

PRODUCTION OF PRIMARY ENERGY IN THE EUROPEAN UNION VS. ROMANIA

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Abstract

Through this paper we have proposed a quantitative analysis on the production of primary energy, in the European Union and Romania, in the period 2010-2020. Therefore, it will be used the quantitative research to make a detailed statistical analysis to establish the increasing or decreasing trend in terms of production of primary energy. Regarding the data collected at the level of the European Union, it may be observed and noted the accelerated growth trend of renewable energy resources and the decreasing trend for solid fossil fuels. For Romania, it can be observed a slight increase of renewable energy resources, if not a stagnation. The interpretation of statistical data for all primary energy resources shows that the largest decrease was recorded by solid fossil fuels for both the European Union and Romania. Since 75% of greenhouse gas emissions come from the use and production of energy, the importance of the research lies in the fact that to address the issue of decarbonization of the energy sector in Romania, the starting point must be the analysis of primary energy production and primary energy resources.

Keywords: *economy, energy, production of primary energy, sustainable development goals, national recovery, and resilience plan, decarbonization.*

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Introduction

The major global crises that humanity has been facing since the outbreak of the coronavirus pandemic in 2020, followed by the current economic or even energy crisis, bring new perspectives in terms of achieving the ambitious measures defined by the European Union in the field of environmental protection (Council Regulation (EU) 2020/2094 of 14 December 2020 establishing a European Union recovery instrument to support recovery from the COVID-19 crisis). With the adoption of the European Green Deal, a commitment has been made "greenhouse gas emission reductions target for 2030 to at least 50% and towards 55% compared with 1990 levels in a responsible way" (Communication from the Commission, The European Green Deal, 2019). Thus, by 2050, Europe will become the first climate-neutral continent. An important objective of the European Green Deal is to decarbonize the energy sector, as 75% of greenhouse gas emissions come from the use and production of energy. The transformation of the entire energy system is a major challenge, and this can be addressed through a combination of coordinated actions at European level.

According to Gerlagh (2007) reducing emissions can generate a positive learning dividend when the social value of the change induced in learning exceeds the costs. Bilgen (2014) stated that "considerable effort is being devoted to reduce greenhouse gas emissions because of the Kyoto Protocol on climate change."

Right from the beginning of the century, energy security became the number one priority in the world (Bongars, 2008). In this regard, each country has tried hard to alleviate dependence

on primary energy sources. If we report worldwide, the Asia-Pacific region has seen the highest energy demand compared to the rest of the world. This is largely due to the fast economic growth being recorded in recent decades by the big giants, China, and India.

Bongars already stipulated in 2008 a great truth regarding the importance of this energy sector in relation to the economy of a country. According to him, energy is the foundation stone of any economy; therefore, a great resistance from those interested can be expected in all cases to any substantial change in the market, being such a fundamental and high interest field.

Will renewable energy reshape the 21st century just as it did with oil in the 20th century?

The answer to that question can be found in the analysis conducted by Bongas (2008), according to which we can state with conviction, in short, that 'not really', but the conclusions that were identified during the oil crisis should be considered in the future. It is also stipulated that to meet this huge energy challenge, conventional energy sources, including hydro and nuclear energy, will continue to occupy a big part of the total energy mix. Bilgen (2014) stated the “multidisciplinary perspectives on the interrelated topics of energy consumption, energy security and energy policy” and concluded that energy resources “are limited” resources and “can become a major source of conflict, which is another direct threat to sustainability”. Furthermore, according to him, “energy demand will keep increasing but the conventional sources for generating electricity will deplete with time or may become environmentally hazardous enhancing global warming.”

According to Zhang, Ji et Fan (2013) “one of the major energy policy concerns adopted by the Chinese government was oil security. This concern was due to several factors, but the main elements were the lack of an effective substitute for oil, on the one hand, and the dependence of imported oil internationally, on the other hand.” Therefore, the main risk identified was the gap between supply and demand, and the solution found by the Chinese government to this problem was to diversify the import of oil, improve the conditions of transnational pipelines and strengthen domestic production, to ensure enough oil quantity on the national market. Similarly, to the Chinese market, in the European market, we can see that in addition to sustainability and competitiveness, energy security is an important, if not the most essential, element in energy policy. If we consider chronologically the events that have taken place in recent decades, energy security was approached as an international problem even in the 1970s, with the onset of the oil crisis.

The definition of energy security can be addressed through the supply-demand relationship, the existence of a secure, sufficient, and uninterrupted supply on the market to meet the needs of an entire economy at reasonable prices. Or in other words, ensuring the regular supply of energy at affordable prices, over a given time horizon.

For European energy security, the highest risks are associated with natural gas in terms of disruption of its supply. If we are talking about energy dependency or energy independency, involuntarily the current geopolitical context urges us to a small exercise in analysing the current situation in Europe. Energy security versus energy independence have become essential topics if we refer to the sharp drop in Russian gas supplies to the Member States of the European Union and solutions are constantly being sought.

The purpose of this paper consists in the analysis of primary energy production in the European Union and Romania and the formulation of some conclusions regarding the similarities or differences found. This analysis is also essential because in the future we propose to approach and analyse the decarbonization of the energy sector in Romania, in the context of the adoption of the National Recovery and Resilience Plan. The data used in this paper are official data, collected at the level of the European Union and at the level of Romania, their processing allowing the formulation of relevant conclusions regarding not only the similarities and differences found but also the trend of increase or decrease of

primary energy resources in the analysed period. The motivation for choosing this sector is because this topic is especially important one and through future research, we propose to formulate some scenarios that would support the approach of decarbonization of the energy sector in Romania. The research method used in this paper is quantitative analysis to better understand behaviour and to support informed decision-making in this energy sector. Regarding the structure of this paper, it is divided in four parts. In the first part, the regional context and the current situation are presented. In the second part, it was proposed to present the National Recovery and Resilience Plan of Romania, especially the Energy component. In the third part, the collected data are analysed, and conclusions are formulated for each research objective separately. In the last part the future research directions are addressed, as well as the main conclusions regarding the analysed data, the increasing or decreasing trends and the similarity or difference ratio between the European Union and Romania in terms of production of primary energy.

1. General context

Because the leaders of the European Union were concerned about energy security versus energy independence and about some measures to resolve the conflicts in Ukraine, the Versailles Declaration was adopted (Versailles Declaration, Informal Meeting of Heads of State or Government, 2022), at the Informal Meeting of Heads of State or Government. This Versailles Declaration is a document containing details of the “commitment of the Member States of the European Union to managing the crisis generated by Russia's aggression against Ukraine, as well as strengthening capabilities to defend, reduce energy dependencies and build a stronger economic basis.”

Therefore, the member countries have concluded that it is necessary to reduce and even phase out the European Union's dependence on Russian imports of gas, oil, and coal, as quickly as possible, by (Versailles Declaration, Informal Meeting of Heads of State or Government, 2022):

- “a) accelerating the reduction of our overall reliance on fossil fuels, considering national circumstances and Member States’ choices of their energy mix.
- b) diversifying our supplies and routes including using LNG and the development of biogas.
- c) further developing a hydrogen market for Europe.
- d) speeding up the development of renewables and the production of their key components, as well as streamlining authorization procedures to accelerate energy projects.
- e) completing and improving the interconnection of European gas and electricity networks and fully synchronizing our power grids throughout the EU.
- f) reinforcing EU contingency planning for security of supply.
- g) improving energy efficiency and the management of energy consumption and promoting a more circular approach to manufacturing and consumption patterns.”

Therefore, to materialise what was agreed at that meeting, the European Commission drew up a plan, called REPowerEU, as a possible response to the disruptions in the global energy market caused by Russia's invasion of Ukraine. The main objective of this REPowerEU plan is to reduce Europe's dependence on Russian fossil fuels as well as other concrete measures presented below. The focus will be on accelerating the clean energy transition, building a more resilient energy system and a true Energy Union.

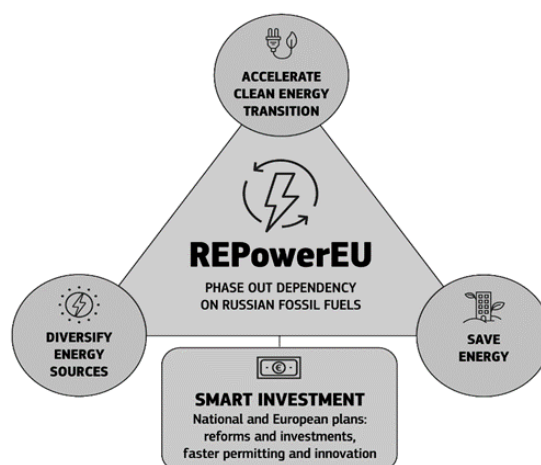


Figure 1. Additional set of actions - REPowerEU

Source: Communication of the Commission to the European Parliament, the European Council, the Council, the Economic and European Economic and Social Committee and the Committee of the Regions, COM (2022) 230 final, (18.5.2022), <https://eur-lex.europa.eu/legal-content/RO/TXT/HTML/?uri=CELEX:52022DC0230&from=EN>

In line with the above, the European Union has made available to the Member States a long-term budget and NextGenerationEU, “representing the largest incentive package ever to be financed in Europe, with a total value of €2,018 billion”, according to Table 1. (Communication of the Commission to the European Parliament, the European Council, the Council, the Economic and European Economic and Social Committee and the Committee of the Regions, COM (2022) 230 final)

Table 1. Total budget from the Multiannual Financial Framework 2021-2027 and NextGenerationEU

| No crt | Name of intervention | MF 2021-2027 (billion euros) | NextGenerationEU (Billion euros) |
|--------|---------------------------------------|------------------------------|----------------------------------|
| 1 | Single market, innovation and digital | 149,50 | 11,50 |
| 2 | Cohesion, resilience, and values | 426,70 | 776,50 |
| 3 | Natural resources and environment | 401,00 | 18,90 |
| 4 | Migration and border management | 25,70 | 0,00 |
| 5 | Security and defence | 14,90 | 0,00 |
| 6 | Neighbourhood and the world | 110,60 | 0,00 |
| 7 | European public administration | 82,50 | 0,00 |
| Total | | 1.210,90 | 806,90 |

Source: author's data processing based on the official budget published by the European Commission

The main purpose of this financing package for the reconstruction of the European Union after the coronavirus pandemic, includes concrete measures aimed to repair the immediate economic and social damage. NextGenerationEU is a temporary recovery instrument, the core of which is the 'Recovery and Resilience Facility' (MRR), totalling €723.8 billion for grants and loans to support Member States in implementing reforms and investments. To access these funds made available by the European Union to all Member States, they should draw up their own recovery and resilience plans, which include the conditions under which these funds will be invested. An important thing to keep in mind is that these investments must reach certain milestones and targets, and the payments will be made, only after a detailed analysis conducted by the European Commission, in terms of achieving them. As regards the remaining NextGenerationEU funds, they are redirected to Member States through other European programmes.

On the 11th of February 2021, the Regulation establishing the Recovery and Resilience Facility was adopted, aimed at providing support for the “green and digital transitions, enabling the economies of the European Union countries to become more sustainable and resilient.” And to access the funds of this mechanism, member countries included in their recovery and resilience plans, a “coherent package of projects, reforms, and investments in six policy areas (Regulation (EU) 2021/241 of the European Parliament and of the Council of 12 February 2021 establishing the Recovery and Resilience Mechanism):

- green transition.
- digital transformation.
- smart, sustainable, and inclusive growth and employment.
- social and territorial cohesion.
- health and resilience.
- policy for the next generation, including education and skills.”

Member countries had to submit until the 30th of April 2021 their national recovery and resilience plans setting out the reforms and investments to be implemented by 2026. To access the member countries recovery and resilience plans the European Commission has made available on its official website a dedicated section for this purpose, suggestively titled, the Recovery and Resilience Scoreboard.

2. Romania's National Recovery and Resilience Plan – Component 6 – Energy

Romania's recovery and resilience plan was transmitted to the European Commission on 11 June 2021. The plan consists of 107 investment measures and 64 reforms structured around six pillars and fifteen components. Each pillar is articulated around components that provide for coherent and complementary reform and investment packages. They will be supported with an estimated €14.24 billion in grants and €14.94 billion in loans.

Energy is one of the main components of this Recovery and Resilience Plan of Romania (Government Emergency Ordinance no. 124/2021 regarding the stability of the institutional and financial framework for the management of European funds allocated to Romania through the Recovery and Resilience Mechanism, Government Emergency Ordinance no. 155/2020 regarding some measures for the development of the National Recovery and Resilience Plan necessary for Romania to access repayable and non-repayable external funds within the Recovery and Resilience Mechanism).

But what are the actual goals of this component - Energy? In particular, the Energy component focuses mainly on the next reforms (Romania's National Recovery and Resilience Plan, 2021):

- “Electricity market reform, replacement of coal in the energy mix and support for a legislative and regulatory framework for private investment in renewable electricity production.
- Improving corporate governance of state-owned companies in the energy sector.
- Green budgeting.
- Developing a favourable legislative and regulatory framework for future technologies, in particular hydrogen and storage solutions.
- Reducing the energy intensity of the economy by developing a sustainable mechanism to boost energy efficiency in industry.
- Increasing competitiveness and decarbonization of the heating - cooling sector.”

By carefully analysing the measures established within this component, we can conclude that its main objective is to address the challenges of the Romanian energy sector in terms of decarbonization and air pollution. The established measures propose to accelerate the decarbonization of the energy sector by phasing out lignite and coal-fired power plants by 2032 and facilitating the deployment of renewable and alternative energy sources such as green hydrogen. It also aims to achieve the digitalization of the energy sector, to increase the flexibility of the electricity grid and to reduce the energy intensity of industry. Another important objective is to create “corporate governance of state-owned enterprises” in the energy sector (Romania's National Recovery and Resilience Plan, 2021).

Therefore, a major objective is the development of this plan to phase out coal from the energy mix and to enhance the environment of mining sites by 2032. This deep reform of the generation structure is also related to the commissioning of flexible and efficient capacities for electricity production, in cogeneration, which would ensure and facilitate the “connection of the new capacities of renewable energy sources (RES), and thus make it possible to achieve the targets assumed by Romania through the National Integrated Energy and Climate Change Plan (PNIESC)” (Romania's National Recovery and Resilience Plan, 2021). All these new flexible and efficient capacities will be ready for the use of decarbonated gases and hydrogen in blending. By phasing out coal from the energy mix and replacing it with natural gas, renewable energy sources or hydrogen, it can lead in the long term both to the reduction of budgetary expenditure (decrease of the amount of subsidies for the mining sector or even disappearance), and to some benefits, such as the increase in renewable production capacities, which “directly contribute to the achievement of the Sustainable Development Goals 7 and 13 of the 2030 Agenda” (Romania's National Recovery and Resilience Plan, 2021, SDG7 - Affordable and Clean Energy and SDG13 - Climate Action). On the other hand, decarbonization helps to reduce import dependency and exposure to the volatility of fossil fuel prices.

As Niu, Y. (2011) predicted in his study, that “low carbon economy is the inevitable result of the capitalist production model and is economic development model which humankind is forced to adopt. The measures to reduce carbon emissions mainly include laws and regulations, carbon taxes or carbon trading, subsidies or tax cuts on clean production, technological innovation, and demand reduction. These measures have respective advantages and disadvantages.” He also considered, that “technological innovation and demand reduction are long-term solution of these measures.” Just like Yang, Ch. (2020), who stipulated that “environmental protection awareness deserves more attention”.

3. Analysis of production of primary energy in the European Union and Romania

“Decision makers need to have reliable information about production, trade, stocks, and consumption of energy sources, but basic energy data are not always available and reliable

due to diminishing statistical expertise caused by budget cuts and simultaneous increase of data requests, liberalisation of energy markets which led to difficult gathering of basic information and other factors” (International Energy Agency, Eurostat, 2004). Besides, it is also stipulated that” energy statistics on supply, transformation and consumption usually are the basis for any energy, economic or environmental policy-related decisions.”

Since several studies have predicted the decrease in production because of the depletion of raw material reserves, it is interesting to verify the confirmation or denial of this hypothesis. It is also foreseen by several studies, that the “utilization of renewable energy sources is essential in the supply of low-carbon energy” (International Energy Agency, Eurostat, 2004). For the analysis of the indicator – production of primary energy - we will use quantitative analysis. To use this method, we will start by defining primary energy resources. Primary energy production comprises production obtained from the exploitation of energy sources existing in nature (in deposits, forests, watercourses, etc.), which can be used on its own or after prior processing (sorting, washing, decanting, purification, etc.), which does not change the structure of the assortment but improves its quality with a view to its use as fuel or as a raw material to produce other combustible or non-combustible products (INSSE methodology - annual statistical surveys on energy resources and their use (E01), electricity and heat generation (E02), Regulation (EC) 1099/2008 of the European Parliament of the Council on energy statistics, as amended).

Conducting a quantitative analysis at European Union level on the production of primary energy, presented in Fig. 2, shows us the trend of increasing or decreasing the primary energy resources from the total amount of available resources in the period 2010 - 2020. At the level of 2020, the total production of primary energy was to 24.027 petajoules (24.027.000 terajoules). If we refer to primary energy resources, namely solid fossil fuels, natural gas, and oil, we can identify a trend of accelerated decline. Nuclear energy recorded a trend of stagnation, with relatively stable values, and after 2019 recorded a significant decrease. The only component of the total primary energy resources for which there was an accelerated growth trend was for renewable energies. Thus, we can conclude that in the European Union during this period under review, there was a downward trend for solid fossil fuels, oil, and natural gas. The biggest drop was recorded by natural gas, followed by solid fossil fuels and oil. Regarding the production of primary energy from renewable sources, we can see a trend of accelerated growth.

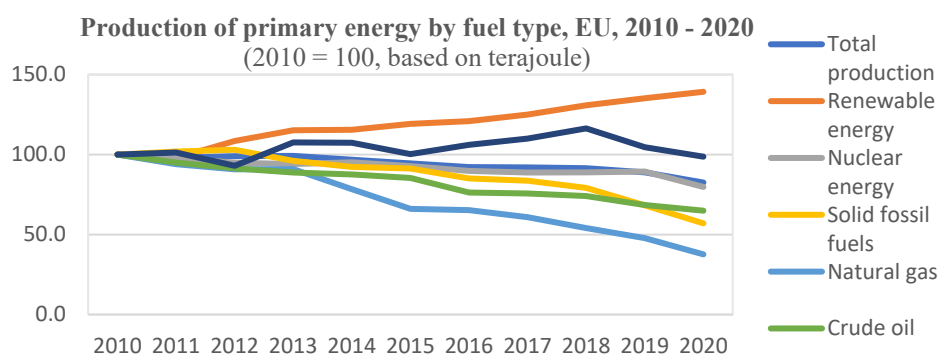


Figure 2. Production of primary energy by fuel type, EU, 2010-2020
Source: Eurostat (online data code: nrg_bal_c)

Conducting a quantitative analysis on primary energy production in Romania, presented in Fig. 3, shows the trend of increasing or decreasing primary energy resources from the total resources available in the period 2010 - 2020. In 2020, the total value of production was 936 petajoules (936. 000 terajoules). If we refer to solid fossil fuels, we can identify an increasing trend in 2012, after which a downward trend follows, registering the maximum level in 2020. For natural gas and oil, we can see a stagnation recorded during the analysed period. The same can be seen for nuclear energy. For renewable energies, we can see a decrease until 2011, after which an increase is followed and remains linear until 2020. Thus, we can conclude that in the last decade (2010-2020), primary energy production has generally recorded a slight upward trend until 2012, for solid fossil fuels, oil, natural gas, and nuclear energy, followed by a trend of stagnation until 2020, and the biggest decrease recorded in this period was for solid fossil fuels in 2020. As far as the primary energy production from renewable sources is concerned, we can see a decrease until 2011, after which a slight upward trend follows, registering the maximum level in 2016.

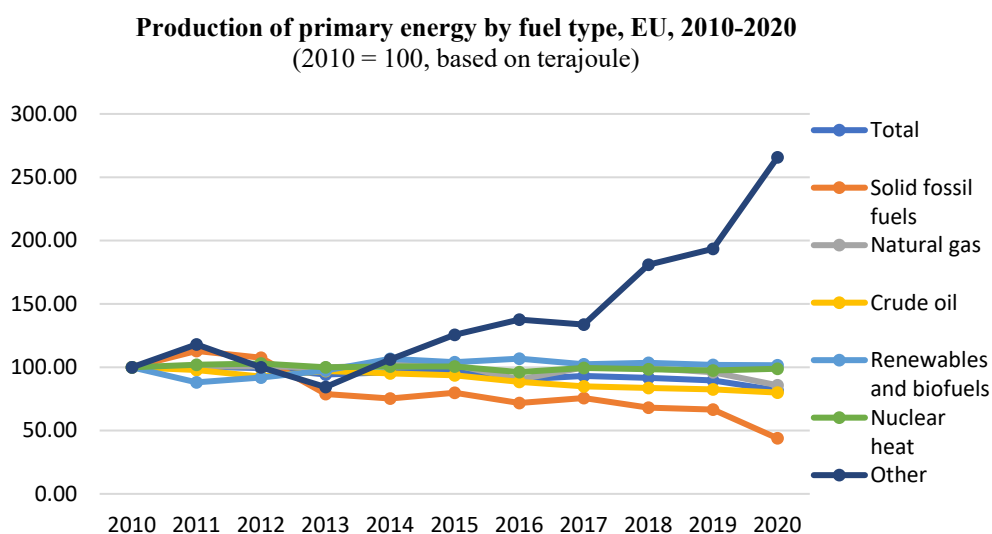


Figure 3. Production of primary energy by fuel type, EU, 2010-2020

Source: data processing by authors based on official amounts published by Eurostat

If we refer to Romania, regarding the production of primary energy from fossil solid fuels presented in Fig. 4, we can certainly see a downward trend after 2011. Between 2010 and 2011 there was an increase, after which a downward trend was recorded. But the biggest decrease recorded over the analysed period was between 2012 and 2013.

Production of primary energy by solid fossil fuels, Romania, 2010 - 2020

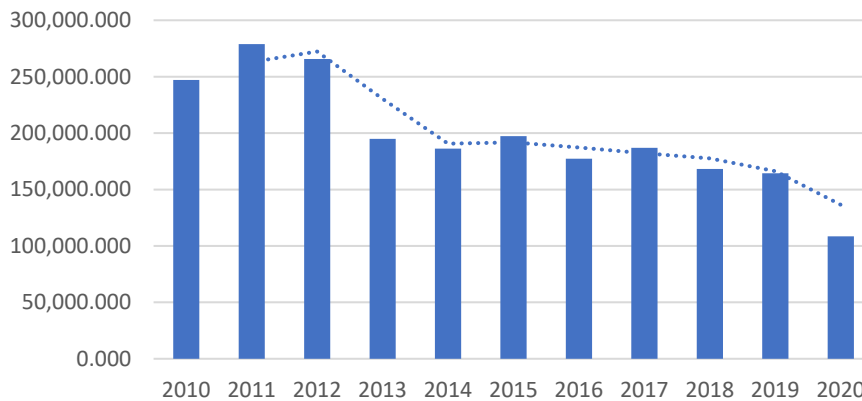


Figure 4 Production of primary energy through solid fuel fossils, Romania, 2010 – 2020

Source: Eurostat (online data code: nrg_bal_c)

4. Conclusions and proposals

As stipulated in the first part, the importance of the research lies in the fact that to address the issue of decarbonization of the energy sector in Romania, the starting point must be this analysis of primary energy production and primary energy resources.

Conducting this analysis, as presented in the third part, the production of primary energy recorded a global decrease both in the European Union and Romania, except for renewable energy resources. This can be attributed, at least in part, to the depletion of raw material reserves. However, we can state as well, that during the analysed period there was a positive trend in the production of primary energy from renewable resources. Our results also suggest that lower production could automatically lead to an increase in primary energy imports, to satisfy consumption.

One of the most relevant conclusions of this quantitative analysis of the production of primary energy indicator at the level of Romania, consists in the fact that for primary energy resources, in this case, for solid fossil fuels, a downward trend was registered during the reference period 2010-2020. This is an extremely important aspect, if we refer to the energy sector in Romania, as it is a well-known fact, that coal is the main responsible for air pollution. So, in the future, starting from this quantitative analysis, a socio-economic analysis can be developed, regarding the decarbonization of the energy sector in Romania, in the current context of adopting the National Recovery and Resilience Plan. Starting from this premise and because 75% of the emissions in the European Union come from the production and usage of energy, the reforms proposed by Romania within the National Recovery and Resilience Plan address several aspects that support the decarbonization of the energy sector in Romania. Even if it was foreseen in this mechanism to develop a plan to phase out coal from the energy mix and to enhance the environment of mining sites by 2032, this still represents a major challenge for the Romanian energy sector. However, it is well known that all decarbonization scenarios also involve actions to combat climate change.

So, to embrace the full scale of the rapid changes in our energy landscape, education and capacity building are essential: and preparing future generations for the formidable task ahead

is by far the biggest challenge of all. But if resources from renewable energies show a growing trend, we can say that we are in an optimistic scenario.

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