ECONOMIC AND ENVIRONMENTAL ASPECTS ASSOCIATED WITH THE TECHNOLOGIES FOR ELECTRICITY PRODUCTION FROM CONVENTIONAL SOURCES AND MEASURES TO MITIGATE THE PRODUCED IMPACTS

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Abstract: The electricity sector represents the sector with the greatest impact in terms of producing climate change, mainly due to the greenhouse gas emissions generated through the burning of fossil fuels. It is not however the only negative aspect associated to the classic technologies of electricity production. This paper aims to assess the economic and environmental aspects associated to the technologies for the electricity production from conventional sources and as a conclusion of the research it will also propose certain specific measures designed to mitigate their impacts.
Therefore, the analysis will focus on economic issues, such as limited resources of fuels and the significant fluctuation in fuel prices, low energy efficiency, environmental protection expenditures and health issues as a result of the pollution generated by the electricity production and environmental aspects related primarily to the burning of fossil fuels, but also to extraction, transport and storage, aspects concerning the management of waste generated by the energy sector or to the risks associated with the process of producing electricity. In the final part of the paper a few measures will be proposed to mitigate the impact on the environment and economic development of such technologies, as well as increasing energy efficiency, promoting renewable sources of energy, carbon dioxide capture and storage, limiting deforestation, afforestation or the prevention of accidents in the energy sector.

Key-words: conventional sources, fossil fuels, greenhouse gases emissions, energy efficiency

JEL classification: Q32, Q35, Q40, Q42, Q54

1. Introduction

The energy sector represents the sector with the most important contribution to the generation of greenhouse gas emissions, mainly through the burning of fossil fuels. Given the association of greenhouse gases emissions with climate change, the technologies that produce electricity from conventional sources are the most responsible for producing climate change. Under these conditions, the energy from alternative sources is gaining momentum at global-scale.

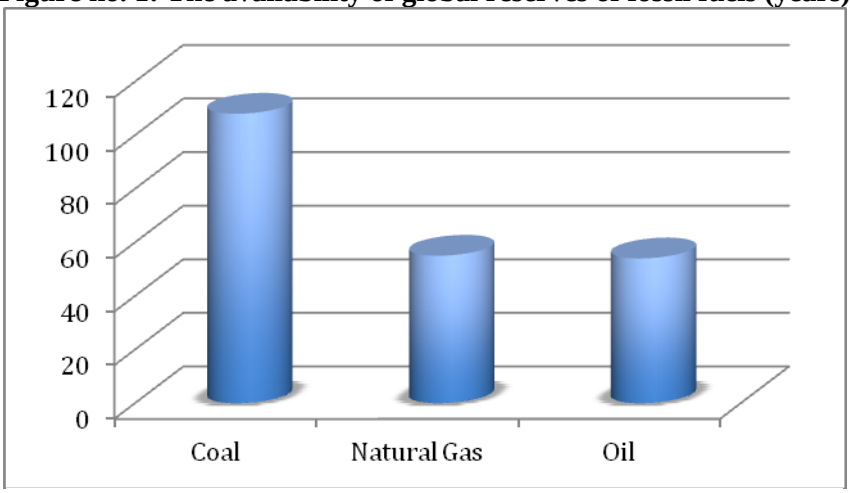
At the same time, having in mind that, besides the negative impact on the environment of the classic technologies for the electricity production, by producing climate change, there are economic problems associated to the energy-climate change relationship. In the following we will be analyse both the economic and the environmental aspects associated to the technologies to produce electricity from conventional sources.

2. Economic issues associated with the technologies for electricity production from conventional sources

2.1 Limited fuel resources and the significant price fluctuation

A first important aspect related to the conventional technologies is represented by the limited resources of fossil fuels and their significant price fluctuation. "Statistical Review of World Energy, a report published by British Petroleum (BP) in mid-2014 reveals that the world has reserves of 892 billion tons of coal, 186 trillion cubic meters of natural gas and 1688 billion barrels of crude oil. According to the mentioned study, albeit these figures seem impressive at a first glance, taking into account the current level of extraction, the proven reserves of coal will be depleted in 113 years, the last cubic meter of natural gas will be extracted by 2069, and until 2067 there will be no reserves of crude oil/the reserves of crude oil is about to run out by 2067.

Figure no. 1: The availability of global reserves of fossil fuels (years)



Source: BP Statistical Review of World Energy - 2015 Main Indicators

Fossil fuel reserves are concentrated in a relatively small number of countries. According to experts, 80% of coal reserves are located in only six countries, the European Union having only 4 percent of the stock. The EU share in total world gas reserves fell from 4.6% in 1980 to 1.3% in 2009. It is expected that these reserves will be depleted before the year 2030. Over half of global stock is found in only three countries: Iran, Qatar and Russia (24% in 2009), the latter representing a leading provider of gas for the EU. Ten countries (eight of which are members of the Organization of the Petroleum Exporting Countries - OPEC) own 80% of the world reserves of crude oil. Some of these countries can exercise their power to restrict the supply and to influence the price.

EU dependence on fossil fuels registered an upward trend, currently reaching approximately 55% of total consumption. Some Member States (e.g. Estonia, Italy, France and Sweden) have considerable stocks of shale gas. A reduced external supply can encourage them in to exploit these resources. It is estimated that in the Arctic region exist substantial quantities of crude oil, approximately 90 billion barrels, while the European Union reserves are around 12 billion barrels).

Besides the global consumption of fossil fuels, another important aspect is related to the fluctuation of prices. The quantities extracted from fossil fuels will fluctuate depending on economic conditions and, at the same time, their price will fluctuate. In other words, the quantities extracted will decrease when the price will be too low for these fossil fuels to be recovered economically advantageous, and they will increase when prices will cover the economically loss of fuel reserves. In addition, the price trend of fossil fuels affects the consumption. On the other hand, the price fluctuations affects other variables such as inflation, global GDP growth, etc. Consequently, the size of the reserves of fossil fuels depends on their price.[1]

2.2 Energy efficiency

The efficient use of energy, entitled "energy efficiency" represents the objective to reduce the amount of energy required to deliver products and services. Low energy efficiency represents a higher cost to produce the same quantity of energy. The problem of energy efficiency constitutes an important economic aspect on electricity production.

[1] Bharat, R., Onkar, S., (2012), *Global Trends of Fossil Fuel Reserves and Climate Change în the 21st Century*

There are many motivations for implementing measures to improve energy efficiency. Reducing the use of energy reduces costs and that may lead to a reduction in the costs to the consumer, where energy savings offsets any additional cost of implementing a cost-effective technology.

By the efficient use of energy, the energy bills of the European citizens can be reduced, they can reduce their dependence on external providers of oil and gas, and it can also help protect the environment. An important aspect is that the energy efficiency can be increased throughout the energy production. At the same time, the benefits of increasing energy efficiency must be higher than the costs. Therefore, the EU measures should focus on the sectors with a higher the potential for savings.[2]

2.3 Environmental protection expenditures

The expenditures on environmental protection represents another relevant aspect within the economic relationship energy - climate change. Accordingly, the costs associated with activities aimed to the direct prevention, reduction and elimination of pollution or environmental degradation must be taken in consideration. The statistics on environmental expenditures allows the identification and measurement/quantification of the society's response to environmental issues and the ways to finance this activity.

Environmental protection expenditures can be analysed according to the type of activity that requires such expenses. There are three main sectors: the public sector, industry (mining and quarrying, manufacturing, electricity production, the supply of water and natural gas) and specialised producers of environmental services, such as collection, treatment, recovery and disposal of waste, these services being provided by the authorities or private companies.

Most of the amounts representing expenditures for environmental protection in the EU – about EUR 145 billion – was directed towards specialised producers of such services, over half of the amount (51.1%) of the total expenditure, the other half being divided between public sector spending (EUR 87.2 billion) and expenditures in the industry sector (EUR 51.6 billion). During 2003 and 2013, the expenditures targeted to specialised producers in the EU have increased by more than two-fifths (41.8%) calculated at current prices. At the same time, environmental protection expenditure of the public sector have increased by 40%. By 2013, the costs in the industrial sector had overcome with more than 21.3% the values recorded in 2003. This means that the environmental protection in the industrial sector had recorded low values early in 2000 and 2009. In both cases, these reductions have been linked to a reduced industrial activity, i.e. the decrease in 2009 can be associated with the global financial crisis.[3]

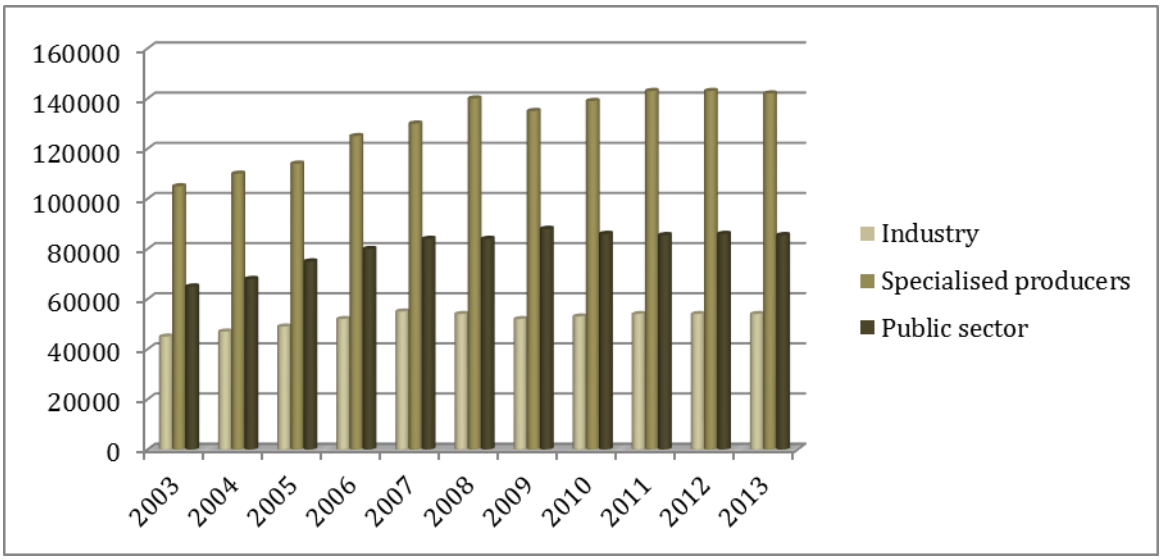
This fact is also confirmed by reversing the growth trend of spending on environmental protection in the European Union during 2008-2009. It was registered a reduction of 7.8% of the expenditures in the industry sector, while expenditure on specialised producers have decreased by 5.7%. In contrast, public-sector spending increased by 5.1%. During 2010-2012, industry and specialised producers have seen their spending increased, while public sector spending declined in 2010-2011, before an increase in 2012. In 2013, the expenditure of the public sector have fallen once again, as well as those recorded by specialised producers, while the industry has seen only a small increase.

The ratio of expenditure on environmental protection and the gross domestic product (GDP) is an indicator representing the importance of environmental protection in relation to the economic activity. In the European Union, for the specialised producers the ratio was of 1.11% of GDP in 2013, compared to 0.67% for the public sector and 0.40% for industry. Expenditure on environmental protection specialised producers (as a percentage of GDP) surged 0.10% between 2003 and 2013, while the same ratio for the public sector grew by 0.06%. In contradiction, the expenses incurred by the industrial sector fell slightly in relation to GDP between 2003 and 2013 (-0.02%).

Figure no. 2: Trends in spending on environmental protection in the European Union during 2003-2013 (EUR million)

[2] European Parliament, (2012), *Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC*

[3] Eurostat, (2015), *Enivironmental protection expenditure*



Source: Eurostat

Table no. 1: Total environmental expenditure o of the EU Member States during 2003-2013 (EUR million)

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
EU - 28	65651	74248	81154	83932	84123	88446	86427	86251	87340	87183
EU - 15	63029	69014	75346	79344	77883	83722	80568	79498	80915	81273
Euro area (19 countries)	51598	53164	55009	57139	59007	64849	60669	60921	61235	61190
Belgium	1717	1599	1812	1831	1954	2066	2152	2589	2355	-
Bulgaria	68	86	104	161	209	223	183	231	293	425
Czech Republic	-	-	599	477	541	609	774	795	857	724
Denmark	-	-	-	1262	1302	1405	1421	1300	1360	1597
Germany	8420	8140	8220	8020	8070	8110	8270	-	-	-
Estonia	19	25	21	25	25	41	23	50	-	-
Ireland	-	-	-	-	-	-	-	-	-	-
Greece	-	-	-	-	-	-	-	-	-	-
Spain	2618	3041	2777	3121	3186	3507	2638	2750	2298	-
France	8891	9650	9827	10355	11023	11398	11570	11646	12065	-
Croatia	-	23	31	154	10	11	33	142	113	139
Italy	12073	12324	11902	12378	13190	13562	13624	13860	-	-
Cyprus	41	-	-	-	-	-	103	103	76	84
Latvia	6	96	116	198	201	163	104	137	163	-
Lithuania	58	10	181	255	274	319	375	290	298	195
Luxembourg	187	218	215	195	191	241	216	223	240	259
Hungary	573	692	620	317	270	284	446	389	407	-
Malta	62	70	80	92	92	93	124	80	95	-
Netherlands	-	7620	-	9022	-	8504	-	8626	-	-
Austria	1787	1742	2077	2047	1652	1643	1419	1253	1358	-
Poland	610	860	1281	1328	1469	1490	1751	1966	2015	1878
Portugal	696	736	749	831	935	1000	889	828	841	723

Country	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Romania	134	186	527	716	804	699	1012	1254	787	647
Slovenia	257	236	219	246	285	321	259	290	246	-
Slovakia	94	99	117	131	155	168	187	214	228	204
Finland	887	821	957	981	1045	1013	1146	1116	1231	-
Sweden	979	1172	1232	1192	1146	1057	1175	1275	1388	1397
United Kingdom	8747	-	17800	19931	16680	16647	17647	16453	17465	-

Source: Eurostat

2.4 The impact of pollution generated by the energy sector on public health - costs

In the process of producing electricity through the burning of fossil fuels, significant quantities of greenhouse gases are emitted, as well as a number of other specific pollutants (SOx, NOx, metals, etc.), which may cause adverse effects to the population health, both in the short (acute) and long-term (chronic diseases).

Accumulation of toxic contaminants in the body can trigger severe allergies, asthma and other diseases of the respiratory tract. According to statistics, the number of people affected by such disorders has increased, and any sick person represents a cost, both for the state and for all the factors involved. Greenhouse gases do not have a direct effect on human health, so do not generate conditions through the direct impact of pollutants. Long-term effects can be associated only with the consequences of global warming.

Considering these issues, it is necessary to increase the expenditure for the treatment of patients with chronic or acute respiratory disorders, sustained efforts being needed, because not treating can lead to the death of patients. According to a 2011 statistic published by the World Health Organization, it is estimated that urban air pollution generated by the burning of fossil fuels produces 3 million deaths annually, of which approximately 350,000 casualties within the European Union.[4]

3 Environmental aspects associated with the technologies for electricity production from conventional sources

3.1 Extraction, transport and storage of fossil fuels

The activities of extraction, transport and storage of fossil fuels may be harmful to the environment as a result of a series of negative effects they may produce.

In the extraction of fossil fuels, greenhouse gases emissions can be generated. For example, drilling, extraction and transport of natural gas through the pipes can lead to loss of methane, a greenhouse gas that has an associated global warming potential higher than that of carbon dioxide. Preliminary studies and field measurements show that methane leakages varies from 1% to 9% of the total emissions during the life cycle of the extraction unit.[5]

According to the experts, the future fossil fuel exploitation threatens the world's richest areas in terms of biodiversity around the globe, namely, Northern South America and the Western Pacific Ocean. In a study conducted by a group of researchers in environmental protection from Australia, it is indicate that the extraction of fossil fuels can have a double impact on animals and plants. In a recent study conducted by Professor Hugh Possingham from the Centre of excellence for environmental Decisions at Queensland University, the author points out the probability of occurrence of both an evident direct impact and a subtle indirect impact that is considered to be highly detrimental.[6]

Also, both during transport and during temporary storage of fossil fuels, fugitive emissions may occur, including greenhouse gases, particularly in the case of natural gas and crude oil. Pollutant emissions may occur accidentally and have destructive effects for the environment, but also under controlled conditions when well

[4] World Health Organisation, (2011), *Outdoor air quality and health*
[5] Tollefson, J., (2013), *Methane leaks erode green credentials of natural gas*
[6] Possingham, H., (2013), *Biodiversity Risks from Fossil Fuel Extraction*

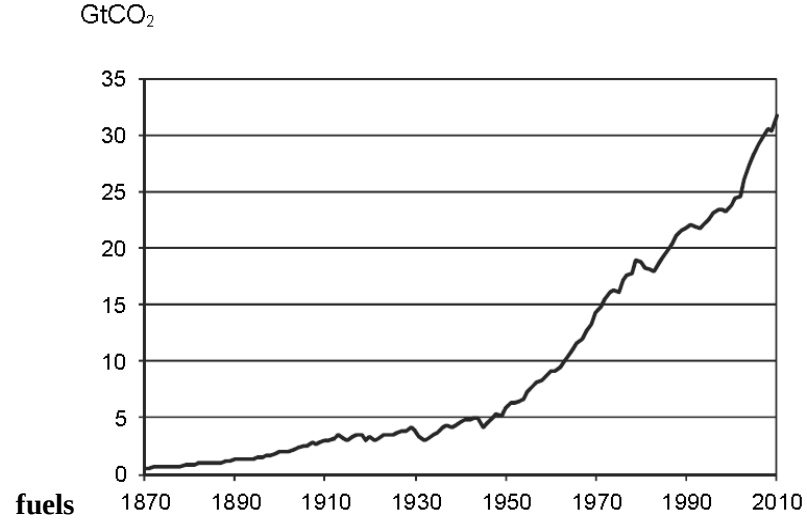
established procedures for such activities are applied. Modern techniques aim at continuously reducing emissions relating to these activities, in order to protect human health and the environment.

3.2 Combustion of fossil fuels

Furthermore, there are a numerous serious environmental problems associated with the use of fossil fuels. . Burning fossil fuels produces about 21.3 billion tonnes of carbon dioxide per year, while it is estimated that natural processes can absorb only half of this amount, resulting thus in a net increase of about 10.65 billion tons of carbon dioxide per year.[7] Besides the carbon dioxide emissions generated by burning fossil fuels other pollutants are also emitted into the atmosphere, their quantity and type depending on the type of fossil fuel (coal, oil, and natural gas), the type, efficiency and operation of the combustion plant as well as the existence of the sequestration facilities of the emitted pollutants.

Figure no. 3 illustrates the evolution of carbon dioxide emissions resulting from the combustion of fossil fuels in the last century and a half.

Figure no. 3: The evolution of the level of CO_2 emissions worldwide resulting from the burning of fossil fuels



Source: Carbon Dioxide Information Analysis Center, Oak Ridge Național Laboratory, US Department of Energy

Coal represents the fossil fuel that emits the most significant amount of pollutants by burning. Coal combustion generates besides carbon dioxide, also other toxic pollutants such as sulphur dioxide, nitrogen oxides and carbon monoxide. At the same time, during combustion are emitted significant quantities of particulate matter. Large quantities of wastes (slag) are generated also.

In the case of natural gas, during combustion to produce electricity significant quantities of carbon dioxide, nitrogen oxides, carbon monoxide and volatile organic compounds are emitted into the atmosphere as well as significantly lower amounts of sulphur dioxide and particulate matter.

3.3 Aspects concerning the management of wastes generated by the energy sector

Waste generated by the electricity production activity through combustion of fossil fuels are ash, slag, retained particles from flue gases, petroleum residues. In the United States of America, these wastes are considered to be "special waste" by the Environmental Protection Agency (EPA) Protection. The management of such wastes being regulated by specific legal acts, other than federal regulations on hazardous waste.[8]

With regard to electrical transformers, equipment that is part of the systems for the electricity transportation, they are loaded with synthetic or mineral oils that may contain polychlorinated biphenyls (PCBs), substances from the category of persistent organic pollutants (POPs). Transformers which have become waste are a major danger for the environment as a result of the occurrence of oil spills, in this case both

[7] US Department of Energy, (2007), *What Are Greenhouse Gases?*
[8] EPA, (2014), *Fossil Fuel Combustion Waste*

the environment and on the long term, the human health can be affected. In Romania, the management of PCBs is covered by HG 235/2007 on the management of waste oils.

Another important aspect is that of the petroleum residue pollution, considering that dumping these residues in water may represent an extremely dangerous element, both to groundwater and surface waters. The consequences can be extremely serious and long-lasting, given the fact that there is a chemical contamination, with negative effects on the conditions of the groundwater and surface water quality, respectively the aquatic flora and fauna.

3.4 Risks associated with the process of producing electricity

The life cycle of a power plant operating with fossil fuel, implies for the operating phase, several main stages associated with the main raw material, the fuel.

For a coal-fired power plant, these stages are: coal extraction (open-air excavation or mine), pre-processing and temporary storage, transport, processing, storage and usage to the electrical plant. The risks are associated mainly to the extraction activities (especially mining) and in-situ storage, as well as the storage in the plant. The main risks are explosion/fire and are generated by the accumulation of methane and other gases desorbed from coal. In mining perimeters there is also the risk of accidental pollution with mine water.

There are a few stages in the life cycle of a liquid fuel power plant, namely: the extraction, transportation, storage and processing of crude oil and transportation and storage of the oil products. Accordingly, the main risks are posed by eruptions/explosions/fires at the extraction wells, explosion/fires at refineries (risks related to the processing and/or storage of crude oil/finished products) and in the premises of the power plants (fuel storage risks). Transport and storage of crude oil/oil products were also associated with the risk of accidental pollution (soil, groundwater and surface water) with crude oil/oil products, as a result of losses/leaks in case of breakage of pipes or tanks.

For a natural gas power plant, the stages in the life cycle consist of extracting, transporting and, if necessary, the storage of natural gas. The main risks are posed by eruptions/explosions/fires at the extraction wells, explosions/fire at the transport and storage systems.

A risk related to all the power plants operating with fossil fuels is represented by the explosions at the steam boilers.

The industrial and transport accidents may have very serious effects on the environment, population and operators.

4 Types of measures to mitigate the impact of the technologies for electricity production from conventional sources on the environment and on the economic development

4.1 Measures to mitigate the impact on the economic development

Improving energy efficiency

According to the experts' opinion, energy efficiency measures are the most advantageous alternative in terms of cost-effectiveness, to mitigate the impact of the energy sector on the economic development. Therefore, a high energy efficiency lowers the costs. By consequence, within the decision-making process should be considered measures to improve energy efficiency throughout the entire chain of energy production.

The 2012 European Union Directive concerning the energy efficiency sets out a set of measures designed to support the European Union's ability to achieve the 20% target regarding energy efficiency. According to the directive, all Member States are required to use energy in an efficient manner throughout the chain, from production to final consumption. At the same time, Member States were required to transpose the directive into the national legislation by the date of June 5, 2014.

The scale of the investments needed to meet the EU's goal regarding the energy efficiency is estimated at around 100 billion euros per year. The European Union has increased the funds available for energy efficiency, but it is necessary to stimulate private investment in energy efficiency through a proper use of public funds, and also through investments and solid support activities for project developers.

Carbon capture and storage (CCS)

Carbon capture and storage (CCS) represents the process by which carbon dioxide from the source of generation, such as the production of energy through combustion of fossil fuels, is transported to a storage site and it is stored, normally in underground geological formations, in such a form that it does not re-enter the atmosphere. The objective is to prevent the release into the atmosphere of large quantities of carbon dioxide (from the use of fossil fuels in energy production and other industries), but also to reduce the impact on the economic development by reducing the amount used for the costs of remediation.

CCS technology represents an important mean of mitigation of emissions from the combustion of fossil fuels to produce climate change. Although carbon dioxide was injected into geological formations for several decades for various purposes, including for the recovery of crude oil, long-term storage of carbon dioxide represents a relatively new concept. The first commercial example has been Weyburn in 2000. Other examples include SaskPower's Boundary Dam Power and Mississippi's Kemper Project. CCS can be described as a technique for purifying the air from carbon dioxide emissions.

Such a facility integrated in power plant began to operate in September 2008 at the power plant Schwarze Pumpe from Germany, operated by Vattenfall, in the hope to answer the questions related to the technical possibilities and economic efficiency. CCS technology applied to a modern conventional plants can reduce the carbon dioxide emissions into the atmosphere by approximately 80-90% compared to a plant without CCS. The International Panel for Climate Change (IPCC) estimates that the economic potential of CCS could set between 10% and 55% of the total effort to mitigate the impact of carbon dioxide by the year 2100.

Capturing and compressing carbon dioxide can increase the fuel requirements of a coal-fired power plant using CCS by 25-40%. These and other system costs are estimated to increase the cost of the produced energy with 21-91%. Implementation of this technology to existing plants would be more expensive, particularly if they are located farther from a storage location. Recent reports suggest that, if the research in this area will continue, by the year 2025 energy production in a power plant that uses coal and CCS technology will be less expensive than at a similar plant, which does not have the CCS technology.

Storing carbon dioxide can be achieved both through injection in deep geological formations, as well as in the form of mineral carbonates. Storage in the ocean is no longer considered feasible because it creates the problem of acidification of the oceans. Geological formations are currently considered as the most promising storage location. National Laboratory of the United States concerning energy technology (The National Energy Technology Laboratory-NETL) reported that North America has a sufficient storage capacity for more than 900 years, considering the current emissions. A general problem is that long-term predictions related to the security concerning the underground storage are very uncertain, because the carbon dioxide can be emitted into the atmosphere.

4.2 Measures to mitigate the impact on the environment

Promotion of renewable energy sources

Promotion of renewable energy sources is the most important measure to mitigate the impact of electricity production on the environment, the gradual replacement of conventional technologies of energy production with alternative technologies reducing the greenhouse gases emissions generated by burning the traditional fuels.

Besides the undeniable benefits in terms of protecting the environment and reducing the emissions, the technologies that use renewable sources have certain economic benefits, including diversifying the energy supply, reducing energy dependence in relation to imports of fossil fuels, supporting economic growth and job creation.

The EU renewable energy Directive lays down a general policy for the production and promotion of renewable energy in the European Union. It is necessary for the Union to cover by 2020 at least 20% of its energy needs using RES, and this goal should be accomplished by achieving the national targets. At the same

time, EU Member States must ensure that at least 10% of the fuels used in transport are derived from renewable sources.[9]

Each Member State has its own resources and own energy markets, which reveals that Member States will have to follow separate paths at the time that they will fulfil their obligations under the Directive regarding the renewable energy sources, including the targets for 2020. In the national plans, the Member States demonstrate how they will meet these targets.

Carbon capture and storage

The implementation within the energy production plants of the technologies for carbon capture and storage can be regarded as a measure with double impact, both on the economy by reducing in the long run of the depolluting costs, and, mainly, on the environment by reducing the greenhouse gases emissions generated by the electricity production through the burning of fossil fuels.

In the experts' opinion, CCS will have a particularly important role in reducing global emissions of carbon dioxide and some specialists consider that this technology will have a more important contribution than the implementation of the technologies that use renewable energy sources.

The amounts invested in technologies of carbon capture and storage should be perceived as a "learning cost", which is covered in time, because the costs reductions generated by CCS technology will be higher compared to its required installation investments.

Limitation of deforestation and afforestation

The forest's role is to act as an absorption sink for the greenhouse gases emissions, including those arising from the electricity production. In this context, it should be immediately acted to limit deforestation, and for a massive reforestation worldwide.

Worldwide, the biggest initiative in this regard is the "REDD" Programme (Reducing Rmissions from Deforestation and Forest Degradation), representing a mechanism which has been under negotiation since 2005 by the United Nations Framework Convention on Climate Change (UNFCCC) and having the objective of limiting climate change by reducing greenhouse gases emissions through consolidating the management of forests in developing countries.

In the past two decades, various studies estimate that changing land use, including deforestation and degradation of forests contributes with approximatively 17-29% of the emissions of greenhouse gases at a global level. For this reason, the inclusion of emissions from land use change is an essential element in order to meet the objectives of the UNFCCC.

The principle of the "REDD" Programme is basically creating a financial value associated with the carbon stored in forests, providing incentives to developing countries in order to reduce emissions through forested land. An important element is that the "REDD+" Programme was developed a framework that not only refers to deforestation or to forest degradation, but at the same time it includes the role of the conservation and sustainable management of forests.

Measures related to waste management in the energy sector

Waste management measures within the energy sector represents an important mean to mitigate the environmental impact of the energy sector. Therefore, for the implementation of these measures all decision makers must be involved, and to stimulate electricity producers, regulations must be adopted in order to lead them to intervene by taking the necessary measures. Therefore, as has been mentioned above, the main aspects of waste management in the energy sector refers to petroleum residues and used transformers that became waste.

Regarding the petroleum residues, the main negative aspects are related to the possibility of accidental spills or leaks of residues from tanks. To solve this problem related to residues from the combustion of heavy

[9] European Parliament, (2009), *Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*

fuel oil, it is necessary the water washout and treating with a 5% solution of calcium hydroxide during collection of deposits.

Transformers which have become waste, particularly old ones (that have PCBs oils) should be collected in specialized centers. At the same time, it is necessary for policy makers to take drastic measures for persons or enterprises that do not comply with the legislation in force regarding this type of waste.

Prevention of accidents in the energy sector

For the prevention of accidents taking place within the process of energy production a proactive attitude should be taken into consideration, which is the only approach which can be successful in this case.

Therefore, measures for the prevention of accidents refer to periodic technical inspection of plants, installation of smoke detection systems, investments in the repairing or replacement of technical installations which are technically or morally used, organizing courses to improve management of the operators, periodic testing of personnel, both physically and mentally, in order to ensure that the personnel can deal with stress to which it is subjected (in particular of staff within nuclear power stations) and severe sanctioning of any deviations in non-compliance with the obligations to submit aspects relating to waste management or environmental protection.

5 Conclusion

Within this paper were presented and evaluated the economic and environmental aspects associated to the technologies for the production of electricity from conventional sources and were proposed measures to mitigate the impacts produced. Therefore, in the case of the conventional technologies for the electricity production we have analysed several economic aspects as the limited resources of fuels and significant price fluctuation, the low energy efficiency, costs related to the environmental protection and health as result of pollution generated by electricity production, as well as environmental issues such as extraction, transportation, storage, and in particular the burning of fossil fuels, management of waste generated by the energy sector or the accidents that take place during the process of obtaining electricity. Regarding the types of measures proposed to mitigate the impact of classical technologies of energy production on the economic development, these are related to improving energy efficiency or implementation of carbon capture and storage technology (CCS), while the mitigation measures of the environmental impacts are related to the promotion of renewable energy sources, the limitation of deforestation and afforestation, to waste management or the prevention of accidents in the energy sector.

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[2] EPA, (2014), *Fossil Fuel Combustion Waste*

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[4] European Parliament, (2009), *Directive 2009/31/EC of the European Parliament and of the Council of 23 April 2009 on the geological storage of carbon dioxide and amending Council Directive 85/337/EEC, European Parliament and Council Directives 2000/60/EC, 2001/80/EC, 2004/35/EC, 2006/12/EC, 2008/1/EC and Regulation (EC) No 1013/2006*

[5] European Parliament, (2009), *Directive 2009/28/EC of the European Parliament and of the Council on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC*

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