

The Evolution of Renewable Energies in Portugal and the Role of SU ELETRICIDADE as the Aggregator of Last Resort

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Abstract. In Portugal, the installed capacity based on photovoltaic production technology has increased sharply in the last 4 years. Part of these capacity is fulfilled by small units not rewarded with feed in tariffs and the owners of those units do not have easy access to the electricity market to monetize the electricity injected into the electrical grid by their units.

SU ELETRICIDADE, acting as the Aggregator of Last Resort, guarantees the acquisition of electricity from producers up to 1MW which are under market-based remuneration regimes.

Key words

Renewable Energy, Photovoltaic Technology, Aggregator of Last Resort, Self-Consumption unit, SU ELETRICIDADE.

1. Introduction

Issues such as "climate urgency" and "energy security" have risen to the top of the policy agenda. Within this context, Portugal has emerged as a proactive and ambitious actor, defining innovative energy policies aimed at mitigating carbon emissions and bolstering domestic energy resilience. Consequently, there has been a discernible shift towards the adoption of renewable energy sources for electricity generation.

In addition to the longstanding contributions of hydro and wind technologies, recent years have witnessed a notable surge in interest surrounding photovoltaic technology. Portugal, endowed with ample solar exposure, stands as a prime candidate for the widespread deployment of photovoltaic systems. A key advantage of solar photovoltaic production lies in its adaptability to local consumption needs, enabling decentralized installation suited to varying power demands. This accessibility has empowered individual consumers to invest in photovoltaic solutions, particularly for self-consumption purposes, a realm once dominated by large corporate entities. Consequently, by the end of 2024, the nation witnessed a scenario where the installed capacity of conventional

photovoltaics does not substantially differ from the installed capacity of photovoltaics for self-consumption [2].

This trajectory of growth is still in its early stages. The Portuguese government has defined ambitious targets within the National Energy and Climate Plan for the horizon of 2030 (PNEC 2030). Under the PNEC ambit, Portugal aspires to achieve an 85% incorporation of renewable sources in electricity production by 2030. To realize this ambition, the Plan delineates the attainment of 20.4 GW of solar photovoltaic capacity (14.9 GW centralized and 5.5 GW decentralized) alongside with 12.4 GW of wind power (10.4 GW onshore and 2.0 GW offshore) [1].

With this article, the main objective is to present the "state of the art" of electricity generation using renewable energy sources in Portugal, address some of the challenges associated with the growing integration of renewable energy sources into the electricity grid and assess the impact of the Aggregator of Last Resort on the acquisition of electricity from producers up to 1MW which are under market-based remuneration regimes.

2. Evolution of Installed Renewable Power Capacity in Portugal

Portugal's commitment to energy transition is underscored by the widespread promotion of renewable energy sources for electricity generation. By the end of the year 2024, the total installed capacity for this purpose reached 20,361 MW. While hydro and wind technologies still dominate and accounted for approximately 40% and 29% of the total, respectively, photovoltaic technology already represents 27%.

The installed capacity based on photovoltaic production technology experienced a significant growth in recent years. The 27% figure impresses when compared to approximately 7% at the end of 2020.

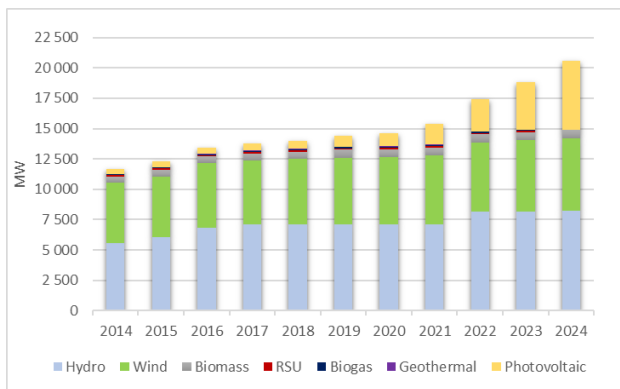


Fig.1. Installed Capacity – Electricity Production – Renewable Sources

Source: Direção Geral de Energia e Geologia [2]

The evolution of legislation in Portugal has played a crucial role in enabling and supporting the growth of photovoltaic technology, with a particular focus on both conventional and self-consumption. By the end of the year 2024, installed photovoltaic capacity amounted to 5.667 MW (conventional = 3.109 MW | self-consumption = 2.102 MW). The remaining 456 MW were divided between Small Production Units, Microproduction and Miniproduction.

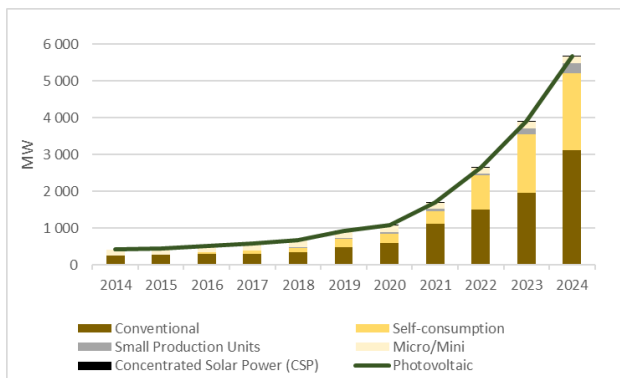


Fig.2. Installed Capacity – Photovoltaic Technology

Source: Direção Geral de Energia e Geologia [2]

3. Evolution of Renewable Electricity Generation in Portugal

The change in the electricity generation park is directly reflected in the production mix. Electricity production from renewable sources in Portugal is primarily based on four predominant technologies:

- Hydro
- Wind
- Biomass
- Photovoltaic

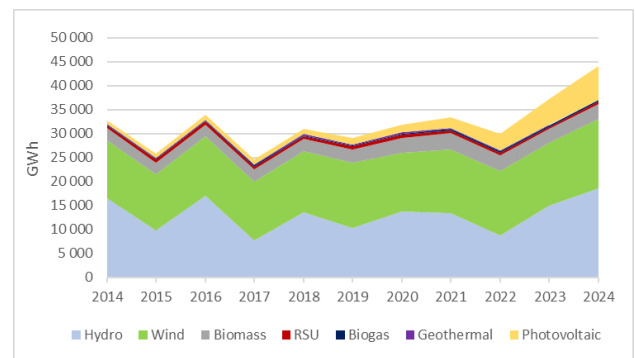


Fig.3. Annual Electricity Production - Renewable Sources

Source: Direção Geral de Energia e Geologia [2]

Despite the relative weight of hydro and wind technologies, accounting respectively for approximately 44% and 33% of the total electricity generated by renewables in the year 2024, electricity production originating from photovoltaic solar technology contributed with more than 7 TWh (~16% of the total renewable).

The electricity generated by photovoltaic solar panels more than quadrupled between 2020 and 2024.

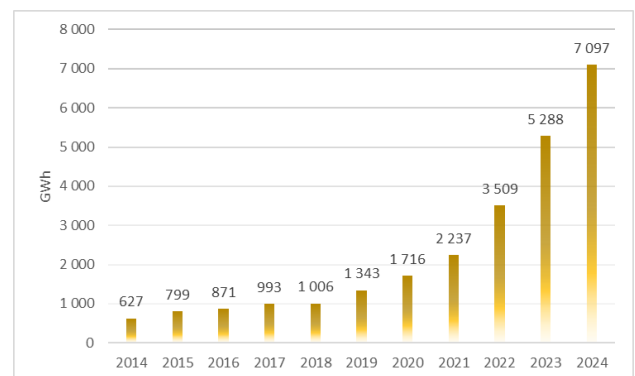


Fig.4. Annual Electricity Production - Photovoltaic Solar

Source: Direção Geral de Energia e Geologia [2]

In this context, the incorporation of renewables in electricity production in Portugal has consistently remained above 50%. There has been growth over the last four years, with values approaching and even exceeding 60%.



Fig.5. Incorporation of Renewables in Electricity Production in Portugal

Source: Direção Geral de Energia e Geologia [2]

The 62% figure in 2023 compares with the EU-27 (27 member states) average of 45%. In that same year, Portugal ranks as the 4th country with the highest renewable energy incorporation rate within the EU-27.

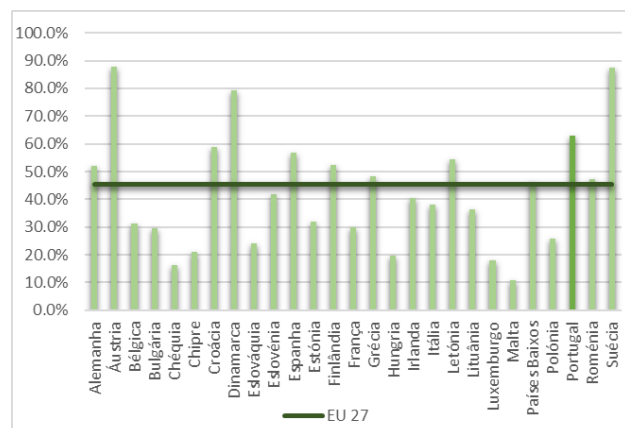


Fig.6. Incorporation of Renewables in Electricity Production [2023]

Source Direção Geral de Energia e Geologia [2]

4. Self-Consumption Units

Aligned with the expansion of photovoltaic technology, there has been a significant increase in the operation of self-consumption units.

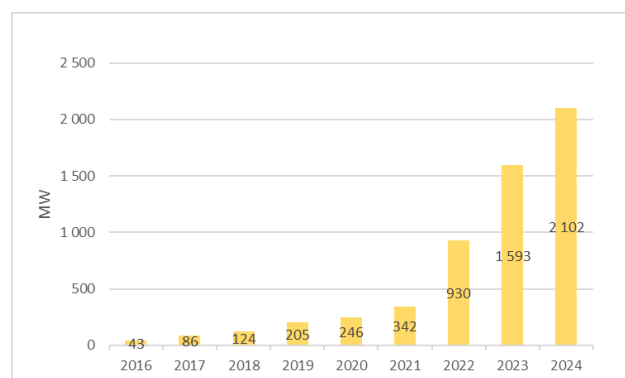


Fig.7. Installed capacity – Self-Consumption Units

Source: Direção Geral de Energia e Geologia [2]

By the end of 2024, the total installed capacity of self-consumption production units reached 2.102 MW, marking an increase of over 750% since 2020. Owners of these installations can significantly mitigate their exposure to market prices by generating their own electricity and may also generate additional revenue by selling any surplus of electricity generated and not consumed.

5. More Renewables, new challenges

In the future, the integration of such a significant volume of intermittent and variable renewable energy sources into the electricity system, with a special focus on distributed renewable energy generation, less predictable, despite being a push for decarbonization, entails significant challenges such as financial sustainability, grid stability and security of supply.

Regarding the financial sustainability, there are concerns about the effectiveness of the merit order model and marginal pricing in reflecting the real cost of electricity production, especially as renewable sources like wind and solar, which have no marginal cost, increasingly dominate the grid. The low prices during high renewable output periods may lead to a lack of proper remuneration for generation capacity, renewable and non-renewable, that undermine the financial viability of power plants. The impact is higher in traditional power plants that are essential for grid stability and the reliability of the power supply.

A system flooded with renewables, with no firm power, creates new challenges for Transmission System Operators (TSOs) which contract ancillary services that are crucial for maintaining the balance between supply and demand and guarantee the security of supply.

Despite the challenges mentioned above, Portuguese law still encourages the installation of small production units for self-consumption. Units with a connection capacity of up to 30 kW are guaranteed certification.

6. Aggregator of Last Resort SU ELETRICIDADE

The evolution of the renewable energy sector has progressed through several stages. Initially, there was the establishment of legislative and technical conditions to facilitate the emergence of renewable energy producers. In a subsequent phase, efforts were made to stimulate the renewable energy sector by providing guaranteed remuneration schemes or support mechanisms. These incentives clearly promoted investment and the maturation of technologies, thereby enabling the fulfillment of internationally assumed commitments. In the current third stage, there is continued investment in more mature technologies and the promotion of technologies in less advanced stages of maturity. Additionally, there has been a shift away from guaranteed remuneration and support schemes (feed-in tariffs) toward market-based remuneration regimes [3].

Until the transition to market-based remuneration regimes, installations benefiting from feed-in tariffs were assured of energy purchase. SU ELETRICIDADE, acting as the Aggregator of Last Resort, assumes the responsibility of acquiring this energy.

SU ELETRICIDADE, a company of EDP Group (EDP Energias de Portugal, S.A.), operates as Supplier and Aggregator of Last Resort.

As Aggregator of Last Resort, as stipulated by Decree-Law No. 15/2022, dated January 14th, SU ELETRICIDADE acquires:

- Electricity generated from renewable energy sources, with the exception of hydroelectric power plants with a connection power exceeding 10 MVA, and benefiting from guaranteed remuneration schemes or other subsidized remuneration schemes.

- Self-consumers who inject surplus electricity into the Public Electricity Grid.

With the transition to market-based arrangements for installations that previously benefited from guaranteed remuneration or support regimes, it became imperative to revise the legislation. Decree-Law No. 215-B/2012, dated October 8th, aimed to streamline the sale of electricity produced by installations under market-based arrangements through aggregators operating in the free market, and introduced the concept of a market enabler (a function assigned through licensing).

In 2019, legislation stipulated that, until a market enabler license was issued, the Supplier of Last Resort, SU ELETTRICIDADE, would ensure the acquisition of electricity generated by producers under special regimes whose authorized injection power into the Public Electricity Grid did not exceed 1MW. In 2020, following the legislation, SU ELETTRICIDADE began to ensure the acquisition of electricity produced from renewable energy sources by producers and self-consumers with assigned connection power not exceeding 1 MW, under the general remuneration regime, whenever requested.

It is worth noting that all producers can establish contracts for the sale of their electricity with any aggregator authorized for this purpose, under freely established conditions.

The remuneration scheme for the electricity acquired under the general regime, by SU ELETTRICIDADE, is established by current legislation, according to the following expression:

$$Rm_{i,m} = En_{i,m} \times Pr_{MIBEL} - PT,m - Enc_{i,m}$$

- « $Rm_{i,m}$ », the remuneration for electricity supplied to the Public Electricity Grid by producer i in month m , in €;
- « $En_{i,m}$ », the electricity supplied to the Public Electricity Grid by producer i in month m , in kWh.;
- « $Pr_{MIBEL} - PT,m$ », the simple arithmetic average of the hourly closing prices of the daily market, allocated to the Portuguese area of MIBEL, published by the Iberian Market Operator, adjusted to the generation profile of producer i , for month m , in €/kWh.;
- « $Enc_{i,m}$ », the charges, as defined by ERSE, incurred with the market representation of producer i , including deviations from scheduling due to participation in the Portuguese area of MIBEL, network access tariffs, and other charges, for month m , in €;
- « m », the month to which the counting of electricity supplied to the Public Electricity Grid by producer i refers.

Therefore, the electricity injected into the Public Electricity Grid is valued at the hourly price of the OMIE daily market, from which charges related to producer market representation are deducted.

The charges include:

- Monthly fixed charge, indexed to the installed capacity of the unit.
- Monthly variable charge, related to deviations from the programming unit dedicated to these contracts.

The electrical energy acquired in this context is sold in the spot market (OMIE) through a dedicated selling unit, in an efficient and transparent manner, based on forecasts prepared by SU ELETTRICIDADE [5].

The legislator, through the adopted solution, has enabled producers with connection power below 1 MW to sell their energy in the market regime, while also ensuring that the Portuguese electricity system is not burdened.

7. Evolution of SU ELETTRICIDADE's Producers Portfolio under the General Remuneration Regime

Since 2020, SU ELETTRICIDADE has been entering into several contracts in this regard. The contracting process is entirely digital, with SU ELETTRICIDADE having developed a web form through which producers can request contract execution and submit all necessary documents. After validation of all information, the contract is drafted and sent to producers via a platform that enables digital signing.

Additionally, as part of contract management, SU ELETTRICIDADE is responsible for issuing all billing documents in electronic format and providing producers with all necessary information to fulfill their tax obligations.

At the end of 2024, SU ELETTRICIDADE's portfolio comprised 4.649 active contracts, totaling an installed capacity of approximately 142 MW.

The portfolio is primarily composed of photovoltaic self-consumption units.

Technology	Contracts	Installed power (MW)
Biogas	3	2.9
Photovoltaic	4	0.1
Hydro	4	1.4
Solar Self-consumption	4638	138.0
Total	4 649	142.4

Fig.8. Contracts and Installed Power in the general regime in SU ELETTRICIDADE's portfolio [2]

Source: SU ELETTRICIDADE

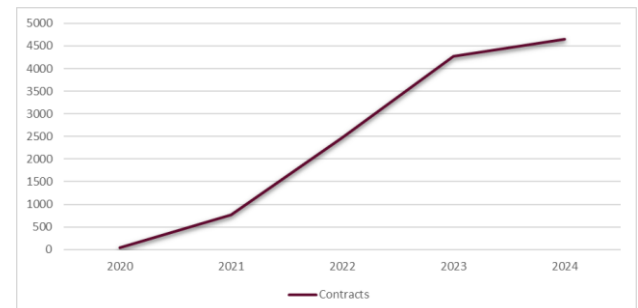


Fig.9. Number of contracts in the general regime in SU ELETTRICIDADE's portfolio [4]

Source: SU ELETTRICIDADE

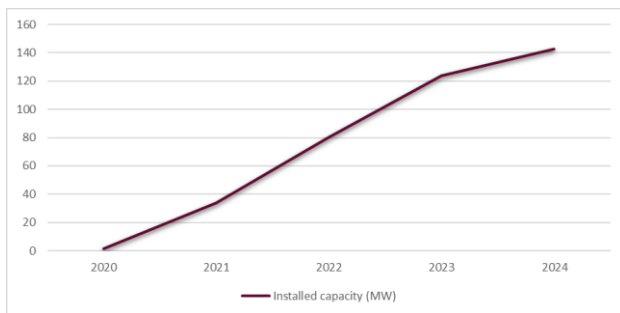


Fig.10. Installed Capacity in the general regime in SU ELECTRICIDADE's portfolio [4]

Source: SU ELETRICIDADE

In terms of acquired electricity, the figure reached 57 GWh in 2024 (which increased more than 10 times when compared to 2021).

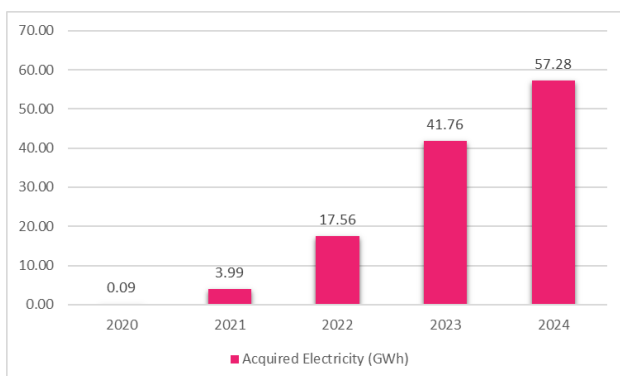


Fig.11. Acquired Electricity in the general regime in SU ELECTRICIDADE's portfolio [4]

Source: SU ELETRICIDADE

Alongside all the work carried out in contracting and billing, these contracts present significant challenges in terms of producer experience. Most of the producers requesting contracts are small producers with little familiarity with the concept of electricity generation, making it essential to provide information and clarification of concepts to ensure that the producer feels involved and comfortable with the electricity selling process.

8. Conclusions

Portugal's journey towards a more sustainable future has been one of leadership and ambition. Electricity production from renewable energy sources already supplies over 60% of consumption, marking just a transitional point on the path towards the 85% target by the end of 2030 [3].

National legislation has evolved to ensure steady and consistent progress towards the proposed objectives. Moving from a regime of guaranteed tariffs or support mechanisms that allowed significant investments in the past, there has been a gradual transition towards a general remuneration regime. From a predominantly centralized production model, accessible only to large economic groups, we have reached a scenario where investment in self-consumption solutions, accessible to the average citizen, has been a strong focus.

SU ELECTRICIDADE has been accompanying this path within the scope of its assigned functions. More recently, following the assignment of the function to acquire electricity produced under the general remuneration regime by producers under special regimes with an authorized injection power into the Public Electricity Grid not exceeding 1MW, its portfolio of producers has considerably grown. By the end of 2024, it boasts nearly 4,700 active contracts with an installed capacity close to 142 MW. The total electricity injected into the grid by these installations and acquired by SU ELECTRICIDADE was approximately 57 GWh.

The growth potential is tremendous, and SU ELECTRICIDADE is prepared to contribute to this journey.

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