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Renewable energy sources potential evaluation in Romania

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Abstract. Renewable energy sources (wind energy, solar energy, energy hydropower, ocean energy, geothermal energy, biomass and biofuels) are alternatives to conventional fuels in the greenhouse gases emissions reduction process. Because of the EU legislation support, the renewable energy sources have evolved significantly in recent years and in 2009 EU set a target of 20% energy consumption comes from renewable energy sources by 2020. In 2018, the target has been set for 32% of energy consumption from renewable energy sources by 2030. There is currently a debate on the policy framework future for the period after 2030. Greenhouse gas emissions is considered a serious threat regarding climate change, with potentially disastrous effects on humanity. The use renewable energy sources (RES), together with improved energy efficiency, can contribute to the reduction of energy consumption, the reduction of greenhouse gas emissions and, consequently, to prevent dangerous climate change. The potential of biomass, solar, hydro, wind and geothermal energy is very important, especially in recent years, due to financial support mechanisms such as green certificates, which in many European countries helped this sector to developed progressively.

1. Introduction

Greenhouse gas emissions is considered a serious threat regarding climate change, with potentially disastrous effects on humanity. Renewable energy sources (wind energy, solar energy, energy hydropower, ocean energy, geothermal energy, biomass and biofuels) are alternatives to conventional fuels in the greenhouse gases emissions reduction process [1, 2].

Despite Romania generally had the third least energy reliance rate in the EU, because of natural gas and oil reserve and to an oversized energy production network. The use renewable energy sources (RES), together with improved energy efficiency, can contribute to the reduction of energy consumption, the reduction of greenhouse gas emissions and, consequently, to prevent dangerous climate change. The potential of biomass, solar, hydro, wind and geothermal energy is very important, especially in recent years, due to financial support mechanisms such as green certificates, which in many European countries helped this sector to developed progressive. In the last ten years Romania has invested much in renewable energy especially in wind and solar power. In this sense the country boasts as Europe's largest onshore wind park, namely the 600 MW Fântanele-Cogealac, in the region of Dobrogea.

In Romania, grid operators are obliged to connect renewable energy plants to the national grid and to supply electricity from renewable sources as a priority.



2. Methods and procedures

This article reviews the potential of the renewable energy sources exploitation in regard to the European Union legislation and objectives. Until 2020, the European Union had three targets: 20% cut in greenhouse gas emissions, 20% of EU energy to come from renewables, and a 20% improvement in energy efficiency. The EU took action in different areas and now the targets are met. In the future, EU provides a new action plan called the European Green Deal. The new EU target is to be climate neutral in 2050 [3].

During 2016, the European Council (EC) presented two packages of proposals for reforming European energy policies, anticipated in 2015 through the Energy Union Framework Strategy. These packages are defining for the European energy sector, and implicitly for the Romanian one, in the period 2020-2030, being meant to accelerate the energy transition in the EU.

In July 2016, a first package of proposals was published on: reducing non-ETS emissions in each state for the period 2021-2030. In this proposal Romania is allocated a 2% reduction rate, accounting for the resulting GHG emissions from land use, land use change and forestry, as well as a communication on a European strategy for the decarbonization of the transport sector [2, 4].

The EC proposal for updating the RES Promotion Directive (EC 2016b) provides for six directions for action. The first proposes general principles to be followed when Member States define support policies for RES, using the principles of transparency, economic efficiency based as much as possible on competitive market mechanisms. These elements are brought together in the Strategy, under the principle of technological neutrality.

3. Renewable energy sources in Romania so far

In order to decarbonize the power sector while keeping up with the continuously growing energy demand, renewable energy technologies is essential. Renewable energy in Romania had a delayed boom compared to the European Union, yet Romania managed to meet the 2020 targets. So far, the most used renewable energy source in Romania is the hydropower and it is followed by wind, solar, biofuel and biogas (figure 1).

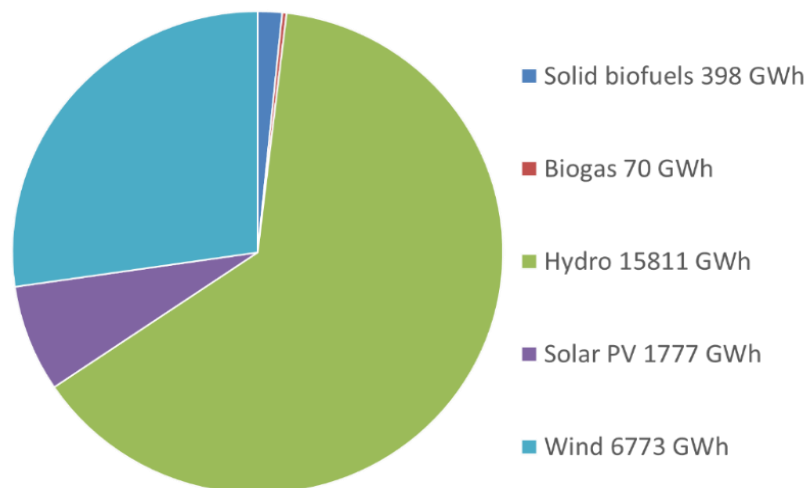


Figure 1. Renewable and waste energy data in Romania in 2019 [5]

4. National strategies

The National Integrated Plan in the field of Energy and Climate Change 2021-2030, provides that the share of renewable energy will reach 27.9% of Romania's gross final energy consumption in 2030, just an idea higher than the level achieved 15 years earlier. According to Eurostat, the statistical office of the European Union, 25% of energy consumption in 2016 was from renewable sources [5].

The Ministry of Energy mentions, in PNIESC, that more production capacities will be installed, but also the final consumption will increase, by approximately 18% in the period 2021-2030. Half (50.9%) of the energy consumed in Romania will be for heating or cooling, according to estimates, a slightly lower percentage than at present (54.6%), but still significant [5].

5. Development projections of the Romanian energy sector

In 2013, Romania was included in Top 15 most attractive countries in the world for investments in renewable energy. Our country is considered to have the highest wind potential in Southeast Europe. The second greatest wind-potential area on the continent, is considered the Romanian region of Dobrogea. Worldwide wind power is estimated at 57 PWh/year whereas the off-shore wind energy, estimated at 25-30 PWh/year. Eolian energy potential in one year, in Romania is estimated at a value of approximately 23 TWh.

The largest contributor Romania's energy potential derived from renewable-energy sources is represented by hydro energy, followed by wind energy. The main advantage of hydroelectric power is that can be stored, and electricity can be produced at a constant rate. The hydropower potential of our country is between 50 and 100 TW h/year.

Romania has also a high potential for harvesting solar energy in significant regions of the country, especially in south and on the Black Sea coast.

The development perspective of the energy sector by 2050 is useful for two main reasons: (1) the energy sector has a high capital intensity and many projects have a long investment cycle, so a large part of the investment decisions that will have place in the near future will continue to take effect in 2050; and (2) EU energy and environmental policies, including targets for 2030, are built around the long-term goal of reducing GHG emissions by at least 80% by 2050.

The global goal of climate change mitigation can only be achieved through transformative actions and measures at the global level. A main direction of action will be to accelerate the energy transition. Many of the long-term transformations of the energy sector can be anticipated, given the slow pace of energy infrastructure replacement.

Development trends refer to: increasing the sustainable role of biomass in the energy mix; the future of electromobility; increasing the share of RES in the electricity mix and the use of CCS technologies; forms of energy storage; energy efficiency, especially of buildings; electric heating based on heat pumps. [6, 7].

Romania ranked 7th in the EU in 2019 in terms of the share of electricity obtained from renewable sources, according to data published by Eurostat, ahead of Germany and above the European average.

With a percentage of 41.71%, is behind Austria (75.14%), Sweden (71.19%), Denmark (65.35%), Portugal (53.77%), Latvia (53, 42%) and Croatia (49.78%), but unfortunately the percentage has been decreasing by about a point and a half over the last four years, from 43.16% in 2015.

The idea is that Romania is the only state that has been satisfied with the progress made initially, and in the last few years has not made the necessary investments and has not taken support measures to sustain the long-term progress. This fact is relevant because it is not valid only in the case of electricity from renewable sources [8].

Regarding the share of energy from renewable sources in total national energy mix, Romania is slightly weaker. It ranks 10th, also above the EU average, but it was content to reach its 2020 target and has taken the step from 2016 onwards (in 2016, we were already at 25.03%, but by 2019 we had a marginal decrease in 24.29%).

Considering the European level, both hydropower and wind farms contributed about 35% to the supply of electricity, followed by solar panels (13%), solid biofuels (8%) and other sources (9%). For Romania that the largest development was in the solar energy sector, which crossed the threshold of 1% of the total energy mix in 2008 [8].

All these developments, although expected to reduce GHG emissions, could have a strong impact on the environment, and the opportunity for the development of new technologies on a large scale needs to

be carefully considered. Most likely, new generations of these technologies, more efficient and greener, will be widely adopted.

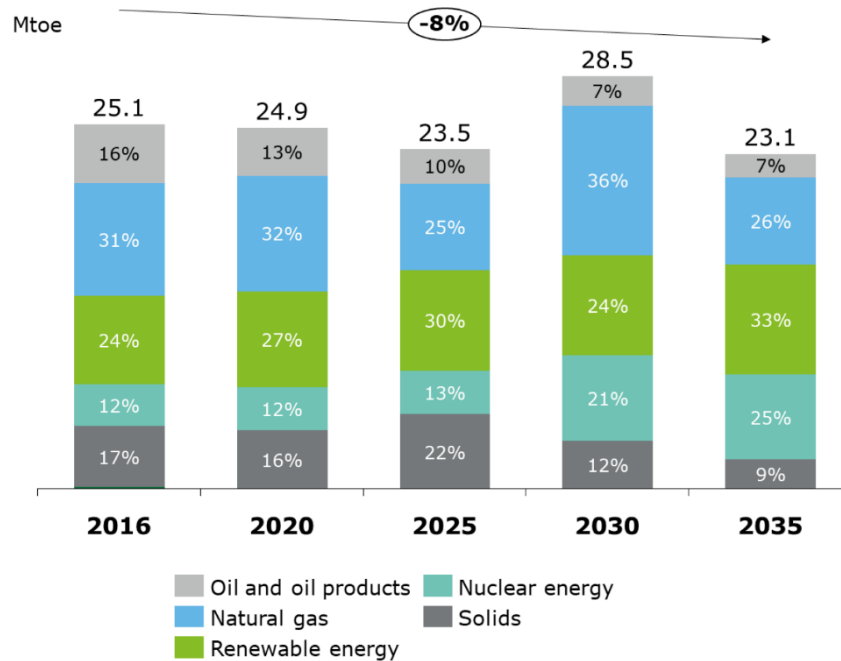


Figure 2. Expected development of the primary energy generation, by energy sources, with existing policies and measures [5]

According to Romanian Wind Energy Association (RWEA), Romania can reach a share of 32.4% conservatively and inertially in 2030, with the more ambitious potential to reach 35%, with additional wind capacities between 3000 and 4000 MW; and this is achievable with significantly lower investments than those considered by PNIESC [3].

With existing policies and measures, the projection shows a decrease of energy generation, which is mainly caused by a reduction of solid fuels and natural gas production. [4]

The use of renewable resources in energy generation has experienced an upward trend in recent decades, the determining factor for this trend being the research and accelerated development of new technologies that were possible only through the financial support of several countries. And, perhaps the most important aspect relates to that energies renewable energy sources lead to a reduction in energy dependence.

6. Conclusions

Sustainable development, involves the use of renewable energy to produce electricity is a clean and environmentally friendly way, and by all means the producers should be encouraged to invest in this sector. Over 1200 wind turbines are spread on the entire surface of Romania, with an installed power of 600 MW. This development of wind farms was achieved primarily in two regions: the core in Dobrogea Plateau with near 78% of the total power installed, and a secondary one in Bârlad Plateau. Romania's largest solar park, with a surface of 200 ha, was inaugurated in 2013 and it is placed in Ucea de Sus, Brasov County. It has an installed capacity of 82 MW and uses 320,000 PV units.

Investors in Romania prefer to develop more photovoltaic and wind facilities rather than other alternatives (i.e. biomass) which pose risks, have climate restrictions and require experience.

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