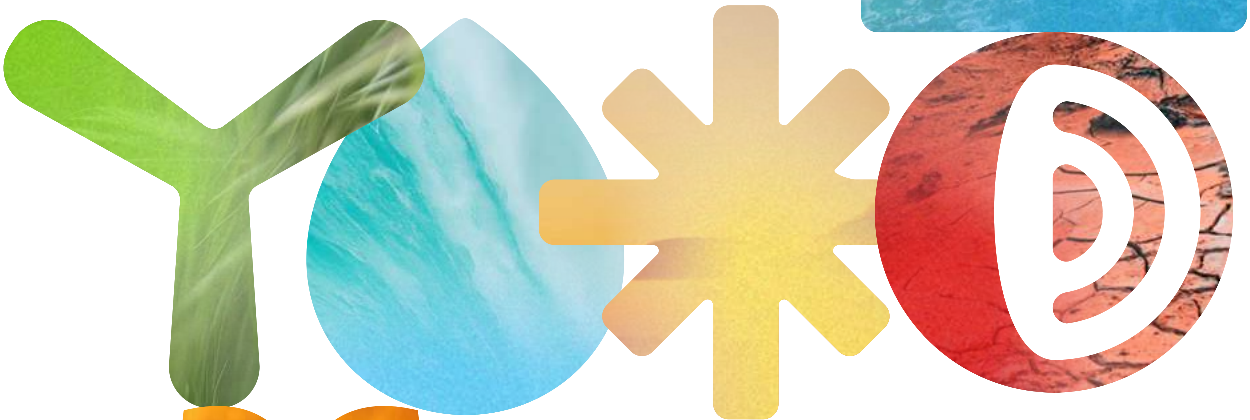
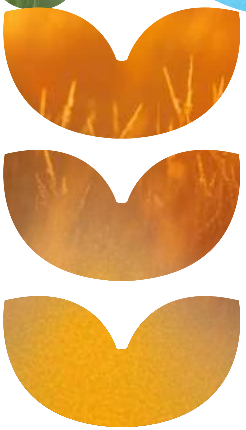
RENEWABLE ELECTRICITY IN REVIEW 25





PORTUGAL NEEDS OUR ENERGY

APREN Associação de Energias Renováveis

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National and Community Energy Panorama

From 2023 onwards, the Iberian electricity market showed relatively high prices, with the average spot market price for Portugal being around 88 €/MWh. The scenario described by a highly volatile environment, marked by geopolitical conflicts such as the war in Ukraine and uncertainties in the supply of natural gas, kept the costs of CO_2 allowances and other consumption high. Nonetheless, being a more favourable hydrological year for Portugal, 2023 saw an increase in hydroelectric production, which eased the need for production by non-renewable thermoelectric plants and consequently helped control electricity prices, albeit with different impacts on industrial and domestic consumers.

In 2024, the market saw a sharp drop in wholesale electricity prices, with an average price of 63 €/MWh, which represented a reduction of around 28% compared to 2023. This decrease was due to the stabilisation of the markets and the fall in the cost of commodities, as well as the implementation of regulatory measures that reassessed the costs of sustainability and general economic interest, adjusting tariffs to real market values. In addition, the progress of the energy transition, with a greater share of renewable energies - wind, solar and hydro - diversified supply and reduced dependence on fossil sources, creating a more favourable environment for the economy by reducing inflationary pressures.

In terms of the most impactful legislative events in the renewable sector, the year 2024 began with important developments at EU level with Regulation (EU) 2024/1252, which aims to guarantee a stable and secure supply of critical raw materials essential for strategic technologies that are key to the European Union's digital and energy transformation. It establishes rules for the exploitation, trade and management of materials such as lithium, cobalt and nickel - indispensable for the production of batteries, electric vehicles, machinery for electrical production and semiconductors - and, at the same time, guides the diversification of supply sources and the strengthening of the supply chain, promoting sustainable extraction and processing practices, in line with the European Union's environmental principles.

Subsequently, Regulation (EU) 2024/1747 was published, introducing the much-needed reform of the design of the European electricity market, with the aim of guaranteeing affordable and competitive prices. This regulation focuses on electricity price stability by incentivising Power Purchase Agreements (PPAs) and Contracts for Differences (CfDs), promotes investment in the installation of renewable projects and introduces measures to reduce consumption peaks and increase system flexibility. It is also adapting the intraday markets to boost the participation of renewables and accelerating the energy transition towards climate neutrality by 2050.

Also noteworthy is the launch of Regulation (EU) 2024/1735, more commonly known as the Net-Zero Industry Act (NZIA), the scope of which is to strengthen the production of carbon-neutral technologies

March 19th
Publication of Decree-Law No. 22/2024

April 11th
Publication of Regulation (EU) 2024/1252

April 30th
European Hydrogen Bank auction

June 26th
Publication of Regulation (EU) 2024/1747

in Europe. Its aim is to guarantee the security and continuity of supply of the raw materials needed to manufacture these technologies, expanding the sector's production capacity and resilience. Measures include reducing the risk of supply interruptions, creating a European market for CO_2 services, encouraging demand for sustainable technologies via public procurement, strengthening skills with specialised support, promoting innovation through regulatory sandboxes and improving risk monitoring and management.

On the national scene, the most recent revision of the 2030 National Energy and Climate Plan (NECP) sets more ambitious targets for investment in renewable energies, with targets of 51% renewables in final energy consumption and installed capacity of 43.5 GW, of which 20.8 GW for solar energy, 2 GW for offshore wind, 10.2 GW for onshore wind and 2 GW for battery storage.

Two pieces of legislation should also be highlighted: Decree-Law No. 22/2024, which extends the deadline for measures to simplify renewable energy production processes, amending Decree-Law no. 30-A/2022 for the third time, and Decree-Law No. 122/2024, which creates the Agência para o Clima, I.P., responsible for implementing climate policies, including planning, monitoring and accountability. The Agency's objectives will be to speed up permitting, simplify procedures and ensure transparency and efficiency in evaluations and public tenders.

Another important development for the sector was the publication of Decree-Law No. 99/2024, which changed the regulatory framework for renewable energies in Portugal in order to speed up the energy transition and meet climate targets. Its main measures include simplifying and speeding up the licensing of production units, extending these processes in extraordinary cases and partially transposing Directive (EU) 2023/2413 (RED III), adjusting rules for licensing and connecting projects. It also establishes a specific regime for energy storage, differentiating between autonomous and collocated storage, and extends the concept of "hybridisation" to integrate new storage units into power generation centres or UPACs.

Finally, it is important to mention Decree-Law No. 116/2024, which amends and extends the exceptional measures of Decree-Law No. 30-A/2022, constituting its fourth amendment. This brought short-term legal predictability to renewables projects, maintaining the simplified procedures until 31/12/2026. This extension is especially important in the context of the energy transition and adapting to the reinforcement of European Union standards, such as the RED III transposition.

June 28th
Publication of Regulation (EU) 2024/1735

December 3rd
Publication of Decree-Law No. 99/2024

December 30th
Publication of Decree-Law No. 116/2024

December 31st
Publication of Decree-Law No. 122/2024

Impact of the Renewable Sector on Energy Dependence and the National Economy

As illustrated in Figure 1, the growing commitment to incorporating renewables has accompanied a steady increase in electricity consumption (yellow bars), heating and cooling (green bars), transport (blue bars) and final energy consumption (grey line). On December 3rd 2024, the Parliamentary Environment and Energy Committee approved the update of the National Energy and Climate Plan 2030 (NECP 2030), which set new targets for the renewable electricity sector: by 2025, installed renewable capacity should reach 24.7 GW, with 500 MW of battery storage and, by 2030, these figures will rise to 44.9 GW and 2.0 GW of storage, respectively. In terms of renewable incorporation in energy consumption by 2030 (2025), the NECP 2030 revision establishes 93% (86%) in electricity consumption, 63% (46%) in heating and cooling, and 29% (19%) in transport. Regarding final energy consumption, the revised plan envisages 51% (40.6%).

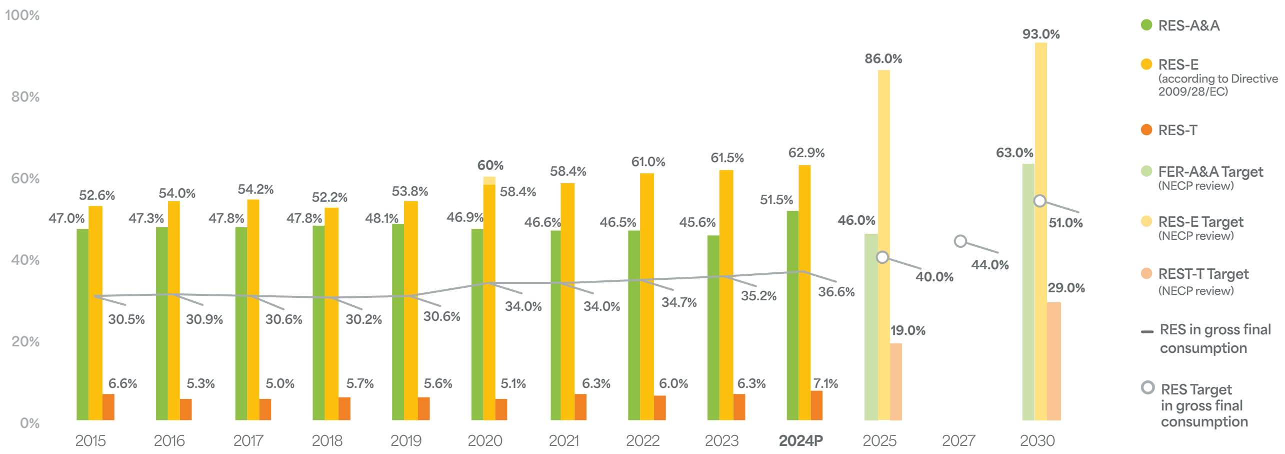


Figure 1 - Incorporation of Renewable Energy Sources (RES) in electricity consumption (RES-E), heating and cooling (RES-A&A) and gross final energy consumption, as well as the NECP 2030 targets. Sources: DGEG; NECP 2030 (03/12/2024); APREN Analysis.

APREN estimates[1] that by 2024 the upward trend in renewable incorporation in the sectors considered in Figure 1 will continue. Of particular note in this analysis is the potential achievement of the renewable incorporation target in heating and cooling as early as 2024 (forecast). With regard to the other sectors, the revision of the NECP reinforces the ambition of the previous Plan, which will require considerable investment in renewable solutions and the electrification of this consumption.

[1] Incorporation of RES in electricity, transport and heating and cooling for 2024 (forecast) calculated from linear regression using the historical values published by the DGEG.

As for energy dependence, the graph in Figure 2 shows that, in general terms, and for the time horizon shown (2005 - 2024), Portugal is showing a downward trend, which is equal to 22 percentage points less between 2005 and 2023. On the other hand, between 2020 and 2023, it is positive that the year 2023 ended with a reversal in the trend of energy dependence, which had been increasing in previous years due to the pandemic and European energy crisis. According to the latest Synthetic Energy Balance published by DGEG, energy dependence in 2024 stood at 64.1%, already below the 65% target set in the NECP for 2030.

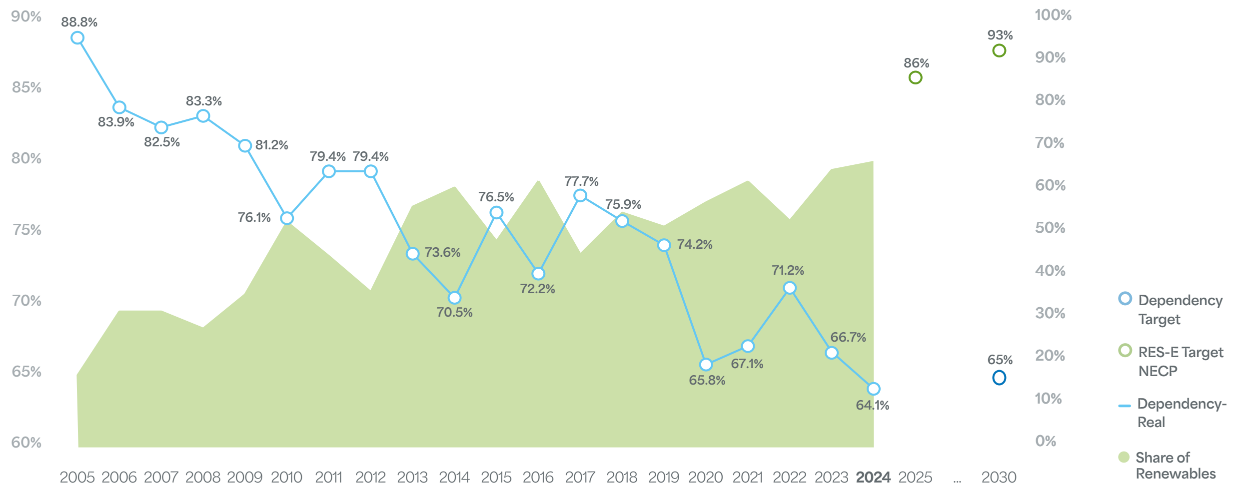


Figure 2 -Energy dependence and RES-E share up to 2024 and NECP 2030 target (revision 3/12/2024). Source: NECP 2030 (3/12/2024); DGEG; APREN Analysis.

Regarding the share of renewables in electricity generation and taking advantage of the record-breaking momentum recorded in 2023, this indicator reached a new all-time high of 78.8% (actual figure) in 2024. This new record was mainly supported by hydroelectricity, which contributed 30.9% of the total generated, followed by the national wind farm, with a contribution of 30.3%, and finally solar photovoltaics, with a contribution of 10.4%[2].

NOTE: Dependency value calculated in a linear regression, based on historical values (2005 - 2023). Source: DGEG

[2] National renewable incorporation values. Source: REN; EDA; EEM.

The graph in Figure 3 shows that since 2020, after the peak of the pandemic, Gross Domestic Product (GDP) has grown continuously. In the year under review, GDP is estimated to have grown by 0.7 percentage points (p.p.) compared to the previous year, totalling 252,000 M€. If confirmed in the future, this will be the highest GDP figure ever.

In the last 10 years (2015 - 2024), the contribution to GDP from renewable electricity production was between 1.5 and 2.8%. Focusing on the last 5 years (2020 - 2024), 2022 stands out as the year in which the contribution of renewables to GDP was lowest. Nevertheless, the contribution of renewables to GDP is estimated to have reached a new all-time high in 2024, at around 7,045 M€.

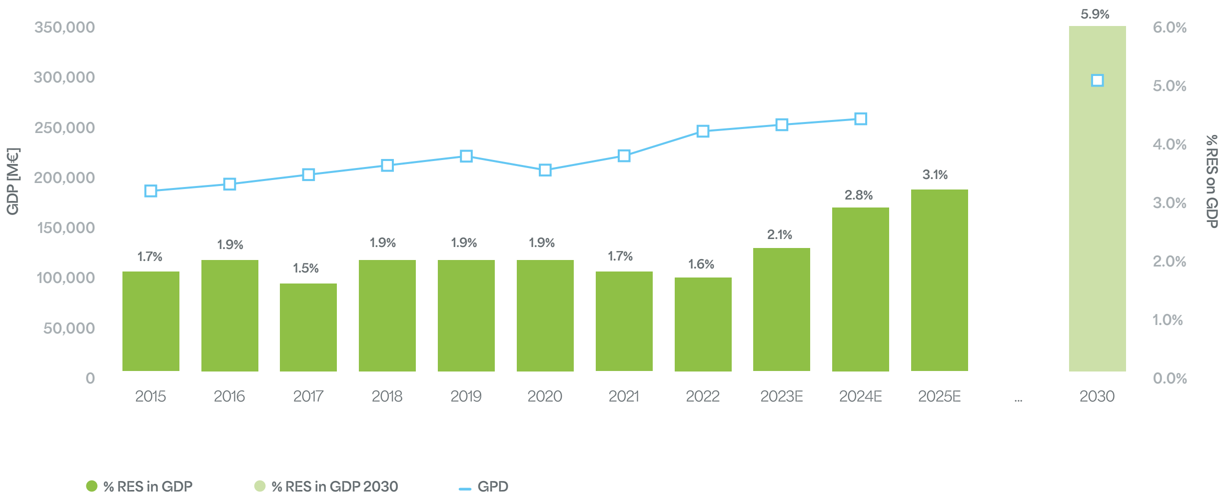


Figure 3 - Impact of Gross Value Added (GVA) generated in the renewable electricity sector on GDP. Sources: Deloitte 2023; INE; APREN analysis.

Electricity in 2024

As far as the national electricity generation park is concerned, 2024 ended with an increase of approximately 2 GW in installed capacity on national territory, which represents an increase of 8.0% on the previous year. Continuing the dynamism seen in 2023, the main driver of this growth was once again the solar photovoltaic sector, which saw an increase of 1,772 MW in installed capacity. This increase was underpinned by strong investment in decentralised solar production, particularly the expansion of Small Production Units (UPP), which grew by around 114 MW, and Self-Consumption Production Units (UPAC), with an increase of 509 MW. Looking at the period between 2020 and 2024, Figure 4 shows an overall reduction in the installed capacity of fossil-fuelled electricity plants (natural gas and oil products), at a rate that enabled the fossil-fuelled capacity target for 2025 to be reached. In addition, it can be prudently anticipated that Portugal is on the right track to achieve the respective target set for 2030.

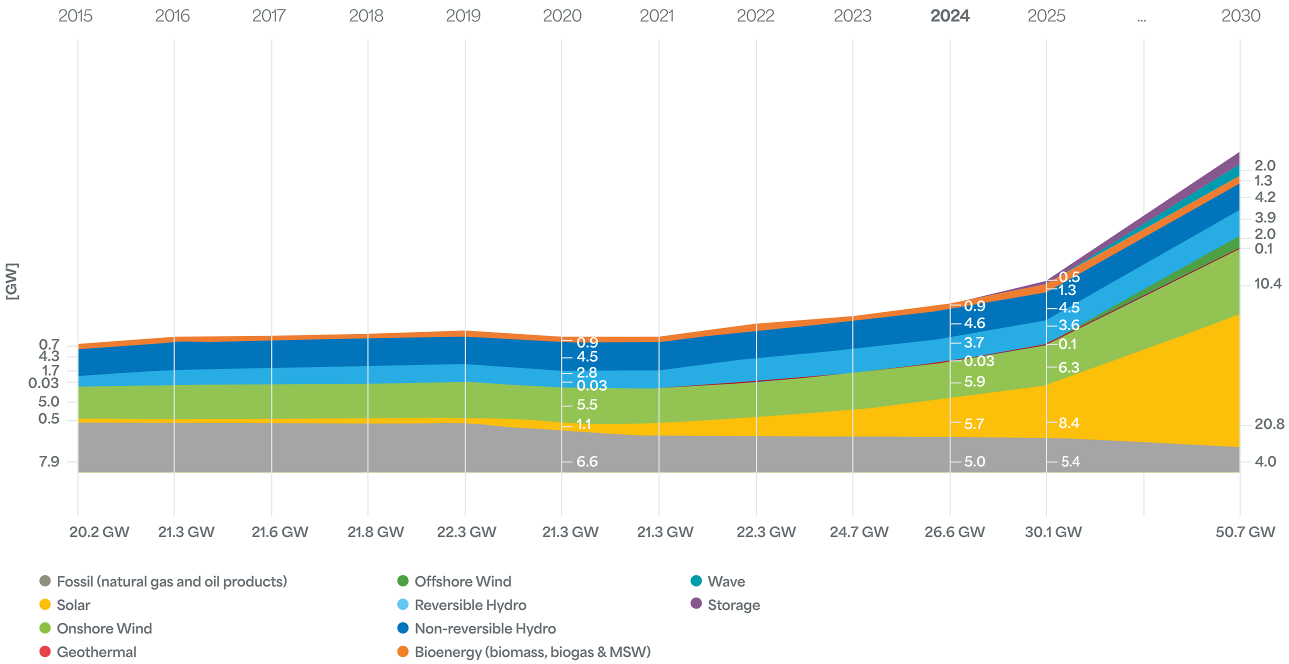


Figure 4 - Evolution of installed capacity in the Portuguese electricity generation system. Sources: REN; DGEG; NECP review; APREN analysis.

Focusing on the renewable sector, the opposite trend to fossil fuels can be seen. Over the period under consideration, there is a strong national commitment to strengthening installed renewable capacity, which grew by around 6 GW between 2020 and 2024, and this growth is once again mainly due to photovoltaics, which grew by 4.6 GW in this period, or 74.2%. As previously mentioned, the most recent revision of the NECP 2030, approved in December 2024, revised the national renewable capacity incorporation targets upwards. Given the total installed in the year under review, Portugal will need to incorporate 3.5 GW (22 GW) by the end of 2025 (2030).

The success of the targets set in the most recent NECP 2030 will only be possible if the regulatory and economic context is favourable to investment in new renewable capacity.

In 2024, electricity production by mainland Portugal's power system reached a total of 45,637 GWh, 77.8% of which came from renewable sources, thus surpassing the peak reached in the past by 7.1 p.p..

Breaking this figure down into the different renewable sources, we can see that hydro and wind technology occupy the top positions with 30.8% and 30.0% respectively. Next is solar photovoltaics, with a contribution totalling around 10.7% of renewable production in the year under review.

Compared to 2023, there is a positive trend towards the progressive suppression of production through fossil fuels, which is most noticeable in the case of natural gas, whose contribution fell by 8 p.p.. In the case of production through fossil cogeneration and others, there was a slight reduction in production, but it remained relatively constant in absolute terms when compared to the previous year.

As far as renewables are concerned, all of them increased their production, the most appreciable being hydroelectric, with a 4.3 p.p. increase in production, followed by solar with a 1.8 p.p. increase. Also worthy of positive mention is the 1.6 p.p. increase in production from pumping.

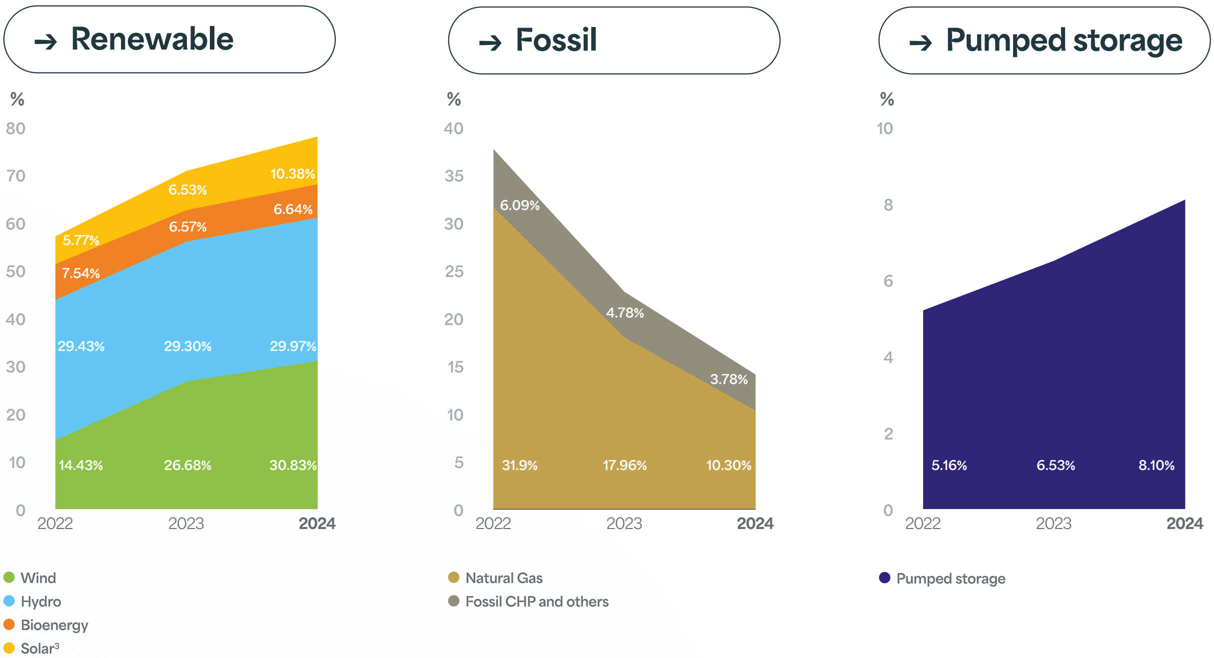


Figure 5 - Evolution of mainland Portugal's electricity generation mix from 2022 to 2024. Sources: REN; APREN Analysis.

[3] Disclaimer: the graph in the figure does not consider production through decentralised solar.

When considering electricity production at national level, including the Autonomous Regions (AR), the total generated amounts to 47,437 GWh. In this context, the renewable contribution drops slightly to 77.6%, despite the additional 0.3% contribution from Geothermal, as shown in the figure below.

This slight decrease is the result of the greater weight of production from fossil fuels, increasing by 0.9 p.p. compared to production on the mainland alone, since fuel consumption continues to play a fundamental role in meeting the Autonomous Regions energy needs.

The renewable fraction grew by 7 p.p. compared to the previous year, with an increase of around 3 p.p. and 4 p.p. in solar and hydro production, respectively.

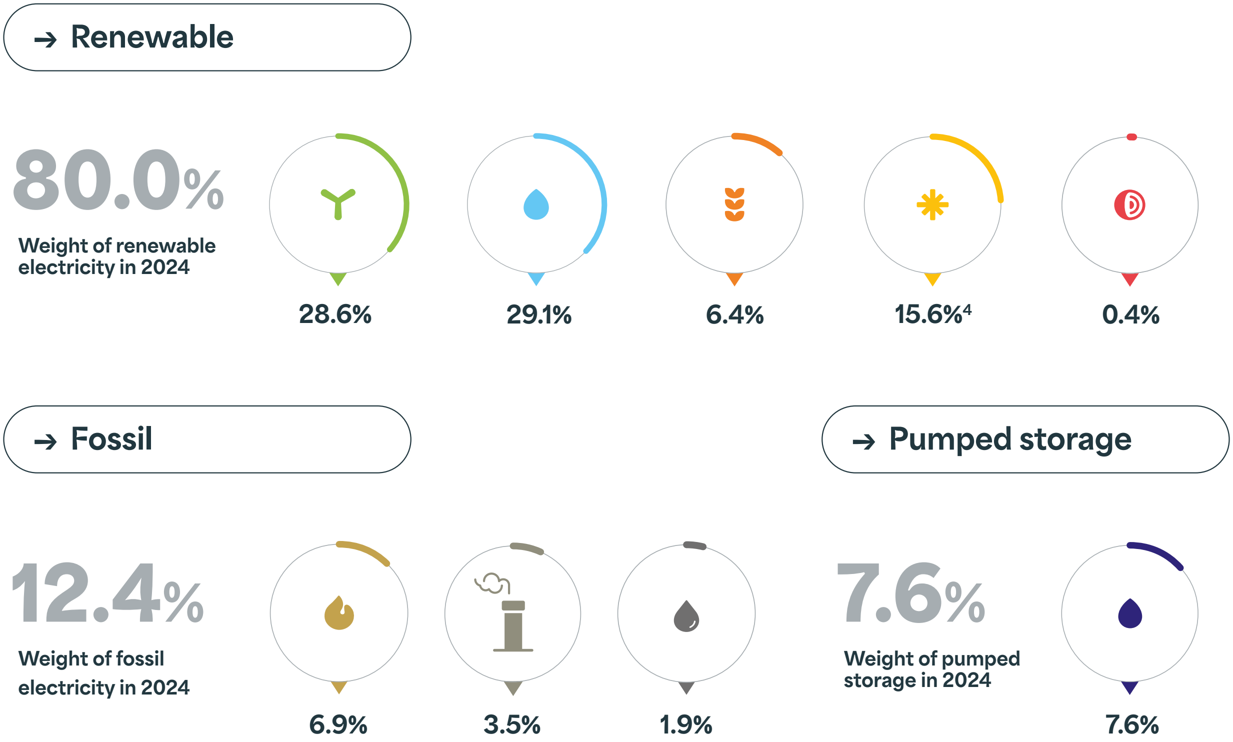


Figure 6 - Electricity generation mix of Mainland Portugal and Autonomous Regions in 2024. Sources: REN, EDA and EEM, APREN Analysis.

[4] Disclaimer: includes decentralised production.

Next, the performance of the most representative technologies in the continental electricity generation system is analysed in detail, in order to better understand the most common operating regimes.

In the case of hydroelectric technology, it can be seen that the distribution of values is unimodal and skewed to the left, where for more than half of the 8,784 hours of the year under review (4,684 h ~ 53.3%) the power regime of this technology occurred up to 1,800 MW. The peak of the distribution was in the 600 to 900 MW power regime, totalling 1,013 hours in this range, or roughly 12% of the total.

→ Hydro Technology

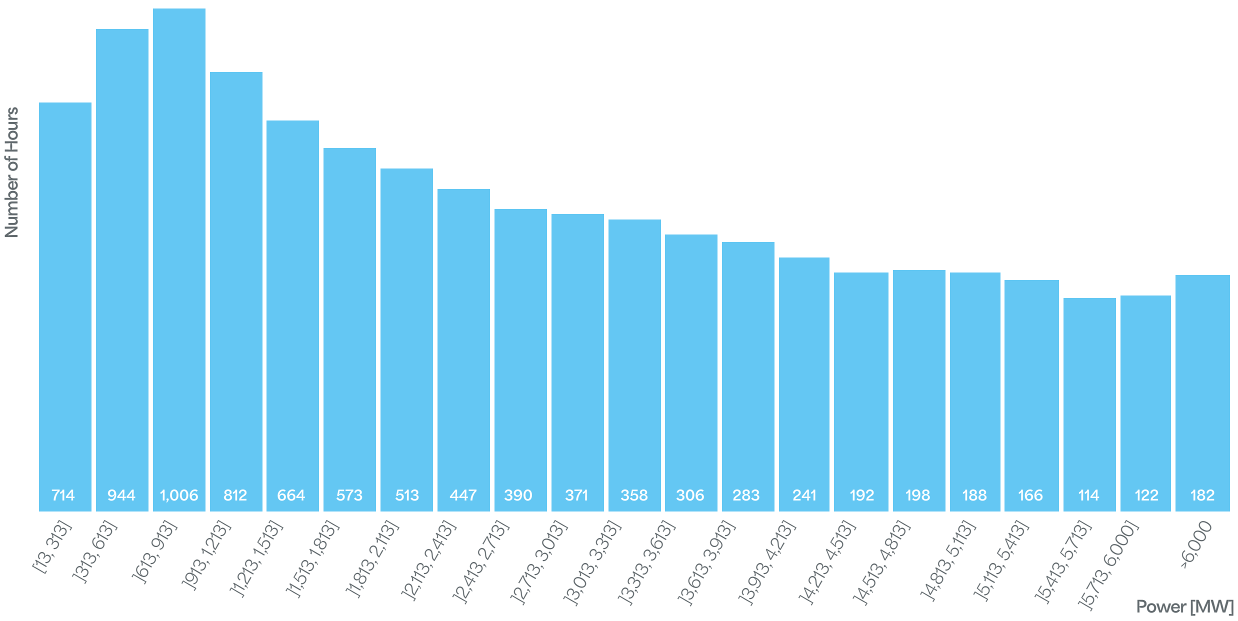


Figure 7 - Annual frequency distribution of operating power for **hydro** technology in 2024. Source: REN; APREN analysis.

As far as wind technology is concerned, the behaviour is similar to that of hydro. As such, more than half of the operating hours for this technology were in the operating range up to 1,500 MW, with a peak of 957 hours in the power range between 250 and 500 MW.

However, there is a plateau between 500 and 1,250 MW of power, with these intervals having very similar values in terms of the hourly distribution of production.

→ Wind Technology

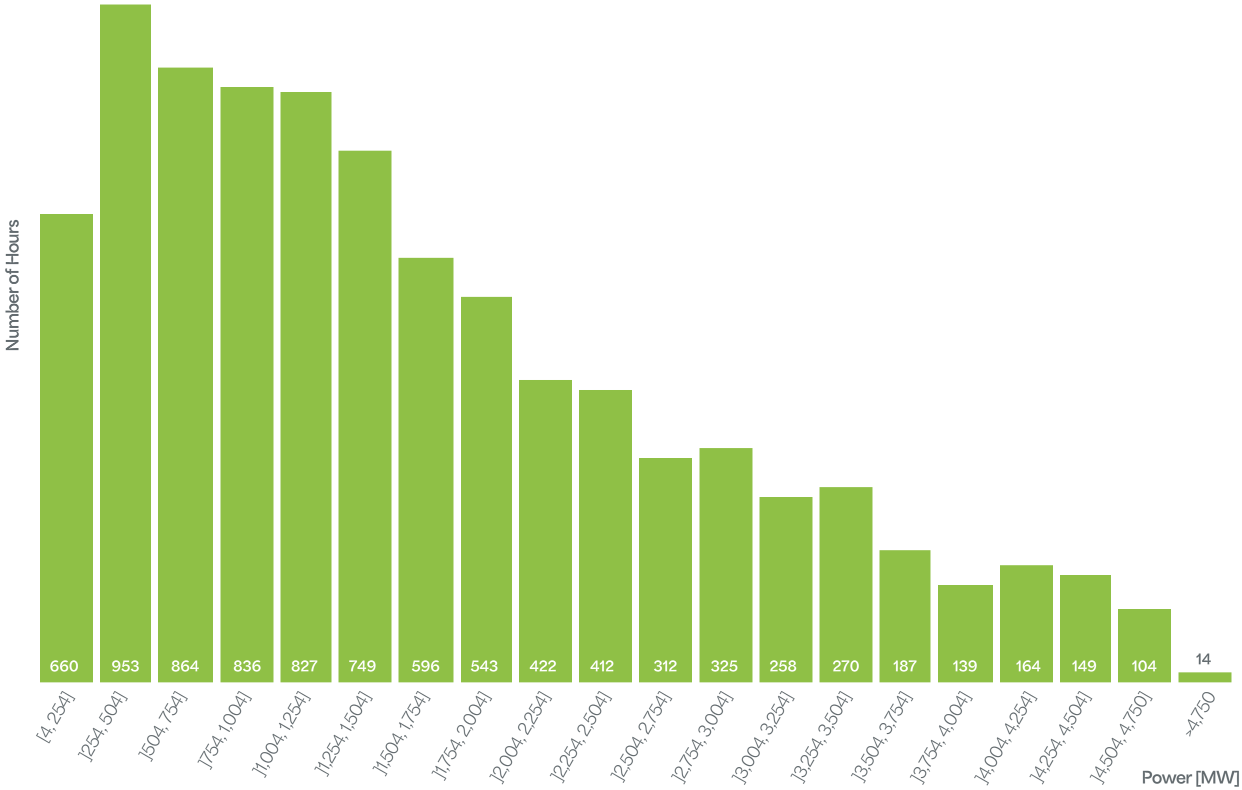


Figure 8 - Annual frequency distribution of operating power for **wind** technology in 2024. Source: REN; APREN analysis.

The solar electricity generation park has perhaps the most interesting histographic distribution, as it operates quasi-symmetrically between the day and night periods, as well as the homogeneity of the distribution of operating hours between the various regimes.

Nevertheless, it is worth noting the increase of 1,047 operating hours for the > 1,800 MW operating regime compared to the previous year, which is clear evidence of the heavy investment in the installation of new solar capacity.

→ Solar Technology

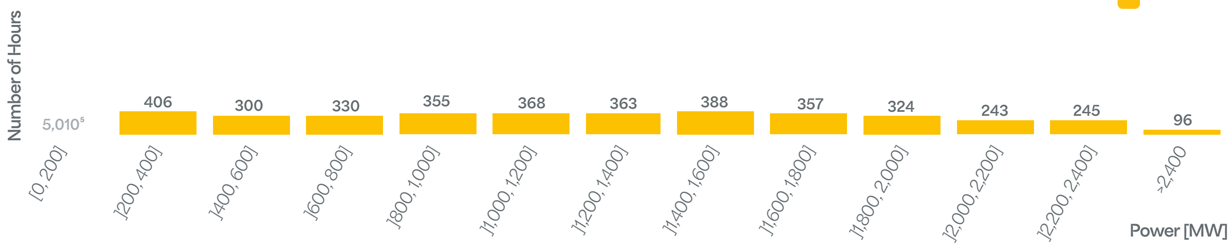


Figure 9 – Annual frequency distribution of operating power for **solar** technology in 2024. Source: REN; APREN analysis.

[5] For the sake of clarity, hours with operational power below 200 MW have been excluded from the chart.

Finally, and taking into account the baseload behaviour of biomass plants, it is clear that the most common operating regime was between 330 and 370 MW, for a total of 4,525 hours, or 51.5% of the hours in 2024.

→ Biomass Technology

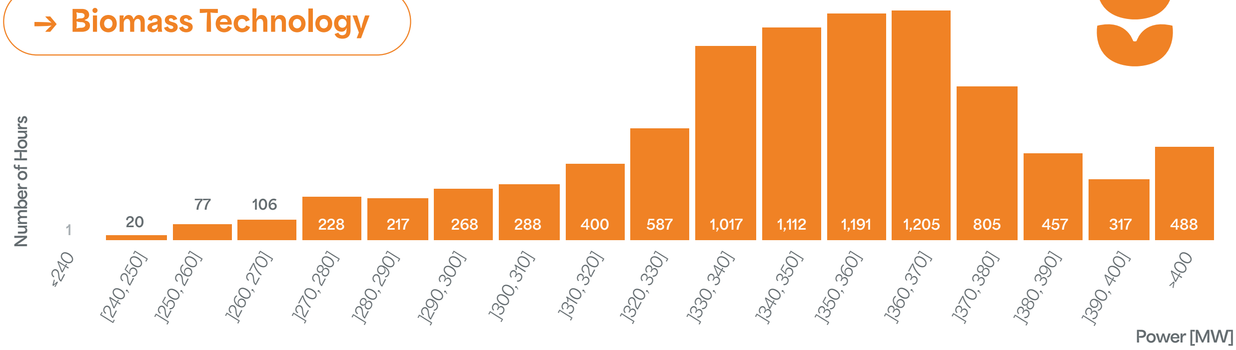


Figure 10 – Annual frequency distribution of operating power for **biomass** technology in 2024. Source: REN; APREN analysis.

A seasonal analysis of the performance of the most representative technologies in the national electricity generation park makes it possible to assess the availability of the respective endogenous resource monthly.

In terms of water productivity and taking advantage of the momentum seen in the last few months of 2023, the water resource was most significant in the months of January to April 2024. At the end of this period, the hydroelectric production park closed with a hydroelectric producibility index for the calendar year of 1.40 and reservoir storage of 2,866 GWh, corresponding to 88.1% of storage capacity. Also noteworthy in this period was the month of March, in which 75% of the hours of the month the operating power was equal to or less than 5 GW. Despite the slight easing of the drought situation in Portugal during the year under review, in the following months hydro production fell considerably, reaching its lowest point in August, when the third quartile corresponded to an operating power of around 1.6 GW. In line with last year's trend, it can be concluded that despite the slight upturn in the last three months of the year, it was not as significant as in the previous year.

→ Hydro Technology

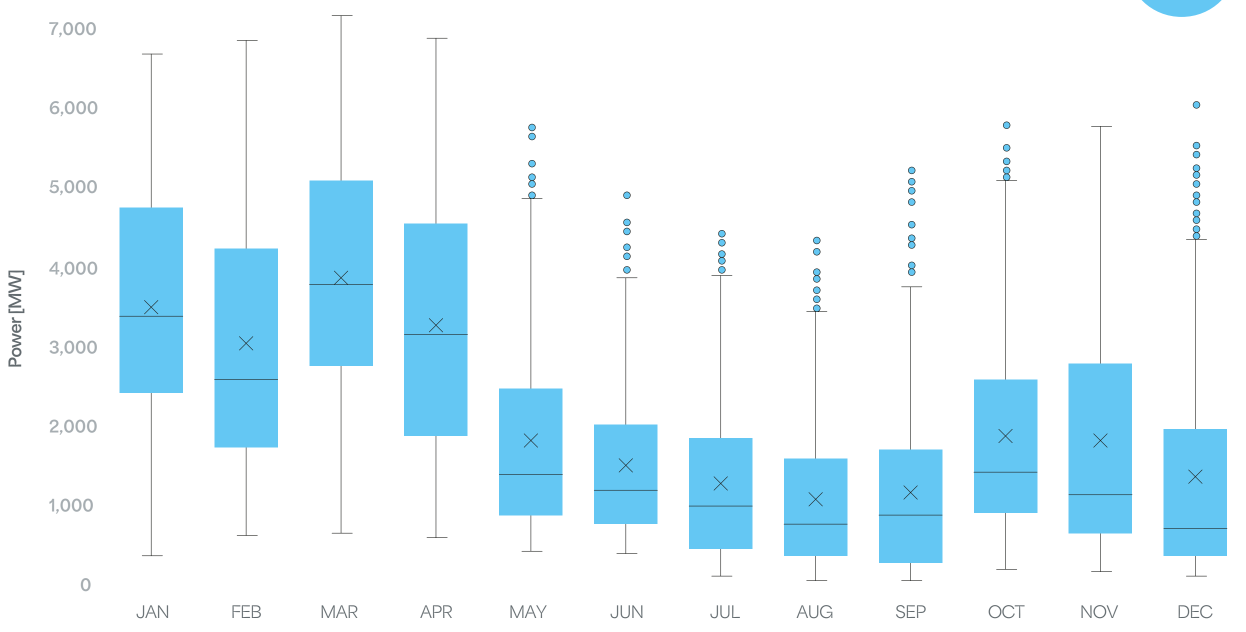


Figure 11 - Monthly distribution of average hourly operating power for **hydro** technology in 2024. Source: REN; APREN Analysis.

As for wind productivity, a seasonal pattern is evident. If you analyse the corresponding graph in Figure 12, you can see that the wind resource is most expressive in the period between January and April, followed by a period between May and August, in which wind productivity drops, and then picks up again in the last four months of the year. Wind production was most significant in February, when the third quartile corresponded to a power output of approximately 3.8 GW, while the appreciable wind output in October and November is also noteworthy.

→ Wind Technology

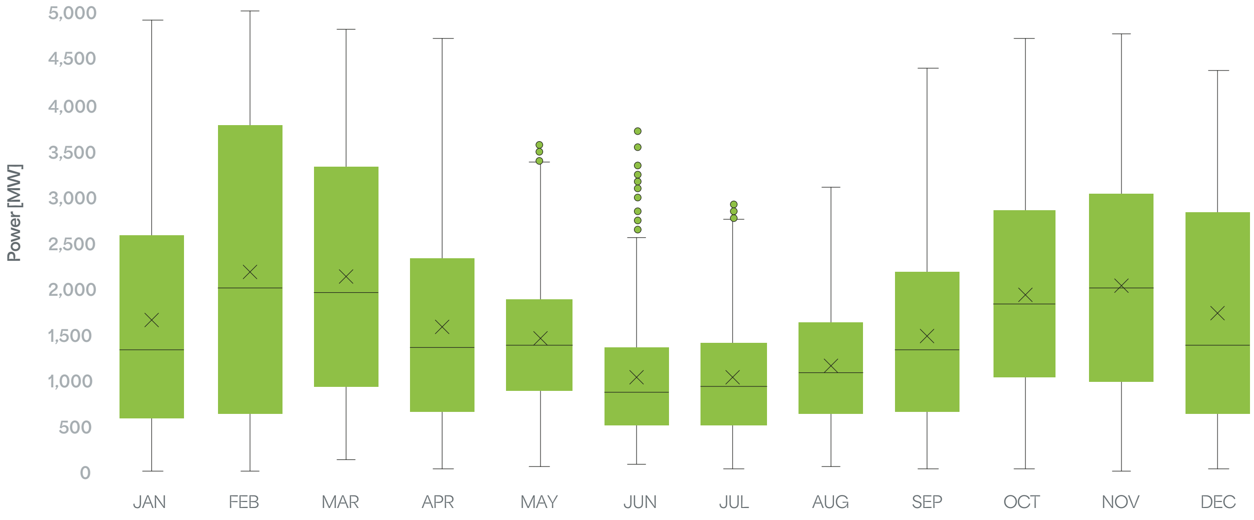


Figure 12 - Monthly distribution of average hourly operating power for **wind** technology in 2024. Source: REN; APREN Analysis..

Regarding solar photovoltaics, it is easy to see the correlation between the seasonality of electricity production and the solar irradiance available on the continent. Considering that solar irradiance typically approximates a normal distribution over the twelve months of the year, this correlates with greater interquartile distances in the spring and summer months, which are naturally smaller in the winter and fall months. In addition, compared to the previous year, there is an increase in the amplitude of the "boxes", showing the increase in installed solar capacity in 2024.

The baseload operating regime of biomass power stations can also be seen in Figure 14, which is characterised by little variation in operating power over the various months.

It is also worth noting that in the first six months of the year under review, renewable incorporation in relation to production was over 80%, with April being particularly noteworthy, when the figure rose to 87.6%. In annual terms, the average monthly renewable incorporation in relation to production was 80%.

→ Solar Technology

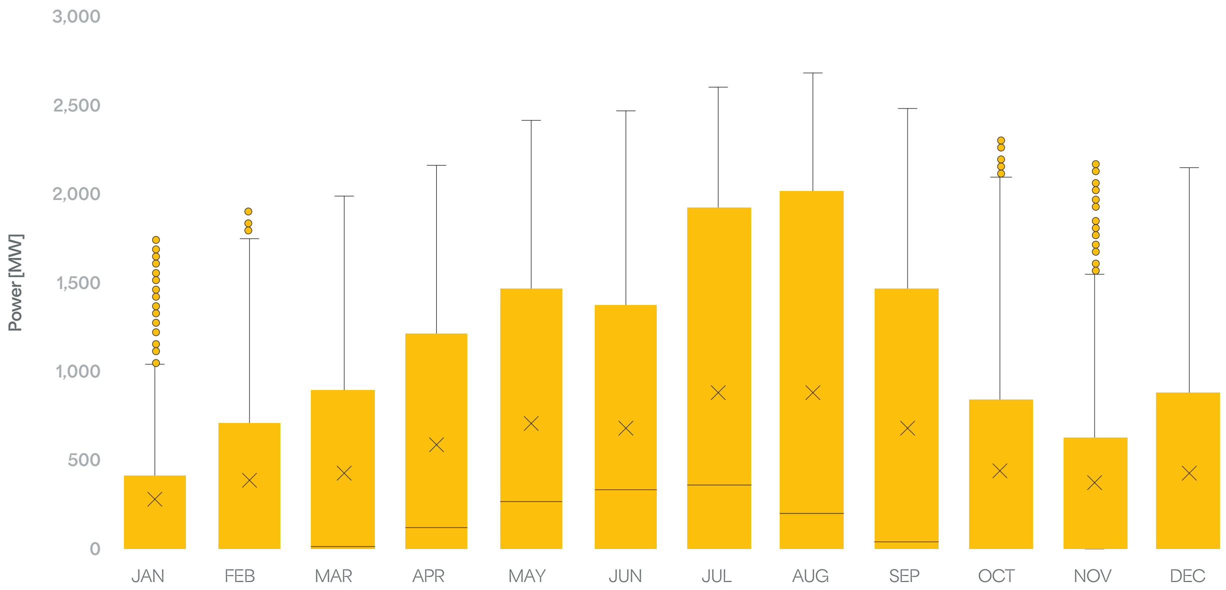


Figure 13 - Annual frequency distribution of operating power for **solar** technology in 2024. Source: REN; APREN analysis.

This allowed the wholesale market to close with 100% renewable generation for a total of 1,867 non-consecutive hours, which is equivalent to around 78 days of the year. In addition, it should be noted that the average MIBEL price during these hours was 43.5 €/MWh.

→ Biomass Technology

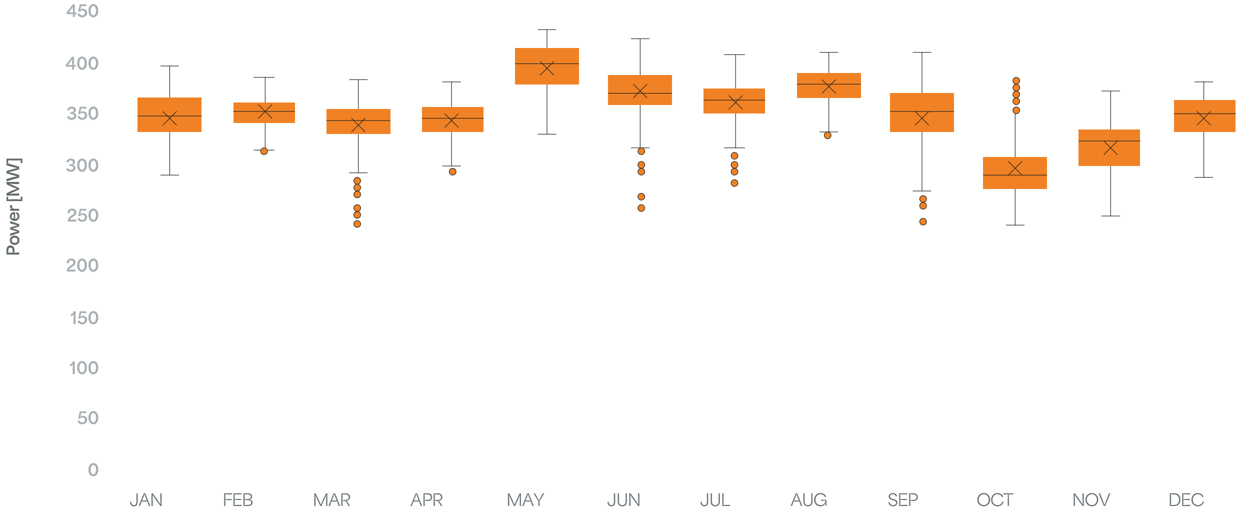


Figure 14 - Annual frequency distribution of operating power for **biomass** technology in 2024. Source: REN; APREN analysis.

Figures 15, 16, 17 and 18 show the average hourly power for each day in 2024. Once again, the complementarity between renewable technologies can be seen, emphasising the greater scarcity of the hydro resource in the hot months, as well as the "dispatchability" of hydro at the beginning and end of the day (times when electricity consumption increases rapidly), almost complementing the increase/decrease of solar. Wind power, on the other hand, appeared to be more consistent intra-day, showing greater inter-day variation and less resource between June and August. As for solar, the circadian cycle and the greater power during the zenith are evident, as are periods of cloudiness and night-time hours. The greater constancy of biomass is also observed, with months of greater production corresponding to the best time to harvest the resource, late winter or spring, or to excess storage, late summer.

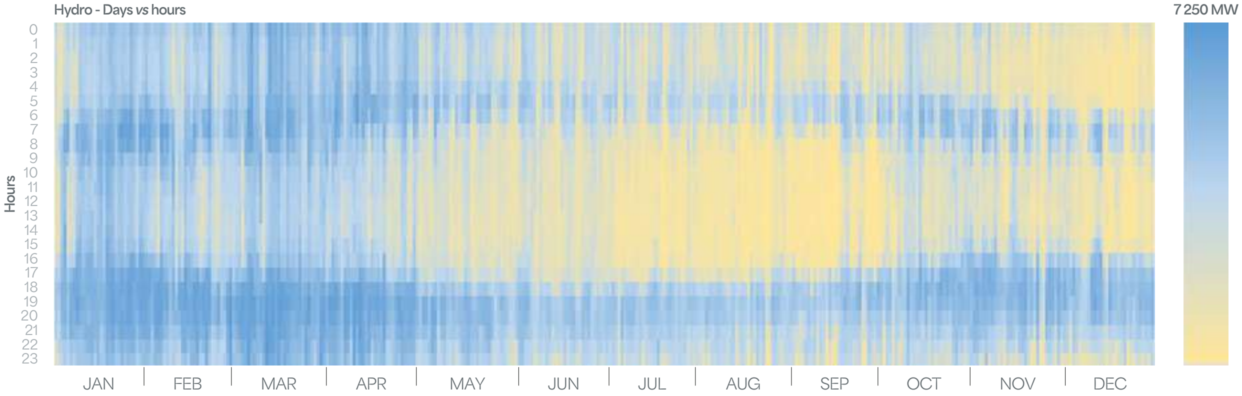


Figure 15 - Hourly distribution of average operating power in 2024 for hydroelectric technology. Source: REN ; APREN Analysis..

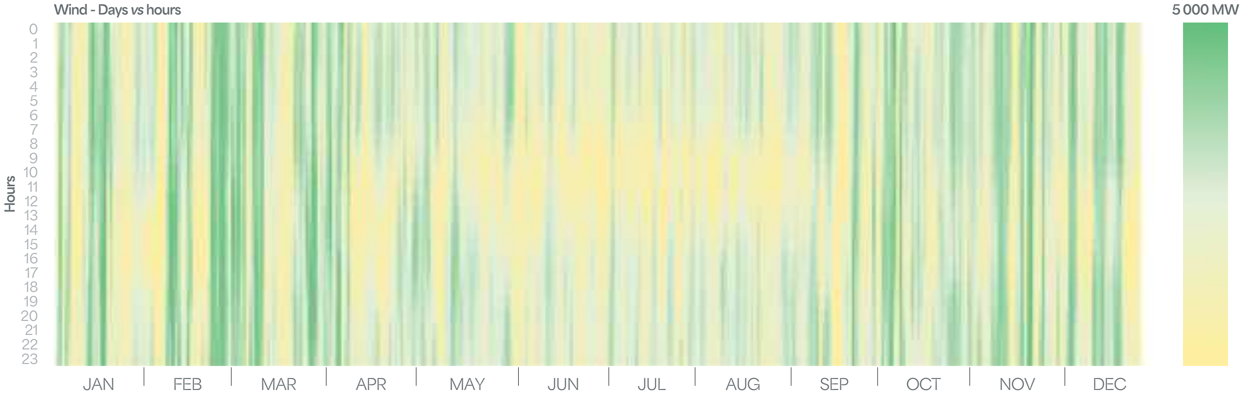


Figure 16 - Hourly distribution of average operating power in 2024 for wind technology. Source: REN ; APREN Analysis.

Electricity in 2024

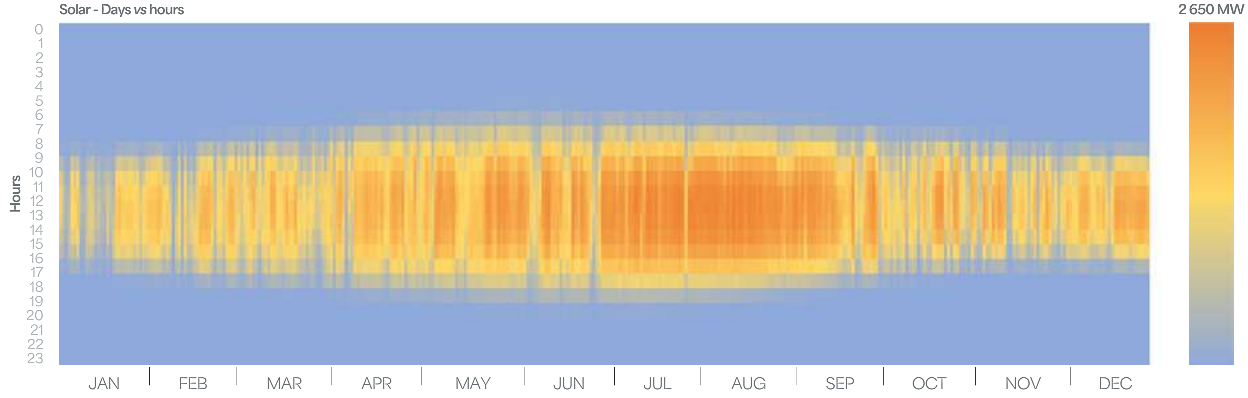


Figure 17 – Hourly distribution of average operating power in 2024 for solar technology. Source: REN ; APREN Analysis.

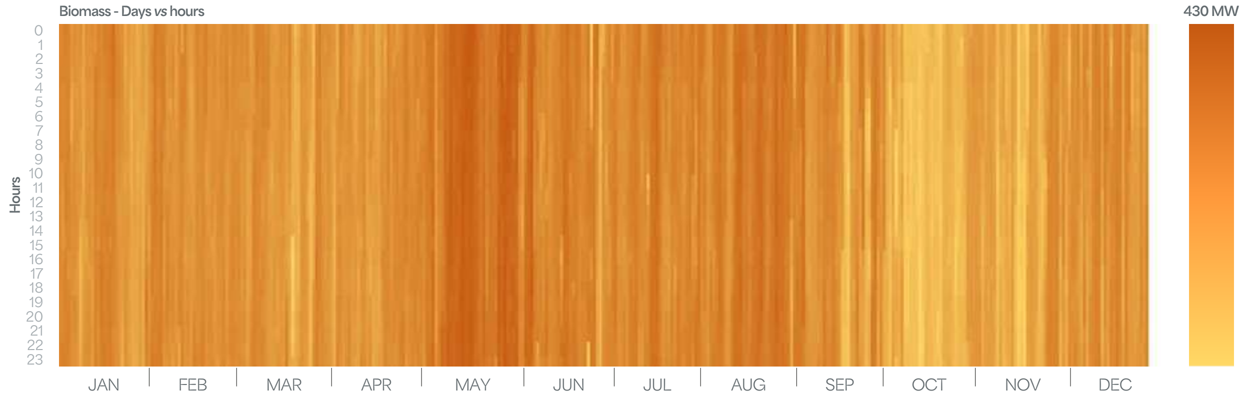


Figure 18 – Hourly distribution of average operating power in 2024 for biomass technology. Source: REN ; APREN Analysis.

The electricity market in 2024

In 2024, the average hourly price in MIBEL was 63.5 €/MWh, which, compared to 2023, represents a reduction in the average price of electricity of 24.8 €/MWh. In three months of the year under review (February, March and September), the minimum price was 0 €/MWh. However, it is important to note that in six months of the year (April, May, June, July, August and October) the minimum price of electricity was negative, with its minimum in June, when it was -2.0 €/MWh. The graph in Figure 19 correlates the impact of the variation in renewable generation with the electricity market price. In the years of recovery from the socio-economic consequences of the COVID-19 pandemic and the continuation of the war in Ukraine (2023 and 2024), the upward trend in annual renewable generation has made it possible to return to the trend of lower average annual prices in MIBEL.

In terms of national renewable generation in 2024, this figure was 36.7 TWh, corresponding to an increase of 5.5 TWh of energy generated and a new all-time high for renewable generation. In terms of national consumption, this totalled 55.4 TWh, corresponding to an increase of 4.7 TWh in energy consumed, which is also a new all-time high. These figures confirm a relative recovery in the national economy after the contraction seen in 2022, due to the reasons mentioned above.

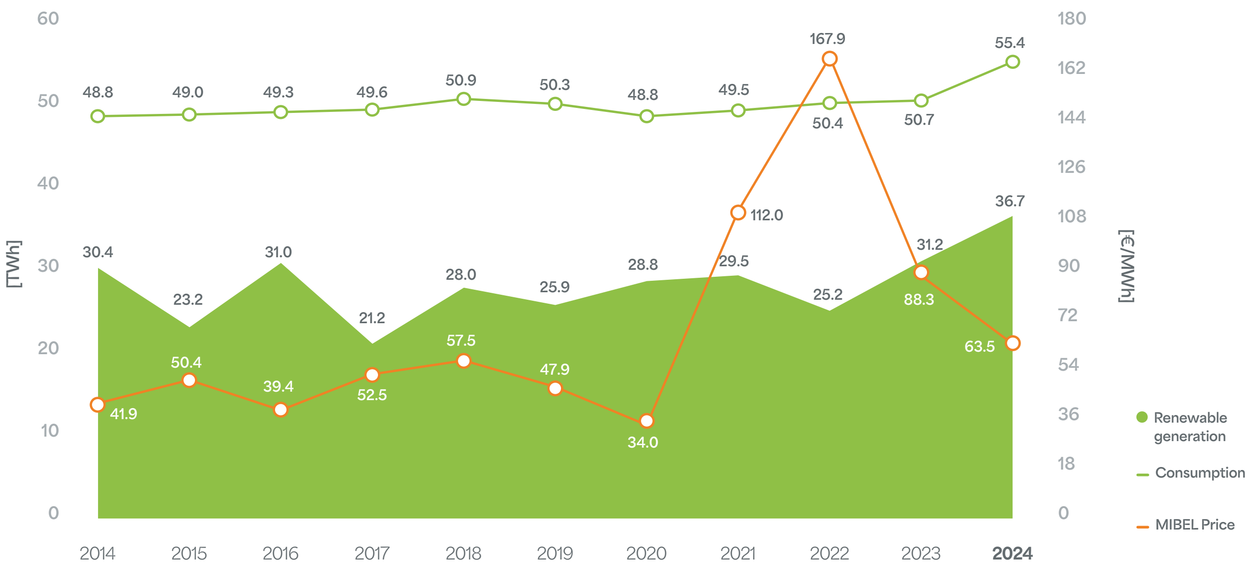


Figure 19 - MIBEL electricity price in Portugal, renewable electricity generation and electricity consumption. Sources: OMIE; REN; APREN analysis.

Building on last year's momentum, the average price of natural gas fell again in 2024, closing at 34.6 €/MWh, which corresponds to a reduction of 6.7 €/MWh compared to 2023. This decrease in the average price of natural gas can partly be explained by the gradual reduction in the use of electricity plants based on this resource to meet national electricity needs.

Regarding the average price of CO_2 emission allowances, we can see that the upward trend in this instrument was reversed in the year under review. In 2024, the value of these allowances was 65.3 €/tCO_2, with renewables saving 683 M€ in emission allowances.

This reversal can also be explained by the reduction in industrial demand, especially in the electro-intensive sectors, because of the events already reported in 2022, which in practice translated into a reduction in the need to buy allowances to offset emissions. On the other hand, the growth of renewable electricity generation and the phasing out of fossil fuels has led to a reduction in pressure on this market. Another factor that may have influenced the reduction is the adjustment of supply through the Market Stability Reserve (MSR), which contributed to an excess of allowances available on the market.

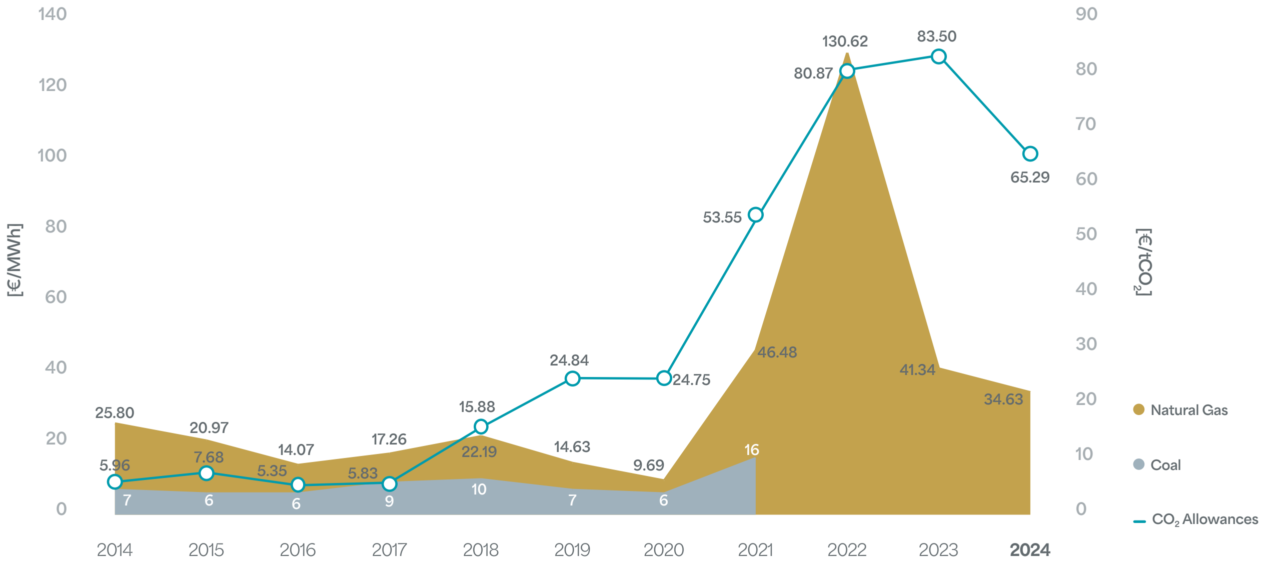


Figure 20 - Commodity prices: coal, natural gas and CO_2 allowances. Sources: DGEG; THE WORLD BANK; SENDECO2; APREN Analysis.

In 2024, the electricity-producing sector was responsible for the emission of 1.82 MtCO_2-eq, 55% less than in 2023, thanks to the increase in renewable capacity and the greater incorporation of renewables in electricity production, as well as less use of natural gas combined cycle thermal power stations.

These emissions translated into 44 grams of CO_2 emitted per kWh produced, which represents a significant decrease on the previous year and a historic low. As a result, 11.4 Mt of CO_2 emissions were avoided in 2024.

As can be seen in Figure 21, the sector's specific emissions have been decreasing since 2017, a very dry year which saw the lowest hydro productivity value of 0.47 and the highest specific emissions of 360 gCO_2/kWh in the last 10 years. Compared to 2024, which was a year with good water, wind and solar resources, the producibility indices were 1.16, 1.06 and 0.94, respectively.

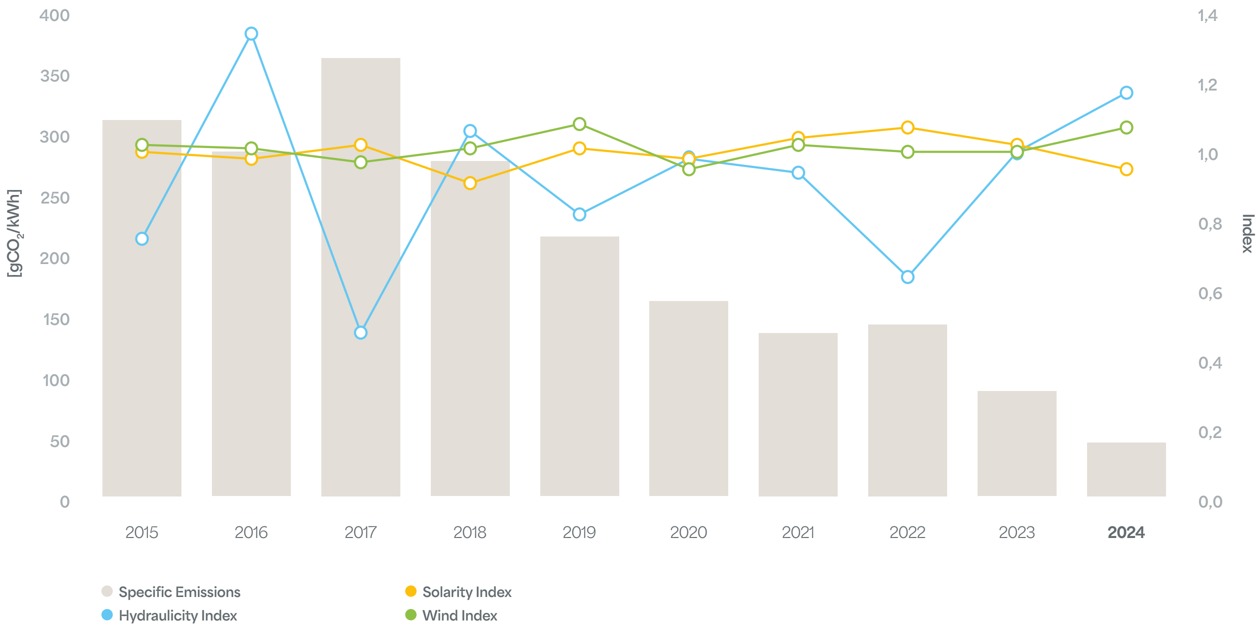


Figure 21 - Specific CO_2 emissions and hydraulicity, wind and solarity index. Source: REN; APREN analysis.

Let's now analyse the economic performance of Special Regime Production (PRE), a remuneration regime provided for in Decree-Law 29/2006 (article 18th) whose objective is to boost electricity production through technologies that contribute to a more sustainable energy system, by means of support mechanisms (incentive tariffs) that guarantee a more predictable return for investors, shielding them from possible market volatility.

The graph in Figure 22 shows a breakdown by technology included in this remuneration scheme, as well as its market value, the average annual price on the spot market (MIBEL), and the average price of purchasing electricity under this scheme. Analysing the graph in the figure below, we can see that the cost of this remuneration scheme, for the period under consideration, has remained relatively constant, with the average cost being €1,856,000 (2021-2024).

For the year 2024, the cost of Special Regime Production totalled 1.944 billion euros.

Regarding the progression of the curves for the average annual MIBEL price and the average electricity purchase price under the aforementioned regime, we can see that the latter (average PRE price) was lower than the average annual MIBEL price for the years 2021 and 2022. As a result, 2021 and 2022 ended with a negative PRE cost differential, which translated into an excess gain for the National Electricity System. From 2023 onwards, there was a reversal of this relationship (average PRE price > average MIBEL price), with the surplus being reduced in 2023 and even reversed in 2024 (surplus cost).

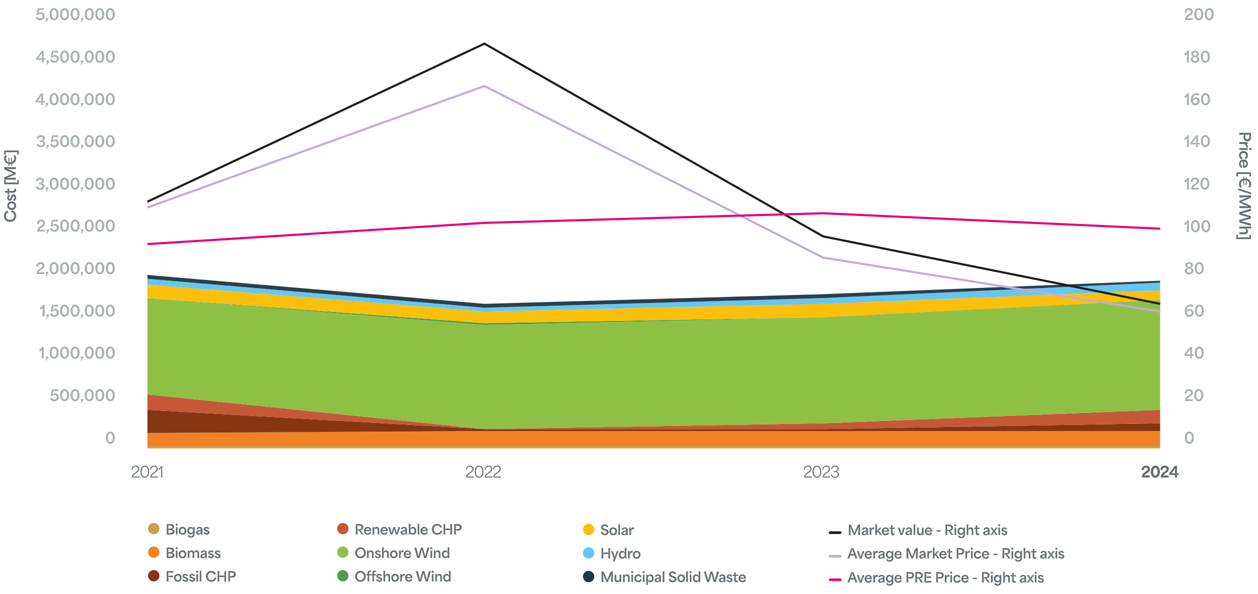
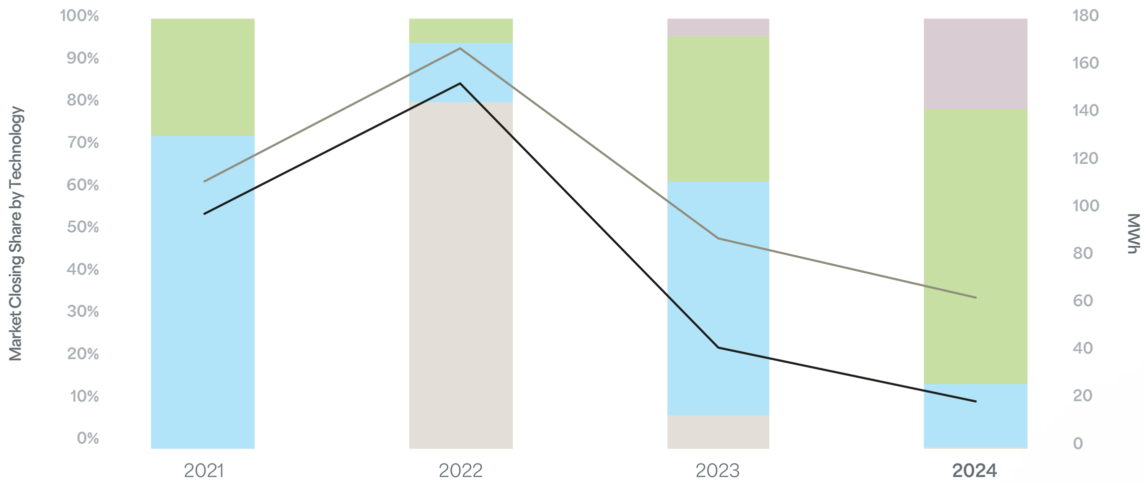


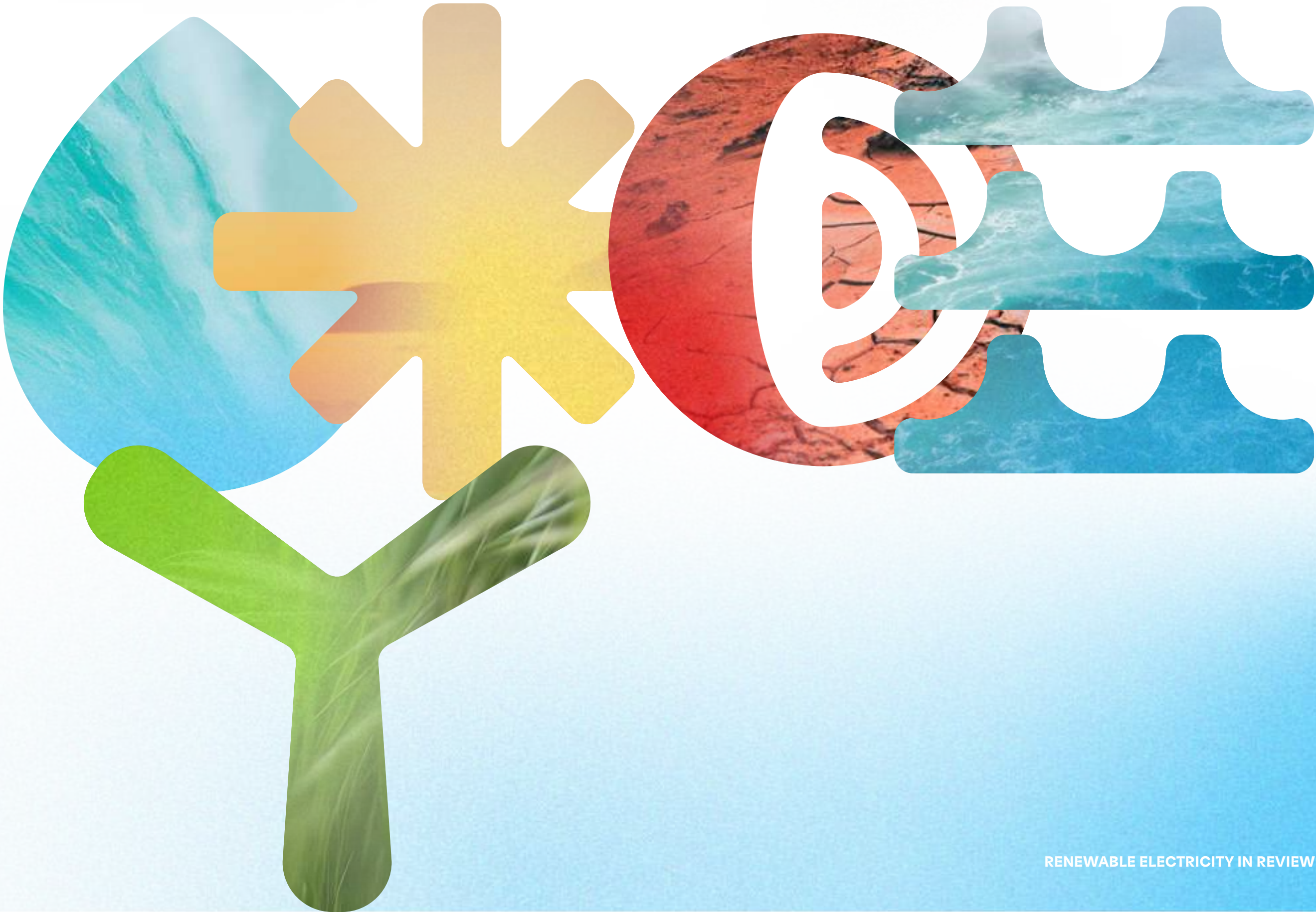
Figure 22 - Impact of Special Regime Production (PRE) with guaranteed remuneration (2021 - 2024). Source: ERSE, MIBEL; APREN Analysis.

Let's move on to analysing electricity imports from the Spanish market, broken down by technology and their impact on the price of electricity at these times of import. The aim of this analysis is to show the market closing share by technology at times when the National Electricity System imported electricity and the impact of this import on the price of electricity. The main conclusion that can be drawn from the graph in the figure is that, for the time horizon considered, the average hourly price of the electricity market at the times when the SEN imported electricity from the Spanish market did so at a lower average price than the average hourly price of MIBEL.



	2021	2022	2023	2024	
Nuclear	0	0	9	**148**	Hours
Various	16	18	78	**452**	Hours
Spanish market import	43	45	125	**104**	Hours
Conventional Thermal	0	263	18	**3**	Hours
Average hourly price at times of electricity import	98.33	152.94	42.29	**20.06**	€/MWh
Average price on MIBEL	112.01	167.89	88.27	**63.45**	€/MWh

Figure 23 - Number of market closing hours, MIBEL average hourly price and average hourly price at times of electricity import . Source: REN; OMIE; APREN Analysis.



International trade in 2024

In 2024, the import balance increased, remaining relatively close to the figure recorded in 2023. Portugal ended the year as an electricity importer, with an import balance of 10.4 TWh, to which 14.9 TWh of imports and 4.5 TWh of exports contributed. It's important to note that the amount of imports recorded prevented the use of fossil fuels to meet electricity needs, while avoiding a greater impact on GHG emissions. Even so, despite the all-time high in renewable incorporation, which also led to a reduction in production from fossil fuels, the increase in the import balance is considered to be the result of increased consumption compared to 2023, making electricity imports more competitive in terms of offers on the Iberian market.

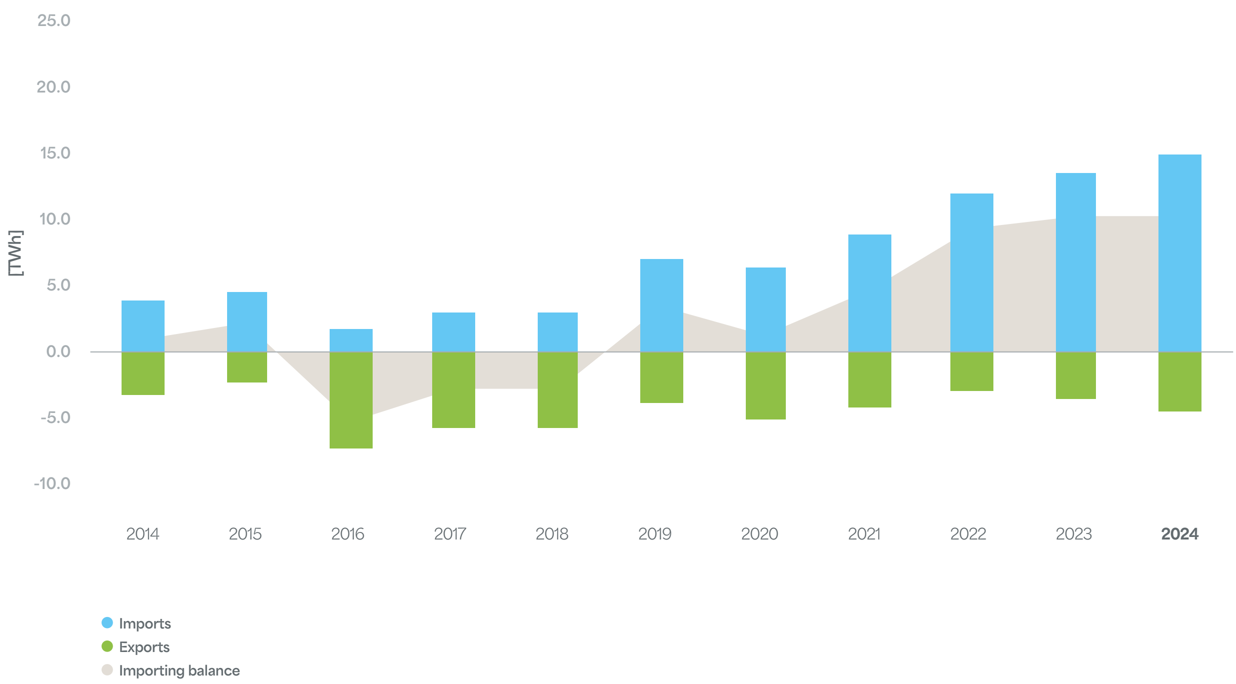


Figure 24 - Portugal's international electricity exchanges between 2014 and 2024. Source: REN; APREN Analysis.

Analysing international trade in 2024 in more detail, it can be seen that March was the only month in which exports exceeded imports, with Portugal closing the month with an export balance of 505 GWh. On the other hand, the import balance was more significant in the months of May to December, with particular emphasis on July, which closed with an import balance of 1,655 GWh. In line with developments in installed capacity in the year under review, especially in the solar sector, this may have an impact on the monthly balance of international trade, specifically in the months when solar radiation is most intense.

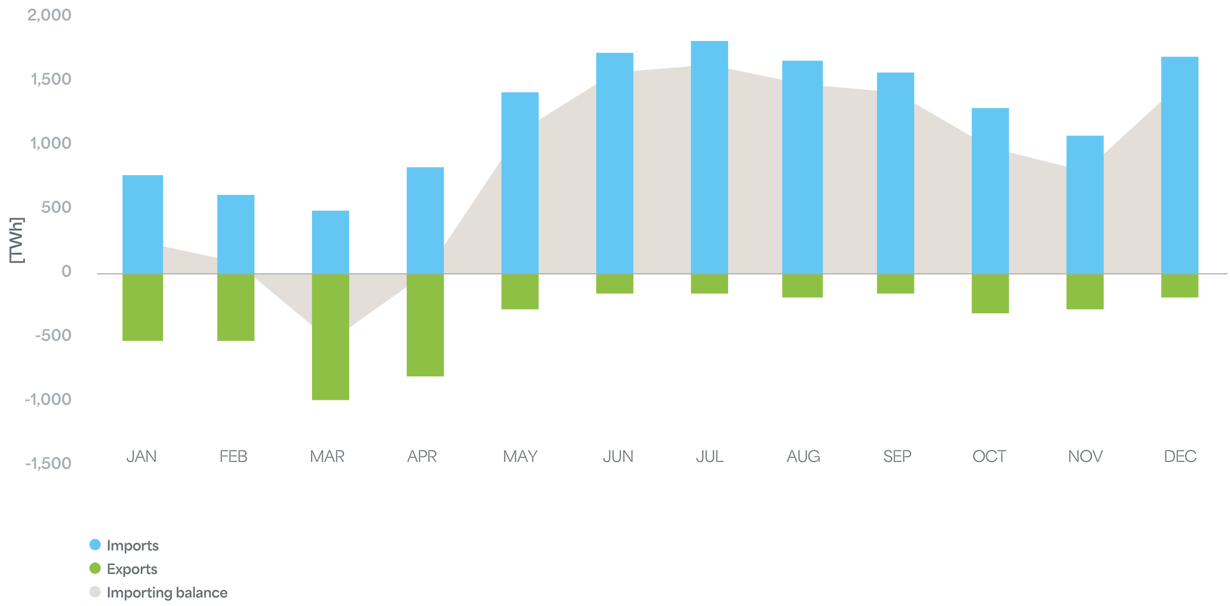


Figure 25 - Portugal's monthly international electricity exchanges in 2024. Source: REN

On the horizon 2025

With hindsight, the information provided in this publication allows us to conclude that 2024 was a good year for the renewable sector, both from an operational point of view, with very appreciable productivity and considerable progress in terms of the evolution of installed capacity, and from a legislative and regulatory point of view, with important advances in the regulatory framework that made it possible to modernise the operation of electricity systems and make them better able to accommodate the technological developments necessary for a sustainable and fair energy transition.

Nevertheless, it's important to note that the sector's biggest challenges, at national and EU level, are still current and that, given the current political, economic and social context, the level of uncertainty about the future has worsened. From the EU's point of view, and given the impact that recent US government decisions have had on the European economy, it is with concern that we see the paradigm shift regarding security, more specifically with regard to the ReArm Europe plan. This change in priorities could lead to delays in the discussion and operationalisation of various social and economic issues that are essential to the sustainable development of European society. This change in mentality among EU political decision-makers, justified by the uncertainty regarding strategic partners, will necessarily have an impact on the public's perception of which sectors are prioritised for the allocation of European funds.

In addition, the biggest challenge to the sector's development at the moment, at EU and national level, which is the lack of electricity grid capacity to connect more renewable capacity, remained unchanged from the previous year. At national level, in order to make up for this delay in the expansion of the electricity grid, the Regulation on Access to Networks and Interconnections (RARI) was expanded to accommodate the figure of the Access Agreement with Restrictions, which allows for the connection of new capacity taking into account the technical restrictions found in a given geography. Although this is a positive step forward, we emphasise that this type of agreement should be limited in time and should not overlap with the development of electricity networks.

At national level, the political instability that culminated in the fall of the Portuguese government has created an environment of uncertainty that is directly reflected in the renewable energy sector. In this turbulent scenario, the approval of essential legislation to consolidate incentives and modernise the sector's regulatory framework will suffer significant delays. This delay not only slows down the implementation of strategic policies for the energy transition, but also undermines investor confidence, jeopardising the progress and competitiveness of clean energies in Portugal.

By 2025, we see a strong commitment to hybrid solutions and storage systems to overcome the intermittency inherent in renewable sources, guaranteeing a more stable and efficient operation of the electricity grid. By combining different technologies - such as solar, wind and hydroelectric power - in integrated systems, hybridisation boosts generation capacity, while storage systems, such as batteries and other means, make it possible to regulate supply during periods of low production. This synergy not only increases security of supply and operational flexibility, but also drives decarbonisation, reducing dependence on fossil sources and promoting a more resilient and sustainable energy economy.

AVENIDA DA REPÚBLICA 59,
2^{nd} FLOOR
1050-189 LISBON

+351 213 151 621
apren@apren.pt

www.apren.pt

APREN Associação de Energias Renováveis