

ELECTRIC POWER PRODUCTION AND NATIONAL ENERGY SECURITY CONSIDERATIONS

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Abstract: This paper analyzes the electricity production system in Gorj County, the Oltenia Energy Complex, coal-based energy producer, considering the important share it holds in the electricity production market in Romania. In the current context, marked by the emergence of increasingly severe environmental regulations in the energy field, by adopting the Energy Union Strategy, the European Union has assumed an important role in combating climate change, and the CEO wants to consolidate its earned reputation on the competitive Romanian market, by guaranteeing a safe, clean and efficient lignite energy production, carried out in sustainable conditions by protecting and preserving the environment. The modeling of the Romanian energy system is also presented based on the expected evolution of policies and measures, in accordance with various other technical and economic factors and indicators.

Keywords: electricity, efficiency, pollution, strategy, energy transition.

1. INTRODUCTION

Following the EU's accession to the Paris Agreement and with the publication of the Energy Union Strategy, the Union assumed an important role in combating climate change, through the 5 main dimensions: energy security, decarbonization, energy efficiency, the internal energy market and research, innovation and competitiveness. Thus, the European Union is committed to leading the energy transition at a global level, by fulfilling the objectives set out in the Paris Agreement on climate change, which aims to provide clean energy throughout the European Union. To fulfill this commitment, the European Union has set energy and climate objectives for 2030 as follows:

- The objective of reducing domestic greenhouse gas emissions by at least 40% by 2030, compared to 1990;

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- The objective regarding energy consumption from renewable sources of 32% in 2030;
- The objective of improving energy efficiency by 32.5% in 2030;
- The objective of interconnection of the electricity market at a level of 15% by 2030.

Regarding the share of renewable energy, the European Commission recommended that Romania increase the level of ambition for 2030, up to a share of energy from renewable sources of at least 34%. Consequently, the level of ambition regarding the share of energy from renewable sources has been revised compared to the updated version of the PNIESC, from an initially proposed share of 27.9% to a share of 30.7% [5], [10].

The new target was calculated mainly on the basis of the Commission's recommendation to align national macroeconomic forecasts with those of the "Aging Report Economic and budgetary projections for the 28 EU Member States (2016-2070)", correlated with decommissioning of coal capacities.

The European Commission mentioned, on the other hand, that Romania will have to propose a greater reduction in primary and final energy consumption by 2030, in order for the Union's energy efficiency objective to be achieved [9], [13].

2. NATIONAL ENERGY SECURITY MEASURES

Romania considers the security of energy supply from internal sources a primary objective for ensuring national energy security. Romania aims to maintain a diversified energy mix on the horizon of 2030, taking into account both the decarbonisation objective of the energy system, as well as ensuring its flexibility and adequacy. In this sense, the evolution of installed capacities in the period 2020-2030 is presented in Fig.1.

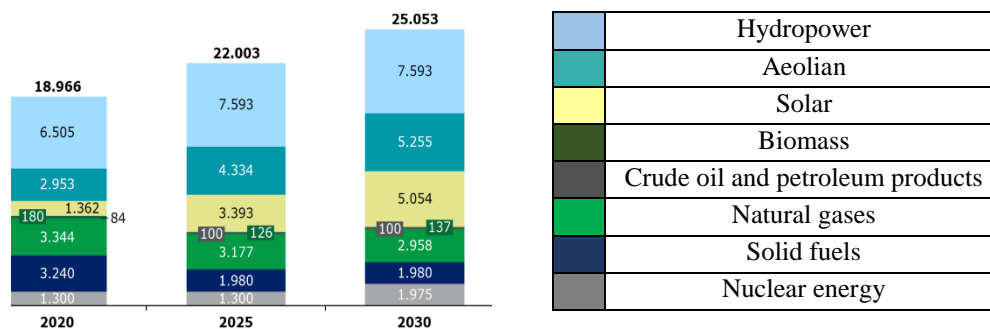


Fig.1. Indicative trajectory of net installed capacity, by source, [MW]

(Source: Deloitte calculations based on information provided by the PNIESC Inter-institutional Working Group and COM recommendations)

In order to ensure energy consumption, 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) energy capacities, which will lead to an increase in domestic energy production, thus ensuring a higher degree of energy independence.

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The positive impact can be seen in particular in the reduction of dependence on imports from third countries, from a level of 17.8% in 2030, representing one of the lowest levels of dependence on energy imports in the European Union.

It is also expected to replace several coal-fired units with natural gas-fired combined cycle units, to retrofit one nuclear unit, and to build at least one new nuclear unit by 2030.

The modeling of the Romanian energy system was based on the expected evolutions of policies and measures, in accordance with various other technical and economic factors and indicators. In this regard, the proposed policies determined a series of inputs and assumptions, as well as outputs of the modeling [4].

The model is a complex one that analyzes the links between various energetic and non-energetic parameters and their impact on the calculated indicators [11], [12].

In recent years, covering electricity consumption at the level of the system is proving to be more and more difficult to achieve from own energy resources, in order to give a correct picture of the operation of the National Electric Power System, but also to attract new investors in the area of production of electricity, the relevant Ministry and ANRE decided to remove from the records all the groups whose license was withdrawn/modified, the value of the power installed in the National Electric Power System being identical to the value of the installed power of all the groups included in the producers' licenses [6], [15].

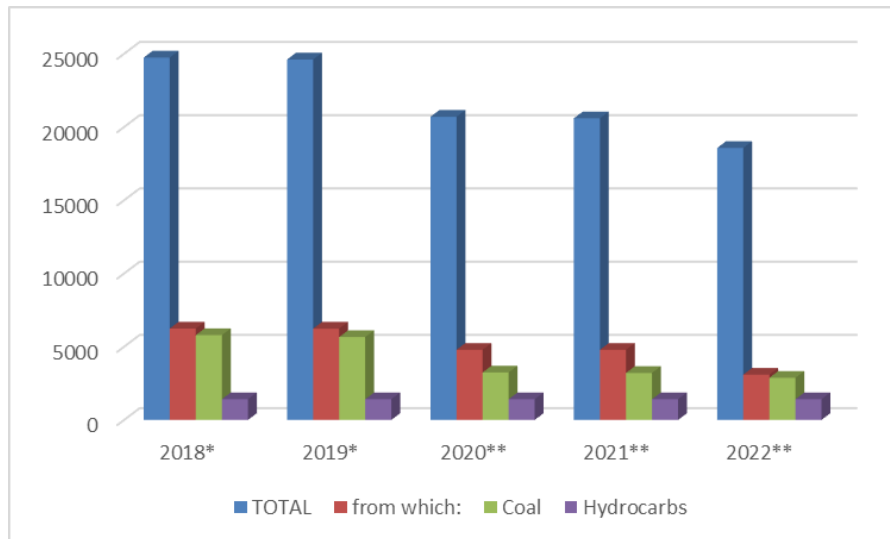


Fig.2. The power installed in the SEN [MW]

* Groups under conservation and groups withdrawn from operation for more than one year that are undergoing rehabilitation are not included. Also included are the groups in technological trials with a view to putting them into operation [8].

** Installed power in electricity production capacities in commercial operation (www.anre.ro)

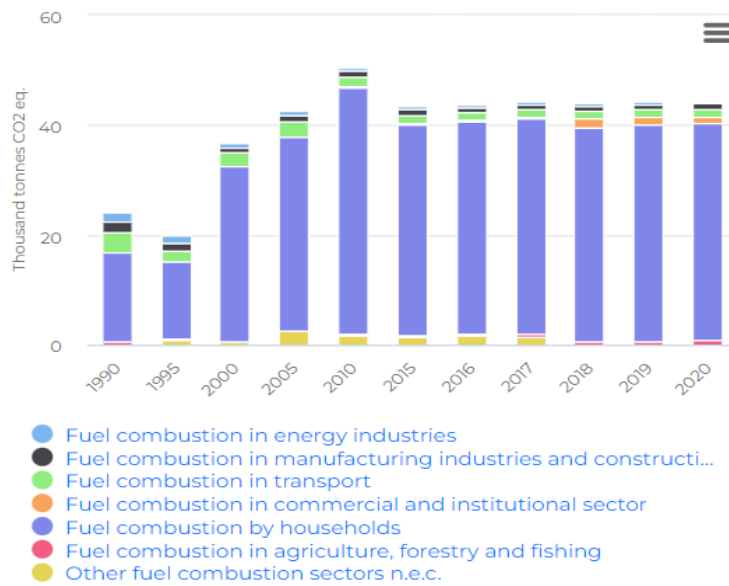


Fig.3. Greenhouse gas emissions intensity of energy consumption Romania (Source: Eurostat)

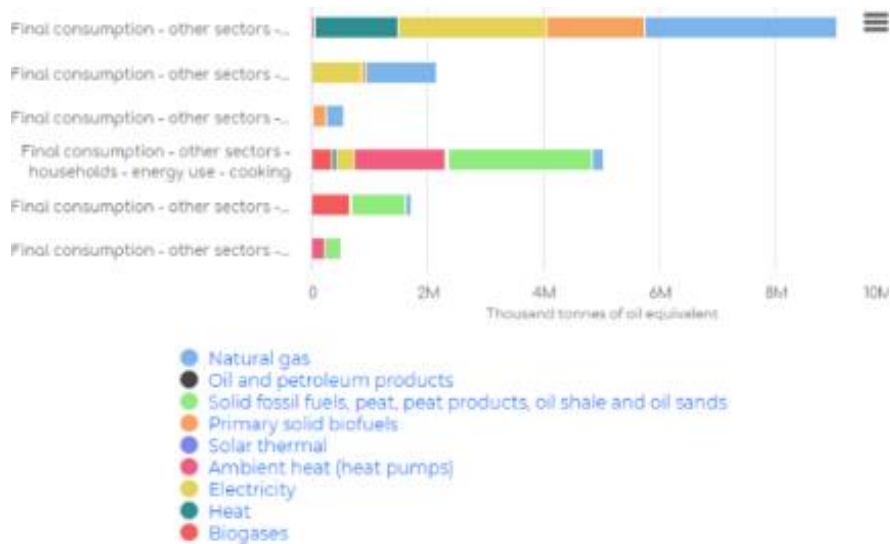


Fig.4. Disaggregated final energy consumption households quantities EU (Source: Eurostat)

The evolution of the energy sector in Romania in recent years has been sinusoidal, offering more market openness and the facilitation of diversity, better interconnection with neighboring states, but at the same time legislative and regulatory instability, the reduction of production capacities, the increase of dependencies on imports, the politicization of state-owned companies and the discouraging of new investment

On Romania's borders with Hungary, Bulgaria and Serbia, capacity allocation is carried out through market mechanisms, bilaterally coordinated in both directions, on the UIOSI principle ("use it or sell it"), Regional cooperation is an effective solution to energy supply crises [16].

Romania must maintain its position as an energy producer in the region and strengthen its role as an energy security provider in the management of stress situations at the regional level. Romania will continue the integration process in the European energy markets, making an important and profitable contribution to regional energy stability and security. The European approach to energy security policies is based on intra- and extra-community cooperation rules, norms and institutions. Romania currently has an energy security level score higher than the OECD average and better than its neighbors (Institute for 21st Century Energy 2013). In the EU Energy Security Strategy, the key to improving energy security lies in "improving cooperation at regional and European level in the functioning of the internal market and, secondly, in more coherent external action" [17].

3. THE ENERGY POTENTIAL OF GORJ COUNTY

Gorj county is, from an economic point of view, a mono-industrial county, the economy being based, for the most part, on the production of coal-based electricity, as well as on its related activities.

The main economic entity in Gorj County is the Oltenia Energy Complex, a coal-based energy producer that has approximately 12,858 direct employees and indirectly involves over 23,000 other employees in service companies and suppliers (production of assemblies and subassemblies, public food services, transport services, medical services, security and protection services, etc.), and represents about 12% of the total number of employees in this sector at European level (Source: Proposal of regulation of the European Parliament and of the Council establishing the Fund for a just transition) and approximately 40% of all employees in Gorj county (Source: AJOFM Gorj).

The Oltenia Energy Complex has a total installed capacity of 3,570 MW and an average annual production of 14 TWh and holds 22% of the electricity production market in Romania, energy produced as a result of mining activity from 9 (nine) extraction sites, of which 7 (seven) located on the territory of Gorj county.

CEO is a company of national interest, which was established by Government Decision no. 1024 of 12.10.2011 and was established through the merger of the following commercial companies:

- Craiova S.A. Energy Complex
- Rovinari S.A. Energy Complex
- Turceni S.A. Energy Complex

Oltenia S.A. National Lignite Company, and later, by payment, SC Power plants Group – SE Chişcani. The development strategy of Oltenia Energetic Complex SA has as its fundamental objective the production and supply of electrical and thermal energy, as well as the provision of services at exceptional standards for customers, in conditions of safety, accessibility and sustainability [7].



Fig.5. CEO activity

In the current context, marked by the emergence of increasingly severe environmental regulations in the energy field, Oltenia S.A. Energy Complex wants to consolidate its reputation earned on the competitive market in Romania, as a manufacturer that ensures SEN safety, by guaranteeing an energy production on safe, clean and efficient lignite, made in sustainable conditions by protecting and preserving the environment. CEO produces approximately 30% of the energy consumed in the system, having the following production capacities:

- a) 10 energy blocks, with an installed capacity of 3,270 MW,
- b) 2 energy blocks of 150 MW/160 Gcal on lignite, in cogeneration.

Oltenia S.A. Energy Complex can extract and deliver around 30 million tons of lignite per year, with the help of the following machines:

- a) 69 large-capacity excavators (rotor excavators, of which 29 are modernized);
- b) 46 dump trucks;c) 27 mașini de depozit;
- c) 327 km conveyor belts;
- d) 41 diesel, electric and hydraulic locomotives of 2100 HP, respectively 1250 HP;
- e) 129 km industrial railway.

The main source of air pollution is the polluting substances from the combustion gases discharged through the desulphurization stacks. The main pollutants emitted into the atmosphere, contained in the gases resulting from the combustion of fuel together with the combustion air, in the hearths of the boilers, are: SO₂, NO_x, CO₂, CO, unburned dust and particles and traces of heavy metals (Hg, Sb, As, Pb, Cr, Co, Cu, Mn, Ni) [9-11].

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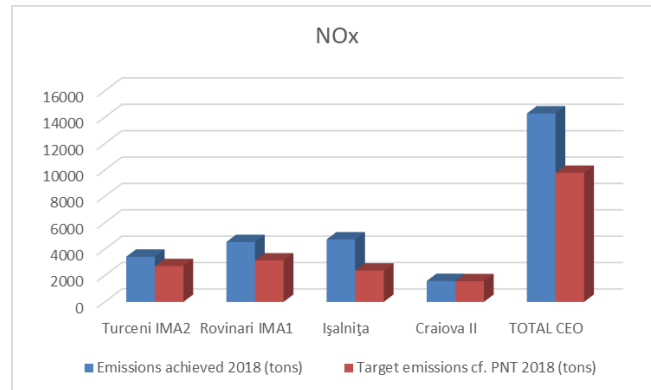


Fig.6. NOx emissions at CEO

According to GEO no. 196/2005, with subsequent amendments and additions, C.E.O. transferred in 2018 to the Environmental Fund Administration the following amounts as a result of pollutant emissions (SO₂, NO_x, dust) discharged into the atmosphere from fixed sources [2], [3].

The effects of the change in air quality, caused by the works within the mining operations, will materialize through the possible increase, in certain points of the mining perimeter, of the concentration of dusts, gases and smoke, resulting from the deployment of technology in the pits.

The main specific pollutants are represented by:

- suspended powders, settleable powders;
- combustion gases - machines, regardless of their type, operate with Diesel engines, the exhaust gases discharged into the atmosphere contain the entire complex of pollutants specific to the internal combustion of diesel: nitrogen oxides (NO_x), non-methane volatile organic compounds (VOCs) , methane (CH₄), carbon oxides (CO, CO₂), ammonia (NH₃), particles with heavy metals (Cd, Cu, Cr, Ni, Se, Zn), polycyclic aromatic hydrocarbons (PAH), sulfur dioxide (SO₂) [1]. In 2018, Oltenia S.A. Energy Complex produced 17,232 (GWh), representing 22.82% Market share (%) [3], [9].

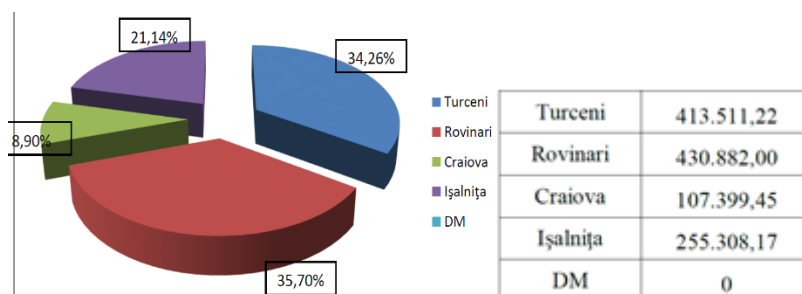


Fig.7. Amounts transferred by the CEO, as a result of pollutant emissions, AFM

According to the data from the National Integrated Plan in the Field of Energy and Climate Change (PNIESC), by 2030, the market share of coal-based energy producers will decrease from 25%, as it is currently, to 15%.

In this context, the Oltenia Energy Complex is to decrease the installed capacity based on lignite, by more than 45%, respectively from 3,570 MW to 1,605 MW. Implicitly, this decrease implies the closure of some coal mining perimeters, namely Husnicioara (Mehedinți County), Peșteana (Gorj County) and Lupoaia (Gorj County), but also a significant reduction in the number of personnel.

The restructuring plan foresees the closure of four of the 11 quarries that the company operates. In parallel, the company intends to invest in renewable energy production capacities, namely 8 photovoltaic parks, with a total installed capacity of 725 MW, located on closed slag and ash deposits. At the same time, the Oltenia Energy Complex is to rehabilitate and modernize a micro-hydro power plant with an installed capacity of 10 MW in SE Turceni and, last but not least, to build two natural gas power groups, with a total installed capacity of 1,325 MW.

The main sources of electricity are represented by the Turceni Energy Complex, with an installed capacity of 1980 MW, the Rovinari Energy Complex, with an installed capacity of 1320 MW, as well as the Târgu Jiu Hydroelectric Branch, with an installed capacity of 200 MW, which processes the energy potential of the waters within the Cerna, Motru, Tismana, Bistrița and Jiu hydrographic basins.

From the analysis of the territorial development of Gorj county, it shows that there are significant discrepancies between the county seat municipality of Târgu Jiu and the rest of the cities, but also between the urban environment and the rural environment, human resources, labor force, economic activities, services being concentrated in the urban environment, with especially in the county seat municipality.

From the point of view of urban settlements, in Gorj county there are municipalities and cities that do not meet some minimum criteria for the category in which they are placed, requiring urgent investments in the development of their urban infrastructure, in improving accessibility, social services and in supporting the business environment. The Paris Agreement on climate change, the policies and strategies promoted by the European Union, places particular importance on increasing the area of green areas in cities, reducing carbon dioxide emissions and energy consumption. The urban environment in Gorj county does not meet the community and World Health Organization standards for green spaces, currently only two localities exceed the European norm for green spaces in the urban environment of 26 sq m/inhabitant (the city of Novaci with 40.76 sq m/inhabitant and the city Țicleni with 40.06 sqm/inhabitant).

In terms of reducing energy consumption and the circular economy, Gorj County benefits from plans and programs to improve energy efficiency.

The energy efficiency improvement program for the municipality of Târgu Jiu provides a series of objectives in line with the economic potential of the city, investments from its own budget and financing based on credits or European funds, among which:

- reduction of the total consumption of thermal and electrical energy in municipal buildings;
- building energy production units for own consumption (photovoltaic energy, solar panels for obtaining hot water, wind energy);
- the introduction of provisions related to energy efficiency in the technical projects for new municipal buildings, so that they correspond to high energy efficiency standards;

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- the purchase of electronics used in local administration that meet the economic efficiency requirements in force at European level;
- increasing the energy efficiency of rehabilitated buildings;
- reducing the fuel consumption of vehicles controlled by Târgu Jiu town hall (student transport, sanitation) by 10%;
- reducing energy consumption at the level of the population and economic agents by making citizens responsible; modernization and energy efficiency of homes by attracting European funds; creating an infrastructure for urban bicycle transport and promoting it within the community;
- promoting among the community the purchase and use of hybrid vehicles;
- increasing the level of awareness and accountability of citizens and economic agents regarding local energy problems and finding optimal energy efficiency solutions [1-3], [14];
- promoting eco-efficient behavior within the local community.

In the context of the current European decarbonization policies, CEO is considering the implementation of a Development and Decarbonization Plan that will allow it to make a transition as realistic and sustainable as possible towards efficient electricity production and with as few carbon emissions as possible, in this case, the transfer from coal-based capacities to those based on natural gas and renewable energy sources, contributing to ensuring energy security and reducing dependence on external energy resources. Energy security is the main pillar for Romania and achieving the transfer from coal to gas and renewables, according to a well-defined decarbonization plan in time and from a financial point of view, is crucial for reaching Romania's targets and objectives for the year 2030.

Maintaining production capacities at CEO in the period 2021-2025 is absolutely necessary to ensure Romania's energy security and the stability of the national electricity network, and the reduction of lignite capacities until the phase-out must be aligned with the increase of renewables in the system and commissioning of new gas plants, with the possibility of using green gases, to reach the energy and climate targets in 2030 and to prepare the energy system in Romania for climate neutrality in 2050, in accordance with the Green Deal [18].

4. CONCLUSIONS

Oltenia Energy Complex is an important producer on the electricity market, and in the current context, considering the increasingly severe environmental regulations in the energy field, it wants to consolidate its reputation earned on the competitive market in Romania, as a producer of safe, clean and efficient lignite energy, made in sustainable conditions by protecting and preserving the environment.

Based on the modeling carried out for the Romanian energy system, it is found that in recent years it is increasingly difficult to cover electricity consumption at the level of the system from its own energy resources, and Romania considers the security of energy supply from internal sources a primary objective for ensuring energy security national and aims to maintain a diversified energy mix, taking into account both the decarbonisation objective of the energy system, as well as ensuring its flexibility and adequacy.

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