PN-ABM-229
79191

INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENT IN LATVIA:
Policy Options and Institutional Roles

Prepared for:

U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT
Bureau for Europe
Development Resources/Energy and Infrastructure
Washington, D.C. 20253

HBI Reference No. 92-4055-201-5

Prepared by:

RCG/HAGLER, BAILLY, INC.
1530 Wilson Blvd, Suite 900
Arlington, VA, USA 22209-2406
(703) 351-0300
and
ENERGI-R, LTD.
Aizkraukles 21
Riga, Latvia
(7-0132) 55 14 75

Prepared under:

U.S.A.I.D. EMERGENCY ENERGY PROJECT FOR LATVIA
Contract No. EUR-0015-C-00-1007-00

August 1992

INDUSTRIAL ENERGY EFFICIENCY IN LATVIA:
Policy Options and Institutional Roles

TABLE OF CONTENTS

Chapter 1: **Policy and Institutional Factors Affecting Industrial Energy Efficiency in Latvia**
by EnPro Engineers Bureau

1.1 Background 1.1
1.2 Current Management Practices in Industrial Enterprises 1.11
1.3 Industrial Investment Decision-making 1.15
1.4 Availability of Technical Services and Equipment Related to Energy Efficiency 1.17
1.5 Industrial Reforms Under Consideration 1.17
1.6 1992 Experience in District Heating Energy Rationing 1.22

Chapter 2: **Observations on Latvian Industrial Enterprises**
by RCG/Hagler, Bailly, Inc.

2.1 Organization 2.1
2.2 Marketing 2.3
2.3 Production 2.4
2.4 Finance and Investment 2.5
2.5 Management and Administration 2.6
2.6 Research and Development 2.9

Chapter 3: **Industrial Energy Efficiency Policy Options for Latvia**
by RCG/Hagler, Bailly, Inc.

3.1 Background 3.1
3.2 Industrial Management - Improving Productivity, Quality and Efficiency 3.3
3.3 Techniques for Improving Industrial Energy Efficiency at the Enterprise Level 3.8
3.4 Policy and Programs to Accelerate Improvements in Industrial Energy Efficiency at the Enterprise Level 3.13

Chapter 4: **Roles of Latvian Institutions in Accelerating Industrial Energy Efficiency Improvements**
by RCG/Hagler, Bailly, Inc.

4.1 Introduction 4.1
4.2 Role of Government 4.2
4.3 Role of Energy Supply Companies 4.2
4.4 Role of Industrial Enterprises 4.3
4.5 Role of Financial Institutions 4.4
4.6 Role of Non-profit, Non-governmental Organizations 4.4
4.7 Role of Academic Institutions 4.5
4.8 Role of Private Sector Energy Efficiency Industry 4.6

Chapter 5: **Preliminary Recommendations for an Industrial Energy Efficiency Program**
by RCG/Hagler, Bailly, Inc.

5.1 General Recommendations for Industrial Energy Efficiency Program Design 5.1
5.2 Recommendations for a Long-term Industrial Energy Efficiency Program in Latvia 5.4

Appendix 1: **Industry and Energy, Republic of Latvia**

Appendix 2: **Tariffs for Electricity, Gas, and District Heat**

Appendix 3: **Law "on Foreign Investment in the Republic of Latvia"**

ABBREVIATIONS

CIS	-	Commonwealth of Independent States
DHN	-	district heating network
DoE	-	Estonian Sate Department of Energy
EE	-	Eesti Energia (Estonian Electricity Company)
EFTA	-	European Free Trade Association
EBRD	-	European Bank for Reconstruction and Development
GDP	-	gross domestic product
GoE	-	Government of Estonia
HFO	-	heavy fuel oil (mazout)
IMF	-	International Monetary Fund
ITEP	-	Institute of Thermophysics and Electrophysics
LFO	-	light fuel oil (middle distillate)
MIE	-	Estonian Ministry of Industry and Energy
NUTEK	-	Swedish National Board for Industrial and Technical Development
OPET	-	Organizations for the Promotion of Energy Technologies
TTU	-	Tallinn Technical University
USAID	-	US Agency for International Development
WB	-	World Bank

ACKNOWLEDGEMENTS

RCG/Hagler, Bailly, Inc. and Energi-R, Ltd. gratefully acknowledge the assistance and cooperation shown by USAID/Riga, the Latvia Ministry of Industry and Energy, Institute of Physical Energetics of Latvian Academy of Sciences, Riga Technical University, State Company Energy Development of Latvia (LEA), Latvenergo, Latvijas gaze, and the industrial and district heating plants in Latvia visited as part of this program.

RCG/Hagler, Bailly, Inc. would like to recognize the guidance and technical contributions of Mr. Robert Archer, Deputy Chief of Energy and Infrastructure, USAID Bureau for Europe. Mr. Archer's analysis of energy efficiency policy and institutional roles in many countries in Eastern Europe over the past two years served as the basis for many of the ideas included in this report for Latvia.

The team of professionals who contributed to this report consisted of:

USAID Bureau for Europe

Robert Archer	Project Officer

RCG/Hagler, Bailly, Inc.

David Keith	Project Director/Policy Specialist/Principal Engineer
Mark Oven	Principal Engineer/Energy Audits
Dr. Larry Banta	Principal Engineer/Energy Audits

Team organized by Energi-R, Ltd.

Dr. Peteris Shipkovs	Director, Energi-R Scientific Secretary, Institute of Physical Energetics
Dr. Dagnija Blumberga	Associate Professor, Riga Technical University
Dr. Janis Bazhbauers	Dean of Thermal Engineering, Riga Technical University
Dr. Namejs Zeltinsh	Leading Research Associate, Institute of Physical Energetics
Dr. Ivars Veidenbergs	Associate Professor, Riga Technical University
Dr. Viktors Zebergs	Head of Laboratory, Institute of Physical Energetics

INTRODUCTION

In November 1991, the U.S. Agency for International Development launched the 1991 U.S. Emergency Energy Assistance Program for Latvia. Component #1 of this program relates to industrial energy efficiency (the prime contractor for Component #1 is RCG/Hagler, Bailly, Inc. of Washington, D.C., and its subcontractors are EnPro Engineers Bureau, Termox, and Tallinn Technical University). The program's other component is energy price reform.

Under the industrial efficiency activities (Component #1), the RCG/Hagler, Bailly team was assigned the following tasks:

1) Screening of plants in the industrial sector to identify four representative and appropriate plants for the energy management programs to be funded under Component #1.

2) Performance of energy audits and training in each of the four plants, focusing on the identification of short-term measures to be implemented at no cost, or at low cost with quick payback.

3) Identification of low-cost equipment for procurement for each of the four plants under the program (such as energy monitoring instruments, up to about $30,000 per plant).

4) Assessment of national institutional and policy issues related to energy efficiency.

5) Procurement of equipment and delivery to the plants.

6) Return to each of the plants to monitor the results of the program and assist with any problems related to the equipment.

7) Preparation and presentation of a one-day wrap-up seminar in Latvia for the management and technical staff of the four plants, and presentations by each of the four plants at a regional industrial energy efficiency conference sponsored by USAID in Lithuania.

From November 8 through December 20, 1991, RCG/Hagler, Bailly placed a team of three senior industrial engineers in Latvia to implement Tasks 1 , 2 and 3. From May 11 - 20, 1992, RCG/Hagler, Bailly's Project Director worked in Latvia on Task 4. EnPro and RCG/Hagler, Bailly continued work on Task 4 from May 20 - July 1, 1992. Tasks 5 through 7 are still in progress.

This report summarizes the experiences of the RCG/Hagler, Bailly energy policy expert and the industrial engineers regarding Task 4 above. The objectives of Task 4 were the following:

- provide an analysis of the policy and institutional factors (including financial institutions) influencing energy efficiency investment decision-making
- develop recommendations to address the findings and conclusions of the study.

The primary basis for this report is a series of visits and meetings held by the energy policy expert with government officials, industrial managers, management of financial institutions, staff of universities and technical institutions, NGOs, and private companies. The report also includes the observations and experience of the audit teams that worked in the industrial plants.

This report is organized in several sections:

- Chapter 1 discusses the factors affecting energy efficiency at the national level, including government ministries, technical and financial institutions, and non-government and private organizations. Laws and regulations, and the impact of the restructuring under way in the Latvian economy are also discussed.
- Chapter 2 presents observations on energy efficiency at the plant level, including management practices, investment decision-making, and barriers to energy efficiency.
- Chapter 3 discusses industrial energy efficiency concepts and techniques, and then develops policy and program options which are appropriate for consideration by Latvia.
- Chapter 4 discusses the role of various institutions in accelerating improvements to industrial energy efficiency in a market economy, with particular emphasis on the role of government, non-profit non-governmental organizations, and the private sector.
- Chapter 5 provides recommendations for improving industrial energy efficiency, and for a long-term industrial energy efficiency program for Latvia.

CHAPTER 1: POLICY AND INSTITUTIONAL FACTORS AFFECTING ENERGY EFFICIENCY IN LATVIA

by Energi - R, Ltd.

1.1 BACKGROUND

The current situation in Latvian large-scale industry is now critical, as a result of the shortage of raw materials, energy and spare parts. There is no ready market for industrial products and consumer goods because the prime cost and price of output is high and continuously rising. It is impossible to settle accounts between the enterprises because the banking sector cannot keep up with transactions, and because the monetary supply is insufficient. A rapid "brain drain" is occurring from state enterprises to small, private firms (where the salaries are much higher).

Juris Ozolins (Ministry of Industry & Energy) in his article [Government newspaper "Diena," 20 May '92] points out, that the 61 largest factories need a sum of credits equal to 5.5 billion roubles[1]. But there are 350 factories in Latvia, therefore, the total sum of credits could be as much as 30 billion roubles.

The bulk of state budget income is based on taxes levied on large-scale industry. To avoid the bankruptcy of the industrial sector, that could occur by autumn 1992, there is an urgent need for a Government-guaranteed credit of US$600 million for purchasing fuel, gasoline, gas oil, etc.

In 1991, industrial production has declined by 25.4% or 6.7 billion roubles. The urged stoppage cost 3.8 billion roubles [Newspaper "Latvijas Jaunatne," 13 May '92]. In the 1st quarter of 1992, the output is only 70-72%, as related to the 1st quarter of 1991.

The industrial output of various subsectors for the period January - March 1992, in comparison with the same period of 1991, is shown in Table 1.

[1] Approximately $45 million at July 1992 exchange rate.

Table 1

Branch of Industry	Output %
Power production	81.3
Fuel industry	85.4
Metallurgy	48.1
Chemistry and Petrochemistry	79.9
Machines	68.3
Wood, paper & pulp	71.3
Glass, Porcelain & finance	95.9
Light industry	82.5

Two hundred seventy industrial enterprises (out of 350) were insolvent as of June 1992. The production accumulation in inventories is 10 billion roubles. Russian enterprises' debt to Latvian enterprises is approximately 4 billion roubles (Latvian industry production exports to Russia used to be 95%).

The premier of Sweden Karl Bild forecasts a 15-30% production decline in Baltic States ["Diena," 29 April '92].

The Government of Latvia (Ministries of Economic Reforms, Industry, Agriculture, Fisheries, and Building Construction) has selected more than 700 state enterprises which are to be privatized in 1992/93, the rest (470 enterprises) being not privatized. Deputy Minister N. Luste (Ministry of Economic Reforms) thinks that the best way to privatize is to reorganize the enterprise in a statute-company, but the officials of enterprises offer resistance. They want to privatize without the state joint-stock company phase.

The next way of privatization could by leasing the enterprise. It is the opinion of Deputy General Director of "Rigas Birža" (Riga Stock Exchange) Uldis Ziemelis:"...the most important condition for shares to come on the market, is the Parliament Act on the securities "[Diena," 28 May '92].

1.1.2 Current Situation of Energy Demand in the Industrial Sector and District Heating in Latvia

In the 1st quarter of 1992, 44% of electric energy consumed in Latvia was imported. Latvia's hydro-power plants produced 408 million kWh more than predicted ["Diena," 3 June

'92]. In 1991, the hydro-power plants cascaded on the Daugava River produced 4.5 TWh electric energy.

In the 1st quarter of 1992, as compared with the 1st quarter of 1991, the consumption of electric energy decreased by 11.4% (the greatest decline was in the agriculture sector). The only group of consumers which expended more electric energy than in 1991 was households. This could be because in the spring of 1992 the district heat supply was stopped, and some apartments were heated by electricity.

The further decline of electric energy consumption is connected with the slow-down of large-scale industry production.

Table 2
Consumption of Electric Energy (million kWh)
in different branches of economy ["Enerģētikas Vēstnesis," 12 May '92]

Branch	1st Quarter of		Growth	
	1991	1992	Change	%
Industry	994	860	-134	-13.5
Agriculture	511	387	-124	-24.3
Transport	50	47	- 3	- 6
Household	341	384	43	12.6
Other	991	881	-110	-11.1
Total	**2,887**	**2,559**	**-328**	**-11.4**

The consumption of heat energy also decreased, mainly as a result of the shortage of fuel.

Table 3
Consumption of Heat Energy (thousand Gcal)
State enterprise "Latvenergo" ["Enerģētikas Vēstnesis," 12 May '92]

Branch	1st Quarter of		Growth	
	1991	1992	Change	%
Industry	714	528	-186	-21.1
Household (district heating & hot water)	1,263	1,026	-237	-18.8
Other	1,173	925	-250	-21.3
Total	**3,152**	**2,479**	**-673**	**-21.4**

The heat supply in district heating in 1992 was stopped on April the 15th (the previous practice being the 10th May). As a result, for weeks residents were suffering from cold. The problem was that Latvia got only 73,000 tonnes of heavy fuel oil from Russia instead of 587,000 tonnes as stipulated by clearing agreements ["Diena," 03 April '92]

Improvements in fuel supply will result from "privatization and demonopolization" according to Prime Minister Ivas Godmanis ["Diena," 13 May '92]. There are no guarantees of fuel supply from Russia in the future, because Russia does not fulfil its contractual obligations.

Deputy Minister of Industry and Energy G. Koemecs points out ["Diena," 03 June '92]: "Resource demand audits indicate that for normal living conditions next winter, Latvia needs US$750 million (with an emergency minimum level being US$400 million) to purchase fuel, gasoline, gas, etc."

Table 4
The Necessary Fuel Supplies and Finances for the Winter 1992/93
["Diena," 03 June '92]

Fuel	Emergency	Normal	Emergency Finances
Fuel oil	1 million t	1.8 million t	US$ 95 million
Natural gas	2-2.6 billion m^3	3.3 billion m^3	US$ 250-300 million
Gas oil	0.75 million t	1.5 million t	US$ 150 million
Coal	0.5 million t	1.3 million t	US$ 20 million

The heat supply management in the capital Riga will be reorganized and decentralized. The Municipalities will run the generation plants by themselves and set their own heat energy prices.

The Government and Municipalities are planning heat economy measures, for example, the installation of heat energy meters in apartments. A part of resources planned for cultural and social activities will be spent for heat supply needs ["Diena," 30 May '92].

1.1.3 Identification and Structure of Latvian Agencies Working in Energy Efficiency

It could be said there is chaos in energy economy in Latvia. In the period of 1990/91, there was an Energy Economy Program, but now it is out-of-date. There was not the slightest progress toward solving the problem. Neither the energy producers, nor the energy consumers had any interest to raise energy efficiency.

The coordination of energy economy was undertaken the Ministry of Industry & Energetics.

The activities of the Ministry are described in Appendix 1.

Today, several other ministries and institutions also carry out activities in energy efficiency.

1.1.3.1 Ministry of Architecture & Construction proposes the following measures:

- Minister Aivars Prūsis has issued an order to improve the dwellings' heating system design policy;
- for the emergency situation, there is a program to install 400,000 wood-burning metal stoves which can be produced by the enterprise "Lokomotive" (in Daugavpils);
- to introduce a room temperature set-back schedule in factories, shops, etc.;
- to purchase heat-energy meters ($2.5 million).

1.1.3.2 Ministry of Economic Reforms

The measures are the following [according to Government official information 15 May '92]:

11

- to reconstruct boiler-houses for different fuels (especially indigenous fuels);
- to organize stove heating in dwelling houses (where it is possible), using wood fuel;
- to buy, produce and install the energy meters and regulators for heat and gas;
- to improve heat insulation of houses and district-heating networks;
- to use steam locomotives as local heat generators.

1.1.3.3 **The Government** is preparing acts concerning waste-energy utilization.

1.1.3.4 **Forest Ministry** coordinates the production of gas generators (wood gasification).

1.1.3.5 **Latvian Union of Municipalities** issued an act cancelling the debts of heat generation plants which install and deliver energy meters.

1.1.3.6 **The State Enterprise "Latvenergo"** is checking the energy economy in the enterprises.

1.1.3.7 **The Institute of Physical Energetics**

- is working out the conceptions of perspective fuel and energy balance;
- investigates the automation of heat-supply;
- investigates the use of alternative energy.

1.1.3.8 **The Riga Technical University:**

- a conference "Energy Management and Environmental Protection" was given July 2-3;

- the Faculty of Power investigates the energy efficiency in enterprises;
- the specialists of the Faculty of Power cooperate in working out energy management programs.

1.1.3.9 **The State Enterprise (LEA)** receives financial resources from the state budget to support the energy efficiency measures.

1.1.4 Description of Recent, Current and Proposed Activities of Agencies Identified Above

1.1.4.1 **The Previous Ministry of Energy** has worked out an Energy Program consisting of:

- a new commercial account system;
- a program for minimizing waste heat;
- introducing the energy passports;
- energy generation and consumption examination by experts (energy audits);
- improving a synchronous machine design.

In 1990, there was reached an agreement with Hudson Institute (USA) concerning this "Energy Program" but there is no information about fulfilling the agreement.

1.1.4.2 **The State Enterprise "Latvenergo"** has had an adjusting group, which was controlling the energy economy in the cogeneration plants (TEC-1, TEC-2, district boiler-houses, etc.) There is no such a group at the present moment, but there is a gas inspection group at the enterprise "Latvijas gāze," which controls the gas economy and waste-heat utilization.

1.1.4.3 **Energy management and development**

13

In 1992 two groups of specialists have worked out two different plans of energy management and development up to the years 2005-2010. One of these conceptions declares that energy economy measures in Latvia can compensate 20-30% of surplus energy demand. Taking into account these two plans, the Ministry of Industry & Energy, is working out a new energy plan considering the following aspects:

- the current situation in Latvia;
- characteristics of existing energy-supply systems;
- scenarios of national economic development;
- forecasts of fuel, power and heat demand (until the year 2010);
- environmental protection;
- policy of efficient energy supply;
- the degree of installation of Baltic energy system.

The program will be worked out in November 1992.

1.1.5 Description of Recent, Current and Planned Activities in Energy Efficiency in Latvia Funded by World Bank, European Bank for Reconstruction and Development, and European Countries

Foreign countries' activities in energy situation are as follows:

- USAID Emergency Energy Program for Latvia;
- World Bank activities in financing the emergency fuel supply;
- European Bank for Reconstruction and Development activities in funding the supply of technical resources;
- the technical aid of European Community (the programs PHARE, THERMIE);
- the activities of European countries (Denmark, Sweden, Germany).

1.1.5.1 In "Latvia World Bank Country Economic Memorandum" the Aid Priorities Are:

- defining an energy pricing & metering strategy;
- preparing industrial energy audits;
- preparing contracts for energy trade;
- preparing a strategy for oil and gas trade;
- preparing proposals for energy sector restructuring;
- electric power master plan;
- preparing pre-feasibility costing of the main electricity generation investment options;
- preparing district heating master plans.

World Bank has proposed to provide a credit US$40 million in October 1992 for purchasing fuel, medical remedies and agricultural products. World Bank suggests that one third of credits ($13 million) should be used for fuel supply (heavy fuel oil or gas) [Newspaper "Neatkarīgā Cīna," 3 June '92].

Deputy Minister Koemecs estimates that $13 million can only secure the heat supply in a cold winter for 20 days, taking into account Russia's current fuel prices, not possible future ones ["Diena," 30 June '92].

1.1.5.2 The European Bank for Reconstruction and Development has decided (together with the governments of Latvia, Lithuania and Estonia) to investigate the energy situation as a whole, the situation at the power plants and the facilities for import of oil products from the West to the three Baltic countries.

EBRD's investigation has been carried out as follows:

- reconnaissance trip through the three states, meeting with Norwegian-Danish consultants (coordinator AB Jacobson & Widmark);

15

- expert term tour in three countries visiting officials from ministries and organizations;
- a final coordination meeting in Riga, May 1 and 2, 1992.

The final report is: "Study of Emergency Energy Supply to the Baltic States" (for European Bank for Reconstruction and Development), by NorConsult, Draft Report, May 13, 1992.

The Report describes the existing facilities which could be utilized to import fuel and also proposes necessary changes or temporary installations for unloading of vessels into storage tanks and for loading railway tankers and/or road tankers.

A further EBRD mission in July 1992 worked to identify specific projects, develop specifications, and develop loan disbursement procedures. The amount of the EBRD project is expected to be on the order of $50 million. Of this, at least $26 million will be loaned, and part will be cofunded by grants from various bilateral agencies, especially Scandinavian.

1.1.5.3 **PHARE** - on April 2, 1992, Deputy Minister M. Gailis (Ministry for Foreign Affairs) and director of European Community's program PHARE (Poland-Hungary Action Reconstructing Economy) Tom Gervy signed a memorandum. Program PHARE is assigning US$ 19 million (15 million ECU) to support privatization, reconstructing of enterprises, development of small and medium enterprises. The amount for energy supply is US$ 1.5 million ["Diena," 03 April '92].

1.1.5.4 **OPET (Organization for Promotion of Energy Technologies)** is a network of organizations in the European Community. The program THERMIE is developing energy technology. OPET consists of 35 organizations and employs 1500 experts. As part of OPET Thermie, the Spanish Firm IDOM has founded the Energy Center of Riga (May 21, 1992), together with Latvia's state-owned energy development enterprise (LEA). IDOM has planned to investigate the energy situation in 25 Latvian enterprises (energy audits) and to work out suggestions for energy efficiency. Their work will be finished in October, 1992.

1.1.5.5 In the frame of **Master Plan two firms are working in Latvia: 'WatterfallAB' (Sweden) and 'Imatran Vioma Oy' (Finland).** The Finnish energy economy project scheme is shown in Figure 1.

16

Insert Figure 1

17

The project is considering energy efficiency in industry and generation plants.

1.1.5.6 Danish Firms (Danfoss, Danish Power Consul, Grundfos, Nordisk Gasteknisk Center, Volund Energy Systems)
regularly exhibit their energy equipment in Riga. They are signing contracts for orders.

The Government of Sweden supports Latvia by giving credits for equipment. The Swedish firm "Carton AB" has opened an office in Latvia.

German specialists assist in working out the energy standards.

1.2 CURRENT MANAGEMENT PRACTICES AT THE INDUSTRIAL ENTERPRISES LEVEL

1.2.1 Ownership and its Effect on Management Structure

There are several acts of the Latvian Council of Ministers related to energy management.

- Act No. 47 "Consumers power-supply" (Feb. 10, 1992)
- Act No. 105 "The Ministry of Industry & Energy Regulations" (March 27, 1992).
- Act No. 137 "Electric Energy Tariffs" (Apr. 21, 1992)

These Acts concern energy supply, maintaining the order and tariffs, but do not regulate energy efficiency.

"The State Program of Energy" (not confirmed by the Government) has proposed the energy-supply scheme for industry (not carried out) shown in Figure 2.

Insert Figure 2

19

The "Program" envisages the energy efficiency mechanism (not carried out) shown in Figure 3.

"The Program" includes the following measures:

- information system, containing the results of scientific research in energy efficiency and alternative energy;
- annual international exhibitions;
- annual proceedings "The Energy Economy";
- alternative energy and energy efficiency schools;
- standards of energy consumption;
- organization of the Baltic Center for Renewable Energy (Bal REC) (by the aid of Danish Folkcenter for Renewable Energy);
- new residential energy consumers' account system;
- new standards of heat insulation for houses;
- minimizing heat loss in heat supply networks;
- energy audits of enterprises;
- the developing of synchronous machine design.

On June 8, 1992 the Parliament, Council of Ministers and Municipalities came to an agreement which states that the natural gas purchases remain centralized by the contracts between governments, not private managers.

The Government is planning to divide the stocks of enterprise "Latvijas nafta" (the oil storage in towns Ventspils, Rezekne and Cesis) in three equal parts. One of these parts will remain the state property. The second part will be sold to foreign investors, but the third part will be transformed to enterprises on hire, private enterprises and municipality enterprises.

Insert Figure 3

21

1.2.2 Management Organization and Allocation of Responsibility for Energy Efficiency

The typical organization chart for Latvian industry is shown in Figure 4.

From this organization, the chain of command for energy consuming problems is as shown in Figure 5.

There are energy-saving plans at the enterprises, but they are used only in the case when the energy-supply is strongly limited.

In general, the accounting of electricity, gas and heat energy can be done for the enterprise as a whole, not for separate consumers. The reasons are following:

- there are not enough measuring instruments (energy meters);
- the energy supply system does not allow the measurement of consumption in separate shops and departments without reconstruction.

The characteristic drawbacks in organizing energy efficiency are:

- there is no energy account in separate shops, therefore, the energy resources are distributed with the great degree of subjectivity;
- there is no real account of heat energy. For the bulk of consumers, the payments for heat energy are based on theoretical calculations, not measurements. These calculations consider the theoretical energy demand (in industry) or the area (m^2) of the apartments (in residential sector);
- enterprises have not enough financial resources for adjusting the equipment because costs are rising and enterprises have debts;
- the staff is not interested in energy efficiency.

1.2.3 Command and Control Procedures Used by Energy Companies to Allocate Scarce Energy Supplies

The state enterprise "Latvijas gāze" allows a consumer to connect with the network only when there will be sufficient supply of gas, and when it appears that the efficiency of gas consumption will be normal.

insert Figure 4

23

insert Figure 5

The energy supervision "Energokontrole" (state enterprise "Latvenergo") is providing regular inspections on electricity efficiency.

The Ministry of Industry & Energy has distributed all consumers in three groups. Every group can be load-shed from the electricity distribution network by special time-schedule.

There are limits for energy consumption and maximum capacity for electric energy and gas. If the consumption-limit is exceeded, the cost for gas is two-fold in summer and five-fold in winter. Recently, however, the cost of gas is so high that these penalties are no longer enforced.

When the electricity limit is exceeded, the penalty paid is stated as ten-fold, but there have not been any such penalties applied yet.

The Act No. 27 of the Council of Ministers states that the enterprise "Latvenergo" is not responsible for an unsatisfactory electricity supply, if such a supply is the result of shortage in fuel-supply.

1.2.4 Accounting Procedures for Measuring Cost of Production and Profit or Loss

In Latvia, the ex-USSR standards for fixing the prices were used. Now, in calculating the prime cost, enterprises take into account that the energy prices have risen 100 times, or more. Thus, these high energy prices are simply added to the prime cost. Producers are allowed to add a profit margin to the prime cost to calculate selling price.

The USSR regulation RD 34.09.301-89, "The estimation of economical efficiency" in Latvian enterprises is used. The economical effect of a new technology is calculated by means of a formula which includes the expected results of the improvement, a capital cost recovery factor, and the increased (decreased) operating expenses connected with the new technology.

1.2.5 Procedures for Measuring Plant Output and Energy Efficiency

There was a USSR regulation 27322-87, concerning the industrial enterprises' energy balance. There was a practice to put together such a balance in every enterprise. Afterwards this standard was changed. At the moment, such balances are not formed generally, but only in some enterprises.

25

The enterprises are forming annual accounts but they consist only of data without analysis.

1.2.6 Incentives for the Plant to Minimize Energy Costs and to Raise Energy Efficiency

Until recently, efficiency issues were dealt with on all levels, including party committees, voluntary public inspection and public prosecutor's offices. At present, there are energy efficiency targets, tests of electric motors, plans for equipment repair and adjustment set in every plant, however, all responsibility for the fulfillment of these plans rests with the Production Department. The existing industrial enterprises are notorious for energy intensive production due to obsolete technologies and outdated equipment.

1.2.7 Incentives for Individuals to Suggest and Implement Energy Efficiency Improvements

Regulations and methods previously adopted that provided for the payment of bonuses for energy efficiency are still formally valid. These regulations made it possible for some workers to receive extra money, though often undeserved. At present, there are neither limits on wage increases, nor premiums paid for energy efficiency directly.

1.2.8 Perceptions of the Importance of Energy Efficiency Relative to Other Objectives

In the course of 50 years until March-April of 1992, power facilities in every plant have been allocated the role of subsidiary shops. Production and technology have always been indisputable priorities and few were those plants' managers who realized the significance of energetics. The technologist of the plant was Czar and proposals for energy efficiency did not count much. The reasons for it were the low price level of energy (fuel, heat and electricity), meager salaries paid to energeticists and great responsibilities they had to assume (not so rare were the cases when non-professionals trained in other specialists, being far from and not related with energetics, worked as energeticists). In larger enterprises, the chief energeticist, who is the department head, is in charge of energy facilities, in smaller ones - energy management is the responsibility of a chief mechanic or chief engineer. This, of course, explains the backwardness of energy systems at almost all the plants.

Since March 1992, in connection with sky-rocketing prices on fuel and electricity, the situation has drastically changed. Monopoly enterprises are still not concerned very much about energy efficiency improvements, but on the other hand, those enterprises which experience a production slump or can go bankrupt, are now forced to deal with energy efficiency issues.

21

Due to rising energy prices, a great many enterprises have sorted out energy efficiency improvements as chief priorities in their business activities. Many enterprises have run up a debt to "Latvenergo" for energy. At present, a question about the closure of enterprises unable to pay for energy had been raised, so that "Latvenergo" could purchase fuel and not go into bankruptcy.

1.3 INDUSTRIAL INVESTMENT DECISION-MAKING

1.3.1 Sources and Availability of Capital

According to the existing legislation in the Republic of Latvia, the basic sources of capital investments are comprised of the financial resources of an enterprise, including the resources of its interested physical and legal entities, and Government budget financing.

The sources of capital can be formed when the enterprise is bringing profit and it is possible to retain earnings (make deductions from contributions to Government) for this purpose. According to the existing legislation, the tax on profits is 35%. But at the present moment there exists tax relief for this profits tax (up to 60% of the tax calculated), for example:

- newly established enterprises are exempted from the payment of profits tax for two years starting with commencement of operations. This does not apply to enterprises formed on the basis of liquidated enterprises;

- the part of the profit that is taxed can be reduced by 30% of expenses related to the development of scientific, research, experimental and design works, for mastering new progressive technologies and new types of production, if these expenses come from the part of the profit that remains at the enterprise disposal;

- the part of the profit that is taxed can be reduced by 30% of the expenses on environment protection if it is carried out using the part of the profit that remains at the enterprise disposal;

- the part of the profit that is taxed can be reduced by twice the sum that is paid for different cultural, health protection, scientific, national economic and charity activities, funds or programs in a kind of donation, grant or transfer, but no more than 20% of the whole taxed profit.

These rules can be attributed also to activities in the field of energy efficiency.

27

Stable tax rules are necessary for the provision of stable entrepreneurial activities. In most countries no tax relief is provided, and so in Latvia it is expected that tax relief will be abandoned for producers and employers.

The resources from the state budget are allocated by the Supreme Council of the Republic of Latvia according to the information and proposals given by the Ministry of Finance, which are accordingly formed taking into consideration the applications of the Ministry of Energy and Industry.

If the enterprises have no resources of their own as well as no budget financing at their disposal, it is possible to get credit loans, especially in commercial banks. The interest for short-term credits in State Banks is 15-30%, in commercial banks up to 120% per annum. For agricultural enterprises and farmers, the interest rate is 8-25%, but it is clear, that such a small interest is not profitable for banks. Industrial enterprises cannot receive any donation from the budget but in cases when the industrial object is nearly completed (by 60-90%), it can get budget donation to finish the project, which is not repaid.

1.3.2 Investment Criteria Used by the Financial Institutions Providing Capital

The Ministry of Finances prepares proposals to the Supreme Council for further decision taking according to the following scheme.

insert figure

The main investment criteria according to this scheme are the following:

1) the Government priorities according to the conception adopted at the beginning of the fiscal year, are taken into account. At the present moment, such priorities are energetics and agriculture;

2) the status of completion of the object is taken into account. Practically today, it must be 60% or more.

3) the priority for budget financing is given to budget-financed organizations (for example, schools and hospitals), for which the budget is the only financial resource;

4) the social importance is considered (for example, the priority is given to the equipment for purification of sewage comparing with other objects);

5) the proposals of branch and financial experts are taken into consideration.

After comparing these criteria for objects claiming to budget financing, the enterprises' own resources are investigated and the possibility of self-financing is considered if, by the opinion of financial organs, these resources are sufficiently great.

1.3.3 Investment Criteria Used by the Firm

In the present situation, the decision about the financing of a project, considering its technical documentation and estimate, is made by the director of the enterprise, consulting the appropriate specialists in the enterprise, and outside it. The main criteria of the decision are the following:

1) the profitability of the project, as estimated by payback period. To our opinion, this represents 90% of the criteria. Other secondary criteria include:

2) the bulk of additional production or energy output;

3) estimation of the interest rate (if interest rates are too high, all projects will be delayed);

4) it should be shown that the activity would influence the energetical independence of the enterprise as well as would elaborate the safety of energy supply;

5) social aspects;

6) the aspect of fine and tax payments must be considered -- whether they would diminish after introducing new activities in energy efficiency, as well as environmental pollution must be taken into account, etc.

1.3.4 Policy and Institutional Factors Influencing the Decision-Making Process

Under the drastic economic depression existing in Latvia at present, it is difficult to keep consistent policy hence, many unknown factors are operating simultaneously, including changes in costs of energy resources in Russia and other countries. For example, the rise of electricity price due to the rapid increase of electricity import prices from Estonia was so fast that housing block managements could not ensure the proper returns from inhabitants (in less than a year the electricity price for 1 kWh rose from 0.04 ruble to 1 rouble). As a result, the energy supply firm (Latvenergo) was facing bankruptcy because it did not receive payment for electrical energy in the new prices.

1.3.5 Perceptions of the Importance of Energy Efficiency Investments Relative to Other Potential Uses of Capital

The priorities that are in place at the present moment (see below) could be changed already next year.

The main priorities in Latvian national economy in 1992

I. The minimal provision of heat and energy.

1) The Government is solving the problem of energy resources supply in 1992 in order to provide the minimal needs. The Government is forming the special state reserve fund of energy resources for the heating season of 1992-1993. The Government will support any entrepreneurial activity to meet all other demands for energy resources.

2) The state provision of minimal energy resources in 1992 is shown in Table 5. The amount of financial resources for obtaining the minimal energy resources is estimated as 275 million US$. It can be covered as a kind of humane support, using the loans of some countries and credits of international financial institutions (The European Bank for Reconstruction and Development, the World Bank, International Currency Fund, etc.).

In order to reduce the necessary credit sums:

-- the clearing payment system must be maximally used dealing with Eastern and Eastern European countries;

-- the barter deals must be promoted;

-- the export of goods and service rendering must be extended in order to replenish currency resources and maximally ensure the payments by own financial resources.

3) The fuel supply will be ensured by commercial, state, as well as private structures. The amount of the latter must grow and the free competition stimulated.

4) At the same time, it is necessary:

-- continue the changes in sale's prices and tariffs according to actual expenses for fuel and all other energy resources;

-- coordinate the payment system dealing with Russia and Baltic States.

5) As the cost of energy resources is rapidly increasing the energy efficiency becomes more significant.

Therefore, the following activities are planned.

-- boilerhouses should be rearranged in such a way that alternative types of fuel could be used. Such actions were carried out in some small towns last year providing the usage of different fuel types (gas, mazout, fuel oil and solid fuel, including peat);

-- the house heating should be rearranged for stove heating with firewood, where it is technically possible, replacing fuel oil and central heating system;

-- necessary testing, measuring and regulation devices should be obtained, produced and installed, first of all -- for heat energy, and gas;

-- additional warming of dwelling and public houses and improvement of heating nets insulation;

-- heat locomotive engines should be used as additional heating source.

II. Reliability of transport and communication systems.

III. Food and medicine provision.

IV. Balance of financial system.

V. Trade

VI. Social politics and employment.

VII. Ensuring of court activities and public order.

Table 5
State Provision of Energy Resources, Meeting the Minimal Needs in 1992

	Minimal need in 1992	Coordinated supplies (01. 05.92)	Must be bought additionally till the end of the year	
			Real quantity	million US$
Diesel fuel thousand t	1,095	510.5 173.9[1,2]	584.5	116.9
Bensin thousand t	561	186.4 41[1,3]	374.6	86.2
Mazout thousand t	1,300	838	462	32.3
Natural gas million m^3	3,000	2,600	400	40
Liquefied gas thousand t	60	61.7	--	--
			Total	**275.4**

[1] Actually received till 01. 05. 92.
[2] Including the commercial activities of State Enterprise Latvijas Nafta and export duty -- 82.5 thousand t.
[3] including the commercial activities of State Enterprise Latvijas Nafta -- 10.8 thousand t.

There also exists a plan of foreign investments up to year 2000 (see below), indicating long-period priorities. As it is seen from this program, energetics will have indisputable priority.

Table 6

Draft programs and activities realized with foreign investments taken as a basis of the Decision No. 84 of the Council of Ministry of the Republic of Latvia, March 12, 1992, Riga

(millions of US$)

Draft Programs and Activities	Possible term of fulfillment	Possible expenses	Feasible Financial Sources			Resources for prior needs (from the whole sum) in 1992-1993
			Foreign credits (guaranteed by Government of Latvia)	Credits for joint enterprises (guaranteed by Latvian Bank)	Other sources	
1	2	3	4	5	6	7
Total		12,974.5	3,236	9,692	46.5	2,635.5
incl. measures for elimination of unfavorable external economic conditions		3,200	---	3,200	--	1,000
1. State draft programs		4,252	2,924	1,297	31	773
1.1 Energetics		2,763	2,048	705	10	522
Reconstruction of underground gas repository in Incukalns	1992-1995	97	97	--	--	60
Gas repository in Dobele (5,5 bill. m^3)	1992-1994	150	--	150	--	150
Oil refining plant (2-3 mill. t raw oil per year)	1993-1994	150	150	--	--	2
Natural gas thermo-power station (600 MW) -the firm ENRON	1993-1994	480	--	480	--	280
Nuclear power station (600 MW) or	1994-2000	1,730	1,730	--	--	--
Coal thermo-power station	1994-2000	1,170	1,170	--	--	--
Construction of distribution transformers shop (output - 5000 transformers per year)	1991-1993	10	--	--	10	10

Table 6 (continued)

1	2	3	4	5	6	7
Modernizing of Riga Electric Bulb Plant	1992-1996	60	--	60	--	60
Reconstruction of power plants	1992-1996	57	57	--	--	1
Formation of accounting system for main gas pipes	1993-1996	9	9	--	--	5
Construction of mazout reservoirs for state reserve fund (300,000 t oil products)	1993-1996	2	2	--	--	2
Exploring works for oil extraction in the Baltic Sea	1992-1995	3	3	--	--	3
1.2 Paper and Pulp	1992-1996	938	516	422	--	155
1.3 Cement	1992-1995	90	90	--	--	60
1.4 Culture	1991-1996	21	--	--	21	16
1.5 Pharmacy and biotechnology	1992-1998	350	180	170	--	5
1.6 The programs Grain, Sugar, Plant Oil, etc.	1991-1997	90	90	--	--	15
2. The drafts of branch programs		3,812.5	312	3,485	15.5	582.5
2.1 Development of sea transport (passenger and cargo), reconstruction of sea ports providing oil product import	1992-1998	600	200	400	--	50
2.2 Technical provision of railway transport	1993-1998	400	100	300	--	30
2.3 Tram production in Riga Carriage Plant	1992-1995	15	--	15	--	5
2.4 Reconstruction of Metallurgical Plant in Liepaja (output 570,000 t rolled metal per year)	1992-1996	200	--	200	--	--
2.5 Construction of garbage processing center	1993-1998	50	--	50	--	--

Table 6 (continued)

1	2	3	4	5	6	7
2.6 Development of produc-tion of construction materials	1993-1995	170	--	170	--	--
2.7 Modernizing of Timber Plants Bolderaja, Liepaja, Riga	1992-1993	55	--	55	--	--
2.8 Construction of Timber Plant in Gulbene	1992-1993	10	--	10	--	5
3. Restructuring of industry, demonopolization		410	--	410	--	30
4. Development of the private sector and securing the monetary and bank system		1,300	--	1,300	--	250
4.1 Formation of credit resources	1992-1995	1,000	--	1,000	--	--
4.2 Formation of initial capital of Agrarian Bank	1992-1995	100	--	100	--	30
4.3 Formation of stability fund for introduction of national currency	1992-1993	200	--	200	--	200
4.4 Formation and develop-ment of bank and insurance systems	1992-1995	50	--	50	--	20
5. Expenses on preventing emergency economical situation		3,200	--	3,200	--	1,000
5.1 Fuel	1992-1995	1,600	--	1,600	--	400

1.4 AVAILABILITY OF TECHNICAL SERVICES AND EQUIPMENT RELATED TO ENERGY EFFICIENCY

1.4.1 Supply of Technical Services in Energy Efficiency

The following design institutions in Latvia are offering technical services in designing and reconstructing boiler houses, supplying energy efficient equipment, etc.:

- "Rūpnīcprojekts" ("Industrial Project") - Department of Heat Engineering -- specializes in utilization of flue gas waste heat by design and installation of heat exchangers;

- "Agroprojekts" ("Agrarian Project") - specializes in problems of local fuel supply for small-scale boiler houses using domestic solid fuels (wood, etc.) on the basis of Finnish experience;

- "Komunālprojekts" ("Communal Project") - specializes in flue gas heat utilization by heat exchangers for small boilerhouses,

Technical services in energy efficiency are offered by the following organizations:

1. "B. V. Ekodoma Ltd.," is a private firm offering consulting services in energy efficiency and environmental protection. Ekodoma's chief energy efficiency projects involved:

   -- Recommendations for energy efficiency improvements at the plant "Etna" in Madona (fuel-coal) including the measurements of heat energy consumption, boiler efficiency, harmful CO, CO_2, NO_2, SO_2 emissions as well as proposals for a water chemical treatment system. Year -- 1991.

   -- Express audits of 17 boiler houses in Gulbene, partly making measurements of boiler performance efficiency and environmental pollution. Results were discussed in a review seminar March 2, 1992, where energetics and municipality officials from the towns of Gulbene and Madona took part.

   -- Boiler efficiency tests and emissions control of mazout-fired boilers of the Central district heating boiler house in Ventspils. Recommendations for energy efficiency improvements have been put forward. As a result of analysis, improvements to the water chemical

treatment system for district heating have been suggested using newly-purchased Swedish pipes. The work was started in 1991 and is still in progress.

-- A project financed by the Ministry of Industry and Energy "Classification of Boilers in Latvia" is well under way.

2. "Energi-R Ltd" is a private firm offering consulting services in energy efficiency and in energy planning. Energi-R specializes in:

-- energy balance of industrial enterprises,
-- alternative energy sources,
-- rational use of energy,
-- fuel and energy metering systems,
-- pricing and tariffs,
-- information systems of power utilities,
-- utilization of secondary resources,
-- combined heat supply systems,
-- cooling-heating systems,
-- inspection and auditing of power utilities.

3. "Latvias Energi Attistiba, LEA" ("Latvia Energy Development") is a state-owned firm operating in support of the Ministry of Industry and Energy, Energy Division. LEA's chief activities involve:

-- Mediating functions between foreign partners specializing in energy efficiency and local organizations (IDOM, negotiations with a Finnish firm IVO International OY).

-- Organization of seminars, discussions, etc., in energy efficiency (IDOM).

-- Coordinating responsibilities involving fund-rising for different projects via the Ministry, for example, Master Plan Program.

Under the 1991/92 USAID Emergency Energy project, RCG/Hagler, Bailly awarded subcontracts to Ekodoma, Energi-R, and LEA as partner firms to assist in the implementation of the energy management program. Each partner firm was assigned one industrial plant or district heating enterprise (Ekodoma was assigned two). In the assigned plant, the partner firm had the following tasks:

- Provide two engineers to join the energy audit team for the work in the client plant. The engineers will assist the RCG/Hagler, Bailly engineers by translating English, making measurements, collecting data, making engineering calculations, identifying potential efficiency improvements, and determining equipment to be purchased. The team will work under the direction of the RCG/Hagler, Bailly Task Leader.

- Provide transportation for the audit teams and RCG/Hagler, Bailly's audit tools and make hotel reservations.

- Provide communications between RCG/Hagler, Bailly in the U.S. and the client plant.

- Receive the draft energy audit report from RCG/Hagler, Bailly, translate the report into Latvian and Russian, and present the results on behalf of RCG/Hagler, Bailly in a meeting at the client plant.

- Develop engineering specifications for the equipment package from the U.S. and obtain the client plant's approval for the specifications.

- Coordinate receiving of the equipment in Latvia, delivery to the client plant, assistance in use of diagnostic instruments, and supervision of the installation of the equipment in the client plant.

- Participate in seminars on energy management to be held in Latvia and Lithuania at the end of the program.

Technic . services in boiler monitoring are offered by state-owned, private, cooperative firms and limited companies, a great number of them specializing in gas-fired boilers. These firms have been established by specialists from the former state gas company "Latvijas gāze" (Latvian Gas). While carrying out maintenance work on boiler controls, these companies undertake the adjustment and testing of auxiliary devices, too. Such companies as "Infralit," "Enerģija GA," "Koprolat" as well as private firms "Gricāns" and "Garkājis" are in this business. These companies make use of chemical gas analyzers for O_2 and CO_2 detection as well as portable chromatographs. Chromatographs are seldom used since it is difficult to set a reference point for them. Equipment already installed in boiler houses (manometers, pressure gauges, steam flow meters, etc.) is extensively used in the course of boiler control.

Boilers fired by coal, mazout (heavy fuel oil) or diesel are being dealt with by other companies, for example, "Promenergo," state firms "Orgpiščeprom," "Control and Repairs

Works" in Tukums. A limited private company "Komnleks" offers technical services for boiler feedwater treatment.

Repairing and adjustment of the energy equipment in thermal electric plants are carried out by companies from other republics, i.e., "Kaunas Power Equipment Repairs" (Lithuania), "Central Boiler and Turbine Institute" (Russia) as well as by the plants themselves and equipment suppliers. Erection work can be performed by a Latvian energy company "Energoremonts" ("Power equipment repairs"). Services in pipe insulation are rendered by a limited private company "Termo."

To pick out the needed company offering services in repairs, erection and control, Latvian customers today take into account the following factors:

a) whether the company have all the necessary materials and equipment for erection work in case replacement is required;

b) possibilities for long-term cooperation; and

c) former connections.

1.4.2 Privatization of Entities Offering Technical Services

There is no law on privatization in Latvia at present, on May 5, 1992 a second reading of a draft law package was conducted at the session of the Latvian Supreme Council. It comprises the following draft laws:

1) On the order of privatization of state and municipal property;

2) On the management of state and municipal property in free enterprises;

3) On the order of assessing state and municipal property subject to privatization ["Diena," June 3, 1992].

It has been forecast that later in June a package of laws might be adopted in the third reading, and then after the drawing up of privatization projects in enterprises it would be possible to embark upon privatization in three month's time.

The Council of Ministers proposes that privatization be carried out via the Ministry for Economic Reforms, whereas the Latvian Supreme Council (SC) insists on it being done through branch ministries. SC holds a view that the Ministry for Economic Reforms is in no

40

position to cope with privatization alone. In its turn, the Council of Ministers is of opinion that placing all responsibilities with one ministry will decrease the number of people who might try to grant themselves privileges in the course of privatization. The final decision will be adopted later in June when the package of draft laws is put to vote.

Privatization is to be implemented in several ways ["Diena," June 3, 1992]:

1. Sale by public auction or by selected candidates' auction for labor certificates or property (former owners' property compensation) certificates or other existing means of payment currently in circulation within Latvia. In the latter case only 5-10% of the actual entity's value is to be paid.

3. Competition sale with secret bids (competition regulations are to be approved and published by a ministry or municipality possessing the property for sale).

4. Transformation into statutory companies.

5. A hire-purchase system.

6. Separate selling of real property and movable property of an entity.

In the energy sector, enterprises "Siltums" (Heat) and "Latvijas Siltums" (Latvian Heat) have undergone decentralization. Boilerhouses have been handed over to municipalities ["Diena," May 14, 1992]. Large entities, such as heat utilities and regional boilerhouses remain under the authority of Latvenergo. The entities offering technical services (boiler control, repairing, erection) for the most part are state, private, cooperative and limited companies. Those cooperative, private and limited companies have not emerged as a result of privatization but are founded by the specialists who have given up their former "state" jobs.

1.4.3 Examples of Appropriate Energy Efficiency Equipment

The Latvian Ministry for Economic Reforms has worked out a project "Urgent Measures for Latvian National Economy in 1992" providing for economy of energy resources. "For this purpose, it is necessary to procure, produce and install all the necessary measuring instruments and adjustment devices, firstly for heat energy, secondly -- gas" ["Diena," Supplement No. 20, May 15, 1922]. Following Prime Minister I. Godmanis discussions with municipality officials of Riga, it has been admitted that in order to save energy it is necessary to install heat controllers that would encourage people to cut their energy consumption. Prime Minister's adviser on energy matters J. Luns says: "It is clear now that we must have heat controllers and gas meters installed in our flats. When are they going to

be produced and fitted? It is difficult to give a correct answer. I suppose the work would be finished no sooner than in two or four years" ["Neatkarīgā Cīņa," October 29, 1991].

Deputy Minister of Industry and Energy, G. Koemecs is of opinion that "various heat energy saving and measuring devices might be supplied to all consumers in five year's time at best ["Diena," April 3, 1992]. There are no data available on the required number of heat controllers. The Latvian Ministry of Industry and Energy estimates that about 500,000 gas meters might be needed, providing gas meters are installed for:

a) liquid gas consumers (very expensive),

b) natural gas consumers who have also stoves for burning firewood (they try to substitute firewood for natural gas), then the required number of gas meters substantially goes down.

According to the Ministry of Industry and Energy about US$2.5 million are necessary to install consumption measuring equipment for all energy forms ["Diena," June 3, 1992].

Apart from energy metering equipment for individual consumers, measuring instruments for energy efficiency estimation are needed in the industrial sector. Each industrial branch has its specific character, however, there are many common processes and ways of their evaluation. The following processes and their control devices can be mentioned as an example:

1) Detection of leaks in heat supply and steam generating equipment distribution systems (ultrasonic detectors);

2) Performance diagnostics of bearing and rotating parts in an energy equipment and determination of the character of changes (ultrasonic detectors, stroboscopes);

3) Tests of the steam generator and hot water boiler system efficiency and possible improvements (gas analyzers which measure CO, O_2, NO_x, SO_2, feedwater hardness meters, pyrometers, thermocouples, gas and surface temperature meters, determination of soot amount, flue gas and air flow velocity meters);

4) A survey of electric motors and electric distributing devices (electric survey meter with power factor);

5) Control of characteristic parameters of a technological process - dependent on the production process itself (lime production - temperature measuring and registration

42

with infrared sensors in lime-burning furnaces; paper production -- measuring and registration of paper humidity);

6) Establishing and introduction of an energy management system (hardware and software).

1.4.4 Identification of the Critical Factors Restricting the Supply of Energy Efficient Equipment

It is possible to point out the following factors:

1) Need for greater understanding of the role and necessity of energy efficiency at all levels, from Government down to the plant personnel. At June 6 meeting of the Latvian Popular Front Council, which was attended by Prime Minister I. Godmanis, State Minister J. Dinevitch and MP J. Dobelis et al., severe criticism was passed on the Council of Ministers project "Urgent Measures for Latvia's National Economy in 1992." It was stated that the project would remain a mere declaration, since there were no financial resources available to implement it. Moreover, the project does not provide for the measures of energy efficiency ["Diena," June 9, 1992].

2) A network of local organizations, that might assist the enterprises to streamline energy efficiency, is rather underdeveloped:

   a) it is necessary to train the specialists of the said organizations in energy management and efficiency improvement.

   b) the local entities providing technical services are poorly equipped as regards measuring and control instruments.

3) The existing forms of ownership and the lack of economic incentives do not encourage energy efficiency:

   a) most enterprises are monopolies within an industry include energy costs in the prices of their products,

   b) state companies lack an economic mechanism that could evaluate and stimulate real improvements in energy efficiency,

   c) the privatization of state companies has not yet begun.

4) Society is not adequately informed about the possibilities for energy efficiency improvements. Public opinion is deeply concerned about the rapid rise in prices for fuel, gas, heat and electricity to unaffordable levels. Society's growing regard for energy efficiency issues will encourage Latvian authorities to deal seriously with these problems.

5) There are enterprises in Latvia that could undertake the production of energy efficient equipment and measuring instruments (for example, gas and heat meters -- the Riga Plant of Automobile Electric Devices; ELAR, other plants in the towns of Jelgava, Babīte, which are ready for producing of heat controllers). There are serious impediments, however, for launching production, such as:

   a) insufficient financial resources,

   b) a lack of technical design documentation,

   c) uncertainty of the government policy,

   d) difficulties of finding a ready market for the products.

6) It is necessary to change the psychology of people. Privatization -- the foundation of economic reforms -- is oriented towards the restoration of the proprietary class. Life, however, calls for another type of a proprietor. It should be a hard-working proprietor. It should be a class which could combine the property management function with productive labor ["Diena," June 9, 1992].

1.4.5 Availability of Imported Energy Efficiency Equipment

The following was recently reported, "Danish specialists will help us with heat controllers. Our foreign partners have made a promise to supply us with a new type of heat controllers free of charge this November. How many? About as many as will be needed to equip four large multi-storied houses. We have planned to supply two houses in Riga with these heat controllers, one in Latvian resort Jūrmala and the other in the Riga region. If they prove to be good by experiment, then evidently we will start producing those Danish prototypes in Latvia. Of course, their manufacture and installment in our flats is going to be luxury." [Newspaper "Neatkarīgā Cīņa," October 29, 1991].

In September 1991, a protocol on installing heat controllers and water and gas consumption meters in 4 dwelling houses was signed between the Danish firm "Brunata Holding" and the Department of Municipal Services of the Ministry of Architecture and Construction. The

protocol provides for founding a joint venture enterprise "Brunata-Latvia" that will be responsible for fitting all regulating and measuring equipment (except gas meters) in flats and supplying the maintenance services. Commenting on this event, newspaper report that "the private firm R.A.S.A. led by Prime Minister's former advisor on energy and industry G. Pīlādzis has set up a joint venture firm with a Danish private firm "Brunata" that specializes in the manufacture of water consumption meters and other measuring devices necessary for our flats and homes" ["Neatkarīgā Cīņa," May 20, 1992].

According to "Rīgas gāze" officials, several lots of gas meters have already been delivered to Latvia. Commercial enterprises are engaged in this business. The price of a meter designed for individual use is about US$100. Used meters at a price of 6000 roubles (about US$50) are also being brought to Latvia. The specialists of "Innovation Centre" assert that used meters can be bought at approx. 120 DM (about US$80) or more depending on their applications.

The European Bank of Reconstruction and Development is planning a project to provide funds for energy efficiency equipment and meters to alleviate the energy crisis. One part of this project is of special importance as it deals with organization of measurements on the gas pipeline transporting gas from Russia to Latvia via Lithuania. So far, no measurements have been made and the amount of gas to be delivered is calculated in terms of gas consumption balance of Latvia, Lithuania and Kalinigrad together.

1.4.6 Options in Local Manufacturing of Energy Efficiency Equipment

Rolands Makulis, a specialist of the Regional Engineering Department, said: "Boilers for heating fired by solid fuel, which are designed for individual homes as well as for village boilerhouses, are being manufactured by 18 different firms and plants in Latvia. A stock company in Tukums "Komforts" is one of the leading companies among them. Larger boilers with a capacity to 1.6 MW are being manufactured by the Jelgava regional association "Lauktehnika." A cooperative firm "Jauda" offers 30 kW boilers. In brief, the demand for boilers can be sufficiently satisfied in the "Republic" ["Neatkarīgā Cīņa," May 20, 1992].

The joint-stock company "Komforts" produces 70 boilers per month of three types -- 35 kW, 50 kW and boilers with built-in heat exchangers. Following the opening of a new workshop it will be possible to produce up to 2,500 boilers a year. Convectors for homes and greenhouses are also being produced ["Neatkarīgā Cīņa," May 20, 1992]. A state company "Gamma" produces the RK-1-6 boilers of 1.85 MW capacity, steam-water and water-water heat exchangers with a water consumption controller "PP" and temperature controller "TPb."

45

One should also mention such enterprises in Latvia as:

- The Ventspils Ventilator Plant,
- The Riga Diesel Engine Plant -- diesel engines for civil applications and defense.

Electric motors are purchased partly from Lithuania, where the Kaunas Electric Motor plant produces small electric motors with a capacity ranging between 0.37-7.5 kW. The Volta plant in Tallinn produces medium-sized motors, up to 100 kW.

There are plants in Latvia, which are ready to manufacture gas meters, such as the Plant of Automobile Electric Devices, Komutators and Elar. However, before organizing the production process, the plants want to have a market for their products. Due to uncertain attitude of the Government as regards industrial policy, this process has not begun yet.

A Danish-Latvian joint venture company in Mārupe could soon undertake the production of heat controllers. The Innovation Centre has made an effort to produce heat controllers. One of the heat controllers has already passed a state test audit and in June 1992 production began with a run of ten controllers. Subsequent to its state test audit, permission will be granted for the manufacture of 1,000 controllers per year. The Centre plans to turn out one hundred controllers this year, but next year one thousand. Water consumption meters are bought from Russia. However, should Latvia want to keep money within the republic, their production must necessarily be organized on the spot and the required materials -- PIFE and stainless steel tubes -- supplied. The Plant of Vacuum Coatings is ready to produce these controllers. The cost of a heat controller and its installation amounts to about 60,000 roubles (US$500).

Extension of this work could benefit from a better-defined policy on the part of the Government. The Chairman of the Riga District Deputy Council Jānis Ruško said: "There was a suggestion to alleviate taxes to those commercial enterprises that are engaged in procuring water, gas and other measuring devices and their installing ["Latvijas Jaunatne," May 26, 1992]. Unfortunately, such resolutions have not been passed and a lot of firms have adopted a wait-and-see policy.

1.5 INDUSTRIAL REFORMS UNDER CONSIDERATION

1.5.1 Latvian Energy Pricing Practices and Trends

In 1992, the main problems of energy price formation in Latvia are connected with the continuous increase of prices of primary energy resources from Russia and general inflation. The recent history of this process is shown in Tables 7 through 12. The energy supply organizations are setting retail energy prices according to their usual, well-known methods taking into account the price of purchased primary energy resources, the cost of energy transformation and transfer, the expenses for organization maintenance, etc.

The state institutions are controlling these expenditures and are fixing the level of tariffs, based on a maximum mark-up over the cost of energy resources. These institutions are also affirming the structure of tariffs over the consumer groups.

The Latvian Government allows the tariff increases for electricity, heat and gas by energy supply organizations with a certain delay, as regards to the expenditure growth of these organizations (including the purchase price of primary energy resources). That delay is being done on purpose to reduce the social shock to inhabitants and to allow industry to get ready for the new energy prices. However, the delay has led the energy supply organizations to incur heavy short-term debts, and they are now almost going into bankruptcy. Therefore, it is very important to calculate how frequently and how much to raise prices (tariffs) so, that energy prices would develop optimally.

The Latvian Government finds it impossible to release energy prices completely to market forces at the present moment. The prices of gasoline are practically released at the present moment due to the Government's rule to release prices and let different commercial enterprises to deal with fuel supply in Latvia. In January and February, 1992, Latvia was suffering from the shortage of gasoline and the transportation system was under threat of complete halt. Beginning with the second quarter of the year 1992, after the introduction of free prices, the fuel shortage was eliminated. The activities of private firms, however, are based on much lower fuel prices in Russia and other ex-USSR republics for the time being. After the fuel price release in Russia there may again be some problems with fuel supply in Latvia.

The same situation exists with coal supply in Latvia. The state enterprise "Kurināmais" (Fuel) cannot afford to sell coal for such a low price as some private firms do (because of their great expenses for maintenance and transport). This will lead to the bankruptcy of "Kurināmais", since under competition they cannot sell enough coal to meet fixed costs. The privatization of this firm is now under the discussion, thus, stimulating them to reduce

Table 7
Growth of Gas Tariffs in Latvia
October 31, 1991 -- June 1, 1992

	Oct. 31, 1991	Jan. 10, 1992	May 1, 1992	June 1, 1992 (Projected)	Notes
1. Tariffs for natural gas sales to consumers having gas meters					
1.1 Residential consumers	50	1,080	2,885	6,910	rbl/000m^3
1.2 Industrial and commercial consumers	61	1,187	5,267	n/a	
2. Tariffs for natural gas sales to residential consumers having no gas meters in their apartments					
2.1 Households with gas used for cooking in apartments with gas cooking appliances and district heating	0.40	8.64	23.08	55.28	rbl. per person per month
2.2 Households with gas used for cooking and hot water in apartments with gas cooking appliances but no district heating	0.55	11.88	31.74	76.01	rbl. per person per month
2.3 Households with gas used for cooking and hot water in apartments with gas cooking appliances and individual gas water heaters	0.83	17.82	47.60	114.02	rbl. per person per month
2.4 Heating of apartments and individual houses with gas boilers	0.20	0.50	---	---	rbl./m^2 of living space per month
2.5 Refrigerators operated with gas	1.38	29.81	79.63	190.72	Refrigerat or per month
3. Prices of LPG					
3.1 Residential consumers	0.65	9.50	---	---	rbl/kg
3.2 Industrial and commercial consumers	0.95	27.44	---	---	rbl/kg
4. Exchange rate (rbl/US$)	40	100	120	120	

Table 8
Growth of Electricity Tariffs in Latvia
Dec. 1991 - May 1992

	Dec. 1991	Jan. 16, 1992	May 1992
Group I consumers:			
Large industrial consumers, 400 kVA or more (as of Jan. 16, 1992 - 750 kVA or more			
Demand charge (rbl/kW/month)	14	540	2,880
Energy charges:			
General rate (rbl/kWh)	0.03	0.33	1.35
Daytime rate (rbl/kWh)	0.035		
Night time rate (rbl/kWh)	0.02		
Reactive energy (rbl/kVAR)	0.005	0.02	
Group II consumers:			
Other industrial consumers			
General rate (rbl/kWh)	0.06	0.44	1.60
Daytime rate (rbl/kWh)	0.065		
Night time rate (rbl/kWh)	0.02		
Group III consumers:			
Bulk power (for resale)			
Average tariff (rbl/kWh)	0.038	0.35	1.30
Group IV consumers:			
Non-industrial (rbl/kWh)		0.40	1.60
Group V consumers:			
Residential consumers			
Daytime rate (rbl/kWh)	0.04	0.03	1.00
Night time rate (rbl/kWh)	0.015		
With elec. stove (rbl/kWh)	0.02	0.25	0.90
Group VI consumers:			
Villages (rbl/kWh)		0.27	1.00
Group VII consumers:			
Electric heating			
Daytime rate (rbl/kWh)	0.15	0.75	4.00
Night time rate (rbl/kWh)		0.25	
Approx. exchange rate (rbl/US$)	80	100	120

Table 9
Growth of District Heating Tariffs in Latvia
1970 - Jan. 16, 1992 (rbl/Gcal)

	1970-1990	1991	Jan. 16, 1992	Apr. 15, 1991
Industrial consumers	12	27	298	1,790
Residential consumers	2.5	2.5	19	1,790[2]
Heat for resale	--	--	--	1,200

Table 10
Growth of Solid Fuel Prices in Latvia
1990 - June 1, 1992

	1990	Jan. 1, 1992	June 1, 1992
1. Coal - average (rbl./tonne)	50-60	400	220-2,400
1.1 Residential consumers (rbl./tonne)	10.6		
2. Peat briquettes average (rbl./tonne)	25	60	400
2.1 Residential consumers (rbl./tonne)	15		
3. Wood fuels - average (rbl./m^3)	6.5-10	40	200
3.1 Residential consumers (rbl/m^3)	6.0		

Table 11
Growth of Petroleum Product Prices in Latvia
1990 - June 1, 1992

	1990	Apr. 1992	June 1, 1992	June 1992 Decontrol price
Gasoline				
A-76 (rbl/liter)	0.3	14	16	16-18
A-93 (rbl/l)	0.4	16	18	21-23
Diesel fuel (rbl/l)	0.24	10	13	13-15
Heavy fuel oil (rbl/tonne)	102-125	5,000	5,000	8,600-13,000

[2] Announced for 1992/93 heating season, but still topic of debate.

maintenance and other expenses, as well as ensuring the more active attitude towards fuel saving.

One specific problem is connected with Latvian Government's policy to form reduced fuel prices for inhabitants (firewood, coal, etc.) so that those having individual heating stoves and small boiler houses would be in the same situation as those having district heating systems. That, of course, might worsen the financial situation of the state enterprise "Kurināmais."

The value of a policy of reduced fuel prices to ensure the social protection of inhabitants (partly also meant for industry) is debatable. The subsidies have been shown on the accounts of the energy supply organizations, so worsening their financial situation (greater bank debts). In any case, the magnitude of the debts and the duration of subsidies should be properly considered.

When the energy prices in Latvia reach the world's level, this problem will lose validity and it will be possible to use market forces in forming of fuel (and electricity) prices.

A further discussion of tariffs by RCG/Hagler, Bailly is shown in Appendix 2.

1.5.2 Russian Energy Pricing and Trends

Up to now, under the condition of the planned economy in Russia, fixed fuel prices have been used, taking into account the actual expenses for extraction, transformation, its quality, and the development expenses of different branches of energetics as well as other important considerations. At present, that is valid only for the planned bulk of the state order, since a certain part of fuel extracted and refined by firms (still state owned) can be sold using their own discretion. Such a situation now allows some ex-USSR republics (also in Latvia) to form a free market for fuel. For the time being, it relates mainly to gasoline and partly to coal. This means, that in these newly-born countries, the monopoly of fuel and coal supply can be liquidated.

The price release of energy resources is also now underway in Russia. According to different decontrol conceptions, the rise in prices may be restricted to 2.5-10 times. In any case, some improvement in energy efficiency is expected. The fuel savings could be exported and the hard currency obtained could be used for stabilization of the rouble. It is clear, of course, that energy saving in the short-term will take place not because of the use of new technologies but simply from diminishing of purchasing power. The reforms of Russian energy economy could not be realized due to the social shock after the releasing of fuel prices (including the industry collapse, unemployment, etc.). Also, it is possible that extraction of energy resources would diminish faster than activities of energy economy would

be carried out. In any case, the fuel saved in Russia may be available in Latvia, especially if the difficulties will arise to sell it in the Western countries. In such a situation Latvia would possibly purchase energy resources from Russia cheaper than from the West, but at much higher price than presently.

As of the latest agreement between Russia and Latvia, signed March 6, 1992, the price of petroleum products and natural gas are set in rubles on the basis of Western European market prices and an exchange rate. As of that date, the exchange rate was 55 rubles per US$, which was about half of the free market rate. The agreement is basically a "food for energy" barter arrangement, and also sets quantities and prices for food products and other goods to be shipped from Latvia to Russia.

Table 12
Trade Agreement Between Russia and Latvia
Date: March 6, 1992
Clearing Exchange rate: 55 rubles/US$

Commodity	Units	Price (US$/unit)	Quantity	Value (US$) million
1. Latvia's Imports				
Gasoline	000 ton	230/ton	90.00	20.70
Diesel fuel	000 ton	200/ton	400.00	80.00
Aviation gas	000 ton	230/ton	0.40	0.09
HFO	000 ton	73/ton	587.00	42.85
Marine fuel oil	000 ton	150/ton	31.00	4.65
Lubricants	000 ton	500/ton	4.10	2.05
Lubricants (av)	000 ton	500/ton	0.36	0.18
Natural gas	million m^3	100/000m^3	2,600.00	260.00
LPG	000 ton	200/ton	58.70	11.74
TOTAL				**422.26**
2. Latvia's Exports				
Hydrocylinders	000	203	243.00	49.33
Vehicles, motors	000	3.87	15,110.00	58.48
Integrated circuits	million $			22.73
Fiber cord	000 m^3	2.39/m^3	50,000	119.50
Lubricant pump sets	million $			19.00
Meat products	000 ton	1,661/ton	24.10	40.03
Milk, dairy products	000 ton	339/ton	150.00	50.85
Eggs	million	100/000	23.80	2.38
Fish products	000 ton	1,380/ton	39.70	54.79
Vegetables	000 ton	450/ton	3.65	1.64
Potatoes	000 ton	150/ton	11.00	1.65
Canned conserves	000 ton	230/ton	8.10	1.86
TOTAL				**422.24**

1.5.3 Decontrol of Markets in the Industrial Sector

Under the conditions of monopoly, the only possibility to protect consumers' interests is by the help of state's institutions to control the formation of production prices (actual production expenses and profit). Unfortunately, under the conditions when all energy expenses can be added to the price of goods, energy efficiency is not stimulated. The industrial enterprises do not seek for possibilities to cut down production expenses, including saving of energy resources. These monopolies still exist, and new private enterprises cannot yet create competitive conditions.

Local markets are more or less already open to competition from foreign goods (in hard currency shops). However, the purchasing power of Latvian inhabitants is falling every day, so the home market possibilities of industrial production at controlled prices (and sale of hard currency goods) are diminishing.

The government is planning to abandon export restrictions of different goods (licensing). This will be regulated by customs duty only so, giving vast possibilities for trading with Russia and other states selling Latvian goods at existing prices.

1.5.4 Privatization and Industrial Restructuring

At present, many industrial enterprises are being released from the guidance of ministries. The role of state orders has been severely cut concerning supply of raw materials and energy resources. The transforming of the state enterprise into a joint-stock company is unfortunately very often formal. The most essential thing would be the privatization of the enterprise and the organization of joint ventures with foreign companies. That would lead to competitive market conditions.

The incomplete state of legislation is one of the reasons preventing the privatization of industry and participation of foreign investors in the development of the Latvian national economy. It creates obstacles also, for financing of industrial development and for formation of an appropriate banking system.

The Latvian industrial structure can be characterized as having only a small amount of heavy industry. Therefore, energy saving activities will be expensive and will be connected with great investments for wide introduction of new technologies. The perspective branches, wood refining and production of construction materials, will be the most energy-intensive ones.

The law "On Foreign Investment in the Republic of Latvia" is shown in Appendix 3.

1.5.5 Energy Sector Restructuring

The most rapid process of decentralization in energetics takes place in gasoline supply, where the free market is forming. This can be explained by the difference of fuel prices in Latvia and Russia, the source of the supply. Therefore, many private firms are very active. For the time being, the state is controlling their activities as regards to expenses for supply and profit. The free market economy is not fully introduced, due to the fact that all oil storage enterprises and gasoline filling stations are the property of the state enterprise "Latvijas nafta." This enterprise has monopoly and it dictates its own rules to fuel suppliers. The privatization of oil storage enterprises and fuel filling stations will elaborate the situation reducing the expenses for fuel supply operations and ensuring competition. Now the problem of renting and purchasing of such enterprises is being considered.

In 1992, the firm "Latvia Traffic Service", a joint venture of Neste (Finnish state-owned oil company) and "Latvijas nafta" opened its first filling stations - brand new, modern facilities under the Neste name selling for rubles and hard currency. There are also "black market" gasoline stations appearing on the roadside, consisting of 100-liter tanker trucks filling 20-liter cans and vehicle tanks.

The same situation in Latvia exists concerning coal supplies. There are many firms that are offering coal, without the mediation activities of coal storage enterprises, straight from train carriages at lower prices than those at the state enterprise "Kurināmais."

Evidently, the monopoly in natural gas supplies will remain for some time. Gas prices will form considering contracts between Russia and Latvia or between appropriate concerns and by state regulations. Simultaneously, different firms dealing with gas equipment service can be privatized. That will promote gas saving and reduction in supply expenses.

Also power system management will evidently remain under the control of state institutions, including electric power price formation. The fact that production and sale of electricity is under the control of one single state enterprise "Latvenergo" prevents the development of small capacity private firms producing electricity. Under the conditions of electric energy deficit existing in Latvia (the local power stations are producing only 50% of energy consumed), it would be effective to construct small cogenerating power stations in industrial enterprises, small capacity hydro-power stations, etc. That would give a certain energy saving. Separation of the energy distribution enterprise from the energy generation one would create favorable economic preconditions for such activities.

The formation of a unified power system for all the Baltic states is another specific problem, which could be economically profitable. Joint action and development of power stations and

55

demand-side management in the scale of the whole Baltic region would also optimize energy efficiency.

The boilerhouses of industrial enterprises will be privatized as a part of the enterprise, thus ensuring the improvement of its technology considering fuel saving. The municipal boiler houses are planned to become a municipal property. In such a way, the firm "Latvijas siltums," which previously partly governed these boiler houses, would turn into a service firm and it would be privatized as well.

1.5.6 Impact of these Reforms

The economic reforms taking place in the process of transition to the free market are encouraging energy efficiency improvement. The very important matter in this process is the formation of energy management, including price formation on energy resources and the organization of appropriate state institutions with corresponding functions.

But economic policy can differ under the conditions of the free market from that under the conditions of a transition period. In the transition period, energy efficiency is based more on simple restrictions due to the mere lack of resources or finances. Therefore, besides price formation, some administrative measures should be used, i.e., the regulations of state institutions still remain to a great extent. For example, a minimal level of energy consumption can be established for consumers at one price, and they must pay a higher price for consumption over this level (a so-called "lifeline" tariff).

Energy pricing is complicated in the transition period due to the necessity (in the opinion of the Latvian Government) to protect inhabitants from rapid growth of prices of some energy resources, which could cause social disturbances. Therefore, cross-subsidies are employed within the frame of one branch of energetics (electrical energy, gas supply, heat supply, etc.) as well as between energy forms. The mutual subsidy of energy resources can be done also within a frame of municipalities or straight from the budget. The aim of such energy policy is to move gradually to world market pricing of energy resources, taking into account the purchasing power of inhabitants. Such policies do not always ensure energy efficiency improvement and it is difficult to consider it together with active policy of energy saving. Within feasible limits, the formation of prices and tariffs should be done in such a way that it would encourage energy efficiency improvement.

At the same time, under the process of privatization of the energy supply organizations, as well as consumer enterprises (industrial enterprises, including joint ventures) a competitive market will be created, so encouraging energy efficiency improvement by introduction of new technologies for cost reduction. Energy supply and generating organizations will try to diminish

56

energy costs, including those of energy losses. The industrial enterprises will strive to reduce expenses for good quality production, including the help of energy efficiency improvement.

The formation of appropriate legislation and foundation of organizations with functions that will encourage measures for energy efficiency improvement will play an important role in the realization of economic reform.

1.6 1992 EXPERIENCE IN DISTRICT HEATING ENERGY RATIONING (Forced Energy Conservation)

1.6.1 Brief Description of Riga District Heating System

In Riga, the main method of heat supply for space heating and domestic hot water is centralized heat supply from thermal-electric stations (TES), which are combined heat and power cogeneration stations consisting of steam boilers and backpressure steam turbines. The Riga heat supply network is also served by four boilerhouses. These six heat production plants (HPP) are shown in Table 13.

Table 13

Name of heat generation station (HPP)	Design Capacity Gcal/hr	Energy supply to connected network Gcal/year
Riga Heat-Power Plant TES-1	600	2,200,000
Riga TES-2	760	3,000,000
Riga Andrejosts Power Plant	300	600,000
Imanta Boiler Plant	300	1,300,000
Zasulauks Boiler Plant	300	600,000
Kengarags Boiler Plant	210	550,000
TOTAL	2,470	8,250,000

The heat sources named in Table 13 are situated throughout Riga as shown on Figure 6. In addition, the heat supply from these main source is augmented by special boilerhouses of industrial enterprises. All heat sources in Riga have 20% reserve capacity.

Figure 6

There are 3 main stages in heat supply system in Riga:

1. Generation of heat in TES and boilerhouses (HPP).

2. Distribution of heat to customers on District Heat Centres (DHC).

3. Heat supply of customers on House Heat Centers (HHC).

The distribution of customers from main power plants is as follows:

residential customers	60%
industrial customers	40%

The heat supplied is used for the following purposes:

for heating in natural convectors	50%
for heating in forced convectors (with ventilation)	25%
for hot water supply	25%

There are two types of connection of customers to heating network:

1. Direct connection (HHC to mains) - exists in houses built in 1958-70.

2. Connection through DHC - exists in houses built since 1970.

The arrangement of buildings with these two types of connection through Riga is shown on Figure 7. Every DHC has about 10 customers with total requirement capacity nearly 10 Gcal/hr.

All heating plants use hot water as heat carrier in a two-pipe (supply/return) system. Hot water is transported to customers according to temperature regime "grafik" depended from ambient temperature data.

1.6.2 Traditional Supply Temperature Regime "Grafik"

Temperature regime "grafik" is accepted for so-called "qualitative" regulation of heat supply from power plant. The usual temperature regime "grafik" is as shown in Table 14.

Figure 7

The temperature regime is chosen according to the ambient temperature of previous day at 21:00 (9 p.m.). Regulation of heat supply in DHC is achieved by regulation of temperature of supplied heat carrier, the mixing flow-ratio of which is kept constant over the heating season, based on a set-up maintenance before the start of the season. Thus, only so-called rough "qualitative" regulation occurs. Although this "grafik" supposedly must be strictly kept, our observation during the last 8 years is that the temperature of supplied heat carrier never exceeded 135°C.

Table 14

Ambient temperature °C	Water Temperature		
	In supply main from HPP, °C	After mixing, in DHC, °C	In return main to HPP, °C
+10	70.0	50.6	41.7
+8	70.0	50.6	41.7
+6	70.0	50.6	41.7
+5	70.0	50.6	41.7
+4	73.0	52.4	43.0
+2	80.2	56.4	45.6
0	87.2	60.3	48.1
-2	93.3	64.2	50.7
-4	101.0	68.0	53.1
-5	104.2	69.9	54.3
-6	107.2	71.7	55.5
-8	114.3	75.5	58.0
-10	120.7	79.1	60.1
-12	127.1	82.6	62.3
-14	134.0	86.3	64.7
-15	136.8	87.8	65.5
-16	139.8	89.6	66.6
-18	146.3	93.2	68.9
-19	150.0	95.0	70.0

1.6.3 Actions Taken in 1991/92 Heating Season to Ration Heat

1.6.3.1 Industrial Customers

Except heat used for technological purposes, industrial enterprises require heat for:

- heating of administrative buildings,
- heating of production shops in fan-coil units (ventilation),
- hot-water supply.

As a measure to ration heat, it is possible to improve the control of heating systems of administrative buildings by automatic controllers. The main controllers used for this purpose are "Electronica R1-M1," which decrease the temperature in heated buildings during nighttime and non-working days (set-back thermostat). At the present time, the production of "programmed controllers" which also permit to ration heat supply in heating systems of industrial enterprises is organized.

To reduce the heat requirement for ventilation, a new so-called "group" scheme of connection to heat pipes was developed and realized. The main effect, reached in this scheme is recycling of incoming supply water through mixing pumps.

Heating systems of industrial enterprises are connected to supply mains both directly without decreasing of water temperature and through so called elevator (ejector).

Hot-water supply systems are connected to main pipes through a closed system using heat exchangers as water-water heaters, connected mainly according to two-stage scheme (first heated by return water, then by supply water). The classical scheme of connection is shown on Figure 8.

During the 1991/92 heating season, a valuable reduction of heating requirements was reached in a very simple way. Connected with total slowing of business, industrial enterprises, instead of working 5 days a week, often worked only 2 days, and thus the requirement for heat was reduced. But we hope, that it will be a temporary phenomena and the situation will improve.

1.6.3.2 Residential and Institutional Buildings

Eighty-five (85) percent of residential customers in Riga are connected to main pipes of heating through DHCs. There are near 170 DHCs which connect customers with main pipes at present time. The principal schemes of connection of DHC to main pipes is shown on Figure 9. DHC sends received from heat plant heat carrier to customer according to temperature regime "grafik" 95-70°C.

62

Figure 8

Figure 9

The connecting equipment in former USSR and in Eastern Europe differs from that in Western Europe, in which pressure for raising hot water to the top of buildings is achieved mainly by electric-driven circulation pumps. In Riga, the connection nearly 100% realized by ejectors, which use the pressure available in supply water to provide the necessary lift. Thus the use of electric motors and pressurization energy is also centralized. Circulation pumps and individual heat exchangers are used only in special buildings.

As a measure to reduce heat consumption in Spring of 1992, heating of residential customers was stopped on April 13, 1992, approximately one month earlier than normal. Earlier stopping of heating was possible in 1990 when the Spring was warm (average temperature of April was 8.2°C), and so heating could be stopped on May 3, 1990. But during the last two years (1991 and 1992), spring was cold and late. The average temperature of April 1991 was 5.9° and 4.7°C in 1992, and average temperature of the beginning of May 1992 was only +3°C. Early stopping of heating created a great social stress and led to increased instances of colds and other diseases, rising of discomfort, appearing of panic-stricken moods about next winter.

1.6.4 Effects of These Actions of Energy Consumption

1.6.4.1 Ambient Temperature Data for 1990/91 and 1991/92 Heating Seasons

The climatic situation in Riga depends on conditions in the neighboring Baltic Sea. The Baltic Sea determines such characteristics as cool summer and temperate winter.

The following are normal climatic characteristics in Riga:

1.	Duration of solar radiation (hours in year)	1,800
2.	Cloudy days in year	90
3.	Average autumn date of ambient temperature decreasing to 0°C	20 November
4.	Average Spring date of ambient temperature increasing to 0°C	25 March
5.	Average ambient temperature of April (°C)	4.5
	a) maximum deviation (°C)	6.3
6.	Date of snow melt	
	average	5 April
	latest	12 May
7.	Duration of heating season (days)	205
8.	Amount of days in summer when temperature is	
	higher than 10°C	135-140
	higher than 15°C	65-70
9.	Amount of sunny days in year	more than 30

65

10. Average ambient temperature in July °C	17.0
a) maximal deviation	7.2
11. Average ambient temperature in September °C	11.5
a) deviation °C	6.5

Month's average ambient temperature data in 1990/91 and 1991/92 heating seasons are shown in Figures 10 and 11 accordingly.

1.6.4.2 Energy Consumption Data for 1990/91 and 1991/92 Heating Seasons

As one can see from Figure 10 and 11, ambient temperatures during heating seasons in 1990/91 and 1991/92 were unusually warm. Comparing with 1987/88 heating season average ambient temperature was +1.9°C higher in 1990/91 and +0.6°C higher in 1991/92. During these seasons, because of the high ambient temperature, heat supply to Riga was reduced 950,000 Gcal in 1990/91 and by 300,000 Gcal in 1991/92, based on heat supply performed according to temperature regime "grafik." Maximum heat requirement in Riga in these both seasons was equal 1824 Gkal/hour.

Stopping of residential customers heating for a month earlier permitted to reduce heat supply by about 1,000,000 Gcal.

6.5 ANECDOTES OF OTHER EFFECTS ON RESIDENTS AND PUBLIC REACTION (such as published press)

The Governmental daily newspaper of Latvia "Diena" did not explain the stopping of heating a month early, except for a short article which said, that "in the parliament building it is also cool".

Prime-minister of Latvia Ivar Godmanis in his speech on TV and mass media promised that situation with heating will become worse. He also said, that government was relieving itself of undertakings to ensure heating of residents, and they had to do this themselves. He said that existed a point of view in government that it had to change centralized heating into simple but effective stove heating, so-called "bourgeois" (portable metallic stoves for different solid fuels, such as wood or peat briquettes). Government intends to ensure a supply of firewood for these stoves only to child-care institutions and to houses for aged people. Ministry of Industry and Energy did not say a word to comment on this declaration.

Figure 10

Figure 11

In the Russian language paper "SM-today," an interview with prime-minister was published, where he said that "government keeps responsibility only for vitally important branches -- agriculture, but only for a season of field works" (SM-today, 13 May '92).

There were also some articles in the press about the increasing incidence of colds and other diseases after the heating was stopped. An article about the investment of 2 billion roubles at the Daugavpils Railway Plant to produce stoves to be sold in Latvia (SM-today, 23 May '92), and an article indicating that firewood heating is 40% less expensive than gas heating.

1.6.6 Plans for Rationing District Heat in 1992/93

First of all, government relies on the assumption that people themselves will reduce their heat requirements in response to higher prices. Although prices of heat energy rose 50 times comparing to "Soviet time," the Prime Minister promised that to autumn, that one would rise more than 9 times.

As a first step to reduce heat consumption, it may be that domestic hot water supply is stopped. This measure will reduce heat supply (and fuel consumption) by 22%.

As a second step for next year, heating network directors are discussing a project of changing of temperature regime "grafik." They calculate that reducing the supply heat carrier temperature by 10°C may cause the reducing of heat supply to 30-40%[3]. The possibility that at an ambient temperature of 0°C the temperature inside flats will be 14.7°C, or at an ambient temperature of -10°C it will be 6.4°C inside flats, doesn't seem to worry them. They discuss a question about reducing the heat carrier's temperature by 20, 30, and even 40°C.

[3] We expect a lower savings from this action.

CHAPTER 2: OBSERVATIONS ON LATVIAN INDUSTRIAL ENTERPRISES

by RCG/Hagler, Bailly, Inc.

2.1 ORGANIZATION

All industrial companies have certain generic functions - marketing, production, finance, management and administration, and research & development. Whereas each of these functions usually represents a division in an American company, in Latvia, organizations are structured differently. In most of the companies surveyed, there are only two primary divisions: technical and economic. The heads of these two divisions are sometimes referred to as deputy general directors, and report to the general director.

The technical division has as its departments the various production units, as well as energy, maintenance, and (if found) research and development (often designated as investment and construction). The economic division has as its departments personnel, finance, accounts, commercial (or sales and purchasing), planning, social (offices and other communal buildings), and perhaps other administrative units.

The organization in Latvian industries is very hierarchical, and decision-making is concentrated at the top. Typically it is not possible to get information across departments; information and orders move only vertically. This creates decision bottlenecks at the General Director and Technical Director levels, and results in delays in executing tasks related to efficiency (such as equipment maintenance) which would be considered more urgent in a Western company. This problem is growing worse, as the Technical Directors are often taking on new responsibilities related to privatization or technical sales for export markets, with extensive travel.

The ownership of Latvian industry is still dominated by the state. However, there is an active privatization campaign underway, and nearly every company has plans for privatization. In most cases, these plans revolve around the hope that a Western joint venture partner will be found.

Typical Organization Chart -- Latvian Industry

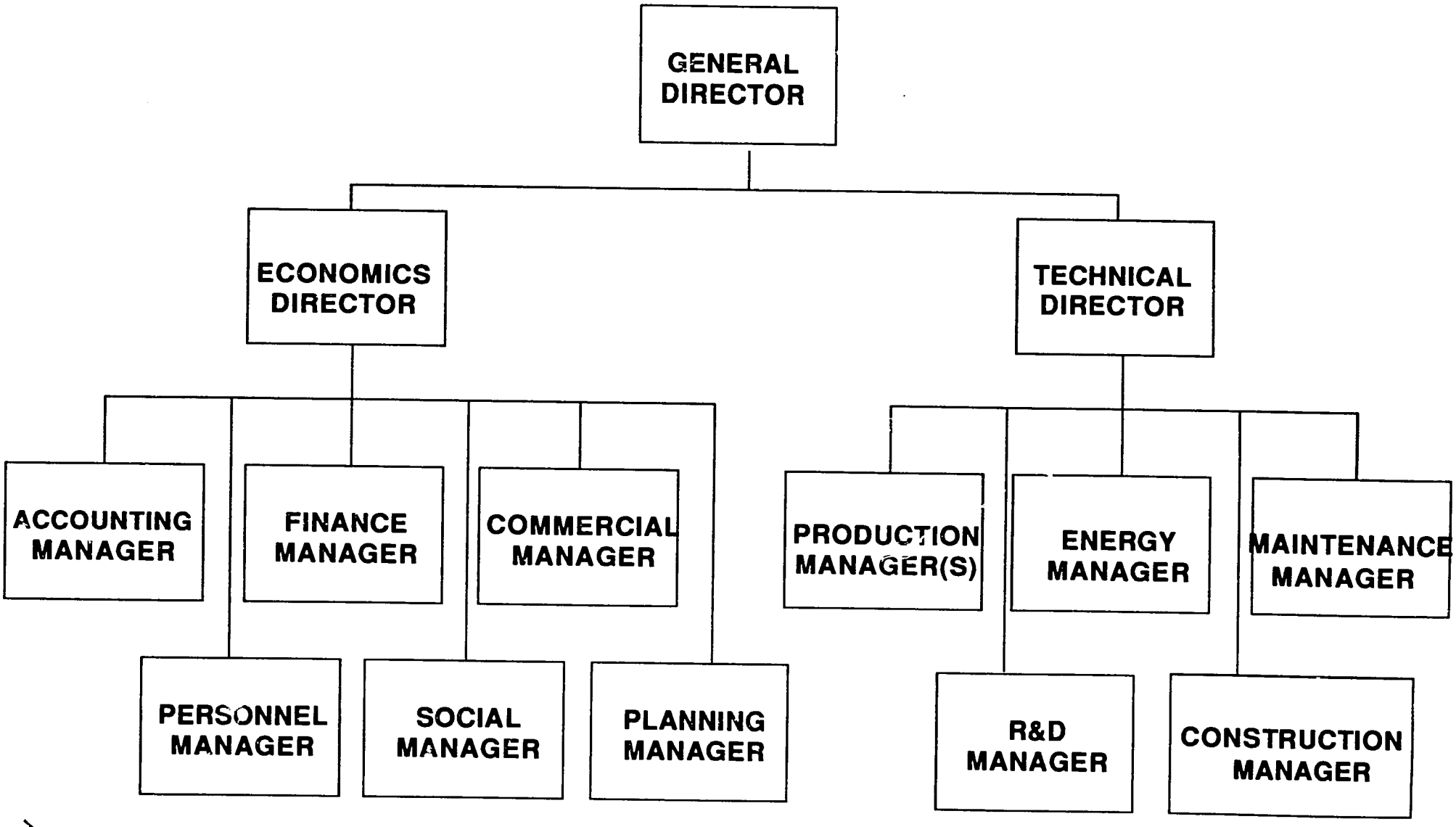


Figure 4.

In the past, there was a notion that energy, like production, should be consumed according to plans. These plans were developed by the planning department, based on historical energy consumption, expected production, and normatives (multipliers to convert projected production into expected energy consumption). The plan was used to develop an allocation by the energy supply companies.

In many cases, the normatives are not realistic. Today, in most cases they are too low, since they were developed based on the original equipment design ratings. Since that time, production levels have been reduced, equipment efficiency has deteriorated and energy losses (such as in distribution systems) have increased. Further, the normatives are simple multipliers, and do not consider that there are fixed energy requirements (to keep the plant hot or rotating equipment turning) and variable energy requirements (per unit of production). Thus in times of operation at reduced capacity, fixed energy requirements are more dominant, and the normatives underestimate energy consumption.

2.2 MARKETING

As could be expected, the marketing function appears to be a fundamental weakness in most companies. In the past, orders for products simply appeared, without any effort on the part of the company. This has created tremendous inertia, in two ways.

First, because of the certainty of former orders for its products, the size of the company's sales staff is minimal and is mainly made up of individuals skilled at administrative tasks. There is no network of external sales staff. In the organization, there are none of the "salesmen" as we know them, that is, personalities strongly motivated to generate sales.

Second, because of the former system of orders being made directly to the company, there is a definite tendency to continue to rely on a similar phenomenon. Simply put, the "sales" staff is sitting in the office waiting for orders. Because of the current strong interest of various Western companies to learn about entering the Eastern European market, there are a number of buyers who are making the rounds and visiting the manufacturers. This temporary phenomenon is unfortunately perpetuating the "myth" that sales can be made without travel and effort. It also is locking the manufacturers into deals that may not be the most favorable to them. The most that companies are doing is setting up a network of agents or representatives in the various market countries.

Generally, top managment recognizes their company's naivete regarding the "marketplace". In the majority of plants surveyed, general managers indicated that assistance in helping them learn "how to enter the market economy" was the one of the best ways they thought the U.S. Government could assist them.

72

The plans for privatization of most companies, which are based on joint ventures with foreign partners, include assigning responsibility for marketing (at least overseas marketing) to the foreign partner.

2.3 PRODUCTION

A primary objective of the 1991/92 USAID Emergency Energy Program is to achieve immediate and lasting energy savings at low cost. The best way to accomplish this goal is through improvements to plant and equipment operations and maintenance. The program in Latvia has had substantial success, mainly due to the willingness of management to make such changes and the catalytic role afforded the USAID-sponsored consultants, who in most cases are the first Westerners to advise the plant's production staff. Some brief observations on energy utilization and production in Latvian companies follow across the key dimensions of production (staff, technology, operations, maintenance, organization, and energy management).

Staff - The production function, from inputs of raw materials (including energy) to outputs of finished products, is generally well understood by the technical managers and supervisory staff in the plants surveyed. It is clear that in Latvia, the production function has been able to attract the keenest minds available in the industrial sector. This is in clear contrast to the United States, where R&D or consulting is a bigger attraction to the best engineers, and where keen analytical minds often find their way into legal or financial professions, instead of engineering, in the first place. In general, capable technical engineering talent can be found in most Latvian companies. Further, the general director is typically promoted from production (unless he is appointed by political fiat), whereas in American companies, the path to the top usually passes through the finance department. Energy managers are generally well-informed about energy conservation, but are at a lower level of authority than the production managers. Thus the energy managers are not in as good a position to receive fudning for annual budgets for new equipment or maintenance.

Technology - Equipment which would be deemed obsolete in western plants is still in place in most medium-sized Latvian factories. Instrumentation and controls are the most evident need for improvement. In the case of some joint venture plants, such as in textiles and wood processing, new, modern equipment has been installed. In the case of other plants, most notably the chemicals sector, plants which have excessive pollution and very dated technology are still operating.

Operations & maintenance - Because of the generally high level of staff education, the level of production operations is fairly good, except in plants which are run at less than full capacity. New, market-driven situations are requiring equipment "turndown". Reduction of production

rate below the plant capacity requires optimizing machine operations at less than full load, and this is uncharted territory in most plants, which were run according to plans. Operation of energy equipment (such as boilers) is at a lower level because of the continued use of outdated manual control systems. The level of maintenance is generally lower than that found in Western plants. Preventive maintenance seems to be the exception rather than the rule, and inadequate attention is given to routine maintenance (such as repair of steam, water, and compressed air leaks). The reasons for this are complex, and are related to the limited funding available, the weakness of management in the organization, and a general lack of care for equipment. Latvia is now refurbishing, and recovering from years of neglected maintenance. The mindset of refurbishing, or repair (breakdown maintenance) instead of preventive maintenance may be difficult to change. Managers are not accustomed to enforcing good housekeeping.

Organization - In some cases, energy has been elevated to the position of a department, at the level of a production unit (producing steam, hot water, electricity, etc). This was been done based on a government mandate related to energy conservation (circa 1980), which includes the assignment of energy managers and energy reporting systems.

Giving energy a high level of importance has proven to be both an advantage and a disadvantage. On the positive side, this structure has created an awareness of energy and a full-time position for a manager of energy. But at the same time, the structure may have made energy too independent from the production process. This separation seems to have relieved the production departments from the responsibility to manage energy and seems to have elevated the energy department to a position of no longer having to serve the production department. In the worst cases, this dichotomy of functions has resulted in the staff of the energy department practically not being allowed to enter the production areas. The separate energy department serves to supply energy, and in the worst cases has lost touch with reality (the plant exists to make a given product), and at the same time the production department does not regard energy supply as being reliable enough. At best, energy efficiency is the hobby of the energy manager.

2.4 FINANCE AND INVESTMENT

In Latvian industrial companies, the finance department has been primarily concerned with developing an annual budget and with managing expenditures. Financing, whether through government budget, sales, debt or equity inflows, has been handled by the trusts, which are akin to holding companies. Because of the long history of government ownership, there has been little attention paid to investment financing. The assumption has always been that the necessary capital will be there when needed.

The current financial climate in Latvia is one of severe restrictions on credit and high interest rates. There is a dire shortage of investment capital and the preferred method of privatization, which nearly all companies are seeking, is to initiate a joint venture with a Western partner, thus injecting new capital into the system. There does not seem to be a clear system of evaluating joint venture proposals.

Investment decisions are made based on proposals submitted to the Directors by the operating divisions. The Directors generally have established priorities, and they set up an annual capital budget, with the help of the Finance department.

In the transition period, and the current economic hardship, investments which relate to the survival of the plant are given top priority. These include product quality improvement (at most plants audited), diversification to products acceptable to Western markets (chemical plant), and increased production capacity. Large investments are generally being postponed or cancelled now. Decisions are often biased and not optimal.

The recent rises in energy prices has stimulated interest in energy efficiency investment, but capital is not available. It appears to be easier to get money to rebuild an old boiler than to replace it with a modern new one. The attention is being paid to capital cost, instead of life cycle cost. Further, boilers are a priority in investment decisions because without steam there can be no production. Turbogenerators are not a priority, because steam pressure can be reduced through a valve and electricity can be purchased from the grid (production can continue, although the cost of production will be higher).

There also appears to be an unfortunate tendency to repeat decisions or to consider sunk costs. For example, because a large sum of money was spent to rebuild one boiler, a similar project should be carried out on the other boilers, instead of considering alternative investments. Or, because a large sum was spent overhauling a boiler, it should be kept in operation even if it is inefficient, even if analysis indicates a good payback on a new boiler.

Latvia's chief investment problem today is the severe shortage of available capital. In the short-run, the government assumes (no doubt correctly) that the domestic economy will be essentially unable to generate any significant amount of capital. Therefore, foreign investment capital inflows are being actively sought.

2.5 MANAGEMENT AND ADMINISTRATION

Management is the area with perhaps the greatest need for improvement in Latvia today.

In American companies, there is generally a clear distinction between workers and management. Decades of socialism have left no true management class in Estonian industry. There may be trappings, such as separate cafeteria meals, or even executive dining rooms, company automobiles, and different forms of dress (the Western-style business suit), but there does not seem to be a separate mentality.

In the past, workers could get production incentives but foremen and managers could not. As a result, workers were often able to earn much more than their supervisors - a situation which left them unable to manage the workers. The poor housekeeping in the plants is evidence of this.

This lack of a management consciousness is still clearly evidenced in decision-making. Relatively small decisions become weighty problems, particularly if they involve relationships with workers. The toughest decisions, and the most critical in Estonia's present transition period, relate to shutting down all, or even just a small part of, an operation, in response to the reduced demand from the market. It is difficult for management to forget the doctrine upon which they were raised, that their factory is a "national treasure," a tool of production. Their job is to utilize this tool to its fullest.

Management's role was always to achieve production - to meet the plan. The task was not to achieve production at a given cost (this would be a fundamental first step toward maximizing profit), so efficiency is basically a new concept.

Given the lack of sophistication of their former COMECON market, changes are required to produce the right product at the right quality, the right price and in the right package. These all-important values of the Western market are the keys to the future survival of each Estonian manufacturer, and all of these fundamental guiding principles of industrial production are new. As Estonian industries come up the learning curve, they will be very vulnerable to ill-advised management decisions.

Worker productivity seems to be a major problem in most companies. The basis of the problem seems to be the fact that the factories were built as production tools, but once in place, were used by the political directorate as employment generators. Specific hiring targets were set in each year's plan. With this mission in mind, management in most, if not all, plants has hired to the point that plants are grossly overstaffed, with at least twice as many workers as would be needed in a Western plant[1]. It is human nature to take advantage of

[1] Overstaffing is the rule, resulting from several factors. A technical factor is the use of manual control systems on process and energy equipment, instead of automatic controls. An organizational factor is that social enterprises included as part of the organization, so employees work in company stores, canteens, or housing. The company

loopholes in the system, so some workers do little more than collect their pay, and laugh at the system that makes it possible and scorning those who do bother to give a few hours of honest work. Again, this is a reflection mainly of the management problem - there is a good bank of skills available who can probably perform well if managed properly.

A derivative of the same employment generation theme is that salaries are very uniform throughout a given company and across the industrial sector. There may be only 25% difference in salary between a new shop-floor worker and his co-worker with 20 years experience. In the traditional European system, this would have been a craftsman-apprentice relationship, a concept that has been diminished if not destroyed in the socialist system. Further, the manager of an entire production department probably earns less than double the salary that the inexperienced new-hire is given. This lack of recognition of value-added saps the motivation of the experienced workers, particularly those responsible for decisions which might optimize operations.

Because salaries are low in absolute terms ($20-50 per month, probably from the bottom to the top of a typical state-owned company), Estonian products may be price-competitive on world markets, even with the over-staffing. Companies wish to reduce payrolls, but the government has ordered that stability be maintained. Many companies seem to be trimming staff (now by attrition rather than layoffs), and using the additional funds to upgrade the salaries of their most valued workers.

At the same time, new ventures with foreign joint venture partners are using injected capital to buy equipment and using the new company name to reset staff levels, giving a quantum upgrade to salaries. These joint ventures are thus able to attract staff from other concerns, who jump at the chance to double or triple their income. By doing so, these workers may be able to quit their "second" job. Holding two or more jobs is a practice that is becoming more and more prevalent, especially among the educated or professional staff. This is sapping workers' energy from their primary task.

In general, the plants that are undertaking investments in process modernization and energy efficient technology seemed to have "new style" managers. These managers are extremely well-motivated, feel that they are part of the reconstruction effort of the country, are ready to move ahead, do not want to waste time looking backward, and have turned a page of history. Some other plants are still controlled by "old style" managers, who adopt a low profile and a wait-and-see attitude. These old-style managers are unable to make decisions for one reason or the other, whether a lack of confidence, authority or guidance.

---

may have its own trucking company. A personnel factor is the legacy of hiring "political appointees" and the inability to reduce staff now.

As noted above, plant operations (especially when running at less than full capacity) and maintenance (losses) does not appear to be adequate in many plants. Based on the experience during the audits, in the near term, the best opportunity for energy efficiency improvement in large plants may be process optimization. In these projects, operations and maintenance of process equipment are optimized to reduce energy and raw material requirements for a given level of production. These projects may involve loss reduction, productivity improvement, partial shutdowns of the least-efficient parts of the production process, preventive maintenance, rehabilitation, or low-cost improvements.

The ability to make basic day-to-day management decisions seems to be a clear problem. Good decisions are needed regarding hiring and firing, which equipment to operate and at what loads, retiring obsolete equipment, the allocation of costs across production units, scheduling of production runs, transportation optimization, cost control, preventive maintenance, overtime and employee benefits.

The primary reason why day-to-day decision-making is weak is the lack of a modern management information and control system. The systems in place offer very little information to management, and certainly do not provide sufficient information on performance ratios or the cost of production. The systems are operated "open-loop", and there is a tendency to perpetuate old practices inherited from the past, even under the new economic environment. This lack of information serves as one barrier to changing the attitude of "old style" managers. In cases in which we have been able to clearly present information related to the cost and benefit of operational decisions to Latvian managers, they have agreed to make changes which improve efficiency.

2.6 RESEARCH & DEVELOPMENT

In a few industries, particularly those producing a diverse slate of products (such as pharmaceuticals or household chemicals), an organized research and development department is in place. The R&D departments that exist are busy developing new products or testing existing ones, and seem to be in touch with the Western world. In other large industries, an investment department or construction department exists instead. The investment departments are looking forward to expanding operations or modernizing equipment.

The fundamental question that does not seem to have been addressed by these R&D departments is the transition to the market economy. Market surveys, consumer surveys, analysis of competitor's products, or industrial engineering production cost analysis do not seem to be a priority.

78

CHAPTER 3: INDUSTRIAL ENERGY EFFICIENCY POLICY OPTIONS FOR LATVIA

by RCG/Hagler, Bailly, Inc.

3.1 BACKGROUND

Over the past ten years, industrial energy efficiency[1] in the United States and other OECD countries has improved by about 30%, on average. This improvement can be directly attributed to several actions:

- Market energy prices which reflected the cost of supply, without subsidies, administered prices or price controls;
- Structural adjustment in the industrial sector, away from energy-intensive industry and toward services and high value-added manufacturing;
- Increased awareness of energy efficiency techniques in industry to improve operations and maintenance;
- Investment in improvements to modernize industrial processes.

Experience in many countries has shown that the rationalization of energy prices is necessary to achieve energy efficiency. Without the right pricing signals, energy consumers and equipment designers make decisions which do not take the value of energy into proper account. When energy prices are set artificially low, decisions are taken that result in energy consumption at a higher level than the economic optimum. Establishment of competitive energy markets, with pricing based on production costs, is a crucial first step to energy efficiency.

However, it has been widely recognized that while the right energy pricing policy is necessary to achieve energy efficiency, it is usually not sufficient, in itself, to realize the needed improvements, especially in a reasonable period of time. This situation arises because of various market distortions which prevent the energy pricing signals from being taken quickly into account. Many of these distortions are related to information and decision-making, and can be overcome by establishing energy efficiency policy and by developing institutions that can carry out actions to effect this policy.

[1] As measured by the ratio of industrial energy consumption to industrial share of GDP

Since 1990, RCG/Hagler, Bailly, Inc. has made energy efficiency inspections of more than 50 industrial facilities in Central and Eastern Europe and the former Soviet Union (for convenience, we will use the abbreviation former COMECON, in recognition of the fact that these countries were all members of the now-defunct Council for Mutual Economic Assistance), led teams of experts who carried out detailed energy management programs to improve energy efficiency in 21 industrial enterprises[2] in the region, conducted energy pricing studies and related training in four countries in the region, and held numerous interviews regarding energy efficiency with professionals who are active in energy efficiency in the region. This experience in the region, together with RCG/Hagler, Bailly's extensive experience in industrial energy efficiency in the United States, western Europe, and many other countries, has been used to develop the conclusions reached in this report.

[2] Similar studies were also undertaken in six district heating enterprises in the region.

3.2 INDUSTRIAL MANAGEMENT - IMPROVING PRODUCTIVITY, QUALITY AND EFFICIENCY

3.2.1 Measuring industrial energy efficiency

A definition may be a useful way to determine an objective function. In the case of the countries of Central and Eastern Europe and the former Soviet Union, this is especially important, since these are economies in transition.

Usually, for energy audits or engineering studies of an individual enterprise, a measure of specific energy consumption can be determined (such as Gcal/ton product). A similar alternate financial definition (such as dollars of sales per dollar of energy cost) could be developed. This definition would relate output (either revenues or earnings) to energy cost.

At the enterprise level, it is important that the distinction between two definitions be clearly made. The fact that the ratio of GDP to energy consumption in former COMECON countries is far higher than in the West has attracted considerable attention. Economic policy planners seek changes in the ratio, and actions on either side of the ratio can achieve improvements to energy efficiency.

The distinction is important because of the transition in the economies in the region. Many economists in the region believe that the transition to an economy which is less energy-intensive means a metamorphosis, with the result being an economy like that of a western European country, say, Sweden, Belgium, or Italy. This would call for investment exclusively in services and low-energy industries, with most energy-intensive industries being phased out.

3.2.2 Energy efficiency as an integral part of industrial management

Energy efficiency in the industrial enterprise is generally regarded as one important technique of cost reduction. Cost reduction is not the only objective of industrial management, and sometimes higher priority is given to investment in marketing, quality improvement, or production expansion. Cost reduction programs must take their rightful place in the priority structure in competition for capital investment and scarce human resources (management, engineering and maintenance attention).

The appropriate place for investment in cost reduction is determined based on the conditions of the market, and the relationship of the individual enterprise to its competitors.

Improvements to energy efficiency (defined as an output/input ratio) can be achieved as part of projects designed to improve quality or productivity. A holistic approach, which takes this into account, is best used in designing energy efficiency policy.

Production expansion projects, including market development, also are vital to improve energy efficiency. In any production process, there is a certain amount of fixed energy consumption required to bring the process up to operating conditions, and a variable consumption which is related to the volume of production. This fixed consumption goes for rotating equipment friction and inertia, and for bringing heating and cooling processes to the required temperature. The fixed consumption can be quite substantial, especially for the so-called energy-intensive industries. As production is reduced below the capacity of the plant, which is the case now in the majority of industrial plants in all former COMECON countries, this fixed energy consumption is spread over fewer and fewer units of production. Thus both the physical ratio of Gcal/ton, and financial ratio of sales/energy cost, will deteriorate as production is reduced.

The scatter diagrams on the following page, taken from RCG/Hagler, Bailly's detailed studies of an energy-intensive factory in Hungary, illustrate:

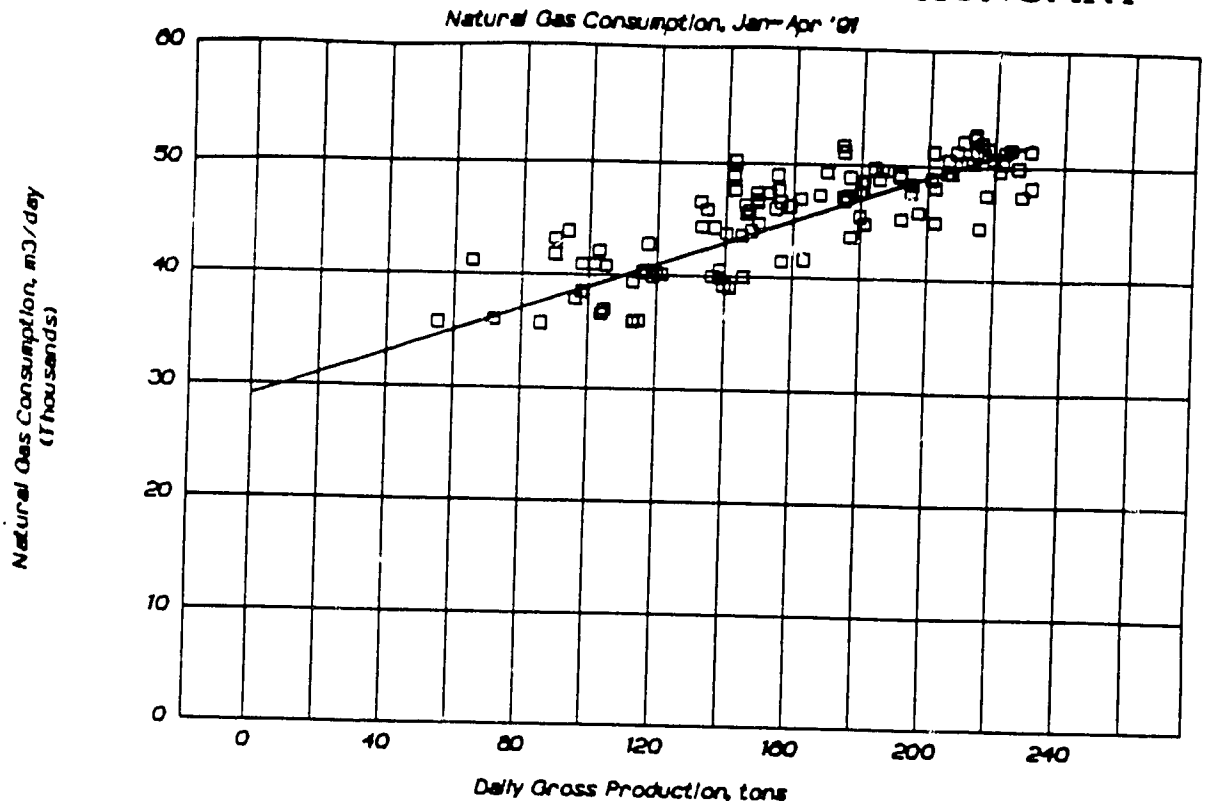
(1) daily energy consumption vs. daily production rate, showing fixed energy consumption (29,000 m^3/day) plus variable energy consumption (110 m^3/ton);

(2) energy cost per unit of production (a good measure of energy efficiency) vs. daily production rate.

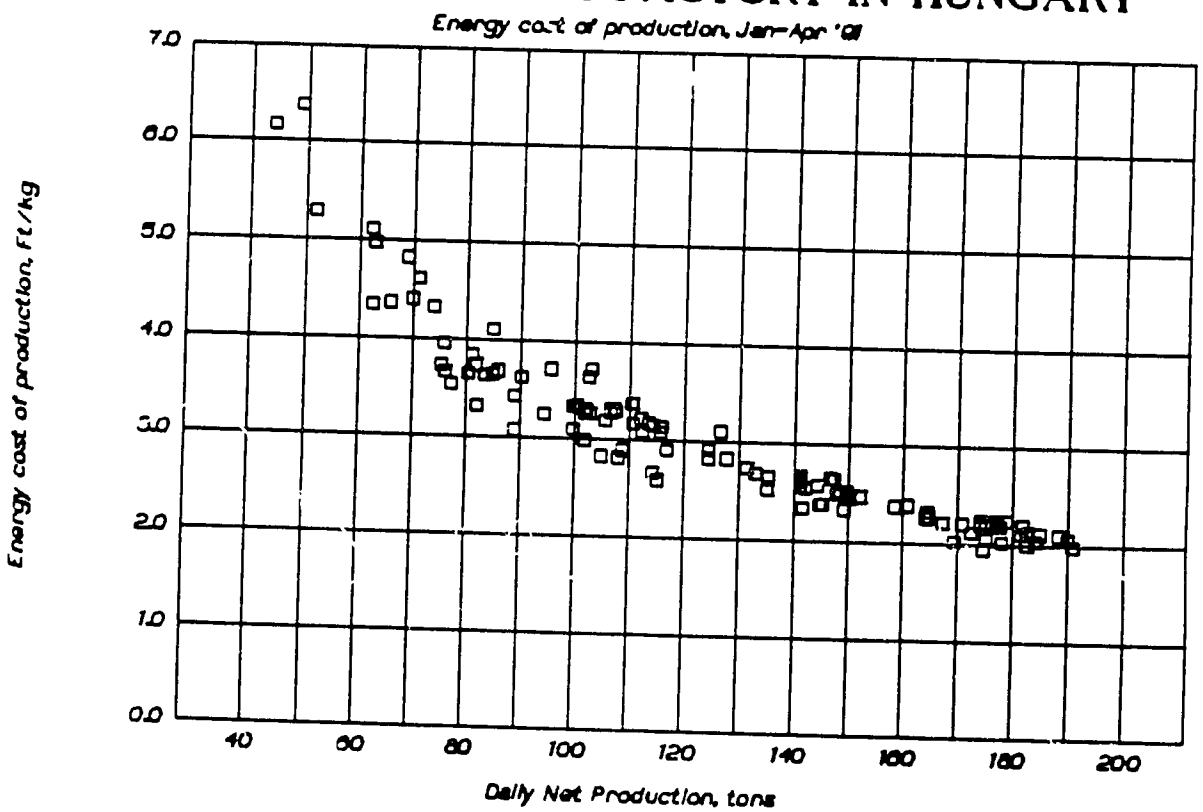
From these data, which are typical of many factories in the region, it is clear that energy efficiency is a function of production rate. Further, at any given production rate, there is significant scatter in the data, 10-20% variability in energy consumption. This indicates that management has the opportunity to improve control of operations, an thereby influence efficiency.

Industrial energy efficiency can best be achieved when industrial enterprises are market-driven. If there is no market for the product of the enterprise, the enterprise must either change its product or close its doors. The decision to close or consolidate operations is most critical for energy-intensive industries with high fixed energy consumption. In 1991, as part of the AID Emergency Energy Project, a glass container plant in Hungary consolidated operations from four melting furnaces to three. This measure alone saved the factory $2 million per year in natural gas cost.

ENERGY-INTENSIVE FACTORY IN HUNGARY



ENERGY-INTENSIVE FACTORY IN HUNGARY



3.2.3 Defining industrial energy efficiency at the enterprise level

Earnings (profits) are very important to the owners of industrial enterprises. Retained earnings are used for investment in expansion, modernization, and rehabilitation of capital stock. Dividends to shareholders find their way into other the sale of consumer products, and investments, such as building construction and shares of other companies. Even in former COMECON countries, industrial enterprises have sought profits. These profits have been used to develop social infrastructure for the benefit of the workers, including housing, kindergartens, and recreational facilities.

A financial definition of industrial energy efficiency can be made. Performance indicators, in the form of financial ratios, are the common way of evaluating industrial firms in a market economy. In a monopolistic situation, however, these indicators may not give an accurate view. A financial definition might be:

$$\text{Energy efficiency} = \frac{\text{output (\$)}}{\text{energy costs (\$)}}$$

Under this definition, there would be several general types of projects which could improve the ratio:

Energy efficiency projects, which act mainly on the denominator of the ratio:

- Energy conservation projects which reduce fixed energy consumption, such as operating most efficient equipment in priority, repair of leaks, upgrading of insulation, improved lighting, or load management;
- Energy conservation projects which reduce variable energy consumption, such as installing low-energy process equipment, the use of catalysts, improved metalworking tools, and radiant heat transfer equipment;
- Fuel substitution projects which reduce the cost per Gcal, or which reduce the level of fines for environmental emissions (increasing profits).

Other projects, which assist by acting on the numerator of the ratio:

- Production enhancement projects, which would spread fixed costs and fixed energy consumption over a greater number of units of production, thereby

increasing profit per unit and reducing the specific energy consumption ratio (Gcal/unit);

- Quality improvements, which could reduce scrap (wasted energy) or would enable the product to be more marketable, while maintaining about the same specific energy consumption ratio (Gcal/unit);

- Marketing improvements, which would improve output (sales volume or selling price and profit margin) without affecting energy consumption;

A financial definition points out that improvements to energy efficiency is not merely a task for energy efficiency experts. The work of industrial process technologists, management experts, quality experts, and productivity experts are all needed to maximize energy efficiency.

3.3 TECHNIQUES FOR IMPROVINC INDUSTRIAL ENERGY EFFICIENCY AT THE ENTERPRISE LEVEL

Any improvements in industrial energy efficiency, as measured at the sector or sub-sector level, can only be achieved by taking specific, detailed actions at the enterprise level. These actions involve changes to operations, maintenance, or equipment. An energy efficiency program at the enterprise level typically involves 10-20 actions, each of which improve efficiency by 1-2%.

Achieving and maintaining industrial energy efficiency in an enterprise is a never-ending process, and so must be fully integrated into the normal course of business operations. The standard of efficiency is always increasing, as dictated by the competition in any given market.

There are a myriad of techniques for improving industrial energy efficiency, but these are often simplified by categorization in four groups, on the basis of the investment required:

A. Management and organizational improvements, which generally require little or no investment;

B. Low-cost measures to improve operations and maintenance, projects which provide a payback of one year or less;

C. Minor investments to upgrade existing equipment, projects which provide a payback of three years or less, based on energy savings;

D. Major investments to acquire new, modern equipment, which may have multiple benefits in productivity, quality, and energy efficiency.

In the sections that follow, RCG/Hagler, Bailly has used experience gathered in industrial energy efficiency programs in the former COMECON region over the past two years to develop generic examples of actions which are suitable for the region. These actions may or may not be applicable in all industrial plants, depending on the specific circumstances and existing conditions in the enterprise.

3.3.1 Examples of "Type A" actions, management and organizational improvements

- Change ownership so that a new "owner's mentality" and sense of purpose for the future is created. This new mentality must establish a management

commitment to quality, productivity and efficiency. The owner may take an active approach to seek out foreign joint venture partners.

- Change organizational structure to establish energy department as a profit center, "selling" energy to production department, and thereby place responsibility for energy efficiency (including identification and implementation of energy saving ideas and projects) at the production level, where most energy is consumed.

- Establish energy accounting systems and management information systems to allow management to monitor efficiency in time to take control actions.

- Create working conditions that motivate all employees (especially those in the production departments) to improve efficiency, productivity and quality, including financial incentives and feedback of results.

- Provide information and training appropriate to employees at management and engineering levels in energy efficiency technology and techniques.

- Establish a "total quality management" program in the plant, based on employee participation in a process of continuous improvement based on planning, testing, action, feedback of results, and refinement.

- Organize a market-driven decision-making process for difficult, but essential, management decisions which are urgently required, but are being delayed, such as:

  -- Which markets to be in
  -- Which products to produce
  -- Level of quality needed by the market
  -- Type of packaging needed by the market
  -- Transportation needed to get to the market in time
  -- Which parts of the plant to close down

- Establish a marketing department with sufficient staffing and funding[3] to increase sales, so that the plant can operate at higher capacity factor, and thereby spread fixed energy consumption over more units of production.

[3] Many western companies spend 20% of revenues, or more, on marketing.

- Establish a production process R&D department to learn the state-of-the-art in the selected markets/products, and plan the future modernization of the plant. Provide a budget for experts to carry out market research and feasibility studies[4].

- Optimize operations, so that production is carried out using the most efficient equipment in the factory in the most efficient way (least-cost production).

3.3.2 Examples of "Type B" actions, low-cost improvements to operations and maintenance

- Upgrade the general standard of maintenance throughout the plant, and provide maintenance personnel with tools, training, status, and management reinforcement to carry out the job.

- Establish teams dedicated to specific efficiency-related tasks (such as for steam/heating, electric motors/drives, compressed air, and combustion) and provide them with the necessary diagnostic instruments, repair tools, and budgets (for assistance from professional consultants or incidental expenses). These teams will have several tasks:

  - To identify obvious energy waste, such as steam leaks, idling equipment or underloaded operations, and carry out necessary repairs.
  - To identify low-cost improvements to operations and maintenance, and to establish new procedures.
  - To identify minor retrofit improvements needed, and to develop cost and benefit estimates
  - To develop specifications for future procurement, and thereby upgrade the standard of efficiency over time.

- Upgrade the level of instrumentation in the plant, especially for energy flows and efficiency-related parameters, and establish procedures based on instrument readings.

- Establish a preventive maintenance system in the plant, with necessary monitoring instruments, procedures, and dedicated staff, to improve equipment reliability (reduce downtime) and thereby increase efficiency.

---

[4] Many Western companies allocate 10% of revenues to R&D and new product development.

88

- Provide information and training in energy efficiency technology and techniques, appropriate to employees at various production, operations and maintenance levels.

3.3.3 Examples of "Type C" projects, minor investments in equipment upgrading

- Improvement of control systems, including automation and regulation, such as boiler air-fuel control.
- Installation of heat exchangers to recover waste heat in production processes.
- Improvement in quality control equipment to reduce scrap generated by production process.
- Install recycling equipment to convert scrap generated at intermediate stages of the process.
- Rehabilitation of boilers, ovens, dryers, kilns, and heat exchangers to clean radiant and convective heat transfer surfaces and repair internal leaks.
- Rehabilitation of process equipment to improve reliability and reduce start/stops and downtime.
- Installation of efficient lighting systems, variable speed drives and other cost-effective retrofits where feasible.

3.3.4 Examples of "Type D" projects, capital investments in modernization

- Conversion of a plant to produce a different, but related, product that offers a higher value-added for a given level of energy consumption.
- Installation of new process technology for the same product to improve productivity, increase reliability, improve quality, and reduce specific energy consumption.
- Conversion to alternative fuel that offers benefits in lower cost, improved product quality, or reduced pollution.

- Installation of new boilers, turbines, and prime movers that offer higher efficiency.

- Installation of cogeneration - combined heat and power systems, possibly including sale of power to grid or sale of heat to the neighboring district.

3.4 POLICY AND PROGRAMS TO ACCELERATE IMPROVEMENTS IN INDUSTRIAL[5] ENERGY EFFICIENCY AT THE ENTERPRISE LEVEL

Since the mid-1970's, Governments in countries around the world have instituted policies and programs designed to improve industrial energy efficiency. Since its founding in 1980, RCG/Hagler, Bailly has assisted the US Federal and State Governments and Governments in many other countries to develop energy efficiency policy and has been actively involved in the design and execution of such programs. Before instituting any policy or designing any program, it is important to first establish the objective of the effort. RCG/Hagler, Bailly suggests the following objective statement:

> It is the Government of Latvia's objective to establish a policy framework that provides incentives for energy efficiency, to the extent appropriate to a modern market economy. Furthermore, in recognition of the period of transition to a market economy, it is the Government of Latvia's objective to use limited resources to institute programs to overcome market distortions, and thereby accelerate improvements to energy efficiency.

Many different policies and programs have been adopted by market economies, designed to overcome specific market distortions. Examples which seem relevant to Latvia are provided in the sections that follow. These are listed by RCG/Hagler, Bailly as options for consideration, not absolute recommendations.

3.4.1 Industrial energy efficiency policy options

Policy options which RCG/Hagler, Bailly suggests as appropriate for Latvia are listed in the following section.

3.4.1.1 Establish an energy supply policy designed to promote industrial investment

Industry today competes in a world marketplace, and there is tremendous competition for new investment, both within the region and in other locations. Many countries provide strong incentives for industrial development. Over the long run, investment in industrial technology is the key to improving energy efficiency.

[5] With additional references to district heating

91

At a minimum, a stable and secure supply of reasonably-priced energy is necessary to industrial development. Without development and investment, industry will become less and less efficient over time.

Government policy must be directed toward establishing the trading links necessary to secure energy supplies. For Latvia and many countries in the former COMECON region, historical oil and gas supply was from a single source, Russia, and this dependency continues today. To the extent that this supply is not secure, the risk to developers is increased, and investment will tend to locate elsewhere. Thus the establishment of infrastructure, including parallel sources of supply, should be regarded as a part of industrial energy efficiency policy.

3.4.1.2 Establish energy pricing policy based on costs

Obviously, a higher level of energy prices will promote improvements in industrial energy efficiency. Thus it is important that industrial energy prices reflect market prices, or economic border prices, at a minimum.

Beyond that, Government faces strong temptation to introduce taxes, or to raise prices on industrial consumers so that residential consumers can benefit from cross-subsidies. In fact, most countries in the former COMECON region are doing just that. Government should be warned that this policy may "kill the goose that laid the golden egg". Cross-subsidies to maintain low household energy prices are politically popular, but they may scare away potential new industrial developers. If the existing industry is not competitive, the factory may be forced to close, leaving the workers (who support the households that were being subsidized) with no income.

Beyond considerations of the level of prices, there are various structural considerations in energy prices that can encourage industrial energy efficiency, especially in relation to the investment in and utilization of energy infrastructure required to serve the industrial sector. These structural pricing policies include:

- Establishing energy prices on the basis of long-run marginal costs (LRMC). LRMC are typically lower for larger (bulk) consumers, or electric consumers at high voltage.

- Introducing two-part energy prices for electricity and gas, based on capacity and consumption, the relationship of which is established by LRMC.

- Making capacity charges on the basis of meter readings, rather than allocative subscription charges.

- Introducing fine-tuned LRMC prices, such as time-of-use rates for both capacity and consumption, and adjustments for distribution losses, such as for power factor (cosine phi).

3.4.1.3 Establish a stimulative industrial investment policy

This is because the design of industrial process equipment is continuously evolving, and new designs are more energy efficient that older designs, especially since the late 1970's. For example, a typical ammonia plant built today is designed to use 30% less energy per ton than one built in 1980. Further, even new equipment of the same design efficiency as the old equipment it replaces will provide better energy efficiency, because efficiency deteriorates over time, as equipment wears out with use.

Investors in industry have many alternative investments from which to choose, including productivity, quality, and efficiency. If energy prices are appropriate, efficiency will take its proper place in the decision-making trade-off decisions.

Investors also have many locations from which to choose, even if they have already decided to invest in the former COMECON region. Latvia is attractive in some ways, but now Russia itself is opening up to foreign investment. This market is now very competitive, and many countries have begun adopting the same investment promotion strategies used by developing countries, such as long-term tax holidays and other concessions.

In the 1970's, many industrialized countries (including U.S., U.K., and Japan) offered investment incentives to promote energy efficiency. Investments which qualified as energy saving projects were eligible for tax credits. This policy was judged by many to have been instrumental in stimulating investment. However, since that time, general industrial investment incentives (without the energy project restriction) have been almost equally effective in stimulating efficiency improvement. The difference has been that projects of marginal financial viability (such as some renewable energy projects) have not been implemented.

3.4.1.4 Establish an import regulation policy which fosters competition

A policy to open Latvia's markets to competition will promote industrial energy efficiency. Over the years, western industrial process technologies have evolved which are more efficient than the technologies of the former USSR. The shortest course to improvement in energy efficiency will be to introduce and adapt these proven technologies.

Further, the monopolistic situation that exists in many industries in Latvia and other former COMECON countries enables costs to be passed on to the consumer, providing no incentive for efficiency.

The temptation to levy duties on imports is strong. However, high import duties will reduce the rate of improvement of industrial energy efficiency in two ways:

- by preventing access to modern, energy-efficient technology, and
- by reducing competition, and hence the need for existing industry to improve its energy efficiency and competitiveness

The need to develop and maintain local industry is great. However the greatest need is to earn hard currency. If local industry is to compete in hard currency markets, the best place to begin to do so is at home. If the local market is a fair one, then industry can feel confident to export.

3.4.1.5 Maintain control over fiscal and monetary policy

A lack of discipline in fiscal and monetary policy will lead to high inflation, which will reduce industrial energy efficiency. In periods of high inflation, nominal interest rates also become very high, and decision-making is made with fear under great uncertainty. In such times, the best decision is often no decision, so investment is delayed, even investment in low-cost, quick-payback projects like maintenance and rehabilitation.

RCG/Hagler, Bailly has observed a lack of interest among industry in the former COMECON region in any energy efficiency project (unless a payback period of one year or less seems guaranteed) or other investment which requires financing. This view reflects a combination of a lack of trust for the newly formed banks, the inflation climate which makes nominal interest rates seem very high, the lack of capital available (which drives up real interest rates), and the relative priority that energy efficiency has in today's survival/shake-out period.

3.4.1.6 Privatize, or at least rationalize, industry in a competitive environment

Privatization of industrial enterprises will quickly improve industrial energy efficiency. The ownership question is central to decision-making in Latvia. The rules must change. An owner's mentality is needed to make the tough decisions.

As long as the Government is the owner, two things will happen:

- Decisions regarding the closing of inefficient plants will be delayed because of social considerations.

- Factory workers will continue to have insufficient respect for management, property, or energy and will continue wasteful behavior.

If an industrial enterprise is to run efficiently, the boss must boss. Under the old rules, the all workers were equal. In the Japanese model, there is an appearance of equality, but in reality there is a strong respect for superiors and orders are followed gladly. The situation in many former COMECON factories was that management received little or no respect, and some workers regularly sabotaged a co-worker who rocked the boat by showing any initiative or being more productive than the bare minimum. Thus, state ownership of industry in a competitive market may not work as well in former COMECON countries as it does in western Europe.

3.4.1.7 Require energy supply enterprises to consider demand-side opportunities as an integral part of expansion planning

Electric, gas, district heat and water utilities historically are faced with growing demand for their services, due to population growth and industrial development. This growth leads to requirements for expansion and capital investment. However, energy audits in Latvia and most other former COMECON countries by RCG/Hagler, Bailly and other contractors under the USAID Emergency Energy Program have shown that there are economic opportunities to improve efficiency on the demand side, on the order of 10-30%. These opportunities offer an economic return on investment which is higher than investment in traditional supply-side expansion.

Experience in the U.S. has shown that electric utilities need regulatory guidance in order to stimulate them to pursue demand-side opportunities nearly as aggressively as supply-side investment. The concept of integrated resource planning, in which demand-side and supply-side projects are considered on an equal footing, has since arisen as a new discipline, which enlightened electric utilities have accepted as being in not only the country's interest but also their own.

3.4.1.8 Reduce the standard of district heating services

The temperature of district heating supply water is based on ambient temperature conditions, according to the standard "grafik". Under the new market conditions, the economy may no longer be able to afford to supply heat energy in the same quantities as in the past.

In a market economy, the level of heating services provided by the Government should represent a minimum level, rather than a comfortable level. If consumers want more services, they should pay for them directly. This could be accomplished over the long run by installing electric or gas-fired augmentation heaters.

The temperatures specified in the grafik are design conditions, and are not adjusted for actual installed conditions. The result is overshooting/undershooting of the necessary temperature. Reducing the supply temperature slightly will save energy (as much as 20% over a heating season), while still maintaining adequate comfort levels (at least 15° in flats).

The Government should require each district heating utility to carry out an optimization program to update the grafik for the new market energy pricing conditions and the physical characteristics of its heating system, based on a trial and error procedure.

3.4.1.9 Institute equipment efficiency standards

Another possible government policy option is to introduce minimum standards for equipment efficiency. This policy has been effective in the U.S. in stimulating energy efficiency improvements in the automobile industry. Similar programs have been used in other countries to require improvements in the efficiency of electric appliances and air conditioners[6].

Such a policy has limited applicability in the industrial sector. The characteristics of an industrial plant are based on many considerations, primarily the process itself.

One ubiquitous piece of equipment is the electric motor. In smaller sizes, western motor manufacturers offer two product lines, standard and high efficiency (for a higher price, up to 50% more). The high efficiency models save from 1% (50 kW size) up to 10% (0.5 kW size). A policy could be developed that requires the use of electric motors of a minimum efficiency, however caution must be applied. If a motor has a low duty factor (used only occasionally), the incremental cost of the high efficiency motor may not offer an attractive return on investment.

[6] The US opted for a consumer information program to require that manufacturers display labels on the appliances which list expected annual energy costs, so that consumers can compare alternatives.

The same tradeoff is true of most other standards, which makes a consumer education policy a better alternative. Energy users should not be required to make decisions based on energy considerations alone - other issues may be more important.

3.4.2 Industrial energy efficiency program options

Program initiatives generally require government expenditure, or access to precious donor financing. Most Western economists agree that the primary role of government is the provision of specialized services that cannot be provided by the private sector, such as police, defense, justice, and social safety nets. Many believe that government should provide other social services, such as education, water, sanitation, and health care. Fewer agree that government should be the owner of industry or assist industry directly, other than ensuring that the right policy framework is established. Program initiatives for industrial energy efficiency are controversial, and should be carefully targeted, if used at all.

Program initiatives should be designed to overcome market distortions. Market distortions are usually limited to temporary inadequacies, so the programs should be terminated when the market matures. The government must be particularly careful that its programs do not become subsidies, or represent conflicts with the development of the private sector. For example, what chance does a private Latvian engineering consulting firm have to sell energy audits if western consultants are doing free energy audits under a donor-financed program?

Examples of market distortions which reduce the opportunity for industrial energy efficiency include:

- Incomplete information or education, which impedes rational decision-making leading to action;
- Lack of available technology for implementation due to regulated markets or monopolistic position of suppliers;
- Lack of services available for implementation;
- Lack of available financing for necessary investment.

3.4.2.1 Information and education programs

It is widely accepted that information and education programs offer the best return on investment for government expenditure in energy conservation programs[7]. Energy conservation awareness or public relations campaigns can be effective at an early stage, but they must then quickly proceed to educational campaigns, in which real facts are provided, giving information about ways to save energy. Educational programs need to be targeted to specific audiences, and to provide technical information in a suitable level of detail.

Government sponsorship does not necessarily mean the program is implemented by government employees. Government can provide contracts or grants to private or non-governmental organizations to carry out the programs.

Examples of options for industrial sector information and educational programs under government sponsorship are listed below. Many of these programs are provided without government support in some countries, when an ability and willingness to pay develop.

- Public relations and awareness campaigns[8]
- Energy management training courses for plant managers and plant engineers
- Specific energy efficiency training courses for energy using technologies or techniques, such as for:
  - energy accounting,
  - boiler operations and maintenance,
  - dryers, ovens and kilns,
  - electrical systems operations,
  - energy monitoring instrumentation
  - energy control systems
  - vehicle fleet management
  - refrigeration and air conditioning
  - waste heat utilization
  - institutional building energy management

[7] Research by Georgia Institute of Technology on their industrial energy efficiency programs in the southeastern US during the late 1970's discovered this, and it was confirmed by an audit of all industrial energy efficiency programs sponsored by US Department of Energy by Price Waterhouse in 1981.

[8] RCG/Hagler, Bailly warns that these may not be appropriate in former COMECON countries because of previous Governments' longstanding reputation for issuing false propaganda.

98

- -- electric motors, pumps, compressors, and drives
- -- steam systems operations and maintenance
- -- compressed air systems operations and maintenance
- -- preventive maintenance programs
- -- project management
- -- industrial process-specific energy[9]

- Publication of handbooks or training manuals for above short courses
- Energy auditor training programs, to develop skills among private sector consulting engineers
- University degree curriculum in energy management
- Publication of case studies of successful energy efficiency projects
- Conferences designed to disseminate successful experiences to peer groups and allow networking
- Exhibitions and trade fairs designed to match suppliers of energy efficiency products and services with energy consumers

3.4.2.2 Demonstration activities in individual plants

There are very good reasons why the Government should avoid carrying out energy efficiency activities in industrial plants. First, there are limited resources available and so those few plants that receive the assistance (especially the early ones) will obtain an unfair advantage. Secondly, by providing these services at low or subsidized cost, the Government deprives the private sector energy management consultants of a business opportunity. Finally, good energy efficiency projects are cost-effective, and so Government subsidies are very questionable.

Having said this, there are important reasons to consider a well-designed program, particularly since any improvement to industrial energy efficiency can only begin from micro changes at the plant level. It must be recognized that each plant is different, and so a given plant will benefit most from a program of expert advice tailored to their needs. Further, case studies in individual plants will provide concrete examples of potential savings and actual results of energy efficiency improvements, that can lend credence to the information and training programs. Finally, these programs can be used at an early stage as a training ground for

[9] Such as "energy efficiency in the pulp and paper industry"

99

private sector energy management consultants. One program which was used to good effect was the US Department of Energy "Schools and Hospitals Energy Conservation Program", which provided grant funding for 50% of the cost of investments in energy conservation in public school and hospital buildings during the late 1970's to early 1980's. All design, procurement and construction work under this program was carried out by consultants and contractors from the private sector.

Programs to consider include:

- Plant visits to explain energy efficiency techniques one-on-one, inspect facilities, and offer limited advice
- Brief energy audits[10]
- Provision of limited packages of generic, low-cost energy efficiency equipment
- Installation of specific energy efficiency technologies which have wider application within the industry

3.4.2.3 Technology research and development (R&D) programs

In the US, significant government programs are funded toward energy efficiency technology research and development. Principal examples of agencies carrying out such programs are the national R&D laboratories of the Department of Energy[11]. These programs identify a specific need, such as energy losses through windows in buildings, then carry out R&D with the objective of developing technologies to improve efficiency. After developing a technology, it is released to the private sector for commercialization. The technical success of this approach in the US has been proven in a few cases, such as the pulse furnace and heat barrier windows. The cost-effectiveness of the approach is marginal, at best, compared to energy efficiency technologies developed and patented by the private sector.

[10] Under the early government-sponsored energy conservation programs in the US, limited energy audits were carried out. For example, in the programs designed and implemented by Georgia Institute of Technology, assistance to any one plant was limited to one engineering man-week, which included one day in the plant and four days of follow-up research and analysis. These audits referred the plant to a list of professional consulting engineers (offering services for a fee) for further assistance to implement projects or conduct feasibility studies.

[11] Most notably Oak Ridge National Laboratory, Brookhaven National Laboratory, Battelle Pacific Northwest Laboratory, Argonne National Laboratory, and Lawrence Berkeley Laboratory.

100

There are significant energy R&D facilities and personnel in Latvia in the various research institutes. There are opportunities to continue to apply these resources to apply modern technology and perhaps develop new technology. However, these projects require significant funding, without any assurance of success. Latvia has limited resources at this time.

RCG/Hagler, Bailly suggests that the economy may be well served by applying the tremendously innovative human resources now available in these institutes to private sector enterprises seeking to commercialize energy efficiency.

3.4.2.4 Service development programs

The service sector was noticeably absent from the economy of the USSR. This lack of available services leads to an implementation gap in project execution. RCG/Hagler, Bailly observed in Latvia that a simple project, 25 ton steam/hour boiler rehabilitation, required six months, which is almost 10 times longer than a similar task takes to accomplish in market economies.

There are many services that now need to be developed to improve energy efficiency, including:

- Energy management consulting
- Energy auditing
- Sales and service of energy efficiency equipment
- Maintenance services for energy-intensive equipment

The Government can assist the development of a services sector mainly by providing training and information. Beyond that, the possibility of certification should be examined. Finally, if the Government intends to carry out any in-plant energy audits or demonstration programs, these must be contracted to the private sector, so as to create a market and a base of experience for these emerging industries. If bilateral donor agencies carry out in-plant programs, these must be done with local private sector senior experts as an integral part of the team, so that they benefit from the experience and exposure to a Western consulting approach[12].

[12] This program design was used successfully by RCG/Hagler, Bailly in the US Emergency Energy Program for Central and Eastern Europe.

3.4.2.5 Financing programs

There is a very serious shortage of capital available in Latvia. Energy efficiency is far below western standards. Many plant managers cite this capital shortage as the greatest obstacle to improving energy efficiency.

Governments have the opportunity to make funds available for energy efficiency from several sources. Governments of many developing countries borrow funds from the World Bank and other multilateral developing banks to be applied to energy efficiency. In addition, private sector sources, such as foreign investors and commercial banks, will make financing available.

Industrial sector loans can be very useful in stimulating energy efficiency improvements, and the borrowing country Government should assure that the loans can be used for such investments. These funds allow projects with multiple benefits (productivity, quality, efficiency) to be packaged and funded. The World Bank has provided many sector loans for such purposes in other countries. Usually the World Bank requires a preliminary study of rationalization of the industry, which leads to conditions precedent to the loan approval or disbursement (such as restructuring of the industry).

3.4.2.6 Convert district heating to a market commodity

As developed in the USSR, district heating is the classic example of the triumph of theory over practice. High thermodynamic efficiency was achieved at the supply side, particularly when the heat is derived from combined heat and power stations. Even when the heat is provided by boilerhouses, there are economies of scale which make this the least-cost form of generation.

From the heat source, heat transfer losses and leaks in the distribution system rob the district heating technology of part of its efficiency. Because of a low standard of maintenance, these losses have increased as the system has deteriorated over the years. But even after these losses, the system is an efficient way to deliver heat to the building.

At the building level, the realities of the system illustrate the failure. According to schematics included in textbooks published in the west describing Soviet district heating systems, meters and temperature controllers (including thermostatic radiator valves) are installed. Experts also claim that systems were built to these standards. However, upon inspection of these systems, and having discussions in four countries, RCG/Hagler, Bailly has found that meters and controls are simply not there.

Only in Budapest, Hungary are heat (Gcal) meters commonly found in substations or building inlets, and that is because an aggressive program of installing meters has been carried out by Budapest District Heating Works over the past three years.

Manual valves have been installed in some cases to regulate the flow of hot water through radiators, but we have learned that these have not been used or maintained for 20-30 years. In some modern construction, so-called one-pipe systems are installed, in which radiators on different floors are connected in series. In these systems, valves cannot be installed unless bypass loops are also installed.

Energy consumption in district heating systems in the former USSR is not metered, and is not controllable. In a way, increasing prices for district heat hardly seems fair when the energy consumers cannot change their consumption.

Projects to make district heating systems meterable and controllable, and to institute heat tariffs based on consumption, represent infrastructure improvements that are good projects for Government intervention. Government attention is needed to attract the large amount of financing required, and because the consumers on their own probably will not be able to make the investment, for physical as well as financial reasons.

CHAPTER 4: ROLES OF LATVIAN INSTITUTIONS IN ACCELERATING INDUSTRIAL ENERGY EFFICIENCY IMPROVEMENTS

by RCG/Hagler, Bailly, Inc.

4.1 INTRODUCTION

There are many institutions that can work to accelerate improvements industrial energy efficiency. Generally these can be grouped into six types of organizations, each with important roles to play:

1) Government - which has the responsibility to establish the energy policy framework conducive to improved industrial energy efficiency;

2) Energy supply companies - which have the responsibility to supply energy carriers (oil, gas, electricity, etc.) reliably, and at least economic cost;

3) Industrial enterprises - which must supply industrial products (chemicals, metals, food products, etc.) that are competitive in terms of quality and price;

4) Financial institutions - which must attract savings and may make loans to viable industrial enterprises for working capital or attractive investments;

5) Non-profit, non-government organizations (NGOs) - which may assume responsibility for energy efficiency awareness-building, networking, and policy advocacy;

6) Academic institutions - which may assume responsibility for energy efficiency training, information, and research;

7) Private sector energy efficiency industry firms - which must provide products (energy efficient equipment) and commercial services (such as energy audits and implementation of energy efficiency measures) that are competitive in terms of quality and price.

The general distinctions listed above sometimes blur, and this can lead to conflicts. Such conflicts are very undesirable, as they can lead to a reduced rate of implementation of energy efficiency improvements. Sometimes energy efficiency projects fail simply because the wrong organization took responsibility for project execution. Too often, many institutions seem to be vying for the same role. This is unfortunate, since it will require the efforts of many agencies and individuals to succeed.

One typical source of conflicts arises when Government extends its mandate outside of the policy realm, and into energy efficiency training, research, energy audits, or implementation. In such instances, the rate of implementation of energy efficiency is slowed considerably.

4.2 ROLE OF GOVERNMENT

In a market economy, Government has a stimulative role in industrial energy efficiency, but should not be involved in implementation. Government has the responsibility to establish policy conducive to improved industrial energy efficiency. The first step is to establish the right energy pricing policy. The next steps are investment policy, industrial development and restructuring policy.

Agencies of Government which influence industrial energy efficiency include:

Ministry of Industry and Energy

Industry - must establish privatization and restructuring policy

Energy - must establish market-based energy pricing policy

Local government - must determine regional development and district heating system policy

Ministry of Environment - must set policy to regulate airborne environmental emissions which are related to energy consumption, such as SO_2 and NO_X

Ministry of Finance - must establish fiscal, monetary, taxation, and foreign investment policy to control inflation and promote investment in industry

4.3 ROLE OF ENERGY SUPPLY COMPANIES

Energy supply companies have the responsibility to supply energy carriers reliably and at least economic cost. Reliability is important because outages or shortages result in economic losses, and a waste of energy in starts/stops of industrial equipment. Least economic cost development requires consideration of not only traditional supply-side investments but also possible investments in demand-side efficiency improvements at the same time.

It has been demonstrated in many countries that some demand-side management (DSM) investments reduce requirements for power (kW) and energy (kWh) at lower cost than

equivalent power and energy supply-side investments. To the extent that this is shown to be true in the industrial sector, the energy supply company should develop DSM programs to increase the market penetration of these technologies. DSM programs in the industrial sector can consist of financial incentives (or partial payments) for training, information, energy audits, and investments.

Monopolistic energy supply companies assume their 100% market share will last forever, but changes are definitely coming. Good customer relations develop consumer confidence and lasting relationships that help build market share. The best customer is a well-informed customer. Innovative energy supply companies in the US now know that in the long term they will also benefit from customer efficiency improvements. But in the short term, they will suffer a loss of revenues, and so financial mechanisms have been designed to compensate the energy supply company for investments in DSM.

DSM programs are particularly well-suited to the electric and gas energy systems. In addition, petroleum supply companies can also provide information and training to help their customers use energy more efficiently.

Finally, energy supply companies have an obligation to maintain high standards of energy efficiency in their own operations (power generation heat rate, distribution losses, refinery conversion efficiency, pipeline losses, etc.). Financial profits of electric companies in the US are usually directly determined by efficiency and management of the enterprise.

4.4 ROLE OF INDUSTRIAL ENTERPRISES

The primary function of industrial enterprises is to supply industrial products (chemicals, metals, food products, etc.) that are competitive in terms of quality and price. In Latvia today, this has become a matter of survival for each and every industrial concern. Energy efficiency improvement is one way to increase the probability of survival, and in some industries it may be the key to survival. But in most industries, efficiency is just one part of the problem, and solutions must be integrated with productivity and quality improvement programs.

The first step to energy efficiency improvement (and productivity and quality as well) is management commitment. If the boss doesn't care, nobody cares. In RCG/Hagler, Bailly's 1991 surveys of COMECON industries, we found that only about half of factory directors could be described as committed to change.

Given top management commitment, the next step is to establish a team dedicated to the task of energy efficiency. The efficiency team will include factory managers, engineers,

accountants, and outside contractors. The outside contractors may be energy management consultants, maintenance technicians, design engineers, and installation contractors.

The efficiency team must develop a tailor-made energy management program. An energy audit is usually a good first step in such a program. The energy audit identifies energy usage in the factory, identifies ideas for efficiency improvement, and develops estimates of cost and benefit for each idea. The energy audit develops an energy management action plan, and sets goals for efficiency gains.

However, the energy audit is just the starting point. Actual energy savings will only result from the efforts of the energy efficiency team to make changes over time. The efficiency team will act on the plan. Over time, the objective of the team will be to identify other ideas for improvements and carry out works to see that they are implemented.

As time goes by, the program must be monitored and feedback of results must be passed to the team. Recognition of the efforts of the team, particularly with financial incentives, is important to long-term success. Industrial energy efficiency is just part of operations and maintenance, and is a never-ending task.

4.5 ROLE OF FINANCIAL INSTITUTIONS

Banks and other financial institutions must attract investment capital and make loans to viable industrial enterprises for working capital or attractive investments. Energy efficiency is one such investment alternative.

It is the responsibility of financial institutions to develop an awareness of the need for financing of energy efficiency investments, so that they may receive proper consideration in the loan approval process.

Financial institutions must offer terms on loans that can sustain operations, but are not onerous. Industrial managers in Latvia are not accustomed to debt. In today's unprecedented inflationary spiral, it may be difficult for industrial managers to understand the banks' need to maintain positive real interest rates, and thus high nominal rates. Bankers must work to educate their borrowers, so that the whole system does not shut down, out of fear.

4.6 ROLE OF NON-PROFIT, NON-GOVERNMENTAL ORGANIZATIONS

Non-profit, non-government organizations (NGOs) are usually created for a single purpose, and have a responsibility to their constituents to carry out activities related to that purpose.

Examples of NGOs include industry associations, professional associations, and advocacy groups.

Most NGOs are formed by people who feel a moral obligation to do good. There is an important role for altruistic, hard-working individuals in stimulating energy efficiency.

The best ways to apply the NGOs in energy efficiency are in the areas that are generally regarded by the private sector as having little or no potential for profit, for example:

Public relations - to build awareness of the need for energy efficiency through appearances, public service advertising

Information dissemination - to prepare publications regarding energy efficiency technologies and techniques

Policy advocacy - to speak out, within a democratic framework, urging Government to adopt policy and legislation which can accelerate energy efficiency improvements

Commercial trade associations (clearinghouse) - to serve as a meeting ground and referral service for buyers and sellers of energy efficiency technology and services, to provide information about available suppliers

Industry associations - to inform member companies from a specific industry about process-related opportunities for energy efficiency, productivity and quality improvement, and to put together managers of industry in conferences to share experiences and case studies.

Professional associations - to inform member professionals (such as engineers, lawyers, managers) about opportunities in energy efficiency in their profession, and to put together peers in conferences to share experiences and case studies.

NGOs will not be as efficient as the private sector in the potentially profitable activities, such as energy audits, energy management consulting, and implementation. The competitive power of the marketplace will work best in these areas, so that implementation will spread as quickly as possible.

4.7 ROLE OF ACADEMIC INSTITUTIONS

Academic Institutions in Latvia include universities and other training institutions, research institutes, engineering design institutes, and the various laboratories of the academy of

science. As with NGOs, most members of the technical staff of these institutions are well-motivated. The best ways to apply the academic institutions in energy efficiency are also in areas that are generally regarded by the private sector as having little or no potential for profit, for example:

Information dissemination - to prepare publications regarding energy efficiency technologies and techniques

Training and education - to introduce energy efficiency concepts as an integral part of the science and engineering curriculum at all levels of schooling, to hold specific short courses, certificate programs, and advanced degree programs in energy efficiency topics

Research and development - to carry out programs designed to investigate the effect of policy, programs and technology on energy efficiency, to perform general scientific and engineering studies toward designing improvements in energy efficiency

As with NGOs, academic institutions will not be as efficient as the private sector in the potentially profitable activities, such as energy audits, energy management consulting, and implementation. The competitive power of the marketplace will work best in these areas, so that implementation will spread as quickly as possible.

4.8 ROLE OF PRIVATE SECTOR ENERGY EFFICIENCY INDUSTRY

Private individuals go into business for two reasons: because they have an idea or are interested in providing a specific product or service, and/or to make money.

The energy efficiency business is like any other business. To survive, firms in the energy efficiency business must provide products and commercial services that are needed by the market and are competitive in terms of quality and price.

The private sector is now starting to grow rapidly in Latvia. Entrepreneurial spirit exists, and many professionals who have dedicated their careers to energy efficiency in the past are interested in going into business in this area. They have a real challenge to first develop a market, and then to develop products and services to serve that market. There are substantial risks in going into this business in Latvia today.

There are many business opportunities that exist, that can contribute to improved energy efficiency. These include:

- consulting firms to offer energy audits, management consulting, and feasibility studies

- manufacturing of equipment which can improve efficiency, including diagnostic instruments, repair tools, control equipment, and high efficiency energy-using equipment

- sales centers to distribute high efficiency equipment, or to represent manufacturers from other countries

- maintenance service firms to upgrade the standards of maintenance and carry out repairs, such as boiler tune-ups, boiler rehabilitation, steam line insulation.

- financial service firms to lease equipment or provide loan funding for project implementation

- construction and installation contractors to carry out projects to ut energy efficiency equipment into operation

- energy efficiency service companies ("ESCOs") to offer implementation services, including performance contracting or shared savings contracts

CHAPTER 5: PRELIMINARY RECOMMENDATIONS FOR AN INDUSTRIAL ENERGY EFFICIENCY PROGRAM IN LATVIA

by RCG/Hagler, Bailly, Inc.

5.1 GENERAL RECOMMENDATIONS FOR INDUSTRIAL ENERGY EFFICIENCY PROGRAM DESIGN

RCG/Hagler, Bailly recommends that the following considerations be included in the design of programs to accelerate industrial energy efficiency. These recommendations are directed at the industrial enterprise level, which is where actions to improve efficiency will be taken. Therefore, a national program should be designed with activities which will stimulate the enactment of these recommendations.

- **Create a policy framework that stimulates industrial energy efficiency improvements.** Government policy must be directed toward improving energy efficiency. As described in this report, this will require policy initiatives which can adopt cost-based energy prices, assure reliable energy supplies, stimulate investment, promote competition and private sector development, and rationalize district heating systems.

- **Adopt an integrated industrial management approach to achieve improvements to industrial energy efficiency.** There is a need to emphasize that industrial energy efficiency is process-related, and will be best served in Latvia by projects that address the transition to a market economy. The private sector will hold the key to efficiency in two ways - through privatization industries will have the incentive to become more efficient, and the development of private sector energy efficiency service industry will assist in implementing improvements.

  Energy efficiency programs should emphasize projects that have multiple benefits toward process refinement and cost optimization, such as product changes (modernizing uncompetitive energy-intensive products), quality control (thereby reducing energy waste through scrap generation), productivity improvement (thereby minimizing fixed energy losses), and process upgrading.

  Large projects focused on achieving only energy savings benefits, such as heat recovery, cogeneration and alternate fuels projects, may have payout times of 5 years or more. In making these investments, extreme care must be taken to first ensure the survival of a given industry.

- **Companies need to focus on daily energy management and efficiency.** Vast amounts of energy consumption data are collected which are used for administrative purposes, but not energy management. Plants need to relate energy consumption to production on a near-continuous basis (as part of the daily report, at a minimum) in order to exercise management control. In the near-term, personal computers can help management begin to address this task in a manual information and control system. In the long-term, modern computer-based industrial process control systems should be installed to achieve true closed-loop control systems.

- **Task forces should be established to plug leaks.** Management should set up teams with specific missions to cut energy losses. Dedicated teams should be established to attack problems in production (quality, productivity, reliability) and energy systems (steam, electrical, hot water, compressed air, heat gain/loss). Management must provide these teams with the tools and budgets necessary to do the job (very low cost, compared with the benefits). Specialists with appropriate incentives, such as private sector energy efficiency companies, should lead these teams.

- **Production operations must be optimized.** Existing production equipment and processes can be 10-40% more energy efficient through optimization, particularly during the shrinking market of the transition period. Management must make sure the most efficient equipment is operated and maximize the load on machinery in operation, running the minimum number needed and shutting down others.

- **Marketing demands urgent attention.** Optimization of operations, and hence energy efficiency, must be based on the demands of the market. In the near term, the best optimization opportunity for many companies will be the creation of a market. Some companies are just producing at reduced (inefficient) levels for inventory, in the hopes that the market will return.

- **Upgrade efficiency monitoring instruments.** In many plants, there is a need to modernize and expand instrumentation to meter energy and production more frequently and more accurately. In particular, submetering for gas, electricity and steam is needed at each production line. Final product quality monitoring is inadequate - more frequent testing is needed and laboratories need modern testing equipment. Raw material and intermediate product testing needs to be improved greatly, and these improvements could offer great benefits in reducing the generation of scrap.

- **Modernize production accounting systems, particularly production costing.** Based on the upgraded instrumentation, production costing can be improved. In a market economy, knowing production cost is all-important. The allocation of costs across a company's product slate needs to be improved to better reflect true costs, instead of design guides or formulae. The penalty of inaccurate costing could be that a company misjudges its competitiveness, makes the wrong decision to enter or leave a market, and ends up making a loss instead of a profit.

- **Stimulate awareness and motivation.** Management needs to involve production workers in energy conservation, as one of the keys to the survival of their jobs.

- **Modernize production shop-floor control systems.** There is a clear need for assistance in addressing the complete spectrum of industrial engineering topics, such as production scheduling, inventory control, reliability, work-in-process management, preventive maintenance, tool management, product line change-over, and automation.

- **Restructure natural gas and fuel oil prices.** Latvia has raised energy prices to levels on a par with those of most Western European countries. However, the structure of energy prices still includes substantial cross-subsidies, especially for two of the primary industrial energy sources, gas and electricity. In today's design, industry pays higher gas prices than residential customers (by a factor of three). Electric prices may not reflect the true cost of service at the various voltage levels.

- **Industrial pollution control problems need to be solved.** The needs in this area has been well-documented, and projects are being prepared by many donors to address them. At the plant manager level, there is an awareness of the need for attention in this area. In some cases, pollution abatement programs can use waste-to-energy systems.

- **Plant environmental quality and safety needs urgent attention.** Less media and donor attention has been focused on the conditions inside the plants, which is poor in many cases (particularly the metallurgy industry). It is ironic that a system built on glorifying the worker requires them to toil in such unsafe conditions. This environment has adverse affects on motivation and worker productivity, ultimately being reflected in product quality, cost, and even energy waste through excessive scrap.

13

5.2 RECOMMENDATIONS FOR A LONG-TERM INDUSTRIAL ENERGY EFFICIENCY PROGRAM IN Latvia

5.2.1 Objective

1. Demonstrate market-oriented approaches to industrial management, problem solving, energy efficiency, and decision-making, and serve as catalysts for action by Latvian counterparts.

2. Demonstrate technologies and services which are well-suited to addressing the needs of Latvian industry and thereby stimulate joint ventures in these areas.

3. Provide training and introduce Latvian managers to their counterparts in industry in western countries.

4. Foster development of self-sustaining delivery and implementation systems for energy efficiency, such as utility-sponsored demand-side management programs, private sector engineering companies, maintenance specialists, and energy service companies, and lending organizations.

5.2.2 Focus

1. Focus on projects in energy efficiency, especially improving energy management. Concentrate on short-term, low-cost actions to optimize operations and maintenance.

2. Use the energy management principles and tools as examples to catalyze management action in other areas of the organization, such as:

   Product cost optimization
   - Waste minimization
   - Raw material utilization

   Process refinement
   - Quality control
   - Productivity improvement
   - Production scheduling and flow

   Management strategy and restructuring
   - Product slate
   - Production lines

- Marketing
- Packaging
- Production cost accounting

5.2.3 Program elements

For the Focus shown above, provide elements of assistance that can have a measurable positive impact in the short term (within six months in each plant assisted).

1. Carry out studies and provide support to develop government policy which will stimulate industrial energy efficiency. Key areas in which to be involved include energy supply reliability, energy pricing, industrial investment policy, and industrial restructuring.

2. Establish energy efficiency program implementation systems in the energy supply companies (electric, district heat, gas, oil), based on U.S. demand-side management (DSM) programs and efficiency-related services offered by U.S. oil companies.

3. Provide consulting advice to advise and catalyze industry management in the Focus areas. Provide assistance to 30 companies per year, with a phased program leading to a self-sustaining financing structure, paid by the client plants. Develop local industrial management consulting firms to provide these services. Consultants must provide expertise in energy management, and other areas such as management consulting, process optimization, process technology refinements, for example:

   energy management - efficient technologies, information & control systems

   management consulting - marketing, production costing, joint ventures

   production optimization - operations, maintenance, shutdowns

   process technology refinements - quality, packaging, productivity

4. Provide hardware and software to demonstrate state-of-the-art U.S. technologies and services that address current needs and offer an opportunity for Latvian private enterprise development through joint ventures, for example:

   process measurement & control equipment - quality control, quantity monitoring

   production scheduling software - shop floor control and decisions

145

energy management information and control systems, efficiency monitoring

instruments for leak detection/plugging teams (heat, steam, water, electricity)

computer software for scenario analysis and decision-making

production cost accounting systems

5. Finance feasibility studies for investment projects in energy efficiency that can be implemented by multilateral development banks.

6. Provide training for Latvian industrial managers and energy efficiency engineers, particularly internships and study tours, conferences & exhibitions.

7. Procure products and services in the Latvian market, so as to stimulate a demand and encourage joint ventures with U.S. firms.

5.2.4 Duration

A duration of three (3) years is recommended, 1993-95.

5.2.5 Budget

A budget of $13 million is recommended for the project. The method of funding recommended is a grant basis ($10 million), with at least 25% matching funds from the plants for project elements that give them immediate benefits (except feasibility studies and training), achieved on a phased basis over the life of the program. No matching funds from the Government of Latvia are anticipated.

	Project Contribution	Industry Matching
1. Support to policy development	$ 1 million	
2. Establish DSM implementation	$ 2 million	$ 1 million
3. Consulting services to plant management	$ 3 million	$ 1 million
4. Demonstrate technologies	$ 2 million	$ 1 million
5. Finance feasibility studies	$ 1 million	
6. Sponsor training, internships, study tours	$ 1 million	
TOTAL	$10 million	$ 3 million

APPENDIX 1

INDUSTRY AND ENERGY

INDUSTRY AND ENERGY

Republic of Latvia

Riga 1992

118

Dear reader,

You can not step twice into the river's stream as well as into the time's flow.

The Republic of Latvia during it's first independence period (1918-1940) was highly developed agrarian country with the large impact of the Western capital.

We are an independent country now again and we must start from the very beginning with the recovery of national economy, with the restructuring and privatization of regionally overdeveloped industry and unbalanced energy.

We will do our very best and we believe that Latvia could become again the country of the European Community with the appropriate level of industrial and energy development.

I believe the information we have prepared about Latvian industry and energy as well as about the Ministry of Industry and Energy at the first anniversary of it's renewed independence, will rouse your interest and will promote your incentive to cooperate with the Republic of Latvia in 1990's.

You are welcome in Latvia

Aivars Millers
Minister of Industry and Energy

REPUBLIC OF LATVIA
Fact sheet

COUNTRY: The Republic of Latvia

POPULATION: 2.7 million, *(similar in size to Ireland or Norway)* 52% are ethnic Latvians, 37% are Russians, the rest are Ukranians, Byelorussians, Poles and other nationalities.

SIZE: 64,589 square kilometers or 25,400 square miles *(the combined size of Belgium and Neutherlands, the size of Switzerland in Europe, of West Virginia in the United States).*

LOCATION: Gateway between West Europe and the ex-Soviet Union, on the eastern shore of the Baltic Sea, south of Finland. It has 500 km sea coast with unfreezing ports, developed for commercial cargo traffic, an easy transit from and to Russia.

CAPITAL: Riga *(population 915,000 or 34,1% of the population of Latvia)* was founded in 1201. It is located in the middle of the Baltic area. Distances from Latvian capital to the nearest European capitals are less than 1000 kilometers:

Helsinki	*360 km*	*Berlin*	*840 km*
Stockholm	*440 km*	*Oslo*	*840 km*
Warsaw	*540 km*	*Moscow*	*850 km*
Copenhagen	*720 km*	*Prague*	*970 km*

HISTORY: The Latvian Republic was proclaimed for the first time on November 18, 1918 and was secure on it's territory until the Soviet Union invaded it in June, 1940.

Latvian parliament on August 21, 1991 declared Latvia's full independence and for the second time in 20th century it was internationally recognized by the majority of the world's governments.

TRANSPORT AND COMMUNICATION: Road transportation is serving most domestic and international needs (*road Via Baltica* - see Appendix 1). Airlines are linking Riga with Helsinki, Stockholm, Kopenhagen, Frankfurt-on-Main, major ex-Soviet cities. Railways and ocean transportation is covering most Latvian import and export.

Local mobile cellular telephone network has direct dialling capabilities abroad. The most reliable form of international communication is still via telex.

LATVIAN INDUSTRY AND ENERGY

INTRODUCTION

Latvian economy in 1918-1940s is best identified with plural structure and remarkably successful small privately-owned manufacturing (see Appendix 2), which exported mainly food *(butter, bacon, spicies - 29%)* and wood products (*timber, ply-wood, paper - 42%*) to the West. Revealing feature of Latvia's industry during the first period of independence (1918-1940) was the fact that **the bulk of the shares and credits belonged to foreigners**.

Current economy of the Republic of Latvia has inherited from the ex-Soviet Union so called "planned economy": a) regionally unbalanced industrial base (see Appendix 3), created with a reliance on electric energy (*about 50%*, see Appendix 4 and 16), oil product (*100%*, see Appendix 5) and raw material import (*90%*) and finished product export (*80%*) to the East, to the ex-Soviet Union market; b) state-owned large-scale properties in economy, with the dominance of engineering industry (Appendix 3) c) limited and unexperienced trade with Western Europe; d) lack of foreign credits and investments.

Latvia has its own raw materials like gypsum *(1 bill.tonns)*, timber (*5,3 bill.cubic meters*), peat *(3,2 bill.cubic meters)*, hydropower resources. Oil in Baltic gulf, iron-ore, heavy metals are discovered recently.

Radical changes take place in the **global economy in the 1990s**. Dozen countries have launched major economic reforms. Technological changes, which are diffused through investments in physical and human capital and through trade, have enabled countries to use their resources much more productively than ever before. Global integration in investment, technology and communication has been tieing economies together. Government disciplined (competent, pragmatic and flexible) interventions in the market are essential for development and have provided remarkable achievements of East Asian economies (World Bank, 1991).

I. INDUSTRY

Latvia has an attractive geographical position (Appendix 1). Its industry formally does not belong to that of the emerging countries. There are three main types of legal corporate entities in the industrial sector: state-owned enterprises (*about 95% of the stock capital*), joint stock companies (*about 300 companies, foreign capital 40 %*) and share holding companies. The Gross National Output (GNO) in 1990 included 60,3 % of industry production. Latvian industry consumed 33% of power energy (Appendix 6) and 15% of total fuel supply (Appendix 7), and employeed about 30 % of engaged labour force .

The major priority of industrial policy is the privatization of the state-owned enterprises (see Appendix 8 and 9), which posseses the main goal - to start to become an internationally competitive manufacturer and exporter of industrial goods.

The main priorities for industrial manufacturing are: 1) the technologies based on the efficient processing of domestic raw materials and producing goods for local and international market; 2) the skill intensive know-how processes and technologies; 3) the technologies promoting very efficient and nonintensive energy consumtion.

The recovery and further development of Latvian industry increases significantly the need for direct foreign investments *(credits, loans - see Appendix 10)* and technical assistance *(know-how, technology and service)*.

1.1. The Metal Manufacturing Industry

The Metal manufacturing was a sector with the greatest impact on GNO of the Latvian industry. As an engineering industry branch it is characterized by energy-consuming technologies (Appendix 11 and 12), large impact of imported metals. The domestic market could absorb a small part of the potential output. It could be divided into five branches: 1) Basic metal industry- "Liep jas Metalurgs" (*the medium size steel mill, uses scrap, produces rolled steel,employee 2700*); 2) Transport machinery - Riga Carriage Factory *(passenger coaches, electric and diesel trains, employee 3600)*, Riga Minibuses Factory *(employee 3700)*, Riga Diesel Factory *(stationary and mobile diesel engines, employee 1100)*; 3)

Agricultural machinery - Riga Factory of Agricultural Machinery (*machinery for manure spreading,employee 700)*, Rezekne Milking Equipment Factory *(employee 1300)*; 4) Equipment, tooling - Riga Industrial Robots Factory *(employee 300)*, Riga Experimental Factory of Machinery Attachments *(press tools, dies, moulds, employee 1100)*; 5) Metal manufacturing - Daugavpils Driving Chains Factory *(employee 2500)*.

1.2. The Chemical Industry

This sector of industry is cosiderably larger, more modern than that of basic metals, employs more than 22 thousand people (Appendix 3), originally used imported raw materials. The main branches are pharmacy, synthetic fiber and resin production, have a skilled staff. Applied household chemical products as paints, varnishes, cosmetics, plastics are manufactured.

The most important enterprises are Synthetic Fiber Factory (*employee 4500, producer of threads, synthetic textil cord)*, "Latvbiofarm" *(employee 700, producer of medicals)*, Plastic Processing Factory (*employee 700, producer of plastic consumer goods, technical tools)*, "Sarkanais Kvadrats" (*employee 2300, producer of rubber footwear and technical goods)*, Glass Fiber Factory (*employee 2400, producer of glass fiber and cloth)*.

1.3. The Electronic Industry

The electronic industry is highly developed, but the local market could support a small fraction of its present capacity. The largest firm in microelectronics is "ALFA" (*employee 5900, produced semi-conductors,memory chips,integral microschemes)*. The means of communication are manufactured in "VEF" (*employee 13000, producer of telephone, equipment, radio sets*) and " Radiofactory" (*employee 7000, producer of radio sets*). The electrical equipment are produced in 13 enterprises, one of them is " Riga Electric Machine Factory" (*employee 4300, producer of electrical motors, contactors, washing machines)*. Other domestic goods are manufactured in "Straume" (*employee 1700)*. Well known apparatus and technical appliances are elaborated in 7 enterprises, one of them - monopolist in ex-Soviet car industry - is named Riga Factory of Car Electric Equipment (*emploee 2600, producer of devices and instruments for cars)*.

1.4. The Wood Industry

The wood processing industry (profit in 1991 - 302,0 mill. rbl.) could be divided into four subbranches: timber cutting (round timber manufacturing), timber-processing (ply-wood, saw timber production), chemical processing of wood (pulp and paper production), wood commodity production (furniture, matches, construction material production).
The area of forests coveres 2,7 thousand sq km (*woodness 41,2%*). 85 per cent of forests are state-owned in Latvia. Potential yearly growth is 12.7 million cubic meters of wood. At present about 4.5 million cubic meters (out of 383,7 of wood) are processed a year in Latvia, equivalent to approximately $ 10 million. The production of ply-wood (64,7 thousand cub.m.), saw materials (787,0 thousand cub.m.) and other products must be doubled.

Latvia's paper industry comprises 8 enterprises and employee 4.600 people, several of which have relatively modern equipment, producing goods to European standards. The total paper and cardboard output potentials are 150 000 tons, but most modern paper machine in Sloka is from 1965 and it would be necessary to invest capital to turn it into a cost efficient mill and proper on environmental grounds.

The republic has adequate forest resources to cover a major part of its pulp needs. This potential would require substantial investments in new pulp and paper mills.

1.5 The Light Industry

It was and it is the most developed sector of Latvia's industry, the most exciting for foreign investments in 1930's and privatization in 1990's. The great majority of Latvian textile firms were small establishments in 1939 (*406 plants*) and employed 15% *(16,9 thousand people)*. Whereas the cotton industry imported practically all raw material, the wool - only half, the flax industry used exclusively domestic one. Today 35 textile companies are mostly large, modern and highly productive and covers spinning and weaving of both cotton, wool, linen, knitting, garment manufacturing. The average production value per emloyee is about 23.000 Russian rubles.

An up-to-date yarn firm in Ogre (*employee 3700*), stocking factory "Aurora" (*employee 1850*) and large leather processing factory "Kosmoss" (*employee 300*), which is in ecological conflict situation with the environment, are the typical manufacturers in light industry.

Failing raw material supplies from ex-Soviet Union are the major reason for decline in many medium size (Māra, Sarma) factories to which Ogre supplies wool and induce the decrease of production capacity in cotton enterprises (Rigas Manufaktūra, Rita, Aurora). Cotton purchase from the Western market needs a credit of $ 1 mill., wool purchase - a credit of $ 0,6-0,8 mill., as well as $ 1 mill. for chemicals and dyes.

The Masterplan on flax cultivation and processing is designed to reestablish and to develop the domestic raw material based industrial subbranch.

II. ENERGY

Energy complex is an infrastructure that actually pertains to all branches of national economy. The predominance of low energy-intensive industries (see Appendix 11) and absence of large heavy industrial enterprises, smallest per capita electric energy consumption (*3843 kWh per capita*) are the main features of Latvian energy sector.

Latvia will remain 100% dependent on imports of oil, natural gas and coal. Only 12% of Latvia's total energy consumption was derivered from domestic hydro, peat, firewood resources. The natural gas is the major source *(about 40%)* imported via piplines (Appendix 13) from the West Siberia. During the period from November to April the flow from Russia is disconected implying that gas is only supplied from the underground storage *(capacity 2,1 billion cubic meters)*.

Latvia is an important oil and oil product transit country (see Appendix 14). The city Ventspils is the only loading harbour *(capacity 32 million tonns/year)* of the piplined crude (50%) and railwayed oil products (50%) for Russia in Baltic Sea region. Latvia has no its refinery plant. The importance of fuel oil in its energy balance comprises about 37%, which is purchased from the nearest (at a distance of 160-500 km) operating refineries in Lithuania (Mazheikai), in Belorussia (Novopolock) and in Russia (Kirishi).

Coal has the smallest impact, only 11% of total power sources (Appendix 7) used for thermogenerating plant and local boiler supply.

The Latvian power production system consists of hydro and thermal power plants. Total consumption of electricity in Latvia was 9.8 TWh in 1991 (see Appendix 4). It is provided by three hydroelectric stations (Riga, Kegums, Plavinas) located on the river Daugava (total capacity 1.463 MW) and two thermal power plants in Riga (total capacity 512 MW). About 35%-44% of total consumption is covered by hydro resources The missing ammount of electricity is being imported from Estonia or is delivered to Latvia through the unified Baltic 330 kV transmition line network (Appendix 15) from Lithuania or Russia. The dispatching center of the Baltic states is located in Riga.

A pre-war study calculated that low-head hydro plants on 134 small rivers (out of 1000) could be harnesed to generate extra (*up to 500 MW)* hydro power.

The heat consumtion is about 31 PCal, most of which is used in household and public service *(45%)* and in industry *(44%)*. Gas *(about 67%)* and heavy fuel oil *(about 32%)* are the main energy sources used for heat power generation. Heat is supplied through the central district heating network (*in Riga*) and the local distribution system (*in towns and country-side*). The heating sector has a huge potential for energy savings.

The unique natural underground storage for natural gas in In"ukalns secures the Baltic region. The actual amount supplied at present is 3,3 bilion cubic meters of natural gas a year. Total consumption of fuel in Latvia is shown in Appendix 7.

Riga and Liepaja harbours, ice-free port in Ventspils are engaged in crude oil and oil product export *(from Russia)* and import (*from the West*) transactions.

Currently all heat and power objects according to their direct subordination are state-owned. The Ministry of Industry and Energy runs the whole complex and realize the state's energy policy with respect of the declared short-term priorities: 1) 1)renovation of existing facilities, 2) an efficient energy supply, 3) improvement of price and tariff structure, 4) enhanced environmental performance. The long-term priorities are the following: 1) creation of selfbalanced energy supply system in Latvia by constructing new power generation and gas storage facilities, 2) energy conservation and diversification of primary energy sources, 3) improvement of district heating network.

The major enterprises in energy and fuel complex are: "Latvenergo", (*employee 8400*), "Latvijas Gāze" [Latvia Gas] (*employee 3344*), "Latvijas Nafta" [Latvia Oil] (*employee 1708)*, company "Latvijas Kurināmais" [Latvia Solid Fuel] with 9 fuel supplying enterprises (*employee 835*), "Latvijas siltums" [Latvia heat] with 23 district heating utilities *(employee 3035)*.

Latvian economy is entirely dependent on supplies, rational utilization, mastering unconventional energy sources *(wind, solar, geothermal power, biogas)*, but they would not contribute significantly to country's energy balance before the end of the century.

Quite many problems have piled up in Latvian energy complex.
An efficient international cooperation between Latvia and the World Bank, European Community, European Bank for Reconstruction and Development and different institutions, companies in Denmark, Sweden, Finland, United States, United Kingdom has a hopeful prospect for the energy development.

The Ministry of Industry and Energy

The Ministry of Industry and Energy was established on November 27,1991 instead of two previous: Ministry of Industry and Ministry of Energy.

The foremost task of the Ministry is to determine frameworks and regulatory systems, to create the most favoured climate for manufacturing, commercial and entrepreneurial activity, to strengthen the market institutions and to help to facilitate the process of global integration of Latvian economy.

RESPONSIBILITY

The Ministry of Industry and Energy is responsible for :

* the design of a general framework and guidlines for short and long-term industrial and energy policy and development;
* the takeover and conversion of ex-Soviet Union military enterprises;
* the structural and sectorial measures, implementation of privatization of the state owned enterprises;
* the power and heat energy production, the efficient consumption policy of the domestic and imported energy resources;
* participation in the activities of international organizations and institutions within industry and energy;
* the proposals on the legal acts to improve taxes, custom rates and regulations, the legislation on restructuring and privatization;
* the assistance in the business and management profesionals training in the transition period to the market economy.

ORGANIZATION

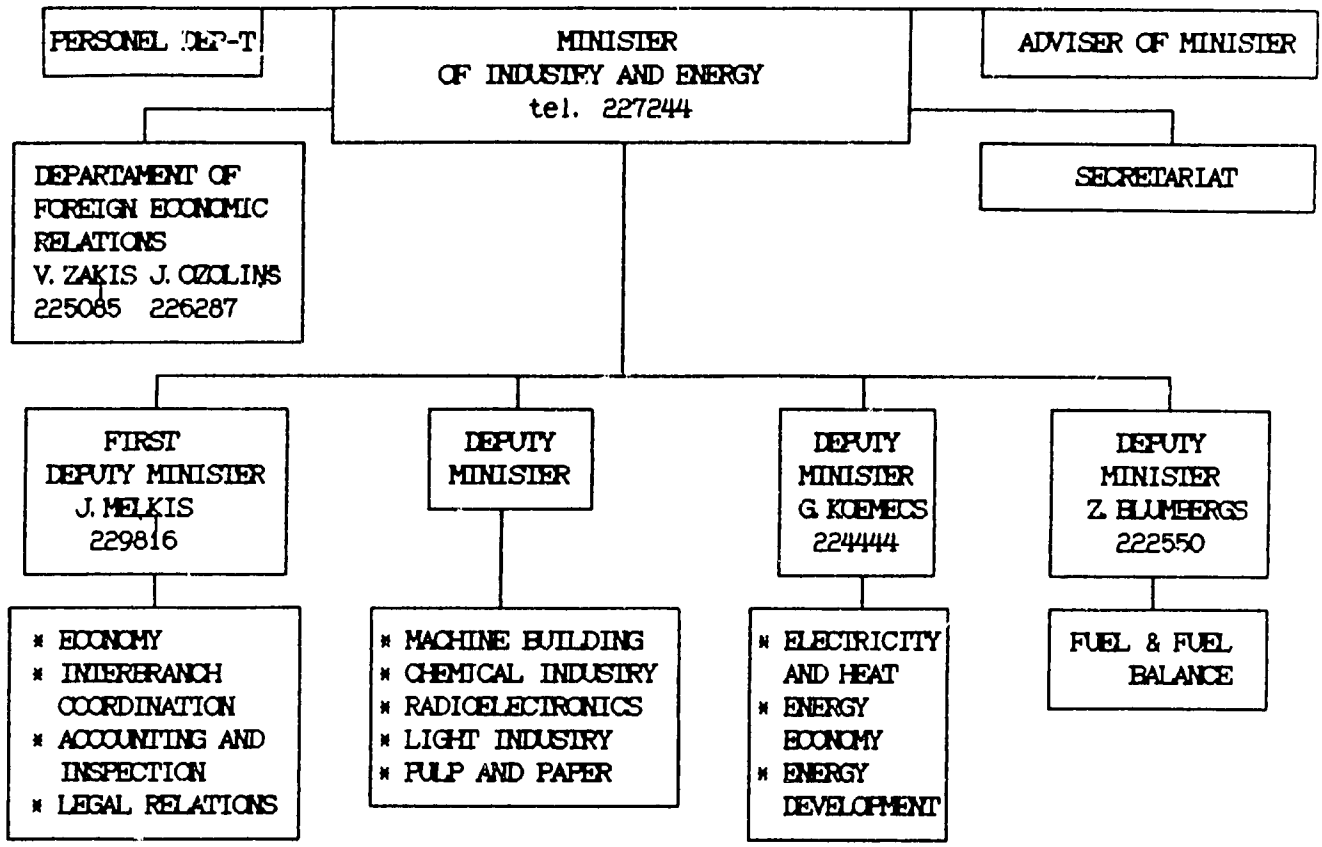
The Ministry of Industry and Energy has **two main domains**: funtional and branch structure, and one secretariat (see Appendix 3).

Functional structure consists of **eight departments**, which deal with interdivisional items: *financial and economical items, general industrial policy, information funding, control and inspection of contract obligations, legal application of acts,regulations and other legal questions, international relations.*

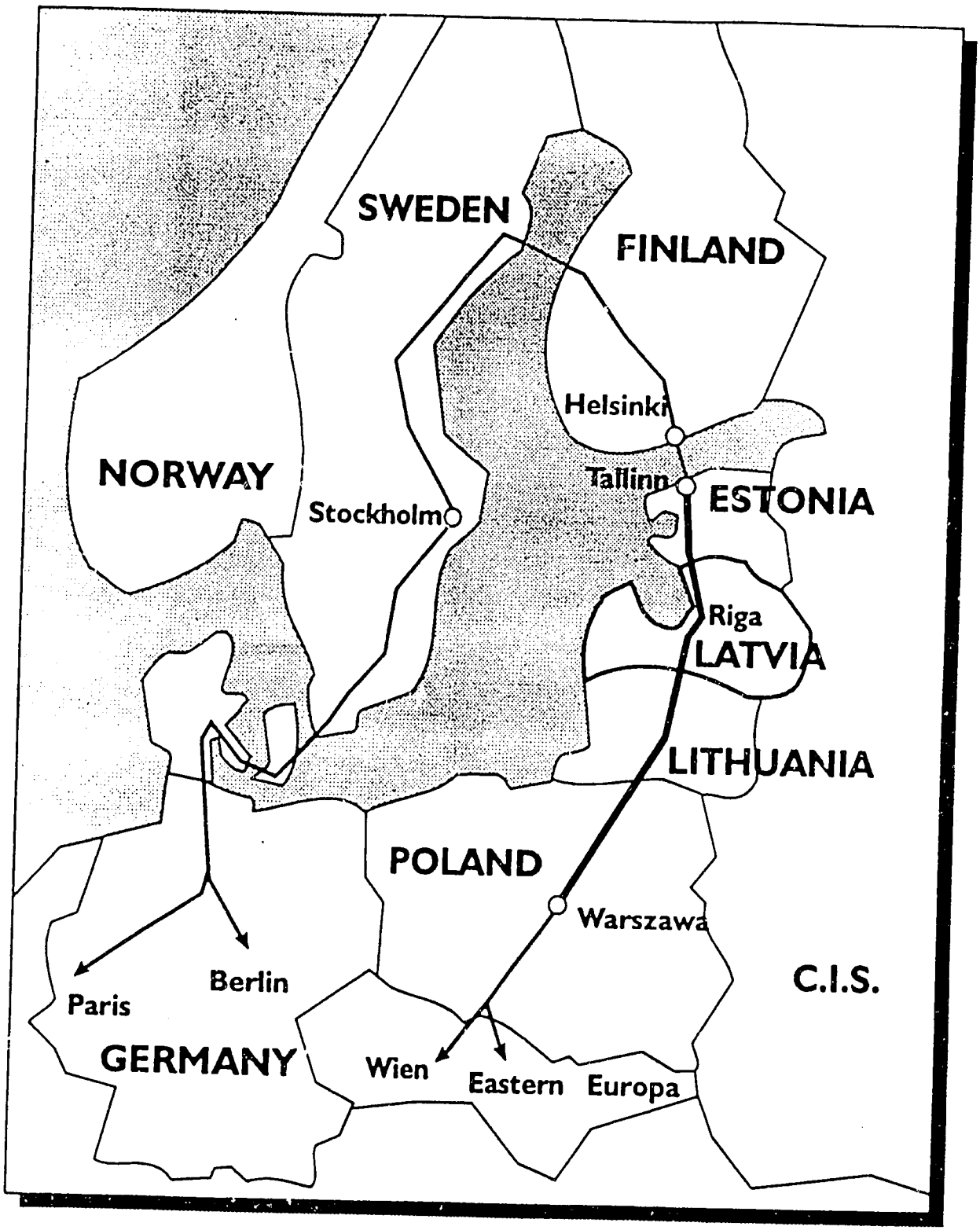
The branch structure has **six departments**, five of them deal with industry sector and one with energy sector. They carry out : *consultancy with the enterprises in matters related to manufacturing and regional trade policies , ownership question within the Ministry's sphere of interests, the projects and programms for economic restructuring and development, the affirmation of general managers for state-owned enterprises and bilateral contracts, the implementation of privatization of public property.*

The total number of employees is around 120.

26. MARCH 1992



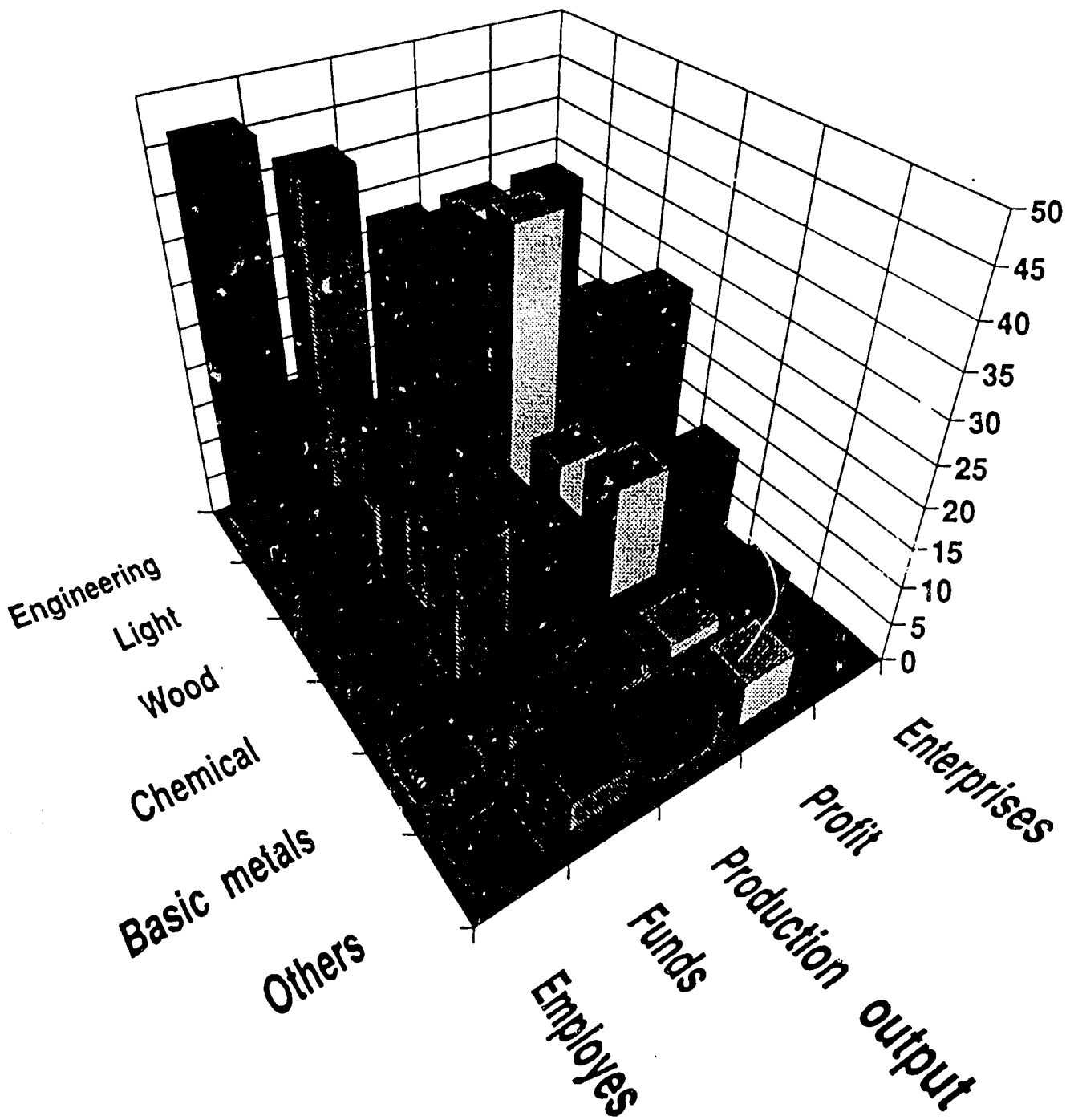
VIA BALTICA


SWEDEN
FINLAND
Helsinki
NORWAY
Tallinn
ESTONIA
Stockholm
Riga
LATVIA
LITHUANIA
POLAND
Warszawa
C.I.S.
Paris
Berlin
GERMANY
Wien
Eastern Europa

Sectorial Distribution of Industrial Enterprises and Employees

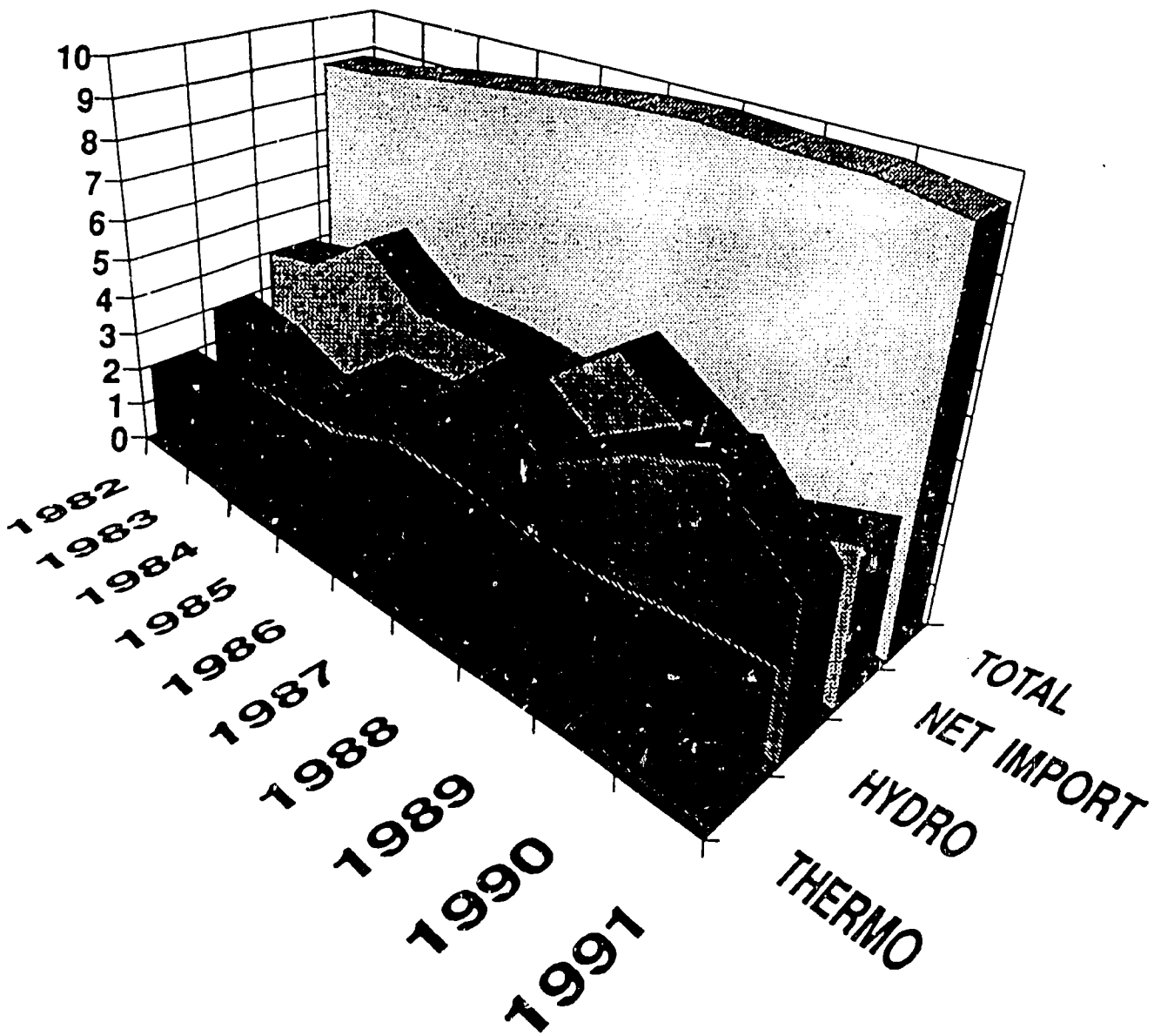
INDUSTRY	1939	1992
Total enterprises	6067	369
employees(thousands)	117,5	228,3
Metal manufacturing		
enterprises	714	48
employees	16,4	35,6
Electronic industry		
enterprises	57	35
employees	3,9	52,3
Chemical industry		
enterprises	184	30
employees	5,7	22,5
Wood, paper, peat industry		
enterprises	1262	67
employees	18,5	28,1
Light industry		
enterprises	779	52
employees	23,5	43,0
Food industry		
enterprises	1868	99
employees	18,9	23,1
Construction materials		
enterprises	806	33
employees	19,6	18,1
Average amount of employees in an enterprise (without food ind. and ind. of constr. materials)	19,0	789,5

Sectorial distribution of indystry in 1991

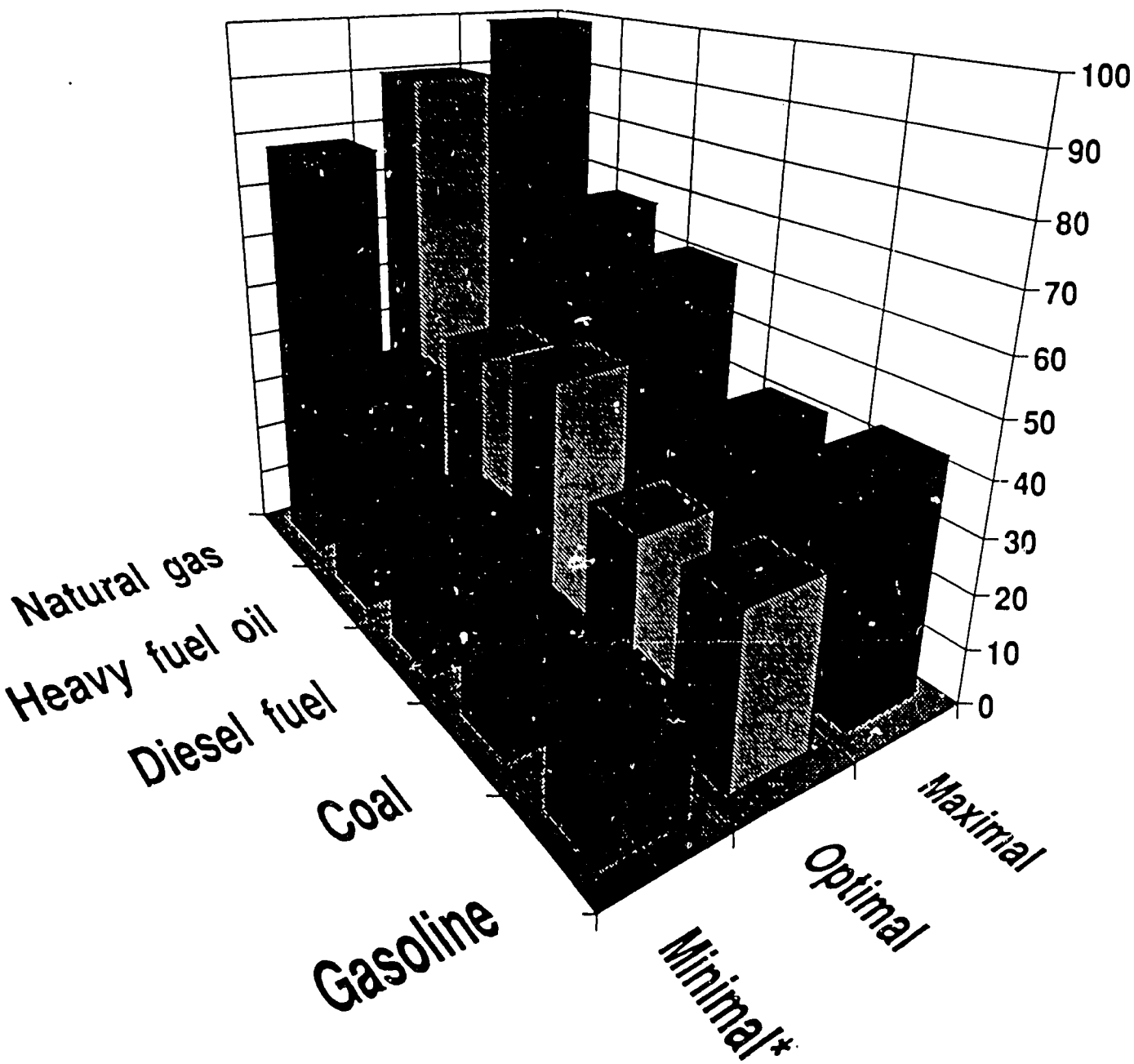


Electricity production and import (in TWh)

Latvian economy 1982-1992



Annual demand on imported enrgy sources in LATVIA in 1992 (PJ)



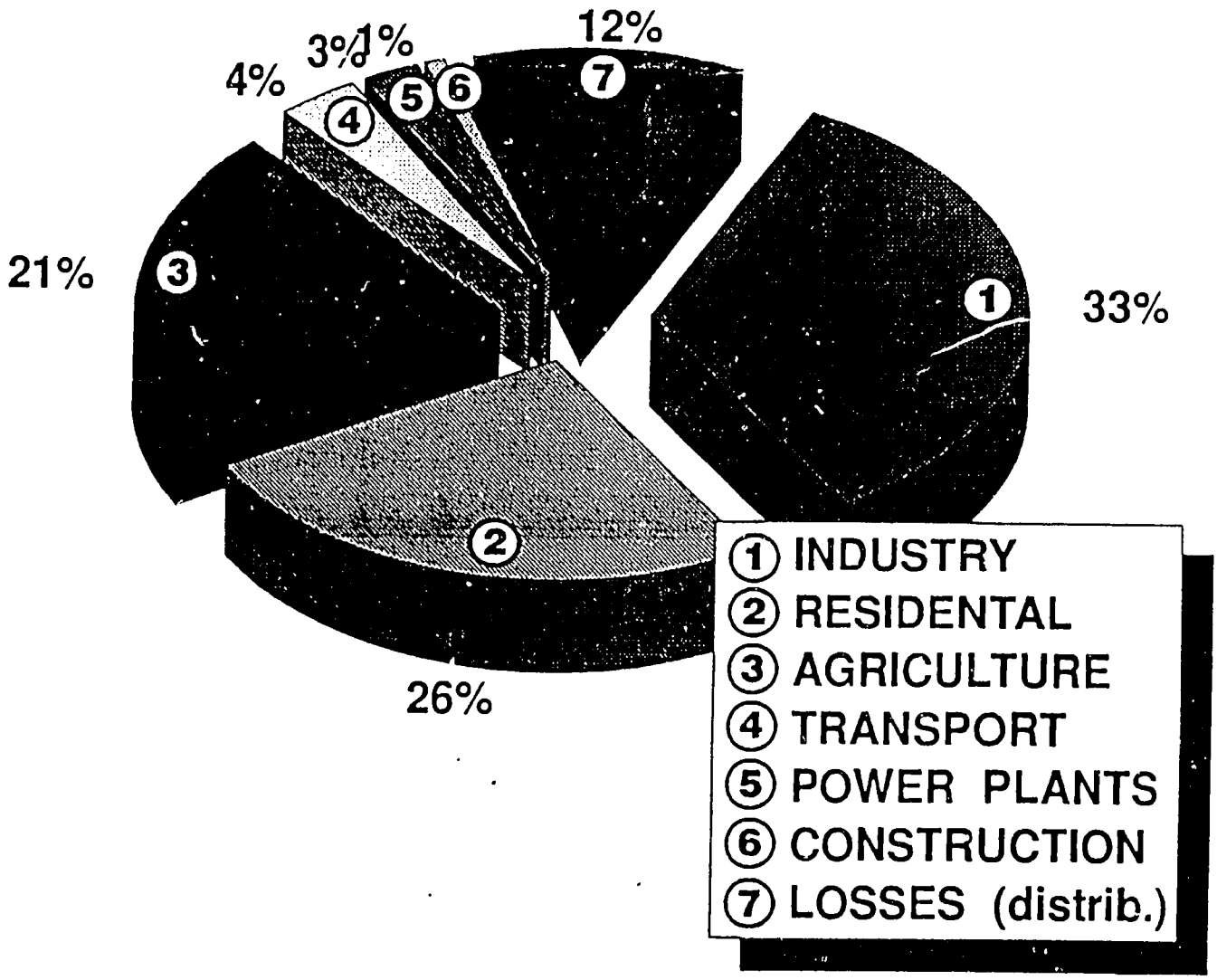
*** Minimal demand for urgent needs is covered only**

ANNUAL DEMAND ON IMPORTED ENERGY SOURCES IN LATVIA IN 1992

		MAXIMUM	OPTIMUM	MINIMUM
NATURAL GAS	milj.m^3	3300	3000	2600
HEAVY FUEL OIL	thous.tonns	1800	1300	1300
DIESEL FUEL	thous.tonns	1500	1200	750
COAL	thous.tonns	1300	1000	500
GASOLINE	thous.tonns	780	600	470
FLEET MAZUT	thous.tonns	128	60	30
LIQUID STOVE FUEL	thous.tonns	250	100	50
LUBRICANTING OIL	thous.tonns	16	13	6
LUBRICANTS (max 35.sort)	thous.tonns	2.1	1	0.5
LIQUID GAS	thous.tonns	80	65	60

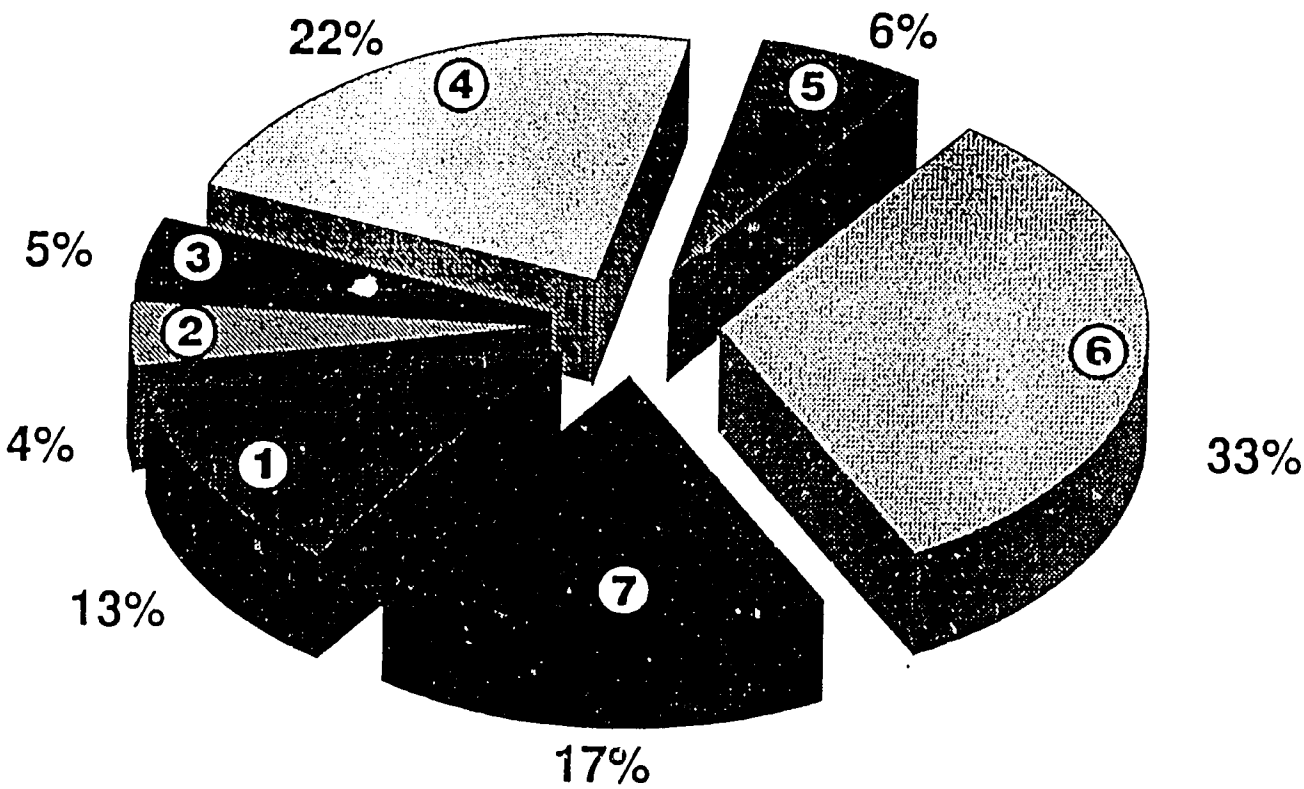
Electricity consumtion

Latvian economy 1990



Fuel consumtion

Latvian economy



1 INDUSTRY
2 TRANSPORT
3 AGRICULTURE
4 HOUSEHOLD&SERVICE
5 OTHER
6 BOILERS
7 POWER PLANTS

Appendix 8

Draft

PRIVATISATION STRATEGY

of the state - owned industrial enterprises in Latvia

Number of enterprises to be privatized

Investors	Trade sale	Limited sale of enterprise
Domestic investor	110	96
in 1992	-	3
Foreign investor	5	96
in 1992	5	3

LIST

OF THE STATE OWNED INDUSTRIAL ENTERPRISES ON A TRADE SALE F OR FOREIGN INVESTOR

Factory	Address	Phone	Production	Employees	Assets milj..r.	Productin area thous. m^2
Enterprise "ANDA"	23 Zala str. Livani 228264	253-43646	glass, china, faiance	27	2,72	2,0
Factory of industrial robots	200 Vienibas gatve Riga 226067	623610	mechanical engineering	247	57,2	1,75
Electro-machine building plant	31 Ganibu dambis Riga 226045	382077	electrotechnical goods, electric engines	4302	61,6	330,0
Experimental plant of functional microelectronics	5 Kurzemes prospect Riga 226067	411358	radiosets	293	24,8	23,0
Enterprise BISHUMUIZHA	145 Bauskas str. Riga 226004	620921	glass, china faiance	107	1,6	6,0

Factory	Address	Phone	Production	Employees	Assets milj..r.	Productin area thous. m^2
Textile company "RITMS"	5/7 Tallinas str. Riga, 226013	373627	wool yarn, wool fabrics, non weared goods	186	7,67	5,83
Sewing factory "ROSME"	18 Hanzas str. Riga 226219	325456	sewed goods textilfabrics	531	7,32	4,85
Synthetic leather & sport equipment factory	2 Strugu str. Riga, 226018	229140	synthetic leather goods, leather textile	119	0,64	1,6
Leather processing company "KOSMOSS"	114 Kr.Valdemara Riga, 226013	374518	leather processing (beef, pig)	348	11;305	18,9
Peat factory "LIELSALA"	"Lielsalas" turn Valdgale Talsu region 229595	232-43242 232-22652	peat for agriculture & export (non packed)	40	5,340	0,36
Krustpils founding enterprise	10 F.Engelsa str. Krustpils 228200	252-30092	ferrous metalurgy	-	50 projected 6 constructed	260

Appendix 10

PROPOSALS FOR FOREIGN INVESTMENT IN INDUSTRY AND ENERGY

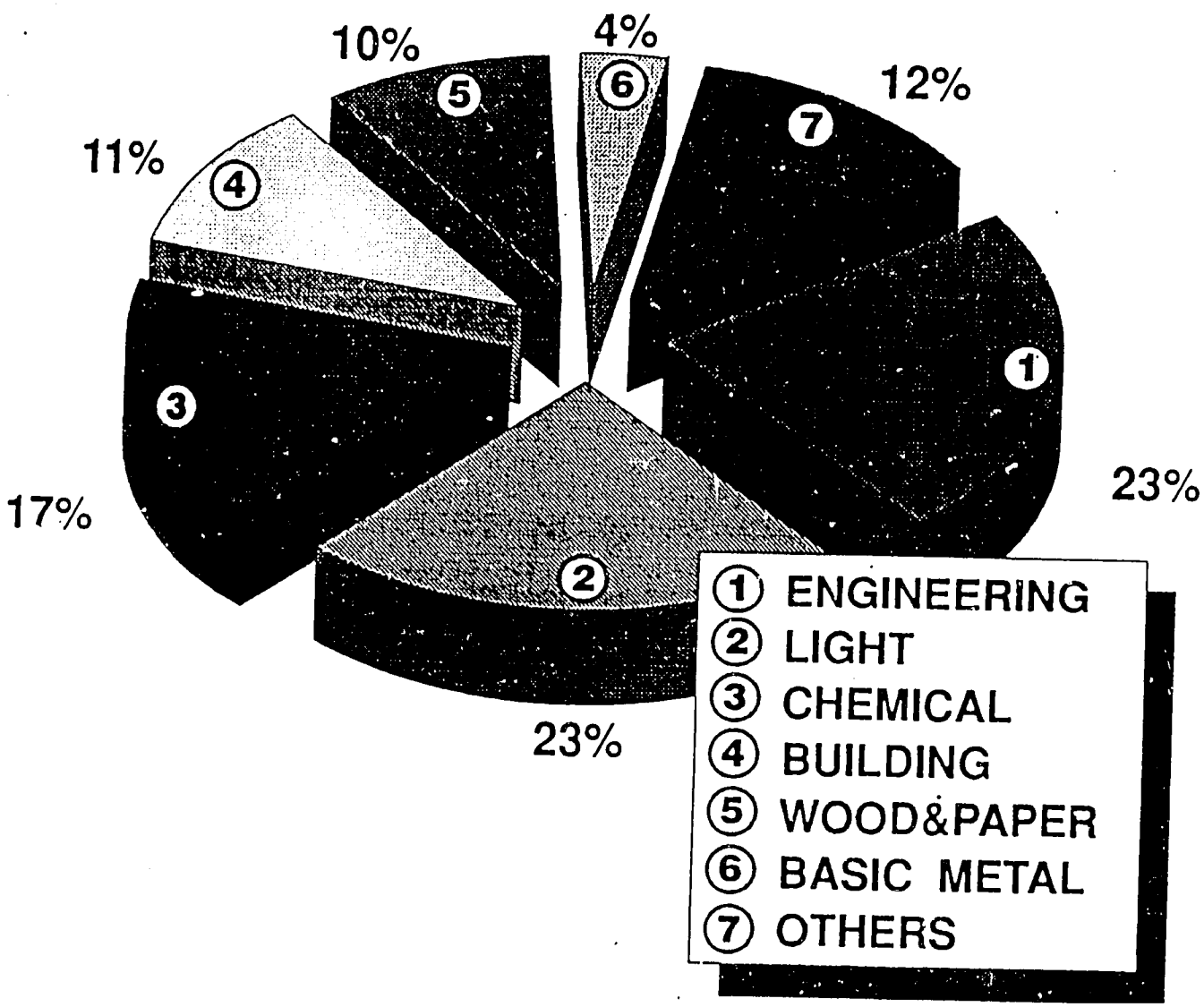
Content, name of projects and programs	Possible terms of realization	Possible costs of relization $miljon	Power	
			Current	After project implementation
1	2	3	4	5
1.Energetics				
Technical reconstruction of Kegums HES	1991.-1997.	13,5	64 MW	80 MW
Construction of transformator manufacturing shop in Riga	1992.-1995.	7,3		500 pcs
Reconstruction of underground gas depository of Inčukalns	1994.-1998.	36,2	2,5 billon m^3	2,5 billon m^3
Gas depository of Dobele	1994.-	18,1		5,5 billion.m^3
Oil refining plant	1993.-1994.	550		5,8milj.tons
Thermo-electric power station of coal in Liepaja	1994.-1997.	506		230MW
Thermo-electric power station of coal in Daugavpils	1996.-2000.	759		345MW
Nuclear power station	1994.-2000.	2600		600 MW
or Thermo-electric power station of coal	1998.-2000.	1440		600 MW
Modernization of Electric Bulbs Plant of Riga (production of halogen lamps)	1992.-1995.	3,0		1 miljn pcs

1	2	3	4	5
Organization of the production of asynchronous electromotors	1992.-1994.	32		1,5 miljn pcs
Organization of international accounting system of gas-mains	1994.-1996.	4,25		
Construction of containers for heavy oil products	1993.-1996.	2,5	325t.m3	630 t.m3
Research of oil deposits	1992.-1995.	4,3		
Gas meters supply	1993.-1995.	18		300 thous.pcs
Reconstruction of Riga LPG import harbor	1993.-1996.	18	4 thous.t.	12 thous.t.
1.2 Industry				
Construction of Pulp and Paper Mill	1992.-1996.	660		445 thous.t. 135 thous.t. paper 311 thous.t. pulp
Construction of mackle-paper processing mill	1992.-1996.	25		60 thous.t.
Organization of securities printing	1993.-1995.	16		
Formation of sugar substitute production plant	1992.-1998.	5,0		40 thous.t.
Production of trams at Riga Carriage Factory	1992.-1995.	15,0	400 pcs	520 pcs
Reconstruction of Mettalurgical Factory of Liepaja	1992.-1996.	656,0	500 thous.t.	570 thous.t. rolled metal
Establishing of a new technological plant at Minibus Factory in Jelgava	1992.-1994.	1505,0	16,7 thous.pcs	50 thous.pcs

1	2	3	4	5
Modernization of Riga-Varnish and Paint Enterprise for furniture and printing industry	1993.-1994.	5	50 thous.t.	60 thous.t.
Thin wood particle board shop of plant "Furnieris"	1993.-	18,0		35,7thous.m3
Wood fibre board shop technical modernization of "Bolderaja"	1992.-1993.	15,0	11 milj.m3.	15 milj.m.3
Planed veneer production shop of plant "Zunda"	1992.-1993.	6,7	2,5 milj.m2.	7,5 milj.m2.
Wood particle board plant of enterprise "Baltija"	1992.-1994.	10	-	56 thous.m3.
Reconstruction of furniture producing shop of enterprise "Baltija"	1992.-1993.	5,5		45 thous.pcs
Sloka Pulp and Paper Mill, reconstruction of mechanical woodpulp plant	1992.-1994.	25,0	12,5 thous.t.	80,0 thous.t.
Utilising boilers at "Bolderaja" enterprise	1992.-1993.	2,4		66 thous.m3.
Enterprise "Larelin" -reconstruction	1992.-1995.	144,2 -	3000 thous.m.	7580 thous.m.
Installation of a polyethylene regeneration plant in Olaine	1992.-1992.	0,5		
Development of of children's knitwear production	1992.-1995	9,0		
Reconstruction of textile integrated plant "Astotais Marts"	1993.-1995.	7,0	1230 thous.m.	1500 thous.m.

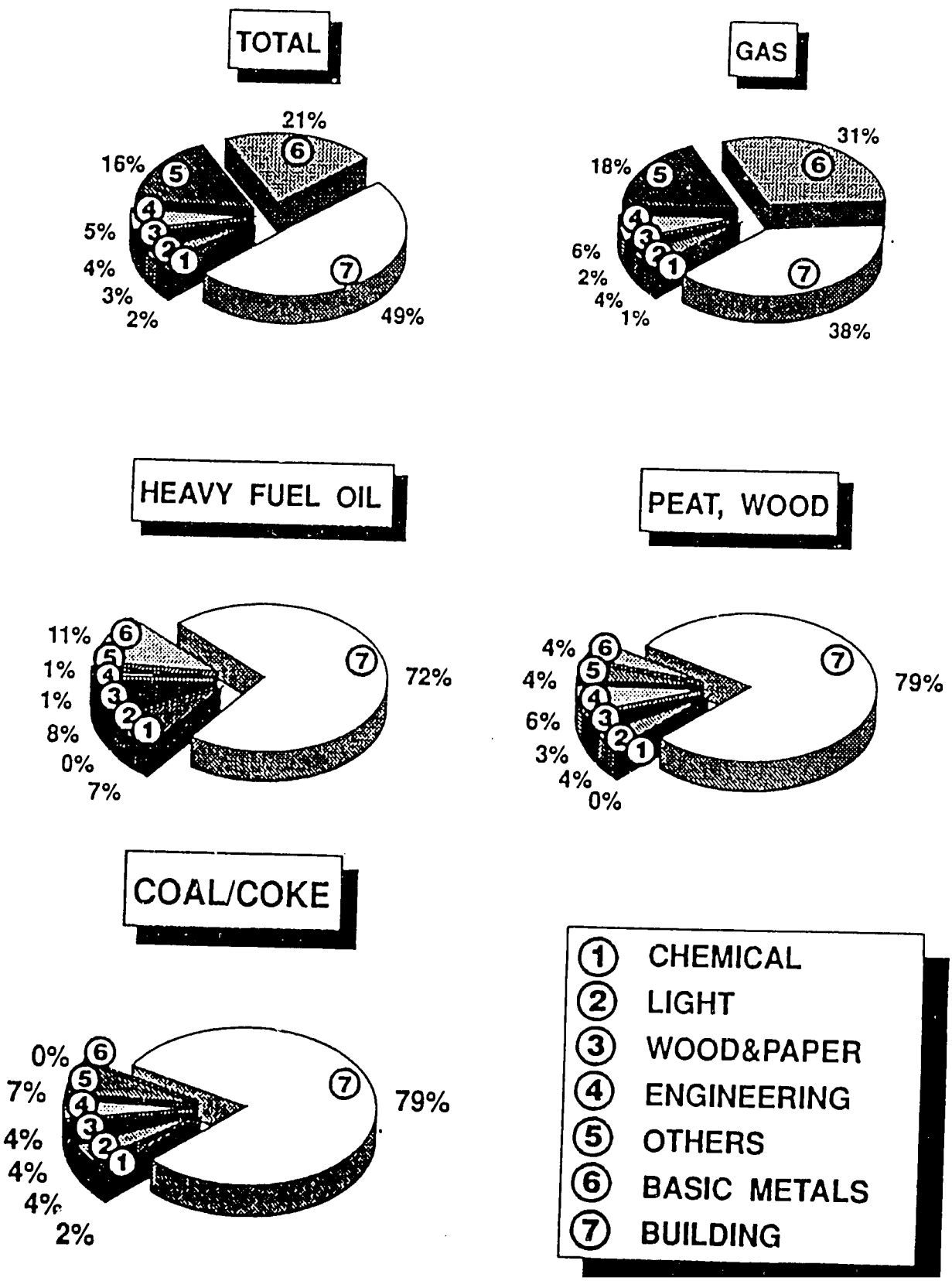
Electricity consumtion

Latvian industry 1990

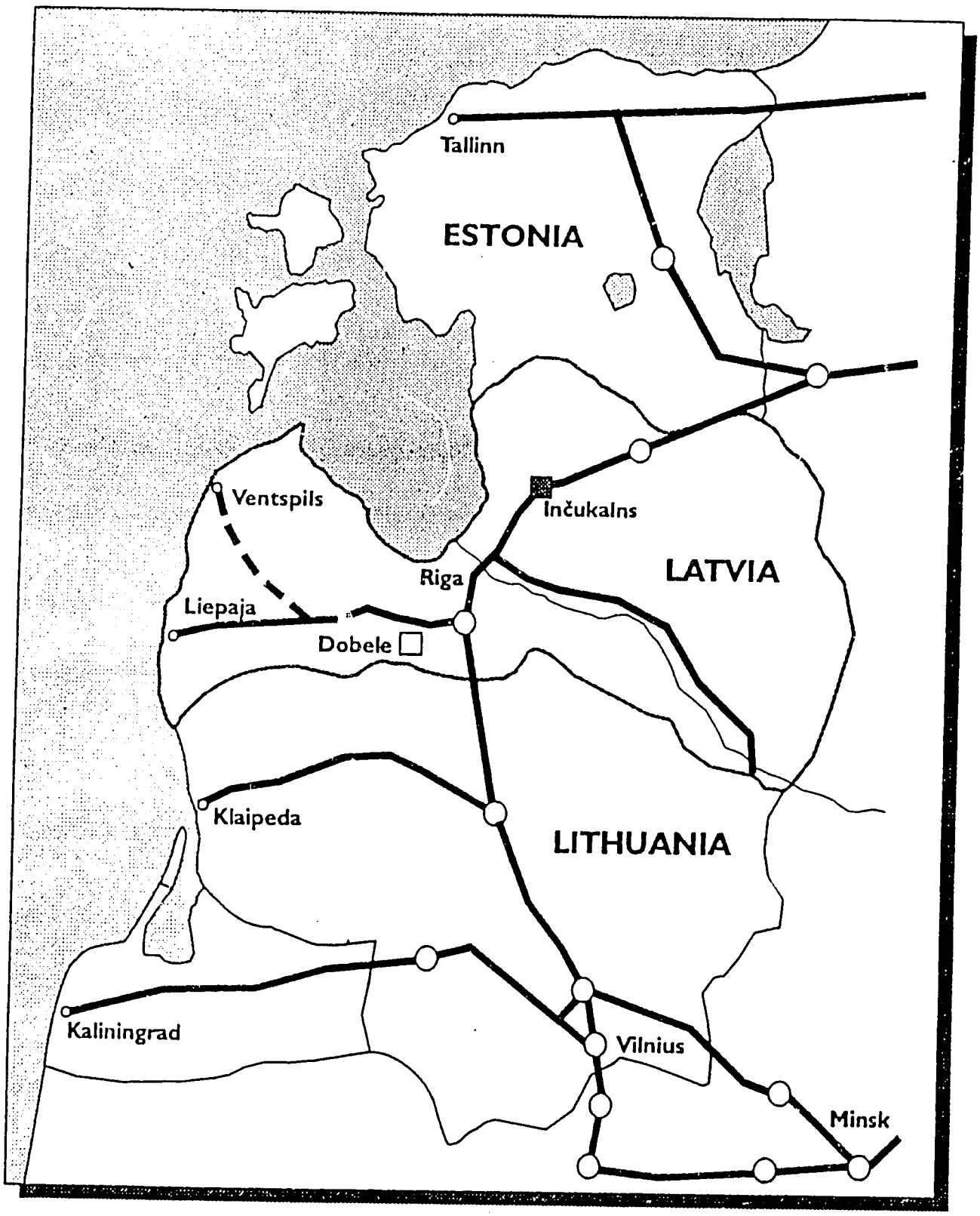


Fuel consumtion

Latvian industry



The natural gas networks in Estonia, Latvia and Lithuania

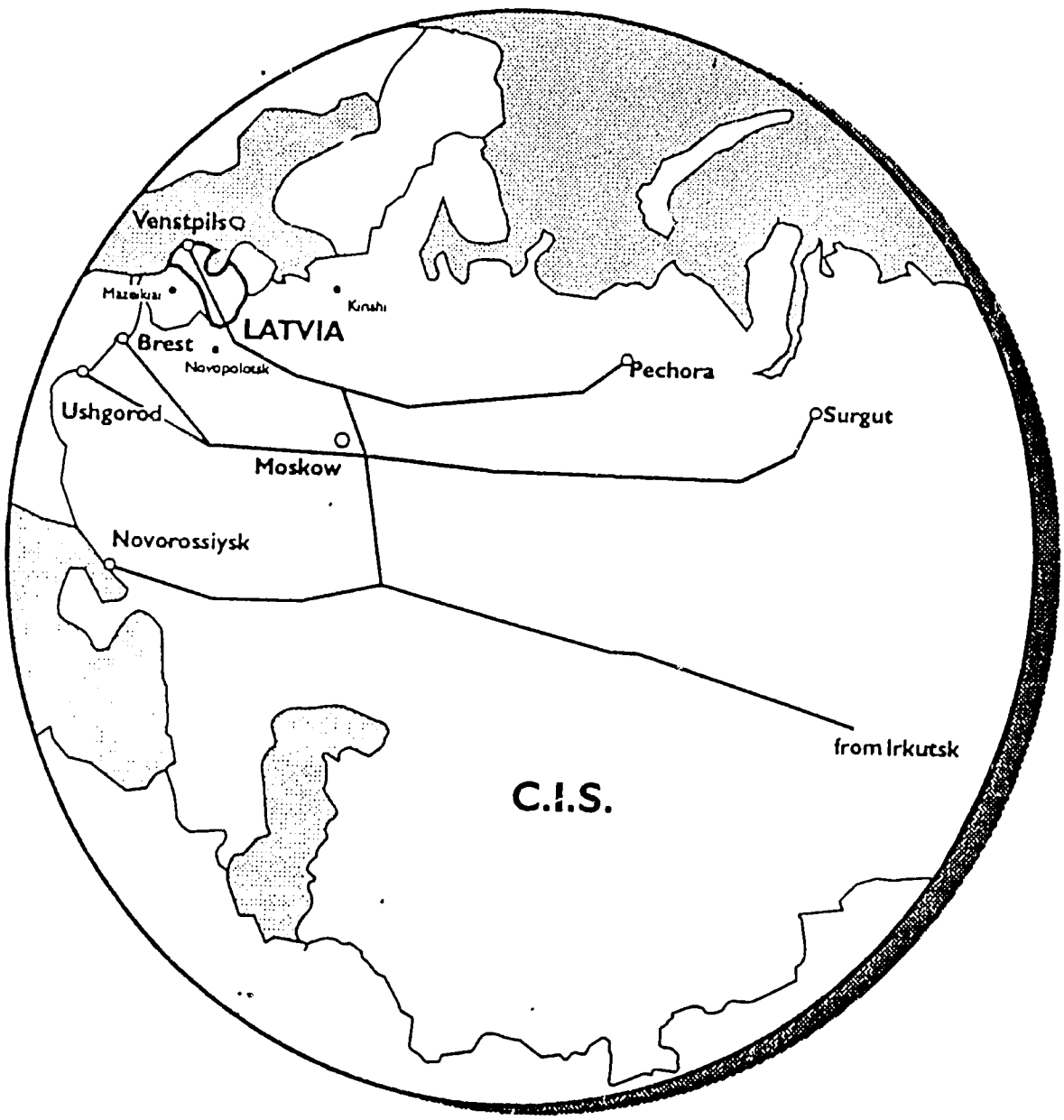


Gas pipelines

- existing and under construction

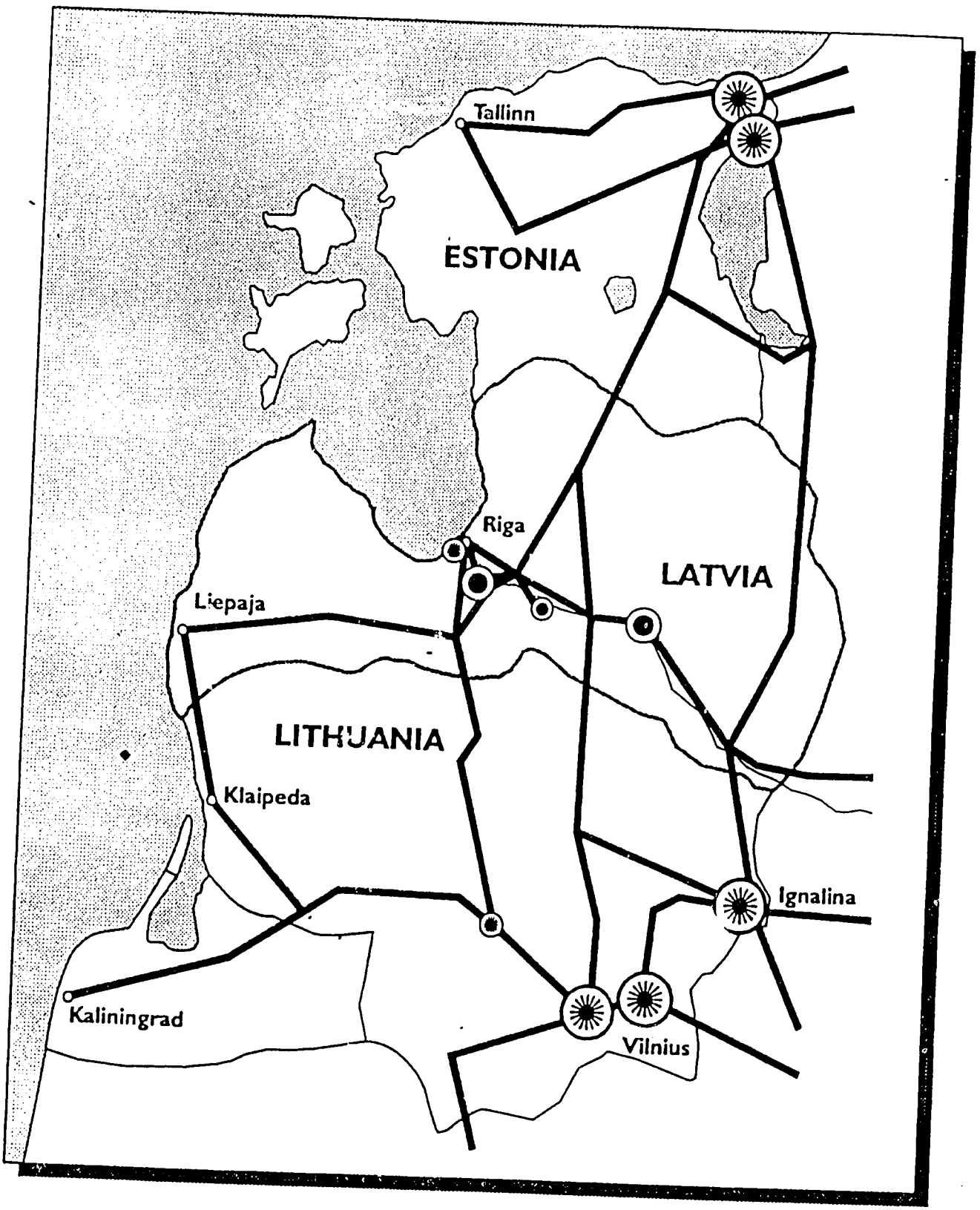
- compressing gas stations
- underground gas storage

Oil Export Pipelines of the C.I.S.



• Mazeikiai - Oil Refineries

The 330 kV electrical network and the connections to the North-Western power system



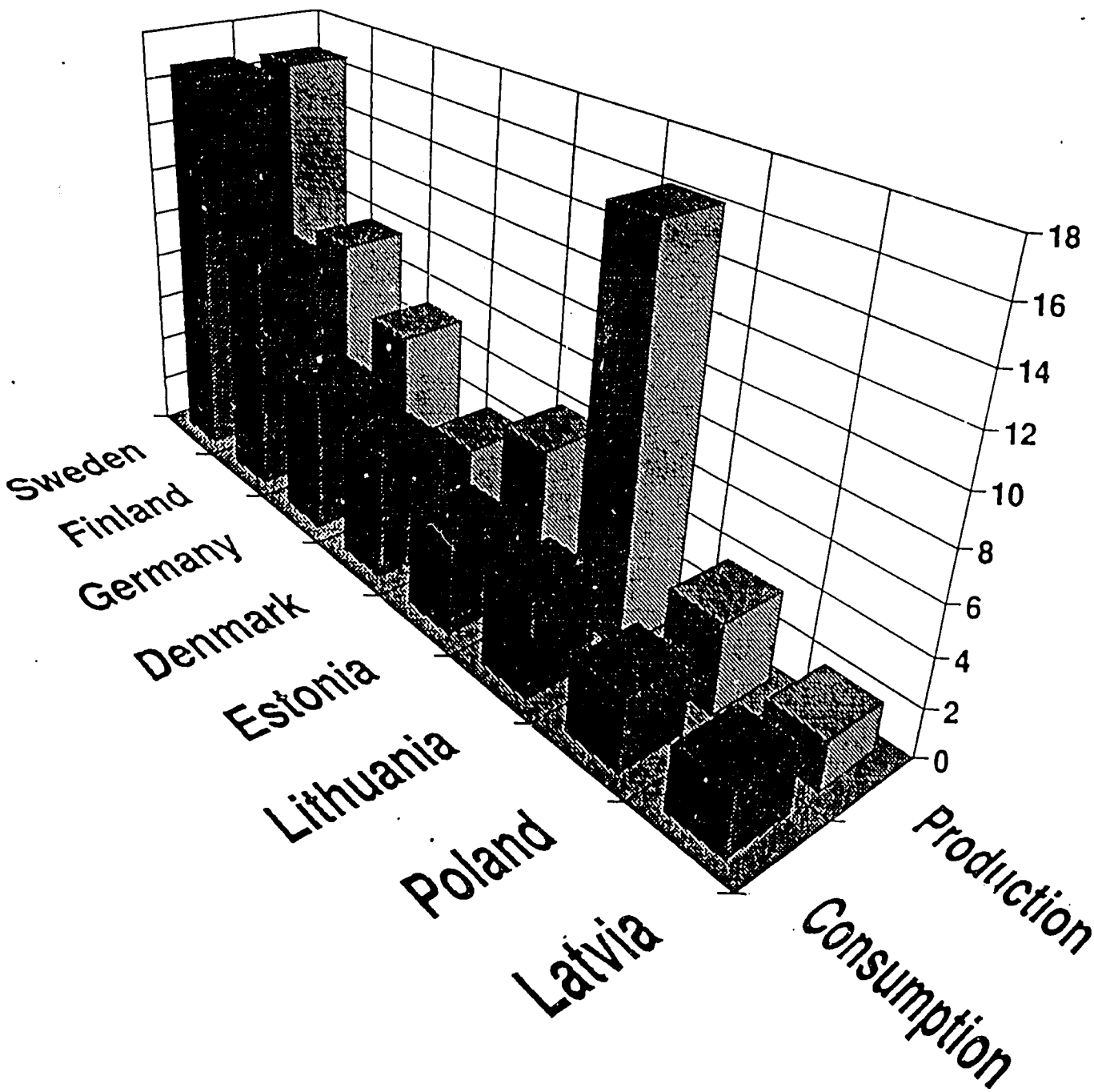
Capacity in megawats

- thermal power plants

- 100-300

145

Electricity balance in European countries in 1989 (in TWh)



JOINT VENTURES IN LATVIA

Country	Number of joint ventures	Basic capital (thousands rbl)	Share of foreign capital %
Germany	50	12 651	22,6
USA	47	10 770	19,2
Russia	15	7 154	12,8
Sweden	23	4 908	8,8
Spain	4	3 018	5,4
UK	13	2 803	5,0
Italy	8	2 779	5,0
Turkey	2	1 855	3,3
Netherlands	2	1 505	2,7
Poland	19	1 497	2,7
Switzerland	4	1 272	2,3
Finland	7	725	1,3
France	8	618	1,1
Canada	8	588	0,8

APPENDIX 2

TARIFFS FOR ELECTRICITY, GAS, AND DISTRICT HEAT

APPENDIX 2: TARIFFS FOR ELECTRICITY, GAS, AND DISTRICT HEAT

Latvia

Electric tariff increases in Latvia have been driven by increases in the cost of imported power plus increases in the prices of natural gas and heavy fuel oil. During the 1991-1992 winter there were severe shortages of heavy fuel oil which forced Latvenergo to rely on natural gas in gas-capable boilers and move heavy fuel oil by train to the boilers that rely exclusively on heavy fuel oil. By the end of March, the amount of natural gas in underground storage was drawn down to a very low level.

In the electricity tariffs effective January 15, 1992, industrial customers received less favorable treatment than residential customers, in two respects:

1) Large industrial customers are subject to peak demand allocations, and there are severe financial penalties for consumption in excess of the demand "quota" set by the electric company. These quotas may be revised on a daily basis. The penalty for "violations of electric consumption" is 200 rubles per kW per month. On days when the power system has a shortage of capacity, the large industrial customers are the first customers to face peak demand restrictions.

2) Industrial customers pay higher prices than residential customers, although the cost of service would have to be higher for the residential customers. For example, industrial customers with less than 740 kVA of demand pay 44 kopecks per kWh while residential consumers pay 25 kopecks per kWh if electricity is used for cooking and 30 kopecks per kWh otherwise. A large industrial consumer with a load factor of 70 percent would pay 41.5 kopecks per kWh, including the demand charge, and with any lower load factor the price would be higher.

There is some political pressure to make industrial customers bear the burden of increases in the cost of fuel and purchased power. There is also some political pressure to use electricity price increases to subsidize district heat. Latvenergo does not support the idea of having industrial customers subsidize household customers, but has been instructed by Parliament to compute tariff proposals that involve this type of cross-subsidy.

(Tariffs were probably raised in April due to an increase in the cost of purchased power. RCG/HB will obtain updated information.)

Natural gas tariff increases in Latvia are driven by the cost of gas imported from Russia. Latvia is entirely dependent on Russia for gas supply, although Latvia has an underground

storage field at Incukalns with a capacity of 2.1 billion cubic meters (BCM). Latvia's total gas consumption was 2.899 BCM in 1990 and 3.112 BCM in 1991. At the beginnning of the 1991-1992 winter the gas in storage provided a buffer against gas price increases. At the end of March 1992, however, the amount of gas in storage (purchased at low prices) was so small that it probably can no longer provide a buffer against increases in the border price of gas imported from Russia.

The economic incentive to conserve natural gas is placed upon metered customers, including all industrial and commercial customers. A large portion of the residential customers in Latvia are billed on the basis of number of inhabitants, or floor area, because a gas meter is not installed.

Industrial consumers do not pay demand charges for gas. Among customers with gas meters, industrial consumers pay a higher price than residential customers. In the tariffs effective January 10, 1992 the price differential was only 10 percent, however. The more difficult comparison to make is the comparison between prices to industrial consumers with meters and prices to residential consumers without meters. Clearly the industrial customer has a stronger incentive to conserve natural gas than the residential customer who has no gas meter.

LPG prices in Latvia clearly discriminate in favor of residential consumers. Under the tariff effective January 10, 1992, industrial consumers in Latvia pay almost three times the price charged to residential consumers.

District heat prices in Latvia do not include demand charges, although the management of Latvenergo District Heating Networks is interested in introducing demand charges. District heat involves a large subsidy of residential consumers by industrial consumers. Under the Latvenergo District Heating Networks tariff effective January 16, 1992, industrial consumers pay 298 rubles/Gcal while residential consumers pay 19 rubles/Gcal. As a result of this price differential the economic incentive to conserve district heat is placed upon industrial consumers.

Some industrial enterprises provide their own district heat and even supply apartment houses with district heat. These enterprises face the strongest incentive to conserve heat because they are not buffered from increases in the price of oil or gas. If the heating system depends on heavy fuel oil, the enterprise may be unable to obtain the oil and therefore it may be forced to shut down the heating system.

District heat supplied by Latvenergo District Heating Networks was cut off on April 15, 1992 due to a shortage of fuel and the difficulty of paying for fuel at prices prevailing in April. Large price increases are likely.

Electricity Tariffs in Latvia
Effective January 15, 1992

Customer Group		Demand charge, rubles per kW per year	Energy charge, kopecks per kWh
Group 1	Large industrial consumers (more than 750 kVA)	540	33
Group 2	Other industrial consumers (less than 750 kVA)	0	44
Group 3	Bulk power consumers (sale for resale)	0	35
Group 4	Small businesses	0	40
Group 5	Residential consumers	0	30
	Residential consumers using electric power for cooking	0	25
Group 6	Small villages that are connected to a single substation	0	27
Group 7	Electric boiler houses:		
	day rate	0	75
	night rate	0	25
Charge for reactive power		0	2
Individual residences with heat pumps		0	20
Power sales in convertible currency		0	11 US cents per kWh

NOTES:

1. The penalty for the voluntary connection of electric heating appliances to the main system, and for other violations of electrical consumption, is 200 rubles per kW per month.

2. The electric rates for Group 4 can be applied to individual farmers who use 20A or more, and farmers with two or more meters.

3. Power sales for convertible currency are effected on mutual agreements in compliance with the existing legislation of the Republic of Latvia.

Source: Energokontrole (affiliate of Latvenergo).

Natural Gas Tariffs in Latvia
Effective January 10, 1992

Tariffs for Natural Gas Sales to Consumers Having Gas Meters

Residential consumers	1080 rubles per thousand cubic meters
Industrial and commercial consumers	1187 rubles per thousand cubic meters

Tariffs for Natural Gas Sales to Residential Consumers Having No Gas Meters in Their Apartments

Households with gas used for cooking, in apartments with gas cooking appliances and district heating	8.64 rubles per person per month
Households with gas used for cooking and hot water, in apartments with gas cooking appliances but no district heating	11.88 rubles per person per month
Households with gas used for cooking and hot water, in apartments with gas cooking appliances and individual gas water heaters	17.82 rubles per person per month
Heating of apartments and individual residences with gas boilers	0.50 rubles per square meter of living space per month
Refrigerators operated with gas	29.81 rubles per unit

Prices of LPG

Residential consumers	9.50 rubles per kg
Industrial and commercial consumers	27.44 rubles per kg

Source: Rigas Gaze.

District Heating Tariffs in Latvia

For Latvenergo District Heating Networks

Tariffs Effective January 16, 1992

Industrial consumers	298 rubles/Gcal
Residential consumers	19 rubles/Gcal*

Tariffs in Effect in 1991

Industrial consumers	27 rubles/Gcal
Residential consumers	2.5 rubles/Gcal

Tariffs in Effect from 1970 to 1990

Industrial consumers	12 rubles/Gcal
Residential consumers	2.5 rubles/Gcal

* This figure includes an allowance of 4 rubles/Gcal for maintenance of district heating substations.

Source: Meeting with Arnold Korp, Deputy Director, Latvenergo District Heating Networks, February 24, 1992.

APPENDIX 3

LAW "ON FOREIGN INVESTMENT IN THE REPUBLIC OF LATVIA"

TRANSLATION

THE REPUBLIC OF LATVIA

LAW

"On Foreign Investment in the Republic of Latvia"

The goal of this law is to promote foreign investment in the Republic of Latvia, while guaranteeing that the interests of the Republic of Latvia are observed.

Definitions of terms used in this Law:

Foreign investors: foreign registered physical and legal entities, who invest in entrepreneurial activity in the Republic of Latvia..

Foreign investment: convertible currency earmarked for entrepreneurial activity in the Republic of Latvia, as well as physical and/or intellectual property of foreign investors imported from abroad which is valued in convertible currency. Calculations of values in convertible currency are done according to the exchange rate set by the Bank of Latvia on the day of the property's transfer.

Enterprises with foreign investment: newly-formed or existing enterprises (entrepreneurial associations), which are the objects of foreign investment.

Foreign control over an enterprise: the rights of a foreign investor to control the enterprise's type and direction of business activity through voting rights or other means.

National laws: the legal regime under which foreign investors have the same rights and obligations as the physical persons and legal entities of the Republic of Latvia.

Article 1. Application of national laws to foreign investors

Foreign investors in the Republic of Latvia are guaranteed the rights and obligations of the national laws excluding exceptions stated in this law.

Article 2. Types of entrepreneurial activity

1. Foreign investors have the right to engage in entrepreneurial activity only by establishing limited liability associations or joint stock companies, with or without the participation of a local partner or by participating in such associations or companies.

2. A foreign enterprise may be the sole founder of an enterprise with foreign investment.

3. Foreign enterprises in the Republic of Latvia may establish branches in accordance with of this Article.

4. Foreign enterprises may open agencies which are not entitled to undertake business activities in the territory of the Republic of Latvia.

- establishes a new enterprise, whose material and financial assets exceed 1,000,000 (one million) US dollars or an equivalent sum in convertible currency.

2. In order to receive permission for the foreign investment, the foreign investor must submit to the Council of Ministers of the Republic of Latvia the information outlined in Appendix 2 of this Law.

3. The Council of Ministers of the Republic of Latvia or its authorized institution must make a decision within 30 days of the receipt of such application.

4. In making its decision on the foreign investments outlined in this Article the Council of Ministers of the Republic of Latvia or its duly authorized institution shall consider:

1) the investment's impact on the economy of the Republic of Latvia, especially with regards to:

- the creation of new jobs;
- the processing of local resources and use of local services;
- the export of goods manufactured in the Republic of Latvia;

2) the investment's impact on raising productivity, developing technology, improving product quality and diversity in the Republic of Latvia;

3) the investment's impact on competition in the respective industry;

4) the possibility of an investment from a foreign country dominating the economy of the Republic of Latvia;

5) the investment's impact on the competitive position of Latvian products in the world market;

6) the investment's impact on the ecological situation.

Article 7. Registration of an enterprise with foreign investment

Enterprises with foreign investment are registered in accordance with the Republic of Latvia law "On the Enterprise Registery of the Republic of Latvia".

Article 8. Protection of foreign investments

1. The Republic of Latvia ensures the protection of foreign investments. Alienation of foreign investment in the Republic of Latvia may be carried out only in accordance with the procedures stipulated by the laws of the Republic of Latvia. A compulsory alienation of foreign investments in the interests of the State of Latvia is permissible only by the decision of the Supreme Council of the Republic of Latvia.

2. If a foreign investment is forcedly alienated in the interests of the State of Latvia, then its owner is compensated for the full extent of his losses in convertible currency within three months from the date such investment was alienated.

3. In case of disputes, the amount of such losses is determined by the court.

4. If future laws of the Republic of Latvia worsen investment conditions, the foreign investment is subject to the laws which were in effect on the date of such investment for a period of ten years.

5. The procedures stipulated by Paragraph 4 of this Article do not apply to the changes in the laws of the Republic of Latvia necessitated by national security, social order, taxation system (except for the tax relief stipulated by

156

3. Foreign investors may repatriate profit from the Republic of Latvia after the payment of taxes required by the Republic of Latvia laws.

Article 12. Repatriation of investment

The foreign investor may, after satisfying all obligations to creditors, freely repatriate his investment in an enterprise of the Republic of Latvia.

Article 13. Exemptions from customs duties

Property, which is brought into the Republic of Latvia as a part of a foreign investment and which is not intended for sale, is not subject to customs duties.

Article 14. Social security and insurance for employees

Social security (except for foreign employees employed by an enterprise with foreign investment) and social insurance are provided for employees employed by enterprises with foreign investment in accordance with the laws of the Republic of Latvia.

Article 15. Accounting and statistics

Enterprises with foreign investment must keep accounts and provide information necessary for state authorities to calculate taxes, to carry out statistical reviews and to audit the observance of this Law in accordance with the procedures stipulated by the laws of the Republic of Latvia.

Article 16. Dispute resolution

Disputes between enterprises with foreign investments and other enterprises and organizations, mutual disputes between enterprises with foreign investments, as well as disputes between the participants of the enterprises on the issues pertaining to the activities of the enterprise, are resolved through the court, or upon mutual agreement, by third-party arbitration.

Article 17. Liquidation procedures

Enterprises with foreign investments must be liquidated only in accordance with the regulations set forth by the Republic of Latvia law "On Entrepreneurial Activity".

Article 18. Payment of taxes in the event of the enterprise's liquidation

In the event of liquidation of the enterprise with foreign investment, the portion of the profit, on which taxes have not been paid, is subject to tax.

157

APPENDIX 1

to the Republic of Latvia law
"On Foreign Investment
in the Republic of Latvia"

INFORMATION ABOUT FOREIGN INVESTMENT

Information about the foreign investor:

1. Name.
2. Mailing address.
3. Telephone, telefax.

Information about the foreign investment:

4. Country from which the investment originates.
5. Purpose of investment (to gain control of an existing Republic of Latvia enterprise or to establish a new enterprise in the Republic of Latvia).
6. Date of proposed investment.

Information about the enterprise in the Republic of Latvia:

7. Name of enterprise.
8. Mailing address.
9. Brief description of the current and planned operations of the enterprise.

If the investor will be gaining control of the Republic of Latvia enterprise, then the following information must be included:

10. The number of employees of the enterprise.
11. The total value of the assets of the enterprise.

If a new enterprise is being established, then the following information must be included:

12. The projected number of employees at the end of the first full year of operation.
13. The projected amount of investment during the first year of operation.

Entrepreneurial activity

15. A detailed description of the foreign investor's business plan regarding the enterprise over which control will be assumed, taking into account the factors listed in Article 6 of this Law and the current operations of the enterprise, as well as the statement of ecological experts on the disposal of production wastes.

Information to be given in the case of the establishment of a new enterprise

Information about the investor:

16. The name of the foreign investor.
17. Mailing address, telephone and telefax number.
18. Country from which the foreign investment originates.
19. If the investor is subject to control by another entity, then the following information must be supplied:
    - name and address of the controlling entity,
    - the nature of control.
20. Annual reports (financial statements) of the investor for the previous three years of entrepreneurial activity.
21. Description of business activities of the investor and the controlling entity (if such exists), the statutes and copies of the incorporation certificates.

Information about the new enterprise:

22. Detailed description of the business plan of the foreign investor regarding the proposed enterprise, taking into account the factors listed in Article 6 of this Law.
23. The location (locations) in Latvia where the new enterprise will conduct business.
24. A summary of necessary funds for starting up operations stating separately:
    - capital invested,
    - borrowings,
    - other means of financing.
25. Financial projections (budget) for the new enterprise for each of the first three years of operations, detailing projected income, expenditures and profit or losses.
26. The projected balance sheet at the end of the first, second and third years of operations.
27. The projected number of employees at the end of the first, second and third years of operations, separately giving the number of specialists to be brought in from other countries, and justifying the bringing in of such foreign specialists.