THE ECONOMIC IMPLICATIONS OF THE GEOTHERMAL POTENTIAL OF WEST AND NORTHWEST REGION OF ROMANIA

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The energy crises of the 70s led to the vigorous interventions of the industrialized states in the energy sector. On the European political agenda a new problem appeared, namely the one regarding the security of the energy supply. Romania is the third geothermal power in Europe, after Italy and Greece. The energy potential produced by means of geothermal resources of the West and North - West regions is approximately of 144 MWt. The production of a MWt of electricity through conventional sources (in our case study we chose diesel) emits into the atmosphere about 21,673 tons of CO2. If it's used the entire installed capacity in these areas Romania reduces pollution by approximately 6,935,552 TCO2.

Keywords: durability, externalities, renewable, geothermal, energy independence, pollution.

Jel classification: H23 - Externalities; Redistributive Effects; Environmental Taxes and Subsidies

For a long time it has been considered that the production and selling of energy is an area regulated by national policies and direct involvement of the governments. The natural monopole of production and distribution of energy activities and transport activities represents one of the reasons that determined the strengthening of the initial ideas of the governments.
The energy crises of 70s led to the vigorous intervention of the industrialized states in the energy sector. On the European political agenda a new problem appeared, namely the one regarding the security of the energy supply. Costly programs were initiated for the construction of nuclear plants and were allocated grant – in – aids for alternative energy. International Energy Agency was created in order to supervise the allocation of the financial resources and to encourage the diversification of alternative forms of energy. Meanwhile, in a modest way, began to emerge national energy policies and the implementation of agencies. However, some traditionally planned interventions proved to be hasty or even useless, so the capacity of the governments alone to intervene in energy policy began to be questioned.[157]
In the history of the European Communities, the energy policy has been rather insignificant, although, paradoxically, two of the basic treaties, *the Treaty establishing the European Coal and Steel Community (ECSC) and the Treaty establishing the European Atomic Energy Community (EAEC or Euratom)* refers to energy. ECSC established through the Treaty of Paris of 1951, created a common cola market. Then was the Euratom Treaty that was signed in Rome in 1957, which originated in the Suez oil crisis of 1956. 1956. It aims to reduce the dependence on imports from the Middle East. Also, *the Maastricht Treaty* signed in 1992 and known as the EU Treaty, has brought some additions to the definition of the internal energy market (PIE).

[157] http://www.renerg.eu/Document_Files//Evenimente/00000058/9dn9j.

The European Commission plays a central role in the debate between different actors on the energy market, some of them wanting decentralization, while others, on the contrary, as it had been seen previously. The first statement of the European Commission that approaches the issue regarding a common energy policy dates from 1995 and was called the Green Paper "For a European Union Energy Policy." In the same year came out, the White Paper "An Energy Policy for the European Union, then a new sequence of communications in 1996 and 1997, called "Green Paper for a Community Strategy - Energy for the Future: Renewable Sources of Energy "and" White Paper: Energy for the Future - Renewable sources of Energy.

These documents underpin the current common energy policy and the European legislation designed to implement it. The complexity of the problems regarding the production of energy, the transport and the energy consumption has much increased in the last decades, together with the ingravescence of the global environmental problems, climate changes and depletion of natural resources. In addition, the EU confronts itself with some specific problems among which the most serious being the one linked to the increased dependence on imported energy resources.[158]

The efficient conservation, valorization and in an ecologic manner of the energetic resources and also the sustainable use of these resources, represent in recent decades is a major worldwide concern. Finding viable solutions for the problems with which man confronts today in the energy domain, is imperative because of:

- the gradual depletion of oil resources;
- the increased rhythm of growth of the greenhouse gases' emissions;
- the expansion of the nuclear power plants, having as consequence the volume of radioactive wastes;

In order to avoid these unwanted phenomena, over time it has been tried the adoption and implementation of measures designed to prevent the occurrence of this phenomenon. In this category belong the eco-taxes or environmental taxes that represent "extraordinary constraints" introduced by governments as to counterbalance the social costs resulting from damages to the surrounding environment due to externalities generated by people. This notion was introduced by the economist Alfred Pigou in 1920 which stated that for an economy it would be useful to correlate the price of goods with that of the common consumption goods by using property taxes.

Another implication is this sense has the British economist Ronald Coase, Nobel Prize winner in Economics in 1991 who contributed to the development of the economic Theory of Externalities.

Marketable pollution licenses - LPT (Tradable Permits)[159] are based on the principle of the right to emit pollutants within the limits stipulated by laws and regulations concerning environmental protection. This system is the most often used in the U.S.A. (regulated by the *U.S. Clean Air Act).* Through the system of tradable pollution licenses a company or a country has the permission to sell to a third party the right to issue the amount of pollutants due to the difference between the level of pollution permissible by law, considered as the maximum allowable level of pollution and achieved by adopting new ecologic technologies or ecologising the existing ones.

Reducing the environmental impact of the energy sector involves the use of regenerable energies including biomass, geothermal energy, solar energy, aeolian and hydropower that should play a key role in the future. On the other hand, it is necessary to strive for a more efficient energy use, as a relatively easy means to reduce the environmental impacts of energy. Thus, the geothermal potential of Romania and especially of the west and north - west region shows a great energy importance and implicitly an economical and environmental one for the country.

The population of the West and Northwest area

[158] Idem.

[159] http://www.bibliotecadigitala.ase.ro/biblioteca/pagina2.asp?id=cap4.

The northwest Region is one of the eight development regions of Romania and includes six counties: Bihor, Bistriţa-Năsăud, Cluj, Maramureş, Satu Mare, Sălaj. The surface area is of 34,159 square kilometres, representing 14.32% of the country's surface, with a total population of 2,744,914 inhabitants.

The West Region of development of Romania is located at the border with Hungary and Serbia, and is organized from administrative and territorial point of view in four counties: Arad, Caras-Severin, Hunedoara and Timis. The West Region's population is of 1,924,442 inhabitants, representing 8.93% of Romania's population. The West Region covers up an area of 32,034 km2, representing 13.4% of the country.

The table below presents a synthesis of the main parameters of the important geothermal perimeters from Romania, including theoretical power potential. Using the extracted geothermal energy is used for heating in a proportion of 37%, 30% for agriculture (greenhouses), 23% in industrial processes and 7% for other purposes. From a total number of 14 geothermal wells dug from 1995 to 2000 at depths of 1500-3000 m, only two wells were unproductive, registering an 86% rate of success.[160]

Table 1. The Geothermal System Today

No. Unit	The geothermal system	Estimated area	No. of wells	Drilling Depth	Exploitable flow	Resource's temperature	Theoretical energy potential
		km^2		m	$\frac{l * s^{-1}}{m^3 * h^{-1}}$	^0C	MW_t
1.	**Crişul Negru – Someş** Săcuieni, Margita, Ciumeghiu, Salonta – the counties of Bihor and Satu Mare	3570	18	1500	$\frac{148}{533}$	77	29,14
2.	**Borş** Borş City – Bihor County	13	4	2800	$\frac{148}{533}$	100	8,79
3.	**Oradea** Oradea City –Bihor County	77	12	2800	$\frac{151,5}{545,4}$	83,8	34,1
4.	**Mures – Crisul Negru** Curtici, Macea, City of Arad - Arad County	1060	113	1500	$\frac{79}{285}$	58	9,3
5.	**Western Banat** Nădlac, Sâmnicolau Mare, Săravale, Tomnatic, Lovrin, Jimbolia, Periam, Teremia Mare, Comloşu Mare, Grabat, Beregsăul Mic – the counties Arad and Timiş	2790	20	2000	$\frac{318}{1144,8}$	77	62,75

Source: http://www.minind.ro/domenii_sectoare/energie/studii/potential_energetic.pdf

National exploitable reserve of geothermal water is of approximately 167,000 tep / year of low enthalpy resources, which currently capitalizes about 30 000 tep/ year. The total installed capacity in Romania in the west and northwest part is of 320 MWh (for a reference temperature of 300 °C).

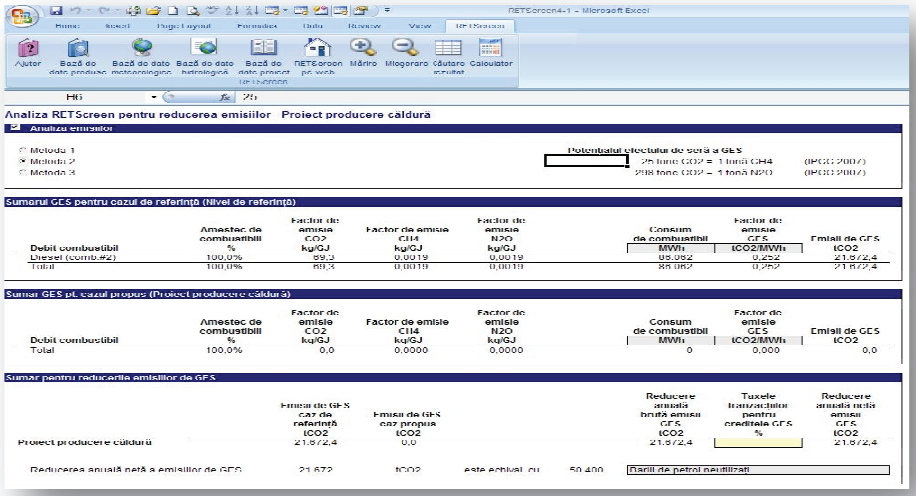
Western and North – Western Regions have an electric potential of approximately 144 MWt of the current well installed. The production a ton MW_t of electricity through conventional sources (in our case study we chose diesel) produces and emits into the atmosphere about 21,673 tons of CO_2.

From a simple calculation we observe that if we use the entire installed capacity in these areas of Romania reduces the pollution by about 6,935,552 TCO_2. By the end of 2009 the price of pollution certificate was of 15 Euros (a pollution certificate equals a ton of CO2 emanated in the atmosphere). So, we can observe the economic benefits that Romania would obtain in the case of using at maximum the installed capacity of electricity generation that is of 104,033,280 Euros.

[160] http://www.minind.ro/domenii_sectoare/energie/studii/potential_energetic.pdf.

In the White Paper it is proposed that by the end of 2010 to be produced using geothermal resources 1GW $_t$ of electricity and 5 GW of thermal heat. The production of 6 GW $_t$ by burning liquid combustibles can generate and emanate approximately 21,672,499 TCO $_2$. Or, it can reduce pollution it the case of using available geothermal potential or other renewable resource.

Graphic no.1. Analysis of CO2 emissions for the production of one MWt, using liquid fuels



Source: The data were elaborated by the authors with the help of Retscreen

Graphic's explanation

RETScreen Analysis for emission reduction – Heat production project

Emission Analysis

Method 2 Greenhouse effect's potential of GES

25 tons CO2 = 1 ton CH4 (IPCC 2007)

298 tons CO2 = 1 ton N2O (IPCC 2007)

GES Summary for the case of reference (Level of reference)

Combustible debit	Combustible mix	Emission agent CO2 kg/GJ	Emission agent CH4 kg/GJ	Emission agent N2O kg/GJ	Combustible consumption	Emission agent GES	GES emissions tCO2
					Mwh	tCO2/MWh	
Diesel (comb# 2)	100.0%	69.3%	0.0019	0.0019	86.062	0.252	21.672.4
Total	100.0%	69.3%	0.0019	0.0019	86.062	0.252	21.672.4

GES Summary for the proposed case (Heat production project)

Combustible debit	Combustible mix	Emission agent CO2 kg/GJ	Emission agent CH4 kg/GJ	Emission agent N2O kg/GJ	Combustible consumption	Emission agent GES	GES emissions tCO2

					Mwh	tCO2/MWh	
Total	100.0%	0.0	0.0000	0.0000	0	0.000	0.0

Summary for reducing emissions of GES

	Emission of GES Reference case tCO2	Emission of GES Proposed case tCO2	Annual gross emissions reduction GES tCO2	Transactions' taxes for GES credits %	Annual net emissions reduction GES tCO2
Heat production project	21.672,4	0.0	21.672,4		21.672,4
Annual net emissions reduction of GES	21.672	tCO2	equivalent with	50.400 Unused oil barrels	

Source: The data were elaborated by the authors with the help of Retscreen

In Romania, the capitalizing degree of renewable geothermal energy resources is low, the main cause being determined by the lack of proper financial support, which doesn't favour the development of the energy sector with superior financial and economic effects. Using geothermal water constitutes a viable option when the extracted agent at surface insures a supply system at a constant flow, and the variation of the energy demand at the consumer in different periods of the year is not great. The recommended system is the one with several active wells, of which some will be for re-pumping. The advantages of this system, besides the provided energy, are the conservation of the water reserve and that of the water's layer pressure. In the U.S.A., the energies obtained from renewable sources, 5% came from geothermal sources and 1% of solar power.[161]

At the present time, studies reveal that the Earth's geothermal potential is about 13,000 per year ZJ, of which approximately 2000 ZJ could be used to produce electricity, with the geothermal plants. If we could get to use only 0.25% of this potential, we won't need coal, plutonium, oil and gas for the production of electricity. Currently, we use only 1% of the world's electricity need which is covered by geothermal sources, so use 0.0025% of the full potential.[162]

We consider being worth mentioning and underlined the positive effects of using this resource:[163]

- Reducing the imported primary energy resources dependence (primarily fossil fuels)
- The diversification of the available energy resources.
- The production capacities considered for different parts of the country will simultaneously lead to employment's increase and the labour market will diversify its offer.
- The business environment will be diversified by attracting private companies (domestic and foreign) as well as local and central public authorities, in the process of exploiting regenerable energy resources.
- Investments in the domain of renewable energy resources will enable the manufacture, transfer and sale of products and modern technologies in this field.

[161] http://www.agir.ro/univers-ingineresc/energia_geotermala_1664.html.

[162] http://www.energeia.ro/energie-geotermala/potentialul-geotermal-al-terrei-de-4000-de-ori-necesarul-energetic-global-549/.

[163] http://www.fonduri-structurale-europene.ro/poscce/valorificarea-resurselor-regenerabile-energie.html.

- The valorisation of renewable energy resources will lead to a greater emissions' reduction possibly resulting from the fossil fuel combustion process and to the preservation of the environment.

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