

OVERVIEW OF THE ROMANIAN FOSSIL FUEL MARKET BETWEEN 2002 AND 2012

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Abstract

In a context in which the energy needs seems to increase fast and the limited stocks of fossil fuels can generate negative impacts on human society, biodiversity and environment, the policy makers proposed several economic models for achieving sustainable development, like green economy, which appears to promote the necessity of decreasing fossil fuel consumption and of increasing energy savings. This paper aims to emphasize the evolution of fossil fuel market, and the electricity generated from fossil fuels since 2002, and especially after 2010, when in Romania were taken some measures for implementing the principles of green economy. In order to see their effects, this research presents an historical analysis for Romania based on the data obtained from European Commission and Romanian Institute of Statistics. The results indicate decreasing trends of primary energy production and consumption, and decreasing trends of electricity generation from fossil fuels due to the more and more use of renewable and nuclear energy sources. The results highlight the need of taking more actions in the energy sector by promoting even more the renewable energy production and consumption for reducing the fossil fuel use, and by promoting, also, a more efficient use of fossil fuel resources for a sustainable future.

Keywords: fossil fuels, electricity generated from fossil fuels, energy regulation, green economy, historical data analysis, Romania

Introduction

The changes in the fossil fuel market influence both the environment and the human welfare, and represent an important factor for achieving the sustainable development in Romania. Considering the green economy, which has also objectives in the energy sector, it could easily be emphasized the impact of fossil fuels on the current activities of mankind. They are not influencing only the sectors directly dependent on them like transportation and energy sector, but also the ones indirectly dependent on them like agriculture. As a result of these issues, and especially considering that these resources are limited, it can be said that their management is an important priority for any state, especially in the current context of high uncertainties and fast changes. In the European Union, the strategy in the energy sector is oriented toward diminishing the consumption of fossil fuels and increasing the energy efficiency. This strategy could indicate the wanted results only by applying by all Member States, with consciousness and transparency, all the regulation and measures specific and needed for each country. According to European Commission (Eurostat, 2014), Romania had in 2012 compared to 2005 an increase of 8.4% in energy saving in primary energy consumption, value which exceeds the European average. Another good direction for Romania in the energy sector is the change of the legislative framework starting with 2008, and the fact that until 2013 had one of the most attractive scheme for promoting the energy production from renewable energy sources from Europe, which attracted many foreign investors who have strongly developed the wind and solar energy production after 2011. This improvement in the legislative framework, and poor development of industry led to a decrease in the use of fossil fuels for energy, but also led to increases in the electricity prices at final consumers. As “Jamásb [5] sustains, these price increases produce losses in the population welfare and the risk that these services it could no longer be affordable for the poor population”. Moreover, “the regulations must be always improved in order to ensure the liberalization of markets” [5]. In this regard, the electricity and gas prices should reflect both the level of costs and the impact on environment and human health. Of course that the last variable is difficult to be monetarily evaluated, but should be integrated at least one minimal monetary value of the impact.

In this context, this paper aims to present the legislative framework from Romania and the market organization for the energy obtained from fossil fuels and renewables. Also, we want to highlight the evolution of some important indicators of the Romanian fossil fuel market and to emphasize the evolution of the prices of electricity and of gas. This study analyses the fossil fuel market from the point of view in which these resources are used for obtaining electric and thermal energy. In order to fulfil the objectives of this study were used national and international databases such as data from European Commission, from the Romanian Institute of Statistics and the International Environment Agency. At the end of this research were presented the conclusions regarding the status of the fossil fuel and electricity market.

1. The energy sector: policy, regulation and market organization

Like the rest of the economic sectors, the energy sector has seen big changes both at national level and at European Union level in order to solve big challenges, like pollution, economic crises and poverty of population, by applying policies and innovative economic models, like the green economy [11]. The European Union promotes the objectives of green economy by assuming the fulfilment of targets proposed by each Member State in the field of energy. Green economy promotes the reduction of fossil fuel use and desire to find new energy sources for the development of human activities, because these are limited resources that will be available just a few years now on considering the growth of population worldwide and the increase of energy consumption over the existing capacity of support of the environment. So, in the future, must be used new renewable sources of energy in order to satisfy the current and the future consumption of energy. Also, a desired objective of European Union, which could be fulfilled through green economy, is to decrease the use of fossil fuels in the electricity production by using renewable energy, and by increasing the energy efficiency. All of these objectives of green economy must be fulfilled because of the fossil fuels' impacts on environment and on human health. In the scientific literature are studies about these impacts which showed negative impacts of fossil fuel use, like increasing the level of pollution, contaminating the soil, the groundwater and so on [2]. Of course, the contamination of environmental factors will lead to the degradation of human health and of Earth's biodiversity.

The Romanian Energy Strategy for 2020 adopts the objectives set at European level in the energy sector, and, by taking the appropriate measures, aims to ensure the safety and security of the national energy sector.

In order to align the national legislation at EU directives, Romania has adopted the following major pieces from the legislative framework:

- Law no. 23/2014 approving Government Emergency Ordinance no. 57/2013 amending and supplementing Law no. 220/2008 on establishing the promotion system of energy production from renewable energy sources, published in the Official Gazette, Part I no. 184 of 14.03.2014.
- GEO 106/2013 amending and supplementing Petroleum Law no. 238/2004, published in the Official Gazette, Part I no. 767 of 9.12.2013.
- Order no. 50/2013 for the approval of the General Rules concerning the centralized gas market, published in Official Gazette, Part I no. 436 of 07.17.2013.
- Electricity and Natural gas Law no.123/2012, published in Official Gazette, I Part, no. 485 of 16.07.2012.
- Resolution no. 1661/2008 approving the National Program for increasing energy efficiency and the use of renewable energy sources in the public sector for 2009-2010, published in Official Gazette, Part I no. 858 of 19.12.2008.
- GO No. 22/2008 on energy efficiency and on promoting the use of the final consumers of renewable energy, published in Official Gazette, Part I no. 628 of 29.08.2008.
- Resolution no. 638/2007 regarding the full opening of electricity and natural gas markets published in Official Gazette, Part I no. 427 of 27.06.2007.
- Resolution no.1069/2007 approving the Romanian Energy Strategy for 2007-2020, published in Official Gazette, Part I no. 781 of 19.11.2007 [9].
- Resolution no. 1007/2004 for the approval of electricity supply to consumers published in Official Gazette, Part I no. 673 of 27.07.2004.
- Petroleum Law no. 238/2004 published in Official Gazette, Part I no. 535 of 15.06.2004.
- Mining Law no. 85/2003 published in Official Gazette, Part I no. 197 of 27.03.2003.
- Resolution no. 1248/2002 on the amendment of Regulation for licensing and authorization in the gas sector, approved by Government Decision no.784/2000, published in Official Gazette, Part I no. 840 of 21.11.2002.

The regulations presented above stipulate the national framework for using, transporting, distributing, storing the fossil fuels, measures to increase the energy efficiency, ways to finance investment projects and all other conditions for organizing and functioning of each sub-sector's markets. Although the legislative framework between 2008-2013 was favourable to green energy investments, starting with 2013 this was seen as being unstable, because was adopted the Emergency Ordinance no. 57/2013 for amending and supplementing the Law no. 220/2008 on establishing the promotion system of energy production from renewable energy sources, which was published in Official Gazette, Part I no. 335 of 07.06.2013. This Emergency Ordinance established the fact that the green energy investors will receive a smaller number of green certificates than before, situation which affected directly the financial projections made by investors, and by other stakeholders of green investment projects. The decision of diminishing the green certificates was good, because the final consumers were supporting the huge financial benefits of energy investors obtained from green certificates, but the timing was not right. This decision should have been implemented from the beginning, since 2008, but the lack of fair and transparent analysis, and the political and the legislative instability led to the emergence of this situation.

Enhancing competitiveness on the energy market, especially in what concerns the fossil fuel use, is determined by the implementation of major investment projects. These projects have a high economic value which require big investments that is why this could be one of the reasons why Romania has only one transport operator for natural gas named SNTGN Transgaz S.A. and only one transport operator for electricity named C.N.T.E.E. Transelectrica S.A.. In 2013, were a number of 6 natural gas producers (www.anre.ro) and a number of 39 license holders who ensure the supplying of gas to final customers [8], among which are found the European leaders: E.On Energie and GDF Suez

Energy [10]. According to the National Authority for Energy Regulation (www.anre.ro) Romania has 620 producers of electricity, 190 suppliers of electricity, 41 producers of thermic energy and 6 producers of energy from cogeneration. Both for electricity and natural gas are two types of energy markets: the regulated market and the competitive market. The regulatory authorities regarding the fossil fuels are: the National Authority for Energy Regulation and the National Agency for Mineral Resources. Since 1990 the Romanian economy has change and is still changing, especially regarding the liberalization of markets. So, in 2001 began the gradual opening of the natural gas market with a percentage of 10% [1] reaching today at an opening percentage of the market of 100% for all consumers, but in reality this percentage is much lower.

The market share of the largest electricity generator has decreased with 5.7% in 2011 compared to 2004 with a fluctuating trend during 2004-2011. It reached the minimum in 2011 with 26% of the market and the maximum in 2005 with 36.4% of market share. Compared with the other Member States, in 2011 Romania was placed 5th according to the small size of this indicator after Poland, Spain, Lithuania and Finland. In 2010 Romania was on the 8th place and in 2009 she was also on the 5th place. Almost all Member States have a decreasing trend between 2000 and 2011, this indicating an increased competitiveness of the energy sector at European level. One of the explanations of this minimum could be the development of the renewable energy producers starting with 2011. It should be interesting to analyse what will happen after 2011, but the trend seems to be to implement measures to increase energy efficiency together with the promotion of renewable energy.

2. Fossil fuels in Romania: potential, production and consumption

The fossil fuel resources are limited and the population needs are increasing, so permanently evaluating their use and analysing the factors which influence the fossil fuel evolution are required for designing sustainable development strategies. The European Union [3] proposes the increase of renewable energy consumption in order to achieve energy security by reducing the imports of fossil fuels. In this regard, seems desirable to promote the diminution of fossil fuel production and consumption because of the limited stocks which seems that fossil fuels would not allow the achievement of energy security on long term.

The Romanian Energy Strategy for 2007-2020 estimates the Romanian potential of fossil fuel resources. The coal reserves are estimated to be sufficient for the current consumption for about another 220 years. The oil and natural gas reserves are estimated to be sufficient for current consumption for about another 10 years. (Resolution no.1069/2007) These forecasts could depend on how much fossil fuels we will consume and on the findings of new energy stocks available for consumption.

During 2002-2012 the opening stock of natural gas had an increased evolution, with a growth of 235.8%, although the gas reserves are lowering. The opening stock of coal has decreased with 41.82% during the entire analysed period of time while the opening stock of crude oil has increased with 11.62%. It can be noticed that after 2010 the opening stocks have started to shrink, especially in the case of natural gas. This can be attributed to the policies that aim to create a green economy, which among others had the effect of increasing the use of renewable energy. It is presented the evolution of the opening stock of primary energy resources in Romania (figure 1).

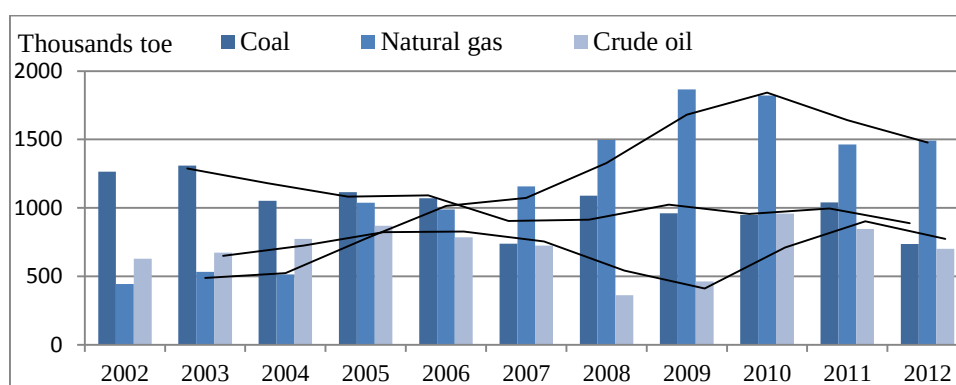


Figure 1. The opening stock of the primary energy resources

Source: based on the data from Romanian Institute of Statistics, www.insse.ro, 2014

The legislative framework and the public opinion should be very important in what concerns the available opening stocks from Romania that is why the decision makers should reevaluate the ways of giving the permits for using the Romanian energy resources taking into consideration without hesitation the human health and the environmental aspects. In this respect, it should be respected the rights of the population, and the principals of environmental protection.

In what concerns the production and the consumption of fossil fuels, they both had decreased after 2002, but this decline can be attributed on account of poorly developed industries. The evolution of the production of the primary energy resources is illustrated in (figure 2). As can be seen the productions of crude oil and of natural gas have decreased with 34.6% and 15.5% compared to 2002 while the production of coal has increased with 3.73% compared

to 2002. Overall, primary energy production has followed a downward trend over the whole analysed period, having a drop of 15.3%.

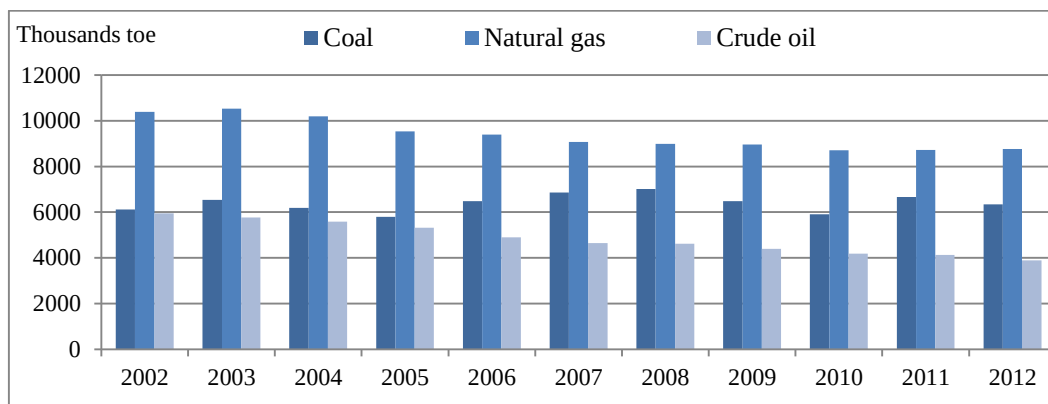


Figure 2. The primary energy production during 2002-2012

Source: based on the data from Romanian Institute of Statistics, www.insse.ro, 2014

The decreased production is determined by the evolution of consumption. Compared to 2003, in 2012 the gross inland consumption was smaller by 22.2% per total fossil fuels consumed. The highest decrease of gross inland consumption was in the case of natural gas with a percentage of 26.6. The gross inland consumption of solid fuels was decreasing with 19.3% and for petroleum products with 18.7% during 2003-2012. In 2012 the consumption has dropped compared to 2011. This could have been influenced by the increase of electricity and gas prices. In the case of electricity, the increase in the renewable energy production has led to an increase of prices, mainly due to the green certificates scheme, because the costs of green certificates were attributed to the final consumers. We presented the evolution of gross inland consumption of fossil fuels (Table 1).

Table 1. Gross inland consumption by type of fossil fuel during 2003-2012

Gross inland consumption	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
	Thousands toe									
Solid fuels	9423	9311	8787	9514	10145	9602	7555	7008	8161	7603
Natural gas	14729	13937	13923	14198	12762	12159	10580	10788	11105	10812
Petroleum products	10767	10293	10286	10918	10842	10565	9294	9309	9328	8758
Total fossil fuel	34919	33541	32997	34631	33749	32328	27430	27106	28595	27175

Source: based on European Commission database, Eurostat, 2014

Although the consumption decreased during the analysed period, however, the internal production is not sufficient to meet the energy needs of the Romanian population that is why is resorting to imports. Romania is a net importer even though these have also decreased during 2003-2012. The imports of coal has decreased the most by 62.97% compared to 2003, because the internal production was the only one growing compared to the other fossil fuels. So, the imports of fossil fuels decreased with 31.59% in 2012 compared to 2003. This is a good thing because the reduction of imports will contribute at increasing the degree of energy independence.

By analysing the production and the consumption of fossil fuels we can argue that the positive effects of implementing the measures for achieving the targets of green economy are still expected to occur, because Romania still has problems regarding the increase of energy efficiency, the ways of using these resources, the diminishing of fossil fuel consumption, the management of renewable energy. An important key in this matter is represented by the legislative framework and by the public policies implemented in the energy sector, of course related to all other sectors of the national economy.

3. The electricity obtained from fossil fuels

The green economy promotes the use of renewable sources of energy in order to reduce the fossil fuels use because these contribute at increasing the greenhouse gas emissions which have negative effects on environment, biodiversity and human health. In this context and considering that our society needs the electricity to develop the daily activities it is appropriate to analyse the fossil fuels consumed for producing electricity. So, according to the International Energy Agency [4], in Romania, the electricity generation from fossil fuels represented in 2011 approximately 50% from the total electricity generation. Since 2003, the electricity generated from oil and natural gas had a decreasing trend while

in the case of coal and peat was an increasing trend. The reduction in the electricity generation from the first two presented fossil fuels is actually compensated by the increase in the electricity generation from coal and peat. The highest share of electric energy is produced in the thermoelectric plants which use mainly fossil fuels. In 2002 the production of electricity from thermoelectric plants had a share of 60.76% of the total electricity produced by all electric plants and in 2012 has reached to a share of 55.22% of the total electricity produced by all electric plants. Moreover, the use of fossil fuels in the thermoelectric energy production has declined to 72.7% in 2012 from 84.8% in 2002 of the total electric energy produced in this plants, but the minimum was reached in 2010 with 70.2% fossil fuels used. After 2010, we found an increase in the total share of fossil fuels used for thermoelectric plants, but a decrease with 12.1% for the entire analysed period of time. Although the electric energy produced in thermoelectric plants has decreased with 2.31% in 2012 compared with 2002, this fact is mainly caused by the increased production of nuclear-electric plants and of renewable energy plants like wind farms. In 2012 the production obtained from thermoelectric plants was of 32.6 million MWh while in 2002, respectively 2003, the production was of 33.3 million MWh, respectively 38.4 million MWh. We illustrated (figure 3) the evolution of the use of each type of fossil fuel in producing thermoelectric energy.

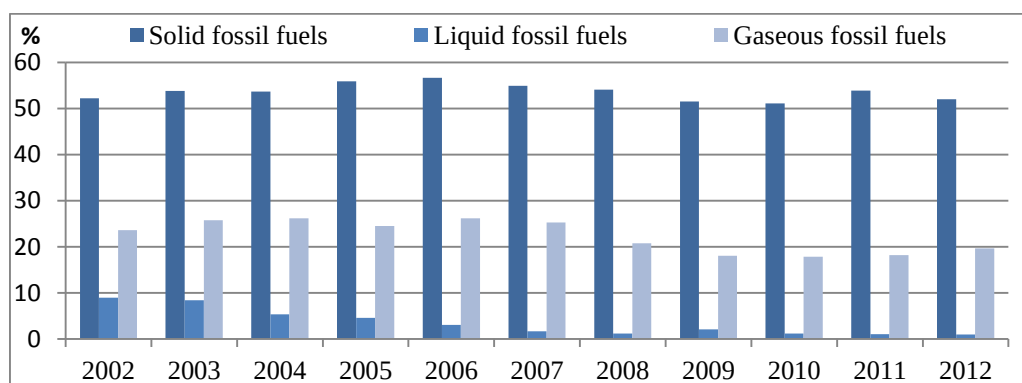


Figure 3. The type of fossil fuel used for thermoelectric energy production
Source: based on data from Romanian Institute of Statistics, www.insse.ro, 2014

It could be noticed (figure 3) that the solid fossil fuels like coal and waste have the smallest decrease with only 0.38% between 2002 and 2012. The liquid fossil fuels (heavy fuel-oil) have incurred a big decrease, of 88.89%, during the analysed period of time and the gaseous fossil fuels (natural gas) have had a decrease of 16.53%. These decreases in the fossil fuels use show that have been taken a few measures in order to diminish their use, and by doing that are applied the green economy's objectives. However, it is important to analyse if the decreasing electricity generation from fossil fuels was not also due to the decrease of electricity consumption. So, after was analysed the statistical data about electricity consumption, was obvious that this indicator have had a growing trend during the hole period of time, with an increase of 19.1% in 2012 compared to 2002. Even though in industry and in the transport sector the electricity consumption decreased, the overall increase is due to the other sectors. For example, the electricity consumption of households has increased with 54.86% in 2012 compared to 2002. This increase is not due to a more use of fossil fuels, but is due to a renewable and nuclear energy increase (IEA, 2014). Moreover, the level of electricity consumption in Romania is smaller than the entire quantity of electricity generated in this country; thereby Romania is a net exporter of electricity with almost a third of the total produced electricity.

The decreasing electricity generation from fossil fuels was due to the more and more use of renewable and nuclear energy for producing electricity, meaning that small steps in diminishing the use of fossil fuels are taken in Romania. The public authorities must design and implement the energy policies in a transparent and efficient manner for achieving the objectives of green economy and to create the sustainable energy system, so much desired at international level. The trend of these public policies and programmes must be towards improving the energy infrastructure to be able to support renewable energies obtained at small as possible costs, even in the short term, because, in the context in which the electricity consumption is increasing, the impact of fossil fuels would be devastating for human society and for Earth.

4. Historical analyses of the electricity and gas prices in Romania

The electricity and gas prices are influenced by many factors and by the economic crises worldwide. Among that factors are found the evolution of the fossil fuel prices on international markets, geopolitical factors, natural disasters, climatic seasons, and the increasing demand of energy. After 2004, the electricity and gas prices have suddenly grown. The electricity prices for industrial consumers have almost doubled in 2005 reported to 2002, and the gas prices for industrial consumers have registered a smaller increase, by approximately 60% between 2003 and 2005. Some factors of these increases could have been the market opening of gas and electricity in Romania and the policies pursued by the Romanian authorities in this sector. The electricity and gas prices are also influenced by the taxes which are applied by the Romanian authorities and which have increased in the past years.

Analysing the Romanian electricity prices during 2005-2013, we noticed that these reached the peak in 2013 both for households and industrial consumers with 0.089 euro/kWh and 0.0904 euro/kWh and that the minimum price was reached in 2005 with 0.0655 euro/kWh for household consumers and 0.0769 euro/kWh for industrial consumers. After 2010, the minimum level of electricity prices was in 2011 for industrial consumers, namely 0.08 euro/kWh, and in 2012 for household consumers, namely 0.0795 euro/kWh. In 2013 there was a small difference of only 1.5% between the prices for household consumers and for industrial consumers, in the favour of household consumers. In (figure 4) is illustrated the evolution of electricity prices during 2005-2013.

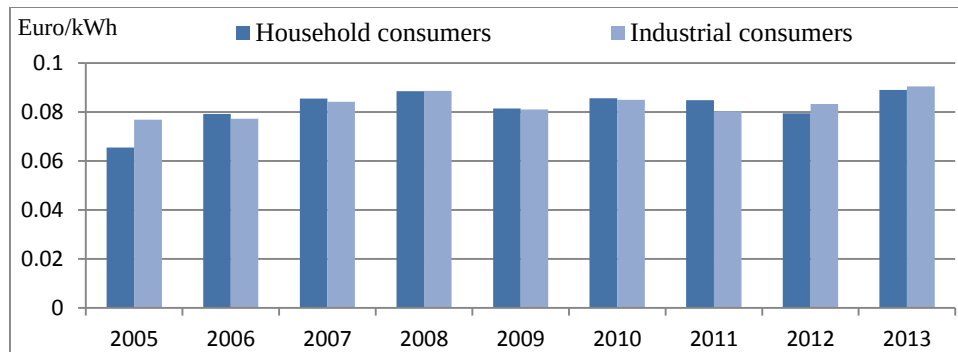


Figure 4. Electricity prices during 2005-2013

Source: based on European Commission database, Eurostat, 2014

Since 2008, when the legislative framework for promoting the energy obtained from renewable energy sources was approved, the electricity prices started to be influenced among other factors also by green certificates. These influence the final consumer prices by increasing the value of the bill. This happened especially since 2011 when investments in wind and solar projects began to grow exponentially due to the existing promoting scheme of energy production.

In 2008 and since 2011, the gas prices for industrial consumers became higher than the ones for household consumers and in 2012 and 2013 could be observed a relatively big difference of the price level for the two types of consumers. The prices of the household consumers were with approximately 26% smaller than the ones for the industrial consumers. Analysing the Romanian gas prices during 2005-2013, it was noticed that the gas prices reached the peak in 2007 both for households and industrial consumers. In 2013, the gas price for household consumers was 4.21 euro/gigajoule while in 2005 this was 4.02 euro/gigajoule and after 2007 the minimum price was reached in 2012 of 3.94 euro/gigajoule. The price level of the gas has increased during the analysed period of 2005-2013 with a small percentage of 4.79 for household consumers and with 56.32% for industrial consumers. The gas prices are influenced by the national regulations, by the liberalization of markets, by the relations with Russia, and by other national and international risks [6]. In figure 5 is illustrated the evolution of gas prices during 2005-2013 in Romania.

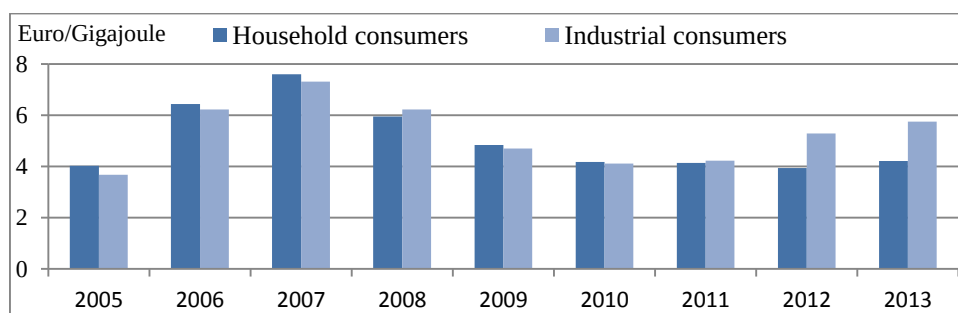


Figure 5. Gas prices during 2005-2013

Source: based on European Commission database, Eurostat, 2014

The reforms in the energy sector, the economic crises and other natural factors influence the gas and electricity prices [7]. The electricity prices did not have the same trend like the gas prices during the analysed period; this is also due to the facts that are different determinants of the prices for electricity and gas. The energy prices are influenced by many factors, like the low competition on the market, the policies pursued by the national governments, the demand for energy, but these influences should be reduced gradually in order to make the energy sector more affordable for the population. Also, the prices should be lower for those countries which use local energy resources, but with a careful management of energy consumption, in the sense that the final consumer trend is to consume more energy when prices are lower, so the waste of energy must be carefully managed.

Conclusions

The European Union, and particularly Romania, pursues a policy of reducing the use of fossil fuels and of increasing the use of renewable energy sources in order to reach the objectives of sustainable development by applying a green economy.

The first part of the paper regarding the policies, regulations and market organization could be concluded with the fact that Romania still has a lot to improve in the legislative framework of the energy sector. Romania still has two types of markets: the regulated market and the competitive one for both gas and electricity market. The lack of a full liberalization market in this sector influences electricity and gas prices and the competitiveness and development of this market.

In the second part, were analysed the fossil fuel production and consumption during 2002-2012 for which we conclude that these both indicators have decreased on the analysed period. The decrease of fossil fuel production by 15.35% was due particularly to the decrease of the crude oil and natural gas production, even though the coal production has slightly increased. The total decrease in the gross inland consumption, by 22.18%, was due to all types of fossil fuels. Although the production and consumption of fossil fuels have decreased, these still have to be carefully managed because of the limited stocks that will last only a few decades from now on in the context of the fast growth of population on the Globe who has more and more increased needs.

In the third part, was analysed the relation between electricity and fossil fuels, particularly the generation of electricity from fossil fuels and their use in the thermoelectric plants. These both indicators have had a decreasing trend due to the increase of the energy production from renewable energy resources, especially after 2008. This situation appears to be positive for the achievement of green economy's objectives in the energy sector and might contribute to climate change mitigation.

The last part of this research analyses the evolution of electricity and gas prices during 2005-2013 and presents some possible drivers of price changes in this sector in Romania. The electricity prices have increased by 35.88% in 2013 compared to 2005 for household consumers and by 17.56% for industrial consumers. After 2011, the prices for industrial consumers became higher than the ones for household consumers. In what concerns the gas prices, these had a fluctuating trend due primarily to the policies pursued by the state authorities. These prices have also increased by 4.79% in 2013 compared to 2005 for household consumers and by 56.32% for industrial consumers. After 2010, in the case of household consumers, the minimum was reached in 2012 for both electricity and gas prices and in the case of industrial consumers the minimum price at electricity was reached in 2011 while the minimum price at gas was reached in 2010. Also, during 2005-2013, the maximum price level for gas was reached in 2007 and for electricity in 2013. These increases may lead to decreases in consumption, fact that will contribute to achieving the targets of green economy and to pursuing the sustainable development of this country.

In conclusion, the fossil fuels are limited resources which must be used rationally, because they influence the activities in all economic sectors. In order to do that the Romanian authorities should create a better legislative framework in this sector, should promote a smaller use of fossil fuel in the electricity production by increasing the efficiency and competitiveness in this sector and should ensure the energy security for Romania.

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