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STATISTICAL EVALUATION OF THE ENERGY, ECONOMIC AND SOCIAL POTENTIAL FROM RENEWABLE SOURCES IN ROMANIA

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Abstract

Worldwide, reducing energy consumption and increasing energy efficiency are the main objectives of an integrated approach to economic, energy and climate policy. The energy sector has vital importance for the economic and social development and improves the quality of life. Ensuring sufficient energy supply and broad access to energy services, particularly in the green from renewable sources is a basic requirement of sustainable development. The use of renewable energy has many potential benefits, including a reduction in greenhouse gas emissions, a diversification of energy supply and a reduction in dependency on fossil fuels markets. The development of renewable energy sources can also have the potential to stimulate employment by creating jobs in the new "green" technologies sector. In this context, the study aims to achieve a statistical evaluation on the energy potential from renewable sources in Romania. It also will carry out an assessment of the renewable energy sources available at national level and their potential benefits. Based on the results obtained, we emphasize that economic growth can be achieved by adopting a common vision based on efficient and non-polluting alternatives for the energy production.

Keywords: Renewable Energy, Economic Development, Sustainable Development, Statistical Analysis

JEL Classifications: C15, D24, F64, O52, Q21, Q56

1. Introduction

One of the main goals of global energy policy is to develop renewable energy as a clean energy globally which, in the context of sustainable development, aims at reducing fossil fuel consumption, reducing greenhouse gas emissions and developing new viable technologies in energy production (Evans *et al.* 2012; Mahila *et al.* 2014). At the international level, facing the global challenges of climate change, biodiversity, biosecurity, etc., requires both real commitment and effective cooperation, as well as awareness and prompt action by decision makers and responsible institutions (Ozyuksel and Gunay, 2019).

At the level of the European Union (EU), the main objectives of the European Commission include those on sustainable development, environmental protection and combating climate change. Sustainable development is based on a coherent energy policy. Currently, obtaining energy in a clean and efficient manner is a major challenge.

Romania is interested in developing renewable energy production, using the latest generation of technologies that will lead to increased energy efficiency (Haralambie, 2017; Poteraş *et al.* 2017). The spectrum of depletion of energy resources in the following years was a serious alarm signal and led to the identification of the possibilities of replacing the exhaustible resources and the diminution environmental imbalances caused by the exploitation, processing and use of the resources used so far (Nicolae *et al.* 2019; Baraitaru *et al.* 2019). It is necessary for these new resources to gradually replace the traditional exhausted resources, ensuring the protection of the natural environment and energy security. The energy sector is vitally important for both economic and social development and for improving the quality of life of the population.

The European Union is increasingly exposed to instability and rising prices on international energy markets. Year after year reports appear alerting to the health and economic costs generated by the air pollution caused by the energy sector. These costs can be avoided by adopting a common vision based on efficient and clean energy alternatives.

Romania is in this context as a member state of the European Community, as a state with an industry based largely on the consumption of exhaustible resources, but also as a state with real possibilities to develop an energy structure based on renewable energies. According to Transelectrica (2019), 3% of the installed net power comes from solar energy, 15% wind power, 31% hydropower, 18% from hydrocarbons, 26% from coal and 7% from nuclear power.

Romania has renewable energy production units with an installed capacity of over 4,500 MW, which is equivalent to almost a quarter of the total units. Most of the renewable energy production capacity is represented by wind units. The government is currently supporting the production of energy from renewable sources through the green certificates system.

Increased use of energy from renewable sources is essential to reduce both EU greenhouse gas emissions and the Union's dependence on fossil fuels and energy imports, thus contributing to the security of its energy supply. Both the production and the consumption of energy from renewable sources are increasing in the EU, but it is necessary to continue the efforts if the objectives of the EU regarding the energy from renewable sources are set, that is to say, the share of this type of energy in the final consumption reaches 20% by 2020 and at least 32% by 2030. According to Eurostat (2019), 17.5% of the energy consumption in 2017 was from renewable sources in the European Union (EU).

World energy markets are undergoing a transformation. According to the Report of IEA (International Energy Agency, 2019), a major transformations are underway for the global energy sector, from growing electrification to the expansion of renewables, upheavals in oil production and globalisation of natural gas markets. By 2030, half of the EU's electricity production will come from renewable sources. Renewable energy will play a major role in the transition to a "clean" energy system (Calanter, 2018).

The purpose of this study was to carry out a statistical evaluation regarding the potential energy from renewable sources in Romania and the potential benefits they bring.

2. Renewable energy in gross final energy consumption

The energy from renewable sources in the EU has increased strongly in recent years. More specifically, the share of energy from renewable sources in gross final energy consumption has reached almost double value in recent years, from about 8.5% in 2004 to 17.0% in 2017 at EU level and from about 16.2% in 2004 to 24.5% in 2017 in Romania (Figure 1).

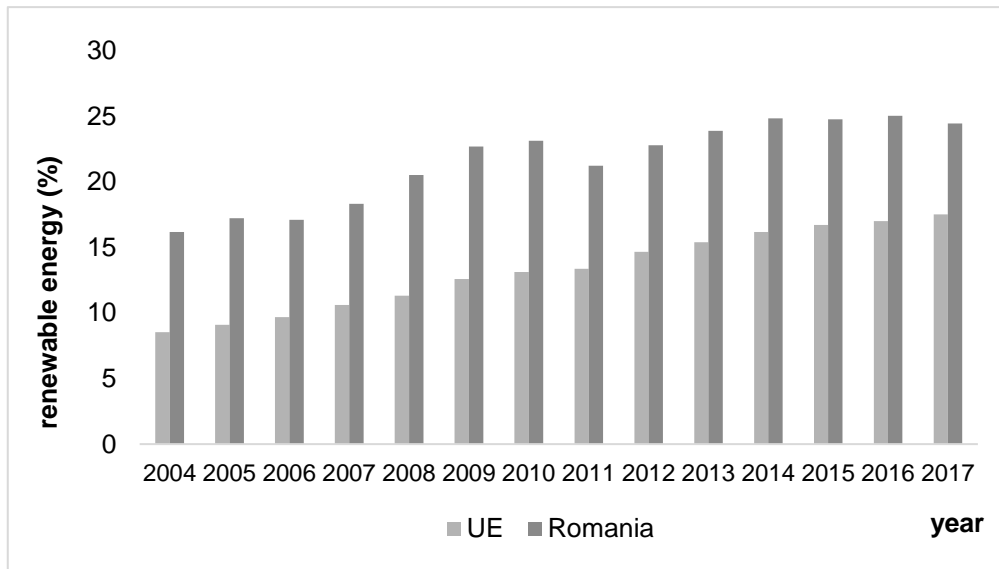


Figure 1. Share of renewable energy in gross final energy consumption in Romania and UE
Source: Eurostat (2019)

The EU aims to have a share of 20% in the final consumption of energy from renewable sources by 2020. Renewable energy sources include wind energy, solar energy (thermal, photovoltaic and concentrated), hydroelectric power, tidal energy, geothermal energy, biofuels and the renewable part of waste (Baraitaru *et al.* 2019).

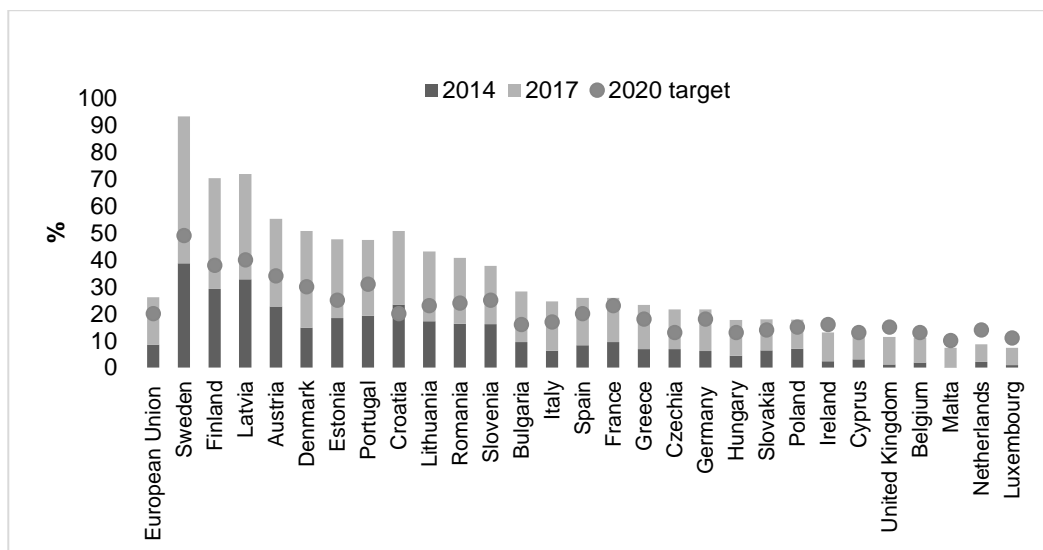


Figure 2. Share of energy from renewable sources(in% of gross final energy consumption)
Source: Eurostat (2019)

The use of energy from renewable sources has many potential benefits, including a reduction of greenhouse gas emissions, diversification of energy supply and reduction of dependence on fossil fuel markets (in particular, the oil and gas market). The development of renewable energy sources may also have the potential to stimulate employment in the EU by creating jobs in the sector of new "green" technologies.

Although the EU as a whole is on track to meet its 2020 targets, some Member States will have to make additional efforts to meet their obligations regarding the global share of renewable energy in gross final energy consumption (Figure 2 and Table 1).

The most recent data available regarding the share of energy from renewable sources refers to the reference year 2017. The share of energy from renewable sources in gross final energy consumption is identified as a key indicator for measuring progress under the Europe 2020 strategy for smart, sustainable and inclusive growth. This indicator can be considered as an estimate for the purpose of monitoring Directive 2009/28/EC on promoting the use of energy from renewable sources - however, the statistical system in some countries for specific technologies in the sector of renewable energy has not yet been fully developed to respond. The requirements of this directive, for example, environmental heat energy for heat pumps is not reported by many countries (European Parliament, 2009).

Table 1. The renewable energy in gross final energy consumption in UE

Countries	Range of values		
Ireland United Kingdom Belgium Netherlands Cyprus	6.38-10.651		
Germany Poland Hungary Slovakia Czech Turkey France		10.651-16.3	
Spain Italy Greece Bulgaria Macedonia Slovenia			16.3-21.547
Romania Croatia Austria Portugal Lithuania Estonia			21.547-32.558
Sweden Finland Norway Iceland Latvia			32.558-71.571

Source: Eurostat (2019)

3. Renewable energy sources

Romania has rich and varied renewable energy resources: biomass, hydropower, and geothermal potential, respectively for wind, solar and photovoltaic energy (Table 2). They are distributed throughout the country and will be able to be exploited on a larger scale as the performance-price ratio of the technologies will improve, as new generations of related equipment and installations mature.

Table 2. The potential of renewable energy sources in Romania

Renewable source	Annual potential	U.M.	Application
Solar energy	60	PJ/h	Thermal energy Electrical energy
Wind power	23	TWh	Electrical energy
Hydro energy	36	TWh	Electrical energy
of which below 10 MW	3.6	TWh	
Biomass and biogas	318	PJ	Thermal energy Electrical energy
Geothermal energy	7	PJ	Thermal energy

Notes: TWh = terawatt hour, PJ = Petajoule, (1 Petajoule = 278 million kilowatt hours)

Source: Energy (2019)

According to Eurostat (2019), the most important sources of renewable energy are biomass and waste in Romania (Figure 3).

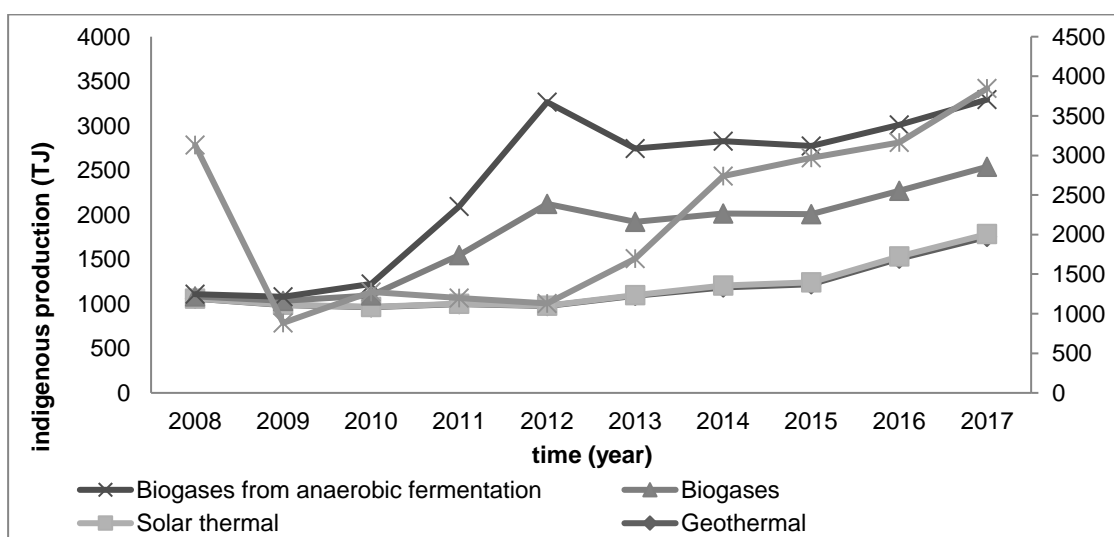


Figure 3. The contribution of renewable energy sources to primary energy consumption

Source: Eurostat (2019)

4. Electricity production from renewable sources

The production of electricity from renewable energy sources in Romania shows a significant increase, from the wind energy sources from 314 to 1001 GWh and from biomass from 1134 to 3654 GWh (Table 3).

Romania has renewable energy production units with an installed capacity of over 4,500 MW, which is equivalent to almost a quarter of the total units. Most of the renewable energy production capacity is represented by wind and biomass units. According to the specialized reports (Romanian Regulatory Authority, 2017), Romania has assumed a target of 24% energy produced from renewable sources in the final energy consumption, this target being composed of three sectoral objectives:

- Share of energy used for heating and cooling from renewable sources,
- Share of electricity from renewable sources,
- Share of energy from renewable sources in transport.

Both the trajectory of these objectives and the target values can be observed in Table 4.

Table 3. Forecasted electricity production from renewable sources

Renewable sources	Reference Year		U.M.
	2010	2015	
Solar energy	1.860	11.600	GWh
Wind power	314	1.001	GWh
Hydroenergy - total, from which: hydroenerg low power(max 10 MW)	18.200 1.100	18.700 1.600	GWh
Biomass	1.134	3.654	GWh
Total	19.650	23.367	GWh
ESRE weight in electricity consumption	30.00	30.40	%

Notes: GWh = Gigawatt Hour

Table 4. Energy produced from renewable sources (ERS) in the final energy onsumption

ERS (%)	2005	2010	2015	2016	2017	2018	2019	2020
ERS-I & R	18.72	17.86	17.07	17.27	18.07	18.86	20.44	22.05
ERS-EE	30.08	27.48	41.86	42.84	42.57	42.63	42.70	42.62
ERS-T	1.39	5.82	8.11	8.43	8.80	9.23	9.69	10.00
Global weighting ERS	17.90	17.50	20.13	20.59	21.21	21.83	22.92	24.00

Renewable energy production in Romania is significant, ranking second in Southeastern Europe, after Poland, and at a considerable distance from other European states (Restartenergy, 2019).

5. Energy prices from renewable sources

Energy prices and costs for supporting renewable energy have been a concern of the European Commission, the price of electricity from renewable sources at European level has varied according to the potential of renewable energy, economic performance and the share of renewable sources in gross final energy consumption.

Biomass is the basis of the energy of the future, because CO₂ is neutral, so only that amount of CO₂, which was previously absorbed from the air by photosynthesis, is released by combustion. Biomass is an innovative source of energy that regenerates practically under our eyes. Its availability is safe in the event of a crisis, does not generate high transport costs and does not cause ecological disasters. The way forward for the EU is an integrated energy and climate change policy, as the burning of fossil fuels for energy is the main determinant of climate change.

To underline its determination and to set an example for its partners, the EU has agreed to reduce its greenhouse gas emissions by at least 20% by 2020, no matter what the actions of other states will be. The EU aims to achieve this reduction through actions planned under the new integrated energy and climate change policy, which will align with existing measures (Eurostat, 2018).

The energy sector must develop through distributed generation, which means that instead of large power plants, generation units (photovoltaic, wind, geothermal, biomass) are built very close to where this energy will be consumed. The advantages of this type of energy production include the relatively low costs of the power plants with reduced capacity, the possibility to easily adapt to the demand for energy and the low level of losses in transport and distribution, considering the proximity to the place of consumption. Another important aspect is the advanced network management technologies, which allow the connection of renewable energy to the grid.

6. Conclusion

Energy is very important in our lives, but energy production and consumption also have serious consequences, which have a negative impact on the planet, and we must make every effort to reduce them.

With the maturation of renewable energy technologies, renewable energy production has grown steadily and costs have been reduced. Different renewable energy sources are in different stages of technological and commercial development. Under favorable conditions, wind energy, hydropower, biomass and solar-thermal energy represent economically viable alternatives.

Increasing the use of energy from renewable sources could reduce the EU's dependence on fossil fuels and energy imports, thus contributing to the security of its energy supply. Based on the results obtained, we emphasize that economic growth can be achieved by adopting a common vision based on efficient and non-polluting alternatives for energy production.

The intensive development of new energy technologies will contribute to solving environmental problems and probably to mitigating the effects of climate change.

The study shows that the Romania has a high potential for renewable energy production, distributed in all areas of the country, which makes Romania an attractive location with alternative for renewable energy investors.

One of the main objectives of the energy policy in the European Union and implicitly in Romania is the development of renewable energy production in the sustainable development context, as it contributes to reducing greenhouse gases and to the environment protecting and to increasing the security of energy supply and to the development of sustainable energy technologies.

In the future, instead of large power plants, the energy sector must develop through distributed generation, which means that generating units (photovoltaic, wind, geothermal, biomass) will be built very close to where this energy will be used. These power generation units will have the advantage of low relative costs, an increase in energy efficiency by eliminating the distance between the generation and consumption points and a reduction of CO₂ emissions through the generation of energy from renewable sources.

The Member States of the European Union, including Romania, are still highly dependent on fossil fuels, but there is considerable potential and interest for renewable energy, determined by both the need to reduce greenhouse gases and the energy policy of the European Union. Although renewable sources have been observed as provides a clean energy, it is necessary to increase their market share and to impose them as economic and be widely used options.

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