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ROMANIA
SECOND TURCENI THERMAL POWER PROJECT
STAFF APPRAISAL REPORT

December 19, 1978

Projects Department
Europe, Middle East and North Africa
Regional Office

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ROMANIA

CURRENCY EQUIVALENTS

| | | |
|---------------|---|--|
| Currency Unit | = | leu, lei (plural) |
| lei 18 | = | US\$1.00 |
| leu 1 | = | US\$0.0556 |
| lei 1,000,000 | = | US\$55,556 |
| US\$1 | = | lei valuta 4.47 in convertible currency terms |

WEIGHTS AND MEASURES

| | | | | |
|--------------------|---|--------------------------------|---|---|
| m | = | meter | = | 3.28 feet |
| km | = | kilometer | = | 0.62 mile |
| m ³ | = | cubic meter | = | 1.31 cubic yards |
| kWh | = | kilowatt hour | = | 3,414 British thermal units |
| GWh | = | Gigawatt hour | = | 1 million kWh |
| kW | = | kilowatt | = | 1 thousand watts |
| MW | = | Megawatt | = | 1 thousand kW |
| kV | = | kilovolt | = | 1 thousand volts |
| ton | = | metric ton (tonne) | = | 1.1 US tons = 2,204.6 pounds = 1,000 kg |
| kg/cm ² | = | kilogram per square centimeter | | |
| m ³ /s | = | cubic meter per second | | |
| hr | = | hour | | |
| toe | = | ton oil equivalent | | |
| a/ | = | per annum | | |

GLOSSARY OF ABBREVIATIONS

| | | |
|-----------|---|---|
| MEE | = | Minislaubi Energiei Electrice (Ministry of Electrical Energy). |
| CIPEET | = | Centrala Industriala de Producere a Energiei Electrice Si Termice (Industrial Central for Production of Electric Power and Heat). |
| CIRE | = | Centrala Industriala de Retele Electrice (Industrial Central for Transmission and Distribution of Power). |
| ISPE | = | Institutul de Studii si Proiectari Energetice (Design Institute for Thermal Studies). |
| ROMENERGO | = | Foreign Trade Procurement Enterprise. |

GOVERNMENT OF ROMANIA

Fiscal Year

January 1 to December 31

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CHAPTER I

THE POWER AND ENERGY SECTOR

A. Romania's Energy Sector

Energy Resources

1.01 Romania was one of the world's first oil producers and still meets more than 80% of its energy needs from indigenous oil and gas resources; however, production is declining despite intensive secondary and tertiary recovery efforts. By 1985, 50% of Romania's commercial energy needs may have to be imported, mostly in the form of oil. This situation has led to intensive efforts to develop all other indigenous energy resources, including hydropower, coal, lignite, and bituminous shales.

1.02 The published guidelines for the preparation of the 1981-85 Plan dictate continued enforcement and improvement of conservation and efficiency measures in the energy-consumptive sectors. These were initiated in 1973 and are implemented through a highly-structured program consisting of reviews of all industrial and chemical processes and production plans by special committees seeking conservation opportunities, in accordance with the directive by the State Planning Commission to reduce oil imports and use imported oil only for petro-chemicals (see Economic Report, No. 1601-RO, March 31, 1978).

1.03 The guidelines indicate also large investments in resource exploration development e.g. "drilling to great depths", but details are lacking. Although expensive, this is not to imply that these developments are necessarily uneconomic--the studies for the proposed bituminous shale based power plant at Anina, for instance, indicate that the cost is competitive with other power resources being developed in Romania, which themselves are competitive with generation based on imported oil.

1.04 Wood is still quite widely used in Romania as a domestic fuel for cooking purposes. It is assumed that the availability of wood as fuel is limited and that it will stabilize at somewhat over 3 million tons annually on a sustainable yield basis. Other materials such as maize stalks and corncobs are used for domestic fuel in rural areas but no estimate of the quantities involved is available. Romania does possess some peat deposits but these are apparently not considered to be economically exploitable.

1.05 More detailed information on the power/energy sector is given in previous appraisal reports (Turceni Thermal, Loan 1028-RO; Riul Mare-Retezat Hydro, Loan 1242-RO), and an energy sector survey undertaken in connection with the basic economic mission in October/November 1976.

Organization of the Energy Sector

1.06 No single entity is responsible for energy in Romania. Responsibility for the sector rests with the Ministries of (i) Mines, Petroleum and Geology; (ii) Electrical Energy; (iii) Chemical Industries; (iv) Metallurgical Industries; and (v) Forestry Economy and Construction Materials. The State

Planning Committee is responsible for coordinating energy planning in addition to arbitrating differences between Government Ministries.

Past Growth of Energy Consumption

1.07 Energy demand including wood and other "non-commercial" fuels in Romania has risen dramatically over the last three decades as a result of the policy of rapid industrialization; from about 6.8 million tons oil equivalent (toe) ^{1/} in 1950 to about 52.1 million toe in 1975. (No statistics are available for 1976 and 1977, but best estimates are 56 million toe and 61 million toe respectively.)

1.08 Prior to 1950, oil and oil products supplied most energy needs. The development of heavy metallurgical industries, primarily iron and steel increased consumption of coke and coking coal and prompted rising imports of these fuels starting in 1955. Natural gas from the Transylvanian Basin became increasingly important starting in 1960 and by 1965 became the largest single source of energy in the Romanian economy. Current consumption of natural gas is about 36 billion cubic meters/a. The changing structure in the primary energy supply is brought out in Table 1.1.

National Energy Policy

1.09 The national energy policy contained in 1976-1980 Plan can be summarized as follows:

- (a) maximum reliance on domestic production of primary energy resources;
- (b) priority in the development of coal, hydroelectric and nuclear power, while utilizing hydrocarbons preferably as raw materials for the chemical industry; and
- (c) greatly increased utilization of indigenous solid fuels having low calorific value (lignite and bituminous shales).

Forecast Energy Supply and Demand

1.10 The 1976-1980 Plan specific production targets for the four principal forms of energy show that electricity and coal are the fastest growing during the five years (Table 1.2).

1.11 Energy consumption is expected to increase to 78 million toe by 1980. Plans for massive expansion of metallurgical and petrochemicals industries will increase consumption substantially. Consumption estimates are conservative as they include planned savings through higher efficiencies in the industrial sector (about 8 million toe) and increased waste heat recovery (about 5 million toe).

^{1/} One ton oil equivalent, toe = 10.6 million kilocalories.

B. Romania's Power Subsector

Organization

1.12 Romania's power subsector is effectively managed by the Ministry of Electrical Energy (MEE) through a board comprising the Minister, three Deputy Ministers and the various directors of subordinated organizations. Up to October 1, 1977, all MEE generation, transmission, and distribution facilities were the responsibility of a single entity, the Industrial Central for Electric Power and Heat (CIEET). Under the present organization, CIEET has been replaced by two entities; Industrial Central for Production of Power & Heat (CIPEET) in charge of power generation and district heating stations, and Industrial Central for Transmission and Distribution of Power (CIRE), in charge of bulk transmission and distribution. Figure 1.1 shows MEE's latest organization chart and Figures 1.2 and 1.3 CIPEET's and CIRE's respectively.

1.13 Another recent development, also affecting the power subsector, is the general restructuring of Romania's economic and financial system announced by the President of Romania in February 1978. Among other reforms, enterprises would have a greater responsibility for their own financial and operating performance, production planning, and marketing at home and abroad. State funds would still be available to the enterprises. These changes will be put into effect beginning January 1, 1979. At the moment, it is unclear how much decentralization will actually take place and because of the uncertainties this appraisal does not take the proposed changes into account.

Tariffs

1.14 Tariffs are approved by the Council of Ministers and are uniform throughout the country. Until January 1, 1977 they had been virtually unchanged since 1963 except for some restructuring in 1974 to introduce differential tariffs for low, medium and high voltage consumers. However, from January 1977, electricity prices were reduced 28-30% and thermal energy rates about 7% (para. 3.02). This reduction was part of a general restructuring of the prices to the manufacturing sector of inputs from the basic industries (e.g. power, mining, petroleum, metallurgy, chemicals, etc.). The purpose of this restructuring was to increase the profitability of end users, i.e., manufacturers. The effect of this change has been to reduce average revenue per kWh sold from about 0.321 lei or US 1.6 cents equivalent to 0.237 lei or US 1.3 cents equivalent. This price restructuring has not significantly altered the electricity consumption pattern. Large industrial consumers increased their usage slightly from 70% of total consumption to 71% between 1976 and 1977. On the other hand domestic consumers increased their proportion from about 9% to 10% in the same period, even though the domestic price of electricity was not changed.

1.15 In recent years, rates have adequately covered operating and administration costs and provided a reasonable portion of future investment needs. The tariff structure includes time-of-day rates, differential peak and off-peak demand and energy charges and other elements of marginal cost pricing

conducive to efficient allocation of resources but it has not been possible to confirm positively that the rate structure reflects the marginal costs of supply in the absence of a comprehensive study of actual and planned system costs in Romania. However, the elements of the tariffs and penalties imposed for excessive use (para. 3.05) give the tariffs a strong marginal-cost based flavor. Illustrative of the span of tariffs, the average cost of electricity to domestic consumers is about 80% above that paid by large industrial consumers who utilize about 50% of electricity sold in Romania and who benefit from the most favorable tariff rates. No future increases in rates are planned but they are likely to be necessary during the 1981-85 Five-Year Plan because of the higher cost and newer technology of the plant planned for construction in this period.

Planning

1.16 Mathematical models to evaluate and compare alternative power system development patterns have been used by MEE for more than 10 years. A paper describing the Romanian planning models was presented at the June 1969 Power System Computation Conference in Rome, under the title "Models for the Study of Power System Development by Means of Digital Computers". The paper described a linear program to determine the least-cost development plan. The plan is updated from time to time to supply current information to the overall national planning process conducted by the State Planning Committee. A least-cost development study was received by the Bank in July 1977. Subsequent review revealed the study was highly constrained by resource availability and technical alternatives. All solutions selected lignite capacity up to the maximum available and kept nuclear capacity to a reasonable minimum. The net effect of the study was, then, to make only marginal determinations, in this case the division between hydro and nuclear 1/ capacity. However the deficiencies pointed out by the Bank were clarified after detailed discussions with the Romanians and the resulting development program has been recognized by the Bank as the least-cost option within the context of Romanian economic policy. Nevertheless, further work is being done to improve planning by (i) incorporating in the model benefits other than power, and (ii) reviewing carefully cost estimates and technical proposals for the marginal hydro projects.

Existing System and Development Program

1.17 In 1977, Romania's interconnected generating capacity 2/ was 13,184 MW; 2,951 MW consisted of hydro and 9,487 MW of thermal plants belonging to MEE. The rest, 746 MW, were mostly thermal captive plants operated by auto-producers (Table 1.3). System peak was 9,360 MW and total gross generation

1/ Romania is actively negotiating for a nuclear plant based on Canadian technology, but the construction schedule has not yet been determined. However, given the growing energy deficit it is likely that nuclear power will figure prominently in Romania's long-range energy program.

2/ 97% of Romania's total installed capacity is interconnected.

and purchases 61,595 GWh. MEE plants generated 56,551 GWh, auto-producers 3,306 GWh and imports amounted to 1,738 GWh. Exports were 1,882 GWh.

1.18 Sales in 1977 were 49,690 GWh, an increase of only 4.4% over 1976, compared to an average annual growth of sales of 10.0%/a for 1970-1976 (Table 1.4). This marked drop in the rate of load growth was probably caused mostly by the simultaneous occurrence of (i) a slowdown in construction activities as a consequence of the March 1977 earthquake; (ii) reduced consumption in irrigation pumping due to favorable rainfall; and (iii) impact of strong conservation efforts (para 1.02). Table 1.4 also shows the marked reduction in transmission and distribution losses obtained through energy conservation measures since 1973.

1.19 The projected consumption figures prepared by the mission are based on national planning targets and imply average annual load growth of 6.1%/a for 1978-85 (Table 1.5). The estimate reflects slower industrial load growth (5.3%/a in 1978-1985 against 11.3%/a in 1970-1977) in line with an expected slowdown in the industrial production growth rate and planned strong conservation measures by Government throughout the economy.

1.20 Power system expansion plans follow a least-cost development program within national energy policy objectives (para. 1.09) and take into account adequate system reserve planning and performance criteria (para. 1.16). Table 1.6 shows MEE's generation expansion plan for 1978-1985. Total estimated subsector investment for 1978-1985 shown in Table 1.7 is 141,424 million lei (US\$7,857 million), not including investment in distribution facilities at the local level in municipalities--total distribution investment could be estimated at about twice the figure shown for distribution in the table. Distribution construction in the municipalities is carried out by construction units within each distribution enterprise. These units are self-accounting and financed from local funds. Of the investment shown, 36%, 51,483 million lei (US\$2,860 million), would be for 8,490 MW of thermal plants (Table 1.8); 42%, 59,483 million lei (US\$3,305 million), would be for 4,066 MW of hydro plants and the other 21%, 30,200 million lei (US\$1,678 million), would be for bulk transmission and distribution, dispatching and other sector investments under MEE.

1.21 The large amounts shown for generation expansion reflect the current emphasis being given to accelerated construction of high cost, multipurpose hydro installations under the development program entrusted to MEE.

Role of the Bank

1.22 The Bank has made two loans for power in Romania. Loan 1028-RO (\$60 million) in 1974 for the first stage of the Turceni Thermal Power Project (1,320 MW) and associated transmission, and Loan 1242-RO (\$50 million) in 1976 for the Riul Mare-Retezat Hydro Power Project (355 MW at Retezat plus 14 MW at Clopotiva, downstream). In addition to providing needed base load generation to the system, the first loan contributed to the transfer of up-to-date industrial technology. Manufacture of the boilers, turbines and generators is taking place in Romania using modern, proven designs acquired through licensing agreements with foreign manufacturers. The second loan helped finance a key

component of a cascade development designed to supply hydro peaking power to the system.

1.23 Progress on the first Turceni stage can be considered good in spite of an overall nine months' delay to date. Construction problems are well under control. No major additional delays are foreseen and the last of the four units is expected to start up in December 1979.

1.24 The Riul Mare-Retezat Hydro-Power Project, on the other hand, has been plagued by recurrent shortages of tunneling manpower. Start-up of the first unit in the Retezat station is likely to be 10-12 months late. To prevent further slippage manpower deficiencies are expected to be offset by introduction of a tunnel boring machine starting in early 1979.

The Borrower

1.25 The Borrower for the proposed loan would be the Investment Bank, which is the specialized agency, under the Ministry of Finance, for investment projects in all sectors of the economy except agriculture (including water resources) and food processing. It has a large technical and economic staff with branch offices in all districts of the country. The Investment Bank's involvement in investment projects commences in the preparation phase of a project; its staff appraises all major investment projects technically and financially and recommends approval or otherwise of their financing to the Council of Ministers. When a particular project and its financial plan has been approved by the Council of Ministers, all major funds are channeled through the Investment Bank in accordance with the approved financial plan. All payments for the execution of a project have to be authorized by the Investment Bank which keeps separate accounts for each category in the financial plan for every enterprise. It is the Investment Bank's obligation to ensure that a project is executed according to the financial and technical data included in the final technical and economic study approved by the Council of Ministers. Its inspectors check whether the project is proceeding according to the schedule approved in the Plan.

The Project Entity

1.26 Turceni enterprise, one of the generating enterprises reporting to CIPEET (para. 1.12) will be responsible for Project implementation. This enterprise was established in 1973 by decree of the Council of Ministers specifically for the Turceni Thermal Power Plant Project and is currently carrying out the first stage of construction (4x330 MW) under Bank financing (para. 1.22).

1.27 The manager of the Turceni enterprise is responsible for the administration, recruitment and training of future plant operating personnel. Training is arranged with the aid of technical schools, universities, on-the-job training at existing power stations and by association with the erection staff during the final stages of the Project through start-up and commercial operation.

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SECOND TURCENTI THERMAL POWER PROJECT
Composition of Primary Energy Supply, 1965 and 1975
 (Thousand Tonnes Oil Equivalent)

| <u>Energy Source</u> | <u>1965</u> | <u>Percentage of Total Primary Energy Supply</u> | <u>1975</u> | <u>Percentage of Total Primary Energy Supply</u> |
|--|-------------|--|-------------|--|
| <u>Solid Fuels</u> | | | | |
| (a) <u>Domestic Production</u> | | | | |
| <u>Coal and Anthracite</u> | 2,363 | 7.4 | 3,449 | 5.8 |
| Lignite | 920 | 2.9 | 3,354 | 5.7 |
| Brown Coal | 101 | 0.3 | 111 | 0.2 |
| Bituminous Shale | - | - | - | - |
| Wood | 604 | 1.9 | 740 | 1.3 |
| Subtotal Domestic Production | 3,988 | 12.5 | 7,654 | 13.0 |
| (b) <u>Imports</u> | | | | |
| Metallurgical Coke | 658 | 2.0 | 1,795 | 3.0 |
| Washed Coal and Anthracite | 533 | 1.7 | 1,826 | 3.1 |
| Subtotal Imports | 1,191 | 3.7 | 3,621 | 6.1 |
| Total Solid Fuels (Net Domestic Consumption) | 5,179 | 16.2 | 11,275 | 19.1 |
| <u>Hydrocarbons</u> | | | | |
| (a) <u>Domestic Production</u> | | | | |
| <u>Crude Oil</u> | 12,571 | 39.2 | 14,590 | 24.7 |
| Natural Gas Liquids | 410 | 1.3 | 452 | 0.8 |
| Natural Gas | 13,605 | 42.4 | 25,608 | 43.3 |
| Subtotal Domestic Production | 26,586 | 82.9 | 40,650 | 68.8 |
| (b) <u>Imports</u> | | | | |
| Crude Oil | - | - | 5,085 | 8.6 |
| Natural Gas | - | - | - | - |
| Subtotal Imports | - | - | 5,085 | 8.6 |
| (c) <u>Exports</u> | | | | |
| Crude Oil | - | - | - | - |
| Natural Gas | 154 | 0.5 | 149 | 0.2 |
| Petroleum Products | 5,849 | 18.2 | 6,182 | 10.5 |
| Subtotal Exports | 6,003 | 18.7 | 6,331 | 10.7 |
| Total Hydrocarbons Supply | 26,586 | 82.9 | 45,735 | 77.4 |
| <u>Electrical Energy</u> | | | | |
| Domestic Production (Hydropower) | 226 | 0.7 | 1,956 | 3.3 |
| Imports | 59 | 0.2 | 113 | 0.2 |
| Exports | (126) | (0.4) | (655) | (1.1) |
| Net Electrical Energy Supply | 159 | 0.5 | 1,414 | 2.4 |
| Total Domestic Energy Production | 30,800 | 96.1 | 50,260 | 85.1 |
| Total Energy Imports | 1,250 | 3.9 | 8,819 | 14.9 |
| Total Primary Energy Supply | 32,050 | 100.0 | 59,079 | 100.0 |
| Total Energy Exports | 6,129 | 19.1 | 6,986 | 11.8 |
| TOTAL DOMESTIC ENERGY CONSUMPTION | 25,921 | 80.9 | 52,093 | 88.2 |

SOURCE: Economic Report on Romania. World Bank Report No. 1601-RO, March 31, 1978

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SECOND TURCENI THERMAL POWER PROJECT

1976-1980 Plan Production Targets for Primary Energy

| | ---1976--- ^{1/} | | <u>1977</u> | <u>1978</u> | <u>1979</u> | <u>1980</u> |
|---|--------------------------|---------------|-------------|-------------|-------------|-------------|
| | <u>Plan</u> | <u>Actual</u> | | | | |
| Electric Energy (TWh) ^{2/} | 57.5 | 58.3 | 63.1 | 65-67.7 | 70-73.4 | 75-78.8 |
| Coal (net) (Million tons) | 29.6 | 28.1 | 33.5 | 38-40.7 | 45.5-48.2 | 53-56.6 |
| Petroleum Extracted (million tons) | 14.7 | 14.7 | 14.8 | 15.1 | 15.3 | 15.5 |
| Methane Gas Extracted (billion m ³) | 26.8 | 36.5 | 27.8 | 26.8 | 26.8 | 26.8 |

^{1/} No complete statistics available beyond 1976.

^{2/} Gross generation figures.

SOURCE: Economic Report on Romania, World Bank Report No. 1601-R0, March 31, 1978.

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ROMANIASECOND TURCENI THERMAL POWER PROJECTMEE Interconnected System, Installed Generating Capacity, 1977

| | <u>1977</u> (MW) |
|---|---------------------|
| Total installed capacity in interconnected system | 13,184 |
| Total MEE, of which: | <u>12,438</u> |
| A) hydro | 2,951 |
| B) thermal | <u>9,487</u> |
| of which: | |
| i) coal fired, | <u>4,184</u> |
| of which: | |
| - straight condensing | 3,731 |
| - heat and power | 453 |
| ii) gas and oil fired, | <u>5,194</u> |
| of which: | |
| - straight condensing | 2,575 |
| - heat and power | 2,619 |
| iii) combustion turbine plants | <u>109</u> |
| | (GWh) |
| Gross Generation, | <u>59,857</u> |
| of which: | |
| MEE Thermal | 46,751 |
| MEE Hydro | 9,800 |
| Autoproducers | 3,306 |

SOURCE: MEE

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SECOND TURCENI THERMAL POWER PROJECT

Sector Generation and Sales, 1970 - 1977
(GWh)

| | <u>1970</u> | <u>1971</u> | <u>1972</u> | <u>1973</u> | <u>1974</u> | <u>1975</u> | <u>1976</u> | <u>1977</u> |
|--|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 1) Net generation by auto-producers | 2,874 | 2,944 | 2,971 | 2,958 | 2,742 | 2,930 | 3,104 | 3,306 |
| 2) Consumption by auto-producers | <u>2,869</u> | <u>2,937</u> | <u>2,963</u> | <u>2,948</u> | <u>2,735</u> | <u>2,922</u> | <u>3,093</u> | <u>3,306</u> |
| 3) Balance, sold to MEE | 5 | 7 | 8 | 10 | 7 | 8 | 11 | - |
| 4) Net generation, MEE stations | 29,713 | 33,810 | 37,735 | 40,962 | 43,373 | 47,594 | 51,593 | 52,853 |
| 5) Imports | 28 | 64 | 411 | 251 | 785 | 502 | 684 | 1,738 |
| 6) Total delivered to MEE system | <u>29,746</u> | <u>33,881</u> | <u>38,154</u> | <u>41,223</u> | <u>44,165</u> | <u>48,104</u> | <u>52,288</u> | <u>54,591</u> |
| 7) Station use, district heating plants | 816 | 821 | 1,048 | 1,095 | 1,143 | 610 | 588 | 926 |
| 8) System (T&D) losses, ^{1/} as % of 6 | 3,316 11.1 | 3,611 10.6 | 4,238 11.1 | 4,627 11.2 | 4,281 9.7 | 4,059 8.4 | 4,111 7.9 | 3,975 7.3 |
| 9) MEE sales, of which: | 25,614 | 29,449 | 32,868 | 35,501 | 38,741 | 43,435 | 47,589 | 49,690 |
| - industrial | 16,727 | 18,966 | 21,034 | 23,068 | 26,304 | 30,363 | 33,287 | 35,472 |
| - transport & telecommunications | 659 | 778 | 813 | 984 | 1,116 | 1,321 | 1,487 | 1,626 |
| - construction | 662 | 707 | 718 | 852 | 890 | 978 | 1,016 | 1,199 |
| - agriculture | 710 | 835 | 992 | 1,334 | 2,027 | 2,014 | 2,521 | 2,481 |
| - municipal services | 2,204 | 2,431 | 2,688 | 2,281 | 2,007 | 2,035 | 2,883 | 2,229 |
| - residential | 2,239 | 2,513 | 2,887 | 3,183 | 3,257 | 3,717 | 4,255 | 4,801 |
| - exports | 2,413 | 3,219 | 3,736 | 3,799 | 3,140 | 3,007 | 2,140 | 1,882 |

- 10 -

^{1/} Progressive T&D loss reduction reflects strong conservation efforts after 1973.

SOURCE: MEE data

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SECOND TURCENI THERMAL POWER PROJECT

Forecast Sector Generation and Sales, 1978 - 1985
(GWh)

| | -----F o r e c a s t----- | | | | | | | |
|---|---------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| | <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
| 1) Net Generation by auto-producers | 3,760 | 3,900 | 4,100 | 4,250 | 4,400 | 4,600 | 4,800 | 5,000 |
| 2) Consumption by auto-producers | 3,530 | 3,630 | 3,820 | 4,000 | 4,150 | 4,370 | 4,520 | 4,740 |
| 3) Balance, sold to MEE | 230 | 270 | 280 | 250 | 250 | 230 | 280 | 260 |
| 4) Net Generation, MEE Stations | 57,054 | 60,817 | 65,411 | 69,279 | 73,878 | 78,466 | 81,132 | 86,340 |
| 5) Imports | 250 | 250 | 250 | 250 | - | - | - | - |
| 6) Total Delivered to MEE System | <u>57,534</u> | <u>61,337</u> | <u>65,941</u> | <u>69,779</u> | <u>74,128</u> | <u>78,696</u> | <u>81,412</u> | <u>86,600</u> |
| 7) Station use, district heating plants | 1,002 | 1,070 | 1,186 | 1,223 | 1,299 | 1,379 | 1,427 | 1,518 |
| 8) System (T & D) losses, as % of 6 | 3,832 6.7 | 3,867 6.3 | 4,055 6.1 | 4,184 6.0 | 4,445 6.0 | 4,719 6.0 | 4,882 6.0 | 5,193 6.0 |
| 9) MEE Sales, of which: | 52,700 | 56,400 | 60,700 | 64,372 | 68,384 | 72,598 | 75,103 | 79,889 |
| - industrial | 37,019 | 39,382 | 41,987 | 44,086 | 46,291 | 48,605 | 51,035 | 53,587 |
| - transport & telecommunications | 1,757 | 1,944 | 2,243 | 2,467 | 2,714 | 2,985 | 3,284 | 3,612 |
| - construction | 1,317 | 1,475 | 1,664 | 1,968 | 2,226 | 2,423 | 2,636 | 2,860 |
| - agriculture | 2,887 | 3,151 | 3,545 | 3,856 | 4,280 | 4,660 | 5,070 | 5,500 |
| - municipal services | 2,448 | 2,615 | 2,822 | 2,912 | 3,082 | 3,355 | 3,651 | 3,960 |
| - residential | 5,272 | 5,833 | 6,439 | 7,083 | 7,791 | 8,570 | 9,427 | 10,370 |
| - exports | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | 2,000 | - | - |

SOURCE: Mission estimates based on MEE data.

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ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

MEE Interconnected System, Generation Reserve Planning, 1978-1985

| | | <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|--|---------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Installed capacity as of Dec. 31, | MW | 14,674 | 15,660 | 17,101 | 18,748 | 20,211 | 21,803 | 22,721 | 25,218 |
| Available capacity at maximum peak load ^{1/} | MW | 14,144 | 15,384 | 16,501 | 18,300 | 19,698 | 20,850 | 22,380 | 24,069 |
| Maximum peak load | MW | 10,025 | 10,750 | 11,660 | 12,740 | 13,974 | 15,235 | 16,300 | 17,740 |
| Reserve for unavailable power & station deratings | MW | 930 | 950 | 1,050 | 1,100 | 1,150 | 1,200 | 1,250 | 1,310 |
| Effectively available power | MW | 13,214 | 14,434 | 15,451 | 17,200 | 18,548 | 19,650 | 21,130 | 22,759 |
| Load reserve | MW | 225 | 233 | 242 | 253 | 265 | 277 | 207 | 299 |
| Reserve for planned repairs at peak load | MW | 1,524 | 1,999 | 2,013 | 2,415 | 2,580 | 2,609 | 2,573 | 2,768 |
| Reserve for new units breaking-in periods | MW | 725 | 600 | 609 | 770 | 620 | 300 | 790 | 680 |
| Reserve for unplanned repairs | MW | 715 | 852 | 927 | 1,022 | 1,109 | 1,149 | 1,100 | 1,272 |
| Total reserve at peak load | MW % | 4,119 29.1 | 4,634 30.1 | 4,841 29.3 | 5,560 30.3 | 5,724 29.0 | 5,615 27.0 | 6,080 27.2 | 6,329 26.3 |
| Total reserve on Dec. 31 | MW % | 4,649 31.4 | 4,910 31.3 | 5,441 31.8 | 6,008 32.0 | 6,237 30.8 | 6,148 28.8 | 6,421 28.3 | 7,478 29.7 |

^{1/} Based on expected annual maintenance cycle.

SOURCE: MEE

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ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

MEE Investment Program 1978-1985
(Million Lei)

| | <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1978-1985</u> |
|-------------------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------------|
| TOTAL | 10,570 | 10,893 | 11,711 | 14,200 | 17,300 | 21,200 | 25,900 | 29,650 | 141,424 |
| of which: | | | | | | | | | |
| - thermal plants | 4,393 | 4,070 | 4,620 | 5,100 | 6,100 | 7,370 | 9,500 | 10,330 | 51,483 |
| - hydro plants | 3,176 | 3,765 | 4,100 | 5,900 | 7,650 | 9,680 | 11,600 | 13,870 | 59,741 |
| - transmission | 1,965 | 1,879 | 1,765 | 1,900 | 2,100 | 2,400 | 2,650 | 2,800 | 17,459 |
| - distribution | 1,000 | 1,150 | 1,200 | 1,250 | 1,400 | 1,700 | 2,100 | 2,600 | 12,400 |
| - dispatching and other -- | 36 | 29 | 26 | 50 | 50 | 50 | 50 | 50 | 341 |

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ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

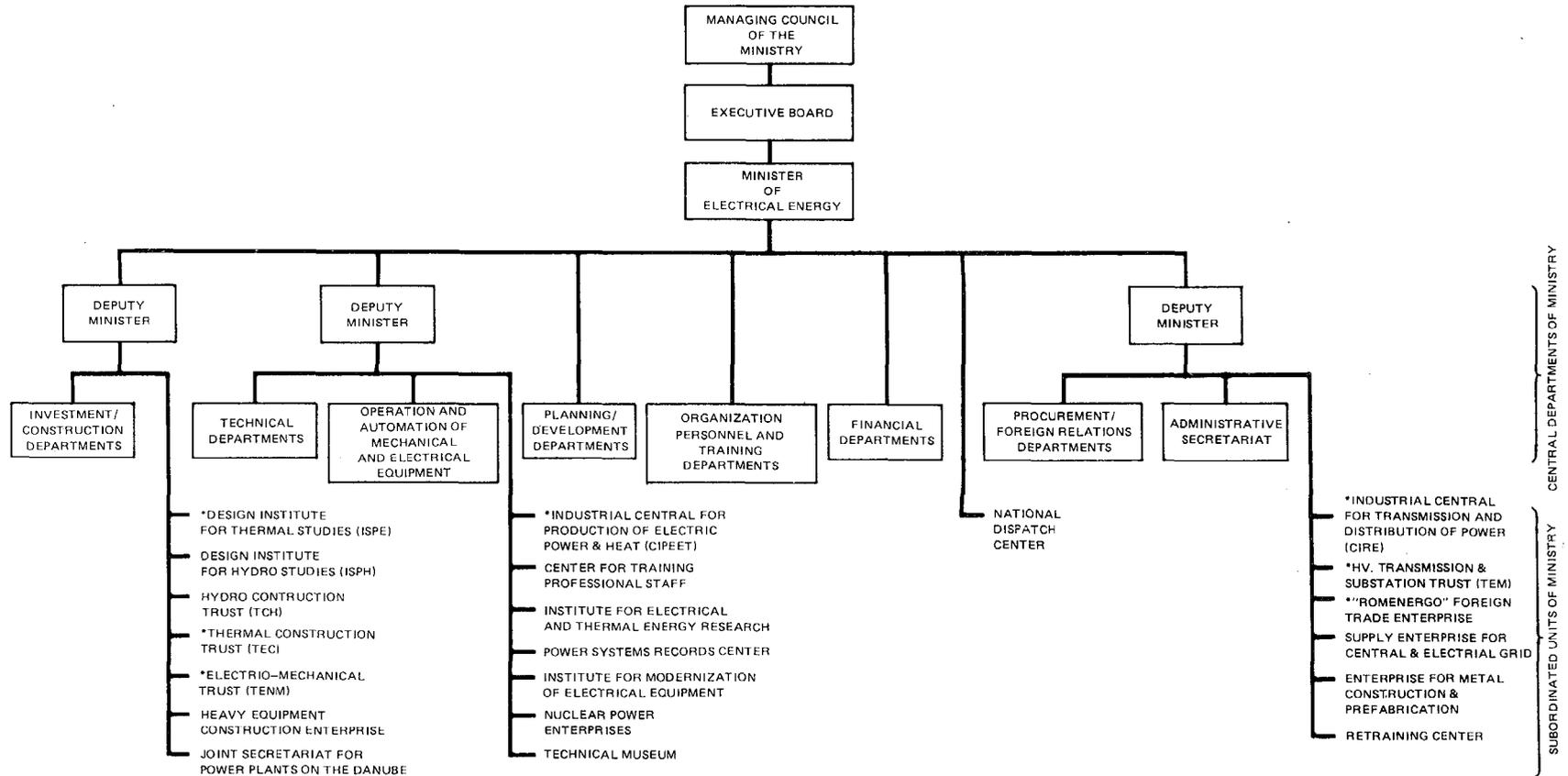
MEE Interconnected System Planned Capacity Additions, 1978-1985
(MW)

| | <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1978-1985</u> |
|-------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|------------------|
| TOTAL | 1,558 | 999 | 1,477 | 1,789 | 1,502 | 1,219 | 1,457 | 2,555 | 12,556 |
| of which: | | | | | | | | | |
| A) hydro | 148 | 289 | 357 | 349 | 472 | 379 | 757 | 1,315 | 4,066 |
| B) thermal, | 1,410 | 710 | 1,120 | 1,440 | 1,030 | 840 | 700 | 1,240 | 8,490 |
| of which: | | | | | | | | | |
| a) coal-fired | 860 | 660 | 920 | 1,290 | 930 | 720 | 340 | 340 | 6,060 |
| b) oil/gas-fired | 550 | 50 | 200 | 150 | 100 | 120 | 360 | 900 | 2,430 |

SOURCE: MEE

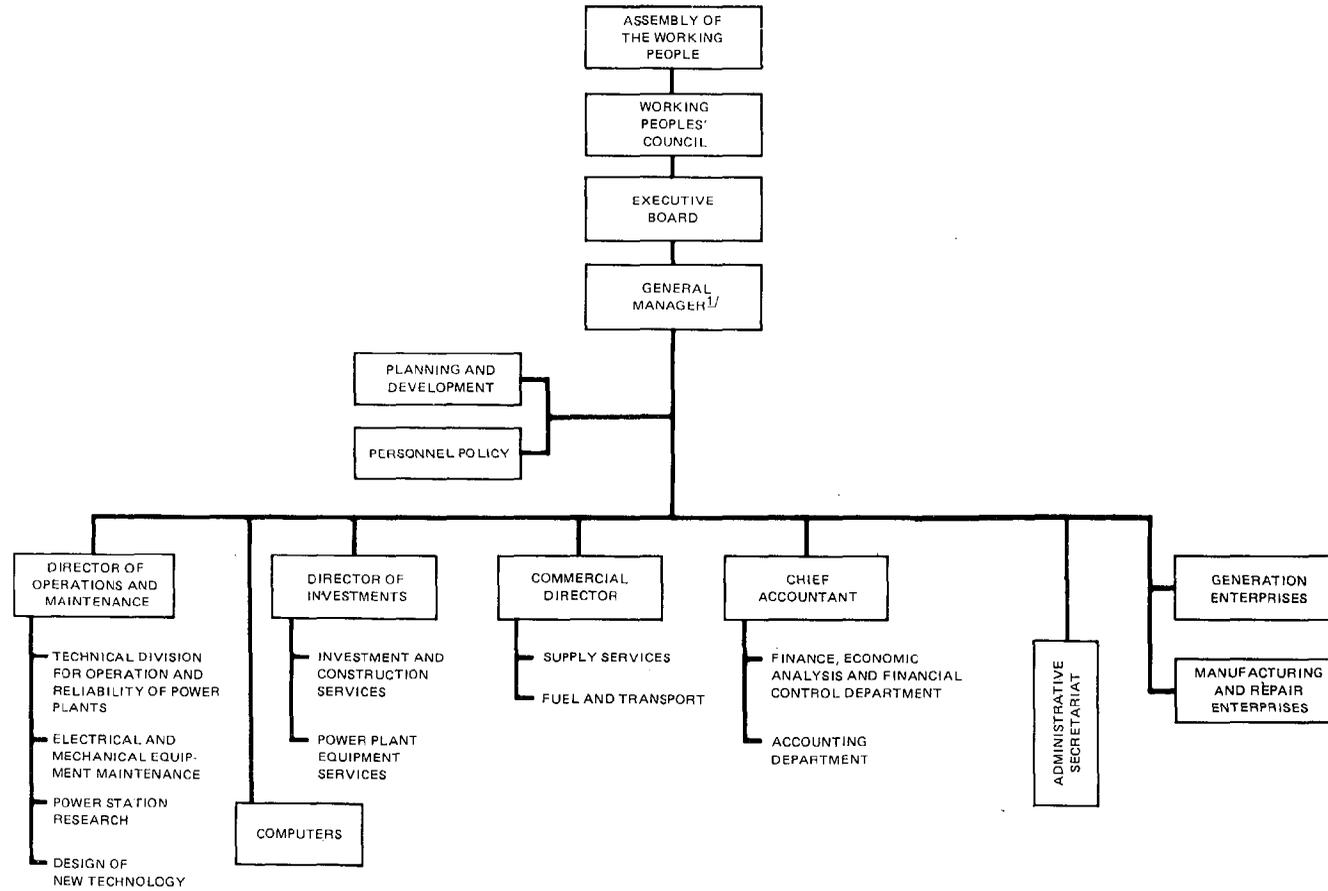
December 1978

**ROMANIA
MINISTRY OF ELECTRICAL ENERGY
ORGANIZATION CHART**



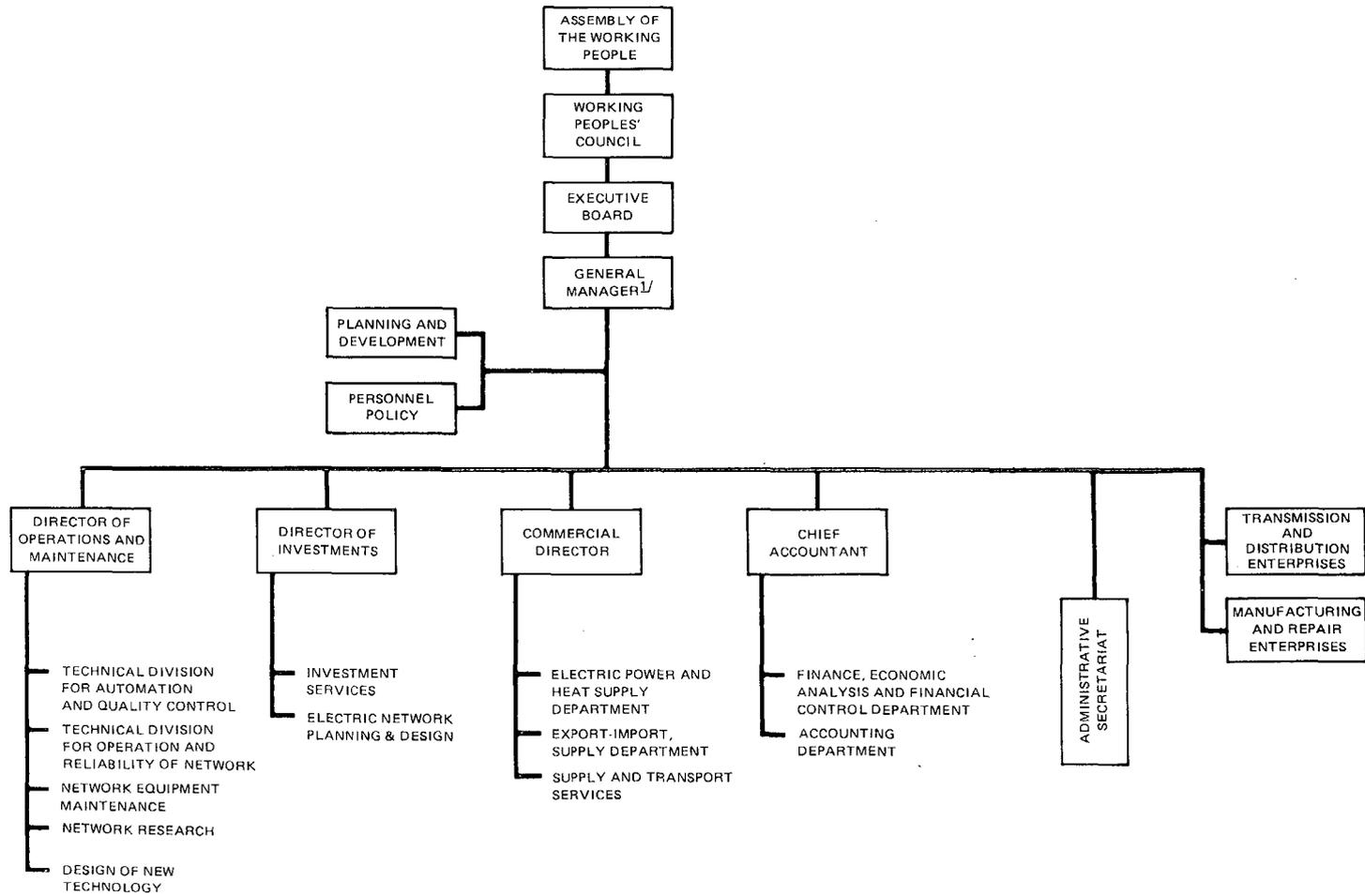
*Units Directly Concerned With The Turceni Project

ROMANIA
INDUSTRIAL CENTRAL FOR PRODUCTION OF ELECTRIC POWER AND HEAT (CIPEET)
ORGANIZATION CHART



^{1/} General Manager is a Deputy Minister of the Ministry of Electrical Energy.

ROMANIA
INDUSTRIAL CENTRAL FOR TRANSMISSION AND DISTRIBUTION OF POWER (CIRE)
ORGANIZATION CHART



1/ General Manager is a Deputy Minister of the Ministry of Electrical Energy.

CHAPTER II

THE PROJECT

Description

2.01 The Second Turceni (Turceni II) Thermal Power Project comprises:

- (a) a thermal power station with four 330-MW lignite-fired units delivering 7,920 GWh/a to the interconnected system at a plant factor of 74%, as an extension to the first 4x330-MW Turceni stage (Turceni I) under construction in southwestern Romania with Bank financing (Loan 1028-RO).
- (b) about 288 km of 400-kV transmission lines connecting Turceni with Cluj via Rovinari (Map IBRD 10830R).

2.02 Fuel supply and site facilities (railroad, river diversion, ash handling, etc.) will be as provided for in Turceni I (Map IBRD 10831R), but will involve opening of additional new mines both open cast and underground (para. 2.03).

Fuel Supply

2.03 In addition to lignite, the basic fuel, Turceni plant will also burn fuel oil for start-up and stabilization of lignite burning at partial load. Turceni II will require about 11 million tons/a of lignite and 0.8 million tons/a of fuel oil. Adequacy of lignite supplies for the life of the station was ascertained as detailed in the report from Mr. P.W. Rickes, lignite consultant to the appraisal mission. A summary of the report is included as Annex 2.1.

2.04 Total annual lignite consumption is estimated at 55 million tons/a starting in 1984/1985 for all existing and presently planned lignite-fired stations--Turceni I and II (8x330 MW), Rovinari (1,770 MW), Craiova (1,035 MW)--and a number of small industrial plants and other minor consumers. Lignite production from existing known deposits would be capable of supplying the total estimated consumption for at least 60 years. The Government and the Borrower confirmed that they will provide semi-annually lignite production figures for the preceeding 6 months and estimated production for the 6 months immediately following. The first of these statements would be expected by August 31, 1979.

Estimated Project Cost

2.05 The following is a summary of the Project cost estimate:

| | <u>-----Million Lei-----</u> | | | <u>US\$ Million equivalent</u> | | |
|---|------------------------------|----------------|----------------|--------------------------------|----------------|--------------|
| | <u>Local</u> | <u>Foreign</u> | <u>Total</u> | <u>Local</u> | <u>Foreign</u> | <u>Total</u> |
| <u>(a) Thermal Power Station</u> | | | | | | |
| <u>(4x330 MW), base cost /1</u> | 5,450.2 | 1,540.5 | 6,990.7 | 302.8 | 85.6 | 388.4 |
| <u>Contingencies</u> | | | | | | |
| Physical | 545.0 | 154.0 | 699.0 | 30.3 | 8.5 | 38.8 |
| Price | - | 224.5 | 224.5 | - | 12.5 | 12.5 |
| Subtotal | 5,995.2 | 1,919.0 | 7,914.2 | 333.1 | 106.6 | 439.7 |
| <u>(b) Transmission Lines & Substations</u> | | | | | | |
| <u>(288 km, double circuit, 400 kV), base cost /1</u> | 533.8 | 155.2 | 689.0 | 29.6 | 8.6 | 38.2 |
| <u>Contingencies</u> | | | | | | |
| Physical | 53.4 | 15.6 | 69.0 | 3.0 | 0.9 | 3.9 |
| Price | - | 16.7 | 16.7 | - | 0.9 | 0.9 |
| Subtotal | 587.2 | 187.5 | 774.7 | 32.6 | 10.4 | 43.0 |
| <u>TOTAL ESTIMATED /2</u> | | | | | | |
| <u>PROJECT COST</u> | <u>6,582.4</u> | <u>2,106.5</u> | <u>8,688.9</u> | <u>365.7</u> | <u>117.0</u> | <u>482.7</u> |

/1 At late 1978 prices.

/2 For construction period 1977-1984.

The estimated foreign exchange requirement, US\$117 million, 1/ covers the cost of direct imports and foreign exchange costs of local supplies. The proposed loan (US\$70 million) would finance about 60% of this cost. Local costs are based on existing contract prices which are not subject to escalation. Therefore, no local cost price contingency is included. Escalation of foreign currency costs was taken as 9% for 1977, 7% for 1978, 6.5% for 1979 and 6.0% for 1980 through 1984 and applied to direct import items and imported materials and components for locally supplied goods. A 10% physical contingency was applied to both local and for ign currency costs in line with experience in the first stage of Turceni. Details of the development of the Project cost estimate are given in Annex 2.2. At negotiations, the Government clarified

1/ The foreign exchange Project cost estimate is made up of direct import assemblies (10.0% of total foreign exchange cost), imported components for incorporating into Romanian-made equipment (63.9%), indirect foreign exchange expenditure for depreciation of manufacturing and construction equipment (2.6%), imported automotive fuel and lubricants (2.3%), and reinforcing and structural steel (21.2%).

that import duties have been imposed on equipment and machinery imports since 1974. Accordingly, taxes and duties are included in the local currency portion of the Project cost estimate based on the approved ceiling for direct imports (US\$8.9 million, para. 2.15) and applicable import taxes and duties 1/. On the other hand, local turnover taxes are not applicable to transactions between state-owned enterprises and are therefore omitted.

2.06 The generating component of the Project is estimated to cost 7,914.2 million lei (about (US\$440 million) or about 5,996 lei/kW (US\$333/kW). Given the circumstances in Romania, this cost is reasonable.

Project Financing Plan

2.07 The Project represents about 8% of the MEE's investment program which is expected to cost about 112 billion lei (US\$6.2 billion equivalent) during the construction period of the Project through 1984. It will be financed principally from State Budget allocations. The MEE expects that the Turceni enterprise will also provide part of the financing for this Project from its internal funds (i.e. benefits and depreciation). These internal sources are planned to become available beginning late in 1978 or earlier in 1979 after commissioning of the first unit of Turceni I but no specific amounts have been provided in Romania's current 5-Year Plan 1976-80. The decision of the Council of State (Decree No. 239 dated July 26, 1977), which includes the technical and economic indicators for the Project (Annex 2.3), constitutes the Government's authorization for the Project's construction and the expenditures to be incurred. Submission of an official copy of this decision to the Bank is a condition of loan effectiveness.

2.08 The proposed Bank loan of US\$70 million is expected to finance about 14% of the estimated cost of the Project. The loan would be made to the Investment Bank which would make the proceeds available to the Turceni enterprise on the same terms. It has been assumed that the Bank loan would be for 15 years including a 3-year period of grace. As was the case under the first two power loans, the Investment Bank would meet the debt service up to the time the project enterprise begins producing revenues and has further agreed that the sum of the annual benefits and provisions for depreciation of the Turceni enterprise would, after 1981, be sufficient to cover the debt service payments on both Bank loans for Turceni.

2.09 No cost overrun is expected. However, should additional funds be required, they would be provided in the first instance from resources of the MEE or, if they proved to be insufficient, from the State Budget. Any foreign exchange risk related to the Bank loan would be borne by the Investment Bank.

1/ An average of 15% ad valorem. Import duties range from zero to 35% for thermal power plant components, with most values falling between 11% and 17%.

Environmental Considerations

2.10 Remedial measures to minimize undesirable consequences of large scale mining and lignite-fired power generation are being undertaken. Following established practices, mine overburden is to be dumped in worked-out areas and the land leveled and replanted. Station design includes high stacks equipped with electrostatic precipitators to comply with Romanian clean air standards. These standards prescribe a maximum daily average concentration of sulphur dioxide of 0.25 mg/m³, the maximum momentary SO₂ concentration is not to exceed 0.75 mg/m³, non-toxic suspended powder should not exceed 0.15 mg/m³ and surface deposition of ash emitted with flue gases should not exceed 200 tons/km²/a. Slag and ash will be pumped in fluid suspension to the nearby, barren Ceplea Valley (about 5 km away) capable of accepting dumpings from the 2,640 MW station for about 30 years.

Implementation

2.11 Design engineering is complete and construction of the second Turceni stage is proceeding immediately following the first stage. Building extension and foundations for the second stage are approximately 25% complete. Work is progressing satisfactorily and the first unit (No. 5 unit not financed by the Bank) is expected to start up in June 1980. Civil works and installation and erection are under the Thermal Construction Trust and Electro-Mechanical Construction Trust respectively. Project management is under the Turceni enterprise assisted by the Design Institute for Thermal Studies (ISPE) acting as consultants; and the Investment Bank also monitors performance during construction. In addition, ISPE provides overall project supervision and start-up engineering. Figure 2.1 shows the estimated Project construction schedule.

2.12 Romania's construction industry is highly efficient and no delays are foreseen. Development of new mines should present no problems (para. 2.03). Open-cast mining employs large, electric powered bucket-wheel excavators manufactured in Romania to German designs. No problems in meeting delivery dates for these key items are foreseen. The above implementation arrangements are the same as were made for Turceni I. In view of the relatively good progress of Turceni I (para 1.23) they are considered to be satisfactory for this Project.

Procurement

2.13 Contracts for civil works--not being financed by the Bank--have been negotiated with the Thermal Construction Trust as an extension of the work in progress for Turceni I. Installation and erection will be carried out by the Electro-Mechanical Construction Trust under similar conditions. Both trusts are specialized contractors with a wealth of experience in similar work in Romania. These arrangements have been proven effective in the past and are considered satisfactory for the Project.

2.14 Contracts for three (3) complete turbine-generator sets and minor electrical and mechanical equipment (valves, instrumentation and controls, hydraulic couplings etc.) to be financed from the proposed loan would be awarded through international competitive bidding (i.c.b.) under the Bank's Guidelines for Procurement. Due to the competitiveness of the Romanian thermal power equipment manufacturers, it is expected that the contract to supply the turbine-generator sets will be awarded to Romanian suppliers. On the other hand, the contracts for the balance of i.c.b. items totalling about \$8.9 million (Annex 2.4) are expected to go to foreign manufacturers. For bid evaluation, a domestic preference of 15% or the applicable customs duty, whichever is the lesser, would be granted to participating Romanian manufacturers. Bidding documents for all items were reviewed by the mission before being issued. Bid openings were scheduled between September 18 and October 3 for the minor items, and October 4 for the turbine-generators. Turbine-generator bids were opened on schedule. Three bidders participated. Bid evaluation is expected to take 3-4 months and contract award made about mid-February 1979. To help maintain the proposed implementation schedule (para. 2.11) advance contracting of the minor items (not to exceed US\$8.9 million) has been allowed. Delivery schedule for the three (3) turbine-generator sets is not as critical (para 2.11), however, and no advance contracting would be required in their case.

2.15 Decree No. 239 of the Council of State approving the Project (para. 2.07) sets the limit on the amount of foreign exchange to be expended by MEE on direct imports of goods from convertible currency countries at US\$8.9 million. This limit may be exceeded should the cost of imported equipment prove to be higher than estimated for the minor components and also in the event that a foreign supplier wins the contract for the three turbine-generators. Under such circumstances, MEE is expected to apply promptly to the higher authorities for removal of the US\$8.9 million limit as required to ensure Project implementation within the conditions set out in the Loan Agreement specifying the eligibility of funds for disbursements. The Investment Bank has undertaken to take measures for increasing the US\$8.9 million limit if it becomes necessary.

Disbursement

2.16 Disbursement of the proceeds of the loan would be for (a) 72% of foreign expenditures and 72% of ex-factory cost of locally manufactured items in the case of the three turbine-generators, and (b) 100% of foreign expenditures in the case of other equipment for the thermal power station. The expected disbursement schedule is shown in Table 2.1. Unused portions of the proposed loan, if any, due to project cost savings would be cancelled. The closing date would be December 31, 1982.

Risks

2.17 No special risks are foreseen. The borrower (Investment Bank) and executing agencies (Turceni Enterprise and ROMENERGO) have performed well under the previous loan for the first stage of Turceni (Loan 1028-RO). No difficulties are expected in fuel supply or other operation aspects.

Table 2.1

ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Estimated Disbursement Schedule

| <u>Bank Fiscal Year and Quarter Ending</u> | <u>US\$ Million Cumulative Disbursements at the End of the Quarter</u> |
|--|--|
| <u>1979</u> | |
| June 30, 1979 | 6.2 |
| <u>1980</u> | |
| September 30, 1979 | 13.1 |
| December 31, 1979 | 17.2 |
| March 31, 1980 | 33.2 |
| June 30, 1980 | 39.2 |
| <u>1981</u> | |
| September 30, 1980 | 52.1 |
| December 31, 1980 | 59.2 |
| March 31, 1980 | 63.1 |
| June 30, 1980 | 67.6 |
| <u>1982</u> | |
| September 30, 1981 | 68.5 |
| December 31, 1981 | 70.0 |

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ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Summary of Lignite Mining Consultant's Report

The following summarizes the situation of lignite supply for Turceni thermal power plant:

- (a) lignite deposits comprise sufficient, economically and technically mineable reserves for the supply of all power plants in Oltenia region in operation or planned, for their total expected useful life;
- (b) the coal demand of all consumers will amount to approximately 55 million tons/a from 1984/1985 onwards;
- (c) the planning and development of the number of mines correspond to an annual output of 55 million tons coal/a;
- (d) installation and erection work in progress as well as the planned date of completion of the equipment correspond to the required capacity increase;
- (e) construction of mining equipment is mainly effected under the management of Krupp (Federal Republic of Germany) and similar firms from the German Democratic Republic. Adequate instruction and training of Romanian engineering personnel is being carried out by Krupp and future production on their own seems feasible;
- (f) the solution of problems still existing in the open-cast mines could lead to cost reductions. Special attention should be directed to the mixture of coal rich in ash or coal poor in ash, in order to supply the boilers with a fuel having a calorific value as constant as possible;
- (g) mining techniques both for the open-cast operation and for the deep mining are in line with the latest technical developments;
- (h) additional investment to supply the second stage of Turceni power plant amounting to approximately 11 billion lei, seems to be very high. Nevertheless, provision for these funds is included in the national budget;
- (i) production costs will rise from approximately 84 lei/ton in 1978 to approximately 126 lei/ton in 1980, and later decrease to approximately 92 lei/ton with increasing production. These figures are relatively low;

- (j) the sale price is determined by the State and remains unchanged at 107 lei/ton; and
- (k) freight costs amount to 12 lei/ton between the Jilt basin and the power plant Turceni by railway. They are paid by the power plant.

In sum, it can be concluded that the fuel supply for the Turceni power plant, both for the first and second extension stages, can be regarded as secured. No special risks on account of fuel supply are acknowledged.

ROMANIA
SECOND TURCENI THERMAL POWER PROJECT
Development of Project Cost Estimate

| | <u>-----Million Lei-----</u> | | | <u>Million US\$ Equivalent</u> | | |
|---|------------------------------|----------------|----------------|--------------------------------|----------------|--------------|
| | <u>Local</u> | <u>Foreign</u> | <u>Total</u> | <u>Local</u> | <u>Foreign</u> | <u>Total</u> |
| <u>Base Prices, late 1978</u> | | | | | | |
| A) <u>Thermal Power Station</u> | | | | | | |
| - civil works | 829.8 | 212.5 | 1,042.3 | 46.1 | 11.8 | 57.9 |
| - boilers | 1,168.4 | 717.0 | 1,885.4 | 64.9 | 39.8 | 104.7 |
| - turbine-generators | 1,901.5 | 566.7 | 2,468.2 | 105.6 | 31.5 | 137.1 |
| - miscellaneous electrical and mechanical equipment | 567.5 | 11.4 | 578.9 | 31.5 | 0.6 | 32.1 |
| - automation | 276.6 | 15.2 | 291.8 | 15.4 | 0.8 | 16.2 |
| - fuel handling | 416.5 | 9.4 | 425.9 | 23.1 | 0.6 | 23.7 |
| - water treatment (reduced size) | 18.2 | - | 18.2 | 1.0 | - | 1.0 |
| - ash disposal | 132.3 | 8.3 | 140.6 | 7.4 | 0.5 | 7.9 |
| - commissioning and supervision | 70.0 | - | 70.0 | 3.9 | - | 3.9 |
| - training | 29.9 | - | 29.9 | 1.7 | - | 1.7 |
| - engineering | 39.5 | - | 39.5 | 2.2 | - | 2.2 |
| Subtotal | 5,450.2 | 1,540.5 | 6,990.7 | 302.8 | 85.6 | 388.4 |
| B) <u>Transmission Lines & Substations</u> | | | | | | |
| 288 km, double circuit, 400 kV Turceni-Rovinari-Cluj | 533.8 | 133.2 | 667.0 | 29.6 | 7.4 | 37.0 |
| Total Base Cost | <u>5,984.0</u> | <u>1,673.7</u> | <u>7,657.7</u> | <u>332.4</u> | <u>93.0</u> | <u>425.4</u> |

SOURCE: MEE

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ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Development of Project Cost Estimates, Local Currency, Firm Prices Not Subject to Escalation

| | <u>Work in Progress as of 12/31/78</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1978 -1984</u> |
|---|--|--------------------|--------------------|--------------------|--------------------|------------------|-----------------|--------------------|
| A) Thermal Power Station (4x330 MW) | 430.6 | 861.1 | 1,351.7 | 1,351.7 | 937.4 | 490.4 | 27.3 | 5,450.2 |
| Physical Contingency, 10% | 43.1 | 86.1 | 135.2 | 135.2 | 93.7 | 49.0 | 2.7 | 545.0 |
| Total Thermal Power Station | <u>473.7</u> | <u>947.2</u> | <u>1,486.9</u> | <u>1,486.9</u> | <u>1,031.1</u> | <u>539.4</u> | <u>30.0</u> | <u>5,995.2</u> |
| B) Transmission Lines and Substations (288 km, double circuit, 400 kV) | - | 160.1 | 213.5 | 160.2 | - | - | - | 533.8 |
| physical contingency, 10% | - | 16.0 | 21.4 | 16.0 | - | - | - | 53.4 |
| Total Transmission Lines and Substations | - | 176.1 | 234.9 | 176.2 | - | - | - | 587.2 |
| Total Local Currency Project Cost | <u>473.7</u> | <u>1,123.3</u> | <u>1,721.8</u> | <u>1,663.1</u> | <u>1,031.1</u> | <u>539.4</u> | <u>30.0</u> | <u>6,582.4</u> |

SOURCE: MEE

December 1978

ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Development of Project Cost Estimates, Foreign Currency, Including Escalation
(Million Lei)

| | Work in Progress as of 12/31/78 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1978 -1984 |
|--|------------------------------------|-----------------|-----------------|-----------------|-------------|-------------|------------|------------------|
| A) <u>Thermal Power Station (4x330 MW)</u> | | | | | | | | |
| 1. Not subject to escalation <u>1/</u> | 12.5 | 25.0 | 39.2 | 39.2 | 27.2 | 14.2 | 0.9 | 158.2 |
| Physical contingency, 10% | <u>1.3</u> | <u>2.5</u> | <u>3.9</u> | <u>3.9</u> | <u>2.7</u> | <u>1.4</u> | <u>.1</u> | <u>15.8</u> |
| Subtotal | 13.8 | 27.5 | 43.1 | 43.1 | 29.9 | 15.6 | 1.0 | 174.0 |
| 2. Subject to escalation <u>2/</u> | 94.7 | 220.9 | 346.7 | 346.7 | 240.5 | 125.8 | 7.0 | 1,382.3 |
| Physical contingency, 10% | <u>9.4</u> | <u>22.0</u> | <u>34.7</u> | <u>34.7</u> | <u>24.1</u> | <u>12.6</u> | <u>0.7</u> | <u>138.2</u> |
| Subtotal | 104.1 | 242.9 | 381.4 | 381.4 | 264.6 | 138.4 | 7.7 | 1,520.5 |
| Escalation factor <u>3/</u> | - | 0.0325 | 0.09695 | 0.1628 | 0.2325 | 0.3065 | 0.3849 | - |
| Price contingency | 10.9 | 7.9 | 36.8 | 62.0 | 61.4 | 42.5 | 3.0 | 224.5 |
| Total Thermal Power Station | 128.8 | 278.3 | 461.3 | 486.5 | 355.9 | 196.5 | 11.7 | 1,919.0 |
| B) <u>Transmission Lines and Substations</u> (288 km, double circuit, 400 kV) | - | 46.6 | 60.2 | 46.6 | - | - | - | 155.2 |
| Physical contingency, 10% | <u>-</u> | <u>4.7</u> | <u>6.0</u> | <u>4.7</u> | <u>-</u> | <u>-</u> | <u>-</u> | <u>15.6</u> |
| Subtotal | - | 51.3 | 66.2 | 51.3 | - | - | - | 170.8 |
| escalation factor <u>3/</u> | - | 0.0325 | 0.09695 | 0.1628 | - | - | - | - |
| price contingency | - | <u>1.7</u> | <u>6.6</u> | <u>8.4</u> | <u>-</u> | <u>-</u> | <u>-</u> | <u>16.7</u> |
| Total Transmission Lines and Substations | - | <u>53.0</u> | <u>74.8</u> | <u>59.7</u> | - | - | - | <u>187.5</u> |
| Total Foreign Currency Project Cost | 128.8 | 331.3 | 536.1 | 546.2 | 355.9 | 196.5 | 11.7 | 2,106.5 |

1/ Includes manufacturing license fees and depreciation of imported manufacturing plant and construction equipment.

2/ Direct imports (151 million lei) and materials and components for locally produced items (1,047.8 million lei), total 1,198.8 million lei valued as of January 1, 1977.

3/ For 9% price contingency in 1977, 7% in 1978, 6.5% in 1979 and 6% in 1980-1982, according to best available information.

SOURCE: MEE

December 1978

ROMANIA
SECOND TURCENI THERMAL POWER PROJECT
Summary of Project Cost Estimates
(Million Lei)

| | | Work in Progress | | | | | | | |
|--|----|------------------|---------|---------|---------|---------|-------|------|-----------|
| | | as of 12/31/78 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1978 1984 |
| A) Thermal Power Station (4x330 MW) | LC | 473.7 | 947.2 | 1,486.9 | 1,486.9 | 1,031.1 | 539.4 | 30.0 | 5,995.2 |
| | FC | 128.8 | 278.3 | 461.3 | 486.5 | 355.9 | 196.5 | 11.7 | 1,919.0 |
| | T | 602.5 | 1,225.5 | 1,948.2 | 1,973.4 | 1,387.0 | 735.9 | 41.7 | 7,914.2 |
| B) Transmission Lines and Substations (288 km, double circuit, 400 kV) | LC | - | 176.1 | 234.9 | 176.2 | - | - | - | 587.2 |
| | FC | - | 53.0 | 74.8 | 59.7 | - | - | - | 187.5 |
| | T | - | 229.1 | 309.7 | 235.9 | - | - | - | 774.7 |
| Total Estimated Project Cost | LC | | 1,123.3 | 1,721.8 | 1,663.1 | 1,031.1 | 539.4 | 30.0 | 6,582.4 |
| | FC | | 331.3 | 536.1 | 546.2 | 355.9 | 196.5 | 11.7 | 2,106.5 |
| | T | 602.5 | 1,454.6 | 2,257.9 | 2,209.3 | 1,387.0 | 735.9 | 41.7 | 8,688.9 |

SOURCE: MEE

December 1978

ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Technical and Economic Indicators for the Project

The main technical and economic indicators for the Project contained in Decree No. 239 dated July 26, 1977 approved by the Council of State of the Socialist Republic of Romania are:

| | |
|--|-------------------------------------|
| 1. Total value of the investment | 6,386 million lei |
| of which | |
| construction | 2,743 million lei |
| equipment | 3,277 million lei |
| other expenses <u>1/</u> | 366 million lei |
| 2. Total installed capacity | 1,320 MW |
| 3. Annual production of electric power | 8,580 GWh/a |
| 4. Electric power to be delivered to the system | 7,920 GWh/a |
| 5. Electric power cost | 0.210 lei/kWh |
| 6. Plant investment cost | 4,838 lei/kW |
| 7. Total value of imports | 198 million lei |
| from convertible currencies | 160.2 million lei (US\$8.9 million) |
| from socialist currencies | 41.4 million lei |
| 8. Specific fuel consumption for power delivered | 364 gr cc ^{2/} /kWh |
| 9. Total personnel to be employed for operation | = 1,100 |
| of which workers | = 1,015 |
| 10. Specific index of personnel | 0.83 men/MW installed |
| 11. Commissioning dates for the units | |
| Unit 5 - June 1980 | |
| Unit 6 - June 1981 | |
| Unit 7 - December 1981 | |
| Unit 8 - June 1982 | |

1/ Includes 211 million lei physical contingency.

2/ cc = Conventional coal, 7,000 kcal/kg

- 12. Time to implement project - 50 months
- 13. Period to reach full capacity - 3 months
- 14. Period to achieve other indicators - 12 months

ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Supply Contracts Expected to be Awarded to Foreign Bidders

US\$8.9 Million Estimated Total

1. Lot -- forged parts and connecting pieces for high-pressure piping
2. Lot -- steel pipe and elbows with basalt lining
3. Lot -- gate and stop valves
4. Lot -- safety valves
5. Lot -- check valves
6. Lot -- control valves
7. Lot -- hydraulic couplings
8. Lot -- ash and slag handling equipment
9. Lot -- asbestos compensators
10. Lot -- electric drives for motor operated valves
11. Lot -- control and measuring instruments
12. Lot -- electric hoists

ROMANIA
SECOND TURCENI THERMAL POWER PROJECT
Estimated Project Implementation Schedule

| ACTIVITY\YEAR | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
|---|--|------|------|------|------|------|------|------|
| Engineering & Supervision | [Horizontal bar spanning from 1977 to 1982] | | | | | | | |
| Site Preparation, Civil Works, Equipment Installation and Erection and other Field Activities | [Horizontal bar spanning from 1977 to 1984] | | | | | | | |
| Delivery of Romanian Equipment | [Horizontal bar spanning from 1978 to 1981] | | | | | | | |
| Delivery of Imported Equipment | [Horizontal bar spanning from 1978 to 1981] | | | | | | | |
| Testing & Commissioning | <div style="display: flex; justify-content: space-around;"> Unit #5 Unit #6 Unit #7 Unit #8 </div> | | | | | | | |

World Bank - 19170

CHAPTER III

FINANCE

Past Performance and Present Position of the Sector

3.01 Under the first two loans for power, the financial performance of the electricity sector in Romania has been remarkably stable despite the energy crisis; one of the principal reasons being the introduction in 1973 of strict controls on the consumption of electricity and other forms of energy. Although sales growth was sluggish at 4.7%/a in 1973, it picked up to 9.1%/a in 1974. The rate of return on average net fixed assets in 1973 and 1974 was between 8% and 9%. Despite the disastrous floods of 1975, these trends in the rate of return and sales growth were maintained in 1975 and 1976 as the rate of return remained within the 8-9% range and sales increased 12.1% and 9.6% respectively.

3.02 However, there were problems within the economy which led the Romanian authorities to introduce radical changes effective January 1, 1977. Firstly, the tax on invested funds which had been introduced in 1974, was becoming an increasing burden on all capital intensive sectors. In the case of the power sector, it amounted to about 4%/a of net fixed assets and working capital. At the same time the comprehensive review and re-structuring of prices which had been carried out over the previous 2-3 years had apparently not been fully effective in reducing distortions in certain sections of the economy. Accordingly strong measures were taken which have substantially changed the financial performance of the electricity sector:

- (a) electricity rates were reduced about 28% and rates for the sale of thermal energy by about 7%. The average revenue per kWh sold fell from 0.322 lei in 1976 to 0.237 lei in 1977;
- (b) depreciation rates were reduced by increasing the average life of depreciable assets. This reduced the average depreciation rate from 3.4% in 1976 to 2.5% in 1977; and
- (c) the tax on invested funds was abolished.

3.03 The result of these changes in terms of net income to the electricity sector was small since the reduction in tariffs was more than offset by the reduced depreciation charges and the repeal of the tax on invested funds. These changes were not confined to electricity enterprises; similar measures were taken in all basic industry sectors: mining, machine building, metallurgy, chemicals and petroleum. However, for the electricity Central,

they produced only a 2.1% rate of return in 1977. ^{1/} On the other hand the level of cash generation from internal sources rose to 40% compared to only 35% in 1976. This increased contribution to investment was achieved because of lower investment expenditures, largely delays in installing new plant to which the 1977 earthquake would have contributed, and the reduction in the annual contribution from net income to the State Budget.

3.04 Since the last power loan was approved in April 1976 (Loan 1242-R0), there has been no significant change in the financial position of the sector. It has no long-term debt other than the Bank's two previous loans. Sales growth in 1977 did fall off somewhat (to 4.4%/a) following the severe earthquake in March as restoration work delayed completion of new irrigation and industrial plants. Fixed assets continue to be valued at historical costs. This valuation is appropriate given the continuing low level of inflation in Romania. The State Budget still provides 50-60% of investment needs, the Bank loans now represent about 5% and, as previously mentioned, internal sources provide about 35-40%.

3.05 The financial performance and position of the electricity Centrals is considered satisfactory, despite the 1977 reforms. Contributions to the State Budget were reduced by the elimination of the tax on invested funds and the lower distribution from net income, but these have more than matched the reduction in revenues from the sale of electricity and thermal energy. The net result has been a small but significant improvement in the level of self-financing (para. 3.03). The low rate of return performance should be ignored since prices in Romania do not nor are they intended to reflect more than the cost of supply plus a small margin of profit for specified purposes. Power prices have been trimmed by removal of taxes and contributions to the budget but are still expected to yield a mark-up on cost of 8-10% per year to cover bonus payments to the workers, and to provide funds for housing, repayment of loans, social and cultural activities. Any surplus is available for financing new works. Power prices represent a resource transfer price which has no relationship to the normal demand and supply mechanism or role in the allocation of resources. In practice, costs are tightly controlled and have been virtually unchanged in terms of cost per unit sold since 1974. Savings through increased efficiency, although not directly identifiable in the income statements, are a significant factor in holding cost increases in check. Continuing emphasis is being placed on reduction of losses in power plants, in the transmission and distribution systems and on the reduction of energy waste in industrial processes (Tables 1.4, and 1.5). Penalties amounting to as much as 200% of the cost of electricity are imposed on consumers who exceed their planned electricity allocation. All these factors point to the growing efficiency of the electric power industry in Romania. It also is important to keep in mind that the electricity sector is an integral part of

^{1/} The large change in the rate of return accompanying the small movement in net income occurred because the tax on invested funds was previously treated not as an operating expense but as an interest charge. Therefore, the net effect of the January 1, 1977 measures was to reduce operating income and, hence, rate of return while net income changed little.

Romania's centrally planned economy under which all enterprises conform to national development plans which are financed from the State Budget. Since 1977, power prices have been set to minimize the contributions by power sector enterprises to the budget in the form of taxes and payments from surplus income. This was done to allow the industrial, agricultural and manufacturing enterprises to increase their profits but at the same time to transfer the point of collection of revenues from the state to the industrial and manufacturing enterprises since they will be subjected to a new and progressively heavier rate of taxation on surplus income. In essence, part of the former earnings of the power sector are being transferred to the industrial and manufacturing sectors. For this reason, the performance of the power sector cannot be reviewed in isolation from the rest of the economy, but a review of the entire Romanian productive sector is beyond the scope of this report.

Financing Plan

3.06 The forecast sources and applications of funds for the electricity sector during the project construction period (1978-84) are given below:

| <u>Sources of Funds</u> | <u>1978-84</u> <u>(Millions of Lei)</u> | <u>%</u> |
|---|--|------------|
| <u>Internal Sources</u> | | |
| Benefits Reinvested | 13,163 | 12 |
| Depreciation Reinvested | 25,100 | 22 |
| Sales of Scrap | <u>422</u> | <u>1</u> |
| Gross Internal Sources | 38,685 | 35 |
| Less: Debt Service | <u>(1,810)</u> | <u>(2)</u> |
| Net Internal Sources | 36,875 | 33 |
| <u>External Sources</u> | | |
| State Budget Allocation | 72,253 | 64 |
| Investment Bank Loans | 607 | 1 |
| Existing IBRD Loans | 779 | 1 |
| Proposed IBRD Loans | <u>1,260</u> | <u>1</u> |
| Total External Sources | 74,899 | 67 |
| Total Sources of Funds | <u>111,774</u> | <u>100</u> |
| <u>Construction Requirements</u> | | |
| Proposed Second Turceni Thermal Power Project /1 | 8,897 | 8 |
| Other Construction | <u>102,877</u> | <u>92</u> |
| Total Construction Requirements | <u>111,774</u> | <u>100</u> |

/1 Includes interest during construction on proposed Bank loan of 208 million lei.

3.07 The financing plan is almost identical with the one presented in the appraisal report for the last power loan; the "Appraisal of the Riul Mare-Retezat Hydropower Project (Report No. 1103-R0). It will require about 112 billion lei (US\$6.2 billion equivalent) for financing construction requirements and be financed 33% from own sources of the electricity sector, 64% from the State Budget, 2% from IBRD loans and 1% from Investment Bank credits.

3.08 The financing plan for 1978 through 1980 is based on the MEE's latest estimates made during the appraisal (June 1978) and reflects the 1978 annual plan and the revised outlook for the two remaining years of the 1976-80 5-Year Plan period. For the period 1981-85 for which no formal 5-Year Plan forecasts have been prepared, the plan is based on the MEE estimates but duly modified to reflect the Bank's lower expectation with respect to growth of the power market through 1985.

3.09 The availability of internal sources of funds for meeting 33% of investment needs through 1984 is doubtful. The source of this uncertainty is the planned introduction of new procedures for increasing the role and autonomy of enterprises in Romania especially with respect to planning and management, including allocation of their internal sources of funds and the distribution of net income. These procedures were first announced by President Ceausescu in February of 1978 and are planned to become effective in 1979. Under the present system the enterprise has little control over these matters with plans being set and approved by the State. However, under the new system, the worker's councils will be given greater responsibility for planning and distribution of income. Instead of paying depreciation and a pre-planned portion of net income to the State, 1/ depreciation will be retained by the enterprises and a tax on net output will be paid to the Republican budget and to the local administration budgets. Net income will be used firstly for repayment of loans and then for payments of workers' bonuses. Increases in working capital funds, housing, social and cultural activities will be met according to each enterprise's plan from net income. The remainder of net income will be available for financing new investment. The Romanians nevertheless expect the level of self-financing to be more or less unchanged since all that is being changed is that taxes and payments to the State are being reduced to meet expenditures formerly financed from the central budget but which will now be financed instead by each enterprise. However, whether this will be so or not is not yet clear. Until the laws putting into force the various changes are enacted and the 1981-85 plan is drawn up, it will not be possible to determine clearly their full impact. From the point of view of the Bank and its concern for sound financial planning in the power sector, it would be expected that any reduction in the availability of the enterprises' own sources of funds would be made up from the State Budget. Since this is the only recourse to the Romanians, no specific undertaking to this effect has been sought.

1/ Enterprises in Romania have customarily paid monthly to the Investment Bank a twelfth of the planned annual depreciation expense.

Future Financial Position

3.10 The financial forecasts 1978-1985 and the assumptions on which they have been based are given in Tables 3.1, 3.2 and 3.3, and Annex 3.1. Electricity prices and operating costs through 1985 are not expected to change significantly. The income statements show that the rate of return on average net fixed assets and working capital funds will be 2.3% in 1978 gradually declining to 1% in 1985. The operating ratio will be 89% in 1978 rising to 94% in 1985 and the profit margin will exceed the 8-10% range set by Romania's planners, except in 1985 when it is only expected to be 6.3%. At the same time, the MEE is expected to finance 42% of its investment needs in 1978 gradually reducing to 31% in 1985.

3.11 Although the rate of return performance is low, it is not considered to be a relevant measure of the efficiency or the financial performance of the Romanian power sector (see para 3.05). Efficiency is better measured by the indicators which the Romanians now use for monitoring performance. In the future, there are plans to improve the economic and financial indicators used by all sectors as part of the general process of increasing the autonomy of enterprises. Financial performance is best looked at in terms of cash generation. As in the case of previous loans where it was established that the Bank's conventional financial covenants were unnecessary, no specific financial covenants have been sought. Instead the Bank has obtained the same undertakings relating to cash generation as were given for the previous power loan (Loan 1242-RO). These confirm that the Government plans for the power sector to generate 30% of its own investment capital up to 1985. Despite the planned changes in the role of power enterprises, this is still a realistic planning objective. However, the Government and the Investment Bank have confirmed that information on the planned and actual performance measured by indicators which are used or planned for adoption by the MEE will be furnished to the Bank as part of the Project information requirements to be included in the Investment Bank's annual financial report to the Bank. The indicators are expected to provide additional data on the sector's operating performance and efficiency. A list of these indicators is given in Annex 3.2.

Accounts and Audit

3.12 Although there was a delay in the submission of the audit reports for 1977, the auditing provisions for the previous power loans have been retained, except that the time for submission has been extended to six months in accordance with other recent Bank loan agreements with the Investment Bank. These provisions require that the financial statements of the Central, the Project enterprise and the Investment Bank be audited each year by the Ministry of Finance and furnished to the Bank within 4 months of the end of each fiscal year. However, since there are now two centrals (para 1.12) the Government and the Investment Bank have agreed that the audit report will be based on the consolidated accounts of the two power centrals.

ROMANIA
SECOND TURCENI THERMAL POWER PROJECT

Income Statements (1975-85)
(in millions of lei)

| | -----ACTUAL----- | | | -----FORECAST----- | | | | | | | |
|--|------------------|--------|--------|--------------------|--------|--------|---------|---------|---------|---------|---------|
| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
| Year Ended December 31 | | | | | | | | | | | |
| Electric Energy Sales (GWh) | 43,435 | 47,589 | 49,690 | 52,700 | 57,240 | 60,470 | 64,372 | 68,384 | 72,598 | 75,103 | 79,889 |
| Average Revenue per kWh (lei) | .321 | .322 | .237 | .237 | .238 | .238 | .238 | .247 | .247 | .247 | .247 |
| <u>Operating Revenues</u> | | | | | | | | | | | |
| Sales of Electricity | 13,955 | 15,342 | 11,772 | 12,510 | 13,645 | 14,415 | 15,900 | 16,891 | 17,932 | 18,550 | 19,733 |
| Sales of Heat | 1,590 | 1,664 | 1,482 | 1,713 | 1,882 | 2,051 | 2,128 | 2,298 | 2,479 | 2,675 | 2,871 |
| Other Operating Revenues | 1,100 | 1,277 | 1,422 | 1,454 | 1,433 | 1,574 | 2,747 | 2,895 | 2,890 | 2,781 | 2,539 |
| Total Operating Revenues | 16,645 | 18,283 | 14,676 | 15,677 | 16,960 | 18,040 | 20,775 | 22,084 | 23,301 | 24,006 | 25,143 |
| <u>Operating Expenses</u> | | | | | | | | | | | |
| Operation, Maintenance and Administration | 3,379 | 3,703 | 3,869 | 4,025 | 4,234 | 4,544 | 5,793 | 5,813 | 6,026 | 6,234 | 6,551 |
| Purchased Power | 157 | 393 | 747 | 83 | 93 | 93 | 94 | 68 | 69 | 70 | 71 |
| Fuel | 5,462 | 5,955 | 6,195 | 7,137 | 8,013 | 8,528 | 9,463 | 10,121 | 10,745 | 10,965 | 11,584 |
| Depreciation | 2,704 | 2,906 | 2,388 | 2,667 | 2,950 | 3,180 | 3,507 | 3,828 | 4,248 | 4,720 | 5,331 |
| Total Operating Expenses | 11,702 | 12,957 | 13,199 | 13,912 | 15,290 | 16,345 | 18,857 | 19,830 | 21,088 | 21,989 | 23,537 |
| <u>Operating Income</u> | 4,943 | 5,326 | 1,477 | 1,765 | 1,670 | 1,695 | 1,918 | 2,254 | 2,213 | 2,017 | 1,606 |
| <u>Other Income</u> | 113 | 110 | 42 | 127 | 137 | 150 | 138 | 162 | 177 | 154 | 109 |
| Gross Income | 5,056 | 5,436 | 1,519 | 1,892 | 1,807 | 1,845 | 2,056 | 2,416 | 2,390 | 2,171 | 1,715 |
| <u>Interest</u> | | | | | | | | | | | |
| IBRD Loans | - | - | 110 | 130 | 171 | 222 | 260 | 255 | 247 | 233 | 220 |
| Other Interest | 3,106 | 3,400 | - | - | - | - | - | - | - | - | - |
| Gross Interest | 3,106 | 3,400 | 110 | 130 | 171 | 222 | 260 | 255 | 247 | 233 | 220 |
| Less Interest Charged to Construction | - | - | (110) | (130) | (171) | (222) | (176) | (173) | - | - | - |
| Net Interest | 3,106 | 3,400 | - | - | - | - | 84 | 82 | 247 | 233 | 220 |
| <u>Net Income</u> | 1,950 | 2,036 | 1,519 | 1,892 | 1,807 | 1,845 | 1,972 | 2,334 | 2,143 | 1,938 | 1,495 |
| <u>Rate of Return %</u> | | | | | | | | | | | |
| Average Net Fixed Assets in Service and Actual Working Capital | 56,347 | 61,786 | 68,984 | 78,507 | 87,356 | 94,686 | 103,344 | 114,351 | 128,349 | 145,952 | 165,401 |
| Operating Income as a % Thereof | 8.8 | 8.6 | 2.1 | 2.2 | 1.9 | 1.8 | 1.9 | 2.0 | 1.7 | 1.4 | 1.0 |
| Operating Ratio | 70 | 71 | 90 | 89 | 90 | 91 | 91 | 90 | 91 | 92 | 94 |
| Rentability (Profit Margin) | 13.2 | 12.4 | 11.5 | 13.6 | 11.8 | 11.3 | 10.1 | 11.7 | 10.0 | 8.7 | 6.3 |

December 1978

ROMANIA

SECOND TURCENI THERMAL POWER PROJECT

Balance Sheets (1975-85)
(in millions of lei)

| | -----ACTUAL----- | | | -----FORECAST----- | | | | | | | |
|---------------------------------------|------------------|---------------|---------------|--------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | 1985 |
| Assets | | | | | | | | | | | |
| Fixed Assets | | | | | | | | | | | |
| Fixed Assets in Service (at cost) | 78,358 | 86,059 | 97,286 | 110,436 | 120,481 | 130,951 | 144,001 | 160,011 | 179,721 | 203,881 | 228,301 |
| Less Accumulated Depreciation | (20,586) | (23,123) | (25,334) | (28,178) | (31,128) | (34,308) | (37,815) | (41,643) | (45,891) | (50,611) | (55,942) |
| Net Fixed Assets in Service | 57,672 | 62,936 | 71,952 | 82,258 | 89,353 | 96,643 | 106,186 | 118,368 | 133,830 | 153,270 | 172,359 |
| Work in Progress | 18,842 | 20,484 | 20,211 | 16,921 | 16,934 | 17,363 | 17,903 | 18,583 | 19,463 | 20,593 | 25,213 |
| Total Net Fixed Assets | 76,514 | 83,420 | 92,163 | 99,179 | 106,287 | 114,006 | 124,089 | 136,951 | 153,293 | 173,863 | 197,572 |
| Current Assets | | | | | | | | | | | |
| Cash at Bank | 232 | 239 | 304 | 350 | 375 | 400 | 473 | 512 | 550 | 580 | 619 |
| Fuel and Material Stocks | 1,491 | 1,890 | 2,013 | 1,613 | 1,766 | 1,913 | 2,223 | 2,386 | 2,579 | 2,754 | 2,991 |
| Accounts Receivable | 835 | 408 | 521 | 630 | 640 | 730 | 851 | 921 | 991 | 1,045 | 1,114 |
| Total Current Assets | 2,558 | 2,537 | 2,838 | 2,593 | 2,781 | 3,043 | 3,547 | 3,819 | 4,120 | 4,379 | 4,724 |
| Total Assets | 79,072 | 85,957 | 95,001 | 101,772 | 109,068 | 117,049 | 127,636 | 140,770 | 157,413 | 178,242 | 202,296 |
| Liabilities | | | | | | | | | | | |
| Equity and Borrowings | | | | | | | | | | | |
| Fixed Assets Fund | 57,634 | 62,893 | 71,900 | 82,178 | 89,271 | 95,505 | 104,192 | 115,280 | 130,911 | 150,525 | 169,778 |
| Investment Bank Loan | 38 | 43 | 52 | 80 | 82 | 85 | 84 | 87 | 92 | 97 | 118 |
| IBRD Loan No. 1028-RO | | | | | | 1,053 | 1,025 | 994 | 961 | 926 | 888 |
| IBRD Loan No. 1242-RO | | | | | | | 885 | 852 | 816 | 777 | 735 |
| Proposed IBRD Loan | | | | | | | | 1,155 | 1,050 | 945 | 840 |
| Total Equity and Borrowing | 57,672 | 62,936 | 71,952 | 82,258 | 89,353 | 96,643 | 106,186 | 118,368 | 133,830 | 153,270 | 172,359 |
| Sources of Investments | | | | | | | | | | | |
| Internal Cash Generation (Reinvested) | 4,274 | 4,545 | 3,908 | 4,478 | 4,627 | 4,887 | 5,424 | 6,061 | 6,556 | 6,860 | 7,147 |
| State Budget Allocation | 11,614 | 13,462 | 13,926 | 9,091 | 8,388 | 8,810 | 9,421 | 10,656 | 10,953 | 11,665 | 15,534 |
| Accounts Payable Construction | 2,914 | 1,760 | 1,043 | 1,700 | 1,750 | 1,700 | 1,798 | 1,866 | 1,954 | 2,068 | 2,532 |
| IBRD Loans | 140 | 717 | 1,334 | 1,652 | 2,162 | 1,966 | 1,260 | - | - | - | - |
| Total Sources of Investments | 18,842 | 20,484 | 20,211 | 16,921 | 16,934 | 17,363 | 17,903 | 18,583 | 19,463 | 20,593 | 25,213 |
| Sources of Working Capital | | | | | | | | | | | |
| Working Capital Fund | 1,062 | 1,127 | 1,071 | 1,074 | 1,180 | 1,278 | 1,485 | 1,595 | 1,724 | 1,841 | 1,999 |
| Short Term Loans | 368 | 355 | 469 | 328 | 370 | 410 | 444 | 479 | 516 | 551 | 587 |
| Total Sources of Working Capital | 1,430 | 1,482 | 1,540 | 1,402 | 1,550 | 1,688 | 1,929 | 2,074 | 2,240 | 2,392 | 2,586 |
| Current Liabilities | | | | | | | | | | | |
| Accounts Payable-Operations | 875 | 796 | 1,280 | 908 | 980 | 1,110 | 1,236 | 1,329 | 1,432 | 1,510 | 1,627 |
| Customer Deposits | 253 | 259 | 18 | 283 | 251 | 245 | 382 | 416 | 448 | 477 | 511 |
| Total Current Liabilities | 1,128 | 1,055 | 1,298 | 1,191 | 1,231 | 1,355 | 1,618 | 1,745 | 1,880 | 1,987 | 2,138 |
| Total Liabilities | 79,072 | 85,957 | 95,001 | 101,772 | 109,068 | 117,049 | 127,636 | 140,770 | 157,413 | 178,242 | 202,296 |

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SECOND TURCENI THERMAL POWER PROJECT

Sources and Applications of Funds (1975-1985)

(in millions of lei)

| Year Ended December 31 | -----ACTUAL----- | | | -----FORECAST----- | | | | | | | | |
|--|------------------|---------------|--------------|--------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|----------------|
| | <u>1975</u> | <u>1976</u> | <u>1977</u> | <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> | <u>1978-85</u> |
| <u>Sources of Funds</u> | | | | | | | | | | | | |
| <u>Internal Cash Generation</u> | | | | | | | | | | | | |
| Operating and Other Income | 5,056 | 5,436 | 1,519 | 1,892 | 1,807 | 1,845 | 2,056 | 2,416 | 2,390 | 2,171 | 1,715 | 16,292 |
| Less Benefits Distributed | (679) | (1,419) | (28) | (131) | (176) | (184) | (206) | (240) | (248) | (229) | (193) | (1,607) |
| Benefits Reinvested | 4,377 | 4,017 | 1,491 | 1,761 | 1,631 | 1,661 | 1,850 | 2,176 | 2,142 | 1,942 | 1,522 | 14,685 |
| Depreciation Reinvested | 2,663 | 2,908 | 2,388 | 2,667 | 2,950 | 3,180 | 3,507 | 3,828 | 4,248 | 4,720 | 5,331 | 30,431 |
| Sales of Scrap, etc. | 47 | 55 | 29 | 50 | 46 | 46 | 61 | 68 | 74 | 77 | 81 | 503 |
| Total Internal Sources | <u>7,087</u> | <u>6,980</u> | <u>3,908</u> | <u>4,478</u> | <u>4,627</u> | <u>4,887</u> | <u>5,418</u> | <u>6,072</u> | <u>6,464</u> | <u>6,739</u> | <u>6,934</u> | <u>45,619</u> |
| <u>External Sources</u> | | | | | | | | | | | | |
| State Budget Allocation | 5,699 | 5,890 | 5,089 | 5,623 | 5,747 | 5,972 | 8,716 | 11,475 | 15,152 | 19,568 | 23,100 | 95,353 |
| Investment Bank Loans | 60 | 41 | 63 | 80 | 82 | 85 | 84 | 87 | 92 | 97 | 118 | 725 |
| IBRD Loan No. 1028-RO | 140 | 577 | 365 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 | 106 |
| IBRD Loan No. 1242-RO | --- | --- | 252 | 346 | 207 | 120 | --- | --- | --- | --- | --- | 673 |
| Proposed IBRD Loan | --- | --- | --- | --- | 310 | 756 | 194 | --- | --- | --- | --- | 1,260 |
| Total External Services | <u>5,899</u> | <u>6,508</u> | <u>5,769</u> | <u>6,155</u> | <u>6,346</u> | <u>6,933</u> | <u>8,994</u> | <u>11,562</u> | <u>15,244</u> | <u>19,665</u> | <u>23,218</u> | <u>98,117</u> |
| Total Sources | <u>12,986</u> | <u>13,488</u> | <u>9,677</u> | <u>10,633</u> | <u>10,973</u> | <u>11,820</u> | <u>14,412</u> | <u>17,634</u> | <u>21,708</u> | <u>26,404</u> | <u>30,152</u> | <u>143,736</u> |
| <u>Applications of Funds</u> | | | | | | | | | | | | |
| Construction Requirements (Including Interest Charged to Construction) | 9,839 | 10,059 | 9,640 | 10,570 | 10,893 | 11,711 | 14,200 | 17,300 | 21,200 | 25,900 | 29,650 | 141,424 |
| <u>Debt Service</u> | | | | | | | | | | | | |
| Amortization of Loans | 41 | 29 | 37 | 63 | 80 | 109 | 128 | 252 | 261 | 271 | 282 | 1,446 |
| Interest on IBRD Loans | --- | --- | --- | 130 | 171 | 222 | 260 | 255 | 247 | 233 | 220 | 1,738 |
| Interest on Other Loans | 3,106 | 3,400 | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Less: Interest During Construction | --- | --- | --- | (130) | (171) | (222) | (176) | (173) | --- | --- | --- | (872) |
| Total Debt Service | <u>3,147</u> | <u>3,429</u> | <u>37</u> | <u>63</u> | <u>80</u> | <u>109</u> | <u>212</u> | <u>334</u> | <u>508</u> | <u>504</u> | <u>502</u> | <u>2,312</u> |
| Total Applications | <u>12,986</u> | <u>13,488</u> | <u>9,677</u> | <u>10,633</u> | <u>10,973</u> | <u>11,820</u> | <u>14,412</u> | <u>17,634</u> | <u>21,708</u> | <u>26,404</u> | <u>30,152</u> | <u>143,736</u> |
| % Contribution to Investment | 40 | 35 | 40 | 42 | 42 | 41 | 37 | 33 | 28 | 24 | 22 | 31 |

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SECOND TURCENI THERMAL POWER PROJECT

Notes and Assumptions for Financial Forecasts

A. Income Statement

1. Electricity Sales are based on forecast growth in electricity sales of 6.1% in 1978, 8.6% in 1979, 5.6% in 1980, 6.5% in 1981, 6.2% in 1982, 6.2% in 1983 and 3.5% in 1984, 6.4% in 1985. Details of forecast generation and sales are shown in Table 1.5. Electricity tariffs are assumed to be constant through 1981 and in 1982 the average revenue per kWh sold is planned by the Romanians to be increased from 0.238 lei per kWh in 1981 to 0.247 per kWh in 1982, an increase of 3.8%.

2. Sales of Heat were assumed to be at constant prices (i.e. 37 lei per gigacalorie) Romania's sales estimates are:

| <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 46.3 | 50.9 | 55.4 | 57.5 | 62.1 | 67.0 | 72.3 | 77.6 |

3. Other operating revenues include:

- (a) Income from sales of steam, industrial water and ash; and
- (b) Revenues from the manufacturing/repair enterprises.

4. Other Income includes net income of the distribution construction units (Santier Constructu Montaj - SCM) which are self-accounting and independent from the enterprises.

5. Operating Expenses

- (a) Operation, maintenance and administration expenses are based on the average cost per unit sold estimated by the MEE as follows (in lei per kWh);

| <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| .076 | .074 | .075 | .090 | .085 | .083 | .083 | .082 |

No escalation in costs has been provided for since prices are fixed. Savings expected to be achieved through reduction of losses and increased efficiency will be passed on in the former of higher benefits to workers.

- (b) Purchased power comes from three distinct sources:
- (i) imports from neighboring countries with whom transmission lines are interconnected;
 - (ii) surplus power from auto-producers largely that of the Ministries of Chemical Industry and Heavy Machinery which generate power for heating purposes; and
 - (iii) electricity generated during the commissioning of new plant (operating costs are capitalized after off-setting revenues received).
- (c) Fuel costs are based on MEE estimates as follows (in lei per kWh sold).

| <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| .136 | .140 | .141 | .147 | .148 | .148 | .146 | .145 |

No escalation in costs has been provided for since prices are fixed. Fuel prices used by the MEE are:

- (i) lignite, 103-109 lei per ton;
 - (ii) brown coal, 122-146 lei per ton;
 - (iii) coal, 264-396 lei per ton;
 - (iv) bituminous shale, 101 lei per ton;
 - (v) crude oil, 414 lei per ton; and
 - (vi) natural gas, 200 lei per thousand cubic meters.
- (d) Depreciation is calculated using the conventional straight-line method. The following annual average percentage rates of depreciation which were based on MEE's estimates, have been used:

| <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| 2.41% | 2.45% | 2.43% | 2.44% | 2.39% | 2.36% | 2.32% | 2.34% |

The above figures include depreciation on the assets of the manufacturing/repair enterprises, but not on the distribution construction units. Depreciation on assets used by the distribution construction units which operate within each distribution enterprise is not included since these units are self-accounting.

6. Interest

Interest and commitment fees on the existing IBRD loans have been provided for according to the terms of the loans. In the case of the proposed loan, a rate of 7-1/2% has been assumed. Interest has been charged to work-in-progress up to the commissioning dates for the Bank financed projects. There exists the possibility that interest and commitment fees on IBRD loans will be financed from Investment Bank credits until the plants are commissioned. These credits would be on the same terms as the Bank loans. After commissioning they would be repaid from income earned by the Projects. However, since these arrangements have not been confirmed all interest charges are assumed to be financed by the MEE. This was the procedure adopted for earlier Bank loans for power.

B. Balance Sheet

7. Fixed Assets

Assets are valued in respect of their foreign content when financed from the proceeds of a Bank loan at the existing agreed conversion rate for traded goods plus the duty applicable except where items manufactured or similar to those manufactured in Romania are imported in which case they will be valued according to the Romanian catalogue price (internal prices) plus duty. However, they no longer use the Romanian internal price for goods manufactured in Romania which are financed from the loan but the foreign trade price converted at the current conversion rate for traded goods. All other fixed assets are valued at construction cost. Investments made by other Ministries and vice versa, as they are generally not known, have been ignored. It is expected they would largely offset each other. Net fixed assets in service correspond to the total of equity and borrowings.

8. Work in Progress

Finance for capital work in progress comes from three sources: internal cash generation, state budget allocations and investment creditors. The sum of these sources is equal to the work-in-progress figure in each year of the forecasts.

9. Current Assets and Current Liabilities

Forecasts are based on estimates projected by the MEE. Undistributed benefits at year end have been included under accounts payable - operations and enterprise current balances are included under accounts receivable.

10. Sources of Working Capital

Funds are provided to each enterprise by the National Bank for working capital to meet costs of production. They take two forms: a working capital fund which is fixed annually based on the minimum "normal" working

capital required during the year and short-term loans which are drawn as required to meet any excess. Short-term loans are made available from the National Bank at rates of interest around 2-5% for periods up to a maximum of one year. They are repaid from benefits.

C. Sources and Applications of Funds

11. Benefits reinvested is the balance remaining to meet debt service and internal requirements after deducting benefits distributed from operating and other income. Benefits distributed comprise: state budget allocations, annual bonus distribution to workers, increase in working capital funds, payments for modernization of plant, social welfare and the reserve fund. New procedures for the distribution of benefits have been outlined but their impact is not reflected in these forecasts.

12. Depreciation

Similarly, with depreciation, an assumption was made that all depreciation moneys paid to the Investment Bank by the enterprises of the Industrial Central would be reinvested in the sector. It is expected that depreciation will, in future, be retained by the enterprises and distributed according to the new procedures for distribution of benefits. However, in the case of fixed assets that have reached the end of their useful life, depreciation charges are no longer made. This is in accordance with revised procedures and rates introduced from January 1, 1977.

13. Sales of Scrap are derived chiefly from materials used on investment projects. These funds are paid directly to the National Bank and are not treated as income in the income statement.

14. The construction requirements and sources of funds included in the sources and applications of funds statement relate only to centrally planned investments. Movements in working capital are not planned beyond one year and decentralized investments (for example: most distribution construction) are excluded since the MEE has no reliable means of determining their extent.

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SECOND TURGENI THERMAL POWER PROJECT

Financial Plan Indicators for Power Sector

Existing Indicators

1. Expenditure (in lei) per 1,000 units of production.
2. Revenue (in lei) for each kWh sold.
3. Value of benefits (net income).
4. Value of production sold.

Planned New Indicators

1. Labor productivity expressed in net output and in physical terms as work time consumed per unit of product.
2. Co-efficient of utilization of materials; norms and standards of consumption for fuel and energy.
3. Personnel standards.
4. Profit and net output obtained per 1,000 lei of fixed capital.

CHAPTER IV

ECONOMIC JUSTIFICATION

Least-Cost Alternative

4.01 The Project is the next step of generation in MEE's least-cost development program in line with Romania's aims to maximize utilization of available lignite and keep nuclear capacity to a reasonable minimum (para 1.16).

Economic Rate of Return

4.02 The incremental supplies of electricity to consumers represent the main benefits of the Project, but in the first few years of operation there are also fuel savings through substitution of Project output for generation from older, less efficient plants (Annex 4.1). The reduced electricity rates introduced by Government decree in 1977 understate the value of the incremental sales, since prior to 1977 consumers had demonstrated that they were willing to pay the higher rates then in effect for comparable quantities of electricity. The 1976 average revenue of 0.322 lei/kWh is therefore regarded as a more adequate measure of consumers' willingness to pay than the current average revenue of 0.237 lei/KWh resulting from the lower rates in effect since January 1, 1977. The resulting economic rate of return is at least 6.4%. This figure is comparable to the base case economic rate of return calculated for the previous power loans for Romania: (i) Riul Mare-Retezat, 6.5%, and (ii) Turceni I, 8.6%. For Turceni II, the rate of return is sensitive to changes in average revenue. A 10% decrease in average revenue drops the rate of return from 6.4% to 2.5%. On the other hand, a 10% increase in Project capital costs drops the rate of return only from 6.4% to 5.4%.

4.03 The return on investment for the Project calculated in accordance with the above methods cannot be used to judge the efficiency of resource allocation in Romania nor the extent to which tariff levels succeed in conveying to power consumers the value of the resource inputs used for production of electricity. Allocation of resources in Romania is not based on prices that reflect market scarcities but is based on a material balance technique. Available resources are allocated in accordance with the production needs to meet the objectives of the development plan. Prices in Romania are set by the Government's Committee for Prices and are used to measure performance of productive enterprises and the degree to which they achieve plan targets.

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SECOND TURCENI THERMAL POWER PROJECT
Calculation of Return on Investment

| Year | ----- Million Lei ----- | | | | | | | | | |
|------|-------------------------|-------------------------------|-------------------------------|---------------|--------------|-------------------------|---------|-------------------------------------|---|---|
| | Net Generation (GWh) | Incremental Sales (GWh) | Economic Dispatch (GWh) | Capital Costs | | Operation & Maintenance | | | Benefits | |
| | | | | Generation | Transmission | Plant O & M | Fuel | T & D @ 0.02462 lei/ kWh Sold | Incremental Sales @ 0.3220 lei/kWh Sold | Fuel Savings @ 0.3159 lei/ kWh Gen. |
| 1977 | - | - | - | 164.9 | - | - | - | - | - | - |
| 1978 | - | - | - | 426.6 | - | - | - | - | - | - |
| 1979 | - | - | - | 1,183.0 | 220.1 | - | - | - | - | - |
| 1980 | - | - | - | 1,857.0 | 293.4 | - | - | - | - | - |
| 1981 | 1,980 | 699 | 1,281 | 1,857.0 | 220.4 | 79.2 | 304.9 | 16.2 | 211.6 | 404.7 |
| 1982 | 5,940 | 4,619 | 1,321 | 1,287.8 | - | 237.6 | 914.7 | 106.9 | 1,398.1 | 417.3 |
| 1983 | 7,920 | 7,638 | 282 | 673.8 | - | 316.8 | 1,219.6 | 176.8 | 2,311.9 | 89.1 |
| 1984 | 7,920 | 7,920 | - | 37.6 | - | - | - | 183.3 | 2,397.2 | - |
| 1985 | - | - | - | - | - | - | - | - | - | - |
| 1986 | - | - | - | - | - | - | - | - | - | - |
| 1987 | - | - | - | - | - | - | - | - | - | - |
| 1988 | - | - | - | - | - | - | - | - | - | - |
| 1989 | - | - | - | - | - | - | - | - | - | - |
| 1990 | - | - | - | - | - | - | - | - | - | - |
| 1991 | - | - | - | - | - | - | - | - | - | - |
| 1992 | - | - | - | - | - | - | - | - | - | - |
| 1993 | - | - | - | - | - | - | - | - | - | - |
| 1994 | - | - | - | - | - | - | - | - | - | - |
| 1995 | - | - | - | - | - | - | - | - | - | - |
| 1996 | - | - | - | - | - | - | - | - | - | - |
| 1997 | - | - | - | - | - | - | - | - | - | - |
| 1998 | - | - | - | - | - | - | - | - | - | - |
| 1999 | - | - | - | - | - | - | - | - | - | - |
| 2000 | - | - | - | - | - | - | - | - | - | - |
| 2001 | - | - | - | - | - | - | - | - | - | - |
| 2002 | - | - | - | - | - | - | - | - | - | - |
| 2003 | - | - | - | - | - | - | - | - | - | - |
| 2004 | - | - | - | - | - | - | - | - | - | - |
| 2005 | - | - | - | - | - | - | - | - | - | - |
| 2006 | - | - | - | - | - | 316.8 | 1,219.6 | 183.3 | 2,397.2 | - |

Notes:

1. All costs and benefits are expressed in 1977 prices.
2. Average revenue is based on pre-1977 tariffs used as a proxy for the consumers' willingness to pay - tariff levels were lowered in 1977.
3. Average plant operation and maintenance cost is estimated to be approximately 0.04 lei/kWh (US\$0.002/kWh).
4. Fuel at 364 grams conventional coal (7,000 kcal/kg) average net station heat rate and 107 lei/ton of lignite (1,700 - 1,800 kcal/kg).
5. Transmission and distribution (T & D) cost is estimated at 0.02462 lei/kWh (US\$0.00137/kWh).
6. Allows for 6% transmission and distribution losses.
7. Derived from the savings in fuel oil stemming from the integration of the plant into the power generation system of Romania.

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SECOND TURCENI THERMAL POWER PROJECT
Forecast Economic Dispatch and Fuel Savings

| | <u>1978</u> | <u>1979</u> | <u>1980</u> | <u>1981</u> | <u>1982</u> | <u>1983</u> | <u>1984</u> | <u>1985</u> |
|---|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| Net Generation, GWh, of which: | 57,054 | 60,817 | 65,411 | 69,279 | 73,878 | 78,466 | 81,132 | 86,340 |
| A. Hydro | 10,200 | 10,600 | 11,800 | 12,800 | 13,500 | 14,500 | 15,900 | 17,500 |
| B. Thermal, of which: | 46,854 | 50,217 | 53,611 | 56,479 | 60,378 | 63,966 | 65,232 | 68,840 |
| i) Existing plant | 43,794 | 43,386 | 43,000 | 41,719 | 40,398 | 40,116 | 38,467 | 35,710 |
| ii) New plant, of which: | 3,060 | 6,831 | 10,611 | 14,760 | 19,980 | 23,850 | 26,765 | 33,130 |
| Turceni II | - | - | - | 1,980 | 5,940 | 7,920 | 7,920 | 7,290 |
| Other plant | 3,060 | 6,831 | 10,611 | 12,780 | 14,040 | 15,930 | 18,845 | 25,840 |
| Increment (decrement) over previous year | | | | | | | | |
| - Existing thermal plant | - | (408) | (386) | (1,281) | (1,321) | (282) | (1,649) | (2,757) |
| - Turceni II, of which: | - | - | - | 1,980 | 3,960 | 1,980 | - | - |
| - Economic dispatch | - | - | - | 1,281 | 1,321 | 282 | - | - |
| - Incremental Sales | - | - | - | 699 | 2,639 | 1,698 | - | - |

----- Million Lei -----

Fuel Savings at 0.3159 lei/kWh
(234 gr oil/kWh and US\$75/ton oil)

| | | | | | | | | |
|--|---|---|---|-------|-------|------|---|---|
| | - | - | - | 404.7 | 417.3 | 89.1 | - | - |
|--|---|---|---|-------|-------|------|---|---|

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SECOND TURCENI THERMAL POWER PROJECT

Assumptions Used for Calculation Economic Rate of Return

1. Measurable Benefits

These refer to the segment of the Project benefits that are measurable in money terms. Two streams of measurable benefits are used in the analysis: (a) the revenue accruing from the sale of output, and (b) the economic value of the fuel saved (Table 4.1).

- (a) Revenue Accruing from Sales of Output: The average revenue (ratio of revenue from sales and net electricity sold) calculated at pre-1977 rates is used as a proxy for the consumers' willingness to pay. The reduced electricity rates introduced by Government decree in 1977 understate the value of these benefits, since prior to 1977 consumers had demonstrated their willingness to pay the higher rates then in effect for comparable quantities of electricity.
- (b) Fuel Savings: While the Project is intended primarily to help meet system load growth, Turceni II capacity will be added in blocks of generation larger than required just for that purpose during the first three years of Project operation (1981-1983). Therefore, during that period some of the Turceni II output will result in displacement of generation from older, less-efficient plants (Table 4.2) as determined through economic dispatch of available system generation, with corresponding savings in fuel costs. These savings would be the difference between the cost of the additional lignite required by Turceni (0.154 lei/kWh) and the value of the reduction in fuel consumption at the displaced plant (0.316 lei/kWh).

2. Measurable Costs

The measurable costs consist of two categories: fixed costs and variable costs. The former does include the capital cost and the cost of replacing the capital equipment. The latter encompasses all costs that vary with the level of output such as lubricants, fuel, operation and maintenance costs, etc.

- (a) Fixed Costs: These include two streams, the costs of constructing the power plant and the costs of erecting the segment of the transmission network that would connect the power plant to the national power system.
- (b) Variable Costs: These include three streams: the operation and maintenance costs, the fuel costs, and the costs of transmission and distribution.
- (i) Operation and Maintenance Costs: The cost of operation and maintenance per unit of output (kWh) used is 0.04 lei (US\$0.0022/kWh). This is based on the historically observed operation and maintenance costs for the entire thermal generating system in Romania.
- (ii) Fuel Costs: The Project would be fueled by domestically produced lignite. The location and quality of Romania's lignite deposits render their development for export uneconomic. However, these deposits are sufficient to meet Romania's future lignite requirements (power sector and other industries) for approximately the next 60 years. For the analysis, the price of lignite is set equal to the incremental cost of extracting and delivering an additional ton of lignite to the power plant (107 lei/ton, based on 1977 Romanian internal prices which were provided by Mr. P. Rickes, consultant to the Bank).
- (iii) Cost of Transmission and Distribution: The cost of transmission and distribution at each voltage level was not readily available, consequently, a proxy for that cost was derived for the analysis. A fixed cost for transmission and distribution of 0.0246 lei (US\$0.00137) was attributed to each unit of output (kWh) produced by the power plant.
- (iv) Transmission and Distribution Losses: 6% of net MEE deliveries to the system.

CHAPTER V

AGREEMENTS REACHED AND RECOMMENDATIONS

5.01 During negotiations, agreement was reached on the following principal issues:

- (a) the Government and the Investment Bank confirmed that they will provide semi-annually lignite production figures for the preceding 6 months and estimated production for the 6 months immediately following (para 2.04);
- (b) the Investment Bank has undertaken to take measures for increasing the US\$8.9 million ceiling on foreign exchange expenditures for the Project if it becomes necessary (para 2.15);
- (c) the Government clarified that the Project cost estimate includes import duties and taxes (para 2.05);
- (d) the Government confirmed that it plans for the power sector to generate 30% of its own investment capital up to 1985 (para 3.11);
- (e) the Government and the Investment Bank have confirmed that they will furnish to the Bank additional indicators on the sector's operating performance and efficiency (para 3.11); and
- (f) the Government and the Investment Bank have confirmed that the audit report for the power sector will be based on the consolidated accounts of the two power centrals (para 3.12).

5.02 Submission to the Bank of a copy of the technical and economic indicators for the Project would be a condition of loan effectiveness.

5.03 Agreement having been reached on the principal issues, the Project is suitable for a Bank loan of US\$70 million to the Investment Bank with the guarantee of the Republic of Romania. An appropriate term for the loan is 15 years, including 3 years of grace. The loan is expected to become effective within 3 months of loan signing.

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Selected Documents and Data Available in the Project File

A. Selected Reports and Studies Related to the Sector

- A1 - Study on the optimum structure of the thermal and hydropower station development program of Romania, set up on the basis of the linear programming mathematical model. MEE, Bucharest, July 1977.
- A2 - Methodology for the determination of capacity reserves necessary in electrical systems for covering capacities out of operation in breakdowns and for ensuring the safety of power supply. MEE, Bucharest. (No date)

B. Selected Reports and Studies Related to the Project

- B1 - Data and Economic and Technical Elements Concerning the Feasibility of the Turceni Thermal Power Station Scheme. MEE, Bucharest. (No date)
- B2 - Mining of Brown Coal (Lignite) in the Romanian province of Oltenia with special regard to supply for Turceni Thermal Power Plant. Rheinbraun Consulting GmbH, Cologne, Federal Republic of Germany. June 2, 1978.
- B3 - Some technical and economic data related to Turceni II power plant. Investment Bank, Bucharest, February 6, 1978.

C. Selected Working Papers

- C1 - Development of Project cost estimates and construction scheduling.

December 19, 1978



