社会開発調査部報告書

913
61.9
SSS

JAPAN INTERNATIONAL COOPERATION AGENCY (JICA)

MINISTRY FOR ENVIRONMENT AND REGIONAL POLICY
THE REPUBLIC OF HUNGARY

THE STUDY
ON
AN INTEGRATED AIR POLLUTION CONTROL PLAN
FOR
SAJÓ VALLEY AREA

FINAL REPORT

Supporting Report

JICA LIBRARY
1120134[0]

27823

January 1995

PACIFIC CONSULTANTS INTERNATIONAL, TOKYO

In association with

JAPAN ENVIRONMENT ASSESSMENT CENTER CO., LTD., TOKYO

In this report, project costs are estimated based on December 1993 prices with an exchange rate of 1 US$ = 100.19HUF (=¥109.35)

国際協力事業団
27823

ACRONYMS

ÁNTSZ	:	National Public Health and Medical Officer's Service
ÁNTSZ-BAZ	:	Institute of ÁNTSZ in BAZ County
BAZ County	:	Borsod-Abaúj-Zemplén County
BAZKF	:	BAZ County Transport Management Office, KHVM
ÉKF	:	North Hungarian Environmental Protection Inspectorate, KTM
IKM	:	Ministry for Industry and Trade
JICA	:	Japan International Cooperation Agency
KHVM	:	Ministry for Transport, Communication and Water Management
KTM	:	Ministry for Environment and Regional Policy
MKI	:	Miskolc Road Management Office, KHVM
MVM Rt.	:	Hungarian Electricity Companies, Ltd.
NM	:	Ministry of Welfare
OKI	:	National Institute of Hygiene
OMSZ	:	National Meteorological Service

The Study on an Integrated Air Pollution Control Plan for Sajó Valley Area

FINAL REPORT

Supporting Report

Table of Contents

Page

Chapter 1 INTRODUCTION

1.1 Background of the Study 1-1
1.2 Outlines of the Study 1-1
1.2.1 Objective of the Study 1-1
1.2.2 Study Area 1-2
1.2.3 Scope of the Study 1-2
1.2.4 Work Flow and Time Schedule of the Study 1-3
1.3 Study Organization 1-6
1.3.1 General 1-6
1.3.2 Japanese Organization 1-7
1.3.3 Hungarian Organization 1-8

Chapter 2 SOCIAL AND ECONOMIC CONDITIONS

2.1 Administration, Population and Household 2-1
2.1.1 Administration 2-1
2.1.2 Population and Household 2-5
2.2 Economy, Industry and Employment 2-9
2.2.1 National Trend and Policy 2-9
2.2.2 Trends in Borsod-Abaúj-Zemplén County 2-20
2.2.3 Economic Geography of the Study Area 2-28
2.3 Energy Situation 2-30
2.3.1 National Energy Policy 2-30
2.3.2 National Energy Balance 2-36
2.3.3 Energy Consumption by Economic Sectors 2-43
2.3.4 Electricity and Heat Supply 2-48
2.3.5 Energy Prices 2-51
2.3.6 Fuel Consumption in the Study Area 2-54
2.3.7 Future Energy Demand 2-63

Chapter 3 ANALYSIS OF AIR QUALITY AND METEOROLOGICAL DATA

3.1 Outline of Monitoring 3-1
3.1.1 Ambient Air Quality Monitoring 3-1
3.1.2 Upper-layer Meteorological Observation 3-5
3.1.3 Air Quality Measurement at Roadside 3-6
3.1.4 Measurement of Ambient Concentration of Mercury 3-8
3.1.5 Measurement of Falling Dust 3-9
3.2 Analysis of Automatic Monitoring and Meteorological Observation Data 3-10
3.2.1 Air Quality at Automatic Monitoring Stations 3-10
3.2.2 Surface Meteorology 3-37
3.2.3 Upper-layer Meteorology 3-46
3.2.4 Cross Analysis of Meteorology and Pollutants 3-49
3.2.5 Summary 3-79
3.3 Results of Other Measurements 3-87
3.3.1 Air Quality at Roadside 3-87
3.3.2 Ambient Concentration of Mercury 3-89
3.3.3 Falling Dust 3-91

Chapter 4 PRESENT STATE OF AIR POLLUTION SOURCES

4.1 Survey of Stationary Pollution Sources 4-1
4.1.1 Questionnaire and Visiting Surveys on Factories 4-1
4.1.2 Survey of Combustion Facilities and Exhaust Gas Measurement 4-4
4.1.3 Questionnaire Survey on Home Heating 4-6
4.1.4 Fuel Analysis 4-9
4.2 Survey of Mobile Pollution Sources 4-11
4.2.1 Traffic Volume Survey 4-11
4.2.2 Travel Speed and Mode Survey 4-17
4.2.3 Emission Factor Test by Chassis Dynamometer 4-19
4.3 Air Pollutant Emission 4-21
4.3.1 Stationary Sources 4-21
4.3.2 Mobile Sources 4-22
4.3.3 Total Amount of Pollutant Emission 4-24

Chapter 5 ANALYSIS OF THE PRESENT AIR QUALITY BY AIR QUALITY SIMULATION MODEL

5.1 Outline of the Air Quality Simulation Model 5-1
5.1.1 General Process of Air Quality Simulation 5-1
5.1.2 Basic Frame of Simulation Model 5-2
5.1.3 Meteorological Model 5-3
5.1.4 Pollution Source Model 5-9
5.1.5 Dispersion Equations 5-19
5.1.6 Dispersion Parameters 5-22
5.1.7 NO_2 Conversion Model 5-23
5.1.8 Method of Model Evaluation 5-24
5.2 Air Quality Simulation Under the Present Conditions 5-27
5.2.1 Model Evaluation Against Observed Data 5-27
5.2.2 Pollutant Concentration Distribution in the Study Area 5-36
5.2.3 Analysis of Source Contribution to Ambient Concentration 5-44

Chapter 6 ANALYSIS OF SOURCE CONTRIBUTION OF TSP BY CMB METHOD

6.1 Outline of the CMB Method 6-1
6.2 Composition Analysis of Particulate Matter 6-4
6.2.1 Composition of TSP in the Ambient 6-4
6.2.2 Composition of Particulate Matter at Emission Sources 6-6
6.3 Source Contribution Analysis by the CMB Method 6-11

Chapter 7 STUDY ON AIR POLLUTION CONTROL MEASURES

7.1 Institutional Framework 7-1
7.1.1 Legal Framework 7-1
7.1.2 Air Pollution Control Organization 7-35
7.2 State of Air Pollution Control at Stationary Sources 7-43
7.2.1 Quality of Fuels 7-43
7.2.2 State of Air Pollution Control at Major Stationary Sources 7-46
7.2.3 Existing Pollution Control Plans at Major Stationary Sources 7-55
7.2.4 Problems in Air Pollution Control of Stationary Sources 7-65
7.3 Study on Pollution Control Technology for Stationary Sources 7-76
7.3.1 SO2 Emission Control Technology 7-76
7.3.2 NOx Emission Control Technology 7-88

7.3.3 Energy Saving Measures and Organization 7-96
7.4 Air Pollution Control of Mobile Source 7-101
7.4.1 Present State 7-101
7.4.2 Existing Motor Vehicle Pollution Control Plan 7-103

Chapter 8 PREDICTION OF FUTURE AIR QUALITY

8.1 Target Year 8-1
8.2 Basic Future Conditions of Pollutant Sources 8-2
8.2.1 Power Stations 8-2
8.2.2 Major Factories 8-3
8.2.3 Communal Facilities 8-6
8.2.4 Motor Vehicles 8-10
8.3 Future Cases for Prediction of Air Quality 8-13
8.3.1 Case of No Air Pollution Control (Case F-0) 8-13
8.3.2 Case of Existing Air Pollution Control Plan (Case F-1) 8-15
8.3.3 Case of Additional Pollution Control Measures (Case F-2) 8-20
8.3.4 Amount of Pollutant Emission in the Future Cases 8-24
8.4 Prediction of Future Air Quality 8-41
8.4.1 No Air Pollution Control (Case F-0) 8-41
8.4.2 Existing Air Pollution Control Plan (Case F-1) 8-47
8.4.3 Additional Air Pollution Control (Case F-2) 8-52
8.4.4 Quantitative Comparison of Air Quality of the Future Cases 8-57

Chapter 9 INTEGRATED AIR POLLUTION CONTROL PLAN

9.1 Cost Estimation 9-1
9.1.1 Existing Control Plan 9-1
9.1.2 Additional Measures 9-3
9.2 Proposed Air Pollution Control Plan 9-4
9.3 Institutional Measures 9-6
9.3.1 Legal Control Measures 9-6
9.3.2 Reinforcement of the Organizations 9-7
9.3.3 Financial Measures for Executing the Control Measures 9-10
9.4 Implementation Program 9-14

Chapter 10 RECOMMENDATIONS 10-1

REFERENCES R-1

List of Tables

Page

Chapter 2

Table 2.1.1 Changes in the Number and Category of Communities in Hungary... 2-1

Table 2.1.2 Changes in the Population Share of Urban and Rural Communities 2-2

Table 2.1.3 Number and Distribution of Communities by Population Size (1990) 2-2

Table 2.1.4 The Community-Based Definition of the Study Area by the Nomenclature of the 1990 Census 2-4

Table 2.1.5 Time Series of National Population Statistics 2-5

Table 2.1.6 The Number and Composition of Households (The number is in thousands) 2-5

Table 2.1.7 Population Trends in BAZ County (1970-1992)..... 2-6

Table 2.1.8 Number and Composition of Households (BAZ County) 2-7

Table 2.1.9 Changes in the Number of Persons in Households and the Size of Households (BAZ County)..... 2-7

Table 2.1.10 Population and Household Number of the Study Area and Their Shares in the County and the Nation 2-8

Table 2.1.11 Comparative Rates of Inter-census Population Change on the National, BAZ County and Study Area Levels (in %) 2-8

Table 2.2.1 Gross Domestic Product by Industries at Constant Prices (In million HUF)..... 2-9

Table 2.2.2 Gross Output by Industries at Constant Prices (In billion HUF) 2-10

Table 2.2.3 Long-range Volume Indices of Gross Domestic Product (1960 = 100, at constant prices) 2-10

Table 2.2.4 Specific Materials and Energy Intensities of GDP (At current and 1988 prices)..... 2-11

Table 2.2.5 Long-term Trends in the GDP Share of Industry (At basic prices; GDP total = 100 %)..... 2-12

Table 2.2.6 Long-term Comprehensive Indices of Industrial Development (1980 = 100.0)..... 2-12

Table 2.2.7 The Branch Structure of Industrial Production (Percentage, at 1985 constant prices)..... 2-13

Table 2.2.8 Trends of Production in Selected Branches of Industry (1987 = 100.0)..... 2-14

Table 2.2.9	Long-term Trends of Employment in Branches of the Economy (1976-92, in percentage)	2-18
Table 2.2.10	Trends of Employment in Selected Branches of Industry (1980 = 100)	2-18
Table 2.2.11	Registered Unemployment	2-19
Table 2.2.12	Registered Unemployed Eligible for Benefit and Vacancies	2-19
Table 2.2.13	Trends in Income and Price Conditions	2-20
Table 2.2.14	Long-term Trends in BAZ County's Intra-national Placement (BAZ County economy, industry and employment data as percentages of national totals)	2-22
Table 2.2.15	Inter-county Comparison of Some Major Economic Indices	2-23
Table 2.2.16	Long-term Indices of Industrial Production in BAZ County	2-24
Table 2.2.17	Change in the Output of Some Major Industrial Products (1980 = 100)	2-24
Table 2.2.18	County and National Level Decline in Industrial Production and Employment, 1990-1992 (1985 = 100.0)	2-25
Table 2.2.19	Employment Trends in the Material Branches of the Economy in BAZ County	2-26
Table 2.2.20	Trends of Unemployment in BAZ County (In each year's January)	2-26
Table 2.2.21	Indices of Sales in Branches of BAZ County Industry, 1992 (in percentage of 1991)	2-27
Table 2.3.1	Energy Consumption and Economic Performance of Hungary and Some European Countries Between 1973 and 1989	2-37
Table 2.3.2	Trends in the Balance of Energy (In TJ)	2-39
Table 2.3.3	Structure of Energy Sources (In % based on heat values)	2-39
Table 2.3.4	Distribution of Domestic Primary Energy Production (In % based on heat values)	2-40
Table 2.3.5	Import of Fuels and Electricity in 1992	2-42
Table 2.3.6	Energy Consumption by Sectors of the Economy (Percentages)	2-44
Table 2.3.7	Energy Consumption by Economic Sectors (1991-1993)	2-46
Table 2.3.8	Trend in Energy Consumption per Unit of Gross Domestic Product (Energy Intensity)	2-46
Table 2.3.9	Trend in Energy Consumption per Unit of Industrial Production (Specific Energy Consumption)	2-46
Table 2.3.10	Balance of Electric Energy (In GWh)	2-49

Table 2.3.11	Energy Source and Energy Prices in January (HUF)	2-52
Table 2.3.12	Electric Current Tariff Structure	2-53
Table 2.3.13	Result of Investigation of Fuel Consumption in the Study Area	2-56
Table 2.3.14	Future Electricity Demand Forecast by MVM Rt	2-63
Table 2.3.15	Forecast of Electricity and Thermal Energy Demand for Cardinal Years (for medium increase of demand)	2-65
Table 2.3.16	Changes in the Electricity Intensity - An International Comparison	2-65

Chapter 3

Table 3.1.1	Measuring Items in Existing Monitoring Stations	3-3
Table 3.1.2	Measuring Items in JICA Established Monitoring Stations	3-3
Table 3.2.1	Ambient Air Quality Standards of NOx (ppm)	3-10
Table 3.2.2	Measurement Results of NOx (ppm)	3-11
Table 3.2.3	Ratio of NO2 to NOx	3-12
Table 3.2.4	Ratio of Concentration (heating / non-heating season)	3-13
Table 3.2.5	Coefficient of Variation (30 Minute Values / mean)	3-13
Table 3.2.6	Coefficient of Variation (24 Hour Values / mean)	3-13
Table 3.2.7	Ambient Air Quality Standards of SO2 (ppm)	3-14
Table 3.2.8	Summary of Measured Results of SO2 (ppm)	3-14
Table 3.2.9	Ratio of Concentration (heating/non-heating season)	3-15
Table 3.2.10	Coefficient of Variation (30 Minutes Values / mean)	3-15
Table 3.2.11	Coefficients of Correlation Between Pollutants	3-31
Table 3.2.12	Coefficients of Correlation Between Pollutants	3-32
Table 3.2.13	Coefficients of Correlation Between Pollutants	3-33
Table 3.2.14	Coefficients of Correlation Between Pollutants	3-33
Table 3.2.15	Coefficients of Correlation Between Monitoring Stations	3-35
Table 3.2.16	Coefficients of Correlation Between Monitoring Stations	3-36
Table 3.2.17	Pasquill's Atmospheric Stability Classes (Modified)	3-43
Table 3.2.18	Occurrence of Inversion Layer	3-46
Table 3.2.19	Days of High Pollutant Concentration	3-76

Table 3.3.1 Concentration of Vapor Hg in Ambient Air 3-90

Chapter 4

Table 4.1.1 The Types and Number of Facilities for Exhaust Gas Measurement 4-4

Table 4.1.2 Amount of Primary Fuel Consumption per Person (November 1992 - March 1993) 4-8

Table 4.1.3 Amount of Sub-fuel Consumption per Person (November 1992 - March 1993) 4-8

Table 4.2.1 Trends in Traffic Volume by Car Type 4-13

Table 4.2.2 Locations of Traffic Volume Survey 4-16

Table 4.2.3 Parameters of Traffic Flow for Emissions Mode 4-19

Table 4.2.4 Technical Data of Tested Passenger Cars 4-20

Table 4.2.5 Technical Data of Tested Small Commercial Vehicles 4-20

Table 4.3.1 Emission Factors for Estimation of Pollutant Emissions 4-23

Table 4.3.2 Annual Average Daily Pollutant Emission in Major Roads by Car Type 4-24

Table 4.3.3 Total Emissions of SO2 and NOx (Present) 4-24

Chapter 5

Table 5.1.1 Pasquill's Classification of Atmospheric Stability 5-7

Table 5.1.2 Dispersion Parameters for Windy Conditions 5-22

Table 5.1.3 Dispersion Parameters for Calm and Breeze 5-23

Table 5.1.4 Conditions for Evaluation of the Accuracy of the Dispersion Model 5-26

Table 5.2.1 Computed Concentration of SO2 5-28

Table 5.2.2 Observed Concentration of SO2 5-28

Table 5.2.3 Computed Concentration of NOx 5-31

Table 5.2.4 Observed Concentration of NOx 5-31

Table 5.2.5 Result of Model Evaluation for SO2 5-34

Table 5.2.6 Result of Model Evaluation for NOx 5-34

Table 5.2.7 Background Concentration 5-35

Table 5.2.8 Source Contribution to SO2 Concentration at Each Monitoring Station (%) 5-45

Table 5.2.9 Source Contribution to NOx Concentration at Each Monitoring Station (%) 5-45

Chapter 6

Table 6.2.1 Stationary Sources for Dust Sample Taking 6-7

Table 6.3.1 The Average Concentrations of Elements in TSP 6-11

Table 6.3.2 Selected Stationary Sources by Fuel Type 6-12

Table 6.3.3 The Contents of Elements by Pollution Sources 6-12

Table 6.3.4 Source Contribution to Ambient TSP 6-13

Chapter 7

Table 7.1.1 Ambient Air Quality Standards in Hungary 7-3

Table 7.1.2 Proposed Future Health Ambient Air Quality Standards of Air Pollutants regulated by Limit Values 7-17

Table 7.1.3 Proposed Future Combined Health Ambient Air Quality Standards in the Case of Continuous and Parallel Measurements of SO2 and Total Suspended Particulate Matter (TSP) 7-17

Table 7.1.4 Proposed Future Health Ambient Air Quality Standards of TSP and Its Certain Components 7-17

Table 7.1.5 Proposed Future Ecological Ambient Air Quality Standards (Concentration) 7-18

Table 7.1.6 Proposed Future Ecological Ambient Air Quality Standards of Sedimentation 7-18

Table 7.1.7 Proposed Future Limit Values Imposing Smog-alarm Measures 7-19

Table 7.1.8 Proposed Future General Emission Limit Values of Stationary Sources concerning Solid Materials and Inorganic Dust Materials 7-21

Table 7.1.9 Proposed Future General Emission Limit Values of Stationary Sources concerning Inorganic Materials in Vapor or Gaseous State 7-21

Table 7.1.10 Proposed Future Technological Emission Limit Values concerning Glass Industry 7-22

Table 7.1.11 Proposed Future Technological Emission Limit Values concerning Cement Industry 7-22

Table 7.1.12 Proposed Future Technological Emission Limit Values concerning Cupola Furnace 7-22

Table 7.1.13 Proposed Future Technological Emission Limit Values concerning New Firing Equipment operated with Solid Fuels 7-24

Table 7.1.14 Proposed Future Technological Emission Limit Values concerning New Firing Equipment operated with Liquid Fuels 7-24

Table 7.1.15	Proposed Future Technological Emission Limit Values concerning New Firing Equipment operated with Gaseous Fuels	7-25
Table 7.1.16	Proposed Future Technological Emission Limit Values concerning New Firing Equipment (Gas Turbines)	7-25
Table 7.1.17	Proposed Future Technological Emission Limit Values concerning Medium-capacity Firing Equipment	7-27
Table 7.1.18	Proposed Future Technological Emission Limit Values concerning Small-capacity Firing Equipment	7-28
Table 7.1.19	Proposed Future Permissible Limit Values of Average Pollutant Content of the Exhaust Gas of Motor Car with a Total Mass not exceeding 3500 kg and with a Planning Speed above 50 km/h	7-33
Table 7.1.20	Proposed Future Permissible Limit Values of Trucks, Buses, and Tractors equipped with Compression Ignition (Diesel) Engine, with a Total Mass above 3500 kg and with a Planning Speed above 25 km/h	7-33
Table 7.1.21	Proposed Future Permissible Limit Values of Motor Cars provided with a Type-certificate before January 1, 1994 with a total mass not exceeding 3500 kg and with a Planning Speed above 50 km/h	7-34
Table 7.2.1	Categorization of Major Stationary Pollution Sources	7-47
Table 7.2.2	Present State of Central Heating in the Sajó Valley Area	7-53
Table 7.2.3	Principal Measures for Energy Saving in Iron Factories	7-71
Table 7.2.4	Specific Energy Consumption in DNM	7-71
Table 7.2.5	Heat Supply from Power Stations in Hungary	7-72
Table 7.3.1	NOx Generation Control Principles and Technology	7-92
Table 7.3.2	Outline of Decision Criteria for Energy Consumption Rationalization by Plant	7-100
Table 7.4.1	Number of Registered Motor Vehicles by Type (in 1990)	7-101
Table 7.4.2	Summary Table of Hungarian Action Plan for the Period 1994 - 1998	7-104

Chapter 8

Table 8.2.1	Energy Production and Fuel Consumption Planned for Borsod Power Station	8-2
Table 8.2.2	Energy Production and Fuel Consumption Planned for Tisza I Power Station	8-3
Table 8.2.3	Electricity Production and Fuel Consumption Planned for Tisza II Power Station	8-3
Table 8.2.4	Age Distribution of Registered Motor Vehicles in Hungary (1990)	8-12

Table 8.2.5 Emission Factors of NOx for Motor Vehicles 8-12

Table 8.2.6 Emission Factors of SO2 for Motor Vehicles 8-12

Table 8.3.1 Factories Having Pollutant Emission Control Plan 8-16

Table 8.3.2 Factories Selected for Emission Control Measures 8-20

Table 8.3.3 Reference for the Figure Number Which Shows Pollutant Emission by Grid Elements 8-24

Table 8.3.4 Amount of SO2 Emission by Sources and Cases (ton/y) 8-25

Table 8.3.5 Amount of NOx Emission by Sources and Cases (ton/y) 8-26

Table 8.4.1 Person-average Exposure Concentration (PAEC) 8-57

Chapter 9

Table 9.2.1 Summary of Air Pollution Control Measures and Simulation Results 9-5

Table 9.4.1 (1) Contribution Concentration and Its Ratio by Sources in Major Cities of The Study Area 9-16

Table 9.4.1 (2) Contribution Concentration and Its Ratio by Sources in Major Cities of The Study Area 9-16

Table 9.4.2 Implementation Program of Air Pollution Control for Sajó Valley Area 9-18

List of Figures

Page

Chapter 1

Figure 1.2.1 Study Area 1-4

Figure 1.2.2 Time Schedule and Work Flow for the Study 1-5

Chapter 2

Figure 2.2.1 Volume Index of Industrial Output (1985 monthly average = 100.0) 2-13

Figure 2.2.2 The Territorial Distribution of Hungarian Industry by Counties in the Second Half of the 1980's 2-20

Figure 2.2.3 The Change of Industrial Production in BAZ County (1988 = 100) 2-24

Figure 2.2.4 Change in the Output of Some Major Industrial Products (1980 = 100) 2-25

Figure 2.3.1 Connecting Opportunities for Hungarian Crude Oil Pipeline 2-31

Figure 2.3.2 Connecting Opportunities for Hungarian Natural Gas Pipeline 2-32

Figure 2.3.3 The Hungarian Electricity Grid with International Connections 2-33

Figure 2.3.4 Trends of Energy Supply in Hungary 2-38

Figure 2.3.5 Hungary's Import Dependency of Energy (1989) (An International Comparison) 2-40

Figure 2.3.6 Domestic and Import Shares for Domestic Consumption of Energy Carriers (1991) (Source : Ref. A-20) 2-41

Figure 2.3.7 Trend in Shares of Sectoral Energy Consumption (%) 2-44

Figure 2.3.8 Trend in Total and Sectoral Consumption of Energy (Total in 1980 = 100) 2-45

Figure 2.3.9 Energy Consumption and Value Produced by Various Industrial Sectors (1990) 2-47

Figure 2.3.10 The Role of MVM in Hungarian Energy Sector (1992) 2-48

Figure 2.3.11 Electric Energy Consumption by Sectors 2-49

Figure 2.3.12 Fuel Consumption and Energy Output in Borsod Power Station 2-58

Figure 2.3.13 Fuel Consumption and Energy Output in Tisza I Power Station 2-59

Figure 2.3.14 Fuel Consumption and Energy Output in Tisza II Power Station 2-60

Figure 2.3.15 Total Fuel Consumption and Energy Output by Three Power Stations 2-61

Figure 2.3.16 Yearly Change of Productions of DIMAG Group..... 2-62

Figure 2.3.17 National Electricity Demand Forecast by MVM Rt. (Source : Ref. A-24.) 2-64

Chapter 3

Figure 3.1.1 Location Map of Automatic Monitoring Stations of Ambient Air Quality and Meteorology..... 3-2

Figure 3.1.2 Locations of Roadside Measurement of NO and NO2 by Simplified Method..... 3-7

Figure 3.2.1 Daily Variation of NOx Concentration (October - January) 3-18

Figure 3.2.2 Daily Variation of SO2 Concentration (October - January)..... 3-19

Figure 3.2.3 Cumulative Frequency Curve of NO Concentration (30 minutes value, all season)..... 3-24

Figure 3.2.4 Cumulative Frequency Curve of NO2 Concentration (30 minutes value, all season)..... 3-24

Figure 3.2.5 Cumulative Frequency Curve of NOx Concentration (30 minutes value, all season)..... 3-25

Figure 3.2.6 Cumulative Frequency Curve of SO2 Concentration (30 minutes value, all season)..... 3-25

Figure 3.2.7 Cumulative Frequency Curve of CO Concentration (30 minutes value, all season)..... 3-26

Figure 3.2.8 Cumulative Frequency Curve of O3 Concentration (30 minutes value, all season)..... 3-26

Figure 3.2.9 Cumulative Frequency Curve of SPM Concentration (30 minutes value, all season)..... 3-26

Figure 3.2.10 Wind Direction Distribution Diagram (JF1, JM1, JF2, J7) 3-38

Figure 3.2.11 Mean Wind Speed by Wind Direction (JF1, JM1, JF2, J7)..... 3-40

Figure 3.2.12 Hourly Variation of Wind Speed (JF1, JM1, JF2, J7, 00:00-23:30) 3-41

Figure 3.2.13 Monthly Variation of Wind Speed (JF1, JM1, JF2, J7 May - April)..... 3-41

Figure 3.2.14 Appearance Frequency of Wind Speed Ranks (all seasons)..... 3-42

Figure 3.2.15 Appearance Frequency of Stability Classes (JF1, JM1, JF2, J7) ... 3-45

Figure 3.2.16 Location Map of Monitoring Stations (Northern Part) 3-51

Figure 3.2.17 Location Map of Monitoring Stations (Southern Part) 3-52
Figure 3.2.18 (1) Mean Concentration of NOx by Wind Direction (JF1)..... 3-53
Figure 3.2.18 (2) Mean Concentration of NOx by Wind Speed (JF1)..... 3-53
Figure 3.2.19 (1) Mean Concentration of SO2 by Wind Direction (JF1)..... 3-54
Figure 3.2.19 (2) Mean Concentration of SO2 by Wind Speed (JF1)..... 3-54
Figure 3.2.20 (1) Mean Concentration of NOx by Wind Direction (J2) 3-57
Figure 3.2.20 (2) Mean Concentration of NOx by Wind Speed (J2)..... 3-57
Figure 3.2.21 (1) Mean Concentration of SO2 by Wind Direction (J2)..... 3-58
Figure 3.2.21 (2) Mean Concentration of SO2 by Wind Speed (J2) 3-58
Figure 3.2.22 (1) Mean Concentration of NOx by Wind Direction (J3) 3-60
Figure 3.2.22 (2) Mean Concentration of NOx by Wind Speed (J3)..... 3-60
Figure 3.2.23 (1) Mean Concentration of SO2 by Wind Direction (J3)..... 3-61
Figure 3.2.23 (2) Mean Concentration of SO2 by Wind Speed (J3) 3-61
Figure 3.2.24 (1) Mean Concentration of NOx by Wind Direction (JF2)..... 3-63
Figure 3.2.24 (2) Mean Concentration of NOx by Wind Speed (JF2)..... 3-63
Figure 3.2.25 (1) Mean Concentration of SO2 by Wind Direction (JF2)..... 3-64
Figure 3.2.25 (2) Mean Concentration of SO2 by Wind Speed (JF2)..... 3-64
Figure 3.2.26 (1) Mean Concentration of NOx by Wind Direction (J7) 3-66
Figure 3.2.26 (2) Mean Concentration of NOx by Wind Speed (J7)..... 3-66
Figure 3.2.27 (1) Mean Concentration of SO2 by Wind Direction (J7)..... 3-67
Figure 3.2.27 (2) Mean Concentration of SO2 by Wind Speed (J7) 3-67
Figure 3.2.28 Cumulative Frequency of SO2 Concentration by Wind Direction (JF1) 3-69
Figure 3.2.29 Cumulative Frequency of SO2 Concentration by Wind Direction (J2) 3-70
Figure 3.2.30 Cumulative Frequency of SO2 Concentration by Wind Direction (JF2) 3-71
Figure 3.2.31 Ratio of Concentration of NOx by Stability of Atmosphere..... 3-73
Figure 3.2.32 Ratio of Concentration of SO2 by Stability of Atmosphere 3-74
Figure 3.2.33 Weather Map of Heavily Polluted Day (11/27 ~ 11/29)..... 3-77
Figure 3.2.34 Weather Map of Heavily Polluted Day (1/9 ~ 1/11)..... 3-78

Figure 3.3.1 Attenuation of NO, NO2 and NOx Concentrations by Distance from the Road Edge 3-88
Figure 3.3.2 Annual Average of Hg Concentration 3-90
Figure 3.3.3 (1) Monthly Variation of Falling Dust in Sajo Valley Area (Ozd and Kazincbarcika) 3-92
Figure 3.3.3 (2) Monthly Variation of Falling Dust in Sajo Valley Area (Sajoszentpeter and Miskolc) 3-93
Figure 3.3.3 (3) Monthly Variation of Falling Dust in Sajo Valley Area (Tiszaújváros) 3-94

Chapter 4

Figure 4.1.1 Location of Major Stationary Pollution Sources 4-2
Figure 4.1.2 Location of Heating Centers 4-3
Figure 4.1.3 The Area of Questionnaire Survey on Home Heating 4-7
Figure 4.2.1 Road Network and Existing Traffic Survey Points in the Study Area 4-12
Figure 4.2.2 Trends in Traffic Volumes 4-13
Figure 4.2.3 Trends in Traffic Volumes by Car Type 4-14
Figure 4.2.4 Locations of Traffic Volumes Survey 4-15
Figure 4.2.5 Routes of Driving Speed and Mode Test 4-18
Figure 4.3.1 Shares of Source Categories in the SO2 Emission 4-25
Figure 4.3.2 Shares of Source Categories in the NOx Emission 4-25

Chapter 5

Figure 5.1.1 General Process of Air Quality Simulation 5-1
Figure 5.1.2 Meteorological Blocks for the Study Area 5-4
Figure 5.1.3 (1) Wind Roses at 10m Height (Whole Year) 5-5
Figure 5.1.3 (2) Wind Roses at 10m Height (Whole Year) 5-6
Figure 5.1.4 Appearance Frequency of Atmospheric Stability (All season) 5-8
Figure 5.1.5 Annual Amount of SO2 Emission From Industries (Present) 5-13
Figure 5.1.6 Annual Amount of SO2 Emission From Communal Facilities (Present) 5-14
Figure 5.1.7 Annual Amount of SO2 Emission From Motor Vehicles (Present) 5-15

Figure 5.1.8	Annual Amount of NOx Emission From Industries (Present)	5-16
Figure 5.1.9	Annual Amount of NOx Emission From Communal Facilities (Present)	5-17
Figure 5.1.10	Annual Amount of NOx Emission From Motor Vehicles (Present)	5-18
Figure 5.1.11	Correlation Between Observed Concentrations of NOx and NO2...	5-25
Figure 5.2.1 (1)	Comparison of Computed and Observed Concentrations of SO2 ...	5-29
Figure 5.2.1 (2)	Comparison of Computed and Observed Concentrations of SO2 ...	5-30
Figure 5.2.2 (1)	Comparison of Computed and Observed Concentration of NOx	5-32
Figure 5.2.2 (2)	Comparison of Computed and Observed Concentration of NOx	5-33
Figure 5.2.3	Annual Average Concentration Isopleth for SO2 (All Sources).....	5-38
Figure 5.2.4	Concentration Isopleth for SO2 in Heating Season (All Sources)...	5-39
Figure 5.2.5	Annual Average Concentration Isopleth for NOx (All Sources).....	5-40
Figure 5.2.6	Concentration Isopleth for NOx in Heating Season (All Sources)...	5-41
Figure 5.2.7	Annual Average Concentration Isopleth for NO2 (All Sources).....	5-42
Figure 5.2.8	Concentration Isopleth for NO2 in Heating Season (All Sources)...	5-43

Chapter 6

Figure 6.2.1	Monthly Variation of TSP and Carbon Concentration	6-5

Chapter 7

Figure 7.1.1	Organizational Structure of the Ministry for Environment and Regional Policy and Bodies Under its Control.....	7-39
Figure 7.1.2	Organizational Structure of the Ministry for Transport, Communication and Water Management (KHVM).....	7-40
Figure 7.1.3	Organizational Structure of North-Hungarian Environmental Protection Inspectorate (EKF)	7-41
Figure 7.1.4	Organizational Structure of B.A.Z County Transport Management Office (BAZKF)	7-42
Figure 7.2.1	Correlation Between Combustion Temperature and SOx Concentration	7-44
Figure 7.2.2	Movements of Energy Intensity - An International Comparison.....	7-68
Figure 7.2.3	Electric Energy Loss in Hungarian Power Stations and on the Network	7-73
Figure 7.3.1	Various Desulfurization Method	7-77

Figure 7.3.2 Procedure for Energy Diagnosis 7-99
Figure 7.4.1 Shares of Passenger Cars by Manufactures 7-102
Figure 7.4.2 Age of Registered Motor Vehicles in Hungary (1990) 7-102

Chapter 8

Figure 8.2.1 Towns and Villages Where Natural Gas Pipe Lines Have Been Laid 8-8
Figure 8.2.2 Towns and Villages Where Natural Gas Pipe Lines Will Have Been Laid by the Year 2005 8-9
Figure 8.2.3 Projection of Number of Motor Vehicles in Hungary in 2005 8-11
Figure 8.3.1 Amount of SO2 Emission by Sources and Case (ton/y) 8-25
Figure 8.3.2 Amount of NOx Emission by Sources and Case (ton/y) 8-26
Figure 8.3.3 Annual Amount of SO2 Emission (Case F-0, Industries) 8-27
Figure 8.3.4 Annual Amount of SO2 Emission (Case F-0, Motor Vehicles) 8-28
Figure 8.3.5 Annual Amount of NOx Emission (Case F-0, Industries) 8-29
Figure 8.3.6 Annual Amount of NOx Emission (Case F-0, Motor Vehicles) 8-30
Figure 8.3.7 Annual Amount of SO2 Emission (Case F-1, Industries) 8-31
Figure 8.3.8 Annual Amount of SO2 Emission (Case F-1, Communal) 8-32
Figure 8.3.9 Annual Amount of SO2 Emission (Case F-1, Motor Vehicles) 8-33
Figure 8.3.10 Annual Amount of NOx Emission (Case F-1, Industries) 8-34
Figure 8.3.11 Annual Amount of NOx Emission (Case F-1, Communal) 8-35
Figure 8.3.12 Annual Amount of NOx Emission (Case F-1, Motor Vehicles) 8-36
Figure 8.3.13 Annual Amount of SO2 Emission (Case F-2, Industries) 8-37
Figure 8.3.14 Annual Amount of SO2 Emission (Case F-2, Communal) 8-38
Figure 8.3.15 Annual Amount of NOx Emission (Case F-2, Industries) 8-39
Figure 8.3.16 Annual Amount of NOx Emission (Case F-2, Communal) 8-40
Figure 8.4.1 Annual Average Concentration Isopleth for SO2 (Case F-0, All Sources) 8-43
Figure 8.4.2 Average Concentration Isopleth for SO2 in Heating Season (Case F-0, All Sources) 8-44
Figure 8.4.3 Annual Average Concentration Isopleth for NO2 (Case F-0, All Sources) 8-45

Figure 8.4.4 Average Concentration Isopleth for NO2 in Heating Season (Case F-0, All Sources) 8-46

Figure 8.4.5 Annual Average Concentration Isopleth for SO2 (Case F-1, All Sources) 8-48

Figure 8.4.6 Average Concentration Isopleth for SO2 in Heating Season (Case F-1, All Sources) 8-49

Figure 8.4.7 Annual Average Concentration Isopleth for NO2 (Case F-1, All Sources) 8-50

Figure 8.4.8 Average Concentration Isopleth for NO2 in Heating Season (Case F-1, All Sources) 8-51

Figure 8.4.9 Annual Average Concentration Isopleth for SO2 (Case F-2, All Sources) 8-53

Figure 8.4.10 Average Concentration Isopleth for SO2 in Heating Season (Case F-2, All Sources) 8-54

Figure 8.4.11 Annual Average Concentration Isopleth for NO2 (Case F-2, All Sources) 8-55

Figure 8.4.12 Average Concentration Isopleth for NO2 in Heating Season (Case F-2, All Sources) 8-56

Chapter 9

Figure 9.3.1 Conceptual Structure of Training Center for Air Pollution Control 9-12

Figure 9.3.2 Conceptual Structure of Air Pollution Monitoring and Assessment Center 9-13

Figure 9.4.1 Shares of Sources in SO2 Emission 9-15

Figure 9.4.2 Shares of Sources in NOx Emission 9-15

CHAPTER 1

Chapter 1 INTRODUCTION

1.1 Background of the Study

The Sajo Valley is located in the Borsod-Abaúj-Zemplén County (hereinafter called "BAZ County") in the northeastern part of the Republic of Hungary. The valley is formed along the Sajo River which flows in from Slovakia and runs through the area of BAZ County from northwest to southeast. The principal city of the Sajo Valley area is Miskolc, the third largest city in Hungary after Budapest and Debrecen with a population of about 200,000.

The greatest industrial development in Hungary was achieved in the Sajo Valley area. Iron and steel plants, chemical plants, power plants and related industries are located in the area. As a consequence, the area has been suffering air pollution due to exhaust gas emissions from these industries. The situation was said to be very severe during the time of the socialist regime when plants were fully operated to meet the demands from the Soviet market. Since the collapse of this market, industrial productions in the area have been decreased, and the air pollution level has been improved in some extent. However, many plants are still in operation and most of them are not capable to meet the exhaust gas emission standards of the country because of insufficient emission control measures. In addition, the number of automobiles in the area, that are also sources of air pollutants, have been steadily increasing.

Under such circumstances, the Government of Hungary requested the Japanese Government for cooperation in preparing an air pollution control plan for the Sajo Valley area. In response, the Government of Japan decided to conduct "the Study on an Integrated Air Pollution Control Plan for Sajo Valley Area" (hereinafter referred to as "the Study") and entrusted the Study to the Japan International Cooperation Agency (JICA). The scope of work (S/W) for the Study was agreed upon on April 10, 1992 between the preliminary study team of JICA and the Hungarian authorities concerned. The Study began in September 1992 with the first visit of the comprehensive study team of JICA (hereinafter called "the JICA Study Team") to Hungary.

1.2 Outlines of the Study

1.2.1 Objective of the Study

The objective of the Study is to formulate an integrated air pollution control plan based on the field investigation and analysis on the relation between socio-economic activities and air pollution in Sajó Valley Area.

1.2.2 Study Area

Figure 1.2.1 shows the study area which covers approximately 1,900 km^2 of the area in the BAZ County. Major cities or towns in this area include Miskolc, Özd, Kazincbarcika, Sajószentpéter, Edelény, and Tiszaújváros.

1.2.3 Scope of the Study

The scope of the Study is detailed in the Scope of Work (S/W) agreed upon between the Hungarian and the Japanese authorities. Major items of the Study are as follows.

(1) Collection and Analysis of Existing Data

1) Meteorological data
2) Ambient air quality data
3) Stationary sources data
4) Mobile sources data
5) Data on socio-economic condition
6) Laws and regulations
7) Administrative and financial system
8) Others

(2) Basic Survey

1) Meteorological survey
2) Survey of ambient air quality
3) Survey of stationary sources
4) Survey of mobile sources
5) Survey of elemental composition of particulate matter
6) Others

(3) Analysis of the Air Pollution Mechanism and Development of a Simulation Model

1) Arrangement and analysis of the data acquired through the basic survey described in above (2)
2) Comprehensive analysis of the relationship among meteorological condition, pollutants discharged and ambient air quality
3) Development of a simulation model based on the results of the above 2)

(4) Analysis of Future Conditions Relevant to Air Pollution

1) Analysis of future socio-economic conditions related to air pollution

2) Estimation of future pollution loads
3) Application of the simulation model to predict the future ambient air quality, and to identify the pollution contribution by source

(5) Recommendation of an Integrated Air Pollution Control Plan

1) Emission reduction plan
2) Supporting measures to implement the emission reduction plan
3) Implementation plan for the emission reduction plan

1.2.4 Work Flow and Time Schedule of the Study

Figure 1.2.2 shows general work flow and time schedule of the Study.

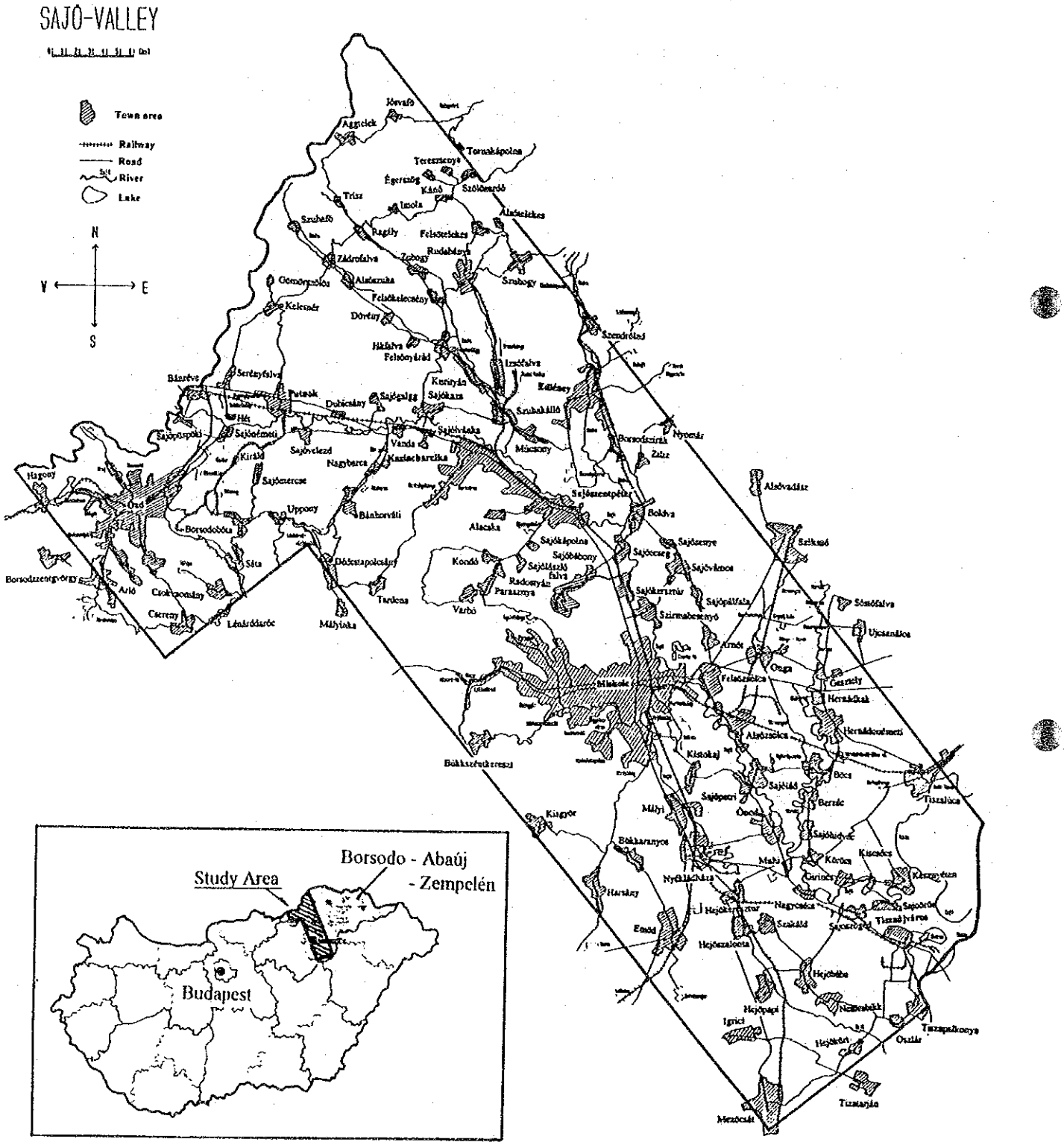


Figure 1.2.1 Study Area

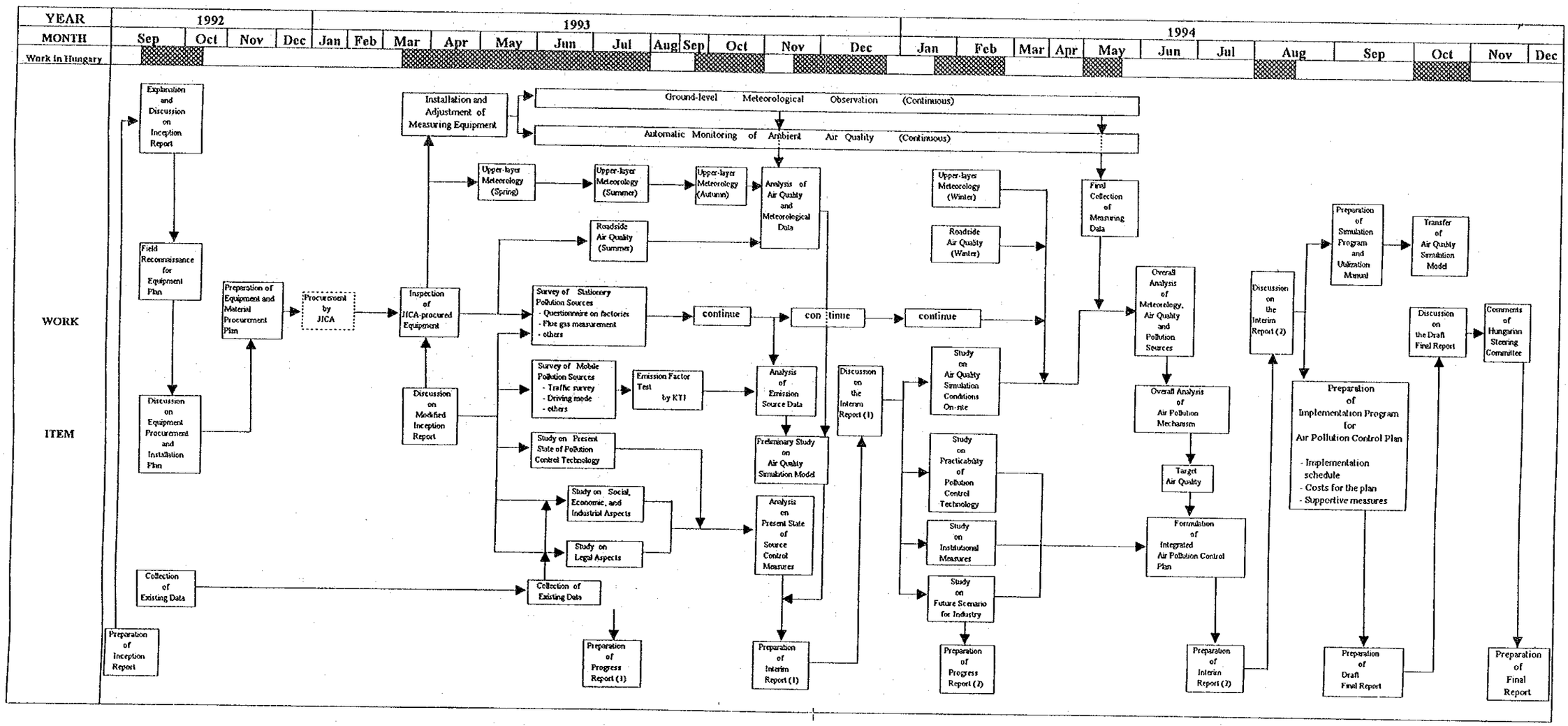
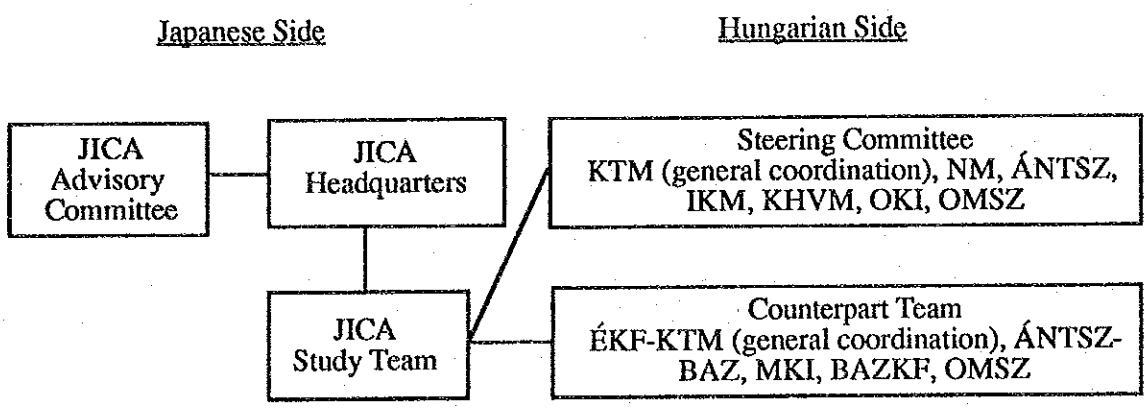


Figure 1.2.2 **Time Schedule and Work Flow for the Study**

1.3 Study Organization

1.3.1 General

A general organization for the execution of the Study is as follows:



Note:

JICA:	Japan International Cooperation Agency
KTM:	Ministry for Environment and Regional Policy
NM:	Ministry of Welfare
ÁNTSZ:	National Public Health and Medical Officer's Service
IKM:	Ministry for Industry and Trade
KHVM:	Ministry for Transport, Communication and Water Management
OKI:	National Institute of Hygiene
OMSZ:	National Meteorological Service
ÉKF:	North Hungarian Environmental Protection Inspectorate, KTM
ÁNTSZ-BAZ:	Institute of ÁNTSZ in Borsod-Abaúj-Zemplén (BAZ) County
MKI:	Miskolc Road Management Office, KHVM
BAZKF:	BAZ County Transport Management Office, KHVM

1.3.2 Japanese Organization

Members of the JICA Study Team and the JICA Advisory Committee are as follows:

(1) JICA Study Team

Name	Field in Charge	Firm
Akira UCHIDA	Team leader	PCI
Masao KANEKIYO	Pollution control technology (general)	JEAC
Susumu KOMATSU	Pollution control technology (facility plan)	JEAC
Kazuyuki YAMAKAWA	Measurement (ambient air quality)	JEAC
Minoru HIRAO	Chemical analysis (ambient air and pollution source)	JEAC
Shinji WAKE	Analysis of air pollution mechanism	PCI
Motoji KATSUTA	Measurement (pollution source)	JEAC
Tsutomu KURIHARA	Monitoring system/institution	PCI
Norifumi YAMAMOTO	Pollution control planning	PCI
Tadashi OGAWA	Measurement (meteorology)	JEAC
Makoto YAMATO	Simulation model analysis	PCI
Attila M. GERGELY	Socio-economy and industrial trend analysis	Hungarian expert
Mitsuaki INO	Pollution source analysis	PCI

Note: PCI: Pacific Consultants International, Co., Ltd.
JEAC: Japan Environmental Assessment Center, Co., Ltd.

(2) JICA Advisory Committee

Name	Field in Charge	Present Post
Senro IMAI	Chairman/ environment control	Development specialist, Institute for International Cooperation, JICA
Tadashi TAKEUCHI	Atmospheric environmental analysis	Deputy Director, Air Pollution Control Division, Air Quality Bureau, Environment Agency
Kazuo MATSUSHITA	Pollution source analysis	Supervisor, Inspection and Guidance Division, General Affairs Department, Hiroshima Prefectural Health and Environment Center

1.3.3 Hungarian Organization

Members of the Hungarian Steering Committee and Counterpart Team are as follows :

(1) Steering Committee

Mr. Róbert RAKICS	Head of Department for Air Pollution and Noise Control, KTM
Ms. Ágnes TIBIÁSSY	Senior Officer, Department of Development, IKM
Dr. Miklós SZOBOSZLAY	Department of Development, KHVM
Dr. Ildikó SZENTGYÖRGY	Medical Officer, ÁNTSZ
Mr. Zsolt ZÁRBOK	Head of Observation Department, OMSZ
Dr. Magdolna KERTÉSZ	Head of Department of Air Hygiene, OKI
Dr. Mária SEDLÁK	Director, ÁNTSZ - BAZ

(2) Counterpart Team

Leader	Mr. Róbert RAKICS, KTM
Leader in Miskolc	Mr. István GAVALLÉR, Director of ÉKF
Acting leader in Miskolc	Mr. József KOVÁCS, ÉKF
Socio-economic analysis and energy supply/demand	Ms. Ágnes TIBIÁSSY, IKM
Meteorological observation	Mr. Zsolt ZÁRBOK, OMSZ
	Mr. Péter NÉMETH, OMSZ
Air quality monitoring	Mr. Ferenc NAGY, ÁNTSZ-BAZ
	Mr. Ferenc BOKROS, ÁNTSZ-BAZ
	Mr. József KOVÁCS, ÉKF
	Mr. József TROPOLAY, KHVM
Pollution source investigation	Mr. Imre SZEKERES, KHVM
	Mr. József KOVÁCS, ÉKF
	Mr. András BISZTERSZKY, ÉKF
Modeling and simulation	Dr. László BOZÓ, OMSZ
Pollution source control	Ms. Istvánné CSOKNYAI, KTM
	Mr. Róbert TÓTH, KTM
	Ms. Ágnes TIBIÁSSY, IKM
Supportive measures planning	Mr. Róbert RAKICS, KTM

CHAPTER 2

Chapter 2 SOCIAL AND ECONOMIC CONDITIONS

This chapter presents basic information concerning the social (such as population and household) and economic aspects and the energy situation of the Study Area in relation to those at the national and county levels. The dimension of the society which can be influenced by air pollution will be clarified and the general background information on causes of air pollution will be provided.

2.1 Administration, Population and Household

2.1.1 Administration

(1) Nation

The Hungarian Republic, with a two-tier system of territorial administration consisting of a national and a county level, has 19 counties and Budapest as its capital. Since October 1989, several changes have taken place in the administrative structure as compared with the previous administrative system, partly to redress the effects of overcentralization in the post-war decades. The number of local self-government units has increased and the process of urbanization has advanced. Since these trends are observable both on the County and Study Area levels, their changes on the national level are shown in Tables 2.1.1 through 2.1.3.

Table 2.1.1 Changes in the Number and Category of Communities in Hungary

	1975		1980		1990		1992	
	Number	%	Number	%	Number	%	Number	%
Urban settlements	83	2.6	96	3.1	166	5.4	177	5.7
Rural settlements	3,100	97.4	3,026	96.9	2,904	94.6	2,915	94.3
Total	3,183	100.0	3,122	100.0	3,070	100.0	3,092	100.0

Source : Ref. A-1.

Table 2.1.2 Changes in the Population Share of Urban and Rural Communities

	Budapest	Other Urban	Urban Together	Rural	Total
1960	18%	34%	52%	48%	100%
1970	19	37	56	44	100
1980	19	41	61	39	100
1990	19	43	62	38	100

Source : Ref. A-1.

Table 2.1.3 Number and Distribution of Communities by Population Size (1990)

Size-bracket	Number of Communities	% of Population
499	965	2.6
500 - 999	709	5.0
1,000 - 1,999	647	9.0
2,000 - 4,999	479	13.7
5,000 - 9,999	130	8.5
10,000 - 19,000	80	11.0
20,000 - 49,999	40	11.4
50,000 - 79,999	11	6.8
80,000 - 119,999	5	4.0
120,000 - 220,000	4	8.5
2,004,000 (Budapest)	1	19.5
Total	3,071	100.0

Source : Ref. A-1.

The average population size for all urban communities, Budapest included, was about 38,000, and for all rural communities it was about 1,350 in 1991. The aggregate population volume of urban communities decreased by 0.6 percent form 1986 to 1990, that of the rural communities by 4.0 percent during the same period.

(2) BAZ County

BAZ County, having had 7.3% of the country's total population, comprised 8.5% of the number of towns and 11.4% of the number of villages in 1992. In the County's

population the share of urban communities was 54.3% (as opposed to 62.3% in the nation) and the average population size of villages was 1,036 (1,342 nationally) in 1991. Thus the rate of urbanization is slower and the typical population size of a village is smaller, while the number of communities per 100 km^2 is larger than the national average (4.8 in the county and 3.3 nationally).

In 1992, the County had 15 towns and 333 villages, altogether 348 communities. There were 148 "local councils" in 1988, many of them being consisted of more than one villages.

Among the 333 villages, 225 have a population under 1000, and among the 225, 130 have a population under 500. In 1987, 149 communities were classified as "underdeveloped areas" and the county government introduced a long-term development project for supporting them.

(3) Study Area

The communities comprising the Study Area are shown in Table 2.1.4 according to the subdivisions of the 1990 Census (exceptions are Mezõ-csát as a "town" which was still a "village" at the time of the 1990 census and Tiszaújváros which used to be "Leninváros").

Thus the Study Area consists of 9 towns and 113 villages, altogether 122 communities, out of the totals of 15 towns and 333 villages in BAZ County. These numbers amount to 34% of the villages and 60% of the towns within BAZ County.

Table 2.1.4 The Community-Based Definition of the Study Area by the Nomenclature of the 1990 Census

Towns :	Dubicasány	Kisgyör	Sajónémeti
Miskolc	Emõd	Kistokaj	Sajóörös
Edelény	Ègerszög	kondó	Sajópálfalva
Kazincbarcika	Felsõkeleceény	Köröm	Sajópetri
Mezõcsát	Felsõnyárád	Kurityán	Sajópüspöki
Tiszaújváros	Felsõteleks	Malyi	Sajósenye
Ózd	Felsõzsolca	Mucsony	Sajószoged
Putnok	Fony	Muhi	Sajóvamos
Sajószentpéter	Gesztely	Nagybarca	Sajóvelezd
Szikszó	Girince	Nagycsécs	Sáta
Villages :	Gömörszölös	Nemesbikk	Serényfalva
Aggtelek	Hangony	Nyékládháza	Sakáld
Alacska	Harsány	Nyomár	Szalonna
Alsószuha	Hejõbába	Onga	Szendrõlád
Alsótelekes	Hejõkeresztúr	Ónod	Szirmabesenyõ
Alsõzsolca	Hejõkürt	Oszlár	Szõlõsardó
Arló	Hejõpapi	Parasznya	Szuhafõ
Arnót	Hejõszalonta	Radostyán	Szuhakálló
Bánhorváti	Hernádkak	Ragály	Szuhogy
Bánréve	Hernaádnémeti	Rudabánya	Tardona
Berzéve	Hét	Sajóbábony	Teresztenye
Boldva	Igrici	Sajóecseg	Tiszaluc
Borsodbóta	Imola	Sajógalgóc	Tiszapalkonya
Borsodszirák	Izsóofalva	Sajóhidvég	Tornakápolna
Böcs	Jákafalva	Sajóivánka	Trizs
Bükkaranyos	Jósvafõ	Sajókaza	Uppony
Bükkszentkereszt	Kánó	Sajókápolna	Vadna
Csernely	Kelemér	Sajókeresztúr	Vardó
Csokvaomány	Kesznyér	Sajólád	Zádorfalva
Dédestapolcsány	Királd	Sajólászlófalva	Ziliz
Dövény	Kiscsécs	Sajómercse	Zubogy

2.1.2 Population and Household

(1) Nation

Table 2.1.5 shows changes of the national population since 1950. Since 1980, the population has been gradually decreasing due to the decreasing birth rate and the increasing death rate.

Table 2.1.5 Time Series of National Population Statistics

	1950	1980	1985	1990	1993
Size of population *	9,293	10,709	10,599	10,375	10,311
Live birth rate **	20.9	13.9	12.3	12.1	11.7***
Death rate**	11.4	13.6	14.0	14.1	14.2***
Natural in/decrease**	9.5	0.3	-1.6	-1.9	-2.5***
Age (60 and over)	11.7%	17.1%	18.0%	18.9%	19.2%***

Note : * in thousands ** per 1000 inhabitants *** for 1992
Sources : Refs. A-1, A-3.

The number of households has been on the increase for several decades. This trend has been primarily the result of the growing number and proportion of one-person households (see Table 2.1.6) and is accompanied by the decline of the number of persons per household: 2.95 in 1970, it fell to 2.79 by 1980 and to 2.60 by 1990.

Table 2.1.6 The Number and Composition of Households
(The number is in thousands)

Type of Household	1970	1980	1990
One-family	2,515 (74%)	2,705 (73%)	2,693 (69%)
Two-or-more-families	185 (6%)	159 (4%)	100 (3%)
One-person	590 (17%)	731 (20%)	946 (24%)
Other	87 (3%)	125 (3%)	151 (4%)
Total	3,378 (100%)	3,719 (100%)	3,890 (100%)

Source : Ref. A-4

(2) BAZ County

Table 2.1.7 shows the population trends in BAZ County between 1970 and 1990.

According to January 1992 official data, BAZ Country is the second largest among the 19 counties of the Republic, both by population and territory measures: with its 753,000 inhabitants and 7,247 km^2, it had 7.3% and 7.8% of the country's population and territory, respectively. For about a decade, however, the County has had a shrinking share in a decreasing national population: 7.5% in 1980 , 7.4% in 1985, 7.3% in 1990 of the country's population.

From the early 1950s to the end of the 1970s, the Country's population grew relatively dynamically. It has been since 1980, as a function of general population and economic decline, that decrease has set in, but the county must have lost its potential to attract migrants already in the 1960s: the balance of migration turned into the minus around the mid-sixties and has remained negative ever since. From the second half of the eighties the typical size of migration-induced annual population loss has been between 4,000 - 6,000, about 60-70% of which meant outmigrants below 30 years of age. The index of the balance of the natural increase/decrease of the population for 1,000 persons is still positive, but steadily declining: it was 7.8 in 1975, 3.0 in 1980, 0.1 in 1991. In January 1991, the percentage of the 60 years and older population at 18% was somewhat below the national average of 19%, but has been growing both in absolute and relative terms.

Table 2.1.7 Population Trends in BAZ County (1970-1992)

In persons:	1970	1980	1990	1992
Resident population	779,916	809,468	761,963	749,063
Natural in/decrease *	57,707	48,901	8,474	**
Balance of migration *	-5,033	-19,349	-55,979	**
Total change *	54,613	29,552	-47,505	**
Elderly (60-X years)	111,149	119,148	132,635	135,899
In indices:				
Natural in/decrease ***	7.9	6.3	1.0	**
Balance of migration ***	-0.7	-2.5	-6.9	**
Total change ***	7.5	3.8	-5.9	**
Elderly (60-X years)(%)	14.3	14.7	17.4	18.1

Note : * inter-census in/decrements
** Next census is scheduled for 2000
*** in percents of the opening numbers of the inter-census periods
Sources : Refs. A-6, A-7.

While the number of family households has fallen in the County since 1980, the number of non-family (largely one-person) households has risen rapidly resulting in the decrease

in the number of persons per household (see Tables 2.1.8 and 2.1.9).

Table 2.1.8 Number and Composition of Households (BAZ County)

Type of Household	1970	1980	1990
One-family	182,490 (77%)	199,392 (75%)	197,640 (73%)
Two-or-more-families	14,756 (6%)	13,188 (5%)	8,614 (3%)
One-person	34,424 (14%)	46,215 (17%)	56,404 (21%)
Other	4,910 (2%)	7,583 (3%)	9,285 (3%)
Total	236,580 (100%)	266,378 (100%)	271,943 (100%)

Source : Ref. A-6.

Table 2.1.9 Changes in the Number of Persons in Households and the Size of Households (BAZ County)

	1970	1980	1990
Persons in households	750,416	780,998	743,884
Persons per household	3.17	2.93	2.72

Source : Ref. A-6.

(3) Study Area

Table 2.1.10 shows the population and household number of the Study Area, and Table 2.1.11 shows the rates of population change, comparatively, for the nation, BAZ County and the Study Area.

In 1990, the population of the Study Area at 499,024 was 65.5% of the BAZ County's population and 4.8% of the country's population.

As can be seen in Tables 2.1.10 and 2.1.11, the population is declining also in the Study Area due to migratory decrease, but not so rapidly as in the County (which is decreasing faster than the country as a whole). In result, the Study Area could even enlarge its population weight within the County.

Table 2.1.10 Population and Household Number of the Study Area and Their Shares in the County and the Nation

	Resident Population			Inter-census Pop. change 1980 - 1990		Number of Households
	1970	1980	1990	Natural	Migratory	1990
Towns Total	312,844	360,300	341,202	9,616	-28,714	124,054
Miskolc	181,398	208,103	196,442	1,487	-13,148	73,500
Other 8 Towns	131,446	152,197	144,760	8,129	-15,566	50,554
Villages Total	162,708	161,447	157,822	2,507	-6,132	54,126
Study Area Total	475,552	521,747	499,024	12,123	-34,846	178,180
Inter-census Change	-	9.7%	-4.4%			-
Share in BAZ County	61.0%	64.5%	65.5%			65.5%
Share in the Nation		4.9%	4.8%			4.6%

Source : Ref. A-6.

Table 2.1.11 Comparative Rates of Inter-census Population Change on the National, BAZ County and Study Area Levels (in %)

	1970	1980	1990
Nation	3.6	3.7	-3.1
BAZ County	7.5	3.8	-5.9
Study Area	-	9.7	-4.4

Source : Ref. A-6.

The community-specific population and household distributions within the Study Area are shown in Tables D2.1.1 (1) through D2.1.1 (4) in the Data Book.

The Study Area comprised 44% of the County's village households, 84% of its town households and 66% of all of the County's households in 1990. Regarding the natural gas supply of the Study Area, approximatively 57% of the Study Area's households had pipe-lined natural gas in March 1994, on the basis of 1990 household number and the December 1993 statistics of the Trans-Tisza Gas Supply Company Ltd.

2.2 Economy, Industry and Employment

2.2.1 National Trend and Policy

(1) Economy

The GDP declined by 14.4% between 1988 and 1991 (see Tables 2.2.1), while Gross Output dropped by 19.1% (see Table 2.2.2). These indicate that input (output minus GDP) fell by 22.3%. For the 1992 GDP, a further decrease of 4.5% was recorded, and according to preliminary estimates, the shrinking of the GDP continued also for 1993. In experts' opinion the total fall of the GDP since 1988 may have approached the 25% level by the end of fiscal year 1993.

The latest available official figure for per capita GDP is USD2,982 for 1991 according to Central Statistical Office calculations (based on current prices).

Table 2.2.3 shows long-range indices of GDP.

Table 2.2.1 Gross Domestic Product by Industries at Constant Prices
(In million HUF)

	1988	1989	1990	1991	1992
Gross Domestic Product	1,448,213	1,458,878	1,407,866	1,240,442	1,187,103*
Material industries	1,004,501	1,006,823	948,417	822,842	
Mining, electr., manu.	430,756	422,260	389,804	320,113	
Construction	102,846	111,370	86,996	73,956	
Agriculture	200,529	198,017	188,849	173,581	
Forestry	9,624	9,601	9,094	8,091	
Transport, post&telecom.	101,632	108,621	100,655	89,153	
Trade	128,008	126,301	141,165	129,387	
Water works and supply	17,273	17,053	16,219	13,545	
Non-material industries	266,306	273,577	283,476	277,383	
Net taxes on products	177,406	178,478	175,973	140,237	

Note : * Estimated
Source : Ref. A-10

Table 2.2.2 Gross Output by Industries at Constant Prices
(In billion HUF)

	1980	1985	1988	1988*	1989	1990	1991
Gross Output	1,992	2,218	2,373	3,466	3,460	3,269	2,808
Material industries	1,711	1,906	2,023	2,790	2,784	2,577	2,170
Mining, electr., manufac.	990	1,095	1,152	1,545	1,532	1,400	1,134
Construction	143	136	143	233	250	197	163
Agriculture	317	369	390	509	491	450	387
Forestry	15	18	21	25	25	24	21
Transport, post & telecomm.	104	120	133	184	191	175	150
Trade	113	131	138	234	234	269	257
Water works and supply	19	23	25	35	34	31	26
Non-material industries	200	241	268	498	498	516	498
Net taxes on products	81	71	83	177	179	176	140

Note : * The System of National Accounts changed its price-base in 1988.
Source : Ref. A-10.

Table 2.2.3 Long-range Volume Indices of Gross Domestic Product
(1960 = 100, at constant prices)

Year	GDP	Industry's contribu-tion	Domestic use of GDP	Final consumption	Individ. consump.	Gross capital formation	Fixed cap. form.
1960	100	100	100	100	100	100	100
1970	168	190	170	159	155	201	219
1980	267	331	251	232	223	306	342
1988	308	376	263	257	242	275	309
1989	309	368	265	259	248	275	325
1990	299	340	257	252	239	253	297
1991	263	279	234	239	225	210	276
1992	251	*	*	234	220	163	254

Note : * Figures missing due to differences in the categorial breakdown of the sources.
Sources : Refs. A-1, A-10.

The trend of Material and Energy Intensity (MEI) of production (the relative share of the materials and energy used for producing one unit of GDP's gross value) is shown in Table 2.2.4.

Table 2.2.4 Specific Materials and Energy Intensities of GDP
(At current and 1988 prices)

	1988	1989	1990	1991
At current prices	61.5	60.4	60.1	59.5
At 1988 prices	61.4	61.0	60.2	58.8

Source : Ref. A-11.

It is apparent from the table that MEI figures indicate some, but insufficient improvement over those years.

From the economic indices presented above, the overall degree of the ongoing economic crisis can be inferred. The major factors for the crisis can be pointed out as follows:

- the collapse of the former COMECON market on which the Hungarian exports depended up to 60-70%.
- the world-wide recession on other traditional markets
- the long past neglect of production and infrastructural development
- the acute shortage of domestic capital aggravated by an international debt burden (US$23.8 billion in August 1993), a surging deficit of the state budget (almost HUF 330 billion in the 1994 budget plan), and by the accelerating impoverishment of the population (net monthly average income at HUF 15,000, the equivalent of about US$170 in 1992)

The government's policies for institutional restructuring of the economy have been aiming at developing a "social market economy". The process on the one hand implies the decomposition of many of the controls the government had over the economy, on the other hand it necessitates the simultaneous guidance of reconstructing and privatizing the national economy.

The government's explicit and active privatization policy was announced in February 1991, in its Program for Economic Reconstruction. According to the program, state-ownership in the productive property of the economy should be reduced below 50% within three years, while the share of foreign ownership thereof should be increased up to 20-30%. With these targets in view, privatization intensified from the spring of 1991. Officials in charge envisaged that 80% of the (former) state-run economy would be transferred into private ownership by 1995 .

According to expert estimates, about one third of the GDP was produced by private entrepreneurs by the middle of 1992, the GDP share of the private sector rose to about 40% until the end of the same year, and the ratio approached 50% by the end of 1993 (with the private sector employing about half of the workforce, too).

(2) Industry

The change in the industry's relative weight in the economy is shown in Table 2.2.5.

Compared to 1985, the relative contribution of industry as a whole to the GDP fell until the end of 1992 by about 10 points, to the level of 27-28%.

Table 2.2.5 Long-term Trends in the GDP Share of Industry
(At basic prices; GDP total = 100 %)

	1970	1975	1980	1985	1988	1989	1990	1991	1992
Percentage	38.6	40.7	37.7	37.8	34.1	34.2	31.1	30.4	28*

Note : * Estimated on the basis of the 1992/1991 % index published in Ref. A-1.
Source : Ref. A-11.

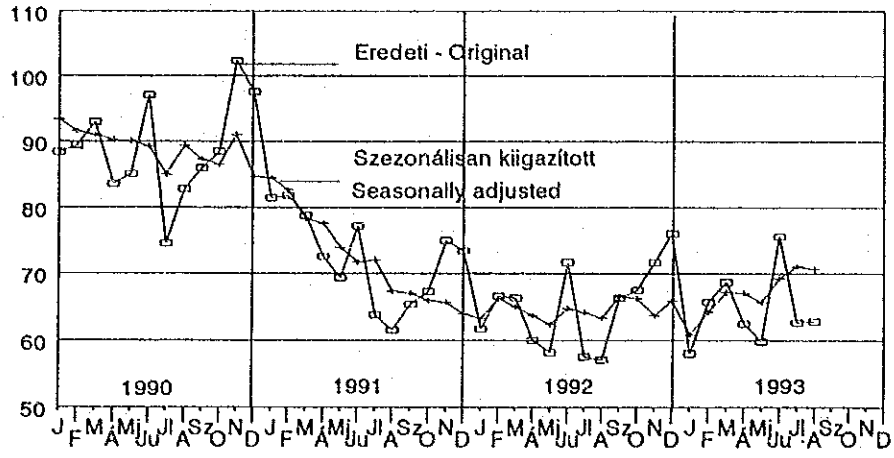
The long-range trends in the internal development of industry are observable in Table 2.2.6.

Table 2.2.6 Long-term Comprehensive Indices of Industrial Development
(1980 = 100.0)

	Production		Sales		
	total volume	per employee	total	domestic	export
1970	62.1	59.3	63.7	69.9	46.6
1980	100.0	100.0	100.0	100.0	100.0
1985	109.3	117.7	108.1	104.4	121.5
1988	114.8	131.1	112.7	108.0	130.3
1989	112.4	130.5	108.3	102.0	131.2
1990	100.9	124.0	98.0	95.1	109.6
1991	84.2	116.3	80.5	79.3	85.6
1992	75.9	120.7	75.3	73.7	82.3

Source : Ref. A-1.

The volume index of industrial output in the 1990-1993 period calculated on the base-line of 1985 monthly average as 100 is shown in Figure 2.2.1.



Source: Ref. A-13.

Figure 2.2.1 Volume Index of Industrial Output (1985 monthly average = 100.0)

Table 2.2.7 shows the change in the branch structure of industrial production between 1985 and 1992, and Table 2.2.8 shows the yearly change of the production index of selected branches during latest several years.

Table 2.2.7 The Branch Structure of Industrial Production
(Percentage, at 1985 constant prices)

	1985	1992
Mining	7.3 %	7.3 %
Electricity supply	5.6	8.6
Manuf./basic metals and casting	8.2	5.7
Manuf./machinery and equipment	24.1	16.5
Manuf./building materials	3.1	2.9
Manuf./chemicals	20.9	24.5
Light industry	13.0	11.3
Food industry	16.8	22.7
Other industries	1.0	0.5
Total	100.0	100.0

Source : Ref. A-1.

Table 2.2.8 Trends of Production in Selected Branches of Industry (1987 = 100.0)

	1987	1988	1989	1990	1991	1992
Mining	100.0	96.3	91.3	80.5	71.7	58.0
Electricity supply	100.0	101.1	102.3	102.5	94.3	83.5
Manuf./basic metals&casting	100.0	104.3	108.9	88.2	59.4	43.8
Manuf./machinery&equipment	100.0	100.0	100.2	84.0	54.7	40.0
Manuf./building materials	100.0	101.6	100.0	95.0	63.7	55.0
Manuf./chemicals	100.0	101.3	97.3	92.0	75.0	64.8

Source : Ref. A-16.

In Table 2.2.8, those branches of industry which are of critical importance in the Study Area are represented.

In the 1989-91 period, the heavy decline of production was even more pronounced in industry than in the economy as a whole. Gross industrial production in 1992 was at 66% of the 1988 level (see Table 2.2.6) and some branches of industry, like metallurgy and machinery, matched less than 50% of that (see Table 2.2.8).

Decline decelerated, however, in 1992 as observable in Figure 2.2.1. The volume of industrial production was 9.8% below the 1991 figure (see Table 2.2.6), but this decline was only half of the decrease of the preceding year. While output during 1992 more or less stagnated at the 1991 year-end level, it seems to have left that bottom-line, and since January 1993 even some signs of a slight growth have appeared. Based on the preliminary data of the Central Statistical Office, i.e. 3.4% growth in the first three quarters of 1993, experts suppose that industry closed the year with 3.7% growth. At the same time, it must be added that the upward trend may be rather fragile, since production exceeded total sales, exports further decreased, and the rise in output indices is backed for a large part only by domestic sales insufficient for sustained growth.

By macro-diagnoses of the state of industry, various branches are classified into 4 groups: 1) those worstly hit by the crisis; 2) those the decline was not so bad as in the group 1), but conditions are still rather precarious; 3) those the decline was around the average; and 4) those the decline has been less than the average level. The four groups of industry by their relative decline-levels are as follows:

1) 1992 first-half output ranged around 20-40% of that for 1985:

Manufacture of transport equipment
Manufacture of instruments and appliances
Manufacture of fertilizers and plant-protecting agents
Textiles
Manufacture of leather, fur and footwear

2) 1992 first-half output ranged around 30-55% of that for 1985:

Coal mining
Manufacture and casting of basic iron and steel
Manufacture of machinery and equipment
Manufacture of electrical machines and appliances
Pharmaceutical industry
Textile clothing

3) 1992 first-half output ranged around 50-70% of that for 1985

Manufacture and casting of aluminum
Iron and metal ware production
Manufacture of building materials
Manufacture of organic and inorganic chemical products
Printing

4) 1992 first-half output ranged around 75-90% of that for 1985

Crude oil and natural gas mining
Electricity supply
Crude oil processing
Production and distribution of gas
Manufacture of paper products
Timber processing
Food industry

The relative weights of the groups in total industrial output were about 20% , 20% , 15% , and 45% , respectively.

The Ministry for Trade and Industry (IKM), in charge of about 70% of the Hungarian economy, envisages that by 1995 the following branches may successfully emerge from

the present acute crisis:

- Manufacture of tools and equipment for small companies in the food industry and for bio-technology
- Car manufacturing
- Engineering and manufactureing of certain household appliances
- Industries related to environmental protection
- Pharmaceutical industry
- Processing of synthetic materials
- Printing
- Construction
- Manufacture of building materials
- Textile clothing

On the other hand, shrinking will continue until 1995 or even beyond in the following, largely loss-making, sub-branches:

- Coal mining
- Manufacture of basic metals (metallurgy)
- Casting (metallurgy)
- Textiles
- Manufacture of leather and footwear
- Timber processing

It is evident that these schemes have fairly direct regional implications, also for BAZ County and for the Study Area, in particular.

Along with managing the crisis of industry, IKM is currently engaged in the various programs including the following high-priority programs:

- coupled consolidation of industrial debtors and creditor banks
- promoting various schemes of privatization
- enterprise reorganization programs of the State Property Agency
- guiding infrastructural development
- stimulating exports
- interfacing relevant processes of European integration
- enhancing foreign capital investment
- up-dating research and development activities
- restricting material- and energy-intensive production

Partly as a result of related policies, the structure of industry has considerably changed as exemplified by the following:

- The groundwork for the legal and institutional system of a market economy has been laid down also in industry.
- In the second half of 1993, the Employee Share Ownership and Management Buy Out types of privatization accelerated.
- Material- and energy-intensity, though not sufficiently, has been reduced.
- Five hundred enterprises have been involved in the Ministry's export drive application program.
- By the end of 1992, 2,865 foreign affiliated joint companies were established in industry; 22% of all the joint companies in Hungary were established in the past few years (62% of all foreign capital investment went into processing industries).
- Energy-dependency, particularly on the former Soviet Union, has been somewhat eased.

One major field of concerns of IKM with high priority has been the regional development. Since 1990, the government has paid special attention to those regions in which the consequences of economic and social crises were most concentrated, to BAZ County among them. Schedules for framing up various policies were established, but the most critical government decisions about the future of the region's industry were still pending in February 1994.

(3) Employment, Incomes and Inflation

In postwar times, the economically active population was the largest in 1977 at 5,777,000, and this figure declined until 1992 by 10% to 5,200,000, its lowest value since 1971 (Refs. A-10, A-11).

The long-term trend of the labour force distribution over the various economic branches is shown in Table 2.2.9, and the employment trends in selected branches of industry in the latest several years are summarized in Table 2.2.10. These trends clearly reflect overall economic changes in the country.

Table 2.2.9 Long-term Trends of Employment in Branches of the Economy (1976-92, in percentage)

	1976	1981	1989	1991	1992
Industry	35.0	32.9	30.4	29.7	28.9
Construction	8.3	7.8	7.0	7.0	6.4
Agriculture, forestry	21.3	21.1	18.4	16.1	16.2
Transport, post & telecommunication	7.9	8.0	8.3	9.0	8.8
Trade	9.2	9.8	10.8	12.0	13.3
Water supply	1.4	1.5	1.6	1.4	1.4
Other material branches	0.8	0.9	0.9	0.9	1.0
Material branches total	83.9	82.0	77.4	76.1	76.0
Non-material branches	16.1	18.0	22.6	23.9	24.0
Total	100.0	100.0	100.0	100.0	100.0

Source : Calculated from Refs. A-1, A-2.

Table 2.2.10 Trends of Employment in Selected Branches of Industry (1980 = 100)

	1988	1989	1990	1991	1992
Mining	89.2	82.1	68.3	57.2	39.6
Electricity supply	112.8	111.6	117.2	109.3	104.2
Metallurgy	87.7	80.6	70.7	58.0	45.5
Manufacture of machinery	87.1	85.9	81.9	70.0	48.3
Manufact. of build. materials	84.4	82.9	81.3	73.8	53.5
Manufacture of chemicals	99.4	101.7	101.2	95.6	93.6
Industry total	87.6	86.1	81.4	70.8	65.9

Source : Calculated from Refs. A-1, A-2.

Major trends of unemployment are shown in Tables 2.2.11 and 2.2.12.

Table 2.2.11 Registered Unemployment

	1989	1990	1991	1992
Unemployed registered	28,490	79,521	406,124	663,027
Manual / skilled	nd	21,875	135,661	232,243
semi-skilled	nd	17,316	97,148	154,857
unskilled	nd	24,384	105,810	167,063
Non-manual	nd	15,946	67,505	108,864
Rate of unemployment %	0.7	1.7	8.5	12.3
Recipients of unempl.benefit (thousands)	7.9	61.7	312.1	477.0

Note : nd = no data
Source : Ref. A-17. (The National Labour Center's data at the end of the year)

Table 2.2.12 Registered Unemployed Eligible for Benefit and Vacancies

	1990	1991	1992
Registered unemployed eligible for benefit	32,498	144,840	477,987
Registered vacancies	34,048	13,583	15,124
Unemployed per vacancies	1	11	31

Source : Ref. A-17 (The National Labour Center's data at the end of the first quarter)

At the end of 1992, 477,000 persons were eligible for unemployment benefit, and additional 42,000 received welfare benefits for not being entitled any more to receive the unemployment benefit. In the first quarter of 1992 the average unemployment period was 28 weeks, by the end of the same year it increased to 38 weeks, while the average number of reported vacancies for 100 unemployed fell to 3.6 and the average sum of benefit per recipient was HUF 8,814 for a month (about US$ 111 at that time, when the official minimum subsistence level for a two-adults-two-children urban household was HUF 39,066 or US$ 495). Income and price conditions further aggravated the financial situation even for those regularly employed. Some of the key-trends are shown in Table 2.2.13.

Table 2.2.13 Trends in Income and Price Conditions

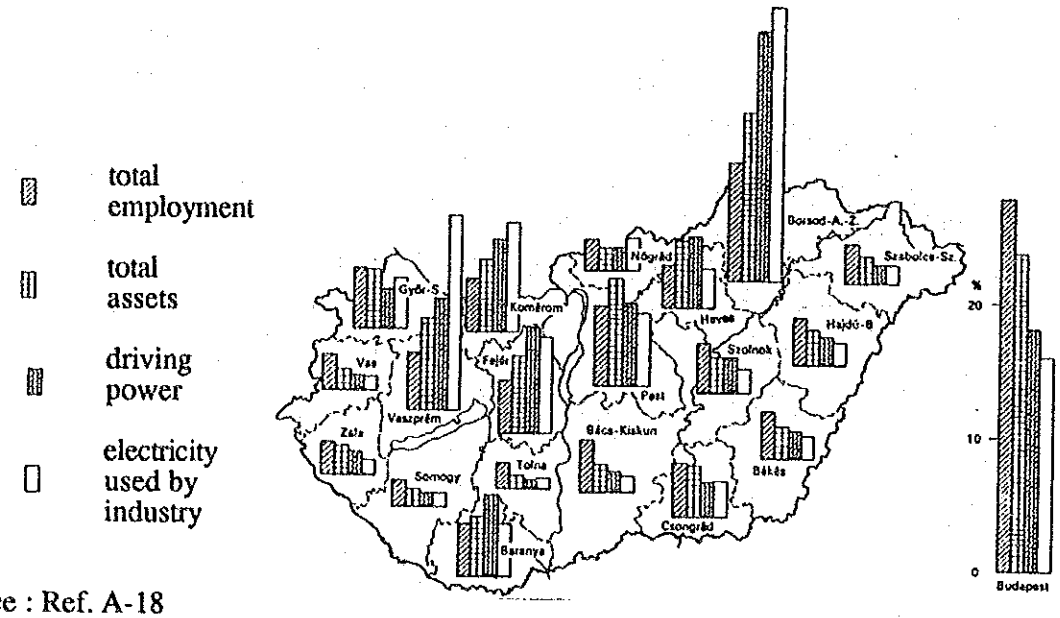
	1980	1985	1989	1990	1991	1992
Total per capita income (1980 = 100.0)	100.0	108.8	114.8	113.1	109.0	106.9
Annual growth rate of individual consumption (% at constant prices)	0.6	1.7	2.7	-3.3	-5.6	no data
Consumer price index (previous year = 100.0)	109.1	107.0	117.0	128.9	135.0	123.0

Source : Ref. A-1.

2.2.2 Trends in Borsod-Abaúj-Zemplén County

(1) Intra-national and Inter-regional Comparisons

Economy, industry and employment are markedly different between by regions. BAZ County is the most industrialized county in Hungary after Budapest and its metropolitan area: in the end of the 1980's more than 10% of the national industrial output was produced in the County, its share in the national labour force was above 9%, and 11-23% of the national stock of fixed capital in various branches of industry was operated there. (See. Figure 2.2.2.)



Source : Ref. A-18

Figure 2.2.2 The Territorial Distribution of Hungarian Industry by Counties in the Second Half of the 1980's

While the Hungarian economy depended on Comecon markets for its external trade by 60-70% in general, the BAZ County's dependency amounted to about 90%. As a consequence, the County's mostly industrial economy was among the ones worst hit by the sudden collapse of Comecon trade in the end of the 1980's, and the County has become one of the most critical regions in the territorial structure of the national economy.

The industrial organizations in the County produced less by 30% (at constant prices) in the first half of 1992 than a year before (when they had already a sharp drop in their output from the end of the 1980's on). The outputs in the worst hit branches of metallurgy, machinery manufacturing, and chemical industry were lower by 70%, 50% and 27%, respectively, than in the first half of 1991. The number of firms with 300 or more employees was down by 20% only in 1992. In 1992, 411 or 15% of the total of 2,785 economic organizations with legal entity within the County was under liquidation, bankruptcy or final clearance procedure, while the County rate of unemployment exceeded 20% by September 1993.

Tables 2.2.14 and 2.2.15 show placement of the County's economic, industrial and employment conditions in intra-national and inter-county comparisons, respectively.

Table 2.2.14 Long-term Trends in BAZ County's Intra-national Placement (BAZ County economy, industry and employment data as percentages of national totals)

	1980	1985	1990	1991	1992
Population	7.5	7.4	7.3	7.3	7.2
Economy					
Capital investments:					
Mining, electr., manufac.	9.4	9.8	9.3	8.5	9.6
Construction	7.1	2.5	1.9	1.4	2.3
Agriculture, forestry	4.7	4.6	4.7	4.5	7.3
Transport, post&telecom.	4.1	4.6	4.9	4.2	5.0
Trade	4.3	3.1	3.8	4.1	-
Water supply	6.3	7.4	5.9	5.8	-
Other material branches	1.1	3.4	2.9	8.7	-
Material branches total	6.9	7.3	6.8	6.3	-
Non-material branches	5.6	5.7	4.4	3.8	-
Capital investments total	6.6	7.0	6.3	5.7	6.1
Capit.invest per capita (nation=100)	-	-		78	84
Industry					
Gross value of fixed assets	14.1	12.4	10.8	10.0	9.5
Gross value of fixed assets per capita of employment (nation=100)		-	-	138	105
Gross value of production					
machinery	-	-	-	11.2	11.3
brown coal	36.2	30.8	28.0	26.3	27.6
iron ore, crude	100.0	100.0	-	-	-
electric energy	29.5	25.0	12.3	11.5	13.8
pig iron	63.3	65.4	48.5	32.9	21.9
crude steel	61.0	59.7	52.1	34.9	21.3
rolled steel	60.0	59.4	44.5	30.8	16.0
propilen	100.0	77.8	68.5	73.5	71.3
artificial fertilizer	26.9	28.6	40.3	24.5	13.0
Employment					
In the economy					
Number of employees	-	7.9	7.6	7.4	6.6
Average gross monthly earnings (national=100)	-	98	94	93	90
Unemployed (January)	-	-	16	14	12
In industry					
Number of employees	9.1	9.3	9.1	8.8	8.7
Joint companies					
Number	-	-	1.9	1.8	1.9
Foreign capital investment	-	-	4.2	3.7	3.1

Note : The sign "-" in the table indicates missing data in the sources.

Sources : Refs. A-1, A-7, A-8.

Table 2.2.15 Inter-county Comparison of Some Major Economic Indices

County	A	B*	C	D* Unemployment in June 1992		E
	Private entre-preneurs per 1000 inhabit-ants, 1991	Profit-ability of firms 1991 (HUF)	Personal income tax per inhab-itants, 1991 (HUF)	Unem-ployed (%)	Unem-ployed over 6 months (%)	Number of cars per 1000 in-habitants, end of 1990
Szabolcs-Sz.	31	-1.42	8,322	20.5	11.2	164
Nógrád	32	-2.31	10,795	18.2	11.0	198
Borsod-A-Z	27	-3.38	11,948	17.9	9.5	164
Jász-Nk-Sz	32	-0.94	11,399	15.9	8.0	183
Bács-Kiskun	39	-0.80	10,433	14.7	8.0	261
Békés	39	-0.80	10,433	14.7	8.0	261
Heves	36	-2.11	11,099	13.8	7.3	215
Hajdú-Bihar	31	0.30	11,736	13.6	5.5	174
Komárom-Eszt.	41	0.36	15,700	13.5	5.7	225
Tolna	37	2.25	13,037	13.3	7.2	240
Fejér	43	-0.41	15,992	11.9	5.2	209
Baranya	40	0.31	13,059	12.9	6.4	235
Veszprém	41	-1.67	14,144	10.8	5.4	223
Csongrád	41	0.27	13,314	11.0	5.7	242
Somogy	43	-0.61	11,007	10.1	4.5	229
Pest	41	0.12	14,569	9.4	4.2	205
Zala	41	0.77	13,059	8.5	3.9	230
Vas	37	-2.09	12,570	8.1	3.1	211
Győr-M-S	43	0.47	13,274	7.6	3.5	224
Budapest	47	2.64	29,109	5.9	2.0	235

Note : B - the profits of firms in HUF per HUF 100 of net price-income in 1991.
D - the rate of unemployment relates the number of unemployed to that of those in economically active age.

Source: Ref. A-19.

It is evident from Table 2.2.15 that BAZ County is one of the three most handicapped counties (all in the North-East) and in the most disadvantaged position in the first two indicators.

(2) Trends Within the County

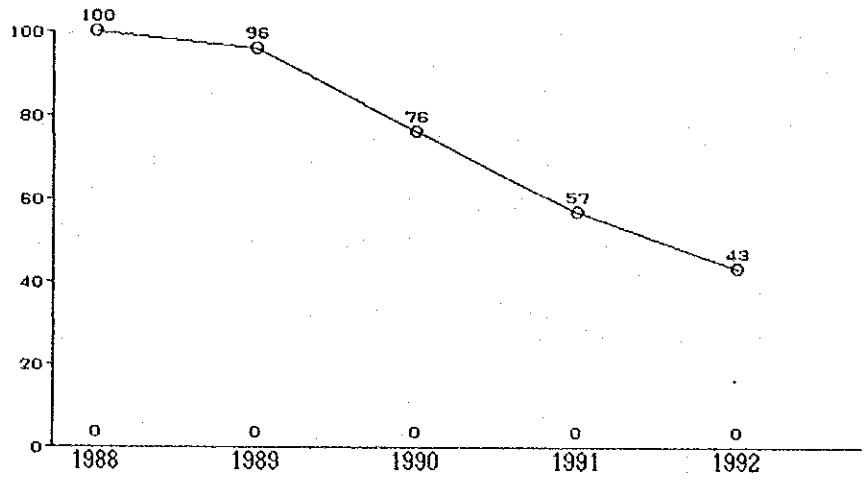
1) Industry

Industrial production trends in BAZ County are shown in Table 2.2.16 and Figure 2.2.3, and Table 2.2.17 and Figure 2.2.4.

Table 2.2.16 Long-term Indices of Industrial Production in BAZ County

	1985	1990	1989	1990	1991	1992
	in % of 1980	in % of 1985	in per cent of 1988			
Mining	82	71	100	78	68	68
Electricity supply	105	74	96	85	85	77
Metallurgy	91	59	91	64	33	12
Manufact./machinery	117	48	85	58	38	21
Manufact./chemicals	126	89	104	83	72	59
Building materials	87	91	94	88	55	43
Total	103	72	96	76	57	43

Sources : Refs. A-8, A-9.



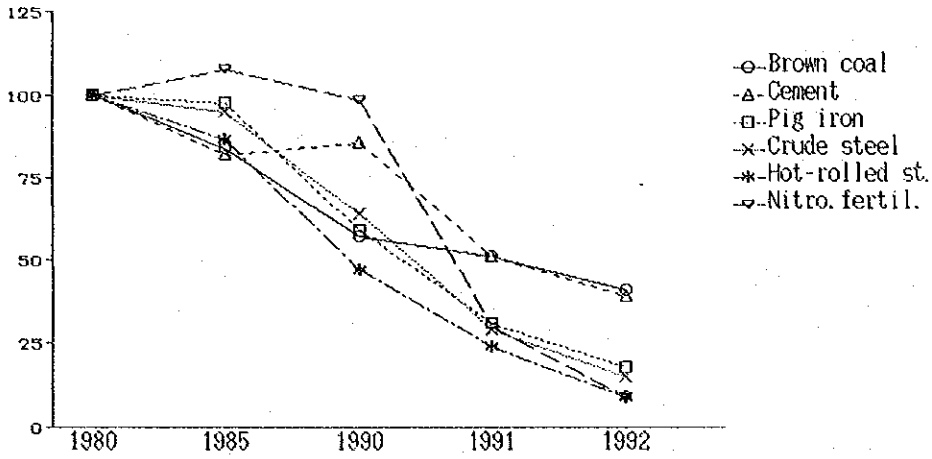
Source : Ref. A-9

Figure 2.2.3 The Change of Industrial Production in BAZ County (1988 = 100)

Table 2.2.17 Change in the Output of Some Major Industrial Products (1980 = 100)

Product / year	1980	1985	1990	1991	1992
Brown coal	100	84	57	51	41
Cement	100	82	86	51	39
Pig iron	100	98	59	31	18
Crude steel	100	95	64	29	15
Hot-rolled steel	100	87	47	24	9
Nitrogen fertilizer (20.5%)	100	108	99	30	9

Source : Ref. A-7.



Source : Ref. A-7.

Figure 2.2.4 Change in the Output of Some Major Industrial Products (1980 = 100)

The fall of production in the County's industry in the years 1990-92 was drastic even in its comparison to the national economy's average decline as shown in Table 2.2.18.

Table 2.2.18 County and National Level Decline in Industrial Production and Employment, 1990-1992 (1985 = 100.0)

	1985	1990	1991	1992
Production				
BAZ County	100.0	72.4	54.6	41.4
National economy*	100.0	94.6	81.3	67.3
Employees				
BAZ County	100.0	83.0	71.9	60.0
National economy	100.0	87.6	78.0	67.8
Production per employee				
BAZ County	100.0	87.2	75.9	69.6
National economy*	100.0	108.0	104.2	99.3

Note : * Based on Gross Output

Source : Refs. A-1, A-7.

2) Employment

Table 2.2.19 describes the main patterns in the distribution of the labour force in BAZ County over the material branches of the economy.

Table 2.2.19 Employment Trends in the Material Branches of the Economy in BAZ County

	1980	1985	1989	1990	1991	1992
Industry	146,809	139,731	123,306	116,310	101,421	86,891
Construction	23,935	17,543	15,493	15,122	12,743	8,260
Agriculture	56,930	63,203	48,329	39,993	26,941	15,227
Transport communcat.	28,538	28,207	26,757	26,081	24,631	21,029
Trade	28,878	27,863	25,496	24,113	21,794	16,304
Other material branches	5,800	8,306	7,919	7,476	6,144	5,340
Material branches total	290,890	284,853	247,750	229,095	193,674	149,959

Source : Ref. A-7.

One of the most pressing economic and social concerns in today's BAZ County is certainly that of unemployment. The recent figures are presented in Table 2.2.20.

Table 2.2.20 Trends of Unemployment in BAZ County (In each year's January)

	1990	1991	1992	1993
Number of reported vacancies		400	322	1,847
Number of registered unemployed	3 900	14,011	50,757	75,873
Number of unemployed per vacancy		35	158	41
Rate of unemployment	1.1	3.9	13.1	20.3
Inter-county rank-order of BAZ in the intensity of unemployment	-	3	4	3

Source : Ref. A-7.

3) Latest Trends

The statistical evidence cited above clearly demonstrates the continuing trend of recession in the County's economy in general, and in its industry in particular for 1992. The number of economic organizations increased (those with legal entity surpassed the figure 2,900 at the end of the year), but 411 organizations, about 14% of the total, went bankrupt (more than half of it in industry and construction), unemployment increased and living standards further declined.

Industrial production fell by appr. 24% in 1992 at constant prices in comparison to 1991. Within industry, metallurgical production declined by 63%, the manufacturing of machinery by 46%, nitrogen-fertilizer output by more than 67% as compared to 1991.

Exports increased somewhat, but 78% of all the price-incomes were due to domestic sales; 75% of foreign sales were realized in the chemical industry. Total sales were down by 22% (see Table 2.2.21) at constant prices, and 80% of all the sales was realized in the chemical, electricity and food industries (37, 26 and 17%, respectively).

Table 2.2.21 Indices of Sales in Branches of BAZ County Industry, 1992 (in percentage of 1991)

	Output	Total sales	Export sales
Mining	99	104	--
Electricity supply	90	92	--
Metallurgy	37	37	64
Manufact./machinery	54	57	67
Manufact./chemicals	82	86	105
Building materials	79	84	100
Industry total	76	78	94

Source : Ref. A-7.

The number of those employed in the County fell by 24% in 1992. By the end of the year the volume of unemployment passed the 72,000 level, and the rate of unemployment stood at 19% (by 51% higher than the national average). The money income of the County's population was up 15%, but considering the 23% rate of simultaneous inflation, the resulting net change was 8% decrease in real value.

The latest, preliminary data for 1993 suggest that the trend of economic and industrial decline has slightly decelerated in 1993. While total industrial production declined by 24% in 1992 as compared to that of 1991, the percentage of decrease in the first half of 1993 was only 5% in comparison to the first half of 1992. Likewise, total sales in industry were down in 1992 by 22% compared to those in 1991, but the drop in the first half of 1993 was not more than 6% when compared to the first half of 1992. Finally, industrial employment fell by 14% from 1991 to 1992, while the drop in the first half of 1993 was only 9% as compared with the first half year level of 1992. (The source of the data just quoted on the first half of 1993 is Ref. A-3, the STADAT on-line data-base system of the Central Statistical Office.)

Though the latter data are officially not yet fully approved and refer only to the first half year of 1993, and government policies for restructuring the County's heavy industry may cause further decline in industrial production and employment in 1994, it is not entirely

out of the emerging pattern to expect that industrial erosion may have reached its bottom-line in BAZ County by 1992.

2.2.3 Economic Geography of the Study Area

The foregoing county-level statistics well approximate the industrial conditions of the Study Area, since about 90% of the County's industry is located in the Sajó Valley. Still, there are some specific features of the economic geography in the Study Area. The most authoritative manual of Hungarian economic geography offers the following general description.

> "The Sajó valley agglomeration is the country's largest industrial concentration, outside the Budapest agglomeration, and comprises industrial centres and satellite and dormitory towns alike. Its focus is Miskolc, which is a regional centre and [until end of the 1980's] the second largest town of the country ... [now it is the third one after Budapest and Debrecen]. It developed as one of the market towns on the fringe of the Northern Mountain range [and of the Great Plains], while nearby Diósgyõr was built as a typical company town during the 19th century. Later the two settlements completely coalesced. Favourable communications in the foreground of the Sajó area and nearby raw materials promoted the industrialization of the city. Until quite recently, the city had a neglected look about it, but extensive development has gone a long way towards remedying this. A great problem for further development, however, is its location in a long valley, which has prevented transverse expansion. As a result, expansion has tended to be concentrated in the mouth of the valley. It has been a primary task of urban development to strengthen both the industrial and general urban functions of the city, and its importance in the commerce of the region is now greater than before. At the same time it has also become a significant centre of higher education with its technical university, and a cultural, health and tourist centre. It has absorbed such recreational and resort places as Lillafüred along with adjacent areas of the Bükk Mountains and Miskolc-Tapolca-Fürdõ. Kazincbarcika is a satellite town of the agglomeration north of Miskolc, and these two towns together along with the other settlements of the Sajó valley, now constitute a kind of conurbation. Kazincbarcika has grown out of the amalgamation of a few minor settlements to which have been added modern urban districts ... It is the centre of coal-mining in the Sajó valley as well as serving a highly important role in the chemical industry. Leninváros [now: Tiszaújváros] ... is an other satellite town of Miskolc, and is the centre of olefin chemistry ... the prime function of both satellite towns is industrial. The centre of a minor industrial concentration in the northern part of the Sajó valley is Ózd ... The town itself originated as a company town, and came about as a result of development of metallurgical activities and coal mining in the surrounding area. With the construction of

several new housing estates and the creation of new urban functions, it has undergone a rapid transformation." (Ref. A-18, PP. 373-374)

Though the authors did not envisage in their text the crisis visiting the region from the end of the 1980's, it is an observation of continuing validity that the industries of the Sajó Valley, based on natural resources, endowments and traditions, are in a basic complementarity with the agricultural potential of the adjacent sub-regions of the Great Plains providing an economic interface for developing an inter-regional division of labour. The industrial complex to the north and the agricultural one to the south, both poorly equipped for the economic functions of the other, are in a fundamental complementarity, with Miskolc and its environs providing a natural area for marketing and exchanging mutually needed products and services.

2.3 Energy Situation

2.3.1 National Energy Policy

The Hungarian administration propounded its energy policies in an extended and updated version in its report on "The Hungarian Energy Policy" in 1992 (Ref. A-20) and submitted it to the Parliament of the Republic. The following is based primarily on that document.

The Government's energy policy emphasizes the following strategic guidelines:

(1) diversification of energy resources
(2) protection of the environment
(3) conservation of energy and the improvement of efficiency
(4) publicity, social acceptance and training
(5) flexible system development

(1) Diversification of Energy Resources

In contrast to the decades of former Soviet dominance when energy policy was dictated on the promise of ever expanding energy imports from the Soviet Union, the explicit main goal of current energy policies is to reduce and possibly to eliminate the country's unilateral import dependency. This requirement entails also the profitable exploitation of domestic energy sources, partly through the proper application of new concession and mining laws, as well as through establishing organizational links between mines and power stations. (The Coal Mining Restructuring Centre has been facilitating the process ever since.) The reduction of unilateral import dependency is particularly stressed in respect to energy carriers supplied through pipeline or grid. In 1991 Hungary's oil consumption was close to 8 Mt, and imports - the balance of imports and exports - had a share of over 60% in the total demand for oil. The political and price risk factors, both in the case of the CIS and in that of the former Yugoslavia, the potential emergence of new transit tariffs, etc. urge to explore additional options, e.g., by joining West European pipeline systems. Existing crude oil pipeline system is shown in Figure 2.3.1.

Much the same goes for natural gas. Existing natural gas pipeline system is shown in Figure 2.3.2. Its consumption in 1991 was 11 billion m^3/yr and more than half of it was supplied from territories of the former Soviet Union. Future rigorous prescriptions for environmental protection can result in a 10-15% rise in the demand for it by the turn of the century. Diversification strategies have practically two options: to join the northern

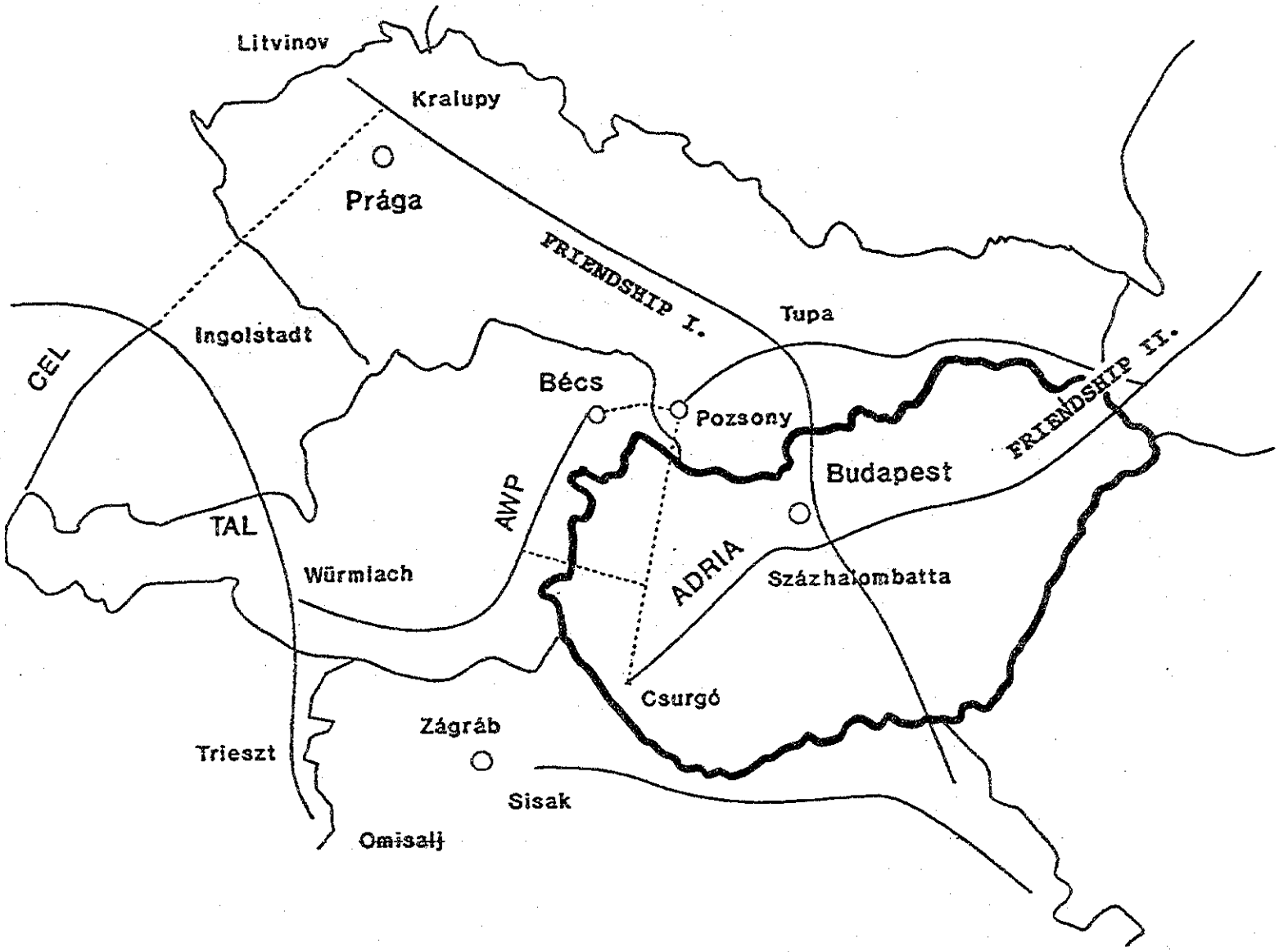


Figure 2.3.1 Connecting Opportunities for Hungarian Crude Oil Pipeline

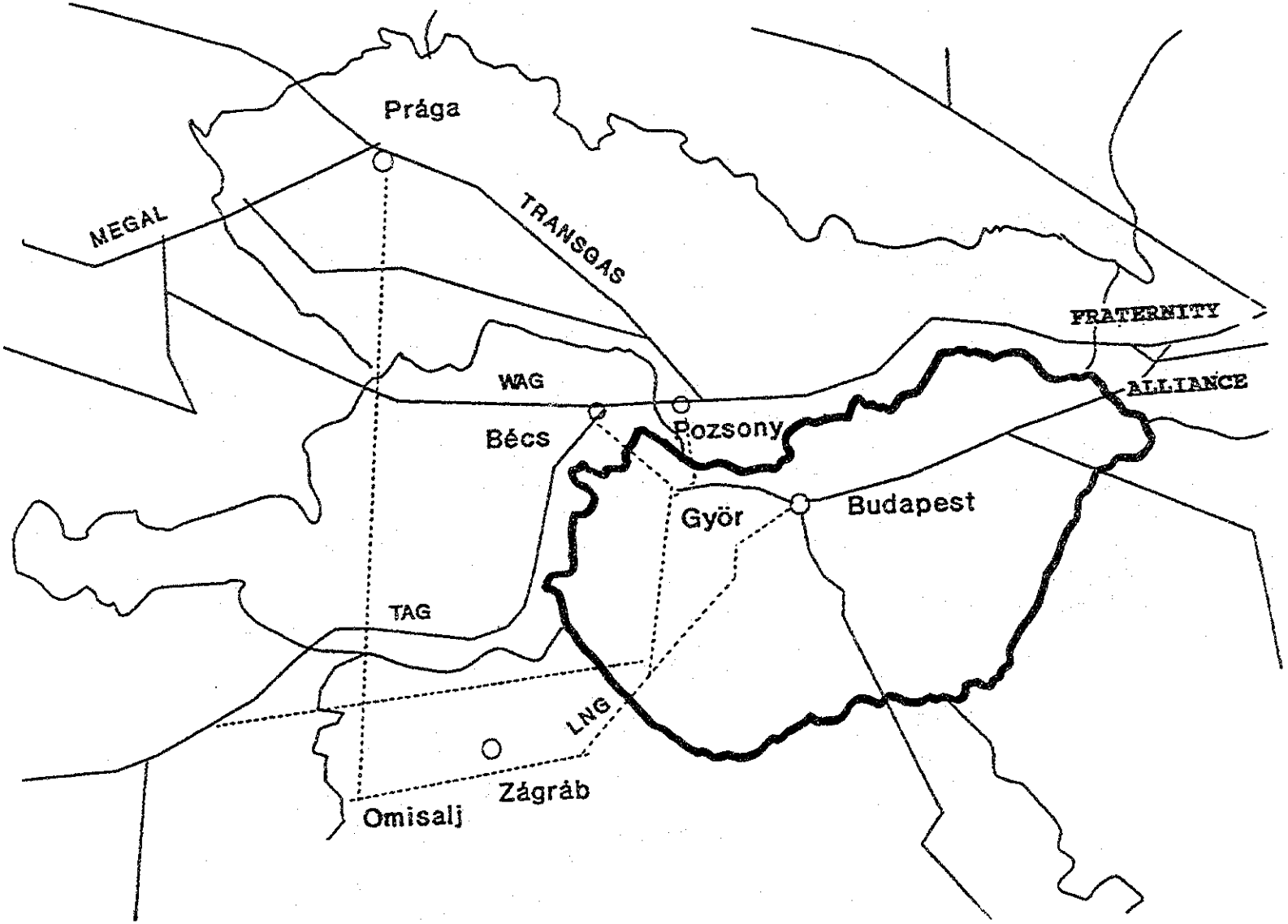


Figure 2.3.2 Connecting Opportunities for Hungarian Natural Gas Pipeline

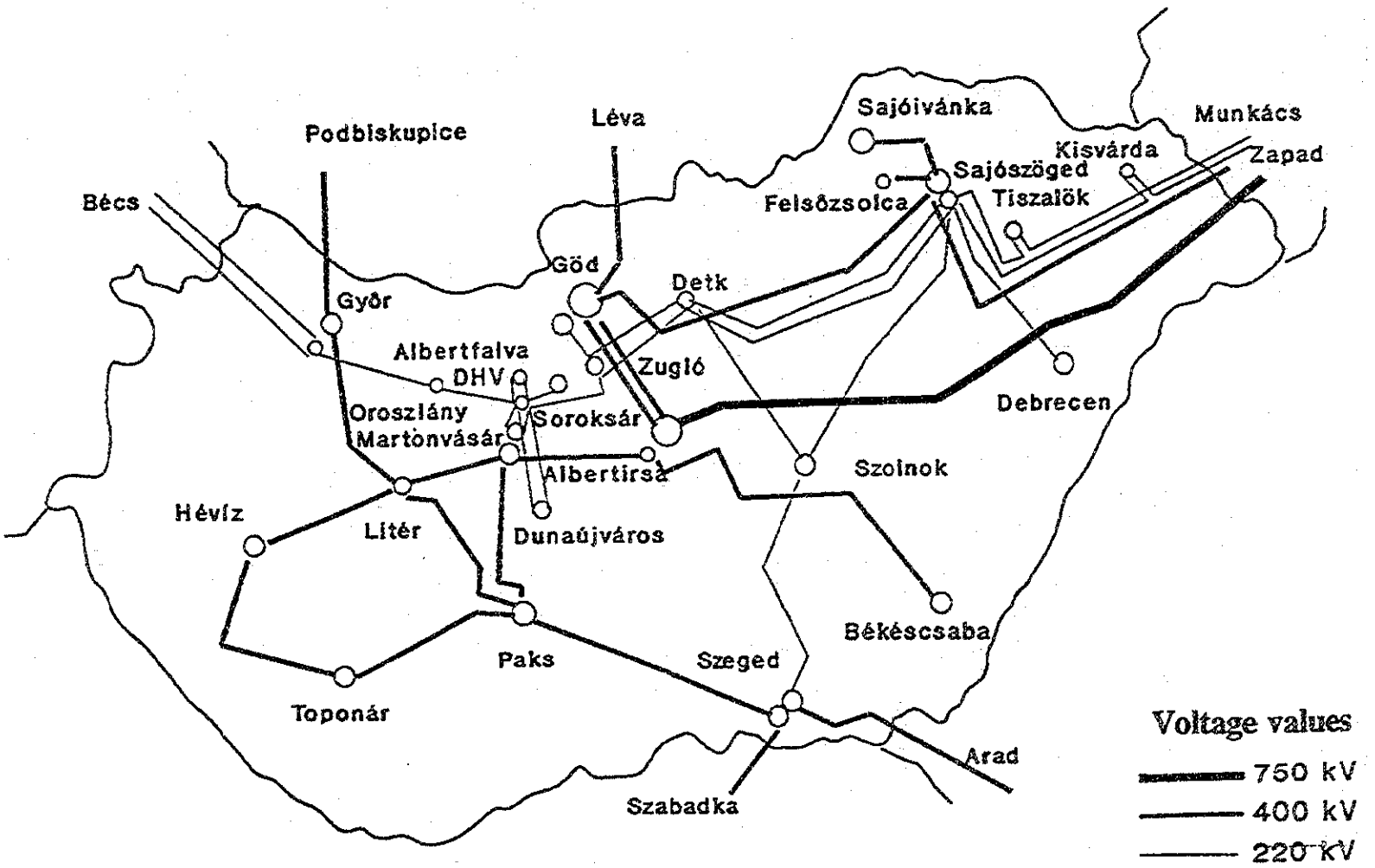


Figure 2.3.3 The Hungarian Electricity Grid with International Connections

gas fields through German and Austrian pipeline systems, or to get access to Algerian natural gas through the Italian and Slovenian networks. Since CIS suppliers are in a monopoly position, they tend to exact a monopoly price (which is higher for Hungary than for West European countries), it is imperative to get access to new supply sources by the middle of the 1990's. (In longer term, with Europen cooperation also, the access to Iranian gas sources - potentially the second largest in the world - may become feasible.)

In 1991, the share of imports in electricity consumption was nearly 20%, though since then it has decreased considerably. Its major part has been derived from the CIS countries through the grid system shown in Figure 2.3.3. To alleviate this problem, the limited capacity connection to the West Europen electric network was decided to be expanded by the completion of the high voltage grid between Győr and Vienna. As the Guidelines state, the purpose of joining the West European Electricity System (UCPTE) is not to purchase electricity from the West in a continuous fashion, but to reduce the danger and effect of eventual power shortages. The main precondition to joining the UCPTE, however, is the establishment and guarantee of a balance between the demand for electricity and the capacity for its generation. This requirement necessitates the construction or enlargement of generating capacities, since the latter in Hungary is very small in per capita international comparison.

(2) Protection of the Environment

The technical and legal regulatory systems, the criteria and standards of international agreements, charters and conventions should be gradually adopted and observed also in the energy sector of the economy, and this is of special importance in respect to the protection of the environment. While the emission regulations of the EC are to be introduced up to the year 2000, the currently operated power stations are polluting the environment with a load factor several times exceeding international norms. Hungary already has to meet international obligations in the energy sector concerning the emission of sulphur dioxide (Helsinki Convention) and nitrogen oxides (the Sofia Protocol). A 30% drop from the SO_2 emission level of 1980 was feasible by the end of 1993, but the obligation of a further 20% reduction may well call for projects of desulphurizing the flue gas in several power stations. The prescription of the Sofia Protocol in achieving the NOx emission level of 1987 should be met by the end of 1994.

(3) Conservation of Energy and Improvement of Efficiency

Largely as a heritage of past policies routinely neglecting both environmental and

efficiency criteria, the energy efficiency of the Hungarian economy is rather low when compared with that of the developed economies, the latter being 2-4 times higher.

The more advanced economies produce more, and are more profitable, at a lower level of energy consumption. According to estimates, 80-85% of the gap is attributable to the relatively low marketability and profitability of contemporary Hungarian products, while an additional 10-15% may be due to the relative under-development of energy transformation and utilization technologies. Therefore, beyond the development of a more competitive and profitable product structure, the efficiency of energy generation, transformation and utilization is to be advanced. Among the various kinds of energy, the rationalization of electric energy consumption is of special importance. Hungarian electricity consumption is of a relatively low level if its per capita amount is considered; it is too high, however, if the electric energy intensity of production is taken into consideration. One of the most critical factors in stimulating energy conservation and efficiency may be an adequate pricing system absorbing the costs of exploration, production, conversion, storage, distribution, re-cultivation and environmental protection of energy systems. Adopting a transparent real-price system is a precondition also to entering the European energy market. By mid-1991 all direct centrally imposed subsidies to energy prices were abolished and a policy to harmonize Hungarian energy prices with those of the EC is being implemented.

(4) Publicity, Social Acceptance and Training

The undesirable effects of "natural monopolies" have to be avoided, the workings of the energy-related institutions should be transparent to the public and the social acceptance of energy policies has to be promoted, communication and training have to be improved.

(5) Flexible System Development

It involves first of all the stock-piling of adequate reserves. In 1992 the crude oil reserve amounted to 40 days of consumption, storage facilities for gas could accommodate about 2 billion m^3 of natural gas, and nuclear fuels in reserve were sufficient for 18 months.

2.3.2 National Energy Balance

Table 2.3.1 shows the trends of energy consumption and economic performance in Hungary during the period from 1973 to 1989 in comparison with some European countries.

Figure 2.3.4 and Table 2.3.2 show trends in the national energy balance during the period of 1980 - 1992. Tables 2.3.3 and 2.3.4 show the percentage distributions of energy sources and domestic primary energy production, respectively, during the same period.

During 1970s and 1980s, both GDP and energy consumption increased significantly in Hungary. The growth rates of GDP and energy consumption in Hungary were maintained at high levels in comparison to western European countries.

However, due to the overall transition of the economy, total energy consumption fell by 20% during the three years period from 1989 to 1992. The real GDP decreased by 19% during the same period as indicated in Table 2.2.1. Simultaneously, the structure of production and consumption also changed. The share of coal production decreased, while the proportions of both oil and natural gas increased.

Hungary imports energy by about 50% of the total energy demand. Figure 2.3.5 shows international comparison of import dependency of energy. Figure 2.3.6 shows domestic and import shares of basic energy carriers in 1991, and Table 2.3.5 shows the import shares in 1992.

In 1991, 62% of crude oil and oil products, 56% of natural gas, 32% of coals, and 20% of electricity were imported. In 1992, import of electricity dropped considerably to the level of 10%. But import of oil increased to 76%.

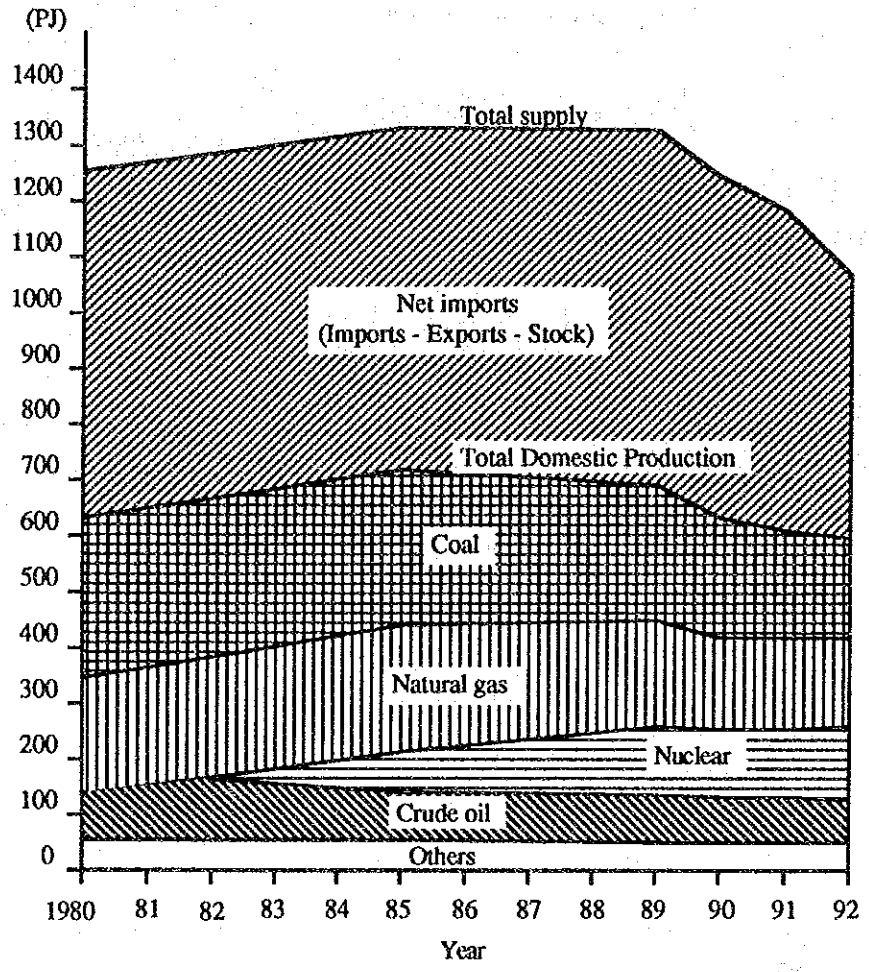
Although import dependency of the Hungarian energy system is quite significant, there are several developed market economies (e.g., Japan and Italy as shown in Figure 2.3.5) still able to secure the energy demands. The danger implied in Hungary's import dependency lies in the one-sided exposure to CIS suppliers, and not in the degree of such dependency.

Table 2.3.1 Energy Consumption and Economic Performance of Hungary and Some European Countries Between 1973 and 1989

Unit of measurement	Countries					
	Denmark	Belgium	Holland	Austria	Italy	Hungary
GDP (on 1985 prices)						
1973 USD bn	46	64	101	50	303	15
1979 USD bn	51	73	119	59	377	19
1989 USD bn	61	90	138	73	483	22
Average growth rate between 1973 - 1989 %/y	1.85	2.10	1.95	2.40	2.95	2.66
Total energy consumption						
1973 Mtoe *	19.7	46.4	62.8	21.5	130.5	23.5
1979 Mtoe *	21.1	48.5	69.4	23.4	141.3	29.1
1989 Mtoe *	17.9	47.3	65.1	23.8	153.5	30.4
Average growth rate between 1973 - 1989 %/y	-0.6	0.1	0.2	0.6	1.0	1.6
Electricity consumption						
1973 TWh	18.9	39.4	51.4	29.7	145.1	22.3
1979 TWh	25.3	50.7	64.5	36.7	184.8	30.6
1989 TWh	32.2	64.5	77.8	47.0	241.0	40.7
Average growth rate between 1973 - 1989 %/y	3.4	3.1	2.6	2.9	3.2	3.8
Share of electricity in % of the total energy consumption						
1973 %	22	21	19	21	22	20
1989 %	42	34	24	26	29	27

Note : * Million ton oil equivalent calculated in accordance with international methods.

Source : Ref. A-20.



Source : Drawn from Table 2.3.2

Figure 2.3.4 Trends of Energy Supply in Hungary

Table 2.3.2 Trends in the Balance of Energy (In TJ)

	1980	1985	1989	1990	1991	1992
Domestic production	632,220	703,554	682,675	603,391	596,000	563,145
Coal	290,719	263,104	221,732	188,181	180,100	159,129
Hydrocarbons	326,069	359,717	306,912	264,441	263,200	250,126
crude oil	83,289	80,457	78,188	78,495	77,700	72,543
mining PB gas	10,982	10,500	11,054	10,227	9,800	10,225
natural gas	213,125	244,262	197,678	159,583	160,200	151,314
gasoline	18,673	24,498	19,992	16,136	15,500	16,044
Electr. energy/nuclear	–	64,796	138,910	137,310	137,300	139,640
Electr. energy/hydro~	1,319	1,549	1,583	1,780	2,000	1,580
Firewood	14,133	14,388	13,538	11,679	13,400	13,270
Imports	691,706	705,280	730,077	724,743	617,000	537,133
Sources total	1,323,926	1,408,834	1,412,752	1,328,134	1,213,000	1,100,878
Exports	44,447	66,891	85,268	70,846	49,000	58,663
Change in stocks	+19,950	+18,032	+11,153	+13,087	-11,000	-14,913
Supply total	1,260,529	1,323,911	1,316,331	1,244,201	1,175,000	1,057,128

Sources : Refs. A-1, A-16.

Table 2.3.3 Structure of Energy Sources (In % based on heat values)

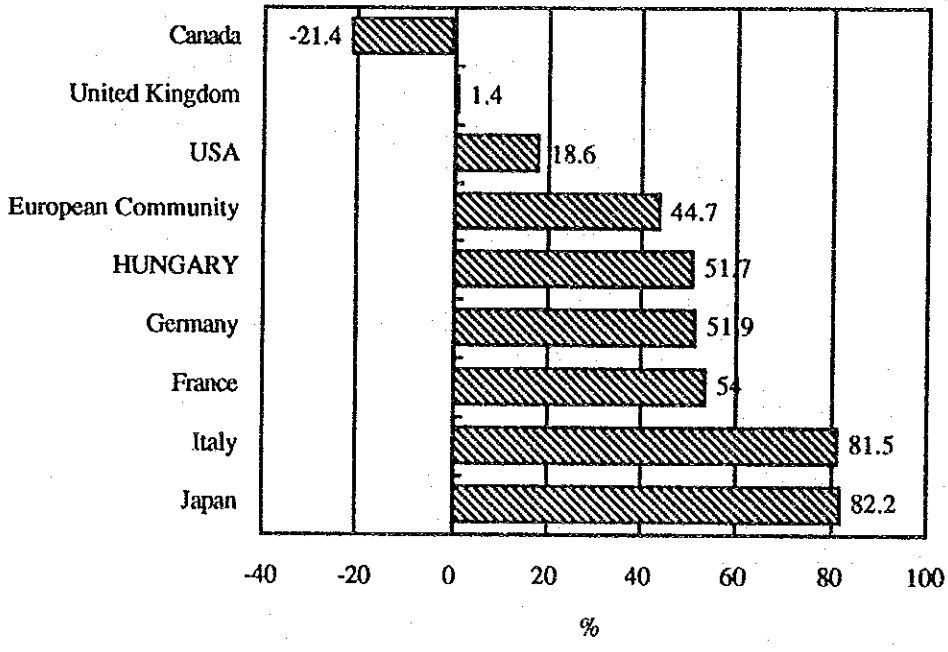
	1980	1985	1989	1990	1991	1992
All kinds of coal	28.8	26.7	22.2	19.1	21.8	18.8
Hydrocarbons	63.6	59.9	59.0	61.2	59.6	64.1
crude oil & products	37.4	32.8	30.7	32.8	29.2	34.7
natural gas	26.2	27.1	28.3	28.4	30.4	28.4
Electric energy/nuclear	--	4.6	9.8	10.3	11.3	12.7
Electric energy/imported	6.5	7.7	7.9	8.4	6.0	3.1
Other fuels	1.1	1.1	1.1	1.0	1.3	1.3
Total	100.0	100.0	100.0	100.0	100.0	100.0
Share of all imports	52.2	50.1	51.7	54.6	50.9	48.8

Sources : Refs. A-1, A-16.

Table 2.3.4 Distribution of Domestic Primary Energy Production
(In % based on heat values)

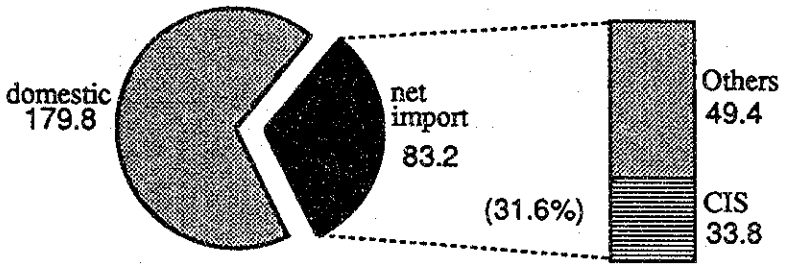
	1980	1985	1989	1990	1991	1992
Coal	46.0	37.4	32.5	31.2	30.2	28.2
Hydrocarbons total	51.6	51.1	45.0	43.8	44.2	44.4
crude oil	17.9	16.4	16.0	17.7	17.0	12.8
natural gas	33.7	34.7	29.0	26.1	27.2	26.8
Electr. energy/nuclear	---	9.2	20.3	22.8	23.0	24.8
Electr. energy/hydro~	0.2	0.2	0.2	0.3	0.3	0.3
Firewood	2.2	2.1	2.0	1.9	2.3	2.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

Sources : Refs. A-1, A-16.



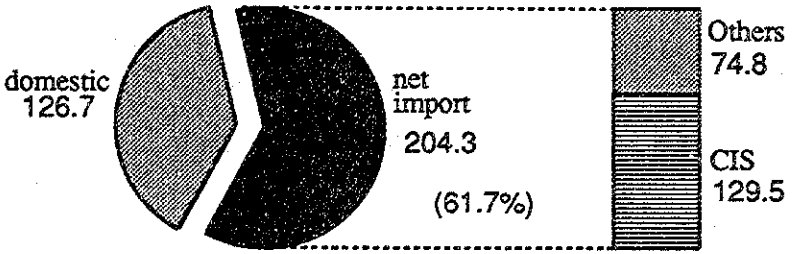
Source : Ref. A-20.

Figure 2.3.5 Hungary's Import Dependency of Energy (1989)
(An International Comparison)



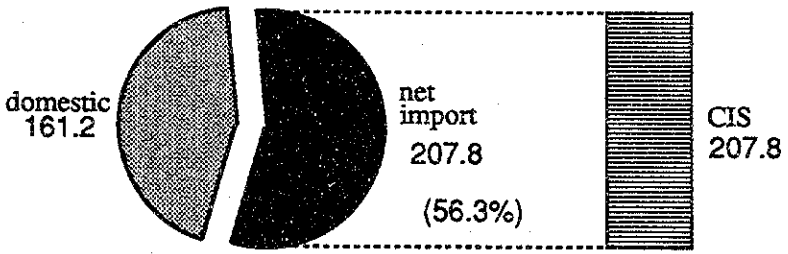
263.0 PJ

solid energy carriers



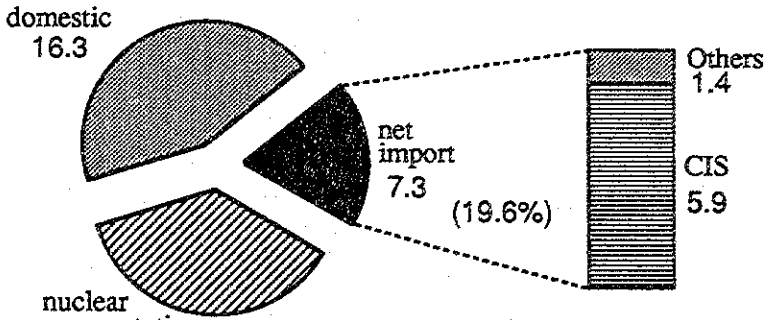
331.0 PJ

crude oil and products



369.0 PJ

natural gas



37.3 TWh

electricity

Note:
Gross oil import from CIS is 177 PJ. For reasons of accounting techniques, exports to other countries have been deducted from gross imports from CIS.

Figure 2.3.6 Domestic and Import Shares for Domestic Consumption of Energy Carriers (199 1)
(S ource : Ref. A-20)

Table 2.3.5 Import of Fuels and Electricity in 1992

Coal-based sources (Mt)	1.4 (9 %)
Crude oil (Mt)	5.7 (76 %)
Oil products (Mt)	1.1
Natural gas (billion m^3)	5.1 (53 %)
Electricity (TWh)	3.5 (10 %)

Source : A-21.

2.3.3 Energy Consumption by Economic Sectors

(1) General Trend

Table 2.3.6 shows trends in energy consumption by sectors of economy between 1980-1992. From Table 2.3.6, Figures 2.3.7 and 2.3.8 were drawn, the former showing the trend in shares of sectors in energy consumption, and the latter showing the trend in total and sectoral consumption of energy.

It can be seen that the energy consumption by the industrial sector has been markedly decreasing not only in its quantity, but in its share also. Its share of over a half of the total in 1980 was reduced to one third in 1992. On the other hand, household energy consumption has increased dynamically by 1989, and maintained that level since then even within the shrinking volume of total energy consumption. In 1992, its share surpassed that of industry. The sector of commercial and others has also increased its energy consumption volume and share. The combined share of energy consumption by latter two sectors exceeded 50% in 1992, and still growing as shown in Table 2.3.7.

(2) Energy Consumption Efficiency

Table 2.3.8 shows relative changes in energy consumption per unit of GDP (energy intensity) between 1980-1992. And Table 2.3.9 shows the trend in energy consumption per unit of industrial production (specific energy consumption).

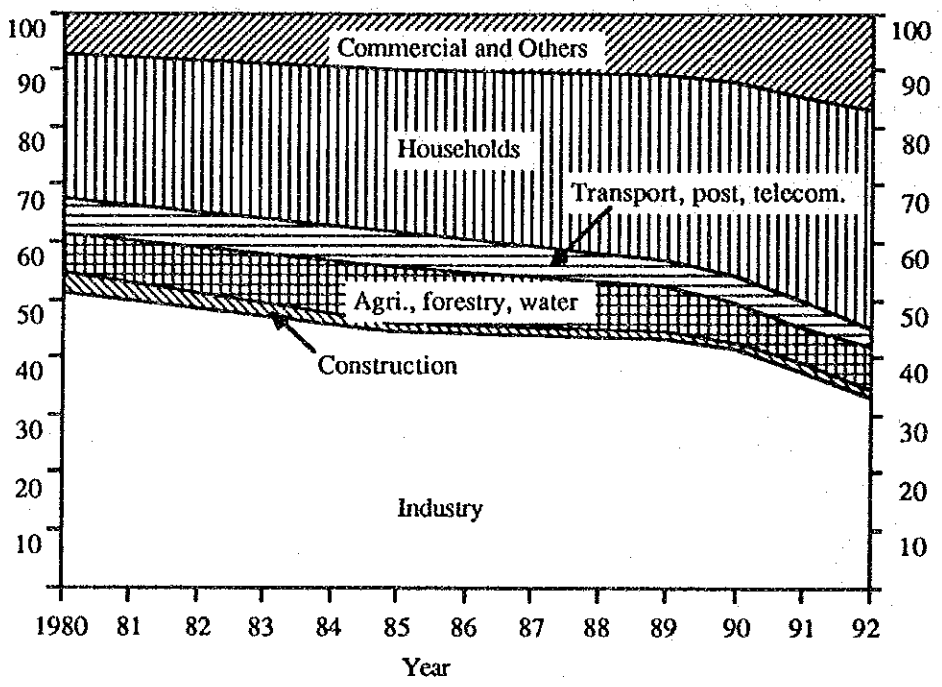
It is apparent from these two tables that energy consumption efficiency has been improving more in industry than in the whole national economy. But even the former is in need of further reduction, as often cited by Hungarian experts, to catch up with competitive international levels.

Figure 2.3.9 shows energy consumption and value produced by various industrial sectors for total energy and electricity. It is evident that the energy consumption efficiency of the raw material producing sector is very low.

Table 2.3.6 Energy Consumption by Sectors of the Economy (Percentages)

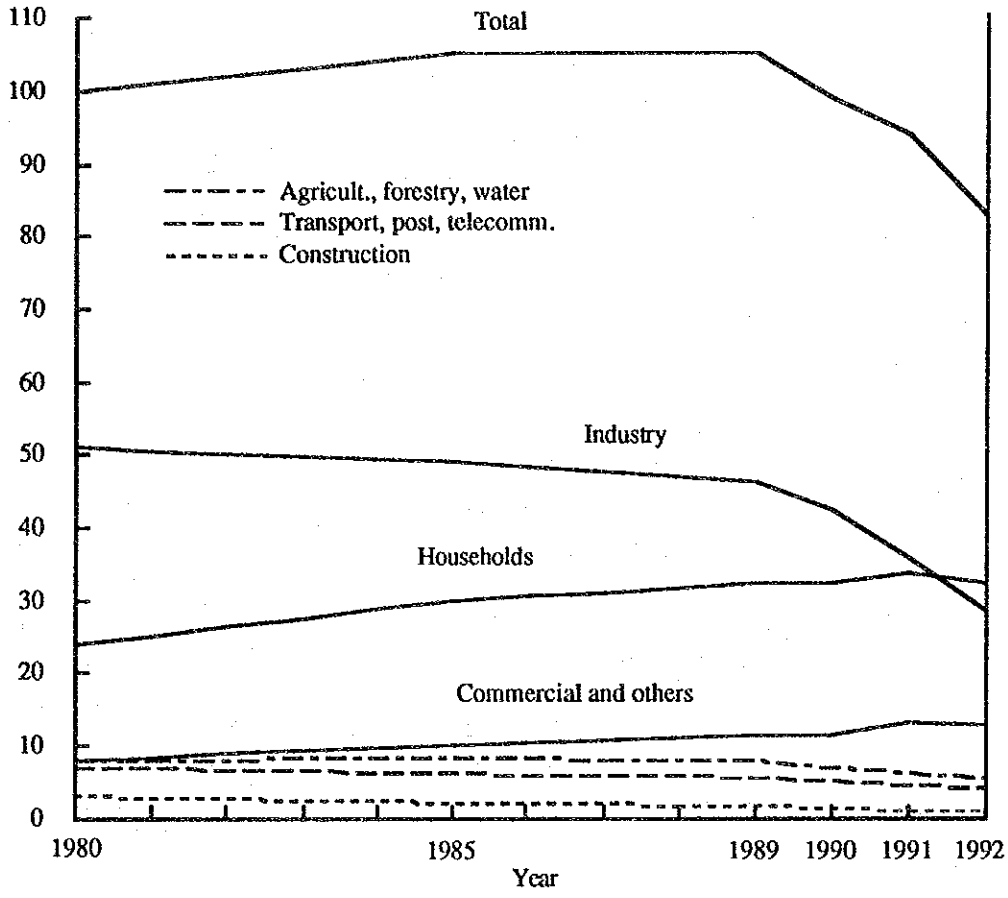
	Industry	Construcion	Agricult., Forestry, Water supp.	Transport, post and telecomm.	Households	Commercial and Others	Total
a) Each sector in 1980 = 100							
1980	100	100	100	100	100	100	100
1985	96	71	104	89	125	127	105
1989	91	56	100	80	134	141	105
1990	83	51	89	73	135	141	99
1991	70	34	77	66	140	166	94
1992	56	32	68	57	134	163	83
b) Each year total = 100							
1980	51	3	8	7	24	8	100
1985	46	2	8	6	28	10	100
1989	44	1	8	5	31	11	100
1990	42	1	7	5	33	11	100
1991	38	1	6	5	36	14	100
1992	34	1	6	5	38	16	100

Source : Ref. A-1.



Source : Table 2.3.6

Figure 2.3.7 Trend in Shares of Sectoral Energy Consumption (%)



Source : Derived from Table 2.3.6.

Figure 2.3.8 Trend in Total and Sectoral Consumption of Energy (Total in 1980 = 100)

Table 2.3.7 Energy Consumption by Economic Sectors (1991-1993)

Unit : PJ and (%)

Sector	1991		1992		1993	
Industry	437.4	(37.2)	388.6	(36.8)		
Construction	17.0	(1.4)	8.7	(0.8)		
Agriculgure, foresty, water	77.6	(6.6)	54.8	(5.2)		
Transport, post telecomm.	56.3	(4.8)	49.4	(4.7)		
Subtotal	588.3	(50.1)	501.5	(47.4)	496.9	(46.6)
Household	440.0	(37.4)	396.1	(37.5)		
Commercial and others	146.7	(12.5)	159.5	(15.1)		
Subtotal	586.7	(49.9)	555.6	(52.6)	570.1	(53.4)
Total	1,175.0	(100)	1,057.1	(100)	1,067.0	(100)

Sources : Refs. A-1, A-5, A-22.

Table 2.3.8 Trend in Energy Consumption per Unit of Gross Domestic Product (Energy Intensity)

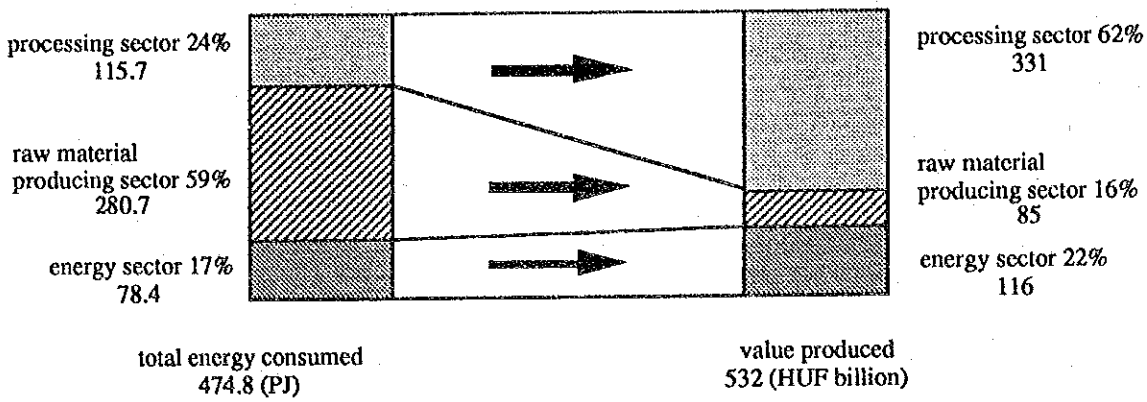
	1980	1985	1989	1990	1991	1992
1970 = 100.0	86.7	83.9	78.9	77.1	83.0	78.0
Previous year = 100.0	100.1	102.7	98.3	97.7	107.6	93.2

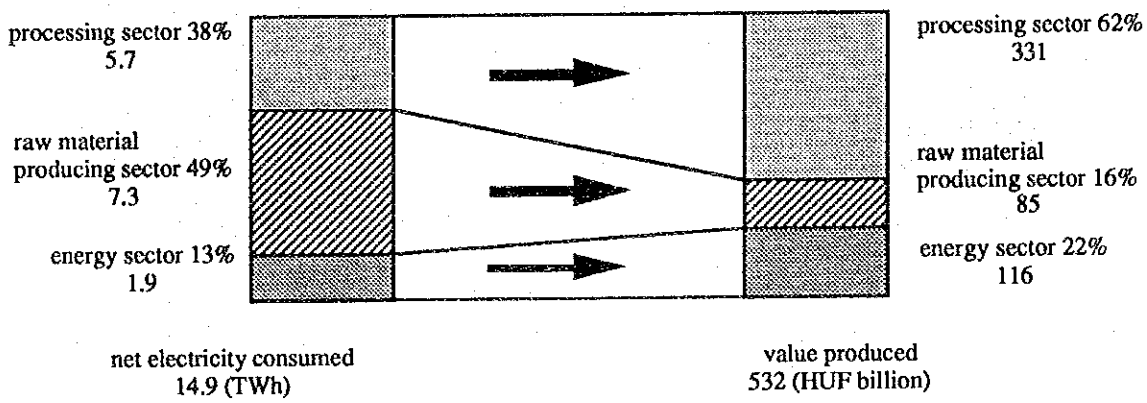
Source : Ref. A-1.

Table 2.3.9 Trend in Energy Consumption per Unit of Industrial Production (Specific Energy Consumption)

	1980	1985	1989	1990	1991	1992
Kilojoule/HUF*	650.2	569.0	513.4	497.5	490.0	434.1
1970 = 100.0	80.6	70.4	64.1	62.1	61.2	54.2
Previous year = 100.0	102.1	97.6	96.9	96.9	98.5	88.6

Note : * Based on 1981 year constant price.
Source : Ref. A-1.





Source : Ref. A-20.

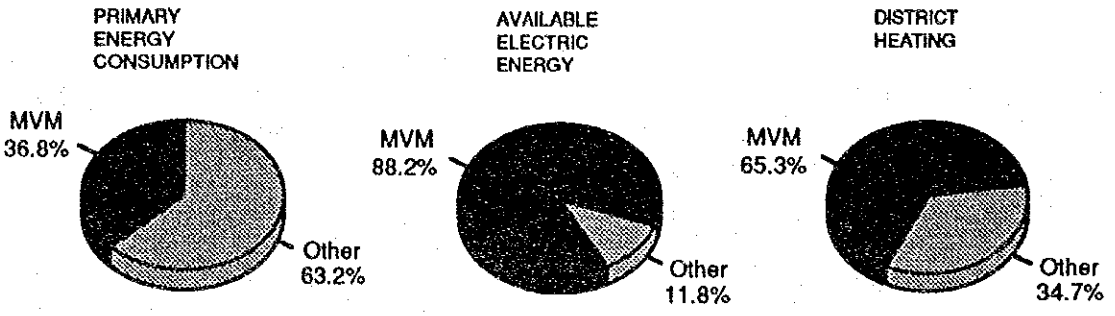
Figure 2.3.9 Energy Consumption and Value Produced by Various Industrial Sectors (1990)

2.3.4 Electricity and Heat Supply

(1) Trend in Supply and Consumption

Among the various types of the energy produced and consumed, electric energy is of particular importance, not only as energy itself but also as an indicator in analyzing economic and industrial movements.

In Hungary, there are 8 power plant companies under Hungarian Power Companies Ltd. (MVM Rt.). In 1992, MVM supplied 88.2% of the total electricity consumption and 65.3% of heat for district heating in Hungary as shown in Figure 2.3.10.



	[PJ]	[TWh]	[PJ]
MVM	386.3	30.7	49.9
HUNGARY	1050.0	34.8	76.4

Source : Ref. A-24.

Figure 2.3.10 The Role of MVM in Hungarian Energy Sector (1992)

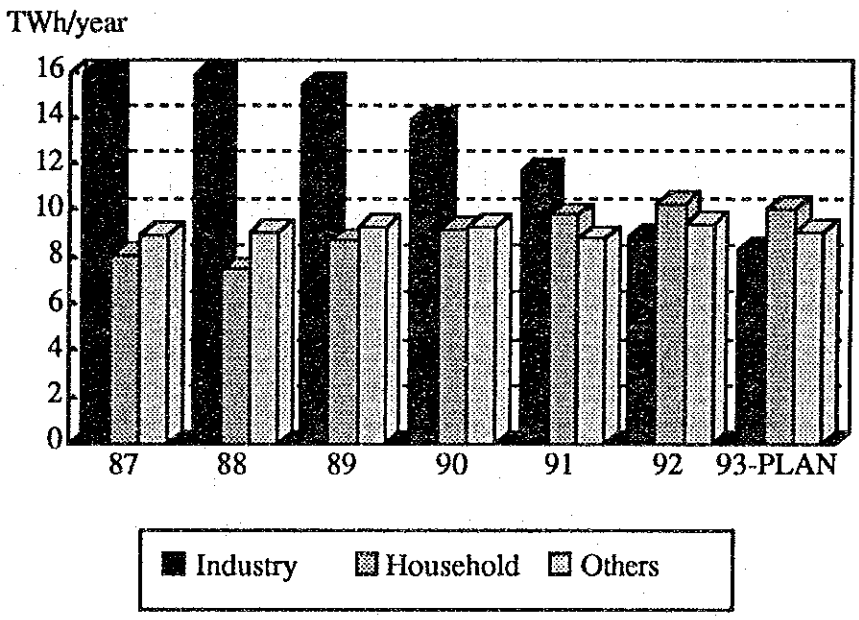
Table 2.3.10 shows trends in the national balance of electric energy during the period of 1980-1992. After 1989, total supply of electricity has been decreasing. In 1992, it decreased to nearly the same level of 1980.

Figure 2.3.11 shows the trend in electricity consumption by sectors. Similar to the consumption of total energy, the electricity consumption by the industrial sector has been dramatically decreasing, while that by households has been increasing. In 1992, the former was surpassed by the latter, and shrank to nearly half of the 1987 level.

Table 2.3.10 Balance of Electric Energy (In GWh)

	1980	1989	1990	1991	1992
Sources:					
Public utility power plants	22,664	28,647	27,463	29,025	30,711
Other industrial power plants	1,210	931	902	907	812
Industrial production, total	23,874	29,578	28,365	29,932	31,523
Other power plants	1	18	45	48	91
Domestic production, total	23,875	29,596	28,410	29,980	31,614
heat power plants	23,763	15,547	14,501	16,060	17,492
nuclear power plant	-	13,891	13,731	13,726	13,964
Imports	10,182	12,959	13,309	8,409	3,540
Sources, total	34,057	42,555	41,719	38,389	35,154
Uses:					
Power plant self-consumption	1,963	2,599	2,541	2,485	2,547
Network & transformation loss	2,832	4,142	4,015	3,762	2,793
Domestic consumption, total	26,467	33,939	33,124	31,095	29,710
Exports	2,795	1,875	2,039	1,047	104
Uses, total	34,057	42,555	41,719	38,389	35,154

Source : Ref. A-1.



Source : Ref. A-24.

Figure 2.3.11 Electric Energy Consumption by Sectors