

Sustainability of use of energy mix in Romania and Europe

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Abstract: The present study make an analysis of the energy sector and energy market in Romania and Europe. The energy strategy project 2016-2020 by 2030 is currently under development and then approved by the Romanian government. This perspective on the development of electricity production in Romania was elaborated on the basis of the assessment of the macroeconomic, industrial and employment impact on energy scenarios. Also others country from Europe have to fallow the energy strategy project for the next years. We can see that the old energy technology needs to be adapted to new environmental requirements and increasingly developed new technologies for obtaining energy from renewable sources which implies the development of a sustainable energy mix adapted to the new environmental and economic requirements. Countries like Germany, France, UK, Poland, Netherlands have already abandoned much the old polluting energy technologies and developed renewable energy, they are also advantaged by a sustainable economic development compared to the low economically developed countries like Romania, Bulgaria and others. Clean energy is at the heart of world's aspirations for a better future, as reflected in the 197 countries that have signed up to the Paris Agreement on Climate Change. The transition from fossil fuels to renewable sources such as solar and wind is key to achieving social, economic and environmental development. This will change the lives of 1,2 billion people who struggle through life with no electricity, will create new jobs and commercial opportunities and it will slash the air pollution that claims millions of lives each year. All this defines the sustainability of the energy mix.

Keywords: *sustainable; energy mix; energy; power plants; renewable sources.*

1.Introduction

The number of studies[1-4] on the development of electricity consumption and the use of various technologies based on primary energy sources has become quite high and implicitly the choice of an optimal decision is difficult to take. There is no common perspective on the part of the producers of the energy generation technologies.

This view makes it clear that in order to meet the demand for electricity and meet the climate change targets in Europe[2,3], it is still necessary to use all the available energy sources and new technologies. All the options of generating electricity have to be used in the long run.

Europe can not cope with a single source of energy to meet its own energy and environmental objectives, and to guarantee sufficient security of supply. Thus the energy mix is necessary.[5-7]

The expansion of renewable energies was primarily characterized by wind energy. It has also been taken into account that over the next few years, first-generation energy sources have come to an end and renewable sources of energy[8-12] will play an increasing role. Between 2020 and 2030, an increased development of solar energy sources is expected. It is estimated that from 2030, European

electricity[1] demand will reach about 48% of renewable energy, 33% of fossil fuels and about 19% of nuclear energy.

Climate protection objectives will require new and replacement investments. However, existing power plants will now have to meet significantly greater flexibility requirements due to the strong expansion of renewable energies[13] in operation.

The trend towards decentralized power conversion will continue. This will allow for additional flexibility but will also develop new infrastructure network requirements.

This perspective shows that much of the expansion of renewable energies and their realistic use can be made to achieve the EU's climate protection objectives by 2020 and 2030[14,15].

As a member of the European Union and Romania, these measures must be taken. Romania has the EU's lowest dependence on energy imports (below 20%), which should exceed 50% over the next 10 years. The energy mix is one of the most diverse in Europe (see figure 1)[16]. Some steps to achieve for a sustainable energy development in Romania would be: reduction of greenhouse gas emissions; the increase of the share of energy from renewable sources; improving energy efficiency.

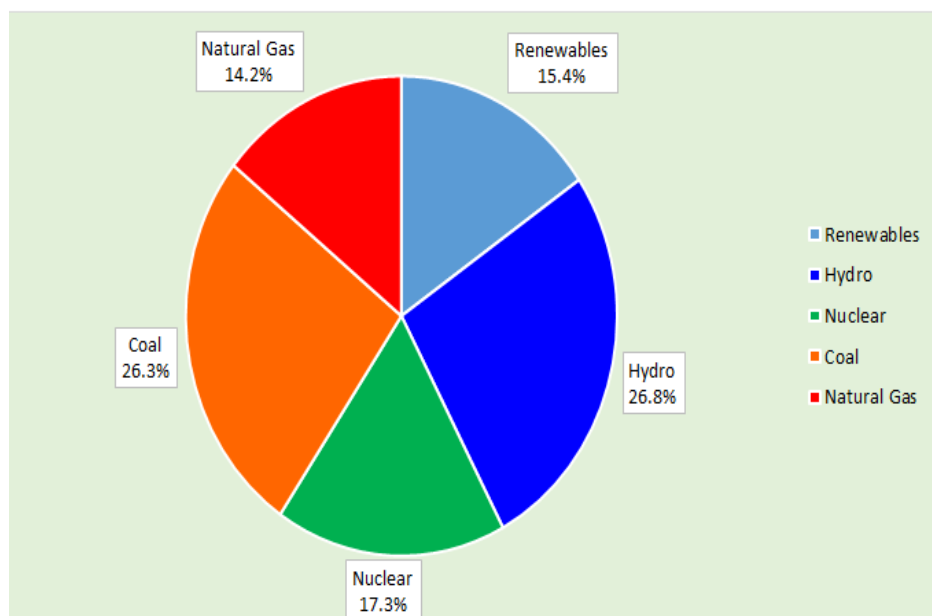


Figure 1. Structure of installed capacity – 2017

In the following it is studied the sustainability of the energy mix in Europe and Romania.

2. Sustainability of the energy mix in Europe

According to the studies and statistics carried out over the period 2007 - 2020 on the development of electricity production in Europe[17], it is noticed that the most sustainable solution is the highest use of the energy mix.

In 2016, renewable energy excluding large hydro accounted for 55,3% of the new electricity generating capacity, the highest proportion in any year to date and the second successive year it has exceeded 50% and , for the first time, there were significantly more gigawatts of solar power added than of any other generating technology. Behind solar, in order of net GW installed, were wind, coal, gas, large hydro, nuclear and biomass.

According to the statistics renewable energy produced an estimated 11,3% of the world's electricity in 2016, up from 10,3% in 2015 and 6,9% five years earlier, in 2011. In the last year's renewables generation prevented the emission of some 1, 7 gigatonnes of carbon dioxide.

Investment in renewables capacity fell by 23% in 2016, it was still roughly double that in new fossil fuel power stations, and more than seven times the amount committed to new nuclear plants. This year was a particularly strong year for investment in energy smart technologies. [35]

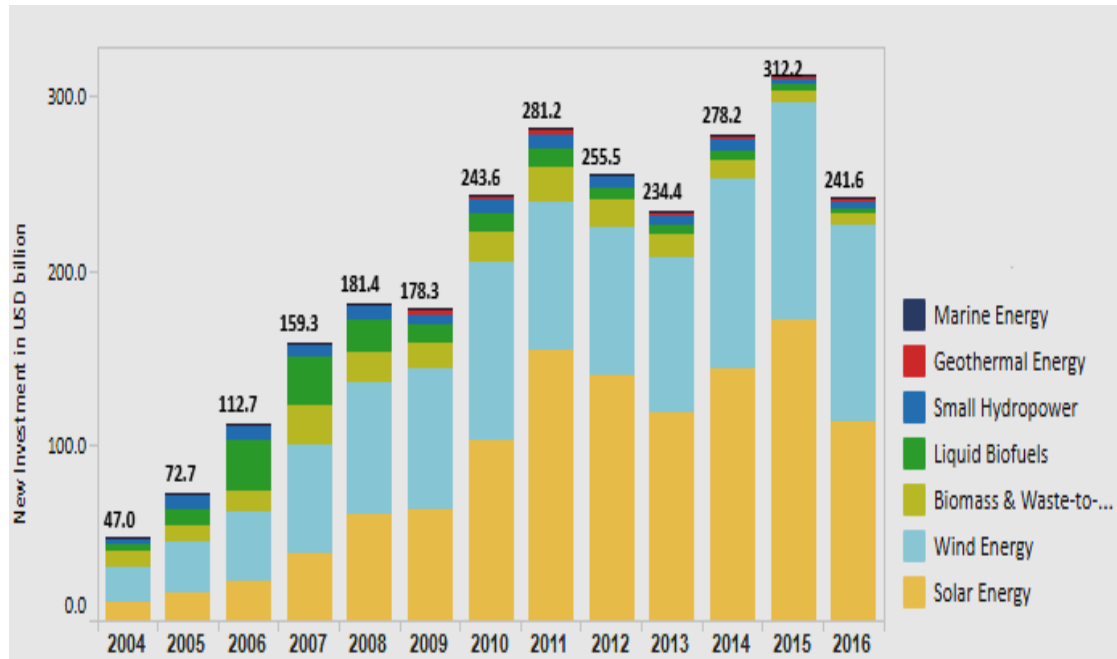


Figure 2. Investment in renewable energy

Under the Kyoto Protocol[18], the European Union's objectives are to reduce greenhouse gas emissions, the European plans already adopted for renewable energy, as it necessarily requires a restructuring of energy supply in Europe.

This restructuring must be continuous, sustainable and without ideology over a longer period of time. The environment and the economy are equally dependent on avoiding unwanted developments due to short, unilateral decisions. Abrupt abandonment of certain primary energy sources or energy technologies would be economically damaging and environmentally hazardous.

Structures in the manufacturing sector have changed dramatically in recent years, notably the strong commitment of renewable energy suppliers and the ever-increasing diversification of technology providers, as well as considerable resources and development needs, a discussion without facts and ideologies.

All those involved have a great deal of interest in a factual discussion, which should be supported by this perspective.

At the same time, the European objectives for the development of renewable energy[19] are predictable - achievable, taking into account the capacity of producers and the fact that today, given the capital market, the framework conditions are set correctly.

However, this ambitious development is only possible if, alongside the expansion of renewable energies and the replacement of conventional power plants, new fluctuating electricity storage facilities are developed, the reconstruction of the grid, energy efficiency in the European economies is firmly pursued. This is the only way to guarantee the security of electricity supply in Europe.

Over the period of time described, more energy sources of about 800 GW will have to be built. This means an investment volume of over € 1000 billion.

The electricity generation capacity and electricity generation will be developed as follows until 2030 (see figures 3, 4,5)[1,12,17,20]

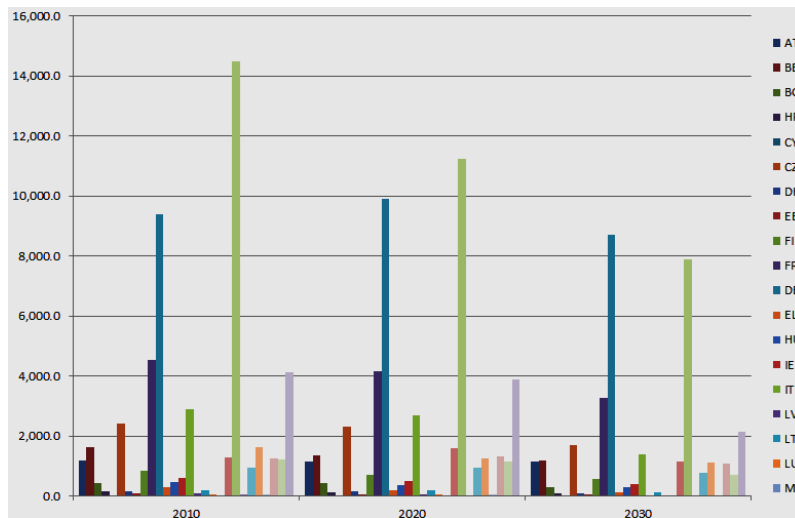


Figure 3 Energy from coal in Europe

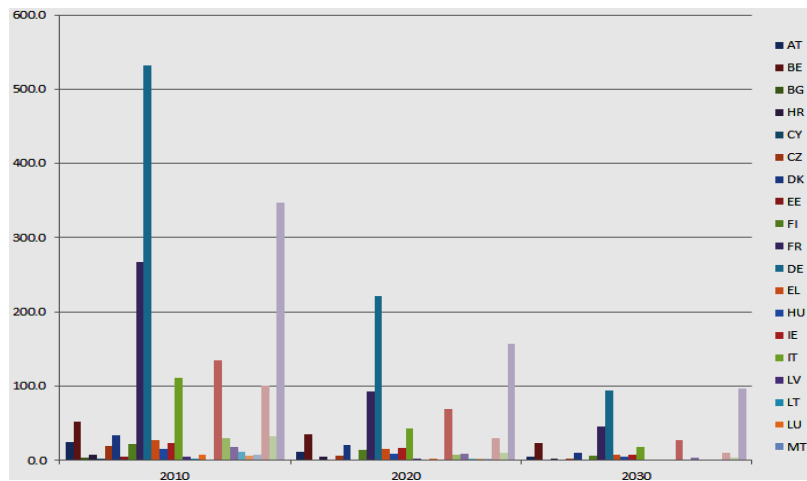


Figure 4. Nuclear energy in Europe

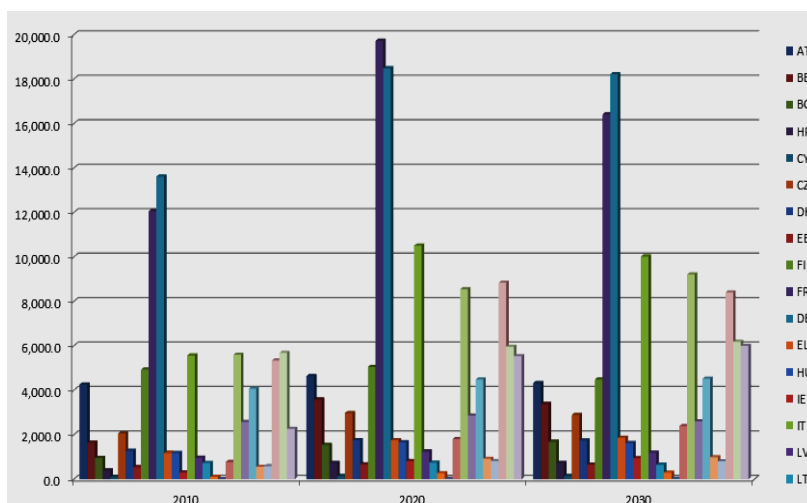


Figure 5. Energy from renewable sources in Europe

The analysis also shows that the route provided by energy suppliers for the low-carbon electricity production in 2050 seems realistic. But more technology is needed. In addition to the necessary energy storage, the use of catches and carbon dioxide storage should also be used.

Finally, the framework conditions for energy policy in the European Member States as well as the legal framework prescribed by the EU will have a significant influence on the development of the electricity mix. The energy policy framework[9,21,22] in the EU needs to be consistently conceived.

The objectives of energy policy must therefore be agreed between the EU and its Member States. What can be regulated and established at Member State level with the same result should ultimately remain within their competence. Thus, Member States compete for different energy concepts and technologies. In addition, the growing structures, geographic location and geopolitical interests of the EU Member States will be taken into account.

Accordingly, gross electricity production in Europe according to statistics will have to be developed as follows (Table 1, Figure 6)[1] to meet the demand for electricity:

Table 1 Developing demand for electricity in Europe

Years	2007	2020	2030
TWh	3306	3655	3736

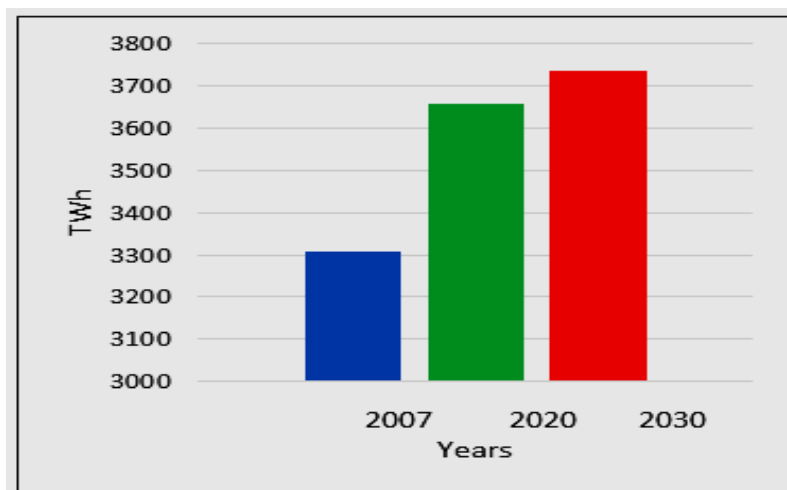


Figure 6. Developing demand for electricity in Europe

By 2030, electricity demand will increase by 13%. The demand for electricity in Europe, which will increase by an average of 0.8% annually by 2020, will only increase slightly over the next decade. The annual increase will be only 0.15% and can be assumed to be almost constant within the predicted uncertainties.

2.1. Developing the European energy mix

In the coming years, there will be a profound conversion of electricity production capacity. This transformation is largely characterized by the significant expansion of renewable energies throughout Europe, driven largely by the growth of wind energy[23]. Both cost growth and increased distribution in Europe's sunny regions will lead to an increase in the share of solar energy[24]. In 2030, it will also represent a relevant share of total energy. But it also becomes clear that in 2030 more than half of the demand for electricity will be provided by power plants. Thus, primary energy sources such as coal, gas and nuclear power continue to play a significant role. Electricity generation and electricity generation capacities 2007 - 2030 in TWh (Table 2, Figure 6) and MW (Table 3, Figure 7) [1,12,17,25].

Table 2

Type of power plant	2007		2020		2030	
	TWh	Percent [%]	TWh	Percent [%]	TWh	Percent [%]
Nuclear	929	28	754	21	715	19
Lignite	365	11	372	10	285	8
Coal	642	19	405	11	248	6,5
Gas	652	20	710	19	465	12
Decentralized gas	105	3	102	3	151	4
Oil	31	1	64	2	32	1
Diesel	63	2	59	1,5	54	1,5
Total power plants fossil fuels	1858	56	1712	46,5	1235	33
Hydro	296	9	375	10	432	12
Eolien	119	3,5	536	15	872	23
Sbvolar energy	4	<0,5	78	2	182	5
Biofuels	7	<0,5	26	1	51	1,5
Biogas	12	0,5	59	1,5	90	2,5
Other renewable sources	74	2	108	3	151	4
Total power plants renewable	512	16	1181	32,5	1778	48
Total	3306		3655		3736	

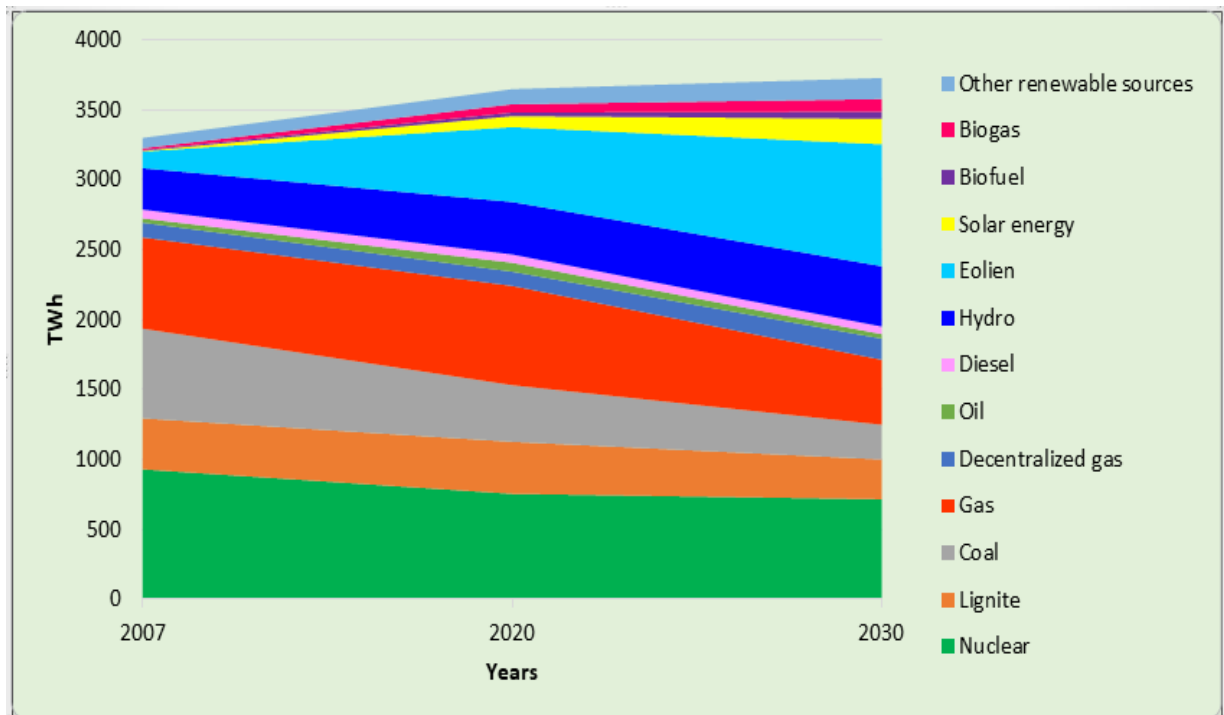


Figure 7. Electricity generation and electricity generation capacities 2007 - 2030 in TWh

Table 3

Type of power plant	2007		2020		2030	
	MW	Percent [%]	MW	Percent [%]	MW	Percent [%]
Nuclear	133005	17	116000	12	110000	11
Lignite	60456	8	60000	6,5	50000	5
Coal	143934	18	90000	9,5	55000	5
Gas	177099	23	200000	21	155000	15
Decentralized gas	15000	2	17000	2	27500	2,5
Oil	63654	8	40000	4	20000	2
Diesel	9000	1	9000	1	9000	1
Total power plants fossil fuels	467143	60	416000	44	316500	30,5
Hydro	101202	13	125000	13	144000	14
Eolien	56500	7	195000	20	280000	27
Solar energy	4730	0,5	65000	7	133000	12
Biofuels	1000	<0,5	4000	0,5	8500	1
Biogas	2000	<0,5	9000	1	15000	1,5
Other renewable sources	13341	2	25000	2,5	35000	3
Total power plants renewable	178773	23	423000	44	612500	58,5
Total	778921		955000		1039000	

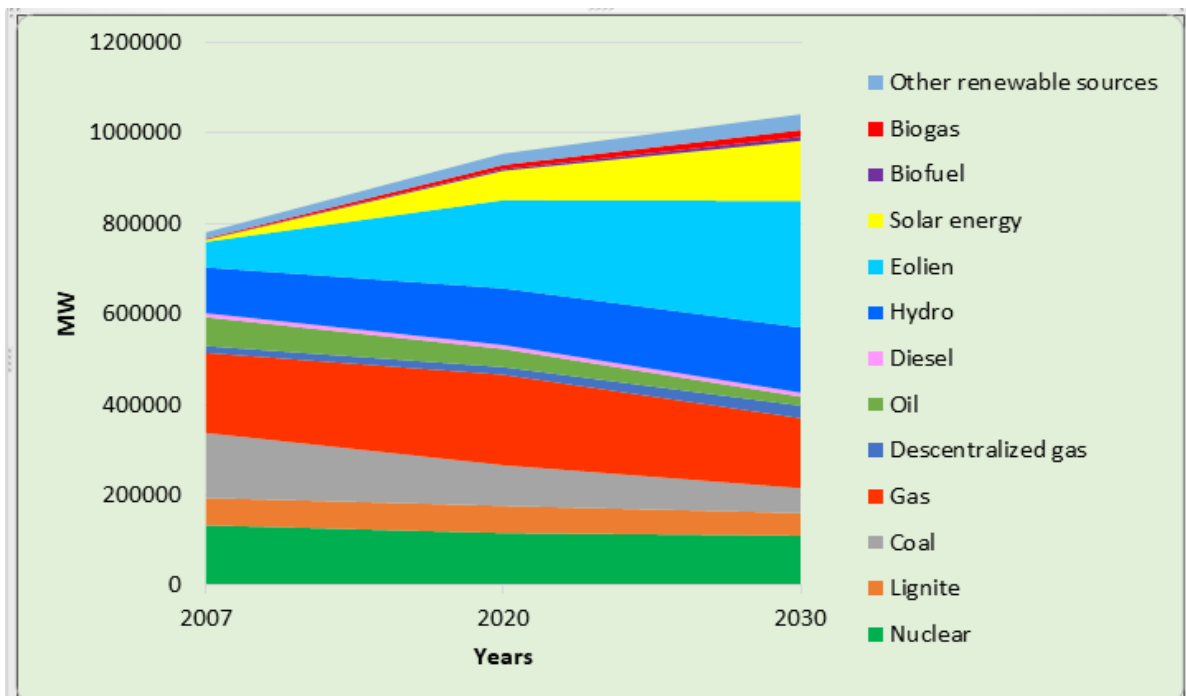


Figure 8. Electricity generation and electricity generation capacities 2007 - 2030 in MW

Due to the increased power supply of fluctuating renewable energy sources, the entire fleet of power plants must gain flexibility. The so-called secure capacity of renewable energy generation,

power available safely in the context of all renewable capacities, will have to increase to about 35% of the installed capacity by 2030[17].

2.2 New construction and replacement needs

The urgent need for new construction and replacement in the field of fossil fuels [26] takes place due to the fact that:

- a) there is a significant aging of the fossil fuel power which prevents a significant reduction in CO₂ emissions;
- b) the need to provide flexible capacity for the fluctuations of renewable sources. Power generation of fossil fuels has been associated with low fuel costs but also with climate protection efforts.

The use of fossil fuels after 2020 will therefore be closely followed by the use of carbon dioxide separation and storage technology (Carbon Capture and Storage, CCS).

Wind power is clearly the engine for the expansion of renewable energies. In this process, expanding the use of offshore wind energy[27] has been massively advanced. Significant increase in efficiency and capacity will also be achieved by replacing first-generation wind turbines as they have low power ratings and often do not contribute to network stability due to lack of control of the network operator. By 2020, about a third of the production capacity will be used for repowering. Over the next ten years, the repair will be already 45%. Offshore wind turbines and modern wind turbines have a longer economic life than the first generation.

Expansion of hydropower capacity relies heavily on the modernization of existing facilities. These facilities, equipped with increased efficiency and additional capacity, significantly increase electricity production. As current construction projects in Finland and France show, as well as construction projects in the UK and other EU countries, nuclear power is also an important option for power generation in the future. In particular, taking into account ambitious climate protection objectives, nuclear energy[20] is considered to be sustainable in most EU Member States.

A powerful engine in the development of decentralized energy generation will be the use of biomass. At the same time, the expansion of combined heat and power production for fossil and biogenic energy sources will be an important element in increasing electricity production.

The expansion of solar energy[24] will largely be driven by the expansion of photovoltaic parks by 2020, before the share of solar thermal power plants plays a larger role from 2020. Solar energy is the form of energy generation that has the greatest discrepancy between production capacity electricity and electricity generation. However, solar energy will increase significantly by 2030 as a result of increased efficiency, greater expansion in the southern regions of Europe and the increasing share of solar thermal energy.

Due to its controllability, the use of bioenergy is characterized by the possibility of producing electricity based on demand and the basic load capacity. Using bioenergy only to produce electricity is usually inefficient. Therefore, the expansion of bioenergy in electricity production will mainly focus on power plants that are suitable for combined heat and power. In addition, the use of bioenergy in co-incineration in conventional power plants and the increased use of residual materials will play an important role.

2.3. Framework conditions for investment

The volume of investment in new power plants estimated at over € 1000 billion is a major challenge for investors and financial institutions on an energy market[28] such as Europe. The longest, clearer and most reliable framework conditions are needed to generate this volume and make Europe an attractive investment location.

The current environment has many problems which, in this context, are an obstacle and need to be addressed. In particular:

- uncertainty regarding the development of international climate protection upon the end of the Kyoto Protocol's 2012[18] implementation and thus the political framework;
- financing difficulties due to the financial crisis;

- uncertainty about future network infrastructures;
- lack of public acceptance of new construction and infrastructure projects in the energy sector. At present, almost all new construction projects are difficult, which affects both fossil power stations and renewable energies such as wind turbines, biogas and geothermal plants, as well as infrastructure measures because the construction of power lines is a great need;
- existing approval procedures lead, in part, to years of project delays. This is counterproductive in terms of the urgent need for action;
- comprehensive political priorities between EU Member States.

A priority objective of political energy concepts must therefore be to promote the need for change, both conceptually and through practical projects. Only this way may it be possible to create new capacities of the power plants and the corresponding infrastructure coordinated over time. Policy and industry need to jointly promote the necessary public acceptance.

3. Sustainable energy mix in Romania

As mentioned above, the energy mix in Romania is sustainable.

According to the statistics provided by the National Energy System[29] we can observe the existence of the energy mix in our country(see Figure 9).

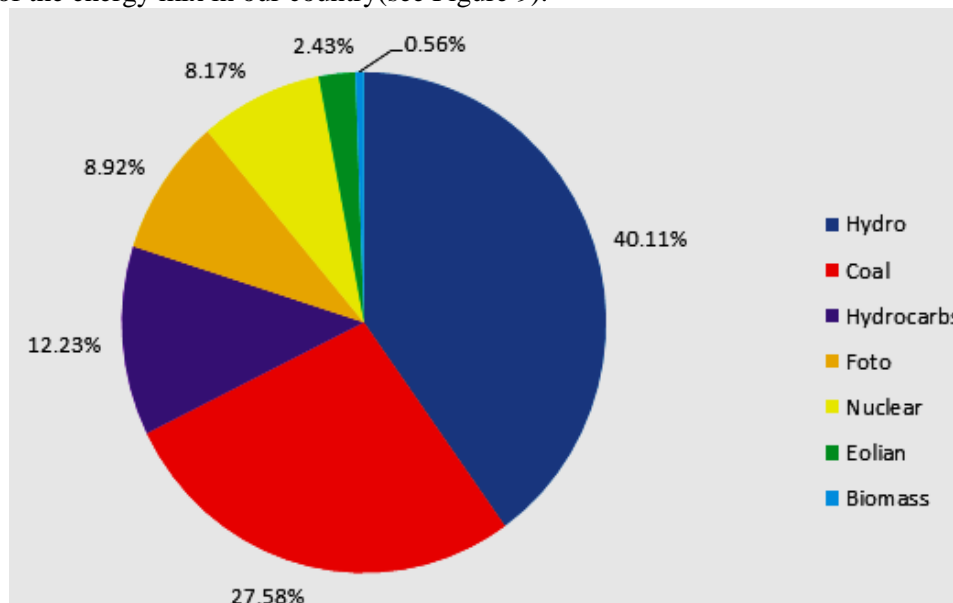


Figure 9. Energy production in March 2018

As an example, we can observe the evolution of Romania's electricity production during 2008-2010 (Figure 10), 2011-2013 (Figure 11), 2014-2016 (Figure 12). Graphs show the evolution of energy from renewable sources, which during this period had an increasing evolution, according to the data presented in the report of the National Regulatory Authority for Energy (ANRE)[30] regarding the results of the electricity market monitoring .

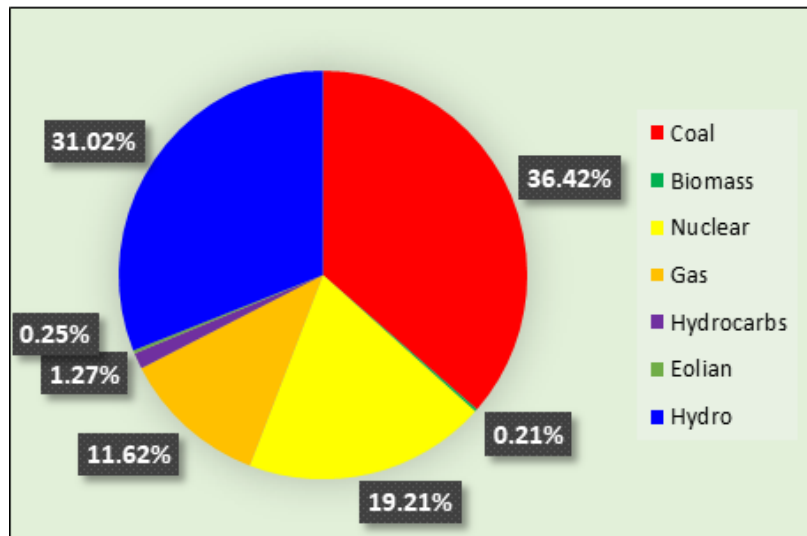


Figure 10. Energy production over 2008-2010

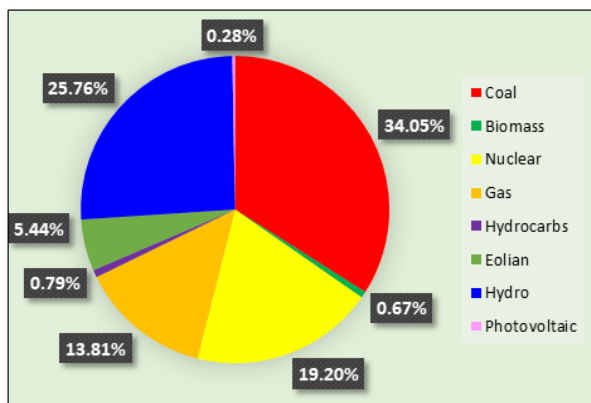


Figure 11. Energy production over 2011-2013

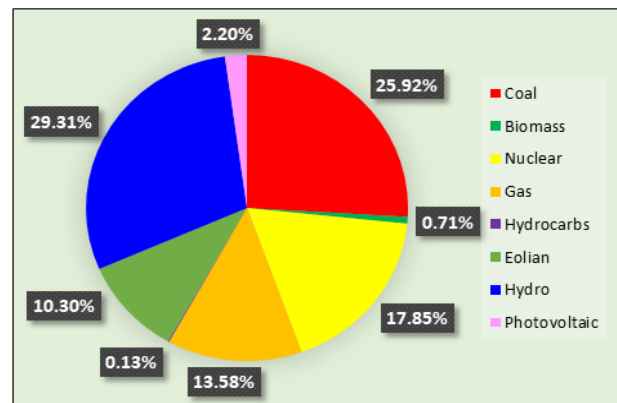


Figure 12. Energy production over 2014-2016

Thus, from renewable sources, hydroelectric power plants provided 29,31% of electricity production, followed by wind power plants (10,30%), solar (2,20%) and biomass (0,71%) over 2014-2016.

Coal was the second most important source for electricity production in 2014-2016, with 25,92% of the total, while the Cernavoda reactors produced 17,85%. natural gas provided 13,58% of the total production, and the fuel 0,13%.

According to the Government, Romania must achieve these objectives, while enhancing energy security and competitiveness.

3.1. The main sub-sectors supplying energy

Oil and gas

Romania is the largest oil and gas producer[31] in Central and Eastern Europe and will play a major role in the European oil and gas market as a result of oil and gas exploration in the Black Sea.

Currently, Romania produces 84,000 barrels per day, and the total daily domestic consumption is 191,000 barrels per day. However, in light of the new discoveries of the Black Sea oil basin, it is estimated that production will grow strongly.

At present, there are only three refineries producing fuel with a refining capacity of 246,000 barrels per day. While the capacity is much higher than the average daily Romanian oil production, refining capacities are quite dated and need investment for modernization and upgrading.

The nuclear sector

According to the results of the Energy Strategy[32], when defining an optimal scenario, the nuclear power will continue to play an important role in the energy mix of the 2030s and 2050s.

Romania currently has a nuclear power plant, Cernavodă, two units in operation and three others under construction (heavy pressure water reactors under CANDU 6 - Canadian deuterium uranium), each with a gross production of 706, 5 MWe. The two reactors operating at the Cernavoda nuclear power plant represent about 17% of Romania's total energy production.

The construction of three other CANDU units (Cernavoda 3, 4 and 5) began in the early 1980s but was discontinued in 1990 and was subsequently included in a conservation program. At present it is estimated that civil works, both in the nuclear and conventional parts of the installations, are about 52% for Cernavoda of 3,30% for Cernavoda 4.

Previous governments intended to complete the construction of Units 3 and 4, but so far no significant steps have been taken. There is a Memorandum signed in 2015 between the Government of Romania and China Nuclear Power Corporation (as an investor) for unit development. After a meeting with representatives of the Chinese investor, the Ministry of Energy confirmed that this is a matter of importance and that they are taking measures to be mandated by the Government to conduct direct negotiations with the CGN investor. Romania will start investing in the Cernavodă units of 3,4, Prime Minister Sorin Grindeanu announced on 25 May 2017.

The prime minister also underlined that Romania's goal is to achieve energy independence. In Europe these are cooperating closely on nuclear power issues, including in research into future reactor designs and infrastructure development.

EU's Sustainable Nuclear Energy Technology Platform (SNETP) agreed by member countries, is structured around three main pillars: NUGENIA, to develop R&D supporting safe, reliable, and competitive GEN-II and GEN- III nuclear systems; the Nuclear Cogeneration Industrial Initiative (NC2I) for the low-carbon cogeneration of process heat and electricity based on nuclear energy; and the European Sustainable Nuclear Industrial Initiative (ESNII) which promotes advanced Fast Reactors with the objective of resource preservation, plutonium management, and minimizing the burden of radioactive wastes. Energy cooperation and integration of energy networks is developing rapidly, both within the EU and between East and West Europe.

The coal sector

The Energy Strategy 2016-2020 / 2030 confirms the role of traditional fuel, such as oil, natural gas, coal and uranium, in the mix of energy provided for Romania over the coming decades. However, natural gas seems to be a favorite because of the relatively low greenhouse gas emissions and the flexibility of the combustion plants. Romania currently produces coal, and in extreme conditions, both in summer and winter, this type of fuel covers one third of the demand for electricity[26] from his power plants (table 4).

Table 4

Power plant	Instalat capacity [MW]
CTE Turceni	4X330
CTE Rovinari	4X330

Charcoal as a primary fuel is recognized as one of the most economically advantageous methods for the production of electricity, especially for large capacity plants. The major disadvantage is the pollution of the environment. In the medium and long term, coal-based energy production will lead to an increase of the greenhouse gas emissions.

In April 2017 the new Industrial Emissions Directive for large combustion plants was approved by the EU, imposing stricter limits on emissions of pollutants such as nitrogen oxides, sulphur dioxide,

mercury and particulate matter from large combustion plants, notably coal-fired power generation. To comply with the new rules by 2021, utilities will either have to invest in new technology to retrofit coal plants, restrict operating hours or close the powerplants. Institute for Energy Economics and Financial Analysis (IEEFA) found that 108 powerplants totalling are responsible for most SO_x and NO_x emissions and are at least 40% above the EU limits. NO_x abatement technology could add €2-4/MWh to the cost of power generation and SO_x abatement could add €6-7/MWh according to the IEEFA and for this it suggests that one-third of the EU's coal-fired powerplants may need to close. The European Union's Directorate-General is to reduce greenhouse gas emissions in order to limit climate change by reducing and even dismantling coal-fired power plants and replacing them with more efficient production facilities.

Experts suspect that several coal-fired power stations will be decommissioned in the coming years due to a lack of major investment in their equipment. Currently, the cost incurred by coal-fired power generators to produce 1MWh is the highest.

Coal-electric power producers are also faced with the obligation to acquire the greenhouse gas emissions certificate, thus making them uncompetitive.

Renewable Energy Sector

Romania aims to get more from its renewable energy needs, in line with EU directives on renewable energy[32]. Therefore, the Government of Romania started to introduce alternative energy incentives in 2005, based on the sale of "green certificates" and mandatory purchasing quotas. The mechanisms were amended in 2011 and checked by the European Commission; they are now the main engine of sustainable development [34].

The green certificate scheme does not apply to projects ordered after December 31, 2016. Romania was considered to be the fastest growing wind energy market in the region, and the capacity to generate wind energy rose from 7MW in 2007 to 1941MW in January 2013 [27,33]. On January 31, 2017, the total installed capacity of the accredited E-RES producers is 4,741.04 MW (wind energy represents 11% of the total annual electricity output of the Romanian bibliography). Total investments in renewable energy are estimated at around 8 billion euros (\$ 8,8 billion).

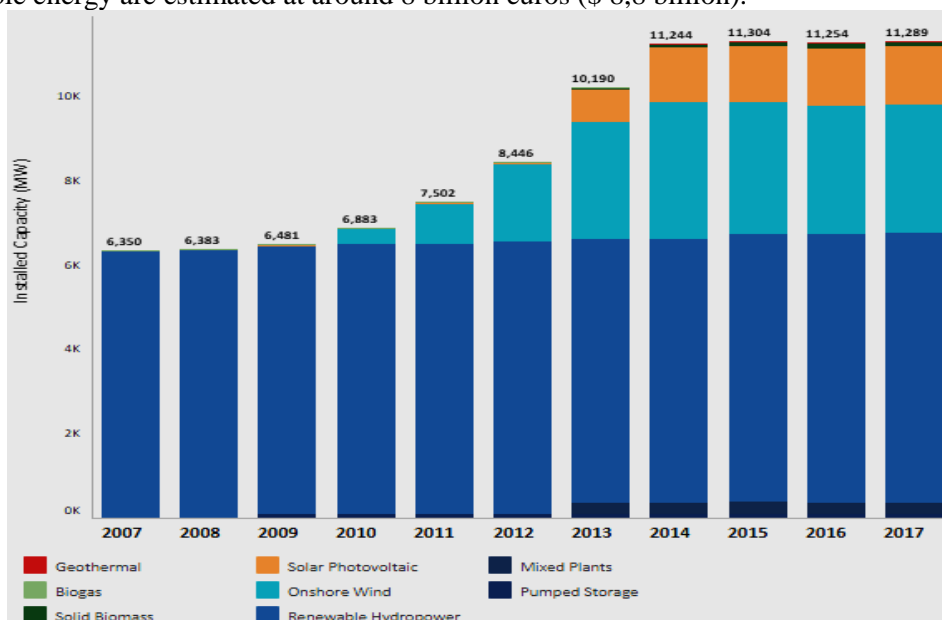


Figure 13. Installed capacity of renewable energy in Romania

From this graphs of renewable energy we can see that starting 2010 the onshore wind was developed and begin with 2013 the solar energy is growing and the trend of renewable energy in the future is to growing.

The total capacity of installed solar power plants is 1,378,099 MW[31]. Starting in 2016, the percentage of solar energy in the total production capacity in Romania was 2%. Solar energy is preferred by the national forwarding operator (Transelectrica) as it does not affect the balancing market like other technologies, with a more predictable operation than wind power plants and not so many fluctuations. A key factor for the viability of renewable energy projects is access to low-cost financing.

The entire Green Certificates Support Scheme was designed and approved as such by the European Commission for projects built, commissioned and accredited by the Energy Regulatory Body (ANRE)[30] by 31 December 2016. Any project commissioned after 1 January 2017 will not receive any green certificate. This is not possible, however, in accordance with EU rules. Market signals indicate that a lot of low-quality products have been installed in the projects they have ordered, and major technical deficiencies currently exist. It may be that in the coming period there are project owners who will decide to change and update the technology used in the projects they have ordered.

Opportunities

Prospects for companies in the energy sector in Romania. The prospects for energy companies will be found in energy systems, energy efficiency products and services (including efficient building materials), smart grid deployment, energy distribution, energy and gas storage, and the potential building of new generating capacities. energy. These opportunities may include equipment, know-how, design and construction technologies, installation, upgrading, maintenance and repair.

In the nuclear sector, the expansion of nuclear capacity in Romania is justified by reasons related to energy security and the reduction of GHG emissions. Units 3 and 4 at the Cernavoda nuclear power plant and the small and medium Saligny radioactive waste repository represent the largest potential investment in the nuclear sector in Romania over the coming decades.

The gas pipeline project (with reverse flows) through Bulgaria-Romania-Hungary and Austria is the major project to be completed in 2019, totaling € 800 million / \$ 880 million. In Romania, the network will stretch over 528 kilometers. Transgaz, the transport operator in Romania, will also build 250 km long pipelines of the Black Sea - Podișor. This project will offer ample opportunities for companies in contracting various engineering, equipment and consulting services.

The discovery of new oil and gas reserves in the Black Sea basin will attract new investments in gas, oil and gas drilling, transmission and refining facilities. The estimates also indicate that oil refinery operators will invest heavily in modernizing their current equipment to cope with the increase in oil and gas production from the Black Sea.

Business opportunities in the energy sector - transmission and distribution systems (high and low voltage) require all modernization work; smart, digital control and service technology could be implemented soon; storage of electricity; energy efficiency equipment; distributed generation systems; gas-fired power generation capacities - high-efficiency turbines, including cogeneration and generation for three generations; coal gasification technologies with carbon capture and storage (CCS) technologies, together with project financing solutions. The main beneficiaries of smart grid projects are municipalities / local authorities that are now looking for providers to optimize their systems / spending / consumption and to improve the quality of their communities' lives.

4. Conclusions

Energy saving is a key point and is the first basic component for achieving an important goal of delivering sustainable energy.

Energy saving contributes to environmental objectives, reduces energy bills, improves business competitiveness and stimulates employment.

There are many opportunities to make significant energy savings. The basic principle is that people and businesses are interested in saving energy and taking responsibility for doing so.

The guaranteed performance of European power plants based on renewable energy is assumed to grow strongly in the coming period.

Industry, agriculture and the commercial sector as a whole contribute to an increase in energy efficiency as an opportunity to increase the competitiveness of enterprise energy, to create new jobs and to achieve climate goals in an efficient manner.

The Emissions Trading Scheme (ETS) is a crucial factor in the long-term transition to sustainable energy supply. For this, four requirements must be met:

- it must provide effective volumetric incentives to attract investment in reducing CO₂ emissions and effectively increasing CO₂ emissions;
- it must promote effective CO₂ emission reduction;
- it must maintain the competitiveness of international energy-intensive companies based on criteria for the best performing companies in the world;
- it must improve the prospects of expanding the ETS system internationally.

Achieving the long-term goal of a 80-95% greenhouse gas savings for the whole economy by 2050 is by tightening the Emissions Reduction Ceilings Trajectory (ETS);

Internationally competitive companies need to secure their position through a 100% free allocation of rights based on realistic data, benchmarks and real production, based on the best performance in the industry.

By 2050, fossil fuels remain an important part of our energy, even if the energy agreement focuses on achieving a CO₂ reduction target from 80 to 95% by 2050, which is expected to use renewable energies in - a 16% share of energy production by 2023.

So the use of the energy mix is a way of saving energy and implicitly of sustainable economic development.

Energy efficiency is a key factor in improving economic, environmental and industrial performance. The overall challenge in this area is to increase access to affordable, responding to the needs of a growing population while providing concrete solutions to help mitigate the effects of climate change.

All investment in renewable energy depends on the availability of finance and the actions are taking over from subsidy programmes as the main way of allocating renewables capacity and they are also delivering cost reductions, with the record-low tariff agreed in 2016 being one of \$29,10 per MWh for a solar project.

European renewable energy projects made a record of investment about \$2,8 billion. The investment in renewable energy starts by highlighting policy instruments.

European Union can double the renewable share in its energy mix from 17% in 2015 to 34% in 2030 if the right enabling frameworks are put in place and this is possible with today's technologies and it makes strong economic sense. By reaching a 34% renewable share in 2030 will also help the European Union reduce emissions and meet the objectives of the Paris Agreement. Renewable energy present an opportunity for the European Union and all its Member States, to boost economic growth, maintain industrial leadership and create jobs, while delivering substantial social and environmental benefits to its citizens.

Reducing carbon emissions and increasing energy from sources such as renewable energies will help ensure the security and sustainability of energy sources for future generations.

Providing clean and renewable energy helps ensure quality of life. Respecting people's electricity needs in a sustainable way is of paramount importance.

Sustainable development refers to three essential aspects embodied in the following syntagms: ecological balance, economic security and social equity. Sustainable development therefore does not just refer to changing people's behavior in relation to the environment, but also to changing the conception of the economy, society and politics.

Terra has a limited capacity to meet the growing demand for natural resources from the socio-economic system and to absorb the destructive effects of its use. Climate change, erosion and desertification phenomena, soil, water and air pollution, forest degradation, accelerated exhaustion of non-renewable natural resources have begun to have negative effects on socio-economic development and people's quality of life in vast areas of the planet. It is essential to use resources wisely and to preserve the quality of the environment for future generations. Using the energy mix will be key to

ensure sustainability from all points of view: energy, economic and social.

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