

# Romania's Energy Security in The Context of the European Green Deal Requirements

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*Abstract: Presently there is a large consensus stating that while energy security remains key for assuring the consumption needs in Romania, its fulfilment may be achieved through two essential factors: the accessibility of resources and their long term availability. In the current geopolitical context, this paper aims to analyse Romania's energy security considering the aspects regarding the European Green Deal. Therefore, in the first part of the paper, there will be presented the general considerations regarding Romania's energy security and the possibility for Romania to become a regional energy security provider. In the second part of the paper, an analysis will be carried out on the functioning of the national system for the 2023-2024 winter, namely forecasts will be made on energy production and consumption while presenting the necessary measures for the proper functioning of economic operators' activities.*

*Keywords: energy security, Green Deal, policies, energy efficiency*

*JEL Classification: Q42, Q47, Q48*

## 1. Introduction

Energy security is a condition of existence, an inalienable and imprescriptible international right, derived from the country's right over its energy resources and from European and Euro-Atlantic treaties that must become one of the long-term governance objectives. Energy security involves ensuring the necessary energy consumption in terms of accessibility to resources while preserving their availability of long-term access.

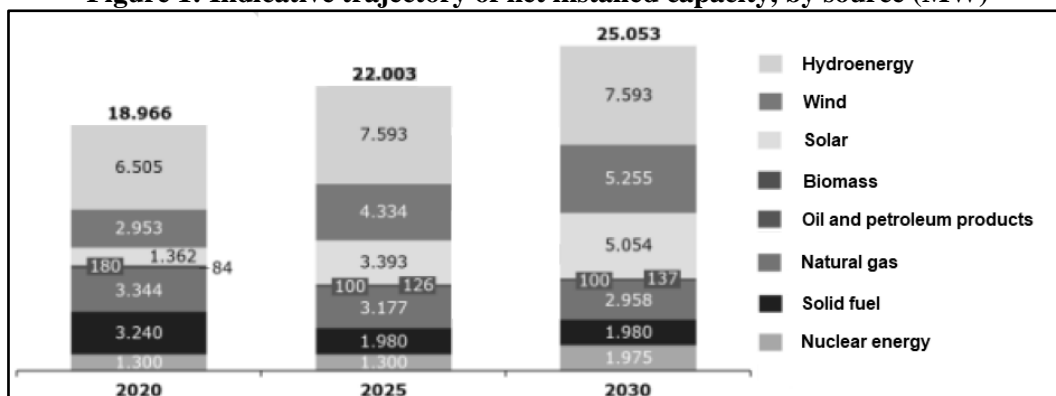
Romania's energy security is linked to the Black Sea, with investment efforts in this area targeting both natural gas production and renewable energy production, especially offshore wind farms. Investment efforts in the Black Sea target both natural gas production and renewable energy production, especially offshore wind farms. The diversification of electricity sources is essential for better integration of renewable energy sources.

Romania is already a regional leader in the renewables sector, ranking 11th in the EU's hierarchy in terms of the share of renewable energy in total consumption (Popa, 2021).

## 2. Romania's energy security - general considerations

Romania considers the security of energy supply from domestic sources a primary objective for ensuring national energy security (Ministry of Energy, 2022). Romania aims to maintain the current diversified energy mix by 2030, considering both the decarbonization objective of the energy system and ensuring its flexibility and adequacy to the national particularities of the energy system. In this respect, the evolution of installed capacities between 2020 and 2030 is shown in Figure 1.

**Figure 1: Indicative trajectory of net installed capacity, by source (MW)**



Source: Deloitte calculations based on information provided by the PNIESC (National Integrated Energy and Climate Change Plan) Interinstitutional Working Group and COM recommendations, 2022.

To meet the needs of energy consumption in Romania, the installed capacity will increase by approximately 35% in 2030 compared to 2020, due to the installation of new wind (2,302 MW by 2030) and solar (3,692 MW by 2030) capacities, which will lead to an increase in domestic energy production, thus ensuring a higher degree of energy independence. The positive impact can be seen in the reduction of dependence on imports from third countries, from a level of 20.8% for 2020 to 17.8% in 2030, representing one of the lowest levels of dependence on energy imports in the European Union (Păcuraru, 2022).

It is also planned the replacement of several coal-fired units with combined cycle units powered by natural gas and units based on renewable energy sources, the retrofitting of a nuclear unit, as well as the construction of at least one new nuclear unit by 2030 (Petrescu, 2023).

As far as the gas market is concerned, Romania benefits from its favourable position regarding the transmission capacities in the region and by the possibility of interconnecting the national transmission system (NTS) with the Central European transmission systems and with the gas resources in the Caspian Basin, the Eastern Mediterranean and the Middle East, through the Southern Corridor. For natural gas supply, Romania is specifically considering the development of the National Gas Transmission System on the Bulgaria-Romania-Hungary-Austria corridor (BRUA) and the development on Romania's territory of the Southern Transmission Corridor for taking over natural gas from the Black Sea shore. The existing interconnections will continue to be used in the Northwest direction (Medieșul Aurit), Sud Est (Isaccea) with Ukraine, in the West direction with Hungary, in the South direction with Bulgaria and in the East direction with the Republic of Moldova.

Ensuring the flexibility and adequacy of the national energy system is an important objective for Romania in the field of energy security. To better achieve a diversified energy mix, Romania aims to replace the electricity production capacities that will go out of operation with new, efficient and low-emission capacities, at the level of 2030. Until coal capacities are replaced with new capacities based on low-emission technologies, rehabilitation works and increasing the energy efficiency of existing capacities are envisaged, which will remain in operation for reasons of ensuring Romania's energy security (Tudorache, 2023).

Romania also has targets on encouraging dispatchable consumption to ensure demand response and targets on energy storage. The development and use of the technical and economic potential of renewable energy sources (RES) in the national energy system (NES) depends on the development of storage capacities as well as on the adoption of technologies for the injection of hydrogen in the form of syngas from RES and the use of hydrogen in industrial processes.

To enable the integration of RES into the national energy system, a transition from coal to natural gas-fired capacity will start in 2024, as this fuel has the advantage of allowing flexible operation. This can ensure system balancing, considering the intermittent nature of RES (Pătru, 2022). In this respect, at least 1400 MW of new natural gas-fired capacity is planned to be installed by 2030.

In order to maintain the adequacy of the energy system, currently, the acceptable limits for power generated from wind and photovoltaic sources are strongly conditioned by the level of hydraulicity and thermal regime. Thus, from the point of view of residual power flexibility, the critical times of the year are the hours of high consumption in winter/summer, the hours of thermal minimum/maximum and the hours of extreme hydraulicity (minimum/maximum). There is the need to install additional capacity of at least and 600 MW (additional to 2020) by 2025. Having this in mind, Romanian authorities may consider supporting priority projects in this field, if market mechanisms are not sufficient, through support schemes (including state aid).

### **3. Romania, regional supplier of energy security**

The current international context for energy markets is volatile while the recent technological developments can significantly change the way energy markets operate. In terms of security of energy supply, the development of renewable and low greenhouse gas energy generation capacities will ensure a balanced and diversified energy mix.

Also, by exploiting the hydrocarbon and offshore renewables potential in the Black Sea, Romania can become a regional supplier of energy security. At the same time, strengthening and modernising networks, digitalising, diversifying of sources and supply routes, increasing and modernising storage capacities compatible with the use of new gases and hydrogen, and increasing interconnection capacities with neighbouring countries are factors that will contribute primarily to ensuring national energy security, but also to Romania's objective of becoming a regional energy security supplier.

In this context, there are premises that, through the development of the energy sector, considering the availability of resources and the stability provided by the efficient transition to decarbonisation and the maturity of new technologies, Romania can achieve and consolidate its status as a regional energy security provider.

## 4. Analysis of national system operation for winter 2023/2024

### 4.1. Estimating the production/consumption balance of electricity and heat in cogeneration for winter 2023/2024

#### *Estimating gross energy consumption*

The monthly average temperatures achieved during November 2022-March 2023 were higher than the multi-year monthly averages over the whole period. The largest deviation from the multi-year average temperature was registered in January (5.1 °C warmer) and the smallest in February (0.9 °C warmer).

Table 1 shows the monthly average temperatures recorded in recent years during the winter months in relation to the standard climatological norm.

**Table 1. Monthly average values of temperatures recorded in recent years in the winter months and standard climatological standard (°C)**

Standard	Month	2016	2017	2018	2019	2020	2021	2022	2023
3.8	November	3.5	5	4.7	8.7	4.2	5.7	4.6	-
- 0.8	December	- 2	1.5	- 0.8	2.3	2.9	1.1	0	-
- 1.9	January	- 2.3	- 6	0	- 2.1	- 0.7	- 0.1	- 0.8	3.2
- 0.2	February	4.7	0.5	- 0.7	1.5	2.9	1.4	2.1	0.7
4.1	March	3.5	6.9	2.4	6.4	2.6	4.2	2.0	5.5

Source: National Administration of Meteorology, 2023

In 2023, due to high electricity prices combined with the slower growth of the economy, as well as with the production of electricity by prosumers using photovoltaic panels - production that is still difficult to record - the measured gross electricity consumption in the first half of 2023 was down more than 8% compared to the same period last year.

As of May 31<sup>st</sup>, 2023, the installed capacity of photovoltaic panels of prosumers was 867 MW. Against the background of the increased interest in the installation of photovoltaic panels and the programmes run by the Administration of the Environment Fund, it is estimated that in the winter 2023/2024 new capacities with an installed capacity of about 1500 MW will be commissioned in such power generation facilities. For their production, which is subtracted from the estimated consumption at national level, a load factor like that of photovoltaic power plants for which metering systems are in place has been considered for the winter period.

The evolution of gross electricity consumption in recent years as well as information on consumption values recorded in the winter period 2022/2023 are presented in Table 2 and Table 3.

**Table 2. Gross domestic electricity consumption in recent years in winter months (GWh)**

Month	2015	2016	2017	2018	2019	2020	2021	2022	2023
January	5551	5630	5896	5671	5819	5593	5625	5536	4893
February	4979	4971	5177	5313	5178	5141	5189	4858	4582
March	5176	5135	5204	5769	5266	5093	5551	5243	4751
November	5019	5258	5277	5340	5091	5237	5142	4621	-
December	5242	5638	5502	5733	5391	5528	5576	4880	-

Source: National Strategy and Forecasting Commission, 2023

**Table 3. Consumption values, peak production and realised temperatures for the period: November 1st, 2022 – March 31st, 2023**

Month	November 2022	December 2022	January 2023	February 2023	March 2023
Gross domestic electricity consumption (GWh)	4621	4880	4893	4582	4751
Peak consumption (MW)	7848	8250	8285	8354	7776
Average monthly temperature achieved (°C)	6.4	2.3	3.2	0.7	5.5
Multiannual average monthly temperature (°C)	3.8	- 0.8	- 1.9	- 0.2	4.1

Month	November 2022	December 2022	January 2023	February 2023	March 2023
Deviation from climatological standard (°C)	2.6	3.1	5.1	0.9	1.4
Maximum peak output (MW)	8388	8410	9924	9691	8658

Source: National Administration of Meteorology and National Strategy and Forecasting Commission, 2023

For the estimation of the country's gross electricity consumption for the period November 1<sup>st</sup>, 2023 - March 31<sup>st</sup>, 2024, the National Energy Dispatcher (NED) considered a medium scenario, with temperatures around the multi-year monthly averages, and a pessimistic scenario, with average monthly temperatures up to 2 °C lower than the multi-year averages (Romanian Government, 2023).

In the medium scenario, for each month from November 2023 to March 2024, assuming temperatures like the multiannual, a positive temperature correction between 2% and 7% was applied for each month, taking as a reference the similar period in winter 2022-2023 when the average seasonal temperature was almost 2.5 °C above the multiannual. About 50-100 GWh representing the estimated production for prosumers in that month was subtracted from the values obtained. Under these conditions, the gross domestic consumption forecast in the average scenario for the period November 1<sup>st</sup>, 2023 - March 31<sup>st</sup>, 2024 is 24400 GWh, about 2.8% higher than the value of 23727 GWh recorded in the previous winter.

In the pessimistic scenario, a similar analysis was made, considering for each month average temperatures 1-2 °C lower than the multiannual ones, resulting in a monthly consumption up to 150 GWh higher than in the average scenario. The gross domestic consumption forecast in this scenario for the period 1.11.2023 - 31.03.2024 is 25150 GWh, about 6% higher than the 23727 GWh recorded in the previous winter season.

For the same period, i.e. November 2023 - March 2024, the National Commission for Strategy and Forecasting (NCSP) forecast an average consumption of 23590 GWh, i.e. 0.6% lower than the values recorded in the same period of the previous year. Based on these assumptions, the consumption forecasts are presented in Table 4.

**Table 4: Domestic electricity consumption - estimated values - monthly averages (GWh)**

Month	November 2023	December 2023	January 2024	February 2024	March 2024
NED forecast medium scenario	4750	5000	5200	4700	4750
NED forecast pessimistic scenario	4900	5150	5350	4850	4900
NCSP forecast	4560	4795	4895	4625	4715
Achieved November 2022- March 2023	4621	4880	4893	4582	4751

Source: National Energy Dispatcher and National Strategy and Forecasting Commission, 2023

Considering the evolution of electricity consumption in recent winter periods and the fact that long-term weather forecasts have a high degree of uncertainty, the production-consumption balance will contain both scenarios analysed by NED, i.e. the medium scenario, in which the forecast gross domestic consumption for the period November 1<sup>st</sup>, 2023 - March 31<sup>st</sup>, 2024 is 24400 GWh, about 2.8% higher than the value of 23727 GWh recorded in the previous winter, and the pessimistic scenario in which an increase in consumption to the value of 25150 GWh has been forecast, about 6% higher than the consumption recorded in the winter of 2022-2023.

### ***Electricity exchange balance***

Regarding the import/export balance (Table 5), compared to the previous winter season, in the context of a higher estimated consumption, DEN considered an import balance for each month, also starting from the evolution of cross-border exchanges in previous years. In this respect, the monthly values of the import balance were estimated at 100 GWh (a total of 500 GWh) in the moderate scenario and 250 GWh in the pessimistic scenario (a total of about 1250 GWh).

At the same time, NSFC estimated, for the period November 2023 – March 2024, a total export balance of 465 GWh, mentioning that these estimates are subject to risks regarding the evolution of the current geopolitical context and climatic conditions, with limited validity in time.

**Table 5 – Export/import exchange balance ("+" import; "-" export), GWh**

Institution	Scenario	November 2023	December 2023	January 2024	February 2024	March 2024	Cumulated
NED	Medium scenario	100	100	100	100	100	500
NED	Pessimistic scenario	250	250	250	250	250	1250
NSFC		60	- 55	- 250	- 140	- 80	- 465

Source: National Energy Dispatcher and National Strategy and Forecasting Commission, 2023

Although the exchange balance, as monthly average values, resulting from the production/consumption balance (Table 6) indicates an import for the first three months in the pessimistic scenario, respectively export for the entire period in the moderate scenario, this will not be found on all trading intervals. Compared to the forecast, the level of the exchange balance will vary depending on the conditions of a lower/higher price from outside compared to the price of energy produced in the country, the climatic conditions recorded at regional level, as well as the existence of an increased lack / surplus of offers for the sale of electricity at national level.

***The domestic production/domestic consumption balance***

Analysing the monthly average estimates and considering the evolution of domestic electricity production in previous winters, it is found that the closure of the production/consumption balance will be directly influenced by renewable productions and that, in special weather conditions (blizzard, soil drought, extremely cold temperatures, etc.), there will be periods of non-coverage of electricity consumption peaks in domestic production.

**Table 6: Electricity production/consumption balance**

Gross electricity production and consumption	Gross electricity production and consumption Forecast of monthly average values for the period November 1 <sup>st</sup> , 2023 to March 31 <sup>st</sup> , 2024						
	Measure Unit	November 2023	December 2023	January 2024	February 2024	March 2024	Cumulated
Total forecasted production of the national system	thousand MWh	4814	5064	5202	4950	5332	25365
	MW	6686	6807	6992	7113	7167	6953
Gross country consumption - mild scenario	thousand MWh	4750	5000	5200	4700	4750	24400
	MW	6597	6720	6989	6752	6384	6688
Gross country consumption pessimistic scenario	thousand MWh	4900	5150	5350	4850	4900	25150
	MW	6805	6922	7190	6968	6586	6894
Consumption coverage from domestic production - moderate scenario	thousand MWh	64	64	2	250	582	965
	MW	89	87	2	360	783	264

<b>Consumption coverage from domestic production - pessimistic scenario</b>	thousand MWh	-85	-85	-147	100	432	215
	MW	-118	-114	-198	144	581	59

Source: National Strategy and Forecasting Commission, 2023

At the same time, unlike in previous periods analysed, due to the sharp decline in consumption, if this trend continues, import values and potential periods of non-coverage of consumption peaks could be lower than those estimated in previous years.

#### **4.2. Measures for the proper performance of economic operators' activities between November 1<sup>st</sup>, 2023 and March 31<sup>st</sup>, 2024**

The electricity balance (production/consumption), the production of heat produced in cogeneration, fuel purchases and stocks, as well as the volumes of water in large hydropower developments are elements of an indicative scenario that may be adjusted depending on the requirements of ensuring the operational security and operational stability of the national electricity system, the climate changes recorded, and in accordance with the monthly programmes for the exploitation of the main reservoirs, in accordance with the situations which may arise.

To ensure a sufficiently high level of certainty in covering the load curve of the national system, even when boundary situations arise according to the scenarios assessed by NED, the transmission system operator considers it necessary to carry out measures and actions to prepare and monitor the functioning of the national system, as follows (Romanian Government, 2023):

1. Ensuring in advance, at the level of all electricity producers, the quantities of primary energy resources to ensure the supply of electricity to consumption, as well as the reserves necessary to cover imbalances generated by subcontracting on electricity markets, accidental outages of energy groups, malfunctions generated by special weather conditions, increases in consumption above estimated values, etc., respectively for electricity supply to the Republic of Moldova, if the energy situation in the area requires it;
2. Establishing supplies of safety fuel in coal-fired power plants;
3. Ensuring a minimum energy supply in lakes attached to hydroelectric power plants;
4. Maintaining institutional coordination and collaboration between all entities involved in ensuring measures regarding the safety level in operation of the national electricity system and in achieving safety supplies;
5. Ensuring gas supply to gas-fired power plants even in extreme weather conditions (frost);
6. Storing natural gas to at least 90% of the storage capacity;
7. Compliance with the schedule for achieving coal, natural gas and water supplies by the start of the 2023-2024 winter season;
8. Carrying out the maintenance programme in the power plants to ensure the highest possible availability, so that in the event of a malfunction of the power units in operation, they can be replaced by power units in reserve;
9. To make available and carry out maintenance works on the energy groups in order to operate during the winter season TA5 - 105 MW and TA6 - 105 MW CET Brazi and TA1 - 50 MW CET Arad;
10. Ensuring the operation of centralised heating systems in terms of maintenance and fuel supply, in order to reduce the consumption of energy resources at the level of administrative units and to avoid an increase in the consumption of electricity and natural gas as a result of substituting thermal energy with electricity or natural gas;
11. The provision of technical and organisational measures for the providers, in cooperation with local authorities, to ensure the operation of land transport infrastructure during winter under conditions as close as possible to normal, particularly during periods of difficult/extreme weather;
12. Increasing the volume of electricity contracted on a medium and long-term basis to supply consumers, in order to reduce the volume of electricity purchased on the market for the following day;
13. Carrying out the maintenance programme of the electricity transmission network and of the electricity distribution network in order to avoid the problems of the power plants or the reduction of availability of power plants due to unavailability of electricity networks;
14. Moving from provisional to definitive design solutions for transmission and distribution grids, possibly with reinforcements and design upgrades where appropriate, to reduce the risk of incidents;
15. Providing maintenance and intervention teams for all entities in the electricity and gas systems to repair the malfunctions;

16. Ensuring sufficient storage of materials and components for the repair/replacement of faults occurring in energy installations so that the repair time is as short as possible;
17. Ensuring rapid access to energy installations for intervention teams through the Emergency Command Center;
18. Providing diesel generators for supplying vulnerable consumers, energy installation aggregates to avoid interruption of natural gas and oil extraction, fuel transport through pipelines, internal services of power plants;
19. In situations of regional or European energy crisis, the decommissioning and use of TA7 Turceni by activating the provisions of Emergency Ordinance no. 108/2022 on decarbonisation of the energy sector;
20. Activating the measures of the Emergency Plan for the security of natural gas supply in Romania, in the event of the occurrence of natural gas supply crises.

## 5. Conclusion

If the year 2022 was the year of energy investments in Romania, the year 2023 continues to be a year of massive investments and the effects of this investments will soon to be seen. At the same time, the Ministry of Energy has signed strong, long-term, strategic partnerships to ensure the country's energy security.

Regarding energy security and reducing the dependence on Russian gas, strong, long-term, strategic partnerships have been concluded to secure natural gas needs for both previous and upcoming cold seasons.

As far as electricity is concerned, the most important pillar is the nuclear one. Units 3 and 4 at Cernavodă, together with the small modular reactor from Doicești, will make the nuclear sector a major part of the energy mix. In connection with this sector, long-term strategic partnerships and relationships have been established with NATO member states and European partners. The integrated nuclear circuit within Nuclearelectrica has been secured and the prerequisites have been created for this sector to be the driving force in the production of clean electricity with zero greenhouse gas emissions in Romania for decades to come.

Nuclearelectrica SA selected the company Candu Energy Inc., member of SNC-Lavalin Group, to carry out additional pre-project works for the CANDU reactor of Cernavodă Unit 1, before extending its lifespan. Under the two-year agreement, worth approximately USD 65 million, SNC-Lavalin will perform long-term engineering and front-end engineering services, in preparation for the future refurbishment project of Cernavodă NPP Unit 1. The refurbishment will extend the operational life of the Unit 1 reactor by another 30 years, until 2060. Starting with 2029, through the refurbishment of Unit 1, approximately 5.5 million MWh of clean, affordable energy will be delivered annually to the national energy system (NES), and over 5 million tons of CO<sub>2</sub> will be avoided annually for another 30 years.

We must also mention the large investments in new electricity production capacities on natural gas, such as the mammoth investment that will be carried out by the private investor who bought the Mintia Power Plant and which will install a power of 1.7 GWh there, using the latest technology in the field. It is not the only investment of its kind – electricity production on natural gas, but it is by far the largest. It is a private investment worth 1.5 billion euro, which represents a record value for an electricity production capacity in Romania. It is also worth mentioning the major investments that will be made at the Oltenia Energy Complex from the Modernization Fund. These are 8 projects submitted by the CEO to produce energy from renewable sources, totalling 670.8 million euro, of which 469.5 million euro from the Modernization Fund. Upon completion, the total production will be 735 MWh. Next, we need to discuss the power installed through the programs that are run through the NRRPs, which means another 1GWh.

Another example of partnership is the submarine cable. The governments of Azerbaijan, Georgia, Hungary and Romania signed a Strategic Partnership Agreement on Green Energy Development and Transport in Bucharest. This document represents the basis of the financial and technical framework for the implementation of the submarine cable project for the transmission of electricity from renewable sources between Romania and Azerbaijan via Georgia and the Black Sea, and subsequently for the transmission of this energy to Hungary and the rest of Europe via the European transmission system. Romania plans to operate a green electricity transmission cable along the Tuzla-Podîșor route, then along the BRUA<sup>1</sup> gas pipeline corridor, to provide a link from east to west Romania. This agreement is based on the interests of the four countries in strengthening national and regional energy security and connectivity in the Black Sea basin, diversifying sources of supply, exploiting the potential for renewable energy production in the Caspian region and increasing the share of renewable energy in the national energy mix. Romania is interconnected in terms of gas infrastructure - gas import/export (reverse flow) with all countries in the region. These are Hungary, Bulgaria, Moldova and Ukraine. This means that gas

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<sup>1</sup> The BRUA pipeline is a natural gas pipeline from [Podisor](#), Giurgiu County to [Recas](#), Timiș County and a part of the future Bulgaria, Romania, Hungary and Austria gas interconnector.

can come into Romania either through the Vertical Corridor, the Transbalkan Corridor or the BRUA. This gives access to gas from the Caspian Sea, but also to liquefied natural gas from LNG terminals in Turkey or Greece.

Our main finding is that for Romania, in real terms, energy independence from Russian gas is achieved through diversification of supply sources, while the country remains a true champion of the renewable energy in the EU.

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