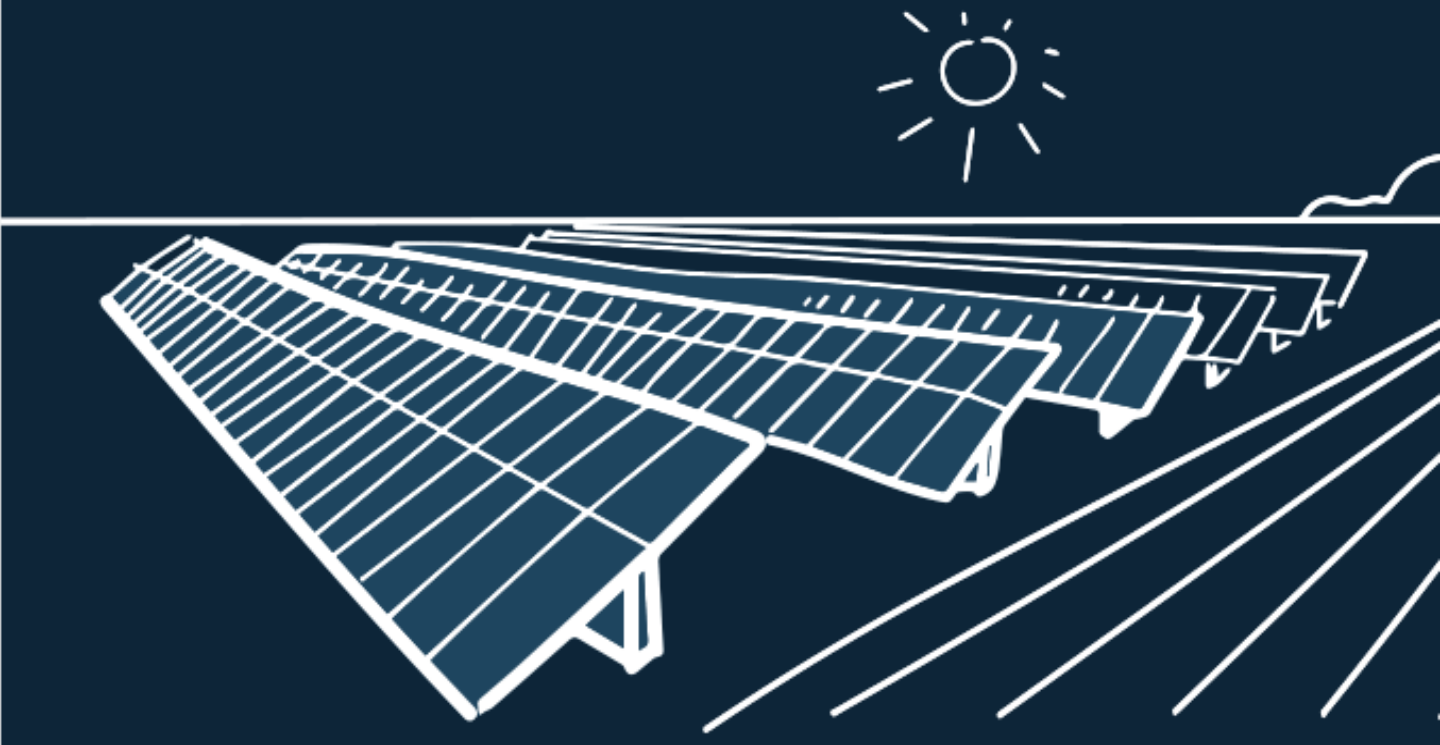
Monitor of the Romanian Photovoltaic Projects

FIRST EDITION March 2024



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CONTENT

Current situation of the photovoltaic sector

Renewable electricity generation is an imperative, not only now, but for the next decade and in the future, too, so that by 2050, 100% of electricity will be from renewable sources. The reasons for this are environmental protection, reduction of greenhouse gas emissions, increased energy independence, diversification of supply sources, economic and social reasons.

GEORGE NICULESCU
President of ANRE

THE EU POLICIES BACKGROUND

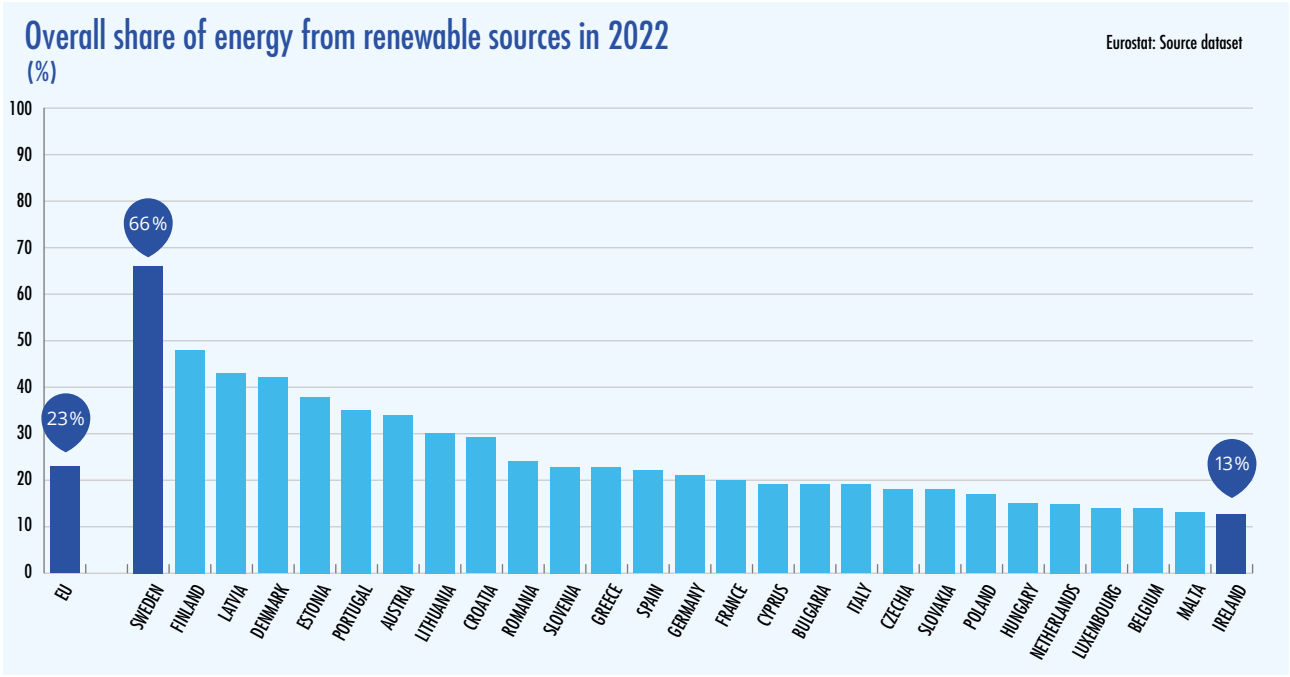
The European Green Pact, a cornerstone of EU policy, commits the European Union to achieving climate neutrality by 2050. This ambitious goal requires a profound transformation of member states' energy sectors. Romania is also aligning itself with the EU directives and regulations in the 'Clean Energy for All Europeans' legislative package.

In response to the challenges and disruptions in the global energy market caused by Russia's invasion of Ukraine, the European Commission launched the REPowerEU Plan in May 2022, aimed at ensuring Europe's independence from Russian fossil fuels well before 2030.

To accelerate the energy transition, taking into account the Fit for 55 package of proposals and complementing actions on energy security of supply and energy storage, the REPowerEU plan proposes an additional set of actions for energy saving, clean energy production and resource diversification to accelerate Europe's clean energy transition through rapid fossil fuel substitution and smart use of reforms to support investment.

As regards the deployment of renewables, the Commission proposes to increase the 2030 target for the share of renewables in total EU energy consumption from 40% to 45% as part of the "Fit for 55" package.

In view of future rising European targets, i.e. an increase in the Union's target for the share of renewable energy in gross final energy consumption in 2030 to at least 42.5%, it obliges Member States to also set new indicative targets for renewable energy.



THE CONTEXT OF NATIONAL PV POLICIES

Romania's energy ambitions are closely linked to the general objectives of the EU energy and climate policy. Thus, Romania has set a target of 30.7% for the share of renewable energy sources in gross final energy consumption for the 2030 time horizon through the National Integrated Energy and Climate Change Plan 2021-2030 - NECP, approved by GD no 1076/2021, with the proposal to amend it to 36.2% through the Draft National Integrated Energy and Climate Change Plan 2021-2030, currently in the process of public consultation on the Ministry of Energy website. This shows the need to increase the installed renewable generation capacity well above the values considered in the current NECP (i.e. an increase of about 7,000 MW, of which about 3,700 MW from photovoltaic sources, 2,300 MW from wind sources and about 1,000 MW from hydro sources).

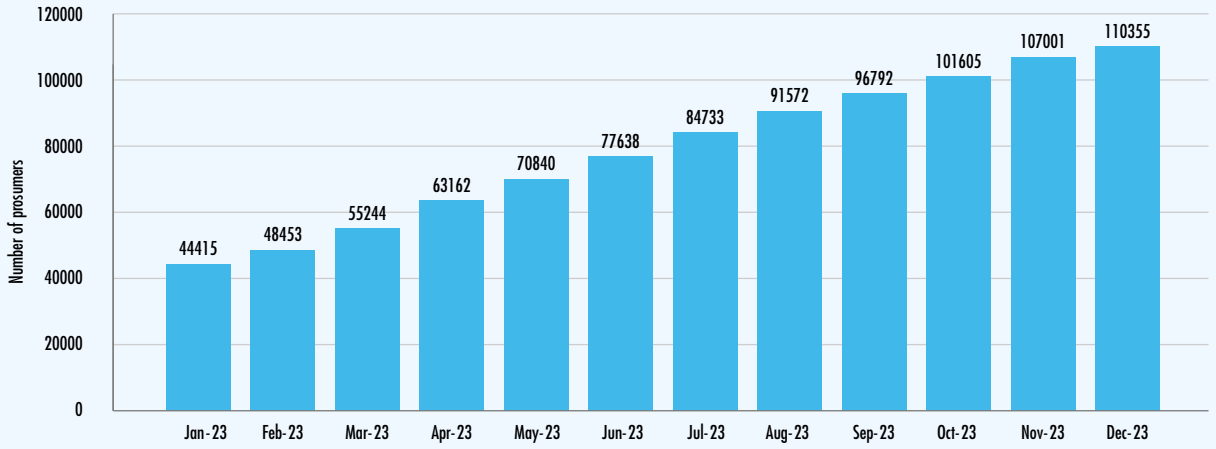
The value for the share of energy from renewable energy sources (RES-E) in gross final energy consumption achieved for 2022 was 23.9%, slightly below the target value for Romania for 2020 of 24%, according to official European data published by Eurostat:

EU renewable energy policies have helped reduce the cost of photovoltaics by 82% over the past decade, making it one of the most competitive sources of electricity in the EU.

Thus, by 2023, in terms of investments in new renewable generation capacity through photovoltaic projects, the prosumer area has become one of the most dynamic areas in the energy sector in Romania, due to the unprecedented increase in electricity prices and the need to transition to a cleaner and more sustainable energy system.

The number of prosumers reached 110,355 at the end of 2023, an increase of about 70,000 prosumers compared to the end of 2022, and a level for installed capacity of 1,443 MW, an increase of about 1,000 MW compared to the end of 2022. The monthly evolution of the number of prosumers connected to the distribution networks of the distribution operators and their installed capacity as of 31.12.2023 is shown in the graphs below:

Monthly evolution of the number of prosumers connected to the distribution networks between January 2023 - December 2023



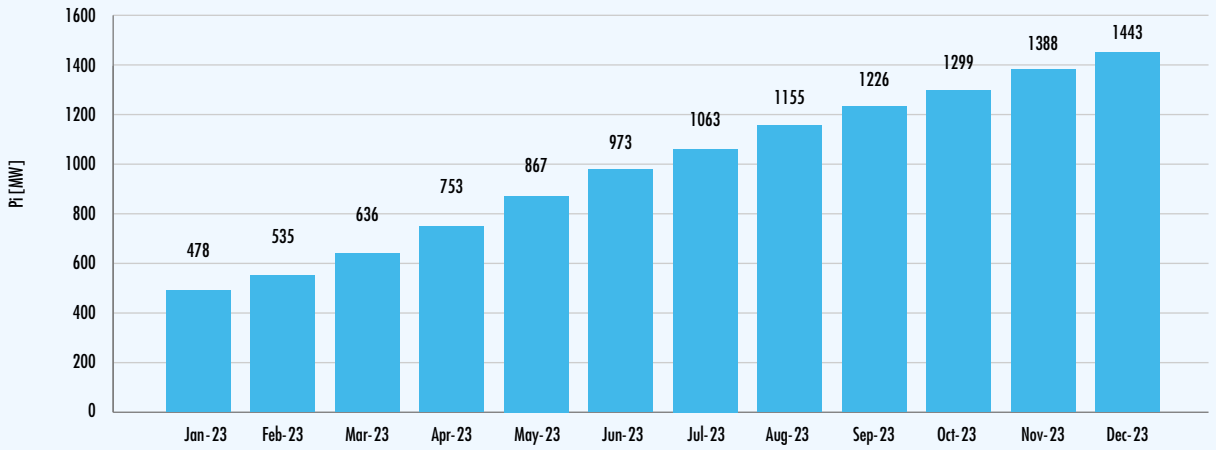
CURRENT LEGISLATIVE STEPS ON PROSUMERS AND TRANSPOSITION BY ANRE INTO SECONDARY LEGISLATION

In accordance with the provisions of GEO No 163/2022, prosumers, including those who own renewable electricity generation plants with an installed electrical capacity of more than 400 kW/ site of consumption/production, as well as those who sell electricity produced and delivered to the electricity grid through negotiated bilateral contracts, will be able to benefit, upon request, from the mechanism for the settlement of electricity produced by prosumers and delivered to the electricity grid with the electricity they consume from the electricity grid to supply other consumption or production and consumption sites. The condition is that all the places of production and consumption or places of consumption of the prosumer in question are connected to the electricity grid of the same distribution system operator and that electricity is supplied to these places by the same electricity supplier.

ANRE intends to amend and supplement the Methodology by ANRE Order no. 15/2022, as subsequently amended and supplemented, in order to introduce the necessary rules for

Monthly evolution of installed power by prosumers between January 2023 - December 2023

(MW)



the implementation of the settlement mechanism through financial compensation between the invoices issued by the electricity supplier/prosumer, for each of the production and consumption sites and the consumption sites owned by the prosumer and nominated by him for this purpose and which are included in this settlement during the billing period.

With regard to the issuing of electricity bills, for the purpose of offsetting bills issued for the legally established quantitative compensation mechanism, electricity suppliers are obliged under the Methodology to issue bills for electricity produced and delivered to the electricity grid and to prosumers, in their own name or in the name and on behalf of certain categories of prosumers.

As of 01.01.2024, the provisions of GEO no. 120/2021, approved by Law no. 296/2023, are also applicable, i.e. the obligation of the issuer of the invoice to send it to the recipient legal entity using the national electronic invoice system RO e-invoice, in compliance with the provisions of Article 4 para. (1) of GEO no. 120/2021, as amended.

IMPROVED REGULATORY FRAMEWORK FOR BETTER GRID CONNECTION

In order to accelerate the implementation of electricity generation projects, including those from renewable sources, ANRE has continuously improved the regulatory framework applicable to the connection of generators to the public electricity grids, both from the perspective of facilitating the connection process, by reducing its duration and bureaucracy, and in order to adapt to certain situations that have arisen in practice, thus seeking to unblock the process of connecting generation capacities.

As regards the national development of electricity generation projects, on 27.02.2024, according to information published on the ANRE website, the installed capacity of electricity generation capacities is 18.3 GW. The installed capacities in the main renewable technologies are about 3 GW in wind sources, representing a share in the total installed capacity of 16.39%, and about 1.6 GW in photovoltaic sources, with a share of 8.88% of the total installed capacity.

With regard to technical connection permits issued by grid operators for the connection of new renewable electricity generation capacity (wind and photovoltaic) to the transmission and distribution grids, there is a significant increase in the number of such permits in 2023 compared to 2022.

For the connection of new wind power generation capacities above 1 MW, 52 technical connection permits were issued by grid operators in 2023 with an approved capacity of about 4.28 GW, while 5 technical connection permits were issued in 2022 with an approved capacity of about 0.9 GW.

For PV projects above 1 MW, 404 technical connection notices were issued by grid operators in 2023 with an approved capacity of about 4.82 GW, while 7 technical connection notices were issued in 2022 with an approved capacity of about 0.1 GW.

The increasing number of technical connection notices issued by grid operators for the connection of renewable energy generation capacities to the electricity grids is a consequence of ANRE's continuous improvement of the regulatory framework, in particular by adapting it to situations arising in practice during the connection process.

METHODOLOGY FOR THE ALLOCATION OF ELECTRICITY NETWORK CAPACITY

Therefore, in order to implement the provisions of Art. 25 para. (2^2) of the Law on Electricity and Natural Gas no. 123/2012, as amended, ANRE has prepared and published on 01.02.2024, for public consultation, a new draft order for the approval of the Methodology for the allocation of electricity network capacity for the connection of electricity generation sites, as well as for the amendment and completion of some orders of the President of the National Energy Regulatory Authority on the connection of users to the public interest electricity network.

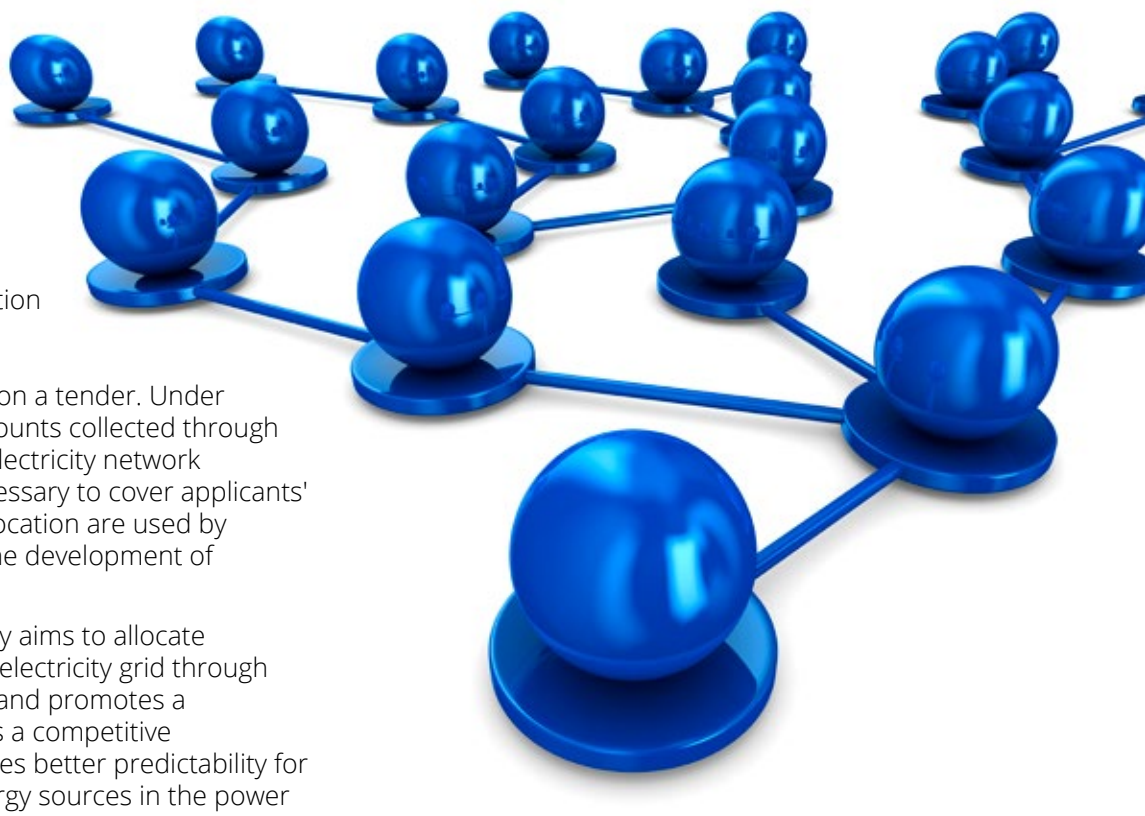
The development of the methodology aims to establish the rules for the allocation by auction of available capacities for the connection of new generation/consumption and production sites with installed capacities of electricity generation installations greater than or equal to 1 MW.

The development and administration of the auction platform and the organisation of this activity will be carried out by the transmission system operator and the deadline proposed in the draft order for the application of the auction mechanism for the allocation of available capacities is 01.01.2025.

The draft order provides for the replacement of the current concept of obliging connection applicants to participate in general reinforcement works in electricity networks upstream of the connection point with a mechanism for allocating electricity network capacity based on a tender. Under this mechanism, the amounts collected through auctions for additional electricity network development works necessary to cover applicants' requests for capacity allocation are used by network operators for the development of electricity networks.

The new methodology aims to allocate available capacity of the electricity grid through market-based methods and promotes a mechanism that ensures a competitive environment that provides better predictability for the development of energy sources in the power system. Thus, by implementing this mechanism in the regulatory framework, applicants that are going to develop generation sites with installed capacities greater than or equal to 1 MW have the possibility to secure the necessary capacities for subsequent connection to the grid, leading to increased resilience of the national energy system.

From the analysis of the data presented above, which shows the increasing trend in recent years of connections to the electricity distribution grid of photovoltaic renewable energy generation capacities, most of which are owned by prosumers, it appears that the primary legislation and regulations issued by ANRE, harmonised whenever necessary with the legislative provisions and with those of the guidelines for accessing funding programmes for the installation of power plants for the production of electricity from renewable sources, and also adapted in order to clarify certain aspects and situations raised by interested parties, have facilitated the connection of prosumers to the public electricity networks. This has had a positive impact on the energy market as a whole, given the increase in the amount of renewable electricity produced, delivered and sold on the energy market.



THE FUTURE OF PHOTOVOLTAIC ENERGY

As a result of changes in the legislative and regulatory framework through the adoption of facilities for prosumers, as well as the possibility for natural and legal persons to access various financing programmes for the installation of power plants for the production of electricity from renewable sources, the number of persons applying to distribution operators for certification as prosumers and applications for their connections has increased considerably in the last 2-3 years.

We believe that the implementation of support programmes for the production of electricity from renewable sources, which implicitly include prosumers, should take into account objectives such as:

- boosting electricity storage capacities,
- ensuring the collection of information on the operation of generation equipment from prosumers at the level of grid operators, by generalising smart-metering at the level of the distribution grid,
- the acquisition of software to process data collected from consumers
- promoting programmes to make electricity grid operation more flexible.

Thus, among the concerns we anticipate regarding the development of utility-scale PV projects in the immediate future, in the context of the large number of investment funding programs for new renewable energy power generation capacity, it is imperative to access and implement grid management programs to increase renewable energy absorption capacity, including:

- Network investments from non-reimbursable funds
- Accurate determination of available capacity for connection at network node level
- Network flexibility
- Assessing the effects of increased capacity from renewable sources on electricity grids:
- Assessment of the change in electricity flows through the grids at all voltage levels
- Identification of storage capacity needs in electricity grids at all voltage levels
- Assessment of the impact on the electricity market
- Stimulating the establishment and commissioning of energy communities and renewable energy communities

Given the above, the digital revolution in this sector will change the way we produce and consume energy, but in order to be successfully implemented, investments are needed to integrate a large number of small consumers and more renewable energy sources into the low voltage electricity distribution subsystem, especially in the context of dispatchable consumption, i.e. smart meters and smart grids throughout Romania's energy system.

In order to facilitate market access for renewable electricity generators, ANRE keeps a close eye on market developments and the requirements for the development of renewable electricity generation capacity projects. When necessary, it intervenes quickly by changing the regulatory framework and proposing amendments to primary legislation. ■

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CIJ Awards 23 ROMANIA

Energy Production Warranty Changes Client-Provider Dynamics

There is one number every investor in solar energy is chasing: The Levelized Cost of Energy (LCOE). This is an estimation of the electricity output of their solar farm.

Energy production warranties mean engineers calculate the possible output of your solar farm. Your contract promises a precise electricity output. In case they don't meet the numbers, the client is compensated for the loss. Not a lot of companies are willing to make that commitment.

Future-Proofing Solar Farms

Founder of Wiren, Dor Marian, explains what it takes to offer production warranties:

> **"Your client is an investor in the production of green energy. An investor is not buying a solar plant, he buys a flow of energy generating a stream of cash."**

He had to build his entire operation around a bulletproof promise: **Wiren solar plants deliver a precise, ambitious energy output.**

- Many market players adapt old projects to new requirements. Even in best-case scenarios, this reduces efficiency. Wiren draws unique projects for the demands of each client.
- Everything from prospecting to implementation is handled by specialized teams of engineers.
- You cannot manage what you can't measure. Wiren has maintenance and monitoring. This allows them fast reaction times (less than eight hours, with remedy).
- When errors do occur, they bring projects back to standards.
- The project is supported by a strong insurance system, there to mitigate losses.

The market came to accept that solar panels rely on unpredictable weather. The fact of the matter is your team of engineers is supposed to calculate and mitigate the uncertainty, not pray for sunshine.

The Current State of Large-Scale PV Projects in Romania:

A COMPREHENSIVE OVERVIEW OF THE PHOTOVOLTAIC SECTOR

Romania has set ambitious targets for developing renewable energy sources, including solar power. This article provides a comprehensive overview of the current state of large-scale PV projects in Romania, covering project details, readiness levels, key players, and the overall impact on the energy sector and the environment. We took into consideration PV projects with installed capacity larger than 5 MW, meant to inject the power into the grid. We gathered and curated the essential information on them and we rated the projects based on a 10-stages rating system we designed – Project Maturity Rating, starting from 01 – Concept and licenses prior to ATR, to 10 – Decommissioning & recycling / Re-Powering. (Read more in the Methodology section!) Here are some considerations based on this research.

GABRIEL AVACARITEI
Chief Editor
Energynomics Magazine

LARGE-SCALE PV PROJECTS IN ROMANIA: A NUMERICAL SNAPSHOT

Romania has made significant strides in developing large-scale photovoltaic (PV) projects, contributing to its renewable energy goals. As of the latest data available, there are over 880 large-scale PV projects in Romania, boasting a cumulative capacity of approximately 46,600 MW. This impressive number showcases the country's commitment to harnessing solar energy as a clean and sustainable source of power.

Regarding project size, there is a diverse range of installations, catering to various needs and locations. Projects with a capacity of 20 MW or less form the majority (390), accounting for a significant portion of the total number (44.02%). They sum up a total capacity of 3.566 MW, which is 7.65% of the total capacity. However, 115 projects above 100 MW also play a crucial role, contributing a substantial share to both the total number of projects (12.98%) and the cumulative capacity (55.21%).

Almost a third of the charted projects are in the slice 20 to 50 MW each, and they total 9.322 MW, which is around 20% of the total.

This mix of project sizes ensures a balanced and flexible approach to solar energy deployment.

The sheer number of projects, their cumulative capacity, and the geographical distribution paint a picture of a sector that is rapidly expanding and contributing to Romania's clean energy future.

REGIONAL DISTRIBUTION OF LARGE-SCALE PV PROJECTS IN ROMANIA: A CLOSER LOOK

The regional distribution of large-scale PV projects in Romania reveals a notable concentration in certain counties, indicating areas with favorable conditions for solar energy development.

Dolj and Arad: Leading the Solar Charge

There are five counties with more than 50 PV projects in our data set - Dolj, Olt, Giurgiu, Prahova, Bihor, and 9 counties with less the 5 PV projects. There is only one in Neamț and Suceava, two in Vaslui and Vâlcea, respectively.

Regional distribution of these projects reveals a concentration in the southern and western areas of the country. Dolj (70) and Olt (56) stand out as the frontrunners, hosting a substantial number of large-scale PV projects. Other counties, such as Prahova (51), Giurgiu (51), Bihor (50), Dambovita (46) and Teleorman (45) are also worth mentioning because of the number of projects identified.

This concentration in these counties highlights their suitability for solar energy generation, potentially due to favorable weather conditions, land availability, and supportive local policies.

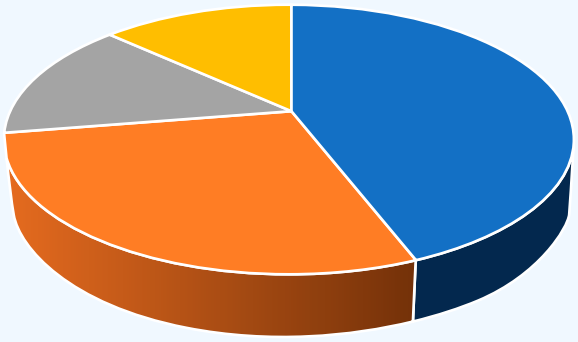
13 counties contribute significantly to the overall capacity, each with over 1 GW in projects identified. Arad (5.40 GW) and Dolj (5.39 GW) are the most promising locations, but counties such as Giurgiu (4), Bihor (3.8), Teleorman (2.6), Timis (2.3) and Dambovita (2.3) also stand out in this respect. This geographical diversity highlights the potential for solar energy development across Romania.

Geographical Diversity Fosters Balanced Development

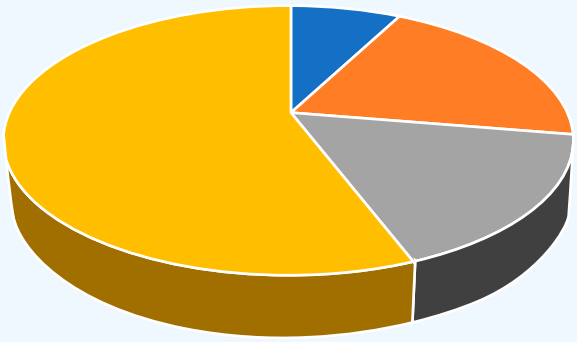
The regional distribution of large-scale PV projects in Romania demonstrates a commendable level of geographical diversity. The presence of projects in various counties indicates a concerted effort to harness solar energy potential throughout the country. This balanced approach ensures that the benefits of solar energy are not limited to specific regions and promotes a more equitable distribution of clean energy generation.

SIZE	NUMBER OF PROJECTS	%	TOTAL CAPACITY PER SLICE	%
>=5 to <=20	390	44.02%	3,566	7.65%
>20 to <50	251	28.33%	9,322	19.99%
>=50 to <100	130	14.67%	8,005	17.16%
>100	115	12.98%	25,750	55.21%
	886		46,643	

Distribution of projects by size (number)



Distribution of projects by size (total capacity)



CATEGORIZING ROMANIA'S LARGE-SCALE PV PROJECTS BY INSTALLED CAPACITY

The landscape of large-scale PV projects in Romania encompasses a wide range of installed capacities, catering to diverse energy needs and project objectives. By categorizing these projects based on their installed capacity, we gain insights into the scale and scope of solar energy deployment in the country.

Ensys Renewable Solutions

We are a **turnkey photovoltaic system integrator (EPC)**, with a turnover of **30+ million euro** in 2023 and over 300 professionals across 6 locations in Romania. With over **70 MWp installed** capacity and **50 MWp in development**, we provide comprehensive services in the generation of energy from renewable sources, including **consultancy, design, approval, supply, commissioning, and maintenance**. **6500+ customers** trust us, from families to multinationals such as **Auchan** and **Leroy Merlin.** Along with **Atnom**, our trusted partner, we spearhead innovation in the realm of renewable energy and storage through continuous research and development efforts.

300 +
dedicated professionals

18 +
years experience

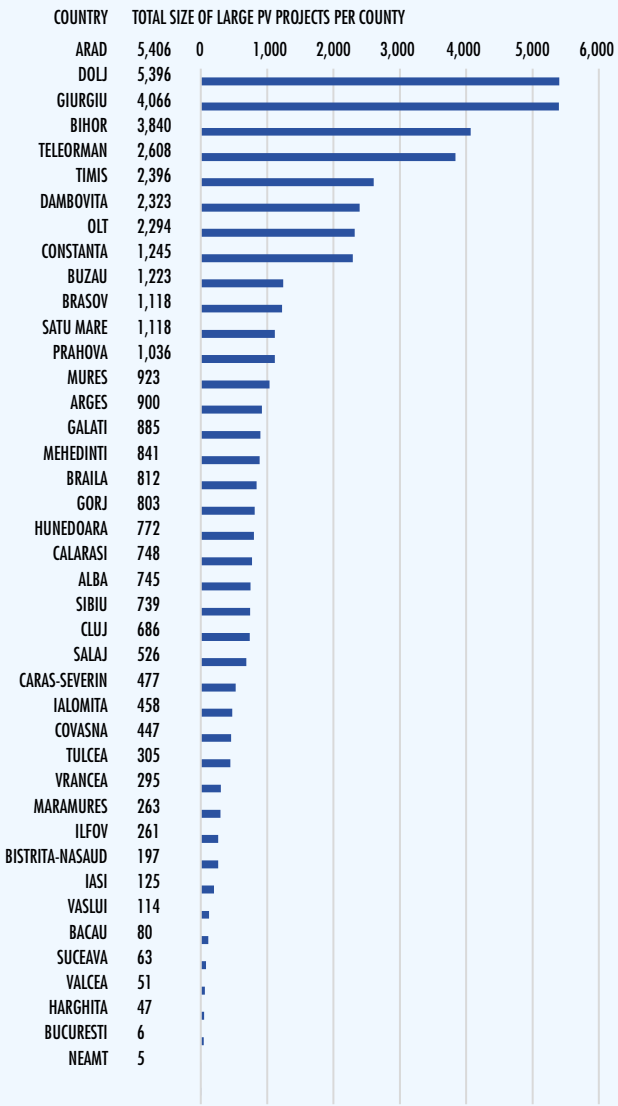
6500 +
PV projects

50 +
million EURO managed

70 +
MWp total installed power

40 +
MWp power in development

Total size of large PV projects per county



Megawatt Giants: Leading the Clean Energy Charge

At the forefront of Romania's solar energy revolution are the six projects with installed capacities exceeding 500 megawatts (MW): Arad Sud (500 MW), Socol, Arad (509 MW), Ogrezeni, Giurgiu (550 MW), Salard, Bihor (595 MW), Gighera, Dolj (721 MW) and Arad 1, Arad (1.065 MW) These mega-projects represent significant investments in renewable energy infrastructure, capable of generating substantial amounts of clean electricity. Their presence signals Romania's potential to transitioning fast to a sustainable energy future.

Large-Scale Contributors: Driving the Energy Transition

The 115 projects with installed capacities ranging from 100 to 499 MW also play a crucial role in Romania's solar energy landscape. 20 of them are over 300 MW each and are distributed in 9 counties.

These large-scale projects contribute significantly to the country's overall solar generation capacity, demonstrating the scalability and versatility of solar energy. Their presence underscores the growing adoption of solar power as a viable and cost-effective energy source.

Mid-sized Projects: Paving the Way for Decentralized Energy

In addition to the large-scale projects, Romania has witnessed the emergence of smaller PV projects with installed capacities between 50 and 100 MW. These 130 mid-scale ventures will contribute to the country's solar energy mix, promoting decentralized energy generation and encouraging local communities to embrace solar solutions. Their presence, with a total of over 8 GW in installed capacity, highlights the inclusivity of Romania's solar energy push, allowing for diverse stakeholders to participate in the clean energy transition.

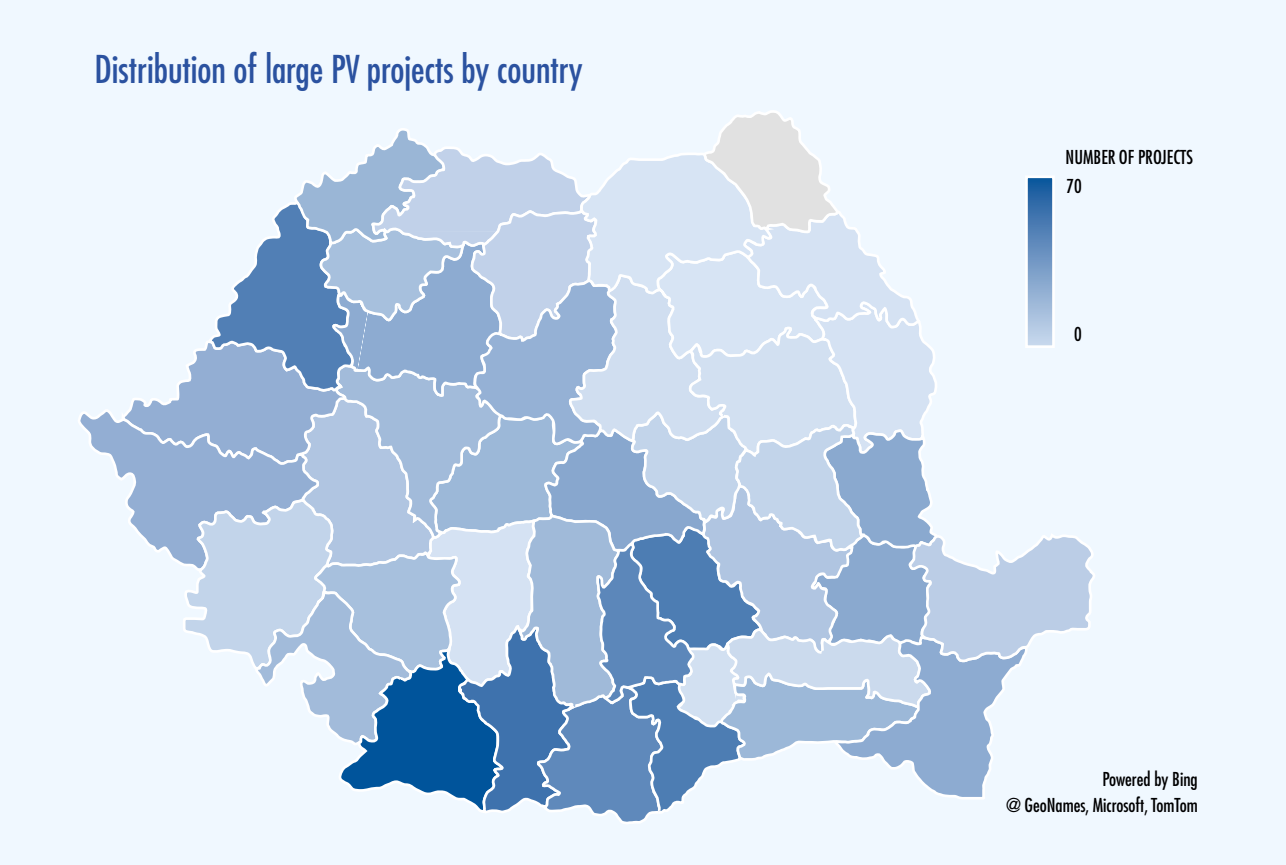
The Cumulative Impact: A Brighter Energy Future

The collective capacity of Romania's large-scale PV projects, encompassing the megawatt giants, multi-megawatt contributors, and small-scale pioneers, paints a promising picture of the country's renewable energy progress. Over 640 projects under 50 MW each means another 12.88 GW to be added to the Romanian PV capacities to be injected into the grid.

This diverse portfolio of projects showcases the scalability, adaptability, and potential of solar energy in meeting Romania's energy needs. The cumulative installed capacity represents a significant step towards a cleaner, more sustainable energy future for the country.

BIG PROMISES FOR THE NEAR FUTURE

The data shows that 2024 and 2025 might witness a surge in the completion of large-scale photovoltaic (PV) projects in Romania, with over 400 projects expected to contribute significantly to the country's goals. Their total capacity is estimated at 30.5 GW.



Obviously, this is the trickiest area in this report. For most of the projects, this piece of information is the estimated year of their entering into operation as appears in the public documents released by the TSO and the DSOs. However, it is widely known and accepted that the PIF date communicated by the project developer is nothing more than a targeted horizon. Phases like the elaboration of the solution study to obtain the Technical Approval for Connection (ATR) might take many months. Even when the project obtained the technical connection notice (ATR) and the connection contract (CR), sometimes the developer delays signing the contract taking its time to secure the most convenient financial scheme. Even after reaching the ready to build phase, other delays might appear in the processes of procurement and contracting, and also, although with less probability, in the construction period.

The most advanced the project – beyond PMR 4, for example, the better is the estimate regarding the year when the PV project will enter into operation.

Thus, only a small portion of the promises in the first paragraph will be completed within these timeframes. However, this will mark a strong of step towards achieving 6 GW of solar power capacity by 2030.

Out of the top 50 largest PV projects planned for completion by 2030 or earlier, 12 are poised to be finalized in 2024 (3.961 MW). Most of them are still in the initial PMR stages. 25 are set to be completed in 2025 (8.192 MW), and only three of them are in the PMR 4 stage, which means they have secured the establishment authorization from ANRE. The remaining projects are either still in the planning stage or have a PIF beyond 2026. The total capacity of these projects nearing completion is substantial and will play a pivotal role in Romania's renewable energy targets.

The completion of these projects will underscore Romania's commitment to transitioning towards sustainable energy sources and reducing its reliance on fossil fuels. The large-scale PV projects will provide clean, renewable energy, contributing to the country's energy security and environmental sustainability.

Moreover, these projects will stimulate economic growth and create employment opportunities in the renewable energy sector. As Romania continues to prioritize the development of renewable energy sources, the successful completion of these PV projects in 2024 and 2025 will serve as a significant milestone in the country's journey towards a greener and more sustainable energy future.

PROJECTS MATURITY DISTRIBUTION

The photovoltaic projects in Romania are at varied stages of development, with many still in the early planning and permitting phases. We used a 10-steps scale named Project Maturity Rating to describe the project maturity from the inception to decommissioning or repowering phase.

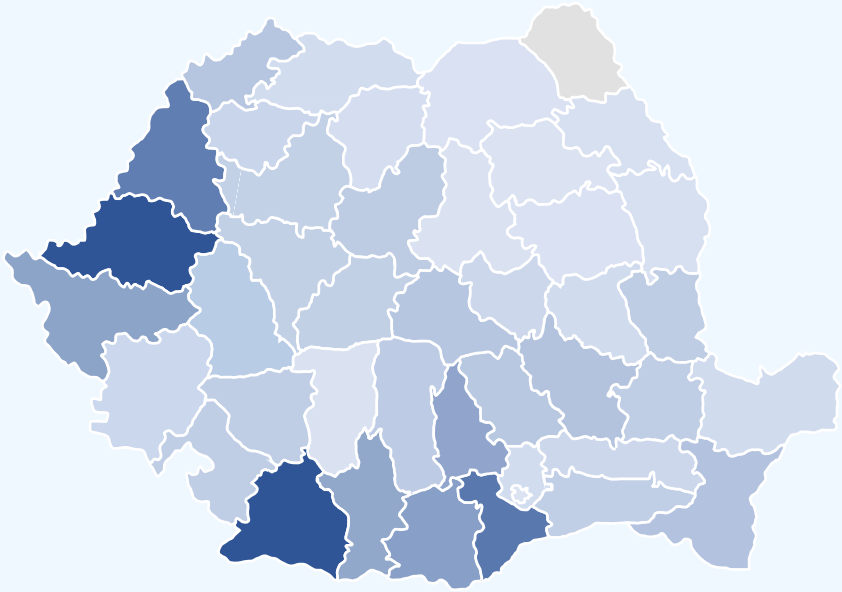
As of February 2024, there are 886 projects we discovered with a combined capacity of 46,643 MW in Romania. Among these projects, 642 are in the early stages of development (PMR 1), accounting for a total capacity of 38,111 MW. Meanwhile, over 75 are nearing the ready-to-build phase (PMR 2-3), with a total capacity of 4,893 MW.

60 projects are in the construction phase (PMR 4-7), totaling 2.300 MW, and lastly, 4 projects (31 MW) are in the testing phase (PMR 8). 101 projects we monitor, with a total capacity of 1,277 MW, are in the O&M phase.

Compared with the situation a few years ago, significant progress is being made, with numerous projects nearing the construction and final stages of development.

The distribution of projects across the different stages of development highlights the Romanian PV sector's infancy. Likewise, the current edition of Energynomics' "Monitor of the Large-Scale PV Projects in Romania" is a first step towards building a better image of an industry in full sprint. Thank you all for your contribution and we count on working together for improving not only this tool, but the general context for a more and more powerful PV industry in Romania. ■

Cumulative capacity of large PV projects by county



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COUNTY & CUMULATED CAPACITY

Arad: 5,406
Dolj: 5,396
Bihor: 3,840
Giurgiu: 4,066
Timis: 2,396
Sibiu: 739
Buzau: 1,223
Arges: 900
Brasov: 1,118
Prahova: 1,036
Satu Mare: 1,118
Teleorman: 2,608
Olt: 2,294
Vrancea: 295
Constanta: 1,245
Dambovita: 2,323
Hunedoara: 772
Covasna: 447
Mehedinti: 841
Calarasi: 748
Ialomita: 458
Mures: 923
Cluj: 686
Ilfov: 261
Braila: 812t
Caras-Severin: 477
Alba: 745
Gorj: 803
Galati: 885
Tulcea: 305
Vaslui: 114
Iasi: 125
Suceava: 63
Maramures: 263
Bistrita-Nasaud: 197
Salaj: 526
Bacau: 80
Harghita: 47
Valcea: 51
Bucuresti: 6
Neamt: 5

ENEVO GROUP

Your Trusted Partner in Sustainability, Power and Automation

As a power and automation company having a multidisciplinary team with various backgrounds, ENEVO Group can implement a wide range of projects in the fields of power generation, energy transmission and distribution, oil & gas, utilities and industrial services.

Promenada Craiova 5.8 MWp, operating since 2023

50+ EPC
for renewable power plants

40+ MWp
self-consumption PV plants

30+
Control systems for renewable plants

20+
Grid connections for renewable plants

PV monitoring & control solutions

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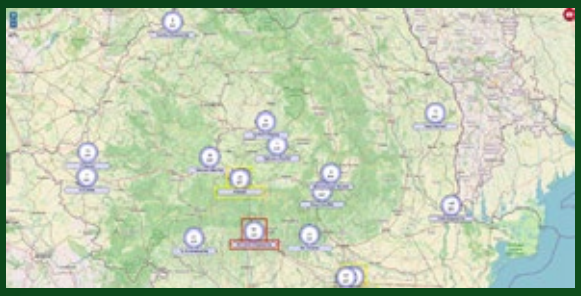

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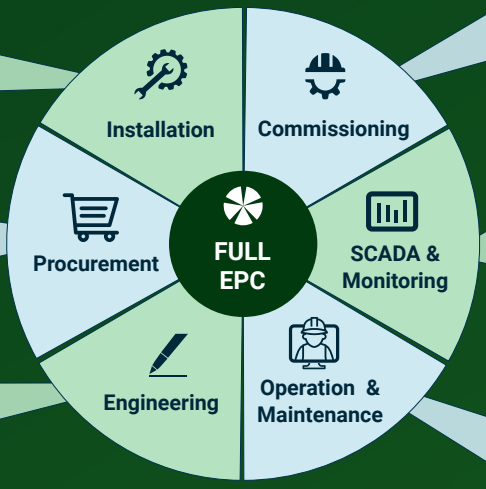

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EBRD supports scaling up of renewable energy sources

Rapid scaling up of renewables is crucial for decarbonization efforts in the power sector, general industry and the entire economy. Investments in RES (renewable energy sources) have been on an upward trend in recent years but progress is not fast enough. In EBRD countries of operations, regulatory frameworks still need improvement to enable an accelerated pace of investment. In Romania, since 2006, cumulative EBRD climate related finance exceeded 2.7 billion euros in 151 projects. This portfolio is estimated to lead to important carbon emissions reductions, water savings and waste reduction annually.

The sector has experienced renewed momentum recently after previous projects experienced regulatory interventions which led to a prolonged period without new developments of renewable energy projects. The renewed activity builds upon the EU-wide commitment enacted in Fit for 55 and REPowerEU to achieve at least 42.5% of final energy consumption from renewable sources by 2030. This supports Romania in achieving its ambitious plans to increase the share of renewables in total electricity consumption from 24.3% in 2019 to 36.2% by 2030 through the addition of 11.9GW of new renewable capacity (based on the updated draft NECP submitted by the Romanian government in November 2023).

According to the EBRD Energy Sector Strategy 2024-2028 and based on information provided by International Energy Agency, electricity from solar and wind is expected to increase fivefold between 2021 and 2030, while generation from unabated fossil fuels is seen as decreasing by more than 40%. By 2050, electricity generation from wind and solar is expected to account for more than 70% of total power generation.

The EBRD is a leading provider of green finance, having committed to make at least 50 per cent of its financing in the green arena by 2025, a target it has met for the past three years in Romania. The acceleration of the decarbonization of the energy sector is at the core of our green strategy, in line with the United Nations Sustainable Development Goals. Recent world events, from the Covid pandemic to more recent price shocks, have slowed SDG advances in the energy sector in some countries, and the UNSDG 2022 report noted that "achieving energy and climate goals will require continued policy support and a massive mobilization of public and private capital for clean and renewable energy, especially in developing countries."

MIHAELA MIHAILESCU,
Deputy Head
for Romania at EBRD

In terms of financing, the **scale up of renewable energy** sources (including solar) at the EBRD can be achieved through:

- **investing directly in utility-scale** renewable energy generation (including when coupled with storage), across all well-established, emerging or less established technologies (including solar and also offshore wind, waste to energy); for example, in 2022 the EBRD supported the construction of Poland's biggest solar photovoltaic (PV) plant via a 45.3 million euros loan. The Zwartowo plant will have a total capacity of up to 285.6 MWp and is expected to lead to carbon dioxide (CO_2) emissions savings of at least 138,000 tons per year.
- **financing, through financial institutions**, facilities that support renewable energy projects, such as Green Economy Financing Facilities, bonds with climate related features, Green Economy Transition (GET) eligible transactions, equity funds, and promote public-private partnerships; such projects were already signed at regional level and also in other countries such as Greece, Poland, Croatia, Bulgaria and Estonia.
- using **blended finance** (combining loans with grants, concessional loans or guarantees such as InvestEU) to scale up renewables and to support innovative green technologies. One example of using such an instrument was the 2023 senior secured loan aimed to finance development, construction, and operation of a 30 MW portfolio of three solar power plants in Croatia.
- Through **the EBRD Green Cities** urban sustainability program, using its focus on energy resilience, including renewables and district energy grids. In December 2022 EBRD signed a solar district heating project to introduce a renewable energy source in Pristina. This will connect neighborhoods not currently served by the existing network, replacing individual heating systems using solid fuel and greenhouse gas (GHG)-intensive lignite.

The EBRD plays an important role offering investment support and engaging in **policy dialogue** with authorities to advance market reforms and to pursue holistic and well-sequenced policy engagements to develop and reform energy markets and regulatory frameworks. The work is delivered considering country-specific characteristics: low-carbon pathways for the power/energy sector as a key operational/policy framework to drive the energy transition, regulatory frameworks and support schemes for established and emerging technologies, covering small-scale and distributed renewable generation sources; competitive price discovery processes and mechanisms; improving the functioning of markets to facilitate arrangements allowing for the uptake of renewable energy by end users (for example, corporate power purchase agreements (PPAs), municipal PPAs, cross-border PPAs and self-consumption regulation).

In Romania, more recently the EBRD provided technical assistance support to the Ministry of Energy to draft a new Electricity Law. It is currently assisting with the development of a Contracts for Difference (CfD) support mechanism – drafting primary and secondary legislation and amendments of existing laws needed for the implementation of the CfD framework, proposals for rules and requirements for a CfD tendering process and recommendations on measures to ensure adequate long-term funding and creditworthiness of the CfD Counterparty.

As well as investments in renewables, an important focus is also placed on **the upgrade and expansion of power networks and storage solutions to integrate renewable energy sources**, through:

- Investing in modernizing and expanding power networks (including transmission and distribution) to facilitate electrification, integrate renewables, grow decentralized energy sources, foster energy efficiency, and improve loss reduction
- Promoting policy engagement and financing that enable investment in energy storage, flexible/dispatchable generation sources
- Investing in the digital transformation and development of digital skills for the energy sector (smart grids, smart meters, the integration of electric vehicles (EVs), active participation in the energy markets of energy consumers/demand response).
- Investing in the expansion and upgrade of network infrastructure, including cross-border, to support the transportation of electricity and energy vectors and regional energy systems integration
- Financing energy-storage solutions to leverage intermittent resources efficiently (for example, batteries, pumped-storage hydroelectricity, and other storage technologies)
- Developing reforms, regulatory frameworks, market rules and regulations, and market platforms (energy exchanges) that promote well-functioning energy markets and support investment
- Financing infrastructure for the increased electrification of the economy (for example, EV charging stations).

EBRD is the largest institutional investor in Romania, having invested ca. 11 billion euros through more than 500 transactions since our set up in the country. Close to 80% of the Bank's investments in Romania are towards the private sector. The past three years marked an increase in our operations in the country, a trend that we expect to continue in the future, focusing our efforts on three pillars outlined in our country strategy for Romania: (1) sustainable infrastructure and regional development, (2) financial intermediation and further development of capital markets and (3) improved productivity by helping private companies expand and improve workforce skills. ■

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Guidelines on developing a solar project in Romania

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Counsel
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1. INTRODUCTION

The last three years put Romania back on the map of the RES investments with an unprecedented appetite from global investors (IPPs, PE funds, infra funds, institutional investors, utilities and developers) accounting to more than 30 GW of projects under development, some being among the largest in Europe in terms of panned size. This wave came on the back of an ambitious national strategy to increase the share of RES, the natural advantages and regional interconnections, the availability of EU grants and a legal framework aligned with the EU common market. Also, the announcement of the implementation of a support scheme in the form of Contracts for Difference for onshore solar and wind, of potentially up to 10 GW by 2030 provided a positive signal to the generators. Also, the newly adopted hydrogen strategy as well as the announced offshore wind legislation provided additional signals that the RES market development in Romania is strongly supported by the authorities. By the same token, important grid modernization and extension work have been announced by the national TSO, including the construction of an interconnector – high voltage direct current cable to be constructed alongside the existing gas interconnector will connect the country to Hungary and is estimated to be finalized in 2029. The power line is necessary to satisfy the needs to connect all the intended new RES capacities and increase the export potential.

This article aims to outline some of the most important steps in the overall permitting process for a greenfield generation capacity in Romania, alongside considerations regarding the available grant funding and support schemes, aimed to accelerate the investments in the renewables sector, to help reach the decarbonization targets at 2030.

2. LAND, PERMITTING AND AUTHORISATION PROCESS FOR OBTAINING THE BUILDING PERMIT AND ENERGY RELATED GRID APPROVALS AND AUTHORISATIONS, INCLUDING ENVIRONMENTAL ASPECTS

Under the Romanian law, the following permits, approval, certificates, authorisations are required for the development and operation of a solar farm having more than 1 MW installed capacity.

The first step in developing a solar plant project in Romania is to secure a title over the land. The most common title, besides the ownership title, which gives right to build and own the respective infrastructure for a solar plant project, is the superficies right. In a nutshell, a superficies right consists of: (i) the right to have or to construct a building on, under or above the land/ building owned by another natural or legal person; (ii) the ownership right to the new construction; and (iii) the right to use the land pertaining to the building (drept de folosinta in Romanian). The Romanian Civil Law limits the duration of a superficies right to a maximum of 99 years, with a prolongation option.

In general, all construction works can only be performed based on a building permit (in Romanian: "Autorizatie de construire") obtained by the beneficiary following the securing of a real right over the land where the construction will be erected. That can be an ownership right, a superficies right, an easement right or a concession right over public owned land.

The first procedural step for obtaining the building permit is for the beneficiary to obtain the urbanism certificate (in Romanian: "Certificat de urbanism"). The urbanism certificate includes a list of all endorsements and approvals that must be in place before submitting the application for the building permit. Usually, among others, these endorsements are issued by the environmental protection agency, the water management and the land planning authorities.

If the Project has not yet been approved through the existing local urban plan for the respective location (i.e. administrative unit, commune, town etc), the urbanism certificate will also make note of the requirement to secure a local urban plan ("PUZ") (in Romanian: "plan urbanistic zonal"), but only if the land has a higher surface area than 50 hectares.

As a novelty on this topic, there have been recent enactments in respect to PUZ and renewable projects. The general rule regarding developments on extra muros land is, as per the Land Law, that constructions on such land are prohibited, so renewable energy projects could be built only on intra muros land. However, Law

254/2022 amending the Land Law in July 2022, introduced the exemption according to which renewable projects could be developed on plots under 50 ha, located on agricultural extra muros land without the need to obtain a PUZ for the transfer of such lands into intra muros regime. The condition imposed by law refers only to the class/ category III, IV or V of agricultural land (where the fertility class is defined through a pedological study endorsed by a special authority, Soil and Agrochemical Survey Offices OSPA).

One of the mandatory permits listed in the urbanism certificate is the environmental permit (in Romanian, "acord de mediu"). The

environmental permit is an administrative document issued by the competent authority for environmental protection, which establishes the conditions and measures for environmental protection during construction stage. The environmental authority verifies whether the proposed type of investment mandatory falls under the environmental impact assessment category (especially high polluters) or if the project falls within the non-mandatory category for which a case-to-case basis assessment is performed (typically the case of wind and solar projects).

In practice, large solar projects may typically fall under the environmental impact assessment process which would follow a legal process whereby the environmental authority and the investor set a public engagement plan which would require at least one public debate session (announced at least 20 days prior). The process is hence extended and may vary from 9 months to more than 1 year.

After obtaining the final act of the environmental protection authority, the investor may resume the administrative circuit of obtaining the building permit.

New electricity production capacities may be connected to the grid under the terms and conditions of the grid connection permit ("ATR") (in Romanian: "aviz tehnic de racordare"). The ATR includes the connection solution and represents the offer of the Grid Operator to the request for connection submitted by the applicant. The ATR is issued by the Grid Operator in accordance with the approved solution study and contains all the technical and economic conditions for the connection to the grid.

The first step towards obtaining the ATR is to request the Grid Operator (Transmission or Distribution Operator) to provide information regarding the conditions to connect to the power grid. The Grid Operator must provide general information regarding the necessity of a location notice, general options for the grid connection, the steps and estimate duration of the grid connection process, the requested documents, the costs of the procedure etc.

The request regarding the connection to the public grid shall be submitted to the distribution operators (in Romanian, operator de distributie) if the electricity produced is less than 50 MW or to the transmission and system operator (in Romanian, operator de transport si de sistem) if the electricity produced exceeds 50 MW. Upon receipt of the ATR, applicants may require the relevant Grid Operator to execute the grid connection agreement.

After obtaining the ATR or the grid connection agreement, the beneficiary may can apply for the setting-up authorisation (in Romanian "Autorizatie de infiintare"). The setting-up authorisation allows the commissioning of a new electricity production unit according to the technical parameters previously established under the grid connection agreement, and it is required in an advanced stage of the permitting process. The setting-up authorisation is issued by ANRE and is required for new electricity production units with an installed capacity greater than 1MW.

After commissioning of the plant, the beneficiary must apply to the grid operator for the conformity certificate (only for solar and wind plants) (in Romanian "Certificat de conformitate"). The technical conformity certificate acknowledges the compliance of solar/wind plants with an installed capacity above 1 MW with the technical requirements for grid connection and represents a prerequisite for the generation licence. The commercial operation license must be obtained from ANRE after the plant is commissioned and before the commencement of commercial

operations. The validity term of the licence is 25 years and may be extended only in the situation when the validity period is less than the maximum duration allowed according to the law.

Another necessary permit for the commissioning of the project is the environmental authorisation (Romanian, "Autorizatie de mediu"). The environmental authorisation is issued by the Environmental Protection Agency and establishes the conditions and / or parameters of operation of an existing activity or a new activity with a possible significant impact on the environment, mandatory for commissioning the project. The environmental authorisation is valid for the entire period when the titleholder obtains an annual visa to confirm that the holder carries out its activity in compliance with the provisions of the law on environmental protection.

3. INVESTMENT OPPORTUNITIES FOR SOLAR PROJECTS

3.1 Contracts for difference scheme (to be implemented in Romania in 2024).

Acknowledging the need of new instruments in low carbon technologies, the Ministry of Energy has worked in the past years for the implementation of a Contract for Differences support mechanism (CfD), with the support of EBRD and a consortium of international consultants, where CMS has led the consortium in the design and implementation matters.

On 6th of March 2024, the European Commission has approved the €3 billion Romanian State aid scheme on Contracts for Difference ("CfD") to support onshore wind and solar photovoltaic installations to foster the transition to a net-zero economy. As a result, the legal framework for CfD is expected to be enforced imminently.

A CfD is, typically, a private agreement between a "buyer" and a "seller" on the two-way support payment which will be the difference between the strike price and market reference price. The generator is paid by the CfD Counterparty when market reference price is below the strike price and the generator pays the CfD Counterparty when market reference price is above the strike price. Total revenue of generators per unit of electricity is given by: Actual Sale Price + (Strike Price – Market Reference Price).

The CfD scheme will involve two rounds of auctions, each with separate tenders for onshore wind and solar photovoltaic eligible generation technologies, and with a total capacity of 5,000 megawatts of new renewables across the two rounds of auctions with two separate tenders for each technology each.

The total indicative capacities targeted are:

1,000 megawatts installed capacity for the production of electricity from onshore wind and 1,000 megawatts installed capacity for the production of electricity from solar photovoltaic sources, both as a result of a first round of auctions to be held in 2024; and

1,500 megawatts installed capacity for the production of electricity from onshore wind and 1,500 megawatts installed capacity for the production of electricity from solar photovoltaic sources, both as a result of a second round of auctions to be held in 2025.

Based on this scheme, it is expected that 2500 MW of solar generation capacity shall benefit of the scheme by the end of 2025, with an expected COD date within the next three years from the award of a CFD contract.

3.2 The Modernisation Fund

In January 2024, the Romanian Ministry of Energy has put on public consultation two call for projects on support for investment in new electricity production capacity from renewable energy sources. The targeted renewable energy sources are wind, solar and hydro. However, investment aid is only granted to new installations, without financing energy storage capacities.

The eligible activities which can be financed are the construction of renewable wind, solar or hydro power generation capacity and the purchase of new plant/equipment for construction of new electricity generation capacity from renewable wind, solar or hydro energy sources.

The total estimated budget of the two calls for projects is the equivalent in RON of EUR 815,000,000 and represents grants from the Modernisation Fund. The first call for projects provides for Support for investments in new renewable electricity generation capacity related to the call for projects for private sector applicants (without self-consumption) and has a total budget of 400.000.000 EUR.

The second call for projects provides for Support for investments in new renewable electricity generation capacity for self-consumption related to the call for projects for private sector applicants and has a total budget of 415.000.000 EUR.

3.3 The National Recovery and Resilience Plan

On 31 May 2021, Romania sent its proposal to the European Commission for its NRRP, which included all seven flagship areas of EU policies to be reached. This NRRP sets out the reforms and public investment projects that Romania intends to implement with the support of the Recovery and Resilience Facility (RRF). In total, Romania has requested €14.3 billion in grants and €15 billion in loans under the RRF.

On 31 March 2022, Romania's Ministry of European Investments and Projects launched a platform for the submission of investment projects to be financed under the NRRP, the guidelines for which are based on the six areas covering Romania's needs and EU priorities: green transition; digital transformation; smart growth; social and territorial cohesion; health and resilience; and policies for the next generation. With the creation of this platform, the Ministry of Energy also launched a call for projects for the state aid scheme aimed at supporting investments for the installation of new electricity generation facilities, such as renewable wind and solar energy sources with or without integrated storage facilities.

The total worth of the project call was approximately 595 million euros with approximately 497 million euros allocated for new wind and solar generation capacities higher than 1MW. According to the Minister of Energy, the scheme has accommodated more than 150 projects with a capacity above 1MW.

In addition, the Ministry of Energy has announced a new state aid scheme supporting investment in the development of storage capacities for energy storage (batteries). The closing date for submission of projects is 21.03.2024 The installation must be commissioned until 30.06.2026.

Overall, it is expected that by 2030, Romania would install 10,000MW in new energy generation projects from renewable sources that will be financed through the NRRP and the Modernisation Fund, which would triple the level compared to the current capacity of 5,000MW. At the same time, the cross-border interconnection capacity of the electric transmission network will also be increased to 5,000MW.

Disclaimer This material is not intended to be exhaustive in presenting the permitting and authorisation process for renewables energy projects, nor intended to constitute legal, regulatory or business advice.

Overview of the Supply Chain for the Romanian PV market

INTRODUCTION

The last few years have been marked by radical transformations in global energy markets, following disruptions caused by the COVID-19 pandemic, the Russian Federation's aggression against Ukraine and the exacerbation of the climate crisis, all of which have profoundly affected supply chains, resulting in a surge in prices. In this new geopolitical and geo-economic context at European level there has been a strategic reorientation, manifested by the large-scale adoption of renewable energy sources (RES).

In order to eliminate dependence on fuel imports from third countries, the European Union (EU) has set an ambitious target for 2030 - that 42.5% of energy should come from RES, aiming for the complete decarbonization of the economy by 2050. Solar photovoltaics play a key role in achieving these targets due to their versatility and low cost. However, while the rate of installations is growing substantially year-on-year in Europe, the supply chain of technologies, equipment and components is concentrated in one geographical location - the Asia-Pacific region. As a result, in response to developments in the international system and taking into account the impact that exogenous phenomena such as pandemics and wars have on the availability of technologies, initiatives have been taken at EU level to reindustrialize and bring PV-related manufacturing back to Europe.

CURRENT STATE OF PRODUCTION OF PV EQUIPMENT AND TECHNOLOGIES

The energy crisis has undeniably stimulated the rapid expansion of the PV sector, globally, regionally and nationally. In Europe, installed capacity has increased by 91% in the last three years, from 136 GW in 2020 to 259.99 GW in 2023 [Solar energy (europa.eu)]. However, while globally demand is on an upward slope, the same cannot be said for the development of supply chains, which continue to be concentrated in the Asia-Pacific region.

IRENE MIHAI,
Policy Officer,
RPIA

The focus is on the use of crystalline silicon (c-Si) modules, which account for more than 98% of global production. Another technology used, albeit to a much lesser extent, is cadmium telluride (CdTe), which accounts for the remaining 2% (ETIP PV, 2023 - PV Manufacturing in Europe: understanding the value chain for a successful industrial policy). In terms of the production of polysilicon, the raw material for photovoltaic panels, China is the global leader (89%), followed by South Korea, the US and the EU. A similar situation is found for ingot and wafer manufacturing (97%), where production capacity is concentrated exclusively in the Asia-Pacific region. Similar statistics are observed in terms of module production, where, although there are assembly facilities in over 38 countries, China manufactures about 70% of the global total, followed by Vietnam, Malaysia, Korea and Thailand [IEA, 2022. Special Report on Solar PV Global Supply Chains: Special Report on Solar PV Global Supply Chains (windows.net)].

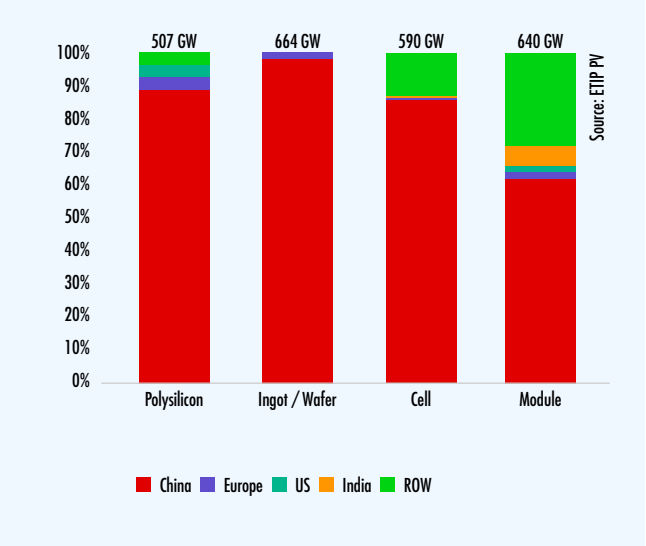
The Asia-Pacific region's geographic dominance of the PV supply chain is the result of China's policies over the past 15 years, coupled with more than 50 billion euros in investments [IEA, 2022. Special Report on Solar PV Global Supply Chains: Special Report on Solar PV Global Supply Chains (windows.net)], which have led to the country consolidating its position as a global leader in technology and component exports and monopolizing market share at every stage of the production process.

The rise of China's PV industry has profoundly reshaped the global manufacturing landscape for the components and equipment needed to capitalize on solar energy, evidenced both by the falling price of PV modules, which in 2023 reached a low point of 0.129 euros/Wp, and by the increasing use of this technology worldwide. However, while the policies and strategies undertaken by the Beijing regime have contributed to lowering costs in the sector, increasing the attractiveness and profitability of the PV industry, developments in the geopolitical context and vulnerabilities in global supply chains, revealed by the COVID-19 pandemic, have led to the emergence of geographic concentration as a potential challenge.

Against the backdrop of the energy crisis, ensuring the availability of photovoltaic technology has become a topic of strategic importance for the EU, which has taken the form of discussions on relocating production as part of the so-called "reshoring" process, with a view to bringing productive activities back to the European continent.

CREATING A COMPETITIVE SOLAR PV SUPPLY CHAIN IN EUROPE

As part of the objective to achieve a 42.5% share of RES-E, the EU aims to install 750 GWdc (600 GWac) of solar PV by 2030. To this end, in order to support investment in the sector, but also to strengthen strategic autonomy, the Commission launched in December 2022 the Industrial Solar Alliance to create an autonomous and resilient European supply chain. In terms of manufacturing capacity development, the target for 2025 is 30 GW, supported by boosting EU manufacturing of modules, ingots, wafers and related technologies to meet internal and external market requirements. It also aims to diversify the components of the international PV value chain and the necessary raw materials through research and innovation [European Solar Photovoltaic Industry Alliance - European Commission (europa.eu)].



Although we cannot speak, at the moment, of a well-defined industry in terms of production, it is important to note that 166 companies are active in this field in Europe, producing annually 14.1 GW of modules, 2 GW of cells, 81.1 GW of inverters, 26.1 GW of polysilicon (SolarPower Europe, 2024. EU Solar Manufacturing Map: EU Solar Manufacturing Map - SolarPower Europe). On the positive side, value chains in this sector are characterized by dynamism and adaptability to new investments, giving them a competitive advantage in the global market. As a result, in recent years, several European companies have started to step up their activities or implement expansion plans. One of the most ambitious projects in the EU aims to commission a 3 GW production capacity that will combine crystalline silicon with other semiconductor materials, with the ultimate goal of increasing cell efficiency and pushing the limits of current photovoltaic technology. The project is part of a global trend of innovation in the sector, seen in other companies, which in early 2024 set a new record for the world's most efficient panel, with a conversion rate of 25%, four percentage points higher than widely used technology, marking a crucial milestone in the energy transition.

However, while the sector has significant opportunities for growth, a key factor in expanding and developing supply chains is building an ecosystem that supports and stimulates the necessary investment, for which the input of each member state is crucial.

DEVELOPING SUPPLY CHAINS - IMPACT ON ROMANIA

While timid trends in the development of a value chain in Romania have been observed since 2010-2014, none of the 166 European companies producing various components and technologies necessary for the photovoltaic industry are based or operate in Romania, which is an economic and strategic disadvantage.

In a positive development, after this lull that lasted for about a decade, a new investment cycle in PV panel production is taking shape. From 2023, several ambitious projects have been announced, including the construction of plants with a total capacity of 10.3 GW. Compared to the previous period, the development of the value chain is supported this time by a series of funding calls through the National Recovery and Resilience Plan (NRRP) amounting to 199,000,000 euros, dedicated to the construction of new polysilicon and wafer production, cell and panel assembly capacities totaling 200 MW, complemented by support for investments in related technologies such as batteries.

While the discussion on supply chains focuses on the production dimension, it is necessary to consider the end-of-life of these technologies. Recycling of panels is key to creating a resilient and sustainable value chain, particularly as the process can recover key raw materials in manufacturing processes. In this respect, the Romanian Photovoltaic Industry Association (RPIA) is actively contributing to the development of the segment, as part of a consortium of 16 entities, whose one project funded by the Horizon Europe program aims to identify innovative processes by which 99% of panels can be reintegrated into a new production cycle (Grant Agreement no. 101122332).

In addition to contributing to strategic autonomy and energy security, the development of supply chains in Romania also has social benefits due to job creation in the production, construction and operation of new facilities. From an economic point of view, every euro invested increases production by 1.3 euros and, considering the projects announced, their realization would bring millions of euros in contributions to the budget (Deloitte&E3M – Renewable Energy in Romania – Roadmap to 2030 – report for RWEA&RPIA).

Materializing investments in the development of PV industry supply chains involves both the creation of an attractive ecosystem and a strategic approach, based on clear and transparent policy documents, where Romania has considerable gaps. At present, there is no comprehensive national vision adapted to the context in terms of industrial policy, providing a concrete direction for action. As a result, there is a need to increase the transparency of decision-making, stimulate innovation and investment at local level, by creating a stable and predictable framework that will increase the attractiveness of the Romanian market. ■

Considerations about balancing and commercial arrangements that can support PV projects

BALANCING COSTS

For investors in the renewable energy sector without operating experience in Romania, one of the crucial unknowns is related to the balancing activity and the costs of balancing of their intermittent energy production.

Balancing costs can vary quite a lot depending on the markets in which the producer participates, his behavior, or the way of trading on the energy markets, but also on the forecasts used by renewable energy producers.

As a BRP with a significant market share (60% of supply segment and 80% of renewable production through Ciga Energy and Cinta Energy) we have relevant data regarding the balancing costs renewable energy producers are facing. Since February 2021, when the Romanian balancing market switched to the 15 minutes settlement period and single price model, we can see that depending on the way of contracting the energy (from short-, medium- or long-term bilateral forward contracts, to the use of spot markets) the share of costs with the balancing for photovoltaic plants from the total revenues from energy production is between 6-15%. For the producers who are member of our BRPs, on average the most balanced scenario seems to be the sale of 80% of the energy on forward contracts and 15% on DAM. Eliminating the extreme values, **results a share of the costs with the balancing from the revenues of approximately 8-9%**. We are talking strictly about the costs of the balancing; these values do not include the possible costs of energy purchased for profiling. Depending on the strategy of each producer, some producers have consistent costs with profiling, others manage to avoid this kind of costs entirely.

ZOLTAN NAGY-BEGE,
Energy Market
Department Director
CIGA Energy

The European balancing market as well as the domestic one have changed a lot in recent years and, especially due to the need for integration and balancing of renewable production, other changes are expected. The EU member states are making progress in implementing the European rules regarding the balancing market.

The Electricity Balancing Guideline (EBGL) was created by the European Commission to establish and regulate the smooth exchange of balancing energy across the internal borders of the European Union. This guideline, which came into force as Regulation 2017/2195, sets the framework for the stabilization of the electricity grid throughout the European electricity market system. The aim is a pan-European market for system services with a harmonized market design and non-discriminatory trading of balancing energy without barriers between markets. As a result, TSOs will be able to procure balancing power more efficiently, more reliably, and cheap.

> The share of costs with the balancing for photovoltaic plants from the total revenues from energy production is between 6-15%.

THE STAGE OF IMPLEMENTATION OF REGULATION 2017/2195 IN ROMANIA

The European legislation regarding the balancing market rules was transposed in the Romanian secondary legislation with two main orders, 127/2021 and 128/2021, which are approving the following regulations:

- Regulation on the clauses and conditions for balancing service providers and for frequency stabilization backup providers.
- Regulation on the clauses and conditions for the parties responsible for balancing.
- The rules for suspending and restoring market activities and the applicable settlement rules.

Initially those new regulations should have been applied from 2023, but on September 22, 2023, ANRE approved the postponement of full application of Orders 127/2021 and 128/2021 until April 1, 2024 (see, ANRE Order no. 88/2023).

Harmonizing the European electricity markets will not be achieved only by executing the Balancing Guideline. The ENTSO-E and its members defined **five key areas** to realize the EBGL:

- European platform for the exchange of balancing energy from replacement reserves **(TERRE)**
- European platform for the exchange of balancing energy from frequency restoration reserves with manual activation **(MARI)**
- European platform for the exchange of balancing energy from frequency restoration reserves with automatic activation **(PICASSO)**
- European platform for imbalance netting process **(IGCC)**
- Frequency Containment Reserve (**FCR**), also known as primary reserve in many countries.

These platforms, each in various stages of development and implementation, will have a decisive role in adapting local balancing markets to the global needs of Europe's energy future, most likely to be dominated by energy production from renewable sources.

The key factors that will determine the future of the European balancing market are: the increased need for the integration of renewable energy, decentralization and distributed energy resources, improved grid flexibility, market coupling and cross-border balancing, shorter settlement periods, digitization and data analysis, markets for demand response and flexibility, hydrogen and energy storage, market reforms and regulatory changes, electric vehicle integration, flexibility markets and aggregators.

So far, from the data available on IGCC – the only platform to which Romania also joined through the presence of Transelectrica –, it is clear that, on the markets where both IGCC and PICASSO are used, the volumes of net imbalances have decreased by up to 20%, since the activation of PICASSO.

> There are technical solutions and commercial models that resulted in IRR between 15-20% for BESS projects.

Transelectrica and ANRE are making progress on the technical and legislative preparation of joining the other two balancing platforms, MARI, and PICASSO, which should happen in the 1st quarter of 2024. The timing should bring a more liquid and mature balancing market, providing more options not only for TSOs, but also for the market participants

According to the Accession roadmap of both Mari and Picasso, Romania should join those platforms in Q1, 2024.

THE BENEFITS THAT SHOULD RESULT AFTER APPLYING THE PROVISIONS OF EBGL

- encouraging effective competition, non-discrimination, and transparency in balancing markets.
- increasing the efficiency of balancing as well as the efficiency of European and national balancing markets.
- the integration of balancing markets and the promotion of the possibilities of carrying out exchanges of balancing services, at the same time contributing to safety in operation.
- contributing to the efficient operation and long-term development of the electricity transmission system and the electricity sector in the Union, while facilitating the efficient and coherent operation of the day-ahead, intraday, and balancing markets.
- ensuring that the procurement of balancing services is fair, objective, transparent and market-based, avoids undue barriers to market entry for new operators and promotes the liquidity of balancing markets, while preventing undue distortions within the internal market of electricity.
- facilitating the participation of controllable consumption, including energy aggregation and storage facilities, while ensuring that they compete with other balancing services on a level playing field and, if necessary, act independently when serving a single consumption site.
- facilitating the participation of renewable energy sources and supporting the achievement of the objective of the European Union regarding the penetration of energy production from renewable sources.

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Elektra Renewable Support is a **Romanian** integrated services company with an **experience of 10+ years in the renewable energy business**. The finest quality solutions for development and operation projects of all sizes are guaranteed by our industry expertise. **Personalized services**, considering each Clients' needs, from design and construction to commercial and technical operation and maintenance, through **our professionals and specialists**, represent **a strong point and a must** onto today's **energy market**.

Producers' experience

All started with the idea to invest as **energy producers**, with an owned operational portfolio of 70MW. Our **services portfolio was developed around demands**. We began with the operation and upkeep the electrical installation, then moved on to the authorized dispatch center, energy income related services, and finally all services required for the **efficient running of any power plant**.

Developers' experience

1000MW+ new renewable grid secured energy portfolio. Hybrid projects, combining wind, solar and storage for obtaining the best result for the owners and the best support for the national grid.

Dispatcher Operative Management, through our authorized **24/7 Dispatch Center** in Cernavodă. **Technical management**, Operation and Maintenance from the grid connection point to the producing unit, no matter the source, wind, solar or even gas, no matter the grid connection voltage level. **Inverters and wind turbine generators O&M.** Advanced technical solutions for aggregated units, combining even producing units, back-up systems and consumers. **Technical consultancy**, from design, to grid connection and technical conformity process. Closing the chain with our vast experience on **Commercial Management**, power forecasts, optimizing and **personalizing power models**, existing energy markets transactions and **24/7 intraday activity**, trading strategy consultancy.

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Methodology

The Monitor of the Romanian Photovoltaic Projects aims to provide a detailed overview of the utility-scale PV projects in Romania and it is essential to understand how this overview is constructed.

We have carefully considered numerous criteria to ensure a relevant and illustrative selection that supports the Monitor's objective of providing users with a detailed and up-to-date picture of the PV landscape in Romania. These criteria guided the process of including projects in the Monitor, helping to provide quality and useful information for industry professionals and those interested in developing PV projects.

To get a comprehensive picture, we use a variety of sources, from government authorities to public communications from companies and direct feedback from stakeholders.

SELECTION CRITERIA

The main criterion is size. We decided to monitor in a first phase only large projects and decided to include only those above the 5 MW threshold. In so doing, we will focus on projects that can make a significant contribution to the development of PV infrastructure at national level. At the same time, we are restricting this first of its kind initiative to a manageable volume.

Choosing the 5 MW threshold is debatable. Some may argue that a 5 MW project is not large at all, so it should not be part of this report. They would have gone for 20 MW, or even 50 MW for the lowest size. While we accept that there is an element of arbitrariness in choosing any number, our decision was based on the fact that most of the projects larger than 5 MW are inherently designed for grid injection.

We list and track both new projects in various stages of preparation and implementation and existing projects.

Then, of course, we should have a clear understanding of what we define as a PV project. For most of the time, when discussing a "project", what we have in mind is not a PV plant in operation, but anything and all before it goes online. Under this perspective, once operational, the project ends as it becomes a productive asset, it enters under different regimes of coordination etc.

Our main argument is that the lifecycle of an energy generation capacity, as well as the owner's responsibilities related to it, only ends with its decommissioning. For most of such projects, repowering is also an option. Both these two options are on the table already for projects in operation in Romania, as they are approaching the stage where either repowering or decommissioning and recycling will be required. In addition, these phases may last for many years and will become rather soon a relevant segment in the PV sector in Romania too.

STRUCTURE

Each fact sheet describes the project in detail, in a consistent format that allows comparison of initiatives.

Size As different sources report different installed capacities, and sometimes the differences can be very large, we have decided that for existing projects we report the installed capacity taken into account by Transelectrica, and not the one analyzed by other public bodies (such as the County Environmental Protection Agencies) at an earlier stage of the project, nor those communicated by the developer or other parties involved (mostly in terms of MWp). In the case of projects under development or construction, we have generally reported the installed capacity reported by the TSO, or the distribution operators or companies involved, in this order, depending on the availability of information.

In addition to the size of the project, we look at other relevant factors for a comprehensive understanding.

Project name We chose that a project is a power plant and use the "name of the plant" as it appears in Transelectrica's reports. In some cases, however, we have included two power plants as one project (e.g. Tg. Cărbunești 1 and 2) when the initiative has been launched, developed, built and is operated as a single project.

Project maturity level is an essential element that provides information on the project's progress and the distance to the point where it will become operational. Segmenting the life cycle of a PV project is largely arbitrary. We decided to adapt the model proposed by Luis M. Camarinha-Matos, Ana Ines Oliveira, Filipa Ferrada, Victor Thamburaj, in 2017, "Collaborative services provision for solar power plants" (https://doi.org/10.1108/IMDS-06-2016-0246). All attributions of a certain project maturity level (PML), belongs to the Energynomics team and results from an assessment in which we sought to involve the companies responsible for the project, without distorting reality in a direction of their choice.

Description In addition to the figures, a discursive description of each project is also necessary, as well as a more detailed presentation of the current status. We also set out the impact of the projects in order to identify the effect of each on the energy sector and the environment.

Companies involved We considered it relevant to list under each project at least 2 names of companies that had and/or have an important role in its success, generally the developer and the operator (O&M). These names are the main benchmarks to consider for future B2B actions.

INFORMATION UPDATE

The workflow we have put in place allows the report to be updated immediately in electronic format, accessing information from our database. The Energynomics team ensures that the data verification process is reliable and that the information is constantly updated with regular consultation of sources.

LIMITS OF THE APPROACH

The Monitor of the Romanian Photovoltaic Projects provides a detailed overview of all large-scale PV projects in Romania. It includes information on project size, location, maturity level, impact, and companies involved, aiding decision-making processes for investors, consulting firms, utilities, developers, and contractors.

Its main value comes from 1/ the large amount of up-to-date and verified information it contains and 2/ the way it is distributed based on a 10-step maturity levels. The two elements listed above are also its two major sources of limitation.

SOURCES

- **Transelectrica – TSO**
- **ANRE (National Authority for Energy Regulation)**
- **Distribution operators (Distribuție Oltenia, E-Distribuție, DEER)**
- **Government of Romania**
- **The County Environmental Protection Agencies**
- **Companies' public communications**
- **Reports from the industry associations**
- **Specialized media outlets**
- **Online business directories**
- **Direct consultation with companies**

PROJECT MATURITY RATING

In the realm of renewable energy investment and construction, access to comprehensive and meticulously curated data is paramount. The Monitor of Romanian Photovoltaic Projects is a tool offering thorough summaries of large-scale PV projects happening all over the country. However, there are some issues that need to be carefully thought through because they could have an effect on many different groups of people.

The Monitor's 10-step maturity rating method is very appealing to investors, experts, and utilities that are looking for solar business opportunities in Romania. We worked hard on this framework in order to make sure it is well-organized. However, it hides a risk that attributing a specific project a specific maturity rating is too much a matter of an opinion.

As we dug deeper into assessments, we saw that all ratings like this had to deal numerous biases and subtleties. What might look like a solid evaluation could actually be skewed by different interpretations. To minimize this risk, we make our best efforts to make each of the 10 levels as clear as possible.

In its search of clarity amidst the complex web of PV projects the Monitor's methodology, another risk is the limitation of oversimplification. The rigid delineation of projects into 10 distinct maturity levels risk failing to capture the intricate nuances that define each endeavor's maturity. Some projects teetering on the brink of advancement may find themselves unjustly categorized. Our answer to this situation is to constantly update the information in the dataset we base our report on.

For all stakeholders, the temporal nature of the Monitor's insights poses yet another challenge. In an ever-evolving landscape, the static snapshots provided by the report may swiftly become outdated, rendering once-reliable assessments obsolete. This inherent limitation undermines the report's utility when used as a one-time product and not as a dynamic decision-making tool, empowering stakeholders to fight against uncertainty and outdated information.

ACCESS TO INFORMATION

In order to ensure the best possible accuracy, we check information from multiple sources and contact the companies involved. Despite our team's best efforts, the reliance on external sources introduces a precarious reliance on third-party data integrity. Missteps in verification and delays in updating could misrepresent specific projects, although not necessarily impacting the overall image of the industry.

The Monitor claims to have the most in-depth coverage, but the accuracy of the data depends on how willing companies are to share information about their projects. In the sometimes opaque world of business, not all parties may be willing to share information, leaving holes in the Monitor's carefully woven web of insights.

As the dynamic nature of the energy landscape presents a formidable challenge, we are constantly looking for updated information. At the same time, the inherent lag between data collection, verification, and dissemination introduces a temporal gap that might seem as inaccurate depiction of projects and key players.

We are open to address possible discrepancies in the impact assessment and interpretation of project data, and we encourage you to contact us and promise to consider every opinion and suggestion for improvement.

Despite these limitations, the Monitor of Romanian Photovoltaic Projects retains intrinsic value for those willing to navigate its complexities with good will and caution. Investors, consultants, utilities, developers, and contractors alike can glean valuable insights from its pages, provided they approach its findings with a critical eye. Along with the Monitor's insights and an understanding of its limits, stakeholders can now see possibilities and deal with problems more clearly and with more strength as they move through Romania's complex solar energy sector.

Milestones	PROJECT MATURITY RATING
Initiation	**01 - Concept, Land Securing, and Preliminary Studies prior to ATR** **Description:** This initial phase involves conceptualizing the project, securing the land, and conducting necessary studies to ensure feasibility. It's a critical step for laying the groundwork. ● Identify potential sites based on solar resource, land availability, and environmental impact. ● Conduct preliminary feasibility studies assessing solar potential, grid connectivity, and economic viability. ● Obtain necessary permits, authorizations, and licenses, including environmental and local zoning approvals. ● Engage with local communities and stakeholders to gain support and input. ● Finalize land acquisition and secure land rights or leases.
	02 - Technical Connection Approval (ATR) **Description:** Gaining ATR signifies the project's technical viability for grid connection. ● Submit detailed project plans to the grid operator. ● Ensure compliance with grid connection standards and regulations. ● Assess and plan for any grid upgrades or modifications required. ● Obtain final approval from the grid operator. ● Negotiate and sign the ATR contract, detailing terms of grid connection.
	03 - Funding Secured **Description:** Securing funding is pivotal for the project's financial viability. ● Develop a comprehensive financial plan, including cost estimates and revenue projections. ● Identify and approach potential investors, lenders, and funding sources. ● Negotiate terms and conditions of financing agreements. ● Secure equity, loans, or grants as required. ● Finalize financial agreements and ensure regulatory compliance.
Ready to Build	**04 - Establishment Authorization and Building Permit Secured** **Description:** This step involves securing formal authorizations for construction and operation. ● Obtain establishment authorization from ANRE, ensuring compliance with energy regulations. ● Prepare and submit detailed building plans for approval. ● Secure building permit from local authorities. ● Address any legal or regulatory compliance issues. ● Develop and finalize construction and safety plans.
	05 - Procurement & Contracting **Description:** This stage involves detailed planning for procurement and contracting based on design specifications. ● Finalize detailed design and technical specifications for the PV system. ● Identify and select suppliers and contractors through a bidding or tender process ● Negotiate contracts for equipment supply, construction, and other services. ● Ensure compliance with technical, quality, and safety standards. ● Finalize procurement and contracting agreements.

Milestones	PROJECT MATURITY RATING
Construction	**06 - Logistics, Site Planning, Civil Works** **Description:** Preparing the site and managing logistics are crucial for smooth construction. ● Develop a comprehensive site plan, including access roads, storage, and staging areas. ● Coordinate logistics for equipment and material delivery. ● Conduct site preparation, including land clearing and grading. ● Implement civil works, such as foundation construction for PV panels. ● Ensure adherence to safety protocols and environmental regulations.
	07 - Mounting Structures and Assembling Subsystems **Description:** This phase focuses on the physical construction of the PV system. ● Install mounting structures for PV panels. ● Assemble PV panels and subsystems, including inverters and electrical components. ● Conduct electrical and mechanical integration of the system. ● Ensure quality control and compliance with technical specifications. ● Implement safety and security measures during construction.
	08 - Testing and Certification for Commissioning, Grid Connection **Description:** Testing and certification ensure the system's readiness for operation. Conduct thorough testing of the PV system, including performance and safety checks. ● Obtain necessary certifications and approvals for commissioning. ● Coordinate with grid operators for grid connection. ● Address any issues identified during testing. ● Officially commission the system for operation.
In operation	**09 - Operation and Maintenance** **Description:** Ongoing operation and maintenance are key for long-term performance. ● Implement monitoring systems for performance tracking. ● Conduct regular maintenance to ensure optimal operation. ● Manage any necessary repairs or upgrades. ● Ensure compliance with operational regulations and standards. ● Engage in continuous performance analysis and optimization.
End of life	**10 - Decommissioning & Recycling / Re-Powering** **Description:** The project's lifecycle concludes with decommissioning, recycling, or re-powering. ● Plan and execute the safe decommissioning of the PV system. ● Recycle or repurpose components in accordance with environmental standards. ● Assess the potential for re-powering or upgrading the system. ● Restore the site to its original condition or prepare it for new projects. ● Conduct final project evaluation and documentation.

ABOUT THE MONITOR

As the energy large-scale deployment is underway,
we help you to keep up with the evolution
of new (and existing) projects.
This up-to-date information will
help you to orient yourself in
a most dynamic landscape.

For improved networking and
better connections, contact us at

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