No. 42

JAPAN INTERNATIONAL COOPERATION AGENCY(JICA)

FEDERAL MISTRY OF ECONOMY
CZECH AND SLOVAK FEDERAL REPUBLIC

FEASIBILITY STUDY ON FLUE GAS DESULPHURISATION FOR THE MELNIK POWER STATION

FINAL REPORT

DECEMBER 1992

ELECTRC POWER DEVELOPMENT CO., LTD.

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CZECH AND SLOVAK FEDERAL REPUBLIC

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PREFACE

In response to a request from the Government of Czech and Slovak Federal Republic, the Government of Japan decided to conduct a feasibility study on Flue Gas Desulphurisation for the Melnik Power Station, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA sent to Czechoslovakia a study team headed by Mr. Jyurou Arai, Electric Power Development Company, Ltd., three times between May and October, 1992.

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

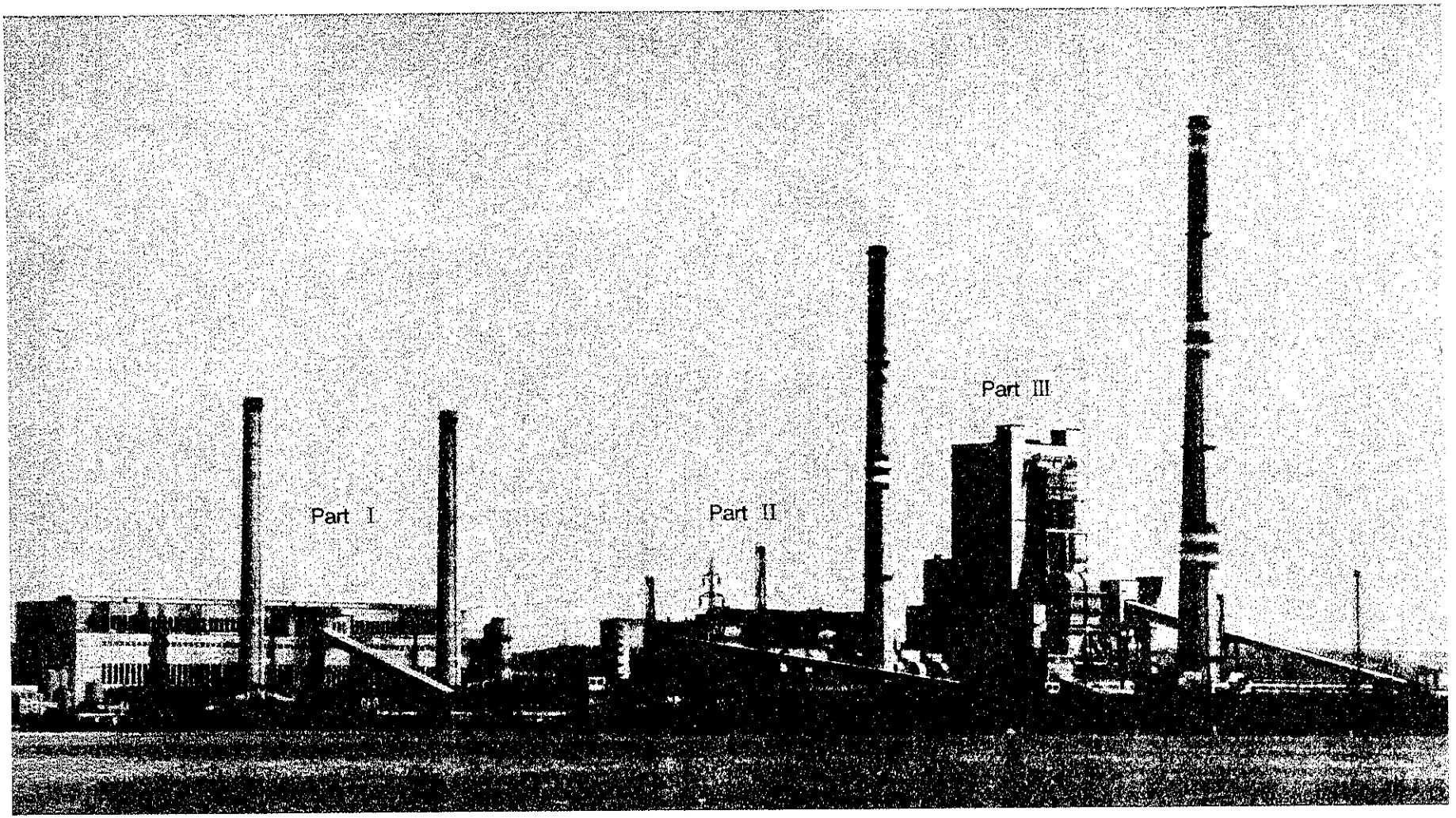
I hope that this report will contribute to the promotion of the project and to the enhancement of friendly relations between our two countries.

I wish to express my sincere appreciation to the officials concerned of the Government of Czech and Slovak Federal Republic for their close cooperation extended to the team.

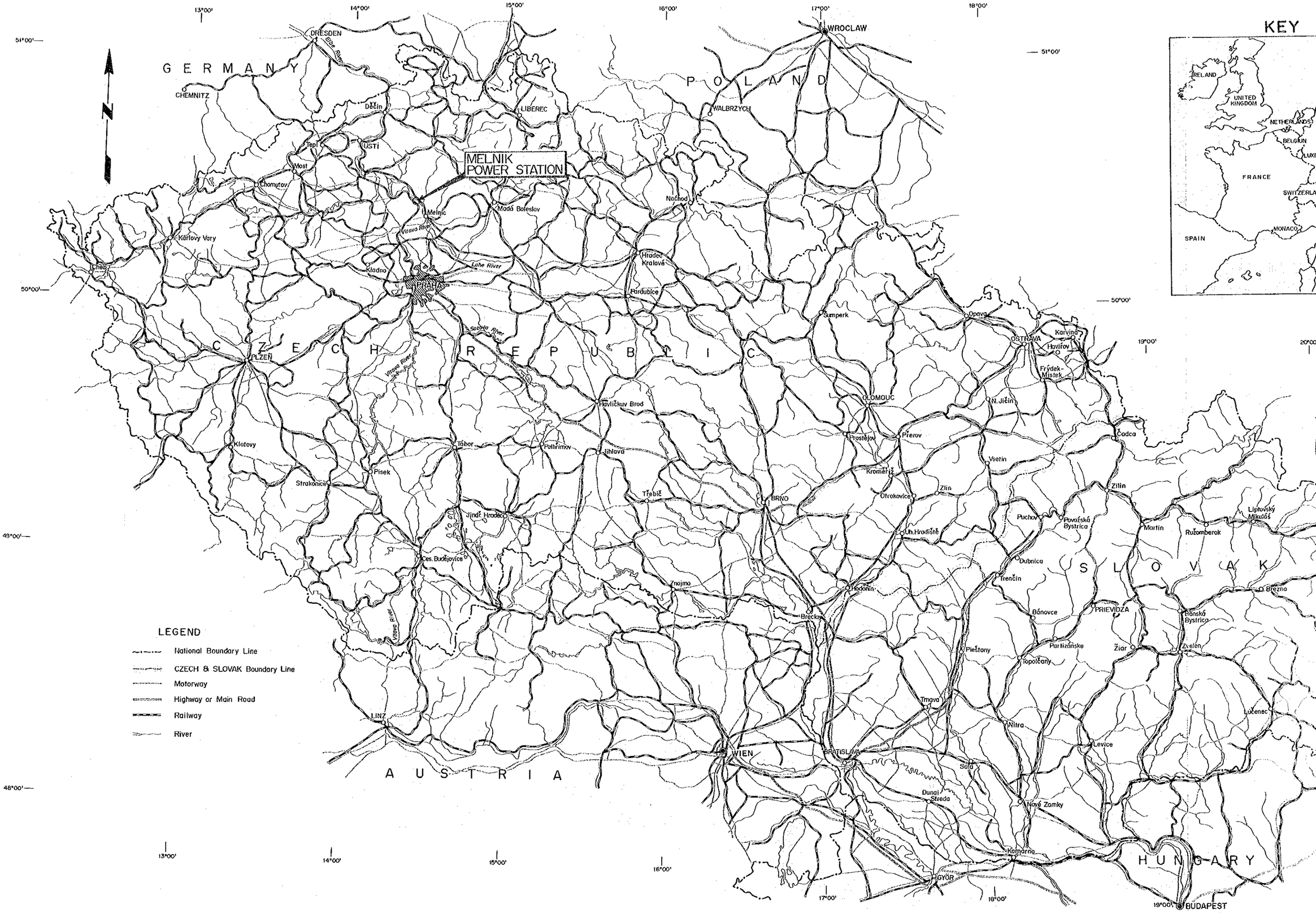
December 1992

Kensuke Yanagiya

Kensuke Yanagiya
President
Japan International Cooperation Agency



THE MELNIK POWER STATION


KEY
IRELAND
UNITED KINGDOM
NETHERLANDS
BELGIUM
FRANCE
SWITZERLA
MONACO
SPAIN
GERMANY
POLAND
CZECH REPUBLIC
AUSTRIA
SLOVAK
HUNGARY
MELNIK POWER STATION
DRESDEN
Elbe River
CHEMNITZ
LIBEREC
WROCLAW
WALBRZYCH
Most
Chomutov
Melnic
Mladá Boleslav
Nachod
Karlovy Vary
Vltava River
Kladno
PRAHA
Lahe River
Hradec Kralové
Pardubice
Sumperk
Opava
OSTRAVA
Karviná
Havírov
Frýdek-Místek
PLZEŇ
Sázava River
Havlíčkuv Brod
OLOMOUC
N. Jičín
Prostějov
Přerov
Čadca
Vsetín
Klatovy
Tábor
Pelhřimov
Jihlava
Písek
Strakonice
Třebíč
BRNO
Kroměříž
Otrokovice
Zlín
Žilina
Jindř. Hradec
Uh. Hradiště
Púchov
Považská Bystrica
Martin
Ružomberok
Liptovský Mikuláš
Ces. Budějovice
Dubnica
Trenčín
Znojmo
Trenčín
Brezno
Bánovce
PRIEVIDZA
Banská Bystrica
Pieštany
Partizánske
Žiar
Zvolen
Topoľčany
Trnava
Nitra
Lučenec
LINZ
WIEN
BRATISLAVA
Šaľa
Levice
Dunaj Streda
Nové Zamky
Komarno
GYÖR
BUDAPEST
LEGEND
National Boundary Line
CZECH & SLOVAK Boundary Line
Motorway
Highway or Main Road
Railway
River
13°00'
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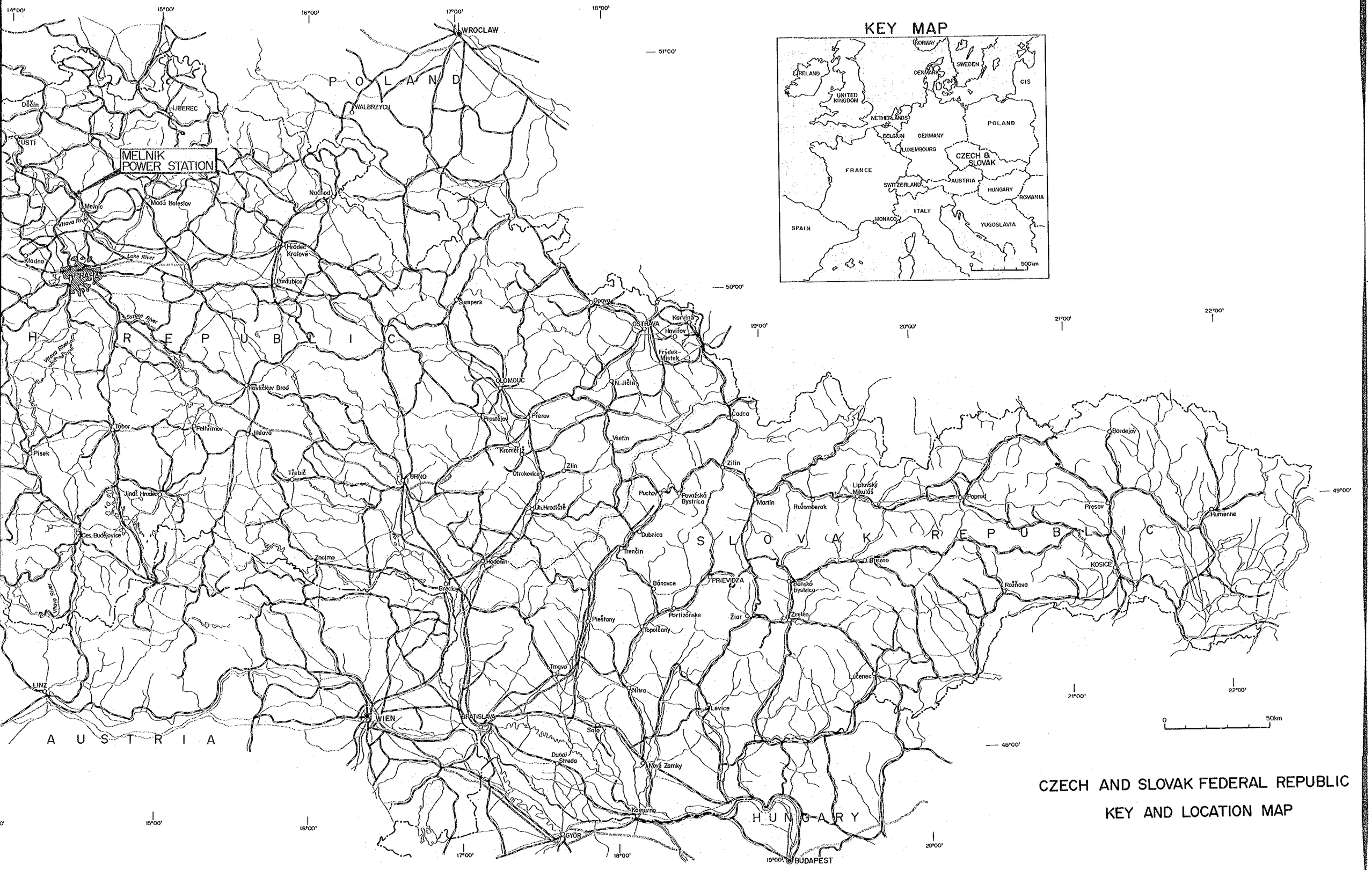
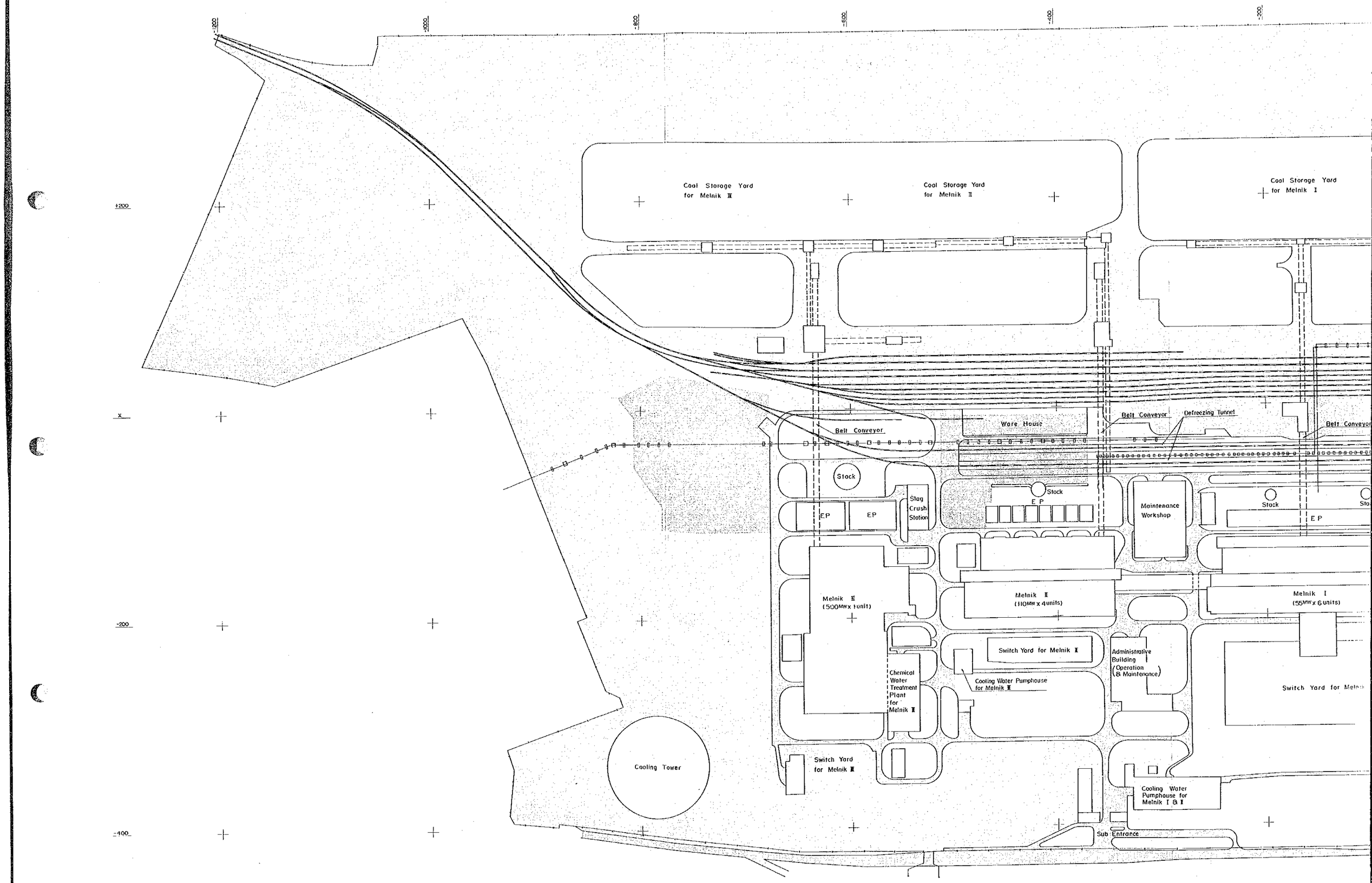
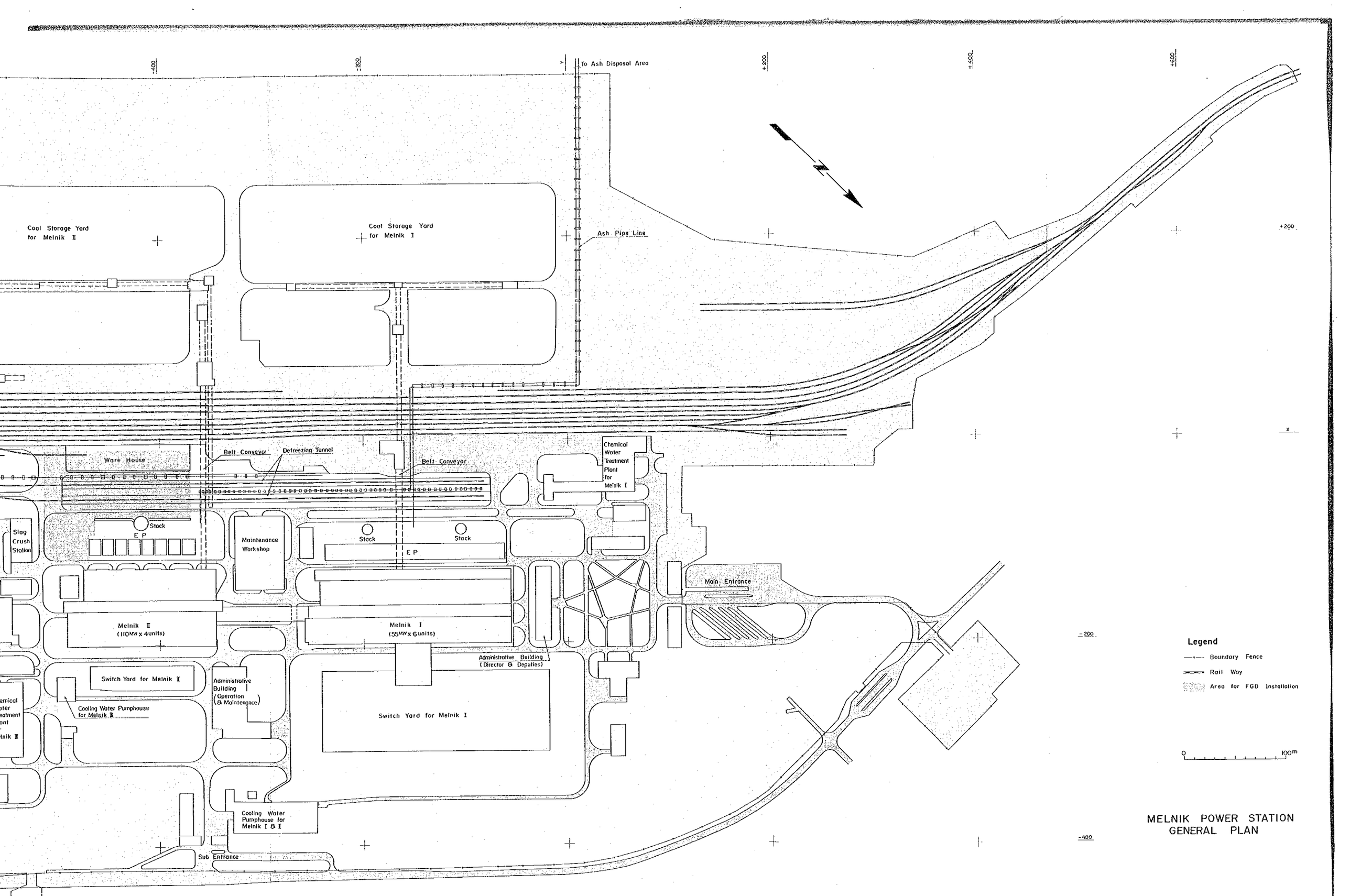


KEY MAP

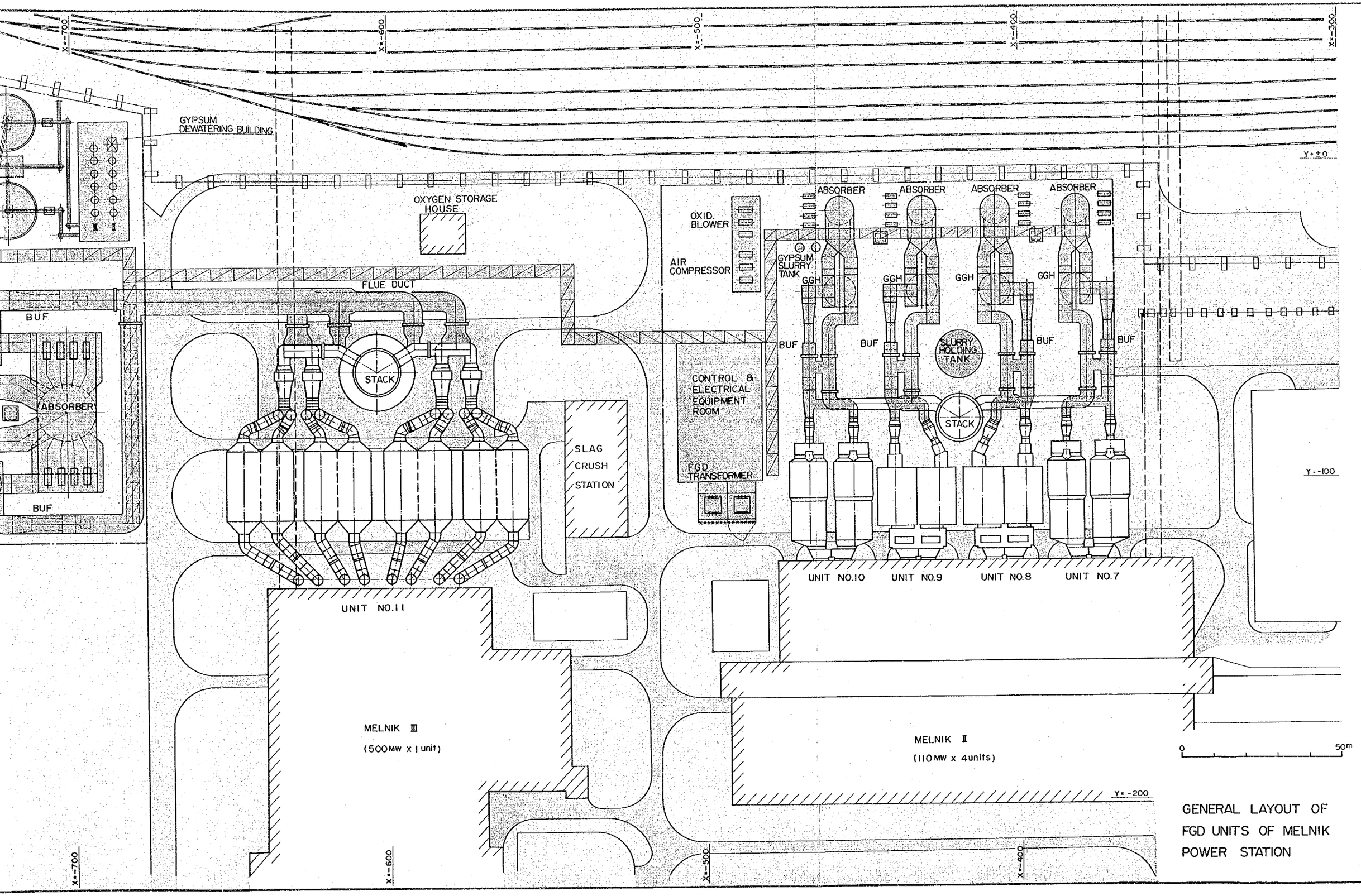
CZECH AND SLOVAK FEDERAL REPUBLIC
KEY AND LOCATION MAP


Coal Storage Yard for Melnik III
Coal Storage Yard for Melnik II
Coal Storage Yard for Melnik I
Belt Conveyor
Ware House
Belt Conveyor
Defreezing Tunnel
Belt Conveyor
Stock
Stock
Stock
Stag Crush Station
EP
EP
EP
EP
Maintenance Workshop
Melnik III (500MW x 1unit)
Melnik II (110MW x 4units)
Melnik I (55MW x 6 units)
Switch Yard for Melnik II
Administrative Building (Operation & Maintenance)
Chemical Water Treatment Plant for Melnik III
Cooling Water Pumphouse for Melnik II
Switch Yard for Melnik III
Cooling Tower
Cooling Water Pumphouse for Melnik I & II
Sub Entrance
+200
-200
-400
-600
-800
-1000
-1200



MELNIK POWER STATION
GENERAL PLAN

X=-800
X=-700
X=-600
X=-500
CONVEYOR
DUMP PIT
LIMESTONE STORAGE YARD
LIMESTONE SILO
CRUSHER
CRUSHED LIMESTONE SILO
MILL
LIMESTONE SLURRY TANK
GYPSUM STORAGE SILO
GYPSUM STORAGE SILO
GYPSUM DEWATERING BUILDING
LIMESTONE MILLING BUILD.
Y=±0
Y=-100
Y=-200
SLURRY HOLDING TANK
WASTE WATER TREATMENT
BUF
GGH
ABSORBER
BUF
GGH
BUF
FLUE DUCT
STACK
OXYGEN STORAGE HOUSE
SLAG CRUSH STATION
OXID. BLOWER
AIR COMPRESSOR
GYPSUM SLURRY TANK
CONTROL & ELECTRICAL EQUIPMENT ROOM
FGD TRANSFORMER
ABSORBER
ABSORBER
GGH
GGH
BUF
BUF
UNIT NO.11
UNIT NO.10
UNIT NO.9
MELNIK III
(500MW x 1 unit)
MELNI
(110 MV
X=-800
X=-700
X=-600
X=-500



GENERAL LAYOUT OF FGD UNITS OF MELNIK POWER STATION

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Chapter 1 Summary and Recommendation

CHAPTER 1 SUMMARY AND RECOMMENDATION

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Chapter 1 Summary and Recommendation

Study items of the Investigation of the Feasibility Study on Flue Gas Desulphurisation of Melnik Power Station in Czech and Slovak Federal Republic were as follows:

1st Stage

a. Collection and analysis of data related to the Feasibility Study

b. Determination of the level of SOx emission from the power plants, and environmental assessment based on the level of SOx emission of the power plants

c. Technical evaluations and economic comparison for selection of the optimum flue gas desulphurisation (FGD) method and equipment for the power plants

2nd Stage

a. Supplementary survey of the 1st stage field survey

b. Conceptual design of DeSOx system

c. Preparation of overall implementation plan

3rd Stage

a. Calculation of new tariff necessitated by introduction of DeSOx system

b. Assessment of benefits from introduction of DeSOx system

c. Assessment of socio-economic effects by introduction of DeSOx system

The Czech and Slovak Federal Republic ratified the Helsinki Agreement in 1985, the country is obliged to reduce the sulfur oxides emission (SOx) to about 70% of the 1980 level by 1993. The New Clean Air Act was enacted in October 1991 because of this background and regulatory limits of the sulfur SOx were defined for respective smoke sources. When such regulatory limits are applied to Part II (110 MW x 4 units) and Part III (500 MW x 1 unit) of Melnik Power Station, which are studied in this Study, the regulation are as follows:

By the 1st of October 1996

Part II : Installation of FGD with deSOx efficiency of over 70% for each of 110 MW power units

Part III : Installation of FGD with deSOx efficiency of over 85% for 500 MW unit

when emission standards are applied to Melnik Power Station, annual SOx emission reduces from about 77,300 ton to 17,500 ton.

Studies were made for the purpose of meeting such requirements and conclusions reached by the study were to install FGD of wet type limestone-gypsum process to both Part II and Part III.

Optimum combinations of power plants and FGDs are as follows:

Part II : To install one FGD unit, of 80% in flue gas treatment rate and 87.5% in deSOx efficiency and 70% in total deSOx efficiency, to each of the 110 MW power units

Part III : To install one wet type limestone-gypsum FGD unit, of entire flue gas treatment and 85% in total deSOx efficiency, to the 500 MW

Based on the above study conclusion of the optimum DeSOx system and combination of DeSOx system installed with power plants, a conceptual design of DeSOx system was carried out at the 2nd stage with further data and information collection by doing 2nd stage field survey.

Furthermore, a study on the project implementation plan was made as the 2nd stage study.

The study suggests that it is necessary to make an order of the FGD equipment by around the end of April in 1994 and to start the erection by around the end of May in 1995 in order to put into DeSOx system commercial operation from the 1st of October, 1996.

Estimations of the construction cost as of the 1st of July, 1992 were

Part II : 114,978,000 US$

Part III : 115,574,000 US$

If the figures are converted into unit cost per kW, they are

Part II : 261.3 US$/kW

Part III : 231.1 US$/kW

Diffusions of SOx emissions of the Power Station after installation of FGD Units were calculated as a part of the environmental assessment, and it reached a conclusion that the SOx level at the point of maximum SOx concentration would be well below the environmental standard to be applied to the environment of the neighborhood of the Melnik Power Station.

Tariff is calculated based on the annual cost including interest during construction. As a result of this calculation, 0.26 to 0.36 kčs/kWh at maximum additional burden in tariff is estimated.

For the economic evaluation, reconstruction of natural gas firing boilers was chosen.

According to this economic evaluation, this project is much superior to the reconstruction of natural gas firing boilers in terms of cost.

Following are analysis on introduction of DeSOx system in Czechoslovak power stations.

- Economic extension and increase in employment attributable to increase in investment.
- Absorbable effect on electricity tariff
- Increase in export

Czech and Slovak Federal Republic is already industrialized. In this project, local procurement shall be extended as much as possible so that technology can be absorbed aggressively. As a consequence, Czechoslovakia will be able to export DeSOx systems to neighbor countries by taking advantage of both its comparatively cheap labor cost and such technology.

What described in respective chapters are outlined below.

1.1 Socio-economic Background

The storms of democratization which occurred in Eastern Europe in the fall of 1989 also blew Czechoslovakia, and the communist rule of the country was demolished by the so-called "Velvet Revolution." The country is on the road to democratization since then.

In foreign relations, the country is starting to make more friends with western countries by changing its former posture with which it had tighter relations with former Soviet Union and other socialist countries. In September 1990, Czechoslovakia joined the IMF and the World Bank, and the country joined the EC as a quasi member in December 1991.

Economic reforms of the country is proceeding based on the "Scenarios of the Economic Reform" drafted in September 1990. Economy of the country, however, has been under negative growth in recent years mostly due to weaker relations with the former Soviet Union since 1989, confusion associated with economic reforms and deterioration in external economic environment.

Major policies being enforced for economic reforms include the following:

(1) Liberalization of pricing

(2) Liberalization of foreign trade

(3) Return of farmland to former owners

(4) Recovery of exchangeability to foreign currencies

(5) Privatization of nationally-owned enterprises

As for the availability of primary energies in Czechoslovakia, natural gas is present little, petroleum is almost nil and hydraulic energy for power generation is not abundant. Czechoslovakia is very cautious in handling uranium in consideration of effects to the environment. The electric power industry, which depends on the power source to electricity for brown and bituminous coals, now over 90%, is managed by two national corporations of the CEZ (Ceske Energeticke Zavody) and the SEP (Slovenske Energeticke Podniky).

The CEZ changed to public limited company in May of 1992. 30% of all shares of CEZ is going to be sold to the public by the coupon system. (70% are going to be held by the republic.)

The total electric power generated in the country in 1991 was 83.4 TWh, and 51.6 TWh of the amount was generated by the CEZ. As for the energy mix of power generation, brown coal accounts for 75%, nuclear energy 23% and hydraulic power 2%. Low quality brown coal is being used much in the country not only for power generation but also for domestic heating. The total emission of SOx in the country is 2.56 million tons per year (current value) which is about 2.5 times as much as that in Japan. The emission rate is especially high in northern Bohemia and Prague region exceeding 100 t/year km^2. Forests have been severely damaged and adverse effects of such emission to humans are apprehended.

With such backgrounds, Czechoslovakia ratified the Helsinki Agreement in 1985, the country is now tackling in full force with air pollution to improve the environment with the help of the New Clean Air Act enforced in 1991.

The total generating capacity of 1,270 MW of the Melnik Power Station is about 6% of the total generating capacity of the country. The Melnik Power Station is the third largest power station in the country, and an important supplier to the capital of Prague.

It is judged, in comparison with other coal fired power plants of CEZ, that the production cost at the Melnik Power station is low (Part I: 535.22 kčs/MWh, II: 477.39 kčs/MWh, III: 435.59 kčs/MWh).

1.2 Conditions of the FGD Project Site

The Melnik Power Station is located on the left bank of the Labe (Elbe) River at about 35 km north of Prague. Roads and the railway from Prague to the Power Station are in good condition, and can be used effectively for transportation of FGD materials.

The climate of Czechoslovakia is just about middle of the oceanic climate of western Europe and the continental climate of Eastern Europe. In comparison with the climate in countries of similar latitudes in Western Europe, it is hotter in summer and colder in winter in Czechoslovakia. The annual precipitation is small at about 530 mm.

The topography around the Melnik Power Station is showing a moderate slope from a small hill (about 260 m in elevation on the southwest of the Power Station, where the ash disposal area is present) toward the Labe River. The elevation at the Power Station is 160 m.

As for the geology around the Melnik Power Station, the land surface is covered with sediments of the Labe River. About 2 m of soil at the top is loess, and layers of sand and gravel are existing down to 11 m deep (EL. 149 m) from the ground level (GL). Rock layers of sandy mudstone and muddy limestone are existing below EL. 149 m.

1.3 Selection of the Optimum DeSOx System

The following possible DeSOx methods were itemized in order to select optimum FGD units for the Melnik Power Station, and technical comparison were made on such methods:

[Wet type]

a. Limestone-gypsum process -- Spray tower method

b. Limestone-gypsum process -- Jet bubbling method

[Semi-dry type]

c. Spray dryer method

d. Limestone injection into furnace method

e. Slaked lime injection into duct method

[Dry type]

f. Activated coke method (regenerative type)

g. Electron beam method

These DeSOx methods were compared in reference to conditions specific to the Melnik Power Station, optimum DeSOx methods and optimum combinations of power units and FGD units for the Melnik Power Station were selected.

Results are as follows:

(1) Part II: For the four power units of 110 MW

FGD units of over 70% in deSOx efficiency are required to each of the 110 MW power units. It is determined that the optimum FGD units are the wet type limestone-gypsum process with 80% flue gas treatment rate and 87.5% in deSOx efficiency.

(2) Part III: For the one power unit of 500 MW

An FGD unit of over 85% in deSOx efficiency is required, and it is determined that the optimum FGD unit is a wet type limestone-gypsum process with 100% of flue gas treatment rate.

The wet type limestone-gypsum process is either the spray tower method or the jet bubbling method. The two methods show little difference, at the stage of this feasibility study, in technical and economic comparisons, and it is

judged that either method can be applied to FGD units of the Melnik Power Station.

The difference in basic DeSOx principles is little between the spray tower method and the jet bubbling method. The only difference is in the way how to bring the absorbent liquid and flue gas to contact for absorption of SOx. In the jet bubbling method, the flue gas is blown into the absorbent liquid present in the absorption tower by using DeSOx fans.

Although it was concluded that either method is applicable to Melnik Power Station, the Study was made for the case of use of the spray tower method, which has been employed for many number of generating units and have been providing much operational experiences for the purpose of the 2nd stage study where conceptual design of FGD units must be carried out.

1.4 Evaluation of Impacts on Environment

Obtain maximum ground level concentrations of SO_2 before and after installation of the FGD units were calculated using diffusion formulas.

There is a plant to retrofit boilers of Part I to FBC boilers in future, and environmental predictions for Melnik Power Station are made for the Power Station after such changes.

When current values (before installation) and values after installation are compared:

- Short-term Predictions

  The level of maximum ground concentration reduces from 0.28 $mg/m^3.SO_2$ to 0.093 $mg/m^3.SO_2$ for 30 minute value, from 0.247 $mg/m^3.SO_2$ to 0.082 $mg/m^3.SO_2$ for 1 hour value and from 0.148 $mg/m^3.SO_2$ to 0.049 $mg/m^3.SO_2$ for 24 hour value.

- Long-term Predictions

  Annual mean ground concentration for 1 hour value reduces from 0.166 mg/m^3.SO_2 to 0.048 mg/m^3.SO_2.

1.5 Conceptual Design of DeSOx System

A conceptual design of the DeSOx system was carried out based on the study results of the selection of the optimum DeSOx system for Melnik Power Station at the first stage of the study.

Following items were studied adding the data and information obtained by supplemental field survey at the 2nd stage.

(1) Basic Plan for DeSOx System
(2) Plan for Layout of DeSOx System
(3) System Diagram of DeSOx System
(4) DeSOx System Material Balance
(5) Conceptual Design of FGD Equipment

1.6 Project Implementation Programme

The project implementation programme and construction schedule were studied based on the conceptual design of the optimum DeSOx system.

The study result shows following implementation programme in order to start the commercial operation of FGDs of Part III and Units Nos. 9 and 10 of Part II on October 1, 1996.

As for Units Nos. 7 and 8 of Part II, the start of operation of FGDs is planned to be just two years after the start of other FGDs. Because the power plants are shutdown for their retrofit for cogeneration till October, 1998.

		Part III and Units Nos. 9 and 10 of Part II	Units Nos. 7 and 8 of Part II
(1)	Completion of the Feasibility Study	End of Dec. 1992	Same as left
(2)	Preparation of Financial Source	End of Jan. 1993	Same as left
(3)	Selection of Consultant	End of Mar. 1993	Same as left
(4)	Detailed Design and Preparation of Tender Documents	End of Nov. 1993	Same as left
(5)	Completion of Tender Evaluation	End of Apr. 1994	Same as left
(6)	Contract Award	End of Apr. 1994	Same as left
(7)	Commencement of Civil Work	Beginning of Sep. 1994	Beginning of Sep. 1996
(8)	Erection Start	Beginning of May 1995	Beginning of May 1997
(9)	Trial Operation Start	Beginning of Aug. 1996	Beginning of Aug. 1998
(10)	Taking Over	End of Sep. 1996	End of Sep. 1998
(11)	Commercial Operation Start	1st of Oct. 1996	1st of Oct. 1998

1.7 Construction Cost and O&M Cost

An estimated amount of construction cost of 500 MW class FGD unit with deSOx efficiency of 85% for Part III and 4 x 110 MW class FGD units with deSOx efficiency of 70% (with the capacity of 80% flue gas treatment and deSOx efficiency of 87.5%) for Part II are shown below respectively.

Part II : 114,978,000 US$ (equivalent to 261.3 US$/kW)
Part III : 115,574,000 US$ (equivalent to 231.1 US$/kW)

Costs are estimated as of July 1st 1992.

(1) Estimated Construction Cost

[Part II]

	x 10^3 kčs	x 10^3 US$
(1) DeSOx System and Associated Equipment	1,865,455	67,151
(2) Transportation	55,921	2,013
(3) Construction	187,209	6,739
(4) Civil Work	318,164	11,453
(5) Modification of Existing Facilities	140,317	5,051
(6) Spare Parts	37,364	1,345
(7) Start-up and Commissioning	38,003	1,368
(8) Import Tax	134,955	4,858
[Direct Construction Cost] (1)~(8)	[2,777,388]	[99,978]
(9) Engineering Fee [5% of Direct Const. Cost]	138,900	5,000
(10) Contingency [5% of Direct Const. Cost]	138,900	5,000
(11) Administration fee [5% of Direct Const. Cost]	138,900	5,000
[Total Construction Cost] (1)~(11)	[3,194,088]	[114,978]
[Construction Cost per kW]	[7,259 kčs/kW]	[261.3 US$/kW]

[Part III]

	x 10^3 kčs	x 10^3 US$
(1) DeSOx System and Associated Equipment	1,949,239	70,167
(2) Transportation	58,505	2,106
(3) Construction	195,627	7,042
(4) Civil Work	360,890	12,991
(5) Modification of Existing Facilities	15,112	544
(6) Spare Parts	39,086	1,407
(7) Start-up and Commissioning	39,725	1,430
(8) Import Tax	133,677	4,812
[Direct Construction Cost] (1)~(8)	[2,791,861]	[100,499]
(9) Engineering Fee [5% of Direct Const. Cost]	139,595	5,025
(10) Contingency [5% of Direct Const. Cost]	139,595	5,025
(11) Administration fee [5% of Direct Const. Cost]	139,595	5,025
[Total Construction Cost] (1)~(11)	[3,210,646]	[115,574]
[Construction Cost per kW]	[6,421 kčs/kW]	[231.1 US$/kW]

(2) Annual O&M Cost

[Part II]

	x 10^3 kčs	US$
a. Utilities Cost	24,711,000	889,525
b. Labor Cost	2,275,000	81,893
c. Maintenance Cost	95,823,000	3,449,352
d. By-products Treatment Cost	9,175,000	330,274
[Total]	[131,984,000]	[4,751,044]

[Part III]

	x 10^3 kčs	US$
a. Utilities Cost	22,186,000	798,632
b. Labor Cost	1,553,000	55,904
c. Maintenance Cost	96,319,000	3,467,207
[Total]	[120,058,000]	[4,321,743]

1.8 Operation and Maintenance

The start up shut down procedures, the points of supervising and the way of daily and annual inspection are explained concretely.

The operational experience in Japan and the features of the FGD plants to be applied to Melnik Power Station are taken into consideration to the explanation.

1.9 Analysis and Evaluation on Socio-economic Impact

(1) Annual cost in each year was calculated from the total construction cost including interest during construction based on the construction cost in Chapter 8.

Total construction cost is shown in Table 10.1-1 and 10.1-2.

Tariff is calculated based on the annual cost. As a result of this calculation, 0.28 to 0.36 kčs/kWh (at maximum for Part II) and 0.26 to 0.32 kčs/kWh (at maximum for Part III) additional burden in tariff are estimated. Increase in tariff enabling to recover this burden is strongly recommended. Tariff trend in each year are shown in Table 10.1-3 to 10.1-6. (With 1992 July cost .. Inflation is disregarded)

(2) For the economic evaluation, reconstruction of natural gas firing boilers is chosen, since it is the least expensive and can meet the regulation of "the New Clean Air Act".

The flow of benefit and cost of the evaluation is shown in Table 10.2-1. EIRR (Economic Internal Rate of Return), Excess benefit (B-C) and Benefit-Cost ratio (B/C) are as follows.

EIRR	39.54%
B-C	23,322.426 x 10^6 k℃s
B/C	4,929

Judging from the study results mentioned above, this project is much superior to the reconstruction of the natural gas firing boilers in terms of cost.

This superiority is maintained until social discount rate which reflects opportunity cost of capital reaches 39.54%.

(3) Evaluation on Socio-economic Impact

a. During reconstruction of Japanese economy after World War II, investment for environmental protection accounted for 3% of total investment of private companies. At that time the position of environmental protection was not clearly specified in the legislation for environmental protection and no governmental agency in charge of environmental issue did not exist.

In the prime of economic high rate growth, around 1970, environmental issue became the nationwide problem. Many environmental acts were enacted and the Environmental Agency was established in 1971. Environmental administration was strengthened in this way.

As in the field of electric utility legistrations were systematized, technology on flue gas treatment was introduced. DeSOx system for coal fired thermal power stations was started at the Takasago Thermal Power Station as a pioneer and at the almost all coal fired thermal power stations and high sulphur oil fired thermal power stations, total 68 units 23,450 kW so far, DeSOx systems were installed.

b. Macro economic method for socio-economical evaluation on introduction of environmental protection has not been fully developed. However,

- At the Tokyo Conference of Roma Club in 1982, Prof. Dr. Yoichi Kaya, University of Tokyo, presented a estimation, based on rough assumptions, that damage amounted to 6,000 Milliard Yen (45 Milliard US dollars) in comparison with that the cost for SOx removal amounted 480 Milliard Yen (4 Milliard US dollars) and

- Environmental White Paper for FY 1977 stipulated that there was hardly no adversal effect on macro economies although countermeasures for environmental protection were carried out from 1965 to 1975.

  Those had affirmative effect that real rate of economic growth was raised by 0.9%.

- Other nations have had similar experiences. As the OECD says, "The effect of anti-pollution investments on GNP ranges from 'neutral' to 'negligible'" (See "The State of the Environment", OECD; 1991).

c. Following are analysis on introduction of DeSOx system in Czechoslovak power plants based on above analyses.

- Economic extension and increase in employment attributable to increase in investment.

- Absorbable effect on electricity tariff

- Increase in export

Czechoslovakia is already industrialized. In this project, local procurement shall be extended as much as possible so that technology can be absorbed aggressively. As a consequence, Czechoslovakia will be able to export DeSOx equipments to

neighbor countries by taking advantage of its comparatively cheap labor cost and such technology.

1.10 Recommendation for the Implementation of the Project

(1) Arrangement of Scheme for Local Portion Investment : Improvement of Domestic Financial Market etc.

It has been studied that the Project be implemented as much as possible inside Czechoslovakia for the least cost and giving good influence on Czechoslovak economy as well as taking into account current level of Czechoslovak technology. Consequently, although our Study has satisfied this requirement, there remains some problems in connection with the financing on the local portion of the Project.

As the present scheme loans on the basis of the Official Development Assistance in every countries as well as loans from organization for international aid such as the World Bank have limitation for credit line for local portion of projects. Therefore, a certain part of investment for local portion shall be funded from domestic financial market. However, since Czechoslovak private financial market is still unmatured, it is difficult to fund from the market at this stage. Therefore, the following schemes for financing on the local portion will be thought necessary to make the Project implement as scheduled.

a. Study the possibility of lowering the financing cost by using part of its own capital for environmental meausres and for building nuclear power plants.

b. Application of a governmental financing entity

If expansion of the activity of private banking system, which is operated on the basis of saving of the national, will not be expected soon, application of a governmental financing entity (if no such an organization, urgent establishment is necessary) shall be studied. Since environmental project is expected to generate

effective demand of Czechoslovak national economy, application of the governmental financing entity will be thought very useful.

(2) Arrangement of the Electricity Tariff System

Unless credit incurred from this Project is duly borne by consumers in electricity tariff, it will increase national financial deficit and make inflation worse. Rise of electricity tariff by the implementation of the Project will be estimated at about only 0.03 kčs/MWh at maximum on the basis of total electricity sales of CEZ. This will not be cause of national financial deficit or inflation, if the cost increase caused from the FGD Units installation of Melnik Power Station can be distributed in total electricity consumption all over the country.

Therefore, it shall be materialized that environmental cost including the investment cost be duly included in a new electricity tariff system, revision of which is under way from the basis of the subsidized by the government to the basis of actual cost.

(3) Treatment of Gypsum Generated as Byproduct

About 100,000 tons/year of gypsum generation equivalent to those from Part III FGD is planned to be recovered and used as the raw material for the Gypsum Board Factory to be installed adjacent to the power station.

On the other hand, about 78,000 tons/year of gypsum generation equivalent to those from Part II FGD is planned to be disposed as of fly ash.

The disposal cost, however, affects economy of the total operation cost greatly. Therefore, it is recommended to make continuous effort to develop the extent of gypsum marketability for future.

Chapter 2 Socio-Economic Background

CHAPTER 2 SOCIO-ECONOMIC BACKGROUND

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Chapter 2 Socio-Economic Background

2.1 Current State of Czechoslovakia

2.1.1 Natural Background

The Czech and Slovak Federal Republic is an inland country of central Europe located between 12° to 13° East and 48° to 51° North, and bordered with Poland and Germany on the north, Germany on the west, Austria and Hungary on the south and Ukraine (formerly with Soviet Union). The land stretches east and west, and western, middle and eastern regions of the country are called Bohemia, Moravia and Slovakia, respectively. Bohemia and Moravia make up the Republic of Czech, and the country is a federated country of the Republic of Czech and the Republic of Slovak. Prague, which is the capital of Czechoslovakia, is also the capital of the Republic of Czech.

The total land area of Czechoslovakia is 127,899 km2 (approximately one-third of Japan), 78,864 km2 for the Republic of Czech and 49,035 km2 for the Republic of Slovakia. The land is generally hilly with many hills and mountains and flat land is scarce. The northern part of Slovakia is especially mountainous with ranges of mountains as high as 2,000 m.

The country has no seas, but some rivers are leading to seas. The Vltava River, in the west, flows, via the Labe River, into the North Sea, the Oder river in the north flows into the Baltic Sea, and the Donau River in the south flows into the Black Sea.The climate is moderate and continental. The cool and cold season is long, and the temperature does not rise much even in summer. The mean annual temperature and precipitation in Prague are approximately 8°C and 530 mm, respectively.

The population of Czechoslovakia, which was 12.34 million in 1950 reflecting the effect of the World War II, recovered to 15.67 million as of December 1990 (see Table 2.1-1).

The rate of population increase in recent years is low and on the order of 0.2%. The annual population increase in 1990 was about 25,000, but the

increase was mostly in Slovakia, and the population has been increasing little in Czech (see Fig. 2.1-1).

Ethnically, Czechoslovakians are mostly Czechs and Slovaks belonging to Western Slavs. Czechs account for about 63% of the total population and Slovaks about 32%. In addition, some minorities are part of the population reflecting racial migrations and changes of borders which occurred in the past in Central Europe. Hungarians, especially, once controlled Slovakia, and as many as 600,000 ethnic Hungarians are living in the country, accounting for about 4% of the total population and about 11% of the population of the Republic of Slovakia. Other minorities include ethnic Germans, Ukrainians, Russians and Poles (see Table 2.1-2).

As for religion, a majority of people are catholic. As for language, Czech and Slovak are official languages.

The population of Prague, the capital of the country, is 1,214.7 thousand (as of January 1990), and the number of cities with population over 100 thousand are 10 including Brno (391 thousand) and Bratislava (440.4 thousand, capital of the Republic of Slovak) (see Table 2.1-3).

2.1.2 Political Status

After the World War II, the Communist Party completely took over every authority in 1948. The name of the country was then changed to the Czechoslovak Socialist Republic and the country took on the road to a socialist state. In 1968, a series of democratic reforms, which was called "Spring of Prague," were started in 1968 by Dopcek who became the First Secretary of the Communist Party in that year, but stopped by military intervention of the Soviet Union and other eastern states.

The storm of democratization which occurred in the fall of 1989 in eastern countries also stormed the country. More and more people of the country demanded democratization led mainly by Civic Forum, a non-official group, and large-scale demonstrations and general strikes occurred in many parts of the country one after another. Pressed by the voice of the people, the Communist

Party rapidly lost the leadership, and Yakesh, the Secretary General of the Communist Party, resigned in November 1989.

In December 1989, in addition, the leadership of the Communist Party was removed from the Constitution. A coalition cabinet having more non-communists than communists was formed, and the communist rule of the country ended completely (which is called the Velvet Revolution).

Vaclav Havel, who is a playwright and leader of the Civic Forum, was elected as the new president, and Charufa of the Communist Party (left the party in January 1990) was elected as the new prime minister. Dopcek, the leader of "Spring of Prague," was elected as the chairman of the Federal Parliament.

The Federal Parliament voted for changing the name of the country in April 20, 1990, and the new name of the country is the Czech and Slovak Federal Republic. The first free election after the communist rule was made in June 1990, and the Civic Forum, which led the democratic movement, won the election, and it was the leading party.

In addition, Havel was re-elected as the president of the country in July 1990. The Civic Forum, however, soon split into Finance Minister Klause's faction advocating radical economic reform and Foreign Minister Dienstbier's faction, which consists of moderate leftists (February 1991). In the Republic of Slovak, a faction lead by Prime Minister Meciar declared to leave the supporting electorate, and Meciar was released from office as a result. The Public against Violence, a group which led the reform hand in hand with the Civic Forum, virtually split due to difference in reform policies (in April 1991).

The issue of independent Slovak Republic is coming more from reaction to the long communist rule, and Slovakian nationalism is being motivated not only by the long Slovakian sentiments but also by the course of events where effects of economic reform such as inflation and unemployment are severer in Slovakia.

A general election for Federal Parliament was carried out on June 5 and 6, 1992, and members of House of the People (lower house; 150 members with 99 from Czech and 51 from Slovak) and House of the Nations (upper house; 150 members with 75 from each Republic) were elected. In Czech, the Civic

Democratic Party (ODS) led by Klause swept the election, and in Slovakia, Meciar's Movement for Democratic Slovakia (HZDS) swept the republic (see Table 2.1-4 for results of the election). The two republics are currently moving toward dissolution of the federation with talks between the two leaders as key elements. It is reported that both ODS and HZDS agreed to regulate "The Law on the Dissolution of Federation" and "The Law on the Dissolution of the State Property" is Federal Parliament, and to complete the dissolution of federation by the end of 1992.

As for international relations, Czechoslovakia is changing the past tight relations with former Soviet Union and other socialist countries and beginning to approach western countries. Czechoslovakia was included as a country to be supported at G-24 in July 1990, and joined IMF and World Bank in September 1990. Czechoslovakia, along with Hungary and Poland, was admitted to the EC as an associate member in December 1991, and the country is striving for the ultimate target of full membership by the end of this century.Foreign Minister Nakayama visited the country in May 1990, and disclosed a support plan. In addition, President Havel visited Japan in April 1992. During the visit, he signed trade agreements and requested Japan's cooperation in efforts for measures against air pollution and the like.

2.1.3 Current Status and Future Prospect of Economic Reform

(1) Trends in Economy

The economy of Czechoslovakia returned to the pre-war level in 1948 due to relatively small damages suffered during the World War II, and saw high growths during the 1950s as seen in the national productive income and the industrial gross production which grew 2.1 and 2.8 times, respectively, during the 10 years. In the 1960s, however, bad effects of centralized planned economy such as failures in all-round investment and relative delays in technical innovation surfaced, and the growth rate deteriorated due to economic disorders associated with the incident of the Spring of Prague notwithstanding economic reforms which were attempted.

The economy developed in good pace in the first half of the 1970s under planned economy. Structural defects in economy such as weakness in advanced technologies and too-late economic rationalization and investment were exposed by the two oil crises, and the growth in Gross National Product was as low as 1.7% during the five years in the early 1980s. In the 8th five-year plan (from 1986 to 1990), it was set to increase Gross National Product, industrial production and agricultural production by 3.4 to 3.5%, 3% and 1.2 to 1.4% in annual means, respectively, from those in the previous five-year plan. Actual results were below the planned targets as shown in Tables 2.1-5 and 2.1-6. It is judged that such bleak performance resulted from further deterioration in productivity due to obsolescence of equipment resulting from suppression of import in the past.

In 1989, especially, Gross National Product against the previous year decreased to 1.7%. In 1990, in addition, the growth rate turned to negative growth of -3.1% due to confusions associated with economic reforms and deteriorations in external economic environments such as low operation rate of factories due to large reduction of oil supply from the former Soviet Union (Oil supply was below 3 to 5 million tons against the supply contract for 16.6 million tons.) and reduced import and export with former East Germany.

(2) Economic Reform and Current State of Economy

The economic reform of Czechoslovakia is going on based on the Scenario of the Economic Reform which was determined at cabinet meeting in August 1990 and approved by the Federal parliament in September 1990. The Scenario says in its prologue that the object of the economic reform is to achieve transformation from centralized planned economy to market economy. In addition, the Scenario also says that the social cost which must be borne in the process of transformation to market economy will be smaller when the economic reform is carried out at higher speed and more completely. It can be judged that the economic reform of Czechoslovakia is aiming at radical reform similar to the so-called "Shock Therapy" of Poland.

The outline and current state of specific policies of the economic reform which fully started in 1991 are as follows:

1) Liberalization of Price

The centrally controlled price system was abolished on January 1, 1991, and about 85% of distributed products have liberalized prices. In addition, prices of basic food products were liberalized in November, and only the rent and energy-related prices are under government control.

The consumer prices rose associated with liberalization of prices, and the rate of price rise in 1991 increased by 57.9% in comparison with that in the previous year (see Table 2.1-7).

The price rise is well over the governmental target to suppress the rate of consumer price rise in that year within 40%.

Consumer prices rose by as high as 26% during only January immediately following the price liberalization which took place at the beginning of the year, but it calmed down during a few months which followed. The rise stopped completely in the third quarter due to the austerity financing and monetary policies of the government, and only a slight increase was seen at the end of the year (see Fig. 2.1-2).

2) Liberalization of Export and Import

Export and import have principally been liberalized since the beginning of 1991.

Imports have been liberalized completely excepting fuels, and exports are free excepting some items which require licenses.

In order to prevent rapid increase of import of consumer products, however, an import surcharge has been imposed since the beginning of 1990. The current import surcharge is 15% as of August 1991.

The settlement by transfer rubles, which used to be applied to trades with former COMECON countries, has been changed to that by hard currencies since January 1991.

When counted in US dollars, exports decreased by 9.2% from the previous year to 10.9 billion dollars, imports also decreased by 25.0% to 10.0 billion dollars, and in total, the trade decreased by 17.5% from the previous year. These figures are directly reflecting the sluggish economy, but the balance was a surplus of 0.9 billion dollars in export in contrast to a surplus of 1.2 billion dollars in import in the previous year because the decrease in import was relatively greater than that in export. Trading partners and their shares are as shown in Table 2.1-8. What remarkable in the table is the decrease of the former Soviet Union in the share of export (25.2% in 1990 and 19.4% in 1991).

3) Returning of Farmland

It was decided in May 1990 to return 150 hectares of farmland and 250 hectares of forest, which were confiscated by the former Communist Party during the period from 1948 to 1990, to former owners. It is taking time, however, in confirming former owners, and cases of actual returning are few.

4) Restoration of Exchangeability of Currencies

Associated with liberalization of external trade, it has become possible for corporates to purchase foreign currencies at banks any time for payment for ordinary trading. Associating with that, the commercial exchange rate and traveler's exchange rate were unified, and now the currency, kcs, has a single exchange rate. The basket system in which the currency is linked with major five currencies (marks, dollars, Austrian shillings, Swiss francs and pounds) is being employed. The current exchange rate is on the order of 29 kcs to the dollar.

5) Privatization of National Corporates

a. Privatization of small corporates

Privatization of small corporates is to sell small corporates (restaurants, hotels, shops, etc.) to the public by auctioning. Small corporates to be sold are about 36,000 corporates. About 23,000 such corporates were sold by the end of January 1992, and selling is still going on.

b. Privatization of large corporates

The act for privatization of large corporates was enacted in February 1991. The method of privatization employed by the act is a coupon system (where coupons are sold to the public of 18 and older at a low price so that such coupons are exchanged with stocks in the future when large corporates are privatized.

The system aims at transferring the ownership of national corporates thinly to a wide range of public. About 1,500 national corporates were privatized in the latter half of 1991 realizing public ownership of privatized companies through the coupon system. It is now expected that direct investment from foreign countries would greatly increase.

In addition to the economic reforms described above, financial reforms from the old system have been carried out. The commercial banking sectors of the Central Bank were separated in January 1990, and banking reforms were carried out for efficient capital distribution. The number of commercial banks are now as many as 28 as of September 1991.

As for the trend in interest rate, the official discount rate was reduced from 10% to 9.5% in September 1991. The lending rate of commercial banks is 15.5 to 16.5% at the base rate and 22% at maximum. The actual interest rate

varies with the performance and type of business of the debtor and lending amount and period, but it is judged that the interest rate of about 18% is usually applied.

Czechoslovakia used to be extremely cautious about borrowing foreign money on the ground that large foreign debt exceeding the paying capacity of the country would strain the public economy. The total foreign debt of the country therefore was 7.9, 8.1 and 9.3 billion dollars at the end of 1989, 1990 and 1991, respectively, which is the second lowest in Eastern countries next to Romania (see Table 2.1-9). The debt balance increases somewhat in 1991 due to the full-swings of economic reform, shift in the means of trade settlement to hard currencies and so forth. The government is still cautious about borrowing foreign money, and it is judged that the foreign debt will increase only slightly in coming years.

The year of 1991 was the first year of full economic reforms described above. The general domestic production (GDP) in 1991 decreased by 16% from the previous year, and the situation was much severer than the scenario which the government was expecting. As for the causes of economic slump, it is true that the crumble of the COMECON market, which the government emphasizes, could be a shock which led the economy to the slump, but the slump in domestic demands for all sorts of money and property (consumption, investment and financial expenditure) is more to blame. The decrease in actual wage (-25%) and that in domestic total investment (-34%), especially, are much to blame for reduction in total demands. When ultimate demands by use of sold industrial products are studied, the reduction ascribable to export is only -5%, but that ascribable to domestic consumption is as much as -30%, and reduction is seen in every sector (see Table 2.1-10). When seen by industrial sectors, the slump is large in consumer goods and machinery, and it is judged that the slump in the GDP is coming mainly from the slump in such domestic demands.

(3) Economic Outlook

The economic reform of Czechoslovakia is still at its beginning, but basic policies for transforming to market economy such as liberalization of pricing have already been enacted. A fierce inflation occurred temporarily as a result, but it is now under control. Social problems such as increase of unemployment are occurring as a result of rapid slump in production (see Table 2.1-11).

The number of unemployed workers reached 523,000 in the whole country at the end of 1991 (6.6% of the total workable population). The unemployment rate is 4.1% in Czech while it is 11.8% in Slovakia showing a large difference between the republics. In the Slovak republic, the arms industry, which is a major industry in the republic, is scaling down, and the increase of unemployment is getting to be a serious problem. Such an economic slump seems to be spurring the rise of nationalism in Slovakia. In addition, some people are against the rapid economic reform and asking for market economy which emphasizes social welfare. Furthermore, it seems that the division of authorities between the federal government and republics is one of the reasons for making it difficult to carry out unified economic reforms.

The Ministry of Finance and the National Bank are predicting that the economy of 1992 will show the inflation rate of 10 to 15% and the GDP of -5 to -10%. It is thought that economic stagnation and inflation remain to be factors of political and economic instability, but it can be said that the issue of independent Slovak is also a key factor.

The government is referring to a tax reform, in the Scenario for Economic Reform, which aims at changing the tax system to one which is closer to that of the EC emphasizing the value-added tax (VAT). Basic tax bills have passed the Federal Parliament in April 1992, and they are going to be enacted in January 1993.

Table 2.1-1 Trend of Population of the CSFR

	1950	1980	1985	1987	1988	1989	1990
Population in Million	12.34	15.28	15.52	15.59	15.62	15.65	15.67
Yearly Increasing Rate (%)	-	-	0.25	0.45	0.19	0.19	0.12

Note: 1950; March 1, 1980; October 1, the others; December 31

Source: Statisticka rocenka CSSR

Table 2.1-2 The Structure of Race of the CSFR (as of 1987)

	Population in 10 Thousand	Ratio (%)
Czech	980.4	62.9
Slovak	495.3	31.8
Hungarian	59.7	3.8
Pole	7.3	0.5
German	5.4	0.3
Ukrainian & Russian	5.5	0.4
Total including the Others	1,558.9	100.0

Source: Official Data

Table 2.1-3 Major Cities in the CSFR with Population larger than 100 Thousand

Region	City	Population
Praque		
Central Bohemia	Praque	1,214,772
Southern Bohemia	Ceské Budejovice	80,762
Western Bohemia	Pilsen	174,676
Northern Bohemia	Ustí n.L.	106,345
	Liberec	104,150
Eastern Bohemia	Hradec králové	101,159
Southern Moravia	Brno	391,093
Northern Moravia	Ostrava	331,241
	Olomouc	106,595
Western Slovakia	Bratislava	440,421
Eastern Slovakia	Kosice	235,623
Central Slovakia	Banská Bystrica	52,953

Source: National Report (1992)

Table 2.1-4 The Structure of Federal Assembly

		House of the People	House of the Nations
CR	ODS	46	37
	Left-Wing Bloc	19	15
	CSSD	10	6
	SPR-RCS	8	6
	KDU	8	6
	LSU	8	5
	Total	99	75
SR	HZDS	24	33
	SDL	10	13
	SNS	6	9
	KDH	6	8
	MKDM	5	7
	SDSS	-	5
	Total	51	75

Source: Newspaper

Table 2.1-5 Main Economic Indicators (the annual increasing rate)

(Unit: %)

	77-75	76-80	81-85	87	88	89	90	91
GNP	5.7	4.1	1.8	2.2	2.9	1.7	▲3.1	▲15.9
Industrial Production	6.7	4.6	2.7	2.4	2.0	0.9	▲3.7	▲23.1
Agricultural Production	2.6	1.9	1.8	0.9	2.2	1.1	▲3.7	▲ 8.8
Investment	6.2	3.5	▲1.1	3.8	4.5	1.6	1.5	▲33.8
Retail Sales	5.4	3.8	3.1	3.0	4.7	3.7	7.6	▲39.9
Export	10.9	11.4	8.4	3.4	5.5	1.7	▲12.4	-
Import	13.4	10.0	8.1	1.4	1.5	2.5	▲3.8	-

Source: Statisticka rocenka CSSR, etc.

Table 2.1-6 Main Economic Indicators (the annual increasing rate) - Plan and Actual

(Unit: %)

	86 - 90 (Plan)*	1987		1988		1989	
		Plan	Actual	Plan	Actual	Plan	Actual
GNP	3.4 ~ 3.5	3.5	2.2	2.7	2.9	2.2	1.7
Industrial Production	3.0	2.3	2.4	2.1	2.0	2.0	0.9
Agricultural Production	1.2 ~ 1.4	1.0	0.9	1.3	2.2	1.3	1.1
Investment	2.0	1.6	3.8	▲2.4	4.5	▲4.0	1.6
Retail Sales	-	2.6	3.0	1.9	4.7	2.6	3.7
Export	3.7	0.5	3.4	2.6	5.5	-	1.7
Import	2.7	0.9	1.4	1.5	1.5	-	2.5

Note: * the yearly average

Source: Statisticka rocenka CSSR, etc.

Table 2.1-7 Consumer Price Index (the yearly increasing rate)

(Unit: %)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992 (1st half year)
CPI	5.1	0.9	0.9	2.3	0.5	0.1	0.2	1.4	10.0	57.9	3.0

Source: Official Data

Table 2.1-8 Trade Statistics

(Unit: Billion US$)

	1985	1986	1987	1988	1989	1990	1991
Export	10.66	12.24	13.63	14.88	14.45	12.04	10.96
USSR and Eastern Europe	5.69	6.74	7.81	8.51	7.76	5.10	4.59
Western Countries	3.35	3.75	4.13	4.58	4.97	5.61	4.35
Others	1.62	1.75	1.70	1.79	1.72	1.33	2.02
Import	10.32	12.36	13.78	14.58	14.26	13.32	10.11
USSR and Eastern Europe	6.06	7.20	7.96	8.22	7.82	5.81	4.96
Western Countries	3.19	3.87	4.56	4.94	4.87	6.05	3.54
Others	1.08	1.29	1.26	1.42	1.57	1.46	1.61

Source: Czechoslovak Statistics Book, etc.

Table 2.1-9 Foreign Debt

(Unit: 100 Million US$)

	1985	1986	1987	1988	1989	1990	1991
Foreign Debt	46	56	67	73	79	81	93
Foreign Currency Reserve	NA	NA	16	18	23	10	33

Source: OECD Financial Market Trends, etc.

Table 2.1-10 The Category of the Drop of Industrial Production in 1991

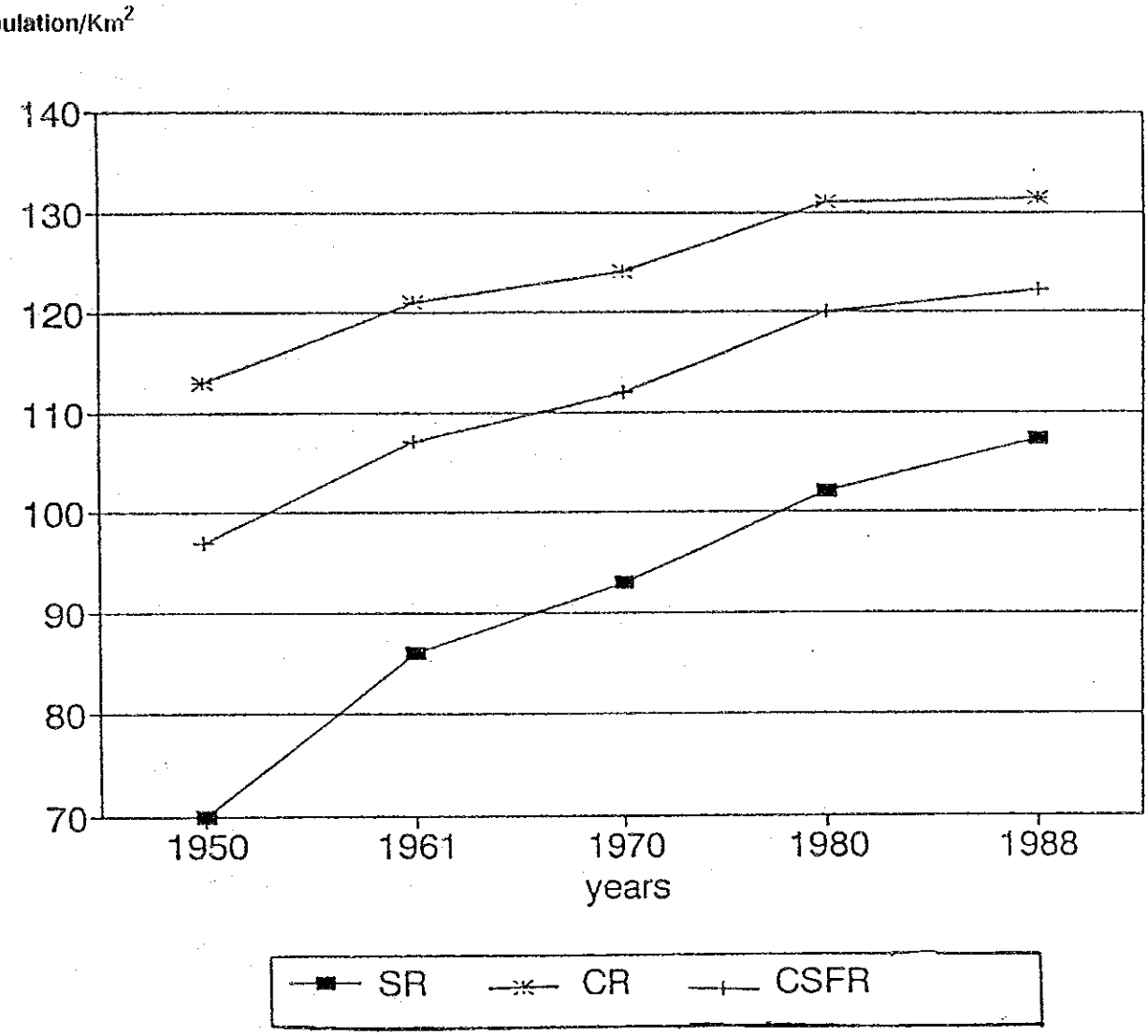
	Annual Increasing Rate (%)		
Clothes	▲40	Mechanical Goods	▲33
Electric Goods	▲39	Print	▲30
Shoes	▲37	Glasses, Ceramics	▲27
Fiber	▲35	Wood	▲26
Construction Products	▲33	Chemical	▲23
Metal	▲33	Steel	▲22
Food	▲17	Fuel, Energy	▲ 5

Source: FME

Table 2.1-11 The Number of the Unemployed

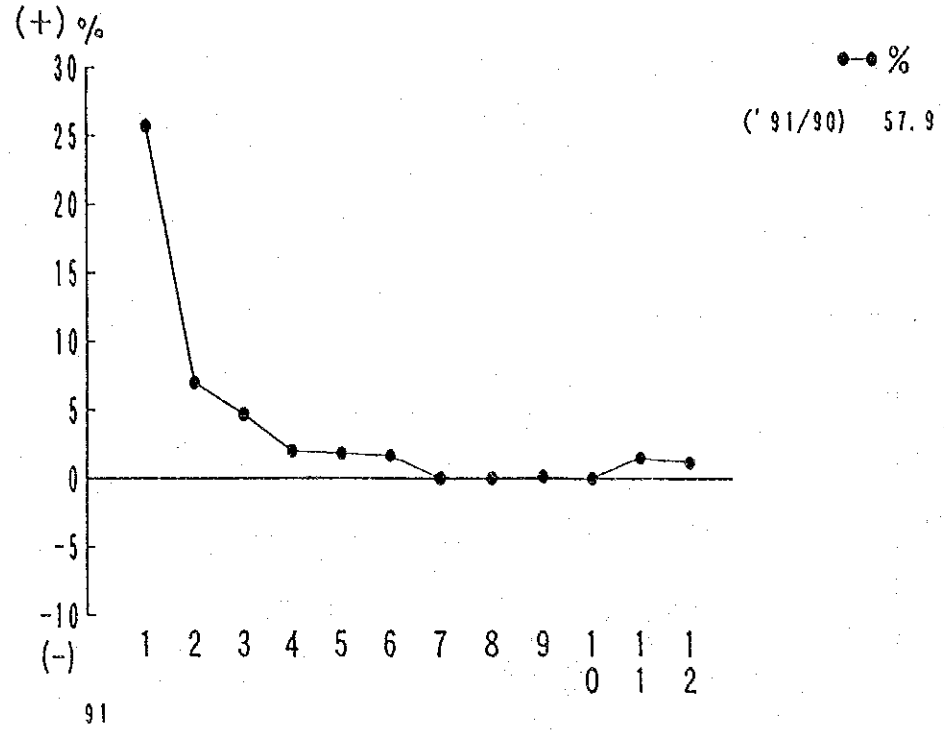
	90/7	90/9	90/12	91/1	91/2	91/3	91/4	91/12
The Unemployed in thousand	19	41	79	119	152	184	223	523
Rate (%)	NA	NA	NA	1.5	1.9	2.6	2.9	6.6

Source: Official Data



(Source) National Report (March (1992)

Fig. 2.1-1 THE DEVELOPMENT OF POPULATION DENSITY IN THE CSFR



(Source) FME

Fig. 2.1-2 CONSUMER PRICE INDEX OF 1991 (MONTHLY CHANGE)

2.2 Current State and Outlook of Energy Demands

2.2.1 Energy Resources

More than 90% of primary energy in Czechoslovakia is supplied by solid fuels such as brown coal and bituminous coal. According to the National Report (March 1992), the proved coal reserve of Czechoslovakia is 18 billion tons, of which 23% is bituminous coal and 77% is brown coal. Major coal mines are two large mines of the Czech republic. One of them is the bituminous coal mine of Ostrava Karvina existing in the central Czechoslovakia along the border with Poland (The coal mine on the Polish side is the Upper Silesia coal mine.), and the mine is supplying about 80% of bituminous coal the country. The coal is mined by underground mining. The coal quality is good, but the mining efficiency is lower, in comparison with that at Upper Silesia coal mine in Poland because of many faults present in the mine. Another coal mine is a brown coal mine existing in northern Bohemia along the border with former East Germany. Brown coal there is mined by large-scale open-cut mining. The brown coal is high in both sulfur and ash contents, and its development and burning (at coal fired power plant is the Czech republic) is posing serious environmental problems. The country produces natural gas only a little (6% of its consumption) and petroleum almost nil (0.9% of its consumption). Hydraulic energy for power generation is not abundant either (see Tables 2.2-1 and 2.2-2).

Uranium mines are existing in Hamr na Jezere in northern Bohemia, and it is said that the uranium reserve would be adequate for decades of consumption at nuclear power plants in the country. Closing of uranium mines are being considered, however, in view of their effects to the environment (It is being afraid that uranium mines might contaminate drinking water reservoirs.) (see the National Report referred above).

The primary energy sources of Czechoslovakia therefore are bituminous coal and brown coal. Czechoslovakia used to import both crude oil and natural gas from the former Soviet Union (thus, Czechoslovakia is also an importing country of primary energy), but it is being planned to import them from Middle East countries for diversification of suppliers.