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ENVIRONMENTAL ISSUES WORKING GROUP MEETING FOR THE CENTREL COUNTRIES

Sponsored by

The United States Energy Association
Utility Partnership Program

in Cooperation with
The United States Agency for international Development

March 28-30, 1995
Budapest, Hungary

AGENDA

B

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The Budapest Marriott
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AGENDA

Tuesday, March 28

7:00 pm- Welcome Reception at the Budapest Marriott Hotel

Wednesday, March 29

U.S. Strategies to Minimize Environmental Impacts of Electric Power Generation

9:00 am- **Welcome and Introductions**
Ruth Cherenson, Deputy Program Manager, USEA

9:30 am- **U.S. Environmental Regulation**
Craig Jakubowics, Counsel, New England Power Service (NEES)

10:30 am- Break

10:45 am- **U.S. Utility Compliance Strategies**
Andrew Aitken, Vice President and Director of Environmental Affairs, New England Power Service (NEES)

12:00 noon- Lunch

1:30 pm- **Enforcement of U.S. Environmental Regulations**
Mike Kahoe, Deputy Secretary, California Environmental Protection Agency (EPA)

3:00 pm- Break

3:15 pm- **Environmental Technology Options and Evaluation**
George Offen, Team Manager, Criteria Air Pollutants and Air Toxics Emissions, Electric Power Research Institute (EPRI)

4:15 pm- General Questions/Discussion

5:00 pm- Adjourn

<u>Thursday, March 30</u>

9:00 am- **Review and Introductions**
Ruth Cherenson, USEA

9:15 am- **U.S. Regional Approaches to Energy-Related Environmental Issues**
Ken Nemeth, Executive Director, Southern States Energy Board

10:15 am- Break

Eastern European Environmental Regulations and Policies

10:30 am- **Environmental Regulation in Hungary and MVM Rt Compliance Strategies**
Vilmos Civin, Head of Section, Environmental Protection, Hungarian Power Companies, LTD (MVM Rt)
Istvan Aved, Plant Manager, Environmental Protection and Water Management, Borsod Energetic Producing and Servicing Limited Liability Company

11:00 am- **Environmental Regulation in Poland and Polish Utility Compliance Strategies**
Mieczyslaw Kwiatkowski, Chief Specialist for Power Sector Planning, PPGC

11:20 am- **Environmental Regulation in the Czech Republic and CEZ a.s. Compliance Strategies**
Zdenek Kostelnik, Deputy Head of Department at Headquarters, CEZ a.s.

11:40 am- **Environmental Regulation in the Slovak Republic and SE a.s. Compliance Strategies**
Elena Michaeli, Environmental Manager, SE a.s.

12:00 noon- Lunch

Working Group Sessions

1:30 pm- **European Participants Meeting with U.S. Profesionals by Country**

MVM Rt -	Craig Jakubowics and Andrew Aitken, NEES
PPGC-	Ken Nemeth, Southern States Energy Board
CEZ a.s.-	George Offen, EPRI
SE a.s.-	Mike Kahoe, California EPA

3:00 pm- Break

3:15 pm- Resume Working Group Sessions

4:30 pm- Regroup for general discussion of preparations for Regional Environmental Cooperation Seminar, June 1995

5:30 pm- Adjourn

CZECH

REPUBLIC

F

The present regulations and standards in the Czech Republic concerning environmental problems, the relationship of these regulations and standards to the regulatinos in effect in the European Union and the programme of the electricity company ČEZ, a.s., for meeting these rules

by Zdeněk Kostelník, ČEZ, a.s., Prague, CZ, March 1995

Regulations covering the following spheres concerning environmental protection are in effect in the Czech Republic now:

1) Protection of the environment in general

2) Protection of the atmosphere

3) Water management

4) Waste management

5) Protection of nature and the landscape

6) Agricultural land available

7) Territorial planning and construction rules and

8) Protection of mineral wealth.

Most of the laws mentioned above were adopted after 1990 and their substance already reflects, *i. a.*, the attitude, and standards, adopted within the framework of the European Union, including international agreements concluded at the level of government the Czech Republic and its respective ministries.

The adoption of these laws by the Parliament of the Czech Republic was motivated by the effort to improve the state of the environment and to attain European standards.

In general, the philosophy of the approach to the protection of the environment in the Czech Republic is based on the possibilities and instruments by which the further devastation of the environment may be forestalled and prevented effectively:

- a system of direct regulation, that is the use of normative means (orders, prohibitions, limits, norms and standards),

- a system of indirect regulations, i.e. the use of economic means (charges, taxes),

- a system of fines for default in maintaining the applicable laws,

- ethical attitudes (education, formation of public opinion, etc., responsibility towards the environment, objective information of the public population about the evolution, and state, of the environment).

Given the thematic orientation of this seminar, I would like to give some details especially as regards the laws most influencing the activities of the ČEZ company, i.e. the generation of electricity and heat, with the aim of minimizing its negative impact on the environment.

1) The Protection of the Atmosphere

In 1991, law No. 309/91 Coll. concerning the protection of the atmosphere against pollutants was adopted. This law lays down emission limits for all sources emitting harmful substances into the atmosphere. Emission limits for new sources are given in table No. 1:

Table 1 - Clean Air Act (Czech Republic) - Limits for Facilities Burning Fossil Fuels

	SO_2 (mg/Nm^3)	NO_2 (mg/Nm^3)	CO (mg/Nm^3)	Ash (mg/Nm^3)
Over 300 MWth:				
Solid fuel	500	650	250	100
Liquid fuel	500	450	175	50
Gas	35	200	100	10
50 - 300 MWth				
Solid fuel	1700	650	250	100
Liquid fuel	1700	450	175	50
Gas	35	200	100	10

If SO_2 limits cannot be met without FGD, then FGD must be installed and the following limits apply:

.Over 300 MWth - Emissions must not be in excess of the 15% of pre-FGD levels

.50 to 300 MWth - Emissions must not be in excess of the 30% of pre-FGD levels

. FGD bypasses (for maintenance, etc.) are allowed maximally for 96 consecutive hours and the cumulative total of 360 hours p.a.

For existing sources, to which all blocks operated by the ČEZ company belong among other things, the so-called temporary emission limits were laid down, which take account of the technological state of facilities, and, simultaneously, time-limits were set within which these sources, too, shall meet the emission limits given in table No. 1. Limiting emission values are fixed according to the heat capacity of a facility and 31. December 1998 is the last date for all sources given in table No. 1 to reach emission limits.

For most ČEZ production facilities, emission limits are as follows:

Fly ash 100 mg/Nm^3

SO_2 500 mg/Nm^3

NO_x 650 mg/Nm^3

CO_2 250 mg/Nm^3

Law No. 389/91 Coll. defines the activity of the state administration for the protection of the atmosphere and sets the charges for its pollution.

A body of state administration, the Czech Inspection of the Environment, operates in each region. On the basis of grounds submitted by the operators of pollution sources, the Czech Inspection of the Environment fixes the amount of annual charges for the quantity of harmful substances emitted into the atmosphere.

These bodies have authority for inspecting, imposing financial sanctions and fines for default in maintaining the applicable provisions of the law and, if need be, for decreeing the limitation, or stoppage, of pollution sources if the applicable emission limits are not maintained or the state of the atmosphere could deteriorate substantially.

The extent of the keeping of operational records of sources and the ways of establishing the quantitiy of emissions is laid down by decrees issued by the Ministry of the Environment. Technological means of measurement of emissions by both large and small pollution sources are also laid down.

Other regulations that are in effect concern the prohibition of the import, and use, of substances damaging or endangering the ozone layer of the earth and of products containing such substances - law No. 211/93 Coll.

As there are, in the Czech Republic, industrial regions where the environment bears a substantial and long-term negative burden (the North Bohemian region, the Ostrava region and Prague), the Ministry of the Environment of the Czech Republic issued decree No. 279/93 Coll., defining the regions requiring special protection of the atmosphere and laying down the principles of the formation, and operation, of smog-regulating systems and other measures for the protection of the atmosphere.

This approach aims at a reduction in emissions in selected sources of air pollution at the time when conditions for the dispersion of harmful substances have deteriorated.

2) Water Management

The protection of water in the Czech Republic is defined by law No. 138/73 Coll., the Water Act, whose provisions aim at the allround protection of both surface and underground water, the provision of balance between consumption and the capacity of water sources and the care of their purity and most economical use.

State administration authority for managing water is defined by law Nr. 458/92 Coll., issued by the Czech National Council. Payments concerning water management are laid down by law No. 281/92 Coll., issued by the Czech National Council.

This law lays down payment for the consumption of underground water and sets the charges for the discharge of waste water into surface water.

Issued by the government of the Czech Republic, decree No. 171/92 Coll. sets the indices (criteria) of admissible levels of water pollution.

3) Waste management

In the Czech Republic, problems of waste management are another important environmental sphere where the influence of electricity generation may be seen. Law No. 238/91 Coll. concerning waste lays down the rights, and duties, of legal entities and natural persons in handling waste.

In the Czech Republic, the keeping of records of waste is defined by regulation No. 521/91 Coll., issued by the government of the Czech Republic, while the law No. 62/92 Coll., adopted by the Czech National Council, sets the charges for waste disposal.

Issued by the government of the Czech Republic, regulation No. 513/92 Coll. concerning waste disposal lays down the duty to differentiate between individual types of waste according to their chemical and physical properties.

After a relatively short time during which the above-mentioned laws concerning the protection of the environment have been in effect and operation, the need has become obvious to amend some of their provisions so as to take account of new experience.

It is expected that the amendments will be adopted in the course of 1995 and 1996.

The Czech Republic is a signatory of several international agreements on environmental problems. It may be said that some of the most important of these agreements are the convention on long-distance air pollution surpassing the frontiers between states, in which its signatories pledge to limit SO_2 emissions (the 1st and 2nd protocols concerning sulphur) and volatile organic substances (VOC) and the Basle convention on the control of the movement of dangerous waste over the frontiers of states and its neutralization.

The Activities of the Company ČEZ, a.s., in the Sphere of Environmental Protection

By its existence, ČEZ, a.s., links directly onto the more than 100-year-old Czech tradition of electricity generation. ČEZ, a.s., was founded in 1992 with the use of the property of the former enterprise České Energetické Závody. The production capacity of ČEZ, a.s, amounts to 11,000 MWt, which means that, on a world scale, ČEZ, a.s., is a medium-size electricity company.

ČEZ, a.s., is the greatest producer, and supplier, of electricity in the Czech Republic.

In 1994, it participated in the total generation of electricity in the Czech Republic with approximately 80 per cent.

This electricity was produced in the following power plants:

Type of power plant	No. of power plants (production unitst)	Installed capacity (as at 31 Dec. 94 /MWt/)	Part in production by ČEZ, a.s. /%/
coal - fired	16	7,977	74
nuclear	1	1,760	24
hydro-electrie	10	1,778	2

Apart from electricity, ČEZ, a.s., produces heat in its power plants and two heating plants, which is supplied to neighbouring localities, thus replacing a large number of small sources of air pollution that would otherwise substantially participate in burdening inhabited areas with immissions.

The quantity of sulphur dioxide (SO2) emissions from ČEZ facilities amounts to approximately 50 per cent of the total quantity of this substance emitted annually in the Czech Republic.

Sulphur dioxide emissions from ČEZ sources have been tending downwards for quite a long time already. This is due to a continuous reduction in electricity consumption in recent years, a reduction in the part of electricity generated in coal-fired power plants and a reduction in specific fuel consumption and the specific content of sulphur in the fuel used.

In particular, a reliable supply of electricity to the distribution networks of distribution enterprises and the generation of electricity and heat in accordance with legal norms concerning environmtal protection are some of the basic aims of the business strategy of ČEZ, a.s.

Based on the adopted laws concerning environmental protection, the programme for making sources ecological is part of the strategic plan of ČEZ, a.s.

The Programme includes in particular:

- definitive shutdown of power plant blocks which do not have good prospects - 2230 MWt in all by the year 2000,
- construction of desulphurization facilities,
- construction of new boilers burning fuel on fluid beds,
- completion of the construction, and commencement of operation, of the Temelín nuclear power plant, having the capacity of 2,000 MWt,
- innovation of electrostatic fly-ash separators,
- implementation of primary measures to reduce nitrate oxide emissions,
- increase in the effectiveness of the transformation of power generation.

This programme, demanding as it is on finances and time-limits, is being implemented and will be fulfilled by 31 December 1998.

Desulphurization equipment installed on 2 blocks in the Počerady power plant (2 x 200 MWt) was put into operation at the end of 1994. The method of desulphurization through wet limestone wash has been used for this. Desulphurization equipment is being installed on 18 blocks whose total installed capacity is 3,110 MW. Contracts for the construction of

other desulphurization units for 10 blocks having a total capacity of 2,120 MW will be entered into in the course of 1995. The total costs of the construction of desulphurization facilities will be approximately 33 billion Czech crowns.

In addition to the construction of desulphurization facilities, four fluid-bed boilers in total (1 x 350 t/h in the Tisová power plant, 2 x 270 t/h in the Hodonín power plant and 1 x 270 t/h of steam in the Poříčí power plant) are under construction. The construction of two other fluid-bed boilers (1 x 350 t/h in the Tisová power plant and 1 x 350 t/h of steam in the Ledvice power plant/ is being prepared. As to the type of fluid-bed combustion technology used, the facilities consist, in all cases, of boilers with a circulating fluid layer.

The total costs of the construction of fluid-bed boilers are in excess of 7 billion Czech crowns.

In order to reduce fly-ash emission, ČEZ, a.s., has gradually exchanged, or repaired, the existing electric separators since 1988 so as to increase the effectiveness of separation. The programme will be finished in accordance with the requirements of the Clean Air Act at the end of 1998 at the latest.

Implementation of primary measures for a reduction in nitrate oxide emission

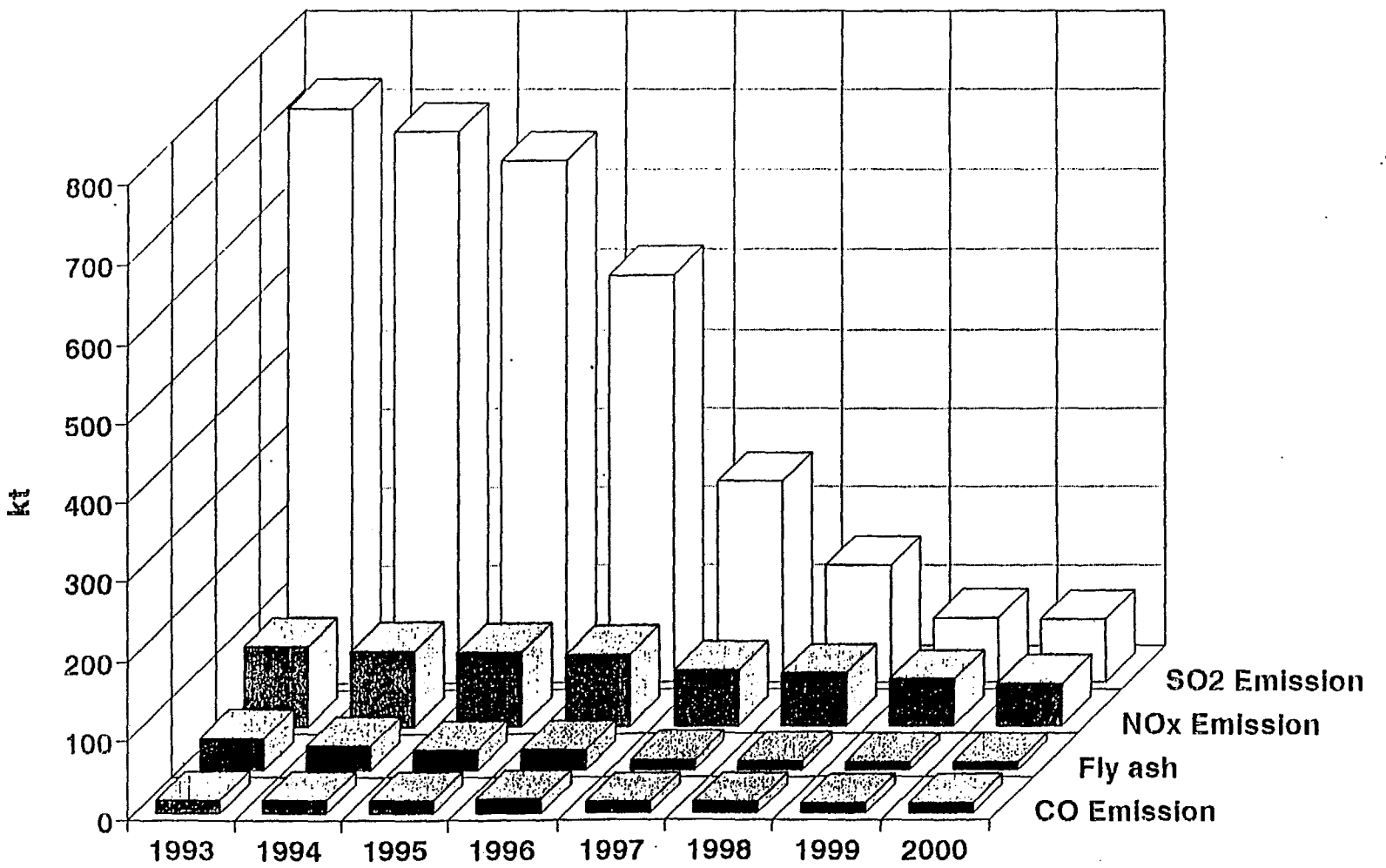
This is a set of measures called primary (adjustment of combustion regime, sealing of boilers, control of the supply of combustion air) to be carried out on all coal-fired blocks where these adjustments have not yet been made. They are being implemented gradually as part of a major overhaul of boilers and will be completed in accordance with the time-limits laid down in the Clean Air Act.

Money for making sources ecological comes from ČEZ own funds and both domestic and foreign capital markets.

The implementation, which is already in course, of the programme for making ČEZ sources ecological will contribute substantially to a reduction in the emission of substances discharged into the atmosphere. In comparison with reality in 1993, sulphur dioxide emission by ČEZ production facilities will be reduced by more than 90 per cent and the emission of nitrate oxidex by more than 50 per cent in 2000 (see the appended chart).

ČEZ a.s.

Thermal Power Plants Emission



HUNGARY

POWER PLANT DEVELOPMENT AND ENVIRONMENTAL ASPECTS IN HUNGARY

I.Bakács, Dr.A.Stróbl, V.Civin
Hungarian Power Companies Ltd.
Hungary

The Hungarian Electric Power System after the Change

After the change of the economic and social structure of Hungary in 1989-1990 the electricity generation, supply and distribution came under control of a two tiered corporate structure group established after the governmental decision in April, 1991. The Hungarian Power Companies (MVM Rt) and its subsidiary (8) power plant companies and (6) regional distribution companies began life on 1 January 1992. The upper level of the concern (MVM Rt) performs a financial holding function and is also responsible for the whole system: it owns and operates the high voltage transmission grid and the load dispatching centre.

The main goals of structural change were first to establish appropriate conditions of privatisation, however, the electricity sector was not considered to be privatised during the first period. At second the mobilisation of possible market forces and as a consequence the increase of the system's efficiency were the main targets to be achieved by the restructuring. The ownership structure changed frequently during the last years. The main owner of the MVM Rt is the State Property Holding Co. (ÁV Rt). The local municipalities have 0.18%. MVM Rt has 50% share of the regional distribution companies. After April 1993, when the Government had decided to merge certain viable coal mines to adjacent power companies (forming unified companies), the Coal Mine Restructuring Centre (SZÉSZEK) obtained in average about 6.5% of shares of the power plant companies. With cca. 1% share of the local municipalities the remained shares belong partly to the ÁV Rt (45.7%) and to the MVM Rt (46.7%).

The main characteristics of the system can be seen in the Table 1

Changes in Electricity Demand. Heat Supply from the Plants of the MVM Group

The development of the electricity demand since 1980 as well as some possible trajectories for the evolution until 2010 are shown on Figure 1. Strategy plans of

the MVM Rt tend towards the lower forecast and are planning the power plant developments and retirements on that basis. Figure 2 shows the planned new units and retirements according to the development strategy of 1993 and taking into account the reserve margin requirements of the UCPTE.

In order to be flexible smaller units with gas turbine combined cycle and fluidized bed boiler units are planned to be built until the end of the century. Figure 3 shows the electricity supply characteristics between 1990 and 1993. Power plants of the MVM Group supply a rather great share of heat for both industrial and household use (Figure 4).

The amount of supplied heat from the MVM plants has been decreasing since 1985 (Figure 5). Power Companies and Plant sites can be seen in Figure 6.

Legal Framework

The current regulatory framework, established by the Electricity Law of 1994, has the objective of generating electric power at least cost as well as assuring stable supply of electricity to the consumers at reasonable prices assuring the profitability of the sector in the same time. The recently established Hungarian Energy Office takes the responsibility to prepare price proposals in accordance with the pricing policy set out in the Law. The prices are subject to the Minister's for Industry and Trade agreement. The Electricity Law also declares responsibilities for licensing of new units in the energy sector. Prior to the licensing procedure a preliminary licence has to be obtained from the HEO. The applicant has to demonstrate its ability to finance the plant (unit) and to provide qualified personal to operate it. The preliminary licence requires public hearings to be held in accordance with an older governmental decree (146/1992). Another governmental decree (86/1993) prescribes environmental assessment studies to be prepared for power generation units of capacities higher than 50 MW and transmission lines higher than 120 kV. If the results of public hearings according to the orders mentioned above are appropriate then the environmental licence for the planned unit can be issued. Units of capacities higher than 600 MW are to be licensed by the Parliament (and all proposals for nuclear units). Governmental approval is needed to have a licence for a plant with a capacity between 200 and 600 MW. Below 200 MW the Minister for Industry and Trade has to approve the choice of fuel. The HEO is empowered to issue licenses for the production, transmission, distribution and supply of energy.

Hungary has only an old Environmental Law on the protection of the human environment that went in force in 1976. Subordinated orders and rules set emission limits for different pollutants. If emissions exceed the limits fine must be paid. Money from these fines - being unfortunately too low to provide incentive to stop violations - can partly be used for environmentally sound investments.

New environmental rules in preparation

Hungary's existing air pollution regulation system was set up in 1986. As mentioned above this system has not been effective enough. The new regulations being now in preparation would set uniform emission standards and technological requirements similarly to the European Union guidelines (Table 2).

The introduction of new and strict emission standards will have a significant effect on the power sector. According to the legislation plans of the Ministry for Environment and Regional Policy a moratory (grace) period will be prescribed allowing for the existing pollution sources to meet the new standards. This will be a key financial issue since none of the coal and oil fired plants belonging to the MVM group can meet the limits without flue gas desulphurization and other equipments. Current proposals for that moratory period vary from six (Ministry for Environment) to at least ten (MVM) years. In the frame of the power plant development program calculations have been made to estimate the needed environmental investments. Capital costs of flue gas desulphurization amount to more than 100 billion Forint in case of six and decrease under 50 billion if ten years were allowed for the existing plants to achieve the limitations for the new units. Besides a global limitation for the electricity sector is also in the proposals (sector's bubble) which can bacame problematic in the case of partial privatization and is under negotiation.

According to the experiences of the preparation efforts for new projects (see later in detail) no energetic equipments can have environmental permission without taking into account the strictest (Western European) emission rules. Regional Environmental Protection Inspectorates taking the responsibility for issuing environmental licences do not allow any excess of the ambient air quality standards (set in 1990 for differently categorized areas) and other rules as well as give only licence for most up-to-date technologies (e.g. gas turbines with less than 25 ppm NOx emission concentration). Similarly strict prescriptions are considered in the case of wastes and by-products such as slag and ash from coal fired boilers etc.

Former Environmental Activities of the Energy Sector

Figure 7 shows the most important air pullutant emissions of the Hungarian power plants between 1985 and 1994 as well as the forecasted emissions according to the recent development and retirement plans. Hungary's coal and oil fired plants are the major sources of air pollution and sulphur dioxide particularly. In 1992 power plants accounted for 50% of national sulphur dioxide and about 20% of nitrogen oxide emissions. The more than 30% decrease of SO_2 emission from 650 kt/y (1980) to 450 kt/y was due to the commissioning of the nuclear plant at Paks. After finishing the electrostatic precipitator (ESP) programme in 1990 all coal fired units were furnished with ESPs and a very low particulate emission level was achieved. In order to diminish the particulate load also in the vicinity of the oil (and gas) fired power plant Dunamenti ESPs will be operated after the units of (boilers

of 670 t/h steam, cca. 650,000 m^3/h flue gas) 215 MW capacity. Since 1991 MVM Rt has made several additional pollution control measures. Four existing boilers of 100 t/h steam production each, have been refurbished to hybride fluid/pulverized coal firing at the Ajka Power Plant (Bakonyi Power Co.) and reduced its sulphur dioxide emissions by 80% and NOx emission by half. At the Dunamenti Plant low NOx burners have been installed but because of the complicated and unusual construction only about 40% emission reduction could be achieved and, unfortunately, some difficulties in operation have also emerged. In order to reduce the amount of transport water in the transportation of slag and ash at the coal fired plant Pécs from the ratio of 7-10/1 (water/ash) to 0.7/1 the so called thick slurry transportation technology was introduced using cleaned communal waste water, too. By this method not only water can be saved but also disposals of lower permeability can be produced. Most of the power plants changed their make-up water treatment technologies to the counter-current regeneration ion exchange producing boiler make-up water of better quality and using less amount of chemicals for regeneration. Moreover at the Oroszlányi Power Plant (Vértesi Power Co.) where a cooling tower of high salt content water is the raw water source even a reverse osmosis plant was commissioned. Compared to the formerly used ion exchange technology less than 1/50 of chemicals is needed and the environmental discharges are proportionally reduced.

Development Strategy

The main principles of the power plant development strategy can be summarized as follows: The uncertainty of the electricity demand forecasts makes necessary to take into consideration more scenarios as mentioned above. In order to be able to follow also unexpected changes during the first period gas turbine units partly in combined cycle operation have to be erected as they can be commissioned in a short period of time. Accordingly, over the first phase of development maximum economic and environmental benefit from the the rapid erection of modern units at the existing sites is to obtained. The development should be flexible. Smaller unit sizes are also desireable for the same reason. The first gas turbine unit at the Dunamenti Power Co. of 145 MW capacity with heat recovery boiler has already been in operation. The Kelenföld project at the greatest site of the Budapest Power Co. is now under construction. Its capacity will be 136 MW electric (gas turbine) and 196 MW thermal (heat recovery boiler). A cogeneration with existing steam turbines is also planned. Possible additional candidates for gas turbine retrofits are the Ujpest and the Debrecen (In the Eastern part of Hungary) plants. The MVM has construction licence for a second cogeneration gas turbine unit at the Dunamenti Power Co. These two units will replace the oldest and most obsolete, heavy oil fired units and reduce the air pollution.

A new coal fired, circulating fluidized bed unit (CFBC) of 150 MW is planned for the Inota Plant (Bakonyi Co). Further units might be constructed at the Pécs, Borsod and Mátra Plants in place of units to be decommissioned. An other option is to use heavy fuel oil of high (3%) sulphur content from the Hungarian refineries in big (5-600 MW) units at the Dunamenti or Tisza Plants. These units will have to

be completed with full environmental control.

The second phase of the development strategy envisages construction of larger units. Indigenous lignite resources are estimated to be adequate for an annual amount of 40-50 PJ. This would justify 900-1000 MW generating capacity. Total additional capacity until 2005 is estimated to be 3000-5000 MW.

After 2005 new, large power stations are envisaged on green field sites. The choice is still wide open. Coal fired plant burning imported hard coal and new nuclear units can be taken into consideration. However, the standard Western reactor size of 1000-1300 MW would be too large for the Hungarian system. New and safe designs now under development of 600-700 MW may be available by that time and implemented into the Hungarian power system.

The development plans foresees investments of about USD 7 billion until 2005. This programme can only be financed partly from MVM's own sources; external capital will be needed in form of export credits, international banks' loans and hopefully the development plan will be attractive also for foreign private investors.

Table 1

Main Technical Characteristics of the Hungarian Power Companies

	1990	1993
Installed Capacity (MW)	7184	7235
Peak Load (MW)	6534	5612
Electricity Demand (TWh)	39.2	35
Net Imports (TWh)	11.1	2.5
Generation of MVM (TWh)	28.1	31.8
of which: nuclear	13.7	13.8
coal	8.6	9.0
oil & gas	5.0	8.3
autoproducers	0.8	0.7
Heat Supplied by MVM (PJ)	55.6	49.1

Table 2

Emission limits for large utility boilers in Hungary ($\geq$500 MW_{th}) (mg/m^3)

	Solid fuels	Liquid fuels	Gaseous fuels
Dust	50	50	5
Special inorganic substances (Cd,Co,Ni,Cr,Pb,V)	-	2	-
Nitrogen oxides in NO_2	400	350	200
Sulphur oxider in SO_2	400	400	35
Carbon monoxide (CO)	250	175	100
Chloride (Cl)	100	5	-
Fluoride (F)	15	2	-

Expexted Electricity Demand

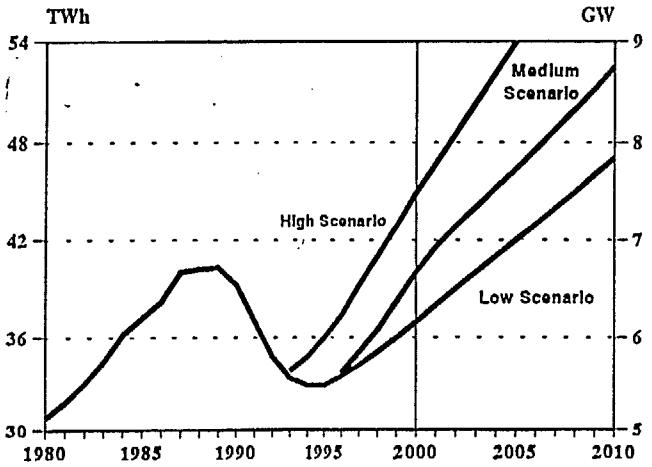


Fig.1

A Possible Version of Power Plant Construction and Retirement

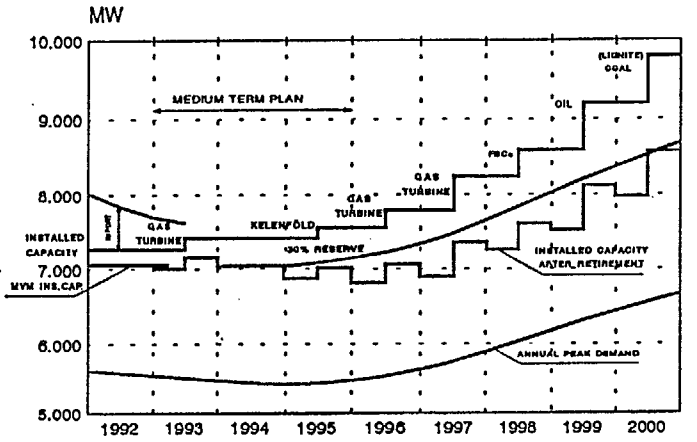


Fig.2

Electricity Supply, 1990-1993

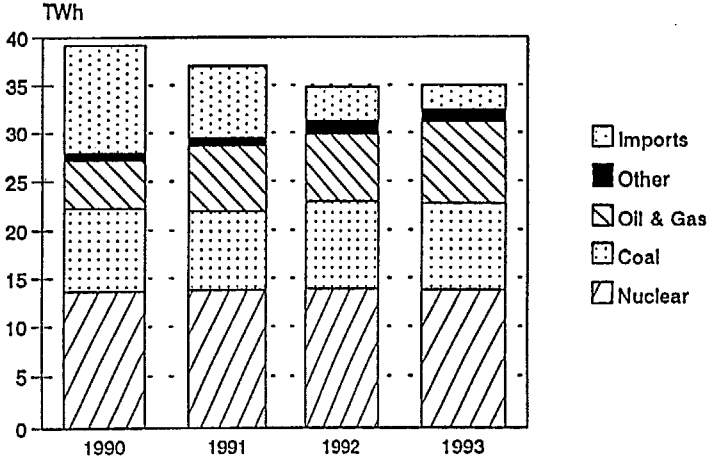


Fig.3

Fuel Shares in Electricity and CHP Generation, 1992

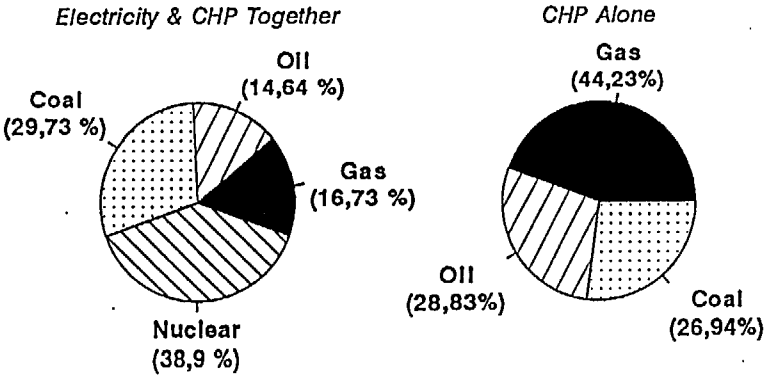


Fig.4

Heat Supply

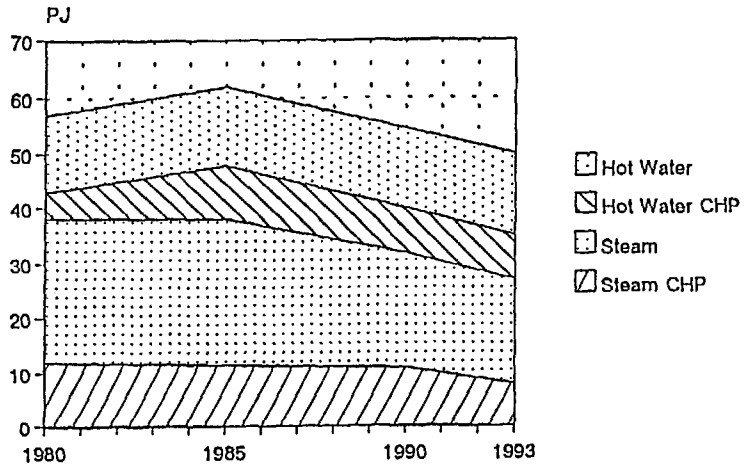


Fig.5

Power Companies and Plants

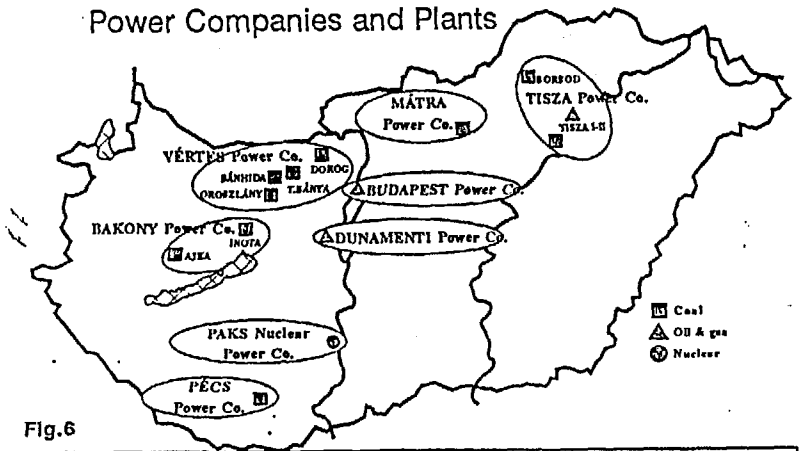


Fig.6

Bakony Power Co. - Ajka 132 MW - Inota I 92 MW GT 170 MW	Budapest Power Co. - Kelenföld 98 MW - Kőbánya 21.9 MW - Újpest 9.6 MW - Angyalföld 9.7 MW - Kispest 24 MW - Révész utca	Dunamenti Power Co. 1870 MW Paks Nuclear Power Co. 1840 MW Mátra Power Co. - Mátra 800 MW	Pécs Power Co. - Pécs 220 MW - Komló 5.9 MW Vértes Power Co. - Dorog 12.5 MW - Bánhida 100 MW - Oroszlány 235 MW - Tatabánya 32.2 MW
Tisza Power Co. - Borsod 171 MW - T.palkonya 250 MW - Tisza II 860 MW			

Electricity Demand and Emissions

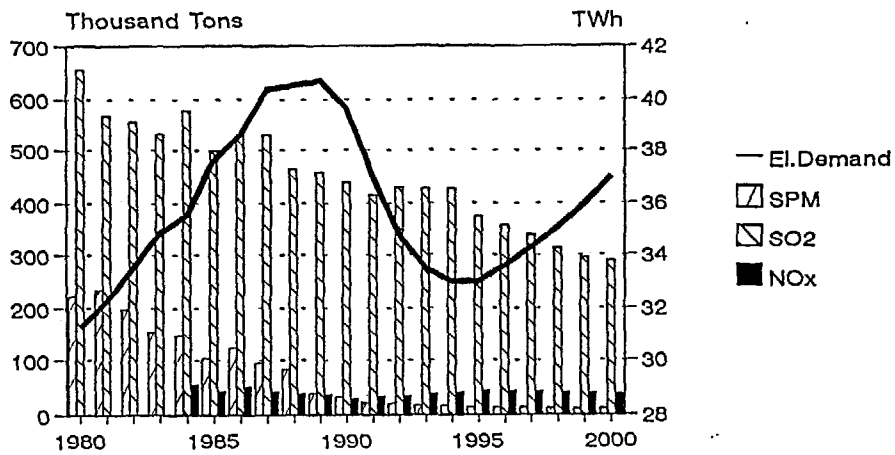


Fig.7

Istvan Ared MUM Rt.

COMPLIANCE STRATEGY IN THE BORSOD THERMAL POWER PLANT

SURROUNDINGS OF BORSOD THERMAL POWER PLANT

The Borsod Thermal Power Plant is situated in the North-Hungarian industrial region, 15 km from the third biggest Hungarian city, Miskolc. The plant belongs to the city Kazincbarcika though it is not the nearest settlement. The outskirts of Sajószentpéter are about 500 m from the plant and most of the environmental impacts effect the inhabitants living here.

BRIEF HISTORY OF BORSOD THERMAL POWER PLANT

The Borsod Thermal Power Plant was built in the early 50's and was put into operation in the middle of the 50's. At that time, technically it was a most up-to-date plant. In the 60's and 70's, its activity was expanded to cover communal and industrial heat supply.

During the time from starting-up, the boilers have been renewed several times, in order to reduce the operational problems, to make them safety and to achieve efficiency improvements. However, the emission properties were left untouched till the early 80's. At that time ESPs were established to each boiler, and the dust emission was reduced by more than 90 %.

At present, due to its wearness, insufficient efficiency and high emission level, the plant works at about 40 % of its original performance.

In order to comply with the emission standards and to reduce the operational costs the complete reconstruction of the entire plant can not be delayed any longer.

TECHNICAL DATA

The original built-in electric capacity of the Borsod Thermal Power Plant is 171 MW. It was performed by 10 boilers of pulverized coal-combustion and 9 steam turbines of several types. In the boilers, the energetic part of the brown coal from Borsod coal mines (unfit to domestic firing), with a low calorific value (9 MJ/kg) and high ash (35-40 %)- sulphur (2.1) content, is fired. The steam pressure provided by the boilers is some 70 bar. At present, 6 boilers and 2 condensation turbines are serviceable, along with the entire co-generation turbine park.

About 300,000 t/year ash, arisen from the combustion, is partly used to make sinter-brick and utilized by the cement industry, but at

least 80 % of the ash and slag has to be deposited in the fly ash pile, 2 km from the plant.

For the condensation turbines and other cooling tasks, 50-60 million m^3 cooling water is drawn from the Sajó river, annually.

INDUSTRIAL ENTERPRISES IN THE BORSOD INDUSTRIAL REGION

In the neighbourhood of the power plant there are several factories of large capacity .

Close to the power plant there is a chemical plant. The Borsod Chemical Works produces PVC powder and PVC products and other chemicals. Also in the close neighbourhood there is a concrete works processing concrete products and a sinter brick factory. The ore dressing plant, 8 km from the power plant, the iron casting and the cement works in Miskolc also considerably contribute to the pollution.

GENERAL SURVEY OF THE ENVIRONMENTAL SITUATION IN THE BORSOD INDUSTRY REGION

Due to the economic recession in the last five years, many industrial enterprises have reduced and others stopped their production. That is why a substantial change occurred in the air pollution without any or with only a few measures taken. Similarly to air pollution, the impurity of surface waters has also been reduced. Unfortunately, the groundwater quality shows a much lower rise, due to the nature of leeching from the existing waste deposits. The vegetation also keeps the signs of the previous air pollution.

According to a survey, the SO_2 pollution in some densely populated area exceeded the air quality standards for both living areas and areas. On the other hand, NO_x pollution remained under these standards.

According to the analysis of pollutant sources during the heating season, the average share

in SO_2 pollution is 30 % of the industrial sources, 65 % of the communal sources and 5 % of motor vehicles,

in NO_x pollution is 8 % of industrial sources, 40 % of communal sources and 52 % of motor vehicles.

The Sajó river has one of the biggest flow rates in the Borsod industrial region. In the last few years, due to closing some in- and outland industrial enterprises, the impurity level of the Sajó river has greatly reduced.

In the region of Borsod Thermal Power Plant, the groundwater has been polluted with waste deposits, some of theme are illegal with unknown history and constitution. The fly ash pile and waste deposit from Borsod Chemical Works is also located in this area. The situation is aggravated by the presence of drinking water wells. The wellhead protection area of these wells includes the above mentioned waste disposal areas.

INVESTIGATIONS IN THE BORSOD INDUSTRIAL REGION

The environmental problems were investigated in Borsod industrial region with the support and direction of foreign institutes. During the last year, a study was drafted on an integrated air pollution plan for the Sajó Valley area by the Japan International Cooperation Agency. It contains an impact assessment for the existing development strategy of power plants and other stationary sources. According to the assessment the air quality of the Sajó Valley can be reduced to meet the requirements in living areas.

The state of the groundwater contamination of the wellhead protection area in the neighbourhood of the Borsod Thermal Power Plant was surveied by the Research Triangle Institute supported by the Agency for the International Development, Washington, DC, US. According to the appraisal the most risky sources are the landfills with unspecified industrial and domestic wastes. Also the fly ash pile appears in the risk potential order. The wells are not in close danger, however, continuous monitoring is necessary to prevent critical situations.

This study was discussed by the representatives of the local governments and industrial enterprises concerned.

ENVIRONMENTAL PROBLEMS OF THE BORSOD THERMAL POWER PLANT

The primary reason for the air pollution is the high sulphur and ash content of the brown coal fired. The major part of the sulphur content gets from the coal into the air in the form of sulphur-oxides, through the 3 stacks of about 100 m height. Because of the ash content, the load of the electrostatic precipitators is rather high so in spite of their good performance, a large amount of flyi ash gets into the air.

Beyond the pollution of point-sources, in windy weather, the fly ash whirls up from the surface of the pile and forms clouds of dust which then settles on inhabited areas in the neighbourhood.

The temperature of the cooling water, utilized for condensing, arises by 8-10 ^{o}C. This excess heat load may cause damage to the

living species in the river, especially when the flow rate is extremely low.

The waste water coming from the make-up water plant, is collected in a reservoir, located near the Sajó river. The waste water seeps into the groundwater and gets into the Sajó river. Because of the relatively big flow rate of the river, it does not contribute to the water pollution.

The slag and ash is transported to the fly ash pile by hydraulic transport. The presently applied method uses a large amount of transport water wich migrates through the ash layer of some 10 m height.

The contamination occurs mostly by sulphates, but arsenic contamination is also detectable in the groundwater.

DEVELOPMENT STRATEGY OF THE BORSOD THERMAL POWER PLANT

The development strategy is defined by the necessity of replacing the old and low efficiency equipments, and strictly complying with the environmental regulations.

The principal direction in the development of the boilers is to partly replace the existing pulverized coal fired boilers to a fluidized bed combustion boiler while the rest is to be furnished in a similar way. The old condensation turbine should be replaced by a new one which should cover heat supply tasks as well. The new boiler-turbine unit would be of 150 MW. The old boilers to be reconstructed will be heat supply reserves and operate only in the heating season. The new turbine planned would be operated with recycled cooling water.

In order to reduce the SO_2 content in the flue gas, limestone powder is to be fed into the combustion chamber. The slag and ash forming will contain a certain amount of gypsum and, and will be transported with a reasonably low water flow rate. The sludge containing gypsum will consolidate and its disposition to dusting is to be stopped. Due to certain advantageous chemical and physical processes in the sludge consolidated, the leakage water from the ash pile will be much less than today and hopefully of almost drinking water quality.

The waste water from the make-up water plant may also be used as transport water and so the groundwater pollution can be eliminated.

THE PRESENT STATE OF STRATEGY IMPLEMENTATION

In 1993 a feasibility study was drafted on the new boiler-turbine unit of 150 MW. A chapter of this study, dealing with environmental aspects, was submitted to the local environmental protection

authority as a preliminary environmental impact assessment. The authorization process has presently been suspended till the end of an official environmental qualification of the sludge with gypsum content. According to the results gained there is a good chance for the gypsous sludge to be qualified as a non hazardous waste.

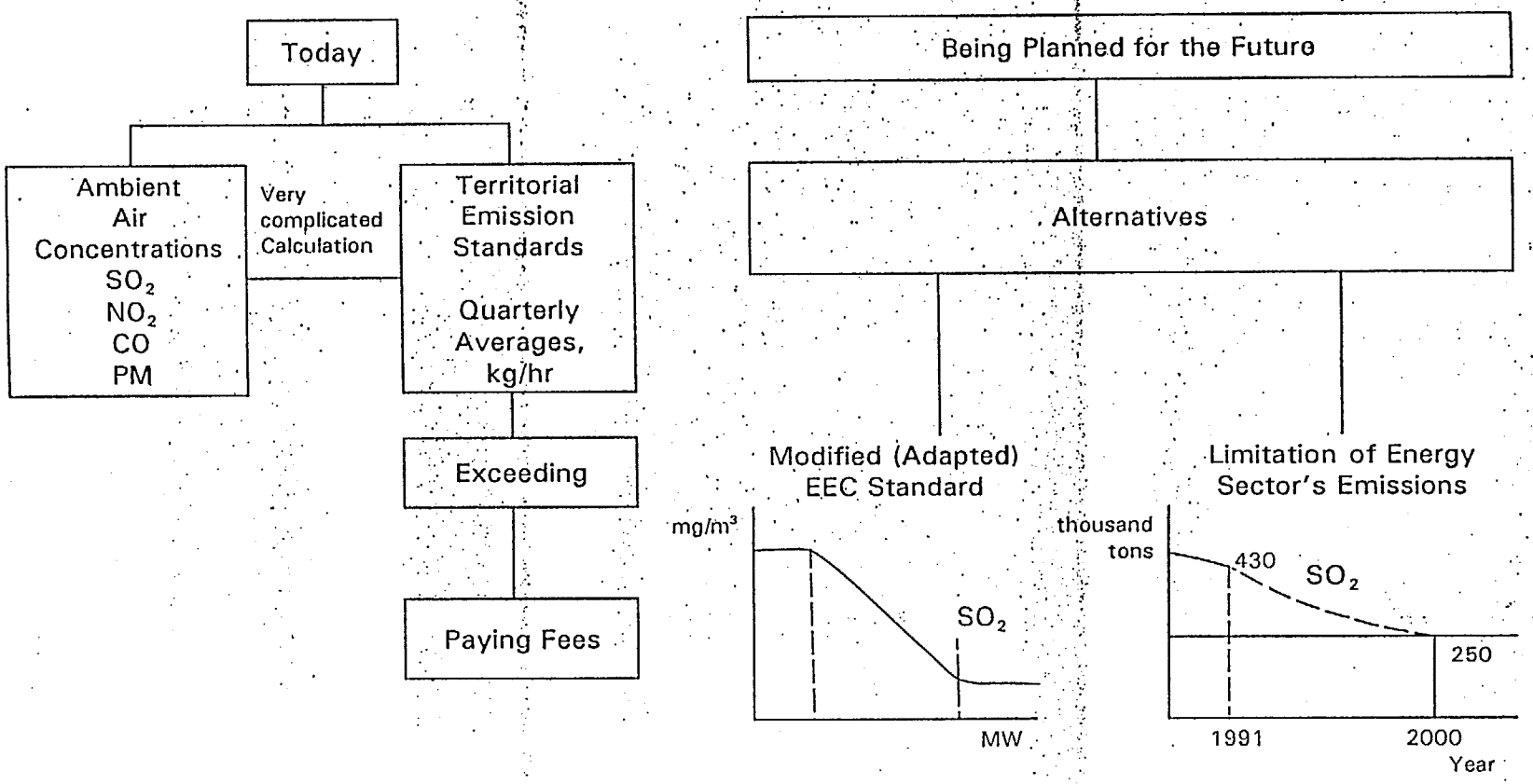
To accelerate the preparation procedures a public opinion poll and a public hearing was held at the end of the last year. People proved to be quite familiar with the plan and they accept the development strategy.

The plans for the reconstruction of 4 boilers in the basis of a Hungarian patent are now being elaborated. The basic engineering and a preliminary environmental impact assessment is ready. After having the appropriate qualification for the gypseous sludge the authorization procedure will be started.

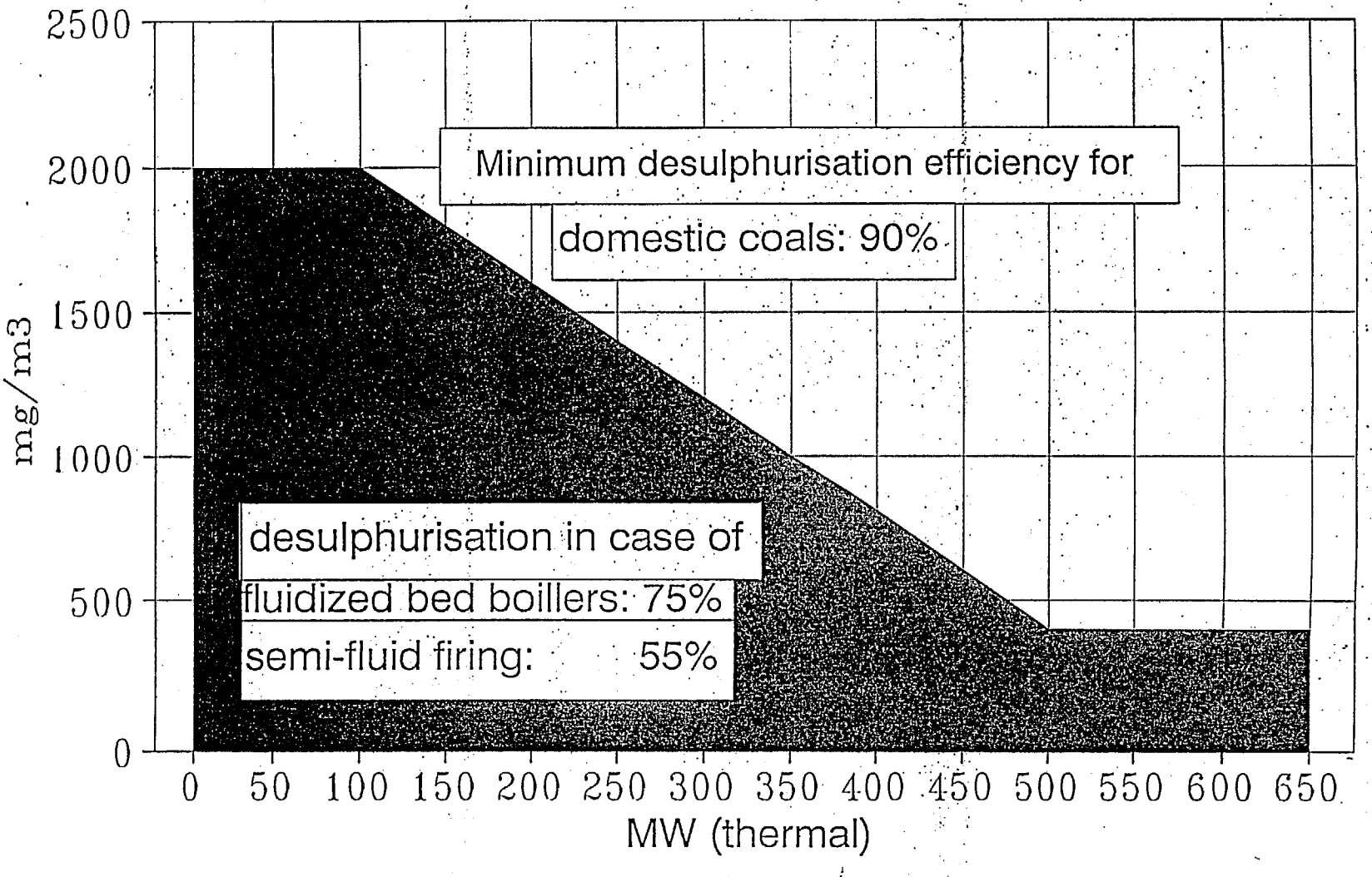
The development strategy implementation has been delayed by the ownership problem which has still not been regulated. At present, the strategy implementation seems to be possible only with the participation of foreign capital. However, at this moment, the chance to be privatized can not be estimated quite properly.

There is another possible way not mentioned so far to reduce the environmental pollution. It is fuel switching from coal to natural gas firing. Probably it would be the most favourable solution, in respect of both economic and environmental point of views. However, the Hungarian electricity sector is forced to utilize indigenous coal, in order to reduce unemployment in the coal mining. As long as this pressure lasts the environmental interests can not be entirely satisfied.

AIR POLLUTION REGULATIONS
(EMISSION)



SULPHUR DIOXIDE EMISSION LIMITS
FOR COAL FIRED BOILERS



PROPOSED EMISSION LIMIT. FOR LARGE UTILITY PLANTS

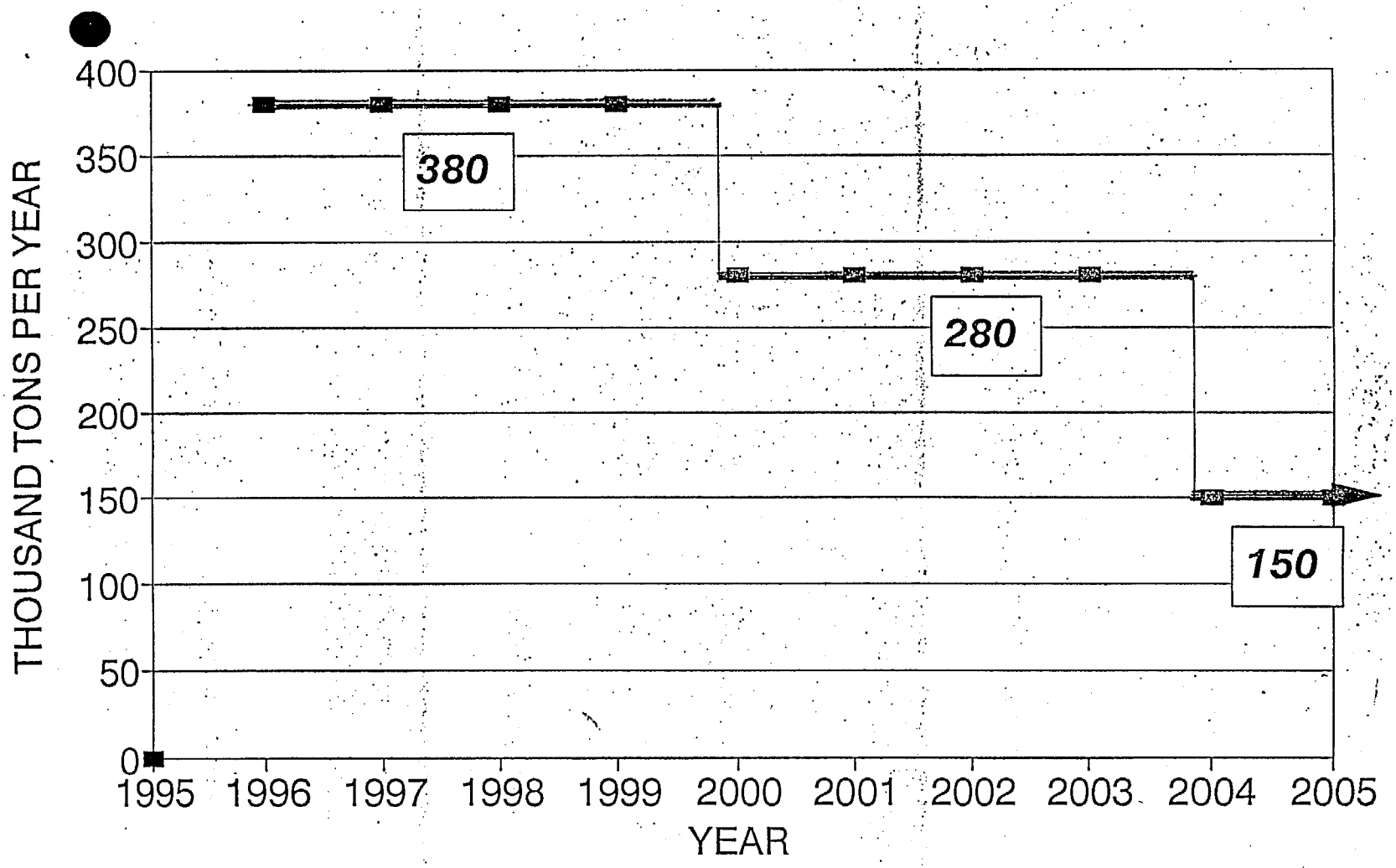
LARGER THAN 500 MW (thermal)

(mg/m^3)

	Solid fuel	Liquid fuel	Gaseous fuel
Dust	50	50	5
Special Inorganics (Cd,Cr,Co,Ni,Pb,V)	NA	2	NA
Nitrogen Oxides	400	350	200
Sulfur Oxides	400	400	35
Carbon Monoxide	250	175	100
Chloride	100	5	NA
Fluoride	15	2	NA

PROPOSED CAP FOR THE ENERGY SECTOR

SULFUR DIOXIDE



A Possible Version of Power Plant Construction and Retirement

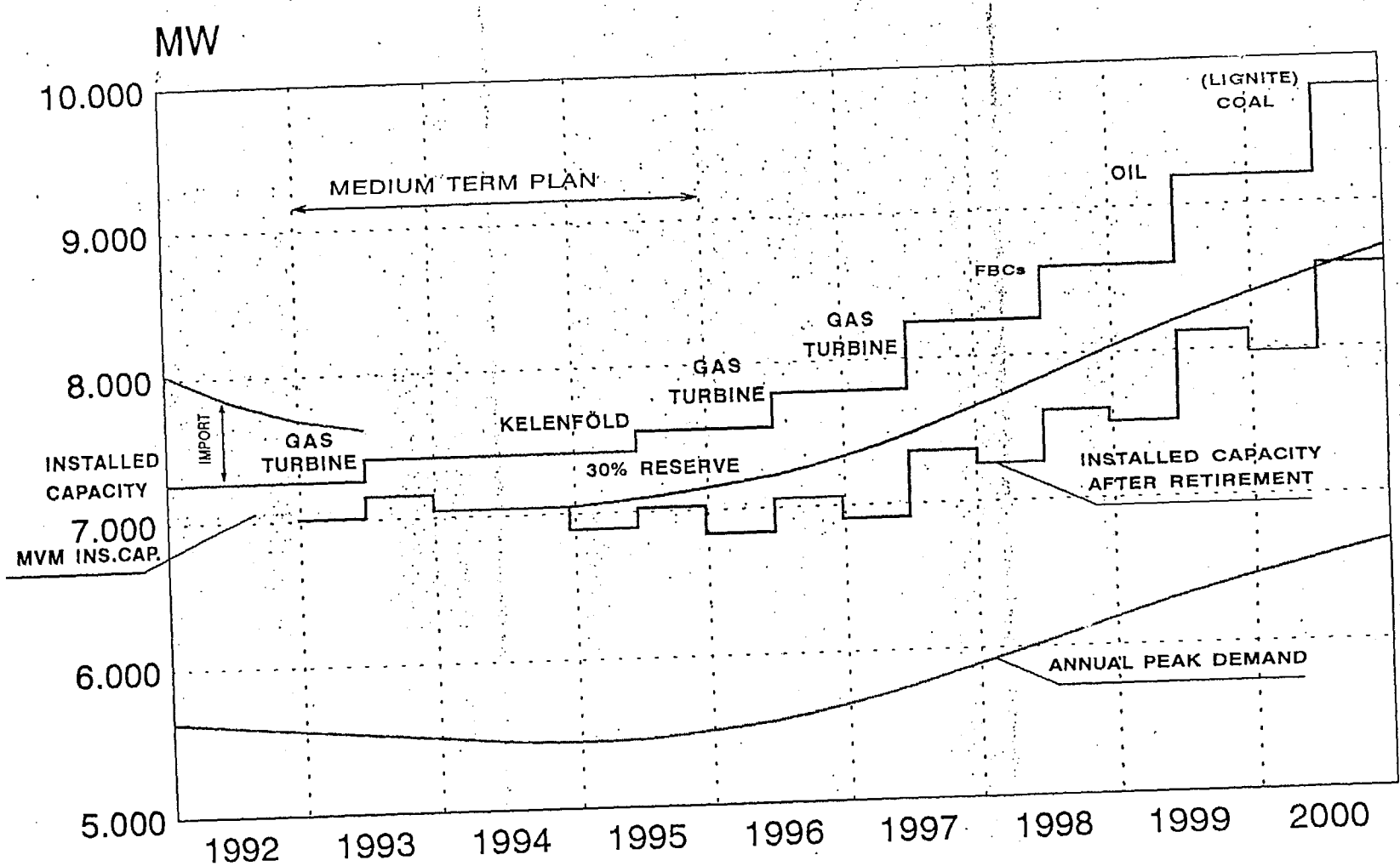


Fig.2

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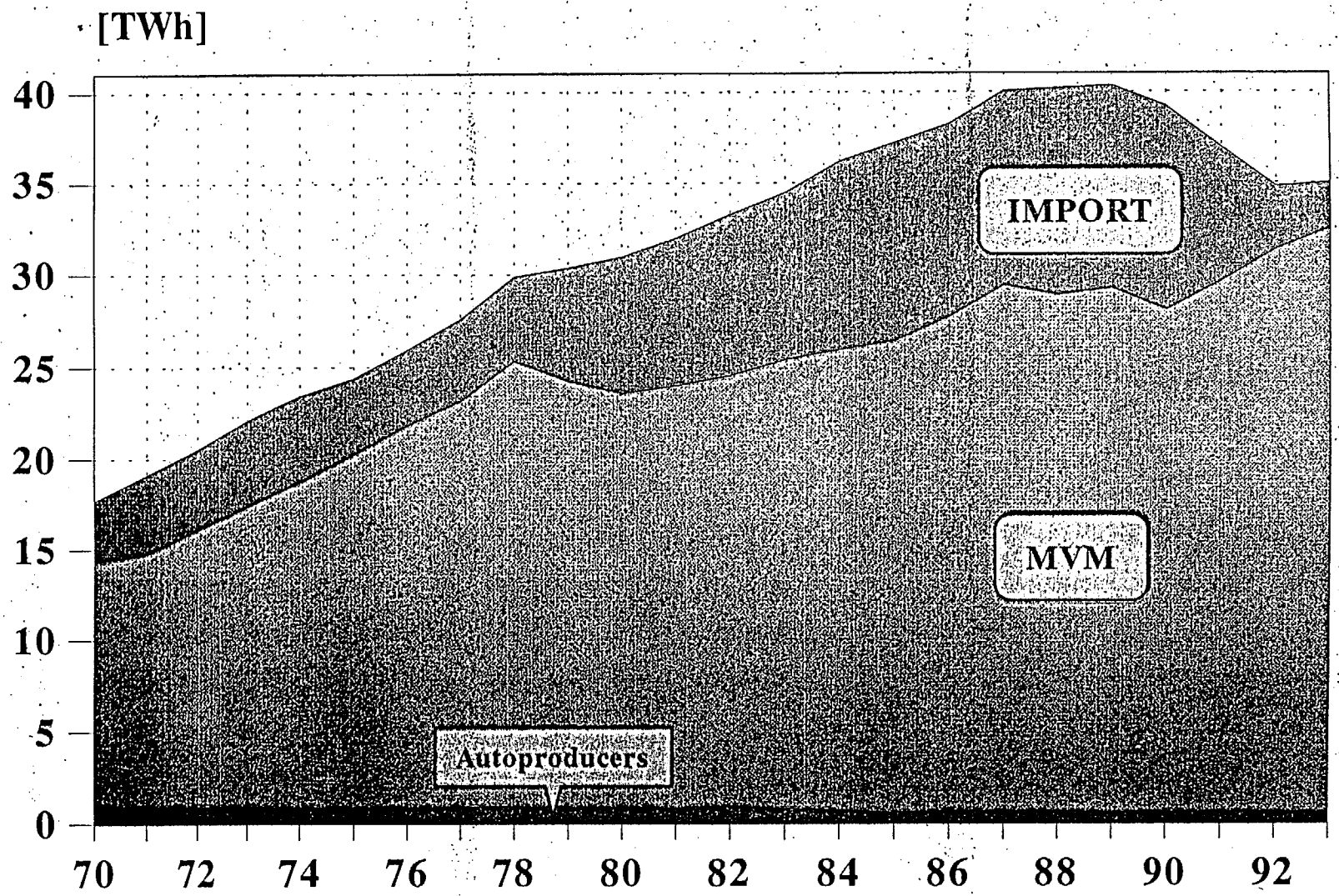
SOURCE OF THE ELECTRICITY



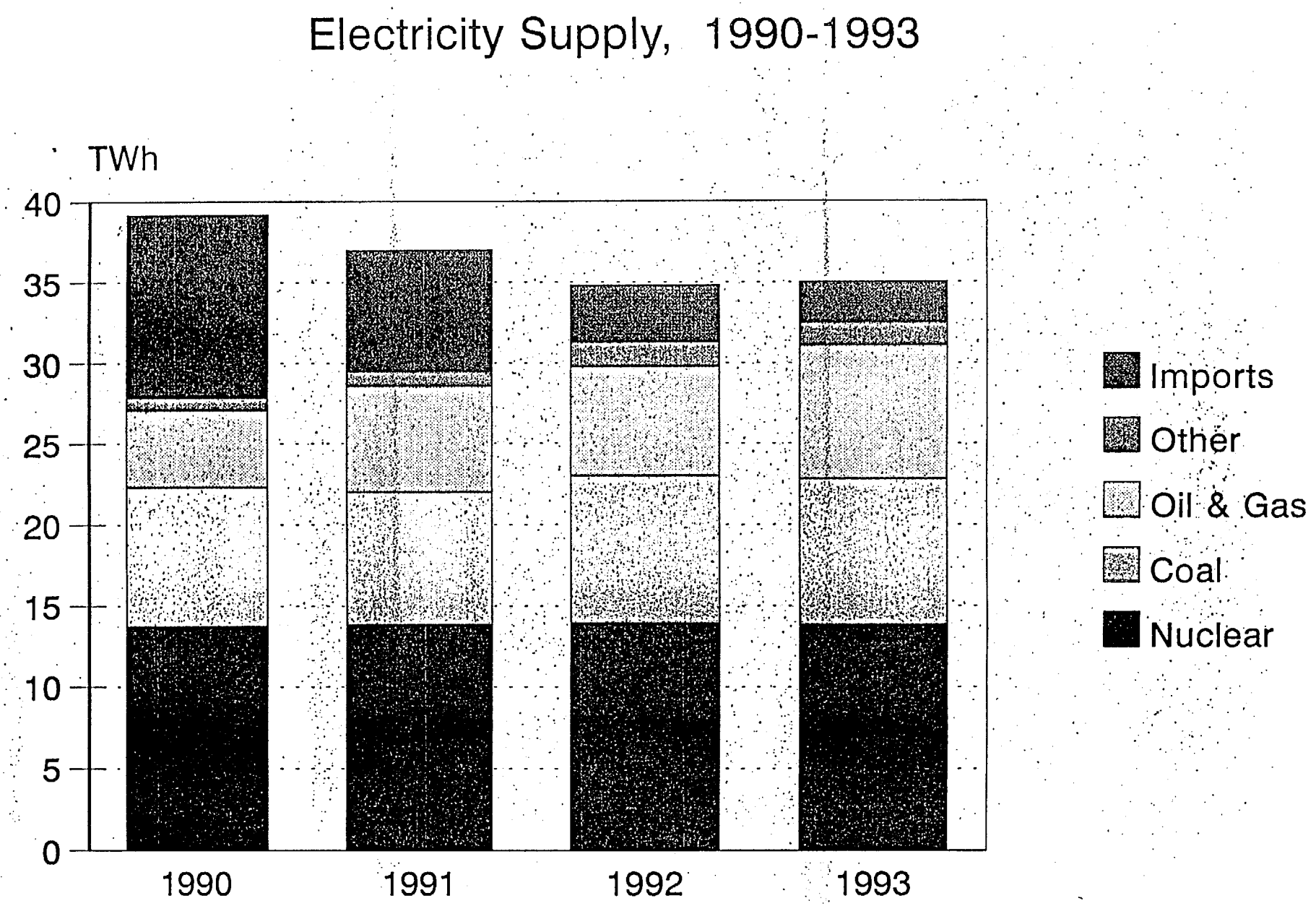

Electricity Supply, 1990-1993
TWh
40
35
30
25
20
15
10
5
0
1990
1991
1992
1993
Imports
Other
Oil & Gas
Coal
Nuclear

Fig.3

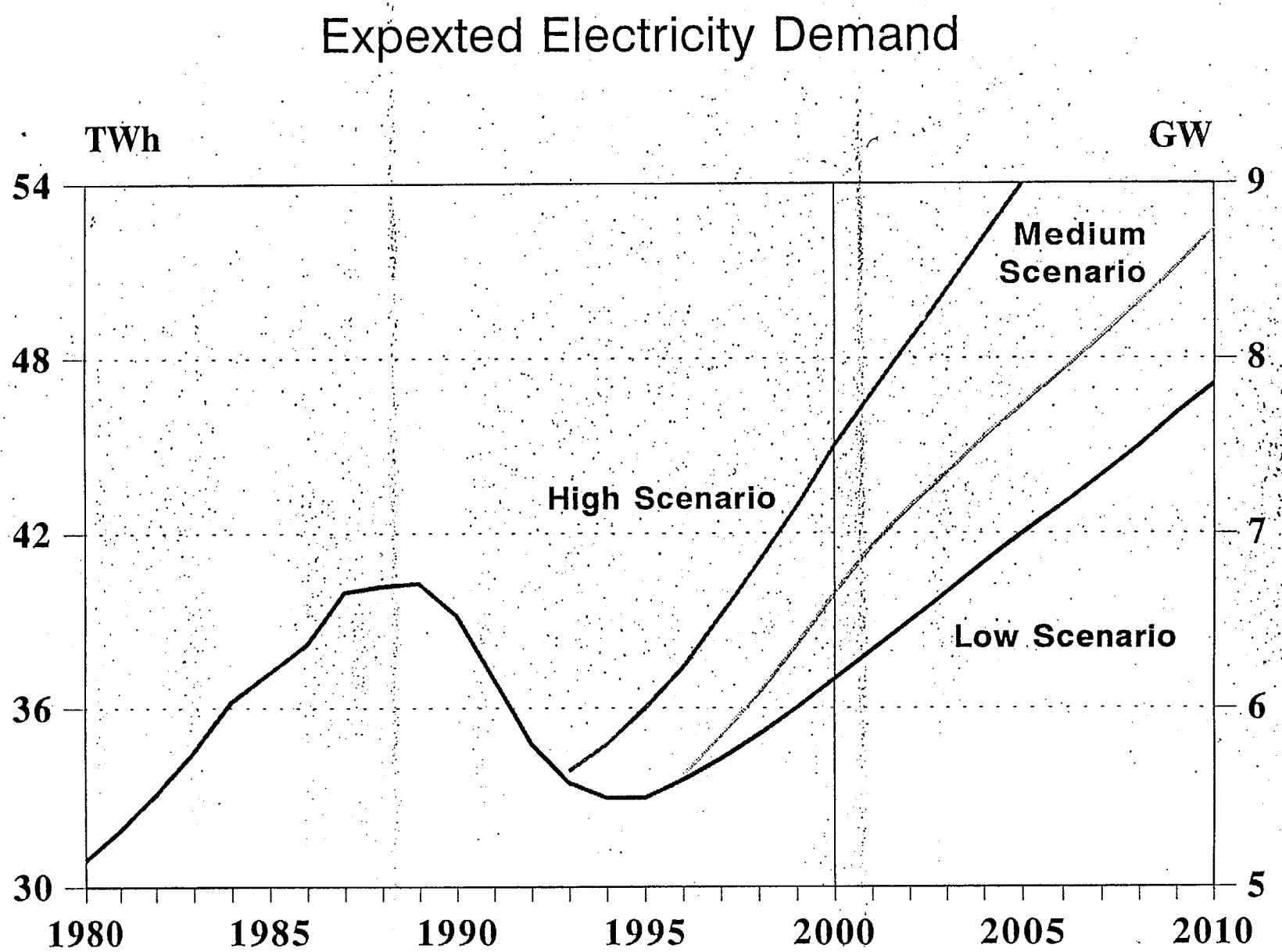

Expexted Electricity Demand
TWh
GW
54
48
42
36
30
9
8
7
6
5
1980
1985
1990
1995
2000
2005
2010
High Scenario
Medium Scenario
Low Scenario

Fig.1

Fig 3.

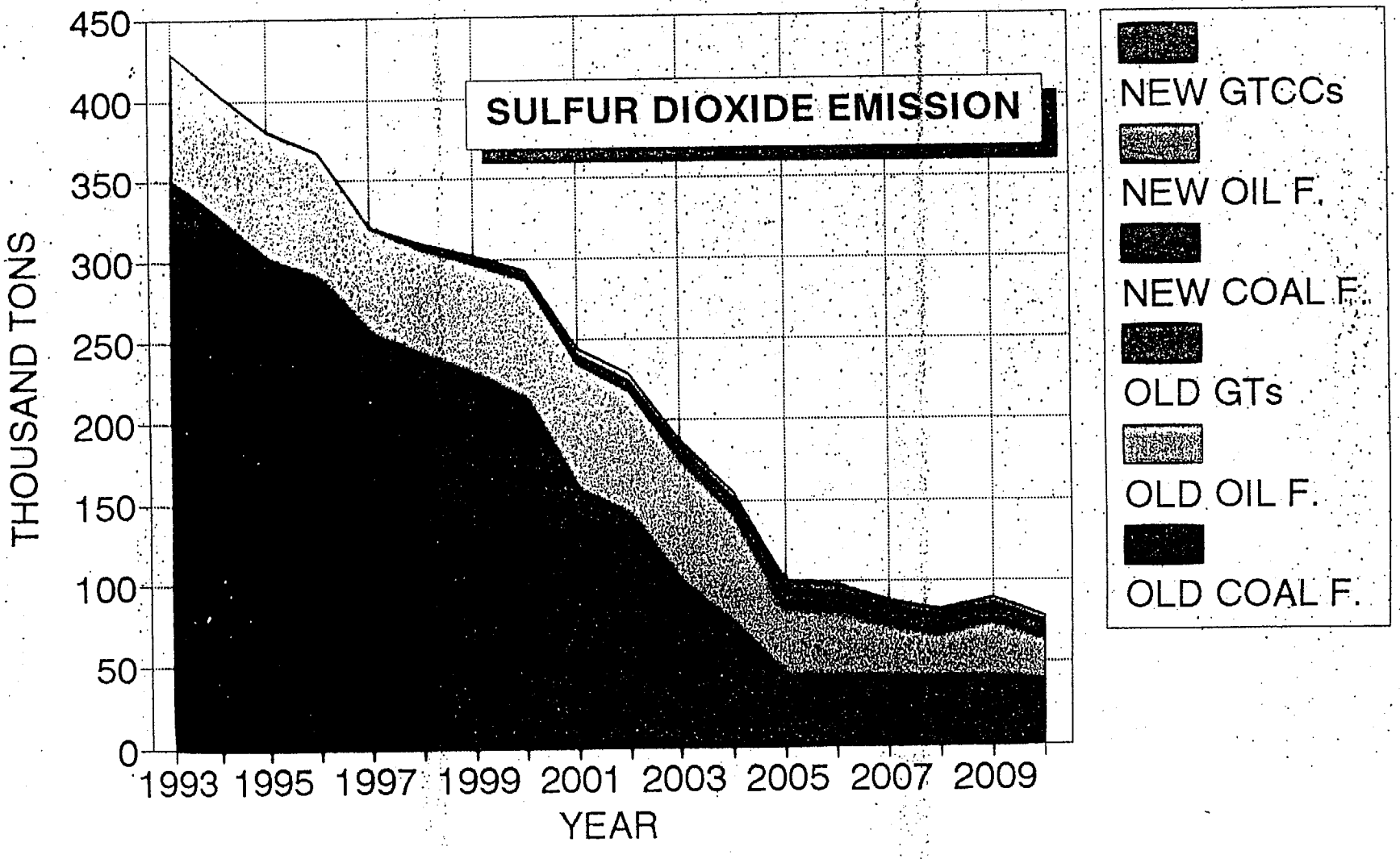
NET EFFICIENCY OF FOSSIL POWER PLANTS

POWER PLANT	MW	FUEL	EFFICIENCY %
Inota	100	coal	19.0
Pecs	245	coal	23.3
Ajka	113	coal	23.7
Borsod	202	coal	24.4
Oroszlany	235	coal	26.4
Matra	800	lignite	27.5
Tiszapalkonya	250	coal	28.0
Banhida	100	coal	30.7
Dunamenti	1850	oil/gas	36.8
Tisza	860	oil/gas	37.4

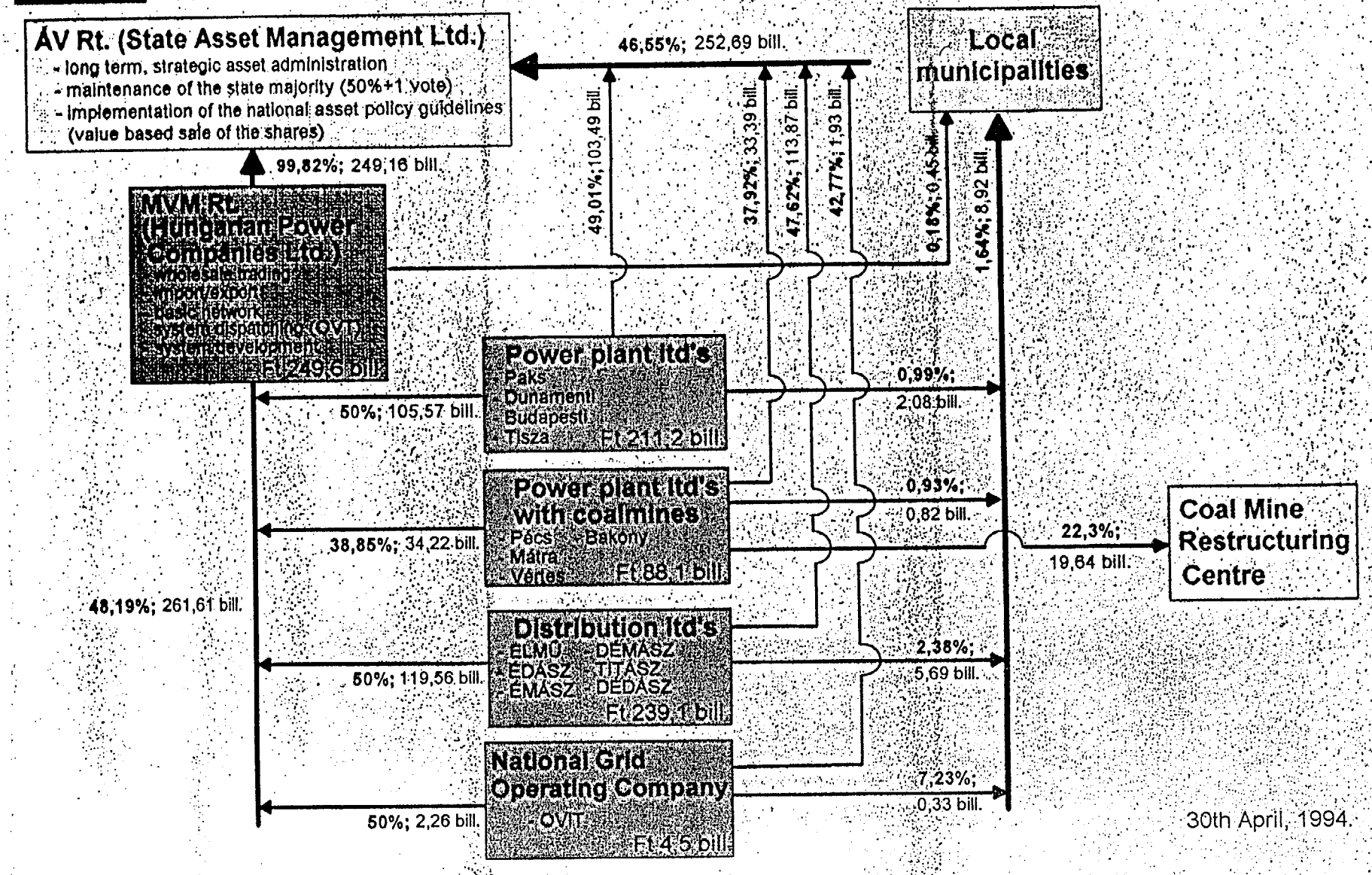
DOING NOTHING CASE

STRATEGY 93.07. VERSION A-A

SO2



OWNERSHIP STRUCTURE OF THE MVM GROUP



30th April, 1994.

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Power Companies and Plants

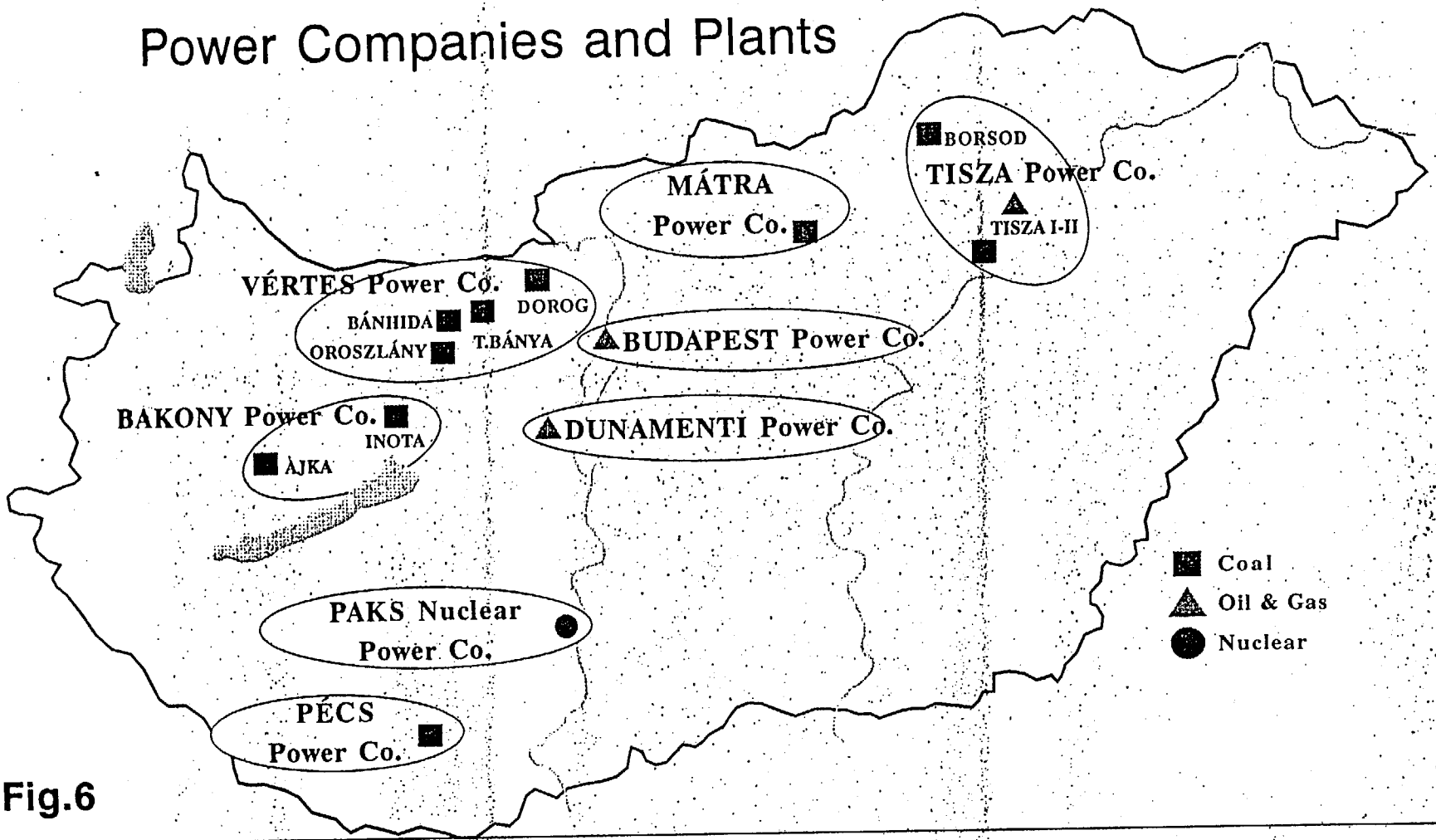

Fig.6

Bakony Power Co.
Ajka 132 MW
Inotai 92 MW
GT 170 MW

Tisza Power Co.
Borsod 171 MW
T.palkonya 250 MW
Tisza II 860 MW

Budapest Power Co.
- Kelenföld 98 MW
- Köbánya 21.9 MW
- Újpest 9.6 MW
- Angyalföld 9.7 MW
- Kispest 24 MW
- Révész utca

Dunamenti Power Co.
1870 MW

Paks Nuclear Power Co.
1840 MW

Mátra Power Co.
- Mátra 800 MW

Pécs Power Co.
- Pécs 220 MW
- Komló 5.9 MW

Vértes Power Co.
- Dorog 12.5 MW
- Bánhida 100 MW
- Oroszlány 235 MW
- Tatabánya 32.2 MW

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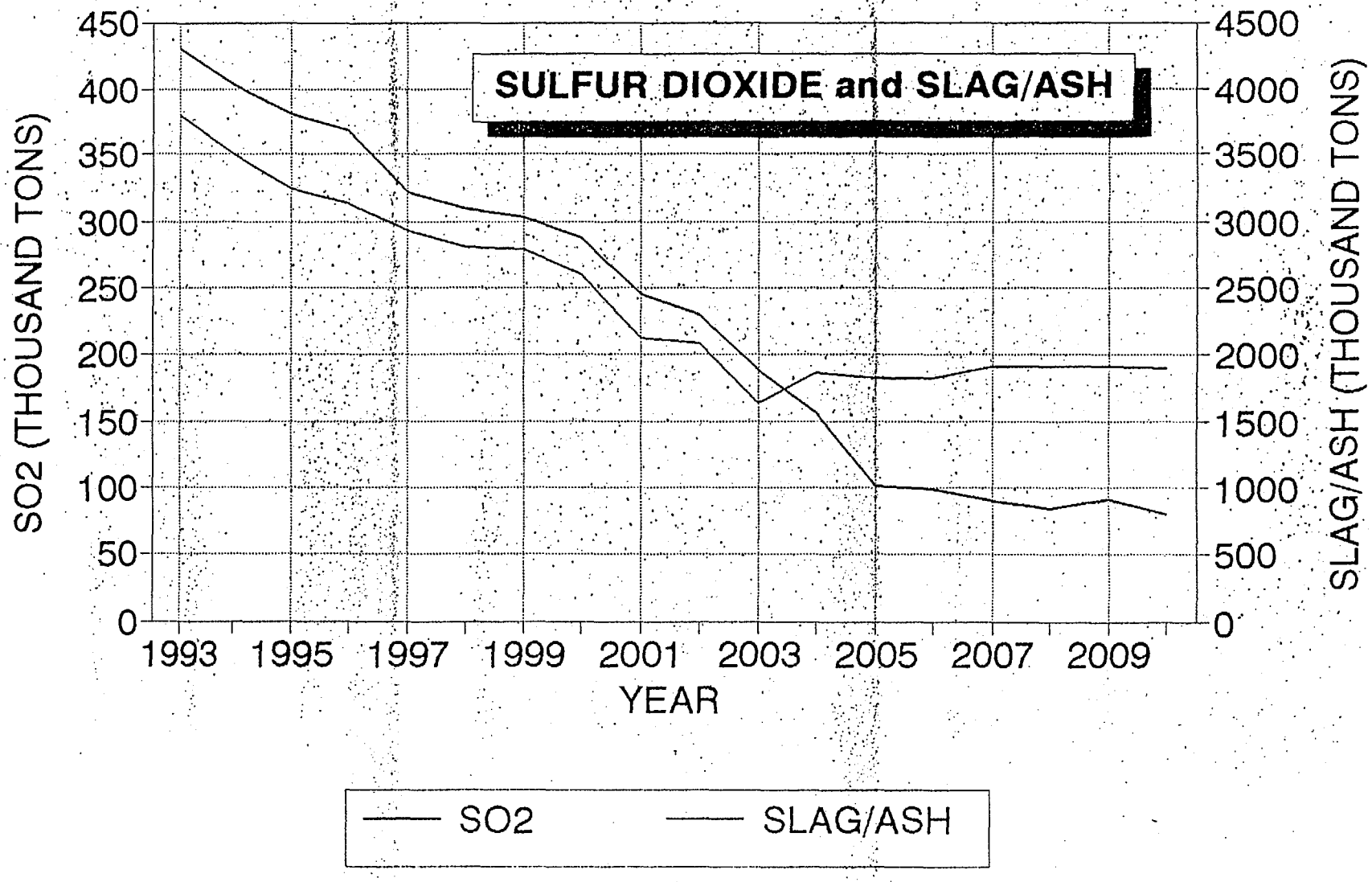
STRATEGY 93.07 VERSION A-A



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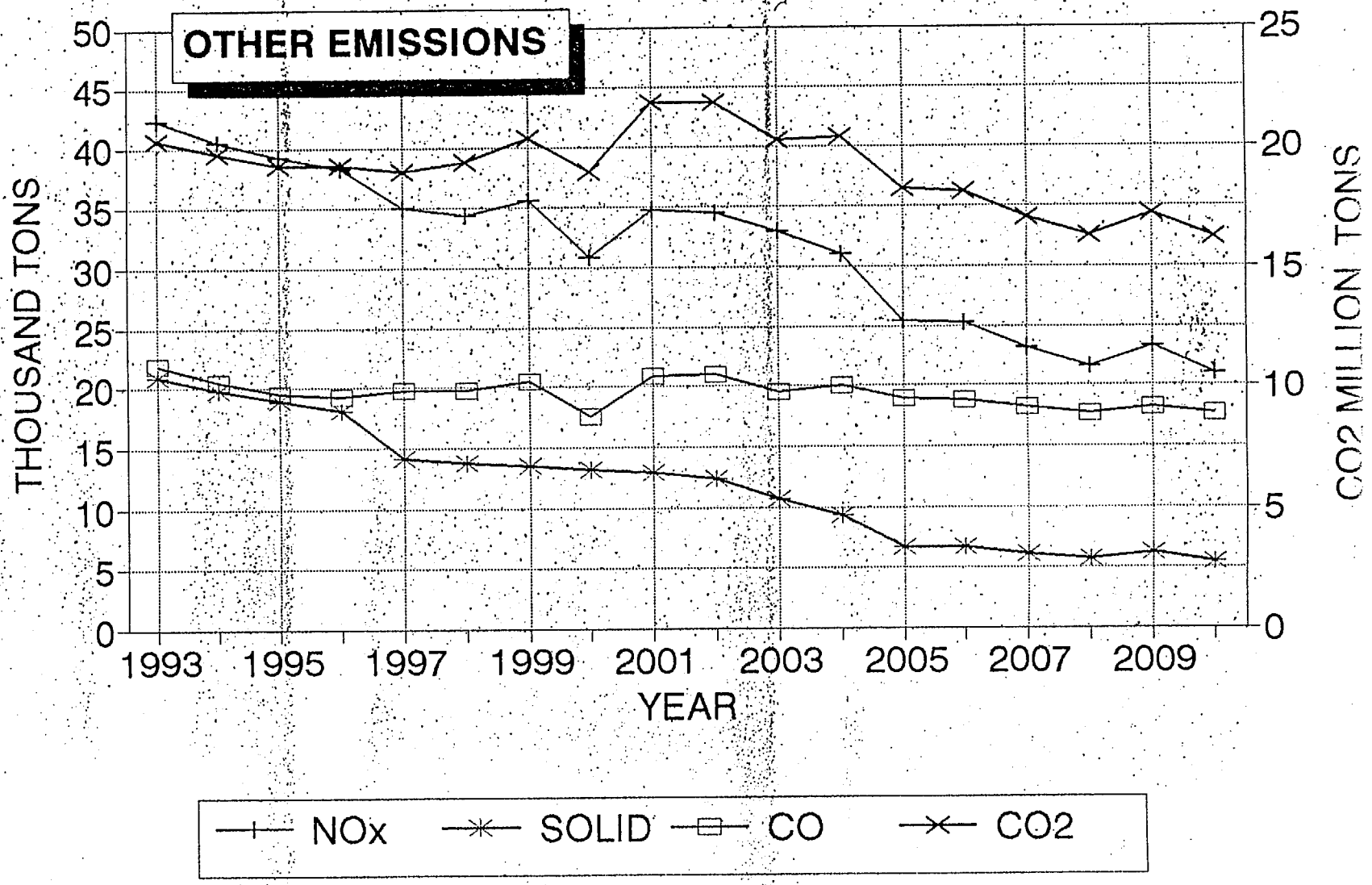
STRATEGY 93.07 VERSION A-A



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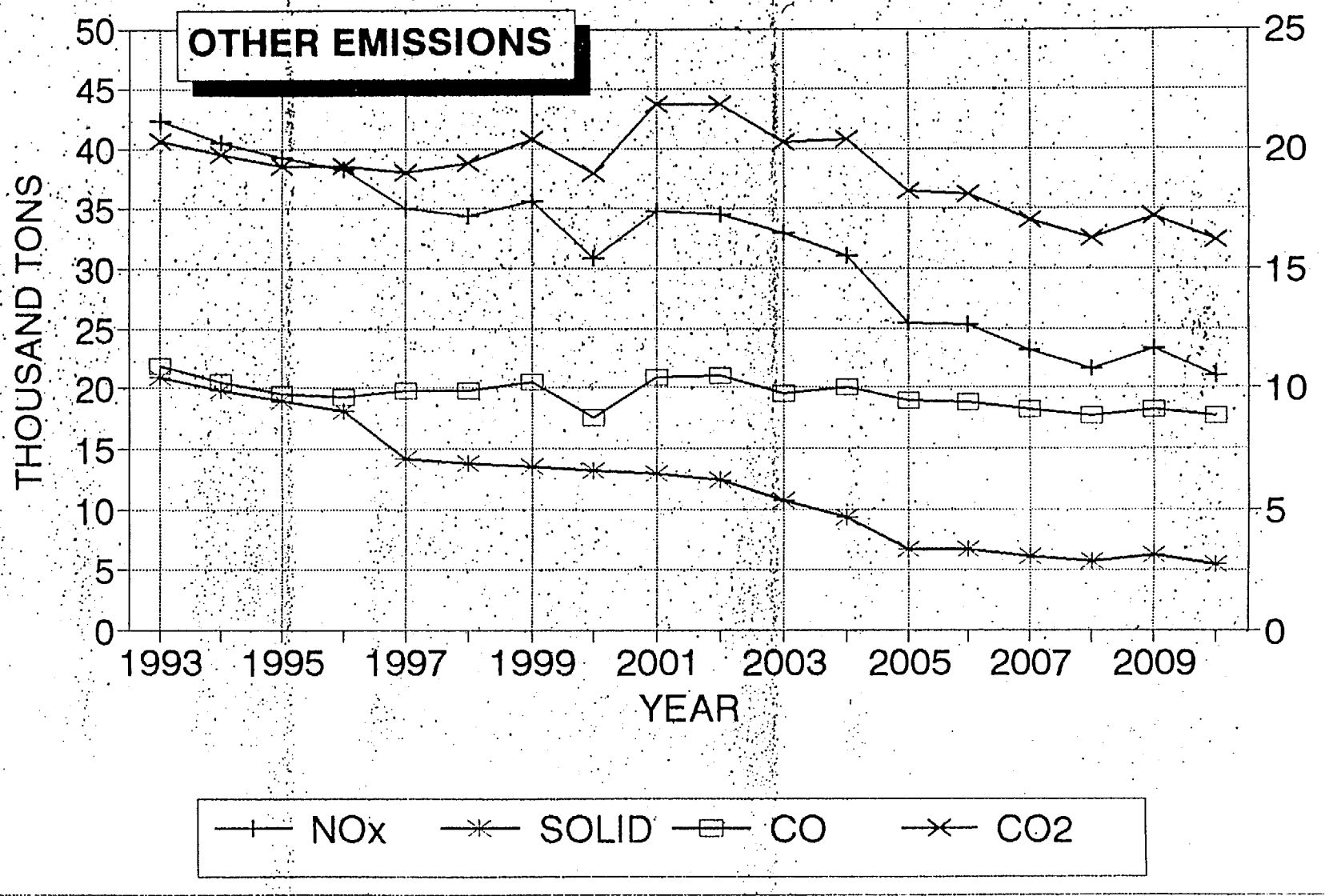
DOING NOTHING CASE

STRATEGY 93.07 VERSION A-A



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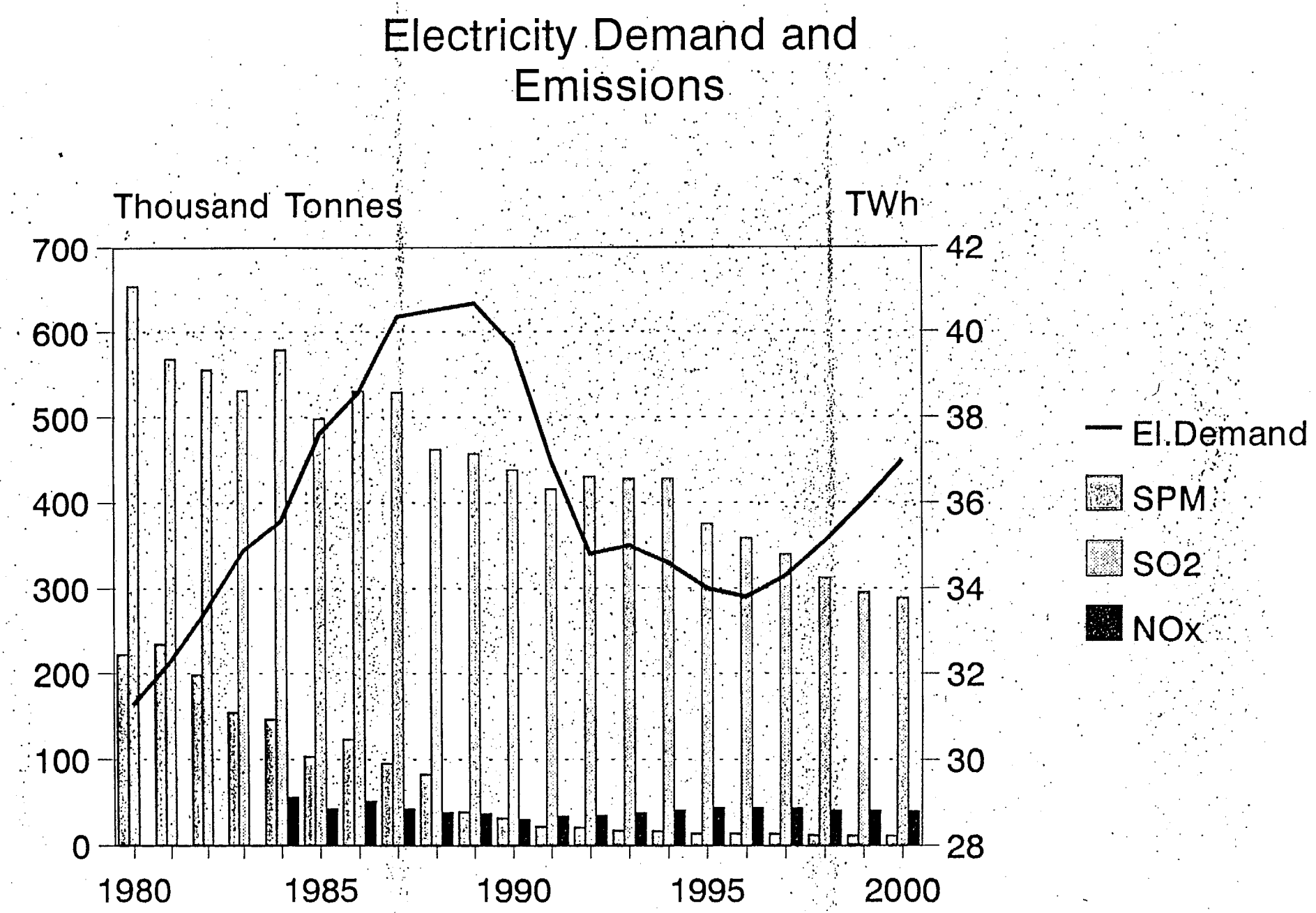

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Fig.7

POLAND

POLAND. ENVIRONMENTAL REGULATIONS AND POLICIES IMPACTING ELECTRIC UTILITIES

Adam GAJDA
Mieczysław KWIATKOWSKI

Polish Power Grid Company

ENVIRONMENTAL ISSUES WORKING GROUP MEETING
FOR THE CENTREL COUNTRIES
USEA / UPP

March 29 - 30, 1995
Budapest, Hungary

CONTENTS

1. Current Status of Environmental Regulations;
2. Emissions in Poland - Power Sector Participation (I);
3. Emissions in Poland - Power Sector Participation (II);
4. Studies on Environmental Upgrading. Assumptions and Methodology;
5. Studies on Environmental Upgrading. Results Considering the Compliance with Existing Regulations;
6. Studies on Environmental Upgrading. International Agreements and Protocols Impact. Total Investment;
7. Proposed Solutions of SO_2 Emission Reduction by Power Sector;
8. Ranking List of System Power Plants for SO_2 Reduction;
9. Investment Program for SO_2 Emission Reduction;
10. Next Steps in Environmental Strategy Developing;
11. Possible utilization of IPM model in definition of environmental strategy;

1. CURRENT STATUS OF ENVIRONMENTAL REGULATIONS

- Up to 1990 year Polish Power Sector has been developed without taking into account environmental consequences ;
- At February 12, 1990 the order of the Minister of Environment Protection, Natural Resources and Forests' Disposition concerning emission standards was issued ;
- Standards were set for 3 groups of power plants and were assigned to single boilers ;

Fuel	Boiler type	Power installation								
		Group A			Group B			Group C		
		SO_2	NO_x	Partic.	SO_2	NO_x	Partic.	SO_2	NO_x	Partic.
Hard coal	Pulverized	1240 / 3348	330 / 891	1240 / 702	870 / 2349	170 / 459	130 / 351	200 / 470	170 / 459	130 / 351
Lignite	Pulverized	1540 / 3619	225 / 529	1540 / 458	1070 / 2514	150 / 352	95 / 223	200 / 540	150 / 352	95 / 223

Group A - pertains to installations existing at the Disposition's coming into force and is in force till December 31, 1997
Group B - pertains to installations existing at the Disposition's coming into force and is in force till January 1, 1998
Group C - pertains to installations commissioned after December 31, 1994 or which construction started at the Disposition's coming into force

Emission standards for power sector (g/GJ) and (mg/Nm^3)

- It was decided, that local authorities are in power of setting stricter standards of emission due to levels of imission;
- Also fees for use of environment were set ;

Particulate [USc/kg]	SO_2 [USc/kg]	NO_x [USc/kg]	Furnace wastes [USD/t]
3	6	6	2

Fees for economical use of environment

2. EMISSIONS IN POLAND-POWER SECTOR PARTICIPATION (I)

Power Sector Features:

- Polish Power Sector consists of over 32 000 MW of available capacity at public power plants and at autoproducers;
- Gross production of electricity equals of ca. 132 TWh for last few years;
- Ca. 97% of electricity production is based on coal (hard coal, lignite);
- Annual power sector consumption of hard coal equals of 41 mill. tones and lignite of 66 mill. tones.

Emission situation:

- In 1993 year Polish Power Sector has produced :
  - 1.3 mill. tones of SO2 (ca. 50% of total volume);
  - 0.37 mill. tones of NOx (ca. 30% of total volume);
  - 0.30 mill. tones of particulates.

Fuel	Number of boilers	Capacity installed [MW_{el}]	Particulate [t/a]	SO_2 [t/a]	NO_x [t/a]
Hard coal	102	13 725	67 000	393 700	147 700
Lignite	28	6 960	129 800	465 300	111 800
Total	130	20 685	196 800	895 000	259 500

Total pollutants' emissions from system power plants

3. EMISSIONS IN POLAND-POWER SECTOR PARTICIPATION (II)

Capacity of units [MW_{el}]	Fuel	Total operation time [hrs]	Number of units	Total capacity [MW]	Emission [mg/Nm^3]			Emission standards of Group B after year 1997 [mg/Nm^3]		
					Partic.	SO_2	NO_x	Partic.	SO_2	NO_x
50	HC	> 120 000	24	1 200	994	1 438	714	351	2 349	459
60	HC	> 120 000	2	120	144	1 430	717	351	2 349	459
120	HC	> 120 000	17	2 060	301	2 760	654	351	2 349	459
200	HC	< 120 000	25	5 000	310	2 289	833	351	2 349	459
200	HC	> 120 000	20	4 000	163	2 372	787	351	2 349	459
500	HC	< 120 000	2	1 000	347	2 098	916	351	2 349	459
120	L	> 120 000	7	840	630	883	566	223	2 514	352
200	L	> 120 000	16	3 200	1 183	2 931	521	223	2 514	352
360	L	< 120 000	12	4 320	207	2 799	510	223	2 514	352
Fuel	HC - hard coal L - lignite									
Group 8	includes Turów power plant which is undergoing boilers exchange and is not representative for average level of pollution reduction determination									

Average pollutants' emissions from system power plants (year 1993)

- For different groups of generating units the required level of the emission reduction is different:

  0 - 55% for particulates;
  0 - 15% for SO2;
  32 - 50% for NOx.

- Existing reduction of total emission in the period 1990 - 1993 was reached due to:

  - lover production of electricity;
  - hard coal parameters improvement;

Year	Coal consumption [t]	Ash content [%]	Sulphur content [%]	Calorific value [kJ/kg]
1989	56 954 162	28.45	1.134	18 308
1990	49 278 207	25.59	0.965	19 600
1991	46 782 590	24.04	0.925	20 373
1992	42 133 566	22.34	0.863	20 920
1993	40 870 406	21.23	0.844	20 989

Parameters of hard coal used for electricity generation

  - activities on environmental upgrading already done or in progress (with capital investments estimated at the level of ca. 600 mill. USD);

4. STUDIES ON ENVIRONMENTAL UPGRADING. ASSUMPTIONS AND METHODOLOGY

- At the end of 1994 year "Least Cost Power Investment Study for the Polish Power Sector" was complited;

- One of the most important assumptions was to work out on expansion strategy, which was consistent with current environmental protection legislation;

- Following technologies were considered in evaluation of environmental upgrading strategy:

  Particulate:
  - flue gas conditioning (SO_3 injection);
  - ESP - rehabilitation or replacement of electrostatic precipitators.

  SO_2:
  - LSP - wet technology; lime solution absorbs SO_2 and gypsum is the waste;
  - DLP - wet technology; SO_2 is absorbed by hydrated lime and hydrated magnesium's solution;
  - SAP - semi-dry technology; injection of sorbent's solution (hydrated lime) into flue gases;
  - DSP - semi-dry technology; ground limestone's injection into a boiler and flue gases' cooling through water injection between air heater and precipitator;
  - DAP - dry technology; dry sorbent's injection into a combustion chamber;

  NO_x:
  - PRM - primary methods; combustion system modification and / or replacement of burners by the low-NO_x-burners

- For singular boiler the final selection of technology was based on the assumption of fulfilling the environmental standards at the minimum of: investment, operating and waste disposal cost;

5. STUDIES ON ENVIRONMENTAL UPGRADING. EMISSION LIMITS FOR EXISTING UNITS AFTER 1997 (GROUP B)

- Selection of measures according to Group B gave finally the total investment costs of 1.1 bill. USD.

Pollutant	Emission [t/h]			Emission reduction [%]	
	1993	after 1997			
		Group B	Group C	Group B	Group C
Particulate	34.51	15.29	15.29	56	56
SO_2	190.28	135.13	35.2	29	81
NO_x	54.84	36.14	36.14	34	34

Specific pollutants' emissions from system power plants after year 1997

- Global results:
  - aver. specif. costs for envir. protect. 0.35 USc/kWh
  - total annual costs (average) 43 mill.USD
  - particulate emission 91.7 th. t/a
  - SO_2 emission 810 th. t/a
  - NO_X emission 215 th. t/a
  - recyclable waste amount 9.0 mill. t/a
  - of this gypsum 0.5 mill. t/a
  - disposable wastes amount 7.8 mill. t/a
- Computations were repeated assuming standards for Group C (New Units) after 1997 year and for "bubble concept" applied for the whole power plant;

6. STUDIES ON ENVIRONMENTAL UPGRADING. INTERNATIONAL AGREEMENTS AND PROTOCOLS

- In June of 1994 the 2nd Sulphur Protocol was signed by the Polish Government.

- For Poland the level of SO_2 total emission reduction was defined in relation to 1980 year;

	Year				
	1980	1990	2000	2005	2010
Actual emission th. [t/a]	4 100	3 210	-	-	-
Target emission th. [t/a]	-	-	2 583	2 173	1 397
Emission reduction [%] (base year 1980)	-	-	37	47	66

SO_2 Emission reduction according to the II Sulphur Protocol

- Also recommendations on SO_2 specific emission reduction for big stationary combustion sources were set;

	Thermal capacity [MW]		
	50÷100	100÷500	>500
SO_2 emission allowed [mg SO_2 / Nm^3]	2 000	2 000÷400	400
1 Total thermal capacity discharging flue gases through common stack			

SO_2 Emission standards according to the II Sulphur Protocol

- Total investments for pollution control installations were calculated and compared to that ones related to existing standards;

	Existing Power Plants [mill. USD]				Existing CHP Plants [mill. USD]			
	SO_2	NO_x	Partic.	Total	SO_2	NO_x	Partic.	Total
Group B	662	261	220	1 143	179	146	170	495
Group C	3 243	261	220	3 724	1 350	146	170	1666
II Sulphur Protocol	3 482	261	220	3 963	1 084	146	170	1400

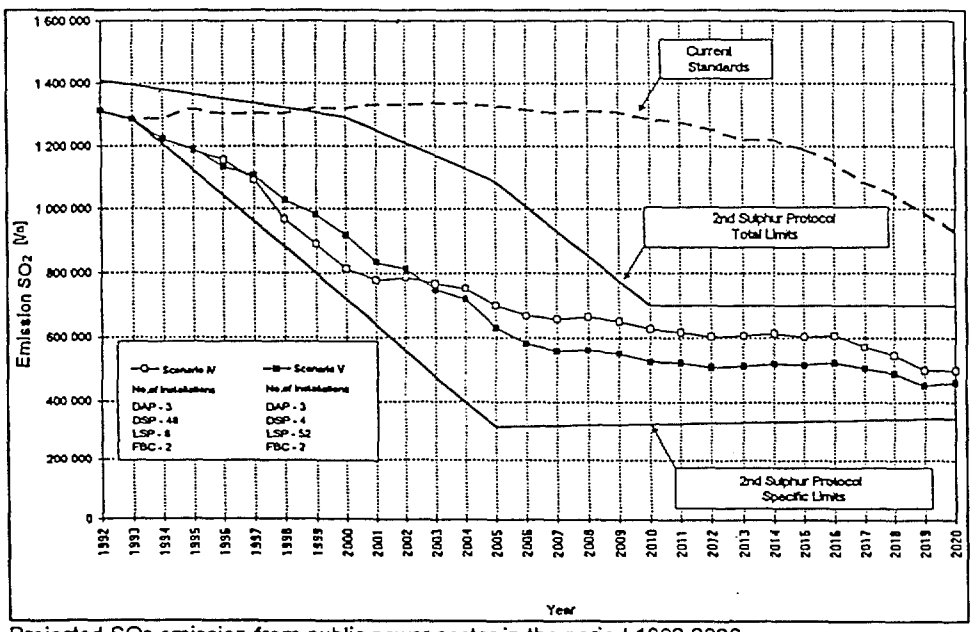
Investment for pollution control installations

7. PROPOSED SOLUTIONS OF SO_2 EMISSION REDUCTION BY POWER SECTOR

- Current emission standards and requirements of the 2nd Sulphur Protocol describe the borders of area, within which a feasible strategy of SO_2 reduction for the Polish Power Sector can be found;

- The feasible strategy was set in site by site study for existing power and CHP plants taking into account assumptions specified in "Least Cost Power Investment Study..." and related to projected capacity, electricity production and time schedules of rehabilitation and retirements;

- Two additional scenarios (IV & V) introducing respectively semi-dry and wet installations for SO_2 emission reduction were defined, beyond these plants where works are completed or in progress;



Projected SO_2 emission from public power sector in the period 1992-2020

8. RANKING LIST OF SYSTEM POWER PLANTS FOR SO_2 REDUCTION

- Defined scenarios of SO_2 emission reduction are still very expensive (dry installation) and inconvenient in introduction (huge amounts of wastes for semi-dry installations);

- In order to support the process of the final strategy creation and at the basis of SO_2 reduction installation selection already done, additional site by site studies tending to prepare the ranking list of the most effective reduction projects;

- Following criteria were taken into account:

  - increase of specific cost of electricity production;
  - specific cost of 1 ton SO_2 reduction;
  - annual total reduction of SO_2 emission.

- Adding the ranks of power plant for different criteria the final ranking list was prepared;

No.	Power Plant	SO_2 Emission Without Installation [t/a]	SO_2 Emission With Installation [t/a]	SO_2 Emission Reduction [t/a]	Cost of 1 Ton of SO_2 Rejection [USD/t]	Increase of Electricity Production Cost [USc/kWh]
1	Bełchatów	325 488	138 357	187 131	739	0.47
2	Rybnik I 4x200	57 627	17 288	40 339	601	0.30
3	Rybnik II 4x200	52 020	15 762	36 259	665	0.29
4	Jaworzno III	93 148	39 529	53 619	785	0.45
5	Turów	135 319	14 441	120 878	633	0.91
6	Połaniec	95 267	16 349	78 918	785	0.62
7	Dolna Odra	95 110	15 440	79 670	872	0.68
8	Łaziska II 4x200	42 004	7 603	34 401	821	0.65
9	Kozienice 8x200	59 382	30 293	29 089	997	0.51
10	Kozienice 2x500	34 924	7 220	27 704	1 052	0.87
11	Ostrołęka	30 053	5 076	24 977	1 001	0.87
12	Łaziska I 2x120	7 904	1 431	6 473	1 326	1.15

Ranking list of system power plants for SO_2 reduction

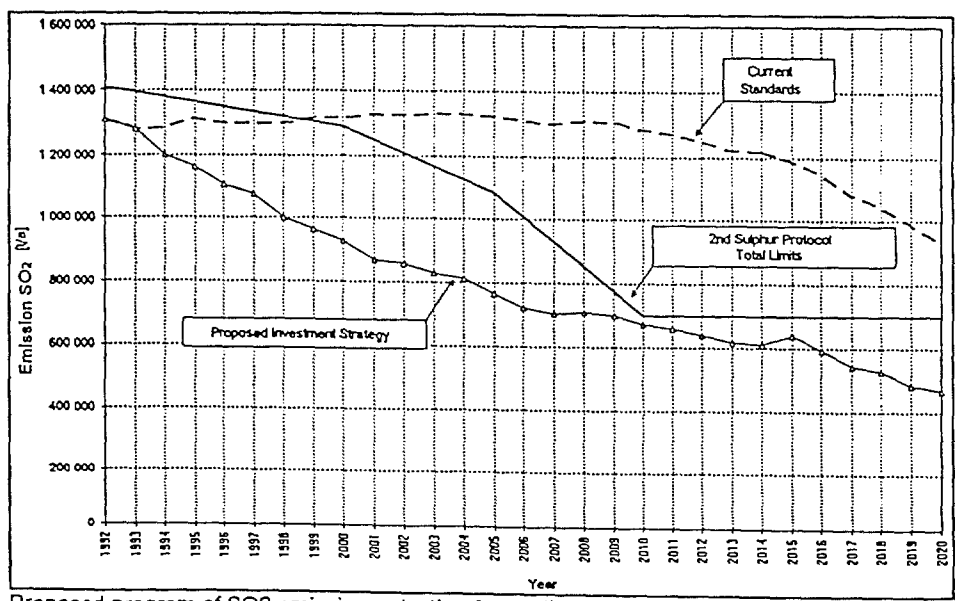
9. INVESTMENT PROGRAM FOR SO_2 EMISSION REDUCTION

- Presented ranking list was completed with proposals regarding SO_2 reduction installations for selected CHP plants;

- Resulting SO_2 emissions were corrected considering projected quantities and quality of hard coal;

- The final program of SO_2 emission reduction in the Polish Power Sector consists of the full implementation of investment program in existing power plants, where tehnologies of SO_2 reduction are determined, and additonally in several power and CHP plants;

- The full investment cost for described program equals 1.6 bil. USD;



Proposed program of SO2 emission reduction for public power sector

- Projected SO_2 emission reduction is higher than included in total limits of 2nd Sulphur Protocol. Apearing surplus of SO_2 reduction can be consumed by other sectors of national economy.

10. NEXT STEPS IN ENVIRONMENTAL STRATEGY DEVELOPING

CENTREL activities:

- The Development Working Group (DWG) of CENTREL has scheduled the next meeting dedicated to environmental protection strategy for June 27-29, 1995 during Regional Environmental Cooperation Workshop in Warsaw;

Regulatory Framework:

- The preparation in Poland of new regulation related to emission standards consistent with international agreements is well advanced;
- Power sector has an active role in creation of a new law. Its own proposals were worked out and presented to Ministry of Environmental Protection. Its representatives take part in formulation of new rules;
- New law will consider the possibility of introduction of the "bubble concept" and emission allowances trade;

Power Sector Expansion Planning:

- CO_2 emission impact studies will be introduced within power expansion planning in PPGC;
- Implementation of new expansion planning tools in PPGC will enable the considering of environmental constraints;
- Testing of IPM model developed by ICF Resources Inc. is well advanced and new planning loop in 1995 will be done by PPGC with utilization of a new tool.

11. POSSIBLE UTILIZATION OF IPM MODEL IN DEFINITION OF ENVIRONMENTAL STRATEGY

- Multi-regional power system representation with transmission limitations between regions and joint limitation across sets of regions, also emission limitation;

- The IPM model can accurately evaluate environmental compliance strategies:

  - SO_2 emission reduction policies;
  - Potential CO_2 emission reduction policies;

- Model can explicit represent SO_2 and CO_2 limitations, monitor and report forecasted levels of these emissions, as well as NO_x, TSP, scrubber sludge and ash;

- It is possible to consider different types of constraints on SO_2 and CO_2 including tonnage caps, different trading schemes, taxes and emission limits;

- Following environmental technologies can be controlled :

  - Retrofit scrubbing;

  - Retrofit / repowering with clean coal technologies;

  - Co - firing with gas;

  - Switching to lower sulphur coals;

- Changes to unit performance characteristics (rating, forced outage, heat rates) are modelled;

- Units dispatch in response to environmental regulation can be adjusted;

- The marginal cost of compliance can be measured;

- Carbon taxes can be modelled;

SLOVAK

REPUBLIC

SE a.s. Slovak republic

Evaluation of Environmental Protection Program

54

1. Introduction

SE a.s. - joint-stock company was originated in November, 1994 from the state enterprise Slovenské energetické podniky.
Today SE a.s. is the biggest producer of power in Slovak Republic.
It carries out activities in three fields:
- electicity generation and transmission
- heat generation and delivery into the distribution network of heat suppliers
- utilization of renewable energy sources and new forms of electricity usage

It produces electricity in nuclear, thermal and water power plants, operates 400 and 220 kV transmission networks , delivering electicity to the distributing companies.

Electricity generation in SE a.s. according to the type of power plant:

- Nuclear Power Plants	1 760 MW
- Thermal Power Plants	2 198 MW
- Water Power Plants	1 923 MW

Another 215 MW of installed capacity belongs to the distributing company.

Power sources of SE a.s.:

- liquid fuels	17,9%
- coal	36,4%
- natural gas	25,9%
- nuclear power	16,3%
- hydro power	1,9%
- import of electricity	0,8%
- new energy sources	0,5%
- others	0,3%

Structure of final energy consumption:

- industry	53,5%
- residence, commerce	43,6%
- transportation	2,9%

Total production of electric energy amounts to 23 400 GWh at the intalled capacity of 6 829 MWe.
Annual electricity consumption per capita is 4 390 kWh.
That means ratio between the total production of electricity and GDP is 2,28 kWh/USD.

SE a.s. was only a state owned utility up till November, 1st, 1994. Since that date it has changed to joint-stock company with new system of organization and property devision restructed as follows:

National Property Fund	51%
Shares to be sold off	16%
Coupon Privatization	30%
Restitution Fund	3%

The major objectives of SE a.s.

- to maintain the balance between electricity generation and its opimized consumption
- substantial reduction of the negative impact of power generation on inhabitants and environment
- electricity generation as economical as posiible
- to provide consumers with perfect services and strive to reduce power consumption

The awareness of responsibility to nature from which we draw the sources for electricity generation as well as the health of inhabitants in Slovak republic represents the ethical aspect of the process of SE a.s. transition into a modern dynamic company. Its program for the improvement of environment and meeting the requirements derived from the laws on the environment protection and the waste management is mainly focused on:

- gaseous emissions reduction
- particulate emission reduction by precipitators enhancement
- implementation of environmentally acceptable manner of solid waste disposal from coal power plants, e.g. in a form of so called stabilizing agent, utilization af ash as a secondary usefull material for construction.
- reliable radiation control of the nuclear power plants environment
- implementation of cleaner production technologies in the process of energy generation

2. Environmental Technology initiatives and regulations in Slovakia

Environment Polution control is full responsibility of national government as well as the Ministery of Environment.
Minister responsible for environment has power to set standards, permits or guidelines, which are valid for both new and existing plants.
New more stringent constrains for electricity producers including SE have been introduced by means of laws, regulations and amendments to existing rules for environmental production.

There are laws issued for: air protection
water protection
solid waste management

AIR PROTECTION

Air protection is secured by Air Protection Act issued in 1991 under the No. 309

Subsequently there were accepted other laws regarding to the air protection. They specify the role of authorities to protect the air, appoint the fees for air pollution.

There is the statement under the Air Act stating the list of pollutants, categorization of the pollution sources, emission standards, imission standards and recommended imissions for smog situation.
There was an amendment of Air Protection Act corespoding to the main principles of air pollution restriction by industrial facilities given in EEC treaty No.84/360. There are principles of implementation of best available technologies, efficient cost to meet standards against pollution.
There are also emission standards necessary to meet for the solid fuels combustion.
All emission standards given below are calculated for dry gas and normal conditions 101,325 kPa and 0° C and for oxygen presence in the flue gases 6% of volume.

Solid fuels combustion

2.1 Emision standard for particulars

2.1.1 New pollution sources

- Above the total output 400 MW not more than 50mg.m^{-3} for utility with solid fuel combustion
- With total output from 50 MW - 400 MW not more than 100 mg.m^{-3} solid fuel combustion

2.1.2 Existing pollution sources

- Above the total output 50 MW not more than 100 mg.m^{-3}

2.2 Emision standards for SO_2

2.2.1 New pollution sources

- For the utilities, combustioning solid fuels with total output

above 400 MW it is 400 $mg.m^{-3}$. Due to high content of the sulphur in the fuel from domestic sources grade of emission can't be more than 10%

- In the case of fluidized bed combustion with total output above 2 MW is emission standard for SO_2 400 $mg.m^{-3}$ or grade of emission can't be more than 15%

2.2.2 Existing pollution sources

Emission standars for existing pollution sources are valid till the end of 2009.

- For utilties with solid fuels combustion with total output more than 300 MW there is limit for SO_2 500 $mg.m^{-3}$
- For utilities with solid fuels firing with total output from 50 - 300 MWthere is limit 1 700 $mg.m^{-3}$. Grade of emission can't be more than 60% that means 3 500$mg.m^{-3}$

After 2009 there is a standard valid as it is for new pollution sources.

2.2.3 Conditions for meeting emission standards

There is a possibility to operate utility with solid fuel combustion in spite of the fact that desulphurization is not in the operation due to breakdown in the case when the duration of the breakdown is not longer than 96 hours continuously and within the year it won't be not more than 360 hours.

2.3 Emission standards for NO_x

For the utilities with solid fuel combustion with total output above 50 MW there is the standard 550 $mg.m^{-3}$

2.4 Emission standards for CO

With total output above 5 MW there is emission standards 250 $mg.m^{-3}$

Liquid fuels combustion

3.1 Emission standards for SO_2

3.1.1 New pollution sources

Up to total output 435 MW there is limit 400 $mg.m^{-3}$

3.1.2 Existing pollution sources

Utilities with liquid fuel combustion, with total output above 300 MW there is limit 500 $mg.m^{-3}$. Validity of this standard is up till 2009.

3.2 Emission standards for NO_x

Above the total output 5 MW there is limit 450 $mg.m^{-3}$

Gaseous fuels combustion

Conditions for emission standards setting: Emission standards are valid for the concentration calculated on dry gas under the normal conditions 101,325 kPa and 0°C and for oxygen contents in flue gases 3%.

4.1 Emission standard for particulates

For the utilities with total output above 0,2 MW there is limit 10 $mg.m^{-3}$.

4.2 Emission standard for SO_2

For utilities with total output above 0,2 MW
- firing industial gas from rafinery 100 $mg.m^{-3}$
- firing industrial gases with low heating capacity 800 $mg.m^{-3}$
- firing other gases 35 $mg.m^{-3}$

4.3. Emission standard for NO_x

For utilities with total output above 0,2 MW there is limit 200 $mg.m^{-3}$

4.4 Emission standard for CO

For utilities with total output above 0,2 MW there is limit 100 $mg.m^{-3}$

WATER PROTECTION

Water Act valid from 1973 states water management with underground water, surface water and water from mining activity. Water Act specifies water protection in river basins, underground water, waste water discharges to the underground and surface waters.

Under the Water Act there is also the statement containing limits and permits for allowed parameters of waste water dicharges. This statement is valid from 1994 and it completes the Water Act. Allowed parameters are given for the recipient discharges. The quality of waste water to the sewage sytems are individual given by permits issued by authorities.

Another law specify the water protection against the harmfull materials like oil, chemicals, solvents, PCB, hydrazine.
There are also statemet appoints the fees for waste water discharging.
Power stations produce waste water which is purified to remove pollutants. Used equipment is needed to retrofit and modernizate. The law limiting content of pollutants is relatively well fulfilled. Legislation rules permit the temperature of discharged cooling water into rivers for 26°C.

At the J. Bohunice NPP it is a problem in maintining tritium concentrations at the level of 1 000 Bq/ly given by standard. To meet this standard it must be carried out the dilution of discharged waste water up to 1 000 Bq/l, what is technically difficult.

WASTE MANAGEMENT

The Act on Wastes No. 236/1991 apoints the fees imposed on waste producers for processing waste in a reusable form, as energy in their own area of activity or for resale.

Waste fees are devided into two groups:
- basic fees
- an additional charge - multiplying by 2 to 16 the basic one paid by the waste producers that fail to meet storage conditions.

Waste is devided into three categories:
- other
- special
- hazardous

At the moment ash disposal meets all the conditions for sale storage SE's aims to reuse bottom ash for the manufacture of:
- cement
- concrete
- air trained concentrate
- artificial stones
- stabilized ash

Nuclear waste from the nuclear PP is reduced in volume before its disposal. Spent fuel has been stored in a special storage building. Since NPP has been in operation all kind of nuclear waste had been safely disposed.
The ambient environment of NPP as well as Thermal Power Plants is regularly monitored and measured.

3.EUROPEAN COMMUNITIES LIMITS AND STANDARDS

3.1 General approach

Under powers granted in the EEC treaty, uniform legislation on environmental issues applying to all Member States can be adopted by a majority vote of the Council (vhich consists of representatives of each Member State).Legislation adopted as a Directive is legally binding on the Member States, who must introduce it inti their national legislation within a specified time period. If this is not done, the country can be subject to proceedings in the European Court, The Member States are: Belgium, Denmark, France, FRG, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, UK.

The EEC has recently agreed legislation controlling emissions from large combustion plants, which includes emission standards for SO2, NOx and particulates. The emission standards will be implemented by their adoption into relevant national regulations, and enforced by relevant authorities within each country. The legislation also sets targets for reduction of total national of SO2 and NOx. emissions of SO2 and NOx.

3.2 Sources of regulation

The directive containing emission standards is the Council Directive on the Limitation of Emission of Pollutants into the Air from Large Combustion Plants (known as the Large Combustion Plants directive)

3.3.SO2 and NOx control

A key feature of the directive is the setting of targets for reduction of total SO2, NOx and particulate emissions from existing large combustion plants during the 1990s and into the next century compared with 1980 levels. The directive sets standard percentage reduction requirement for this period but

certain Member States are allowed derogations from this requirement to take account of reductions achieved before 1980 or their state of economic development. The emission ceilings and corresponding percentage reductions from the 1980 values require of the Member States for existing large combustion plants are shown in Tables 4 and 5 for SO2 and NOx respective

The directive requires that all new large combustion plants (over 50 MWt) should be subject to a licensing procedure and should meet specified emission limits for SO2, NOx and particulates. Stack heights must not exceed 200 m.

3.4 Emission standard for other pollutants

Emission standards for pollutants other than SO2, NOx and particulates have not been introduced.

3.5.Measurement basis

Emission standards are based on measurement of gas volumes at 273 K, 1.013 bar, after correctio for water vapour, and a 6% oxygen content by volume. Plant size is measured in MW thermal output. Emission standards must be met on a calendar monthly mean basis (or a rolling monthly mean where percentage reduction requirements for SO2 rather than emission limits are applied). For SO2 and particulates, 97% of 48 hour mean values must be within 110% of the standard, for NOx, 95% of 48 hour mean values must be within 110% of the standard.

Table 1 SO_2 emission standards

	Plant type	Plant size	Emission standards
Current	New plants	50-99 MW_t	+
		100 MW_t	2000 mg/m^3
		101-499 MW_t	+
		>500 MW_t	400 mg/m^3
	New plants firing high or variable sulphur coal	100-166 MW_t	40% removal
		167-499 MW_t	$
		>500 MW_t	90% removal

\+ Limit to be decided in 1990

\+ Sliding scale between 200-400 mg/m^3

$ Sliding scale between 40% and 90% removal, with 60% removal at 300 MW_t

Table 2 NO_x emission standars

	Plant type	Plant size	Emission standards
Current	New plants	>50 MW_t	650 mg/m^3
	New plants firing coal with volatiles <10%	>50 MW_t	1300 mg/m^3

Table 3 Particulate emission standards

	Plant type	Plant size	Emission standards
Current	New plants	50-500 MW_t	100 mg/m^3
	New plants	>500 MW_t	50 mg/m^3

Table 4 SO2 emission ceilings for existing large combustion plant

Member State	SO2 emissions 1980,kt	SO2 emission ceilings,kt/y			Reduction of 1980 totals, %		
		1993	1998	2003	1993	1998	2003
Belgium	530	318	212	159	-40	-60	-70
Denmark	323	213	141	106	-34	-56	-67
FRG	2225	1335	890	668	-40	-60	-70
France	1910	1146	764	573	-40	-60	-70
Greece	303	320	320	320	+ 6	+ 6	+ 6
Ireland	99	124	124	124	+25	+25	+25
Italy	2450	1800	1500	900	-27	-39	-63
Luxembourg	3	2	1,5	1,5	-40	-50	-50
Netherlands	299	180	120	90	-40	-60	-70
Portugal	115	232	270	206	+102	+135	+79
Spain	2290	2290	1730	1440	- 0	-24	-37
UK	3883	3106	2330	1553	-20	-40	-60
EEC total	14430	11066	8403	6141	-23	-42	-57

Table 5 NOx emission ceilings for large combustion plant

Member State	NOx emissions (NO2) 1980,kt	NOx emission ceilings, kt/y		Reduction of 1980 totals, %	
		1993	1998	1993	1998
Belgium	110	88	66	-20	-40
Denmark	124	121	81	-3	-35
FRG	870	696	522	-20	-40
France	400	320	240	-20	-40
Greece	36	70	70	+94	+94
Ireland	28	50	50	+79	+79
Italy	580	570	428	-2	-26
Luxembourg	3	2,4	1,8	-20	-40
Netherlands	122	98	73	-20	-40
Portugal	23	59	64	+157	+178
Spain	366	368	277	+ 1	-24
UK	1016	864	711	-15	-30
EEC total	3678	3306	2584	-10	-30

4 SE's ENVIRONMENTAL POLICY

The conception of the future development of our company is to be based on the electricity production , utility in Slovakia under reliable operation of the transmission of 400 kV and 220 kV and delivery of the electric energy.
It must also meet other conditions deriving from the character of electric power as a strategic element of the country economy.
This concerns mainly:
- Compliance of the intensions with the approved conception of energy development strategy in Slovak Republic to the year 2005
- Consideration of the environmental protection requirements

The main strategic goal is to by an economically strong and profitable company. To reach this goal, there were tasks set mainly in management activities, financial policy, education of the employees and also the care for an economic consumption of electicity.

Our long term program is based on expected development of electricity in Slovakia.
Environmental policy is oriented with regards to each facility itself.

SE a.s. PROGRAM OF REDUCING THE HARMFUL EMISSIONS

Power Plant	Blocks	Technology	Term of construction	Cost mil. Sk
Thermal				
Vojany	660 MW	desulphurization	1996/1998	874
		denitrification	1996/1998	
VojanyII	660 MW	fluidized bed boilers	1993/1998	5 487
		denitrification	1995/2000	535
Novaky I	108 MW	fluidized bed boilers	1992/1994	770
Novaky II	440 MW	desulphurization	1992/1995	1 880
		fluidized bed boilers	1992/1997	1 970
Tp Handlova	102 MWt	fluidized bed boilers	1994/1996	482
TEKO I	336 MWt	cogeneration	1996/1998	2 619
TEKO II	120 MW	desulphuration	1996/1999	560
	539 MWt	denitrification		

Implementation of the proposed measures will mean in future significant lowering of emissions:

SO_2 - 118 241 t per year

NO_x - 16 643 t per year

Ash - 21 722 t per year

The current transformation of economy does not allowe to work out a final scenario of expected electricity consumption . It was necessary to consider several variants , reflecting the most probable continuation of the industry restruction, the rise of small and medium large bussiness subjects, the development of terciary industry and consumption of electricity in the households.

The future development of energy sources is a question that needs to be considered in relation to ecological problems. Environmetally oriented installations are very investment consuming, making power generation within SE a.s. more expensive.

Air pollution fees

According to the Air Protection Act there is possibility until 1998 not to pay fees in full range

year	1992	1993	1994	1995	1996	1998
Level %	20	40	60	60	80	100
Fees mil.Sk	48	92	156	155	150	135

Emission standards for SE's
Thermal Power Plants

Fuel Pollutants: [$mg.m^{-3}$]	Coal now / 98	Nat.gas	Oil
SO_2	1700/2500	35	1700
NO_x	1100/550	200	450
CO	250	100	175
Part.	100	10	50

Technical measures to meet SO_2 emission standards given in Air Protection Act in Thermal Plants

Utility	Current limit $mg.m^{-3}$	Proposed solution	Emission standard $mg.m^{-3}$
EVO I Bl. 1	5000	a) desulphurization-semidry method b) using coal with low sulphur contents-0,7%	1700
Bl.3-4,6	6100	fluidized bed boilers	400
ENO A	9000	fluidized bed boilers	400
ENO B	10000	desulphurization wet-scrubbing method	1700
TEKO II	2500	using coal with low sulphur contents-0,6%	1700

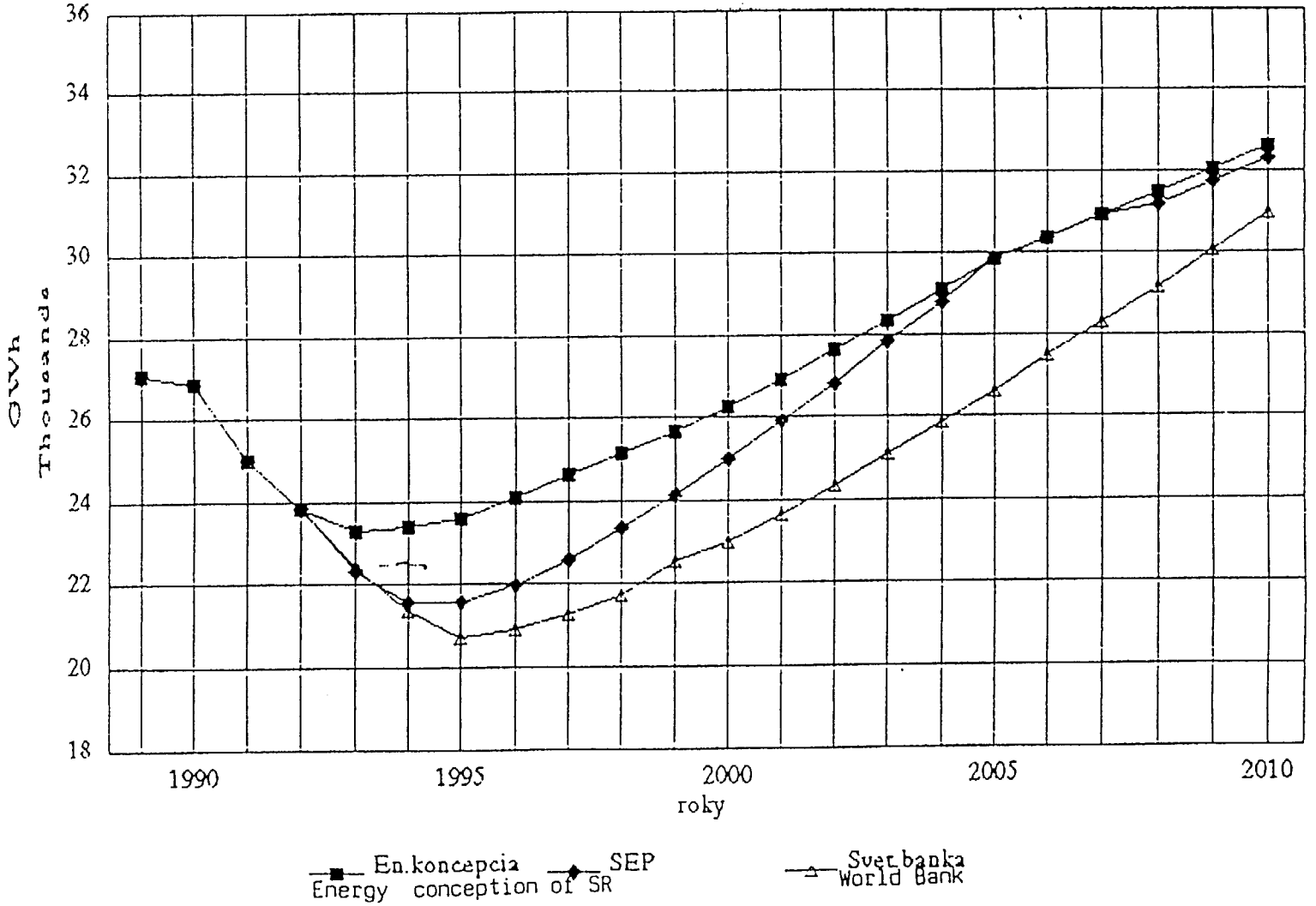
Technical measures 10 meet NO_x emission standards given in Air Protechon Act in Thermal Plants

Utility	Current limit $mg.m^{-3}$	Proposed solution	Emission standard $mg.m^{-3}$
EVO I Block 1	1200	a) low emission burners b) SNCR	1100
EVO II oil Block 1-6 Ngas	850 450	low emission burners	450 200
EVO I Block 3-4	1600	Fluidized bed boilers	400
ENO A K1-K7	800	Fluidized bed boilers	400
ENO B,C Bl.1-4	800	low emission burners	550
TEKO I	800	low emission burners	200
TEKO II	800 1500	a) low emission burners b) SNCR	200 1100

DEVELOPMENT OF DOMESTIC CONSUMPTION IN SR

Vyvoj tuzemskej spotreby v SR

bez sp.na cerpanie a vl.sp.el



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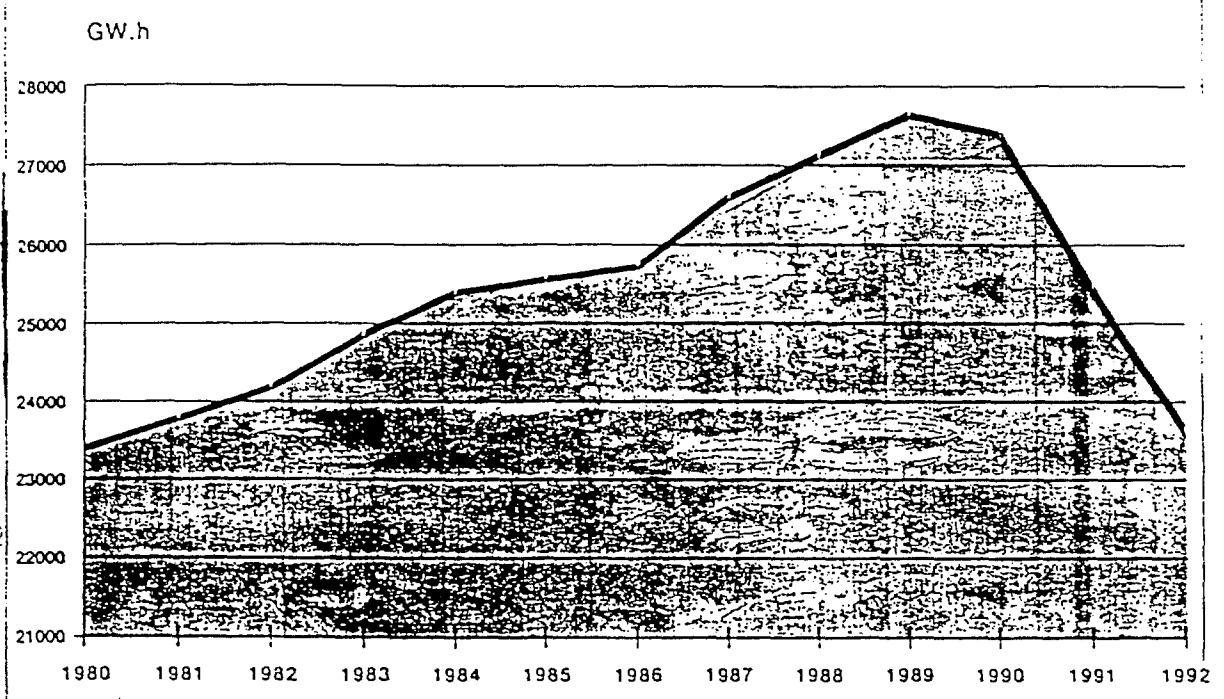
SLOVAK REPUBLIC

DOMESTIC CONSUMPTION



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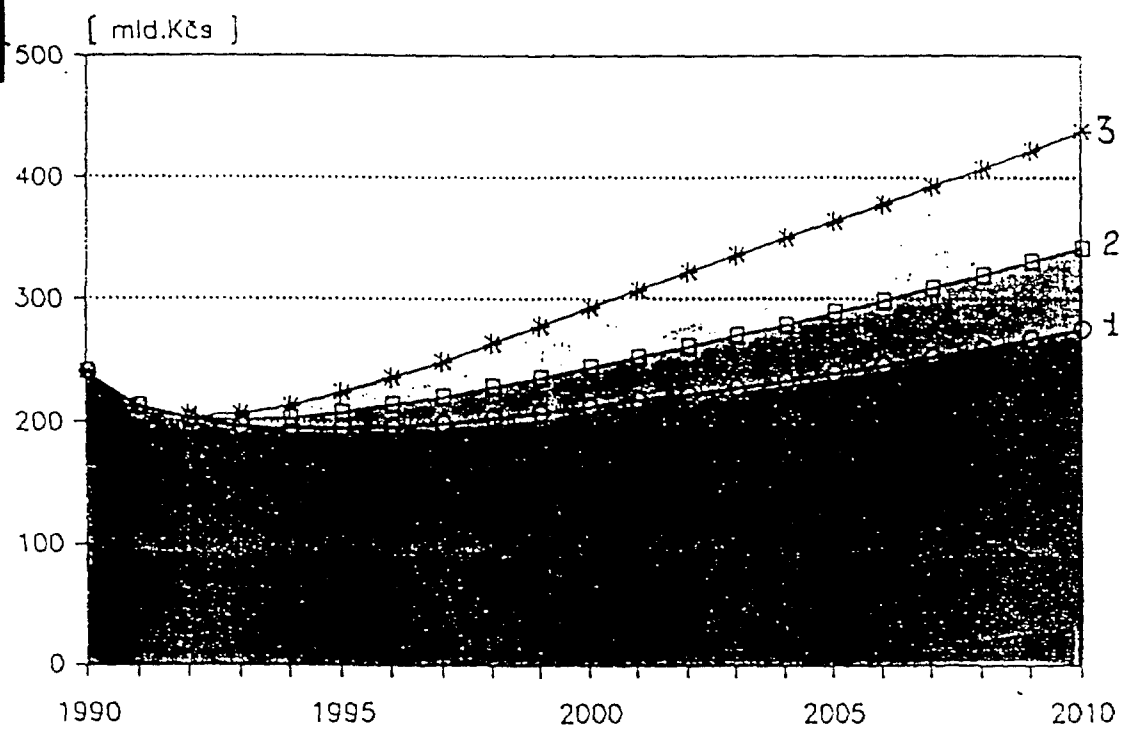
SLOVENSKE ELEKTRARNE

DEVELOPMENT PROGRAM OF SEP s.e.

GDP of SR / FIXED PRICES IN 1990



1 - Pessimistic scenario

2 - Realistic scenario

3 - Optimistic scenario

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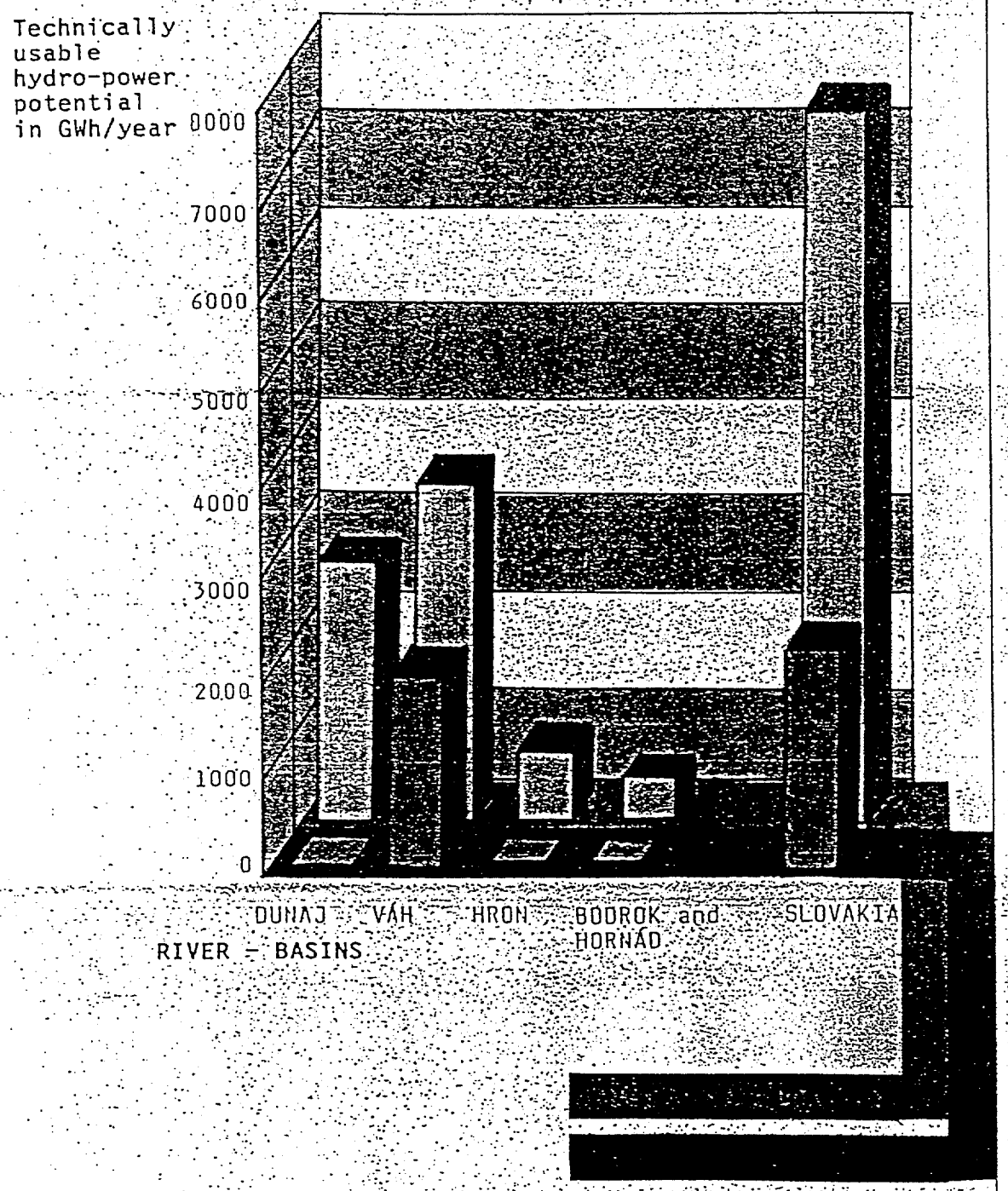
HYDRO-POWER POTENTIAL OF SLOVAKIA



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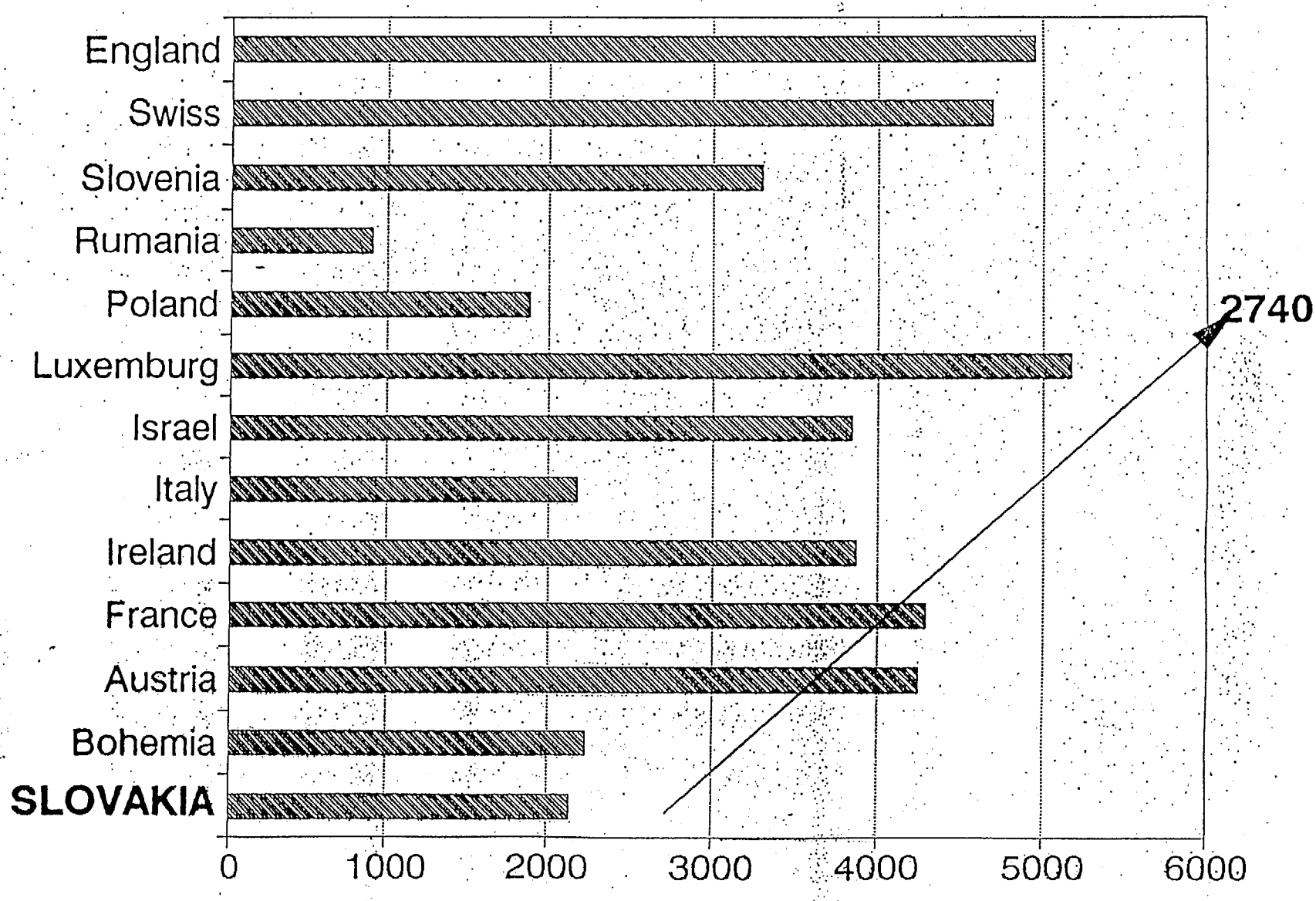
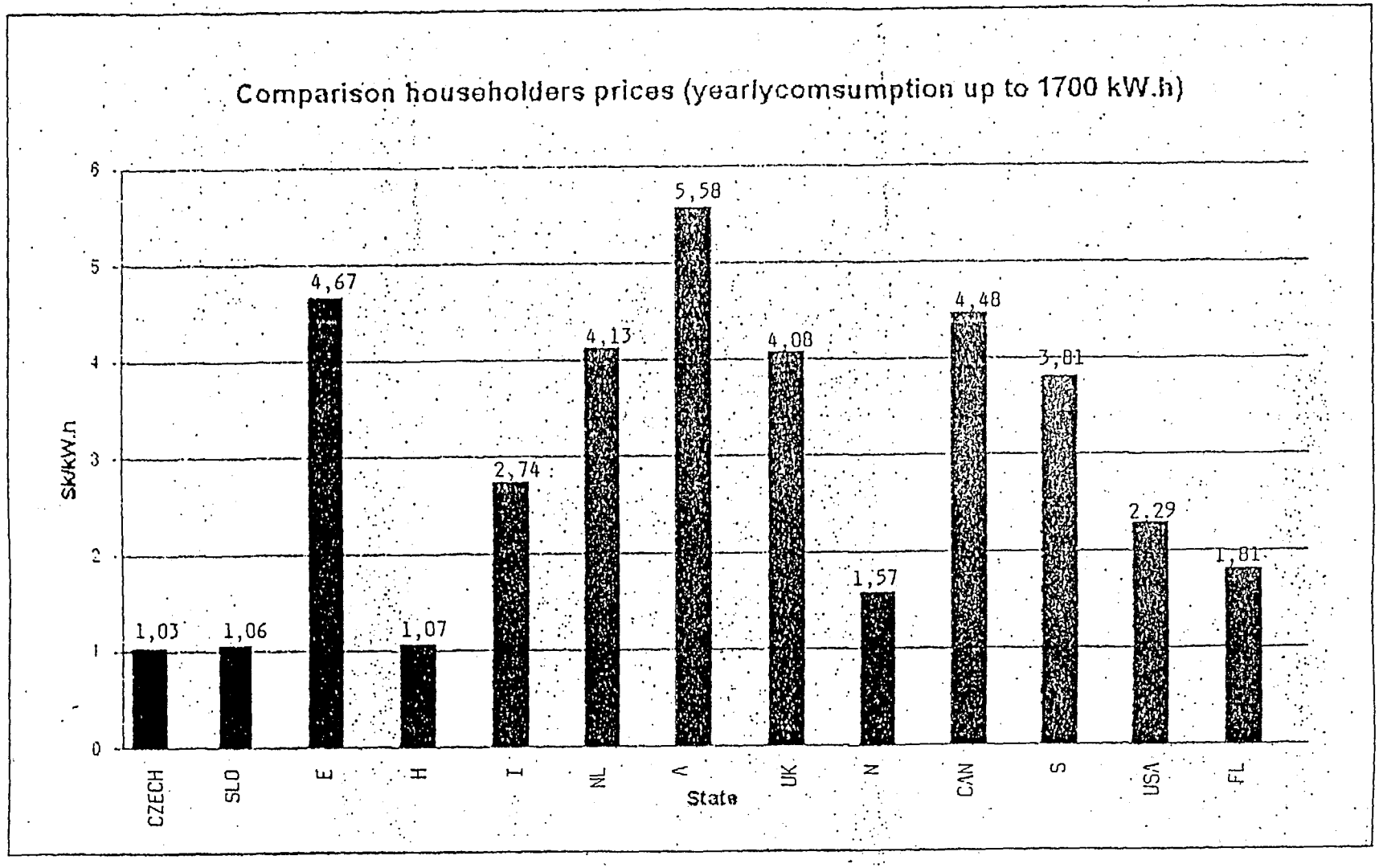
HOUSHOLDERS AVERAGE CONSUMPTION in kW.hr/year




Comparison householders prices (yearlycomsumption up to 1700 kW.h)
Sk/kW.h
0
1
2
3
4
5
6
1,03
1,06
4,67
1,07
2,74
4,13
5,58
4,08
1,57
4,48
3,81
2,29
1,81
CZECH
SLO
E
H
I
NL
A
UK
N
CAN
S
USA
FL
State

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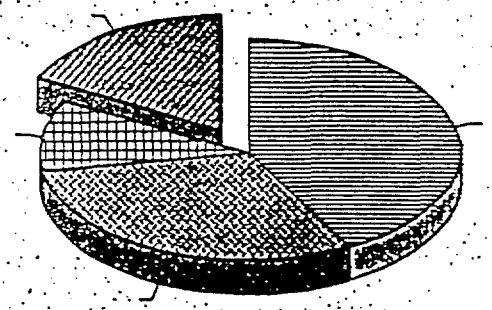
SLOVENSKÉ ELEKTRÁRNE

CONSUMPTION OF FOSSIL FUELS STRUCTURE OF TYPES BY ENERGY IN THE FUEL IN 1992

GAS
13 834 TJ
17,2 %

FLUID FUEL
8 585 TJ
10,7 %

BROWN COAL
24 033 TJ
29,9 %



BLACK COAL
33 990 TJ
42,2 %

USED FUELS

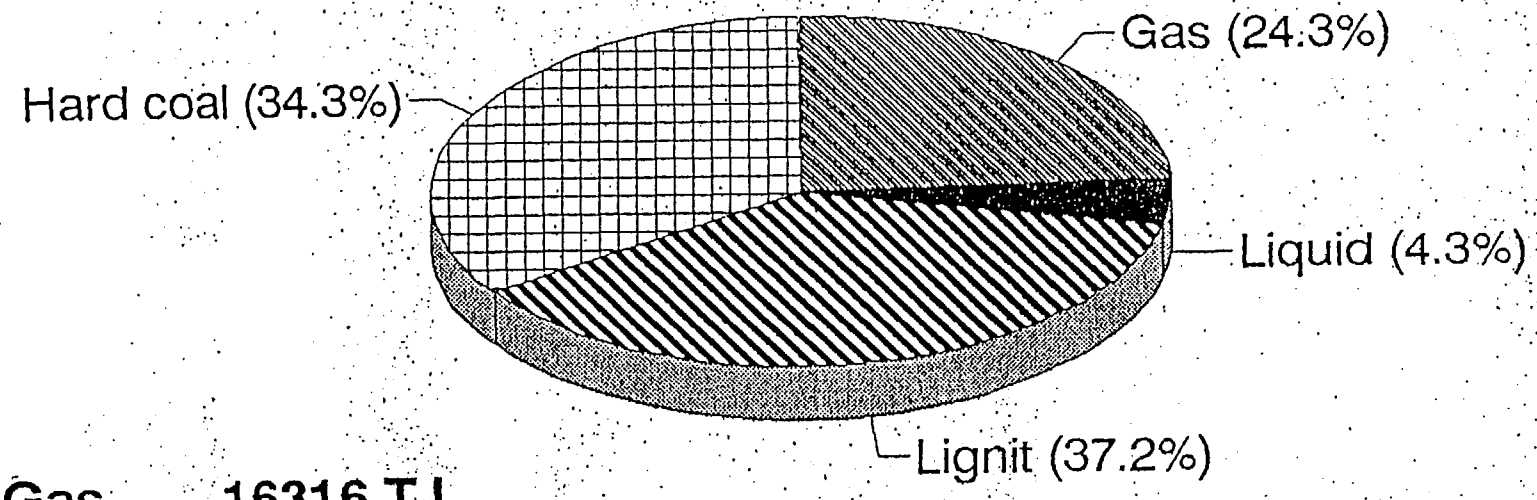
BLACK COAL

Calorific value	25 Gj/t
Ash content	19,42 %
Sulphur content	1,57 %
Water content	6,8 %

BROWN COALE

Calorific value	9,45 GJ
Ash content	30,0 %
Sulphur content	1,65 %
Water content	30,1 %

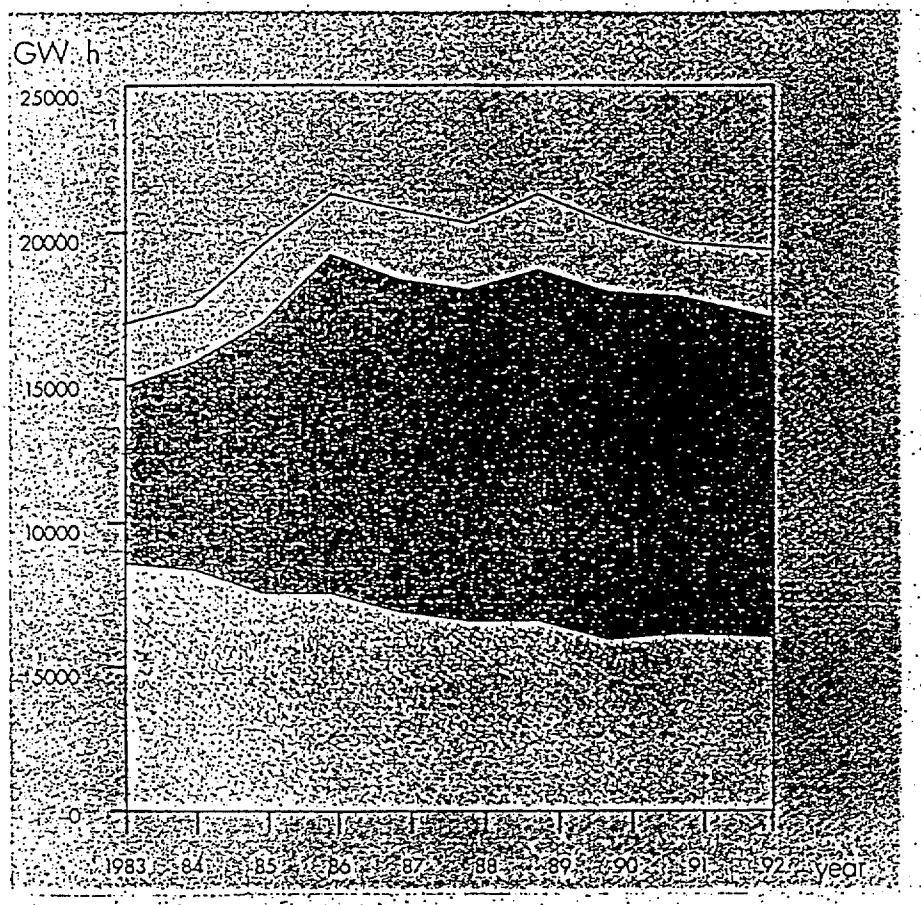
Fuel Consumption Structure in 1994



Gas	16316 TJ
Liquid	2867 TJ
Lignit	25009 TJ
Hard	23043 TJ
TOTAL	67235 TJ

SLOVENSKÉ ELEKTRÁRNE

ELECTRICITY GENERATION



Hydro power plants
Nuclear power plants
Thermal power plants

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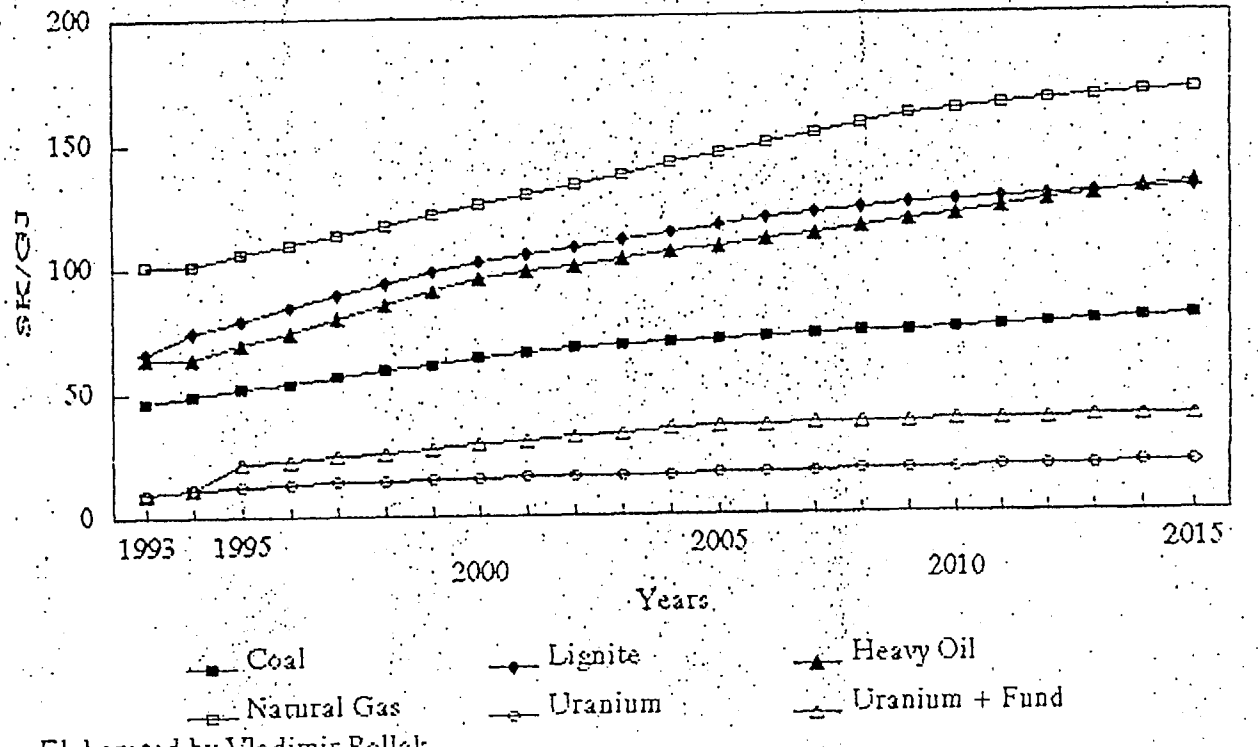
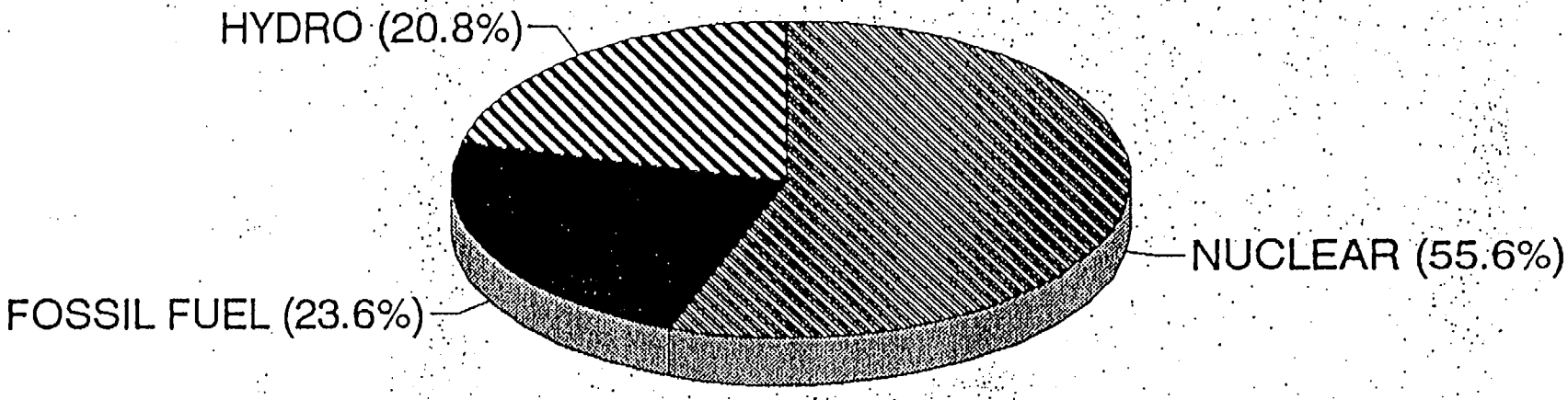
Fuel Price Forecasts until 2015 /transport incl./

December 1994 Prices.



Elaborated by Vladimir Pollak
December 1994

PRODUCTION of ELECTRICITY
1994



Nuclear	12135 GW.h
Fossil	5151 GW.h
Hydro	4539 GW.h
Total	21825

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Slovenský energetický podnik

SEP POWER PLANTS – BASIC DATA

NUCLEAR POWER PLANTS

POWER PLANT		INSTALLED CAPACITY (MW)	FUEL / TYPE OF REACTOR	PRODUCTION (MW.h)
– Bohunice Nuclear	V-1	2x440	V-230 PWR	4 747 244
	V-2	2x440	V-213 PWR	6 275 120
– Mochovce Nuclear		Under construction 1 760	V-213 PWR	
Total		1 760		11 022 364

CONVENTIONAL THERMAL POWER PLANTS

– Vojany	I	6x110	black coal	2 629 883
	II	6x110	oil, natural gas	858 705
– Nováky	A	2x22.4	brown coal, lignite	403 943
		2x32	brown coal, lignite	
	B	4x110	brown coal, lignite	1 286 160
– Košice Heat and Power		1x66	black coal, natural gas	
		1x55	black coal, natural gas	518 803
Total		1 989 80		5 697 494

HYDRO POWER PLANTS

AFFILIATION	POWER PLANT	INSTALLED CAPACITY (MW)		PRODUCTION (MW.h)
– VODNÉ ELEKTRÁRNE TRENČÍN				
ORAVA	Orava	21.75		23 754
	Tvrdošín	6.10	127.85	10 745
	Gerný Váh		735.16	793 12
				352 690
LIPTOVSKÁ MARA	Liptovská Mara	198.00		54 338
				56 535
	Bešeňová	4.64	202.64	115 656
SUČANY	Krpeľany	24.75		49 494
	Sučany	38.40		73 572
	Lipovec	38.40	101.55	67 755
MIKŠOVÁ	Hričov	31.50		46 974
	Mikšová	93.60		127 650
	Považská Bystrica	55.20	180.30	79 834
NOSICE	Nosice		67.50	128 190
DUBNICA	Ladce	15.00		70 155
	Ilava	15.00		72 916
	Dubnica	16.50		73 963
	Trenčín	19.10	62.60	74 109
NOVÉ MESTO n/V	Kostolná	26.50		94 090
	Nové Mesto n/V	25.50		105
	Horná Streda	25.50	76.50	450
MADUNICE	Madunice	13.20		63 [illegible]
	Kráľová	45.00		83 [illegible]
	Kozmálovce	5.37	9.58	63 [illegible]
GABČÍKOVO	Gabčíkovo		450.00	962 [illegible]
– VODNÉ ELEKTRÁRNE DOBŠINÁ				
	Dobšiná	22.82		27 [illegible]
				5 620
	Ružín	60.00		19 965
				336
	Small hydro p. p.	15.62	9.[illegible]	2 [illegible]
Total			2 096,12	3 857 334
From this				3 459 653 *
				397 681 **

Production in combined operation * through-flow ** pumped storages

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Gas emission values from nuclear power plant can reach only a certain percentage of the allowed limits. Maximum limits do not exceed those shown in Table 5.

Table 5

Nuclear plant / Item	EBO V-1 (2x440 MWe)	EBO V-2 (2x440 MWe)
Rare gases	1.4-3.8%	1.4-2.5%
Aerosols	<0.15%	<0.15%
Iodine 131	0.2-0.7%	0.2-0.7%

The reduction of regulated products using freons R11, R12 is shown in Table 6.

Table 6

Year / Item	1992	1993	1994	1995	1996	1997
Consumption of products (kg)	2 423	2 030	1 120	1 105	460	-

The consumption of volatile chemicals (perchlorethylene and trichlorethylene) used in machine servicing and maintenance has also decreased, these being replaced by ecologically safe products (Table 7).

Table 7

Year / Item	1990	1991
Perchlorethylene (kg)	6 960	1 570
Trichlorethylene (kg)	50 060	41 460

Comparison of present emission limits (PE) and target emission standards (ES) for the SPE in mg/Nm3 are illustrated in Table 3.

Table 3

Power station	Fuel	Solid pollutants		SO_2		NO_x		CO	
Boiler		PE	ES	PE	ES	PE	ES	PE	ES
1	2	3	4	5	6	7	8	9	10
Vojany I	HC								
B1-B2		600	100	5 000	1 700	1 200	1 100	100	250
K3-K6		3 200	100	6 100	1 700	1 600	1 100	100	250
Vojany II	NG	-	10	-	35	450	200	100	100
B1-B6	HO	-	50	3 500	1 700	850	450	100	175
Kosice									
B1-B2	HC	100	100	2 500	1 700	1 500	1 100	100	250
	NG	-	10	-	35	800	200	100	100
B3-B4	HC	100	100	2 500	1 700	1 500	1 100	100	250
	NG	-	10	-	35	1 000	200	100	100
WB1-2	NG	-	10	-	35	800	200	100	100
WB3-4	HC	100	100	2 500	1 700	1 500	1 100	100	250
	NG	-	10	-	35	1 000	200	100	100
Novaky A B1-B7	L	700	100	9 000	1 700	800	550	250	250
Novaky B B1-2	L	150	100	10 000	1 700	800	550	250	250
Novaky C	L	250	100	10 000	1 700	800	550	250	250
Handlova	L	600	150	6 000	2 500	750	650	250	250

HC = hard coal
L = lignite
NG = natural gas
HO = heavy oil

B = steam boiler
WB = hot water boiler

The Main Investments Program of Slovak Power Enterpri

-Košice project

new district heating power plant

feasibility study was made by JCI Japan

soft loan credit was permitted by Japanese government

estimated costs 200 million USD

bidding process is under preparation

-Power Plant Vojany

old coal burning plant 6x110MW (26 year old)

feasibility study was made by SEI (Atlanta Georgia)

Units 3 to 6 rebuilding for fluidized combustion

Units 1 and 2 reconstruction due to Clear Air Act

bidding documents will be prepared (june 93)

-Power Plants Novaky

Plant A

rebuilding 4 boilers to fluidized bed combustion 4x110 ton

building started in year 1992

estimated costs 75 million USD

Plant B

building FGD for lignite 2x110 MW

project started in year 1992

estimated costs 50 million USD

-SEP's Information System

new system

first study was made, costs was not estimated

-Power Plant Mochovce

completion of new nuclear plant

project before erection

estimated cost 670 million USD

-Power Plant Bohunice

reconstruction

project is going on

estimated cost 50 million USD

EVALUATIONS

UTILITY PARTNERSHIP PROGRAM
Regional Environmental Working Group Meeting
for the Centrel Countries
Budapest, Hungary
March 28-30, 1995

EVALUATION FORM

For all questions which ask for a rating, please grade each question on a scale of 1-5, 1 being the lowest grade and 5 being the highest.

	Not at all Valuable				Extremely Valuable
1. Overall, how valuable was this working group meeting for you?	1 0	2 0	3 0	4 6	5 9

Comments:

Czech Republic:

All four respondents commented on the value of learning the experiences of the other CENTREL countries as well as the U.S.

Poland:

1. "Problems observant at the meeting were general, but good for the first meeting."

2. Two other respondents wrote that the meeting was a very "clear demonstration".

Hungary:

1. "I appreciated that high level lectures were held. There was a good rapport between the group and the lecturers. All questions were answered immediately. The presentation of different topics was excellent."

2. "Personal contacts."

Slovakia:

1. "To let us know about the energy situation in the CENTREL countries and their impact on environment is very valuable."

2. Were relevant subject areas addressed? YES ___15___ NO _____

3. What subjects would you like to see addressed in future seminars/workshops, particularly at the Regional Environmental Cooperation Seminar in Warsaw, Poland- June 27-29, 1995?

Czech Republic:

1. "More technical details on new technologies and capital investment possibilities in Eastern European countries."

2. "Waste management."

3. "Transport of emissions among CENTREL countries, mostly a transport from Poland to Czech and Slovak Republics."

4. "Especially new technologies for decreasing emissions and experiences reflecting operational conditions."

5. "Monitoring of emissions."

Poland:

1. "Waste management. Incorporation of carbon dioxide issues in question of environmental policy. Coordination of CENTREL countries's efforts at the field of meeting West European standards."

2. Three respondents mentioned CO^2 reduction related to solid fuels, waste management (cost, utilization, recycling etc.) and clean coal technology legislation.

Hungary:

1. "Environmental assessment studies. Solid waste management, disposal."

2. "FGD waste water treatment. FGD operating and maintenance."

3. "SO^2 and NOx emission control."

Slovakia:

1. "Creating of financial sources for environmental protection power industry."

2. "Financing options. Market oriented approach in the frame of environmental management."

4. Were effective methods of presentation used (including distributed materials)? YES __12__ NO____

Which information was most useful?

Czech Republic:

1. "How are solved the environmental laws in the United States."

2. "Possibilities to reduce emissions of technical methods and those made in neighboring countries."

3. "SO^2, NOx control, case studies."

4. "Tackling of problem with environment and health of population."

Poland:

All respondents commented on the organization of the procedures of how new power plants obtain operation licensing. Technical data on environmental protection technologies.

Hungary:

1. "Distributed materials were very informative."

2. "Every information was useful for us. Cooperation (sometimes) with the ministry for Environment."

3. "Environmental law in the U.S.A. and the emission control."

Slovakia:

1. "All presentations were useful."

2. "All information regarding environmental issues and new approach to solve these problems without economical impact that can ruin us."

5. How important would it be to have materials translated?

VERY Important __6__ SLIGHTLY Important __5__ NOT Important __3__

6. What was the most valuable or useful thing you learned/experienced from attending this meeting?

Czech Republic:

1. "The information about system emission allowances."

2. "How important it is to know English language well for contact among CENTREL countries."

3. "Exchange of information and knowledge of people who are responsible for some issues in adjoining states."

Poland:

All respondents mentioned the experience of other CENTREL countries in their introduction of environmental protection strategies was the most valuable thing they learned from this meeting.

Hungary:

1. "Environmental control technologies. Legislation system at NEES."

2. "Shaping of environmental policies, laws, and regulations in U.S.A. Judgement of ash (it is not trash). Capital and operating costs of NOx and SO^2 removal processes."

3. "To have contact to other participants."

Slovakia:

1. "Information about approach to the solution of environmental protection problems in USA and CEC."

2. "To meet all people that are involved in the environmental management process."

7. Did you learn anything that can be used immediately? If so, please explain.

Czech Republic:

1. Four of the participants commented that they did not learn anything that they can use immediately.

2. "Yes. Give new point of view in discuss for modernization our environmental laws."

Poland:

1. Three participants commented that they did not learn anything that they can use immediately.

2. "Yes, all data concerning environmental protection technologies."

Hungary:

1. "The comparison of the environmental standards and laws of the neighbor countries gives tools for us in elevating our standards."

2. "I learned new information. At first I am going to reevaluate some task, connection and method in my thought. (At this moment the time is short.)"

3. "Not immediately, but in the future."

Slovakia:

1. "Yes, I have learned information about market with emission allowances."

2. "Yes, that all measures we'll implement are possible in the long term only because the political situation is so uncertain."

8. What was the least valuable thing you heard, and why?

Czech Republic:

All respondents commented that everything was useful.

Poland:

1. "Details on California regulatory system. It sounded too complicated and was less understandable than the other presentations."

2. Two respondents mentioned that there weren't any parts of the seminar that were not valuable.

Hungary:

1. "Emission Trading. Its impact on solution our problem from reduction of so^2 emission."

2. "Nothing."

Slovakia:

1. "There was nothing."

2. "For me, knowledge that ash from coal firing is not considered as hazardous waste."

9. Was the meeting schedule:

Too HEAVY ___1___ Too LIGHT _____ JUST RIGHT ___14____

10. How will you disseminate the information you received to your colleagues?

Czech Republic:

1. Three mentioned that they would give all of the materials to their bosses and colleagues.

2. "I do not know yet. Probably answering their questions."

Poland:

All mentioned that they would disseminate the information through meetings and discussions.

Hungary:

1. "Directly in conversation with my colleagues."

2. "Meeting for environmental experts; bilateral connection."

3. "Orally or by report."

Slovakia:

1. "Information will be disseminated through special meeting."

2. "This is the most difficult task. Some of them don't want even to listen."

11. What specific things could be done to improve the effectiveness of this working group meeting?

Czech Republic:

1. 2 mentioned that it would be beneficial to have representatives from the state institution participate.

2. "I think you can ask each delegation for real contact among CENTREL countries."

4. "I think the workshop was very good prepared and took up very effectively."

5. "Preparations should be widened. Questions in advance to select topics that would be of general interest. Connections should be kept."

Poland:

1. "During the next meetings more detailed issues interesting for all should be taken into account. Especially CO^2 emission issues."

2. 3 mentioned that more discussions were necessary.

Hungary:

1. "Workshop in several mixed groups."

2. "Visit to power plant (sometimes)."

3. "More interactive conversations."

Slovakia:

1. "Have more opportunities to meet each other to have better information about their personal work."

12. Did you have enough opportunity to participate in discussions/presentations?

YES____13_____ NO _____

13. Did the use of English produce problems? YES____6____ NO ____8____

14. Overall, what would you list as the three top priorities for your company to meet Western European environmental standards?

Czech Republic:

1. 2 mentioned: a. The cooperation states of West and middle Europe
   b. Common solution to environmental problems
   c. The protection of nature and health

2. a. Implementation of FGD program
   b. Reduction of NOx
   c. Reduction of CO^2

3. a. To finish implementation of construction FGD; DeNOx according plan
   b. To finish program of construction of new FBC centers
   c. Reduce particulates

4. a. Money
   b. Knowledge
   c. Proper regulation

Poland:

1. a. SO^2
   b. CO^2
   c. NOx.

2. a. New law regulations
   b. Reduction of SO^2 emission
   c. Fuel diversification

3. a. Reduction of SO^2 emission
   b. New law regulation

4. a. New law regulations
   b. Reduction of SO^2 emission
   c. Reduction of NOx emission

Hungary:

1. a. Energy environmental strategy, Master plan
   b. Environmental activities on market base

2. a. Energy and Environmental conception
   b. Elaboration of environmental master plan
   c. Implementation of priorities based on cost effectiveness

3. a. To know more about the EU regulations
   b. To access actual emission data
   c. To establish personal selections with companies operating on the same head

Slovakia:

1. a. Time schedule for implementation of environmental technology
   b. Financial sources
   c. To be connected on information system in area of environmental technology and legislation

2. a. To regulate the life-time of the sources before deciding about new technology
   b. To meet the standards by its implementation
   c. Measures should be efficient, but with regarding to their costs

15. Do you think that this meeting will prove to be an asset as your company works at the regional level to achieve these standards?

YES __14__ NO ___1___

Please explain your response.

Czech Republic:

1. "This meeting informed me that our way is right and we will do it with high activity."

2. "The program to clean up our sources is coming into being."

3. "Sometimes it was useful and similar opportunities with larger possibilities are necessary but it cannot be stopped."

Poland:

1. "At present there is not too much an opportunity for discussion with other CENTREL countries."

2. 3 participants wrote "the similar goals".

Hungary:

1. "It is important to know the environmental strategy of the neighbor states, experience from U.S. and the possibility to get further information from the U.S."

2. "This Utility Partnership Program give me a new possibility and the experience with full knowledge of the facts can help our work step by step."

3. "Yes, I think the presentations I heard opened new possibilities for me making me to learn more about the EC's environmental legislations."

Slovakia:

1. "I will use information of the meeting for preparation of special report for our top management of SE a.s. and Ministry of Economy."

2. "It is not very usual, but sometime people working in the plants can influence by their comments new legislation. We'll try to do this via local authorities."

16. What kinds of follow - on activities would you suggest, and what would the stated purpose of these activities be?

Czech Republic:

1. "Introduction of successful firms which realize new technology for cleaning air and water."

2. "More such workshops direct one's attention to technology and exchange of experiences."

3. "Technical support and on-site meetings should be arranged with participation of all interested delegations."

Poland:

1. "Exchange of opinions, discussions on directions of environmental policy regarded power sector, possibility of creation of new working group on environmental protection within CENTREL should be considered."

2. "Exchange information (technical, economical, and laws) to achieve our goals and minimize cost."

Hungary:

1. "I would participate in conferences of the same profile to get me updated in Western environmental methodology."

Slovakia:

1. "Information about joint implementation of environmental technology and increasing of energy efficiency."

2. "Regular meetings of members participated in Budapest could help the common problem we have in power generation."

THANK YOU FOR TAKING THE TIME TO SHARE YOUR OPINIONS.
YOUR INPUT IS INVALUABLE.