BIO-SOCIO-ECONOMIC ADVANTAGES OF USING RENEWABLE RESOURCES FOR ENERGY PRODUCTION

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Abstract

Environmental problems are widely discussed all over the world nowadays. In this essay, we present the great damage that using fossil fuels does to our planet. Pollution and decreasing quality of the environment, along with the perspective of running short in conventional resources demand finding solutions.

In the context of growing population and endless request for electrical and thermal energy,it has become clear that we need to figure out other ways to generate these. I find that fossil combustibles belong to the past and the future is represented by alternative resources that are unlimited and ”green” , such as solar light, wind energy and many others.

This paper intends to objectively analyse the interconnections that arise between the environment and the growth of the demand for energy, emphasizing the devastating effects of pollution created by burning fossil fuels in order to obtain electric and thermal power as well as the current and future possibilities for the replacement of these energy reserves with renewable energy reserves. The whole analysis will be accompanied by case studies and will follow strictly imposed goals by sustainable development.

Key words: renewable resources, conventional resources, energy

JEL code: I14, Q4, Q5,

Introduction

Electrical power and thermal power is one of the basic needs of mankind, but when the satisfaction of this need had begun to affect the climate and implicitly individual health this situation turned into a difficult problem to manage.

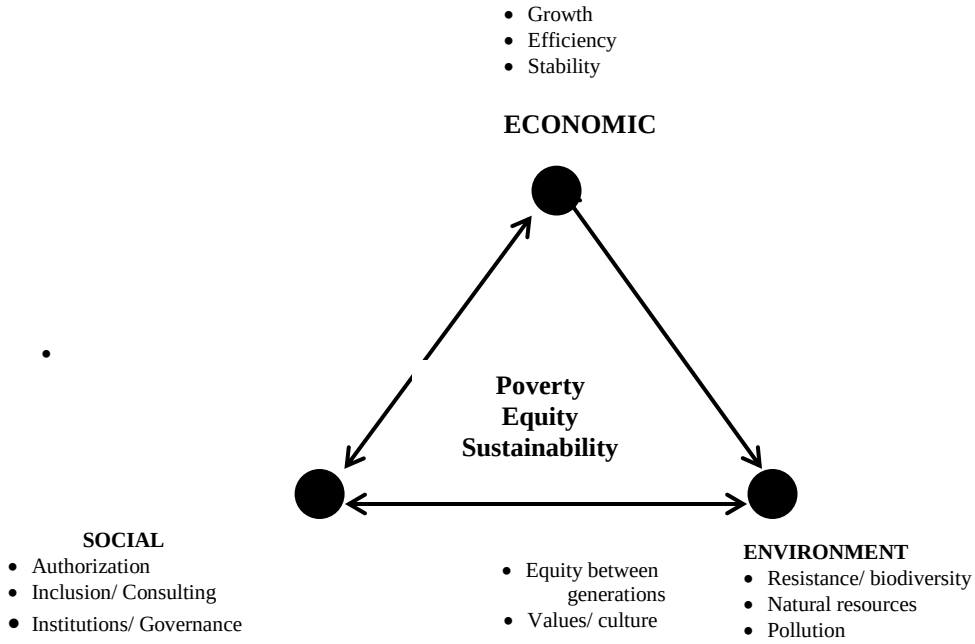
Increasing energy demand seems to be endless. For the first time in decades, energy demand has fallen, but as expected very little, due to recession in which the entire world economy is in. After the industrial revolution cities without precise limits began to appear, with industrial areas developed in the suburbs and with a numerous and growing population. Cities

adapt in order to cope with the supply problems of the population (in these places is self-consumption quite low) and of the industry, of domestic and industry wastes disposal, transportation, insurance of both electrical and thermal energy, thus begin to appear more severe pollution problems. (Binnui Parthan, Marianne Osterkorn, Matthew Kennedy, St. John Hoskyns, Morgan Bazilian, Pradeep Monge: 2010)

1 The negative effects of burning fossil fuels on the social, biological and economic environment

Munasinghe Mahon is considered one of the first researchers focused on studying sustainable development. He was the first to create the triangle or the sustainable development balance (Fig.1), in which he presents the three basic elements, namely: 1. economic - maximizing incomes with the condition of keeping a constant or increasing capital stock; 2. social – maintaining the stability of the social and cultural systems; ecologic - preserving the resilience and robustness of the biological systems.

Fig. 1: Sustainable development triangle



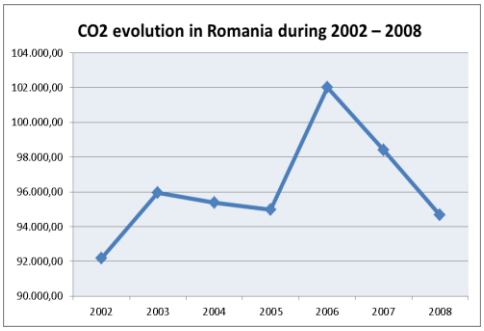
Source: http://www.eoearth.org/article/Sustainable_development_triangle

1.1 Social implications

We start by analyzing the social implications of pollution from John Barry's question: "what is the connection between the social theory and the political practices?", and we entirely agree with him regarding the definition of the environment as the place in which we will grow old in, where our children and grandchildren will be born and raised.

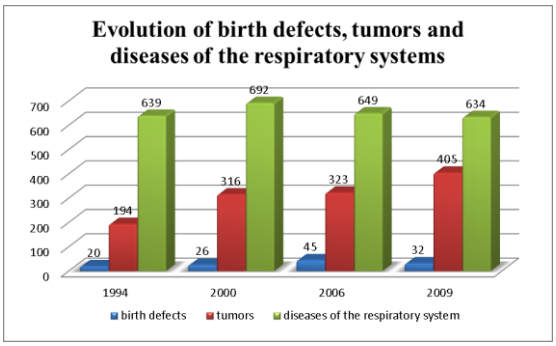
In terms of social development, this includes increasing individual and collective welfare. The analysis of the individual welfare falls into account of the health indicator. Although life expectancy is increasing in most countries, the quality of life at least in some aspects has suffered and here we mean in terms of health. What is life quality of a person suffering from asthma for example, which is the main illness caused by increasing greenhouse gases, a disease that can trigger a deep crisis because that person is near a plant full of pollen and most of all what will be the psychological impact of this crisis knowing that it can be fatal? In addition, labor productivity of a person suffering from asthma is less than a healthy person. So here is another powerful social consequence with micro and macroeconomic effects generated by the increasing levels of environmental pollution. Expressing these implications in exact numbers is impossible because they depend on many factors such as the severity of the disease, the environment in which the affected person is living, the treatment he/she is taking, etc..

Fig. 2: CO2 evolution in Romania during 2002 – 2008



Source:http://search.worldbank.org/all?qterm=co2+evolution&intitle=&as_sitesearch=&as_filetype=

Fig. 3: Evolution of birth deseases, tumors and diseases of the respiratory sistems



Source: *National Institute of Statistics,* avaible on https://statistici.insse.ro/shop/, accesed on 26.10.2011

The social implications of the environmental pollution are many and no matter how we much try we fail to identify them all, as they can be both subjective and objective. In this paper we will focus in detailing the social implications arising from the increasing number of patients (diseases that according to specialized studies have appeared due to increasing pollution) and

hence a lower quality of life, even if this is a composite indicator it has in its composition the health sub-indicator which we will see if it has a descending trend.

The Fig. 2 presented chart clearly shows increasing levels of CO2 in the most periods, fact that increases the number of patients in an alarming rate, which causes a reduction in the quality of life, as we have sustained earlier. We do not think that is sufficient to increase life expectancy only due to the numerous discoveries in medicine and technology if the period of time from a individual's life in which he's healthy is decreasing.

A first explanation which at first sight seems plausible is that the increase in the number of patients is due to the increased life expectancy and therefore the ageing population. But when we take a closer look we see that in the cases of diseases such as: those of the respiratory system and the growth of tumors in the analyzed period was over 50%.

1.2 Ecological implications

In most cases, ecosystems are private just like public goods, which are also considered to be of all, everyone can enjoy them, we may collect their "fruit" but nobody has any obligation to maintain them (process which seems that is currently underway) which will require the adoption of costly alternatives that include strong investments in the natural set necessary for the survival mankind. Each year 1.2 billion tons of CO2 and 2600 tons of radioactive wastes result from energy production in Europe. All these affect life and climate in one way or another. (Emilian Dobrescu: 2009)

Another effect of the global warming is the increasing temperature of the oceans. The described climate models indicate that they will heat up before the atmosphere. Previously there have been few measurements of on the evolution of the water temperature of the oceans but the information provided by oceanographers found an increase of the average temperature of the water in the Pacific, Atlantic and Indian Ocean both north and south in the period 1955-1995 of 0.6 °C between the surface and the deep ocean 1.86 miles (3000 meters). This difference seems small, but given the fact that the oceans play an important role in capturing sunlight from which we deduce that an increase of the ocean water temperature would lead to less solar radiation capture. (Marquise K. Hill: 2010)

In the American state of Alaska, the average temperature increased by 3 °C over the past 30 years, this increase being four times higher than the global average. This fact led to the melting of icebergs in the area much faster than was anticipated in previous years. The research team consisting of experts, professors and researchers from the University of Alaska conducted a series of measurements. Their conclusion was that the melting of the icebergs is faster than ever in that area in comparison to anyplace else, and thus contributing with at least 9% to the increase of Bering Sea level analysed in the twentieth century. (Marquise K. Hill, 2010:196)

The rapid increase of the temperature in Antarctica has affected human and animal life of the region. For example, the number of polar bears has dropped dramatically. But not only the icebergs in Antarctica began to melt but those on mountain peaks too. For example, Kalis Peru Quori glacier in Peru decreased 33 times faster between 1998 and 2000 than it did between 1963 and 1978. In Nepal and Bhutan many lakes around glaciers are dangerously full. If they continue to rise they will flood nearby valleys causing much destruction especially among people living nearby.

1.3 Economic implications

In the following a comparative study has been made on technical and economic implications of the results from the use of fossil fuels, with reference in the case study on coal, fuel oil and methane gas for heating and hot water supply using fossil fuels for a home of 100 square meters.

In the study were considered thermal power plants using coal, oil and gas. The necessary KW of a home with an area of 100 square meters is about 20, which determined the choice in making the present study of those coal plants, fuel oil or gas that has this property.

Tab. 1: Comparative results on heating and providing domestic hot water by using fossil fuels for a home of 100 square meters

Fuel	Coal (Lignite)	Fuel oil	Gas
Capacity	20 kW	20 kW	20 kW
Supplied thermal agent	14 MWh	17 MWh	17 MWh
Seasonal efficiency	50%	50%	50%
Needed fuel	0,1GJ/h	0,1 GJ/h	0,1 GJ/h
Initial costs (investments)	7112 Euro	4110Euro	2156 Euro
Maintanance costs	42 Euro	315Euro	315Euro
Fuel cost	861 Euro	116 Euro	176 Euro
Annual costs	228 Euro	431 Euro	491 Euro
Savings and annual revenues	594 Euro	1665Euro	2081 Euro
Investment regain period	6 months	42 months	16 months
GES emissions	9,8 tCO_2	3,7 tCO_2	6 tCO_2
GES annual reduction of emissions	6,9 tCO_2	4,9 tCO_2	2,9 tCO_2
GES annual reduction net value of emissions	3900 Euro	3160 Euro	1870 Euro

Source: Calculations were made by the author with the help of the RETScreen program.

In the economic analysis we will start by comparing the initial costs respectively the money that is required to be invested to produce and / or purchase of such plants. From the chart below we can see that if the purchasing cost of a coal plant is twice than that of a plant-based on fuel oil or gas. But the cost analysis, in addition to the initial ones must be reviewed and a number of other costs such as: fuel consumption cost, maintenance cost, savings and resulted revenues, investment regain period and other costs.

Fig 4: Comparative analysis regarding the maintenance costs and the used fuel for the production of heat and hot water using the potential of coal, oil and gas

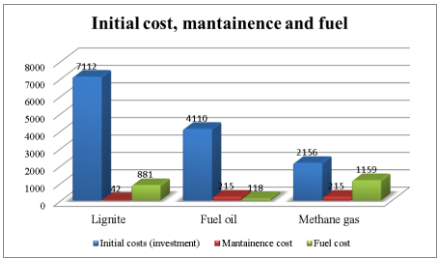
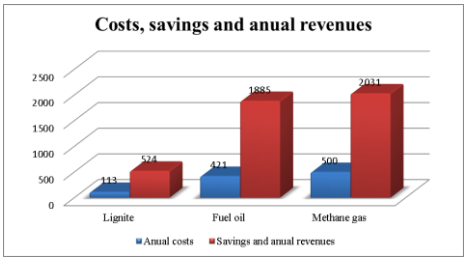


Fig. 5. Comparative analysis of costs, savings and revenues in the case of producing heat and domestic hot water by using the coal, oil and gas



Source: The chart was made by the author with the help of the RETScreen program.

Even if coal plants have higher initial costs, these costs are compensated with those made for maintenance as we can observe in the chart above and they are significantly lower of about eight times than the fuel oil or gas plants.

In the analysis regarding the environmental impact begins with the amount of carbon dioxide emitted into the atmosphere. Notice that the most polluting fuel is lignite which negatively affects air three times stronger than fuel oil burning does, and almost double compared to gas.

Then we will analyze the costs and environmental implications of using renewable resources in order to provide the same amount of kW as when using conventional resources.

Tab. 2: Comparative technical-economic analysis regarding the production of heat and hot water using renewable energy sources

Fuel	Geothermal	Biomass	Heat pump
	Heating a home and domstic hot water		
Capacity	30 kW	30 kW	30 Kw
Supplied thermal agent	16 MWh	17 MWh	14 MWh
Seasonal efficiency	80%	80%	80%
Needed fuel	0,1GJ/h	0,1 GJ/h	0,01 GJ/h
Initial costs (investments)	3203 Euro	2728 Euro	3940 Euro
Maintanance costs	55 Euro	75 Euro	0 Euro
Fuel cost	351 Euro	118 Euro	11,3 Euro
Annual costs	406 Euro	193 Euro	11,3 Euro
Savings and annual revenues	1948 Euro	2081 Euro	1390 Euro
Investment regain period	24 months	18 months	14 months
GES emissions	0 tCO_2	0,1 tCO_2	0 tCO_2
GES annual reduction of emissions	17,5 tCO_2	17,4 tCO_2	17,5 tCO_2
GES annual reduction net value of emissions	11278 Euro	11200 Euro	11278 Euro

Annual reduction net value is calculated at the value of tons equivalent of oil, the data were obtained after the made calculations and they were presented in the appendix, and oil price is the one used on the stock market on the 23.05.2011

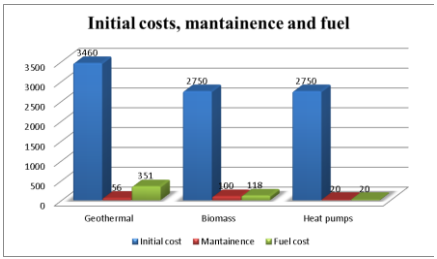
Source: Calculations were made by the author with the help of the RETScreen program.

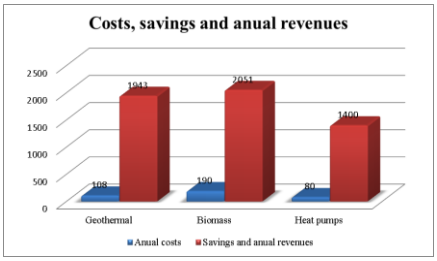
As for the systems based on fossil fuels, plants that have high initial costs, maintenance costs are also inversely proportional to it. For example, the highest initial costs can be found in heat pumps, the cost of these being of about 23% higher, while the lowest maintenance costs are also found in these popmpe, these costs are even zero. This is not the same situation and for energy production using geothermal resources or biomass plants, where maintenance costs variance between 55 and 75 euros.

Fig 6: Comparative analysis regarding the **Fig. 7: Comparative analysis of costs,**

maintenance costs and the used fuel for the production of heat and hot water using the potential of geothermal, biomass and heat pumps

savings and revenues in the case of producing heat and domestic hot water by using the geothermal potential biomass and heat pumps





Source: The chart was made by the author with the help of the RETScreen program.

In terms of fuel costs necessary for thermal comfort and domestic hot water, the highest are in the case of heat and domestic hot water with the help of the geothermal potential and the lowest are obtained by using heat pumps. It should be noted the fact that using the geothermal potential is more advantageous in conditions where it is used by a large number of consumers, whereas, as noted above, the costs are higher than with other renewable energy sources and theinvestment regain period in the first case is as it can be seen from the above table higher. The shorter investment regain period belongs to the heat pumps, period of only 14 months.

In terms of savings and revenues obtained from the use of these renewable energy sources, as shown in figure 7 they are significant, of thousands of Euros. In relation to the initial and maintenance costs, biomass has a major advantage over the other sources, but what it is not mentioned in this calculation are the costs involved, whether the opportunity costs or those of the agricultural work, like seeding or planting, growing and harvesting biomass products entering this category.

In conclusion we cannot say exactly that this source is most economically profitable. Also noted in the chart it can be seen that the geothermal potential is significant, with strong economic and environmental implications. It can be used in an extremely effective manner if it is used by a large number of people, at individual level this is extremely expensive. The effectiveness of these resources can be easily observed from the above mentioned figures thus the development of this sector is undoubtedly a goal for all countries. Only in 2009 worldwide were allocated 174 million dollars for its development,

with $ 12 million more the previous year. (Douglas J. Aren, Alison Wise, Rachel Gelman: 2010)

Fig. 8: Comparative analysis regarding the GES emissions and the annual net reduction from the use geothermal resources, biomass and heat pumps

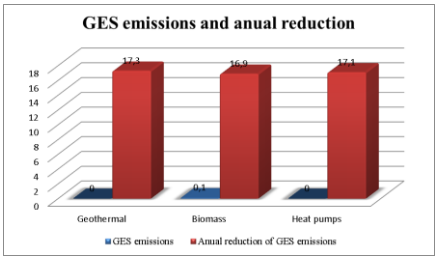
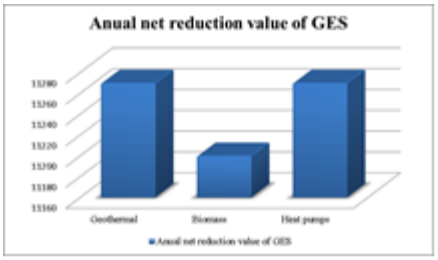


Fig. 9: Comparative analysis regarding the annual net value of reducing greenhouse gas by using geothermal resources, biomass and heat pumps



Source: The charts where made by the author with the help of the RETScreen program.

Figure 8 aims to highlight the amount of carbon dioxide that can be reduced by using these forms of renewable energy the quantity is of tons of CO_2. It is known the fact that renewable energy produce and exudes in the atmosphere a small amount or zero greenhouse gas emissions.

In our example, the only one that issues by firing a tiny quantity of CO_2 is biomass, respectively 0.1 tons. It is worth mentioning the fact that since this category includes products of plant origin that, as it is well known, during their life they absorb a significant amount of carbon in the atmosphere, the absorbed amount is much higher than the one emanated from burning. Therefore, they deserve their place in the category regenerbile resources, because it does not affect the natural balance of the ecosystem. At worldwide level the installed capacity of renewable energy supply is of 125GW, representing about 3% of the total production capacity that is of 3900 GW. (Marc Beaudin, Hamidreza Zareipour, Anthony Schellenberglabe, William Rosehart: 2010)

Conclusion

Through this work we wanted to highlight the social, economic and ecological implications felt by businesses due to the use of conventional resources. In analyzing the economic implications we have highlighted the benefits from the use of unconventional resources. But if we analyze the short-term benefits (without taking into consideration the environmental and

social effects) we could think that they are insignificant due to high initial costs. But if we consider that they do not need any additional costs such as those related to resources' acquisition then we strongly believe that is the best alternative for the production of energy in the future.

In the social analysis we highlighted the need to replace conventional resources with unconventional resources focusing on the negative effects resulting from burning fossil fuels. But there are other specialized studies (Gustave Nguene, Fragnière Emmanuel Roman Kanala, Denis Lavigne, Francesco Moresino: 2011) that describe the manner in which the use of clean resources affect an individual's behavior.

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