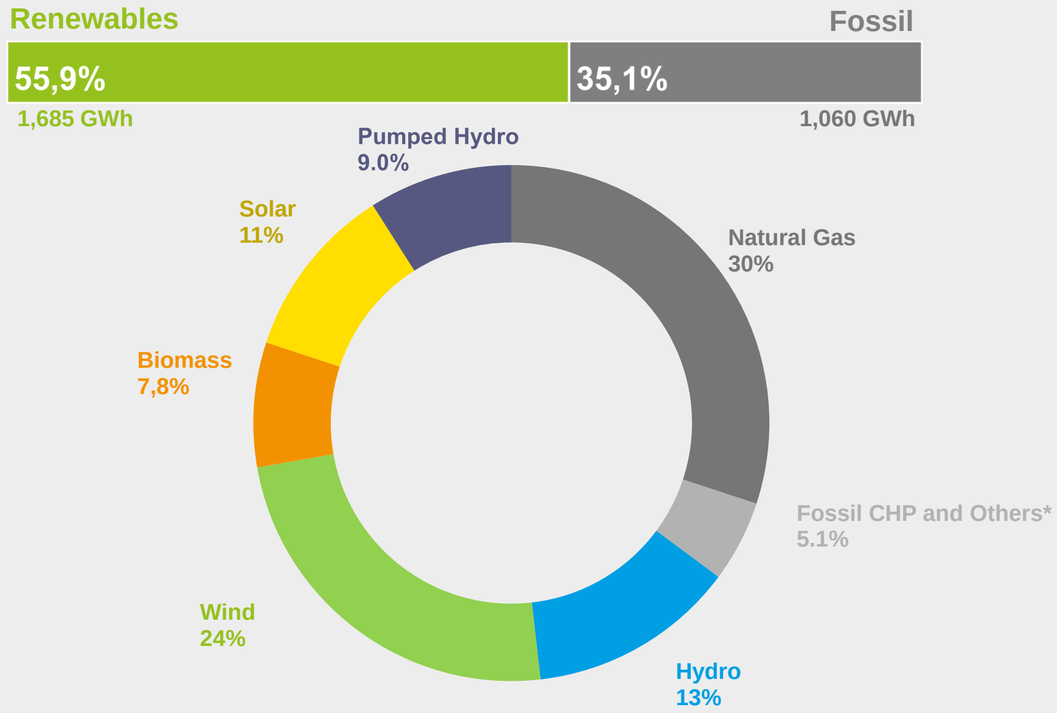
Monthly analysis in Portugal:
September



Between July 1 and September 30, 2023, renewable incorporation was 56%, with a total of 3.017 GWh produced. The decrease of 1.1 % in comparison to September 2022 is due to the decrease in eólic incorporation in 14 %, which produced 730 GWh, in comparison to the 1496 GWh in September 2022, and the increase of the production of the rest of the renewable tecnologies.

* Includes fuel oil, diesel, the non-biodegradable fraction of urban solid waste and other waste.

Indicators of the electricity sector (in comparison to September 2022)

GWh
3,017
Generation[a]

%
56
Renewable incorporation

GWh
3,989
Consumption[b]

▼ **26%**

▼ **1.1%**

▼ **0.4%**

0.94
Wind index

1.03
Hydro index

0.92
Solar index

68%
Storage in dams

[a] Generation refers to the net power generation of the plants, considering the pumping production recently disclosed by REN. Pumping production is not accounted for in the percentage production from RES. Source: REN; Analysis APREN.

[b] Consumption refers to the liquid generation of power of the plants, considering the import-export balance. Source: REN; Analysis APREN

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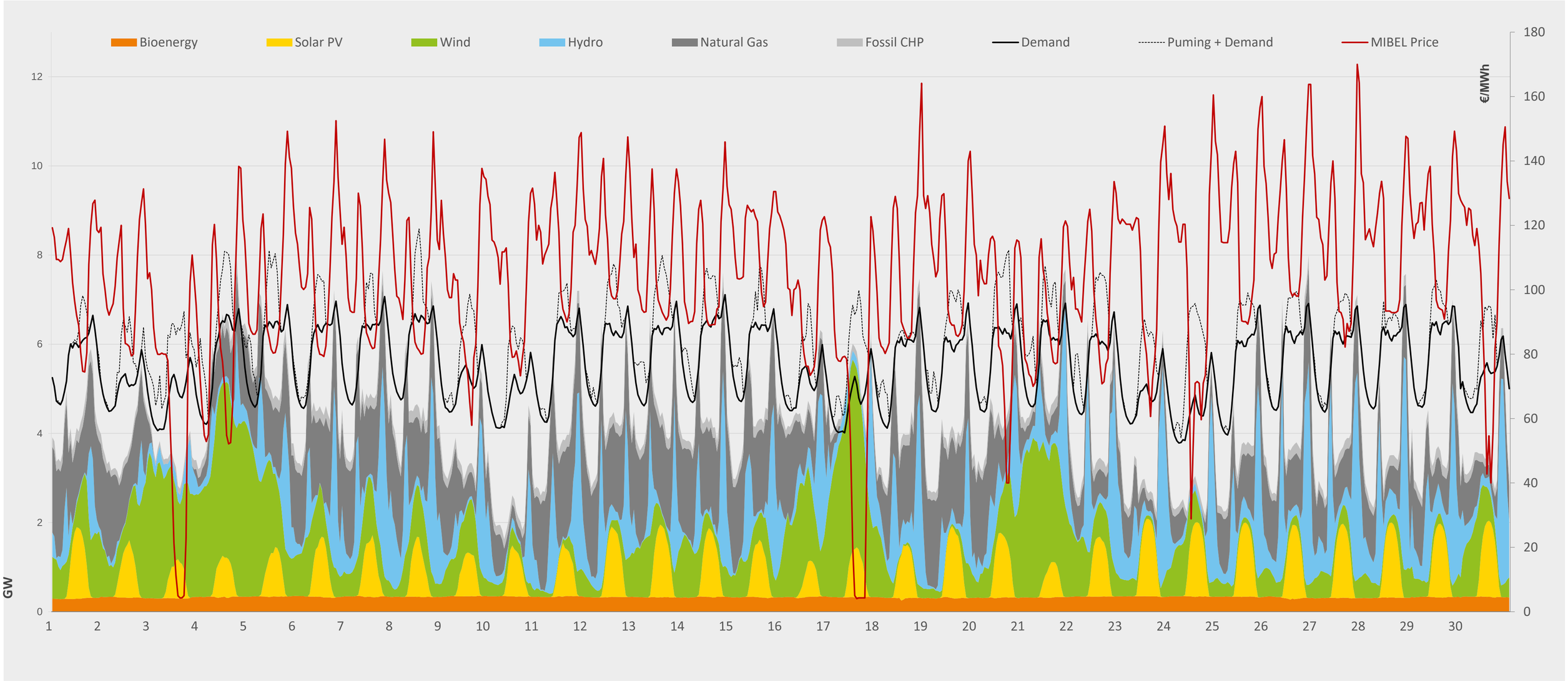
Monthly analysis in Portugal:

Load diagram for the month of September 2023



Source: REN; Analysis APREN

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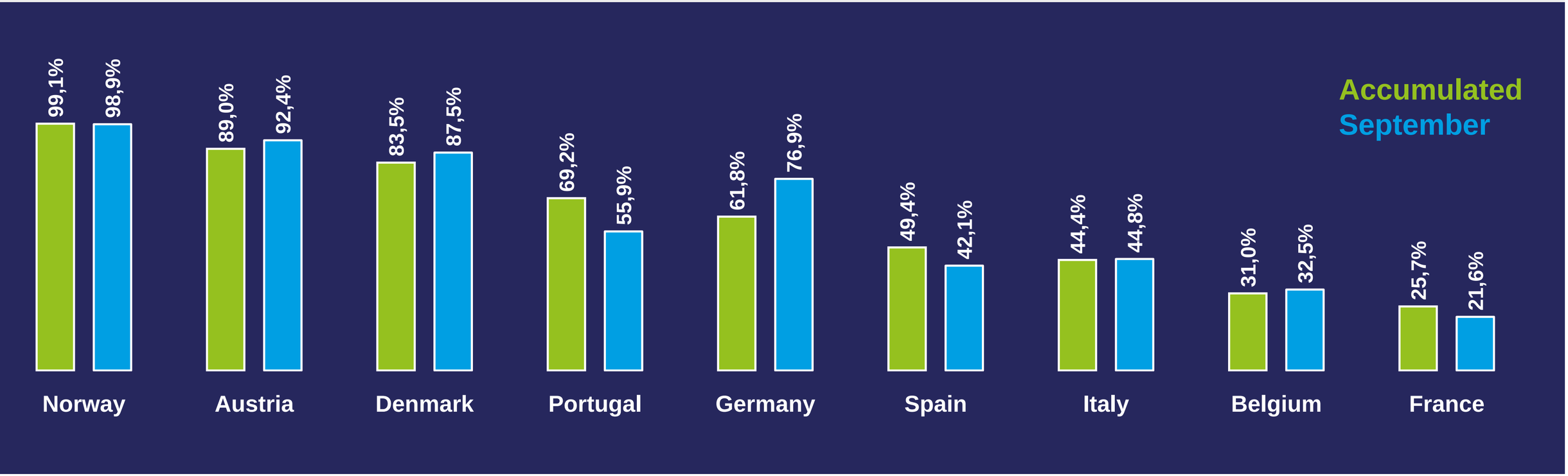
Renewable Electricity

Europe

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

Between January 1 and September 30, 2023, Portugal was the fourth country with the highest renewable incorporation in electricity generation, behind Norway, Austria and Denmark, which obtained 99,1%, 89,0% and 83,5% from RES, respectively. From September 1 to 30, Portugal was in fifth place in the countries considered, with the largest renewable incorporation in Europe.



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

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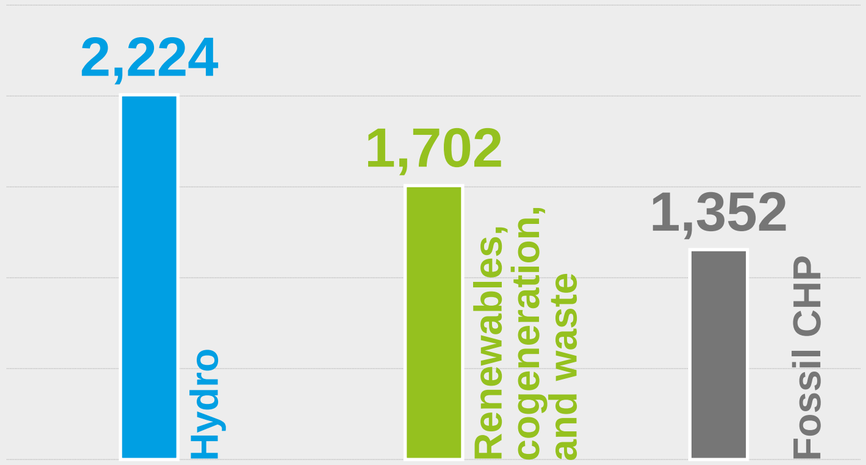
Market price setting

Portugal

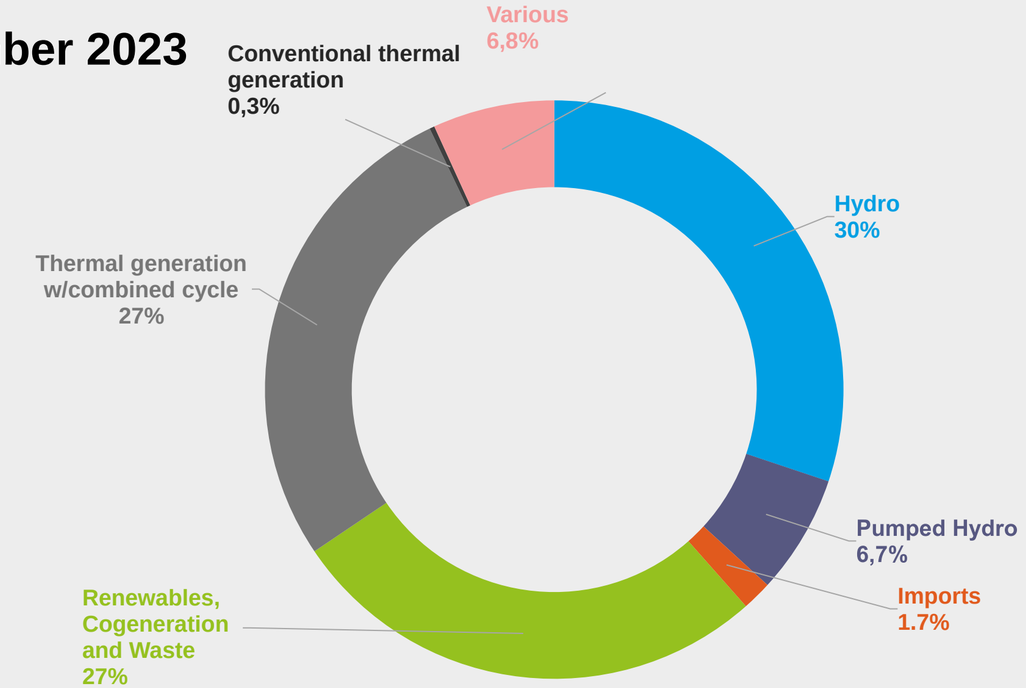
Between January 1 and September 30, hydro was the market price setting technology that recorded the most hours, with 2,224 non-consecutive hours, followed by renewables, cogeneration and waste with 1,702 hours. And termal generation with combined cycles with 1,352 hours.

Accumulated January-September



Number of market price setting hours of the three main market setting technologies (Jan-2023 to September-2023).
Source: OMIE. Analysis APREN

September 2023



Percentage distribution of the number of market price setting hours of the various technologies, in a total 720 hours (September).
Source: OMIE. Analysis APREN

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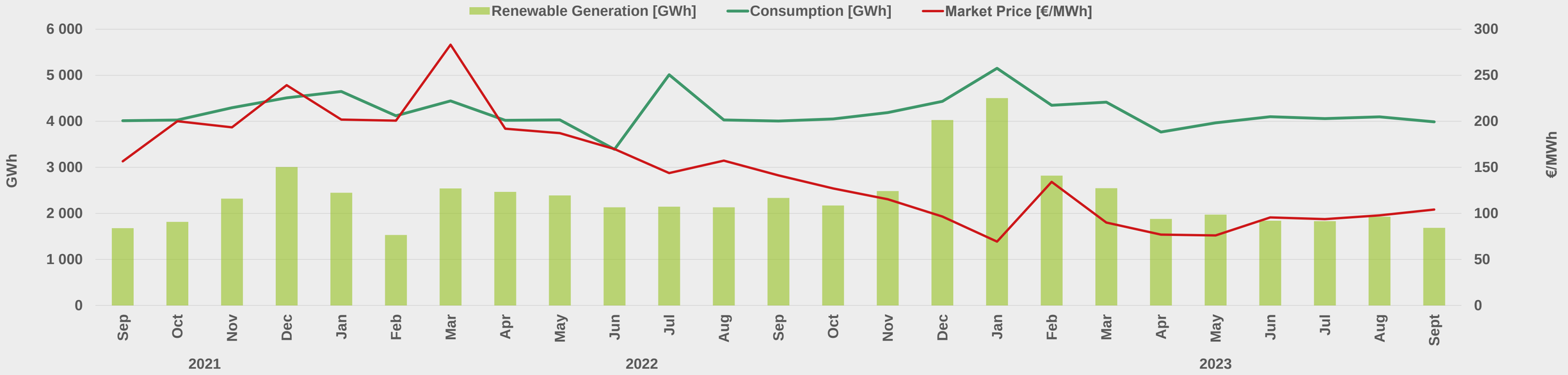
Electricity Market

Portugal

Between January 1 and September 30, the average hourly price recorded in MIBEL in Portugal was €92.7 MWh[c], representing a decrease to less than half compared to the same period last year.

In the same period, 444 non-consecutive hours were recorded, in which renewable generation was sufficient to supply electricity consumption in mainland Portugal, with an average hourly price in the MIBEL of €61.3/MWh. From September 1 to 30, renewable generation was insufficient to supply consumption at any given period of an hour.

Accumulated January-September



Number of market price setting hours of the three main market setting technologies (September-2021 to September-2023).
Source: OMIE. Analysis APREN

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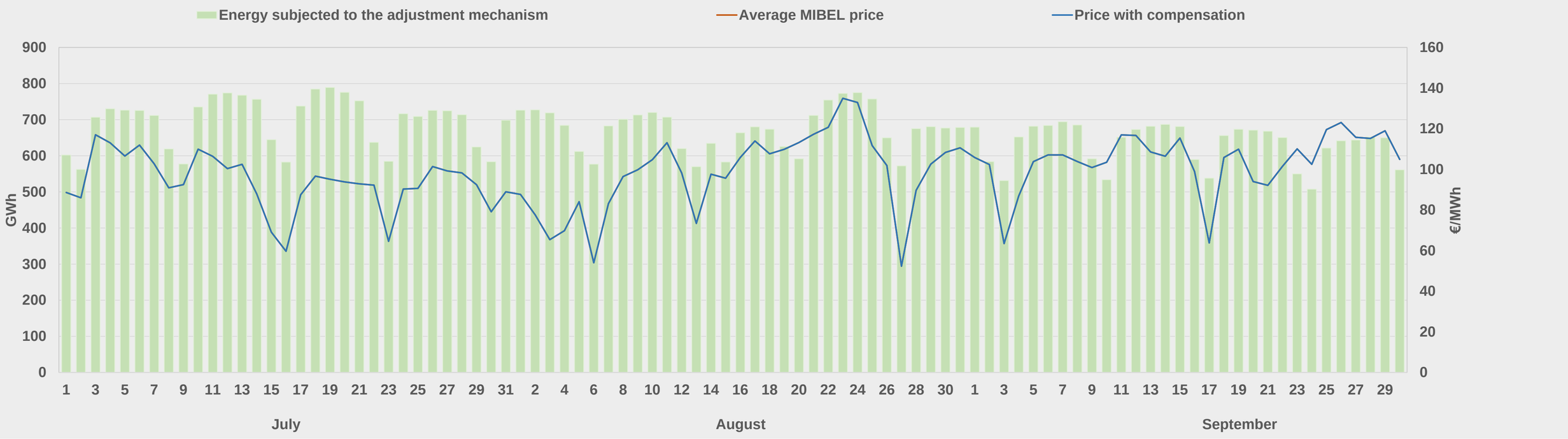
Electricity Market

Iberian gas price limit mechanism

Since June 15, 2022, when the Iberian natural gas price limit mechanism came into operation, until September 30, the mechanism generated savings of €21.3/MWh[c], which amounted to a reduction of 13.1 % in the average hourly price at MIBEL.

The savings due to the price limit of natural gas, correspond to the difference between the price without the mechanism and the price with the compensation to be paid to natural gas plants. During the months of April until August, the price limit on natural gas didn´t introduce changes in the eletricity prices. In total, 264.1 of the 353.9 TWh produced, were subjected to the consumer ajustedment mechanism in the Iberian Peninsula.



[c] Arithmetic average hourly prices
Source: OMIE. Analysis APREN

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Renewable Electricity

Europe

During the month of September 2023, there was a minimum hourly price at MIBEL in Portugal of €4.08/MWh, in which the market setting was with renewables, cogeneration and waste. The maximum hourly price reached €170.0/MWh, where the market set with hydro technology.

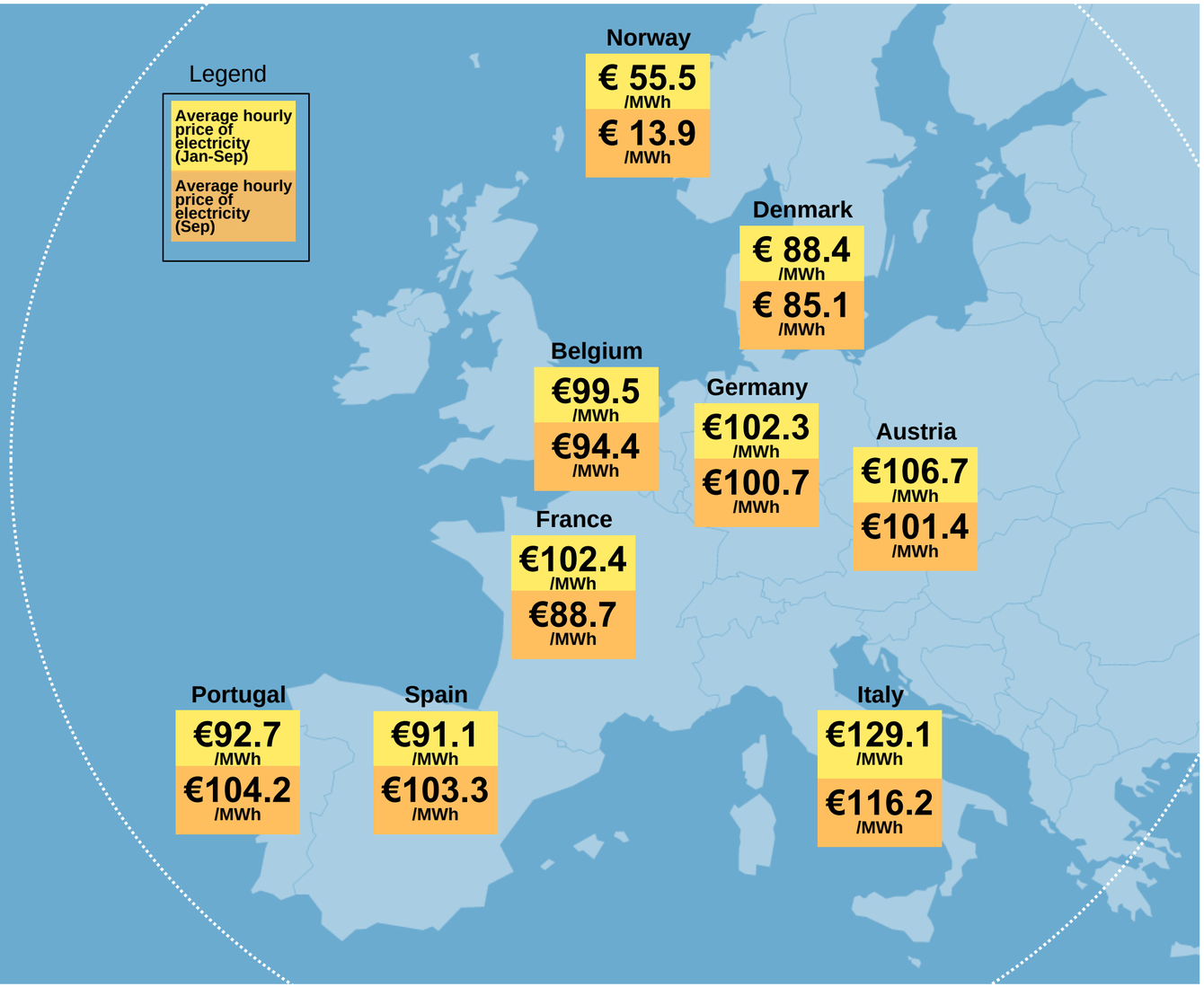
Regarding prices in Europe, it should be noted that the average values were, in general, superior to those of the previous month. The maximum and minimum prices also increased in comparison to the previous month.

Minimum Prices (Sep)

- 1st Germany: €-5.74 /MWh
- 2nd Norway: €-4.51 /MWh
- 3rd Denmark: €-3.80 /MWh

Maximum Prices (Sep)

- 1st Denmark Germany: €524.2 /MWh
- 2nd Austria: €437.4 /MWh
- 3rd Belgium: €330.3 /MWh



Source: ENTSO-E, OMIE. Analysis APREN

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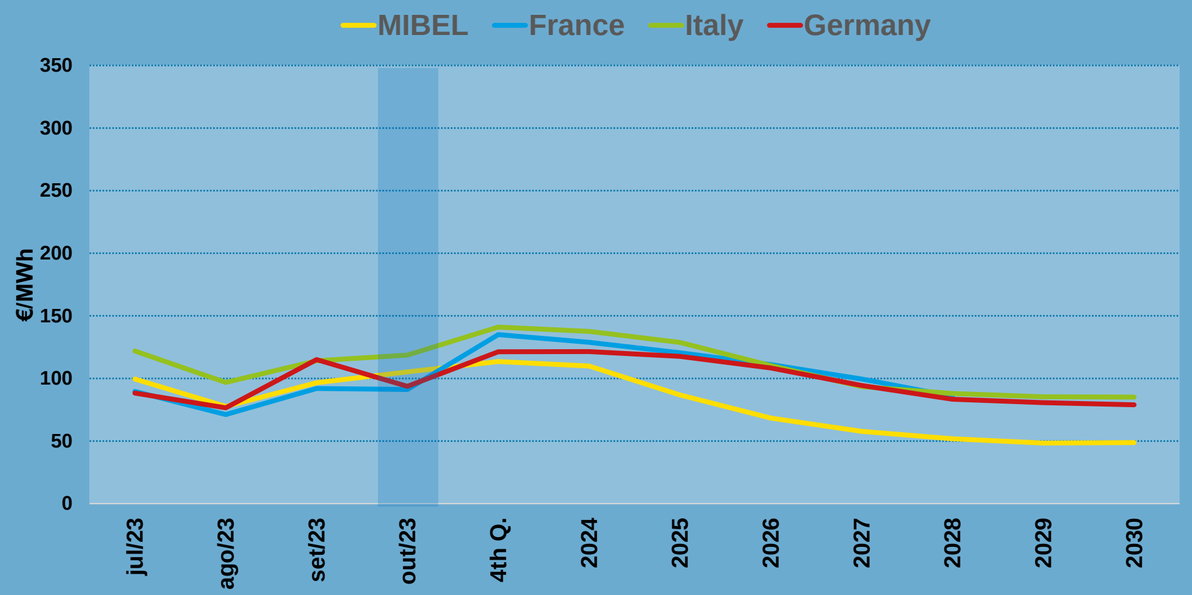
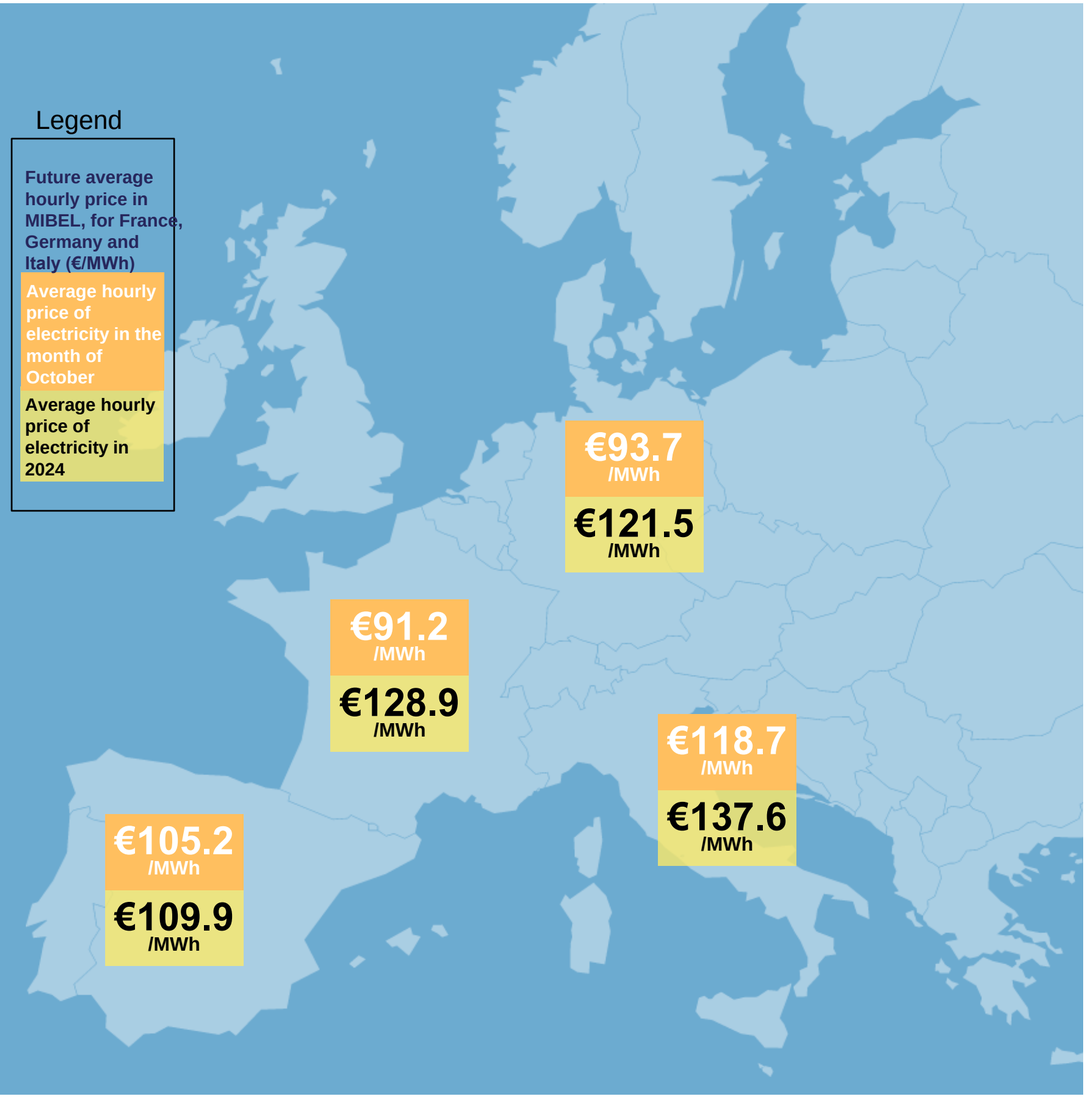
Future Electricity Market

The evolution of the average future hourly price is calculated based on the contracts for the purchase and sale of electricity [d].

The map on the right displays the price values for the next month (October) and for the next year. In both cases, MIBEL has the highest values, while the French and German markets have the lowest.

MIBEL has the lowest figures by 2030, coming from the Iberian gas price limit mechanism by July next year, and from investment in renewable production.





d Values updated on the 3rd of September.
Source: OMIP, EEX. Analysis APREN

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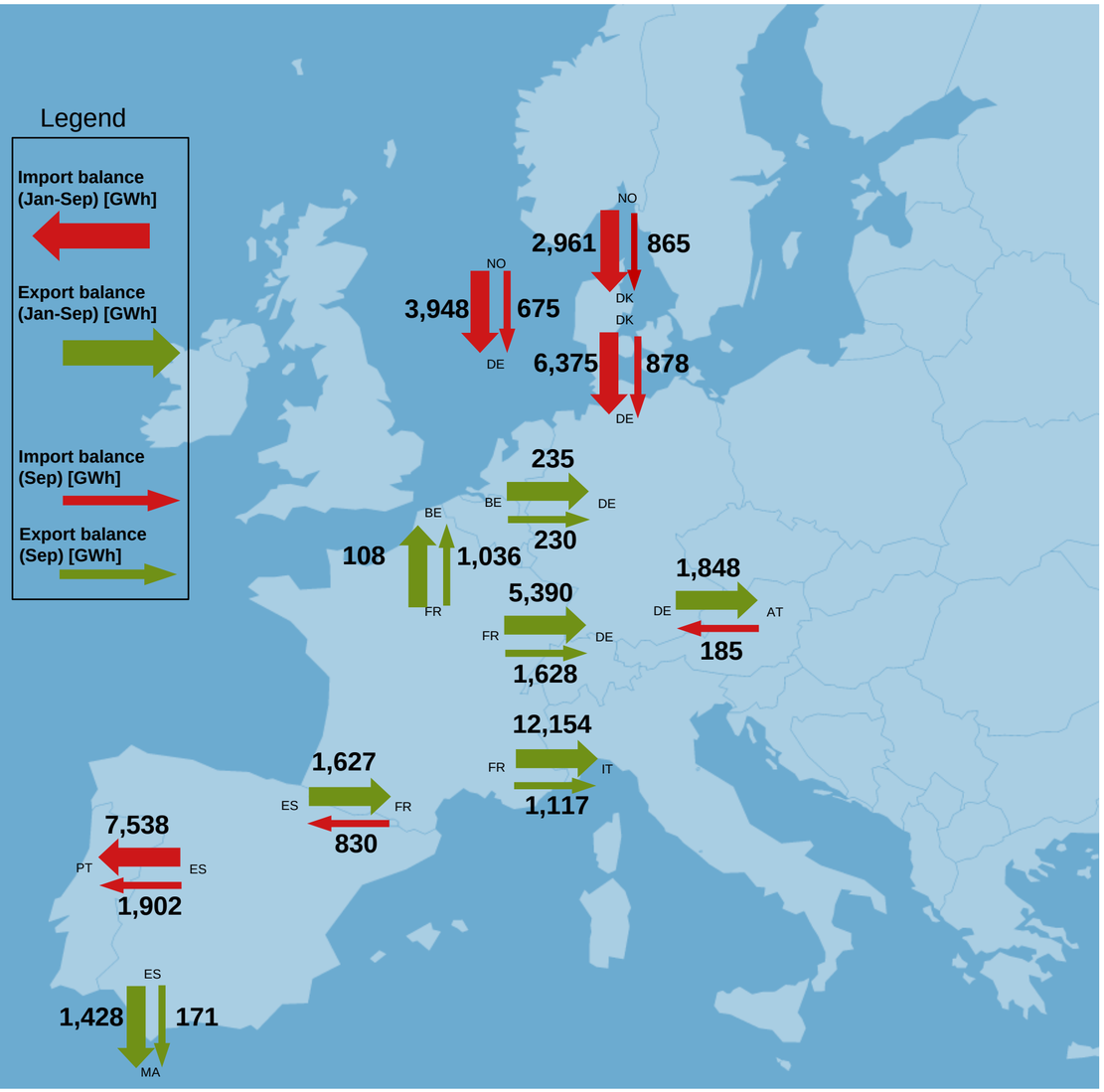
International trade

Europe

Between January 1 and September 30, 2023, the electricity system of Mainland Portugal recorded electricity imports equivalent to 10,877 GWh and exports of 2,044 GWh, with Portugal being an importer with a balance of 8,833 GWh.

Main Interconnection Indicators PT-ES

	PT-ES		ES-PT	
Usage	**5.3%** (Jan-Sep)	**14.3%** (Sep)	**21.5%** (Jan-Sep)	**27.0%** (Sep)
Congestion	**0.0%** (Jan-Sep)	**0.0%** (Sep)	**0.2%** (Jan-Sep)	**1.6%** (Sep)
Markets split	**6.3%** (Jan-Sep)	**4.3%** (Sep)	**65.3%** (Jan-Sep)	**65.0%** (Sep)



Source: ENTSO-E, OMIE. Analysis APREN

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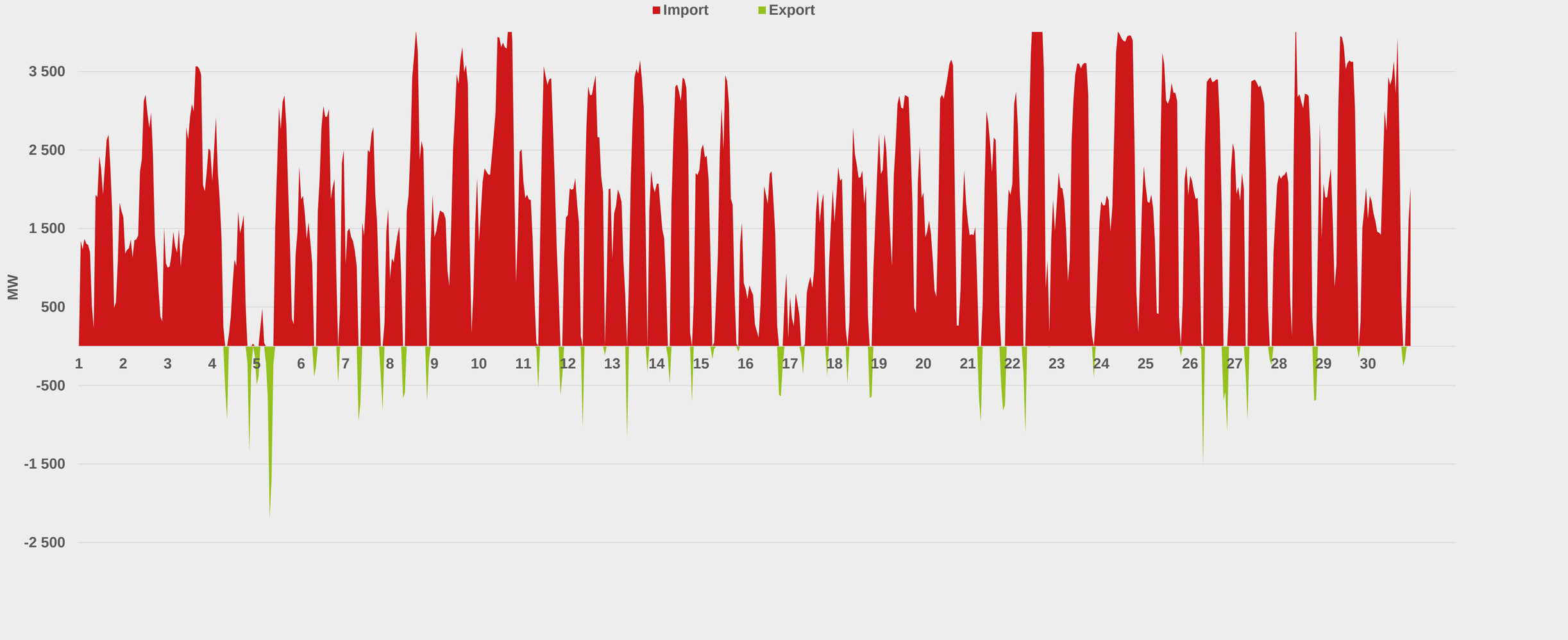
International trade: September

Diagram of imports and exports in Portugal



Source: REN. Analysis APREN

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Power sector emissions

Between January 1 and September 30 , 2023, specific emissions reached 95.1 gCO_2eq/kWh, with a total emissions from the power sector of 3.0 $MtCO_2eq$.

The European Emissions Trading System (EU-ETS) recorded an average price €86.1/tCO_2 [c], a reduction in 5% compared to the same period in 2022.

Sector emissions

3.0

$MTCO_2eq$

44%

In comparison to September 2022

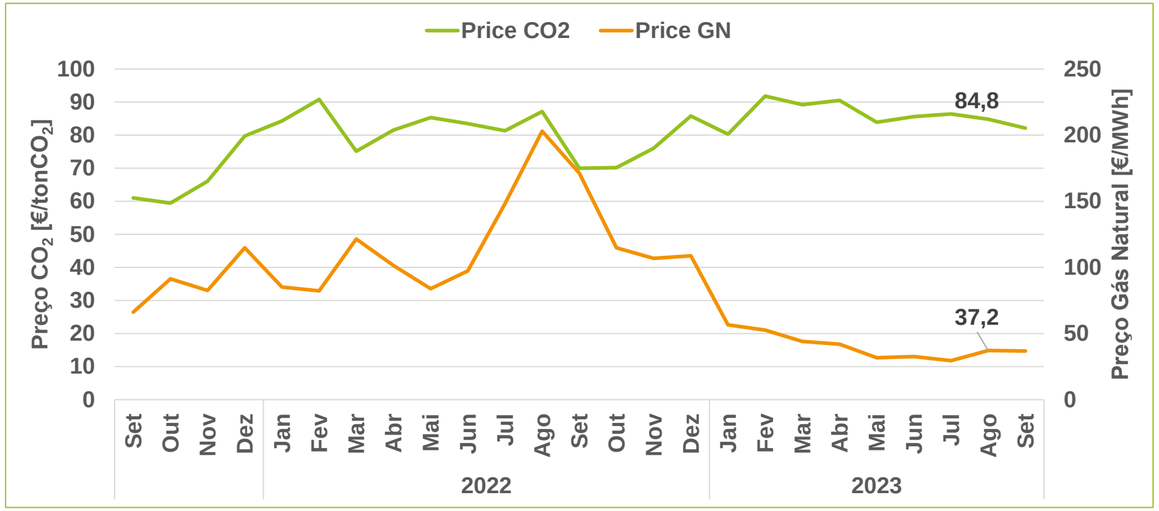
Allowances average price

€86.1

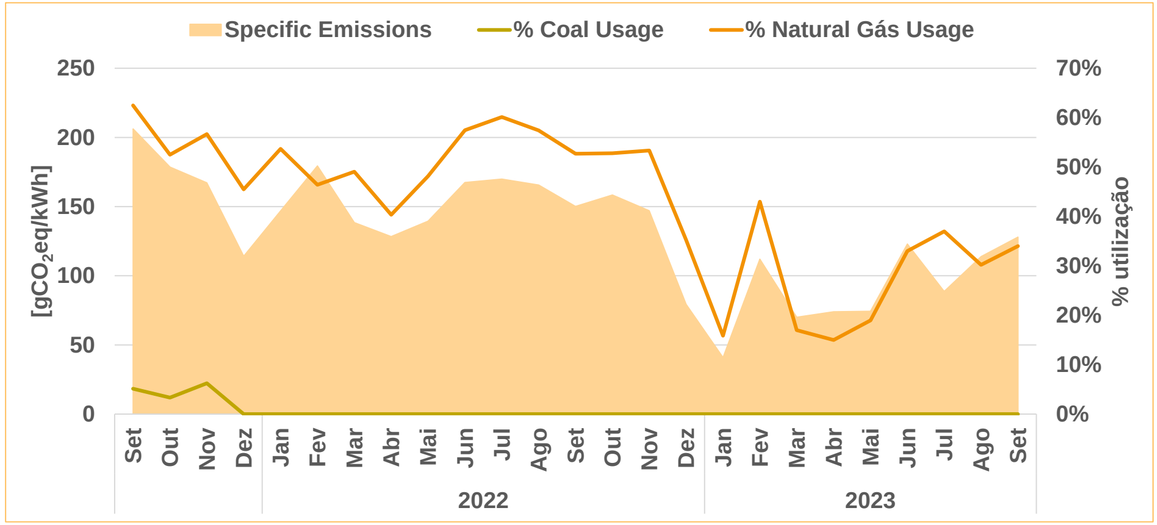
/tCO_2

5%

In comparison to September 2022



Price of CO_2 alowances in EU-ETS and natural gas price in Europe (Sep-2021 to Sep-2023).
Source: SendeCO2, WorldBank.



Specific emissions from the power sector of Mainland Portugal, % use of coal-free power plants and natural gas (Sep-2021 to Sep-2023).
Source: REN, DGEG, ERSE. Analysis APREN

[c] Arithmetic average hourly prices
Source: OMIE, WorldBank.

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Simulation of price formation without SRP

Renewables have avoided:

The indicators below identify the savings achieved between January 1 and September 30, 2023, due to the contribution Special Regime Production (SRP).

This study is conducted for SRP and includes all installed power of fossil cogeneration. Given that the capacity equivalent to this technology within the SRP is quite residual and that the other technologies are renewable, the figures are very close to the real savings generated by renewables.

€150.0/MWh
Accumulated savings (Jan-Sep)

€144.5/MWh
Montlhy savings (Sep)

€4,658.4M
Accumulated savings (Jan-Sep)

€433.8M
Montlhy savings (Sep)

Source: OMIE. Analysis APREN.

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Environmental Service

The figures below identify the savings achieved between January 1 and September 30, 2023, in natural gas, CO_2 emissions and CO_2 emission allowances resulting from the renewable incorporation in electricity generation.

This analysis assumes that, in the absence of renewables, production would be ensured primarily by natural gas, followed by imported electricity.

Renewables have avoided:

€1,375 M
Imported Natural Gas (Jan-Sep)

€124 M
Imported Natural Gas (Sep)

€385 M
Imported Electricity (Jan-Sep)

€0 M
Imported Electricity (Sep)

6.8 $MtCO_2eq$
CO_2 emissions (Jan-Sep)

0.6 $MtCo_2eq$
CO_2 emissions (Sep)

€540 M
O_2 allowances (Jan-Sep)

€51.3 M
O_2 allowances (Sep)

Source: REN, REE, SendeCO2, WorldBank, DGEG, ERSE, Analysis APREN.
Note 1: For the estimate of the savings in imported natural gas, the price of natural gas in Europe indicated in the WorldBank has been considered.
Note 2: For the estimation of savings in imported electricity, the average price on the MIBEL market has been considered.

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