

CONVENTIONAL RESOURCES OF BIHOR COUNTY AND THE IMPLICATIONS OF THEIR USE

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Abstract: The importance of achieving a sustainable development was greatly discussed during the last decades, especially due to the negative implications of pollution on the surrounding environment. During such conferences each country was requested to cut down the pollution level. Of course, ideal would be that this diminishing of green house effect gases to be obtained by gradually replacing the present resources we use with those less damaging to the entire planet, replacement which, as we know, cannot be done as a whole, at least not now. In this paper we have focused our attention on the county of Bihor from Romania, county that has both conventional resources, which, as it may be seen here, are heavily exploited, and also important unconventional ones. The paper has two parts: the first part presents in a nutshell the natural background of Bihor County as well as the existent conventional resources and the situation generated by the exploitation of such resources in order to assure the thermal comfort of the inhabitants. In the second part we describe a scenario about the emissions of CO₂ in Bihor County, under the conditions of assuring the peoples' thermal comfort only by burning fossil fuels. The scenario starts from existent data about the average quantity of thermal energy used by one inhabitant of Bihor County corroborated with the manner of obtaining the thermal energy in this part of the country. What it is intended to highlight in this work are the strong ecological implications (and, implicitly the deriving economic and social ones) of using conventional resources in this area, considering that Bihor County sits on a large geothermal water basin.

Keywords: regenerable resources, Bihor County, sustainable development, pollution, efficiency

JEL: Q34, Q43

1. Introduction. Coal is the most widely used fossil fuel both nationally and internationally. It is a sedimentary rock, of brown-black colour, resulting from certain reminiscent plants from the geologic ages, especially from the giant ferns that 400 million years ago would form real woods. When dying these plants would sink in the swamps where deprived of air would undergo a series of anaerobic processes, in early stages forming the turf.

Due to the gradual climate changes the phenomenon of water migrations appeared that would cover these sediments generating high values of temperatures and pressures. The pressure would eliminate water from the turf giving birth to coal. The higher the pressure generated on the coal, the higher its caloric power,

forming other types of coal such as pit coal and anthracite, which is, at the same time, the oldest coal existing.

In the majority of industrial countries the coal was the main energy source and the engine for economic growth. The heavy use of coal led during years and years to a series of negative consequences on the environment which made people understand the need to replace it with other less pollutant energy sources. In some cases the replacing of coal exceeded the stage of wilfulness, materializing in facts as one may observe in this paper.

Initially coal was used as a source of mainly thermal energy, then electrical energy in households and industries. In the '50's and '60's the main resource used was petroleum as it was cheap then. Along with the crisis in 1970, the price of a barrel increased from 5\$/barrel to 35\$/barrel in one day which turned everybody's attention to coal. It was then that the coal era begun. Its consumption and trade reached huge quotas in no time.

At present, coal represents 23% from the total of primary resources used worldwide which means that it covers 38% from the energy demand of our planet. We shouldn't overlook the fact that there is a black market of coal even if there aren't real data. It is assumed that 573 million tons per year are transacted on such market, out of which 381 Mt is anthracite and 192Mt charred coal (Thomas, 2008:2).

Natural gas is highly used around the globe since the earliest of times. Due to the significant demand that always existed of this valuable unconventional resource, the gas market started to be closely monitored and regulated by laws and conventions. The first such law appeared in 1938 under the name of the Natural Gas Act whose role was to implement principle and rules meant to protect the interest of consumers. In order to be sure that all the objectives of this law are carefully fulfilled The Federal Power Commission was created.

The natural gases market knew a flourishing period between years 1940 and 1950 especially due to the outburst of the Second World War. The instated instability generated oscillations of the demands for this product which, at its turn, considering the law of demand and offer, made prices very instable too. It is here that FPC intervenes encouraging producers to maintain an approximately fix price for these resources, the consumers already being greatly affected by the war.

According to the explanatory dictionary of Romanian language, black oil is a viscous black or dark brown liquid, left after the distillation of crude oil and used as fuel (dictionare.edu.ro).

2. Bihor County, situated in the North-West of Romania, is one of the counties with a large enough surface from Romania, having 7,535 km² and a population of 634,854 inhabitants. The county town of Bihor is Oradea Municipality.

In what the climate of the analyzed county is concerned, it is moderate-continental with an annual average temperature between 6⁰ and 10,5⁰C.

Special attention must be given to the natural riches from the earth of this county which are:

- Lignite (Popești, Borumblaca, Suplacul de Barcău, Oșorhei)

- Bauxite (Piatra Craiului Mountains)
- Geo-thermal waters (Băile Felix, Băile 1 Mai, Mădăras, Tămăşeşu, etc).

Table 1: The population of Bihor County at 31st of December 2013

Total county	662540
Masculine	326810
Feminine	335730
Urban	333492
Rural	329048

Source: Report concerning the environmental state in Bihor County in 2013, available on-line at http://apmbh-old.anpm.ro/upload/138454_Cap%201%20Profilul%20judetului%20Bihor%20-%202013.pdf, accessed at 03.03.2015.

The great part of this county's population is urban (50,3%), phenomenon common in all counties of Romania, the feminine gender inhabitants being more than the male ones.

Table 2: Population of cities from Bihor County at 31st of December 2013

Locality	Number of inhabitants
Oradea Municipality	228258
Beiuş Municipality	12688
Marghita Municipality	19154
Salonta Municipality	22108
Aleşd City	10547
Nucet City	2143
Săcuieni City	13193
Ştei City	10740
Valea lui Mihai City	11247
Vaşcău City	3414
Total number of persons in cities	333492
Total number of persons in the rural area of Bihor County	329048

Source: Report concerning the environmental state in Bihor County in 2013, available on-line at http://apmbh-old.anpm.ro/upload/138454_Cap%201%20Profilul%20judetului%20Bihor%20-%202013.pdf, accessed at 10.02.2015

There are ten cities in this county, one being the capital city (Oradea), inhabited by a number of 333,492 persons, as it may be observed from the above table.

3. The use of conventional resources in Bihor County. At present, both at a global level as well as at a national or local level, the main energy producing sources are the mining and oil resources. In what Romania is concerned, it has,

first of all, a rich tradition in exploiting mining and oil fields and resources. At 01.06.2014 there were 867 mining exploitation licenses issued, 59 of them for mining exploitations as it may be seen in the below table:

Table 3: Situation of concession licenses for mining exploitation activities and exploitations at 01.06.2014

Substance	Number of exploitation licenses			Number of exploitation licenses
	Pending approval	In vigour	Total	In vigour
Ores	1	11	12	13
Coals	28	31	59	22
Utility rocks	316	258	574	13
Ornamental rocks	13	13	26	0
Salt	1	9	10	1
Mineral waters	27	37	64	12
Thermal-mineral waters	25	21	46	17
Therapeutic waters	23	11	34	13
Therapeutic mud	5	6	11	1
Others	0	3	3	0
Non-metalliferous rocks	13	15	28	0
Total	452	415	867	92

Source: The Romanian National Agency for Mining Resources, Romania's natural resources – perspectives and opportunities, 2014, available on-line at http://cnr-cme.ro/foren2014/presentations/KA_2/01%20Irina%20Zamfir%20%20Dutu%20Lucrare%20FOREN%20Resurse%20de%20energie.pdf, accessed at 02.04.2015.

In total in Romania there are being exploited 281 coal beddings, all having the destination of producing energy, such as:

- *Lignite* – 197- the most commonly found coal in Romania and also in Bihor County (important quantities being in Voivozi locality from Bihor) being also called the “energetic coal”;
- *Pit coal* – 54- especially used in thermal plants and also for obtaining metallurgical charred coal;
- *Brown coal* – 28;
- *Anthracite* – 5.

In Bihor County currently there are three mining zones, all being named like that in 1999 by Government Decisions such as: (Morar, www.uoradea.ro):

1. Popești-Derna-Alesd – HG 196/1999
2. Borod-Șuncuiuș-Dobrești --- HG 195/1999
3. Ștei-Nucet ---- HG 194/1999.

Table 4: The evolution of primary energy internal resources production

	UM	2005	2006	2007	2008	2009	2010	2015
Coal total of which:	Mil tep Mil tons	6,19 31,64	7,29 36,6	8 41	7,12 35,2	7,62 38,2	7,8 39,40	7,75 37,1
Lignite	Mil tep Mil tons	5,10 28,69	5,79 32,6	32,6	33	6,12 34,27	6,2 35	6,25 35
Huilă	Mil tep Mil tons	1,09 2,95	0,92 2,59	1,05 3,00	1,05 3,01	1,08 3,10	1,12 3,20	1,50 4,00
Gases	Mil tep Mil tons	10,05 12,48	9,82 12,2	9,40 11,68	9,08 11,28	8,9 11,0	8,8 10,90	8,5 10,60
Crude oil	Mil tep Mil tons	5,53	5,50	5,40	5,2	5,2	5,2	5,10

Source: *The energetic strategy of Romania 2007-2020*, available on-line at http://www.minind.ro/energie/strategia_energetica_a_romaniei_2007_2020.pdf, accessed at 12.02.2015.

Even if in Romania, through strategies and development programs it is aimed to use at a higher degree the regenerable resources, the demand for the mainly used fossil fuels has not diminished, as it may be seen in the below representation.

Mining exploitations from everywhere and also from Bihor County alter the ordinary development of the environment in a negative way, namely (*Crețu*, <https://www.uoradea.ro/display2338>):

- Removal of vegetation on such spots;
- Modification of sights which is a physical and psychological discomfort;
- Formation of dirt areas and dirt-heaps;
- Depositing of industrial waste and littering;
- Noises and vibrations as a result of explosions used to blast down stones affecting negatively the wild life of such places

In Oradea Municipality, thermal energy is assured by CET Oradea. According to the most recent decision of the ANRE President/*The National Agency for Energetic Regulations*/, No. 1279 of 28.05.2014, the main fuel used is coal.

Table 5: Supply of thermal energy in Oradea

Installed electrical capacity	195 MW
Main fuel	Coal

Source: Decision of the ANRE President, Nr. 1279 of 28.05.2014, available on-line at file:///C:/Users/Diana/Downloads/Anexa_Lista_capacitatilor-rev_16.pdf, accessed at 15.02.2015.

As we can see in the following table, to assure the energy requirements for Oradea Municipality hundreds of thousands of tons of fossil fuels are burned, most of them being coal. If in 2005 in the electrical plant from Oradea were burned 313,702 tons of coal, in 2007 the quantity has tripled, more exactly being of 901,840 tons. This is mainly due to the economic growth in that period as well as to the use of significant quantities of natural gases which gradually have been removed from the process.

Table 6: Gross energy consumption in Bihor County

Year	Coal (tons)	Black oil (tons)	Natural gases (tons)	Biomass (tons)
2005	313 702	34 827	123 456	-
2006	304 016	32 752	60 483	1284
2007	901 840	19 154	-	4116

Source: Report concerning the state of the environment in Bihor County in year 2007, available on-line at: <http://www.apmbh.ro/Staremed2007/rapmedcap12.2007.htm>, accessed at 14.03.2015.

Although the demand for electric and thermal energy in Oradea Municipality decreased in some cases, their production in a more sustainable way should be as much a local target as it is a national one.

Table 7: Generation of electric and thermal energy in Bihor County

	Electric energy MWh	Thermal energy Gcal
1995	972.817	1.516.743
1996	763.553	1.586.081
1997	723.467	1.246.440
1998	648.181	958.869
1999	422.664	833.956
2000	377.276	1.069.904
2001	521.026	1.706.679
2002	344.780	1.060.095
2003	417.545	1.237.396
2004	381.377	1.462.790
2005	198.512	1.942.300
2006	406.566	1.493.040

2007	388.221	947.947
2008	395.085	1.002.987
2009	418.390	970.474

Source: *Report on the state of the environment in Bihor County in 2007*, available on-line at <http://www.apm-bihor.ro/StareMediu2009/rapmedcap12.2009.htm>, accessed at 05.04.2016.

The thermal energy consumption calculated per capita in Bihor County between the years 2005 and 2007 has registered values situated between 3,20 Gcal and 3,33 Gcal thus, for a better understanding of data an average will be drawn out and the result is that, in the rough, an inhabitant of Bihor County consumes annually 3,25 Gcal.

Table 8: The thermal energy consumption /inhabitant in Bihor County

Year	Gcal/inhabitant
2005	3,23
2006	3,33
2007	3,20

Source: *Report on the state of the environment in Bihor County in 2007*, available on-line at <http://www.apmbh.ro/Staremed2007/rapmedcap12.2007.htm>, accessed at 25.02.2015.

Further on we shall present a simulation regarding the quantity of thermal energy necessary to assure the comfort of the people living in this county:

Number of persons living in Bihor County = 662,540

In average, one inhabitant of this county consumes 3,25 Gcal/year

⇒ Annually, in order to assure the thermal comfort of the population there are produced

662,540 pers. x 3,25 Gcal = 329,051 Gcal/year

10 Gcal = 41,84 GJ (gigajoule)

⇒ 329,051 Gcal = 1,375,762.23 GJ

1GJ = 277,8 kwh

⇒ 1,375,762.23 GJ= 38,216,747.5 kwh

1kw = 60 kwh

⇒ 382,186,747.5 kwh = 6 369 779.12 kw

Table 9: Scenario about the CO₂ emissions in Bihor County

	Coal	Black oil	Natural gas
20kw	9,8 tCO ₂	3,7 tCO ₂	6 tCO ₂
1 kw	0,49 tCO ₂	0,185 tCO ₂	0,3 tCO ₂
6 369 779,12 kw	3 121 191,77 tCO ₂	1 178 409,13 tCO ₂	1 910 933,74 tCO ₂

Source: Data calculated by the author

The table above presented a scenario with the emissions of CO₂ in Bihor county under the conditions that the population's thermal comfort would be assured only by burning fossil fuels, namely: if the only fuel used is coal, each year this county is responsible for the release in the atmosphere of over 3 million carbon dioxide; in case black oil is used there will be released in the atmosphere over 1,1 million CO₂, and the natural gas releases over 1,9 million CO₂. In conclusion, from the data presented, Bihor County uses the most harmful category of fossil fuels, namely the coal, in order to assure the thermal comfort of the population.

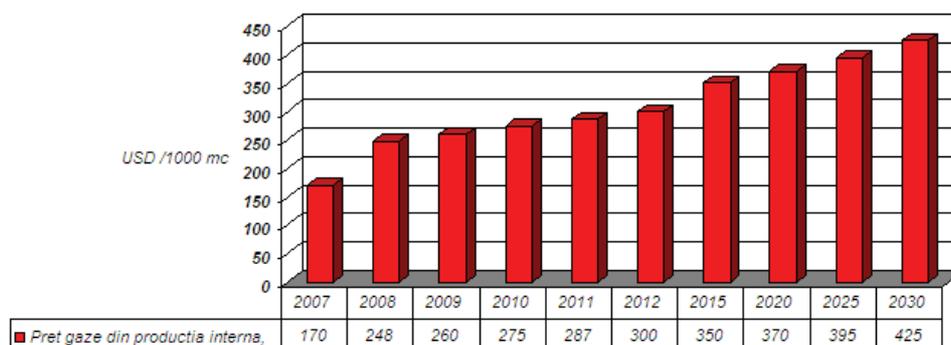
Table 10: Estimation of natural reserves of crude oil and natural gas from Romania until the year 2020

Year	Crude oil – million tons	Natural gases
2006	80	170
2007	76	162
2008	72	155
2009	68	148
2010	64	141
2011	60	134
2012	56	127
2013	52	120
2014	48	114
2015	45	107
2016	41	101
2017	38	95
2018	34	89
2019	31	83
2020	28	77

Source: *The National Agency of Mining Resources*, available on-line on site http://www.academia.edu/10451990/TOTAL_PRODUCTIE_INTERNA_DE_ENERGIE_PRIMARA, accessed at 23.02.2015.

In addition, as all organizations and measurements show, the entire world's reserves of fossil fuels and obviously from Romania, too, are continuously decreasing, being as the name suggests, exhaustible resources. According to the National Agency of Mining Resources from Romania, in 2020 there will be only 28 million tons of crude oil and 77 million tons of natural gases, which is a 65% decrease as compared to the level of year 2006 for crude oil and almost 55% decrease in the case of natural gases.

Figure 1: Scenario with the evolution of prices for the natural gases produced internally



Source: The Energetic Strategy of Romania for 2007-2020

On this market too, as on those of other goods and services, the law of demand and offer is applied, respectively, together with the diminishing of Romania's natural gases reserves, and at the same time of the entire world, the prices will heavily increase. According to the Energetic Strategy of Romania for the period 2007-2020, in 2020 the price will go up by approximately 217% and in 2030 with 250%.

In conclusion, we may state that based on the data presented, Romania's fossil fuels reserves are smaller and smaller, which will determine a continuous increase of their prices. In Bihor County, even under these conditions, coal, natural gas and black oil still remain the main sources for thermal energy production. Considering that the thermal comfort of the population could be assured only by using fossil fuels, namely: if the only fuel used is coal, each year this county is responsible for the release in the atmosphere of over 3 million carbon dioxide; in case black oil is used there will be released in the atmosphere over 1,1 million CO₂, and the natural gas releases over 1,9 million CO₂. In conclusion, from the data presented, Bihor County uses the most harmful category of fossil fuels, namely the coal, in order to assure the thermal comfort of the population.

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