

Trends of Primary Energy Consumption in EU-Its Dependence on Import

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***Abstract:** The dynamics of primary energy consumption in EU can be related to the dynamics of GDP, if during economic boom was evident an increase of consumption with the burst of crisis and afterwards one may see a lowering consumption that stood out. But there were other factors that have influenced the dynamics of consumption, as the trend in oil prices and public policies for energy conservation.*

Dependence on energy imports of the EU has increased in the analyzed period, especially for countries in Central and Eastern Europe, and especially for crude oil and natural gas, while the main suppliers were Russia and Norway. But any serious analysis must be differentiated taken into account the specificity of energy mix/ sector in each MS and broad differences between energy policies across the EU.

***Key Words:** primary energy, consumption, energy intensity, energy mix, energy supply, economic crisis, renewable energy, oil prices*

***JEL Classification:** D47, F64, P18, Q35, Q41, Q48, Q54*

1. Introduction

Evolution of EU primary energy consumption since 1989 only partially confirms the theory of decoupling energy consumption from economic growth, because of slow growth during the economic boom and even a decrease in the period of stagnation (low growth). Other factors like the trend of oil prices, deindustrialization and fast development of green energies, environment protection policies and energy conservation measures had a stronger impact upon consumption growth and its structure. But we can not deny the significant impact of the financial and economic crisis, which led to a rebound of consumption not only in 2009 but later on which one needs to be associated with the impact of policies implemented for reducing energy intensity both at Community and national level. EU seems fully preoccupied by a massive reduction of greenhouse gas emissions while firm commitments and optimistic forecasts for long term periods like 2030 and 2050 are very encouraging and involve major structural changes in consumption besides permanent conservation measures. To enhance energy security is necessary not only the diversification of external supply sources and but also developing and diversifying the domestic energy mix with an accent on renewable resources with great potential as hydropower, biomass, wind.

2. Evolution of primary energy consumption in the EU

The evolution of primary energy consumption in EU countries during the period 1990-2014 is presented in the Table no.1, being worthy of mentioning that there were four waves of enlargement/geographical expansion of the European Community during this period, which increased the number of members from 12 to 28. Consumption of the EU-28 increased from 1569.4 mil. toe (tonnes of oil

equivalent) in 1990 to 1617.9 mil. toe in 2000 and to 1712.8 mil. toe in 2005, followed by a decline mainly due to the financial/economic crisis and secondary to measures for increasing the efficiency (or reducing energy intensity). Thus the total consumption declined to 1693.6 mil. toe starting with 2007, to 1656.4 mil. toe in 2010 and to 1507.1 mil. toe in 2014. The main primary energy consuming countries in the EU were Germany, with a share of 21.2% in total in 1990 and 19.4% in 2014 (decline of consumption), followed by France with 13.7% in 1990 and 15.6% in 2014 (increase of consumption), the UK with 12.7% in 1990 and 12.1% in 2014 (decline of consumption) and Italy with 9.1% in 1990 and 9.5% in 2014 (increase of consumption but it declined noticeably in the recent years). Medium consumers in Western Europe increased their consumption and their share in total consumption in the same period, as Spain had a share of 5.4% in 1990 and 7.5% in 2014, Netherlands 3.6% in 1990 and 4.2% in 2014, Belgium 2.9% in 1990 and 3.0% in 2014, Sweden 2.9% in 1990 and 3.1% in 2014, Austria 1.5% in 1990 and 2.0% in 2014.

Table no.1: Primary energy consumption in EU in 1990-2014 (mil.toe)

Country/year mil. toe %	1990		1995		2000		2005		2010		2014	
	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%
EU (28 countries)	1569.4	100	1567.5	100	1617.9	100	1712.8	100	1656.4	100	1507.1	100
Eurozone (19 countries)	1039.8	66	1055.7	67.3	1125.0	69.5	1202.0	70.2	1161.9	70.1	1057.8	70.2
Belgium	45.5	2.9	48.0	3.1	52.4	3.2	51.4	3.0	53.9	3.2	45.0	3.0
Bulgaria	26.2	1.7	21.5	1.4	17.5	1.1	18.9	1.1	17.4	1.0	17.2	1.1
Czech Rep.	48.2	3.1	39.4	2.5	39.0	2.4	42.2	2.5	41.9	2.5	38.6	2.6
Denmark	17.6	1.1	19.9	1.3	19.4	1.2	19.3	1.1	19.8	1.2	16.7	1.1
Germany	333.3	21.2	318.0	20.3	317.3	19.6	317.2	18.5	310.4	18.7	291.8	19.4
Estonia	9.7	0.6	5.3	0.3	4.8	0.3	5.4	0.3	6.1	0.4	6.6	0.4
Ireland	9.6	0.6	10.5	0.7	13.8	0.8	14.7	0.9	14.8	0.9	13.4	0.9
Greece	21.6	1.4	23.4	1.5	27.6	1.7	30.6	1.8	27.7	1.7	23.7	1.6
Spain	84.2	5.4	94.2	6.0	114.2	7.1	135.9	7.9	123.2	7.4	112.6	7.5
France	214.4	13.7	225.9	14.4	241.4	14.9	259.9	15.2	252.8	15.3	234.5	15.6
Croatia	8.8	0.6	7.0	0.4	7.8	0.5	9.1	0.5	8.8	0.5	7.7	0.5
Italy	143.2	9.1	152.0	9.7	165.8	10.2	181.5	10.6	168.4	10.2	143.8	9.5
Cyprus	1.6	0.1	1.9	0.1	2.3	0.1	2.5	0.1	2.7	0.2	2.2	0.1
Latvia	7.9	0.5	4.6	0.3	3.8	0.2	4.5	0.2	4.6	0.3	4.4	0.3
Lithuania	15.1	1.0	8.1	0.5	6.4	0.4	7.9	0.4	6.1	0.4	5.6	0.4
Luxembourg	3.5	0.2	3.3	0.2	3.6	0.2	4.8	0.2	4.6	0.3	4.2	0.3
Hungary	27.1	1.7	24.5	1.56	23.7	1.5	25.4	1.5	23.3	1.4	20.7	1.4
Malta	0.6	0.04	0.8	0.05	0.8	0.05	1.0	0.05	0.9	0.05	0.9	0.05
Holland	56.9	3.6	64.5	4.1	66.2	4.1	69.3	4.0	70.8	4.3	62.7	4.2
Austria	23.4	1.5	25.7	1.6	27.3	1.7	32.5	1.9	32.5	2.0	30.6	2.0
Poland	99.1	6.3	95.1	6.1	84.3	5.2	87.7	5.1	95.7	5.8	89.1	5.9
Portugal	16.1	1.0	18.6	1.2	22.9	1.4	24.9	1.4	22.6	1.4	20.7	1.4
Romania	57.3	3.6	45.1	2.9	34.8	2.1	36.7	2.1	34.3	2.1	30.8	2.0
Slovenia	5.7	0.4	6.0	0.4	6.2	0.4	7.0	0.4	7.1	0.4	6.5	0.5
Slovakia	20.2	1.3	16.8	1.1	16.9	1.0	17.8	1.0	16.8	1.0	15.3	1.0
Finland	27.4	1.7	28.2	1.8	31.4	1.9	33.4	1.9	35.9	2.2	33.4	2.2
Sweden	45.5	2.9	49.5	3.2	47.2	2.9	48.7	2.8	48.7	2.9	46.2	3.1
United Kingdom	199.8	12.7	209.8	13.4	219.2	13.5	222.8	13.0	204.7	12.4	182.4	12.1

Source: Eurostat. 13.10.2016

Countries of Central and Eastern Europe -CEE 6, outside Eurozone, (see Table no.2) have slightly reduced their consumption in the same period mainly due to deindustrialization process of the 90s, so Poland had a share of 6.3% in 1990 and 5.9% in 2014, Czech Republic of 3.1% in 1990 and 2.6% in 2014, Hungary of 1.7% in 1990 and 1.4% in 2014, Bulgaria 1.7% in 1990 and 1.1% in 2014, Croatia of 0.6% in 1990 and 0.5% in

2014. With the exception of Poland the shares of CEE countries (non euro) in total primary energy consumption of the EU 28 were quite low, reflecting the level of economic development and industry setback, but consumption decline was comparable to that of the EU 28. Romania has supported the most significant decline of consumption in the period 1990-2014 due to its massive deindustrialization, the drop being of 46.25%, from 57.3 mil.toe (3.6%) to 30.8 mil.toe (2.0%). The process may seem positive if it could be achieved by increasing energy efficiency, but energy intensity is on average 2.6 times higher than in the developed countries of the EU.

Table no.2: Share of CEE 6 (non-euro) in EU primary energy consumption in 1990-2014 period

Country /Year	1990		1995		2000		2005		2010		2014	
	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%	Mtoe	%
EU (28 countries)	1569.4	100	1567.5	100	1617.9	100	1712.8	100	1656.4	100	1507.1	100
Bulgaria	26.2	1.7	21.5	1.4	17.5	1.1	18.9	1.1	17.4	1.0	17.2	1.1
Czech Rep.	48.2	3.1	39.4	2.5	39.0	2.4	42.2	2.5	41.9	2.5	38.6	2.6
Croatia	8.8	0.6	7.0	0.4	7.8	0.5	9.1	0.5	8.8	0.5	7.7	0.5
Hungary	27.1	1.7	24.5	1.56	23.7	1.5	25.4	1.5	23.3	1.4	20.7	1.4
Poland	99.1	6.3	95.1	6.1	84.3	5.2	87.7	5.1	95.7	5.8	89.1	5.9
Romania	57.3	3.6	45.1	2.9	34.8	2.1	36.7	2.1	34.3	2.1	30.8	2.0

Source: Eurostat. 13.10.2016

To differentiate the analysis on shorter intervals it should be mentioned that after it has remained relatively unchanged during the period 2003– 2008, the primary energy consumption fell by 5.5% in 2009, a part of this change may be attributed to the lower level of economic activity due to the financial and economic crisis rather than to a structural change in the pattern of energy consumption. In 2010, it was recorded an increase of 3.6% of primary energy consumption of the EU-28 and this was followed by a setback of the same proportion (-3.8%) in 2011. After three years of relatively important changes, in 2012 and 2013 consumption has marked modest rates of change, respectively decreases of 0.6% and 1%. In 2014, the gross domestic consumption of energy has intensified its decline (- 4%) to the absolute lowest level since the beginning of the data series available for the reporting period (1990-2014).

Domestic consumption of primary energy in each EU Member State depends to a large extent on the structure of its energy system, the availability of natural resources for the production of primary energy as well as on the structure and level of development of each economy, this being true not only for conventional fuels and nuclear energy, but also for the renewables. The dynamics of primary energy consumption should be reported to GDP dynamics to see to what extent it has been reduced the energy-intensity of economy in line with the target set at European level to increase energy efficiency by 20% during the period 1990-2020, but also with the objective of raising the productivity of production factors and hence the competitiveness of the European economy. But if the productivity of factors increases faster than the consumer demand due to an unequal distribution of income between capital and labour then one may occur big problems with the level of employment and implicitly of unemployment, and with the emergence of an oversupply of products and services, with particularly very negative effects on prices (deflation), interest rates, savings level, growth rate. We don't have an impressive economic growth in the EU in the period under discussion, for example the average growth in Germany, the engine of EU economy, was just 0.32% per year. On the domestic supply, the energy mix is also quite different in MS, in France predominates nuclear power, in the United Kingdom hydrocarbons, in Italy the same, while in Germany the mix is more balanced, hydrocarbons and nuclear energy have a higher contribution, but coal and green energies have a certain participation. Continental Europe is in general quite poor in hydrocarbon deposits, those in the North Sea being largely exhausted, less natural gas.

Energy intensity is a measure of the energy efficiency of an economy. In 2014 economies with the lowest energy intensity in the EU were Denmark, Ireland, UK and Luxembourg, that consumed the smallest amount of energy per unit value of gross domestic product (GDP). The EU Member States with the higher energy consumption per unit of GDP, in other words the least energy efficient, were Bulgaria and Estonia. The economic structure of an economy plays an important role in determining the energy intensity as economies

based on services will record the lowest energy intensity, while economies with large share of heavy industry (such as steel production) in their economic activity, will have a higher energy intensity.

Between 2004 and 2014 substantial savings of energy were made by Latvia and Poland, as well as by Romania, Bulgaria, Hungary, Greece and Czech Republic, and the amount of energy required to produce an economic unit (measured by GDP) has been reduced by at least a quarter (25.0%). None of the Member States of the European Union has reported an increase of energy intensity between 2004 and 2014, the smallest percentage decrease was recorded in Cyprus and Sweden. The importance of energy-intensive industries in determining international competitiveness of EU economy is slightly exaggerated because these industries represent only 1.3% of the value added as a percentage in total GDP in the EU.

3. Dependence of EU gross domestic consumption on imports of primary energy resources.

Dependence on imports of primary resources of EU Member States (see the Table no. 3) has increased from 1990 to 2014, when it rose from 44.2% to 53.5%. In fact import dependence has increased significantly until 2005 after which it remained at high levels, but the situation differs from country to country depending on the resource endowment of each country and on the dynamics and structure of consumption of primary energy. Germany has increased import dependency from 46.5% in 1990 to 61.6% in 2014, France has decreased its dependence from 52.4% in 1990 to 46.1% in 2014, the UK has increased it from 2.4% in 1990 (when it massively exploited hydrocarbons in the North Sea) to 45.5% in 2014 and Italy has reduced its dependency from 84.7% in 1990 to 75.9% in 2014. Spain has increased its dependence from 63.1% in 1990 to 72.9% in 1990, Netherlands (which has significant gas deposits) from 22.1% in 1990 to 33.8% in 2014, Belgium from 75.1% in 1990 to 80.1% in 2014, Sweden has reduced its dependence from 38.2% in 1990 to 32.1% in 2014, Austria from 68.5% in 1990 to 65.9% in 2014.

Table no.3: Dependence of MS on import of primary energy resources in 1990-2014 period (%)

Country/ Year	1990	1995	2000	2005	2010	2014
EU (28 countries)	44.2	43.1	46.7	52.2	52.6	53.5
Eurozone (19 countries)	57.4	59.7	64.1	65.0	62.0	60.3
Belgium	75.1	80.8	78.1	80.1	77.9	80.1
Bulgaria	62.8	55.9	46.0	46.7	39.6	34.5
Czech Rep.	15.4	20.6	22.9	28.0	25.6	30.4
Denmark	45.8	33.4	-35.0	-49.8	-15.7	12.8
Germany	46.5	56.8	59.4	60.4	60.1	61.6
Estonia	44.2	32.3	32.2	26.1	13.6	8.9
Ireland	68.6	69.5	84.8	89.6	86.6	85.3
Greece	62.0	66.7	69.5	68.6	69.2	66.2
Spain	63.1	71.7	76.6	81.4	76.7	72.9
France	52.4	48	51.5	51.6	49.1	46.1
Croatia	39.8	36.1	48.4	52.5	46.6	43.8
Italy	84.7	81.9	86.5	83.4	82.6	75.9
Cyprus	98.3	100.5	98.6	100.7	100.8	93.4
Latvia	88.9	70.4	61.0	63.9	45.5	40.6
Lithuania	71.7	63.1	59.4	56.8	81.8	77.9
Luxembourg	99.5	97.7	99.6	97.4	97.1	96.6
Hungary	49.0	47.9	55.2	63.1	58.2	61.7
Malta	100.0	104.8	100.3	100.0	99.0	97.7
Holland	22.1	20.0	38.1	38.0	30.3	33.8
Austria	68.5	66.4	65.4	71.6	62.8	65.9
Poland	0.8	-1.2	9.9	17.2	31.3	28.6
Portugal	84.1	85.3	85.1	88.6	75.1	71.6
Romania	34.3	30.3	21.8	27.6	21.9	17.0
Slovenia	45.7	50.9	52.8	52.5	48.6	44.6
Slovakia	77.5	68.5	65.5	65.3	63.1	60.9

Finland	61.2	53.6	55.1	54.2	47.8	48.8
Sweden	38.2	38.9	40.7	36.8	36.6	32.1
United Kingdom	2.4	-16.4	-16.9	13.4	28.4	45.5

Source: Eurostat. 13.10.2016

Countries from Central and Eastern Europe -CEE 6 (see the Table no.4) have increased their dependence on imports, Poland from 0.8% in 1990 to 28.6% in 2014, Czech Republic from 15.4% in 1990 to 30.4% in 2014, Hungary from 49.0% in 1990 to 61.7% in 2014, Croatia from 39.8% in 1990 to 43.8% in 2014, while Bulgaria has reduced its dependence from 62.8% in 1990 to 34.5% in 2014. Romania has decreased its dependence on imports from 34.3% in 1990 to 17.0% in 2014 mainly due to the high decrease of consumption in all industry. With the exception of Romania and Bulgaria the import dependence of other CEE countries (non euro) has more increased than the average of the whole EU 28.

Table no.4: Comparison between EU 28 and CEE 6 (non-euro) concerning the import share of primary energy resources in total consumption in 1990-2014 (in %)

Country/ Year	1990	1995	2000	2005	2010	2014
EU (28 countries)	44.2	43.1	46.7	52.2	52.6	53.5
Bulgaria	62.8	55.9	46.0	46.7	39.6	34.5
Czech Rep.	15.4	20.6	22.9	28.0	25.6	30.4
Croatia	39.8	36.1	48.4	52.5	46.6	43.8
Hungary	49.0	47.9	55.2	63.1	58.2	61.7
Poland	0.8	-1.2	9.9	17.2	31.3	28.6
Romania	34.3	30.3	21.8	27.6	21.9	17.0

Source: Eurostat. 13.10.2016

The decrease of domestic production of coal, lignite, crude oil, natural gas and more recently nuclear energy has led to a situation where the EU had increasingly more to rely on imports of primary energy in order to meet domestic demand, although this situation has stabilized after the financial and economic crisis.

Imports of primary energy in the EU-28 exceeded the exports by about 881 mil.toe in 2014. The largest net importers of primary energy were generally the most populated MS of the EU, with the exception of the Poland (which has huge domestic reserves of coal). In 2004, Denmark was the only net exporter of primary energy among the EU Member States, but in 2013, Danish energy imports exceeded its exports so that there were no net exporting states of energy in EU. Relative to population size the biggest net energy importers in EU were Luxembourg, Malta and Belgium in 2014.

External energy supply sources of EU have recorded some changes in the recent years, although Russia has maintained its positions as the leading supplier of crude oil and natural gas (although its share has decreased in the last years). In 2014, 29.0% of crude oil imports of the EU-28 came from Russia. Also, since 2006 Russia is a leader in providing solid fuels (coal) to the EU, exceeding South Africa, after it exceeded Australia in 2004 and Columbia in 2002. The share of Russian imports of solid fuels to EU-28 increased from 18.0% in 2004 to 30.0% in 2009, falling to 25.7% in 2012 and increasing to 29.0% in 2014. Instead, Russia's share in EU gas imports decreased from 43.6% to 32.1% between 2004 and 2010, but this has subsequently alternated with increases that led to a share of 37.5% in 2014. In the past 10 years, Norway has remained the second largest supplier of EU of crude oil and the natural gas.

The security of EU primary energy supply is threatened where high parts of imports are concentrated among a reduced number of external suppliers. More than two thirds (69.1%) of EU-28 imports of natural gas came from Russia and Norway in 2014, as such there is a greater concentration of imports than in 2010, when the same two countries ensured only 59.6% of EU natural gas imports.

A similar analysis shows that 43.5% of the EU oil imports came from Russia and Norway in 2014 (with Nigeria, Saudi Arabia and Kazakhstan having an appreciable share), while 70.7% of imports of solid fuels of EU-28 had their origin in Russia, Columbia and USA. Between 2004 and 2014 new developing countries have emerged as partners: for oil imports Nigeria, Kazakhstan, Azerbaijan and Iraq and for natural gas imports Qatar and Libya.

The dependence on energy imports of EU-28 increased from less than 40% of primary energy consumption in 1980 to the level of 53.5% by 2014 after reaching a maximum rate of 54.5% in 2008. The highest rates of dependency on energy imports were recorded in 2014 for crude oil (88.2%) and natural gas (67.4%). In the last decade (between 2004 and 2014), EU dependence on the third countries in supplying natural gas has increased by 13.8 percentage points, faster than the increased dependence on oil imports (7.5 percentage points) and solid fuels (7.4 percentage points). Since 2004, net imports of energy in the EU-28 were higher than its primary energy production; in other words, more than half of gross domestic energy consumption of EU-28 was provided by net imports.

The lowest rates of dependence on imported energy in 2014 were recorded in Estonia, Denmark, Romania and Poland. Malta, Luxembourg and Cyprus were (almost) entirely dependent on imports of primary energy, with dependency rates which exceeded 90%.

CEE 6 (non euro) are almost totally dependent on imported crude oil (from Russia and the Middle East), except Romania that produces some of the necessary (around 40%) and also are totally dependent on imports of natural gas (from Russia), except Romania which provides almost all consumption from domestic production. They are less dependent on imported coal because coal production is quite developed in these countries.

More than half the energy of EU-28 come from third countries, outside the EU, and this share has generally increased in the recent decades (although there is some evidence that the rate of dependence has stabilized in the recent years). A large part of the EU imported energy comes from Russia, whose disputes with transit countries have threatened to disrupt winter supplies in the recent years. Concerns about security of Russia supply were further enhanced by the conflict in the Eastern Ukraine. In response to the Russian-Ukrainian gas crisis in January 2009, the legislative framework concerning the security of supply has been revised, and in September 2009, the EU Council adopted Directive 2009/119/EC, which requires MS the obligation to hold a minimum level of stocks of oil and/or petroleum products. These measures targeting oil and gas markets have been designed to ensure that all parts adopt effective measures for the prevention and mitigation of potential disruptions of supply, at the same time creating mechanisms for Member States to work together to effectively cope with any major disturbances in the oil or natural gas supply; it was established a coordination mechanism so that MS may respond uniformly and immediately in emergency cases.

4. Conclusions

In November 2010 the European Commission adopted an initiative entitled "*Energy 2020- A strategy for competitive, sustainable and secure energy*" (COM (2010) 639 final). This strategy has defined energy priorities for a period of 10 years, and measures to be taken in order to address a variety of challenges, including achieving markets with competitive prices and secure supplies, boosting technological innovation and effective negotiation with international partners. One of the priorities was to promote good relations with external suppliers and external energy transit countries. This activity was further developed through Energy Strategy 2030, which provides a political framework for environmental policy and energy policy for 2030 and a Roadmap for energy until 2050, which fixed a long-term goal of reducing greenhouse gas emissions in EU by 80-95% until 2050.

Through Energy Community¹, established in October 2005, the EU is also working to integrate neighboring countries in its internal energy market. A broad mix of energy sources and a diversity of suppliers, of transport routes will play an important role in enhancing energy supply. Building reliable partnerships with supplier, transit and consumer countries is seen as a way to reduce the risks associated with EU big dependence on energy imports. In September 2011 the European Commission adopted a Communication entitled "*The EU Energy Policy: Engaging with Partners beyond Our Borders*" (COM (2011) 539 final).

In response to the constant concerns about EU dependence on energy imports, in May 2014 the European Commission to launched *European Energy Security Strategy* (COM (2014) 330 final), which aims

¹ The Energy Community is an international organisation containing the EU, represented by the European Commission, and the countries of Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Kosovo (*in line with UNSCR 1244 and the ICJ Opinion on the Kosovo declaration of independence*), Moldova, Montenegro, Serbia, and Ukraine - these countries are known as the 'contracting parties'. It aims to extend the EU's internal energy market to South Eastern Europe and the Black Sea region.

at ensuring a stable and abundant supply of energy. Energy Efficiency Directive from 2012, which focuses on energy efficiency in buildings, better management of consumption, energy audits, will be replaced by a new directive this year. New measures in the energy field are going to be announced later this year with the aim to increase EU GDP by 1% until 2030, i.e. a surplus of €190 billion for EU economy and creation of 900,000 new jobs. The new package will cover renewable resources, energy efficiency - particularly in the building sector, design of a new electricity market and governance of EU Energy Union.

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