THE STUDY
ON
RATIONAL USE OF ENERGY
IN
THE REPUBLIC OF HUNGARY

(I)

MAIN REPORT

SEPTEMBER, 1992

JAPAN INTERNATIONAL COOPERATION AGENCY

Preface

In response to a request from the Government of the Republic of Hungary, the Government of Japan decided to coduct a study on The Rational Use of Energy in the Republic of Hungary and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Hungary a study team headed by Mr. Mitsuo Iguchi, The Energy Conservation Center, two times between July 1991 and August 1992.

The team held discussions with the officials concerned of the Government of Hungary, and conducted field surveys at the study area. After the team returned to Japan, further studies were made and the present report was prepared.

I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Hungary for their close cooperation extended to the team.

September 1992

Kensuke Yanagiya

Kensuke Yanagiya
President
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1. Preface

1. PREFACE

1.1 Background to the study

The East European countries, which had established their socialist systems under the influence of the Soviet Union after World War II, carried out rapid political and economic reforms after 1989. In Hungary, reforms for democratization of the country progressed rapidly after the resignation of Kadar as secretary-general of the Socialist Workers' Party of Hungary in May 1988, and the name of the country was changed in October of the same year from the People's Republic of Hungary to the Republic of Hungary. In March 1990, the Democratic Forum of Hungary, a moderate reformist party, became the first party winning more than 40% of the national assembly seats, and a cabinet based on free elections was formed for the first time since 1947.

In the area of economic affairs, the country is promoting a phased switch to a market economy through abolition in principle of restrictions on the introduction of foreign capital, the opening of a stock exchange, and abolition of artificial price systems, etc. However, burdened with large sums of foreign debts and because of the contraction of the former Soviet market, the country has continued a minus growth rate of 4% in the past two years, and is meeting with various economic difficulties in the transitional process to a free economy, such as the progress of inflation, the lowering of the operation rates of factories and an increase in unemployment.

Meanwhile, Hungary, which depended on import for 65% of its energy supply in 1990, is required to diversify the supply sources of its energy requirements, since oil production in the former Soviet Union, which is the main supplier of oil to that country, is declining and its oil export capacity is being lowered. In this situation, the prices of energy, which had been held down to low levels, divorced from their market prices, under the Comecon system, have been substantially raised.

The industrial sector accounts for 37% of the country's energy consumption. It is necessary for the country to restrain growing demand for energy which is rising together with increased production and to maintain its international competitive position under rising energy costs.

The Arche Summit of 1989 and the conference of countries for assistance to Eastern Europe (G24) resolved that the advanced democracies of the West should assist East European countries in their endeavors for democratic reforms. Japan, too, promised to extend as much assistance as possible to these countries.

The present study was conducted by the Japan International Cooperation Agency (JICA) as a first step toward this end.

JICA made adjustments with government organizations concerned of Hungary several times from 1990, and as a result, it confirmed the need of the country for energy-conservation plans.

Thus, in August 1990, it sent a preliminary research team to that country and signed an agreement on the Scope of Work (S/W) concerning various procedures required for conducting the survey with the Ministry of Industry and Trade and the State Authority for Energy Management and Energy Safety .

JICA decided to commission the Energy Conservation Center (foundation) to conduct this survey.

1.2 Objective of the Study

The objective of the Study is to contribute to the promotion and strengthening of rational use of energy in the field of industries in Hungary by studying the technical and managemental applicability of rational use of energy and formulating the report for the promotion of rational use of energy in the representative industries stated below.

1.3 Scope of the Study

In order to achieve the above objective, the Study will cover the following items.

(1) Literature survey on the energy situation in Hungary

① To survey the energy situation in Hungary

② To survey the situation of energy use in the field of whole industries

(2) Study on the promotion of rational use of energy in the industry

① To investigate current program for rational use of energy

② To study and evaluate the activities of State Authority for Energy Management and Safety

ⓐ The current activities for promotion of rational use of energy

ⓑ The achievements of past activities

ⓒ The future plan/program for promotion of rational use of energy

(3) Study on the situation of energy use in model factories of each industry

① To survey the situation of energy use in each factory

ⓐ Outline of the factory

ⓑ Situation of energy management

ⓒ Energy flowchart

ⓓ Situation of major energy consuming equipment

ⓔ Problems found in each factory and countermeasures without changing the existing production process

ⓕ Estimated effects of the countermeasures

② To prepare the reference of the technical guideline for the promotion of rational use of energy in industries

(4) Recommendation for the promotion of the rational use of energy in Hungary

① To recommend measures to promote rational use of energy in the field of industries

② To recommend activities of State Authority for Energy Management and Safety for rational use of energy

③ To recommend countermeasures without changing the existing production process and to estimate their effects

1.4 Counterpart government organizations in the Republic of Hungry and the objects of study

(1) Counterpart government organizations: State Authority for Energy Management and Safety

The State Authority for Energy Management and Safety, which is our counterpart organization in this study, is a nonprofit organization under the direct control of the Ministry of Industry and Trade, and is engaged in energy supply/demand planning, guidance of energy conservation and safety management in the utilization of energy. All its staff members are government officials.

(2) Objects of research

A) Five factories in five industries selected by the State Authority for Energy Management and Safety

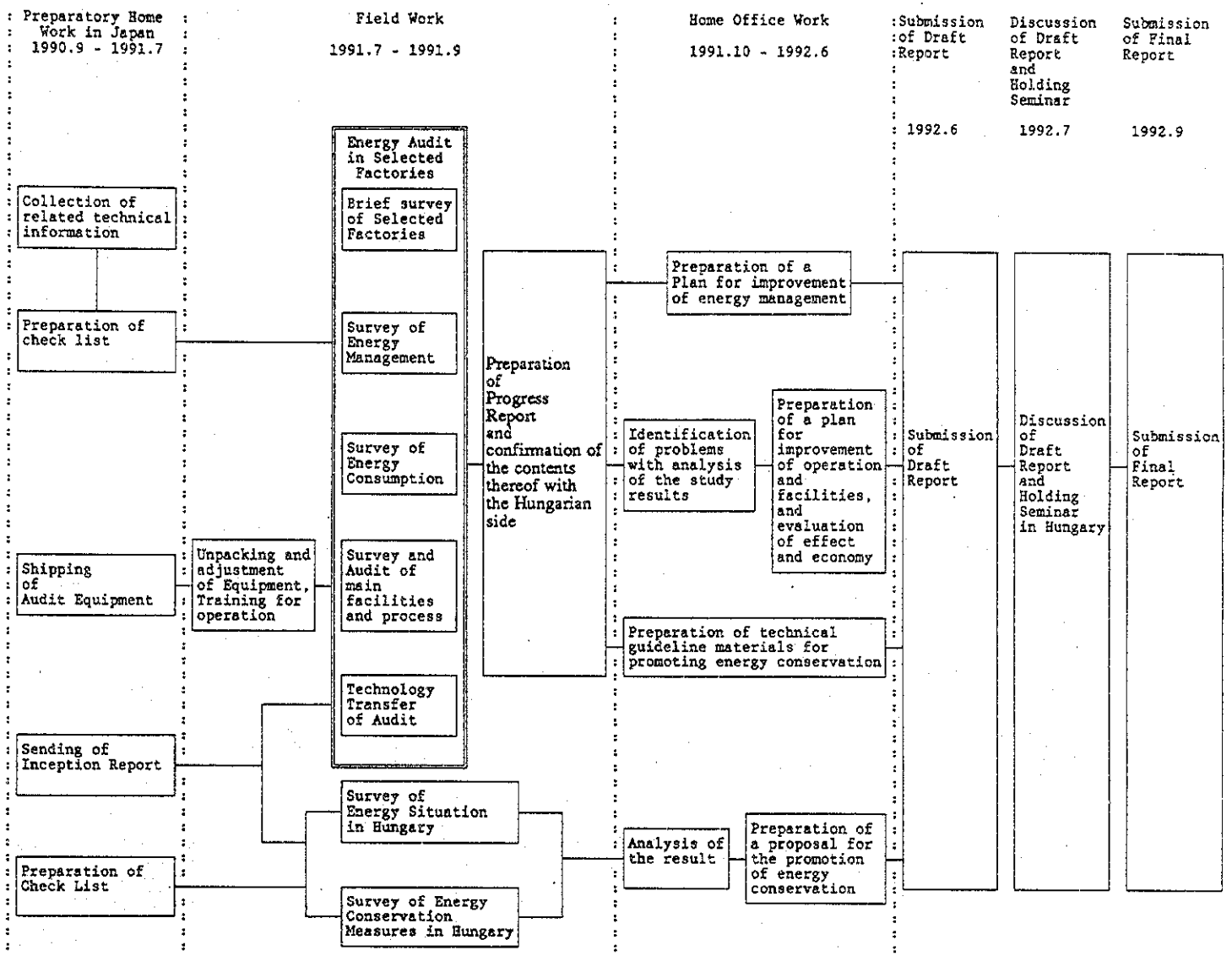
Dycing factory	Budaprint SECOTEX Textilfestó Rt.	(Location: Budapest)
Tire factory	TAURUS Hungarian Rubber Works	(Location: Nyíregyháza)
Alumina factory	HUNGALU	(Location: Almásfuzitõ)
Cement factory	Beremendi Cement és Mészipari RT.	(Location: Beremend)
Iron and steel mill	DUNAFERR, Dunai Vasmú	(Location: Dunaújváros)

B) Energy-related organizations
Ministry of Industry and Trade
Ministry of Finance
Ministry for Environment and Regional Policy
Ministry of International Economic Relations
Central Statistical Office
State Authority for Energy Management and Safety (AEEF)
AEEF: Energy Efficiency Office
Hungarian Electricity Works Trust
Hungarian National Oil and Gas Trust
Institute of Electrical Power Research
Hungarian Chamber of Commerce: Federation of Energy Industries Companies
EGI-Contracting/Engineering Hungary

1.5 Method of study

The general picture of the study is as shown in Fig. 1-1.

Figure 1-1 Outline of the Study on the Rational Use of Energy in Industry in the Republic of Hungary



(1) Field survey of factories (July-September, 1992)

a. Prior to starting the survey of factories, the survey mission explained to the counterpart organizations on how to use diagnosis equipment and trained them in the use of the equipment.

Furthermore, explanations were made to the counterparts and persons in charge of the factories selected as subjects of research, concerning the method of research according to a checklist, and requested preparations for the installation of measuring instruments and provision of necessary data and materials.

b. The survey was done separately by two teams, that is, a team to survey the dyeing, tyre and alumina factories where the main processes were steam heating, and the other team to survey the cement and iron and steel works where high temperature heating processes were employed.

c. The number of days of research per factory was, in principle, five days.

d. Research into the outline of factories and conditions of energy management was done by interviewing the personnel concerned according to the checklist, while data and materials were gathered, data books were checked, and the factories were inspected in order to obtain information on their present state, the problems, and their future plans.

The inspection of energy-using equipment and the survey to identify the problems in the utilization of energy were made by making measurements with diagnosis equipment brought by the mission, examination of diagrams and past data, and through observation of operations and the actual operation methods and the performance of the factory equipment were examined and problems were specified.

In conducting the survey of factories, attention was paid to technology transfer to the counterparts concerning the method of diagnosis and analysis procedures.

e. When the survey of a factory was completed, the results of measurements were made known to its managers and suggestions were made to them, and an exchange of opinions was made.

(2) Survey of the energy situation and energy conservation measures (August-September, 1991)

The survey of the energy situation, energy policy and the implementation of energy conservation measures and plans was made by obtaining information by interviewing responsible personnel concerned of the Ministry of Industry and Trade and related organizations, and also by analyzing data and materials obtained from them.

(3) Domestic study

a. Problems in energy management and energy utilization at the factories concerned and countermeasures

Problems in energy management will be examined regarding the system for energy conservation as a whole including energy management organization, target setting, the recording and utilization of energy consumption data, and the education of employees, referring to the methods of managements which are adopted effectively by similar factories in Japan, and also in the light of conditions in Hungary, and at the same time feasible methods of improvement are proposed.

As for problems in the utilization of energy and countermeasures, measures for the energy conservation such as small scale renovation of existing equipment or addition of facilities which do not require a change in the existing processes will be studied and measures for improvement which are considered suitable to the factories concerned are proposed.

b. Provision of data and materials for the preparation of a technical guideline for the promotion of energy conservation

Those points which require attention in energy management and energy utilization in the different industries concerned will be sorted out on the basis of the results of the survey of the factories concerned, and main energy conservation technologies and examples of implementation of such technologies will be shown to the counterpart organizations so that they may formulate their own technical guidelines for energy conservation on their own.

c. Proposals concerning the energy conservation measures of the Republic of Hungary in the sector of manufacturing industries and proposals concerning the activities of the State Authority for Energy Management and Safety

Measures suitable to the conditions in the Republic of Hungary will be proposed on the basis of the information obtained by the study mission and also of the results of the survey of the factories concerned, and also in reference to energy conservation measures taken by the Japanese government and the government of foreign countries.

1.6 Progress of field surveys

(1) Survey of the energy situation and energy conservation measures

The survey was conducted smoothly thanks to proper arrangements made by the Ministry of Industry and Trade and the counterpart organizations, and the study mission was able to achieve its desired purpose.

(2) Audit of factories

As the cement factory which was originally planned to be inspected had been forced to be suspended due to a fire accident, the factory which the study mission was to visit, was suddenly changed to a factory similar in scale and equipment. Thanks to an enthusiastic attitude taken by the factory side, the study mission was able to do its work smoothly without any trouble.

(3) Counterparts

The counterpart members were equipped with a high technical level, and quickly acquainted themselves with the handling of diagnosis equipment, so that they were able to do measurement work on their own in the process of survey. Furthermore, the work morale of the staff members was very high, and they were very cooperative.

(4) Diagnosis equipment

The diagnosis equipment operated normally. After the survey was over, the equipment was donated to the Hungarian side in the presence of the Vice Minister of Hungarian Industry and Trade and the Japanese Ambassador to Hungary. Many reporters were present at the presentation ceremony and showed great interest in the mission's work.

(5) Progress report

When the field survey was over, a progress report concerning the content of the study work, identified problems, measures of improvement to be incorporated in a future report was prepared and submitted to the State Authority for Energy Management and Safety, which was signed by both sides.

(6) The composition of the research mission, counterparts, and the schedules of the field survey are as shown in attached data (1) - (3).

2. Energy Situation in the Republic of Hungary

2. ENERGY SITUATION IN THE REPUBLIC OF HUNGARY

2.1 Energy Supply-Demand in the Republic Hungary

2.1.1 Trends in actual energy supply-demand conditions

Table 2.1 gives the population, GDP, primary energy consumption, energy consumption per unit of GDP, and primary energy consumption of Hungary from 1980 to 1990, and Table 2.2 compares the GDP and primary energy consumption of Hungary with those of Japan. Following facts emerge from these two tables.

1) GDP trends in 1980-1990 show that the country's economic growth maintained a smooth annual average growth rate of slightly more than 2% up to 1987, but that it slipped to a negative growth rate after 1988, sagging particularly sharply in 1990.

2) The country's energy consumption followed a similar trend. In the meantime, however, energy consumption per unit of GDP improved about 10%.

3) The ratio of electric power to total energy consumption rose from 8.9% in 1980 to 11.5% in 1990.

4) Hungary's per capita energy consumption in 1990 was slightly lower than Japan's, but Hungary's energy consumption per unit of GNP was seven times of that of Japan.

5) Hungary's import dependence for the supply of primary energy rose from 52% in 1980 to 65% in 1990.

Table 2.1 GDP and energy consumption in Hungary (1980-1990)

Item	1980	1985	1986	1987	1988	1989	1990
Population Mil	10.7	10.7	10.6	10.6	10.6	10.5	10.5
GDP Bil Ft (1981)	738.8	819.4	832.0	865.7	864.8	863.2	812.3
GDP/Capita Ths Ft	69.0	76.6	78.5	81.7	81.6	82.2	77.4
TPE PJ	1,260.5	1,323.9	1,318.8	1,356.9	1,336.8	1,316.3	1,244.2
TPE/GDP MJ/Ft	1,706	1,616	1,585	1,567	1,546	1,525	1,532
TPE/Capita GJ	117.8	123.7	124.4	128.0	126.1	125.4	118.5
Total Elec. TWh	31.3	37.6	38.6	40.4	40.5	40.7	39.8
TEC/GDP kWh/Ft	42.4	45.9	46.4	46.7	46.7	47.2	49.0
TEC/Capita kWh	2,925	3,514	3,642	3,811	3,821	3,876	3,790
Dependence on Import	52.2	54.7	56.7	57.0	60.4	61.5	64.9

Source: AEEF

Table 2.2 Comparison of GNP and primary energy consumption between Hungary and Japan in 1990

Item	Hungary	Japan	Hungary : Japan
Population Mil	10.5	123.6	1 : 12
GNP Bil US$ (89)	27.1	2,920	1 : 108
GNP/Capita US$	2,560	23,730	1 : 9
TPE Mtoe	29.7	472	1 : 16
TPE/Capita toe	2.8	3.8	1 : 1.4
TPE/GNP t/1000US$	1.1	0.16	7 : 1

Source: AEEF, World Bank Atlas

2.1.2 Primary energy supply

Primary energy supply in Hungary rose at an annual rate of 3% in the 1970s, but remained almost unchanged after entering the 1980s. The supply of primary energy peaked in 1987 at 1,357PJ (32.41Mtoe). However, it dipped 1.5% in 1988, 3% in 1989 and 8.3% in 1990, taking 1987 as the bench mark year, due primarily to industrial stagnation in the wake of the introduction of a market economy after 1987. In 1990, energy supply slipped below the 1980 level.

Solid fuels accounted for 53.2% of the 1970 primary energy supply mix, but that share later fell gradually as oil, natural gas and nuclear power advanced as alternative energy sources. As a result, in 1990 solid fuels accounted for 20%, liquid fuels 29%, gas fuels 31% and electric power, centered on nuclear power, the remainder.

Nuclear power generation represented 10% of the total primary energy supply in 1990. Hungary depends on the enrichment and reprocessing facilities of the former Soviet Union for the supply of nuclear fuel. (However, it produces uranium ore domestically.)

Solid fuels accounted for 40%, gas fuels 36%, liquid fuels 20% and hydraulic power 0.4% of the domestic production of energy in 1990.

Hungary's energy self-sufficiency rate, which had been 63% in 1970, later declined sharply and in 1990 it stood at 35%. This decline in its energy self-sufficiency rate is attributable to lowered output of domestic coal and increased import of petroleum and natural gas.

In 1990, the country's energy consumption declined to the level of 1980 owing to the fall in industrial production. However, since domestic energy production has already reached its peak, it is feared that the country will have to depend more on imports as energy consumption grows.

The country depends on the former Soviet Union for the supply of petroleum and gas, while importing coal from the former Soviet Union, Poland, Czechoslovakia and other countries. In this way, it depends largely on the former Soviet Union for its supply of energy, including electric power.

The only marine transportation route for importing energy is the Adriatic Pipeline, which stretches from its Adriatic terminal on Krk Island to Czechoslovakia via Yugoslavia. This pipeline was laid to cope with the anticipation of instability in the supply of energy from the former Soviet Union. The operation of this pipeline is now suspended because of political unrest in Yugoslavia.

Hungary is planning to develop infrastructure including oil and gas pipelines connecting it to Western European countries with the cooperation of IEA member states.

Table 2.3 Energy Balance in Hungary

Unit: PJ

	1970	1978	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Coal	383.6	298.6	290.7	291.2	295.2	280.3	277.7	263.1	254.0	255.3	238.7	221.7	188.1
Oil	81.7	100.2	102.0	101.7	102.8	103.0	104.1	105.0	103.9	99.6	100.5	98.2	94.6
Gas	127.5	263.3	224.1	219.4	236.5	228.1	238.4	254.8	243.3	240.5	213.8	208.8	169.8
Hydro Electricity	1.2	1.6	1.3	2.0	1.9	1.6	1.8	1.5	1.5	1.7	1.7	1.6	1.8
Others	17.5	14.6	14.1	14.8	14.5	15.9	13.9	14.4	14.3	13.7	13.7	13.5	11.7
INDIGENOUS PRODUCTION	611.5	678.3	632.2	629.1	650.9	628.9	635.9	638.8	617.0	610.8	568.4	543.8	466.0
Coal	104.6	86.9	91.1	86.0	83.4	83.4	79.4	113.2	110.0	82.5	94.4	92.2	65.2
Crude Oil	169.6	348.4	308.2	289.3	286.5	253.1	270.0	263.5	278.0	265.2	283.6	259.2	263.1
Crude Oil Products	36.5	74.0	73.0	61.2	60.7	59.2	60.9	83.6	80.2	80.5	59.0	65.1	67.7
Natural Gas	7.0	41.4	134.0	135.0	133.9	141.5	131.1	136.9	161.7	164.9	180.8	202.7	217.3
Direct Electricity Import	44.9	52.9	85.4	87.5	96.1	99.8	102.7	108.1	105.2	106.1	112.9	110.8	111.5
Nuclear Power					0.1	24.7	37.7	64.8	74.3	109.9	134.5	138.9	137.3
IMPORTS	362.6	603.6	691.7	659.0	660.7	661.7	681.8	770.1	809.4	809.1	865.2	868.9	862.1
EXPORTS	32.1	25.4	44.4	31.4	37.9	56.2	60.5	66.9	73.5	74.6	87.0	85.3	70.8
STOCK CHANGES	25.1	-3.5	19.0	2.9	7.9	-11.8	-35.2	18.1	34.1	-11.6	9.8	11.1	13.1
TOTAL PRIMARY ENERGY REQUIREMENTS	916.9	1260.0	1260.5	1253.8	1265.8	1246.2	1292.4	1323.9	1318.8	1356.9	1336.8	1316.3	1244.2
Dependence on import (%)	37.2	47.1	52.2	51.2	50.4	51.3	51.7	54.7	56.7	57.0	60.4	61.5	64.9

Source: AEEF

2.1.3 Supply conditions of different energy sources

(1) Petroleum

Up until 1990 there were 22 organizations under the Hungarian National Oil and Gas Trust, which were engaged in a variety of activities related to petroleum, including oil exploration, production, refining and marketing. At present, 13 of them operate as independent entities, while the remaining 9 are still in the hold of the trust. The marketing company is operated independently. Meanwhile, oil importing and exporting is conducted by a number of state companies under the Ministry of International Economic Relations. These companies, however, are expected to be completely privatized in two or three years. Out of the six Eastern European countries, Hungary is second only to Rumania in oil reserves and production. But its known reserves of crude oil are estimated to be slightly below 40 million tons. Formerly, crude oil production in Hungary was confined to Zala County in the western part of the country. Later, however, oil development took place mainly in the Great Plain, to which the center of crude oil production has moved. The country's annual crude oil production is slightly less than 2 million tons. Production was stable in the 1980s, accounting for about 22% of the country's crude oil consumption. Since domestic crude oil production can only partially meet domestic consumption, it is required to import crude oil.

To secure a supply source other than the former Soviet Union, it is reported that Hungary is negotiating with Finland over import of crude oil on a foreign currency basis. Furthermore, there is a prospect of importing crude oil from the Middle East via the Adriatic Pipeline, but its operation is now suspended.

(2) Coal

Solid fuels are the most important domestic resources, accounting for 40% of domestically produced primary energy in 1990. However, they were mostly low quality coal, with brown coal comprising 60%, lignite 30% and bituminous coal the remaining 10% of the total.

Hungary has large quantities of lignite resources, which are estimated to be enough to last for 60 years at the present rate of consumption. Lignite is inferior in quality to brown coal, but it can be strip-mined and can be produced at a lower cost than brown coal.

The supply of solid fuels, consisting of brown coal, lignite and bituminous coal, which totaled about 488.2PJ (11.66Mtoe) in 1970, declined to 381.8PJ (9.12Mtoe) in 1980 and 253.3PJ (6.05Mtoe) in 1990 due to high production costs.

(3) Natural gas

Deposits of natural gas are found in the Great Plain in the southeastern part of Hungary. A considerably large deposit of natural gas was discovered in 1960, and a network of pipelines was laid. At present, it is distributed to all parts of the country by a distribution company affiliated with the Hungarian National Oil and Gas Trust.

In 1990, natural gas comprised about 31% of Hungary's primary energy supply, of which 45% (5 billion m^3) was domestically produced and 55% (6 million m^3) was imported from the former Soviet Union. The production of natural gas peaked in 1985, and declined gradually after that.

The annual domestic production of natural gas by the state-run coal mining company is predicted to decline from the present 5 billion m^3 to 4.5 billion m^3 by 2000.

Meanwhile, imports of natural gas are growing measurably, increasing 30-fold by 1990 from 200 million m^3 in 1970, and are expected to grow to a level of 8 billion m^3 by 2000.

Hungary depends almost entirely on the former Soviet Union for the import of natural gas, so this situation presents a problem regarding stability of supply.

(4) Electricity

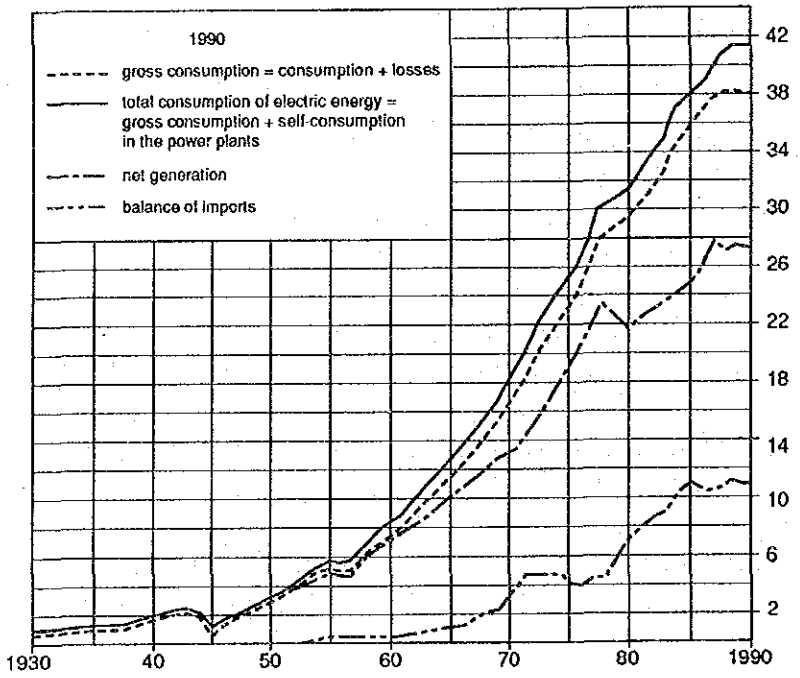
All the electric power-related sectors of the Hungarian economy are under the control of the Hungarian Electricity Trust, which has 22 affiliated companies under three groups — the power generation and heat supply group, the power transmission and distribution group, and the investment, construction and equipment group.

In the 1950s and the 1960s, brown coal was the main fuel, and in the 1970s there was an increase in natural gas- and oil-fired thermal power plants. Thus, in the 1980s, all kinds of fuels, including nuclear power, came to be utilized.

Table 2.4 shows trends in power consumption from 1930 to 1990, indicating a sharp gain in electric power consumption after 1960.

High quality electric power is supplied on a stable basis to Hungary by the former Soviet Union. The amount of power interchange, which had stood at 1850GWh until 1990, was expected to be lowered to 1100GWH in 1991. Hungary expects that the same amount of electric power will be supplied by the former Soviet Union until 2000, but this is not certain as the matter stands at present.

Table 2.4 Generation and consumption of electricity in Hungary



Source: MVMT

2.1.4 Final energy consumption

(1) Shares of different industrial sectors in final energy consumption

Table 2.5 shows trends in the composition of final energy consumption by sector. In 1970, industry accounted for 49.4%, residential & commercial consumption 33.6%, transportation 11.0% and agriculture 6.0% of the total energy consumption, whereas in 1990, industry accounted for 36.0%, residential & commercial consumption 51.4%, transportation 4.9 and agriculture 7.7%. It is mainly because of a decline in industrial production due to changes in the country's economic system that energy consumption by the industrial sector shows a decline. Energy consumption by the industrial sector declined 12% in 1990 from the previous year (1989).

Meanwhile, presenting a sharp contrast to energy consumption by the industrial sector residential & commercial energy consumption tends to show a yearly upward curve. While energy consumption by the transportation sector indicates a small decline, that by agriculture remains almost unchanged.

Table 2.5 Final energy consumption by sector (%)

Sector	1970	1978	1980	1985	1987	1988	1989	1990
Industry	49.4	47.3	46.7	41.5	40.6	40.1	38.6	36.0
Transportation	11.0	8.0	7.5	6.4	6.1	5.7	5.5	4.9
Res. & Commer.	33.6	35.6	37.0	43.7	45.0	46.1	47.9	51.4
Agriculture	6.0	9.1	8.8	8.4	8.3	8.1	8.0	7.7

Source: AEEF

(2) Trends in numbers of factories classified by major industry

The numbers of factories classified by major industry are as shown in Table 2.6. The total number of factories, which had been 1,663 in 1970, increased 2.3 times to 3,686 in 1989. Particularly remarkable is the increase in the number of machining factories.

It is true that the number of factories has grown year after year, but the situation today is such that many factories are forced to curtail their operations due to a decline in order receipts in the wake of the economic reform.

Table 2.6 Changes in the numbers of factories

Industries	197o	1978	198o	1982	1983	1984	1985	1986	1987	1988	1989
Food, Feed	155	195	194	193	191	193	199	2o5	217	22o	279
Textile	42	52	52	53	54	55	67	74	88	96	138
Wooden Product	6o	112	1o6	91	89	84	126	139	153	178	229
Paper & Pulp	1	8	7	7	6	6	9	12	12	14	27
Printing & Publication	39	36	35	35	34	33	48	55	71	83	132
Chemicals	44	52	53	53	53	54	61	64	69	72	1o2
Oil & Coal Cerivatives	6	5	4	4	4	4	4	4	4	4	4
Plastics	8	21	22	26	26	26	5o	62	86	1o1	174
Rubber & Leather	8	31	3o	3o	29	28	39	42	48	57	74
Glass, Cement, Ceramics	49	41	41	47	46	47	54	59	69	82	114
Iron & Steel	19	18	18	14	13	15	23	27	28	32	46
Nonferrous Metal	15	15	15	13	13	17	18	18	18	18	25
Metal Products	33	64	62	6o	61	6o	96	125	151	193	276
Machines	169	25o	253	27o	263	27o	6oo	717	879	1o29	1447
Other Industries	985	485	468	463	456	448	497	511	542	546	619
TOTAL	1633	1385	136o	1359	1338	134o	1891	2114	2435	2725	3686

Source: AEEF

(3) Trends in energy consumption by industry

Table 2.7 sums up trends in the composition of energy consumption classified by major industry. In 1970, the iron and steel industry accounted for 30% of the total energy consumption, followed by the chemical and the glass-cement industries with 15% shares, each. In 1989, energy consumption by the iron and steel industry slipped to 23% and that by the glass-cement industry to 12%, while that by the chemical industry grew to 24% of the total.

Energy consumption by the industrial sector, which peaked in 1978 at 9,846,000toe, gradually declined later until it fell to 8,183,000toe in 1989. Energy consumption by different industries generally follows a similar pattern, except that the increase in energy consumption by the plastics industry and the nonferrous metal industry is remarkable.

Table 2.7 Changes in energy consumption by major industries

1,000 toe

Industries	1970	1978	1980	1982	1983	1984	1985	1986	1987	1988	1989
Food, Feed	543	791	781	765	749	747	755	734	775	783	781
Textile	217	303	249	229	222	212	215	209	209	202	182
Wooden Product	70	89	85	62	57	60	57	56	58	54	55
Paper & Pulp	117	144	141	145	144	144	150	136	144	147	136
Printing & Publication	6	6	6	8	7	7	6	6	6	6	5
Chemicals	1106	2353	2497	2017	2046	2142	2110	2124	2089	1951	1937
Oil & Coal Derivatives	26	51	53	21	22	22	21	20	24	30	28
Plastics	16	33	39	294	323	337	333	330	321	338	322
Rubber & Leather	72	78	99	81	79	84	82	77	74	69	65
Glass, Cement, Ceramics	1128	1318	1249	1151	1113	1107	1059	1022	1054	1024	1002
Iron & Steel	2405	2751	2647	2552	2437	2487	2410	2390	2214	2115	1921
Nonferrous Metal	233	365	346	323	336	343	334	349	349	518	519
Metal Products	84	94	96	89	94	81	76	73	71	65	61
Machines	629	631	606	581	560	571	554	539	605	501	459
Other Industries	565	839	926	862	857	911	875	948	904	866	710
TOTAL	7217	9848	9781	9180	9046	9255	9037	9013	8897	8669	8183

Source: AEEF

(4) Trends in energy consumption per unit of production by major industries

As is clear from Table 2.8, energy consumption per unit of production by typical energy-intensive industries showed a fair improvement between 1980 and 1989. Though a simple comparison is not possible because of differences in materials and product specifications, nonetheless, looking at energy consumption per unit of production by the same industries in Japan, the energy consumption rates by some Hungarian industries are about 20% higher than the comparable Japanese rates.

Table 2.8 Energy consumption rates per unit of production by major industries

Industry (toe/ton of Product)	1980	1985	1989
Iron	0.658	0.639	0.526
Steel	0.102	0.092	0.083
Alumina	0.339	0.339	0.325
Cement + Clinker	0.111	0.108	0.101
Ammonia	1.219	1.204	1.208

Source: AEEF

2.1.5 Long-term energy supply-demand plan

(1) Three energy consumption scenarios up to 2000

The Ministry of Industry and Trade projects three scenarios up to 2000 as shown in Table 2.9 concerning the growth of energy consumption and electricity consumption.

The three scenarios are characterized as follows.

- Scenario A (optimistic scenario)

  This scenario is based on the expectation of a rapid structural reform of industry and sharp 6% growth in the country's GDP, and anticipates a possibility of closing up the long-standing level gap between Hungary and Western European countries.

- Scenario B (moderately optimistic scenario)

  The anticipated GDP growth rate is 3% in this scenario, which is lower than that envisioned in Scenario A. However, it is still higher than what it actually was before. According to this scenario, the level gap between Hungary and Western European countries could be prevented from widening further.

- Scenario C (pessimistic scenario)

  This scenario envisages a GDP growth rate of 1.5%, the lowest of the three scenarios. This scenario may become a reality if monopoly enterprises are not reorganized well in good time.

There is a strong view that of these, Scenario B is the most realistic one.

Table 2.9 Energy consumption outlook in 2000

Scenarios / Items	Scenario A 1993~2000	Scenario B 1993~2000	Scenario C 1993~2000
GDP growth rates (after 1993)	6%/y	3%/y	1.5%/y
Energy consumption	2.2%/y (–3.5%)	0.5%/y (–2.5%)	0.5%/y (–1.0%)
Electricity consumption	3.4%/y (–2.5%)	2.1%/y (–1.0%)	2.4%/y (1.0%)

Bracketed figures denote percentages up to 1993.
Source: Ministry of Industry and Trade.

It is projected in Hungary that the current recession will continue up to 1993 and that the economic situation will improve later, so that the country's GDP will increase 13% over 1990 by 2000. This projection will become a reality if the industrial restructuring process aimed at expanding the food-processing, machining and chemical industries proceeds smoothly. Energy supply is expected to decline between 1989 and 1993, due largely to a lowered demand for energy attributable to industrial stagnation. Total energy demand is expected to be 1250PJ-1450PJ (30-35Mtoe) in 2000, against 1244.2PJ (29.71Mtoe) in 1990, or to remain on about the same level as it was in 1990.

(2) Electric power supply-demand projections

As for electricity, estimated electricity demand up to 2000 in Hungary is as shown in Figure 2.1. According to this estimate, electricity demand will remain unchanged in 1991 and 1992, and turn upward from 1993, until it reaches 44-48TWh by 2000.

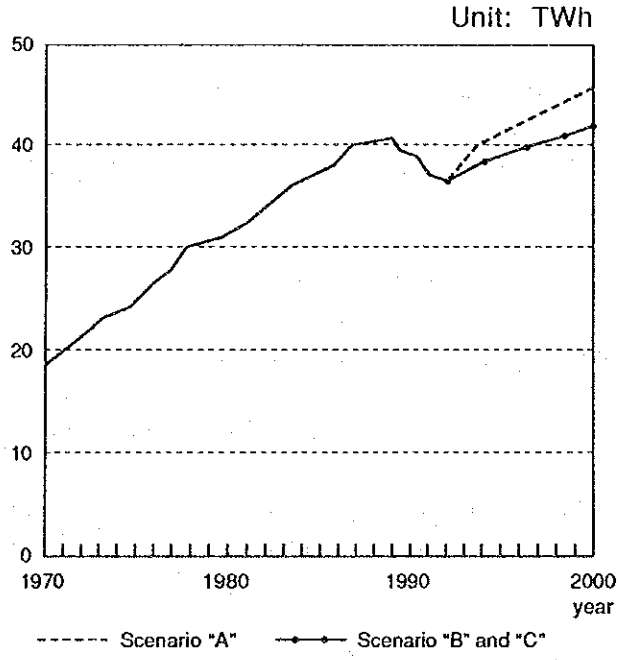


Figure 2.1 Electricity demand outlook in Hungary
Source: Ministry of Industry and Trade

1) Thermal power generation

In Hungary, 75% of domestically produced coal is used for thermal power generation. Coal-fired power plant capacity totals 2,250MW. These plants started operation in 1950-1960 and are now rather old and obsolete. In view of this, a thermal power plant repair program was carried out in the 1980s as a World Bank project. For instance, three 200MW generators at the Gagarin Power Plant were renovated, so that the power plant was improved from 1450-1500KJ/KWh before the renovation to 1300kJ/KWh after the renovation, and its efficiency was improved about 2 percentage points from 25.7% to 27.6%.

The power generation capacity of Hungary's oil- and natural gas-fired thermal power plants is 2,900MW. They were constructed in the 1970s and are able to utilize both oil and gas. They have excellent efficiency. Natural gas is primarily supplied to ordinary households and industry, and only the remainder is used for power generation.

The country's electricity supply plan for the immediate future is to respond to electric power demand by constructing small-scale gas turbines (70 - 100MW) instead of building large-scale power plants. Already one gas turbine of 140MW was completed in August 1990, and is now being test-operated.

It is also planned to make a 400kV connection between Hungary's power grid and that of Western Europe by 1993.

At Hungarian power plants, no matter whether they are coal-, oil- or gas-fired, the only environmental measure is dust removal. They are not equipped with any desulfurization or denitrification facilities.

2) Construction plans for large-scale power plants

The following three alternative plans are under study for the construction of (large-scale) power plants in 2000 - 2005.

1. Nuclear power plants (2000MW)

2. Coal-fired thermal power plants (utilizing domestically produced low quality coal)

3. Coal-fired power plants (using high quality imported coal)

The country plans to attract foreign investments to cover 70% of power plant construction costs, and meet the rest with domestic funds. It also plans to sell surplus electricity to Western Europe.

3) *Adoption of ripple control*

The center controls users' boilers and heaters in order to lower peak power load. It plans to connect its communication system with 1.2 million households (out of the total of 4 million households). This control system can hold down the peak power load of 6500MW by 800MW. As for factories, only 50 are directly controlled by the center, and the center requests other factories to lower their peak power consumption by telephone.

4) Other energy conservation measures are as follows.

1. Sale of surplus heat to private organizations

2. Co-generation (gas turbines)

3. Rationalization of power distribution network

(3) Projected energy consumption classified by industry and estimated energy consumption per unit of production

Hungary intends to carry out a major energy efficiency plan by 2000 mainly through change in its industrial structure, believing that it is necessary to strengthen its basic industries and thereby develop industries creating high added value in order to increase their international competitiveness and assert its industrial presence among European countries.

It also attaches importance to the improvement of the energy efficiency of its energy-intensive industries such as the iron and steel, nonferrous metal, petrochemical and chemical industries.

Table 2.10 shows projected energy consumption by sector up to 2000.

Table 2.10 Final energy consumption by sector in 2000 (%)

Sector	1988	1989	1990	1995	2000
Industry	40.1	38.6	36.0	25.5	26.5
Transportation	5.7	5.5	4.9	6.7	6.7
Res. & Commer.	46.1	47.9	51.4	59.6	58.7
Agriculture	8.1	8.0	7.7	8.2	8.1

Source: AEEF

AEEF estimates the energy consumption per unit of production of representative energy-intensive industries as shown in Table 2.11.

Table 2.11 Energy consumption rates of major industrial products

Industry (toe/ton of Product)	1980	1985	1989	1995	2000
Iron	0.658	0.639	0.526	0.512	0.508
Steel	0.102	0.092	0.083	0.081	0.078
Alumina	0.339	0.339	0.325	0.286	0.276
Cement + Clinker	0.111	0.108	0.101	0.094	0.089
Ammonia	1.219	1.204	1.208	1.200	1.194

Source: AEEF

3. Activities for Promotion of Energy Conservation in the Manufacturing Sector of the Republic of Hungary

3. ACTIVITIES FOR PROMOTION OF ENERGY CONSERVATION IN THE MANUFACTURING INDUSTRIES OF THE REPUBLIC OF HUNGARY

3.1 Implementation of Energy Conservation Measures in Hungary

3.1.1 Basic energy policy

After 1954, a program for energy conservation policy became the focal point of the energy policy of Hungary. In the past, particularly during the two state plans, that is, the sixth five-year plan (1981 - 1985) and the seventh five-year plan (1986 - 1990), energy conservation policy was promoted. However, at present, the past policy has been completely nullified in the wake of the political reform in the country.

Under the new political system, a new energy policy centering on the following seven items was in June 1990.

1) Promotion of energy conservation and improvement of energy efficiency through the restructuring of industry

2) Elimination of one-sided energy import dependence - which results in economic dependence - and realization of import source diversification

3) Introduction of market conditions into energy supply and establishment of a liberalized pricing policy reflecting international energy prices

4) Search for measures to lower energy cost and their economic effect

5) Opening of policy information to the public and promotion of public energy awareness

6) Establishment of new organizations adaptable to market economic conditions and elimination of monopoly capital

7) Limiting State intervention to a justified and necessary level

8) Consideration of environmental protection in the field of erergy

3.1.2 Energy conservation policy of the government

As the Hungarian government formulates its energy conservation measures, the Ministry of Industry and Trade is at the center of the process, and adjustments are being made through consultation with the Ministry of Finance and other government ministries. The basic framework of its measures is as follows.

1) Tax reduction

2) Income tax reduction for companies manufacturing energy conservation equipment

3) Reduction of import taxes on energy conservation equipment

4) Provision of energy conservation information and education in energy conservation

3.1.3 Energy-related organizations in Hungary

Shown below is the organizational chart of energy-related organizations in Hungary. The Ministry of Industry and Trade is engaged in all affairs related to energy, including energy policy and energy conservation policy, the Ministry of International Economic Relations in matters related to energy export and import, the Ministry of Finance in policy on tax systems, and the Ministry of Environmental Protection and Regional Development, in cooperation with the Ministry of Industry and Trade, in affairs of energy-related environmental protection. At present, in the process of economic reform, these organizations are being reorganized. It is expected that the Hungarian Electricity Trust, the Hungarian National Oil and Gas Trust, and the Mining Trust will actively attract foreign capital to promote their management rationalization.

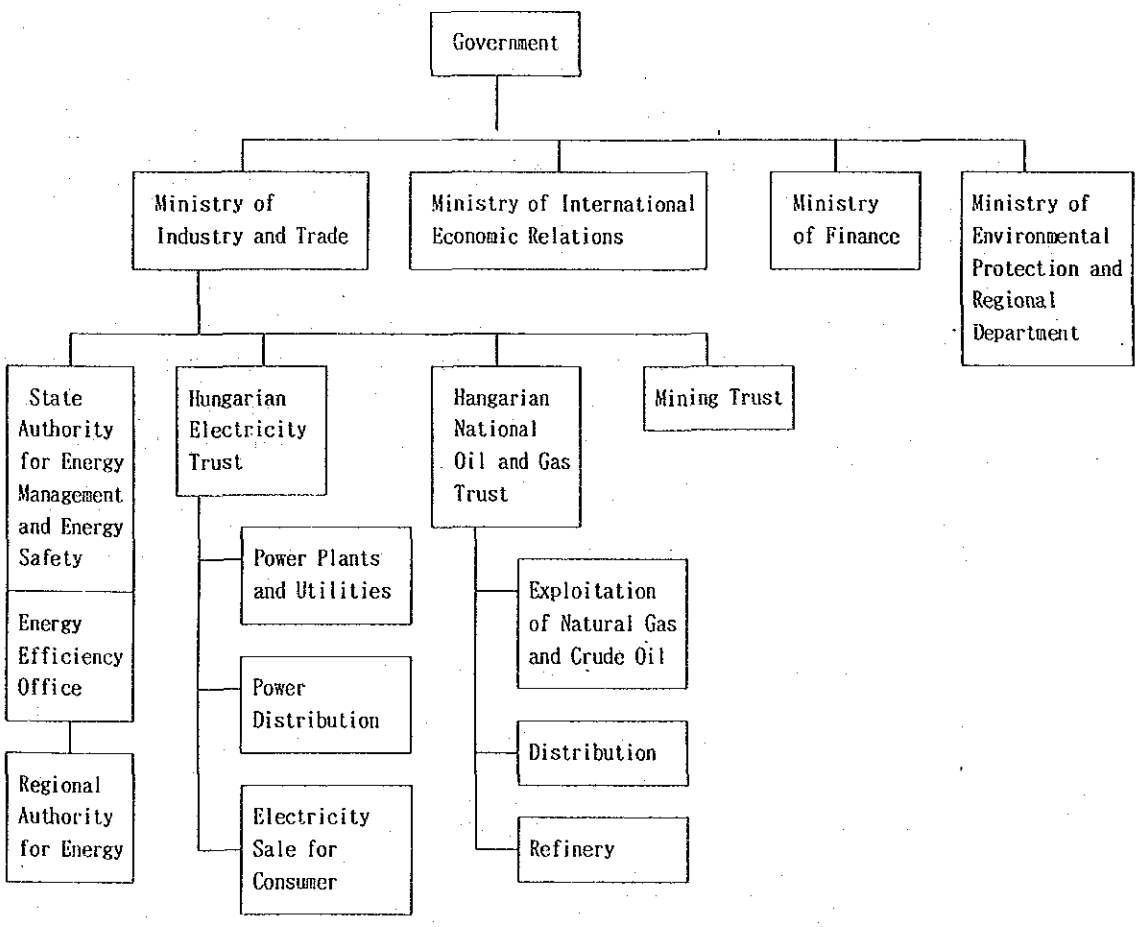


Figure 3.1 Organizational chart of energy-related organizations in Hungary

3.2 Activities for Promotion of Energy Conservation in Hungary

In this section, Hungarian energy conservation programs will be reviewed from the past to the future.

3.2.1 Past activities for promotion of energy conservation

(1) Designated energy management factory system

This system was introduced in 1986. About 4,000 state-run factories were designated as such, and all the designated factories were obligated to make reports to AEEF on energy supply and consumption. Even at present, an energy-designated system is applied to factories consuming 5,000GJ or more energy annually, and under this system 1,400 factories make reports to AEEF on their energy balance.

Of these, about 520 factories consume more than 100,000GJ of energy annually, and these factories account for 95% of the total energy consumption of designated factories.

(2) Energy manager system

Factories consuming more than 10,000GJ of energy annually were obligated to appoint energy managers, who were required to prepare an energy balance sheet for the factory and submit it to AEEF. Before the economic reform, 800 - 900 factories were covered by this system. The obligation of the report to AEEF was abolished in 1989, and at present, each factory manages its energy autonomously.

The number of energy managers was fixed as follows according to the energy consumption of the factory.

1. Factories consuming 10,000GJ or more annually

   One manager (who can do other jobs at the same time)

2. Factories consuming 25,000GJ or more annually

   One manager (full-time energy manager)

3. Factories consuming 50,000GJ or more annually

   Three or more managers
   These factories were required to have an energy management department.

Graduates of technical universities were qualified to be energy managers automatically, and other engineers could be qualified if they attended lecture courses given by AEEF.

(3) Preferential treatment for introduction of energy conservation equipment

A system of preferential treatment according to the effect of energy conservation was introduced for investments in energy conservation equipment by factories, but this system was abolished in 1989.

(4) Factory energy audit

AEEF carried out the factory energy audit of about 400 enterprises over the five years from 1984 to 1989.

(5) Commendation system for energy conservation

This system was introduced in 1985. Under this system, the Ministry of Industry and Trade awarded prizes totaling 50 million Ft annually to individual engineers and groups of them according to the degree of achievement of energy conservation targets. Furthermore, there was a system of commendation for factories which collected their investments in energy conservation equipment earlier than planned.

(6) Information activities for energy conservation by the industrial sector

1) Seminars on energy conservation

The Ministry of Industry and Trade and AEEF jointly hold seminars each year for energy specialists from large and small-and-medium sized enterprises, for which an attendance fee is charged.

For large-scale factories (5 days)
1985 - 89 1,000 persons

For medium and small sized factories (1-3 days)
1985-1989 3,000 persons

In addition, the Ministry of Industry and Trade holds twice a year meetings for persons in charge of energy management in order to explain on the energy situation and exchange information. (Up to 1990, 300 persons attended every year, and in 1991, 180 persons attended.)

Furthermore, AEEF has planned and held seminars on energy conservation at the request of the Energy Economics Research Institute, the Electricity Research Institute and other organizations with the approval of the Ministry of Industry and Trade. The participants in the seminars are given certificates by AEEF. These seminars have been held mainly to upgrade the technical level of those who are non-university graduates.

2) A specialized magazine on energy conservation was issued four times a year under a UNIDO project.

3) An energy conservation booth was installed every year at international exhibitions until 1990.

3.2.2 Present activities for promotion of energy conservation

(1) Soft loan tax system for energy conservation: Preferential finance

1) Low interest loans from Germany's coal gift

Using as a revenue source 900 million Ft obtained through domestic sale of coal provided by Germany as aid requiring no compensation, the government is extending low-interest loans (annual interest on them has been reduced from 40% to 20%). Enterprises which can receive these low-interest loans are selected by EGI and AEEF.

The low interest loan system is applied to the following.

1. Equipment investments for energy conservation

2. Equipment investments by companies manufacturing energy conservation equipment

3. Equipment investments for alternative energy sources

2) World Bank credit

Loans under this system carry an interest rate of 25% and are applied only to equipment imported from Western Europe.

(2) Factory energy audit

AEEF conducts a factory energy audits at the request of factories. This audit is conducted for a fee by 10 - 13 engineers. The audit fee, which was 2,000 Ft per person per day when this system started in 1984, is now 5,000 Ft per person per day.

(3) Technical research and development

3.2.3 Future plan for aid to energy conservation investment

1) Preferential measure to encourage introduction of energy conservation equipment

The Hungarian government plans to promote the introduction of energy conservation equipment. A tax reduction is being introduced by which an enterprise is allowed to enjoy a tax reduction if it achieves energy conservation results by improving factory equipment.

The period of tax reduction in the case of equipment with a 15 year life span is limited to one-third, five years.

2) Reduction of value added tax (VAT) for introduction of energy conservation equipment

The present 20% value added tax rate is scheduled to be classified into 10% and 20% rates. The government is considering a plan to apply a 10% rate to energy conservation equipment and environmental protection equipment.

3) Reduction of import tax on energy conservation and alternative energy equipment

The Hungarian government is considering a plan to reduce the present import tax rates of 20 - 25% on energy conservation equipment to Western European levels of 10 - 15%.

4) Tax reduction for companies manufacturing energy conservation equipment

It is also studying a plan to extend loans for equipment investment and permit a tax reduction for companies manufacturing energy conservation equipment. For instance, a plan is under study for a 20% income tax reduction for companies, etc. manufacturing electric boilers.

3.3 Activities of Organizations for Promotion of Energy Conservation

3.3.1 State authority for energy management and safety (AEEF)

(1) Outline of AEEF

The State Authority for Energy Management and Safety, our counterpart organization in this study, is a nonprofit organization under the direct control of the Ministry of Industry and Trade. When it was established in 1953, it handled only matters related to electricity. However, the safety management task of the heat department of the Ministry of Industry and Trade was transferred to AEEF in 1953 so that AEEF has since been engaged in the safety management of furnaces and heat supply boilers.

All its employees are public officers, and the staff strength is being reduced as its regulatory activities are retrenched in correspondence with the progress of economic reform. Staff strength dropped from 530 persons in 1989 to 450 in August 1991. The president of AEEF is appointed by the Minister of Industry and Trade.

The budget of AEEF was approximately 300 million Ft (about ¥560 million) in 1990, of which one-tenth or 30 million Ft (about ¥56 million) was covered by state subsidies. An organization chart of AEEF is shown in Figure 3.2.

The Energy Measurement Department of AEEF is in charge of promoting energy conservation. Of the total staff of 35 persons, 30 are engineers, who are divided equally into heat and electricity specialists. (See the organizational chart of the Energy Measurement Department in Figure 3.3.)

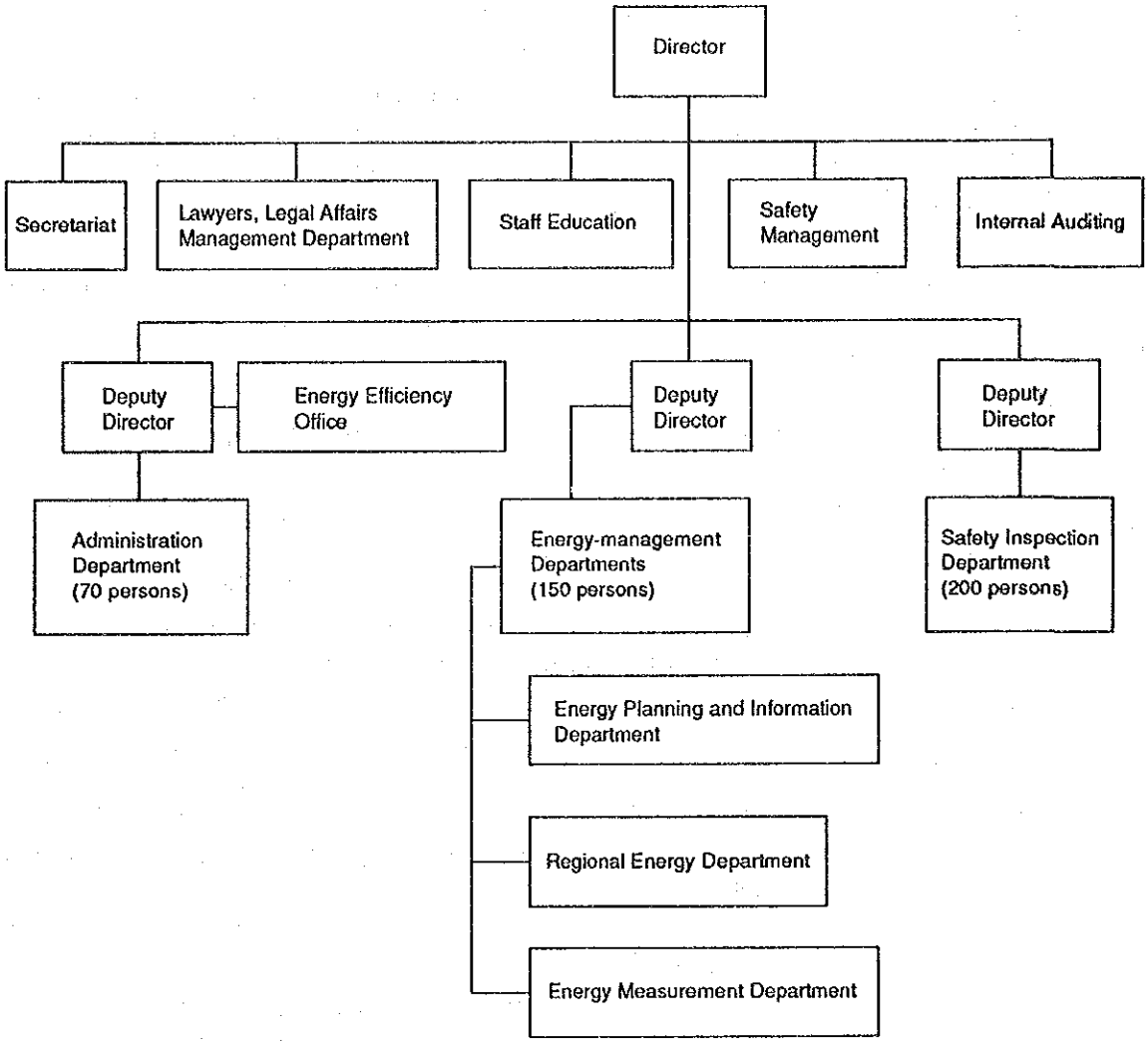


Figure 3.2 AEEF organization chart

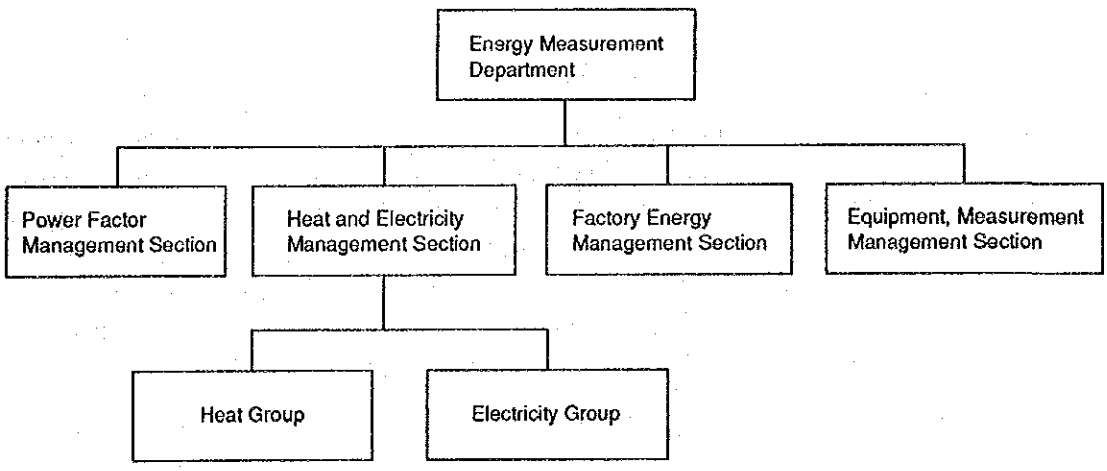


Figure 3.3 Energy measurement department

(2) Scope of activities

The business sections of the department are classified into three major departments, namely, the management, energy and safety inspection departments, whose tasks cover all business related to energy, including energy supply-demand planning, analysis of energy conservation in factories, performance testing of boilers, etc.

The energy-related sections are the following three, whose total staff members have been halved from 260 persons in 1986 due to a decrease in business commissioned by the government.

1) Energy Planning and Information Department (50 - 60 persons)

a. Compilation of energy statistics

Energy suppliers and large-lot energy consumers are obligated to make reports on actual energy supply and consumption to AEEF, and on this basis, AEEF is structuring a data base on energy supply and demand.

b. Formulation of short- and mid-term energy supply-demand plans

Before the economic reform, seven to eight organizations cooperated in formulating government energy-related plans. However, today, because of the lack of government funding for these organizations, AEEF plans to formulate such plans on its own.

c. Efficient supply management of electricity and natural gas networks, peak demand checking

This department is involved in planning for efficient supply of electricity and natural gas and making adjustments to manage peak demand.

d. Emergency power reduction instructions

Electricity is supplied mainly by nuclear power plants and former Soviet union. In case of an abnormality in these systems, the department is empowered to give instructions for consumption reduction in five stages according to a pre-arranged list, which is approved by the Minister of Industry and Trade, and which is made known to all factories. A strict punishment is handed to a factory which fails to abide by its instructions. Energy consumption restrictions under this system were issued for a total of several hours in a recent year.

2) Regional Energy Department

This department is engaged in activities to promote district heat supply systems, including activities for improvement of lighting, popularization of high pressure sodium-lamps and others.

3) Energy Measurement Department

a. Power Factor Management Section

This section extends guidance in energy conservation through improvement of power factor. The country's electricity rate system stipulates a fine for a power factor of 0.9 or less, and also provides for bonuses. It is also engaged in designing measures for elimination of higher harmonics related to the installation of condensers.

b. Factory Energy Management Section

This section carries out screening work on the applicability of new equipment and examination of equipment import licenses while simultaneously conducting statutory performance tests on boilers every year. The business of this section partially overlaps with that of the Safety Inspection Department. This section is also engaged in popularizing energy conservation, including distribution of data and materials (such as examples of energy conservation, collections of entries in design competitions, booklets aimed at medium- and small-sized enterprises, etc.).

c. Equipment, Measurement Management Section

This section is engaged in the development of energy measurement methods.

d. Heat and Electricity Management Section

This section provides energy audit services and guidance to factories.

It started its work of energy audit and guidance in or around 1960, but it was from 1984 that it began to do detailed diagnosis work. It conducted about 400 factory energy audits in 1984-1989.

3.3.2 Energy efficiency office

In addition to the above-mentioned organizations, the Energy Efficiency Office was established at the proposal of the World Bank. It has less of a government office nature than other organizations since it conducts education and dissemination activities related to energy conservation instead of doing regulatory work, and its office is located away from ordinary government offices in order to enable ordinary people to visit it easily.

It is staffed by six persons, and is engaged in doing budgetary management work concerning assistance funds from the World Bank as well as work related to international affairs. It also prepares booklets and holds seminars on energy conservation.

The international cooperation projects on energy conservation it has so far handled include the following.

1) World Bank projects

Hungary received World Bank loans for its two energy conservation programs, that is, one in 1980 - 1985 and the other in 1985 - 1987.

a. Program of improvement of energy conservation equipment in the industrial sector (1983 - 1986)

This program involved introducing energy conservation equipment into 50-60 factories (US$50 - 60 million)

b. Improvement of equipment for energy conservation (1986 - 1987)

Improvement of small-scale energy conservation equipment was carried out in the same manner as item a. (US$24.5 million)

2) Five-nation agreement program (Italy, Austria, Czechoslovakia, Hungary and Yugoslavia)

A five-nation agreement is planned to establish a Hungarian Energy Center with a budget of 0.5 million ECUs in order to promote energy conservation in Hungary and to cooperate in the areas of both software and hardware.

3) Credit from Finland

The credit is for energy conservation and environmental protection and its budget amount is 100 million markka.

4) UNIDO project (1983 - 1991)

A magazine devoted to energy conservation was issued in 1983 - 1991. Four issues of it were published a year, with about 10 European countries participating in its publication.

3.3.3 Research and development

At present, Hungary's research and development spending accounts for 1.7% of its GDP, and the number of researchers is 22 persons per 10,000 of its population.

Research and development work on energy conservation is done by technical development organizations under the control of the National Committee for Technological Development (Hungarian OMFB) established in 1962. Its total budget in 1991 was about 10 billion Ft, of which 12% or 1.2 billion Ft was earmarked for research and development spending on energy conservation. This budget is spent as funds for 51 State research institutes, 18 private research institutes, and other university and private enterprise research institutes.

In addition, energy-related research and development is conducted by MVMT, OKGT and other engineering enterprises on their own. MVMT entrusts a larger part of its research and development work to the Electricity Research Institute. In 1990, MVMT spent US$70 million and OKGT US$12 million in research funds provided to the Housing Research Institute and research institutes attached to their member companies.

3.3.4 Environmental measures

As result of a decline in the utilization of coal, the amount of sulfur released into the atmosphere in the form of SO_2 emissions was reduced from 817,000 tons in 1980 to 710,000 tons in 1987. Nevertheless, Hungary is one of the countries whose SO_2 emissions per unit of energy consumption is the highest in Europe. According to the Helsinki Treaty, the country plans to reduce SO_2 emissions 30% by 1993 from their level in 1980. Furthermore, because Hungary became a party to the Helsinki Treaty, SO_2 emission regulations will be applied more strictly in the country after 1993. Electricity generation is responsible for 40%, industry 40% and consumer-related activities 20% of the total amount of SO_2 emissions generated in Hungary. As mentioned above, environmental restrictions will be an important factor in the future for selecting energy supply sources in the country.

The number of automobiles in operation in Hungary is higher than that in other Eastern European countries. It has increased rapidly in the past 10 years. However, because of the high price of gasoline, gasoline consumption remains almost unchanged. As an environmental measure, it is planned to reduce the lead content in gasoline from the present 0.4g/liter to 0.2g - 0.3g/ liter.

As for the regulation of NOx emissions, Hungary is obligated not to exceed its NOx emission level in 1987 after 1994 according to the Sofia Memorandum which the country signed in November 1988. Therefore, it is necessary for it to tackle NOx emissions as early as possible. Transportation accounts for 50%, electricity generation 20% and other sectors 30% of the country's total amount of NOx emissions.

4. Recommendation for the Promotion of the Rational Use of Energy in the Republic of Hungary

4. RECOMMENDATION FOR THE PROMOTION OF THE RATIONAL USE OF ENERGY IN THE REPUBLIC OF HUNGARY

4.1 Energy Conservation Measures for the Manufacturing Sector in the Republic of Hungary

4.1.1 Necessity of energy conservation promotion

Hungary's dependence on energy imports is growing year by year. Its dependence on energy imports from the former Soviet Union continues to be especially high, and Hungary's energy supply system is becoming increasingly weak.

Therefore, it is necessary for the country to stabilize its energy supply through the expanded utilization of new energy sources and through diversification of supply, at the same time making efforts to develop conventional energy sources. On the demand side, a major role is to be played by energy conservation measures aimed at controlling energy demands, so that it matches energy supply; this is to be done by raising the efficiency of energy utilization to the highest possible level.

A rise in energy prices is unavoidable in Hungary, since prices are being pushed closer to those of the international market. It is essential to minimize subsequent production cost increases and to maintain the international competitiveness of Hungary's manufacturing sector.

Furthermore, the problem of global warming due to carbon dioxide emitted by the combustion of fossil fuels has been attracting serious attention in the world in recent years. This problem cannot be solved separately by individual countries. It is a problem which the world must solve through cooperation. Hungary agrees with the policy of lowering carbon dioxide emissions to their 1985 - 1987 level by 2000.

Improving the efficiency of energy consumption is an effective way to solve this problem.

Needless to say, the importance of energy conservation is sufficiently recognized in Hungary, and not a few energy conservation measures were taken before economic reforms.

The necessity of energy conservation has been regarded as one of the main thrusts of new energy policies since economic reform.

4.1.2 Basic concept of energy conservation

The direction that should be followed to achieve energy conservation is the utilization of energy in such a way that economic development and people's lives are improved to the maximum, taking energy supply, the realities of society and the environmental problems into consideration.

Hungary's social system is now in a transitional stage. Its past policies have been abolished, with new ones established, but concrete measures are yet to be formulated. Thus, as a reaction to excessive regulation under the former socialist system, there are people who demand that all policies, including those concerning energy, be left to independent management; at the same time there are others who are concerned about laissez-faire economic liberalism, and who call for the revival of energy conservation measures.

Energy conservation can not be forced on consumers, but it is necessary to guide them to energy conservation by indicating to them the necessity and direction of energy conservation and by taking necessary incentive measures, including a pricing policy, subsidies, the provision of information, etc. It is the task of the government and governmental agencies to formulate these basic conservation measures and to create a system and an environment aimed at promoting energy conservation. Therefore, it can be said that the way the government and governmental agencies promote conservation and extend proper assistance will determine the effect of energy conservation.

As for energy conservation in the industrial sector, this will bring benefit to the government and to enterprises. However, the reasons for achieving energy conservation are not always the same. The aim of the government is to develop and stabilize the country economically, and to improve its international balance of payments position; enterprises seek to increase their profits by reducing energy costs.

The government's recognition of the importance of energy conservation and the priorities decided by it do not necessarily coincide with the way enterprises would proceed. Therefore, full communication and cooperation between the government and enterprises are both essential in the formulation and implementation of energy conservation measures. Without understanding and cooperation on the part of enterprises which actually carry out energy conservation, no significant results can be achieved.

It is important to switch to the energy conservation measures to guide privatized enterprises, instead of just reverting to the former measures adopted for state-run enterprises under the socialist system.

The government formulates basic policies on energy conservation, but it should not necessarily execute directly concrete measures. It is best that AEEF and other such neutral organizations assume responsibility for implementation.

4.2 Proposals Concerning Energy Conservation measures for Manufacturing Sector in the Republic of Hungary

Based on our study of Hungary's energy conservation policies, we consider the following eight measures to be the most important for energy conservation in the manufacturing sector in Hungary. We will also make proposals for the implementation of these measures.

4.2.1 Energy pricing policy

One of the basic energy policies adopted by the Hungarian government (in June, 1991) is the establishment of a free pricing policy reflecting international prices. Following this policy, the government has raised prices for primary energy, secondary energy like electricity, city gas and petroleum products in the last two years, as shown in Table 4.1.

The government is scheduled to deregulate prices for coal, firewood and LPG during 1991. It also reached agreement with the World Bank on the abolition of all consumer-related energy subsidies by the middle of 1992.

Table 4.1 Changes in energy consumer prices in Hungary

Year / Energy Price	1985	1986	1987	1988	1989	1990	1991	Reference (1990)
Coal Ft/100kg	50.0	54.0	55.6	64.8	71.7	113.0	230	480
Heavy Oil Ft/ℓ	6.7	5.8	5.0	5.2	5.2	12.7	8.19	8
Diesel Oil Ft/ℓ	6.1	6.2	6.7	8	8.6	11	18	14
Gasoline Ft/ℓ	20	20	20.9	23	25.4	39	56	47
City Gas Ft/m^3	2.4	2.74	2.87	3.36	3.92	5.33	7.82	10
Elec. Industry Ft/KW	1.14	1.12	1.33	1.45	1.49	1.63	3.03	7

Source: AEEF

Source for Reference: The Institute of Energy Econonics, Japan
The figures in the Reference column represent energy prices in other countries in 1990: UK for coal and Germany for others.

Great progress was made in energy conservation in many countries, including Japan, because of sharply increased prices for crude oil in the wake of the two oil crises. After the second oil crisis particularly, many energy conservation measures, though requiring large investments, became economically profitable because of steeply inflated prices for crude oil, and energy conservation measures were vigorously promoted. Furthermore, the public became more aware of energy conservation, and many energy saving home electrical appliances were developed to meet demand.

Generally speaking, the introduction of a market mechanism into energy pricing is an extremely effective way of promoting energy conservation in the industrial sector, as it helps motivate enterprises (particularly entrepreneurs) sensitive to changes in energy prices. Furthermore, this serves to promote the domestic development of energy exploration

An increase in energy prices has a major impact on the economic fabric of society as a whole, and may bring about a decline in the competitive position of some of the industrial sector. Therefore, energy pricing policies should be formulated cautiously, after an integrated examination of industrial trade and price policies. However, basically, we support the Hungarian policy of bringing energy prices to international levels.

4.2.2 Formulation of an energy conservation law

It is necessary for the government, government agencies, energy suppliers, energy equipment manufacturers and consumers to promote energy conservation from their respective standpoints, in an integrated way.

In order to promote energy conservation in an integrated manner, it is necessary for the government to express its commitment to energy conservation, and for it to formulate a law on which its various measures are to be based.

It is worthy of note in this connection that the energy conservation law formulated in Japan, just before the second oil crisis, became evidently a standard followed by the industrial sector.

This Japanese law is of such a nature that it makes government policy clear, and requests various industrial sectors to promote energy conservation instead of forcing regulations on them. It also gives inducements for energy conservation in the industrial, transportation and residential & commercial sectors, through the provision of information, subsidies and the promotion of technical development. Furthermore, the law provides guidelines for the different sectors, to judge their effect to achieve their targets for energy conservation. Guidelines for factories specify the direction to be followed in promoting energy conservation in factories and the basic technology for energy management.

Fig. 4.1 shows comprehensive energy conservation measures taken in Japan. These measures are based mainly on the Energy Conservation Law.

It is necessary for Hungary, in formulating its energy conservation law, to incorporate the following energy conservation measures implemented in the past.

1) Designation of energy-managed factories

2) Energy manager system

3) Subsidies for the introduction of energy conservation equipment

4) Technical development

5) Provision of information

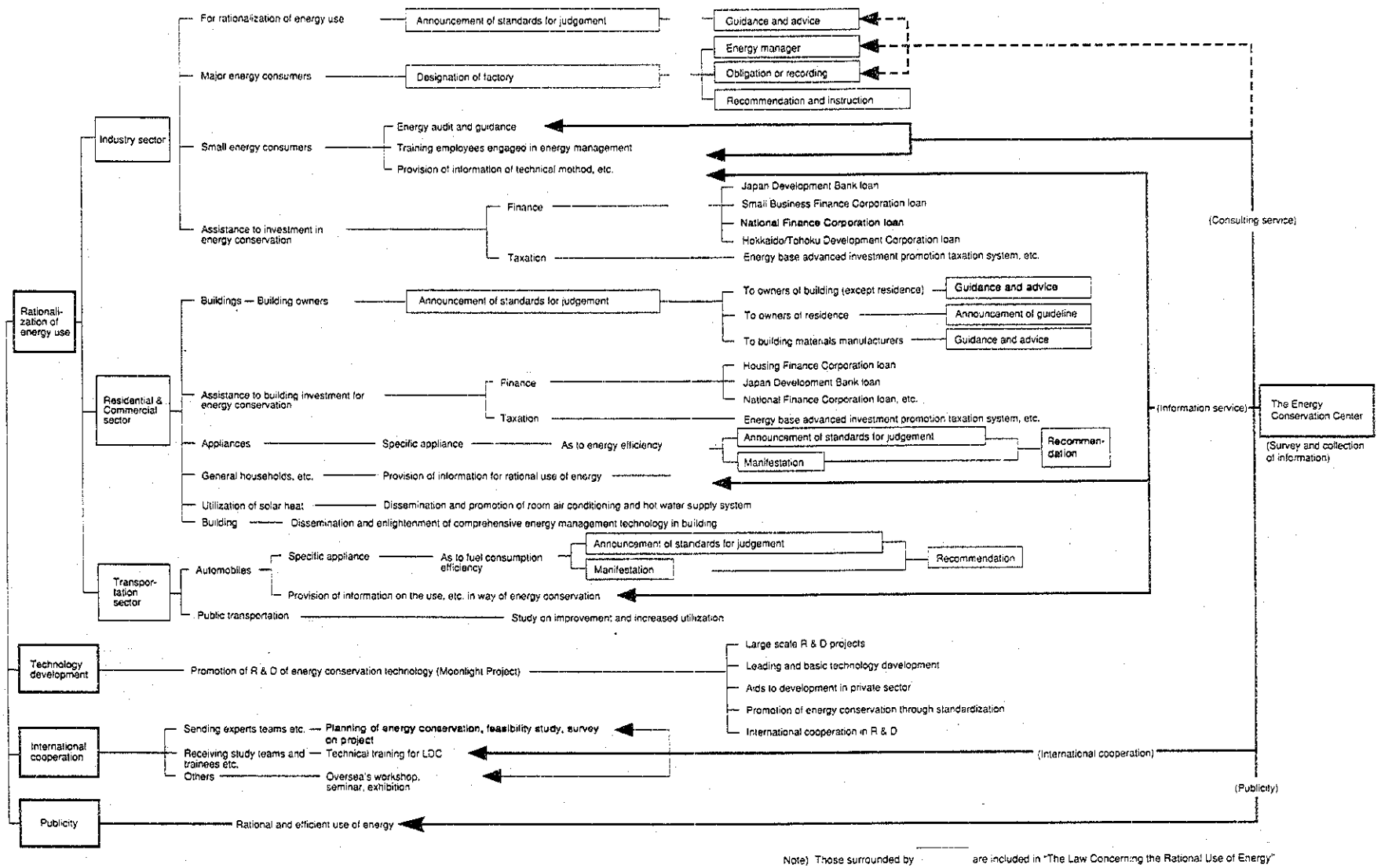


Figure 4.1 Framework of energy conservation measures in Japan

4.2.3 System of designaged energy management factory

To promote energy conservation in the industrial sector, it is effective for the government to designate factories consuming energy in excess of a certain level as designated factories, urging them to effectively carry out energy conservation, and to make reports on the results of their efforts to conserve energy. This will help the designated factories to recognize their energy consumption, and to compare and analyze their energy consumption process-by-process, and to undrestand the causes for fluctuations in energy consumption. As a result they will be able to take effective measures to conserve energy.

At the same time, the Hungarian government will be able to analyze energy data thus made available to it, and to use this data in formulating its policy for the industrial sector.

Hungary started designated energy management factory system in 1986. It designated all state-run factories, numbering about 4,000, as designated factories; these were obliged to report to AEEF on their energy supply and consumption. At present, the government has a system designating those consuming 5,000GJ or more annually as designated factories. 1,400 factories designated as such under this system are making energy balance reports to AEEF.

In Hungary there are about 520 factories consuming 100,000GJ (2,400toe) or more annually in terms of crude oil equivalent; this accounts for 95% of the total energy consumed by designated factories. It will be necessary to determine the criteria to cover 80% or more of the total energy consumption of the country, even after large-scale state-run enterprises are divided and privatized in the future.

In order to make this system more effective, it is necessary to incorporate it into the energy conservation law, together with the following energy manager system.

4.2.4 Energy manager system

It is also an effective means to conserve energy for a designated factory to have an energy manager or managers, and to enable these people to play a key role in promoting energy conservation. Such a system has been implemented with successful results in Japan and many other countries.

Hungary also had a similar system by which factories consuming 10,000 GJ (240toe) or more annually were obliged to put energy managers, who had to prepare energy balance sheets for their factories and submit them to AEEF. Before economic reforms, 800-900 factories were covered by this system.

The number of energy managers which designated factories were formerly required to put, according to their annual energy consumption levels, as in Table 4.2.

Table 4.2 Former energy manager system in Hungary

Annual fuel consumption in terms		No. of energy managers of crude oil
1	10,000GJ (240toe) or more 25,000GJ (600toe) or less	One energy manager who can also hold another position
2	25,000GJ (600toe) or more 50,000GJ (1,200toe) or less	One full-time energy manager
3	50,000GJ (1,200toe) or more	Three energy managers or more. It is necessary to organize an energy management department.

For effective energy conservation, it is necessary to relate the system of designated energy management factory to this energy manager system.

Concretely, it is desirable to institutionalize a system which obliges designated factories to have the necessary number of energy managers. As in Japan, it is better to divide energy managers into heat energy managers and electric energy managers. When energy is managed in a factory, energy managers are usually divided into heat energy specialists and electrical energy specialists.

In order to promote energy conservation in factories, it is necessary to put energy managers who are to manage the energy used by the entire factory and to play a key role in promoting energy conservation.

The energy manager is expected to fulfill the following roles.

1) To record energy used by his factory, collect data, analyze and examine the data, and formulate an energy conservation plan.

2) To receive energy conservation information as the representative of his factory, and at the same time to provide energy data, and give appropriate advice to the factory manager for energy conservation.

3) To give guidance to various workshops in the factory, and act as the central figure examining energy conservation measures and implementing them in the factory.

Because of their important duties, it is necessary that their position in society be held in high regard.

Formerly, Hungary had a system under which qualifications as energy manager could be obtained easily. Thus, graduates of university engineering departments were automatically qualified as energy managers. Other engineers and technicians were qualified as energy managers if they took a test after attending a training course given by AEEF. However, so that the social rank of energy managers can be secured, and so that they may hold appropriate authority, it is important that energy manager qualifications be legally established with a national examination system. For this purpose, it is advisable that the government (or an organization approved by it) hold examinations and regulate a system for qualified energy managers.

The Japanese energy managerial system is similar to the one in Hungary. The energy manager is a specialist who manages energy use in the factory as a whole and plays a key role in promoting energy conservation. In order to become an energy manager, a person is required to pass a national examination. This examination is very difficult, and is regarded as a very authoritative one.

It is advisable to establish measures for a system of designating energy-management factories, and an energy manager system. These which will greatly contribute to nationwide energy conservation measures for the manufacturing sector.

4.2.5 Preferential treatment for the introduction of energy conservation equipment and the establishment of a method to select equipment and machinery

One of the means of promoting energy conservation in the manufacturing sector is to provide financial subsidies and preferential tax treatment for investment in equipment which serves to energy conservation.

The early stages of energy conservation in the manufacturing sector will be as follows. In the first stage, energy conservation will be achieved by eliminating the wasteful use of energy, by improving operation methods, that is, through measures which will not necessitate equipment changes. The second stage will involve the installation of additional equipment, such as equipment to recover waste heat, that is, additional equipment the installation expense for which is relatively low, an investment which can be recouped in a relatively short time. In the third stage, radical measures will be taken, which will require much investment, such as changes in production equipment, new production processes, etc.

No large-scale investment will be needed in the first and second stages. However, as future energy conservation is promoted in the manufacturing sector, it will become necessary to proceed to the third stage, in which investments resulting in much energy conservation will be made.

In view of the fact that all factories, that were surveyed by us in a preliminary field study, pointed out shortages of funds as the main obstacle to promoting energy conservation, when replying to our questionnaire, it is proved necessary to introduce a preferential subsidy system.

Hungary had a financing system for the improvement of equipment in proportion to the estimated effect of energy conservation. But this system was abolished in 1989.

The Hungarian Ministry of Industry and Trade is working out the following plans for preferential measures for investments by the manufacturing sector in energy conservation.

1. Preferential measures for energy conservation planned by the Ministry of Industry and Trade

   1) Preferential measures for the introduction of energy conservation equipment

      According to this plan, a factory will be allowed to enjoy a tax reduction if it has increased energy conservation effect as a result of introduction of equipment. The tax reduciton rate depends on the energy saved.

      The period of tax reduction will be limited to five years (one-third of the service life of equipment concerned, where the service life is 15 years), AEEF will check the results of the investment.

      In Japan, the following preferential tax measure is used for enterprises to installing energy conservation equipment (equipment whose energy conservation capabilities are recognized and which is in the process of becoming commonly used in various industrial sectors. 128 items of such equipment are named for general-purpose industrial use, with an additional 81 for small and medium enterprises) in 1991. Such enterprises can choose either of the following systems: a 7% tax reduction, or the ordinary depreciation plus a special depreciation of 30% of the acquisition price of equipment in the first year.

   2) Reduction of value-added tax for the installation of energy conservation equipment

      In 1992 it is planned to apportion the present 25% rate into two parts: 10% and 20%. If the present rate is divided thus, the 10% rate will be applied to all kinds of energy conservation and environment protection equipment.

   3) Reduction of import tax on energy conservation equipment and alternative energy equipment

      The current import tax rates on energy conservation equipment are 20-25%. At present, the reduction of these rates to 10-15%, or about the same levels as in West European countries, is under study.

4) Tax reduction for companies manufacturing energy conservation equipment

Loans and a tax reduction for equipment investments by companies manufacturing energy conservation equipment are both under consideration, with a view to increasing the manufacture of energy conservation equipment. For instance, a 20% income tax reduction for electric boiler manufacturers is being considered.

All these measures are effective. In implementing them, it is necessary to incorporate them into an energy conservation law, and provide factory managers with information concerning the advantages, so that these measures are utilized fully, and to make them effective.

In implementing preferential treatment for the introduction of energy conservation equipment, it is necessary to select equipment which is not used widely in Hungary, but which promises high energy conservation. In selecting such equipment, a performance evaluation method and equipment tests must be established, with AEEF as the central organization for this system.

4.2.6 Citations for energy conservation

It will be effective to increase business interest in energy conservation by giving citations to individual engineers or groups of employees or factories which achieved excellent results in conserving energy.

Under the system introduced in 1985 in Hungary, prizes, based on the percentage of energy conserved, were given by the Ministry of Industry and Trade to individual engineers and groups of engineers with an annual budget of 50 million Ft. In addition, there was a citation system for factories which recouped their investments in a shorter time than planned after the introduction of energy conservation equipment.

It is considered necessary for the Hungarian government, or any organization approved by it, to publicly commend, about once a year, factories which achieved excellent results in energy conservation, as well as manufacturers who developed equipment highly effective in energy conservation during the year. Such a system will lead to the heightening of the morale of people engaged in promoting energy conservation .

Japan also has a citation system similar to this.

Outlined below, is the citation system for excellent factories and excellent equipment. Receiving citations are those factories which were successful in rationalizing energy consumption, which made constant efforts in energy management, and which, therefore, can be considered models for other factories to follow.

The Ministry of International Trade and Industry is the regulatory body of this citation system, and the Minister for International Trade and Industry commends excellent factories recommended to it by the directors of regional International Trade and Industry Bureaus, the Energy Conservation Center, the Committee for Rational Utilization of Electricity, and other such organizations. The commendation for excellent equipment is made by the Energy Conservation Center, the Japan Machinery Federation, and other independent organizations which are closely related to the government. Applications for citation are made by machinery manufacturers, and are examined by a committee of experienced specialists. Furthermore, successful cases of energy conservation measures taken by employees' voluntary energy-related groups in factories are commended. Such activities are examined by a committee of people of experience and knowledge within the Energy Conservation Center, and prizes commensurate with their achivements are given by the Minister for International Trade and Industry, the Director General of the Natural Resources and Energy Agency, and the President of the Energy Conservation Center.

4.2.7 Technical research and development

Technical research and development projects for energy conservation will become increasingly large and diversified. It is important for the government and private organizations to promote technical research and development for energy conservation in all areas in an integrated and coordinated way, and at the same time to diffuse its product, always keeping environmental protection in view.

EGI (Energy Engineering Institute), which has been engaged since the 1950s in technical research and development for energy conservation, including waste heat recovery technology and cogeneration technology, can be expected to tackle the task of developing more advanced energy conservation technologies.

While energy conservation technologies should be developed in many cases by private enterprises, in an atmosphere of free competition, it is proper that the research and development of basic and common energy conservation technologies which involve risks and require large sums of money, should be undertaken by public organizations such as EGI.

For instance, in Japan, national research institutes are engaged in the technical research and development of fuel batteries, Stirling engines, high efficiency gas turbines, etc.

Furthermore, it is necessary that the government extends subsidies to risky technical development projects undertaken by private enterprises, and also to aid demonstration projects.

4.2.8 Provision of technical information

The provision of technical information is very effective, as it serves to stimulate factories into saving energy, and upgrading the technical levels of engineers. The exchange of information is conducted voluntarily among private enterprises. However, some of the items described in paragraph 4.3, including the audit of factories and training courses, should be conducted by public organizations as part of governmental policy.

4.3 Proposals Concerning AEEF's Activities in the Area of Energy Conservation

It is most proper for AEEF, a neutral organization, to act as the enforcing body for the following concrete measures, due to the composition of its personnel, its experience in the conduct of business related to energy as a whole, and also its accumulation of different technologies for this purpose.

4.3.1 Energy conservation audit of factories

The autit of factories by energy specialists is effective for the promotion of energy conservation in individual factories which do not have an engineer specialized in energy conservation.

One of the ways to expand factory autit for energy conservation is to extend partially free-of-charge guidance services utilizing audit bus. At first, a free investigative service can be extended to factories to identify points to be improved, and to enable them to find ways to advance to the next step, thereby stimulating factories to be more interested in improvement. When a factory further desires a concrete equipment improvement plan, or guidance in factory operations, a paid guidance service can be given. In other words, general diagnosis and guidance by traveling specialists can be given free of charge, and precision and high level diagnosis and guidance service can be provided for a fee. Enterprises will be allowed to choose these services step by step according to their requirements. In order to provide for free diagnosis it is necessary for the government to take the necessary budgetary measures.

AEEF must increase the number of factories investigated making the most of the technology they have acquired during this study period. Furthermore, the results of these factory audits should be discussed at meetings of factory managers and engineers.

AEEF has already carried out an energy audit of 400 factories, for a fee. During our visit engineers conducted a detailed energy conservation study, together with Japanese specialists. Since these engineers have learned the main elements to be improved, as well as important energy conservation measures. They are expected to be able to carry out energy audit more effectively. Furthermore, data and materials for the establishement of technical guidelines will be included in our report. If a guidebook based on these is prepared for energy conservation measures, and if it is utilized, it should contribute to high level energy audit and guidance, and also toward upgrading the technical levels of factories.

At present, in order to make its factory audit more reliable, AEEF makes errorts in improving its related equipment and technology. AEEF will undoubtedly fully utilize its excellent technical resources and knowhow to further develop its traveling factory audit service.

4.3.2 Provision of technical information

(1) Gathering, arranging, and publication of technical information on energy conservation

In order to effectively provide enterprises with technical information on energy conservation, it is necessary to establish a system by which the present situation and future trends in energy conservation technology in various areas can be accurately grasped, and with which such information can be used effectively.

AEEF is already gathering, storing, providing and publishing information on energy conservation. However, it is necessary for it to further expand these activities by broadening its channels for the acquisition of international information, and by structuring its own database. The database should be further expanded, and an online system should be set up to provide information.

For this purpose, as mentioned above, it is necessary for Hungary to promote permanent cooperative relations with overseas organizations for energy conservation, in order to improve the collection of energy conservation information and obtain foreign technical information. At the same time, it is necessary to establish a system with which information and knowhow, which domestic specialists have, can be linked with the government's information service.

There is a plan in Hungary to establish an energy center (with a budget of 0.5 million ECUs). This is a five-nation program (Italy, Austria, Czechoslovakia, Yugoslavia and Hungary) in order to promote among these countries the exchange of technical information on energy conservation. More information on energy conservation is expected to be gathered through the exchange of information with foreign countries in this way, and the information will be made public in a proper manner.

(2) Publication of a magazine devoted to energy conservation

The purpose in publishing an energy conservation magazine is to provide information to energy-related personnel, and to provide an opportunity for the exchange of information.

In Hungary, four issues of a magazine specializing in energy conservation are published each year as a UNIDO project, with the participation of 10 European countries.

In order to promote energy conservation in the industrial sector, it is necessary for the government to constantly provide information on energy conservation to factory managers and engineers, and to contribute toward increasing their energy conservation awareness by showing them successful cases of energy conservation and energy conservation equipment.

(3) Seminars on energy conservation

It is particularly important to spread technical information on energy conservation in order to promote this in the industrial sector. It is effective to spread such information through periodical or occasional seminars, in such a way that it may be utilized to improve the efficiency of energy utilization in actual operation.

In Hungary, various kinds of seminars on energy conservation have been held. The Ministry of Industry and Trade and AEEF jointly sponsor lecture meetings every year for energy specialists in large and medium and small enterprises. In addition, the Ministry of Industry and Trade holds meetings for personnel in charge of energy management in factories twice a year, to make explanations on the energy situation and to exchange information. Furthermore, AEEF has planned and held seminars on energy conservation at the request of the Energy Economics Research Institute, the Electricity Research Institute, and other organizations, with the approval of the Ministry of Industry and Trade. Participants in these seminars are given certificates of seminar completion by AEEF. These seminars are given in order to upgrade the technical levels of mainly non-university graduates.

As one of its projects, AEEF should in future sponsor seminars regularly, at which those who were commended for their remarkable achievements in factory energy conservation will give reports on their experience. Publication of successful examples of energy conservation will be effective in leading the public to recognize the importance of energy conservation, while it serves at the same time to promote energy conservation technological methods in the form of concrete examples.

Generally speaking, many large enterprises have high technical levels of their own, and are active in collecting technical information, but many medium and small enterprises are behind them in this respect. In order to supplement the latters' activities, it is important to hold energy conservation seminars for those in charge of energy management in medium and small enterprises.

Furthermore, as explained in one of our proposals mentioned in item 4.2.4, in order to give greater authority to energy managers, and to make their qualification as energy managers legal, it is necessary to hold seminars to prepare energy managers for an examination. So that energy managers may fulfill their tasks properly, such a seminar should have a proper curriculum as same level as national examination. Furthermore, it will be important to hold seminars for factory managers so that they may be made more aware of energy conservation.

It is proper that these seminars should be held with AEEF, with its excellent technical and information gathering capacity, as the center.

(4) Organization of energy managers

In order to improve the quality of energy managers, it is necessary to organize them, provide them with technical information on energy conservation, train them in energy conservation technology, and give them a technical training course.

It is necessary to register qualified energy managers in factories after energy managers are posted to factories consuming energy in excess of a certain level, and it will be most proper to have AEEF undertake the task of improving their quality and regulating the qualified registered energy managers. At an organizational level, energy managers should be divided into thermal and electrical energy managers, or further subdivided, and it will be possible to provide them with information obtained by factory survey and, foreign information on energy conservation, as well as to communicate government measures to them, and to give specialized technical education regularly in accordance with their specialities.
This group of energy managers also can perform as auditor or consultant for small sized factory.

(5) Exhibitions

In order to provide an opportunity for the public to be aware of energy conservation, it is effective to hold energy conservation exhibitions.

Until 1990, Hungary sponsored an energy conservation booth every year at international exhibitions. It is important to hold exhibitions within the country, to introduce energy conservation equipment, give explanations on the world energy situation (and that of Hungary), and on Hungary's energy policy, etc., in order to enable the public to be more aware of energy conservation. Public interest in exhibitions will be increased if they are held at about the same time of year regularly every year. It will increase effectiveness to hold the above-mentioned seminars and meetings for publication of successful examples, concurrently with such exhibitions.

4.3.3 AEEF as the driving center for energy conservation

At present, AEEF is the central organization in Hungary for the promotion of energy conservation. It is advisable that, in order that it may be concerned not only with energy conservation in industry but also with consarvation on a national level, AEEF have all-rould functions, covering energy conservation in consumer-related areas, transportation areas, technical development, and so on, and that AEEF act as the center for energy conservation.

AEEF, as such a center, will through its activities enable the public to be come aware of the need to use energy efficiently. AEEF can also enable enterprise managers to realize the necessity of promoting energy conservation, and provide engineers education in energy conservation techniques.

Its activities could include the following.

1) Research into energy conservation

2) Collection and analysis of data and information on energy conservation, and provision of the results of its research

3) Technical guidance in energy conservation

4) Education and training in energy conservation technology, for those engaged in operation using energy

5) Research and study of environmental protection related to the consumption of energy

6) Information activities aimed at the ordinary consumer

As will be clear from the above, these AEEF activities will be kept neutral, and are aimed at indirectly assisting the public and enterprises in energy conservation, through the provision of information in various forms, the enforcement of an examination for energy managers, and research into energy conservation equipment, etc. In this way, it will win the confidence of the people and will be taken advantage of positively.

AEEF should start its activities in the industrial sector, since energy conservation measures can bring about quick results there. But instead of confining its activities to the industrial sector, it will proceed in the future to expand into consumer-related areas and transportation.

4.4 Prospects for Proposal Implementation

We have herein made proposals for measures to be taken by the Hungarian government and by counterpart organizations (AEEF), referring to the energy situation, the present state of energy conservation and energy conservation measures in Hungary, and considerating energy conservation measures already taken in Japan and other foreign countries.

Among the proposals made, there are those which have already been implemented and others which call for the revival of abolished measures. In view of this, it is realistic to begin with proposals which do not require great cost or preparation, and then proceed gradually to those proposals which require preparatory measures or a period for legal and system-related adjustments.

It is important to take effective energy conservation measures flexibly and on a sustained basis, responding to social and economic situations, energy conditions, and progress in energy conservation technology. It is hoped that Hungary will make steady, though gradual, progress in the promotion of energy conservation.

Our proposals are summarized in Table 4.3, Table 4.4 and Table 4.5.

Table 4.3 Proposals concerning energy conservation measures in the manufacturing sector of Hungary

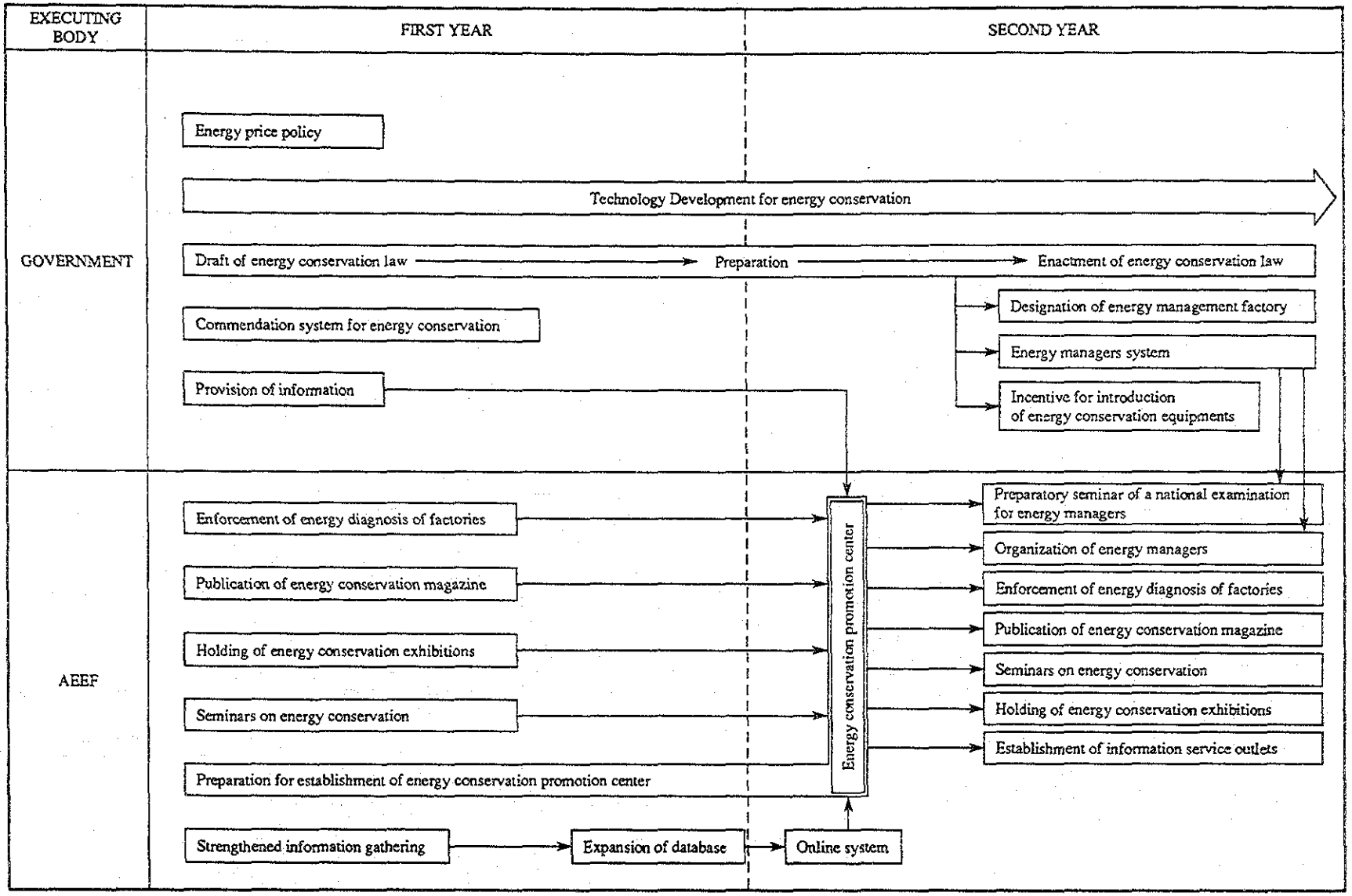
Itemized energy conservation measures	Present state	Problems and analysis	Proposals	Priority order
Energy pricing policy	The government is taking measures to adjust the domestic prices of energy to international levels as one of the basic points of its energy policy.	This policy may lead to a lowering of the competitive position of enterprises but is effective for the promotion of energy conservation.	It is desirable to decide on an energy pricing policy in an integrated way in consideration of the country's industrial, trade and price policies. Basically, however, energy pricing should be based on the principles of a market economy.	A
Energy conservation law	None at present	In order to promote energy conservation, there is a need for a law on which various energy conservation measures can be based.	To formulate an energy conservation law in order to implement measures aimed at various social sections smoothly	A
System of designation of energy-managed factories	Factories consuming 5,000GJ annually are designated as energy-managed factories, and at present, 1,400 factories are designated as such.	It is necessary to obtain accurate information on trends in energy consumption by large-lot users.	To incorporate this system in the proposed energy conservation law, to review the past categories of energy consumption volume and designate energy-managed factories so that they may cover 80% or more of energy consumption, in order to obtain accurate information on energy consumption conditions and lead them to develop energy conservation activities	B
System of energy managers	Factories consuming 10,000GJ or more of energy annually are obligated to have energy managers corresponding in number to the level of energy consumption.	The qualification of an energy manager should be a socially authoritative one. At present, this qualification is not linked to the system of designation of energy-managed factories.	The qualification of an energy manager should be made a national license system in order to ensure the social position of energy managers and should be incorporated in the proposed energy conservation law.	B
Preferential measures for introduction of energy conservation equipment and method of selection of such equipment	The preferential loan system which assisted factories in improving their energy conservation equipment according to its energy conservation effect, was abolished in 1989. At present, the Ministry of Industry and Trade is studying various subsidy systems.	Enterprises are suffering from a shortage of funds for investment in energy conservation equipment, so some kind of government assistance is needed.	All the assistance measures now under consideration are considered to be effective. Such measures should be incorporated in the proposed energy conservation law as measures for energy conservation, and public information activities should be undertaken to increase the utilization rate of such assistance measures.	B
Citation system for energy conservation	There was a citation system with an annual budget of 50 million Ft under which individual factory engineers or groups of engineers were commended. This system was abolished.	Such a citation system is effective for motivating factory managers and engineers to be interested in energy conservation.	If the government or a government-subsidized organization once a year regularly commends factory engineers who have made successful efforts in energy conservation and cases of excellent energy conservation and energy conservation equipment, such a commendation system will serve to heighten the interest of factory employees in energy conservation.	C
Development of energy conservation technology	Technology development activities are being promoted by technical development organizations under the control of the State Technical Development Committee and other individual institutes.	It is necessary to develop technologies meeting the actual conditions of Hungarian enterprises.	While it is desirable that technical development for energy conservation should be undertaken by private enterprises, public organizations should undertake development projects which are risky and require large sums of funds. Furthermore, government assistance is needed for risky technical development and demonstration work by private enterprises.	B
Provision of information	AEEF is conducting guidance activities for factory diagnosis, the Ministry of Industry and Trade and AEEF are jointly holding seminars, and a magazine for energy conservation is published.	Provision of information serves to upgrade the technical levels of factories and stimulate them in their energy conservation activities.	Guidance in factory diagnosis, seminars, publication of technical information magazines and newspapers	B

Table 4.4 Proposals on the energy conservation activities of AEEF

Itemized energy conservation measures	Present state	Problems and analysis	Proposals	Priority order
Enforcement of energy diagnosis of factories	Paid energy conservation analysis was conducted at about 400 factories.	Analysis technology and equipment were not sufficient. Government budget allocation is needed for implementation of free factory analysis.	It is necessary to conduct free energy diagnosis of factories without energy managers in order to interest factories in energy conservation. It is also necessary to conduct paid diagnosis of factories at their request to lead them to take energy conservation measures for factory equipment.	A
Gathering, sorting out and publication of energy conservation data and technology	It is engaged in the gathering, storage, provision and publication of information on energy conservation.	It is necessary to establish proper channels of information, and increase public trust to it as a suppply source of information to the people and enterprises.	Strengthened information gathering (at home and abroad) Expansion of database Expansion of on-line system for information provision Establishment of information service outlets	B C C B
Publication of a magazine devoted to energy conservation	Energy conservation magazine is issued four times a year with the participation of 10 European countries as a UNIDO project.	Sufficient information on energy conservation is not provided to factory managers and engineers.	It is necessary to provide factory managers and engineers with the latest information on energy conservation technology, excellent factories, energy conservation equipment and successful examples of energy conservation, and arouse their interest in energy conservation.	B
Seminars on energy conservation	Seminars are held regularly. Furthermore, the Ministry of Industry and Trade holds meetings twice a year to explain the energy situation and exchange opinions.	There is a shortage of engineers at factories and factory managers are not sufficiently aware of the need for energy conservation.	It is necessary to hold seminars concerning successful examples of energy conservation in factories and give education in energy conservation to engineers in and managers of small and medium factories by holding seminars. It is also necessary to hold seminars to prepare engineers to take a national examination for energy managers.	B B
Organization of energy managers	None	No exchange of information among energy managers	To organize and register energy managers to enable them to exchange opinions, to communicate government measures effectively to them and provide specialist technical education to them, and at the same time to utilize them as factory diagnosis engineers and consultants	B
Holding of exhibitions devoted to energy	The Hungarian government set up its own booth at international exhibitions.	There was no domestic exhibition intended to promote energy conservation and arouse public interest in energy conservation.	For the government and related government organizations to hold an exhibition once a year to increase public awareness about energy conservation	B
Energy Conservation Promotion Center	None at present	It is necessary for AEEF to unify energy conservation promotion organizations to assist enterprises in their energy conservation efforts indirectly through provision of information and win public trust through such activities.	In order to promote energy conservation on a national level, it is necessary to establish within AEEF an organization which will develop activities for the purpose in a unified way.	B

(Note) Priority
A: Highest
B: Higher
C: Generally important

Table 4.5 Recommendations on energy conservation measures



5. Investigation of Use of Energy at Model Factory

5.1 Results of investigation at a dyeing factory

5. INVESTIGATION OF USE OF ENERGY AT MODEL FACTORIES

5.1 Results of investigation at a dyeing factory

5.1.1 Outline of the factory

(1) Company name and factory name: Budaprint SECOTEX Textilfestö Rt.

(2) Category of business : Fabric industry, dyeing and finishing business

(3) Principal product name and production capacity

Principal product name : Textile printed cloth, 80-100 g/m²
(80% cotton, 10% Polyester, 10% Viscose)

Production capacity : 70 million m² per year

(4) No. of employees : 1,100

(5) Location of factory : 1033 Budapest, Szentendrei Út 89-93

(6) History of the factory

This is a specialized factory where the cloth produced at another factory is dyed and finished.

The factory was established in 1908 with capital of Switzerland origin. It was once owned by the government in 1949, but returned to a private enterprise in May, 1989. The shareholders are dyeing companies and trade houses, but American capital is also included partly (5 MFt).

Equipment investment of a large scale was implemented in the first half of 1960's, and bleaching equipment were also introduced. Furthermore, upon entry to the 1970's, modification was made so as to permit treatment of cloth of broad widths, and textile printing machines of rotary screen system were also introduced in 1970's. A modern bleaching machine was also introduced three years ago.

The company was brought into competition with other nations in the Western world accompanying reform of the economy, and they are now urged to produce products of multiple kinds and of higher quality.

The current operation rate is less than 1/3 of the capacity, and operation is performed in such an irregular form that the factory is run for three and 1/3 days or four and 1/3 days per week and running is entirely suspended during the next week. Besides, running is suspended for three weeks in summer and also for one week in the Christmas season.

Little energy conservation measures have been taken up to the present time because energy prices were low. With energy equipment, rationalization of steam lines, and recovery of condensate have been implemented.

The boiler is equipped with a top turbine, but since it is not linked with the system, the steam is dispersed when the demand for steam is small, and it constitutes a factor for high cost.

(7) Investigation period August 12 - August 16, 1991

(8) Investigators

Mitsuo Iguchi	Leader
Teruo Nakagawa	Subleader, Measuring Engineer
Koichi Inaba	Dycing Process Engineer
Taro Ihara	Heat Control Engineer
Tatehiro Tanabe	Heat Control Engineer
Toshiyuki Ochi	Heat Control Engineer
Ken-ichi Kurita	Electrical Control Engineer

AEEF Member

Mr. János Becz	Team Leader
Mr. Ferenc Pardavi	Electrical Engineer
Mr. József Stieber	Instrument Engineer

MVMT Member

Mr. Lajos Roppolyi	Mechanical Engineer
Mr. Miklós Kenézy	Electrical Engineer

(9) Interviewees

Mr. István Csomortány	Vice President
Mrs. Gabriella Ecker	Chief Engineer
Mr. Pál Varga	Boiler Engineer
Mr. László Konkoly	Electric Engineer

(10) Trend of production (Table 5.1.1)

Name of Product		1986	1987	1988	1989	1990
Print	Mm^2	38.6	37.4	41.3	38.5	30.1
White, Dyeing	Mm^2	12.5	12.4	12.3	8.2	7.4
Total	Mm^2	51.1	49.8	53.5	46.7	37.5

(11) Trend of energy consumption (Table 5.1.2)

		1986	1987	1988	1989	1990
Natural Gas	Gm^3	19.5	20.6	18.3	17.5	16.3
Generated Power	GWh	9.7	9.5	8.9	8.3	7.7
Purchased Power	GWh	1.6	2.6	2.4	2.6	2.7
Water	Mm^3	1.69	1.62	1.80	1.76	1.77

(12) Unit energy consumption (Table 5.1.3)

		1986	1987	1988	1989	1990
Total Energy	MJ/m^2	12.8	13.9	11.5	12.6	14.7
Electric Power	kWh/m^2	0.22	0.24	0.21	0.23	0.28

(13) Operating hours (Table 5.1.4)

	1986	1987	1988	1989	1990
Annual Operating Hours	5,928	5,928	5,952	6,096	6,072

Reference operating hours for examination of countermeasures

24 hours/day × 200 days/year = 4,800 hours/year

(14) Energy prices

Fuel natural gas 13.5 Ft/Nm^3
Electric power 3.75 Ft/kWh

(15) Factory layout (Figure 5.1.1)

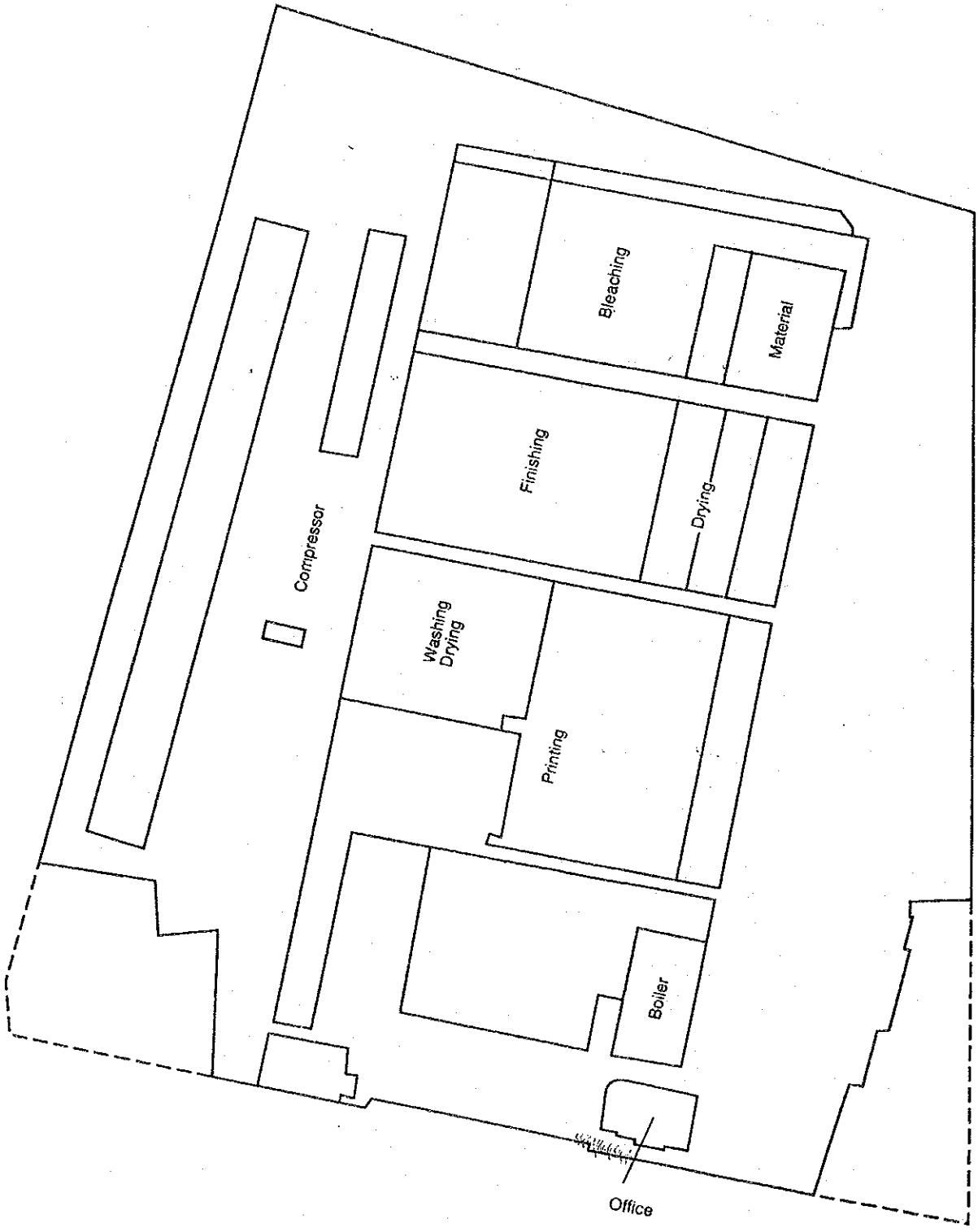


Figure 5.1.1

(16) Manufacturing processes (Figure 5.1.2)

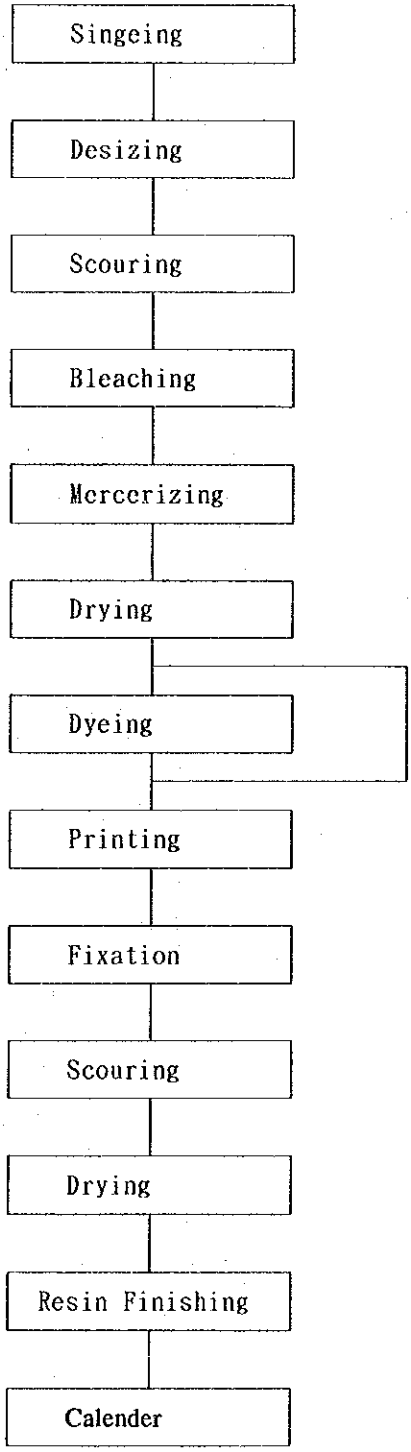


Figure 5.1.2

(17) Electric power one line diagram (Figure 5.1.3)

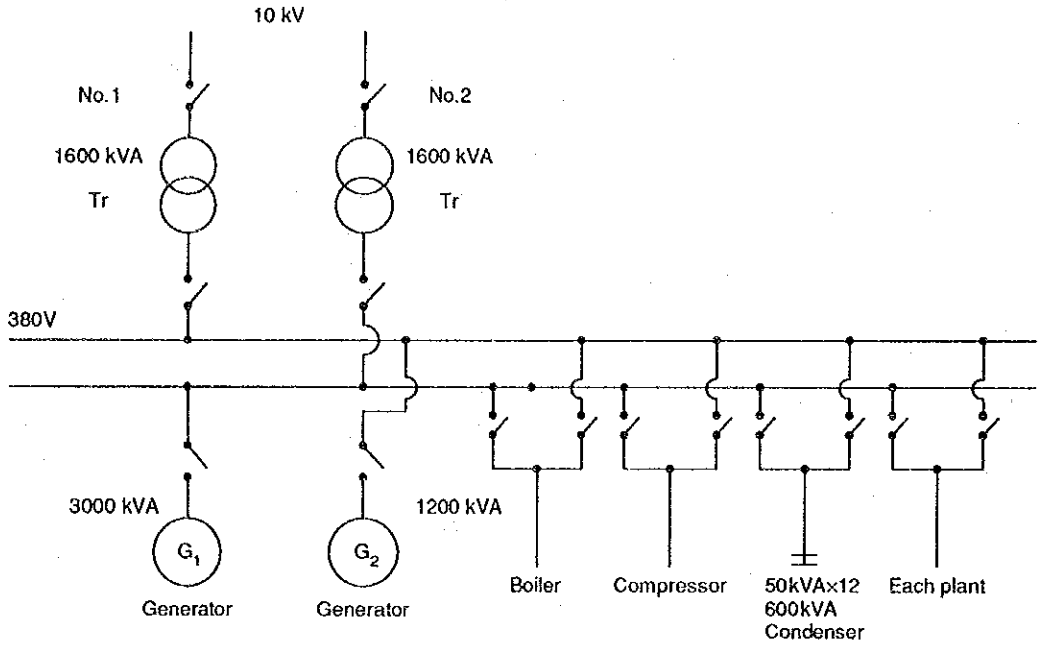


Figure 5.1.3

(18) Outline of principal equipment (Table 5.1.5)

Name	Number	Specification
Bleaching Machine	2	Open Width, 80 ~ 100 m/min Rope
Printing Machine	7	Rotary Type Screen Type
Washer		
Dryer	2	Cylinder
	1	Frame

5.1.2 Situations of energy management

(1) Setup of target of energy conservation

Although an energy consumption plan that takes achievements in the past and product type differences into account is incorporated in the annual management plan and quarterly production plan at this factory, no target of improvement of energy unit consumption has been set.

This factory is currently in the process to cope with changes in the market, and is forced to take an irregular form of operation. Accordingly, the circumstances hardly permit determination of a long-term vision. But the request for reduction of expenses should be stronger at the time when the company faces hardship in the management.

To promote whole-company energy conservation activities, it is at first necessary that the top management appeals to all the employees that energy conservation has an important significance in the management and that it is a matter that should be targeted in the whole company. It is also important that the top management indicates a concrete target and asks for cooperation to hit this target.

Only when the policy of the business is clearly indicated, the employees will pay attention to problems in the works and equipment with problem consciousness, and will take energy conservation actions.

In the case where it is hard to establish a concrete numerical target, it is effective to evolve such a movement that general check of unnecessary lamps or inspection and repair to damaged points of heat insulation at a predetermined date.

There may be differences in the product composition, but the energy unit consumption tends to level off or increase. Since energy prices were low, the interest on energy was minor at this factory. However, the ratio of the energy expenses in the cost has become as high as around 13%, and it is anticipated that positive energy conservation activities are implemented also in the sense to maintain the competitive power in correspondence to freeing of the market.

(2) Systematic activities

Although we were not able to meet the person during the investigation of this time, a staff in charge of energy management has been nominated in the energy department. He patrols the field and checks for wastefulness, and in addition, turn-off of switches for unnecessary equipment is made by shift chiefs as current energy conservation activities.

As the liaison scheme in the whole factory, the problems related to energy are also discussed at the occasions of examination of production plans at the managing staff meetings attended by the chief engineer and division managers. But no meetings for examination of energy of the practical business level attended by representatives from workshops are held.

Thus, the current activities are sporadic, and such a stage that whole-company movement is evolved so that all the employees take actions with interest has not yet been reached.

(3) Management by data

It is basically essential to seize the realities of consumption of energy, to compare them with the plan, and to take corrective measures upon conduct of troubleshooting, if there is any problem. The result data of the factory is an important information source for improvement of energy unit consumption.

Provisions have been made at this factory so that the steam consumption and purchased electric energy are recorded daily, these records are checked by the energy manager and are summarized and submitted to the chief engineer once every quarter.

In order that the gathered data is utilized for improvement of unit consumption, it is necessary that feedback is made to each workshop with the result of examination added to the data before long and that each workshop is made to take concrete measures. The data is useless if it is known by a few persons only. There are cases where saving actions are naturally taken only by informing changes in the energy consumption to the field operators.

The treating conditions are diversified by the product in the dyeing industry, and management of unit consumption is troublesome. It is recommended that management is implemented with a conversion factor setup for each set of treating conditions.

Furthermore, changes in the treating conditions affect the quality in the dyeing industry. To seize changes in the energy consumption is also important from the standpoint of quality control.

Evaluation of records of energy consumption of workshops is made three times a year. But no awarding scheme against the result is established. It is an effective method to promote energy conservation actions by giving incentive and by awakening the consciousness of competition among workshops.

(4) Enlightenment of employees

Consumption of energy is often affected by behaviors of men. It is therefore necessary to instruct correct working methods to operators and to cause them to observe such methods. Furthermore, when it is intended to improve the current working methods and equipment, it is necessary to enlighten the operator as for the trend of the trade, typical cases of improvement and technical knowledge of a certain extent.

Since such a training program that is described below is implemented at this factory, although its objective is not limited to energy conservation, it is considered to be indirectly useful for promotion of energy conservation.

Freshmen are sent to a training course after their working hours for one and a half years. Classes are held for three hours twice a week, and this course is maintained jointly by a number of companies. These trainees are sent to lectures of the fiber department of an industrial college upon completion of the course.

Operators are also sent to skilled worker training courses once every two to three years, and when a new equipment is introduced, they are dispatched to the manufacturer for training.

"Day of Idea", which comes once a year, has been established, and the scheme to collect proposals for improvement from the employees has been established. It was explained that many of proposals are related to safety and upkeep of equipment. It is a good scheme that stimulates the volition of the employees for improvement.

(5) Management of equipment

Places of faulty maintenance such as points where heat insulation materials have dropped off, points of steam leakage and faulty traps are conspicuous in the factory. Among boilers, the boiler of higher efficiency is kept idle because of problems in the hardware. The operation at the present time is irregular, the period during which running is suspended is long and such a situation facilitates maintenance of equipment. Since some portions of repair and maintenance of heat insulation and traps can be made by factory employees, it is desirable that efforts for maintenance is made while suppressing the external expenditure.

5.1.3 Problems in the use of energy and countermeasures

(1) Cylinder dryer

A) Current situations

a. Situations of the equipment (Figure 5.1.4)

The cylinder dryer (No. 85 machine) is composed of 24 cylinders, i.e., cylinders of six rows in the horizontal direction with four cylinders in each row in the vertical direction. The pipeline is divided into three systems. Each system contains a steam feed line and a condensate line, having one trap each.

Each cylinder is of 571 mm in diameter and 2,200 mm in length. The cloth speed is set at 40 m/min. The steam pressure is 1.2 bar(G) at the inlet of each cylinder, and trap type is thermodynamic type.

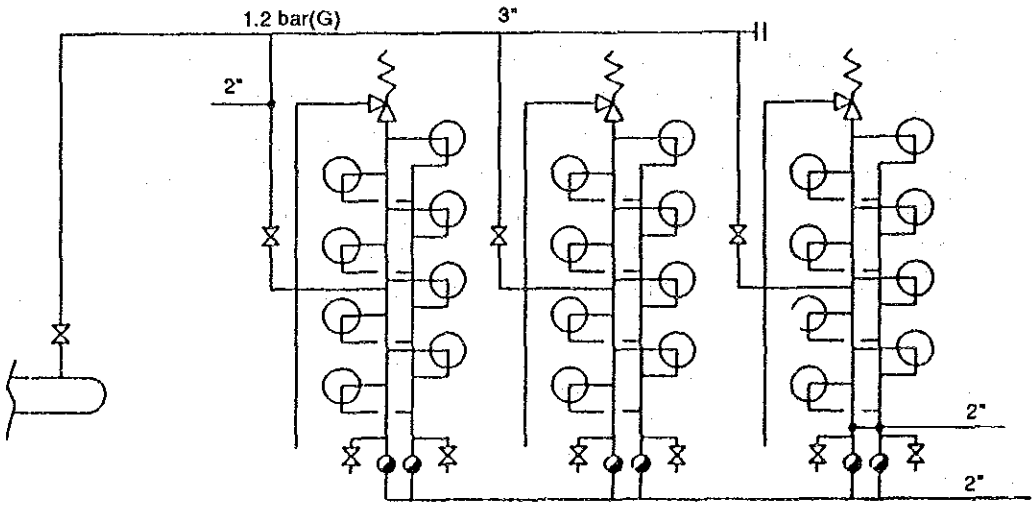


Figure 5.1.4 Cylinder dryer (No. 85 machine)

b. Situations of running

a) Cylinder condensate flow and temperature

One condensate line and one trap are provided for eight cylinders. The condensate flow and temperature were measured with a trap (mechanical type) we brought with us mounted to the trap bypass valve after cutting off the existing trap.

The measuring time was 30 minutes, and the flow rate and temperature were measured once every 30 seconds. The results of measurement are as shown in Figure 5.1.5. The variation of the condensate temperature was minor, but the discharge rate varied irregularly. It is considered to be due to the fact that steam leakage is occurring at flexible joints of cylinder steam feed lines and the condensate in the cylinders is not normally carried to the trap.

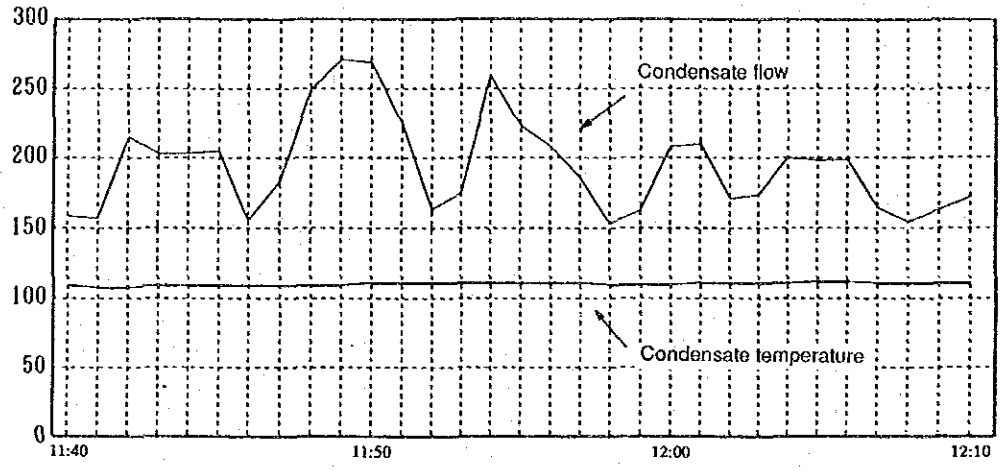


Figure 5.1.5 Condensate flow rate and temperature (No. 85 machine)

In general, with cylinders of this size, the condensate flow per cylinder is around 40 kg/h, and it is around 320 kg/h for a set of eight cylinders. The measured condensate average flow was 200 kg/h, and it means that about 100 kg/h is short by leaking from pipe joints and so forth.

b) Cylinder surface temperature

The cylinder upper side and lower side surface temperature was measured while cylinders were rotating, using thermocouple type surface thermometers. (Table 5.1.6)

Table 5.1.6 Cylinder surface temperature

Zone No.	1	2	3
Upper Side Temp.	119	120	121
Lower Side Temp.	114	117	115

Number of Cylinders = 8 /Zone
Steam Pressure = 1.2 bar(G)

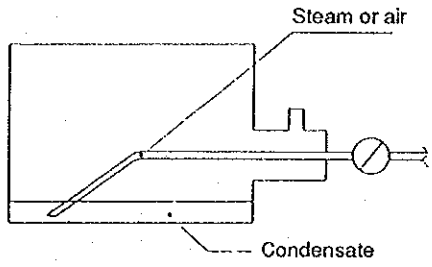


Figure 5.1.6 Cylinder sectional view

A cylinder sectional view is shown in Figure 5.1.6. The state where the majority of the cylinder section is occupied by the steam and the condensate is located only in the lower part is the normal running state. In this case, the difference in the surface temperature between the steam portion and the condensate portion of the cylinder is about 10°C.

The results of measurement of temperature (Table 5.1.6) indicate that the differences are minimum 3°C and the maximum 6°C. It can be said that the condensate build-up is extremely small, and it is estimated that build-up of condensate hardly occurs in the cylinders because steam leakage from cylinder steam feed line joints is large.

c) Operation of condensate discharge traps

One trap for steam feed line and one trap for eight cylinders are mounted per system, and six traps are mounted in total in three systems. Operation of these traps was inspected by the method to check steam leakage by the intensity of ultrasonic wave and to judge block of condensate by temperature. (Figure 5.1.7)

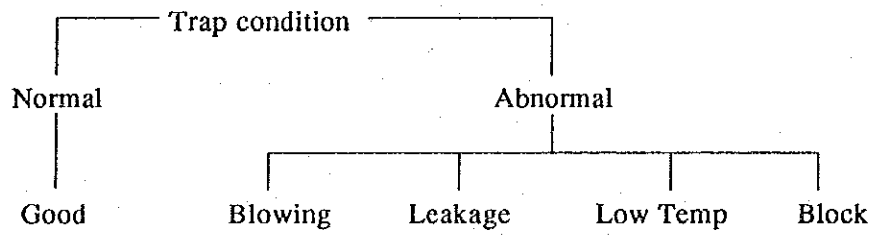


Figure 5.1.7 Judgment of trap operation