THE MANAGEMENT OF ENERGY SOURCES AND RESOURCES OF ROMANIA: A CHALLENGE IN THE CURRENT GEOPOLITICAL CONTEXT

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Scopul acestei lucrări este analizarea situației energetice a României, cu evidențierea principalelor oportunități existente în contextul actual geopolitic. Punctul de vedere exprimat are la bază credința că resursele fosile reprezintă un avantaj natural al României, dar numai prin utilizare şi administrare eficientă şi ecologică durata lor de folosire poate fi prelungită, prin acesta limitându-se dependența sa de importuri, precum şi respectarea mediului înconjurător. Înaintea orientării spre alte surse energetice, investițiile în programe de retehnologizare, de creştere a eficienței energetice şi promovare a reducerii risipei au fost măsurile considerate necesare pe termen mediu.

The aim of this paper is to analyse the Romania's energy situation with an emphasis on the opportunities of the use of fossil fuels in the Romanian economy, given the present geopolitical hazards. This paper argues that, if used environmentally friendly and efficiently, domestic fossil fuels represent the main assets of the Romanian economy, limiting its dependency on imports, while respecting the environment. Rather than switching to other energy sources, investments in technology, energy efficiency enhancement and energy saving programs are required in the medium term.

Keywords: energy, fossil fuels, energy efficiency, import dependency.

Introduction

Romania, a candidate country preparing to join the European Union (EU) in 2007, faced many problems related to its fundamental transformations. These were manly due to the transition from a centrally planned to a free market economy, and especially the energy sector was subjected to radical changes. To cope with the requirements of a 21st century economy, and to fit into the EU accession program, significant changes have took place and are still occurring in the energy sector, including changes in legal framework, institutional structure, modernization of technologies and energy facilities and privatisation.

The real reform of the energy sector started in 2002 when the Romanian Government approved "*Industrial Policy of Romania - National Energy Strategy*",

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a document that analyzed the status of the energy system and established its objectives on long term [1]. In the first half of 2002, in the frame of accession to the EU, Romania opened the "*Energy chapter*", that has been provisionally closed in the second half of 2004, having a transitional period for building up of oil stocks to required levels, until the end of 2012 [2]. The progress towards accession criteria related to energy field involved reduction of subsidies, increasing of the power prices, an improved payments discipline in the power sector, the establishment of independent regulators for power and gas sectors, and restructuring of electricity and gas utilities. Given the efforts made during the past years, Romania has been dubbed a "*functioning market economy*" in October 2004 by the International Monetary Fund, a prerequisite to EU ascension.

The driving forces for energy development must came from the need of establishing national energy policies to reduce import dependency, to efficiently use fossil fuels available, and implement renewable energy sources [3]. Beside the external pressure by the EU, the possibilities of obtaining external financial support for energy related applications are other key factors for regulation the energy sector.

This paper critically analyses the Romania's energy situation and portrays its natural resources that are diversified, as it owns important reserves of oil, coal, natural gas and an important potential for renewable energy (having geothermal, hydro, wind and solar potentials). Therefore, the paper argues that Romania has to use efficiently its natural resources and become less dependent on imported energy sources, knowing the fact that the national endowment with natural resources has been an indication of the fuel option of a country [4]. Thus, for instance, Australia and United States of America (USA) found that is more expensive to reduce coal, as they have large domestic resources. Most of EU countries planned to reduce oil dependency and switch to other forms of energy more strongly than others, simply because most European countries do not own significant oil reserves.

Experimental

The analysis performed in this paper involved the collection of data from different reliable sources, their validation, given the fact that they were reported by various international and national authorities in the domain, and data processing and interpretation. Therefore the analysis involving the primary energy production and consumption over the last years processed data from two different studies of the "Energy Information Administration" (EIA) from USA [5-6]. The data concerning the proven reserves together with the production and consumption of fossil fuels came from various sources: different sections of a large study issued by a large multinational in the energy domain, "British

Petroleum" [7], a study issued by the "National Authority for Regulation of Natural Gas" from Romania [8], some studies presented at the "World Petroleum Congress" in 2003 [9] and the Romanian Strategy in the energy sector [10]. The import dependency was computed using the data from the "Entity of New Technologies, Energy and Environment" from Italy, [11] by the following relationship:

$$\text{Energy dependency} = \frac{\text{Net imports}}{\text{Production} + \text{Net imports}} \times 100 \qquad (1)$$

The measuring units expressing the quantities of fossil fuels produced and consumed involved natural units and tones of oil equivalent (toe), expressing, in heat units, approximately 10 million Kcal, that are equivalent with the burning of 1.5 tones of hard coal or 1.11 m^3 of gas. One million of toe (Mtoe) produces approximately 4.5 TWh of electricity in a modern power station [7].

Results and discussion

1. Analysis of the Romanian current energy situation

After the collapse of the former communist Eastern Block, all countries with a centrally planned economies experienced significant reduction of their economic activity and, as a result, an important reduction of their production and consumption of primary energy [12]. Romania faced the same situation and its economic and energy indicators made no exception (see Fig. 1). Total final energy consumption followed the same trend and sharply decreased in all sectors of the national economy. The Gross Domestic Product (GDP), after a significant decline, seems to be levelling off with the value of 1990, reaching at the end of 2001 the value of 35 billion dollars, at their value from 1995 (bill. USD_{1995}).

Romanian oil and natural gas resources together with its considerable domestic market have proven to be attractive for foreign investors [13]. Consequently, the major oil company, SNP Petrom SA, has been privatised in July 2004, by signing with OMV (Austria) that now owns 51% of the company. In the gas sector, the two distribution companies, SC Distrigaz Nord SA and SC Distrigaz Sud SA, were considered for privatisation and in July 2004, from all the bidders, Gaz de France was selected for SC Distrigaz Sud SA and Rurhgaz for SC Distrigaz Nord SA.

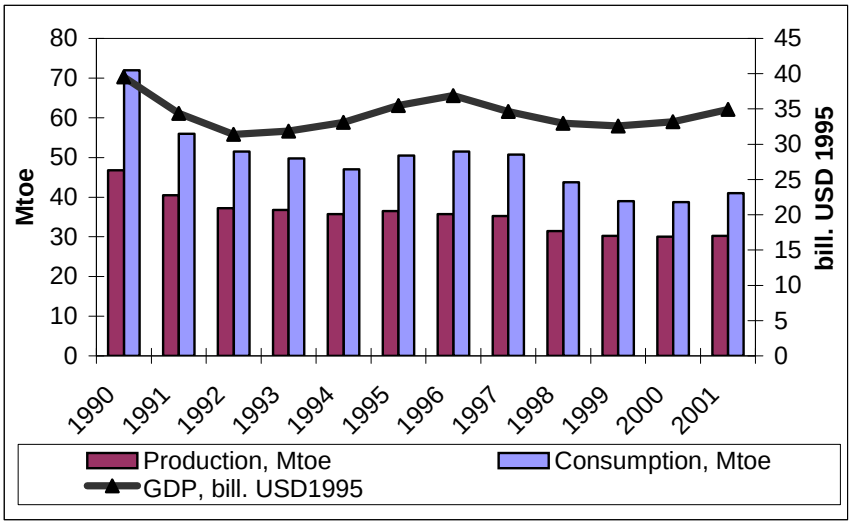

Fig. 1. Variation of primary energy production and consumption in Romania, during 1990-2001 [5-6].

1.1. Oil

Romania, possessing proven oil reserves of 900 million barrels [7], is the only oil producer in the Eastern Europe. However, Romania's oil production has fallen sharply over the past years, from 250,000 barrels per day (bbl/day) in 1980 to 123,000 bbl/day in 2003, a decline of more than 50%. This is the reason of import requirements, Romania being forced to import almost half of its oil needs (see Table 1).

Table 1.

Variation of production and consumption of oil in Romania, during 1990-2003 [7].

Thousands bbl/day	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Production	169	146	142	144	145	145	142	141	137	133	131	130	127	123
Consumption	373	309	258	242	226	274	260	276	242	195	203	217	226	232

Romania is the main actor in the Central and Eastern Europe's downstream petroleum industry, having an annual crude distillation capacity of 34 million tons for all its 10 refineries (see Fig. 2). However, all of country's refineries are operating under capacity because of a lack of crude oil supplies.

Positioned at the shores of the Black Sea, a major route for world oil exports, Romania will develop as transit centre, delivering Russian and Caspian oil to EU market. The Romanian Government proposed a pipeline that connects Constanta-Pancevo-Omisalj-Trieste (CPOT) and the feasibility study for its construction was recently adopted by the involved countries. This pipeline will

extend across Romania to the Pancevo (Serbia), where it will be connected to an existing branch of the Adria pipeline to Croatia, to the port of Omisalj, and Italy [6].

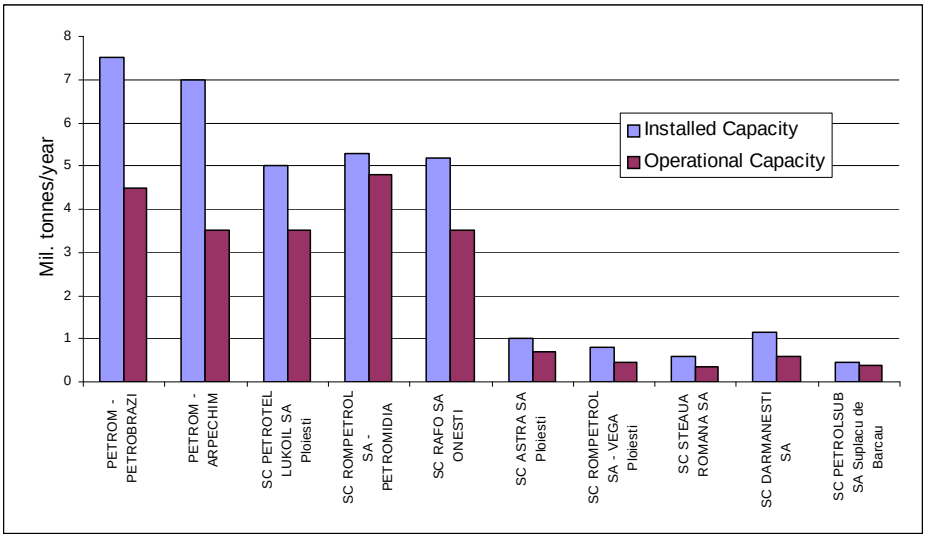

Fig. 2. Processing capacities in Romanian refineries [9].

1.2. Gas

Romania, with its proven gas reserves of 310 billion cubic meters (bill. m^3) [7], is Central and Eastern Europe's largest producer of natural gas, extracting 12.7 bill. m^3 in 2003. But Romania's production has fallen significantly, by more than 50% in respect with the situation in 1990 (see Table 2). The consumption, after an accelerated decline, seems to be levelling off, as economic recovery is progressing, the increasing needs being covered by imports of natural gas from Russia, delivered via the Progress pipeline.

Table 2.

Production and consumption of natural gas in Romania during 1990-2003 [8].

Bill. m^3	**1990**	**1991**	**1992**	**1993**	**1994**	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**
Production	28.2	24.9	21.4	21.3	19.5	18.9	17.4	15.2	14.4	12.8	13.6	12.9	12.1	12.7
Import	7.2	5.2	4.4	4.5	4.4	6.0	7.0	5.0	4.7	3.2	3.3	2.9	3.5	5.6
Consumption	35.4	30.1	25.8	25.8	23.9	24.9	24.4	20.2	19.1	16.0	16.9	15.8	15.6	18.3

1.3. Coal

Romania, with its proven coal reserves of 313 Mtoe [7], produced 7.1 Mtoe in 2003 (see Table 3). Most of its reserves are lignite and sub-bituminous coal, with the largest reserves located in the Jiu Valley.

Table 3.

Coal production and consumption in Romania during 1990-2003 [7].

Mtoe	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Production	8.7	7.4	8.5	8.9	9.1	9.3	9.6	7.4	5.7	5.1	6.4	7.3	6.7	7.1
Consumption	11.7	9.6	10.3	9.5	9.4	9.7	9.5	8.4	7.0	6.7	7.0	7.2	7.6	8.0

1.4. Nuclear energy

Romania has one nuclear power plant, the Cernavoda power station, which accounted for 10% of electricity generation in 2003. The power plant operator is the state owned Nuclearelectrica S.A. The plant, with a capacity of 700 MW, went online in December 1996, and was built by a consortium of Atomic Energy of Canada and Ansaldo of Italy. The fuel is produced in Romania, at Pitesti, where 100 metric tones of enriched uranium are manufactured annually.

Presently, Romania is working to develop a second reactor at the same facility, and hopes to commission the new reactor very soon, when 20% of the electricity generation will be of nuclear origin.

1.5. Renewable energy

The modern renewable energy plays a minor part in the Romania's electricity generation mix. By its strategy in the renewable domain, "Strategy of development of renewable sources", issued on January 2004, the Romanian Government planned to implement a new program for increasing the use of modern renewable energy from sun, wind, biomass and geothermal sources (see Table 4).

The only renewable source with an important development was the hydroelectric power. With its many rivers, Romania has a great potential for hydroelectric power, but this must be tackled with care towards the environment, given the impact of the large scale facilities. The main producer of hydroelectric energy is "Portile de Fier I" (capacity: 1290 MW), a power plant on the Danube River. In addition, there are eleven other hydroelectric facilities with capacities of more than 100 MW, and dozens of medium-sized facilities of at least 30 MW. In addition to these large hydroelectric facilities, there are also many smaller power stations, considered durable. Raul Mare River, situated in the Retezat Mountains, has a series of 10 hydroelectric power plants, each between 10 and 15 MW. Similarly, the Strei River, located in the same area, has a series of seven small hydroelectric power plants, each less than 10 MW. However, presently there are many problems faced by Hidroelectrica S.A. (the state owner of the Romania's hydroelectric power), involving discussions with the private land owners that must be compensated for agreeing with the use of their property in the favour of a given investor.

The electricity annually produced in Romania by the hydropower accounts for almost 28% of its total production of electricity, reaching 13.6 TWh at the end of 2003 [7].

Table 4.

Renewable sources of energy and their potential in Romania [10].

Source	Annual potential	Applications
Solar energy	60×10^6 GJ	Thermal & electrical energy
Wind energy	23.000 GWh	Electrical energy
Hydro energy (more than 10MW)	34.000 GWh	Electrical energy
Hydro energy (less than 10MW)	6.000 GWh	Electrical energy
Biomass	318×10^6 GJ	Thermal energy
Geothermal energy	7×10^6 GJ	Thermal energy

1.6. Import dependency and security of supply

The energy dependency is an important issue on the agenda of EU countries and Romania, given the actual geopolitical hazards. Presently, EU has as main suppliers of oil and gas the OPEC countries (Organization of Petroleum Exporting Countries) and by 2030 its dependency is estimated to increase up to 70% for gas and 90% for oil [3]. The variation in time of the energy dependency is shown in Table 5, indicating a dependency of more than 50% for the EU(15), with only two exceptions, Great Britain and Denmark.

Table 5.

The energy dependency of the EU (15) (%) [11].

Country / Year	1995	1996	1997	1998	1999	2000	2001	2002
Austria	66.0	68.4	68.5	68.2	65.9	65.7	66.6	67.7
Belgium	77.6	78.3	76.9	77.9	76.5	77.3	77.9	76.8
France	46.9	48.5	48.0	50.5	49.9	48.9	49.2	48.4
Finland	56.6	58.7	55.1	59.4	54.2	54.7	55.7	57.3
Germany	58.0	59.9	59.6	61.8	59.9	60.4	60.7	59.9
Ireland	60.7	68.6	76.6	80.7	80.8	83.9	88.2	87.3
Italy	80.9	80.2	80.2	81.6	82.2	83.7	83.6	84.3
Luxemburg	98.6	98.9	98.7	98.6	98.7	98.5	98.4	98.4
Holland	11.6	5.1	14.4	18.5	22.4	26.8	24.2	24.8
Portugal	86.9	84.1	85.3	86.6	89.0	87.2	86.3	89.1
Span	69.7	67.9	70.6	71.6	74.2	74.1	73.5	75.5
Denmark	*23.9*	*23.8*	*6.5*	*4.2*	*-16.4*	*-39.4*	*-33.1*	*-43.0*
Greece	61.3	60.7	62.0	63.2	64.1	63.9	64.0	63.4
Great Britain	*-15.5*	*-15.7*	*-18.1*	*-18.0*	*-21.4*	*-16.7*	*-10.4*	*-11.3*
Sweden	36.2	37.4	34.7	32.8	33.2	35.6	32.9	38.3
EU(15)	**54.6**	**54.9**	**54.6**	**55.8**	**54.2**	**53.6**	**54.5**	**54.5**

Note: negative numbers indicate a surplus of energy over the country's own requirements (negative dependencies indicate a net exporter country).

At the same time, the current Romania's dependency is approaching 27% [14], a figure that is desired to decrease in the following years, if the Government wishes to exploit the country's large energy potential and be safe in respect with large price fluctuations of gas and oil.

2. Remarks and suggested actions

One important comment is that Romania owns significant fossil fuels resources and is a reasonable behaviour to take the advantage of its domestic endowment, given the present geopolitical hazards that are difficult to control. This attitude is supported by the recent announcement of the World Bank that has rejected the advice to abandon oil and mining projects. The Bank officials argued that for some countries "*oil, gas and mining are important assets that will have to play a role*" [15]. Accordingly, Romania must consider very pragmatic its energy situation and take wise decisions regarding its own energy mix that will safeguard the country's energy security.

The refining industry requires funds for modernization, maintenance and improvement of efficiency, given its poor condition owed to the low investment policy of the past years. At the same time, the Romanian coal industry was severely affected by outdated infrastructure and labour instability having as results declines in production. However, the Romanian government is hoping for a revival of the coal industry, by investing in their upgrade and efficiency [16].

Although the climate change, which is mainly due to CO_2 emissions, is generally a well-recognized reality, Romanian energy strategy was mainly focused on the energy security rather than environment. Nevertheless, this is not an exception, the security of supply always came first and it may be also noticed in other European national strategies [17]. Given the current energy dependency, that is estimated to increase in the following years, together with the recent announcement of the European Commission that affirms that will invest in new coal technologies that will capture and store underground the CO_2 [18], Romania has real opportunities to take the advantages of its natural endowment.

Instead to prohibit the fossil fuels use and switch to other energy sources, energy efficiency enhancement and energy savings must become priorities. As a result of our study, the following actions are suggested and require rapid implementation:

- investment in advanced technologies in manufacturing/processing of fossil fuels, especially in the coal mining sector;
- modernization of heating systems;
- modernization and maintenance of thermal power plants, as the great majority has been in operation for more than 30 years;
- investment in the modern nuclear energy;

- improvement of thermal insulation of residential and public buildings.

The security of energy supply must be tackled together with pollution control and permanent increase in energy efficiency. Fossil fuels, if used with consideration towards environment and with efficiency, may represent an opportunity for the Romanian economy in years to come.

Conclusions

The aim of this paper is the analysis of the Romania's sources and resources of primary energy and to emphasize the importance of its natural endowment. Given the current geopolitical hazards that are threatening the security of supply, especially due to political factors that largely influence the fossil fuels' prices, Romania has to reconsider its large energy potential and start investing in the revival of its coal, oil and gas industries. The national energy policy must be renewed with serious Government engagement and must become a national priority.

The quest for new, modern sources of energy must be preceded by energy efficiency enhancement and energy savings. This may be achieved by investments in advanced technologies that will extend the life of the fossil fuels. Fossil fuels, if used with consideration towards environment and with efficiency, may represent an opportunity for the Romanian economy in the next 20 years and more.

Romania should define and start implementing realistic measures for integrating environmental issues into all policy areas, but this cannot be done at the expense of limiting the fossil fuels use, at least on medium term.

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