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PROCEEDINGS OF A CONFERENCE ON ENERGY PRICING IN HUNGARY

Emergency Energy Program
for Eastern and Central Europe

Prepared for:

Bureau for Europe
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SUMMARY OF CONFERENCE PROCEEDINGS

Introduction

In December 1990 the U.S. Agency for International Development organized an Emergency Energy Program to assist the countries of eastern Europe in improving the energy efficiency of their industrial plants and refineries, in rationalizing and reforming their energy price systems, and in improving their oil purchasing techniques. Assistance programs for Poland, Czechoslovakia, Hungary, Romania, Bulgaria, and Yugoslavia were established. Activities under the Energy Price Reform component of the Emergency Energy Program in Hungary were managed by RCG/Hagler, Bailly, inc., a management and technical consulting firm.

One of the objectives of the Emergency Energy Program is to support energy price reform. By helping the eastern European democracies rationalize and reform their energy price systems the United States can help them make a transition from centrally planned economies to market economies. The purpose of the energy price reform component in these countries is to support country efforts to rationalize and reform their energy price systems, with particular focus on petroleum prices.

One of the activities conducted in Hungary under the energy price reform component of the Emergency Energy Program was the organization of a conference on energy pricing in Hungary. The conference was held in Budapest in May 1991 and lasted five days (Monday, May 20 through Friday, May 24). The conference was held at the offices of the Hungarian National Oil and Gas Trust, OKGT, which was the predecessor of the national oil company, MOL Ltd. Invitations to the conference were coordinated by OKGT and the Ministry of Industry and Trade.

The following organizations were represented at the conference:

- Ministry of Industry and Trade
- Ministry of Finance
- National Bank of Hungary
- Budapest Bank Ltd.
- the Hungarian Electricity Board (MVMT)
- the Hungarian National Oil and Gas Trust (OKGT)
- Mining Property Utilization Agency Company Limited (Mininvest Rt.)
- Mining Union (Bányászati Egyesulés)
- Institute for Industrial Economics.

The two government ministries participating in the conference are the ministries responsible for implementing the Hungarian government's system of energy price controls.[1] The RCG/Hagler, Bailly team was told that this was the first conference in Hungary which brought together the major energy sector companies and the key ministries for a discussion of the transition to a market economy.

The conference was held at a critical period in the development of energy policy and price reform in Hungary.

- The conference included a discussion of many of the concepts presented in the document entitled Hungarian Energy Policy that was submitted to Parliament by the Ministry of Industry and Trade in June 1991. The concluding session was chaired by Dr. László Lengyel, Director General for Energy Policy of the Ministry of Industry and Trade.

- The price increases effective June 1991 for household coal and district heat were discussed by Bela Nemeth, the Director for Energy Price Control of the Ministry of Industry and Trade. These were major price increases for the household sector.

- MVMT's proposal for restructuring the electric utility sector was presented at this conference. This proposal articulated a concept for implementing the general guidelines on restructuring the power sector that were accepted by the government of Hungary in April.

Since the time the conference was held, OKGT has been restructured and the process of restructuring MVMT has progressed. On July 1, 1991 the gas distribution companies of OKGT were spun off and on October 1, 1991 the assets of the remaining nine subsidiaries were transferred to a new corporation called MOL Ltd. In the fall of 1991 plans were announced to restructure MVMT by forming separate companies in generation, transmission, and distribution, under the technical and economic management of a "Concern" and under the regulatory authority of a new legal entity.[2]

The following report is a brief summary of the topics discussed at the conference. The purpose of this report is not to provide a detailed record of the proceedings, but to highlight

[1] Prices of household and industrial coal, LPG, and firewood were decontrolled on March 1, 1992, about nine months after the conference.

[2] International Energy Agency, Energy Policies: Hungary, 1991 Survey (Paris: OECD/IEA, 1992), pp. 76-77, 99.

the most important issues raised by the speakers and the attendees during the discussions.[3] Conference participants were invited to raise questions and offer comments immediately after each presentation. The following report summarizes some of these discussions as well as the presentations.

MONDAY, MAY 20

Objectives of the Conference

The conference was opened by a brief address by Dr. Charles Zimmermann of RCG/Hagler, Bailly, Inc. He explained the purpose of the conference in the context of the broader objectives of the Emergency Energy Program in Eastern and Central Europe. The objectives of the conference were:

1. To discuss issues related to Hungary's transition to a market economy in the energy sector, with emphasis on energy pricing issues.

2. To provide a forum in which the major energy supply subsectors (electric power, oil, gas, and coal) could be brought together to facilitate a full discussion of the issues affecting interrelationships among these subsectors.

A market-based economic system is being established in Hungary, concurrently with the building of a democratic society. The energy sector is one of the most difficult to adapt to a market economy and the main players in this sector had not had an opportunity to review the problems and discuss solutions with each other and with foreign experts. The conference was intended to offer such an opportunity for a frank and open exchange.

Energy Pricing and the Transition to a Market Economy

Dr. Gustav Bager, a Director General of the Ministry of Finance, described the Hungarian government's four-year macroeconomic program for the 1991-1994 period. The government's broader objectives are to control inflation, service foreign debt, limit unemployment, and eliminate budget deficits at the national level. Liberalization of prices includes several components: (1) liberalization of the prices of imported goods, (2)

[3] Charles Zimmermann and Donald Hertzmark were the only participants who did not speak Hungarian. Most of the discussion following each presentation was conducted in Hungarian, with some English-Hungarian translation. A complete tape recording of the conference was made by OKGT.

liberalization of wages, (3) liberalization of capital markets, and (4) liberalization of consumer prices. At May 1991, 90 percent of consumer prices had been liberalized. The government plans to promote privatization, make the Forint convertible by 1994, and reduce the role of the state in the economy.

Dr. Bager discussed energy pricing, energy taxation, funding of uneconomic energy enterprises, and the role and treatment of monopolies. One concern was that gasoline, diesel, and heating oil prices in Hungary had declined only slightly following the sharp decline in world crude oil prices that occurred in January and February. High energy prices create economic stress in the Hungarian economy. Another concern was that changes in coal and natural gas prices were both linked to changes in oil prices rather than conditions in coal and gas markets.

To some extent Hungary's oil pricing policies of the 1980s shielded the industrial sector from a sharp transition from lower-cost Soviet oil supplies to world oil prices. During the 1980s, end-use prices for several petroleum products were based on Mediterranean prices despite the availability of crude oil from the Soviet Union; the government of Hungary captured the excess of end-use prices over costs.

Following this presentation the comments from conference participants led to a debate on the following topics:

- *The ability of consumers to pay higher energy prices.* One view is that government price controls are needed to protect the consumer from high inflation, and a deteriorating standard of living during a period of declining employment. Another view is that the government can no longer afford subsidies and the economy cannot afford price controls.[4]

- *The profitability of OKGT.* According to historical accounting records OKGT produced significant profits which were taken away by the government. The current level of profitability (e.g. first quarter 1991) was unclear. One hypothesis was that OKGT's profits are excessive because OKGT is a monopolist. Another view is that OKGT is overtaxed, through excise taxes on gasoline and diesel fuel, at a time when demand is falling and capital requirements are high.

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[4] In May 1991 Hungary had only a few month's experience with the removal of price controls on petroleum products. The IEA found in 1991 that "Product prices have been liberalized but gasoline prices are still subject to government influence - a pricing committee within MOL recommends the refinery gate price for petroleum products, subject to informal approval by the Ministry of Finance." International Energy Agency, Energy Policies: Hungary, 1991 Survey (Paris: OECD/IEA, 1992), p. 43.

- *The high cost of domestic coal.* A widespread view is that domestic coal is overpriced compared to imported coal, when differences in coal quality are taken into consideration. Reliance on coal imports was not considered feasible, however, due to the foreign exchange requirement, the impact of imports on unemployment among miners, and the unsuitability of high-Btu imported coal to boilers and furnaces designed for low-Btu domestic coal.

- *Future sources of capital for power generation.* If the government does not intend to participate in financing the construction of power stations, the power sector must become self-financing. There was some debate whether the necessary capital could be obtained, and some concern about the electricity price increases needed to achieve self-financing.

The Legislative and Policy Framework of Energy Price Controls

Bela Nemeth, Director of Price Controls in the Ministry of Industry and Trade, discussed the enabling legislation under which energy prices were controlled and talked about the price increases that were proposed to go into effect on June 1. He outlined the difficulties his organization encounters in implementing price control legislation, including (1) the difficulty of resolving disagreements between producers and consumers in an objective fashion and (2) the difficulty of complying with bureaucratic procedures required by the legislation and associated regulations.

On May 20, 1991 the Ministry of Industry and Energy was contemplating the following price increases, to go into effect on June 1:

170%	coal
285%	coal briquettes
165%	coke
25%	firewood
70%	district heat
50%	natural gas

The substantial price increases for coal and coke were considered necessary because the government of Hungary planned to remove subsidies, and higher prices were necessary to cover production costs.[5]

[5] Actual price increases effective June 1, 1991 were very close to the percentages discussed at the conference. The price of coal briquettes, in Forint per kilogram, increased only 216 percent instead of 285 percent. The price of household coal, in Forint per

Following the presentation there were questions about the procedures for requesting energy price changes or filing comments and complaints regarding proposed changes. One suggestion was to remove central government control over prices for coal, and let coal prices to be determined by local governments while eliminating central government financial support for coal mines. A related proposal was for new legislation affecting the coal industry that would facilitate agreements between producers and consumers, rather than price determination through administrative settlements.

Conditions for Private Investment in Hungary's Energy Sector

T.S. Tuschak, a private consultant on the RCG/Hagler Bailly team, discussed the major conditions required for private sector investment to take place in the energy sector, which generally necessitates sizeable capital investments and significant financial expertise. These conditions were discussed under six main headings:

1) Political and socioeconomic environment.

2) Market conditions - size, trade barriers,etc.

3) Infrastructure:
   a) Financial markets and institutions;
   b) Judicial and legal framework;
   c) Physical facilities (communication,transport,human resources)

4) Investment incentives, taxation;

5) Comparative advantages;

6) Investment returns and repatriation of profits.

Some concern was raised by the conference participants regarding the implications of foreign investment in a sector in which domestic investment may be inadequate to meet capital requirements. Another issue that was raised was the absence of truly competitive market conditions in the sector which, by its very nature, is highly regulated and monopolistic. The need for impartial regulatory agencies was discussed.

TUESDAY, MAY 21

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kilogram, increased 176 percent and the price of natural gas for households rose 53 percent.

Energy Pricing and Inflation

Dr. Katalin Garbai, Deputy General Manager of the National Bank of Hungary, explained the change in the role of the central bank from the socialist system in which acted as the main source of liquidity to the economy, in accordance with the national plan, to the current more traditional role of monetary policy.

The commercial banking role was devolved to a growing number of state owned and private banks after 1987 and more particularly as the new democratic system's ascension to power in 1990.
The presentation covered the techniques the central bank applies to impact liquidity,interest rates and in this context the price levels of energy and the associated balance of payments effects, including managing inflation levels.

Conference participants reaction, fairly typical to a number of presentations, focused on the social impact of high inflation and the role of fast rising energy prices in the growing economic difficulties of the country.

Energy Pricing and Industrial Structure

This topic was discussed by Dr. Miklos Hegedus, Director of the Institute for Industrial Economics, and Dr. Pal Erdosi, an expert in energy economics and former director of the same institute. One of the principal points of their presentation was that although energy prices in Hungary's industrial sector were low in the 1950-1980 period, by international standards, the high energy intensity of the Hungarian economy is not attributable to the low price of energy during this period. Rather, the high energy intensity of the economy is attributable to an industrial structure which was dictated by central planning in the 1950-1980 period and contains sectors that are inherently energy-intensive. Because real GDP growth during the 1980s was small, the industrial structure of the economy did not change substantially during the 1980s.

In the industrial sector of Hungary, 75 percent of energy consumption is concentrated in raw material production, where the average level of consumption is 11 megajoules per Forint of GDP. The remaining 25 percent of industrial energy consumption is in sectors where the average level of consumption is 0.7 megajoules per Forint of GDP.

In the developed market economies, where industrial energy efficiency can be altered through investment in new equipment, a 1 percent energy price increase may induce an 0.4 to 0.8 percent reduction in energy demand. In the industrial sector of the former socialist economies in the 1970s and early 1980s there was a lack of demand response to prices

because there was a shortage of capital available for investment in more efficient technologies.

These speakers questioned the commonly held view that higher prices provide an incentive to use energy more efficiently and argued that during the transition to a market economy energy prices should be under government control and social concerns must be considered in establishing price levels.

The controversial views expressed in this presentation evoked some debate. The majority of the conference participants appeared to support the view that while energy prices have significant social consequences, particularly during the transition period from a command to a market economy, the process of substituting market determined prices for centrally controlled prices must continue.

The Budapest Bank's Relation to the Energy Sector

This presentation was made by Marta Kismarty, an economist and General Manager of Budapest Bank Ltd. The Budapest Bank is the primary financial intermediary for the energy sector. The energy sector represented about 40 percent of assets, one-third of income, and one-fourth of outstanding credit of the Bank. The oil sector's contribution to the Bank and the economy is favorable, the coal sector's contribution is "outstandingly poor", and the electrical industry's contribution is average. The Bank's credit exposure is considered excessive. The energy sector's indebtedness to the Bank is several times higher than the sector can be reasonably expected to repay.

Lending is not governed by risk and credit considerations, but by the key role the energy sector plays in the national economy. The inappropriate resource allocations of the past will take years to rectify. In the meantime there are difficulties in finding funds to cover the energy sector's needs.

Serious problems will be created for the Bank by the restructuring of the energy sector if the collateral assets securing indebtedness are divested from the borrowers to new entities. Such asset divestitures are being contemplated in restructuring proposals.

The positive aspects of the present turmoil should not be overlooked. Many actions are being taken to correct the anomalies associated with past lending policies. Prominent among these actions are the implementation of a new energy pricing policy and the attempts to resolve the coal industry's financial problems.

WEDNESDAY, MAY 22

Electricity Tariffs Required to Achieve Long-Range Self-Financing

Istvan Zakar, Director of Economics at the Hungarian Electricity Board (MVMT), discussed pricing policies in connection with restructuring and self-financing. Some of the points presented by Mr. Zakar are stated below.

- Under the past system of central planning, electric tariffs were designed to facilitate operations, no provision was made for capital requirements, and investment needs were funded by the national budget. Over the past 15 years the electricity sector contributed more to the consolidated revenue fund of the central government than the amount of revenue it received from this fund.

- To ease the financial burden on the national treasury the private sector will be permitted to invest in future generating capacity, although the transmission and distribution of electricity to the consumers will by and large remain a state monopoly. As the present amortization rate of 4 percent does not offer attractive profits for the private sector, the 4 percent rate should be doubled (for new investments, at least).

- Electric energy prices are not fully subject to market forces. There are large social policy components in price determination. To meet socioeconomic objectives and still attract investment a multi-tier price system should be developed, with prices at the generating station, at the point of delivery to a distribution company, and at the point of delivery to the consumer. This price system would include generation tariffs, sale for resale tariffs, and consumer tariffs. The system for determining prices paid at the generating station could allocate a proportion of electric sales revenue to the individual generators of electricity on the basis of legitimate costs incurred by the generating plant. The distribution would be made from a single pool of funds.

- Subsidies and cross-subsidies should be eliminated. Electricity tariff schedules should not discriminate among customers on the basis of the customer's purpose for using electricity (e.g., manufacture of aluminum). Residential tariffs should be raised, to eliminate subsidies.

Conference participants debated the merits of the proposed system for determining prices paid at the generating stations. This proposal was criticized by several participants; one concern was that the scheme would not provide an incentive to minimize costs.

Development of Electricity Tariffs on the Basis of Marginal Cost

Andras Kacso, an engineer at the Hungarian Electricity Board (MVMT), reviewed the theory and practice of marginal cost analysis, using charts developed by MVMT in connection with a major study released in February 1991. Mr. Kacso described the reasons why it is desirable to develop electric tariffs on the basis of marginal cost; the distinction between short-run and long-run marginal cost; the distinction between an analysis of economic costs and an analysis of financial costs; the components of marginal cost; and the variations in marginal cost over time and over different geographic regions. The energy component of marginal cost and the capacity component of marginal cost can be allocated differently to customer classes. Mr. Kacso also discussed the effect on long-run marginal cost (LRMC) of the selection of criteria used to develop capacity expansion plans. The least risky expansion plan may have a much higher LRMC than the least costly expansion plan.

Electric Utility Regulation in a Market Economy

Charles Zimmermann, of RCG/Hagler Bailly, in his presentation covered six topics:

1) the ownership structure of the power sector and the degree of competition that is possible in a market economy

2) the feasibility of joint ventures between foreign investors and government-owned enterprises in the power sector

3) the merits of regulatory institutions

4) utility regulation in the United States

5) sources of construction funds for the power sector in a market economy

6) sources of construction funds for the power sector in Hungary.

On the question of ownership structure, three alternatives to a state monopoly were outlined: (1) a competitive market for capacity and energy supplied by new generating facilities (2) a combination of a state monopoly and one or more private monopolies subject to government regulation, and (3) a combination of alternatives (1) and (2).

Dr. Zimmermann listed alternative strategies that could be pursued if Hungary's electric power sector faces a capital shortage. One option is to encourage industrial customers to build their own generation and cogeneration plants. Other options are to attract private

power development through suitable wholesale rates, negotiate long term power import contracts with other countries, or raise peak electric rates to induce conservation and reduce the need for new capacity.

Following the presentation there was a discussion of the allegation that MVMT was forced to buy coal at uneconomic prices.

THURSDAY, MAY 23

Case Studies of Oil Price Decontrol

Donald Hertzmark, an independent consultant on the RCG/Hagler Bailly team, presented a general theory of energy price decontrol and described case studies of oil price decontrol in Thailand and Indonesia.

A good set of energy prices is a necessary condition for economic development. The following criteria can be used to determine whether prices are functioning well:

1. Shortages and rationing programs must not exist.

2. Retail prices must be related to supplier incentives.

3. Energy suppliers must have the flexibility to adjust prices frequently if necessary.

4. Domestic energy prices must be consistent with international prices, to prevent exported goods from becoming too expensive in international markets.

The presentation gave several examples of how wrong product price relationships can cause a misallocation of resources, with damaging consequences. In Indonesia, low kerosene prices caused high jet fuel imports, while high prices of LPG caused LPG to be exported. Indonesia has all the symptoms of a non- functioning price system, including shortages and wasteful investment. Price reform in Thailand produced favorable results.

Adjustment to Oil Price Decontrol in Hungary

Zoltan Mandoki, deputy director of the economics department of the Hungarian National Oil and Gas Trust (OKGT), discussed the brief history of price decontrol in Hungary. Several sources of external pressure forced Hungary to raise crude and product prices to international

levels. First, the World Bank asked Hungary to allow prices to rise to international levels. Second, Soviet oil deliveries in 1990 fell 2 million metric tons short of contracted amounts, forcing Hungary to seek other sources of crude oil. Third, in the wake of the Gulf war the Soviets announced that they would require hard currency payments for their oil, effective January 1, 1991.

Mr. Mandoki presented a table showing pre-tax gasoline prices in Europe, in Forint per liter, for 98 octane gasoline. The pre-tax price in Hungary (16.4 Forint per liter) was lower than in Austria, Germany, Switzerland, the United Kingdom, Italy, or Belgium. In these countries the pre-tax price ranged from 19.1 Forint per liter in Germany to 26.5 Forint per liter in Italy. The tax component of the gasoline price in Hungary was high, at 42.6 Forint per liter. This international comparison was used to support the argument that OKGT's profits were not excessive because its pre-tax prices were not excessive.

For a truly competitive market to evolve time is needed. OKGT's monopoly will cease to exist when foreign companies enter the sector. The fact that Shell buys its supplies from OKGT rather than importing products was presented as an indication that Hungary's ex-refinery prices are reasonable.[6]

Following the presentation there was some discussion of the profitability and monopoly power of OKGT. One participant stated that in November 1990 OKGT bought Soviet oil at prices lower than world prices and sold products at world prices. Another argument questioned the concept of setting prices based on Rotterdam plus transport from Rotterdam, when in fact no product imports are made from Rotterdam. There were some differences in opinion regarding the level of OKGT's 1990 profits; figures of 40 billion and 60 billion Forint were cited.

Oil Price Controls in an Industrialized Market Economy

The presentation by T.S. Tuschak, an independent consultant on the RCG/Hagler, Bailly team, related in considerable detail the reasons for the oil price controls instituted in Canada after the price shocks of 1973, and the consequences of these price controls. The administered pricing system, which tended to perpetuate itself, was left in place until 1984.

[6] The IEA does not accept this argument. On February 15, 1991 there was a 4.5 percent import duty on gasoline and middle distillates and a 10.5 percent import duty on heavy products. International Energy Agency, Energy Policies: Hungary, 1991 Survey (Paris: OECD, 1992), p. 44.

The policies appeared to find justification in the distortions and dislocations caused by the impact of steeply rising prices on the different provinces within Canada. The government was concerned that if oil prices were left alone, the accrual of huge incomes in one underpopulated area of the country would become very damaging. Unfortunately, even greater damage was created by this essentially well-meaning policy. The harmful effects on resource allocations, energy uses, and industrial strategy were fully illustrated and documented in this presentation.

The conference participants inquired about the price control mechanisms used and the social implications of price decontrol. There was also discussion of the question whether price controls had the effect of constraining domestic investment and thereby affecting the level of foreign ownership of the oil sector.

FRIDAY, MAY 24

Coal Pricing and Its Relationship to Coal Industry Restructuring

Szabolcs Jene he president of Mining Property Utilization Agency Company Limited (Mininvest) d bed the changes the coal industry has undergone. In 1964 there were 76 mines, 125,0 ners and 30 million metric tons of production, in 1991 there were 32 mines, 50,000 rs and 17 million metric tons of production. Mr. Jenei expressed the following view

- The deb f the industry (35 billion Forint) should be written off because it represent government funding of inefficient and unproductive investments. (Although the status of these debts is unclear, interest is still payable on them.)

- The mines are being asked to cover the shutdown cost of mines, but the coal industry is unable to absorb these costs.

- The cost of retraining miners and their pensions should be considered a social cost that should not be charged to the remaining active mines.

- Long term contracts are needed for coal sold to electric generating stations.

- Coal prices should not be forced to track fluctuations in heavy fuel oil prices.

Hungary can no longer trade coal in the Comecon market. The value of coal can be estimated at 200 to 250 Forint per gigajoule, on the basis of imported electricity prices.

Mininvest developed a coal price proposal on the basis of a comparison between coal-fired plants and gas turbines.

Factors Affecting the Prices of Coal Used in Electric Power Generation

Charles Zimmermann of RCG/Hagler Bailly discussed the factors that explain differences in market prices of coal, and examined the competitive position of coal and residual fuel oil in the power sector.

The presentation included a discussion of reasons why governments may intervene in the electric power sector, to either encourage or discourage coal use. In some countries domestic coal producers are protected, directly or indirectly, from competition with imported oil. In a market economy the government does not necessarily adopt a laissez-faire attitude toward competition between domestic coal resources and imported oil. Coal pricing therefore should therefore be consistent with government policy.

At the time the conference was held, the price of coal used in power generation was subject to price controls based on a linkage between the price of Hungarian coal and international prices of residual fuel oil. One of the principal points of this presentation was that a close linkage between coal prices and residual fuel oil prices is possible under certain conditions, but these are not the normal conditions prevailing in market economies. Normally a coal-burning electric utility purchases a mix of spot and contract coal, and normally spot prices of coal are based upon coal market conditions rather than spot prices of residual fuel.

Conference Findings

In the final session of the conference the discussion was moderated by Dr. László Lengyel, Director General for Energy Policy at the Ministry of Industry and Trade. The product of this discussion was a list of points to be considered in the development of Hungary's energy policy. The participants agreed, for example, that there was a need for regulatory institutions to establish prices of electricity and natural gas, and that long-term contracts in the coal industry and the natural gas industry were needed. The findings were generally consistent with the energy policy document submitted to Parliament in June 1991. (The document on "Hungarian Energy Policy" is included in these conference proceedings, following the copies of papers presented.)

Conference on Energy Pricing in Hungary

OKGT conference room
H-1117 Budapest, Schonherz Z. u. 18
May 20-24, 1991

Hosted by OKGT
and sponsored by the U.S. Agency for International Development
"Emergency Energy Program for Eastern and Central Europe"

Agenda

Monday, May 20 10 am - 3 pm	**Macroeconomic Issues and Policies** Chairman: Dr. Gustav Bager
Objectives of the Conference	Dr. Charles Zimmermann RCG/Hagler, Bailly, Inc.
Energy Pricing and the Transition to a Market Economy	Dr. Gusztav Bager Ministry of Finance
The Legislative and Policy Framework of Energy Price Controls	Bela Nemeth Ministry of Industry and Trade Discussion leader: Ferenc Bathó
Conditions for Private Investment in Hungary's Energy Sector	Dr. T.S. Tuschak Independent Consultant Discussion leader: Ferenc Bathó Ministry of Finance
Tuesday, May 21 10 am - 3 pm	**Macroeconomic Issues and Policies** Chairman: Dr. Miklos Hegedus
Energy Pricing and Inflation	Dr. Katalin Garbai National Bank of Hungary Discussion leader: Dr. Miklos Hegedus
Energy Pricing and Industrial Structure	Dr. Miklós Hegedus and Dr. Pal Erdösi Institute for Industrial Economics Discussion leader: Dr. László Lengyel, Ministry of Industry and Trade
The Budapest Bank's Relation to the Energy Sector	Márta Kismarty Budapest Bank Ltd. Discussion leader: Dr. Miklos Hegedus

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Conference on Energy Pricing in Hungary

OKGT conference room
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"Emergency Energy Program for Eastern and Central Europe"

Agenda (continued)

Wednesday, May 22 10 am - 3 pm	**Pricing of Electricity** Chairman: István Zakar
Electricity Tariffs Required to Achieve Long-Range Self-Financing	István Zakar Hungarian Electricity Board (MVMT)
Development of Electricity Tariffs on the Basis of Marginal Cost	András Kacsó Hungarian Electricity Board Discussion leader: István Zakar
Electric Utility Regulation in a Market Economy	Dr. Charles Zimmermann RCG/Hagler, Bailly, Inc. Discussion leader: István Zakar
Thursday, May 23 10 am - 3 pm	**Pricing of Oil and Petroleum Products** Chair: Zoltan Mandoki
Case Studies of Oil Price Decontrol	Dr. Donald Hertzmark Independent Consultant Discussion leader: Joszef Lakatos
Adjustment to Oil Price Decontrol in Hungary	Zoltan Mandoki Hungarian National Oil and Gas Trust Discussion leader: Joszef Lakatos Ministry of Finance
Oil Price Controls in an Industrialized Market Economy	Dr. T.S. Tuschak Independent Consultant Discussion leader: Joszef Lakatos

Conference on Energy Pricing in Hungary

OKGT conference room
H-1117 Budapest, Schonherz Z. u. 18
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"Emergency Energy Program for Eastern and Central Europe"

Agenda (continued)

Friday, May 24 10 am - 1 pm	**Pricing of Coal** Chairman: Szabolcs Jenei
Coal Pricing and Its Relationship to Coal Industry Restructuring	Szabolcs Jenei Mininvest Discussion leader: László Kalman
Factors Affecting the Prices of Coal Used in Electric Power Generation	Dr. Charles Zimmermann RCG/Hagler, Bailly, Inc. Discussion leader: László Kalman
1 pm - 3 pm	**Conference Findings and Policy Recommendations** Chairman: László Lengyel This session included a discussion of steps that could be taken by the government of Hungary to promote the development of competitive energy markets and to improve price-setting procedures in the electric and gas sectors.

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Participants in the Conference on Energy Pricing in Hungary, May 20-24, 1991

The RCG/Hagler, Bailly participants included Charles Zimmermann, Thomas Tuschak, and Donald Hertzmark, and Alexander Meeraus. Zimmermann and Tuschak participated in the entire conference, while Hertzmark participated in the May 23 session and Meeraus attended a portion of the May 23 session.

Conference arrangements and invitations were coordinated by András Morenth, Head of the Department of Energy Cooperation of the Ministry of Industry and Trade, and Mrs. Dr. Veronika Dank Szentgyörgyi, Head of the Economics Department of the Hungarian National Oil and Gas Trust.

A list of Hungarian participants is presented below. In addition to the individuals listed here, there were some additional staff members from the Ministry of Industry and Trade, MVMT, OKGT, and Mininvest.

Dr. Gusztav Bager
Ministry of Finance
Budapest V., Jozsef Nador ter 2-4

Dr. Ferenc Bathó
Ministry of Finance
Budapest V., Jozsef Nador ter 2-4

Jozsef Lakatos
Ministry of Finance
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CONDITIONS FOR PRIVATE INVESTMENT IN HUNGARY

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CONDITIONS FOR PRIVATE INVESTMENT IN HUNGARY

by T. S. Tuschak

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Most planned economies in their transition to a market system face the difficult question of what kind of conditions have to be created to attract private investment. The often bumpy road to private ownership is relatively easy in small business and service sectors. These require moderate amount of capital, limited markets, unsophisticated technology and the entrepreneurial spirit of one or two people. Most of the time the roots of these privately owned small companies go back quite a few years to the declining period of socialist systems, which systems have tended to recognize lately that the best way to service the population's needs is to allow limited private ownership.

Unfortunately these conditions do not apply to the energy sector. Partly because of its strategic importance and due to its high capital intensity can be privatized only under much more demanding conditions.

What are these conditions, how to create them is the subject of this discussion.

We will attempt to address the following broad issues to facilitate their better understanding. The questions fall into the following general categories:

I **Political and socio-economic environment.**

II **Market Conditions e.g. size, trade barriers.**

III **Infrastructure:**

a) **Financial markets and institutions;**

b) **Judicial legal framework;**

c) **Physical facilities (communication/transport/human resources)**

IV **Incentives, taxation.**

V **Comparative advantages.**

VI **Investment returns and repatriation of profits.**

We will discuss the above issues in a selective manner, putting more emphasis on some problems, than on others.

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I POLITICAL AND SOCIO ECONOMIC ENVIRONMENT

If all we wanted to say was that capital is very nervous and likes security and stability,there would not be much effort needed,or words to be wasted. Everybody is aware of these truisms. Yet there are certain facts that are useful to examine to develop a feel for how and why the private sector might choose to invest in the energy sectors of the newly evolving market economies of formerly socialist countries.

The OECD countries currently account for 80% of, what we used to call the"free world" energy demand. This was one of the consequences of the rapid economic growth of Europe, Japan and North America. By way of example, the U.S. economy grew at an average annual rate of 4.3% and Canada at 5.1% from 1960 to 1973. The impact of the first oil crisis on OECD growth was disastrous. It fell to about 2.6%. During the late seventies and eighties economic growth slowed considerably, albeit at different rates, in every market economy. While the sharp rise in energy prices gave a strong impetus to this slow down, there were other reasons as well. We shall not go into these now.

What is the connection between energy prices and economic growth on the one hand, and private investment in the energy sector, on the other?

The energy crises of the seventies resulting in generally higher price levels (notwithstanding violent fluctuations) have resulted in a general expansion of the investment flows to the energy sectors of the western world.

The dramatic slow down of economic growth, on the other hand, prompts western investors to seek out new opportunities. Based on the well known causal relationship between energy and economic growth, most observers consider the energy sectors of the new market economies as the key to the development of these countries. It is also generally accepted that the crumbling of trade and political barriers will initially reduce energy supplies, before market forces can correct the flows. We all know the reasons for this. They include the problems of the Soviet Union, the major source of energy supplies in earlier days, the lack of hard currency, the unrequited rubel balances, etc. These are propitious times for new actors to enter the energy scene.

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So, why are they not breaking down the gates? For the simple reason, potential investors are waiting to be assured that:

a) the political situation is stable;

b) the inevitably painful transition to a market system is basically accepted by the population, and

c) the government admits private investors into this crucial sector and creates an atmosphere in which profits on such vital commodities is deemed socially acceptable.

(I might add a fourth factor, that where quasi monopolies exist, the private sector wants to be assured that objective regulatory systems exist,which leads us to the next topic.)

II MARKET CONDITIONS, SIZE, TRADE BARRIERS

The first interest by private investors usually comes from gasoline retailers. For large oil companies these are relatively low risk investments which open the way to local markets and offer an outlet to their product surpluses. We understand that of Hungary's approximately 550 retail outlets, 47 are in Shell's hands already and another few are owned by private domestic businesses.

The last available statistics indicate that Hungary has one of the higher car ownerships in eastern Europe, one car per 5.5 persons. This should allow for considerable increase in gasoline and related product retailing. With the introduction of more sophisticated motor cars and environmental protection measures, the refineries are estimated in need of about one billion dollars in investment.

The natural gas industry offers other investment opportunities. Gas production has fallen to 620 mmcfd in 1988 from 725 mmcfd in the early eighties. With an estimated 4.2 Tcf remaining reserves, there is ample opportunity for private capital to invest in the up- and downstream of gas production. Investment needs are estimated by American energy analysts at 4 billion dollars during this decade.

An analysis of investment opportunities in the six ex socialist countries by American geologists, gauged by geological potential and political favorability, places Hungary in second place politically and somewhere in the middle geologically.

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The market for the oil and gas industry is above average. In the upstream the above described reserve estimates offer considerable investment opportunities with assured markets. In addition the electricity generating utilities are facing a coal industry crisis. Domestic coal production is declining and the financial viability of the coal mines is poor now and deteriorating rapidly. The fuel supply for the Hungarian national power company (MVMT) will have to shift gradually to hydrocarbon. This should dispel doubts about markets.

III INFRASTRUCTURE

a) Financial Markets and Institutions

It would be probably helpful to provide some perspective for the Hungarian financial markets by showing a few figures of the country's financial situation in the context of other East European economies.

GROSS INVESTMENT

(percentage change)

Year	Bulg.	Czecho.	Hung.	Poland	Romania	USSR
1986	8.0	1.4	6.5	5.1	1.2	8.3
1987	7.2	4.4	9.8	4.2	0.9	5.7
1988	6.0	4.5	-7.7	6.0	-1.3	4.8
1989	8.0	1.0	-5.7	0.0	n.a.	3.0

As can be seen from the above table the Hungarian investment picture fluctuated quite violently. (These indices are from an IMF publication.)

Without overburdening the audience with statistics it may be useful to provide one more set of indices, showing the countries' exposure to excessive debt.

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NET VULNERABILITY

(Total resources, less total requirements in billions of dollars)

	1985	1986	1987	1988	1989
Bulgaria	n.a.	0.2	0.1	0.1	0.4
Poland	-2.6	-3.0	- 3.0	-0.6	-2.5
Romania	-0.2	0.5	1.1	1.2	2.1
USSR	8.0	7.7	6.7	7.1	4.0
Czechoslovakia	0.9	0.5	0.0	-0.4	-0.5
Hungary	-0.5	-1.7	-2.0	-1.4	-2.6

Note: Total resources = reserves plus unused credit
Total requirements = current a/c balance plus maturities

This IMF index gives a flavour of how careful investors ought to be investing in the countries shown in the above table.

East European countries were, by and large, a favourite investment opportunity for western banks. What the lenders considered to be a disciplined social system implied that leaders could take very long term commitments and had the means at their disposal to make necessary large adjustments in economic policy. A case in point was the Polish and Romanian debt rescheduling crisis in the early eighties, when east Europeans were almost forced out of the international markets The governments of the East European nations responded, however, with a strong domestic adjustment policy. Within two years, the countries of the region moved from deficit to surplus in their current account and a significant net repayment of international debt took place.

Another feature of the financial markets of the recent past was that most financial transactions did not take place in what is called the publicised markets (bond issues and syndicated credits to the ultimate users of funds), rather through traditional bank to bank credits (aforfait market). The impact of these conditions was that as late as in 1987 the USSR and Czechoslovakia were able to borrow for eight-year terms at 1/8th percent above LIBOR.

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There is a substantial change unfolding before our eyes in these East European countries. The political evolution is leading to structural changes in borrowing/financing patterns as well as in their economies. Rather than traditional debt finance, more equity capital is needed. Borrowers are seeking to deal with foreign lending/investing institutions directly. This happens often outside the jurisdiction of the central monetary authorities.

At first blush, this suggests increased risk, but at the same time there are hugely increased opportunities also. Rather than in the traditional fields of straight financial and trade lending new opportunities may be found in assisting direct investment, off-balance sheet financing, facilitating acquisitions i.e. privatization, merchant banking and upgrading the financial services available.

Despite the heavy debt burden, Hungary has the best cultivated relations with the international banking community and maintained market access throughout the eighties even at times when other CMEA countries could not borrow. Hungarian bonds were rated as investment grade by Moody's in the U.S.. A Japanese rating agency initially gave a similar rating, although to the best of my knowledge, this rating has recently been downgraded.

As is well known the Hungarian financial system consists of four basic types of institutions:

- Domestic commercial banks;
- Specialized financial institutions;
- Savings banks;
- Joint venture banks.

The scene changes fast and it may be that my list is not complete. The most interesting group consists of the specialized financial institutions, which although not allowed to take current account deposits of their borrowers, if this restriction still applies, are otherwise full-fledged financial institutions. They have pioneered such services as: leasing, hire purchase, real estate development, and quasi equity type instruments. In 1989 they accounted for about 3% of the assets of the country's financial system.

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It is difficult to know how profitable Hungary's financial system is. It is not really a subject for this paper. It may be of interest to report that a recent article in the 'Economist" questions the extremely favourable results of the Magyar Hitel Bank. It raises the possibility that if the accounts were recast according to western rules the results may be entirely different. The thought behind these doubts must be related to the level of security in both tangible assets and debt servicing ability behind the bank's loans may not stand up to scrutiny. It is not possible to express a view regarding these allegations as in the past the banking system operated according to guidelines set by the government, which may be gradually relaxed as economic liberalization progresses.A sound and profitable financial system is, however, critical for private investment in both direct and portfolio investment format.

It seems that for a full-fledged private sector development much, although not all, the institutional infrastructure is already in place. What is missing is the infrastructure needed for the trading of securities. Although there is an embryonic stock market, which can grow only as private ownership grows. The wealth of financial intermediation instruments geared to raise capital for the different termstructures and ultimate purpose by the investor (short and long term saving) and the uses by the borrowers, e.g. working capital, capital formation, project financing, acquisition of equity, etc. will generate their own institutions as the need so justifies.

b) Judicial Legal Framework

This is a highly technical subject which deserves more attention than we can afford in the given circumstances. We will attempt here to simply touch upon some of the fundamental principles.

During the past several decades the philosophical basis of the system of law was that the purpose of the legal system is to defend the interest of society, as interpreted by the ruling party and the government. The interest of the individual was subordinated, as were property rights of any proprietor below the level of the community.

In capitalist market societies, the philosophical basis of the law is to protect the political freedom and economic interests of the individual against other natural and legal persons and also defend the community against abuses by individuals.

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Due to the lack of real democracy, in the former regime the practice of law was oriented to observing more the spirit of the law, rather than bothering with the letter. The spirit was often interpreted by the political and ideological leadership, in a not necessarily consistent fashion.

In the market economies of the western world, the legal systems fall largely in two categories, both of which took much from Roman Law. These categories are: a) the Code Napoleon, and b) the British Common Law. Most countries laws represent some variation of these systems. The conceptual basis of these laws is that both the letter and the spirit of the law are critical and not subject to flexible interpretation. Any flexibility is open to the justices only and must be devoid of any interference by political or economic influences.

It is held that no private investment can flourish unless the legal system is clear and offers the necessary assurances that obligations are enforceable in a consistent manner regardless whether they favour one or the other party.

It is in this connection that regulating monopolies, monopsonies and other activities not controlled by market forces is a critical function, not only for a special sector but for the entire economy.

c) Physical Facilities (communication/transport/human resources)

This is one of the areas, mentioned above, which, while crucial for private investment, is outside the scope of this paper. The level of activity in upgrading Hungary's infrastructure in these fields suggests that good progress is being made.

IV <u>INCENTIVES, TAXATION</u>

Taxes affect capital flows in three different ways. First, taxes affect aggregate saving and investment in a country and influence the in and outflow of capital. Taxes also influence portfolio composition, the form in which investors hold their wealth, the mix of assets held and liabilities incurred by financial intermediaries, the manner in which firms finance their investments. Finally, taxes affect the location of trading activities which affects gross capital flows from high to low tax jurisdictions.

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There are of course offsetting forces. An increase in tax collection for a given level of government expenditure will raise government saving at the cost of private saving. This should reduce public financing needs and exert downward pressure on interest rates. So, while higher taxes would reduce economic incentives for private investment, the consequential improvement of public sector financial performance will reduce interest rates and provide a stimulus for the private sector. Taxation also affects the terms on which the investor exchanges present for future consumption.

An important issue is the relationship between personal and corporate taxation. The former affects how successful will the government's plan be to create a propertied middle class. Personal taxes determine the level of savings and the forms of investments by individuals. Corporate taxes, on the other hand, will determine foreign capital flows and whether they will be portfolio, or direct investment.

In recent years tax reforms have taken place in a number of industrialized countries (e.g. U.S., Japan, Canada, U.K., Germany.) These tax reforms have typically entailed a reduction in the rates and the flattening of the rate schedules. There have also been changes in the treatment of savings. Most of these shift the preference to the upper income earners. In Canada, for example, the tax sheltered retirement saving scheme has been made much more favourable for incomes upwards of $50,000 while income earners below this level lose some benefits. Although, there are, undoubtedly, some political considerations behind these moves, the economic rationale is clearly there. Promoting savings by higher income earners generates a lot more investible capital flows, than those of low income earners, who anyhow, often do not have the liquidity to take advantage of these tax sheltered opportunities.

Changes in taxes will result in capital flows on an international scale. The supply side economics, which theory has become more or less, the guiding concept in many western economies, have resulted in the preponderance of the thinking that investments should be judged on their own merits without consideration of the tax effects. This led to such changes which reduced the implicit subsidies for investment, for example in the U.S., by reducing not only corporate tax rates but also eliminating investment tax credits and tightening depreciation allowances.

While fiscal policy experts and academics may conclude that investments should be evaluated outside the tax consequences of the investment, investors in this world still seek the highest return no matter what gives rise to same.

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The modality of tax collection is also important. For portfolio investors in debt instruments anonymity is a luring feature (assets that can be held anonymously and free of withholding tax.) The impact of tax withholding on capital movements is also important. Where taxes are withheld only from non residents e.g. Canada and Australia, this tends to discourage capital inflows. In cases where taxes are effectively withheld only from residents, such as the case of France, system encourages capital outflows.

In summary, for the Hungarian energy sector it is very important that the taxation structure should encourage both equity and debt investment. As the industry is strategic the endeavour would likely be in the direction to foster domestic investment along with foreign capital. This means that the taxation system must compete with international investment opportunities in debt and equity. It also means that to attract domestic capital, which would likely derive from mainly institutional sources, the return on investment must be competitive with other opportunities available to the domestic capital markets of the lenders. To the extent social and political constraints limit the attractiveness of the returns in this sector compensating tax incentives may have to be considered.

V COMPARATIVE ADVANTAGES

Comparative advantages can play a powerful role in attracting investment. Some countries outside the Soviet Union in what used to be the CMEA block do have comparative advantages in energy commodities (Poland's coal, Romania's oil), however, Hungary's energy resources, while not negligible, do not offer a comparative advantage. Nevertheless, there are opportunities in promoting energy efficient technologies. Indeed, contrary to ventures in energy supplies, cooperation with regard to energy economy and efficiency is not a matter of a few large enterprises, but of many specialized ones. Hungary can excel in a field where individual inventiveness, creativeness is more important than large amounts of capital.

VI INVESTMENT RETURNS

It is very difficult to offer meaningful comments on this subject, beyond the platitude that private investment requires competitive returns. For example the oil industry, the most likely candidate for private investment, has a widely fluctuating return pattern.

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To provide insight into the kind of returns this industry offers, a summary of the results of the Canadian oil industry are set out below. The period chosen is the first six months of 1988, which was not a good period relative to the year before.

RETURN ON INVESTMENT

	1987	1988
	(percent)	
Return on equity	9.9	6.5
Return on capital employed (total operation)	6.6	5.3
Upstream Operation	6.6	4.2
Downstream Operation	6.3	6.2

It should be noted though that for investment purposes cash flow is probably the most important index. It depends on a number of complex factors the most important of which relates to tax rules.

The relationship of cash flows to investment is generally significantly higher than calculated rate of return on equity or capital employed. Freedom to control cash flows by investors for the purposes of either re-investing or for withdrawals is a criterion of paramount importance for private capital flows.

ELECTRIC UTILITY REGULATION IN A MARKET ECONOMY

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The objective of this paper is to provide information on the organization of the power sector in market economies and on the policy options facing Hungary today. This paper is organized into six sections:

1) a discussion of the structure of the power sector and the degree of competition that is possible in a "market economy"

2) a discussion of the feasibility of joint ventures between foreign investors and government-owned enterprises in the power sector

3) a discussion of the merits of regulatory institutions

4) a brief description of utility regulation in the United States

5) a description of the sources of construction funds for the power sector in a market economy

6) a discussion of the sources of construction funds for the power sector in Hungary.

A decision to create a "market economy" does not resolve the policy questions facing the power sector. There are still several policy decisions to made regarding the ownership of assets and the nature of government control over prices. Only after these questions are answered can tariff calculations be developed and implemented effectively in a market economy.

Structure of the power sector in a "market economy"

When the term "market economy" is used to describe methods of producing and distributing the types of consumer goods found in retail stores, it is clear to the resident of any city in Hungary that a market economy provides him with choices. As a consumer he can decide where to do his shopping (i.e., he can choose among different retail stores or street vendors) and he can choose among similar products offered by different manufacturers. Thus the concept of a market economy is attractive to people who live in formerly socialist countries

even if they have only a vague idea of the way a market economy "works" for a country as a whole. They may like the "democratic" aspect of an economy that provides people with choices, even if they do not understand the theoretical basis for letting the market determine the allocation of resources through the price system, through an uneven distribution of wages and salaries, and through capital markets which provide capital to profitable companies and force unprofitable companies out of business. The average citizen knows that a market economy has a tendency to develop when a democratic government is formed, and this link with democracy may be all that is needed to ensure that a market economy is politically acceptable.

When the term "market economy" is applied to the power sector, however, the average citizen does not have a very clear idea of what a "market economy" requires. He may envision the power sector as a centrally planned sector of the economy that buys fuel supplies at "market" prices, i.e., prices that are influenced by worldwide markets for oil and coal and by European markets for natural gas. Electricity prices are not "market" prices, however, because competition is either very limited or nonexistent. Usually there is no competition among electric transmission companies or distribution companies. The day-to-day operation of existing hydroelectric and nuclear generating stations has little to do with spot prices for fossil fuels or uranium. As a consequence of these conditions, the average citizen in the United States, in Hungary, and in other countries must find it difficult to define a "market economy" in the power sector. Natural gas transmission and distribution, crude oil pipeline transportation, and product pipeline transportation are other energy sector activities in which the purchaser frequently has no competitive alternative, and the concept of a "market economy" is unclear.

To define the market structure of the power sector in Hungary one must address four issues:

- the extent to which the sector will be competitive or monopolistic
- the desired pattern of ownership of the competitive enterprises (if any are anticipated) and the monopolistic enterprises
- the way in which the government-owned enterprises will be managed, and the form of incentives given to efficient operation of government-owned enterprises
- the way in which the privately-owned but monopolistic enterprises will be regulated.

Among OECD countries there are different approaches to the ownership and management of the power sector. In France, citizens must buy their electricity from Electricite de France, which is a state-owned monopoly employing central planners who decide which power plants shall be built, who shall build them, and which prices shall be charged. If you live in France but you would like to buy electricity from a privately-owned company instead of Electricite de France, you will be disappointed.

On the other hand, in the United States most of the electric utility companies are privately owned and most the power stations under construction are privately owned. In many states the majority of these power stations under construction are not owned by the utility companies. In Virginia, for example, the generating stations planned for the 1990s were selected on the basis of a competitive auction rather than central planning. In Virginia the utility company's "independent power" affiliate does not even participate in local competitive auctions to build new power plants. The affiliate company is building power plants in other states and in other countries. This is a much more competitive "market economy" than the centrally planned system found in France. However, the French economy would still have to classified as a market economy.

Instead of a situation which is black and white - market and non-market - we find various shades of grey. The competitiveness of the energy market various from country to country and from state to state (or province to province) within a country. In the United States, for example, different states have different degrees of competitiveness in the power sector. In Texas the power generation sector is dominated by private firms which buy fuel from other private firms in spot and contract markets, while in the state of Washington most of the utilities are government-owned and most of the electricity is generated from government-owned hydroelectric projects.

In the next few years, if not the next few months, Hungarians will have to decide what a "market economy" should mean in the context of Hungary's energy sector. To put the issue in its simplest terms, Hungary has four choices:

1) a state monopoly, which is what MVMT is today

2) a combination of a state monopoly in transmission and distribution and existing generation facilities and a competitive market for the capacity and energy supplied by new generating facilities

3) a combination of a state monopoly and one or more privately-owned monopolies subject to government regulation

4) a combination of a state monopoly, one or more privately-owned monopolies subject to government regulation, and a competitive market for the capacity and energy supplied by new generating facilities.

<u>All</u> of these options include a state monopoly. There is only a very small possibility that MVMT will be able to sell all of its assets to the private sector. For now, total privatization of MVMT may be considered out of the question.

One might ask, Which of these four options is preferred by Europeans? What is the European concept of a "market economy?" We find that there are several different viewpoints. At one extreme the United Kingdom favors the breakup of state monopolies in the generation sector. At the other extreme, the French and Italian governments maintain state monopolies. The Economic Commission for Europe is beginning to challenge the

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power of state monopolies in countries where they are especially powerful, and is supporting "open access" to transmission networks. In Germany, Belgium, Denmark, and Spain there is a mixture of state monopolies and privately-owned monopolies.

The situation is equally complicated in Asian countries. In Hong Kong the utility industry is privately-owned, and generation companies are distinguished from distribution companies. In Japan and South Korea the government owns most, but not all, of the power sector and in Thailand the ownership of the generation sector is partially privatized. In Singapore and Taiwan the power sector is entirely held by state monopolies. There does not appear to be any correlation between successful economic development and the pattern of ownership in the power sector.

The concept of joint ventures with foreign investors

Once the government of Hungary determines the extent to which the sector will be competitive or monopolistic, the government will need to outline the desired pattern of ownership of the competitive enterprises (if any are anticipated) and the monopolistic enterprises. A truly competitive enterprise must be privately owned, but a monopolistic enterprise may be publicly owned, privately owned, or some form of public-private joint venture. It is necessary to identify the ownership pattern that is desired by Hungarians and then evaluate the feasibility of achieving this ownership pattern.

The White Paper prepared by the Minister of Finance contains several statements supporting the general concept of privatization of state-owned enterprise with the use of both foreign and domestic capital. Because the power sector is capital-intensive, privatization would almost certainly require foreign capital . The technical report of the UNDP-IBRD Project on Energy Planning states (at pages 22 and 51) that the preferred method of financing new power stations is a "joint venture with foreign participation" for "the installation of units co-generating electric and thermal energy.". The joint venture concept and the cogeneration proposal both indicate that some sort of private ownership may be possible in Hungary's power sector. A common characteristic of cogeneration projects in western economies is private ownership by the industrial companies which use the steam.

A closer look at public-private joint ventures shows that they are not very promising in connection with MVMT's existing facilities. On its face, the joint venture idea might appear to be a reasonable solution to the Hungarian shortage of capital because in the United States, for example, there are a few generating facilities which are jointly owned by a municipal power company (or non-profit cooperative) and by privately owned electric utility companies. To participate in a joint venture with private firms, however, a government-owned electric utility must be in a very strong financial position. The only reason for public-private joint ventures in the generation sector in the United States is the supposed savings achieved by construction of a small number of large, jointly-owned stations rather than a large number of smaller power stations without joint ownership. Unfortunately, MVMT is not in a very strong financial position, from the viewpoint of a private investor, and all the

utilities in Hungary are part of MVMT. There is no incentive for a foreign firm to acquire a minority interest in any of MVMT's power plants.

In the Soviet oil and gas sector, joint ventures are possible because the Soviets have vast energy resources and reserves, and because oil and gas can be exported for hard currency. In contrast, Hungary does not own vast energy resources and does not have a comparative advantage in energy supply. Hungary is not a major exporter of power.

The motives for seeking joint ventures, as opposed to privately-owned cogeneration facilities or power stations, are therefore unclear. If a private company in Hungary plans to build a cogeneration facility, why would this company want to sell an equity interest to MVMT? If foreigners want to build power plants in Hungary to export power to earn hard currency, is it desirable to ask foreigners to build their coal and nuclear stations in Hungary?

Among the alternatives to public-private joint ventures are private investment in cogeneration and captive generation facilities, private investment in new generation facilities selected through competitive bidding, and privatization of existing transmission and distribution companies. These options have been implemented in the United States and in other market economies.

Regulatory institutions in the power sector

We must return the question of what a "market economy" will look like in the power sector. In principle, one cption is privatization - a transition from state monopolies to privately-owned but regulated monopolies (the third option cited above). This concept may be difficult to implement. We know that hotels and retail shops in Budapest can be privatized. We know that the Ministry of Finance in Czechoslovakia is planning to privatize a large portion of the industrial sector. We have learned from the experience of the United Kingdom (and Chile) that privatization of the electric power sector is possible in some countries. To speak of privatization of the power sector in Hungary is somewhat speculative, however. It may never happen, and it is not a vital political issue.

The most serious economic problems associated with Hungary's socialist economy were not directly related to the absence of private ownership. Rather, they were related to the dominant influence of the Soviet Union, which was able to establish artificial price levels and quotas for international trade among Comecon countries.

Given the decline of Soviet influence, Hungarians are justified in asking whether it is possible to manage state-owned enterprises in an entrepreneurial fashion and thereby achieve the higher levels of efficiency and productivity found in market economies. The Minister of Finance has proposed the creation of "entrepreneurial property embodied through the companies of the State." The translation of this concept into English is awkward, because an "entrepreneur" is one who manages private property. In the power sector, one might ask, can MVMT become just as efficient as American Electric Power or other privately-owned utility companies?

Although it is doubtful that state-owned property will be managed as efficiently as privately-owned property, it is also doubtful that private investors will want to buy all of the assets of MVMT. A reasonable solution therefore would be to try to make MVMT more efficient by introducing western management practices and regulatory practices.

Although privatization of the power sector is not a vital political question, proposals to build new power stations and shut down existing coal mines are politically sensitive. It is quite natural that Parliament may be tempted to take these matters into its own hands, regardless of the level of technical expertise of Parliament members in generation planning.

In the United States the regulatory commissions charged with approving new power plants and establishing the level of electric and gas tariffs provide a "buffer" between the utility companies and the politicians. The regulatory commissions provide a forum in which decisions on technical matters can be made in a democratic fashion, without direct intervention by the legislature. The process of appeal is carried to the courts rather than to the legislature.

The power sector will always have a need for central planning. Due to the technical characteristics of the power sector, a competitive market will never develop in transmission and distribution and would be difficult to develop fully in Hungary in the generation sector. Therefore, the power sector requires central planning - within a broader "market economy." In the power sector, central planning must respect democratic principles as well as technical accuracy. The utility companies may be regulated by democratic institutions.

Therefore, it may be worth considering the idea of restructuring the power sector into one or more utility companies so that each company is managed and operated the way a privately-owned electric utility company would be managed and operated. Because electric utilities in the United States have been subject to price regulation for 84 years, the experience of the United States is particularly relevant to any discussion of the principles of utility regulation.

Utility regulation in the United States

An "electric utility" in the United States is either a private company subject to price controls and other forms of government control, or a government-owned company. Most electric utilities are involved in generation, transmission, and distribution, but some are involved in generation only or in distribution only. Most of the larger utilities are privately owned. Large hydroelectric facilities are typically government-owned. The stocks of the privately-owned utility companies (or their parent companies) are traded on the New York Stock Exchange. Electric utilities are sometimes called "public utilities" because they are obligated to provide electricity to the public, but this phrase is somewhat misleading because public utilities are usually privately owned.

An industrial company has the right to generate electricity for its own use, but does not have the right to distribute electricity to other companies or customers. The same general rules apply to hospitals, universities, apartment complexes, and large office complexes. Any

entity that owns a generating facility but is not an electric utility company is a "non-utility generator" (NUG).

The power sector in the United States is now experiencing a major structural change: new, non-utility generating stations are being built to supplement the capacity available from utility-owned generating stations. The profits of the non-utility generating companies are not regulated by price controls; they are regulated by the market, because proposals to build new generation or cogeneration facilities are evaluated on a competitive basis. Thus we have a utility industry in transmission and distribution, and a mixture of utility and non-utility facilities in the generation sector.

MVMT is a government-owned electric utility. Because it is so large, and because hydroelectric generation represents a small fraction of total generation, we would compare MVMT with a large privately-owned electric utility located in a coal-mining region. We would not compare it with a municipal electric utility or a government-owned hydroelectric authority.

In each state, privately-owned utility companies are regulated by a government agency called a "public service commission" or "public utility commission." These commissions typically regulate a variety of monopolistic industries, including natural gas distribution, local telephone service, and water distribution. Over two-thirds of the states created regulatory commissions between 1907 and 1920, and today there is a regulatory commission in every state. The New York Public Service Commission and Wisconsin Public Service Commission were created in 1907.

When the sale of electricity involves transmission of electricity from one state to another, the Federal Energy Regulatory Commission establishes price controls over the interstate sales. It was created in 1977 through a reorganization of the Federal Power Commission, which was created in 1920.

Because electric utility regulation in the United States is 84 years old, and because railroad regulation is 120 years old, there are many books and reports on utility regulation and there is an enormous number of regulatory decisions on record in the various state commissions. I have provided both MVMT and the Ministry of Industry and Trade with copies of the leading U.S. textbooks on utility regulation. Below, I will provide only a simple summary of the U.S. approach to regulation of electric utilities.

There are six basic concepts in electric utility regulation:

1) Protection of the utility from competition; guarantee of exclusive rights to transmit and distribute electricity in a specific geographic area

2) Protection of the utility's right to dispatch its generating units from hour to hour on the basis of short-run marginal cost

3) Provisions for automatic pass-through, in electric rates charged to consumers, of increases and decreases in the cost of fuel and the cost of imported electricity

4) Establishment of price controls that have the effect of constraining the rate of return on equity to be close to a "target" value selected by the regulatory commission

5) Requirement for "least cost planning," a procedure for planning new generation, transmission, and distribution facilities so that the cost of electricity is minimized over a time frame of 20 years or more, while the reliability and quality of service is maintained at a certain quality standard

6) Provisions for competitive bidding among non-utility companies for the right to build and operate generation or cogeneration facilities that sell power to electric utilities under the terms of long-term contracts.

In the generation sector, exclusive rights are not always granted, because they tend to protect inefficient producers.

The first concept (exclusive rights) is already implemented in Hungary, but it may be modified through restructuring of MVMT. The second concept (economic dispatch) and third concept (the fuel adjustment clause) could be implemented fairly quickly in Hungary, if political support for these concepts exists. Implementation of the fourth, fifth, and sixth concepts (rate of return regulation, least-cost planning, and competitive bidding) would require a substantial amount of work in the development of regulatory institutions and the transfer of expertise from foreign electric utility companies and regulatory agencies to MVMT and to the government officials who would be responsible for regulating MVMT and managing the power sector. Moreover, the amount of political support for economic dispatch and fuel adjustment clauses may depend upon how soon rate of return regulation, least-cost planning, and competitive bidding can be implemented.

Although a lengthy discussion would be required to explain the technical details of these facets of utility regulation, it is possible to briefly summarize the reasons why these concepts have been introduced.

1. Exclusive rights are granted for two reasons. First, unnecessary duplication of transmission and distribution facilities is avoided. Second, the cost of capital (i.e., the minimum overall rate of return needed to attract enough capital to meet the utility company's capital requirements) is reduced because the risk to the investor is reduced. A lower cost of capital will enable the utility to charge lower rates to its customers.

2. Economic dispatch is used to minimize the sum of fuel and operating costs required to meet a given level of load. Economic dispatch requires that fuel purchases are made on the basis of spot prices rather than plans made at the start of a year. It is impossible to guarantee that a "target" level of coal purchases will

be achieved, for example, because coal displaces oil and the level of oil prices is unpredictable. Because economic dispatch exposes fuel suppliers to greater business risk, it may raise the cost of any individual fuel by raising the supplier's cost of capital. At the same time, it should promote competition among fuels and among generating companies, and thereby lower the electric utility's total annual cost of fuel and purchased power. Because any privately-owned firm will want to minimize its costs, privately-owned utilities always want to be permitted to have economic dispatch.

3. Fuel adjustment clauses are used to ensure that the price of electricity rises and falls with the market prices of coal, oil, natural gas, and electricity imports. Fuel cost is the component of electricity prices that is most "market-oriented." The fuel adjustment clause sends price signals to the electricity customer when there is a shortage or surplus of the fuels used to generate electricity.

4. Rate of return regulation is used to ensure that a monopolistic, privately-owned electric company does not make excessive profits by raising prices to its customers. Rate of return regulation is used to ensure that electric rates are at the level needed to achieve self-financing, but no higher.

5. Least cost planning is used to ensure that a monopolistic, privately-owned electric company does not waste money on unnecessarily large and expensive construction projects. Least-cost planning is used to identify the lowest level of cost per kilowatthour needed to balance supply and demand and also maintain an adequate level of reliability. In some situations it may be cheaper for the customer to lower his peak demand than for the utility to increase its peak supply capability. Least cost planning therefore includes an examination of load management alternatives.

6. Competitive bidding is used in the generation sector to give producers an incentive to be as efficient as possible. Competitive bidding creates a competitive marketplace in the generation sector, so that wholesale electricity prices become market prices rather than centrally planned prices.

To determine electric tariff levels it is necessary to establish the rate of return on capital investment that should be used to compute the capital cost component of each tariff. Different rates of return are associated with different sources of capital. Therefore, it is necessary to identify the utility's future capital requirements and sources of capital.

Sources of construction funds in a market economy

In a market economy, power sector assets can be held by three types of entities:

- publicly-owned electric utilities

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- privately-owned electric utilities
- non-utility generating companies.

In the United States all of these entities are "self-financing" because they all recover their capital and operating costs through the rates charged to their customers.

In a market economy, a publicly-owned electric utility has two major sources of construction funds: borrowings and depreciation. Depreciation is used to cover principal payments on debt. For the purpose of computing depreciation, the capital cost of the plant includes direct expenditures on construction plus interest on the funds borrowed during the construction period. If a political decision is made to provide additional funds for construction by raising electric rates, the utility will have a third source of capital: retained earnings. However, it is a bit unusual for governments to raise electric rates in order to avoid borrowing money. In general, governments prefer to raise capital by borrowing money.

In a market economy, a privately-owned electric utility has four major sources of construction funds: borrowings, issuance of new shares of stock, depreciation, and retained earnings. Because the equity investor is exposed to more risk than the lender, a utility company's rate of return on equity is always higher than the rate of return on debt. Equity financing is more expensive than debt financing, but if the utility tries to obtain all of its capital through debt financing the potential lenders will either insist on a very high interest rate (a "junk bond" rate) or refuse to provide debt capital. Therefore a privately-owned utility will not be able to lower its cost of capital simply by issuing a lot of debt.

Because a government-owned utility can raise rates or even use tax revenues to cover its debt service, its debt is less risky for the investor and therefore the utility is likely to have a lower cost of capital (excluding income tax) than a privately-owned utility. In most cases there is an explicit or implicit assurance that the government which owns the utility will guarantee repayment of the utility's debt. This type of government guarantee has the effect of lowering the utility's borrowing cost. The cost advantage of government-owned utilities is even greater when income taxes are taken into account. In most cases, a government-owned utility pays no income tax and therefore is virtually certain to have a lower total cost of capital, which enables it to provide lower electric rates. Because a government-owned utility is not likely to be any more efficient than a privately-owned utility, however, these cost advantages simply represent savings for the electricity customer and not savings for the overall economy. In other words, government ownership of electric utilities typically results in lower electric rates but higher income taxes or higher taxes on commodities other than electricity.

Non-utility generation provides another form of financing for new generating capacity. A new and entrepreneurial non-utility generating company has only two sources of construction funds: borrowings (debt financing) and issuance of new shares of stock (equity financing). Like a privately-owned utility, an older and well-established non-utility generating company has two sources of construction funds: borrowings, issuance of new shares of stock,

depreciation, and retained earnings. There is no reason to believe that a non-utility generator will have a lower cost of capital than a privately-owned utility.

The reason why competitive bidding for new power plant capacity is common in the United States is that many people believe that it is better to have prices determined by a competitive market than by a system of price controls, even when the power generation sector is involved. While few people would dispute the relative merits of competitive markets in consumer goods such as food and clothing, there is still some debate over the merits of competitive markets in power generation.

The principal problem with the creation of a market for power generation is that it is difficult to separate generation from transmission and distribution. Electricity cannot be stored and therefore it is not a true commodity, like wheat or gasoline. Because gasoline can be stored, the value of a gallon of gasoline at 8 o'clock in the morning is the same at 1 o'clock in the afternoon, and buyers and sellers can establish a daily market price in spot markets such as Rotterdam. Because the value of electricity varies from hour to hour, it is much more difficult to establish a spot market or a market price for the producer. Therefore, competitive bidding in the generation sector is limited to bidding for the right to obtain a long-term contract under specified terms and conditions.

Non-utility generation is not expected to yield cost savings as a result of lower-cost sources of capital. On the contrary, non-utility generation may involve higher-cost sources of capital. The proponents of non-utility generation would argue that the higher rate of return on total capital is more than offset by lower construction costs and lower operating costs, as a result of the discipline of a competitive marketplace.

Sources of construction funds for the power sector in Hungary

MVMT's sources of construction funds in the 1990s will be different from MVMT's sources of construction funds in the 1980s. MVMT may also face a shortage of construction funds during this transition to a market economy.

In the early 1980s MVMT had three main sources of construction funds:

- Borrowings
- Customer contributions
- Depreciation, of which only about one-third was applied to capital expenditures.

Borrowings and customer contributions provided 90 percent of the construction funds used in the 1981-1984 period. Because depreciation was used to pay a portion of MVMT's interest expense, as well as principal payments on long term debt, depreciation was not a major source of construction funds. Because pre-tax income (after interest expense) was less than the sum of taxes and transfers to the state, MVMT's after-tax income was negative. In effect

the State collected tax revenue from MVMT and then refunded a portion of this tax revenue by providing "customer contributions" to the capital expenditure program.

Because MVMT was publicly owned it did not raise capital through issuance of new shares of stock. Because MVMT's assets were not valued at market prices, it is difficult to say whether MVMT would have shown a positive pre-tax income during the 1980s if western accounting standards had been used. In other words, it is difficult to say whether MVMT would have been able to raise construction funds from retained earnings, under any sort of tax policy.

To raise construction funds today, MVMT faces several challenges and obstacles:

- New borrowings may be constrained because MVMT and the government of Hungary are already heavily indebted.

- "Customer contributions" are simply not available in a market economy.

- Tariffs may not be high enough to fully fund depreciation, consistent with generally accepted accounting principles.

- Under generally accepted accounting principles, depreciation is computed on the basis of historical cost rather than replacement cost. Depreciation will not be sufficient to cover replacement cost unless there is no construction cost escalation (e.g., no inflation in the economy).

- All over the world there are publicly-owned electric utilities facing similar problems and seeking World Bank financing. According to a report published by the World Bank in 1990, by the end of this decade the Bank will not have enough capital to meet the worldwide "need" in the power sector.

If MVMT's capital requirements are modest, these challenges may not pose serious problems. There are four factors that could lead to substantial capital requirements, however:

- Equipment breakdowns and structural failures in the oldest portion of the generation, transmission, and distribution infrastructure

- Substantial investment in environmental protection (e.g., scrubbers to remove sulfur dioxide from stack gas emissions)

- Rapid growth of peak load and annual energy requirements

- Fuel price changes large enough to justify a major change in the fuel mix (e.g., replacement of coal-fired stations by combined cycle turbines).

Any one of these factors could lead to a capital shortage. If MVMT faces a shortage of capital, there are four obvious policy alternatives:

1) Encourage industrial customers and large commercial customers to build their own generation or cogeneration facilities and sell their excess power to MVMT. Raise electric tariffs, if necessary, to pay market-clearing prices for power purchased from cogenerators and thereby make industrial customers allocate their scarce capital resources to investments in power generation. (This policy would exacerbate the capital shortage in the export sectors of the economy.)

2) Permit foreign investors to build and operate new generation or cogeneration stations in Hungary for the purpose of selling power to MVMT (and, if necessary, selling or transferring power to foreign utility companies). Establish rates necessary to attract foreign capital. In principle this objective could be achieved by awarding long-term contracts to independent power project developers, or by selling portions of MVMT's distribution system to private investors and allowing these investors to raise the electricity tariffs paid by consumers.

3) Negotiate long-term contracts to import power (both capacity and energy) from one or more European countries. This policy alternative could be implemented by negotiating with government-owned utilities, privately-owned electric utilities, or independent power project developers.

4) Do not build any new power plants or sign any new power purchase contracts. Raise peak electric rates until the need for new generating capacity is eliminated. (This policy would probably be inflationary and cause hardships.)

Although there are obvious disadvantages to each of the four policy alternatives listed above, a serious shortage of capital would force Hungary to choose the least damaging alternative or combination of alternatives. Until these issues are addressed it will not be possible to calculate the true long-run marginal cost (LRMC) of electric power in Hungary and it will not be possible to determine whether the country will have an adequate supply of electricity in the future.

For political reasons, the governments of some developing countries have refused to raise electric tariffs to the level needed to meet demand growth and maintain a high level of reliability, despite a shortage of capital. These countries have been forced to either develop a centrally-planned rationing system to curtail peak demand or impose scheduled, rotating blackouts during peak periods. These are not market-based solutions to a capital shortage and are not consistent with the theoretical basis for a market economy. The introduction of these non-market approaches in Hungary appears to be very unlikely.

Given the unfortunate circumstances surrounding the import agreements with the Soviet Union, it is particularly important to examine the third alternative objectively. As suppliers

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of electric power the western European countries should be more reliable than the Soviet Union, because they do not face the energy shortages and economic crises confronting the Soviet Union. Because Hungary is a relatively small country with limited capital resources, it may not be necessary for Hungary to achieve the level of self-sufficiency in power generation that has been achieved by larger European countries such as France and Germany. The government of Hungary will need to determine whether the expected benefits of self-sufficiency are worth the economic cost.

Under a favorable scenario, of course, Hungary's power sector will not face a capital shortage and it will not be necessary to make the difficult political choices among the four policy options listed above. These policy options need to be reviewed, however, so that the government of Hungary can develop a clear statement of its long-term policy objectives and provide potential investors with a statement of the government's policy toward foreign private investment in the power sector.

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ENERGY EFFICIENCY AND ENERGY PRICING IN MARKET AND NONMARKET COUNTRIES

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Energy Efficiency and Energy Pricing in Market and Nonmarket Countries: Summary and Findings

Summary

As countries make the transition from central planning to market systems, the energy sector assumes a key role in promoting or retarding that transition. Energy that is purchased with convertible currency must be used effectively. In a market economy only those firms that gain as much value from energy resources as they must give up to purchase them can continue to operate. At the same time, concerns about energy and the impacts of its transformation and use on the environment proliferate.

As economic activities in Hungary move toward a market system, the costs of energy use in environmental and economic terms will fall on individuals and firms. If more energy is used to produce the economy's output than is the case in a nation's competitors, then other efficiencies or features must be added to compensate. No such offset exists with the environment. Excessive energy use will be reflected directly in environmental degradation. low productivity will manifest itself in the inability to pay to ameliorate the impacts of energy use and transformation on the environment.

This paper addresses three questions about the relationship between energy efficiency and energy pricing in Hungary and in other economies in transition. These are:

1 - What drives the energy pricing systems in a particular country?

2 - What is the current energy pricing system? This means investigating the *level* of prices - the absolute values relative to world prices of energy; and the *structure* of energy prices - the relationships among the prices of various energy products; and

3 - What are the impacts of that system on the allocation and use of energy?

The analysis of energy pricing is presented along with a general discussion of the context in which economic policy is made. It is crucial to place energy use within the relevant economic and policy contexts. This context includes a number of other fiscal policy and social concerns such as:

- The major fiscal and external balance implications of expenditures on energy products and energy infrastructure;
- The strategic role of the energy sector in the national economy and in the development process - i.e., the high levels of investment in energy use and technology relative to other sectors and the importance of energy as a leading sector for technology transfer;
- A concern that energy be made available to all social and economic groups; and
- The pervasive environmental impacts of energy use on land use, forestry activities (from hydro development and from the use of wood for energy), and air and water quality.

The present summary discussion sets the stage for case studies of specific energy pricing policies. In addition, there is a companion paper which contains

a brief guide to price decontrol along with descriptions of both technical and social allocation criteria that are sometimes used to make energy pricing decisions.

Country Case Studies

Two developing countries, Thailand and Indonesia, along with the US and Canada, are used in the case studies.[1] Both the U.S. and Canada have extensive private energy sectors. Virtually all of the oil and gas production in the two countries is undertaken by private firms while most of the electricity is generated by private, regulated companies. Both the U.S. and Canada flirted with price and allocation controls for energy in the 1960s, 1979s, and 1980s. The results of these price controls varied a great deal due to the complex nature of the controls.

In North America, the US has experimented with a variety of price and allocation systems since the early 1950s. Within the context of a market economy, the Federal and state governments have attempted to direct the outcomes of the market in oil, gas, and electricity. By the early part of this decade, many of these price and allocation controls had been scrapped and the energy supply system was forced into a series of wrenching adjustments. By almost all accounts, these adjustments were positive for both the US and world economies.[2]

The major price control programs in the U.S. over the past 25 years have included the following at one time or another:

- Crude oil cost equalization for refiner with differing mixes of domestic and imported crude along with different mixes of equity (self-produced) and purchased crude;[3]
- Regulation of interstate prices of natural gas and refined oil products; and
- Regulation of prices and investments in electric power generation.

In addition, extensive pollution control legislation has had a strong impact on the development of the coal industry and now governs most of the investment in oil refining and marketing. In coal, mandated reductions in sulphur emissions combined with reductions in nitrogen oxides have disadvantaged coal relative to the more efficient gas-fired combined cycle plants and have led to increased

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1 The case of Canada is presented separately.

2 For example, the decontrol of crude oil and refined product prices in the US stimulated both conservation and production in the US, halting the growth of imported crudes, and forcing OPEC to lower its asking prices for crude oil and refined products.

3 In the 1970s the Federal government in the U.S. attempted to equalize the effects of different crude oil costs to U.S. refiners through a program of crude oil entitlements. The program worked by toting up the average crude oil price paid by refiners in any one month. Those below the average would receive a bill for the difference while those above the average would receive a check. It all sounded eminently fair. But the results were disastrous. Small, inefficient refiners were encouraged to proliferate without regard to their inabilities to produce the new higher-grade gasolines and other fuels from an ever-poorer slate of crude oil. No one had an incentive to bargain hard for reductions in crude oil prices and the resultant beneficiaries resided largely in the OPEC nations.

investments in emission control technologies. In the motor fuel market, requirements for producing lead-free gasoline and more recently, to reformulate gasoline and diesel fuel to reduce other pollutants, will give rise to several billion dollars in refinery investments over the next ten years. These investments are feasible only if the costs can be recovered, that is, the pricing system allows firms to compete for the most efficient way to clean up fuels.[4]

The case study shows that while the U.S. has often attempted to make use of price controls, these attempts have led to costs for the economy which usually have at least partially vitiated their usefulness. Hence the trend in the U.S. has been toward an ever-greater role of the market.

The main reason that the impacts of the various regulation programs have become so evident so quickly is that firms in the U.S. must go to capital markets for investment funds. If price regulation reduces the expected profitability of an investment, then the capital market will be less forthcoming with funds. In other words, the consequences of bad price regulation are apparent immediately. The ultimate result of such insufficient investment is a restriction in supply. Such reductions have increasingly plagued regulated electric and gas utilities and have forced them to obtain supplies from outsiders.[5]

A second consequence of improper pricing policies is short term withholding of supplies. In the U.S. producers of gas and oil cannot be forced, except in wartime, to make supplies available to customers. Consequently, pricing regulation in natural gas that has held prices below their market-clearing levels has resulted in occasional supply shortages, especially in the cold winter of 1976-77. Withholding of supplies may or may not have anything to do with actual physical shortages but mean simply that the amount of gas desired at a particular place and time was not supplied by the gas company.

Since oil and gas prices were largely decontrolled in the U.S. in the early 1980s, there have been few or no instances of even localized supply shortages.

The two developing countries studied in this report represent many of the trends that have dominated energy pricing and policy in the world since the 1970s. These trends and characteristics include:

- Government control or regulation of most or all energy prices;
- Prevalence of state-owned monopolies in the energy sector with the concomitant that

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4 The most recent set of environmental interventions in the US fuel market concerns the reduction in volatile organic compounds, the precursors of smog, through reductions in the volatility of motor fuels and by reducing or eliminating the components that can be formed into smog, usually known as aromatic and olefinic compounds.

5 In the electric power industry, supplies from independent power producers (IPPs) now constitute a large fraction of all additions to power generation in the U.S. The smaller IPPs apparetnly find coping with existing regulations easier than do the large utility companies.

investment in energy production and distribution became a government matter;

- The absence of capital markets large and robust enough to finance the typically large energy investments - power plants, refineries, transmission systems;

- Maintenance of "social" tariffs for selected energy forms - e.g., lifeline tariffs for electricity and kerosine while gasoline prices are maintained at a high level;

- Subsidies to certain oil products - e.g., diesel and kerosine;

- Disconnection of the quantity of energy supplied from its price and often from the fiscal impacts of energy use; and

- Major (upward) shifts in pricing policies in the late 1980s.

The study shows that while the two countries started with essentially similar energy pricing policies in the early 1970s, by 1985 there was significant divergence. The changes in pricing policies appeared to have more to do with a country's macroeconomic prospects than whether it was a major energy producer.

For example, by 1986 Thailand had moved toward a rule-based pricing system in which the base prices were adjusted periodically according to the Singapore refined product market. During this time the Thai economy overall was going through a significant deregulation and debureaucratization. Part of this change in the economic climate has resulted in energy supply being explicitly linked to the prices paid for crude oil, gas, electricity and refined products. The rapid expansion of the Thai economy has occurred while the government has moved toward greater reliance on private pricing and allocation decisions.

In Indonesia, falling receipts from the export of raw materials led to steep increases in energy prices. Indonesia has maintained a system of subsidies for electricity and kerosine. Moreover, low tariffs, along with low efficiency, have stunted investment in the country's power infrastructure and gas distribution network.

Major Differences Between Various Energy Pricing Systems

The varied paths taken by the four economies since 1980 has contributed to some emerging differences between the pricing systems used in each of the countries. These differences include the following major elements:

- Energy price level vary greatly across the three countries (See Figure 1);

- Thailand explicitly links its refined product and gas prices to the Singapore market. Prices paid to natural gas producers are also linked to the value of that gas as a fuel;[6]

- Administered differentials between gasoline and middle distillates, diesel and kerosine, have narrowed in both Thailand and Indonesia;

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[6] This is the so-called netback value pricing approach which explicitly links the price of energy to the price of the products made from that energy, in this case electricity. Netback values should be equal to shadow prices in equilibrium.

- Electricity prices in Thailand and Indonesia have been adjusted to better reflect the cost of generation. This adjustment is part of overall programs, not yet fully implemented, to make the utilities capable of operating as independent, perhaps private, entities;

- In the US, refined product and crude oil prices are set entirely by the market, taxes on crude and products are low so that changes in relative product prices or in the price of crude oil are reflected almost immediately in the price of the refined product;

- As a concomitant of the previous point, prices for energy in the U.S. mirror the Rotterdam market closely, except for coal which the U.S. has in great abundance;

- Electricity prices in the US are set increasingly with respect to the *avoided cost* of new generation by a utility, in other words, by market prices for fuel and generating equipment;

Findings

Impacts of Energy Pricing Policies

The success or failure of an energy pricing policy is seen in the greater economy as well as in the energy sector itself. Successful energy pricing policies have several characteristic outcomes. These include:

1 - Absence of shortages or rationing;
2 - Linking supplier incentives to retail prices;
3 - Flexibility and frequent adjustments;
4 - A level and structure of prices that relates the prices that consumers pay to the cost of supplying the energy and to international prices for those products and their substitutes; and
5 - A level and structure of prices that permits the nation to compete successfully in primary and manufactured goods.

In the two developing countries included in this study, the following petroleum sector impacts were typical of energy pricing policies in the 1970s:

1 - Low prices for diesel and kerosine leading to shortages and subsequent purchases of both diesel and jet fuel on world markets, exacerbating the financial impacts of high oil prices;[7]
2 - Very low kerosine prices giving vehicle owners an incentive to adulterate other fuels, especially diesel, with low priced kerosine;
3 - High gasoline and fuel oil prices leading to export of surplus products at distressed prices due to the commonality of pricing policies designed to reduce the consumption of these two products;
4 - Overinvestment in refinery technology to produce middle distillates (i.e., hydrocrackers) relative to the ability to pay for those investments; and
5 - Overinvestment in coal production and use due to artificially high costs of fuel oil.[8]

In many countries, the electricity sector subsidizes some classes of consumers. Such programs originated in the government's legitimate desire to make electricity consumption affordable by the masses. Unfortunately these pricing policies had two major impacts. First, the energy supply company lacked sufficient income to provide adequate or reliable supply. Second, demand for electricity outstripped

[7] Kerosine, the oil product most frequently subsidized, can also be finished into jet fuel, a high netback value product.

[8] For many developing country utilities, the mid and late 1980's could have represented an opportunity to use low cost heavy fuel oil in power stations. However, the headlong rush into coal made this impractical.

the capability of the supply and distribution system. Only in Thailand, where the overall level of electricity prices has remained high, has power generation consistently matched demand. In Indonesia, the result of these policies has been pervasive shortages, poor service, and persistent losses by the state electricity monopoly.[9] Thailand has shown significantly better results, in large measure due to the insistence by the power company management that the entity function as if it were a commercial enterprise with a requirement to return dividends to the

Figure 1: Crude Oil and Refined Product Prices

$US 1990

		Country			
		United States	Thailand	Indonesia	Rotterdam Spot Market
Fuel Type	unit				
Crude Oil	k liters	$116.35	113.21	$103.77	$110.06
Natural Gas	k cu m	$61.80	$88.29	$89.35	NA
Coal (hard)	tonne	$45.00	$38.00	$49.00	$60.00
Refined Products					
Gasoline	liter	$0.26	$0.34	$0.31	$0.19
Jet/Kerosine	liter	$0.23	$0.25	$0.10	$0.24
Automotive Diesel	liter	$0.22	$0.25	$0.13	$0.23
Industrial Diesel	liter	$0.20	$0.12	$0.12	$0.21
Heavy Fuel Oil	tonne	$144.00	$132.93	$127.84	$138.00

Note: these prices are wholesale level prices, exclusive of dealer markups but including most taxes. The Rotterdam spot market prices do not include taxes. Prices for the US and Rotterdam reflect end-1990 prices. Kerosine prices in Indonesia are for household fuel. International Jet kerosine prices in Indonesia are about the same as Rotterdam levels.

[9] A high price level coupled with relatively efficient generation and transmission has enabled the Thai government to repay its power sector loans. However, in Thailand, as in most other developing countries, the national power company and national oil company cannot go to domestic financial markets to raise funds for investment. Such decisions are under the purview of the government as a whole.

Figure 2: Energy Taxes and Other Price Modifications in the Countries Studied

Most nations put a variety of taxes on energy products. For political reasons, it is almost always easier to tax gasoline than it is to tax any other product. In addition, products that are highly tradeable, for example, jet fuel, are hardly taxed at all lest airlines simply purchase fuel in some other stopover.

Gasoline: This product, the most highly taxed product that cannot be drunk or smoked, usually has three types of taxes added to its price:

1 - an excise tax, usually of a fixed amount per unit sold, is used to finance roads and other infrastructure used by autos;

2 - an *ad valorem tax*, of some percentage of wholesale price, goes to general revenues; and

3 - A fuel fund tax to provide working capital that can reduce the impact of crude oil price changes.

In addition to the three types of taxes, some fuels are often **subsidized**. In particular, diesel and kerosine are often chosen for subsidies due to supposed importance of such fuels to farmers or rural households. Studies of the effectiveness of kerosine subsidies for rural households has shown that these programs are an expensive way to help the target population, often spending more than 80% of the subsidy funds on non-target populations (i.e., the wealthy kerosine users or vehicle owners substituting kerosine for the more expensive gasoline or diesel). Finally, middle-distillate subsidies lead to excessive demand often necessitating either rationing or the construction of expensive middle distillate conversion units at refineries.

In the U.S. excise taxes are added to the prices of gasoline and diesel. Electric power and natural gas are taxed to final consumers with a sales tax (% of price). Most other fuels are taxed only lightly at the point of sale with general business taxes.

Thailand and Indonesia both tax gasoline fairly heavily. In Thailand, other petroleum product prices are about the same as the relative world market levels. However, there is a fuel buffer fund to smooth out sudden run-ups in crude oil prices, as happened during the Gulf War.

Indonesia is the only country in our sample with explicit fuel subsidies left. Both of the middle distillate products are subsidized, causing both excessive demand and budgetary stress for the government.

shareholders, in this case the Government of Thailand.

In the United States, regulation stipulating that utilities must purchase electricity that is provided by private firms at or below the utility's avoided cost[10] has become a significant feature of the energy

[10] The avoided cost is simply the cost that a utility does not incur by virtue of purchasing supplies from outside sources. In broad terms the avoided cost is comprised of two sources. The avoided capital cost is the cost that the utility would otherwise incur to make sure that sufficient power (MW) were available at peak demand periods to cover both demand and reserve requirements

supply landscape during the past ten years. By making energy supply prices transparent, such an open supply price system provides a good defense against supplies insufficiencies.

Where prices are controlled at levels below the avoided or opportunity costs, Energy suppliers must rely almost entirely on some form of concessional financing. The inability of domestic energy prices to provide enough funds for the capital and operating costs for the generation of electricity has led many countries to rely almost completely on the World Bank and other donor organizations for the funding of power generation investments. Even with such funding, generation capacity has fallen short in a number of countries. This reliance on external borrowing has led to increasing indebtedness and in Indonesia, and in such major World Bank clients as India, while the lack of reliable capacity has led to the proliferation of self-generation among large industrial energy users. Where donor funding has not been forthcoming, supply has not risen.

In such controlled market economies as Indonesia, power shortages are chronic and severe.[11] The government has had to resort to physical rationing, load shedding and voltage reductions, to control the excess demand. These are perverse outcomes that penalize the very people that low energy prices are designed to help. This occurs in two ways. First, the poor cannot afford the backup generators or fuels as can the wealthy. Second, and more generally, shortages crimp the economy, reducing the additional income and employment potentials for the poor.

Far from being the solution it might appear, such self generation reflects the distortions of the existing energy pricing regimes. In particular, price discrimination against fuel oil in favor of middle distillates has meant that most of the autogenerators use the relative scarce and costly diesel rather than fuel oil. Second, the efficiency of generation from such plants tends to be low, raising the overall cost of producing goods.

In the United States, a long experiment with energy price controls, especially on oil and oil products, ended in the 1980s. It is fair to say that the results have thus far been satisfactory. There are no chronic shortages of energy in the economy and efficient energy supply schemes, including gas-fired combined cycle, make up an increasing proportion of total supply.[12] One country that has moved to-

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while the avoided energy cost is the variable cost, including fuel of providing the requisite kWh. Avoided capacity costs are higher during peak demand periods than during base periods since the equipment is used less frequently while avoided energy costs will also tend to be higher during peak demand periods since less efficient generation units, gas turbines and diesels, predominate the peak period supply.

11 In a fully controlled economy such as the one found in India, the indignity of supply shortages is compounded by the difficulty that firms and individuals have in coping with the shortages absent the ability to invest and to adapt to the given conditions, the *sine qua non* of economic activity in a market setting.

12 By way of contrast, in 1977, at the height of price controls on natural gas, there were shortages in some states during the winter

ward less price control, Thailand, has shown that energy price decontrol can work if it is a part of an overall program of structural adjustment. By freeing up other parts of the economy, the major pitfalls of energy price decontrol - e.g., hoarding and price gouging - can be avoided.

It is the finding of this analysis that intelligent and well functioning energy prices can be one of the cornerstones of an efficient economy. This is not to say that energy price policies are sufficient to bring about overall increases in economic efficiency. Rather, it is to show that energy pricing policies can be a powerful force for the better in an economy as a part of overall economic policy-making. In particular, energy prices can be adjusted to reflect such social and political concerns as environment, balance of payments, domestic technology development and transfer. While energy prices have little worth as magic bullets to cure a country's economic ills, it is also apparent, that detailed price and quantity controls can have disastrous consequences both for the energy sector and for the economy as a whole. That is, the risks of bad energy pricing policies are large while the benefits of good policies are only visible in the context of overall economic policy improvement.

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while in the non-regulated *intrastate* markets of producing states, gas supplies were plentiful.

REFORMING ENERGY PRICES: A BRIEF GUIDE

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Reforming Energy Prices: A Brief Guide

One of the key problems facing a country contemplating price reform is the seeming complexity of the task. In large measure price reform is complicated because of two main factors. These are:

1. High perceived political costs since there must be losers as well as winners; and
2. Additional complications for regulatory bodies not now required to examine and adjust prices periodically.[1]

The particular pattern of energy prices in Hungary has produced disparate impacts on different groups of the population. There have been winners and there have been losers from the price structures for energy that have been in effect over the past 40 years. The winners, those groups benefiting from the current pricing structure, include heavy industry, urban households, and urban commercial users (hotels & shops). On the other hand rural and agricultural groups, motorists, small manufacturers have been the losers in the current energy pricing scheme. Over time, pricing reform that is based on international

How Low Energy Prices Harm Their Intended Beneficiaries

It would seem paradoxical that low energy prices will hurt the interests of the poor. However, where prices are below the costs of production and where supply is rationed administratively *and* where demand cannot respond to changes in the relative prices and availabilities of various fuels, those groups that are not well represented in the allocation process will lose out.

Thus energy is certainly inexpensive for the rural dwellers. But if they have insufficient supplies and the wrong mix of products at that, then the low prices scarcely benefit them. Evidence from other countries has shown time and again that higher prices along with adequate and flexible supplies are generally preferred to low cost but insufficient supplies.

For example, low prices to the agricultural sector may result not only in reduced supplies to that sector and to the economy in general but may also retard the incentives for investment in better and more efficient machinery, safer pesticides, and more efficient processing. And, of course, agricultural output is exquisitely sensitive to timing. Typically, users are willing to pay a premium to obtain energy supplies at the right time, rather than watch a harvest go to waste.

[1] Note that this second factor disappears if the country decides to move to full market pricing.

pricing levels and structures will change some of the relative prices for energy in the country. Some of these changes are predictable. They include:

- Rising coal prices for domestic users and rising costs of using coal as environmental standards are enforced;
- Increased prices for middle distillates, diesel, kerosine and jet fuel, as the excess demand occasioned by years of low prices necessitates higher investment in the refining of such products;
- Rising costs in the refining sector to meet international specifications for gasoline and diesel fuel;
- Demand (capacity) charges for large gas and electricity users; and
- Taxes on refined oil products to provide revenue for the government and also to provide funds for road repairs, airport construction, etc.

Principles of Energy Price Reform and Decontrol

Observing the several principles for pricing listed below can assist a country in reforming its energy pricing system. These principals follow straightforwardly from standard economic policy strictures. They are:

- Some way must be found to compensate the losers - generally the urban poor and heavy industry;
- The efficiency gains from better resource allocation must be identified, where possible, and some of those gains should be distributed to those bearing the costs of such reallocations;
- Reliance on international market prices is simpler than trying to invent complicated cost-plus formulae to price domestic energy resources;
- Pricing adjustments should be frequent and common, not requiring acts of Parliament or the cabinet;
- Quantities of energy demanded must be permitted to vary in response to changes in price;
- Supplies of energy should be linked explicitly with domestic energy prices - that is, energy producers should receive prices that are related and proportional to what consumers pay for that form of energy;[2] and
- All resources required to produce a final product need to be priced efficiently as well.

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[2] To take one of the most common examples, high gasoline prices in most countries have little or nothing to do with ex-refinery prices for gasoline. Hence, when there is a requirement to make massive new investments in gasoline supply to meet environmental restrictions on various components of that fuel, these investments will necessarily take away from other projects. The revenues from gasoline sales, *per se*, do not cover the costs of such investments. Hence the investments may not be made in a timely or appropriate manner.

Efficient Regulation of Energy Prices: An Important Step Toward A Free Market

Few countries are willing to go the route of full deregulation of energy prices. In Hungary, the government has indicated that substantial energy assets, electric power, gas transmission and distribution, coal mining, and some oil refining will remain in state hands. Hence the recommendations below will be aimed at making state-controlled or regulated prices more efficient. Ultimately, an efficient pricing system can assist the nation in making a transition to a largely deregulated energy market.

Steps to More Efficient Price Determination

1. Perhaps the first step is to determine the cost of supplying energy in raw or processed form. The results of such analysis will give policymakers a good idea about whether the sector is operating efficiently relative to world price and cost levels.
2. The second step is to establish a series of basis prices for key energy products. In the refined product sector this can be done be reference to the ex refinery prices of key product outputs at a major international terminal. The country can then decide whether to add some sort of differential to account for local cost differences. For coal, the reference price can be the delivered price of coal at a recognized international terminal (e.g., ARA). Establishing baselines for natural gas is more difficult. However the price of natural gas in domestic markets is bounded from below by its value as LNG feed and from above by the values of competing petroleum fuels, #2 oil or #6 oil or LPG. In the electricity sector, the fuel price basis should be accommodated through a fuel-price adjustment clause.
3. The next step is to decide on the taxes and other levies that will be laid on energy prices. Constant taxes have the advantage of making government revenues predictable while *ad valorem* taxes will keep relative prices constant. Economists prefer *ad valorem* taxes since they distort relative prices the least. If the nation continues to import crude oil on a cash basis, some sort of import tariff will normally be added to the crude oil price. As with the excise levies, economists prefer a percentage tariff rather than a fixed levy. However, revenue considerations may call for a fixed amount of tax in order to maintain stability in government revenues.

Adjustment Intervals and the Mechanics of Changing Prices

Determining a baseline price level and a tax structure gets policymakers to an initial set of prices. The hard part is to determine the proper intervals for adjustment. If prices are not to be adjusted on a daily basis, the country will

need some sort of *buffer fund* to accommodate day-to-day changes in energy prices.[3] This fund will cushion the short term fluctuations in world energy prices. The buffer fund will need to be paid for by a specific tax on energy products, usually a constant amount per unit sold.

To make a system like this sufficiently flexible and to make the size of the buffer fund as low as possible, adjustments should be carried out quarterly at the least but preferably weekly or monthly. Adjustment at this frequency is also useful from a political standpoint since it prevents the buildup of long term imbalances or pressures that make ultimate pricing reform so difficult.

The adjustment interval will need to be based in part on the volatility of the markets on which the country relies for its energy imports. For example, if Hungary purchases most of its oil on the Rotterdam spot market, then adjustments made only on a monthly basis could lead to a large buffer fund requirement. However, to the extent that the crude oil, gas, and coal comes from domestic producers or is purchased on long term contracts abroad, adjustments may be relatively less frequent.[4]

Finally, the system needs to be reviewed periodically to make sure that the bases and the adjustment intervals are still appropriate. For example, a shift to use of more natural gas or coal will make a pricing structure based largely on oil prices more difficult to administer.

Reforming price setting in this manner does not guarantee greater economic efficiency or higher national income. It is a first step in permitting energy users and producer to make the best uses of their energy and investment resources. However, pricing reform, even if brilliantly conceived, will not succeed if rigidities elsewhere in the economy prevent the necessary reallocations of investment and energy resources than must accompany effective price reform.

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[3] Private firms, of course, must use such buffer funds to cushion the enterprise from the daily fluctuations in costs and revenues. In the private sector, this is usually referred to as working capital. Even completely private energy companies do not have daily adjustment of prices at the consumer level. Rather, they will average the prices paid for inputs over a period of time, weight these costs against the market conditions and charge accordingly.

[4] This point does not include exchange rate risks which have the effect of increasing the potential volatility of energy import prices.

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Institutional Aspects of Energy Price Decontrol

There are several key institutional elements of administering an energy price reform program that are crucial to its success. These elements include the following:

- Minimal administrative and political steps in the adjustment process;
- Automatic or formula-based price changes for most products and most sectors;
- Regulatory institutions that are aimed only at representing the public interest vis-à-vis monopolies, not at regulating the energy sector as a whole; and
- Elimination of quantitative restrictions on the trade in energy and refined energy products.

In a country the size of Hungary, the institutional apparatus required for effective price regulation can be quite small. Until and unless independent power generators are allowed to sell electricity in the country's power grid, there will be no particular need for a regulatory agency with a brief in that area. However, once other entities are allowed to sell electric power, an independent regulatory body may need to be created.

In the petroleum and natural gas areas, there will need to be a unit with the responsibility of monitoring the movements of energy prices and also to administer the buffer fund. Once adjustment intervals are set up, the energy pricing unit will not need to intervene on any regular basis.

To accommodate the periodic imbalances that might arise, the energy pricing unit should be involved with the government' s energy planning activities as well.[5] It is advisable to keep pricing and investment decisions tied to the same perceptions of reality in order to minimize the impacts of regulatory and pricing decisions on the investment by private firms and state enterprises.

Finally, there will be a need to look at new enforcement mechanisms, more appropriate to a liberalized market. In particular, better efforts are essential in the following areas: tax collection, contractual enforcement, and environmental protection assurance (e.g., fuel sampling, testing of vehicles and stationary pollution sources). Retail prices for refined oil products should remain outside the purview of the enforcement authorities. In electricity and gas, there will be scant need for enforcement at the present time.

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[5] In fact, if the rules are devised properly, there should not be sufficient work in the price regulation area to keep more than 1-2 people occupied.

OIL PRICE CONTROLS
IN AN INDUSTRIALIZED MARKET ECONOMY

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PRICE CONTROLS IN AN INDUSTRIALISED MARKET ECONOMY

by T. S. Tuschak

The case study related in this paper is of particular interest, because its subject, Canada, had seemingly well justified reasons to introduce energy price controls at a time of rapid escalation. Also, because the consequences of intervention in the market as it turned out were devastating for the country as well as the energy sector.

To begin with, it is necessary to point out, that the philosophical stance of the party in power (Liberal Party) for the most part of the after war period has been, that while market forces are the most important determinants of economic development, they are not capable of satisfactorily addressing all public policy issues, nor should they be allowed, unlimited control to do so. Social issues and regional development are areas, in particular, where government intervention is not only desirable, but, in fact, mandatory. This conceptual licence tended to extend to policies of industrial strategy, which has obvious connection to regional development and equitable income distribution. It has an even stronger relevance to purely economic factors, such as proper resource allocation, return on investment, productivity, etc. In other words a government that did not believe that markets can do everything that is necessary for a just society.

The real difficulty with these issues is, that they are not black and white. There is no country in the world, no matter how market oriented its approach, that does not intervene in some form at some times. The question is how and when and in what issues? As you will see in this case, the case of Canada, the intention was good, the objectives were worthy, yet the results were not. We shall attempt to draw useful conclusions.

Background

Intervention in the oil industry started, in fact, in 1961. Then the so called Borden Commission, in dealing with Canada's growing petroleum wealth and that wealth's best contribution to the country's development, recommended and the government accepted, what came to be known as the Ottawa Valley Line. This policy prevented cheap Middle East oil from being imported further west than the Ottawa Valley. This measure provided safe markets for Canadian oil, albeit more expensive, while it allowed cheaper oil to be imported into Quebec and the Atlantic provinces i.e. eastern Canada.

This policy offered protection for the, at that time, uncompetitive Canadian oil industry so as to help it develop by providing incentives for finding costs averaging somewhere in the $1.50 to $2.00/BBL, compared to the less than $1.00 in Saudi Arabia, Iran, etc.

Consumers in Ontario and western Canada paid for this policy, and questions can be asked whether the lost economic rent which would have accrued to these consumers and industrial users, if they had been allowed the use of cheaper Arab oil, could not have yielded a higher income to the nation as well as the affected regions. However, there was no great outcry against the policy and it resulted in a very healthy and dynamic petroleum industry.

Another intervention in the market place were the tax incentives, which allowed the industry income offsets in varied forms. This resulted in the Canadian oil industry paying only about $700 million in taxes on income of about $24 billion between 1947 and 1972, the time when oil prices started their meteoric rise. This meant that the federal government had forgone about $4 billion in revenues that it would have otherwise collected. The income shortfall had to be made up by other sectors of the economy, in all likelihood the ones which were prevented from buying lower cost oil.

In retrospect, we can see that:

a) The fledgling oil industry was considered in need of protection from lower cost competition;

b) Artificial market protection was introduced;

c) Tax concessions were granted;

d) Both the market protection and the cost of tax concessions were borne by one group of consumers (geographically defined).

The results appear to support the views that these were beneficial government interventions, although they paved the way for further market manipulations as we shall see in the discussion that follows

Introduction of price controls

I shall spare the audience repeating the details of the often heard history of the international energy crises, which started in the fall of 1973 and became a recurring phenomenon during the following decade, other than to say that these crises lead to the issues that will be discussed here.

Canada was an energy exporting nation with export surpluses in oil, gas, coal and electricity. Oil, gas and electricity exports were to the U.S.. The sudden and dramatic increase in energy prices precipitated by OPEC should have been a bonanza to Canada. One would logically expect that the income generated by higher energy prices, as they were not limited to oil and gas, but even coal and the secondary energy of electricity, would boost the national economy, create jobs and raise standard of living in all regions.

Analyses of the situation, while confirming in part these expectations, also found that serious dislocations might occur. What were these? Without getting into the complex legal-constitutional-political picture, all of which contributed to the course the government took, I would like to just list a few of the relevant facts.

Energy resources, primarily oil/gas, (but also coal) were found mostly in western Canada and foremost in the province of Alberta. These regions are relatively thinly populated. Energy consumption, industry and population were centred in central Canada (Ontario and Quebec). The first concern raised was that the higher energy costs will accumulate great wealth in one underpopulated region, while the industrial heartland of the country (central Canada) will have to face competitive disadvantages and significantly higher costs of living, which would set off an inflationary spiral.

A related issue was that the oil industry was at the time about 73% foreign owned and therefore the net benefits would accrue to large multinationals, rather than to Canadians. In Canada royalties on natural resources are collected by the provinces. The province of Alberta quickly stepped in and increased its royalties to roughly 50% of revenues above a certain minimum, and thus creamed off much of the benefits of the higher prices. The federal government which has the responsibility to ensure that all Canadians shoulder the costs of running a country with a high level of social security benefits, and that all regions gain from increased national income, found that the only parties benefiting from the price rises would be Albertans and foreign companies.

One anomaly, which illustrates the situation is, that if no intervention had taken place, the per capita income of the Alberta government (basically oil royalties divided by population) would have been four times that of Ontario, which is the country's richest province. One can imagine what this ratio would have been for the less developed regions, such as the Atlantic provinces. This would have been similar, in an economic sense, to a country made up of say Saudi Arabia and Ethiopia in one. The government felt that this could not be allowed.

Another consideration was that because the income generation would have been in the hands of a provincial government and the foreign owners of the industry, a normal cross country and intersectoral flow of funds would likely not occur. The excessive liquidity in western Canada, most of all in Alberta and escalating energy costs in the central and Atlantic provinces would simply drive inflation to intolerable levels.

The possibility of developing a new industrial strategy predicated on indigenous sources of energy, which might be available at below world prices, was another aspect to take into account by policy makers. This led to the massive development of the petrochemical industry, designed to compete with the huge petrochemical plants of the U.S. Gulf coast. These plants always enjoyed cheap feedstock from Mexican-Caribbean-Texas sources.

The opportunity to reduce concentration of capital in undesirable hands, such as provincial governments and the foreign sector, combined with the ability of the national government to redistribute the windfall economic rent and, also develop economic growth through a new industrial strategy based on cheap energy, appeared at the time to be too good to forego.

A final consideration was that the ever increasing oil prices, at least as they then seemed, would provide enough incentive to the oil industry to invest in further exploration and development, even if Canadian prices were to rise slower i.e. netbacks would temporarily be below world price levels.

From the perspective of macro economic and social policies, it appeared that there were valid and good reasons to intervene in the market place to remedy problems such as:

1) Sudden and drastic rise in income of one region;

2) Undesirable income distribution (regional and sectoral);

3) Inflationary impact of steep price increases;

4) Opportunity to evolve a new industrial strategy;

5) Correct capital flows, which could unbalance the economy in the absence of intervention by concentrating excessive liquidity in the oil sector.

As can be seen from the foregoing discussion, the sudden and dramatic rise in oil prices created serious problems not only in energy deficient economies, but also in ones which were well endowed such as Canada.

Now, we shall examine what measures the government did take, and whether the measures achieved the intended results.

Government intervention measures

Government intervention to address the above issues fell into three categories:

a) Taxation/fiscal measures,

b) Administrative -legal control, and

c) Price controls.

To understand fully the whole picture, it will be necessary to cover all three.

a) Taxation and fiscal measures;

As mentioned above, as soon as world prices increased the provincial government in Alberta stepped in and imposed a 50% royalty on price increases. It appeared at the time that as prices would continue their rise, the province would expropriate most of the economic rent thus generated. The provinces considered all income generated by natural resources as being legitimately theirs and viewed the federal treasury's sharing in it as being a "cash grab".

The federal Minister of Finance responded with a bold step. In a federal budget, he disallowed royalty as a deduction for income tax purposes. This meant that the oil industry had to pay income tax on, what amounted to another form of tax payment to another jurisdiction. It was expected that this would cap further royalty increases as the provinces would not be willing to kill the goose that laid their golden egg, by making the industry lose money on higher prices through double taxation.

Over time, there were in fact further tax increases which were aimed at capping oil industry and provincial revenues and allowing federal tax revenues to increase in order that a wealth redistribution could be accomplished.

To compensate the oil industry for its lost income and increase incentives to invest in exploration and development, part of the tax take was re-injected in the industry through a complicated grant system. The purpose of this was to refund to investors part of cash outlays for new ventures. The grant system was structured so that it tended to divert investments from established petroleum provinces below the 62nd parallel to frontier areas, which were under federal rather than provincial jurisdiction and rewarded Canadian companies at a higher rate than foreign owned ventures.

It was expected that these fiscal measures would change both the ownership structure and the operating theatre of the industry. The federal government - and consequently the entire nation - would benefit instead of only the producing provinces and foreign owners of the industry. The fiscal measures were designed so that both the industry and the producing provinces would retain their income levels in real terms at the pre-energy crisis plateau.

b) <u>Administrative and legal controls</u>

In addition to price controls, which will be discussed in the next section, the government decided to introduce other administrative interventions to achieve the wider goals of social equity and security of supply. In terms of the ownership structure of the oil industry, it was thought, that in addition to the above referred to grant system with a preferential tilt to Canadian companies, it was thought that legal requirements were needed so that any new venture under federal jurisdiction i.e. in the frontier and offshore areas should have at least 50% Canadian ownership.

It was also decided that a Canadian state-owned oil company should be set up. This would provide the government with a "window on the industry", allow it to carry out activities and investments for policy objectives (the rate of return, time horizon, risks, etc. of which would not fit private sector operational conditions), and also enter into state to state oil trading deals. This led to the formation of Petro Canada, which has grown to be a world scale oil company and which is about to be privatized.

Another area of administrative intervention was the establishment of export control. Oil exports were quickly phased out, as it became known that there are no exportable surpluses in the long term. (For some years now, exports have again resumed, but on a net basis, imports and exports are in balance. The international trade is regional export from the west and import into the east of the country, and also some categories of oil such as heavy oil of which large surpluses exist.)

A controversial issue was gas export. Canada has large gas surpluses, but this was not always acknowledged. Gas exports have reached about 6-7% of U.S.domestic demand and were crucial in the northern tier and California. The net benefits of exporting natural gas have been analyzed and it was found that everybody would be better off by permitting the venting of surpluses through exports. The conclusion is, however, not unambiguous. It was concluded that under lower domestic gas prices and no additional exports, as compared to higher domestic gas prices and increased exports, the economic rents to Canadians increase, although total rents are lower. This is so because the increase of rent to domestic energy users is larger than the decrease in rents to governments and producers. Because governments will generally not forego income in favour of their citizens, gas exports were never halted.

Administrative interventions came not only from the federal government, but also from the producing provinces, foremost Alberta. The Alberta Energy Resources Conservation Board (a body somewhat similar to the Texas Railroad Commission), which exercises high quality and very necessary supervision over production techniques of the producing industry and ensures environmental protection, determines production quotas for each well (about 10000)in the province. The Alberta government has used on some occasions production quotas as bargaining tools with the federal government.

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c) Price controls

The final tool in the government's armoury to achieve the above described objectives, was price control keeping Canadian oil and gas prices well below international levels.

The regulated pricing system was highly complicated and I shall not confuse you with all its harebrained details. In essence, before 1980 it attempted to keep prices more or less constant in 1973 real terms, while after 1980 it was to reach international levels gradually, over a ten year period.

The major policy objective of the pre-1980 regime was to protect the consumer, whereas the after 1980 arrangement had as its major goal to revamp the sharing of economic rent.

If the system of the newly introduced National Energy Program (NEP), had stayed in force, as envisaged in 1981 the following rent sharing would have emerged:

Federal government	32%
Provincial government	37%
Consumers	31%
Producers	-3%
U.S. consumers	3%

Calculations indicated that the per capita rents accruing to Alberta were about 700% higher than those accruing to the rest of the country, however, the main population centres of Ontario and Quebec still received significant rents in the form of consumer surpluses taken into account that these provinces do not produce oil or gas.

The essence of the price controls was the categorization of oil into: old oil, whose price was set by the government according to the above described principles, and import as well as new oil, found after January 1, 1974, including synthetic oil and enhanced recovery oil, which were entitled to international prices. The differences between the lower price the consumer had to pay and the higher prices the refiner had to pay for new and imported oil at international prices was refunded to the refiners from a compensation fund, which drew on special taxes introduced to finance this scheme. The compensation fund tended to be inadequate and had to draw on the consolidated revenue fund i.e. general government resources.

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There were measures relevant to gas prices as well. The price of gas was fixed at 65% of the BTU equivalent of oil at the Toronto city gate.

In terms of equity, many argued that subsidising energy is unfair as it favours high income earners over the poor as the rich use more energy relative to their income than the poor, particularly when indirect energy uses are taken into account.

Before we examine the consequences of the above outlined energy and pricing policy it is useful to remind the reader that the NEP and the associated administered pricing was abolished after the then governing Liberal party lost the 1984 election.

Assessment of interventionist policies

As we have seen the emerging circumstances in the energy sector have prompted the government to introduce policies which were designed to thwart market forces. We have also learned that the motivation for these were to:

a) protect the consumer;

b) secure economic rent for Canadians rather than foreigners;

c) redistribute income between regions;

d) secure higher federal income share;

e) help develop promising, but more risky frontier resources;

f) fight inflation, and

g) exploit comparative advantages for new industrial strategy.

Although all these objectives were reasonable, in fact desirable, I venture to conclude that with the exception of d) "secure higher federal income share", none of them had been accomplished. It is a sad commentary, but unfortunately true. Even d) could have been achieved by different means, with less pain and controversy.

Let us examine this conclusion in some detail.

Consumer protection and inflation fight:

It is necessary to analyze these two objectives together for obvious reasons.

The lower than international regulated price had three major effects:

i) Increased energy waste by about $400 MM annually, according to a study conducted by Watkins of the University of Toronto. This waste represents only the wasteful use of energy i.e. direct loss.

ii) Wrong investment decisions i.e. wrong resource allocation based on off market pricing. Since energy using equipment has long life, wrong decisions have long lasting effects.

iii) While gradual phasing in of international prices had a dampening effect on inflation, it is not clear to what extent. The fast rising international inflationary environment affecting the cost of capital as well as goods and services played an overwhelming role in the inflationary psychosis. A short term phasing in might have been beneficial for inflation fighting, the distortions of keeping prices below market for years offset any advantages.

Secure economic rent for Canadians:

This objective was pursued by the dual policies of keeping prices low and also taxing away excess profits. The impact of low prices on the producer were counterproductive. In the first place it resulted in much reduced investment, although oil industry profits were impressive in spite of price controls. It must not be forgotten that most oil and gas produced was from very low cost older wells. While industry cash flows were relatively high, notwithstanding low prices and high taxes, the economics of higher cost new discoveries required significant investment. Although new oil commanded market price, the over regulation of the industry discouraged investment. The arguments over prices and taxes coincided with deregulation of oil in the U.S. where returns in oil were about 400% higher. An exodus of drilling rigs followed and exploration in Canada dropped dramatically.

It is probably correct to observe that although price controls were negative factors, in general, the peculiar Canadian circumstances relating to regional aspects and the ownership structure of the industry made taxation measures more confiscatory than those of other countries necessary.

Secure higher federal income share:

As indicated above this is the one objective which was accomplished by the methods used.

Help develop promising but more risky frontier resources:

This objective was promoted through three policy instruments; frontier oil and gas would get international price; frontier development would be entitled to a grant to defray capital costs, and Petro Canada would be available to pioneer investment and share costs and risks. One of the greatest failures of the NEP was the PIP (Petroleum Incentives Program) which issued grants to qualifying investment. It was a typical case of the government knows best, by channelling investment to areas and projects which bureaucrats thought were the most desirable. The combination of the grant system, called Petroleum Incentive Program, and depletion allowances amounting to 133% of costs incurred made frontier investment practically risk free. All the multinationals had to do was to secure a Canadian participation up to 50% and they were entitled to up to 80% of the costs and tax write offs which made their investment essentially cost free.

These conditions led to the most outrageous wasteful spending. Although most of these incentives were intended for the frontiers under federal jurisdiction at a lower level they were also made available for the established areas. In short, the federal government did almost the same as the socialist economies: companies were stripped of their own resources via price controls and taxation. In return, however, investment capital was provided by the treasury, according to the judgement of government bureaucrats who followed esoteric policy objectives rather than sound business considerations.

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Redistribute income between regions:

This objective was a qualified success.

What I mean by qualified success is, that the combination of low prices, redistributing income to the energy users primarily in the non energy producing areas, and special taxation did achieve the objective. It must also be recognized that the required adjustment could not be achieved by either price control or tax measures alone. The windfall, due to OPEC was so large that this combination of intervention had to be applied.

The consequences of these measures resulted, however, in about ten years of near paralysis in the industry. The nature of the oil industry is such that no outsider can tell it how much and where to invest, nor is it acceptable to spoon feed capital for approved and government influenced projects.

The situation resulted in great fortunes accumulating during the seventies and early eighties by individuals and oil companies facilitated by the loopholes in the system, but nationally useful investment was seriously retarded and also misdirected. However, if it is accepted that the situation got out of hand due to OPEC price escalation within the context of the Canadian constitutional and political conditions the adopted income distribution policy instruments did achieve their objectives.

Exploit comparative advantages for new industrial strategy:

As referred to above, an important attraction of cheap energy by way of price control was the idea that Canada should use its comparative advantage to develop energy intensive industries. Some of this has indeed taken place with very long term impact. A significantly expanded petrochemical industry, which has by now lost its cheap source of energy, has to compete with other areas with more favourable feedstock supply conditions and market locations. The growth of energy efficiency and changes in industrial structure suffered long delays.

In closing, it is noteworthy that the practice of using cheap energy as industrial strategy still continues in Quebec, which is using vast hydro power reserves and resources to lure high energy intensive activities with cheap often below actual cost power supplies.

Summary

As we saw there were valid reasons and worthwhile objectives to support the exercise of government intervention. (There always are.) The policy instruments used were by and large consistent with the objectives. Some of them became administratively so cumbersome that they were in fact counterproductive, but our argument is not really with the administration of intervention, but with the principle and consequences.

A major question the informed reader must inevitably ask is whether even good and justified need for adjustment in market created conditions warrant the kind of dislocations we have seen?
Would markets not correct distortions more easily by allowing natural economic responses free evolution? Are long term consequences of intervention not more damaging, than would the short term effects of undesirable economic shock?

Well, these are questions for another day!

COAL PRICING AND ITS RELATIONSHIP TO COAL INDUSTRY RESTRUCTRUING

Charts Describing Coal Production, Coal Prices,
and Alternative Approaches to Coal Mine Restructuring

Szabolcs Jenei

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Tatabánya, H-2800 I.
Tóth-Bucsoki u. 12
Budapest

Conference on Energy Pricing in Hungary
Budapest, Hungary, May 20-24, 1991

May 1991

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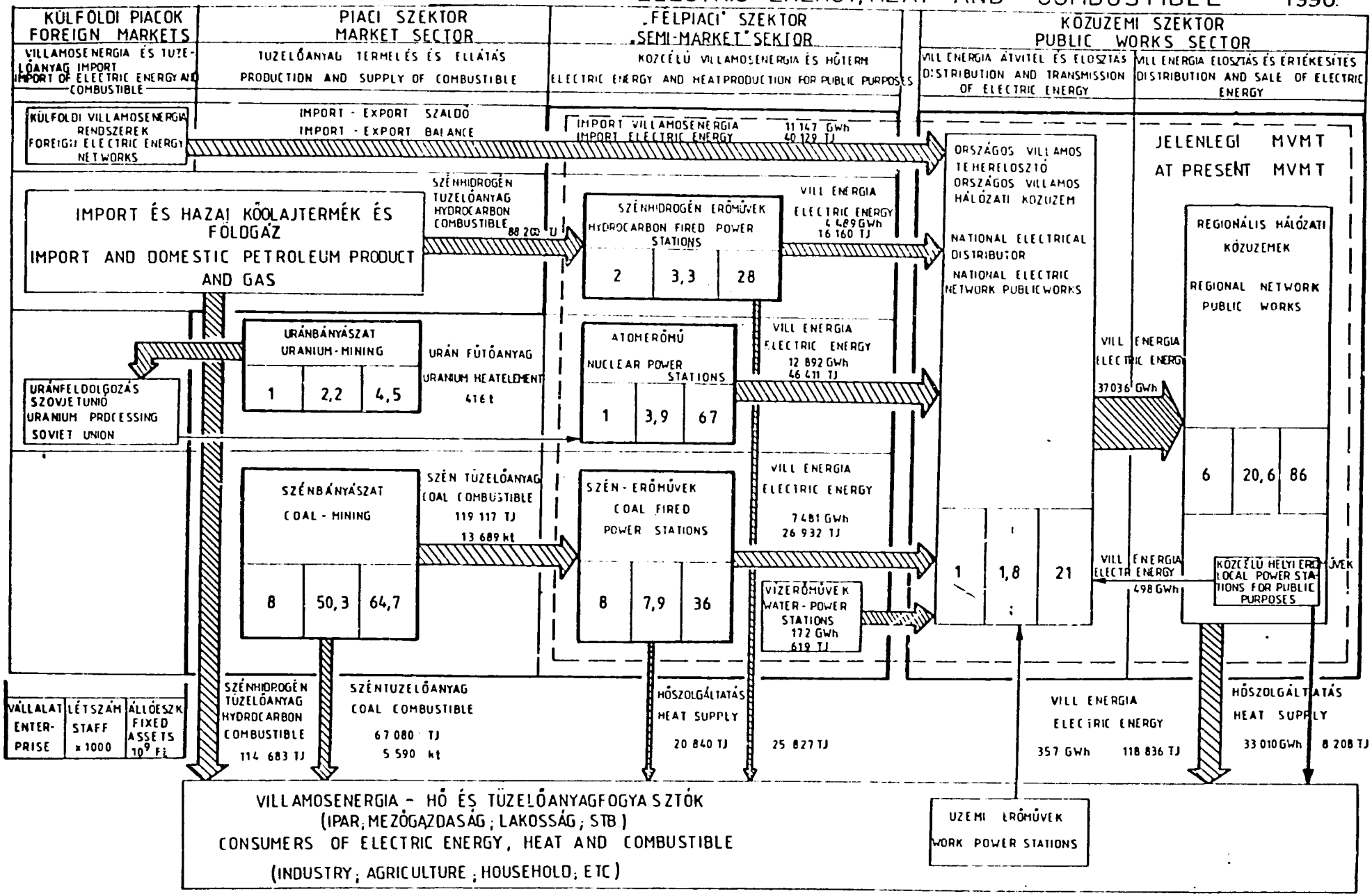
VILLAMOSENERGIA - HŐ ÉS TÜZELŐANYAGFOGYASZTÁS FOLYAMATÁBRÁJA 1990.
FLOW - SHEET OF CONSUMPTION OF ELECTRIC ENERGY, HEAT AND COMBUSTIBLE 1990.



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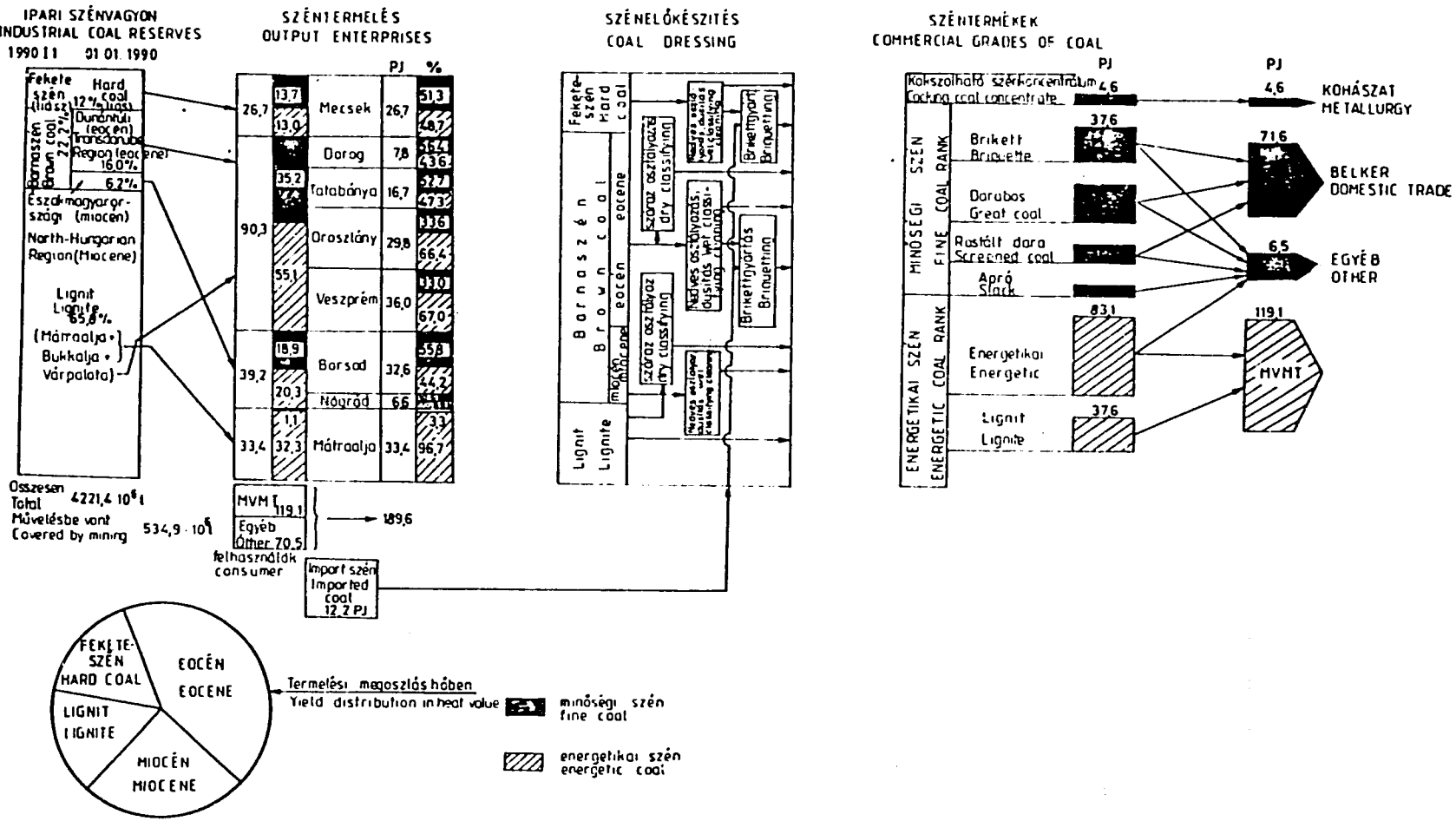
A SZÉNBÁNYÁSZAT FOLYAMATÁBRÁJA

FLOW-SHEET OF THE HUNGARIAN COAL INDUSTRY



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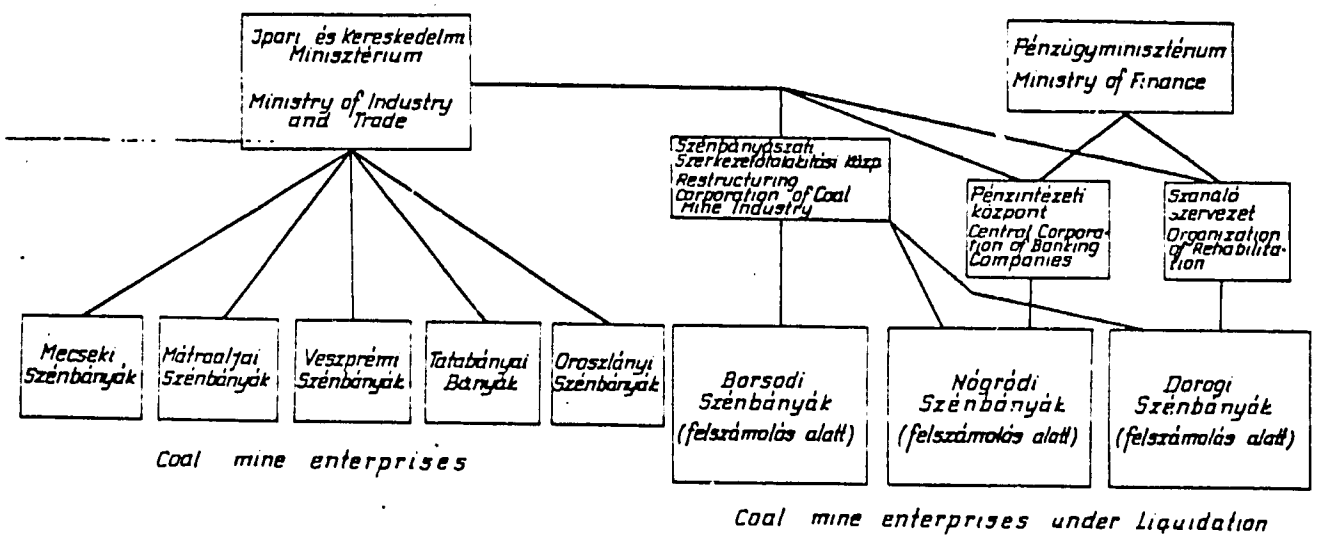
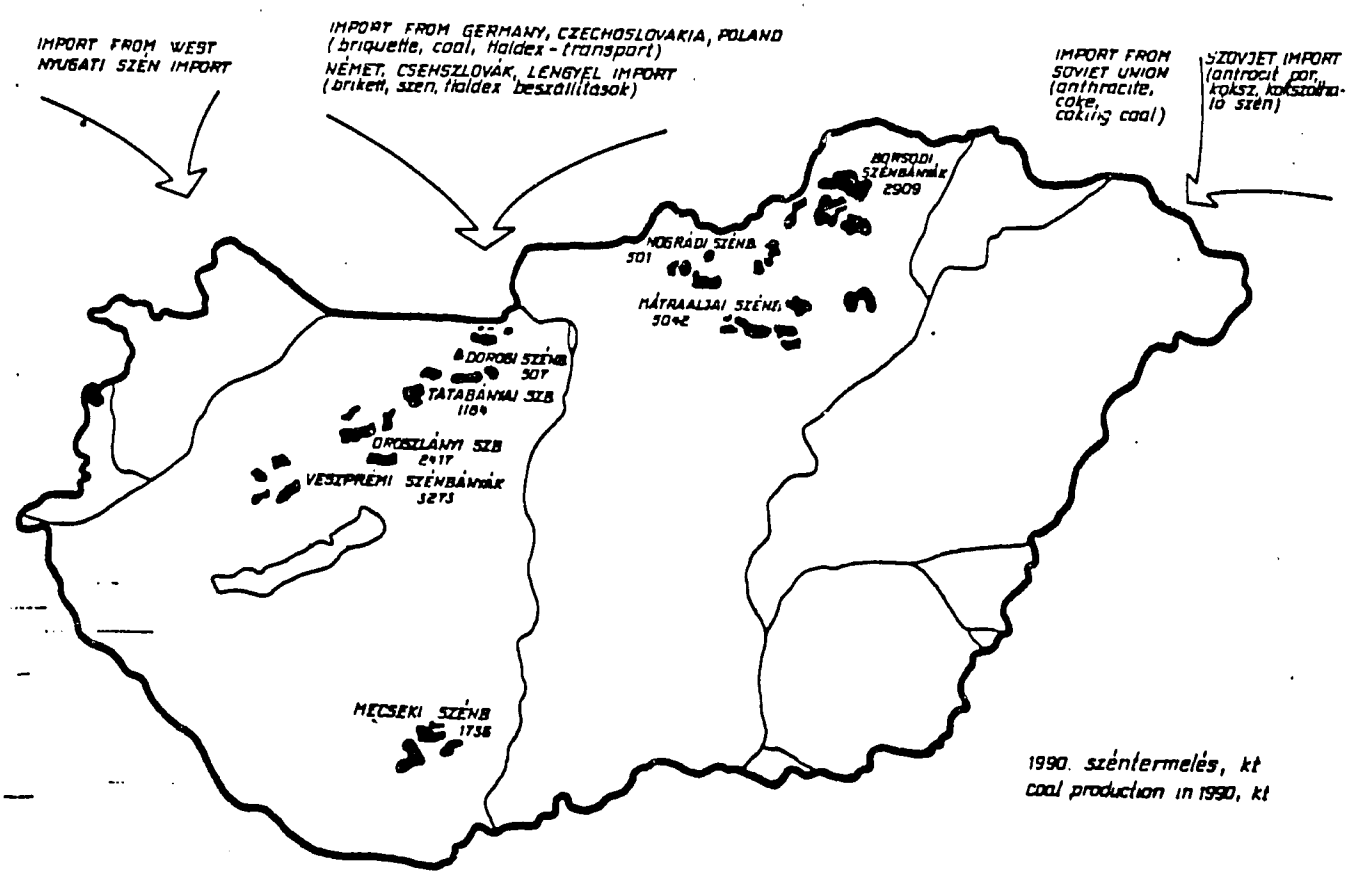
A magyar szénbányászat szervezeti rendszere
(1991. április)

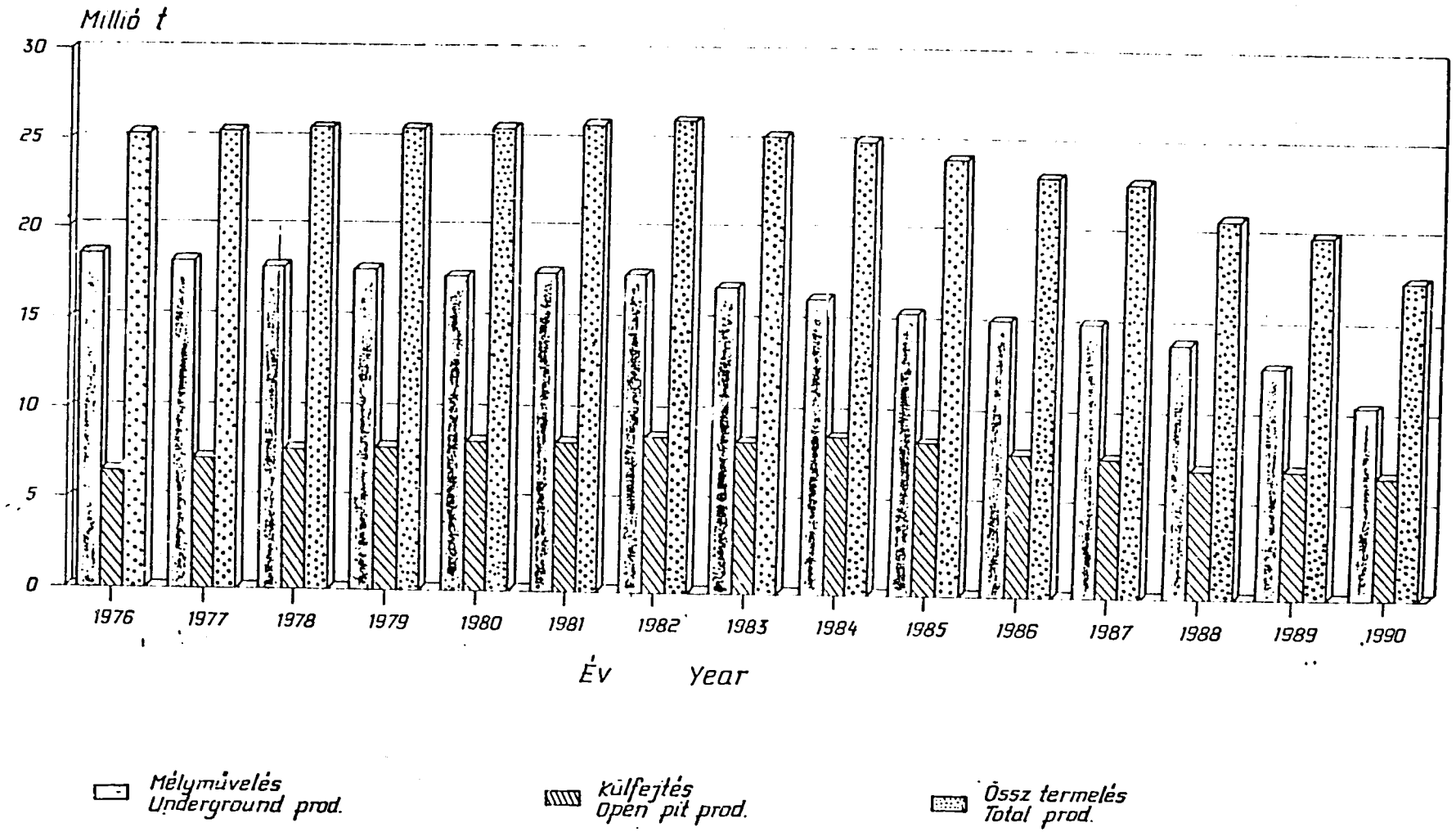
Organization of hungarian coal mine industry
(april, 1991)





Magyarország széneléfordulásai és importforrásai
Coalfields and importsources of Hungary

Szénbányászat termelése
Production of coal mine industry
1976 – 1990



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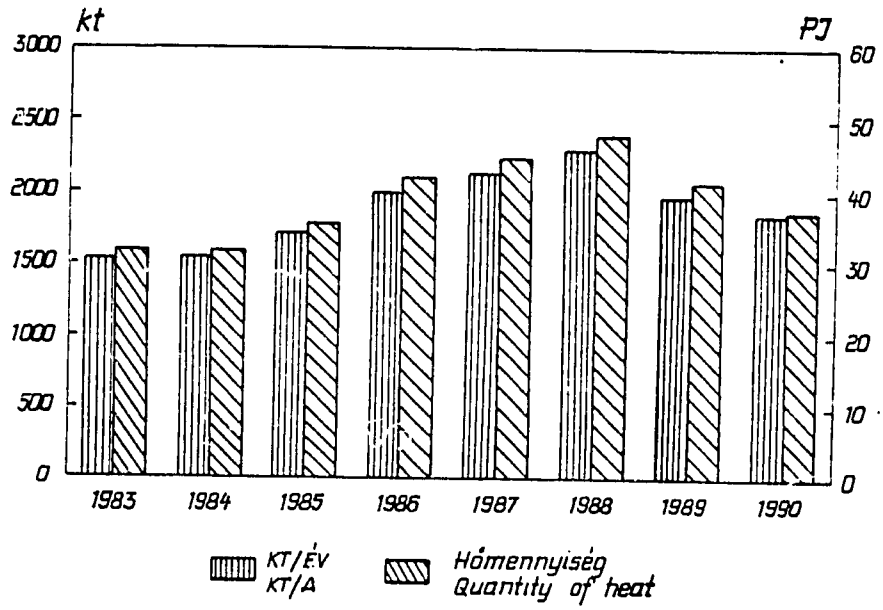
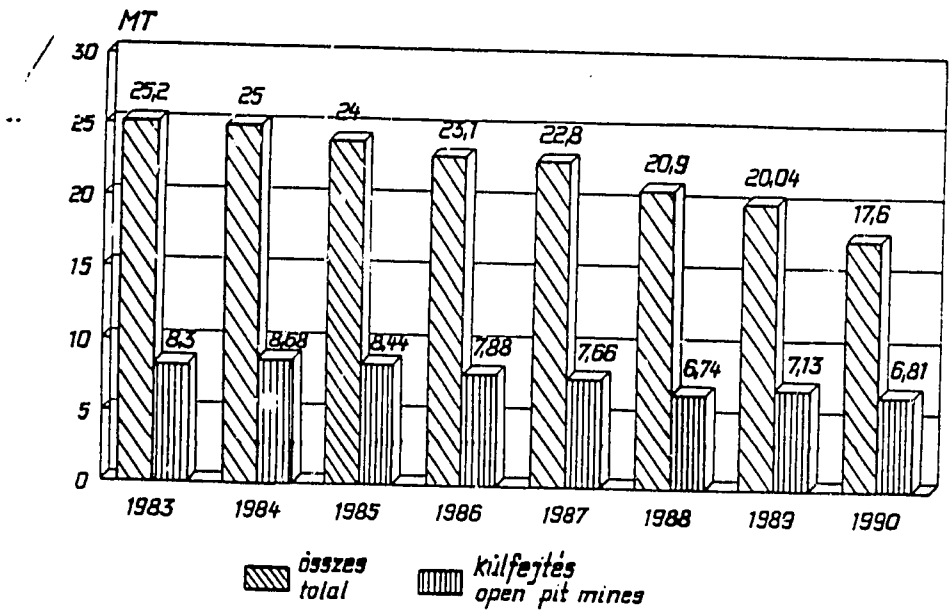
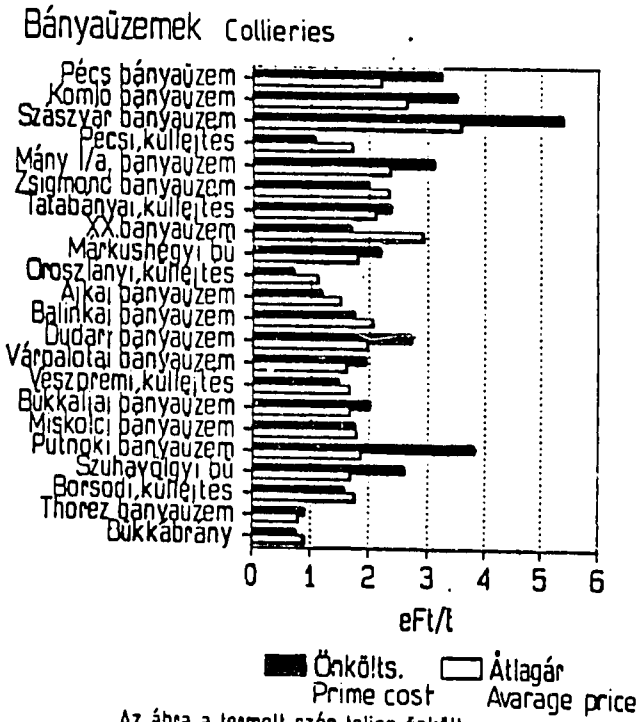
Brikettermelés 1983 és 1990 között
Briquette production between 1983 and 1990



Széntermelés 1983 - 1990 között
Coal production between 1983 and 1990

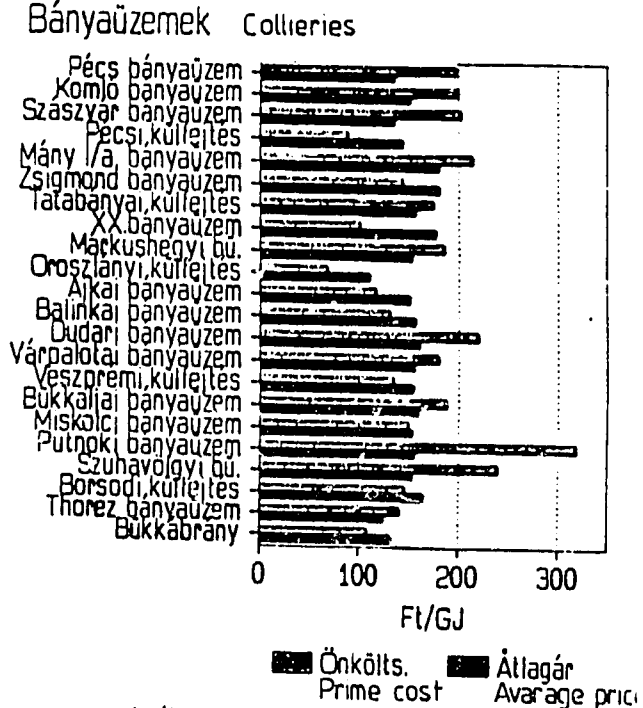


TERMELT SZÉN ÖNKÖLTSÉGE ÉS ÁTLAGÁRA
1990.
PRIME COST AND AVARAGE PRICE OF COAL PRODUCTION



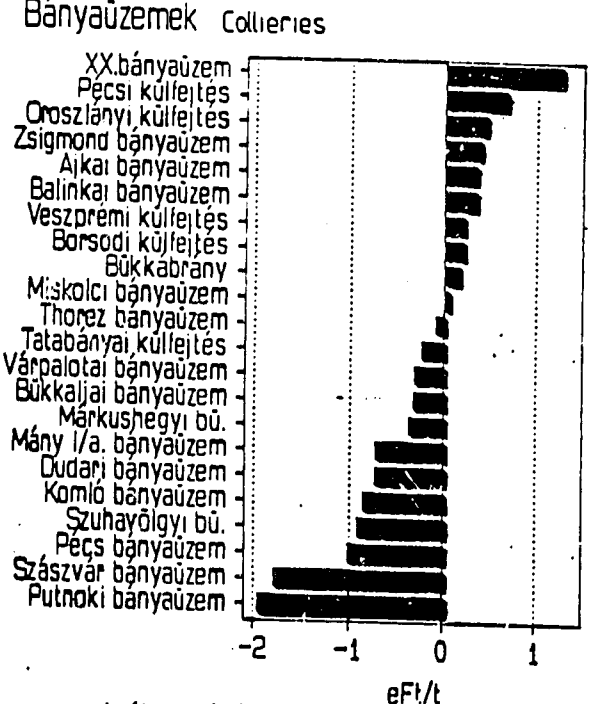
Az ábra a termelt szén teljes önköltségét és az értékesitett szén átlagárát tartalmazza

TERMELT SZÉN ÖNKÖLTSÉGE ÉS ÁTLAGÁRA
1990.
PRIME COST AND AVARAGE PRICE OF COAL PRODUCTIC



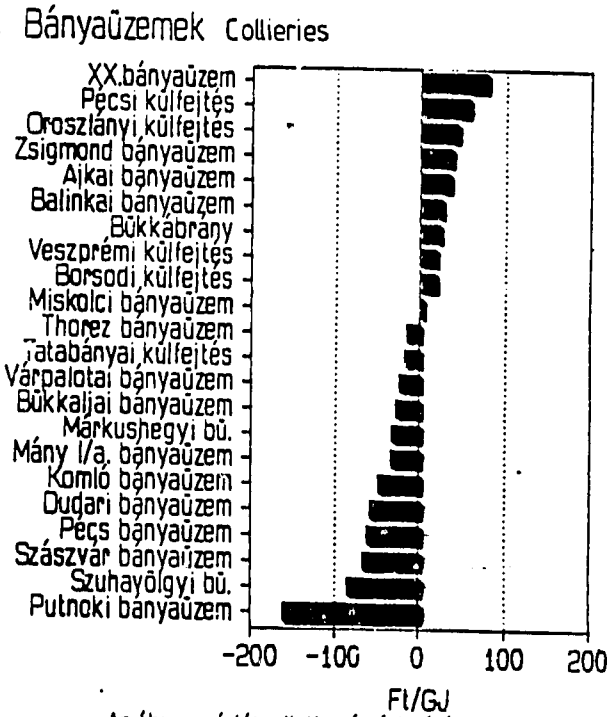
Az ábra a termelt szén teljes önköltségét és az értékesitett szén átlagárát tartalmazza.

ÁTLAGÁR ÉS ÖNKÖLTSÉG KÜLÖNBSÉGE
1990.
DIFFERENCE OF AVARAGE PRICE AND PRIME COST



Az ábra az értékesitett szén átlagárának és a termelt szén,teljes önköltségének különbségét tartalmazza

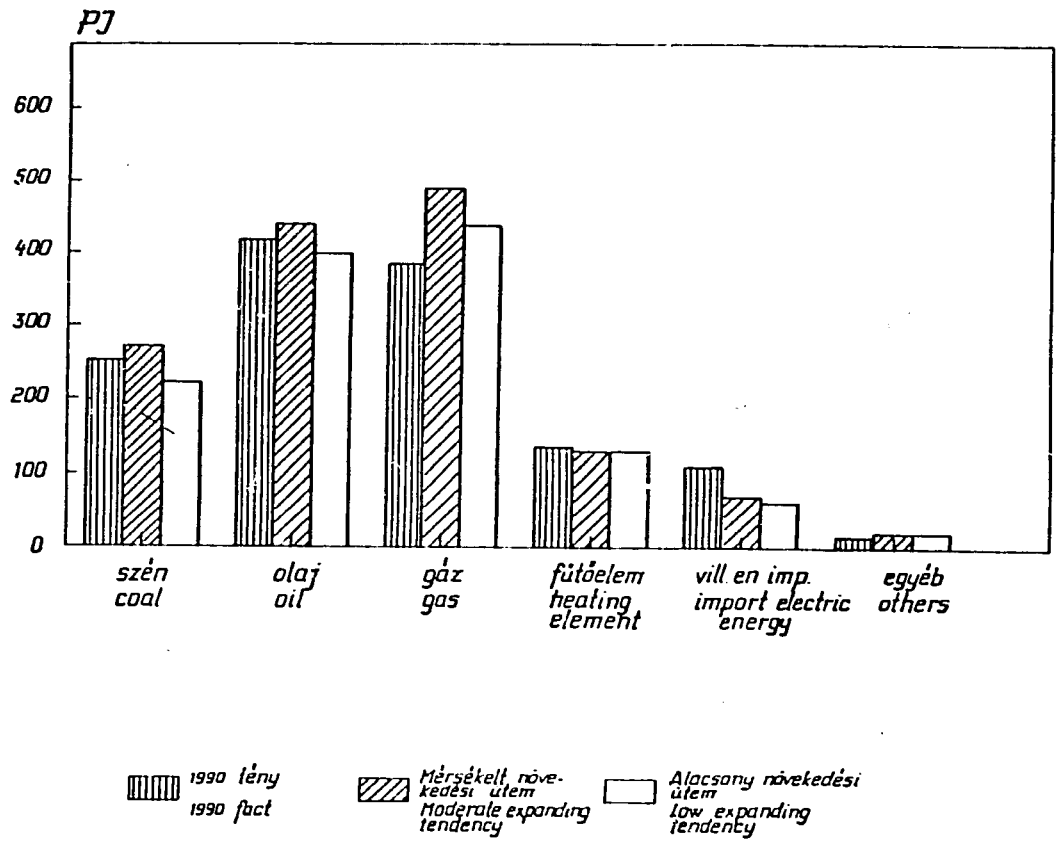
ÁTLAGÁR ÉS ÖNKÖLTSÉG KÜLÖNBSÉGE
1990.
DIFFERENCE OF AVARAGE PRICE AND PRIME COST



Az ábra az értékesitett szén átlagárának és a termelt szén,teljes önköltségének különbségét tartalmazza

Az energia források struktúrája
2000. év

Structure of energy sources
year 2000



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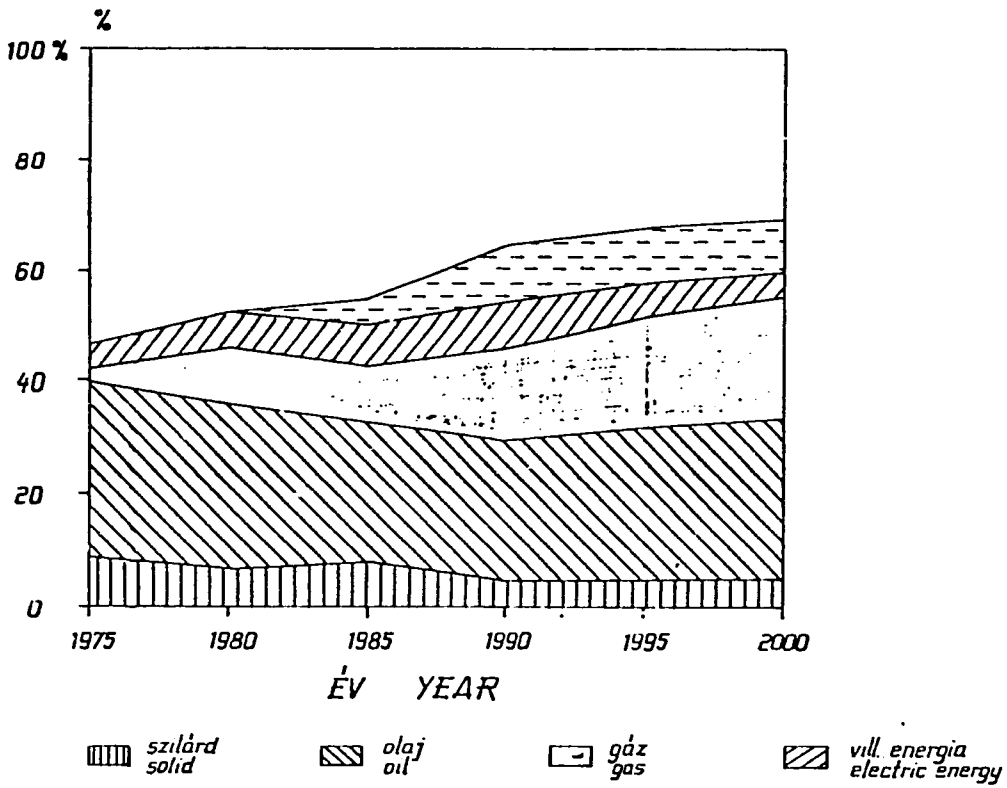
Az import súlya Magyarország energiagazdálkodásában

(Mérsékelt növekedési ütem 1990 - 2000 között)

The role of import in energy economy in Hungary

(Moderate expanding tendency between 1990 and 2000)

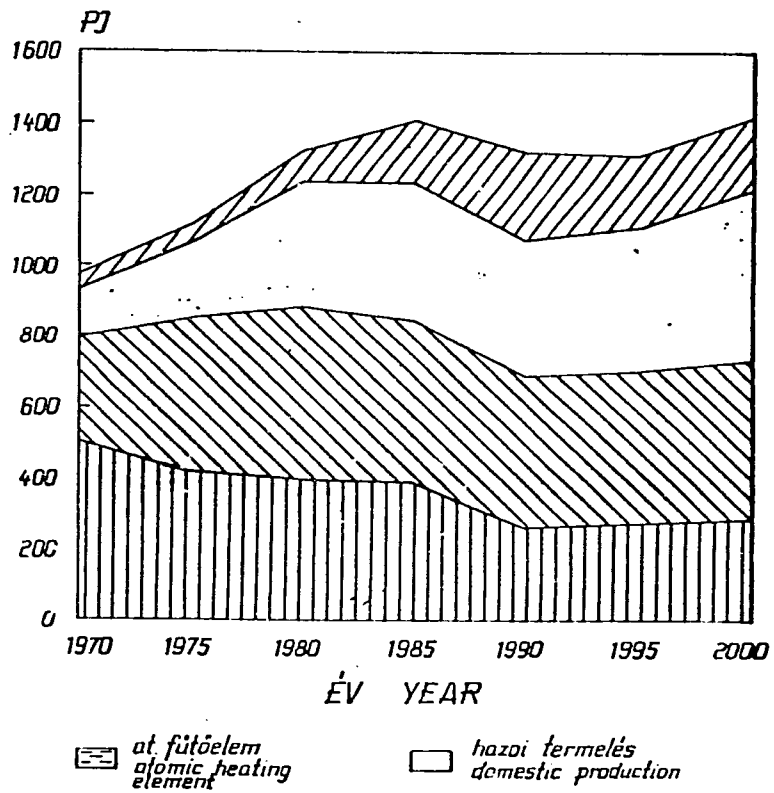


Az energiahordozók forrásszerkezetének dinamikája

(Mérsékelt növekedési ütem 1990 - 2000 között

Dynamics of sourcestructure of energy supporting

(Moderate expanding tendency between 1990 and 2000)



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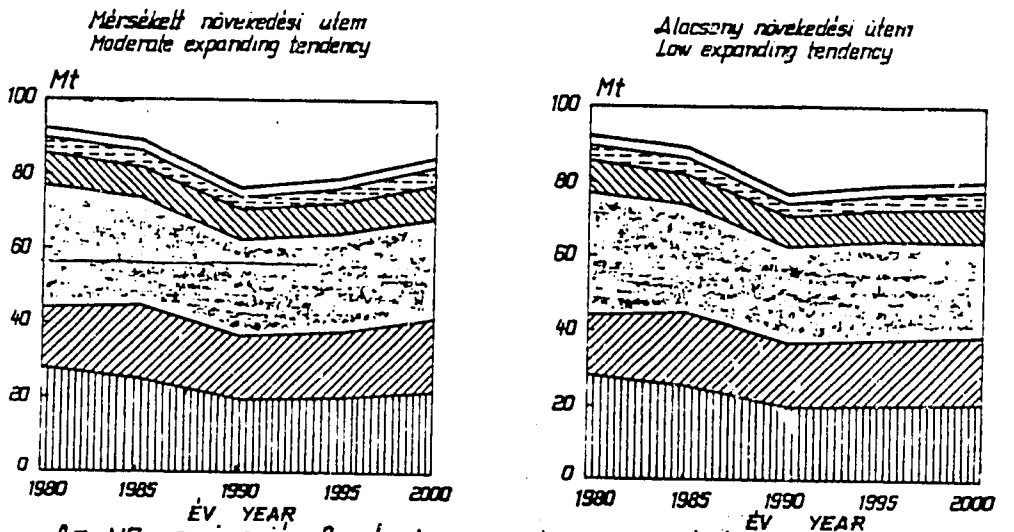
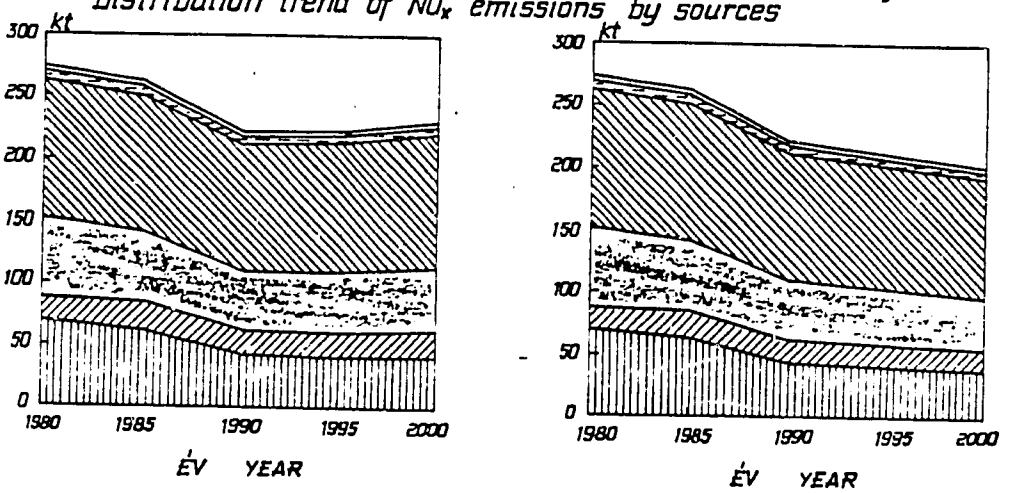
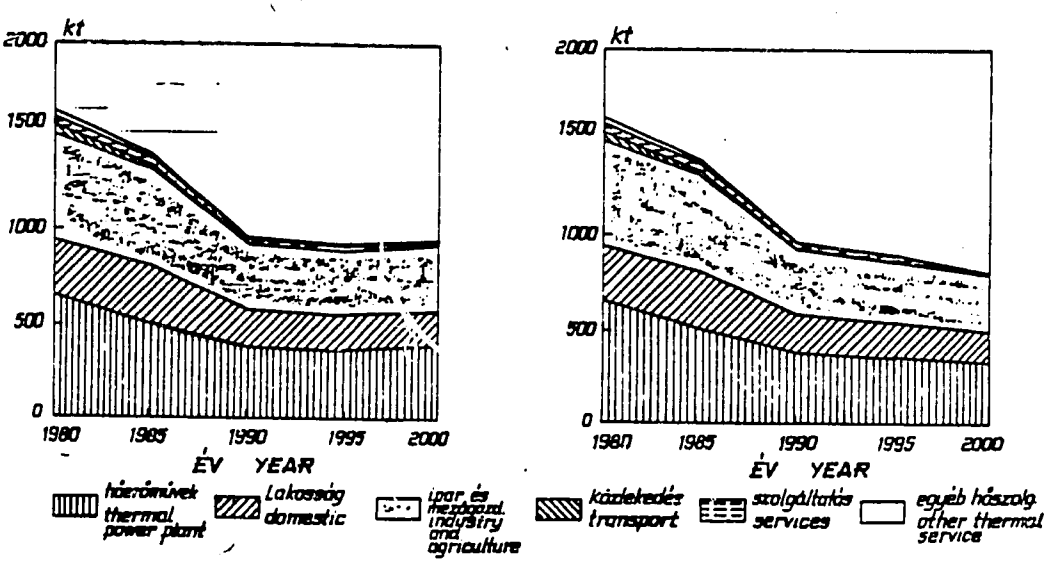
A CO_2 emisszió források szerinti megoszlásának trendje
Distribution trend of CO_2 emissions by sources



Az NO_x emisszió források szerinti megoszlásának trendje
Distribution trend of NO_x emissions by sources



Az SO_2 emisszió források szerinti megoszlásának trendje
Distribution trend of SO_2 emissions by sources

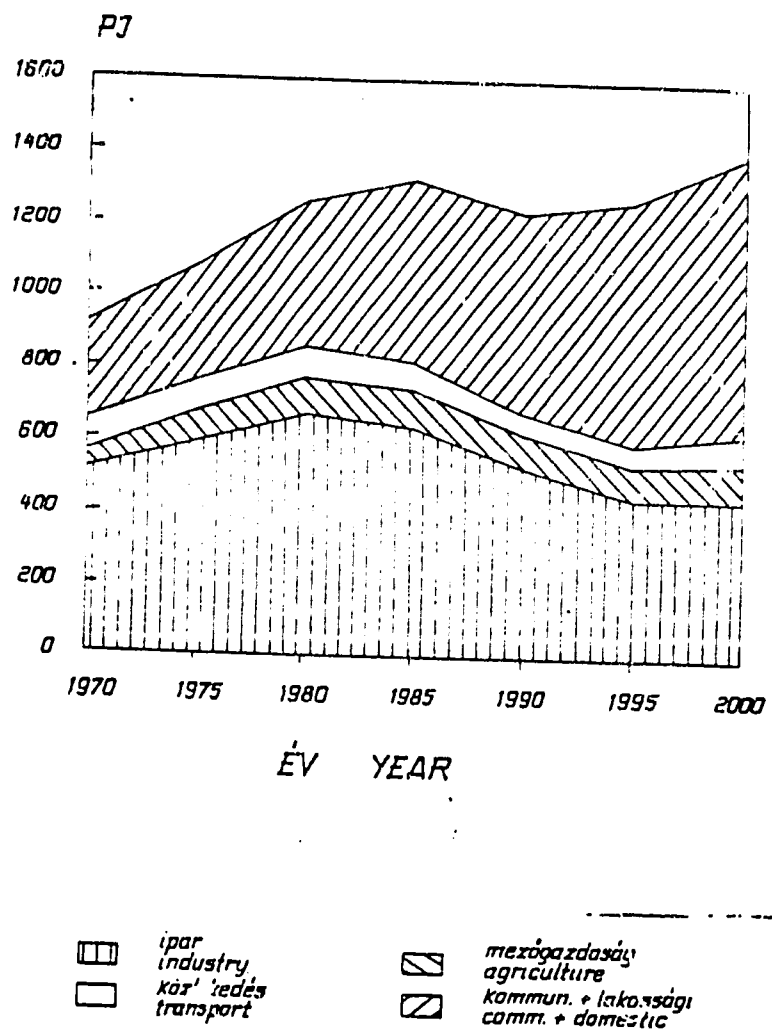


Az energiafelhasználás dinamikája ágazatonként

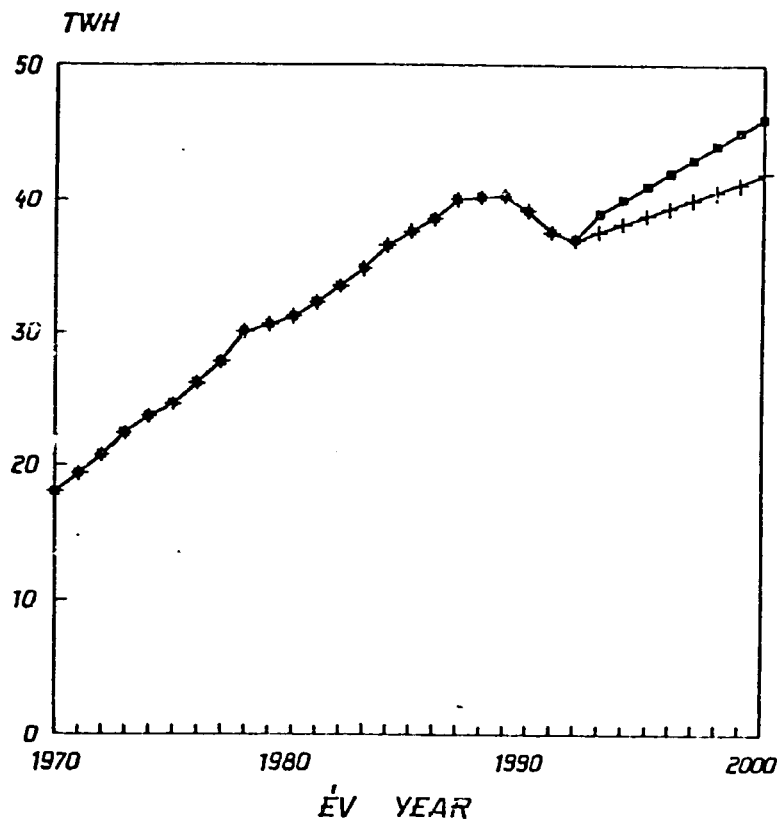
Mérsékelt növekedési ütem 1990-2000 között

Dynamics of energy consumption by branches

(Moderate expanding tendency between 1990 and 2000)



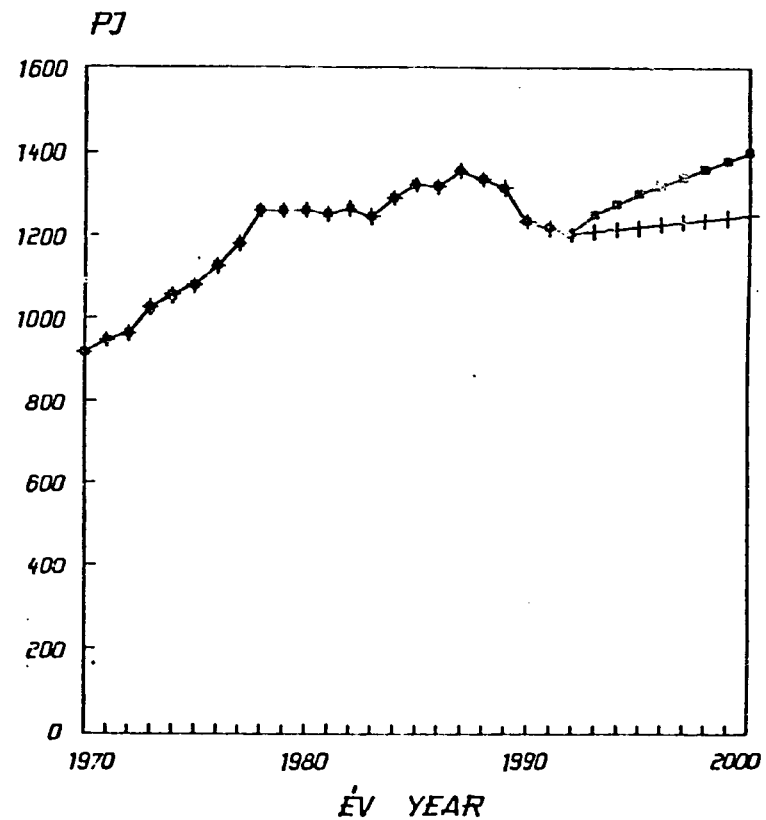
Villamosenergia igények alakulása
Tendency of electric energy demand



Mérsékelt növekedési ütem
Moderate expanding tendency

Alacsony növekedési ütem
Low expanding tendency

Az összenergia igényének alakulása
Tendency of total electric energy demand



Mérsékelt növekedési ütem
Moderate expanding tendency

Alacsony növekedési ütem
Low expanding tendency

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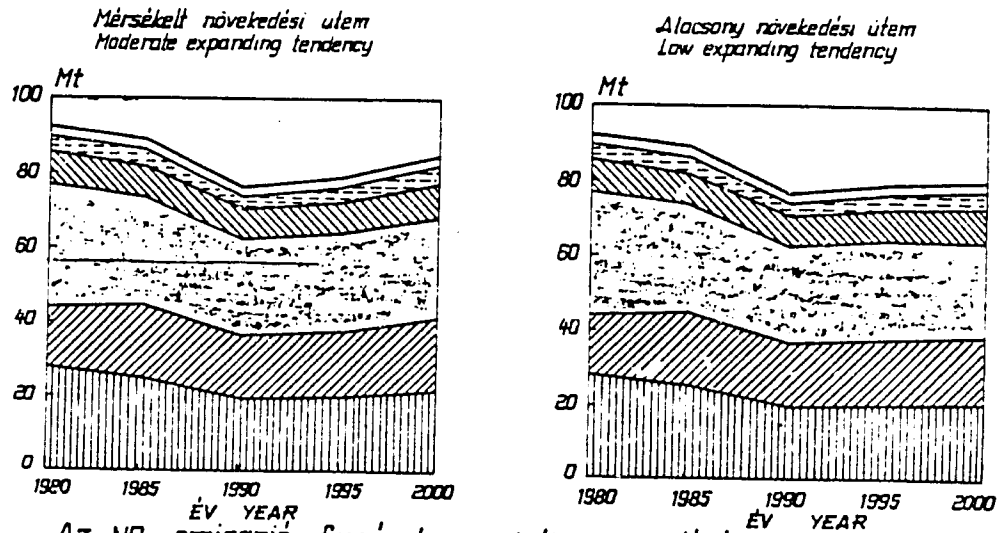
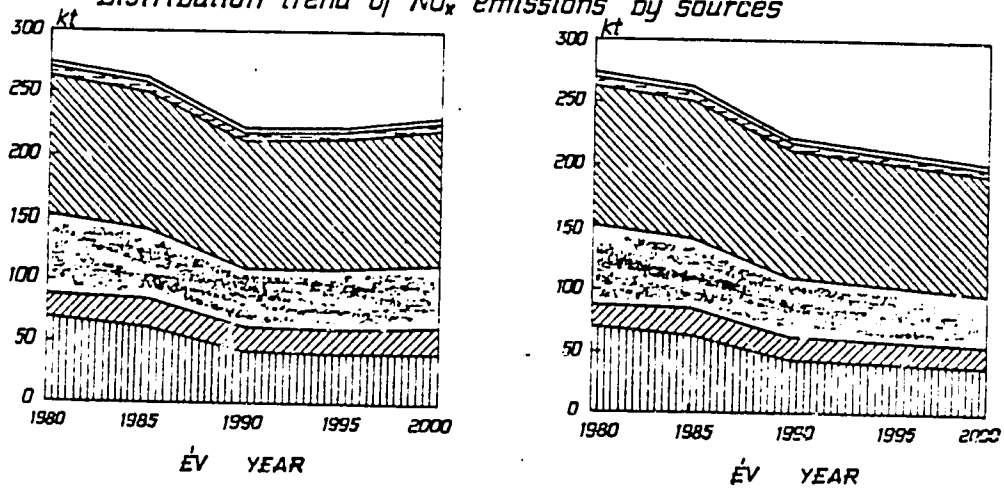
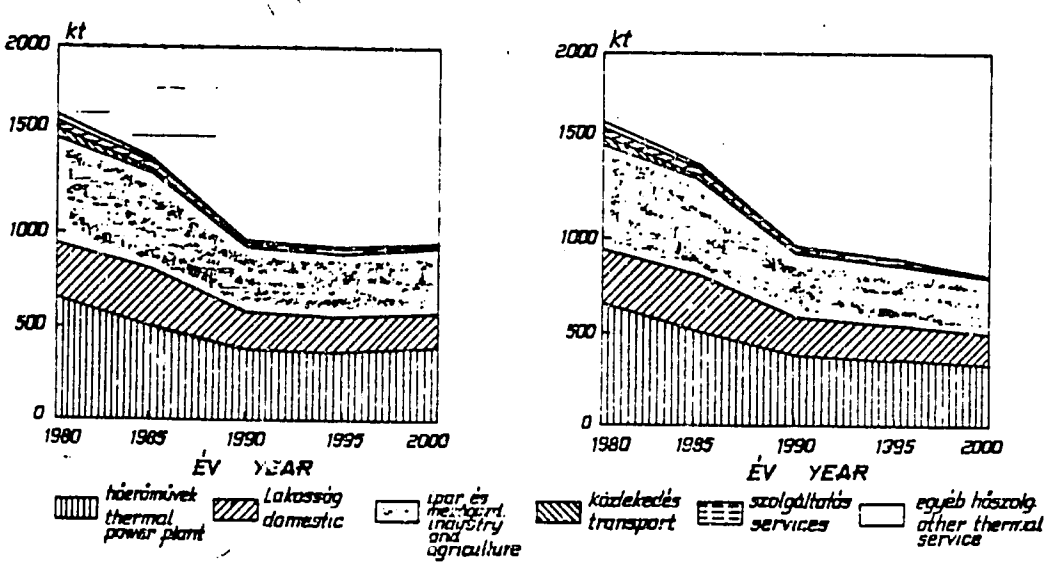
A CO_2 emisszió források szerinti megoszlásának trendje - Distribution trend of CO_2 emissions by sources



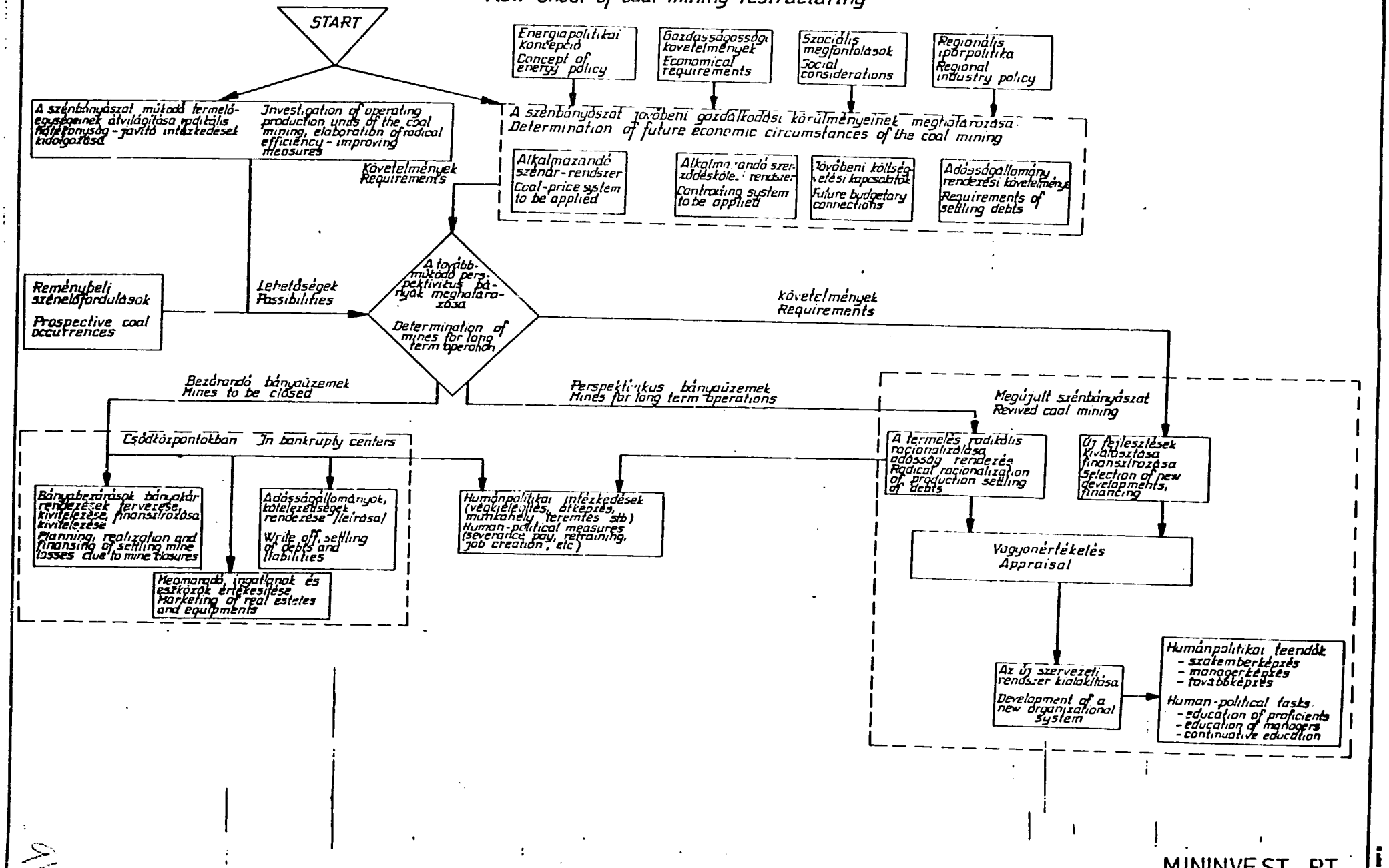
Az NO_x emisszió források szerinti megoszlásának trendje
Distribution trend of NO_x emissions by sources



Az SO_2 emisszió források szerinti megoszlásának trendje
Distribution trend of SO_2 emissions by sources



A szénbányászat szerkezetátalakítási folyamatábrája
Flow-sheet of coal mining restructuring



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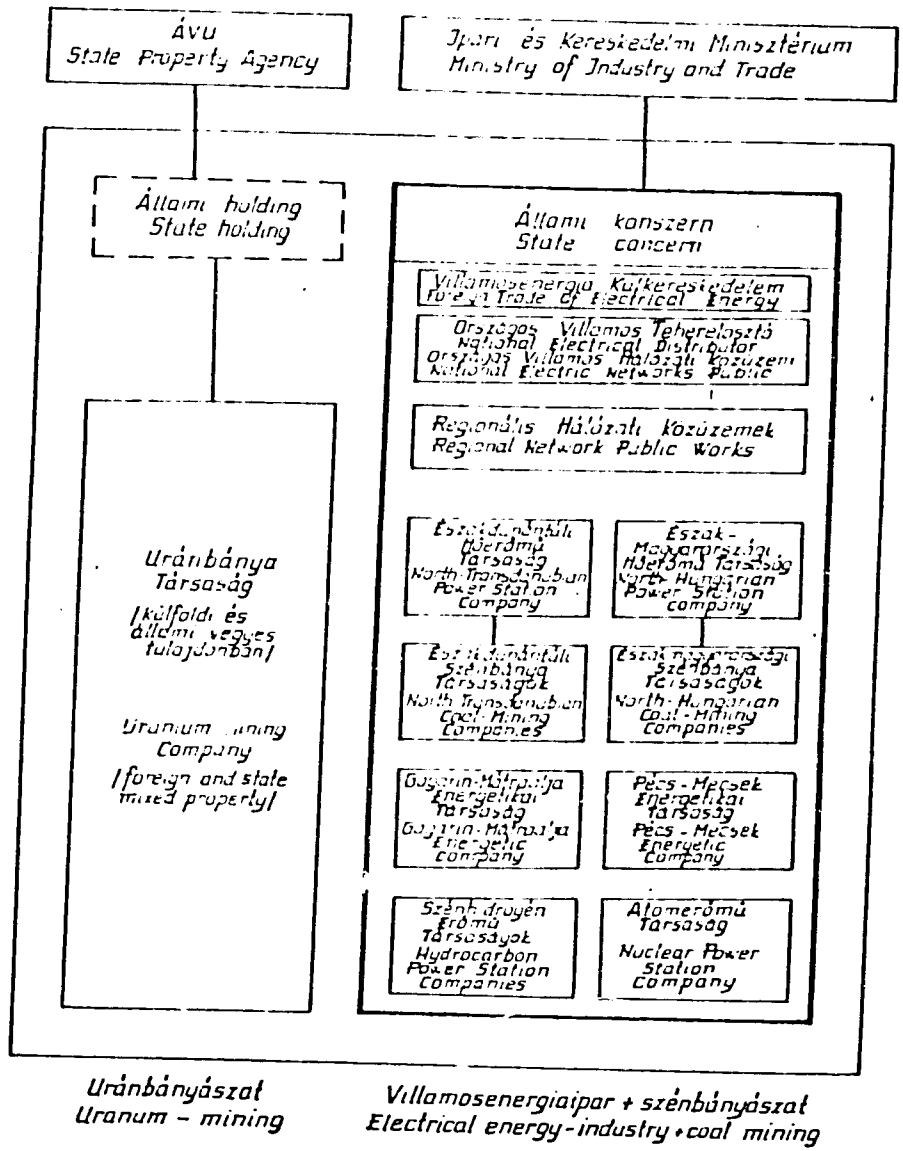
A szénbányászat tulajdonosi, irányítási
és szervezeti átalakításának
az energetikai rendszerbe illeszkedő
– a Szénbányászati Szerkezetátalakítási központ szerinti –
lehetséges alternatívái

(1991 április)

Possible alternatives
of
propriatory, control and organizational restructuring
of the coal-mining
adapted to the energetic system
– complying with viewpoints of the Coal-Mining Restructuring Centre –

(April 1991)

Alapváltozat
Basic alternative



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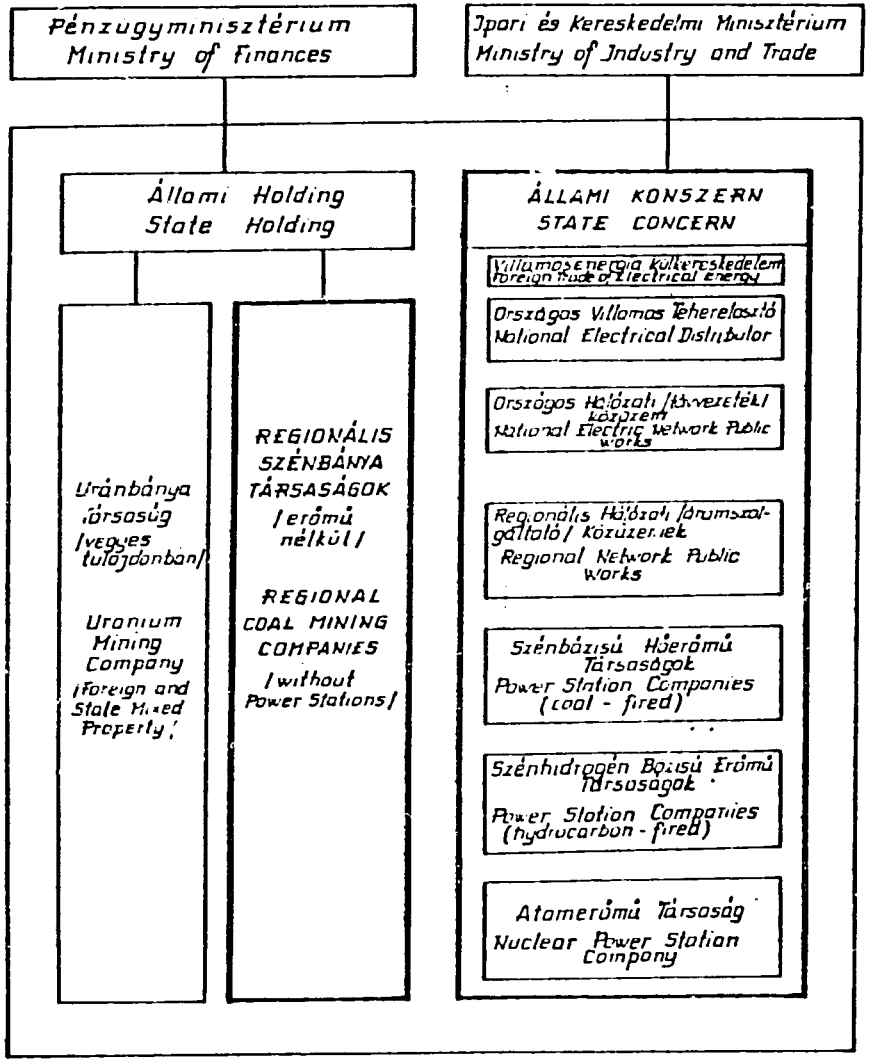
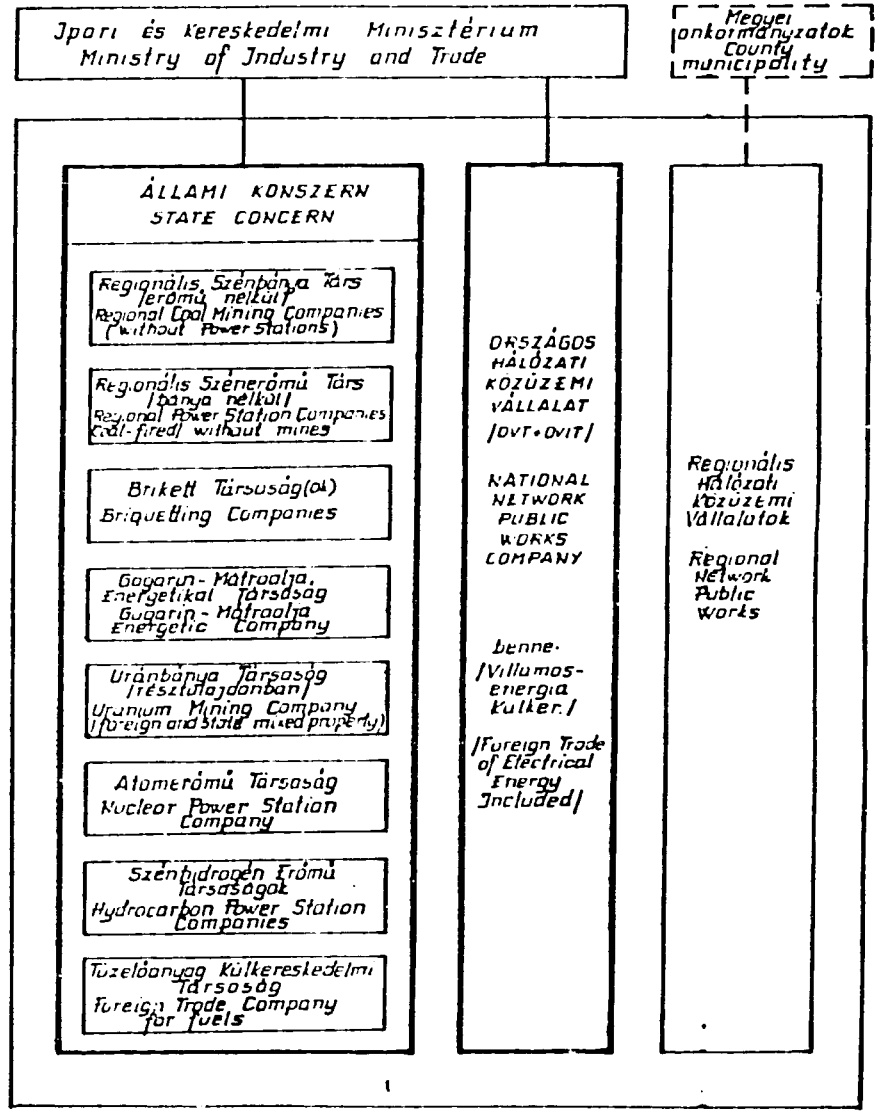
1. változat
Alternative No 1.



bányaipar
mining industry

villamosenergiaipar
electrical energy industry

2. változat
Alternative No 2



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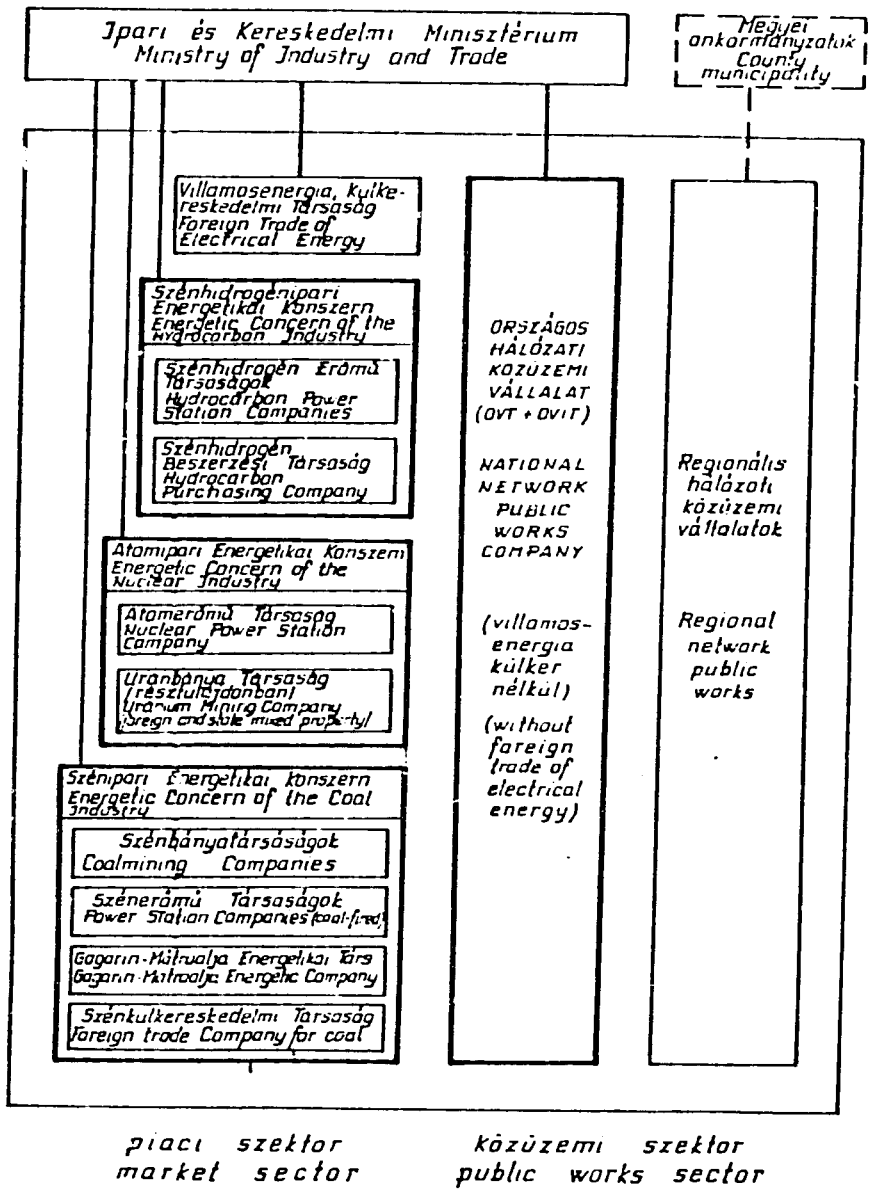
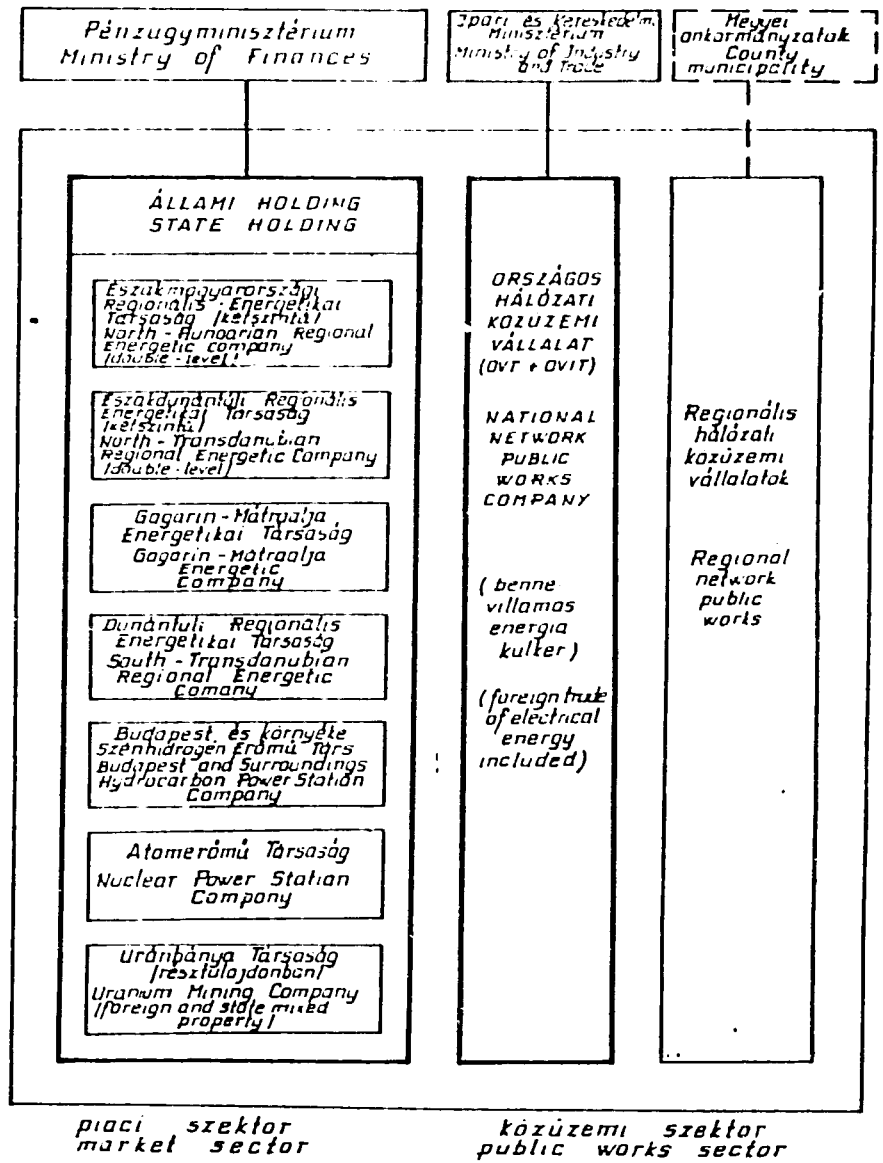
3. változat
Alternative No. 3



4. változat
Alternative No. 4



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FACTORS AFFECTING THE PRICES OF COAL USED IN ELECTRIC POWER GENERATION

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370 L'Enfant Promenade, S.W., Suite 700
Washington, D.C. 20024-2518 USA

Prepared for:

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
Emergency Energy Program for Eastern and Central Europe

May 1991

FACTORS AFFECTING THE PRICES OF COAL USED IN ELECTRIC POWER GENERATION

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Washington, D.C. 20024-2518 USA

May 24, 1991

The objective of this paper is to provide a general discussion of the economics of coal and residual fuel use in the power sector, with a focus on the factors that affect coal prices. The paper addresses the following topics:

- factors affecting coal prices in a market economy
- competition between coal and residual fuel oil in the power sector
- government intervention to discourage coal use
- government intervention to discourage oil use and encourage coal use
- alternative excise tax policies that could be evaluated by government policy makers
- the relationship between spot prices of coal and prices of residual fuel oil.

The unique conditions and problems facing the Hungarian coal industry may require a special type of coal pricing arrangement that is not usually found in OECD countries or in other market economies. Nevertheless, it may be useful for policy makers to have information on the factors affecting coal prices in OECD countries. This paper provides a general discussion of some of the coal pricing issues facing policy makers.

Factors affecting coal prices in a market economy

The price of coal in a market economy depends on the quality of the coal (energy content, ash, moisture, sulfur, and other specifications), the location to which the coal is to be delivered, the duration of the coal supply agreement (spot or contract), the date of delivery, the date of the agreement, and other terms and conditions of the coal supply agreement. Obviously there is no single price that can be called the "international price" or "market price" of coal.

For some commodities it is possible to have an "international" price, however. The concept of an international price may be illustrated by prices of precious metals, which are determined by worldwide supply and demand. A market price can easily be identified for gold, silver, and platinum because these metals are regularly traded on the London Metal Exchange and on other exchanges. Precious metals are so valuable that their shipping cost is a small fraction of the price at the point of delivery to the purchaser. Therefore, on any given day the price of gold is practically the same in New York, London, or Hong Kong. Prices are published daily in business newspapers in these cities. Gold prices are global; even the black market price of gold in the Brazilian jungle is very close to the price of gold on the London Metal Exchange.

Why is it so difficult to determine the market price of coal, when it is so easy to determine the market price of gold, silver, or platinum? There are six reasons:

1. Coal is much less valuable per unit of weight, and therefore the shipping cost is a large fraction of the delivered price. The type of transportation involved and the precise route are very important factors.

2. Coal is not an element such as gold or a simple chemical compound such as methane or propane. Coal is a mixture of hydrocarbons and non-combustible chemicals, and the hydrocarbon molecules are large, diverse, and complex. Coal specifications very according to ash content, moisture content, sulfur content, heating value, and other parameters.

3. The lower the coal quality, the smaller the geographic market for the output of an individual mine. For lower quality coals used in power generation, the cost of shipping the coal must be compared with the cost of transmitting "coal by wire" (i.e., electricity from coal). In some situations a mine-mouth power plant is built because it is not worth shipping the coal at all. When oil and gas prices are low, high-cost and low-quality coal resources may become completely worthless. These issues simply do not arise in the gold market. Because it is so easy to transport gold, the geographic market for gold is global.

4. Boilers and furnaces are typically designed for a specific type of coal and cannot be switched to a very different coal.

5. Coal transportation facilities are often dedicated to coal shipments along a specific route. Long-term contracts may be needed to recover the investment in transportation and coal handling facilities.

6. Coals with a low sulfur content and low ash content command a premium price because these properties lower the cost of compliance with environmental regulations, and create less pollution in regions where sulfur removal equipment or stack gas precipitators are not required by environmental

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regulations. The environmental "premium" in the price of low ash, low sulfur coal varies from one region to another depending on the seriousness of the pollution problem and the strictness of the environmental regulations.

Because brown coal and lignite account for a large share of Hungarian coal production, all of these issues are relevant to the Hungarian coal industry.

Competition between coal and residual fuel oil in the power sector

In many countries coal is used as a substitute for residual fuel oil in the power sector because coal-fired generation is less expensive or less risky from the utility's viewpoint. In some countries, such as India and China, coal is considered the preferred fuel for power generation. In the United States, coal is the preferred fuel among the electric utilities located in and near the Appalachian coal fields. Some electric utilities in the United States use coal for intermediate generation as well as baseload generation and have been able to meet over 98 percent of their annual energy requirements with coal.

On the other hand, there are many countries in which coal is not competitive with the least-cost form of baseload power (nuclear, hydro, residual fuel oil, natural gas, or perhaps geothermal). Many electric utilities have been operated efficiently without using any coal at all. In some cases, power generation from residual fuel oil is cheaper than power generation from coal.

Obviously the level of coal and oil dependence in the power sector is not purely a "market" decision; it is influenced by tax policies, import policies, and other forms of government intervention. To briefly summarize the economics of coal use in the power sector, however, it is useful to characterize the simple case in which the government takes a perfectly neutral position on the coal-versus-oil question. Under these conditions there are four reasons why an electric utility may prefer coal:

1. In existing power plants capable of burning coal or oil, the delivered cost of coal may be lower than the delivered cost of residual fuel oil. This situation is very common in countries with low-cost, high-quality domestic coal resources. Even in regions when oil is normally cheaper than coal, there may be periods when residual fuel prices are higher than coal prices. For example, in August 1990 through December 1990, when oil prices were high as a result of the Gulf conflict, international coal prices were more competitive relative to oil.

2. When a utility has a choice between generating power from an existing coal-fired power plant or an existing oil-fired power plant, the utility will select coal if the variable cost of coal-fired power (the fuel cost plus variable operation and maintenance cost plus variable cost associated with transmission losses) is lower than the variable cost of oil-fired power. This situation is likely to arise

in off-peak seasons of the year, in years in which the utility has a high reserve margin, and in off-peak periods.

3. When a utility faces a decision whether to build a coal-capable power plant or merely an oil-fired power plant, the utility may develop long-term price projections under which the projected cost of power generation from coal may be cheaper than the projected cost of power generation from oil. To develop a capacity expansion plan the utility may look at several different sets of price projections and assign probabilities to each scenario. The expected net present value of revenue requirements may be minimized by a capacity expansion plan containing a new coal-fired power plant.

4. When a utility faces a decision whether to build a coal-capable power plant or merely an oil-fired power plant, the utility may select the coal-capable plant because it is less risky, i.e., it provides a form of insurance against the risk of paying very high prices for oil. In market economies, spot coal prices are influenced by oil prices but do not rise to the GJ equivalent of oil prices during periods when oil prices are very high. Furthermore, long-term coal contracts provide a form of insurance against the risk of paying high prices for spot coal.

All four of these situations may arise in a country with domestic coal resources. If domestic coal is of low quality or if the country is not near the major coal-importing countries, domestic coal will be much more competitive with residual fuel oil in the domestic market than in the export market. Thus the unregulated marketplace has a tendency to support domestic use of coals that are not competitive in international markets.

Coal use can arise in the power sector of an oil-exporting country, even if the country does not have its own coal resources. In an oil-exporting country, the electric utility may develop a set of price projections for oil and coal under which it is better to build a coal- and oil-capable power plant than merely an oil-capable plant. Egypt is in this situation, for example.

Government intervention to discourage coal use

The free market price of coal does not fully reflect the environmental costs of coal mining, processing, and use. When a coal-fired power plant pollutes the air, for example, the consumers of the electricity do not pay for the damage caused by the air pollution, unless the government intervenes on behalf of the people who are most severely affected by the air pollution and by the acid rain caused by air pollution.

The use of coal in eastern European and in the Soviet Union has caused serious environmental damage in terms of air pollution, water pollution, and destruction of soils and forests. Government policies which assign the cost of environmental cleanup and pollution control to the users of coal, or the users of electricity generated from coal, will

tend to discourage coal use and make residual fuel use more attractive for the power sector. It is sometimes cheaper to retire an older coal-fired power plant and replace it with a brand new plant, which may not be coal-fired, than to try to rebuild the older power plant to make it comply with environmental standards.

Because coal mining and coal combustion raise serious environmental problems, many OECD governments have implemented environmental policies that favor natural gas over coal, and some governments also favor residual fuel oil over coal. Very strict environmental regulation (in southern California, for example) tends to discourage even the use of low-sulfur residual fuel oil, but moderate environmental regulation tends to favor low-sulfur residual fuel over coal. Permits for construction of coal-fired power plants or coal mines can be withheld on the basis of environmental concerns.

Governments may indirectly discourage coal use by developing policies that tend to favor the use of residual fuel oil. When export markets for residual fuel offer low ex-refinery prices, or are not accessible, the government of a country may want to encourage residual fuel oil consumption to maximize capacity utilization at refineries that have been designed to yield a high fraction of residual fuel. This is probably not a very good long-term policy, because it can lead to sub-optimal patterns of investment in the refining sector, but the maximum utilization of existing refining capacity is a legitimate policy concern in a transitional period such as Hungary's transition to a market economy.

Government intervention to discourage oil use and encourage coal use

Governments sometimes enact laws and regulations to encourage use of domestic coal, and conduct research programs (through ministries or through the International Energy Agency) to promote coal utilization. Because environmental issues are a major concern, some governments use general tax revenues to fund research and development on technologies for "clean" coal utilization. These research programs are aimed at increasing the level of coal use by developing technical solutions to environmental problems.

There are several reasons why a country might adopt policies to promote coal use:

1. Oil price risk. Coal-burning capability and access to coal resources provide a form of insurance against the risk of paying very high prices for oil. From a government perspective, high oil prices may lead to higher inflation, a trade deficit associated with oil imports, and other macroeconomic problems. An individual company such as an electric utility has no incentive to buy "insurance" against these destabilizing factors in the overall economy.

   In the 1974-1980 period this argument was often presented by the United States Department of Energy and by the International Energy Agency. The need for "energy independence" was cited as a rationale for increased coal utilization, including production of synthetic oil and synthetic gas from coal.

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2. Balance of trade. When domestic coal is used as a substitute for oil, coal makes a positive contribution to the trade balance. In a trade deficit situation or a weak fiscal situation this consideration can be very important. If a higher level of imports of power generation equipment is necessary to displace oil with coal, the trade benefit associated with domestic coal use may be deferred or may even be nonexistent.

   A related argument is that the exchange rate applied to oil imports understates the true cost of oil to the economy when the currency is not fully convertible. According to this argument, some sort of economic penalty on oil consumption is needed to reflect the true cost of imported oil to the economy.

3. Energy security. An oil-importing country with domestic coal resources may regard coal utilization as a form of "energy security," i.e., protection against physical disruptions in the supply of imported oil. For example, South Africa's coal gasification and coal liquefaction programs might be justified on this basis. If the Adria pipeline were destroyed, energy security would be a valid concern for Hungary.

4. Stable employment. If the domestic coal industry employs a large number of workers, the government may want to stabilize coal industry employment or prevent a rapid drop in employment. Germany and the United Kingdom favored such policies during the 1970s.

5. Political sensitivity. In some countries the coal mining industry may simply have political power and have the ability to protect the miners' interests. In this situation the government may enact protectionist legislation, such as duties on imported coal and imported oil, as well as legislation favoring coal utilization over oil utilization.

If one or more of these issues becomes an important factor in energy policy, the government of a country may create incentives for coal use. Although it can be argued that this form of government intervention is harmful to economic development, it is nevertheless common in market economies. An analysis of the first four issues would be considered perfectly "normal" in the context of western European energy policy.

Alternative tax policies

Excise taxes and customs duties are commonly used in market economies as instruments of government policy, when a policy decision has been made to discourage use of certain commodities. Taxes on gasoline are perhaps the best-known example; they discourage automobile use in cities and they encourage use of fuel-efficient vehicles.

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From the standpoint of government policy, one method of making the cost of electricity reflect the environmental cost of coal used to generate electricity is to impose a tax on coal combustion. The tax could be calculated on the basis of tons of ash released from stack emissions, tons of sulfur dioxide released, tons of nitrous oxides released, and other variables. If global warming is considered relevant, a tax on carbon dioxide emissions could be imposed. In theory there could be several taxes - one for each pollutant. A simpler scheme would be a single tax per GJ of energy from coal.

Because a tax on coal use raises the cost of electricity, it is not likely to be regarded favorably by electric utilities and other users of coal. It would be particularly difficult to establish such a tax during a period in which tariff increases are needed simply to cover the cost of generating, transmitting, and distributing electricity.

Tax policies may also be used to reduce a nation's dependence on oil, by discouraging oil use. The simplest form of incentive to substitute coal for oil is a tax on residual fuel oil, which exists in Germany. Because this type of tax raises fuel costs in the power sector, it is against the interests of electric utilities and large industrial consumers of electricity. A tax on residual fuel oil would be favorable to the coal mining industry, however.

Although any form of excise tax on oil consumption tends to be opposed by oil companies, it is not necessarily beneficial to the oil industry to concentrate the petroleum excise tax burden on gasoline and middle distillates. Shifting a portion of the tax burden to residual fuel oil will increase domestic demand for gasoline, aviation fuel, and middle distillates but reduce domestic demand for residual fuel oil. In most countries an analysis would be needed to determine the net effect on the profits of refining and marketing companies. In Hungary it is difficult to export residual fuel oil and therefore the best short-term tax policy is probably one that places the tax burden on the most valuable petroleum products. In the long term, however, this tax policy may need to be reconsidered because Hungarian refiners may be able to export residual fuel or eliminate residual fuel production (and increase production of middle distillates).

If the Hungarian brown coal mines were shut down and natural gas supplies were inadequate to displace residual fuel oil, the power sector would be forced to use residual fuel oil, imported coal, or imported electricity. In this situation a shift in the tax burden toward residual fuel and away from gasoline and middle distillates could be beneficial to the oil refining and marketing industry.

Spot prices of coal and residual fuel oil

When an electric utility in the United States decides to build a coal-fired power plant, the normal methods of coal procurement are to sign a long-term contract with one or more coal mines, or to build the power plant next to a captive (utility-owned) coal mine. However, if a proposed power plant is designed to burn high-quality coal and has the rail or barge or port facilities needed to receive coal from a variety of mines producing high-quality coal, it

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would be possible to rely entirely on spot market supplies of coal. This approach to coal procurement would expose the electric utility to greater risk of fuel price fluctuations, relative to a mix of spot and contract coal, but it would be possible.

If an existing coal-fired power plant is very old, it may be used for intermediate generation rather than baseload generation. Reliance on spot markets may be preferable to a long-term contractual commitment if the plant is nearing the end of its useful lifetime. If the power plant has the rail or barge or port facilities needed to receive coal from a variety of mines, a pure "spot" supply is not only possible but desirable.

In either case - the new power plant or the existing power plant - the spot price of coal is normally based upon coal markets and not residual fuel oil markets. If the power plant is located inland and is not accessible by barge or by ship, residual fuel may not be competitive with coal because it may be expensive to move a spot shipment of residual fuel by rail. To ship coal, the railroads prefer to amortize their investment in rail cars and track by negotiating long-term transportation contracts.

Spot prices of coal are determined by the supply and demand for coal. There may be power plants whose owners are not willing to pay a delivered coal price higher than the price of residual fuel oil, but these power plants are not necessarily "on the margin." They are not necessarily the ones who would buy more spot coal if the spot price of coal were slightly lower, or the ones who would buy less coal if the spot price of coal were slightly higher. This situation arises because spot coal is typically cheaper than residual fuel oil, and because a lot of spot coal is delivered by rail to locations where residual fuel would have high shipping costs.

In Hungary, one approach to setting the price of domestic coal used in the power sector is to compute a value for the coal on the basis of the price of residual fuel oil. In recent months the relationship between actual coal prices and residual fuel oil prices in the power sector has not been a simple one, however.

In the context of the debate over alternative methods for pricing Hungarian coal, it may be useful to identify the conditions under which spot prices of coal will equal spot prices of residual fuel oil, in a market economy. There are three necessary conditions for spot coal prices to consistently track residual fuel oil prices:

1. The delivered cost of coal, including a return on capital investment, must be equal to or greater than the equivalent of the price of residual fuel oil, in Ft/GJ.

2. Coal producers must be able to at least cover their operating costs when spot coal is priced at the equivalent of residual fuel oil.

3. Transportation facilities must be available to deliver residual fuel to locations at which it displaces coal use. In this situation the value of coal to the purchaser

is no greater than the cost of the residual fuel that would be used to displace coal. There are two possible options:

a. Transportation facilities are available to deliver residual fuel to all of the coal-capable boilers.

b. Transportation facilities are available to deliver residual fuel to some of the coal-capable boilers, and there is enough excess capacity in the system to permit the remaining coal-capable boilers to be held in reserve.

The first condition appears to prevail in Hungary, but the second condition is debatable. The third condition may not prevail during peak periods. If the third condition is not present, it may be appropriate to divide MVMT's coal supply into two categories:

1) a portion that can be displaced by residual fuel oil, and is priced at the thermal equivalent of residual fuel oil

2) a portion that is priced on the basis of production cost, or is priced at the thermal equivalent of the imported coal supplies that would be required to displace it.

This discussion of coal and oil prices merely addresses the relationship between spot prices of coal and oil. Coal prices in long-term contracts may be higher or lower than spot prices.

The value of a proposed coal contract to an electric utility can be measured by the expected net present value of its avoided cost. An electric utility negotiating a coal contract will not be willing to accept terms which raise the present value of payments for coal above the maximum amount of cost reduction that the utility would achieve if the coal had zero cost. This maximum equals the present value of revenue requirements associated with the least-cost alternative to the proposed coal supply, minus the present value of revenue requirements that would be associated with the proposed coal supply if the coal had zero cost. Obviously this calculation involves speculative assumptions about future prices of oil and other alternatives to the proposed coal supply. A long-term contract is negotiated on the basis of the buyer's expectations and the seller's expectations about the future.

The point of this discussion is that a close linkage between coal prices and residual fuel oil prices is possible under certain conditions, but these are not the normal conditions prevailing in market economies. Normally a coal-burning electric utility purchases a mix of spot and contract coal, and normally spot prices of coal are based upon coal market conditions rather than spot prices of residual fuel.

MINISTRY OF INDUSTRY AND TRADE

HUNGARY

PRESENTATION FOR THE GOVERNMENT

Re: Information for the Parliament on the Government's Energy Policy

Budapest, June 1991

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INTRODUCTION

Hungarian Energy Policy Following the Change of Political System

The new Hungarian energy policy under development is to provide for the implementation of the secure, rational and economic long term energy supply of the country. The social changes and new international relations, as well as the transformation of the economy, have called for a change of the principles and practice of previous energy policy, the essence of which had been state control through central subsidies and planning.

The major elements of the new Hungarian energy policy are:

- The elimination of one-sided energy import dependence — which results in economic dependence — and the realisation of import source diversification opportunities.
- The improvement of energy efficiency, partially through encouraging energy conservation, and partly through influencing the restructuring of production.
- The establishment of market conditions in energy supply, and the development of a liberalised pricing policy reflecting relative international values. (Which will not only assist economic clear-sightedness, but also serve as a basic factor in the motivation of rational energy conservation).
- Searching for low capital cost solutions and economic means of supply, and the creation of a flexible energy system, adaptable to demand, which promotes such solutions.
- The assertion of environmental protection priorities in the field of energy.
- Involving the public in decisions concerning the development of the system which have an impact on the whole society, and making all efforts to reach social consensus.
- Developing new organisational and control formulae corresponding to the market economy and hindering the workings of monopoly interests.
- Limiting State intervention to a justified and necessary level.

The availability of adequate supplies of energy sources for the operation of the society is the basis of economic development and improvement of living standards. However, energy supply is only a prerequisite of operation and development, and its ability to influence the economy is limited. That is why the objective of energy policy may not be more than an endeavour towards ensuring secure and economic energy supply. Economic development can be realised as a result of the energy-consuming manufacturing sectors operating efficiently, at international standards. The competence of the energy supply system in that area is only limited.

This material summarises the energy policy of the Government up to the turn of the millennium, but the principles and objectives presented here are the outcome of analyses and considerations relating to a much longer time span.

I. ECONOMIC POLICY, ENERGY POLICY AND THE ROLE OF THE GOVERNMENT IN THE ENERGY SYSTEM

In a market economy, comprehensive economic policy which defines the relationship between the state and the economy is indispensable. The energy policy is an essential part of the economic policy and both the economy and society depend on energy supplies, which are paramount from the points of view of production, living standard and social welfare. That is why energy policy should not place constraints on the operation of the economy or on the living conditions of people.

Energy policy forms the basis of a governmental level strategic programme ensuring the availability of energy indispensable to the undisturbed functioning of the society, and the economy. The most important elements of that energy policy bring to fruition the requirements of safety, environmental protection, reliability, and minimisation of costs. At the same time the possibility of social control is assured through public information, and the energy policy contains flexible solutions which enable the energy system to accept various changes and to adapt to different demand levels.

Energy policy on a regional basis must be compatible with the Government's regional policy. The development of the energy system, as a basic infrastructural system may not be independent of other regional development decisions.

Although energy policy on the basis of economic and legal norms fits into the general framework of economic policy, it needs a greater government role and greater state intervention compared to other spheres of the economy, the reason for which is that this sector has certain special elements, like natural monopolies, majority state ownership, etc. However, the regulatory measures used for central control should not limit the entrepreneurial decisions of the players in the market, but should only create a legal environment for those. Furthermore, the energy policy must guarantee the compliance with quality and environmental standards, represent the nation's interests and establish a pricing policy for transmitted energies which enables the suppliers to run a self-financing operation at a low cost.

II. THE ECONOMY AND ENERGY

Review of the Situation

After 1987 the tendency of increase in the country's energy consumption changed. The years between 1988 and 1990 can be characterised by the continuous and significant — on average 3% per annum — decrease in energy consumption. In 1990 the nation's energy consumption equalled 1235 PJ (equivalent to 29.4 M tonnes of oil). Such a low figure has not been recorded since 1977. Also the dynamic growth of electricity consumption had slowed by the end of the 80's, and in 1990 a fall (to 39.5 TWh) was observed. The slowing down, the stagnation and, in 1990, a significant decline in the development of the economy played an important role in the change in energy demand.

The absolute level of our total national energy demand is high compared to that of the Western countries. (In comparison based on purchasing parity we use twice as much energy to produce one unit of GDP as do the developed market economies.) Since 1973, the first oil-crisis, the rate of specific energy consumption (quantity of energy required to produce one unit of GDP) decrease has been rather slow (1% per year), much slower than in the developed countries (2-3% per year).

Also, the absolute level of our electricity intensity is very high, 1.5-2 times higher than that of the developed Western countries. In Hungary specific electricity demand increased at a rate of 1% per year, in the 80's even reaching 1.6% per annum. This is in accordance with international trends, as the modernisation of the developed market economies was achieved with an increase in their electricity consumption, while simultaneously decreasing their specific energy use. However, while this process was coupled with the rapid growth of the economy and improvement of living standards in those countries, in Hungary inefficient economic structures and wasteful energy use - with no positive effect on the quality of life - was preserved.

The low energy efficiency of the Hungarian economy is primarily the result of low profitability and the high material and energy-intensive, obsolete structure of production, oriented mainly toward the undemanding Soviet market and difficult to convert for other markets. The energy policy of the previous period also contributed to the economic problems. This policy - based on the belief that the Soviet Union's energy sources are inexhaustible - applied the strategy of resource development which meant the uncritical satisfaction of all demands. The bad pricing system, the government's subsidy policy, the elimination of the law of demand and supply, the monopolistic character of centralised power companies, and the partial central financing of investment, encouraged no-one to take advantage of energy conservation opportunities. Even the centrally initiated conservation programmes of the 80's could not significantly help this situation. That is how energy policy contributed to the establishment of an underdeveloped, energy and material intensive industry.

In summary, it may be stressed that beside an economy and energy policy ignoring ecology and resulting, in individual areas, in oversized energy supply systems, a society with barely any environmental and conservation awareness has also been formed. From the point of view of the future development of our energy system, it is extremely important that the citizens of our country recognise that energy conservation, and protection of our natural environment are national interests. Only such an approach can help to conserve enough energy to reduce or avoid capital-intensive developments and the need for additional environmental investments, and decrease our dependence on energy imports without risk. It must be realised that improvement of energy efficiency is mainly dependent on modernisation (partly through the renewal of production facilities using energy saving

technologies, and alongside that the increase of profitability partly through supplying a satisfactory range of efficient energy consumption equipment, and finally changes in behaviour that require the introduction of a pricing system that encourages energy-saving).

Forecast for the Turn of the Millennium

It is not possible to prepare "accurate" national and regional energy demand forecasts — so characteristic of the planned economy — for long periods because demand is a function of the growth of the economy, of the changes in the requirements of society, of technical development, and also of the measures taken to improve the efficiency of energy consumption. We need to find a new path, the more so as there is no example in history for the transition of a country from a low efficiency planned economy to a market economy in which the law of the marketplace forces greater efficiency. It seems to be reasonable to split the period to the turn of the millennium into two parts. The first may be characterised by the transition, and the second by the gradual evolution of market conditions.

Taking the four year economic programme as a base, the continuation of the recession may be expected in 1991 — greatly dependent on the demand and solvency of the Soviet market. Following this nadir the economy may step on the path of growth and by 1993 GDP may reach the level of 1989. In line with that, we find it probable that electricity and total energy demand by 1993 will be somewhat lower than it was in 1990 (1200 PJ, and 38 TWh respectively). The new economic structure - the outcome of a three year process - may then serve as the basis of a progressive period in which the market forces may operate, and the positive effects of improving energy efficiency are realised.

The forecasts for the period between 1993 and the turn of the millennium may be expressed in a new flexible relationship "energy demand - energy consumption - GDP development". According to this the rate of growth of energy demand can be estimated as the sum of the specific energy demand rate and the rate of economic growth. When evaluating the potential scenarios of economic growth, it has to be mentioned in advance that the highly developed market economies reached their economic standards with dynamically increasing electricity consumption. While their specific total energy demand decreased rapidly, the total electricity intensity increased significantly. Our country may deviate from international trends only if we use all the opportunities of the transition to the market economy and restructure our economy so rapidly that the development of highly profitable but non energy-intensive fields (processing industries, services, tourism, etc.) will be possible.

It must be emphasised that in Hungary the highly energy intensive basic material industry (in contrast to the processing industry) generates only one sixth of GDP, while it uses almost 60% of the total industrial energy consumption. The specific energy consumption in the service sector is lower, only 30-50% of the consumption of the processing industries. Thus any positive change in the economic structure towards modernisation, or any efficient organisational change, will reduce specific energy consumption significantly. We based the following three scenarios on the assumption that higher economic growth makes possible a more rapid modernisation and a more significant decrease of energy intensity. Differences in energy demand growth between the alternatives are thus narrower than that for GDP.

"A" - optimistic scenario: an optimistic forecast best suited to the four year economic programme. The main characteristics of this scenario are rapid restructuring and dynamic economic growth. GDP increases at a rate of 5% per annum. Specific electricity demand increases then significantly decreases (-2.5% per annum). The decrease of total energy demand is even more significant (-3.5% per annum). Restructuring is assumed in the macro-sphere towards the tertiary sector, and in the industrial sector towards processing industries. Depending on the interdependence between economic growth and energy use, in the period 1993-2000 electricity demand may increase at a rate of 3.4% per annum, and total energy at a rate of 2.2% per annum (to reach 1400 PJ and 48 TWh in the year 2000, respectively). This scenario gives a chance for closing up the gap between Hungarian and Western levels in the long term.

"B" - moderately optimistic scenario: characterised by the elimination of obsolete production, and restructuring at a rate higher than previously but lower than that in scenario "A". GDP increases at a rate of 3% per annum. Total energy and electricity demand decreases at a more moderate rate (-2.5 and -1.0% per annum, respectively). This means that in the period between 1993 and the year 2000 total energy demand increases at an average rate of 0.[illegible]% per annum, and electricity demand increases at an average rate of 2.1% per annum (to reach 1250 PJ and 44 TWh in the year 2000, respectively). However, the implementation of this scenario would only prevent a further increase of the gap between our country and the developed nations.

"C" - pessimistic scenario: this scenario can be characterised by a relatively low, 1.5% per annum, growth of GDP. The slow elimination of obsolete production, and the protraction of the reorganisation of monopoly organisations would result in preserving the present rate of decrease in the total energy intensity and in an increase in electricity intensity (1% per annum). According to this scenario, total energy consumption would increase at an average rate of 0.5% per annum, and electricity consumption would increase at an average rate of 2.4% per annum (to reach 1250 PJ an 45 TWh in the year 2000, respectively). Hungary must avoid this pessimistic scenario. Table a. helps to review the scenarios.

In the aforementioned scenarios, the estimated total energy consumption in the year 2000 may move in a range between the 1990 level and 13% above that. Electricity consumption at the turn of the millennium may be 12-22% higher than in 1990. Based on these assumptions the probable value of total energy consumption in the year 2000 is in the range of 1250-1450 PJ (30-33 M tonnes oil equivalent), while electricity consumption may be projected at around 44-48 TWh. Several other alternatives of socio-economic development over and above the three scenarios mentioned and the effect of these upon energy consumption could be envisaged, however, it is most likely that - with regard to the transition in progress and to the main indicators of international trends - future energy needs will be within the aforementioned extreme values.

The following trends may be envisaged in the structure of energy consumption:

- the proportion of the residential-service sector increases (partly because of the rapid growth of small ventures);
- the proportion of energy sources transmitted by mains (gas and electricity) gradually expands;
- electricity - as a factor of modernisation - will play an outstanding role;
- development of mobility.

For the co-ordination of long-term energy policy matters, the Government has formed an Inter-ministerial Energy Strategy Committee

III. STRATEGIC ELEMENTS OF ENERGY POLICY

Diversification of Imports

At present 65% of our energy consumption is based on imports (10% of which is the nuclear fuel imported from the Soviet Union). The import dependence, which is the result of the moderate quantity and quality of our own domestic resources, developed historically one-sidedly towards the Soviet Union, and from the point of view of energy imports that dependence has been beneficial in the past. At the same time the undemanding Soviet market had an adverse impact on the Hungarian industry offsetting the benefits of a low energy bill by preserving the low level of development.

Because of its small volume, the decrease of coal imports from the Soviet Union does not cause supply difficulties, and it can be counterbalanced from local and other market sources. However, the problem is that the domestic combustion devices of both residential and industrial (power station) consumers, are designed for low quality coal and are not suitable for use with high quality imported coal, without its mixing with poor indigenous coals.

We are able to cover about a quarter of our 8.0 M tonnes of oil demand from domestic production, and in the previous years the balance was covered entirely from Soviet imports. However, in 1990 we were obliged to purchase about 1.5 M tonnes of oil from various sources through the "Adria" pipeline. The necessary oil supply can be provided from multiple sources if the "Adria" pipeline is better utilised and oil trade is liberalised. It is worth considering to join the oil product line connection between Schwechat in Austria and Bratislava in Czechoslovakia in order to create a regional product market as well as to implement real competition.

Nearly half of our 11 billion m^3 national natural gas demand is covered by domestic production while the balance is met by Soviet import, though domestic production is expected to show a slightly decreasing trend in the future. Import from the Soviet Union, up to a level of 5 billion m^3, is based on long term agreements but by the end of the decade the relevant contracts must be renewed. Because of the decrease in domestic production and increase in demand, as well as the need to improve the security of supply, it is a high priority task to establish the connection to the Western natural gas system. One of the short term implementation alternatives is to build a connection between Györ in Hungary and Baumgarten in Austria. Another alternative might be to reach the pipeline in Slovakia which connects the Soviet Union and Western Europe. Implementation of either alternatives would require about one year (after all the agreements have been concluded) and US $ 40 million. It is most probable that this source will be needed not later than 1994.

In the longer term — in the event of long term supply guarantees — the import of Algerian natural gas through Italy in a joint development can be envisaged, assuming that there is readiness for supply. The possibility of importing liquified Algerian gas is being studied with the neighbouring countries. Gas would be transported by sea to a Yugoslavian re-gasifying station from where the gas would be distributed by pipelines. (Of course supply guarantees would need to be assured by proper contracts.) It is also possible to import gas from the North Sea, primarily from Norway, if the necessary connection is constructed.

Our national dependence on electricity import is quite significant, too. The share of Soviet imports has exceeded 25% of domestic use in the past years and even today it is over 16%, which is high by international comparison. Such a high level of import is disadvantageous also from the point of view of reliability as sudden failure of the

import may seriously disrupt our system. It is a task of strategic importance to improve the reliability of the system by diversifying the import sources and developing the generation capacities. Realistically, the primary aim of connecting our system to the Western one is not the regular import of electricity from the West in place of from the Soviet Union, but only the improvement of the reliability of our system.

Since the connection of the former COMECON system to the Western UCPTE system is only possible under certain technical conditions, at present the co-operation between the two systems is limited to island operation and to low capacities (400-500 MW). One of the conditions of connection is that the Hungarian electricity system's energy and capacity balance be stable in the longer term and another is that capacity and frequency control practices must be performed in accordance with UCPTE standards. Power transmission lines of adequate capacity have to be constructed and investment is needed on frequency-stabilisation. (Depending on the capacity required, the technical solution and the method of international co-operation, implementation time is around 3-6 years and the investment costs around US $ 300 million). There are actually several connection alternatives. Among others a unified all-European electrical trading system may be established in the longer term, in which Hungary, due to its central geographical position, could play a key role.

Short-term Energy Supply Strategy

Energy import opportunities for the forthcoming 2-3 years are determined by the present conditions. The quantity of energy offered for 1991 by the Soviet Union in foreign trade agreements with Hungary decreased compared to that of 1990, despite the fact that payment is now in dollars. The main elements of short term procurement strategy are the following:

- to explore market opportunities for multiple-source energy import,
- to prepare and initiate the technical opportunities for multiple-source procurement,
- to explore opportunities for long-term agreements.

In the course of widening the import-base, preference should be given to opportunities in which Hungarian products or services can be used as means of payment. In this way the convertible currency demand of energy imports can be directly balanced by production.

Opportunities for the regional expansion of energy imports vary greatly according to type:

a. The transportability of coal does not limit imports and efforts should be made to procure direct imports (without agents) from the former COMECON countries.

b. At present natural gas can be imported only from the Soviet Union. The conditions for covering expected short-term demand are relatively favourable (70% of our import demand is met by contracts resulting from the co-operation in Yamburg and Orenburg).

c. Potential for oil imports from the Soviet Union is low in comparison to past years, though the balance can be obtained through the "Adria" pipeline. It is reasonable though to exploit the benefits resulting from the existence of Soviet pipelines and cheap transportation, and efforts should be made to increase imports from the Soviet Union Besides the Soviet government, reasonable agreements should be reached with the individual republics, with preference given to long-term barter type agreements.

d. The volume of our electricity import is determined decisively by the readiness of the Soviet Union to supply electricity to us. Based on the indicative list, 6.2 TWh (1100 MW) is offered for 1991 and a similar volume is expected by the forthcoming 2-3 years. The import volume should be increased through barter agreements with the Soviet Union, and through utilising the opportunities of co-operation with the neighbouring countries.

Ensuring the country's energy supply requires a direct state role in energy supply, primarily in:

- negotiating and concluding bilateral and multilateral agreements,
- establishing the possibility of multiple-source energy imports through regional co-operation,
- as well as working out the conditions for accumulating the strategic energy reserves required for the operation of the economy.

The conditions and opportunities for foreign capital involvement in setting up a domestic base load power station must be explored with governmental assistance.

Energy Pricing System

The basic requirements for the modernisation of our energy pricing system are the following:

- producer and consumer prices should follow import prices at the frontier,
- they should reflect real value conditions,
- and they should ensure sector-neutrality, seasonality, and elimination of subsidies

(Major changes have occurred in this field during the past six months, and today most of our energy prices are at the world market level.) In transmitted energy (electricity, gas, heat) the state's control and regulatory power is apparent, and this is reflected in the prices.

Producers' Prices

Producer prices of energy can be classified into two categories. From 1st January 1991 the complete spectrum of crude oil and all refined oil products are in the liberalised (free) price category, with the exception of propane-butane gas which has a regulated price. In order to establish security of supply it was prescribed that a certain portion of imported crude oil and fuel should be stored in reserves. Liberalisation of coal and propane-butane gas prices is expected during 1991, so regulatory intervention affecting those products will be eliminated. That goes together with the liberalisation of the import of coal and propane-butane gas. Electricity, gas and heat (district heat) which due to their physical properties are distributed through fixed pipelines or power lines, are in the category of state cost and price control. Prices of these forms of energy must be determined in such a way to be as low as possible but cover the costs incurred by suppliers. (This means that the long-term price levels are directly set by the state, while the tariff system is worked out by the suppliers based on energy management and profitability considerations.)

Consumer Prices

Incorporating consumer prices of energy into the market economy requires a responsible approach from the Government. Under the obligations undertaken to the World Bank to eliminate consumer price subsidies by 1993 and to establish a true market-based pricing system as soon as possible, elimination of direct and indirect subsidies is required. This has already been done with oil products and the same is expected with coal in 1991. A step-by-step approach is being applied to transmitted energies (electricity, gas, heat), with attention paid to the tolerance levels of the public and the World Bank's specifications. On the basis of social considerations we support all efforts which help to balance partially or entirely the energy bills of the poorest sections of society. A coordinated effort of responsible governmental and local organisations is required to achieve this.

Conservation and Efficiency Improvement

Comprehensive domestic research and international comparison both show equally that future energy consumption and specific energy demand will be mainly determined by the change of the economic structure, by modernisation and the improvement of production efficiency and change of product structure. Thus, a production structure with a lower energy demand formed as a result of sound economic policy will result in lower energy consumption. Stagnation of consumption in the early years is expected to be followed by measured growth dependent on the dynamism of economic growth as a result of Government supported and promoted economic modernisation, energy demand reduction and new production cultures, coupled with an increase in residential energy demand.

The most important factor promoting conservation and improvement of efficiency is prices which reflect real values. In line with the practice of advanced market economies, other measures to promote efficiency of energy use are required. The reason for this is that certain benefits of energy conservation appear on a national

economic level instead of a consumer level. Thus the pollution of the environment is reduced by energy conservation and certain additional investments can thus be avoided, and the nation's dependence on imports decreases. To promote energy conservation and improve energy efficiency measures in harmony with the market should be used. These are the following:

a. Tax allowances for developments resulting in energy conservation. The advantage of this is that the budget only gives up an income, or part of an income which would not in any case be generated without the existence of the tax allowance. Thus the tax allowance does not place an extra burden on the economy or on the budget. Another incentive may be a system of loans on favourable terms but because of the need for refinancing this means budget expenditure. (These two incentives should be offered to both suppliers and consumers.)

b. Giving corporate profit tax allowances for entrepreneurs who manufacture energy-efficient or renewable energy source utilising equipment or other such technologies. Of course, this means a decrease of tax income to the budget, but simultaneously the volume of imports decreases.

c. Reducing customs duty on energy efficient equipment and vehicle imports.

d. Providing VAT reductions for the residential sector when buying energy-efficient products. The same allowance should be given to cultural, educational, and health organisations too. In addition to that, renovations of existing buildings and efficient new constructions meeting the energy saving requirements should be promoted by financial incentives. Also the technical and financial facilities of metering at point of consumption must be established. Conservation in the residential sector should be encouraged not only by realistic prices, reflecting world market values, and tax allowances, but also by a conservation programme which offers technical assistance for conservation and represents the interests of both suppliers and consumers.

Environmental Protection

An organic part of Hungarian energy policy is the minimisation of environmental damage. Energy must be ensured for the operation of an up-to-date competitive economic structure, although it must be understood that each element of the energy chain pollutes the environment. This is why it is a task of key importance to create harmony in energy related development and environmental protection projects when the ecological balance is endangered and capital is scarce. Because of the "indirect" impact of energy use, energy conservation should be regarded as a basic requirement during the formation of the individual sectors' development strategies.

In the formation of decisions concerning energy the protection of the natural and constructed environment must be ensured an outstanding role. Costs related to environmental and nature protection, as well as changes to the built environment must be regarded as an organic part of the costs of development. The reimbursement of such costs must occur similarly to other investments, according to the rules of the market. Before we achieve entry to the Common Market the conditions for the application of Western European standards should be established.

When evaluating the economic efficiency, in the coal mining sector restructuring programme, increased emphasis should be laid on the protection of sub-surface waters, the establishment and maintenance of their equilibrium, as well as to the compatible landscape restoration of open cast mines. Further development, right through the whole cross section of oil refining is required to adapt to European standards in the field of motor and combustion-fuels. It should be emphasised that when the proportion of gas in the energy consumption increases there is a relative decrease of environmental pollution.

The environmental impact of power plant fly ash, slag and hazardous materials is significant and the costs related to their disposal increase continuously. The aim should be the ever greater recycling of these, with attention to their chemical and radiation properties. Pollution by solid particles (dust) has been reduced by efficient electro-precipitators as an organic part of the coal-fired power plant reconstruction programme. Partly as a result of this, power plant dust emissions have decreased to one third of the 1980 level. In heavily polluted regions, to meet environmental policy resolutions, it may become necessary to supply low-sulphur coal to consumers (first of all to residents) at a competitive price.

Nuclear power generation in normal operation is extremely environmentally friendly, though at the same time it could be a potentially hazardous technology. The probability of disrupted operation (malfunction or accident) is very low with up-to-date nuclear power stations and also the risk of that happening is lower than in other

industrial activities. At the same time the storage of spent fuel elements and the storage and final disposal of low and medium level radioactive wastes is difficult. Related research activities should be accelerated. Renewable energies are characterised by environmentally friendly use. Increased exploitation of renewable energy sources is justifiable for environmental reasons, too.

We have international obligations to reduce emissions of SO_2 (Helsinki Agreement) and NO_X (Sofia Memorandum). The share of power plants in SO_2 emission sources is 40%. The production and service sector is responsible for a further 40%, while the residential sector has a share of 20%. SO_2 emission was reduced by 25% between the years 1980-1990 as a result of advantageous restructuring of energy use and power station fuel structure. Our efforts to limit SO_2 emission are focused on coal-fired power plants, with the wider use of fluid bed combustion technology, which can decrease NO_X as well as SO_2 emissions. In the 1990s flue gas desulphurisation must be implemented in some of the power stations which cause the most serious SO_2 pollution. We can fulfil the obligations of the Helsinki agreement, that is we can reduce the volume of our SO_2 emissions by 30% by the end of 1993.

In Hungary 50% of nitrogen-oxide emissions are caused by transportation, 20% by the power plants and 30% by other sources. The fulfilment of the obligations of the Sofia Memorandum (according to which by 1994 we must limit our NO_X emissions to the level of 1987) is decisively dependent on reduction of emissions in the transportation sector, though the importance of decreasing NO_X emissions in the hydrocarbon fired plants by the use of modern combustion techniques is significant. In transportation the use of unleaded petrol should be promoted as well as the use of catalytic converters which simultaneously reduce lead, sulphur and NO_X emissions.

Attention should be paid to the probable development of international regulation of CO_2 emissions accompanying the utilisation of fossil fuels, with respect to the long-term changes in the structure of energy sources. Ensuring, and the methods and means of promotion of, environmental protection in the energy system should be approached in a similar way to energy conservation. Successful, comprehensive energy and environmental policy in small countries like Hungary can only be pursued on the basis of regional co-operation. Thus it is important that the environmental aspects of our energy policy should validate international co-operation.

Capital Economy, Flexible Supply Systems and Foreign Capital Involvement

As a result of previous economic policy a considerable part of the scarce available funds was spent on energy related investments. (45% of all industrial investments at the end of the 1970s and 35% in 1990.) Developments, mainly in industry, to promote the production of energy-intensive products and the investments related to these developments deprived the efficient, value producing, non energy-intensive processing industries of capital. This was true also for the tertiary sector. In the future, this pattern of allocation cannot be maintained. With the implementation of an economically oriented energy strategy a smaller portion of domestic resources should be devoted to energy related developments and wherever it is possible foreign capital should be involved. For this purpose we will create an economic, organisational, and regulatory environment which makes the energy sector attractive to foreign capital. It must be emphasised that in the past many investment projects outside the energy system have been completed in the shadow of energy-related developments. This effect should be restrained in the future.

Besides the need to conserve capital, because of the uncertainty of demand (especially in the field of power plant development) developments must be implemented using system elements which can be flexibly adapted to demand and can be built quickly. Other conditions of meeting demand flexibly are the provision for serving seasonal fluctuations of consumption, the enlargement of the circle of alternative consumers and strategic considerations. At present we are in a position to store enough oil for 30 days, our gas storage capacity will reach 2.0 billion m^3 by 1992, and we have nuclear fuel for eighteen months. Our aim is to further develop our oil storage capacity and, according to financial opportunities, to raise the level of both fossil fuel and nuclear strategic reserves. If our country joins the EC in the second half of this decade then, as required by EC standards, we will have to increase our safety reserve from the present 5% to 25% (90 days). That would mean a single purchase of 1.4 M tonnes of oil and permanent storage. With regard to low storage costs, a 4 years' reserve is desirable for nuclear fuel.

Publicity and Public Information

Because of their effect on the environment, energy related developments can be carried out only if they are accepted by both professional and general public opinion. For this reason, in the course of decision-making on the building of new base load power stations, the Government will publish all the data and expert opinions, and energy-related decision making will occur within the framework of legislation to be made public. This is the only way we can avoid the repetition of the "Bôs-Nagymaros syndrome" — that cost the country US $ 1000 Million — in other areas of energy.

In the western democracies, the approval of large energy-related developments by the public is institutionalised. As that is not to be found here, our aim is to set up such institutions as soon as possible. Over and above that, it is necessary to perform environmental impact studies which ensure the representation of professional and public opinion too. The public is insufficiently informed on energy supply and the importance of energy conservation, which is why related information, training and education activities must be augmented.

IV. ENERGY SUPPLY AND DEVELOPMENT OF RESOURCES

Coal

In recent years the technical-economic conditions of Hungarian coal mining have continuously deteriorated. At the moment the debt of coal mining approximates to the value of its assets, losses represent about 10% of income and expired financial obligations exceed Ft 6500 million. Four coal companies (Nógrád, Dorog, Borsod and Mecsek) are undergoing liquidation (in June 1991) and if circumstances remain unchanged the same fate awaits the other companies as well. The low efficiency and poor management of the enterprises were the result of an economic policy motivating only minimum achievement, a pricing system for coal and briquettes that excluded the possibility of self-financing, subsequent financial interventions and subsidies.

The present critical condition of coal-mining points to human and employment problems beyond the energy effects of future developments. State intervention is unavoidable until, as a result of a restructuring programme pursued on the basis of Government resolution, an economical coal and coal-briquette production structure is established as part of a rational, profitable and environmentally friendly structure, together with a relevant control, organisational and ownership system. Appropriate conditions (through settlement of debts, the costs of winding up uneconomic production, etc.) must be established in the course of the restructuring programme.

In 1990 deep-mine coal production was 12.6 M tonnes and open-cast production of lignite was more than 5.0 M tonnes. Based on studies to date the restructuring programme will result in production as follows from the existing mines:

- the volume of self-financing production, at mine level, will be 7.5 M tonnes (3.0 M tonnes of which will be open-cast lignite) by the turn of the millennium;
- while at company level profitable production is likely to be 11 M tonnes (3.0 M tonnes open-cast lignite). The reason for the difference is that within one company the profit of a production unit may be regrouped to one of less favourable character if the loss is temporary and the closure of the unit would cause supply problems for a power station.

A solution to the problems of the mining sector should be sought on the basis of energy supply and human policy points of view, with respect to domestic and foreign market relations and providing conditions for long-term operation.

The Position of the Long-Term Development of Coal Mining:

- For the lifetime of the coal-fired power stations it is necessary to assure the minimum fuel requirement of the power station capacities (80-100 PJ i.e. 10-12 Mt) which is in itself more than the projected capacity of the existing mines.
- It is difficult to estimate the effect of coal and briquette prices and the elimination of subsidies on the market for domestic (household) coals. Based on the gradually decreasing trend of consumption we expect that the demand will decrease to 4 M tonnes by the turn of the millennium from the present 5 M tonnes. This demand which is at present difficult to forecast (regarding both quality and quantity) will need to be satisfied by imports and competitive domestic production.

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To satisfy the demand for coal in the year 2000 (on the above basis 14-16 M tonnes), in addition to the mines which may be made self-financing at company level, the commissioning of new capacities and the expansion of import sources may become necessary. The 7 M tonne per year lignite demand of the Gagarin Power Station following its rehabilitation will be supplied from the enlarged Thorez open-cast mine (4 M tonnes per annum). Satisfaction of the 7-9 M tonnes per annum deep-mine coal demand may also require the opening of new capacities.

Preparatory to that a feasibility study for the Dubicsány mine will first be completed. With regard to the present position of the companies, it is most probable that the funds necessary to open new mines will not be generated within the sector. That is why, alongside import competition, the full-scale self-financing capability of economic coal supply (production and opening of new mines) should be established partially on the level of regional energy supply companies on one hand, and with the involvement of foreign capital on the other hand.

Hydrocarbons

Domestic hydrocarbon production peaked in 1985. Even taking into account the secondary and tertiary extraction methods with higher production rates and higher costs, a future decrease in production can be foreseen. Production of crude oil will decrease from the present 2.0 M tonnes per annum to 1.5 M tonnes annum by the year 2000, while natural gas production is expected to decrease from the current approximately 5000 m^3 annum to approximately 4000 m^3 per annum or even less, including the production of new expected gas fields.

The gap caused by the decrease in domestic production and increase in natural gas demand must be filled by extra imports. This requires, in addition to the liberalisation of oil trade introduced in the beginning of 1991, the implementation of the new comparative advantage based system in Soviet-Hungarian bilateral commercial relations, and import diversification which is the fundamental strategic element of our energy policy. We must emphasise that the uncertain Soviet imports with low guarantee value make the estimation of the structure of import sources impossible.

The major expected trends in the extent and structure of energy consumption — less capital intensive, flexible development of hydrocarbon based power stations, probably increasing mobility and the demand for improved environmental protection — require the restructuring of the oil and gas industry. Beside the primary crude oil processing requirements, developments satisfying quality requirements and increasing the depth of processing are needed. In 1990 beside the 7.8 M tonnes crude oil processed approximately 1.6 M tonnes of final products were imported. Taking into consideration the uncertainties in the future structure of crude oil and final product imports, the foreseen demand for final products of crude oil processing is estimated around 10-11 M tonnes by the turn of the millennium, while the demand for imported crude oil will be close to 10 M tonnes. The new requirements in the oil industry — diversification, product and quality improvement, unleaded petrol production — form a very wide-ranging programme which can only be implemented with the help of foreign capital and foreign ownership.

Depending on the changes in demand and possibilities of import from the USSR, an increasing percentage of Hungarian oil supply will come from other sources. By 2000 we must prepare to satisfying the bulk of oil requirements from free market purchases and through other advantageous agreements, on top of the decreasing domestic production and uncertain Soviet imports. The "Adria" pipeline provides the necessary technical facilities. However, prudence requires that possible future expansion of transport capacities should also be investigated in order to ensure the transit demand and supply security. Efforts must be made to utilise foreign concession opportunities, which could provide supplemental data sources in exchange of research and production activities.

Natural gas consumption was approximately 11 billion m^3 year in 1990 and is expected to be around 12.5-14 billion m^3 per year by the year 2000. The expected decrease in domestic natural gas production and increase of power station demand requires a considerable increase in imports. The quantity of imported natural gas was 6.2 billion m^3 in 1990, while the contracted quantity for 1991 is 5.2 billion m^3. Of the approximately 8.5-10.0 billion m^3 demand in year 2000, 4.8 billion m^3 is ensured under long-term contracts with the Soviet Union, therefore if the contracts for the late 1990s are extended, some 3.5-5 billion m3 extra natural gas import will be necessary by the turn of the millennium. This may partly come from further Soviet deliveries, partly from some other procurements, such as from some Western European or North African countries (or probably Iran) provided that proper transportation lines are built. The ratio between imported crude oil and natural gas can flexibly vary within certain limits, substituting each other as necessary, depending on the procurement opportunities and the economy.

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Beside the development of the national natural gas system, the opportunity of exploiting small isolated gas lenses must be taken up in future. This task may be solved by using closed or open cycle gas turbines for electricity generation. The generated electricity can satisfy local demand, or be fed into the national grid.

Electricity

Based on per capita consumption data, Hungary's domestic electricity consumption is relatively low. However, in terms of electricity intensity per unit of production, it is too high. This contradiction may be explained partly by the bad economic structure focused on the undemanding Soviet market, and partly by the low profitability of production, the wasteful attitude of Hungarian society and finally, by the low level and backwardness of services. It is basically determined that if the aim of the Hungarian economy is to catch up with the developed world, then two major tasks must be solved in the field of electricity consumption:

a. Electricity required for efficient and profitable production, for household modernisation and for a standard of service which is acceptable by foreign capital, must be supplied. The low level of electrification of our economy (low per capita consumption), and higher requirements triggered by modernisation will contribute to the increase of electricity consumption.

b. Electricity intensity is high, so its gradual reduction is a key condition for our competitiveness. In principle, decreasing specific electricity demand (not total electricity demand) provides an opportunity to achieve significant economic growth while electricity consumption decreases, stagnates or only slightly increases. To date, this potential has not been or has hardly been utilised. In addition to savings in consumption it is very important to use market means to influence consumers' peak demand, which is a vital factor in increasing power stations capacities.

There are many means to decrease consumers' demands in terms of both quantity and capacity, and by the partial or full implementation of these means and by establishing an economic environment promoting consumer and service interests, the potential electricity savings may be realised.

There are productive capacities in industry, both in power generation and transmission, which at present do not co-operate with the grid but operate at lower cost. Through their exploitation the development of the capacity of the present system may be put off for a while. High auto-consumption compared to internationally accepted levels, as well as distribution losses must also be considered as possible sources for electricity savings. The improvement of the grid, modernisation of transformers, more efficient operation of power plants (obviously reducing costs) are all further sources for energy saving. Also electricity distribution companies must take part in micro programmes aimed at decreasing public consumption.

Until the end of 1990 the capacity of Soviet electricity import was 1850 MW, its quantity was 10.5 TWh while in 1991 the contracted capacity was only 1100 MW and the contracted quantity was 6.2 TWh. Taking into account the decreased capacity of Soviet imports and current peak demands, the Hungarian power system has only 15% capacity reserves. This value represents the lowest limit of the necessary reserves under internationally accepted standards. The technical conditions of Soviet power plants question even the maintaining of the current contracted power quantity. Considering the age and technical conditions of Hungarian conventional power stations, domestic capacity cannot cover the peak demands should Soviet imports fail. This is why Soviet imports represent the highest risk in electrical power supply. This risk can hardly be reduced by long-term and large western imports, that is why sensible development of the Hungarian power plants becomes so important.

Due to the uncertainty in long-term forecasts of demand and in order to reduce risk during the next 6-8 years a power station development programme must be implemented which satisfies only the foreseeable short-term demands and must produce enough reserves to cover possible failures. At present 2-3 year plans seem adequate as we have technical solutions that may be implemented within such a time and the required electricity production capacity may be completed by them simultaneously with the development of the economy. During this period simple cycle or combined cycle natural gas fired power stations can be built. These are suitable for peak-load operation and specific investment costs are much less than those of nuclear and coal fired power stations. Their efficiency is outstandingly high and their impact on the environment is small. However, they increase the dependence on hydrocarbon imports, and their world market (oil) price risk is also significant.

Considering that the time required for construction of a power station is 6-8 years, preparation to build a base-load power plant must be made in parallel with utilising the possibilities offered by gas turbine based power stations, so that it could be commissioned following the utilisation of the most efficient elements of the gas turbine programme and the necessary closure of old power stations. Both the construction cost and the environmental impact of a base-load power station are higher than those of a gas turbine plant. (The per unit investment cost of a gas turbine is approximately 25-45 thousand Forint per kilowatt - depending on type, while that of a coal fired power plant is 74-80 thousand Forint per kilowatt, of a nuclear power plant is 120-150 Forint per kilowatt.) Yet its fuel cost is lower, so the costs of electrical power production are more balanced and besides, it causes relatively lower import dependence, so in summary it is more advantageous for higher power production and for supply security.

It is clear from the aforementioned facts that the right approach of the power plant development programme is the subsequent application of these two solutions.

District Heating

The quantity of primary energy sources used for heat supply is 112 PJ per year which is almost 10% of the total energy consumption of the country. Most of the heat — almost equally shared between residential/communal and industrial consumers — is produced in hot water boilers, in a very inefficient way without co-generation. As the heat supply systems can form the basis for the implementation of the gas turbine programme, the energy efficiency of district heating could be improved considerably.

One objectives of our energy policy is to increase co-generation in district heating by identifying opportunities, establishing motivation and ownership systems which help implementation, and involving foreign capital. Billing based on metered heat consumption in residential-communal heat supply must be made widely used. This requires, in addition to the technical facilities, the development of legal and technical framework.

Renewable Energy Sources

The role of renewable energy sources in the domestic energy supply (biomass, geothermal energy, solar energy, etc.) is currently insignificant approximately 1-2%. These sources of energy are environmentally friendly, their utilisation reduces our import dependence and to some extent eases the load of the national energy systems. Furthermore, they improve the security of energy supply, and reduce the dependence on national supply systems in their region. That is why all local initiatives aimed at the exploitation of renewable energy sources must be given all assistance. Local authorities can have an important role in this. Even marketability of renewable energy sources may be improved with proper economic environment and business policy, and the share of these sources could reach 5% by 2000. However, the public must be warned not to overestimate the quantitative opportunities of availability and efficiency of these attractive types of energy, at least on a short or medium term basis.

Elements of Risk in Energy Supply and Areas of Uncertainty in Resource Development

In addition to uncertain economic development and restructuring, and the difficulties in forecasting energy demand, several further risks lay a burden on energy supply. The most important of these are the following:

- the uncertainties of long-term domestic coal demand and the critical situation of coal mining;
- single source, single pipeline natural gas imports from the USSR;
- the type, unit size and the time of commissioning of the new base-load power plant (nuclear, lignite or imported coal based power plant), and the risk caused by the uncertainty of the electrical power imports from the Soviet Union.

Even specialists disagree over these three issues. A consensus of expert opinions (in the case of the base-load power plant a consensus of public opinion) may be assisted by the standpoint of the Government that supports:

- the regional fusion of power plants and mining companies into corporations;
- the establishment of conditions for multiple-source natural gas imports;
- immediate decisions following the identification of the opportunities and fast implementation — especially the establishment of a power transmission line interconnection or for connection with the Czech and Slovak Federal Republic, which will start operation in 1994, requires a fast decision;
- the implementation of the new base-load power plant, financed to a large extent by western capital and built on western technology. The issues of the base load-power station must be decided by the end of 1992 the latest, following a public acceptance. This is why connection with the western electricity system must be established as soon as possible.

V. OWNERSHIP AND ORGANISATIONAL STRUCTURE

The gross value of fixed assets of the energy sector is almost 450 billion Forints. More than 130 000 people are employed in this area. These data indicate that security of energy supply is not only a strategic issue, but energy policy decisions have a serious impact on high value fixed assets and thousands of jobs. Labour efficiency is about half or one-third of what we find in developed market economies. However, the number of employees in the energy sector has a declining tendency in Hungary too. This tendency is expected to be stronger in future. Especially in coal mining, further regional tension may be caused by the effect of structural and organisational changes on staff numbers. A significant task of employment policy is to ease the problems in these areas, by re-training, further training and creation of new jobs.

There are areas in the energy sector where market conditions can only be effective to a limited extent. They are the so called "natural monopolies", the utilities which supply non-storable energies. These companies (which at present are owned by the state) own the technical facilities required for energy supply and customers have no choice as there is no alternative supply. To prevent these monopolies from abuse, it is necessary that the activities of production and distribution companies should be open and controllable for the public and its representatives. Executive power is the competence of the Government and an institutional background must be established. It is also the Government's responsibility to ensure that the self-financing activity of companies with natural monopolies serve national interests and not extra profit generation for the company. Supervisory and ownership interests are contradictory, therefore they must be separated at governmental level, as required by the interest of the nation.

A basic requirement of the electricity system development and of the coal mining restructuring programme is that the minimum quantity of domestic solid fuels needed to operate the coal fired power stations should be ensured (to avoid the construction of new power plants with high investment cost). During the transformation of the organisation and control systems of coal mining and power generation, we propose organisational, financial and financing integration. Our standpoints concerning the integration are as follows:

- the relation between the power plant and the mine must be based on the mine producing coal exclusively for the power plant (power plant related mines),
- during the course of structural changes in coal mining, all other activities, not directly connected with coal production, must stop in these power plant related mines,
- the costs of pure-profile coal mining must be included in the price of electricity, within the limits of world market prices.

The hydrocarbon industry is at present supervised by the Hungarian Oil and Gas Trust (OKGT). Considering the strategic importance of this industrial sector (harnessing the national mineral resources), the successor institution of OKGT must be transformed into a joint stock company under the Governmental decision No.: 3149/1991. Initially 100% of the shares will be owned by the state. Later, as a result of involving foreign partners and/or issuing shares, a real joint stock company will be created. This will ensure its competitiveness with international oil and gas industry. The privatisation process requires the transformation of the present organisation, separation of public supply (public gas supply) activities and the background industry, as well as preserving the original profile and basic activities, adjusting them to meet market demands. Regulations should be developed to ensure

that the capacity of oil, gas and other pipelines, and storage facilities are available at market prices and with a proper tariff system for all those companies which are involved in the production and trade of oil, gas and their products.

At present the electricity industry is organised as the Hungarian Electricity Trust (MVMT). The ownership, operational, control and supervisory functions in the operation and organisation of the Trust are integrated, yet the monopoly and the lack of clear interests hold back effective development. That is why it is necessary to transform the organisation, ownership, and system of operation of production, transmission and distribution companies and to dissolve the present monopoly. Within this framework a transformation must be performed as a result of which the state keeps its majority in the basic areas of strategic importance. This will ensure the implementation of state energy policy and allow domestic and foreign private capital and local authority financial resources to be provided over a wide range, even at power plant level and especially in the field of services.

The most effective way of modernisation is regional integration of generation and fuel production. Within this framework the regional fusion of coal mines, which will be transformed into corporations and restructured through liquidation, and power plants as their consumers may be established. In addition to the general advantages the aim of transforming MVMT into a corporation (concern), and its partial privatisation is to improve market competition, to involve foreign capital and to dissolve the present monopoly. In accordance with legislation and government decisions in force, the transformation of organisations in the energy sector, which has been started, must be completed by the end of 1991.

VI. REGULATION AND ENERGY RELATED LEGISLATION

Although energy policy fits into the framework of economic policy on the basis of economic and legal normative principles, some special elements originating in the special features of this industry remain in regulations. For example the controlling role of the state which is a necessary result of the monopolistic character of energy companies. (This must ensure that no misuse of monopoly can occur, neither in supply nor in pricing.)

In certain areas of the energy sector the budget still levies some special individual income taxes, which are different from the general practice of corporate taxation. These partly arise from the fact that mineral resources are state-owned property (revenues from rents, mine commissions, etc.) and partly come from the state's role in constraining market conditions. The former ones will be introduced or be maintained while latter ones should be gradually eliminated by restricting the influence of the state except through consumer taxes.

In the framework of deregulation the obsolete energy related legislation was already revised last year (regulation concerning energy penalty, temperature norms, etc.). Regulations concerning the organisational and control system of energy organisations was reviewed and modernised this year, when the authoritative character of central control was eliminated in the energy sector.

In addition to the outdated regulations, some Acts were reviewed of which the modification had been prepared through proposals for the Parliament. Thus we propose the modification of the Electrical Power Act, the Gas Energy Act and the Mine Act. It is typical of the proposed modifications that they eliminate the monopolies under the sign of heading for a market economy. The planned liberalisation of coal prices requires the modification of the price regulations too. Parliament has approved the general Concession Law and the proposals for the related sectoral mining concession laws will be proposed soon. These latter ones are related to exploration and production of solid and liquid mineral raw materials and energy sources (including geothermal energy) and will replace the Law No. III/1960 on Mining.

Investigations concerning the modernisation of the organisation of the electricity industry, oil and gas industry and coal mining have begun. The first version of the organisational development concept have already been discussed and the rate of progress ensures that by the end of 1991 the new organisational structure complying with the requirements of a market economy will be established.

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EFFECT OF MATERIAL INTENSITY AND ENERGY INTENSITY ON THE EFFICIENCY OF DEVELOPMENT OF THE NATIONAL ECONOMY

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This is a contribution of the author to a conference on 'Importance of the economic utilization of materials and energy in technical development' held on May 4, 1987, organized by the Department of Technical Sciences of the Hungarian Academy of Sciences.

Adopting a combined technical-economic approach, the author presents a macro-economic situation report on the enormous field referred to in the title. By means of some diagrams, the author casts light upon the most important relationships which have determined the events of world economy in the recent 15 years and on the other hand, he evaluates the Hungarian conditions as a function of international changes called also 'changeover to a new era in world economy'.

Introduction, background, the problem posed

The problem of material intensity and energy intensity** has come to the front in the world's interest more recently as a result of repeated oil price explosions as a problem having both technical and economic implications. At that time, international actions started to hold ground against the rapid increase of production costs, efforts which resulted in the last analysis, at least in some top industrialized countries of a market-controlled economy, in favourable economic changes based on high tech of the present days. These changes are essentially an unprecedented rapid economic restructuring accompanied a rapid reduction of the material and energy intensity in production.

Although the problem has been recognized everywhere, the change has taken place in different ways and at a different rate in the different countries or groups of countries in effort to adjust the economy to the new conditions.

A typical example of this effort is an increase by about 30 to 50% of net production (or GDP) in the industrialized countries as compared with

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the value before the oil crisis while the consumption of material and energy remained more or less unchanged.

Indirectly, the same is suggested by the change in energy intensity in IEA countries (included in the organization of International Energy Agency) in the period between 1973 and 1984. According to Fig. 1 /1/, a reduction of approximately 20% occurred in this period in total energy intensity and that of oil intensity amounted to 30%. However, as seen in the Figure, the improvement occurred in majority in the period after the second oil price explosion.

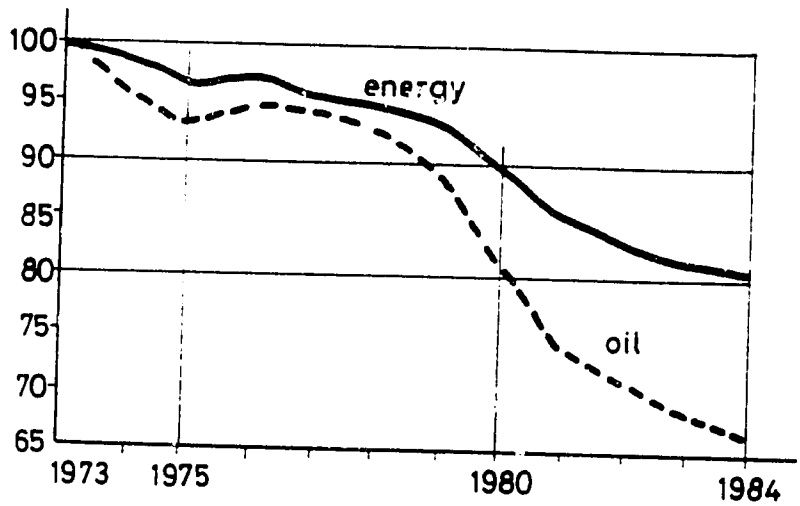

Fig. 1. Energy and oil intensity in total IEA 1973 to 1984 /1/

A reduction of energy consumption or, in other words, a reduced energy intensity necessarily implies a rationalized use of materials, first of all basic materials as the difference of some orders of magnitude (tenfold, twentyfold or even fiftyfold) between the energy intensity figures of basic material industry and processing industry is a well known fact. Hence, the energy demand and energy intensity of the national economy is fundamentally determined by the basic material producer sector in spite of the fact that the contribution of this sector to income is 'insignificant'. The conditions of home industrial production are demonstratively illustrated by the figures tabulated in Table 1 (indicating only approximate numerical values for the most important characteristics). On the basis of the Table, the difference between basic material industry (AIP) on the average and manufacturing industry (FIP) on the average is appreciable.

Tabulated in columns s_i of the Table are approximate values of contribution to GDP while in the second column, the approximate share in

Table 1.

	$s_i = P_i/P$ %	E ratio %	E/s_i %/%	Ratio
AIP	15	70	4.5	15
FIP	85	30	0.3	

energy consumption, the other columns indicating the ratio between these contributions and shares. Conspicuously,

— the contribution of AIP to GDP is about 15% only while its share in energy consumption amounts to 2/3 of total consumption

whereas

— the manufacturing sector with its contribution of about 85% to GDP has a share of only 30% in total energy consumption.

— The quotients of the index numbers show how did the change of the ratio of the different sectors in production affect the energy demand and/or energy intensity. The role of economic restructuring, the magnitude of the effect of changes are demonstrated by these figures.

The tabulated figures are more or less applicable also to international conditions. (According to a Japanese analysis /2/, within the industrial sector, the contribution of basic material industry to GDP is 24%, its share in energy consumption being 67% while within the manufacturing sector, 40% of total industrial production comes from machine industry, highly developed and most up-to-date in Japan, its share in energy consumption amounting to 3% only.)

The significant effect of reduction of material and energy intensity on the efficiency of production is reflected by this situation alone as suggested by the Table unanimously.

Namely, the capital intensity of the energy sector is well known. That means that the capital demand of the energy sector is disproportionately high as compared with the narrow resources available in general.

Moreover, the high energy intensity is usually combined with a high capital intensity. That means that in sectors of a high energy demand, also the capital demand is significant while at the same time the contribution of these sectors to income is relatively small.

Hence, the material intensity and energy intensity of production, denoted hereinafter by α and ε, respectively, affect the efficiency of

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production directly. That is the absolute and specific income of the national economy depends fundamentally on these factors. It is therefore a fundamental requirement that the material and energy intensity be reduced with a view to increase the efficiency of production of the national economy. However, this requirement implies more than a conventional rationalization and conservation effort; it also implies a sectoral and production restructuring.

Methodological considerations, definitions

Before some diagrams of a global character are presented, let us see the simplified formula used in production efficiency analysis based essentially on the conventional equation,

$$c + v + m = x \gtreqless p \text{ (price)} \tag{1}$$

of the value-creating process. According to the formula, costs c+v required to produce a product and at least the assumed (or expected) net income, m, shall be refunded in the course of marketing ($p \geqq x$). Should, however, the price be $p < x$ which means that the product is sold at a reduced price, not only net income m will not be realized but after an additional price reduction, part of the expenditures will not be refunded either.

The relationship applies to individual products and to the production of the national economy alike.

In the present analysis, the simplified formula given above shall be extended.

In so doing, material cost c is broken down to different components and, in addition to energy c_e, the most important groups of material consumption (basic material for metallurgy, chemical industry, agriculture, other materials and components, up-to-date equipment etc. and amortization) are used as an independent component each (c_{Fe}, c_{Al}, c_{Vi}, c_{mg}, ... etc.).

The GDP value added which is essentially the source of final output including private and communal consumption, increase in stocks for investment (and payment for losses due to unfavourable terms of trade and repayment of debts, a serious trouble today) is given as the difference between gross production x (or market price $p \gtreqless x$) and material expenditures c, the ultimate aim of production being an absolute and relative increase of GDP.

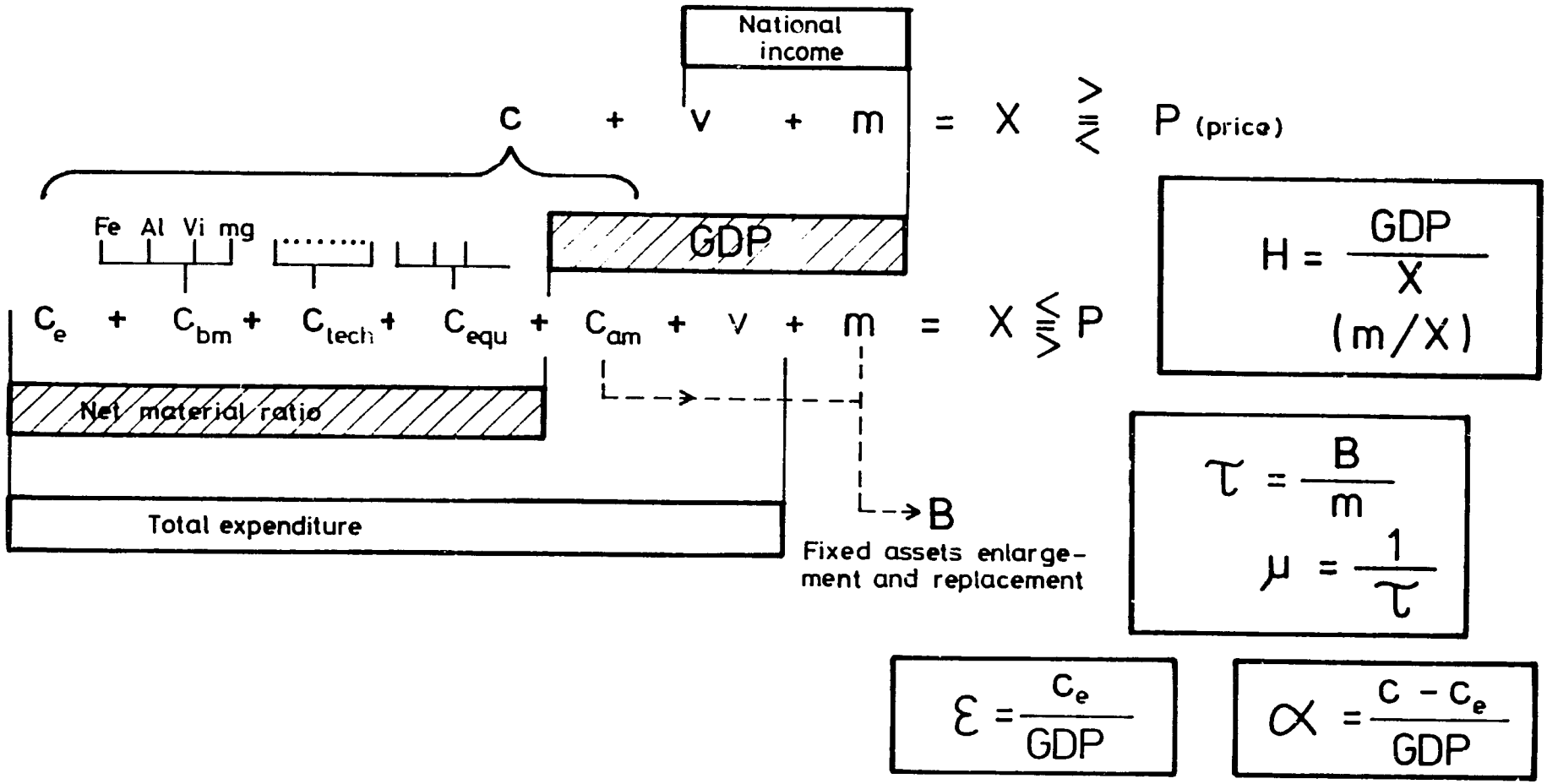

Fig. 2. Basic equations of the value-creating process, most important characteristics

In cost and income analysis, the equations for value creation shall reasonably be related to specific, unit production (as shown by Figs 4 and 5 given later in this work).

The detailed formula permits the following basic relationship, a matter of fact indeed, to be gathered:

For given (e.g. unit) x, the lower the net material consumption, the higher the GDP or in other words, as the energy and material intensity improves, the efficiency of the national production (H) increases accordingly.

Investment B (increase of fixed assets), resulting from amortization and part of net income m, is also included among the relationships given in Fig. 2, which as a certain 'fixed' ratio of GDP serves for simple and progressive reproduction. The specific value of this investment B, related usually to net social income m (or occasionally to GDP (is essentially the 'capital intensity' (τ), its reciprocal (μ) being the specific capital efficiency (taking into consideration also earlier investments).

The efficiency of the national production can be evaluated first of all on the basis of absolute and relative quantities of GDP (or of m); it is essentially index numbers GDP/x or m/x that can be used to describe the macroeconomic efficiency.

The index number defined above and index number

$$\eta_{ng} = \frac{K}{E}$$

describing the efficiency of the national energy system /3/ have much in common. In the above formula, K is the output for utilization in production and in private consumption from total energy input E of the energy system.

In Fig. 3, the above efficiency index numbers of the national economy are illustrated graphically, making use of what is offered by the input-output model. Here

— the mutual inputs (current expenditures on production) and outputs of the sectors are included in quadratic field C,

— the creation of GDP being represented by dark field T (to which import sources I are added) while

— the utilization of GDP appears as field K on the right (completed with field Ex representing export to compensate for import).

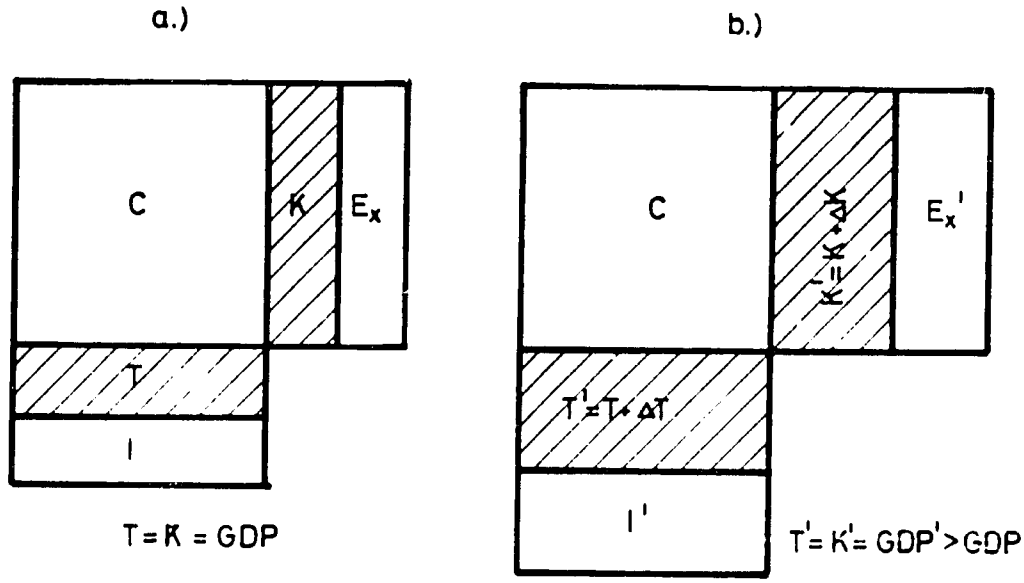

Fig. 3. The ratio between the areas in the input-output balance model is characteristic of the efficiency of production

Efficiency can be characterized essentially by areas, the ratio between their sizes being different. It can be seen without any detailed analysis that e.g. alternative 'b' represents a more favourable production situation i.e. a production of higher efficiency. Namely, a higher output K obtained for C of identical size but of a different (better) sectoral structure means higher efficiency on the basis of relationship $H = \frac{K}{C+K}$. (Analogously, for an identical K, the production is more efficient where C is smaller.) Within a theoretical range $0 < H < 1.0$, the magnitude of the efficiency index depends on whether $K \lesseqgtr C$ (the extremes being $C \gg K$ or $K \gg C$, respectively.)

The relationships formulated above assuming that K = T become more complicated because of inequalities $I \neq Ex$ resulting from the magnitude and structure of import I and export Ex (increasing losses due to terms of trade, including also compulsory debt repayments).

The significance of material and energy intensity in respect of efficiency of the national production (H) is quite obvious provided the fact that the material and energy consumption increases the size of quadratic field C in first line is accepted.

Since GDP is characteristic of the efficiency, energy intensity index ε and material intensity index α shall also be expressed as a specific value related to GDP.

Different cost and income structure, material and energy intensity of the sectors

On the basis of the simplified formulae for cost and income structure (formula 1, Fig. 2), it is easy to plot column diagrams to illustrate the most important, extremely divergent, efficiency characteristics of the different producer sectors. Two diagram types are presented, based on 1985 statistics.

One of them serves for the distribution of costs and incomes in % or in fillér/Ft within the price (x=p=100%) of the product (different components of cost c of Fig. 4, using the symbols and definitions of Fig. 2). The cost and income relations are indicated separately for the average of basic material industry and for that of manufacturing industry in addition to the average characteristics of total industry. (Detailed analyses went down to special branches of industry 74/.)

To contribute to the success of comparative efficiency calculations, the column diagrams indicate also

— the different economic sectors' 'own' capital intensity that is investment or fixed assets per unit net income (B/m) and

— the fixed assets development demand of the energy sector, required for operation of these sectors as a sectoral 'additional' energetic investment (B_E/m).

The other type of column diagrams (Fig. 5) is designed to show expenditures on production of GDP of Ft 1.0 for the most important industrial sectors, that is the material and energy intensity in Ft/Ft. Essentially, the column diagrams illlustrate also H=GDP/x type sectoral efficiency index numbers directly but in a reciprocal sense (that is the Figures are x/GDP Figures). It is enough to look at these diagrams to see what a different expenditure is required to produce unit income in the various producer activities. The difference between their energy and material costs is conspicuous. Moreover, the instability of energy costs as a function of time is significant due to the instable energy prices. Approximate values for the sectors' 'own' (B/m) and 'additional' (B_E/m) capital intensity are indicated also in these Figures.

Summed up below are the most important conclusions that can be drawn from both Figures.

According to the diagrams given in Fig. 4,

— the average industrial GDP ratio amounts to 26%, the share of net income m within this value being about half,

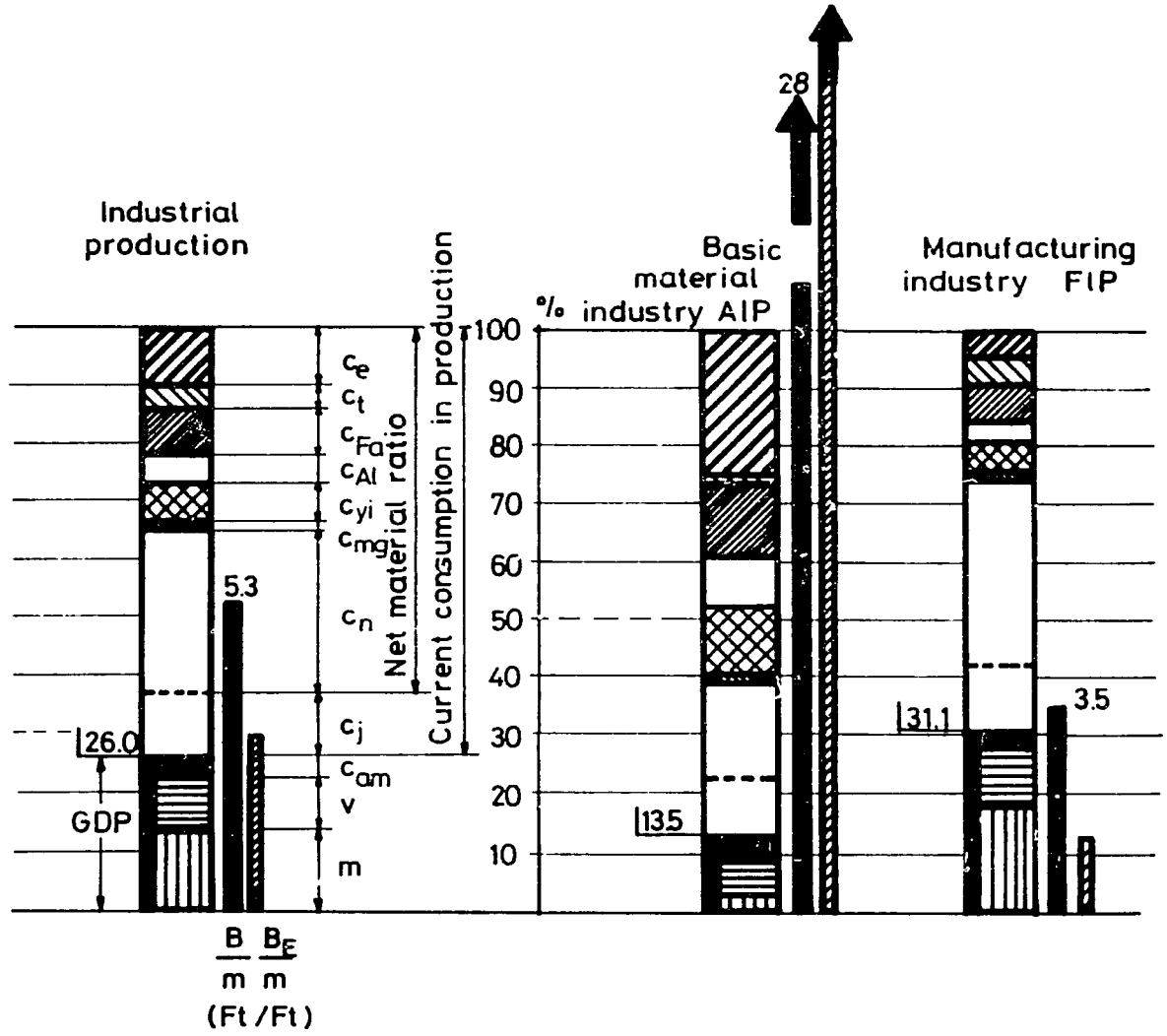

Fig. 4. Sectoral expenditure and income structures (1985) /4/

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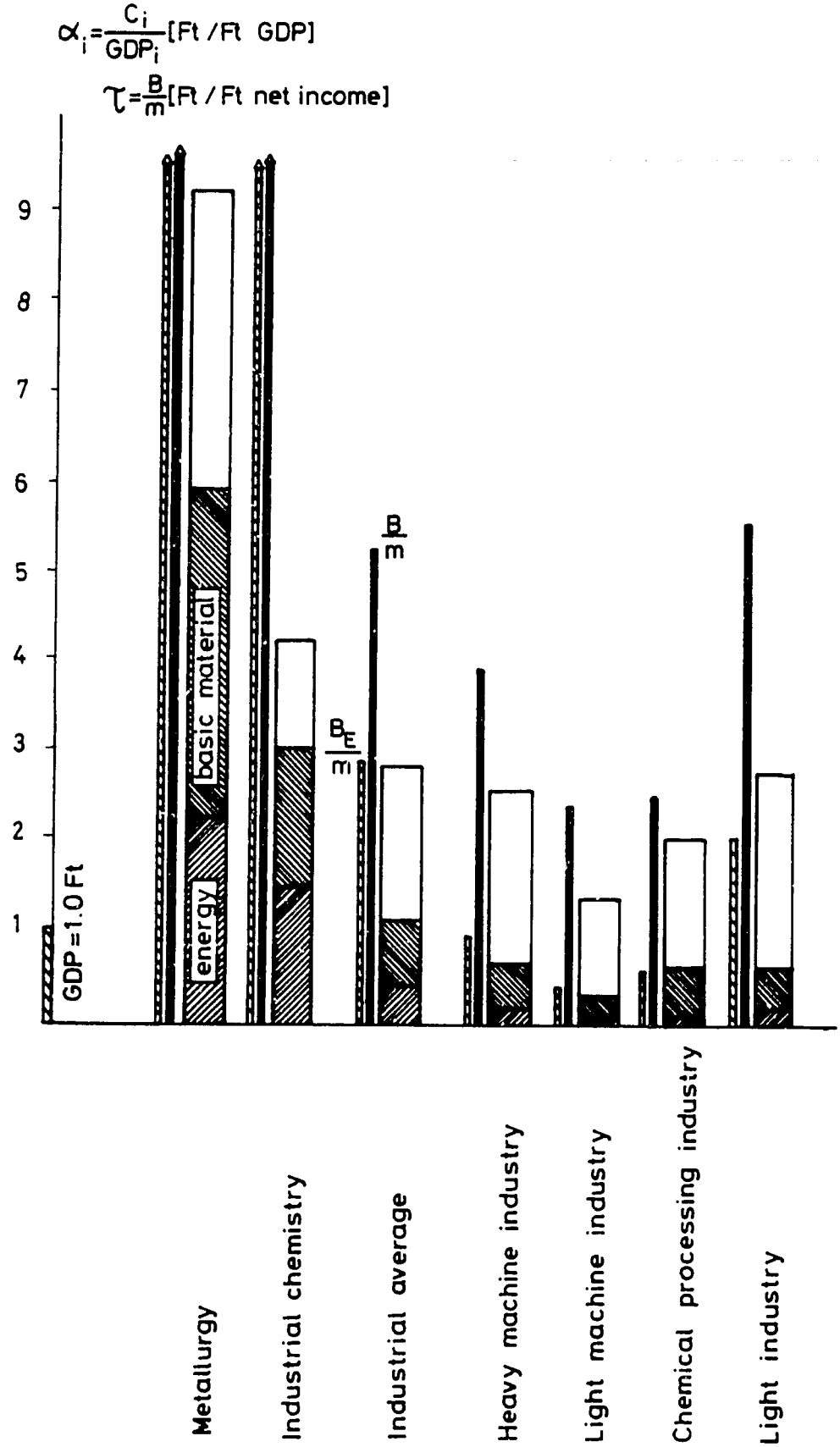

Fig. 5. Sectoral material and energy intensities (1985) /4/

— the ratio of energy costs among the other costs is conspicuous (about 10% of gross production),

— an 'additional' energetic investment of a ratio of about 50% is added to 'own' sectoral capital intensity of about 5 Ft/Ft on the average (resulting in combination in a capital intensity of 7–8 Ft/Ft),

— the average index numbers of AIP and FIP differ significantly from the industrial average and between the two sectors, the difference in some factors is multiple (5fold, 10fold or even 20fold or higher). The variation of the index numbers of the different sectors or special branches is still more significant.

The high capital intensity with an inherently high current expenditure demand (and low income ratio) of the basic material industry on the one hand, and the relatively low capital intensity and high income ratio of the processing industry on the other hand alone indicate the significant effect of different sectoral developments on the efficiency of production of the national economy.

Figure 6 shows clearly that capital intensity (τ) is inoidental to energy intensity (ε) in a sector, indicating also approximate values for capital efficiency (μ) for the purpose of information.

Fundamental conformity condition between economy and energy

The most important relationships to describe the role of energy (inclusive of material intensity) more exactly but still on a global scale are summed up below.

The basic formula expressing the close relation between economy and energy (P and E, respectively) is well known:

$$E = P \cdot \varepsilon \quad . \tag{2}$$

Contrary to accepted opinion, this close relationship is by no means a close correlation between E and P as energy intensity index ε responsible for the relation is a factor varying within wide limits, the magnitude of which being determined first of all by the production structure of the economy.

The production, income, energy demand of any (aggregated) economic unit of a reasonably large size can be algebraically simply summed up as the sum of production, income, energy demand of units of a lower level in economic hierarchy. At the same time, the different technica-economic index

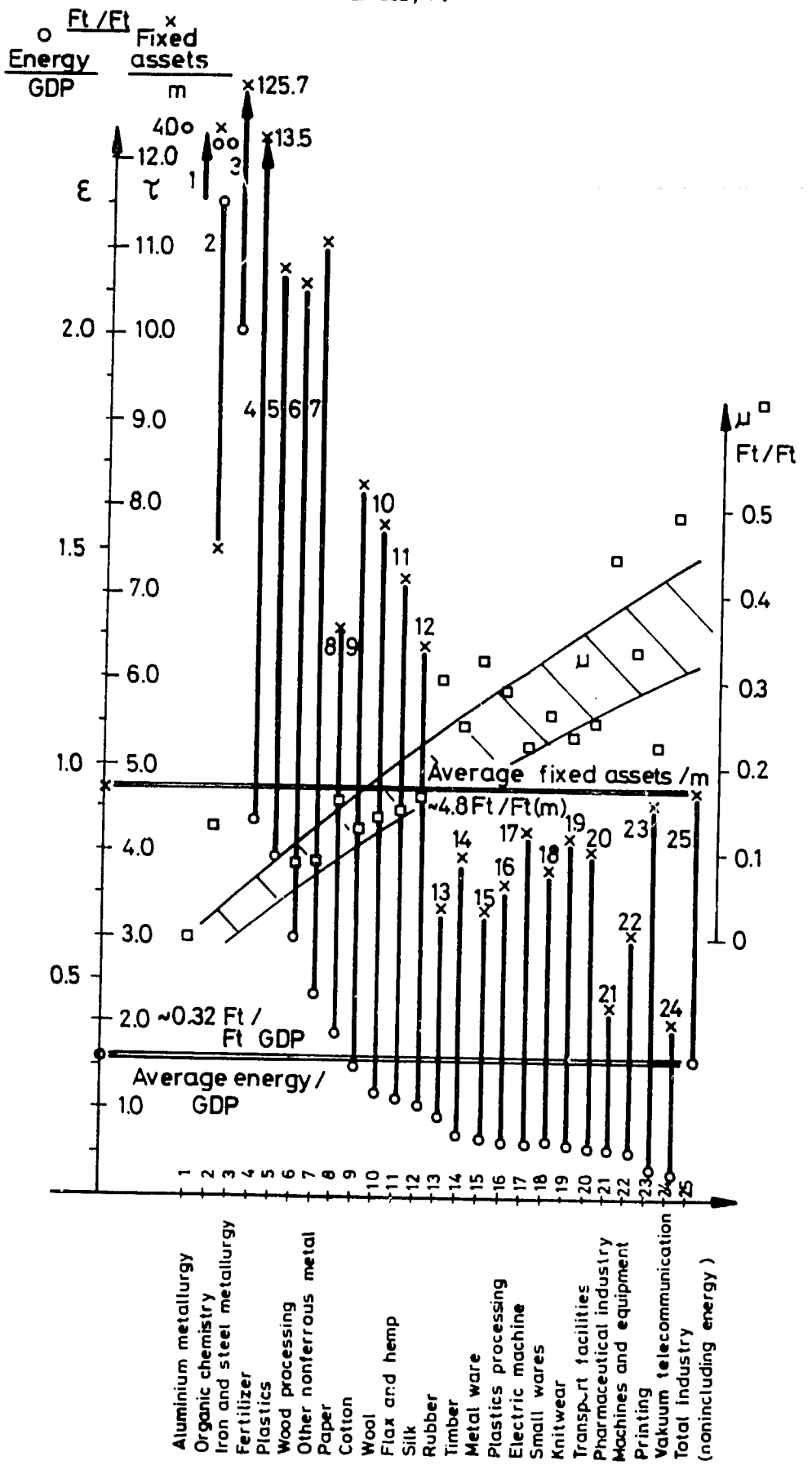

Fig. 6. Sectoral energy intensity, capital intensity and capital efficiency /4/

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numbers (like energy intensity ε, economy or energy growth rate ν, fuel-electricity ratio φ, material intensity α etc.) can always be determined as the weighted average of component units i.

$$P = \sum_i P_i \qquad s_i = P_i/P$$

$$E = \sum_i E_i \qquad s_i^E = E_i/E$$

$$\varepsilon = \sum_i s_i \cdot \varepsilon_i$$

$$\nu_P = \sum_i s_i \cdot \nu_{Pi} \; ; \quad \nu_E = \sum_i s_i^E \cdot \nu_{Ei}$$

On the basis of these general principles, the basic formula of energy demand (2) can be written with different subscripts (for past, future, increment) as

$$E = P \sum s_i \cdot \varepsilon_i \tag{3}$$

where factor s_i stands for P_i/P, the ratio of the different sectors i within total production (GDP).

Should a factor φ expressing the global ratio, calculable on the basis of fixed sectoral ratio φ_i between fuel and electricity consumption, be added to the above formulae according to formula

$$\varphi = \frac{E_V}{E_t} = \frac{\varepsilon_V}{\varepsilon_t} = \frac{\sum_i s_i \cdot \varepsilon_i \cdot \varphi_i}{\sum_i s_i \cdot \varepsilon_i} ,$$

then the following, relatively meaningful formulae are obtained for the growth in energy consumption and growth rate of energy demand:

$$\Delta E = E_1 - E_0 = E_0^t \cdot \left[(1+\nu_P)(1+\varphi_1)(1+\lambda_t) - (1+\varphi_0)\right. \tag{4}$$

and

$$\mu E = (1+\nu_p)(1+\lambda_t)\cdot\frac{1+\varphi_1}{1+\varphi_0} - 1 \quad , \tag{5}$$

respectively, where λ_t (not defined yet) is the rate of improvement of 'fuel energy intensity' $\Delta\varepsilon_t/\varepsilon_t$ without electricity.

In the formulae, each factor is a function of production structure s_i. Accordingly, the following conclusions, which are occasionally quite obvious but often not realized in everyday practice, can be drawn from what has been said above:

— the energy plan can not be independent; it should be always integrated with national economic plans,

— 'accuracy' and validity of an energy plan can only be interpreted, when consistent with the national economic plan; it can not exist alone,

— when forecasting the economy only in global, macroeconomical trends, there is not any possibility to prepare a reliable energy plan at all,

— the magnitude of the energy demand is fundamentally determined, in addition to the economic growth (change of P), by the economic structure characterized by s_i. Because of the multiple, sometimes extremely great difference, between the energy intensities of the different producer units (10fold, 20fold, or even 50fold), this structural effect is decisive in average energy intensity of the national economy (industry) and thus in energy demand $E = P \cdot \varepsilon$ in accordance with $\varepsilon = \sum s_i \cdot \varepsilon_i$.

The contribution of the increase in value resulting from technical development (denominator of the fraction describing energy intensity) to improvement of the individual energy intensity, $\varepsilon_i = E_i/P_i$, is more significant. As compared with this, the effect of energy conservation in the conventional sense (reduction in energy consumption E in the numerator) is little. In other words, there is no choice but to produce products marketable at the highest possible price on the basis of a definite (possibly limited) energy consumption although energy conservation is not negligible either. In this way, the energy intensity of production reduces 'automatically' and significantly.

Note that, considering what has been said above (formulae 3 thru 5), the elasticity index often used in planning for future economy and energy is methodologically unsuited for this purpose. As suggested obviously by formula

$$r = \nu_e / \nu_p = \frac{\Delta E/E_o}{\Delta P/P_o} ,$$

this index is also structure dependent, a function of the level of economic development and of energy consumption as well as of the absolute value of their growth rate. (E.g. an index r = 0.5 = 1.0/2.0 has different implications than and index r = 0.5 obtained for a growth rate of e.g. 1.5% or 3.0%, especially if, moreover, it is associated with a different value of E_o or P_o.) Hence, an elasticity index as a future requirement to be realized would necessitate that 'millions' of economic parameters be specified simultaneously. (The elasticity index can be calculated subsequently, either statistically for the past or in planning for the future as a subsequent checkup or additional information.)

Resources equilibrium condition

It follows from what has been said that, once the trend, magnitude and structure of economic development have been decided, we have no freedom any more in assuming the magnitude of energy demand and at the same time in determining the national economic resources (investment, import) required for energetic purposes. Namely, the resources demands of sectoral and energetic developments shall be closely co-ordinated. Writing the fundamental, but rather simplified, consistence relationship for investment (leaving private energy consumption here out of consideration), the total investment for production purposes will be

$$B_T = \sum_i B_i + B_E = \sum_i (B_i + e_i \cdot B_i) = \sum_i B_i \cdot (1 + e_i)$$

where

$$0.3 - 0.4 < e_i < 1.0 - 3.0 \quad .$$

Depending on the energy intensity of the sectors, the specific values of sectoral 'additional' energetic investment factors vary within wide limits. Accordingly, also the distribution between total sectoral investment $\sum B_i$ and energetic investment B_E may vary significantly, depending on the structure of economic development and as a result, the variation of productivity of the economy may be similarly significant, depending on the produc-

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Table 2. Combined effect of energy and capital intensity upon efficiency of production

	h GDP/en		a Fixed assets /GDP				h.a Fixed assets /en.					h' (u/z) GDP/fixed assets FIP:AIP		A_{en} / ΣA		$A_i/\Sigma A$
	Ft/Ft	FIP:AIP (u)	i	en*	Σ	Σ	i	en	FIP:AIP (z) Σ	i	en	Σ	i	%	FIP: AIP	%
	1	2	3	4	5=3+4	6=7+8	7	8	9=10+11	10	11	12	13	14=8:6	15	16
AIP	0.55	17.1	7.3	10.7	18.0	9.9	4.0	5.9	2.4	4.5	1.0	7.1	3.8	~60	~0.4	40
FIP	9.4		1.9	0.6	2.5	23.8	17.9	5.9						25		75
Metallurgy	0.48	23.7	8.7	10.3	19.0	9.1	4.2	4.9	2.3	3.8	1.0	10.3	6.2	54	~0.4	46
Light machine industry	11.4		1.4	0.4	1.8	20.9	16.0	4.9						23		77

*Approximate figures

Note: The tabulated income figures include only sectoral incomes without those of energy sectors

tion structure. At the same time, it is suggested by the relationship that the ratio of resources engaged by energetic investment (B_E/B_T) can not be assumed or varied freely because distribution of investment allocation between the energy sector and other sectors is strictly determined by the economic (industrial) development structure.

An example given below (Table 2) gives a comprehensive picture of the combined effect of energy intensity and capital intensity upon efficiency, taking into consideration indirectly that, in accordance with the directives of the economic development concept, the growth of energy can take place at a limited rate only. In this example, a comparison of the most important characteristics of basic material industry (AIP) and manufacturing industry (FIP), two poles of industrial production, is given, taking the average of both sectors as a basis. (Average values for metallurgy and light machine industry are also tabulated down in the Table.) The most important numerical values, worth to memorize, are discussed below:

— Essentially, the reciprocal of energy intensity index number, the so-called energy utilization factor denoted by h, is suited to describe the efficiency of production directly from an energetic point of view as a 'GDP/energy' index number expressing income per unit energy. Taking this factor as a measure, there is a 15 to 20fold difference between average basic material industry and average manufacturing industry in favour of the latter according to h (columns 1, 2 in Table 2). Because of the variation in both sectors, the difference between the extremes may be even 50fold. (Differences of 1:80 within industrial activities are mentioned in a similar Japanese study /2/.)

— The difference in 'own' sector fixed assets per unit GDP is about fourfold, again in favour of manufacturing sectors. The ratio of total investments increases to about 7fold by additional energy investments where the difference between the two latters is about 18fold (see columns /fixed assets/GDP/ 3,5 and 4).

— Interesting information is supplied by columns 6 thru 11 denoted by 'h.a', containing the possibilities and distribution of sectoral and total investment for the same (limited) energy consumption. The difference is only 4.5fold between the extremes for sectoral investment while about 2.4-fold for total investment. (Much investment is required in manufacturing industry to consume the envisaged quantity of energy, but it generates much more income simultaneously.)

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— However, in case of identical investment magnitude, also the income resulting from average development in manufacturing industry is much higher, 7.1fold, as shown by ratio h' (u/z) (columns 12—13). The difference is especially significant in the distribution of investment allocation (columns 14—16), the development in manufacturing industry requiring only about 1/4 of total investment for energy investments as compared with 2/3 in basic material industry.

As shown also by the numerical results of comprehensive model studies /5/, even a very small shift in a favourable or unfavourable direction as compared with the present sectoral structure results in a deviation one and a half to two times as much in the net national product. Similar input-output balance studies confirmed numerically the fundamental economic rule according to which

reduction of material and energy intensity results in increasing efficiency of production of the national economy.

Classification of possibilities to improve efficiency

In summing up, let us go back to formula $E = P \sum s_i \cdot \varepsilon_i$ (3) again. Adopting the logic of this formula, effects increasing the efficiency can be classified on the basis of the numerical values presented. Assuming identical economic growth, the lower the average energy intensity of production ($\varepsilon = \sum s_i \cdot \varepsilon_i$), the lower the energy consumption (E) that is the higher the efficiency of production. This criterion will be met if,

— on the one hand, the economic structure is favourable (s_i) that is the ratio of low-energy (low ε_i) activities in production is high. In this case, the production is at the same time less capital intensive and results in a much higher specific income.

— On the other hand, the above criterion will be met if the individual, sectoral energy intensity (ε_i) and specific energy consumption improve significantly. This can be achieved in two ways, index number ε_i being a fraction in each case, namely

= by increase of the denominator of the fraction that is the value produced (GDP) by way of technical development or production restructuring to arrive at $P + \Delta P$ instead of P or

= by reduction of the numerator of the fraction by energy conservation and specific improvement ($E - \Delta E$ instead of E).

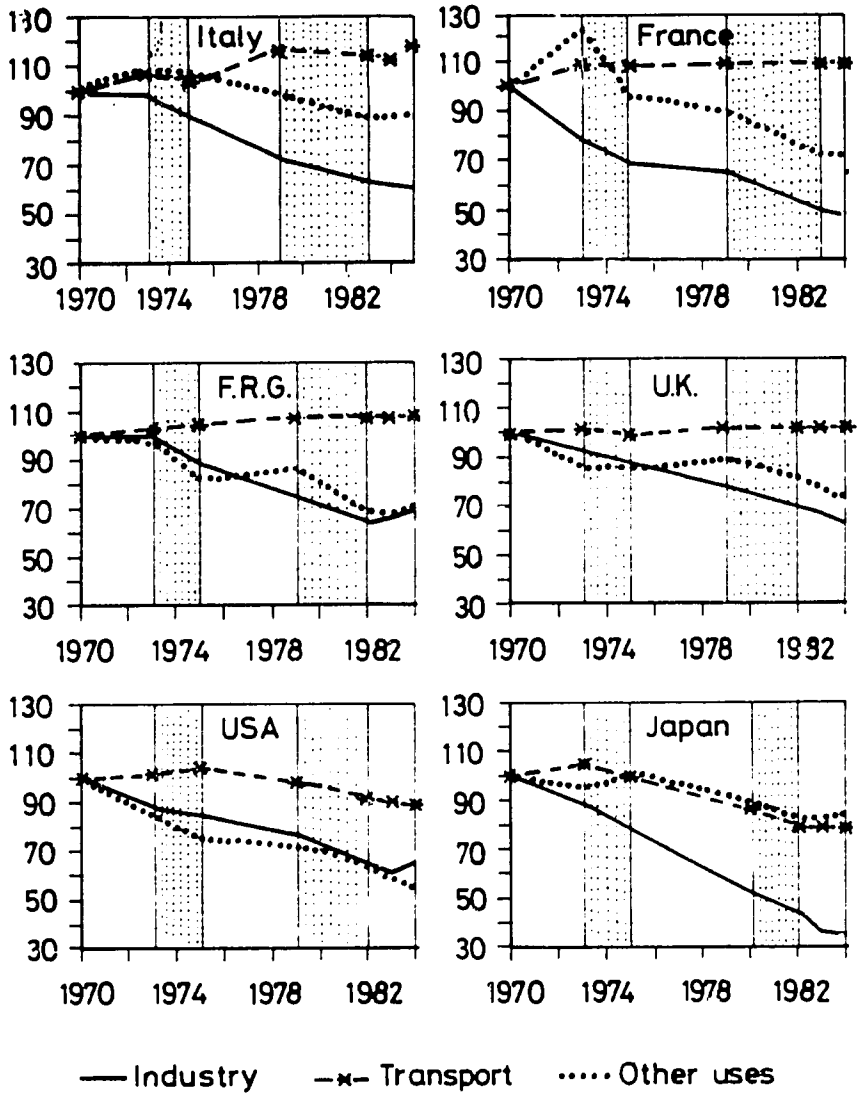

Fig. 7. Non-electric energy intensities in some industrialized countries (1970 = 100) /6/

According to calculations, the improvement in energy intensity resulting from modernization of the production is multiple as compared with the results of direct energy conservation.

International results

And what happened in the world in the recent period of 15 years? Just the most typical phenomena:

– The growth in GDP in the industrialized countries, accompanied with a significant restructuring, has been typically 20 to 60%. All the high-energy industrial activities (iron and steelmaking, production of cement,

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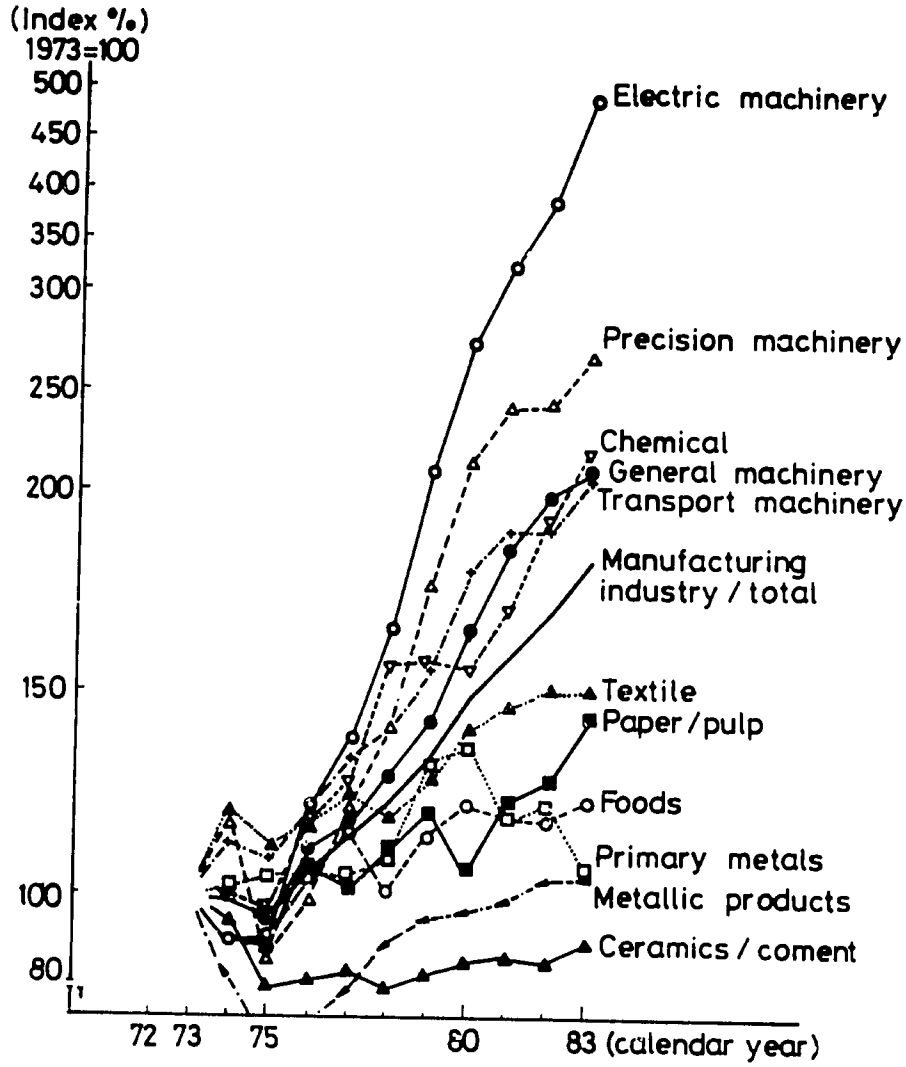

Note: The graduation above 200 are compressed.

Fig. 8. Trends of GDP by industry /2/

plastics etc.) have been kept at, or below, the rate before the oil crisis. This is responsible first of all for a significant reduction in energy intensity in the six top capitalist countries after the oil crisis as shown in Fig. 7 /6/. (Note that the electricity intensity of industry increased in general in the same period in most countries except for the USA and Japan where a reduction of 40% occurred.)

A most typical sectoral restructuring has taken place in Japan where, according to Fig. 8, the increase in GDP of the so-called pulling sectors (electronics, instrument engineering) amounts to 300 to 500% while the production of energy intensive sectors is stagnant or reducing (see Fig. 8).

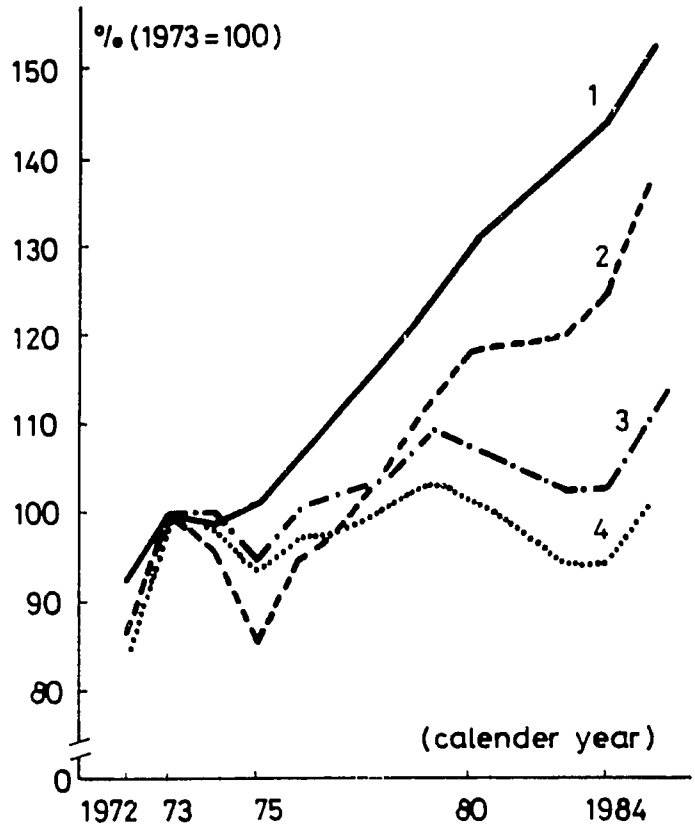

Fig. 9. Trends of GNP, IIP and energy supply and demand /2/
1-Real GNP, 2-IIP, 3-Total primary energy supply, 4-Total final energy consumption

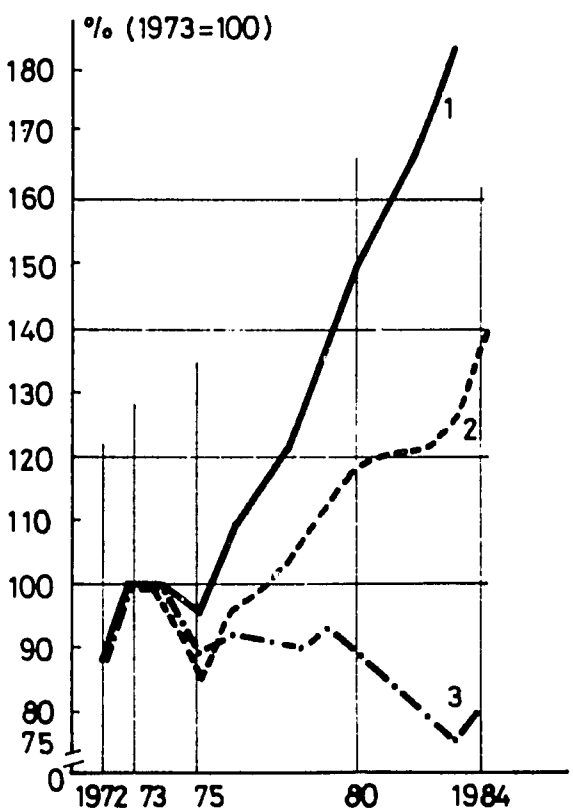

Fig. 10. Trends of industrial energy consumption /2/
1-GNP in manufacturing industry,
2-IIP in the manufacturing industry,
3-Total final energy consumption in the manufacturing industry

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As a result of this deliberate restructuring, there is practically no change in total energy consumption (see Fig. 9 /2/) while the energy consumption of the industry reduced in absolute value in spite of the rapid economic growth (Fig. 10 /2/), hence its ratio within total consumption decreased from 61.5% to 30.4% in this period.

Characteristically of the structural shifts in Japanese economy, an improvement of about 15% occurred in the FIP/AIP ratio in contribution to GDP within only a few years after the oil crisis. (Note that the home ratio has not displaced from the earlier value but it is more or less stable. Moreover, as a result of debt repayment obligation, even a change in reverse direction occurred in some years.)

National tasks

Similar results to be achieved are still among future expectations in Hungary. To meet these expectations, a radical restructuring of both the sectoral structure and production is unavoidable, resulting at the same time in a definite significant reduction of the material and energy intensity. Otherwise no improvement of the efficiency of production is expectable. Quite obviously, restructuring involves 'setbacks' and thus distressing social problems like unemployement, retraining etc. that have to be controlled simultaneously with a view to increase the overall efficiency of production. This cimplex approach shall be adopted in formulating the public interests while in the way out, improvement of the efficiency is a key issue which, however, can never be achieved without a significant reduction of material and energy intensity.

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Electricity Tariffs Required to Achieve Long-Range Self-Financing

Outline of conference presentation by
István Zakar
Director for Economics
Hungarian Electricity Board (MVMT)

I. Long range self-financing

1. Special characteristics of electricity generation

   a. Absence of possibility to store electricity
   b. Natural monopoly
   c. Cooperative electricity system

2. Electricity supply structure

   a. Production
   b. Transmission and distribution
   c. Service

II. Pricing system of electricity supply

1. Determination of price levels

   a. Socially acceptable services and the relevant costs
   b. Dynamism of price levels
   c. Accepted and actual price levels and their treatment

2. Development of tariff systems

   a. Structure of tariff
   b. Alternative structures and individual agreements

Development of Electricity Tariffs on the Basis of Marginal Cost

Outline of conference presentation by
András Kacsó
Hungarian Electricity Board (MVMT)

1. Consequences of natural monopoly

   - The producer should define the priec structure.
   - The tariffs should cover the cost of service.

2. Costs to be included in marginal cost

3. Distinction between short-run and long-run marginal cost

4. Relationship between marginal cost and tariff elements

5. Financial models used for tariff calculations

6. Consequences of tariffs for customers

7. Special tariffs, including agreements with large customers

8. Tariff levels and the relationship among components