



ENERGY POLICY PAPER: ROMANIA 1998

1.0 Background

The purpose of this study is to bring together a wide body of knowledge on the different energy subsectors in Romania, analyse and add to it, and derive the basic information necessary for the Government to formulate a fuel policy. The actual formulation of an energy supply development (or 'fuel') policy, with its social, economic and environmental trade-offs, is not within the scope, but the successful completion of this study would enable that activity to proceed with no further data gathering on fuel supply costs and qualities, investment requirements, capacities, availabilities and environmental impacts, across the whole fuel supply chain. The time-frame of the study is to the year 2020.

1.1 Energy Resources

Romania's commercially exploitable domestic energy resources estimated at about 2034 million toe, consist of natural gas, estimated at 420 billion cubic meters (360 million toe) of proven reserves and 28-70 billion cubic meters (24-60 million toe) of probable reserves; lignite and brown coal, 4.2 billion tons (760 million toe); hard coal, 900 million tons (590 million toe); oil, 200 million tons of proven reserves and an estimated 100 million tons of probable reserves; and a total hydropower potential of about 40 terawatt-hours per year, with 17 terawatt-hours per year developed.

Oil shale reserves are known to exist, but because of technological constraints, their commercial exploitation would remain uneconomic for the foreseeable future. Renewable energy resources in biomass and fuel wood are abundant, whilst geothermal, wind and solar energy are of relatively less significance. Uranium exists in Romania and the Government's nuclear programme is based on using this resource as the main source of fuel.

1.2 Energy Supply

Domestic energy resources meet a significant proportion of the country's energy requirements: 43% of petroleum, 82% of natural gas, 77% of hard coal & lignite, and 99% of electricity ¹ (1994 figures). However, oil and gas production are in decline, and net energy imports have been expected to increase as the economy picks up, though this is now subject to review. Of total primary energy supply in 1994, gas contributed 36%, oil: 30%, coal: 22%, hydro: 6%, renewables and imported petroleum products: 5%; imported electricity: 1%. ²

At the end 1994, the installed power in the electricity sector was 20837 MW, of which Renel, the state-owned electricity utility, owned a total of 20041 MW installed power and heat generating capacity, subdivided as follows:

- coal and lignite fired power plant	7694 MW (of which 2034 MW cogenerating capacity)
- fuel oil and natural gas fired plant, including furnace and coke gas	5761 MW (of which 3046 MW cogenerating capacity)
- hydro-power plants	5776 MW

In addition to this capacity, a number of units totaling an installed power of 810 MW are included in a rehabilitation programme (funded in part by international financing institutions, 'IFIs') and will be re-commissioned when this programme is finished. Cernavoda 1 nuclear power station, 700 MW, is also scheduled to be commissioned in 1996.

More than 60 % of the total installed power in hydropower plants are over 20 years old, and about 73% of the thermal power plants over 15 years old. Some of the lignite and thermal power plants perform poorly, even the younger units, and a significant proportion of the installed power is not available.

Installed power for auto-producers totals 796 MW. A significant percentage of the total installed power, 5.6 GW, is in cogeneration, which also supplies 34 GWt (40% of total demand) of thermal power for

¹ Romanian Statistics Yearbook 1995.

² *ibid.*



industry and district heating systems. Rehabilitation loans for the largest district heating system, in Bucharest, are currently being considered by IFIs.

Domestic oil production started declining from 1976; at present 13,800 wells are in operation, with a total output of 18000 t/d. The rate of decline in oil production is expected to be reduced by the introduction of newer technologies, such as high deviation drilling and horizontal drilling, three dimensional seismic prospecting; and the implementation of modern control and data management systems. The oil production sector is dominated by the activity of one state-owned entity, Petrom.

Gas production has exceeded additions to reserves for a number of years and, as a result, gas reserves have been considerably depleted. High gas production, 19.1 bcm/yr of sales gas, (at a maximum of 53.5 million m³/d), has been maintained only by means of intensive operation, and this has resulted in a reduction of reservoir gas pressure and hence the need for booster compression (1995 figures). There are significant opportunities for increasing production by increasing exploration activity, implementing horizontal drilling and using hydraulic fracturing.

In 1995, imports of Russian sales gas via a pipeline through the Ukraine were 6 bcm/yr, at a maximum rate of 20 million m³/d. Imports were constrained at this level. As a result, Romania has insufficient gas to meet demand, and alternative sources of supply, and storage, are being investigated. The gas sector is dominated by the activity of two state-owned entities, Romgaz and Petrom, though in the near future some gas production is expected from foreign E&P companies operating in Romania.

The oil and gas sectors are beneficiaries of a rehabilitation loan funded by IFIs.

The mining industry produced 4.9 mt of hard coal (0.35 mt coking coal and 4.54 mt power station coal) in 1995, an increase of 2% from 1994 (0.44 mt coking coal and 4.35 mt power station coal). Romanian hard coal is of a lower thermal value than that traded on international markets (3200 kcal/kg vs 7000 kcal/kg). Romania imports higher thermal value coal to supplement its domestic supply; 5.2 million tons were imported in 1993, the majority, 4.7 million tons, being coking coal.

In 1994, of the 9.2 million tons of hard coal produced and imported, 43.4% was used to produce electricity (and thermal energy), 7.6% for coking coal, 44.4% for manufacturing industry, 4% for agriculture and 0.7% for construction. The hard coal sector is dominated by the activity of one state-owned entity, RAH (Regia Autonoma a Huilei).

The mining industry produced 36.2 mt of lignite in 1995, 1.4% higher than 1994. 72000 tonnes of lignite was imported in 1993, and none in 1994. (Note: lignite and brown coal are collectively referred to as 'lignite' throughout this document). In 1995, 98.2% of the lignite was used to produce electricity (and thermal energy). The remainder was used by industry and the residential sector. The lignite sector is dominated by the activities of two state-owned entities: RALO (Regia Autonoma Lignite Oltenia) and RACP (Regia Autonoma Carbunei Ploiesti). The lignite sector has been the beneficiary of a \$27m loan from IFIs to rehabilitate and modernise the sector.

The nuclear industry has the capability to mine and process uranium and manufacture fuel bundles and heavy water. Renel, through its subsidiaries, is responsible for the production of heavy water, and RAMR (Regie Autonoma for Rare Metals) for nuclear fuel bundles.

The renewable energy sector makes a small contribution to Romania's energy needs; in order of importance of production the resources are: firewood, geothermal for district heating, solar heating, wind power, biogas.

The refinery sector is characterised by processing capacity of about 34 mt per year (mtpy) compared to domestic demand of about 14 mtpy (1993), and in 1993 the Government approved a strategy to reduce capacity to 18 mtpy by mothballing process trains. A study is currently being undertaken to consider more widespread restructuring and closures. The refineries currently depend upon imported crude oil for 60% of the requirements of the large refineries. The study is also addressing how to make better use of high quality domestic crude. The refineries are organised as independent state-owned companies overseen by the holding company, Rafirom. The strategy for the sector is developed by the General Directorate for Chemicals and Petrochemicals in the Ministry of Industries. Product retail marketing is partially



controlled by PECO; crude oil transmission is controlled by Conpet and Petrom RA; product transport by Petrotrans, except pipeline transportation which is by Conpet; and crude import and product export is controlled mainly by Oil Terminal. All of these companies are at least 70% state-owned and, with the exception of Petrom, are included in the 1996 privatisation process. There is some discussion in the government about forming a holding company for some or all of the exploration, production, transmission, refining and distribution sectors, though this has yet to be resolved

Rehabilitation loans for the refinery sector are currently being considered by IFIs.

1.3 Socio-Economic Context

The Romanian economy registered a 1% increase in GDP in 1993, 1.5% in 1994 and about 6.9% in 1995 (1995 are preliminary figures). Industrial output follows a similar pattern, with 1% increase in both 1993 & 1994, and more than 8% in 1995 (1995 are preliminary figures).³ Total energy demand was still falling between 1992 & 1993, by 7%, but increased by nearly 4% in 1994. Electricity consumption increased by 8.3 % in 1995 and heat supplied by Renel by 5.6% (preliminary figures).

The structure of energy demand has been changing since 1992, with the proportion of demand from the residential and transport sectors, rising, and from the industrial sector, falling. In 1994, the proportions of demand were: 48% for industry, 26% for residential, 17% for transport, 4.5% for tertiary (eg hospitals), and 4.5% for other. This trend is expected broadly to continue, except that the proportion of demand in the tertiary sector is expected to increase.

About 30% of industrial energy demand arises from just six industries: metallurgy, chemicals, oil refining and coking, building materials, wood, pulp & paper, with 21% arising from metallurgy and chemicals alone.⁴ Reducing over-capacity and introducing energy management techniques could provide significant opportunities for energy saving in these industries.

1.4 Energy Prices and Subsidies

Government policy on energy price reform is to combine price increases and explicit regulatory mechanisms to enable prices of tradeable energy sources to be set to reflect international levels, and to regulate the prices of non-tradeable energy sources produced by natural entities to reflect economic costs. Under an IMF Standby Arrangement, and a World Bank Structural Adjustment Loan, the Government undertook to increase natural gas prices by 10% in real terms every quarter until parity with the price of import gas from the CIS was reached. It further undertook to maintain the international prices achieved in November 1991, and to eliminate subsidies to the residential sector by end-December 1993, though this has now been re-scheduled. Price adjustments have not kept pace with persistent high inflation and the rapid depreciation of the exchange rate. Most energy prices are currently below international parity levels, though not substantially. The situation is complicated by a 2.8 fold discrepancy between the actual exchange rate and the purchasing-power-parity exchange rate.⁵

In 1995, subsidies of 7%, 46% & 48% of costs are granted to the three coal sector companies, RALO, RACP and RAH respectively, and to a lesser extent the refinery and gas sector is subsidised. Substantial cross subsidies are in place for gas, electricity and heat, to protect the domestic consumer at the expense of industry. The price of domestic electricity is currently 57% of the average for industry, and gas is 35%.

A build-up of arrears between major enterprises is also a major obstacle to structural change. The objective of the Government is to continue with price increases but at a pace in conformity with the general economic reform process.

1.5 Legislation

³ National Institute for Economic Research (INCE), Romania, 1994

⁴ Romanian Statistics Yearbook 1995. Preliminary figures from Ministry of Industries.

⁵ Economic Comparative Studies, Vienna. 1995 preliminary figures show the Lei to be 2.8 times as valuable as the actual exchange rate.



The Romanian Government policy is to continue the development of a legislative framework to support the market economy and to eliminate barriers which limit the profitability of companies and trade. To this end, Romania is a signatory to the European Energy Charter and the Energy Efficiency Protocol, and the Frame Convention on Climate Change. The latter has been ratified by the Parliament; the former will soon be debated. An Environment Law (No. 137/95) and a Petroleum Law (No. 134/95) have been ratified by Parliament and a Mining Law is being debated. An Energy Conservation Law, an Electricity and Thermal Energy Law and a 'Promotion and Organisation of Nuclear Activities' Law are in preparation.

1.6 Institutional assessment

The Ministry of Industries (MoI) has primary responsibility for energy policy through its general directorates for Energy, Oil and Gas; Mining and Geology; Chemical and Petrochemical Industry. The National Agency for Mineral Resources (see below) also has a significant role in forming fuel policy, and the Romanian Agency for Energy Conservation (ARCE) provides a focus for energy saving policy. The effectiveness of ARCE has been hindered in the past by uncertainty over its institutional position and scope of responsibility. Its position has recently become more certain, and it is now part of the Ministry of Industries.

The most important source of energy modeling expertise lies in a subsidiary of Renel, the Power Studies and Design Institute, ISPE. ISPE is scheduled to be split from Renel in the immediate future (and later privatised), but will continue in its role of advising Renel and the Ministry of Industries until a more suitable institution is established.

The National Agency for Mineral Resources (NAMR) administers mineral resources and is responsible for the granting of concessions for exploration, licensing for production, and other regulation, of the all mineral resources (ie including oil, gas, coal and uranium). The Ministry of Finance recommends pricing and taxation policies for most energy products in consultation with the relevant directorate in the MoI, or the NAMR in the case of oil and gas. Budgets for strategic industries (Regii Autonome), such as coal, electricity, gas, oil, and energy imports, are established in a similar fashion.

1.7 Fuel Policy

The government has a number of sector-specific strategies in the energy sector including Electricity and Heat, Oil and Gas, Mining, Petrochemicals, Energy Conservation, and also strategies for the energy-intensive industries. In addition, certain non-governmental organisations and research institutions have developed strategies independently of the government. However, at the moment there is not a global energy policy concerning sources of fuels and energy production. In former times the industrial programme was heavily dependent on energy, and this has resulted in a highly energy intensive production sector. Faced with the rapid decline in domestic oil and gas production and the increasing costs in coal production, the Government has formulated a strategy aimed at efficient production and utilisation of energy resources, and in particular the preferential development of indigenous fuel supply. In line with the objectives of this strategy, the Government intends to develop an energy supply option policy that would take into account the country's comparative advantages in energy resources availability and utilisation. Based on its local availability, natural gas is likely to be Romania's major fuel of choice to meet a wide variety of needs (as is the international trend). While a policy to stimulate gas demand would attract the private and state sector to explore for more gas in Romania, such a policy, however, would impact the coal and refinery subsectors, power generation and associated infrastructure, and district heating activities. The environmental impact of continued reliance on solid fuels, especially high sulphur low-grade coal needs also to be considered, particularly in light of the Frame Convention on Climate Change, and the Conventions of Geneva, Espoo and Oslo.

The integrated fuel policy to be formulated for Romania, must ensure that the different subsectors are developed within a coherent framework, which takes full account of economic costs, technological developments as well as environmental impacts. The linkages between the subsectoral studies and the overall integrating study are shown in the diagram (Figure 1) attached. For each of the sectors, the development plan has to address pricing, infrastructure, efficiency and environmental issues. However, the developments of each of the sectors are not independent. At the simplest level, some sources (electricity) use the output from other energy sources (such as coal or petroleum). At a more sophisticated



(and still important level) demand for one type of energy can be influenced by the prices of substitutes as well as their availability. In some cases it may be socially desirable (e.g. for environmental reasons, pricing and availability) to limit the expansion of one type of energy and to encourage that of another. For all these reasons a plan for the energy sector that looked at each subsector in isolation would not be optimal from a national viewpoint.

In addition, there is great uncertainty about the future level of economic growth and the future structure of industrial production in Romania, and this leads to similar uncertainty about the future demand for energy. Another important influence on Romania's energy supply policy is the policies of other countries; the possibility of long term agreements with oil producers, and interconnection with electricity grids and gas networks influences security of supply and costs.

A longer range view of energy development needs to be taken to examine possible future configurations that may be quite different from the system today. Different configurations need to be evaluated under constraints and objective functions that include the following elements:

- (a) the levels of demand and prices that are anticipated for specific purposes such as space heating, mass transport, private transport, and specific sectors, such as industrials;
- (b) the degree of national self-sufficiency desired in fuels and resources and the availability of domestic resources security of supply of certain resources;
- (c) the levels of energy savings achievable and the cost; and
- (d) the level of environmental effects that should be tolerated and the cost.

In addition, it would be appropriate to evaluate a wide range of different energy conversion technologies (both conventional and alternative) and to indicate the optimal combination of energy sources to serve specific demand categories. A multi-objective optimisation needs to be performed with respect to total annual cost or a more generalised concept of costs that include environmental impacts or resource consumption and benefits.