



20  
22

**BULLETIN**  
RENEWABLE ELECTRICITY

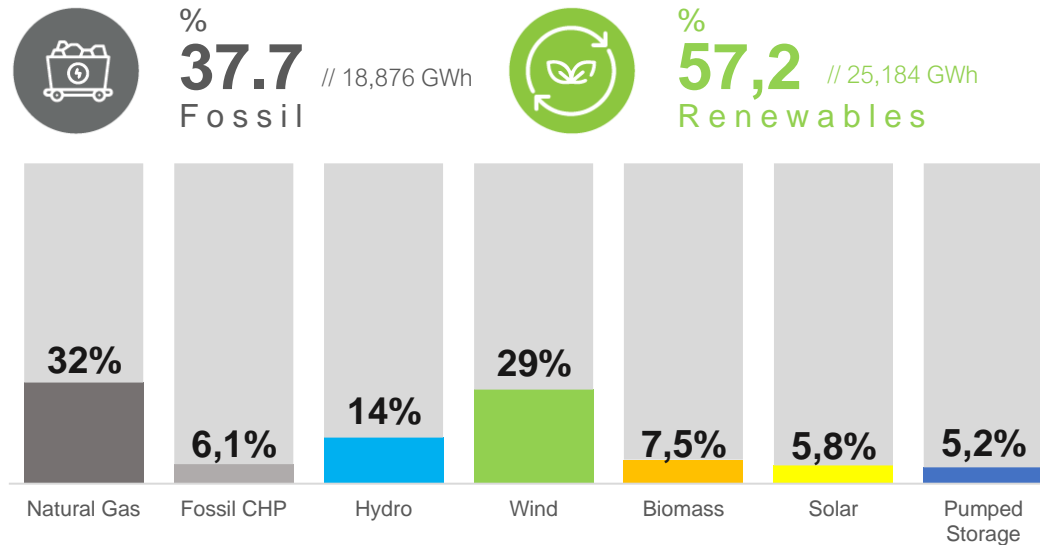
**Portugal precisa  
da nossa energia!**

Portugal needs our energy!

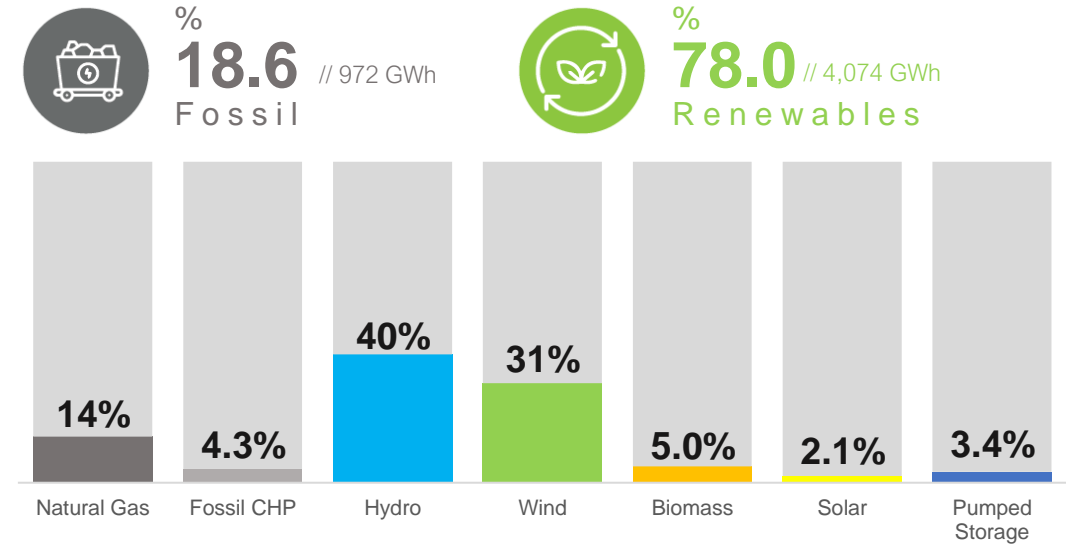


# Executive Summary

## ACCUMULATED GENERATION (Jan-Dec)



## MONTHLY GENERATION (Dec)



## ELECTRICITY SECTOR INDICATORS (Jan-Dec)



<sup>a</sup> 'Generation' refers to the net power generation of the power plants, considering the pumped storage generation recently disclosed by REN. Generation through pumped storage is not accounted for in the percentage of generation from renewable sources. Source: REN, Analysis APREN.

# Electricity Generation: Mainland Portugal

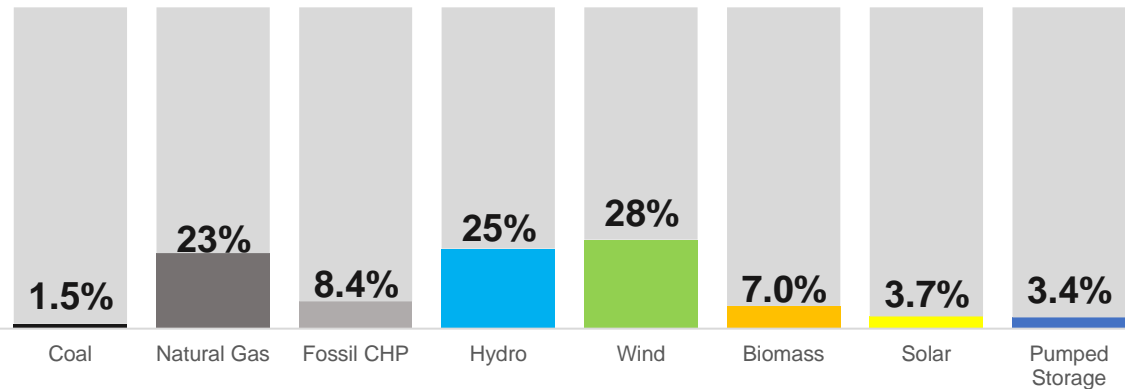
ACCUMULATED DECEMBER 2021 (Jan-Dec)



%  
**33.4** // 17,204 GWh  
Fossil



%  
**63.2** // 29,540 GWh  
Renewables



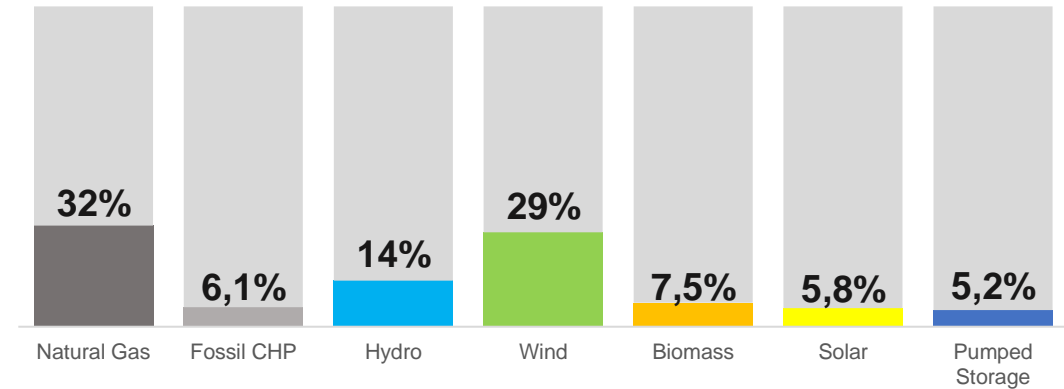
ACCUMULATED DECEMBER 2022 (Jan-Dec)



%  
**37.5** // 18,876 GWh  
Fossil



%  
**57,2** // 25,184 GWh  
Renewables



## MAIN INDICATORS

GWh  
**44,060**  
Generation<sup>a</sup>

%  
**57.2**  
Renewable  
incorporation

GWh  
**50,381**  
Consumption<sup>b</sup>

**0.99**  
Wind index

**0.63**  
Hydro index

**1.06**  
Solar index

▼ **6.0%**

in comparison Dec 2021

▼ **6.1%**

in comparison Dec 2021

▲ **1.8%**

in comparison Dec 2021

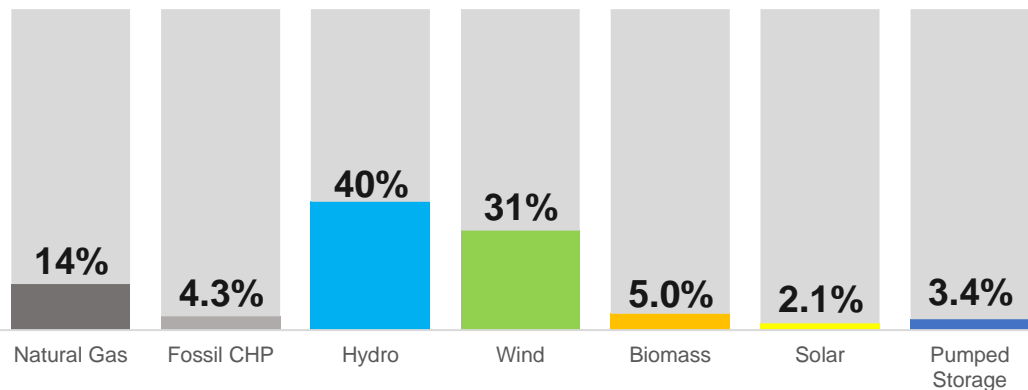
<sup>a</sup> 'Generation' refers to the net power generation of the power plants, considering the pumped storage generation recently disclosed by REN. Generation through pumped storage is not accounted for in the percentage of generation from renewable sources.

<sup>b</sup> Consumption refers to the liquid generation of power of the plants, considering the import-export balance. Source: REN, Analysis APREN.

# Monthly analysis in Portugal: December

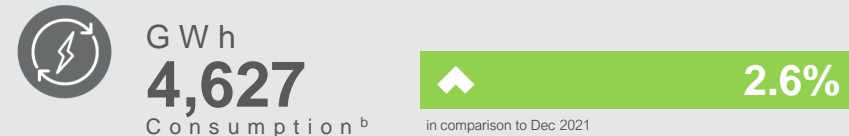
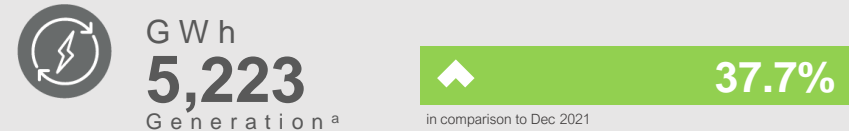
Between December 1 and 31, 2022, renewable incorporation was 78.0 %, totaling 4,074 GWh generated. The 37.7 % increase compared to December 2021 is mainly due to the increase in hydro and wind generation, contributing with 2,087 GWh and 1,617 GWh to production in December compared to 763 GWh and 1,070 GWh, respectively, in the same period last year. It should be noted that in December, both hydro and wind generation reached the highest monthly value in the year 2022, which led to the highest value of renewable incorporation.

Source: REN, Analysis APREN



Source: REN, Analysis APREN

## INDICATORS OF THE ELECTRICITY SECTOR

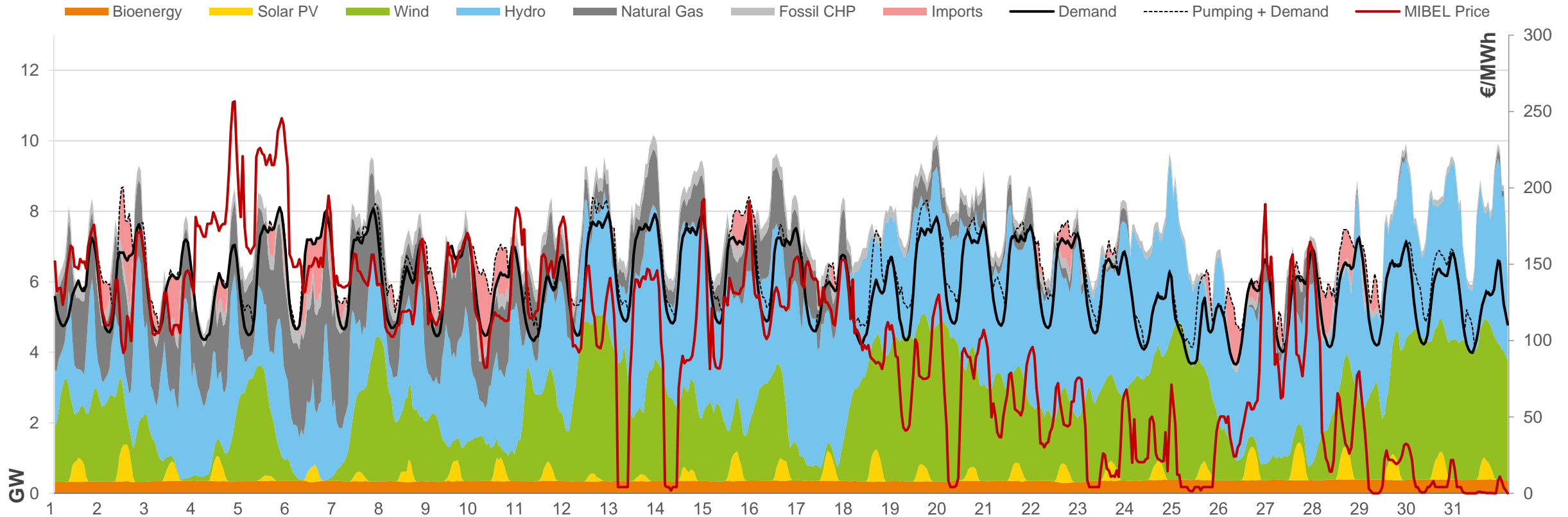


<sup>a</sup> 'Generation' refers to the net power generation of the power plants, considering the pumped storage generation recently disclosed by REN. Generation through pumped storage is not accounted for in the percentage of generation from renewable sources.

<sup>b</sup> 'Consumption' refers to the liquid generation of power of the plants, considering the import-export balance. Source: REN, Analysis APREN

# Monthly Analysis in Portugal: December

## Load diagram for the month of December 2022

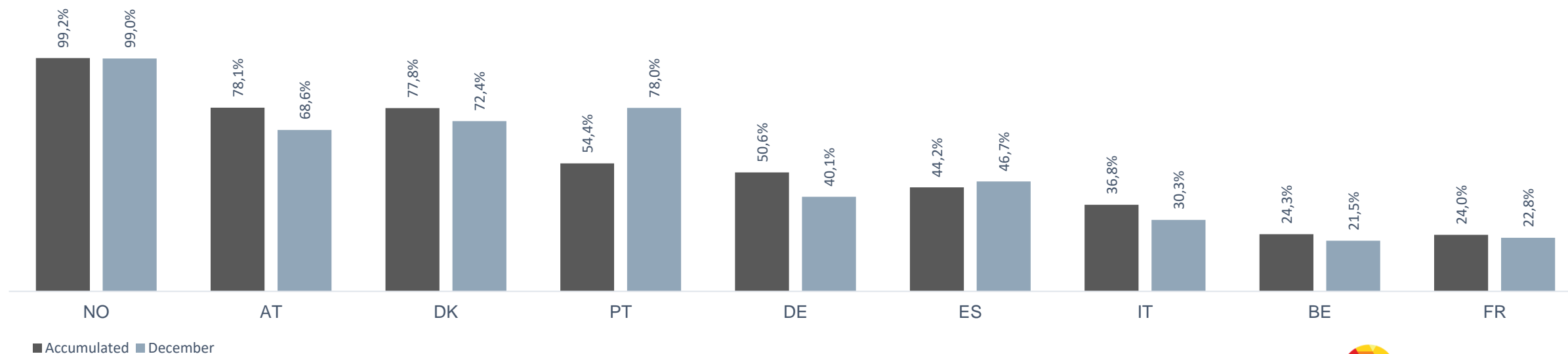


Source: REN, Analysis APREN

# Renewable Electricity Europe

The present analysis considers only the main countries from the different European markets, in order to have a representative framework of comparison. Between January 1 and December 31, Portugal was the fourth country with the highest renewable incorporation in electricity generation, behind Norway, Austria and Denmark, which obtained 99.2%, 78.1% and 77.8%, respectively, from RES. From December 1 to December 31, Portugal was second in the analysed countries with the largest renewable incorporation in Europe.

Source: OMIE, Analysis APREN



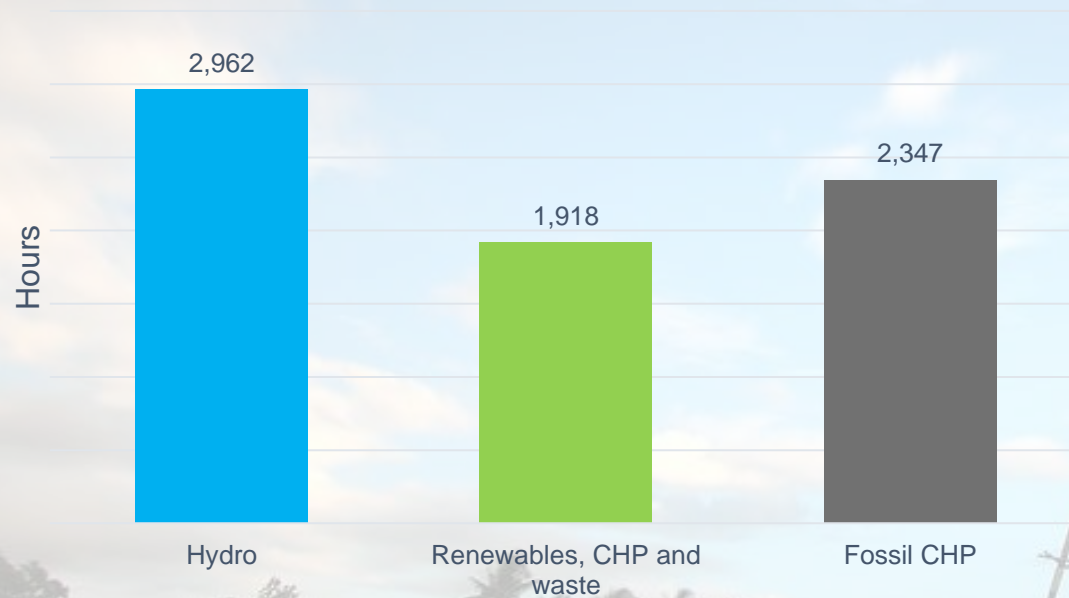
Renewable incorporation in accumulated electricity generation (Jan-Dec) and monthly electricity (Dec).  
Source: REN, Fraunhofer, REE, Terna, National Grid, ENTSO-E, Analysis APREN

# Market Price Setting: Portugal

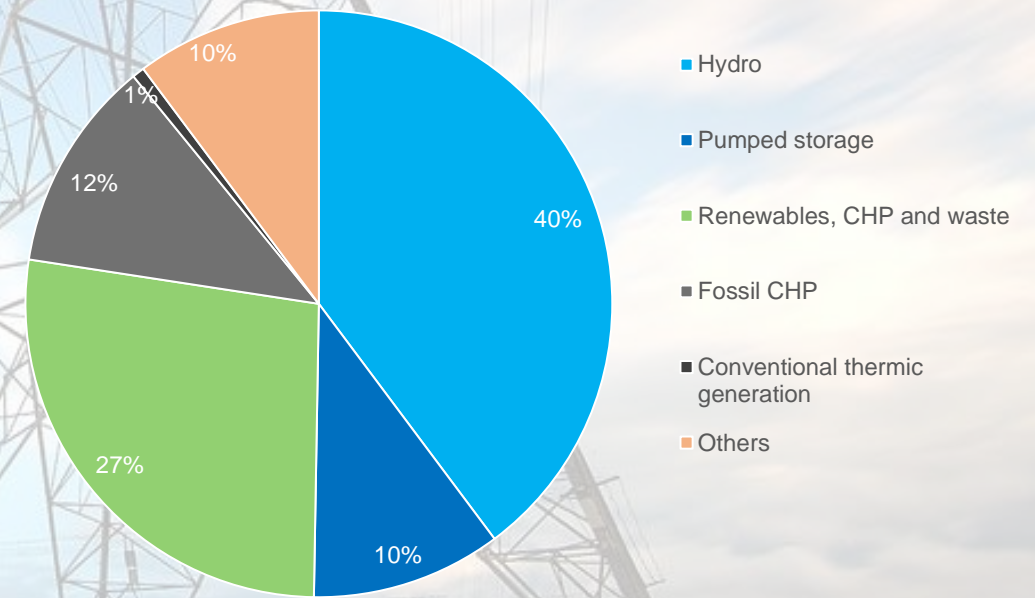
Between January 1 and December 31, hydro was the market price setting technology that recorded the most hours, with 2,962 non-consecutive hours, followed by thermal generation combined cycle with 2,347 hours and by renewables, cogeneration and waste with 1,918 hours.

ACCUMULATED JAN-DEC

DECEMBER 2022



Number of market price setting hours of the three main technologies (Jan-2022 to Dec-2022).  
Source: OMIE, Analysis APREN



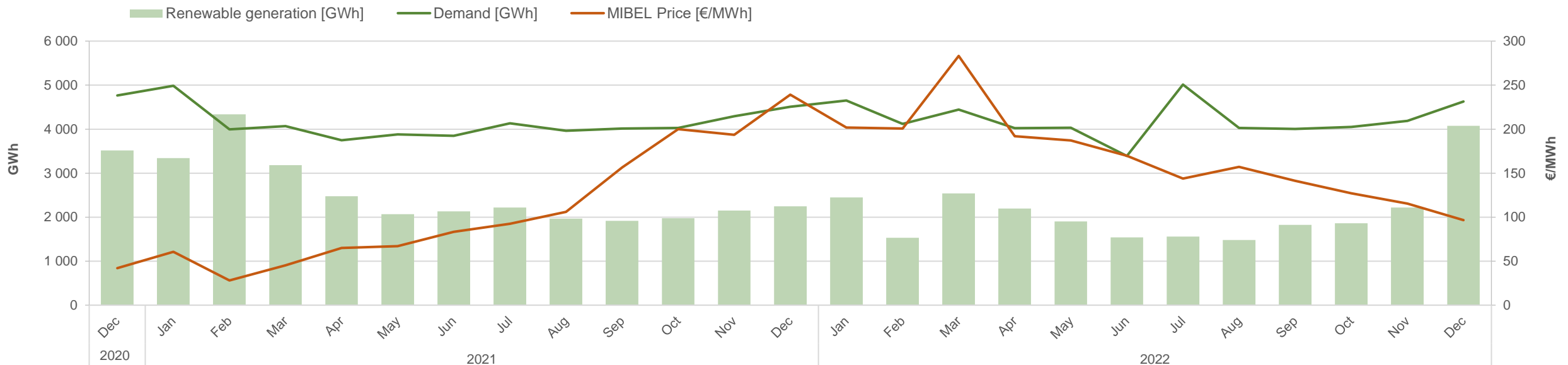
Percentage distribution of the number of market price setting hours of the various technologies, totaling 744 hours (Dec).  
Source: OMIE, Analysis APREN

# Electricity Market Portugal

Between January 1 and December 31, the average hourly price recorded in MIBEL in Portugal (€167.9/MWh<sup>o</sup>), represents an increase to double compared to the same period last year.

In the same period, 454 non-consecutive hours were recorded, in which renewable generation was sufficient to supply the electricity consumption in mainland Portugal, with an average hourly price in MIBEL of €70.9/MWh. From December 1 to 31, renewable generation supplied consumption for 328 non-consecutive hours.

<sup>o</sup>Arithmetic average hourly prices  
Source: OMIE, Analysis APREN



Market price, electricity consumption and renewable generation (Dec 2020 to Dec 2022).  
Source: OMIE, REN, Analysis APREN



# Electricity Market

## Iberian gas price limit mechanism

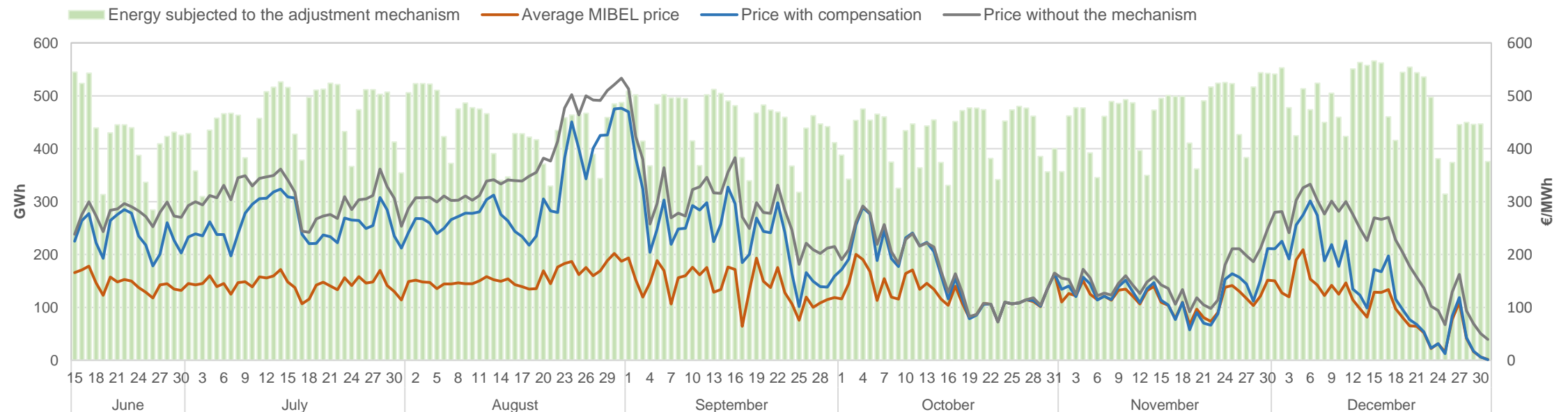
Since June 15, when the Iberian natural gas price limit mechanism came into force, until December 31, the mechanism generated savings of €45.4/MWh<sup>c</sup>, which amounted to a 14.2% reduction in the average hourly price in MIBEL.

The savings due to the limit on the price of natural gas, corresponding to the difference between the price without the mechanism and the price with the compensation payable to natural gas plants, reached a maximum value of €157.2/MWh<sup>c</sup>, and a minimum of €0/MWh<sup>c</sup>.

In total, 90.1 of the 165.9 TWh produced, were subject to the consumer adjustment mechanism in the Iberian Peninsula.



<sup>c</sup> Arithmetic average hourly prices  
Source: OMIE, Analysis APREN



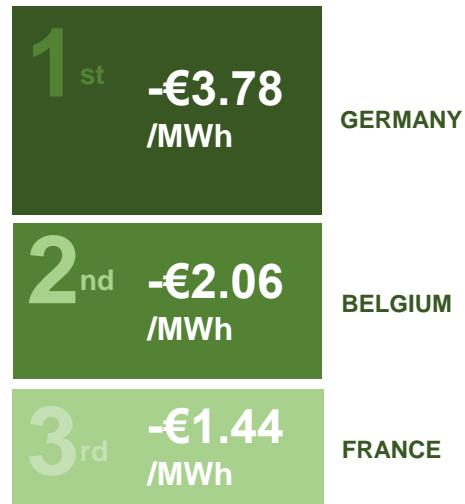
Market price, with and without natural gas price limit mechanism.  
Source: OMIE, Analysis APREN

# Electricity Market: Europe

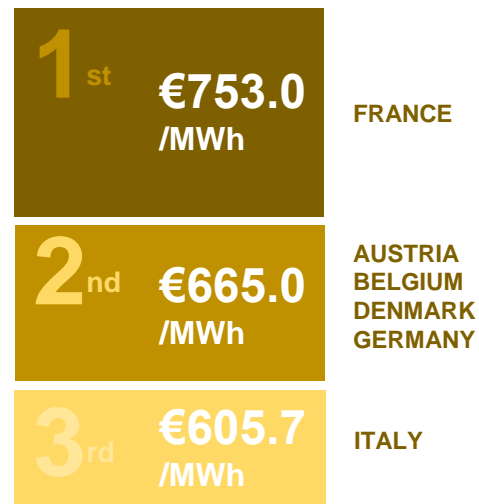
During the month of December 2022, there was a minimum hourly price at MIBEL in Portugal of €0.0/MWh<sup>c</sup>, for 4 hours, with the market price setting was due to various technologies. The maximum hourly price reached €256.7/MWh<sup>c</sup>, where the market closed with renewables, cogeneration and waste.

Regarding prices in Europe, it should be noted that the average values increased, compared to the previous month, except for Portugal and Spain, as well as the maximum prices.

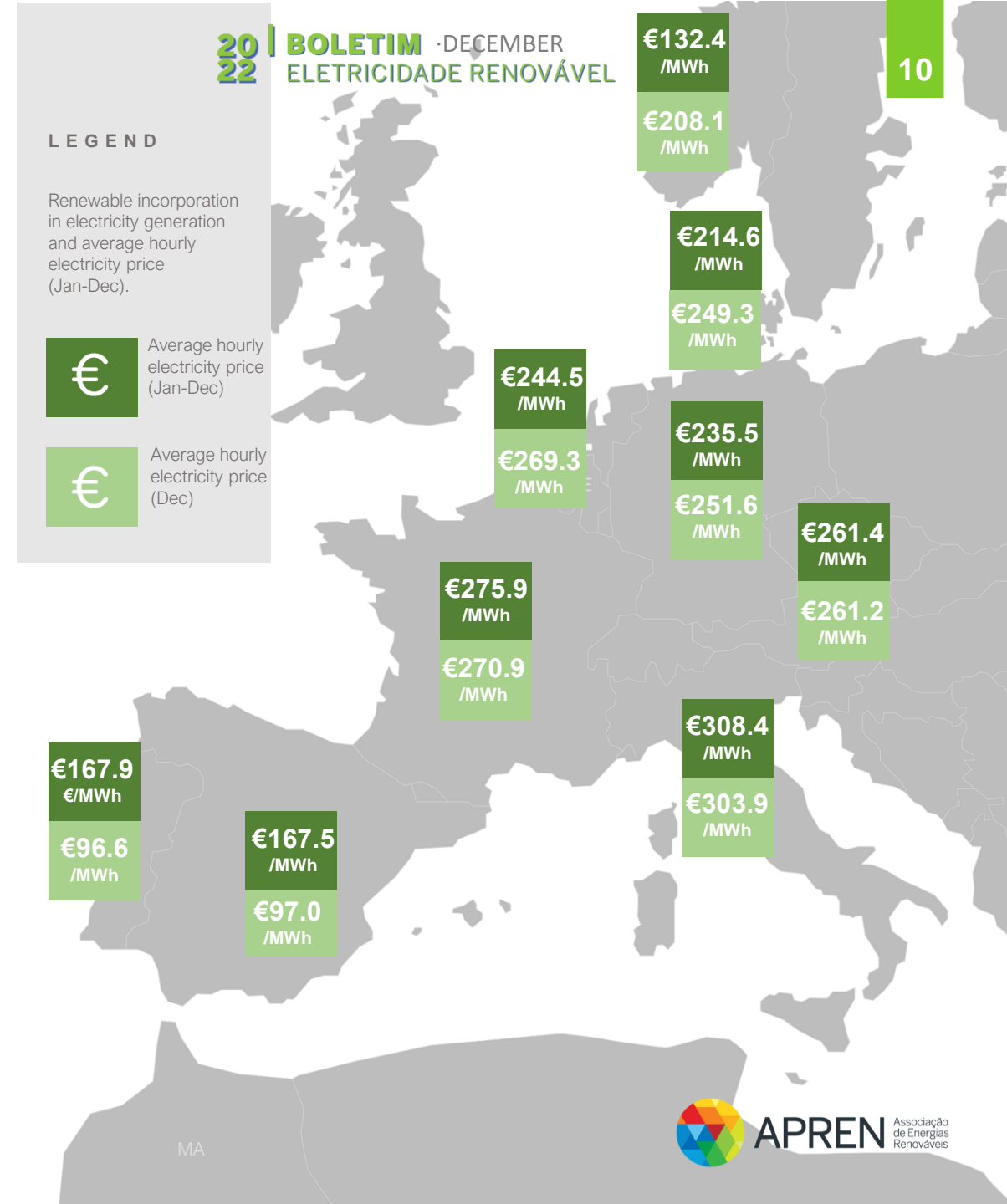
## PRICES MINIMUM (Dec)



## PRICES MAXIMUM (Dec)



<sup>c</sup> Arithmetic average hourly prices  
Source: ENTSO-E, OMIE, Analysis APREN



# Future Electricity Market

The evolution of the average future hourly price shown here, is calculated based on the contracts for the purchase and sale of electricity<sup>d</sup>.

The map on the right shows the price values for the next month (January) and for next year. In both cases, MIBEL has the lowest values, while the French market has the highest ones.

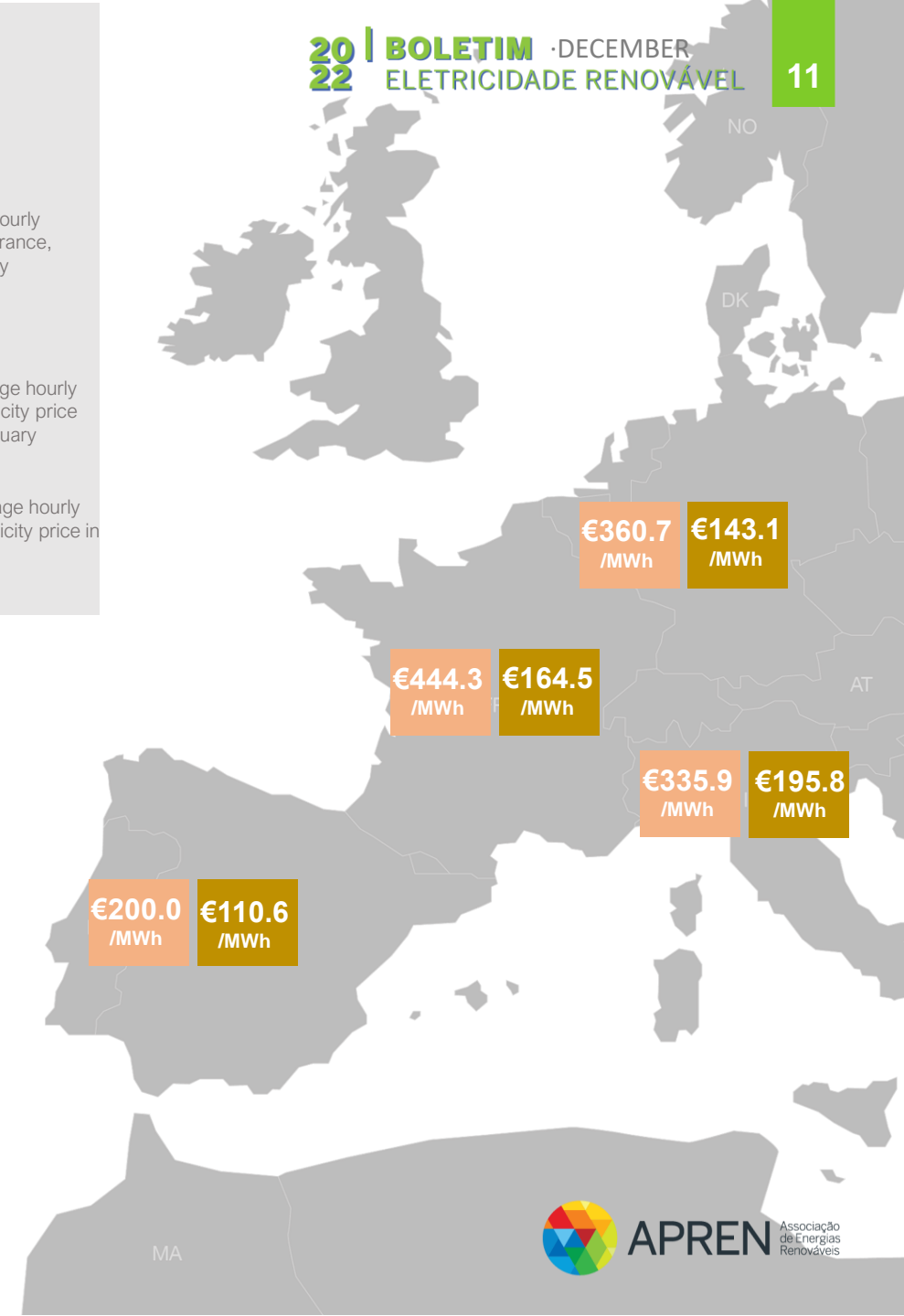
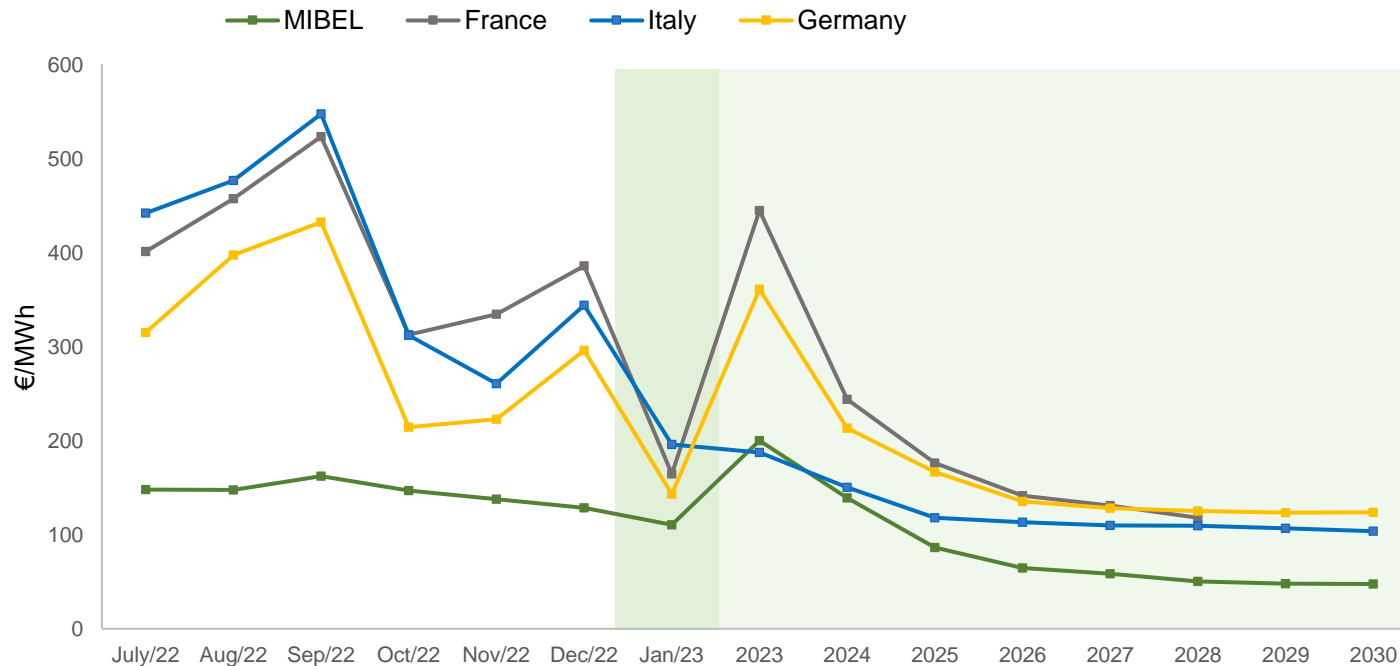
MIBEL also has the lowest figures until 2030, coming from the Iberian gas price limit mechanism by June next year, and from investment in renewable production.

<sup>d</sup> Values updated on January 5th.  
Source: OMIP, EEX, Analysis APREN

## LEGEND

Future average hourly price in MIBEL, France, Germany and Italy (€/MWh)

- € Average hourly electricity price in January
- € Average hourly electricity price in 2023



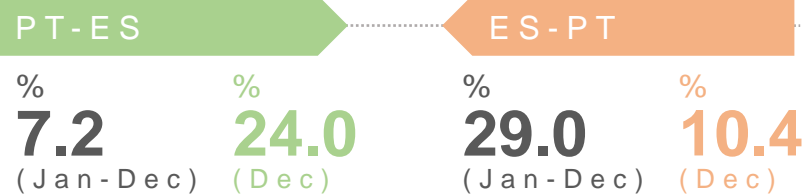
# International Trade

Between January 1 and December 31, 2022, the electricity system of Mainland Portugal recorded electricity imports equivalent to 12,171 GWh and exports of 2,913 GWh, with Portugal being an importer with a balance of 9,258 GWh.

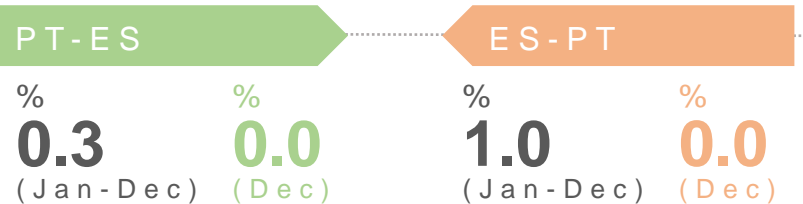
## MAIN INTERCONNECTION INDICATORS PT-ES



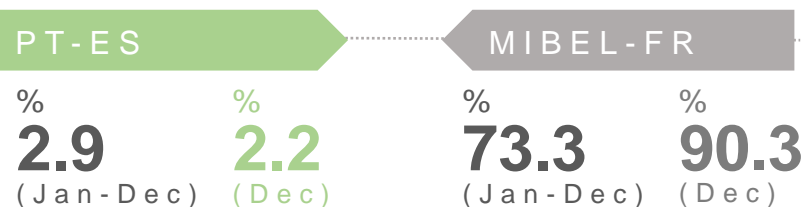
USAGE



CONGESTION



MARKETS SPLIT



Source: REN, Analysis APREN.

### LEGEND

Import balance (Jan-Dec) [GWh]



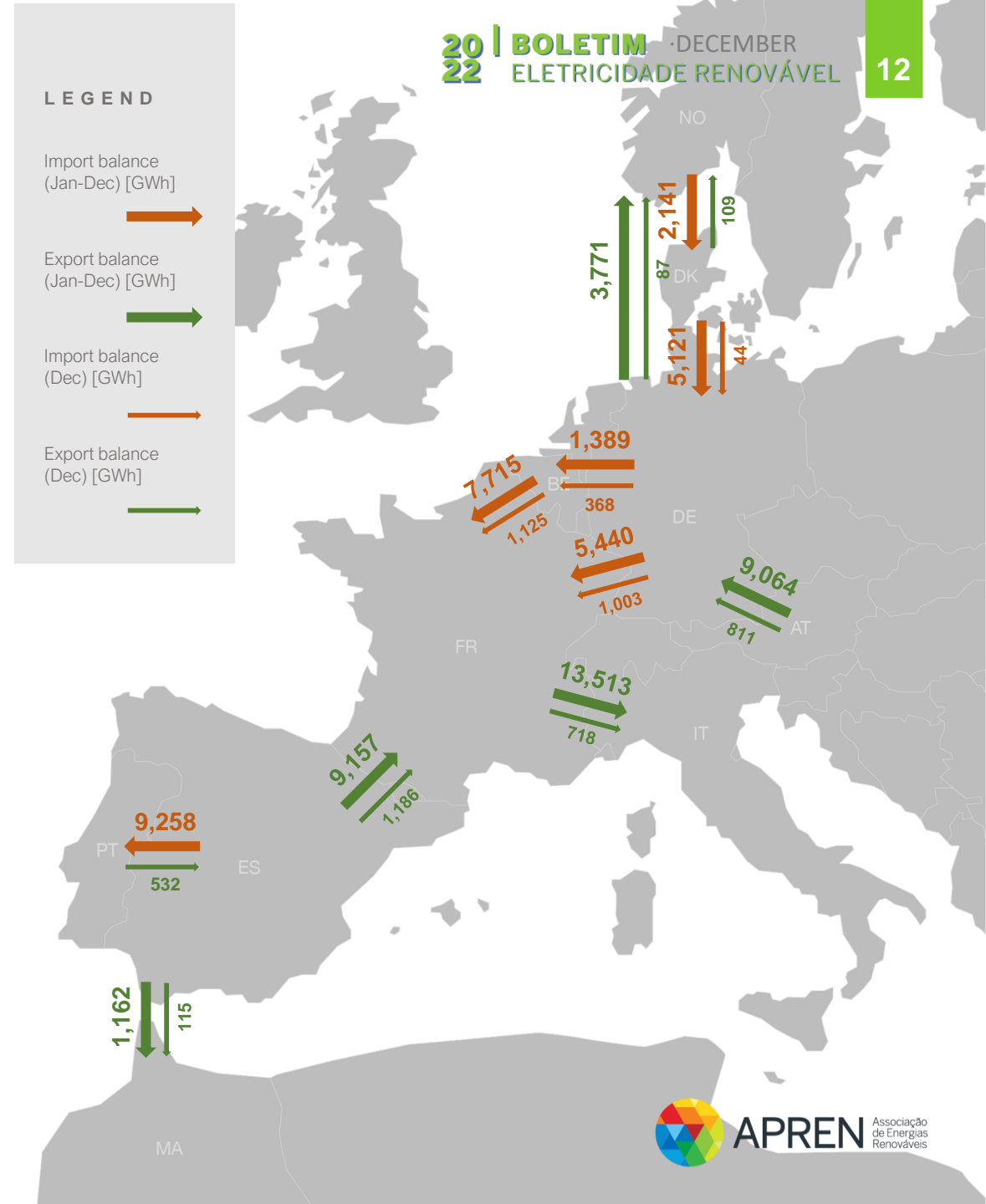
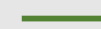
Export balance (Jan-Dec) [GWh]



Import balance (Dec) [GWh]



Export balance (Dec) [GWh]



# Simulation of price formation without SRP

## SRP ESTIMATED SAVINGS

The indicators on the right identify the savings achieved between January 1 and December 31, by the contribution of production under special regime (SRP).

This is a study for SRP, which includes all installed capacity 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 that renewables have generated.



**€196.7/MWh**  
Accumulated savings (Jan-Dec)

**€135.6/MWh**  
Monthly savings (Dec)



**€8,559 M**  
Accumulated savings (Jan-Dec)

**€708 M**  
Monthly savings (Dec)

Note: This analysis is prepared using a program developed by APREN, based on Deloitte's calculation method.

# Power sector emissions

Between January 1 and December 31, 2022, specific emissions reached 137 gCO<sub>2</sub>eq/kWh, while the total emissions from the electro-producing sector reached 6.0 MtCO<sub>2</sub>eq. The European Emissions Trading System (EU-ETS) recorded an average price of €80.9 /tCO<sub>2</sub><sup>c</sup>, a sharp increase compared to the same period in 2021.

<sup>c</sup> Arithmetic average hourly prices.  
Source: OMIE, Analysis APREN

SECTOR EMISSIONS

**6,0**  
MtCO<sub>2</sub>eq

▼ **18.0%**

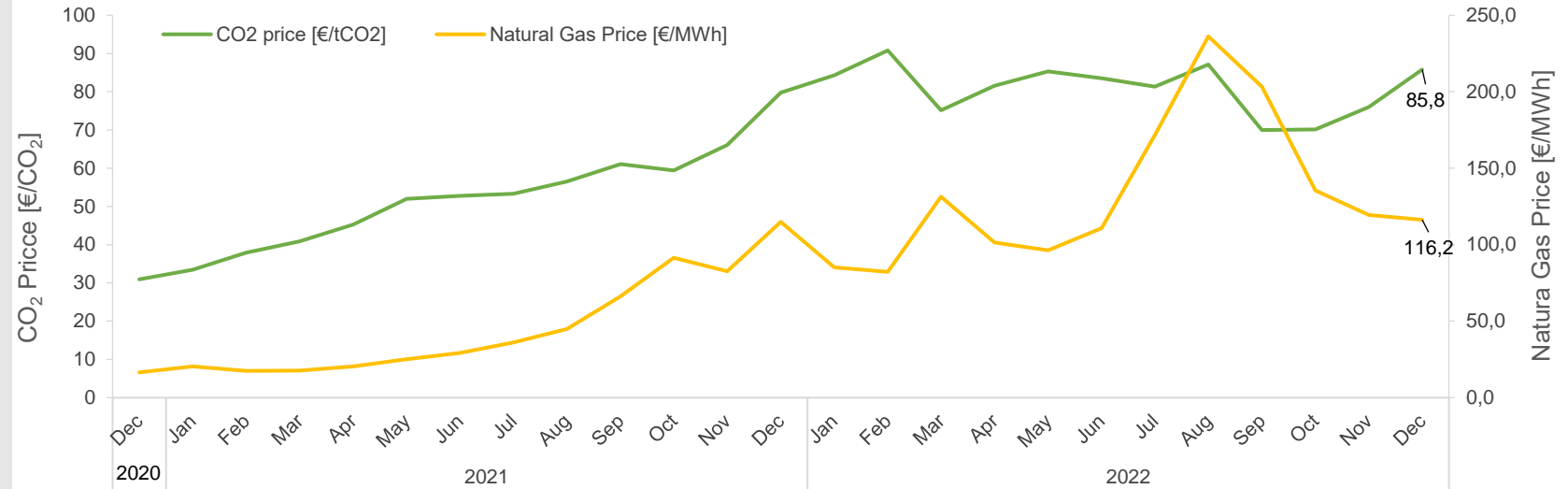
in comparison to Dec 2021

ALLOWANCES AVERAGE PRICE

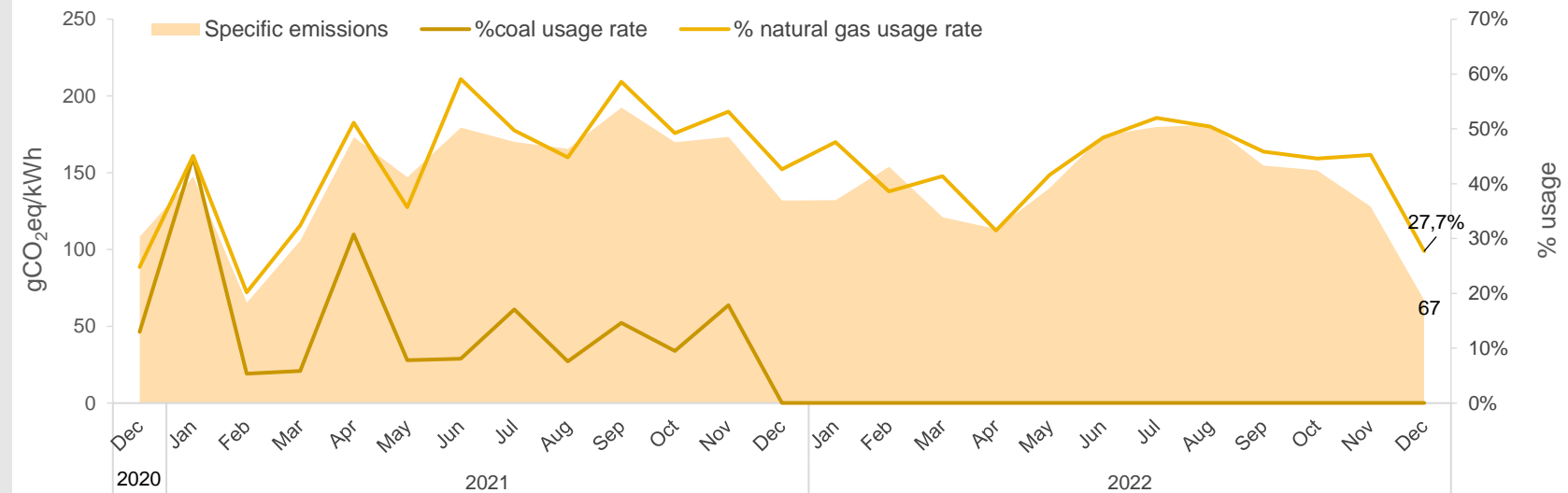
**€80.9**  
/tCO<sub>2</sub>

▲ **52.0%**

in comparison to Dec 2021



Price of CO<sub>2</sub> allowances in EU-ETS and natural gas price in Europe (Dec-2020 to Dec-2022).  
Source: SendeCO<sub>2</sub>, WorldBank.



Market price, electricity consumption and renewable generation (Dec-2020 to Dec-2022).  
Source: OMIE, REN, Analysis APREN

# Environmental Service

The indicators on the right identify the savings reached between January 1 and December 31, 2022, in natural gas, CO<sub>2</sub> emissions and CO<sub>2</sub> emission allowances, resulting from renewable incorporation into electricity generation.

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

## Renewables avoided:



**€5,052 M**

Imported natural gas (Jan-Dec)

**€467 M**

Imported natural gas (Dec)



**8.0 MtCO<sub>2</sub>eq**

CO<sub>2</sub> emissions (Jan-Dec)

**1.0 MtCO<sub>2</sub>eq**

CO<sub>2</sub> emissions (Dec)



**€1,053 M**

Imported electricity (Jan-Dec)

**€200 M**

Imported electricity (Dec)



**€557 M**

CO<sub>2</sub> allowances (Jan-Dec)

**€64 M**

CO<sub>2</sub> allowances (Dec)

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.

# European Barometer

## International hydrogen market

On December 2, the EU and Japan signed a [Memorandum of Cooperation](#) to stimulate innovation and boost the international hydrogen market.

## European Innovation Fund

On December 13, the EU [announced](#) €62 million to be invested in 17 small-scale projects in clean technologies with a fourth round of grants from the EU Innovation Fund.

## Natural gas consumption

On December 20, the EU [presented](#) data from Eurostat showing a 20.1% reduction in natural gas consumption in Europe between August and November 2022, compared with the same period the previous year, under the REPowerEU plan.

## Acceleration of renewable power plants

On December 22, the EU published Council [Regulation \(UE\) 2022/2577](#) of December 22, which establishes a regime to accelerate the deployment of renewable energy.

## Temporary market correction mechanism

On December 22, the EU published Council [Regulation \(UE\) 2022/2578](#) of December 22, which creates a temporary market correction mechanism for orders placed for the trading of TTF derivatives and derivatives linked to other virtual attachment points (VTPs)



# National Barometer

## Simplex

On December 7, the Prime Minister presented a [legislative package](#) within the scope of the Simplex Programme, in which simplifications were announced in the licensing of renewable energy projects, which will come into force on 1 March 2023.

## Consumption of energy from renewable sources

On December 9, the [Decree-Law No. 84/2022](#) was published, establishing targets for the consumption of energy from renewable sources, partially transposing directive (EU) 2018/2001.

## Clearing Mechanism Regulation

On December 15, the Order No. 14384/2022 was published, amending [Dispatch No. 14384/2022](#) of 10 December, which approves the Regulation of the Compensation Mechanism for a fair transition.

## Self-Consumption

On December 21, the [Decree-Law No. 85/2022](#) was published, introducing measures to ease various declaration, payment and invoicing obligations and simplifying the tax obligations arising from the sale to the grid of surplus electricity produced for self-consumption.



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