THE STRATEGY OF THE EUROPEAN UNION MEMBER STATES IN THE FIELD OF ENERGY

Assoc. prof. Mădălina-Gabriela ANGHEL PhD *(madalinagabriela_anghel@yahoo.com)*
„Artifex" University of Bucharest
Prof. Constantin ANGHELACHE PhD *(actincon@yahoo.com)*
Bucharest University of Economic Studies / „Artifex" University of Bucharest
Prof. Alexandru MANOLE PhD *(alexandru.manole@gmail.com)*
„Artifex" University of Bucharest
Lecturer Ana CARP PhD *(karp_ana@yahoo.com)*
„Artifex„ University of Bucharest

Abstract

In this article, the authors paid attention to the analysis of the European Union's energy strategy. The sources of energy are analyzed, how they are used and especially the results recorded in this area, by total, by sources or by member countries. Attention is paid to the analysis of domestic energy demand satisfaction and data on countries importing or exporting energy. Using data published by the European Union and Eurostat highlights how evolved primary energy production, both in the European Union and of each member country. In this context, the analysis regarding the results achieved by Romania in the field of energy is carried out. Particular attention is paid to the analysis of investments in energy production, the cost of energy production, and energy consumption. Romania makes efficient use of energy resources, being an exporter of electricity. In the study, the authors used data sets, tables, graphs and diagrams that facilitate understanding of structure analysis.

Keywords: *energy, wind energy, hydropower, energy union, nuclear energy*

JEL Classification: *O13, Q42, Q43*

Introduction

The energy issue has become a very important one for the European Union in general, but also for each economy in particular, there is a very close correlation between the energy sector and the evolution of the economy as a whole. The issue of energy has been discussed in many ways over the last few years, and a series of measures have been established in the sector's development strategy for the European Union and its Member States. Not only

energy is one of the 10 priorities of the European Commission. It is intended that the „European Union of Energy" ensure the security, sustainability, competitiveness and guarantee of the energy resource. In February 2015, the European Commission established a framework plan for the strategy for the European Energy Union to evolve after its own strategy. The European Union's proposals cover several dimensions of this strategy. First of all, energy security, the solidarity of the Member States of the Energy Union and the mutual trust of the states that are part of the Union are taken into account. Another dimension is that of full European integration on the energy market. In this respect, energy efficiency is intended to contribute to the modernization of the economy as a whole and to be a stimulating factor for the development of this sector. It is intended, as a further dimension, that energy production is increasingly based on fossil fuels that are sufficiently polluting. A last dimension, if we can say so, is competitive research and innovation in this very important area of the European economy and of all the Member States.

Literature review

Hirth (2015) discusses the influence of the variability of renewable energy sources, namely wind and solar power, on the Welfare-optimal deployment of variable renewables. Anghelache (2016, 2015, 2014) has presented an extensive and complex analysis of the Romanian economic status, the study includes energy-related economic aspects. Huber, Dimkova, and Hamacher (2014) develop on the flexibility requirements regarding the integration of two types of renewable energies in Europe, namely the wind and solar power. Scott et al. (2013) discuss on the storage and extraction of carbon as source of energy. Denholm and Hand (2011) evaluate the characteristics of the power grid, in terms of flexibility and storage, which is necessary to ensure an elevated degree of penetration for variable renewable electricity, Lund et.al. (2015) develop on a similar topic. Hirth and Ziegenhagen (2015) analyze the most significant aspects regarding the balance between power and variable renewables. Anghelache and Anghel (2016) is a reference work in the field of economic statistics. Wagner (2014) approaches the expansion of renewable energy usage in the European Union, in the production of electricity. Anghelache et al. (2013) discuss on the management in the field of energy following the disaster at the Fukushima plant. Tavoni and Tol (2010) take into consideration the costs of most stringent climate policies and the risk associated to their improper assesment. Söderholm and Klaassen (2007) develop on the usage of wind power at the European level. Paunica et al. evaluate the perspectives of R&D systems' restructuring. Ferroni and Hopkirk (2016) analyze the Energy Return on Energy Invested indicator for

photovoltaic solar systems in the case of regions where isolation follows a moderate pattern. Neuhoff et al. (2013) consider some aspects related to the integration of renewable electrical energy, Spiecker and Weber (2012) approach a similar topic. Manole et al. (2013) evaluate the situation of energy supplies. Demailly and Quirion (2008) evaluate the European emission trading scheme, focusing on the iron and steel industries, on which basis they build a case study. Kunz and Weigt (2014) develop on the perspectives of the German nuclear power sector. Wagner and Rachlew (2016) analyze the possible development of wind power in Sweden, in place of the nuclear power. Heide et al. (2010) consider the seasonal dimension in the configuration of optimal combination between wind and solar power. Anghelache et.al. (2013) analyze the most important aspects regarding the energetic strategy. Hagspiel et al. describe the optimal extension of the power system from the viewpoint of costs under a given market context (2014). Bertsch et al. (2016) develop on the flexibility dimension of the European power system. Götz et al. (2016) develop on the economic and technological aspects regatring the power to gas process in the context of renewable power sources application. Edenhofer et.al. (2013) present the economic characteristics of the renewable energy sources. Ek and Söderholm (2010) develop on the technological learning development in European wind power. Grand et al. (2016) review the French and German studies on the electrical power production from intermittent renewable sources.

Research methodology, data, results and discussions

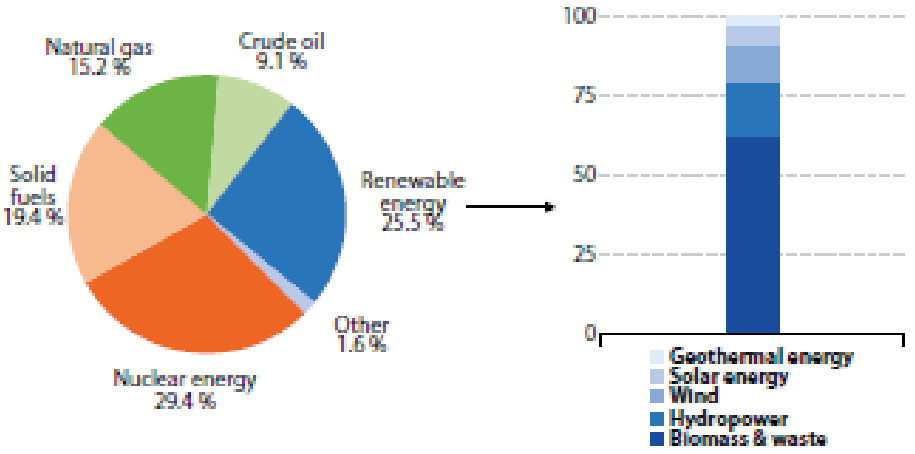
• **Energy production and import**

In 2014, primary energy production in the Member States of the European Union totaled 771 million in equivalent or more. This evolution was driven by the measures that were taken in 2009-2010 when the first consistent steps were taken in terms of energy development in a harmonized program for all the states that are part of the Union. In 2014, primary energy and energy production was 17.3% lower than it was a decade ago, ie between 1994 and 2004. Primary energy production was based on several sources, the most important contribution being made to nuclear power or nuclear power, which accounted for 29.4% of the total energy produced. Approximately 25.5% of primary energy production was due to renewable sources, and 19.4% was based on the use of solid fuels and only 15.2% was based on the use of natural gas. Crude oil had a contribution of 9.1% to the production of energy. The increase in primary energy production was based on the use of all available sources from renewable energy sources, low-power energy, or increased

energy production from nuclear, hydro, thermal, wind and other power plants. Over the last 10 years, renewable energy production has increased by 73.1%. In contrast, production levels based on other sources of general energy were sometimes insignificant. In primary energy production, solid coal, lignite, oil, natural gas as well as energy generated from the use of nuclear power plants and others, such as the wind, have been widely used. In the European Union, primary energy imports have surplus exports because a number of primary energy production units have been polluting and have relied on importing energy shortages rather than producing them under all conditions. Among the Member States of the European Union, there is only one exception, Poland, where the continued use of coal was noted. Member States of the European Union continue to depend on energy imports, which have reached 40% of total energy consumed in 1980, totaling 53.5% of total energy consumption in 2014. This situation, expressed a wide dependence of the EU Member States on energy imports.

Primary energy production in the European Union
(% of total, tons of oil equivalent)

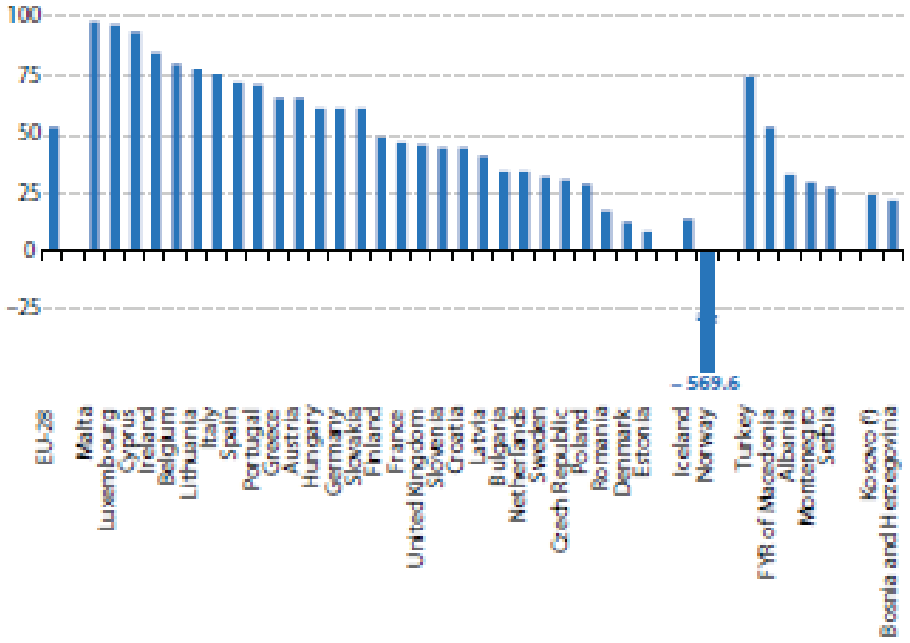
Figure 1



Source: Eurostat - Key figures on Europe 2016, pag. 175

Energy dependence rate in 2014 (% of net imports in gross domestic consumption and bunkers based on tons of oil equivalent)

Figure 2



Source: Eurostat - Key figures on Europe 2016, pag. 176

From this table, we find that a number of states are almost entirely dependent on energy imports. Thus, Malta, Luxembourg, Cyprus, Ireland, Belgium, Lithuania and even Italy are countries that are highly dependent on energy imports, sometimes in these countries import rates are close to 100% as in Malta and Luxembourg, or over 75 % As is the case for Spain, Italy, Lithuania, Belgium, Ireland or Cyprus. We find that alongside Estonia and Denmark, Romania is least likely to import energy. We can estimate that energy imports in Romania are about 19%, Denmark 10%, and Estonia 7%. A closer analysis can highlight the delicate situation of other countries, including Germany, Hungary, Austria, which use more than 50% of energy imports.

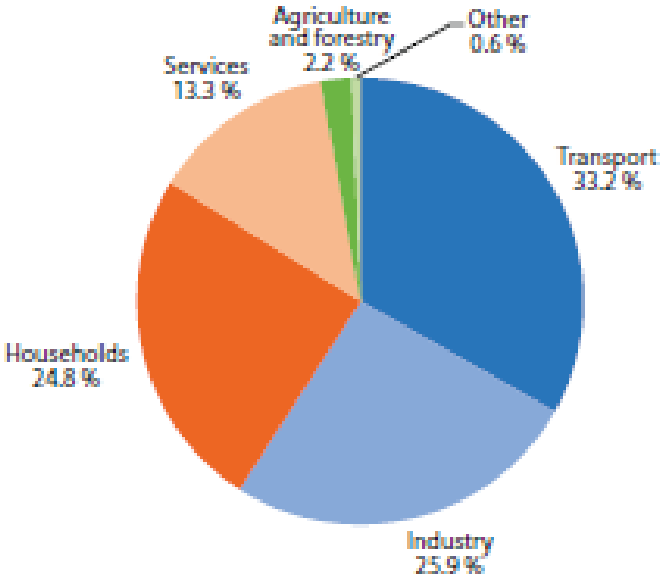
• Energy consumption

Gross energy consumption in the 28 Member States of the European Union in 2015 was 1755 metric tonnes compared to 1606 metric tonnes in 2014. The level of consumption remained somewhat unchanged from 2003 to 2008 when a reduction was achieved Of consumption by 5.85% in 2009

and then it can be estimated that this was due to the crisis situation of the countries of the European Union in 2007-2009. We have to note that after 2009, energy consumption increased by 3.7% in 2010, followed by a similar decrease in 2011. After these three years 2008-2011, where primary energy production in the Union The European Union suffered, 2012 and 2013 showed a low growth rate is true, between 0.8-1%, but this is positive, in the sense that in 2014 the energy consumption remained somewhat constant, being difficult to assure The necessary resources for the economic growth of the Member States. Consumption of gross energy in each of the EU Member States was largely dependent on the structure of the energy system, on the availability of natural resources for the production of primary energy, but also on the structure and evolution of each economy, Used fuel and nuclear power but could not give up renewable energy resources. The issue of energy consumption is particularly important and they are still being paid attention because economic development as a whole depends very much on energy resources. Gross energy consumption in EU Member States also depends on the capacity of each country to use conventional fuels and especially to use renewable resources.

Final energy consumption in 2014 (% tons of crude oil equivalent)

Figure 3



Source: Eurostat - Key figures on Europe 2016, pag. 177

In analyzing the use of energy in the member countries of the European Union between 2014 and 2016, I met three important areas that focused on the energy resource. Firstly, 33.2% of total energy resources were used in transport, 25.9% in industry and industrial production, and 24.8% in household consumption. It has been a changing energy market, especially since 2007. Before that year, energy consumption has steadily grown, with remarkable progress especially since 1990. However, in 2008, the economic and financial crisis has forced the increase in energy consumption In the transport sector by 1.3%. Also, energy consumption in transport and household consumption has increased and has been an important element that has contributed both to the quality and level of production in each economy as well as to the satisfaction of modern household consumption requirements. Table 1 shows the gross energy consumption expressed in millions of tons in crude oil equivalent.

Gross energy consumption in the period 1990-2014
(million tonnes in crude oil equivalent)

Table 1

	1990	2000	2010	2013	2014	Share in EU-28, 2014 (%)
EU-28	1667.9	1730.0	1763.7	1666.7	1605.9	100.0
Belgium	48.6	59.3	61.2	56.5	53.4	3.3
Bulgaria	27.6	18.5	17.8	16.8	17.7	1.1
Czech Republic	49.9	41.1	44.7	42.2	41.5	2.6
Denmark	17.9	19.7	20.0	18.2	16.9	1.1
Germany	356.3	342.3	333.0	324.5	313.0	19.5
Estonia	9.9	5.0	6.2	6.7	6.7	0.4
Ireland	10.3	14.4	15.2	13.7	13.6	0.8
Greece	22.3	28.3	28.8	24.3	24.4	1.5
Spain	90.1	123.6	130.3	119.3	116.7	7.3
France	227.8	257.5	267.1	258.9	248.5	15.5
Croatia	9.5	8.4	9.4	8.6	8.2	0.5
Italy	153.5	174.2	177.9	159.5	151.0	9.4
Cyprus	1.6	2.4	2.7	2.2	2.2	0.1
Latvia	7.9	3.9	4.6	4.5	4.5	0.3
Lithuania	15.9	7.1	6.8	6.7	6.7	0.4
Luxembourg	3.5	3.7	4.6	4.3	4.2	0.3
Hungary	28.8	25.3	25.7	22.7	22.8	1.4
Malta	0.6	0.8	0.9	0.9	0.9	0.1
Netherlands	66.7	78.1	86.1	80.4	76.8	4.8
Austria	25.0	29.0	34.3	33.7	32.7	2.0
Poland	103.3	88.6	100.7	98.0	94.3	5.9
Portugal	18.2	25.3	24.3	22.4	22.1	1.4
Romania	58.1	36.6	35.8	32.4	32.3	2.0
Slovenia	5.7	6.5	7.3	6.9	6.7	0.4
Slovakia	21.8	18.3	17.9	17.0	16.2	1.0
Finland	28.8	32.4	37.1	34.1	34.6	2.2

Sweden	47.4	48.9	50.8	49.1	48.2	3.0
United Kingdom	210.6	230.6	212.5	202.2	189.3	11.8
Iceland	2.4	3.3	5.9	6.1	6.1	..
Norway	21.4	26.4	34.3	33.7	29.2	..
Montenegro	..	..	1.2	1.0	1.0	..
FYR of Macedonia	2.4	2.7	2.8	2.7	2.6	..
Albania	2.6	1.8	2.1	2.4	2.3	..
Serbia	19.6	13.7	15.6	14.9	13.3	..
Turkey	52.3	76.7	106.9	118.5	124.0	..
Bosnia and Herzegovina	5.0	3.2	4.7	5.0	7.8	..
Kosovo (*)	..	1.5	2.5	2.3	2.1	..

Source: Eurostat - Key figures on Europe 2016, pag. 179

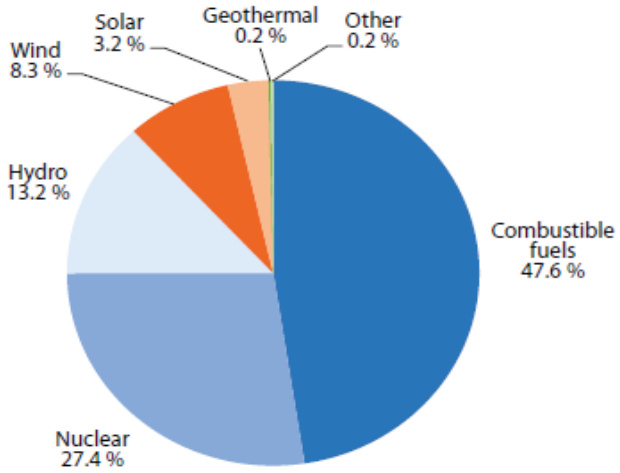
It is noted that from 1990 until 2014, and at the same pace and after 2014 continued to increase energy consumption, and in some countries it decreased. The table is fully enlightening in terms of energy consumption in each country. For example, in Belgium, in 1990 consumption was 48.6 million tons, equivalent to crude oil, reaching 59.3 million tons in 2000, 61.2 million tons in 2010, then remaining somewhat constant over 50 million tons Tons of crude oil equivalent. Germany had the highest consumption among all EU member states during the whole period from 1990 until 2014. In the case of Romania, we find that if in 1990 we had a consumption of 58.1 million tons of crude oil this year decreased Year to 22.1 million tonnes of crude oil in 2014 and to 31.9 million tonnes of crude oil equivalent in 2015.

• Electricity production, consumption and electricity market

Total electricity generation generated in 2014 was 3.03 million (GWh), 2.4% less than in 2013. It was the fourth consecutive year in which electricity production followed a trend Decreasing so that the net level in 2014 was 5.7% lower than in 2008. In 2008, the level was 3.22 million (GWh). More than a quarter of the electricity generated in the EU Member States came from nuclear power stations and 47.6% of the plants using liquid or solid fuels. Among the electricity sources, a high share, 13.2% had the one made in hydropower plants, followed by wind and solar production. Wind generation accounted for 8.3% of total electricity production, and solar, 3.2%. Relative importance was also played by the generation of electricity from renewable sources, thus, in the period 2004-2014, the share of this category of electricity increased from 13.5% to 24.9%, this being the largest share Which the respective resource had. Among the renewable sources of electricity, a significant proportion of the total production generated was through the use of solar resources and wind, so that if in 2004 it represented 0.02%, it reached 3.2% in 2014, solar energy and From 1.9% in 2004 to 8.3% in 2014 in terms of electricity produced from wind turbine resources.

Net electricity production, EU-28, 2014 (% of total, based on GWh)

Figure 4

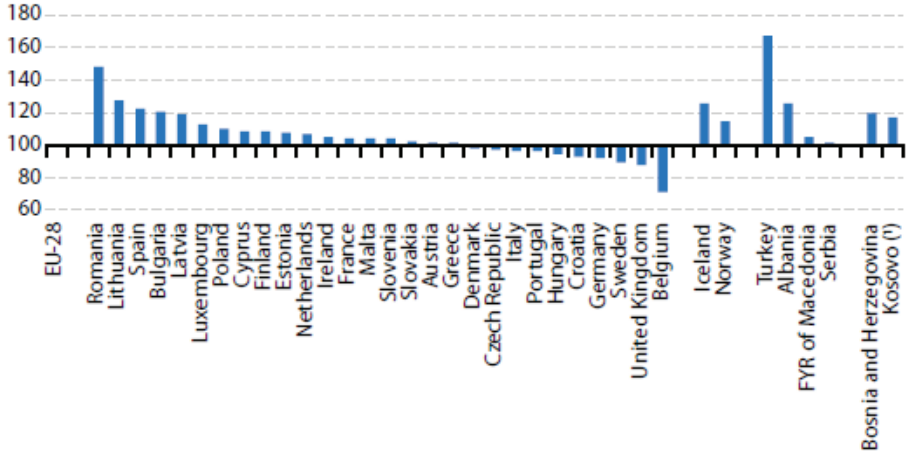


Source: Eurostat - Key figures on Europe 2016, pag. 180

Figure 4 shows a structure chart for electricity generation in the EU Member States in 2014. During the last 10 years, 2004-2014, domestic electricity consumption fell to 1.3%. This value shows that this household electricity consumption has been influenced by how households have recourse to electricity consumption. Another influence of the level of electricity consumption in the household sector was represented by the smaller production of some other sources of energy, or rather by the use of economical consumers in the field of individual households. The level of household electricity consumption in 2014 is shown in Figure 5.

Household energy consumption in 2014 (2004 = 100)

Figure 5



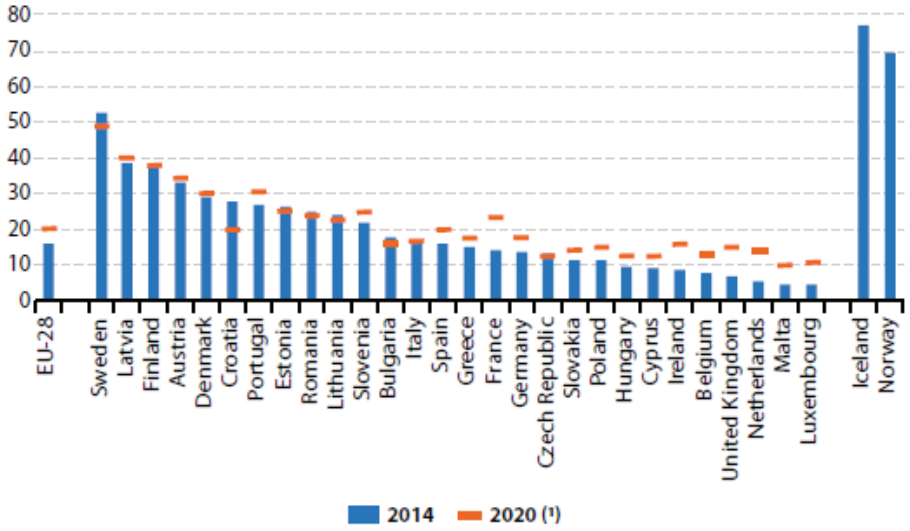
Source: Eurostat - Key figures on Europe 2016, pag. 181

• **Regeneration of energy**

Primary energy production from renewable sources amounted to 196 million tons of oil equivalent in 2014, accounting for 25.4% of total energy production from all sources at one place. A quarter of energy production grew significantly in the period 2004-2014, accounting for about 5.6% annual growth in that range. The use of renewable energy was 12.5% of total energy consumption in 2014. A number of Member States within the European Union have used renewable energy sources on a large scale. Austria, Latvia and Finland being the countries that have used more than 30% of the energy consumption of such resources.

Share of energy consumption from renewable resources, total consumption in 2014-2020 (%)

Figure 6

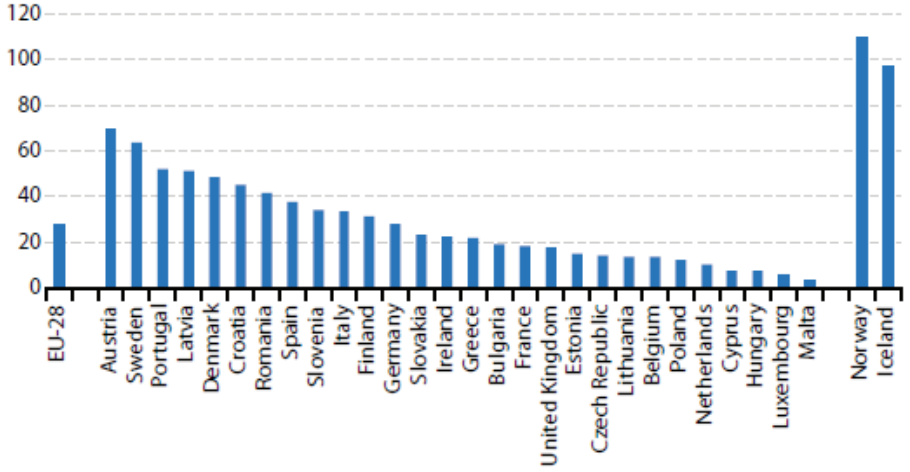


Source: Eurostat - Key figures on Europe 2016, pag. 182

The share of energy consumption from renewable resources over the period 2014-2020, as set out in the energy development plan of the EU Member States, is presented in the member countries. The increase in energy generated from renewable resources in the 2014-2020 period is primarily based on the use of alternative, wind and solar resources to regenerate energy resources so as to ensure significant growth by 2020 and beyond, in line with The European Union's plan and development strategy in this area. Figure 7 shows the proportion of electricity generation based on renewable resources.

Share of electricity generated from renewable resources in 2014 (% of total electricity consumption)

Figure 7



Source: Eurostat - Key figures on Europe 2016, pag. 183

It is a perceptual expression of this production in the total electricity consumption of each country. It is noted that Romania holds an important position, approximately 40%, being ahead of many countries such as Spain, Slovenia, Germany, Ireland, the UK or other countries facing difficulties in this area.

- **The price of energy**

Like any economic activity, the pillar of electricity production is costing particularly high. Of course, each country depends on the production it produces from its own resources, as well as the resources from the import that are used in the production of energy. Thus, between the second half of 2014 and the second half of 2015, energy prices rose by 2.4%, and in some countries energy prices had a gloomy evolution. Within the 28 Member States of the European Union, we find that the price of natural gas, starting in the second half of 2015, has struck a series of countries such as Finland, Sweden, which have hardly found the necessary resources to import the necessary fuels Production. For example, in table 2, we presented the situation of the EU member states in the period 2014-2015 in relation to the electricity production determined by the gas price.

Electricity and gas prices in the second half of 2014 and 2015
(in euro per kWh)

Table 2

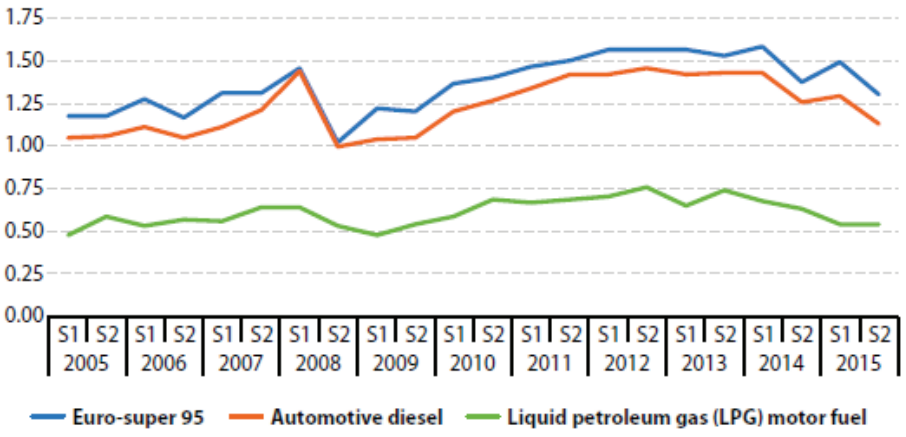
	Electricity prices				Gas prices			
	Households (1)		Industry (2)		Households (3)		Industry (4)	
	2014	2015	2014	2015	2014	2015	2014	2015
EU-28	0.206	0.211	0.120	0.119	0.072	0.071	0.037	0.034
EA (5)	0.218	0.221	0.129	0.125	0.079	0.076	0.038	0.035
Belgium	0.204	0.235	0.109	0.108	0.065	0.062	0.029	0.029
Bulgaria	0.090	0.096	0.076	0.078	0.048	0.039	0.034	0.027
Czech Republic	0.127	0.129	0.082	0.078	0.056	0.058	0.030	0.029
Denmark	0.304	0.304	0.097	0.091	0.088	0.076	0.037	0.034
Germany	0.297	0.295	0.152	0.149	0.068	0.068	0.040	0.038
Estonia	0.133	0.129	0.093	0.096	0.049	0.038	0.037	0.027
Ireland	0.254	0.245	0.136	0.136	0.075	0.072	0.042	0.037
Greece	0.179	0.177	0.130	0.115	0.080	0.075	0.047	0.036
Spain	0.237	0.237	0.117	0.113	0.096	0.093	0.037	0.032
France	0.162	0.168	0.093	0.095	0.076	0.073	0.038	0.037
Croatia	0.132	0.131	0.092	0.093	0.048	0.046	0.040	0.035
Italy	0.234	0.243	0.174	0.160	0.095	0.091	0.035	0.032
Cyprus	0.236	0.184	0.190	0.141	–	–	–	–
Latvia	0.130	0.165	0.118	0.118	0.049	0.049	0.036	0.029
Lithuania	0.132	0.124	0.117	0.100	0.050	0.044	0.037	0.022
Luxembourg	0.174	0.177	0.099	0.089	0.051	0.048	0.039	0.037
Hungary	0.115	0.115	0.090	0.087	0.035	0.035	0.039	0.034
Malta	0.125	0.127	0.178	0.137	–	–	–	–
Netherlands	0.173	0.183	0.089	0.084	0.082	0.077	0.033	0.032
Austria	0.199	0.198	0.106	0.105	0.073	0.071	0.040	0.038
Poland	0.141	0.142	0.083	0.086	0.050	0.050	0.036	0.034
Portugal	0.223	0.229	0.119	0.115	0.104	0.098	0.044	0.038
Romania	0.125	0.132	0.081	0.080	0.032	0.034	0.031	0.029
Slovenia	0.163	0.163	0.085	0.087	0.063	0.061	0.044	0.038
Slovakia	0.152	0.152	0.117	0.112	0.052	0.050	0.038	0.035
Finland	0.154	0.153	0.072	0.071	:	:	0.047	0.042
Sweden	0.187	0.187	0.067	0.059	0.114	0.117	0.044	0.042
United Kingdom	0.201	0.218	0.134	0.152	0.065	0.067	0.035	0.035
Iceland	0.116	0.127	:	:	–	–	–	–
Liechtenstein	0.155	0.180	0.140	0.161	0.086	0.093	0.056	0.060
Norway	0.166	0.143	0.081	0.069	:	:	:	:
Montenegro	0.099	0.099	0.075	0.076	–	–	–	–
FYR of Macedonia	0.082	0.084	0.078	0.081	:	:	0.042	0.027
Albania	0.116	0.082	:	:	–	–	–	–
Serbia	0.060	0.065	0.067	0.068	0.045	0.040	0.038	0.036
Turkey	0.131	0.122	0.081	0.070	0.037	0.035	0.027	0.025
Bosnia and Herzegovina	0.081	0.083	0.062	0.061	0.051	0.051	0.053	0.053
Kosovo (6)	0.059	0.061	0.079	0.081	–	–	–	–
Moldova	:	0.088	:	0.077	:	0.032	:	0.027

Source: Eurostat - Key figures on Europe 2016, pag. 185

Figure 8 also shows graphically the consumer oil prices during the period 2005-2015, with not alarming rhythms of growth, but situations where the price had a particular effect on energy production.

Consumer prices for the main petroleum products in the European Union 2005-2015 (in Euro per liter)

Figure 8



Source: Eurostat - Key figures on Europe 2016, pag. 186

Conclusion

A series of theoretical and practical conclusions are drawn from the study. First of all, the European Union's attention to the development of primary energy production is highlighted. The strategy adopted at Union level suggests the need for increased investment so that primary energy production becomes sufficient for the needs of economic development. The energy sector is one of the top ten priority points of the European Union. The European Union is paying attention to the energy sector by creating a „energy union" that has five dimensions: ensuring energy security, full integration and creating the energy market, increasing the role of energy in developing and modernizing the economy, reducing pollution and developing competitive research and innovation in this sector. The data under analysis reveals how energy resources are used, as well as the untapped reserves. The study on primary energy production can also be extended by using statistical and econometric methods on the basis of which certain forecasts can be made with a high degree of certainty.

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