PN-ACB-746
96095

RMA/LITH-IP-02

INDUSTRIAL ENERGY EFFICIENCY POLICY AND INSTITUTIONAL ANALYSIS IN LITHUANIA

FINAL REPORT

August 1992

Prepared for:

United States Agency for International Development
Washington, D.C.

USAID Contract #: EUR-0015-C-00-1006-00

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PREFACE

The work in this report is being carried out within the framework of the U.S. Emergency Energy Program for Eastern and Central Europe and the Baltic Republics under a RMA contract with the U.S. Agency for International Development. RMA, as Prime Contractor to USAID, is currently implementing the **Energy Pricing Reform Project** and the **Industrial Energy Efficiency Project** in Romania, Czechoslovakia and Lithuania. This report is one of a series describing the activities, results and recommendations of the projects.

The purpose of the Energy Price Reform Project is to provide to the Government of Lithuania an analytical basis for understanding energy flows in the Lithuanian economy, underlying costs in the provision and use of energy, major environmental consequences of alternative energy strategies, appropriate price levels and economic responses to energy prices, and other information to support the transition to a market-based pricing system.

The purpose of the Industrial Energy Efficiency Project is to rapidly bring expertise, advanced equipment and modern concepts of energy efficiency directly to a cross section of industrial facilities. The program is concentrated on low/no-cost problems which could be remedied with expertise and equipment at hand. Significant potential for improvement was demonstrated while RMA engineering teams were on-site.

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Executive Summary

Lithuania faces an immense challenge in restructuring its industrial base and economy as it adopts free market reforms. Energy efficiency is a wide ranging issue in this restructuring effort. In order for real progress to be made in this area, the private sector and government will need to establish a partnership, common goals and a working relationship to achieve improvements in efficiency and realize the associated economic gains. This report analyzes the key factors affecting government policy and recommends institutional actions to promote energy efficiency. Much of the report addresses not only the national (Lithuanian) issues, but presents regional issues and recommendations as well. Regional cooperation issues as they pertain to energy and industrial restructuring are compelling and should be considered in any national policy and institutional analysis.

1. Institutional Setting for Energy Markets. The institutional setting is undergoing rapid change both politically and organizationally. Energy prices are escalating from month to month. Privatization is being carried out, but without an apparent overall national priority plan. The relationship between a strong central authority for energy supply and fuels distribution and the industrial sector is changing. Current lines of authority and responsibility are not clear which has created a vacuum in the establishment of a national energy policy.

The overall result in the institutional structure is static. Government lacks the resources and know-how to assist the emerging private sector with energy efficiency, and seems hesitant to make major initiatives in the area. Without a clear national plan for energy market reform, the government tends to follow the lead of the few proactive (usually private) energy specialists. Instead of promoting and assisting with energy efficiency improvements, the government is reactive, changing regulations and relinquishing authority only when it becomes inevitable.

The lack of established financial services and economic structure has also affected energy markets. Energy price reform is being inhibited by the lack of a commercial banking system, a stable currency, and trade and investment policies.

2. Industrial Energy Management. Industrial energy management in the Baltics has followed a familiar pattern observed in East Europe and the Commonwealth of Independent States (CIS). Heavily subsidized energy prices of past years have created an environment of wasteful energy practices. All sectors of the economy suffer from inadequate infrastructure to meet even minimum standards of energy efficiency. No incentives have existed and as a result, management attention, technology and capital have been applied to other areas. The current economic situation requires greater energy efficiency, but without management direction, knowledge of low-cost/no-cost options, capital and technical resources there is little real progress. Too many managers of industrial enterprises still look to central ministries and government agencies for answers.

3. The Market in Energy Efficiency Services and Investments. The market is developing slowly. The market is constrained by the lack of a clearly defined institutional structure and a reluctant industrial sector. Essential financial services and economic reforms are necessary for private enterprise to develop. The USAID program and a similar Danish program have fostered the development of private energy consultants. Most other private firms entering the field have established affiliations with foreign suppliers and are promoting the sale of specific products and services. The energy services market has potential for those willing to invest the time and effort in training and identification of potential clients. Moreover, the development of this market is essential for promoting energy efficiency. Government is not likely to have the resources or propensity to become the proponent of energy efficiency that is needed. Private energy service firms offer the best potential to promote energy efficiency services, equipment, and management.

Policy Options for Improving Energy Efficiency Services and the Investment Market. The policy options for improving energy efficiency focus on establishing a market environment in which firms offering such services can be established and thrive. Some key elements are:

- Legal/Regulatory. The appropriate legal and regulatory framework for energy efficiency policy options needs to be established and a clear statement of this framework made available to the energy suppliers, consumers and service firms.

- Promotion and Training. The promotion of energy efficiency programs and training of participating organizations will be an essential element of any energy program.

- Energy Efficiency Equipment. A serious barrier to the adoption of any energy efficiency program is the lack of available advanced energy efficiency equipment. Means to acquire this equipment will affect all energy related programs.

- Institutional. The old system of centralized planning and allocation of energy services will ultimately change to a more 'free' or 'market based' system of energy supply, consumption, and services. Government and the emerging private sector will need to seek out the appropriate framework for this transition, and plan for the eventual privatization of the energy market.

- Establishment of a Private Banking System. Capital, particularly for acquiring necessary western technology, is scarce. The recently established Lithuanian Investment Bank should be supported in its role as a source of capital for private enterprises. This is an early step in the establishment of a banking network.

- Policies Related to Energy Management in Private Firms. A series of measures are identified in the next section. This set of policies are important in that the establishment of energy management in private industry and energy utilities will provide much of the demand for an energy efficiency services sector.

- Encouragement of Small Energy Service Firms. Many of the energy service firms will be small and capital short. To overcome barriers to their establishment, special incentives are appropriate and have been put in place as part of the Law on Small Enterprises. These special considerations should be widely publicized and enforced.

- A Stable Currency. An important consequence of currency stabilization will be to provide the opportunity for outside investors, joint ventures and equipment suppliers to have greater confidence that earnings from investments can be converted to other currencies.

Policy Options for Improving Energy Management in Firms. The recommended policy options for improving energy management in firms center around removing barriers and creating incentives, specifically:

- Plant Staff Training. Set aside staff time and supporting budgets for training of plant staff in energy auditing techniques and economic evaluation of energy efficient projects. Promote exchanges of technical personnel with U.S. and other Western firms.

- Management Restructuring. The government should divest itself of management control of enterprises, thus freeing the firms to make changes suitable to its business and facilities.

- Energy Management Equipment. 1) Remove import duties and tariffs for energy efficiency equipment; 2) energy pricing reform and rate restructuring; 3) establish minimum energy use standards; 4) pursue international donor/lender agencies for assistance with energy efficiency equipment and demonstration projects.

- Energy Information Dissemination Organizations. The government could promote the development of a professional energy management and engineering associations with start-up assistance and support.

Recommendations for Improving Industrial Energy Efficiency. The following actions are recommended at the national and regional level:

National:

- Implement energy price reform and tariff restructuring;
- Duty free importation of energy efficiency equipment;
- Establish investment tax credits/tax relief mechanisms;
- Establish a national privatization plan;
- Regulatory agency reform;
- Accelerate privatization;
- Establish professional associations; and
- Investigate BOT and BOO opportunities.

Regional:

- Regional energy management and planning;
- Attract suppliers and service organizations to the region;
- Establish regional professional management and engineering associations;
- Coordinate donor country assistance and loan administration;
- Establish regional industrial restructuring associations; and
- Coordinate regional trade and investment practices, including elimination of Baltic trade barriers.

It is also recommended that the government develop an energy efficiency program with respect to the assistance available from international donors and lenders, specific program elements could include the following priorities:

- Energy price reform and tariff design;
- Education and training;
- Demonstration projects;
- Least-cost planning/demand-side management;
- Professional associations; and
- Service firms start-up assistance.

We recognize that not all of these recommendations can, or should, be implemented immediately. However, it is imperative that the government begin to adopt a long range strategy of policy and institutional reform that will promote energy efficiency in all sectors of the economy.

I. Introduction

The purpose of this report is to provide, for the Government of Lithuania and USAID, a review of the policy and institutional factors influencing energy efficiency decision making in industry. The report provides both findings and recommendations for national policies which encourage energy efficiency. The report also provides recommendations for industrial firm level, management and investment decision making practices. Recommendations are also made concerning the role of international lending and donor agencies.

The institutional setting for energy markets is described in detail in Section II, while Section III provides an overview of the industrial structure and energy profile. Further background information is given in Sections IV and V on industrial energy management and the market for energy efficiency services and investments. This groundwork is the foundation for the analysis of policy options and recommendations presented in Sections VI, VII, and VIII.

Industrial energy management in Lithuania is undergoing rapid and controversial change. Energy management is influenced by many of the same forces affecting the general privatization effort and, on a larger scale, the political and socio-economic transformation of Lithuania at this time.

Energy management from a cost minimization perspective, as commonly defined in market based economies, has not existed in Lithuania to any significant degree. It is only through the recent rapid escalation of energy prices and supply shortages that management has recognized energy as a resource that has significant production cost and supply constraints, and is a manageable cost of production that has potential for significant cost reduction.

Previously, energy was portrayed as limitless in supply and so low in cost as to be not considered a component of production to be managed. In fact, the centralized planning process encouraged inefficient consumption without regard to cost or conservation. The primary barriers to adopting energy efficient technologies were the lack of any incentive (financial or supply) and the lack of available foreign technology. Now that the barriers and the need for improvement are recognized, Lithuania finds itself without any national policy, and severe limitations on available resources to encourage energy efficiency in the industrial sector or the economy as a whole.

Recognizing that the barriers will not be overcome without action on the part of both the emerging private sector and the government, this report analyzes the factors affecting energy efficiency. The needs of the private sector are evaluated along with the potential incentives that government policy and market-based pricing can provide. Experience in other developing countries with policies and institutional development programs is drawn upon to formulate recommendations for the government to consider in its general economic development program.

It is imperative that the government officials act in a timely fashion to enact policies which will encourage the development of an energy efficient industrial base in Lithuania. The privatization process has begun and market based economic forces are influencing the industrial structure and socio-economic changes. By establishing a supportive environment for energy efficiency, private enterprise will have financial incentives to adopt the necessary measures to become more competitive.

II. Institutional Setting for Energy Markets

A. The Public Sector

1. Government Structure

Government energy policy has been traditionally command and control oriented, with an exclusive focus on energy supply. Prior to Lithuania's independence, all of the energy supply or support units reported to energy ministries in Moscow. As a result, Lithuania did not have a consistent picture of energy flows and accounts within its borders.

Since independence, Lithuania has established a Ministry of Energy to which all of the energy supply or support units report, and which provides budgetary support when revenues at any of the units are not sufficient to meet costs. This has been a particular problem since energy price increases set by the government, while startling, have not been sufficient to cover all costs. The massive price increases on imported crude oil and natural gas from Russia and other CIS sources have been so large that the government has not been willing to pass all of the costs on to consumers. This has been particularly true for residential consumers of district heat and electricity.

The procedure for setting energy prices is largely based on cost of supply, plus an allowance for profit. Each of the energy enterprises reports its total costs (and other information) to the Ministry of Energy. The Ministry then takes this information and proposes energy prices and tariffs sufficient, on average, to cover all energy supply costs. Thus, prices were the consequence of institutional factors rather than the driving mechanisms to promote efficiency. In other words, management decisions were made on energy supply costs and energy prices resulted from the costs associated with these management decisions.

The approval of prices is at the cabinet level, and due to various political constraints, the prices set at the cabinet level have not been sufficient to cover all costs. The difference between price and cost has been made up in budgetary allocations to the Ministry (essentially subsidies for the energy sector) and in reduced profit levels for the various energy suppliers.

Even if all costs had been passed through, it must be pointed out that the current "cost based" energy pricing procedure is fundamentally flawed in a number of respects. These flaws include:

1. Existing accounting procedures do not adequately establish the value of capital.

2. There are cross subsidies in the tariff system from industrial users to residential users.

3. The pricing and tariff systems are based on average prices. There is a need to incorporate marginal costs into energy prices.

4. There is no independent regulatory body to oversee natural monopolies in the energy sector.

5. There is no allowance for funds used during construction nor explicit allowance and encouragement for energy utility efficiency investments that could be less costly than new energy supply.

6. Costs and subsequent energy prices and tariffs are based on ruble to dollar exchange rates. Pricing is severely distorted with an unstable currency. A danger of setting prices at world levels using the current ruble exchange rate is that there may be a price overshoot. In other words, energy prices could potentially be set significantly higher than underlying economic conditions justify, damaging economic recovery prospects in the near term and placing undue pain on all consumers.

A diagram of the institutional structure for the Ministry of Energy in Lithuania is shown in *Figure 1*. The diagram portrays both the main offices of the Ministry, as well as the major operating units. It is not known at the present time how many of the operating units may be spun off as independent private or public entities. For example, the energy construction firm might well be transformed into one or more private firms.

The various operating units, such as the Power Board, work with the Ministry of Energy in establishing energy prices. These prices are essentially recommendations that are then forwarded to "the government" for consideration, adoption, or modification. The government is essentially the President and key cabinet Ministers. In other words, in the current environment, energy prices are a highly political decision.

B. The Private Sector Environment

The institutional setting for the emerging private sector is largely a 'shell structure', i.e. many of the institutional requirements exist on paper and in development plans, but little is being aggressively pursued by the existing government. The growth of private industry in general and the energy services sector in particular, is being hampered by the lack of institutional flexibility and privatization incentives.

What does exist is the following:

1. Privatization laws which set most of the regulations and compliance requirements for establishing private organizations. These appear reasonable and not overly restrictive. However, the government bureaucracy is still painstakingly slow.

Figure 1. Structure of Energy Management in Lithuania (1991)

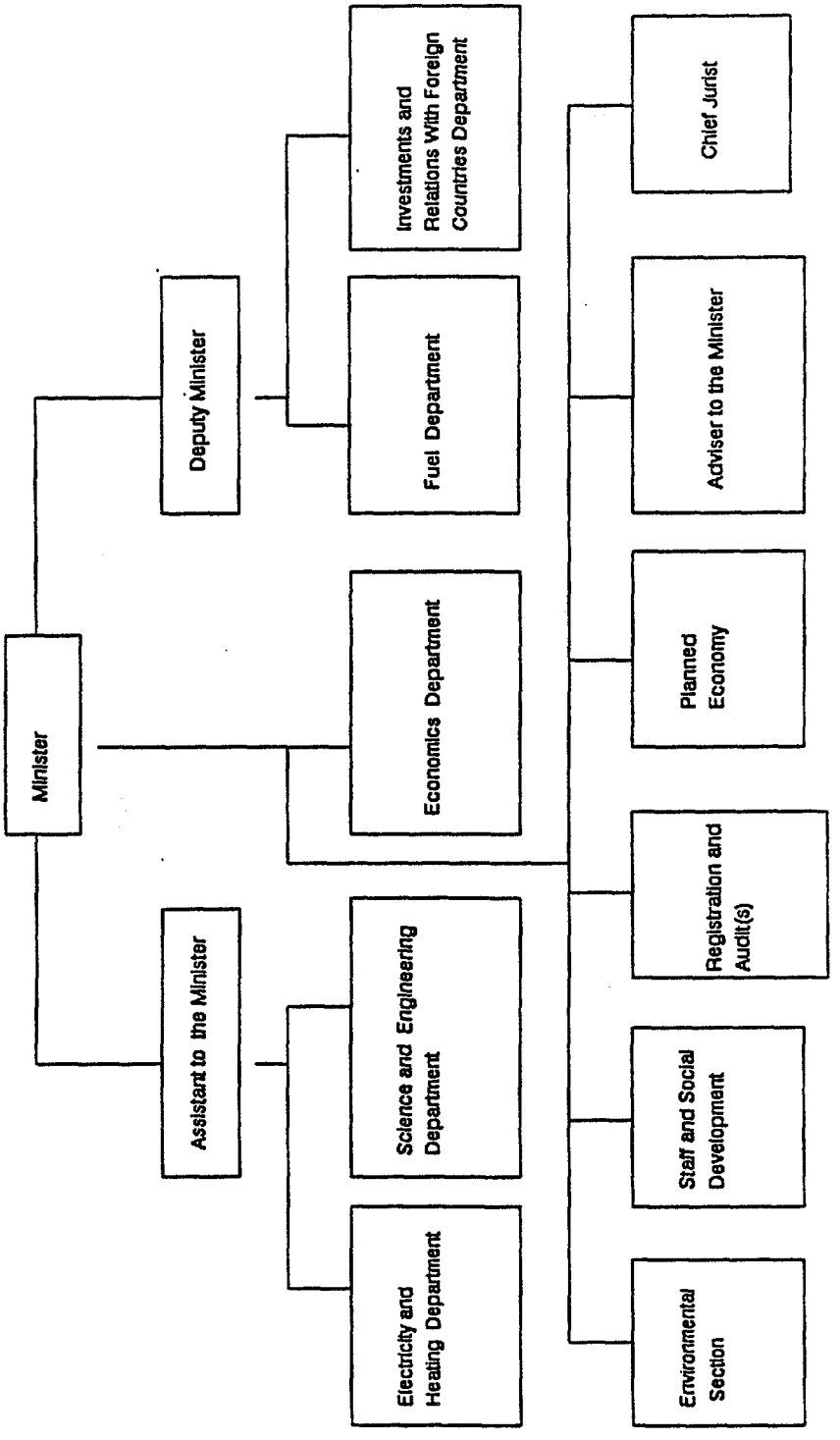

Figure 1. (Continued)

State Utilities and Organizations Which Depend on the Ministry of Energy

Specific State Utilities
The Ignalina Nuclear Power Station
Mazeikiai Refinery
Lithuanian Energy System
Networks of Electricity
Alytus Heat Networks
Siauliai Utility of Electrical Equipment
Gas of Lithuania
Gas Utilities
Liquid Gas
State Utility of Gas Equipment
Heat

Other State Utilities and Organizations
Fuel of Lithuania
Energy Construction Utility
Vilnius Heat and Power Generation Station
Kaunas Energy
Kaunas Ferro-Concrete Structures and Parts Production Plant
Gas Main Construction Utilities
Research Center of Specialists in Energetics
Research Center of Specialists in Gas
Design Institute of Networks of Electricity
Utility of Information of Specialists in Energetics
Joint Stock Company "Energetics"
Maintenance Utility of Maialia
Joint Stock Company of Energy Technology
Geoterma State Utility
VIKTA Engineering Center
Water Supply Utilities

2. Joint venture incentives including tax holidays and repatriation of foreign currency have been enacted.

3. Commercial banking is being established to provide currency exchange and domestic banking services to the private sector, but it is very limited at this time.

4. Some restructuring of government functions to allow for privatization of certain state enterprises. The pace is very slow and the methodology somewhat disorganized.

5. Energy prices are moving toward world market levels based on cost of service. This is a positive trend, however, full rate restructuring and the removal of sector specific subsidies still need to be accomplished.

6. The Ministry of Energy is establishing an Energy Conservation Department charged with improving energy efficiency in the state and private enterprises. This is also a positive move, but the Ministry lacks even the most basic resources to accomplish this task.

What is <u>needed</u> is the following:

1. A clear definition of the role of the public, private and non-profit sectors, in regards to energy efficiency.

2. A well coordinated plan of privatization that provides more incentives, streamlines the bureaucratic process, and targets specific enterprises based on the criteria of most likely to succeed. Given the collapse of the ruble, establishing the value of firms is extremely difficult. A stable currency will help the situation. As this occurs, the privatization process will accelerate.

3. Joint ventures should be more aggressively pursued. Most important, the government needs to identify the barriers to increasing joint venture participation and remove these barriers to encourage partnerships.

4. The commercial banking system needs to be quickly established and financial services offered to the emerging private sector.

5. Government restructuring should be accelerated. There is a strong distrust of current changes in government and a lack of any permanence to the restructuring. Overlapping authority and undefined authority deter participants in the private sector.

6. An independent regulatory body, independent of privately/publicly owned utilities needs to be established. Energy and other utilities, whether private or publicly owned, should by funded entirely by revenues.

Finally, the Ministry of Energy should establish an Energy Conservation Department. Basic resources are needed for this department including a budget for training and equipment. The Ministry should give the department visibility as a provider of information on energy flows, efficiency, and demand-side management programs and experience to utilities and end-users. A credible agency will be an asset to private enterprise wishing to improve energy efficiency, to private sector energy service firms, and other entities as well. Other government ministries need to cooperate with the department to remove existing governmental barriers to private sector development.

C. Macroeconomic Conditions and Issues

The specific nature of the emerging Lithuanian market economy is not yet known. Much more will be known in the coming months as institutional reform takes place in the areas of energy pricing and utility regulation. It is possible at this time, however, to discuss three topics which strongly influence the nature of industrial management in general and industrial energy management in particular. These topics are pricing reform, institutional reform, and industrial restructuring.

1. Pricing Reforms and Their Economic Implications

Within a free market system where not only energy, but all commodities, services, and labor are provided at market prices, industrial plants will rationally purchase all inputs, including energy, only to the degree necessary. Furthermore, industries will actively pursue energy efficiency measures to the point where the last dollar invested in conservation will result in the same return as the last dollar spent on other investments or other inputs, such as energy. The incentive for this behavior which minimizes all costs is that it will maximize profits for the plant owners. In cases where market imperfections exist, this implies the opportunity to earn excess profits. Under perfectly competitive conditions, this implies that the firm will be able to survive, pay workers and managers, and provide sufficient profits to plant owners (workers, managers, and outside investors etc.) to justify their investment in this particular plant. If plant managers do not minimize input costs and/or if other firms in other countries face a different set of input costs, the plant will not be able to compete in the long-run. **The greatest response to energy prices will occur where industrial plants face hard budget constraints.** In other words, industrial plants will have to respond to energy and other prices to survive.

Based on information about the economic transformation to date, it appears that newly privatized industrial plants will be forced to reduce costs and/or improve the quality of production to survive in many domestic and international markets. In other cases where Lithuanian plants have favorable conditions, the minimization of costs will allow for greater

profits. Within this context, **the ongoing movement of Lithuanian energy prices toward market prices will have a great impact on industrial plant management of energy and other inputs.** Managers at industrial plants that can survive the newly emergent competitive conditions, will have to become fully versed in economic evaluation methods, conservation technologies for reducing costs, and the means for acquiring and utilizing new technologies. The industrial restructuring associated with the transformation to a market economy and the associated price reform is discussed below, after considering institutionalization issues in the next section.

The importance of energy use to the Lithuanian economy can be somewhat estimated by considering the size of its annual energy bill and the portion of that energy bill that must be paid in hard currency for the purpose of energy imports. Lithuania's 1990 energy import bill, if it were purchased at world energy prices, would total about $1.5 billion. This compares with a total export in 1990 of about $3 billion. Some of these export markets, the vast majority of which are with trading partners in the CIS, will be diminishing. Thus, while the cost of imported energy (if valued at world prices) will be falling, so will the ability to pay for energy imports. Lithuania must also import many other items beside energy.

2. Institutional Changes and Forces

For prices to play a central, coordinating role in the future Lithuanian economy, first, important institutional changes will need to be undertaken. An independent regulatory body should be established to oversee the establishment of prices for energy forms that are provided by natural monopolies, namely, electricity, district heating and natural gas. This will be necessary to provide an orderly and well-established basis by which energy prices can respond to market conditions.

Under the current structure, energy prices in most areas are set by the central government since a true market does not exist for electricity and natural gas due to inherent natural monopoly conditions. Petroleum product prices are also set by the government because open competition in the market does not yet exist. The government in power is directly responsible for changes in prices.

Although the government has shown considerable courage in changing prices in the last year, it has not always made the necessary changes. Furthermore, the government is subject to considerable direct pressure when prices are changed, which could lead to government instability. Finally, there does not exist a well-established formal basis for setting regulated prices.

The establishment of a independent regulatory body to oversee the provision and pricing of electricity and natural gas offers the advantage of a formalized, defensible mechanism for setting prices and terms of service. It also offers a mechanism which can be open to public scrutiny, participation, and appeal. The potential advantage of an independent regulatory body is that unpopular but necessary price changes can be made without the "blame" focused

directly on the government in power. Whether this type of insulation can be accomplished in the short and medium-term can only be speculated on. The establishment of a regulatory body, however, is part of the long-term educational process required in the adjustment to a market economy.

The institutional structures discussed to this point have focused on those which would be directly supportive of the emergence of prices in a central, coordinating role in the Lithuanian economy. There are however, a number of institutions which indirectly are supportive of the emergence of effective market economies and which are directly supportive of efficient industrial energy management. A few of these types of institutions exist in Lithuania while others, common to market economies, do not appear to exist.

A review of these institutions reveals that there was very little in the way of organizations which shared energy management information across many industrial sectors. Most of the management of this information, and information in general, was vertically oriented within industrial branches reporting to Moscow as discussed previously. Among those that exist in Lithuania at the present time are:

Polytechnic Institutes. A set of institutes in the major cities train engineers and managers across a wide variety of disciplines. The polytechnics are linked with industrial sectors through various research projects as well as providing professional training.

University of Vilnius. There are a number of universities in the country with economics faculty. These faculty are transforming themselves towards market based economics and management.

Lithuanian Energy Institute. This institute at Kaunas is the former Soviet Academy Institute for energy problems, mostly focused on physical and engineering problems. With independence, the Institute is retrenching in the area of physical problems and is expanding its role in the economics area. The Institute has some of the best data sets in the country on energy economic issues. It is unclear at this point how much direct support the Institute will provide for firms and consumers as they adopt to market conditions in terms of management or technology support.

What is notably missing from the Lithuanian institutions, are professional, cross cutting organizations. An energy managers' association does not exist, nor do such professional associations exist in many other related areas. Unions, while they do exist, have provided mainly political organization in the past. Prior to independence, the opportunities available for professionals to interact were controlled by the various ministries. Only limited opportunities existed for professionals to interact with other professionals outside of Lithuania or the former USSR.

3. Industrial Restructuring

The Lithuanian economy has begun a transformation involving a major restructuring of industry away from energy intensive industries such as fertilizers, where Lithuania does not have any natural competitive advantage. The economy is moving towards industries such as tourism, food products, electrical equipment and wood products, where Lithuania has or could potentially have natural advantages internationally or where domestic needs are so great as to support an industry which can successfully compete with competition from outside.

The precise nature of the transformation can only be a matter of speculation and scenario analysis at this time. Some initial scenarios focusing significantly on anticipated changes in energy prices were developed in a workshop in May 1992 with over thirty Lithuanian experts and energy managers. The workshop utilized three models developed for evaluating the evolution of the Lithuanian economy, including the RMA Industrial Sector Energy Model and a Lithuanian Input-Output Model at the University of Kaunas. The RMA Industrial Sector Model simulates production activity in nine industrial and agricultural sectors plus an "other" sector which aggregates the remaining sectors. The eight sectors are: agriculture, food and beverage, chemicals, metal products and machinery, construction and non-ferrous mineral products, light industry, wood and paper, petroleum refining, and other.

The simulations are driven by assumptions regarding underlying output trends if prices remain stable. Trends during 1990 and 1991 were carefully considered. From this base, energy prices were considered in real terms. Energy price effects were represented by impacts on output (output price elasticities) and industrial energy intensity (intensity price elasticities). These price elasticities were influenced by U.S. experience, experience in the Hungarian economy, and judgement.

While this overall picture from the simulations and the workshop is promising, it will clearly involve major dislocations as some plants are closed and new ones, with different products, opened.

III. Profile of Industrial Structure and Energy

A. Energy Use by Sector

The primary energy use by sector in Lithuania is for industry, residential, and transport. Together these three sectors account for 85% of the total energy consumption in the country. A breakdown by sector is illustrated as follows (the tables in this section are taken from a report by the Lithuanian Energy Institute as reported in Energy and Environment in Estonia, Latvia, and Lithuania, edited by Jorgen Fenhamm, Riso National Laboratory, Roskilde, Denmark, January 1992).

Table 1. Primary Energy Consumption in Lithuania
(1,000 TOE)

Sector	1980	1985	1990	Percent
Industry	5,906	7,726	6,336	43.8
Construction	353	413	276	2.3
Transportation	2,201	2,491	2,385	15.5
Agriculture	1,045	1,341	1,335	8.2
Residential	3,755	3,856	4,718	27.0
Losses	326	360	767	3.2
Total	**13,586**	**16,187**	**15,817**	**100.0**

When compared to other European countries, Lithuania falls in the normal range of energy consumption per capita, though the amount of energy consumed per unit of production remains higher than that of developed western countries.

The energy use by sector varies by the type of energy consumed, with heavy industry, transport, and residential sectors consuming the highest proportion of direct-technological fuels. For power, total industry, residential and agriculture are the highest consumers. For heat energy, industry and residential demand make up almost 87% of the consumption. *Table 2* illustrates the energy source breakdown by subsector.

Table 2. Sector Energy Source Consumption 1990

Sector	Power		Heat		Direct	
	GWh	Percent	1,000 TOE	Percent	1,000 TOE	Percent
Industry	8,040	48.9	1,804	48.2	1,650	28.4
Construction	260	1.6	81	2.2	118	2.1
Transportation	250	1.5	45	1.2	2,314	39.8
Agriculture	2,700	16.4	209	5.6	490	8.4
Residential	3,640	22.2	1,448	38.6	1,240	21.3
Losses	1,550	9.4	157	4.2	N/A	N/A
Total	16,440	100.0	3,744	100.0	N/A	N/A

This general consumption pattern is typical for European countries with a similar mixture of industry, agriculture, and residential heating. The pattern supports the general current focus on energy efficiency in the industrial and residential sectors, with transport and agriculture as future areas to be addressed. It also points to the areas in need of governmental policy and institutional change to advocate and promote energy efficiency.

B. Energy Use by Industrial Subsector

Energy use by industrial subsector, as total primary consumption, is fairly diversified with chemicals, oil refining, and building materials as the main consumers. The breakdown by industry subsector is illustrated as follows.

Table 3. Primary Industry Energy Consumption in Lithuania
(1,000 TOE)

Sector	1980	1985	1990	Percent
Oil Refining	285	1,053	943	11.5
Chemicals	1,630	1,822	1,419	24.4
Machinery	661	686	683	10.2
Pulp & Paper	394	443	407	6.3
Building Materials	1,436	1,672	1,227	21.8
Light Industry	373	375	322	5.4
Food	633	667	506	9.1
Miscellaneous	496	927	828	11.3
Total	**5,908**	**7,645**	**6,335**	**100.0**

The type of energy consumption also varies with industrial sector, as illustrated in *Table 4.*

Table 4. Industry Sector Source Energy Consumption 1990

Sector	Power		Heat		Direct	
	GWh	Percent	1,000 TOE	Percent	1,000 TOE	Percent
Oil Refining	460	5.7	190	10.5	7.5	34.5
Chemicals	1,190	14.8	320	17.7	1.1	5.1
Machinery	1,250	15.6	252	14.0	1.0	4.6
Pulp & Paper	560	7.0	202	11.2	0.6	2.8
Building Materials	900	11.2	242	13.4	9.7	44.7
Light Industry	610	7.6	145	8.0	0.2	0.9
Food	480	6.0	288	16.0	0.8	3.7
Miscellaneous	2,580	32.1	165	9.2	0.8	3.7
Total	**8,030**	**100.0**	**1,804**	**100.0**	**21.7**	**100.0**

The breakdown indicates a wide diversity of energy consumption as type of energy by sector. Power is concentrated in chemicals, machinery, building materials and the largest power consumer being miscellaneous industry. This would indicate energy efficiency opportunities in the light manufacturing areas, including: power factor correction, lighting, and motor drivers, insulation, and use of thermal hot water for heating. Heat consumption is highest and fairly uniform among all industry sectors, with miscellaneous and light industry being the lowest. Indicators here are in waste heat recovery and process heat optimization. Direct fuel consumption is concentrated in oil refining and building materials (80%).

C. Description of Fuels

The mixture of primary fuel sources in Lithuania has changed considerably over the past thirty years. In 1960 the primary fuels were wood, peat, and coal. During the past thirty years, the demand for primary fuels has increased fourfold, but the demand for coal has remained constant. The additional energy needs have been provided by imported natural gas and oil. Industry and power generation have been fueled primarily by natural gas. Unlike many western countries, the consumer (residential) consumption of natural gas is very low. This is due to the pipeline infrastructure consisting of only main and large sub-headers. The residential gas distribution system is very small. *Table 5* illustrates the fuel mix breakdown since 1980.

Table 5. Fuel/Energy Consumption in Lithuania

Sector	1980		1985		1990	
	1,000 TOE	Percent	1,000 TOE	Percent	1,000 TOE	Percent
Coal	1,048	7.7	889	5.5	798	5.0
Natural Gas	2,794	20.6	13,960	24.5	5,124	32.4
Heavy Fuel Oil	5,480	40.3	5,484	33.9	3,567	22.6
Light Fuel Oil	327	2.4	379	2.3	460	2.9
Diesel Oil	1,437	10.6	1,365	8.4	1,250	7.9
Gasoline	1,194	8.8	1,143	7.0	1,128	7.1
Liquified Gas	133	1.0	156	1.0	161	1.0
Other Imported Fuels	468	3.4	1,344	8.3	1,526	9.7
Domestic Energy Res.	494	3.6	465	2.9	368	2.3
Includes Peat	*120*	*0.9*	*62*	*0.4*	*23*	*0.1*
Wood	*143*	*1.0*	*150*	*0.9*	*138*	*0.9*
Other	*231*	*1.7*	*252*	*1.6*	*207*	*1.3*
Hydro	117	0.9	95	0.6	92	0.6
Waste Heat	97	0.7	161	1.0	199	1.3
Nuclear	-	-	744	4.6	1,143	7.2
Total	**13,589**	**100.0**	**16,184**	**100.0**	**15,816**	**100.0**

The share of domestic fuel resources is very small, less than 5% of total primary fuel consumption. While there is potential for increasing hydro electricity, wood, and adopting renewable energy sources, the domestic fuel mix will remain small.

This makes Lithuania particularly vulnerable to interruptions in their imported fuels. This was illustrated all too well by the Soviet oil and gas embargo which paralyzed the country with fuel shortages. This situation is unchanged, and as Lithuania begins to modernize its industry the problem will be exacerbated. The heavy dependance on imported fuels for industry and power/heat production make it imperative that Lithuania adopt energy efficiency and conservation measures as soon as possible.

In addition, Lithuania needs to investigate alternate fuel supply sources and shipment routes. Several alternatives have been proposed, including upgrading and expansion of the oil terminal facilities at Klaipeda and a new gas pipeline either from Poland or from Finland via the other Baltic Republics.

D. Regional Issues

Lithuania is closely linked to its neighboring republics in energy imports and exports. Lithuania imports crude oil and natural gas and exports electrical power and some refined petroleum products. A regional approach to energy issues represents an important potential source of stability.

There exists a strong basis for regional cooperation in energy from the standpoint of existing energy infrastructure. Duplication of energy facilities in the Baltics will unnecessarily burden their economies. Using the example of crude oil import to Lithuania, it is probably necessary to find alternative sources of crude oil to the existing Russian supplies provided by pipeline. While the construction of a crude oil terminal at Klaipeda is an option, another option would be to work with Latvia in converting its existing oil product export terminal to be able to handle crude imports as well. The Latvian oil terminal is connected by pipeline to the Mazeikiai refinery, the only refinery in the Baltics.

Other modes of regional cooperation include the construction of a natural gas pipeline using the North Sea or Arctic sources of natural gas. Such pipelines could come from the south via Poland or from the north across Finland, through the Baltics and into Poland.

1. Fossil Fuels. Fossil fuels are very limited in the Baltics. Only Estonia has any appreciable reserves in the form of oil shale. However, Lithuania does operate the only petroleum oil refinery in the region and supplies refined products to the Baltics and for limited other export markets. As mentioned previously, it is imported fuel (including crude oil feedstock to the Mazeikiai refinery in Lithuania) that drives most power production in Lithuania and Latvia, and supplies most industry throughout the Baltics.

As a regional issue, the establishment of a stable fuel supply goes hand in hand with a stable power source. Two important issues for the future are the crude oil terminal and the alternate natural gas pipelines from Finland and/or Poland. The Baltic republics could look at financing these alternate fuel supply sources as a regional project, thus spreading out the financial burden among the three republics. Ensuring the existing fuel supply and power export relationship with Byelorus and Russia is also a top priority.

2. Power and Heat. Energy in the form of heat and power is produced in Lithuania in sufficient quantities to not only supply the population and industry, but electrical energy is also exported to the United North-West electric grid of the former USSR, primarily from the Ignalina Nuclear power station. Some electrical power is also fed to the Kaliningrad region. The North-West grid serves Byelorus, Latvia, Estonia and ultimately Russia. The regional issue here is very important as it affects the following:

- Fuel supplies are received largely through the same areas that Lithuania exports electrical power, thus creating a sort of "mutual dependance" among republics that do not always cooperate with each other. This balance works

as long as all other factors of the energy 'equation' remain constant. However, Lithuania will have to watch the situation closely to ensure its interests are protected. On the positive side, the interdependence creates opportunities to negotiate long-term fuel supply and energy export contracts with neighboring republics.

- Each of the Baltic republics has considerably different energy resources, with Lithuania operating the only nuclear power station in the region and Estonia having domestic oil shale reserves used in power production. Only Latvia is noticeably lacking in domestic energy production. It does have, however, natural gas storage capacity for meeting peak loads as well as an ocean oil terminal. This creates an opportunity for regional cooperation among the three Baltic Republics for establishment of a 'Baltic Grid'. The concept would ensure cooperation among the 'friendly' baltics for energy production and consumption, possibly including a quasi-free trade zone concept of low priced power for all the Baltics.

- Likewise, energy efficiency issues in the industrial sector could be shared among the Baltics, possibly even including incentives and rate adjustments for energy efficiency gains throughout the region.

IV. Industrial Energy Management

A. Historical Energy Efficiency

Lithuania has experienced much of the same historical energy efficiency deficiencies that are present throughout the former USSR and Eastern Europe. These deficiencies can be categorized as follows:

1. Subsidized Energy - The price of energy has not reflected the true cost of production or world market value. In most cases, the proportionate cost of production attributed to energy has been negligible, resulting in no incentive to conserve or become energy efficient.

2. Allocation Structure - The former economic system placed severe requirements on maintaining production quotas at any cost. Energy was allocated as a necessary component of production and not considered a significant cost. Therefore, enterprise intentionally inflated their energy requirements to ensure enough was available for production needs. Any excess was consumed to ensure the next allocation was justified.

3. Lack of Technology - As a direct result of items 1 and 2, energy efficient technologies and associated equipment were not developed or acquired. There was no incentive or access to energy efficient technology even if the enterprise wanted to pursue it.

These three factors combined to form a strong barrier to the adoption of energy efficiency. Even the perception and concept was not developed. There was even a strong organizational disincentive in the form of a strong Ministry of Fuels and Energy which encouraged energy consumption to justify their programs and investments. The Ministry functioned much as any other production enterprise with stringent production quotas of fuels and energy, which promoted consumption rather than efficiency. Government policy did nothing to encourage energy efficiency and contributed significantly to the present situation of wasteful practices.

B. Present Situation

The present situation has been significantly altered by the rapid escalation of energy prices and shortage of fuels. Overnight, the enterprises have experienced price increases of many times prior levels. Energy prices are being rapidly increased as shown in *Table 6*. As of April 1992, energy prices in Lithuania had increased from over ten fold to as much as 150 fold from 1990. The response among management at the enterprises and Ministry has been mixed, but can be categorized in two distinct groupings:

Table 6. Lithuania Energy Prices 1990 to Spring 1992
(Taxes not included)

Sector	Fuel	Unit	1990	1991	1992			Notes
					Jan	Feb	April	
			R/	R/	R/	R/	R/	
Transport	Gasoline	liter	0.4	4	4	10	13	1
	Diesel	liter	0.3	-	-	-	-	
Industrial	Gasoline	liter	0.2	0.5	4	10	13	1
	Diesel	liter	0.12	0.4	3	8	8	
	Light Fuel Oil	ton	-	-	-	-	-	
	Heavy Fuel Oil	ton	30	84	1,320	3,000	4,500	2
	Electricity	kWh	0.023	0.082	0.35	0.44	1	
	Natural Gas	km^3	22.5	51	1,000	1,000	3,400	
	Steam Coal	ton	12	12	72	88	192	
	Coking Coal	ton	-	-	-	-	-	
	Thermal	Gcal	14.85	58.8	284.5	407.5	487	3
Household	Electricity	kWh	0.04	0.06	0.35	0.35	0.5	
	Thermal	Gcal	3.95	12	48	48	48	3

Source: Lithuanian Government

Notes	Comments
1	92 octane
2	oil (burning price)
3	average of prices from Silum & Lithuanian energy system

1. Centralist Approach - Many enterprise managers and ministry level administrators simply look upon the increased energy prices as a component of production to be passed on to the consumers. They are aware of potential energy shortages, but feel that the energy markets will stabilize. They are unaware of Lithuania's position in a competitive world market, and feel that the established socio-economic ties with former Soviet republics will somehow preserve the old centralized economic structure. They support energy efficiency as a concept, but have no real understanding of efficiency as a cost reduction strategy in the context of a free market economy. The response is hesitant: industry waits for government to dictate the framework of efficiency,

while government is unfamiliar with the concept, therefore not integrating it within an emerging market economy.

2. Modern Approach - There is a small but determined emerging group of enterprise managers and Ministry staff who understand the concept of energy efficiency as it relates to a free market economy. However, most of these managers find it difficult to make any real progress. The barriers are well known: lack of technology, limited incentives (prices are still heavily subsidized as shown in *Table 7*), lack of knowledge of potential savings measures and their returns, whether low-cost/no-cost measure or more costly capital intensive measures. The most immediate gains and greatest economic returns are made with no-cost energy improvement measures, and with limited improvement of metering and consumption monitoring. These individuals are preparing efficiency improvement strategies as energy costs rise. They will be well placed to make significant progress as energy prices rise further and when the technologies and capital are made available. Unfortunately, they still function under the burden of ineffective government bureaucracies that deter their efforts. They also have much to learn in industrial energy efficiency.

The present situation is one of slow but determined change. Lack of incentives deter all but the most aggressive managers and public officials. Promoting change is a difficult and still dangerous activity in terms of employment security. However, as the survival of Lithuania's industrial sector becomes dependent on modernization, advancements in energy efficiency are inevitable. This is an opportune time to establish the governmental policy and regulatory framework which will permit the growth and development of energy efficiency in the industrial sector and energy markets in general. However, there are few substantial efforts in this direction. The Ministry of Energy intends to establish an internal agency concerned with energy conservation, but has no knowledge of how to proceed with this. RMA discussions indicate that the old thinking of centralized issuance of directives and regulations is very much present. The concept of "incentive" is not really accepted. It is likely the new agency will have problems for some time if a traditional approach is used; significant results may not be achieved. The data reporting functions of this agency are potentially useful if this can be used to show progress or lack thereof. See Sections VI, VII, and VIII for specific recommended government and private sector actions.

Table 7. Energy Price Comparison - Lithuanian Prices with OECD and U.S. Prices

Sector	Fuel	unit	Lithuanian Prices April 1992 Rubles/	1991 OECD Prices @120R/US$ Rubles/	1991 US Prices @120R/US$ Rubles/	1991 OECD Prices @90R/US$ Rubles/	1991 US Prices @90R/US$ Rubles/
Transport	Gasoline	liter	13	103.41	34.15	77.56	25.61
	Diesel	liter	-	70.09	35.61	52.27	26.71
Industrial	Gasoline	liter	13				
	Diesel	liter	8				
	Light Fuel Oil	ton	-	45,909	29,550	34,432	22,163
	Heavy Fuel Oil	ton	4,500	18,995	9,926	14,246	7,444
	Electricity	kWh	1	7.65	5.70	5.74	4.27
	Natural Gas	km^3	3,400	16,905	11,393	12,679	8,545
	Steam Coal	ton	192	10,759	4,939	8,069	3,704
	Coking Coal	ton	-	6,940	4,662	5,205	3,496
	Thermal	Gcal	847	203.81		152.86	
Household	Electricity	kWh	0.5	13.22	10.27	9.91	7.70
	Thermal	Gcal	48	298.92		224.19	

C. Energy Management at the Industrial Plant Level

Energy management among industrial plant managers ranges from limited to non-existent. This situation is a direct result of the current general management environment. There is a distinct difference between managers who see their role in a market driven economy, and those who are holding on to the past system of centralized control and direction. However, the barriers inhibiting increased energy management are essentially the same. Unlike Eastern European countries, managers in Lithuania perceive energy management as unattainable. They fail to acknowledge that many no-cost/low-cost measures are within their ability to control and implement. They see the problems of lack of technology, advanced equipment, and capital as insurmountable. **The managers also fail to recognize no-cost/low-cost options as being meaningful contributions. The problem is viewed as a matter of level of technology rather than the more fundamental economic issue of minimizing cost for the product produced.** As a result, they tend to take no action.

This is somewhat a hold over from the old system where plant managers did not have much decision-making authority, but relied on central ministries for direction. In this situation they also perceive that energy efficiency remedies are beyond their control, so they do nothing.

The most effective way to change this attitude and thinking is through demonstration: both technically and economically. The current program has transformed many of the plant managers into proactive advocates of energy efficiency. Most importantly, it has removed the stigma of the perceived barriers and demonstrated that real efficiency can be accomplished with **existing resources**. Additional actions include further education on the principles of profit driven plant management, education on low-cost/no-cost as well as higher cost options, awareness of future energy price increases and the resulting impact on production costs, and the very real possibility that only profitable enterprises will survive.

There is a great potential for increased energy management at the plant management level. However, the initiative for this will have to come from the managers themselves, since little incentive is forthcoming from the government or the emerging private sector. As stated previously, it is possible for the government to enact policies to encourage energy efficiency, and this needs to be accomplished as soon as possible.

D. Energy Conservation Decision Making Survey

In order to assess the current state of energy conservation decision making in Lithuanian industry, a survey was undertaken of the four enterprises participating in the program. The results of the survey are contained in Appendix J, and excerpts of the analysis summary are presented as follows:

Plant Characteristics - The surveyed plants range in size from 755 to 3,600 employees and are judged to be typical energy users for this range of facility. All were aware of their gross in-plant usage, especially after the increase in prices. Lack of sufficient metering capability to accurately monitor energy consumption of major energy users is still a problem. The in-plant equipment and physical characteristics are not likely to be altered without major capital investment by the company. This investment is still driven first by production considerations, second by reliability, third by cost, and usually last by energy efficiency. There is great potential to increase effective energy utilization by modernization of plant facilities and characteristics, but lack of capital and access to modern technology are great barriers to this occurring in the near future. Energy costs doubled this year, which reduces the payback period of energy conservation measures, but significant barriers remain.

Access to Information - The surveyed plants have very limited access to information regarding energy conservation, which in the past came mostly from the East. Now information from the West meets language barriers. All the plants get information regarding energy conservation from their own staff, most often related to problems that occur in process technology. Information about energy in technical magazines was oriented

to energy supply side. Information from government agencies still has a regulatory character. Dissemination of information through staff responsible for energy conservation is giving good results.

Barriers to investment in energy conservation - In the past, energy supply and demand were centrally planned and inspected. Hidden energy reserves and inflated energy demands prevented republics and energy utilities and customers from effectively planning energy, production and consumption. The energy supply was planned according to last years achievements and dispensed to energy supplying utilities to distribute to customers. Customers tried to consume all the demand they indicated in the contract, knowing that otherwise they would get the same supply next year. That hidden reserve has potential for energy conservation. Regional electricity utilities make most of their money by selling extra electricity, and have very little incentive to tell their customers how to conserve. There is little awareness or interest in low cost/no cost energy efficiency improvement.

All of the plants surveyed face uncertainty about availability of future energy supplies and stability of production, due to both market fluctuations and the increase in energy prices. Confidence could be restored if the energy tariff system were more flexible and adapted to energy conservation.

None of the plants surveyed knew of modern economic analysis methods when evaluating energy conservation projects, only cost and simple payback. Plants lack trained staff to evaluate projects and create economic criteria systems to fit plant needs for funding from suppliers or banks.

Staff responsible for energy were not interested in economic incentives to implement energy efficiency measures. Money saved went to pay premiums to all of the employees and penalties if measures were not implemented. Privatization was indicated to inspire energy efficiency use.

Actions to save energy - All plants indicated that they have made investments to reduce their energy costs. Until 1989, implementation of energy saving measures was driven by the Energy Inspectorate, which now is one section of the Energy Supply System and paid by utilities. Some positive competition was organized between similar plants to reduce energy use. The indicated approximate cost of these investments differ according to energy rate in production and varies between plants from 3 to 20 percent of annual expenses. Lack of metering devices and governmental support deters plants from applying experimental tariff systems for electricity based on peak and non-peak consumption.

Assistance from Government Agencies - All of the plants surveyed had virtually no experience with effective assistance from government agencies. Past government actions tended to be regulatory in nature and not supportive of innovation or increased efficiency. All of the plant staff acknowledged that increased government assistance would be welcome and beneficial if the long-term pricing politics for energy consumers could be known. But

there is still a measure of distrust and suspicion regarding government intervention. The plant staff acknowledged that emerging private sector firms could provide a wide range of services in assisting plants or firms associated in similar production. Technical assistance from energy service firms could be in the form of energy audits with economic evaluation of short-term and long-term projects; technical consulting and information performance of new systems in other countries; and procurement of equipment and installation of energy efficiency equipment. Governmental agencies could assist the plants in training, equipment for monitoring, and providing tax incentives and duty free exemptions on energy efficient equipment. Plants should be supported with grants for part of the cost of energy conserving equipment which could be allocated from energy utilities. Utilities should be allowed to recover the cost of investments that cut their customers' fuel or electricity bills or allow the cost of such investments to be included in a utility's rate base.

Governmental agencies should insist electricity and fuel utilities decouple profits from sales volume, and link energy efficiency to profits. That could be achieved through experiments to allow bids for energy saving alongside bids for generating new power in firms' boiler plants. This could create competition between consulting companies working in the field. It could also ensure that efficiency investment is at least as profitable as erection of new plants.

V. The Market in Energy Efficiency Services and Investments

A. Energy Efficiency Services

The energy efficiency market is still in its infancy at this time. There are a small number of private engineering consulting firms starting up, primarily with foreign technical and financial assistance. Examples include:

1. NEGA W - The private contractor subcontracted under this USAID program. The company is headed by a former ministry official. After participating in the Screening and Energy Audit phases, NEGA W has acquired several other energy audit contracts from both state and private enterprise in Lithuania. They have won these contracts primarily on the basis of having access to advanced audit equipment, and the experience/training with foreign consultants. NEGA W is now pursuing establishing energy efficiency equipment supplier and maintenance contracts with western firms.

2. Others - A similar program sponsored by Denmark has fostered the growth of a small engineering/consulting firm primarily in the area of residential and commercial energy efficiency. A few other private Lithuanian consulting firms have negotiated agreements with suppliers of equipment. A current government energy manager has started a firm which intends to establish a joint manufacturing venture in controls. To date, however, this firm has not been successful in finding western partners.

The small but rapid success of these emerging companies indicates that the market for energy efficiency services definitely exists, both in all levels of industry and in the residential/commercial sector. As the general energy situation heightens awareness of costs, the market will become more receptive to private engineering consultants and eventually to equipment manufacturers. Their ability to capitalize on this market will depend greatly on their ability to offer basic well-developed services and western technology for energy auditing and some solutions. Other badly needed items such as insulation, improved window design, heat exchangers, more efficient electric motors, and some basic control systems are or can be available from domestic sources. Since most enterprise will remain short of hard currency to procure western technology, the services will likely focus on low-cost/no-cost solutions and domestic equipment.

However, without some level of foreign support this emerging services sector will be severely restricted in its ability to grow. This support should not take the form of direct aid in grants, but should be cooperative efforts with foreign firms in the area of technology transfer, training, and advanced auditing equipment. Some examples:

1. Subcontract Arrangements - The current USAID subcontract with NEGA W is an ideal match of foreign support coupled with a commitment from the host

country firm. They are providing necessary services under the USAID contract while obtaining training and expertise that would otherwise be impossible to acquire.

2. Supplier/Manufacturer Representation - Similar to the subcontracting arrangement, this would allow the host country firm access to foreign technology and training while marketing their products.

Finally, there is the question of government policy. There is probably little more the current government can do to support and encourage the development of these emerging energy efficiency firms. The government has already provided some incentives for all small enterprises (firms employing less than 100 persons) as provided in the Law on Small Enterprises (see Appendix K). For larger firms, the government can move ahead aggressively with privatization, which should accelerate the demand for the services of energy firms, and eliminate tariffs on efficiency equipment.

B. Equipment Manufacturers and Vendors

The opportunity here is considerable despite the relatively smaller market compared to other Central and Eastern European countries, principally because the Lithuania industrial sector needs almost every kind of energy efficiency product available from the West. The primary products, some of which could be manufactured in Lithuania in the near future, are the following:

1. Combustion monitoring and control.
2. General automation and control systems.
3. General energy monitoring systems.
4. Residential/Commercial heating control and monitoring.
5. All types of insulation - piping, manufacturing, buildings.
6. Waste heat recovery systems.

The market exists and many firms are now ready to allocate funds for the procurement of these technological products. As an example, our subcontractor NEGA W has received many inquiries for the procurement of portable energy audit equipment for larger enterprises.

The barriers to increasing the supply of foreign products are well known:

1. Lack of Capital - Most firms are short of hard currency and unwilling to part with it. Their hard currency reserves are the only solid currency foundation they have.

2. Lack of Knowledge - The benefits of energy efficiency equipment are still not widely known or believed.

3. Government Policy - While there are no special restrictions on the importation of energy efficiency equipment, neither are there any incentives.

The government should eliminate all tariff fees on imported energy efficiency and environmental protection equipment. Information dissemination program through existing Ministries could be enhanced, and support given for the development of private engineering/consulting firms. All of these actions would contribute to opening a market which already exists. Some opportunity would also exist for joint venture arrangements for the manufacture of these products in Lithuania.

C. Financial Services

A critical need exists in Lithuania for commercial financial services to support the emerging private sector development in energy efficiency products and services. While it is difficult to define how this service sector would be structured specifically for energy efficiency investments, the need definitely exists. Probably the single most favorable development would be the general expansion of financial services available for private financing.

The government has made a move in this direction by the establishment of the Lithuania Investment Bank. The bank was founded in November 1991, has a staff of 11 and an authorized capital of 100 million rubles (about $1.1 million dollar at 90 ruble/dollar). The Nordic Council of Ministers on March 4, 1992 approved $90 million in investment capital and technical assistance targeted at small and medium sized private sector firms. The fund will be channeled through the three Baltic national investment banks.

Financial support may also be required for energy utilities to implement demand side management programs.

VI. Policy Options for Improving Energy Efficiency and the Investment Market

A. Macroeconomic and Financial Issues

Any discussion of policy options for offering privately based energy efficiency services is predicated on the underlying institutional conditions necessary to support private entities offering those services.

A key institutional need is for currency convertibility. With a stable exchange rate, foreign investors in Lithuania will have increasing assurance of being able to take their earnings out if desired. More immediately, vendors of energy efficiency technology in critically short supply have the opportunity to sell their equipment.

Financial sources for loans in dollars or other tradable currencies have not been widely available. What changes currency convertibility and the entry of outside banks bring will have to be observed in the coming months.

Other institutional issues which are considerations in evaluating policy options include removal of import tariffs, tax incentives for conservation investments, and the existence of energy efficiency codes and standards.

Existing import tariffs for energy efficiency equipment are low. There is, however, no justification for any tariff on this type of equipment. (The need to protect infant industries or to preserve foreign currency for crucial imports may justify tariffs for some consumer items, but these arguments do not pertain to energy efficiency or environmental protection equipment at the present time.)

Another potential avenue to encourage industrial conservation is to allow and encourage Lithuanian electrical distribution companies to participate, through private energy service firms, in promoting energy efficiency. Options include direct investment in efficiency in industrial users (where it is less costly to invest in conservation than to provide additional power), installation of efficiency equipment, provision of interruptable power contracts, and avoided cost rates for the purchase of power from customers with cogeneration. The primary policy change required for these options is to allow the distribution companies to make a return on efficiency investment equal to or greater than return on sales of power. Because of the lack of an independent utility regulatory body at this time, this decision is currently based at the highest levels of government. Ultimately the electric utilities will need to join with the private sector in implementing a national demand side management program.

The primary disadvantages of the distribution companies' potential role as efficiency providers is that in the case of direct investments and the installation of equipment, there is the real possibility of competition with emerging private firms in areas such as energy auditing, vending, and shared savings. These disadvantages could be significantly avoided

by the distribution companies using these private firms to provide these services on a competitive basis.

The final option in this area is to create an environment for the establishment of private Energy Service Organizations. These are firms which provide capital investment in plants in return for the opportunity for profit based on energy sales savings achieved.

B. The Role for Donor/Lender Agencies

Lithuania will soon be in a position to negotiate various loan packages from International Financial Institutions for industrial restructuring projects. They are already receiving some foreign aid, primarily in technical assistance and a few demonstration projects. These donor/lender agencies can fill a much needed void in Lithuania's restructuring of its economy to a market based system. The two areas of greatest need are obvious: technical assistance and capital. The role of these agencies can be constructed to be mutually supportive by the following:

1. Utilizing donor country grant funds for technical assistance in support of capital intensive industrial restructuring projects, and for demonstration projects. Donor country grant funds can also be used to stimulate private sector development of service industries.

2. Utilizing international loans for major industrial restructuring projects that meet established criteria for institutionalization and continuity in the overall restructuring plan.

In order for these mechanisms to be implemented, the institutional recommendations of the report will need to be adopted and the necessary financial controls put in place. It is further recommended that a working group be established for the Baltics on a regional basis to coordinate assistance among donor countries and International Financial Institutions.

1. Energy Advisor Services in the Privatization Process can benefit from donor/lender agencies participation in the following ways:

   - Start-up assistance through training, supply of necessary tools (computers, analysis equipment, etc.), and initial funding.

   - Incorporation of these service firms in the technical assistance portion of industrial restructuring loans.

   - Offshore training programs as a part of donor country technical assistance programs.

2. Assistance with capital availability and financial services can be promoted by donor/lender agencies in the form of:

- Establishing capital funds for industrial restructuring, either as direct loans, loan guarantees, or joint venture arrangements.
- Evaluation and promotion of Build-Operate-Transfer (BOT) and Build-Operate-Own (BOO) projects that meet established criteria for viability. BOT and BOO offer alternative financing mechanisms for large capital projects.
- Assistance with establishment of a commercial banking system.
- Assistance with establishment of accounting rules and standards.
- Training, start-up banking assistance, professional exchanges, and other institutional building activities.

VII. Policy Options for Improving Energy Management in Firms

A. Plant Staff Training

Plant staff training in energy efficiency awareness and technology represents one of the highest priorities for the development of Lithuania industry. There are several policy options that the government could adopt to promote this activity:

1. Set aside a portion of agency operating budgets for the training of plant staff in selected industries. A priority allocation system could be established based on industry earning potential, energy saving potential, export earning potential, etc. The budget could be used to fund foreign consultants for in-country training programs, attendance of Lithuanian nationals at foreign training courses, or a combination of both. Recognizing the limited availability of funds for this purpose, the respective agencies should attempt to negotiate agreements with foreign donor agencies for matching grant funds. Training should also be provided in management and organizational concepts relating to establishing plant energy efficiency programs.

2. Provide tax incentives for Lithuanian enterprise that invest in plant staff training, or similar financial incentives.

3. Promote exchanges of technical personnel with foreign companies interested in establishing business in Lithuania. One mechanism common in developing countries is to swap technical staff between the foreign and host country enterprise. The foreign national working in Lithuania gains insight into the industry in Lithuania and provides valuable training to in-country plant staff, while the Lithuanian national working in a foreign country gains first hand training necessary to represent the foreign firm in Lithuania. Many joint-venture and Build-Operate-Transfer/Build-Operate-Own arrangements incorporate this concept.

B. Management Restructuring

Broad management restructuring is necessary throughout the industrial sector of Lithuania. Government policy will probably not be able to significantly affect the details of this restructuring at the enterprise level. The exact restructuring is better left to individual plant managers, board of directors, etc. However, government can lend support to this restructuring effort by divesting authority from central government agencies and ministries. By decentralizing the management of enterprise and industry sectors, and allowing free market forces to guide prices, the management restructuring will naturally sort out those enterprises that will survive. In the process of selling assets to private investors, it is recognized that some safeguards are necessary to ensure a minimum price. Therefore,

government should take decisive action to remove controls and restrictions on enterprises and allow management restructuring to proceed, subject to only limited safeguards.

C. Provision for Energy Management Equipment

The promotion of energy management equipment in industry is a top priority for Lithuanian industry. Only investments in this equipment by private enterprises will allow widespread energy efficiency to be realized. Government policy can aid in this effort by establishing incentives and removing barriers to the procurement of energy management equipment.

Examples are the following:

1. Remove import duty and tariffs for qualifying equipment.

2. Foster Lithuanian-Western firm linkages through information exchanges and trade shows.

3. Provide energy consumption rate restructuring, credits, and rebates for qualifying equipment.

4. Pursue energy management equipment through official donor country and international financial institution programs.

D. Professional and Other Energy Information Dissemination Organizations

Government policy can promote a much needed role for information dissemination concerning energy management. The following options are suggested:

1. Promote the creation of energy management associations (independent non-governmental organizations) through start-up funding and tax-exempt status. Energy management and engineering associations are ideal organizations for the dissemination of information, through seminars, conferences, and published literature. Government agencies such as the Ministry of Energy can act as a catalyst for the formation of private energy associations.

2. Allocate direct funding to the Ministry of Energy and utilities for information dissemination activities concerning energy management.

3. Include such information dissemination activities in requests for donor country funding and donor country energy programs.

VIII. Recommendations for Improving Industrial Energy Efficiency

A. National and Regional

The recommendations for national and regional improvements of energy efficiency in the industrial sector are closely linked. Promotion of each will benefit the other. Consequently, the recommendations for national could be expanded into regional recommendations as well.

National issues are the following:

1. Energy Price Reform and Tariff Restructuring - The most critical policy issue affecting energy efficiency is price reform and tariff restructuring. As long as energy prices are subsidized, energy efficiency will not receive proper attention. There is a belief among factory managers that energy prices can be passed on to consumers, no matter what the level of increase. As newly privatized companies compete on world markets, they will need to reduce production costs in order to be competitive. These costs can be reduced through energy efficiency measures only if the price of energy reflects world market prices.

2. Importation of Energy Efficiency Equipment - Government can promote the importation of energy efficiency equipment by first enacting price reform. Second, removing import tariffs and duties will allow for easier importation. Third, policy must be enacted that encourages industry to invest in efficient equipment, particularly for those industries which have foreign currency earnings.

3. Establish a Demand Side Management Program - Electric utilities need to immediately begin establishing the basic elements of demand side management.

4. Regulatory Agency Reform - The regulatory agencies, primarily the Ministry of Energy and its sub-agencies, need to reform their activities to become proactive promoters of energy efficiency. Concurrent with energy price reform should be a program of installing electric meters and heat meters throughout industry and the residential sector. Direct energy meters also need upgrading and standardization. Effective metering is the first step in establishing price reform and rate restructuring. The agencies activities should also be directed away from policing outdated regulations, to that of offering incentives to industry to adopt energy efficiency technologies.

5. Privatization - The pace of general privatization should be accelerated. Too many industries rely on central planners for direction. Accountability needs to be firmly in the place of factory managers who make investment decisions at the factory level.

6. Professional Associations - Government needs to strongly advocate and assist with

the establishment of independent non-governmental professional energy and industry associations. By leveraging the private sector interest and commitment, they can replicate progress in energy efficiency measures throughout the industrial sector.

7. Establish a National Privatization Plan Linked to Economic Priorities - The current privatization plan does not establish national priorities based on market priorities. Government should immediately establish a priority plan and investigate incentives to accomplish clearly defined goals for privatization.

Regional issues are the following:

1. Energy Planning - A regional coordinating group should be established to coordinate regional energy issues, and develop regional energy plans. This exists somewhat in the Baltic System Power Resources Association, but a more encompassing and proactive organization should be established. This organization should address the broader issues of regional economic cooperation as they affect energy resources/production development and utilization. The Baltic Republics have a unique opportunity to begin planning their energy infrastructure as a region for mutual benefit, and now is the time to initiate such action.

2. Equipment Suppliers and Services - One problem that is apparent when trying to attract manufacturers and suppliers of energy efficiency equipment and services is the small market size of any one republic. By acting as a region, particularly as a region that could be the gateway to the former USSR, the Baltics will be able to attract more foreign business to set up distributors and service organizations. The market is much more attractive when viewed as a region. Similarly, any joint venture for the manufacture of energy efficiency equipment would be more attractive as a region.

3. Non-Governmental Professional Associations - As mentioned above, professional associations in the energy field are critically needed in the changing industrial sector in all three republics. By acting as a regional association, the level of information and experience is considerably expanded.

4. Non-Governmental Regional Industrial Associations - Similar to the regional professional associations, these organizations would cover similar industrial sectors throughout the Baltics. Information and experience would be shared between industries and information dissemination of energy efficiency measures promoted and linkages established with Western associations.

5. Regional Trade and Investment Practices - Although a complicated issue, trade and investment on a regional basis should be explored. Potential benefits to energy efficiency would be the free movement of equipment across borders, and possible energy rate adjustments specific for Baltic republics.

B. Firms

There are many things that firms should be doing to help themselves via improved energy efficiency, in conjunction with development of government policies:

1. Form a non-governmental independent Energy Management Association - The newly privatized sector will need an active voice to represent their interests in government. These interests can be communicated through a national, and potentially regional, energy managers association, as described in previous sections.

2. Establish Strict Management & Accounting Practices - A major problem with most Lithuanian firms is the lack of knowledge of production costs and how to manage the cost of production. This applies to energy and most other materials and methods of production. Only through strict monitoring and control of costs will enterprise managers be able to effectively manage. The improvement in management techniques is unlimited at this point. Modern methods of information systems, work force motivation, market based economic forces, and free market investment techniques need to be acquired and training provided. Firms also need to begin to manage production, maintenance, and capital improvement budgets as separate entities. Currently these are grouped together and most plant managers do understand the difference.

3. Restructure Enterprise Management - Energy is a significant component of production and one that has largely been taken for granted in the past. Now that prices are moving toward world market levels, energy will make up a much larger cost of production and needs to be managed as such. Firms should immediately establish dedicated energy managers within their organizations. These managers should be charged with developing annual energy management and conservation plans, establishing monitoring programs, and generating capital improvement programs for increasing energy efficiency.

4. Establish Foreign Associations/Partnerships - This is particularly applicable to those firms that generate exports or depend on imported raw materials. The current thrust in the private sector appears to be solely joint ventures. Yet, it is possible to establish other forms of associations and partnerships. Creative investment schemes, acquisition of foreign equipment, barter arrangements, and innovative foreign investment opportunities are possible with aggressive and informed management. Firms need to take an objective look at their place in an international market and capitalize on their assets and potential production output. The same is true for imported materials of production.

5. Participate With Energy Suppliers on Rate Restructuring - Firms should work with energy suppliers on rate restructuring opportunities that could benefit both supplier and consumer. Our discussions indicate that the energy suppliers are not cognizant

of energy efficiency opportunities at the enterprise level, or the potential rate restructuring incentives.

C. International Lenders and Donors

An important early role of these organizations is to encourage and provide practical guidance in laying the groundwork for a fully functional market economy. As described above, essential parts of the groundwork are a convertible currency and the establishment of an independent regulatory body in energy and other natural monopoly areas.

For international lenders, a recommended action is the establishment of a conservation loan fund for private firms to provide hard currency loans through conventional banking sources within the country. International lenders should also expand their role in making loans directly to the private sector. Public infrastructure such as power, water, sewer and roads are examples. While there are needs in these areas, the situation is fundamentally different from developing countries. Lithuania has a substantial public infrastructure in place. Thus, its most critical financing needs at this point are private sector financing. Direct relationships between lenders and the private sector are more appropriate to a market economy.

Selected loans are appropriate for electric distribution companies as nationally owned, but autonomously operated electric utilities. Loans for distribution companies should include funds for investments in industrial energy efficiency as part of demand-side management (an element of least-cost planning). U.S. utilities, which are largely privately owned, are increasingly making energy efficiency investments which are less costly than investments in new capacity.

It is recommended that international donors focus on a variety of targeted programs. Short-term education opportunities in the form of short courses, extension type courses, and conferences are useful in rapidly infusing these markets with some of the essentials of market economy behavior and modern management. Support for long-term training is also extremely useful, but the return on this investment is longer. Semester length visiting professorships in various market management areas, including energy are a recommended means for supporting curriculum reform at the university level. Relatively low cost computers and software for energy management training (both short and long-term) are an extremely attractive area for donor support.

Because of the concentration of energy use in a relatively small number of industrial plants and the desperate need to reduce energy imports, targeted programs to measure these losses and provide limited amounts of equipment for plant guidance in energy management are valuable and timely. Not only are there immediate macroeconomic benefits, and benefits to individual firms, but there are also opportunities to introduce some elements of modern management which can be carried on in the firm and serve as demonstrations to other firms. These programs could very usefully be expanded.

Donors can also provide support in energy pricing, least-cost planning, regulation, efficiency standards, and targeted engineering design support and equipment acquisition. To the degree that international lenders are unable or unwilling to provide loans for industrial conservation or demand-side management, there are expanded opportunities for the donor community.

A particularly attractive design support and demonstration program is in the area of district heating. The losses in the system for both industrial and residential user are enormous. A demonstration project that would provide U.S. or other modern metering, control systems, and tariff reform would provide cost effective energy savings as well as demonstrate U.S. equipment. This could well open the door to subsequent joint ventures with U.S. firms to replicate such a project hundreds of times in Lithuania, the other Baltic Republics, and in the CIS.

Finally, donors can usefully support the development of non-governmental professional management and engineering associations. These institutions could play important roles in supporting the exchange of information in a market economy.

APPENDIX A
The Lithuanian Reform Package

THE REFORM PACKAGE

The pillars of economic indepedence remain to be constructed. Lithuania's industries and infrastructure are a legacy of the Soviet central planning system which bore little resemblance to economic reality. The country has neither its own currency nor, therefore, an autonomous financial and banking system.

Lithuania is quickly introducing price reform, a new banking and finance system, a privatisation programme, a revised legislative structure and social reform.

PRICE REFORM

Since spring of this year most prices have not been regulated by the Lithuanian government. The near-term goal is to free all prices in Lithuania by November 1991, except those for certain basic food items, oil, wood, telecommunications and postal services and apartment rents.

To cushion the impact, the government provides the population of Lithuania with compensation of up to 70% of the price rises. The compensation comes in the form of increases in wages for all workers, while pensioners are compensated from the social security budget. The compensation package is a major burden on the Lithuanian budget, accounting for nearly 50% of its spending articles in 1991.

BANKING AND CURRENCY REFORM.

Lithuania cannot have an independent banking and monetary policy without a national currency. Re-introduction of the long-defunct "litas" (1 litas = 100 centas) will be a popular emotional experience as well as a practical pre-emption of Soviet economic influence. Timing of the litas release is

uncertain. It is widely expected to occur during 1992 but will depend largely on ongoing trade and exchange negotiations with the Soviet Union and options on the appropriate backing for the currency which still remain to be evaluated.

Meanwhile, Lithuanian banking is going through a transitional phase. The ultimate aim is to create a two tier system incorporating a central bank and several commercial and specialised banks. However, the Bank of Lithuania, which reports to the Parliament, is currently undertaking a number of other functions since it cannot fulfil its designated central banking function. Some are of a commercial banking nature - an interim arrangement while newly-born private commercial banks, already numbering ten, attempt to establish a foothold. Other functions are influenced by uncertainties about the eventual distribution of assets and liabilities between the Soviet Union and Lithuania, particularly where these involve easily transportable or transferable items.

THE PRIVATISATION PROGRAMME

Privatisation is central to the government's plans to transform the economy. The transfer of state-owned assets to private ownership is expected to improve economic and industrial efficiency, and where privatisation involves purchase and investment by foreign parties, there will be benefits of transfer of technology in addition to capital investment.

Privatisation legislation is already in place. Laws adopted by the Supreme Council cover the privatisation of industry, agricultural entities and housing, land reform and restitution of property.

Privatisation of industry is proceeding rapidly. The government has adopted the resolution that all union-owned property in Lithuania is owned by Lithuania, although the ownership of other entities is currently under discussion with the Soviet Union.

In September 1991, over 100 small enterprises were sold through public auction to domestic investors, while a further 100 small and medium size enterprises were offered through subscription of shares. In the last quarter of 1991 it is planned to offer in total a further 20% of state-owned enterprises valued at over roubles 5 billion through auction and share subscription.

The privatisations have so far been available to domestic investors only, based on voucher system to ensure rapid large-scale privatisation. Of the 2.7 million people entitled to vouchers, 2 million have already received their entitlement, the rest will be distributed by December. The vouchers entitle the holder to bid for ownership of an enterprise or shares in an enterprise, although a minimum of 5% of the price must be paid in cash.

All auctions and sales are public. Information on forthcoming privatisation opportunities is provided in the government's privatisation bulletins which

are circulated throughout the country and also published in newspapers to ensure equal access to the whole of the population in Lithuania. The lack of understanding of the concept and the mechanisms of privatisation are being overcome through education via media.

The Supreme Council adopted a resolution in May to allow the sale of enterprises to foreigners for hard currency. A list of over 100 specific enterprises for sale to foreign investors has now been approved by the government[1].

Among these enterprises are a number of larger industries based in urban areas which reguire the higher levels of investment of capital and technology available from the west to ensure future profitability.

Even before the list has been released, foreign investors - particularly in the Nordic countries - are showing considerable interest in investment in Lithuanian industry. There has been a noticeable surge of such interest in the few weeks since the recognition of Lithuania's independence by the United Nations.

All state-owned enterprises, apart from agricultural entities are to be offered for sale by the end of 1992. The success of the privatisation programme is dependent on the continued awareness, the interest and the active participation of the Lithuanian people, which is already fairly high.

The transfer of agricultural land to private ownership has been kept separate from the privatisation of industry. The agrarian roots of the Lithuanian people has made this an emotive subject, while the important contribution by the agricultural sector to the economy indicates the need to use the agricultural expertise of Lithuanian farmers efficiently. Priority in agricultural privatisation is therefore to be given to those currently working on the land. Urban dwellers can apply for ownership but their claims will be of lower rank.

The laws on privatisation also cover the restitution of property held by private owners in the interwar period which was subsequently nationalised. Because of the low level of industrialisation during the previous period of indepedence, this mainly applies to agricultural land.

LEGISLATIVE REFORMS

Legislation already passed is far-reaching and diverse, covering economic, financial, industrial and social spheres. The volume is remarkable in such a short time. Foreign lawyers have helped but the laws are carefully adopted to Lithuania's particular situation.

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1 see the List of Enterprises Offered for Privatisation for Hard Currency Appendix II

The first and most important is practical implementation of the laws. Ratification is easy compared with enforcement.

The training of Lithuanian lawyers, economists and business professionals able to understand the new legislation and its consequences is therefore a priority. Sweden has already offered assitance in training, while scholarship schemes for Lithuanians to study abroad are being discussed with other countries.

The second challenge is to improve and expand existing laws, especially those on foreign investment and trade. Laws on bankruptcy, monopolies, the structure of capital markets and registration and transfer of securities are next on the list.

The government is also working to protect individual citizens' rights through a new constitution and civic code. Also being drafted is a consumer protection law.

SOCIAL REFORMS

In line with the economic reforms, social reforms are also being addressed. The first stage was to separate the Lithuanian budget from that of the Soviet Union. The budget for 1991 is now under the control of the Lithuanian government, allowing the country to assess and control income and expenditure for the first time.

The main aim is to ensure that the costs of social insuranse covering health, employment and pensions, can be met from the country's budget and financed primarily through payroll taxes.

Particular emphasis is being put on privatisation and the introduction of competition into the social services to reduce costs and improve the services available. Reforms to the education system are also being reviewed.

In less than two years since indepedence was declared, Lithuania has made tremendous achievements. The basic infrastructure for sustainable growth is now in place and the government is working flat out to implement the necessary reforms.

APPENDIX B
Survey of the Laws Regulating Economic Activities

SURVEY OF THE LAWS REGULATING ECONOMIC ACTIVITIES IN THE REPUBLIC OF LITHUANIA[1]

1. Enterprise Law of the Republic of Lithuania (adopted May 8, 1990).

The law establishes the subjects nested with the right to engage in regular commercial-economic activities, on behalf of their firm, in the Republic of Lithuania, and the legal grounds for their foundation and activities. This law does not apply to national and legal entities engaged in non commercial (non-profit) activities. The law allows the following types of enterprise:

1) individual (personal);
2) partnership;
3) limited partnership;
4) joint-stock company (public and closed);
5) state (municipal) enterprise.

The law enumerates types of activities that require perm'' (license) and establishes the main principles of relations between enterprises and state bodies. State bodies have no right to govern enterprise operation or regulate their activities by means of administrative methods.

Revision or auditing of the activities of the enterprise ca.. be carried out only in cases as specified by the laws of the Republic of Lithuania.

2. Law on Partnerships of the Republic of Lithuania (adopted October 16, 1990).

The law governs the establishment, reorganization, liquidation, management and activities of general partnerships and limited partnerships, rights and obligations of the partners as well as the formation and distribution of partnership capital.

Partnerships are established on the basis of a partnership agreement which spells out the principles of activity and the rights and obligations of partners. The agreement is certified by a notary. There are no limitations imposed on the partnership capital. Partnership income is distributed at the end of the business year in proportion to partners' contributions. Without the consent of all the general partners, a partner has no right to own an enterprise conducting a similar business, or to be a general partner of another partnership conducting a similar business.

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1 for full texts of main laws see: *Selected Anthology of Institutional, Economic and Financial Legislation*. - Vilnius, State Publishing Center, 1991. - 223 p.

3. Law on Joint Stock Companies of the Repulic of Lithuania (adopted July 30, 1990).

The law regulates the foundation, reorganization and dissolution of public stock companies and private stock companies, their management and activities as well as the rights and obligations of shareholders. It can be formed for any business or commercial activity not prohibited by the laws of the Republic of Lithuania. It is a legal entity enjoying the right to commercial, business, financial, organizational and legal independence. Joint stock company is a limited liability formation.

The authorized capital of a public joint stock company can not be less than 250 '000 roubles. It's shares may be sold and bought in public, on the stock exchange or may have a limited sphere of circulation. The amount of the authorized capital of a private joint stock company is not limited. The shares of a private joint stock company can not be sold and bought in public. Joint stock companies can not be founded by commercial banks registered in the Republic of Lithuania. A public joint stock company must have at least five, a private company - two founders. The corporate seat of the company must be in the Republic of Lithuania.

The managing bodies of a joint stock company include the General Meeting, the Council of Observers and the Board of Directors. All joint stock companies shall have the head of management and the chief accountant.

4. Law on State Enterprises of the Republic of Lithuania (adopted September 25 , 1990).

The law regulates the establishment, reorganization and liquidation as well as management, financial and other commercial-economic activities of state enterprises and public joint stock enterprises founded with state (local government) funds. This law is not applicable to state enterprises with a specific field of activities that abide by the regulations of a separate state enterprise. The list and statutes of such enterprises are approved by the Government of the Republic of Lithuania. A state enterprise is an enterprise established from the funds provided from the state (local government) which has not issued shares or which has issued shares with their norminal value not exceeding 1/5 of the enterprise's authorized capital. The shares of a state joint stock enterprise are sold and bought in public or may have a limited sphere of circulation. The shares of a state enterprise can not be bought or sold at the stock exchange and are not registered with the appropriated state bodies. State authorities and governing bodies have no right to own the shares of state joint stock enterprises or state enterprises.

The legal foundation for the establishment of an enterprise is the act on the establishment of an enterprise that may be adopted by the Government of the Republic of Lithuania (local council) or a ministry vested with the appropriate powers by the Government. The body that adopts the decision on the establishment of an enterprise is its founder.

The managing bodies of an enterprise include the Board of Directors, the Council of Observers, and Meetings of employees and shareholders. In special cases prescribed by law the Council of Observers may not be formed.

The rate of interest on the use of the state capital, uniform for all enterprises, is approved by the Government of the Republic of Lithuania or by the local government bodies.

5. Law on Agricultural Joint Stock Companies of the Republic of Lithuania (adopted April 16, 1991)

The law regulates the foundation, management, liquidation and activities of agricultural joint stock companies as well as the rights and obligations of their stockholders, capital formation and distributon. An agricultural joint stock company is a legal entity deriving over 60 per cent of its income from sales of agricultural products or services to agricultural industry.

Its founders may be natural persons of the Republic of Lithuania, as well as foreign citizens who establish joint stock companies with natural persons of the Republic of Lithuania. After the foundation agreement is signed, the founders organize the foundation meeting, which adopts the resolution on the foundation of the joint stock company and applies to municipal administration for the incorporation of the joint stock company.

An agricultural joint stock company uses the state and private land in accordance with the laws of the Republic of Lithuania.

6. Law on the Register of Enterprises of the Republic of Lithuania (adopted July 31, 1990).

This law establishes the Register of Enterprises of the Republic of Lithuania that serves for the registration of enterprises and for accumulation of information about enterprises, subsidiaries of enterprises and offices of enterprises' representatives, as well as about associations and other amalgamations of enterprises. The Ministry of Economics of the Republic of Lithuania is the chief registrar of the Register of Enterprises. Governing bodies of local governments of the higher level are also engaged in the maintenance of the Register. The Ministry of Economics of the Republic of Lithuania registers exclusively enterprises, founded with state capital, Lithuanian-foreign ventures and foreign capital enterprises. All other enterprises are registed by the governing bodies of local governments of the higher level.

All legal and natural persons have the right to use the Register documents and information for a prescribed fee.

7. Law on Taxes on Profits of Legal Persons of the Republic of Lithuania (adopted July 31, 1990).

The law defines taxable entities and taxable profits, establishes tax rates and tax deductions, payment rules, and the liability for proper taxation and payment of taxes. The tax rate for legal entities is 29% of the taxable profit. Municipal councils have the right to reduce Taxable Profit or exempt enterprises from payments of tax profit. The law establishes the procedure for the liability for erroneous assesment of the tax due and faulty payment of the above tax.

8. Law on Foreign Investments in the Republic of Lithuania (adopted December 29, 1990).

The objective of the law is to create favourable conditions for the investment of foreign capital in the Republic of Lithuania and to establish the legal order by which such investment is made. Foreign investment is the investment of financial and material resources in various spheres of activity in the Republic of Lithuania; it permits the transfer of intellectual and economic property rights to legal and natural persons of the Republic of Lithuania. The law allows the following forms of foreign investment:

- ownership interests in a joint venture;
- firms with foreign capital;
- shares in firms of the Republic of Lithuania, and ownership of other securities.

The body authorised by the Government of the Republic of Lithuania issues a licence to make a foreign investment. The decision concerning the application of an interested investor is made no later than 30 days from the receipt of an application. Foreign investment must be made no later than 12 months from the date of the receipt of the licence. If the investment is not made within this period, the licence is revoked. Requirements contained in the laws of the Republic of Lithuania regarding economic entities in Lithuania are applied to the commercial-economic activity of foreign investors, with the exception of cases where special rules regulating such activity under this law and provisions of international agreements to which Lithuania is a party apply. Types of joint ventures of foreign investment are established in accordance with the Enterprise Law of the Republic of the Lithuania. These joint ventures conduct their economic, commercial and financial activity independently. Working conditions in joint ventures are provided by collective and employment contracts which should be no worse than the conditions provided under the Laws of the Republic of Lithuania.

Profit tax of joint ventures is determined by the amount of the foreign investment in the authorized capital and its type of activity (industrial or commercial activity). The minimal rate of the profit taxes is 20%, the maximal

rate is 29%. Joint ventures are exempt from profit tax for a term of 3 years from the date of the receipt of the profit. Dividends to foreign investors received in Lithuania are exempt from taxes. Income received legally by foreign investors and upon which a profit tax has been paid may be repatriated without the payment of any additional tax. Investors who are exempt from profit taxes shall pay a tax of 5% on the repatriated profit. Foreign investors may repatriate their income in kind, that is, in their own products or products or services acquired on the Lithuanian domestic market. Material contributions by foreign investors to authorized capital during the period of the formation thereof are exempt from customs duties.

9. Provisinal Law on Income Tax of Natural Persons of the Republic of Lithuania (adopted October 5, 1990).

Income tax of natural persons is paid by:

1) persons, deriving income through their labour at enterprises, institutions and organizations on Lithuanian territory and abroad;

2) permanent residents of the Republic of Lithuania, deriving income from inhabitants and enterprises, institutions and organizations on Lithuanian territory and abroad not connected with labour relations;

3) private enterprises and partnerships with rights of natural persons which derive income from commercial-economic activities registered in the established manner. Foreign citizens and persons without Lithuanian citizenship pay this tax in the same manner as citizens of the Republic of Lithuania. Income in foreign currency is taxed according to special regulations. The law determines the minimum tax-exempt income received at the principal job.

The income earned at the principal and extra job is taxed at different rates.

Authors and their descendants must pay tax on their royalties for works of science, literature, art, discoveries, inventions, etc., at the rate of 13 per cent. Tax-exempt minimum of royalties for discoveries and inventions is 1000 roubles for each discovery or invention.

The taxable income of companies and private enterprises with the rights of natural persons, derived from commercial activity registered in the established manner, is subject to a 30 per cent rate of income tax. Such enterprises can also be subject to a license fee. Having obtained the license, enterprises do not pay income tax on income derived from the activity indicated in the license. The rate of license fee is determined by the councils of local governments.

10. Law on Spheres of Business Activity Wherein Foreign Investment Is Prohibited or Limited (adopted May 2, 1991).

This law establishes the spheres of economic activities wherein foreign investment shall be prohibited or conditions limiting foreign investment shall be established.

Foreign investment is prohibited in those spheres of activity which are related to the national defence and security of the Republic of Lithuania. Without a special directive of the Government of the Republic of Lithuania, foreign investment is prohibited in state enterprises having a monopoly in the Lithuanian market. In accordance with a resolution of the Supreme Council, prior to the adoption of the Law on Monopolistic Activity, enterprises, producing not less than 50% of total volume of such production manufactured in the Republic, and enterprises operating functioning networks of communications, electric power transmission, gas, oil, water supply, heating and sewage are considered enterprises enjoining a monopoly.

A foreign capital firm or joint ventures functioning not as a state enterprise, or functioning as a public corporation (closed corporation), in the event the Lithuanian founder of such a corporation possesses less than 51% of voting shares, is prohibited from:

- operating oil and gas pipelines, communications, electric-power transmission lines, heating systems, and facilities ensuring these objects' functioning, these objects being of national significance;
- operating highways, railways, seaports, and airports of the Republic of Lithuania according to their functional purpose;
- establishing or operating gambling houses, organising games of chance or holding lotteries;
- engaging in publishing activity, preparing and broadcasting TV and radio programmes, except for the technical servicing and technical maintenance;
- setting up and keeping gamble houses, organizing gambles and raffles;
- organizing publishing activities, preparing and broadcasting radio and television programmes, except for the technical servicing of printing presses, radio and television;
- managing spa treatment.

Foreign capital firms and joint ventures functioning not as state enterprises or as state stock corporations are prohibited from:

- manufacturing vodka, liqueurs, or other alcoholic beverages;
- manufacturing tobacco products;
- treating persons ill with dangerous and especially dangerous diseases, including venereal diseases and infectious skin diseases or aggressive forms of psychic diseases;
- treating animals ill with especially dangerous diseases.

Foreign capital firms and joint ventures functioning not as state enterprises are prohibited from:

- manufacturing weapons and explosives;
- producing and selling narcotics;

- growing and selling cultures containing narcotic, harmful or poisonous substances;
- concentrating and distributing the labour force, settling issues of labour force migration;

Foreign investment firms and joint ventures without a special license issued by directive of the Government of the Republic of Lithuania are prohibited from:

- exploring for and exploiting mineral deposits;
- exploiting natural resources;
- establishing and operating internal public transport and communications systems;
- producing and selling poisonous substances.

11. Law on the Initial Privatisation of State Property
(adopted on February 28, 1991 as amended March 14, 1991)

The law on the Initial Privatisation of State Property sets the rules regulating the process of privatization of the state property. The law does not regulate the privatisation of the state housing fund and the restitution of rights to property confiscated or otherwise taken from Lithuanian residents against their will. The process of privatisation is conducted by the Privatisation Commissions and Privatisation agencies, established throughout the country in accordance with this law and by decision of the local municipal organs. The Central Privatisation Commission, established by the decision of the Supreme Council of the Republic of Lithuania upon the recommendation of the Prime-Minister coordinates the process of privatisation. The main function of privatisation agencies is to collect and process information on the property subject to privatisation and provide free access to this information to interested persons. They also organize auctions and the subscribtion for shares.

According to the provisions of this law any state-owned property can be privatized, except in cases expressely defined by this law. Every object of privatisation must be re-appraised. Some state-owned property can be privatized for hard currency only. The list of such objects must be approved by the Supreme Council of the Republic of Lithuania.

Any legal person, wether a resident of Lithuania or not, can participate in the process of privatisation, though the right to acquire a part of state owned property is reserved for the natural persons who are citizens of Lithuania. The only exception for the nationals of other states exists regarding the property privatised solely for hard currency.In accordance with Article 14 of the law, state-owned property can be privatised either by selling it at auctions or by announcing public subscription for shares. If the initial sale price exceeds 500.000 Rb., the object can only be sold by announcing public subscription for shares.

Auctions are organized by the local privatisation agencies.

Only natural persons can participate in an auction. An auction is considered to be valid if no less than two participants have registered. Participants must register not later than 7 days before the auction and must pay 5% of the initial value of the auctioned object as well as a registration fee of 50 Rb.

The law also sets forth the order and terms of payment for the object thus bought and conditions of the subscription for shares. It also establishes the cases when privatisation auctions are to be considered invalid.

12. Law on the Land Reform (adopted July 25, 1991)

This law regulates the land ownership relations and the manner of land reform implementation.

The aims of the land reform in Lithuania, implemented under this law are the following:

1) to implement the right of Lithuanian nationals to own land;

2) to creat legal, organizational and economic conditions for the expansion of agricultural production;

3) to freely choose the forms of organizing agricultural production.

The law establishes two main land ownership forms: private property and state property.

The acquisition of property under the land reform has two forms: restitution of the land ownership rights to former owners or their heritors; purchasing.

The law on the land reform came into force on the 1st of Semptember, 1991.

13. Law on the Conditions of Citizens Rights to Real Estate Property Restitution (adopted July 9, 1991)

This law regulates the restitution of the rights of Lithuanian nationals to real estate property which was unlawfully confiscated. The law also grants the restitution rights to non-Lithuanian nationals.

Under this law the real estate is returned:

1) in the form of the confiscated real estate; or in the form of real estate equivalent to the confiscated one;

2) in the form of one time state payments that enable such persons to take over a certain part of the privatised state property in cases when the restitution of unlawfully confiscated real estate is not possible.

The law envisages the restitution of ownership rights to land, forests, industrial buildings and dwellings.

14. Law on the Status of Foreign Nationals. (adopted September 5, 1991)

This law establishes the legal status of nationals of foreign states, who temporarily reside in Lithuania and do not have diplomatic and\or consular immunity. Apart from this law such status can be regulated by treaties between the Republic of Lithuania and individual states.

Such temporarily residing foreign nationals have the same rights and duties as Lithuanian nationals if the Constitution of the Republic of Lithuania, its laws and its international treaties do not provide otherwise.

This law also regulates the order of entry and exit of foreign nationals into and from Lithuania, their liabilities and grounds for and order of their deportation.

15. Law on Immigration (adopted September 4, 1991)

The law regulates the immigration process. It sets the immigration procedures for the foreign nationals who desire to obtain permanent residence in the Republic of Lithuania. This law sets immigration quotas, adaptation procedures, limitations on immigration.

It comes into force on January the 1st, 1992 and will be applied to immigrants who come to Lithuania after this date.

APPENDIX C
Economic Potential of the Republic of Lithuania

ECONOMIC POTENTIAL OF THE REPUBLIC OF LITHUANIA

	measure unit	quantity
TERRITORY AND POPULATION		
Territory	**thsd.sq.km**	**65,2**
Agricultural land		
total	thsd.ha	3522,8
including:		
arable land	-"-	2306,6
meadows	-"-	309,8
pastures	-"-	857,3
Forests	mln.ha	1,8
Lakes	units	2830
total area of lakes larger than 0,5 ha in area	sq.km	876
Climate resembles that of West Europe		
Length of the Baltic coast	km	99

	measure unit	quantity
The Klaipėda sea port includes:		
fishing port		
merchant port		
international ferry		
Klaipėda-Mukran (Germany)		
Population (1991)		
total	thsd.people	3751,5
including:		
urban populatin	-"-	2579,9
rural population	-"-	1171,6
Natural increase of population	per mille	4,8
The number of people capable of working	thsd. people	2069,0
Gainfully employed	-"-	1853,0
Employment pattern:	%	
industry	-"-	30,2
agriculture	-"-	17,6
construction	-"-	11,9
transport and communications	-"-	6,2
non-industrial sphere	-"-	26,2
Unemployed	thsd.people	9,3
Pattern of unemployment:		
female	-"-	6,6
male	-"-	2,7
Number of jobs available:	-"-	16,4
workers	-"-	14,7
employees	-"-	1,7

	measure unit	quantity
GENERAL ECONOMIC INDICES OF NATIONAL ECONOMY (1990)		
Pattern of ownership and control:		
public sector	%	72,0
cooperative	-"-	19,0
private	-"-	9,0
Gross national product		
total	%	100
including:		
industry	-"-	54,0
agriculture	-"-	25,3
construction	-"-	10,1
transport and communications	-"-	3,9
trade and other	-"-	6,7
National income		
total	%	100
including:		
industry	-"-	35,9
agriculture	-"-	29,6
construction	-"-	13,4
transport and communications	-"-	5,0
trade and other	-"-	16,1
INDUSTRY (1990)		
Pattern of capital investments		
industry:		
total	%	100
including:		
building	-"-	27,9
equipment	-"-	7,7
transmission devices	-"-	12,0
machinery and other	-"-	52,4

	measure unit	quantity
Industrial output	mln.roubles	13549
Share of main industries in overall output:	% of overall output	
Chemicals and oil	-"-	3,6
Machine building and metal processing	-"-	25,4
Timber, wood processing and paper	-"-	5,1
Light industry	-"-	21,1
Food	-"-	21,0
Number of industrial enterprises		
total number of enterprises		629
including those in:		
Chemicals and oil industry		15
Machine building and metal processing industry		140
Timber, wood processing, cellulose, and paper industry		74
Building materials industry		64
Light industry		107
Food industry		127
Industrial output		
Power industry:		
electricity	mln.kWh	28405
Chemicals and oil:		
monohidrate of sulphuric acid	thsd.t	412
polimeric film	-"-	15,0
chemical fibre and threads	-"-	11,3
mineral fertilizers (100%)	-"-	483
Machine building and metal processing		
alternating current engines	thsd.	415
low capacity electric engines	-"-	7471
electric welding equipment	-"-	77,9
machine-tools for metal cutting	-"-	8,6
electric meters	-"-	3177
units for the production of vitaminised grass flour	-"-	1599

	measure unit	quantity
Miscellaneous manufactured goods:		
furniture	mln.roubles	222,8
TV sets	thsd. units	558,2
tape-recorders	-"-	192,7
household refrigerators	-"-	263,4
bicycles for teenagers	-"-	381
Timber, wood processing, cellulose, and paper industry:		
timber production	thsd.cub.m	2565
including processed timber:	-"-	1892
planks	thsd.cub.m	776
timber shaving plates	-"-	176,3
timber fibre plates	thsd.sq.m	26078
paper	thsd.t.	100,7
cardboard	-"-	116,9
Building materials industry:		
asbestocement sheets (slate)	mln.cond tiles	114
bricks	mln.cond bricks	1100
window glass	thsd.sq.m	3300
Light industry:		
fabrics:	mln.sq.m	203,6
cotton	-"-	98,5
wool	-"-	21,7
silk	-"-	40,0
linen	-"-	28,1
carpets and carpet articles	thsd.sq.m	6551
stockings and socks	mln.pairs	82,2
leather foot-wear	-"-	9,1
rubber foot-wear	-"-	2,8
knitted underwear	mln.units	40,9
knitted wear	-"-	17,9

	measure unit	quantity
Food industry:		
meat (industrial production)	thsd.t.	431,5
non-skimmed milk products	-"-	831,0
granulated sugar	-"-	158,6
butter	-"-	73,9
tinned food (all sorts)	mln.cond. cans	369,0
AGRICULTURE (1990)		
General agricultural production in farms of all categories	mln. roubles	4789,4
including:		
crops	-"-	1404,0
livestock	-"-	3126,5
Output of basic agricultural products		
grain crops	thsd.t.	3265,1
potatoes	-"-	1573,1
flax fibre	-"-	10,1
sugar-beet	-"-	912,4
vegetables	-"-	295,0
fruits and berries	-"-	86,5
meat (carcasses)	-"-	530,1
milk	-"-	3157,0
eggs	mln.	1272,6
Number of livestock (1990)		
cattle	mln.	2,4
including:		
cows	-"-	0,84
pigs	-"-	2,4
fowl	-"-	16,8
Main crops yield in farms of all categories		
grain	cnt per ha	25,4
flax fibre	-"-	4,7
sugar-beet	-"-	286
potatoes	-"-	145

	measure unit	quantity
Per capita production of basic agricultural products:		
grain	kg	876
potatoes	-"-	422
vegetables	-"-	79
fruits and berries	-"-	23
meat	-"-	142
milk	-"-	847
eggs		342
TRANSPORT		
Freight traffic		
by all kinds of transport,	mln.t.	349,3
including:		
railway	mln.t.	27,1
sea	-"-	5,2
road	-"-	308,2
Passenger traffic by public transport		
by all kinds of transport,	mln.people	722,7
including:		
railway	-"-	32,3
buses/coaches	-"-	686,1
air	-"-	0,9
Length		
Railway lines	thsd.km	2
Airline routes	-"-	28,1
Hard surface motorways	-"-	35,5
CONSTRUCTION (1990)		
Capital investments in national economy, total	mln.roubles	2721
including:		
state and cooperative enterprises and organizations	-"-	2147
collective-farms	-"-	472
private housing construction sector	-"-	102

	measure unit	quantity
Value of work done by contractor construction and assembly organizations	mln.roubles	1126
Number of contractor construction and assembly organizations		291
FINANCE (1990)		
Income from enterprises and businesses,		
total	mln.roubles	4064,7
including from:		
industry	-"-	1721,6
agriculture	-"-	984,1
construction	-"-	228,7
State budget income	bil.roubles	4,7
State budget expenditure	-"-	4,5
Residue of personal deposits in savings bank	-"-	6,8
INTERNATIONAL ECONOMIC RELATIONS (1990)		
Exports		
total	mln.roubles	385,9
Commodity composition:	% from total export	
machines, equipment and transport means	-"-	21,6
fuel, mineral raw-materials, metals	-"-	18,7
consumer goods	-"-	26,8
food stuffs	-"-	12,1
Geographical distribution of LR exports/imports		
Belgium	%	9,5/0,4
Bulgaria	-"-	2,7/6,0
Czech and Slovak Federal Republic	-"-	4,9/10,0
Denmark	-"-	1,4/0,3
Finland	-"-	7,6/1,2
France	-"-	3,6/1,5
German Federal Republic	-"-	13,6/15,9

	measure unit	quantity
Great Britain	-"-	2,8/2,4
Hungary	-"-	6,7/6,4
Italy	-"-	2,6/2,7
Poland	-"-	12,4/0,9
Sweden	-"-	1,2/0,9
Switzerland	-"-	2,7/0,7
Imports		
total	mln.roubles	809,4

APPENDIX D
Foreign Capital Investment Opportunities

THE MAIN FOREIGN CAPITAL INVESTMENT OPPORTUNITIES IN THE ECONOMY OF LITHUANIA

GENERAL OUTLINES

The main forms of foreign capital investment into the national economy of Lithuania should be joint ventures with the participation of foreign partners, foreign capital enterprises, foreign capital reinvestment into the national economy of Lithuania and the utilization of foreign credits for the financing of economic projects in Lithuania.

This outline describes the main areas of foreign investment opportunities in the Republic of Lithuania in the current situation, proceeding from the necessity to ensure economic stability during the period of transition to market relations with a subsequent reorientation of the national economy in accordance with long-term perspectives of economic development and the Government economic programes.

The Government of Lithuania ensures support to foreign investments in these areas.

THE MAIN AREAS AND SECTORS FOR FOREIGN INVESTMENTS

Enviroment. The prime goal is to build water treatment facilities in all the largest towns of Lithuania. The Government also focuses on the utilization and management of toxic industrial and household wastes and collection and recycling of refuse.

Energy. Foreign capital investments in the sphere of energy are meant to help improve the fuel balance structure by reducing the consumption of oil products, energy and fuel.

Exploitation of several oil wells has already started in Lithuania. Local oil

is suitable for the production of high quality lubricants. Production of heating meters and heat regulating devices is also important.

Transportations. In the field of transportation foreign capital investments are needed for the following goals: reconstruction of the border area railroad line between Šeštokai and the Republic of Poland in order to connect Lithuania's railroad with the European railroad system; modernization and reconstruction of Klaipėda seaport and Klaipėda - Mukran ferry; construction of an international airport in Vilnius and formation of independent national air lines; reconstruction of the Helsinki - Warsaw highway on the territory of Lithuania and it's use for international cargo shipments and tourism; development of international transit transport systems and appropriate infrastructure. Foreign investments are also needed in motor industry, for the manufacturing of spare parts for cars, trolleybuses and other means of transportation; joint assembly of cars; international cargo transportation; municipal transportation services. Foreign capital enterprises in the above areas could be an option.

Communications. The main areas of foreign capital investments in the communications system are the establishment of independent postal, telephone, telegraph services, radio and television systems, international communications centers and links connecting these centers with the European and world commutator centers; construction of a new international phone call station.

The main projects whose implementation in Lithuania requires foreign capital investments are: construction of international optic fiber line Copenhagen - Kaunas; introduction of satelite communications systems; the first stage of putting into operation of an alternative telephone network.

Lithuania is currently conducting research in optic - electronic communications as well as creation of it's elements. Foreign capital investments and technical support would accelerate research work in the area and it's practical implementation.

Hard currency investments in communication will be repaid through the difference in payments for the incoming and outgoing international telephone calls, communications services to be paid for in hard currency, and sale of postal stamps.

Tourism. Foreign capital investments in tourism are quickly repaid and the development in this area is highly promissing. Construction of hotels, motels, holiday centers, commercial, catering and other enterprises in the main cities of Lithuania, organization and production of goods for tourism are to be carried out according to the masterplan of tourism development.

Priority is given to foreign capital participation in establishing joint ventures, granting long-term credits and their utilization as well as in establishing foreign capital enterprises on the territory of Lithuania.

Industry. In industry priority is given to furniture and paper production,

mashine tools industry, light industry, chemical industry and pharmaceutical industry. The Government will encourage foreign capital investments in the reconstruction and development of enterprises in the above fields as well as establishment of new ones.

Timber, cellulose and paper industries would export furniture, splint board, wood fibre board, different sorts of paper. Investments in such enterprises could be repaid within a short period of time. The Government will also encourage investments in the production of high quality cardboard materials for packaging.

The economic reform in Lithuania is targeted, among other things, to implement a structural reorganization of the mashine tools and metal processing industry. Foreign capital investments are required for the manufacturing of agricultural machinery, implements, food processing equipment, precission tools, TV sets, insulation and sheet construction materials, construction engineering equipment, construction materials.

In light industry Lithuania seeks to modernize flax growing and processing, sewing industry and textiles production. Low cost of relatively highly skilled labour as well as modern and efficient equipment offers good opportunities for foreign capital investments.

In pharmaceutical and chemical industries the Government of Lithuania intends to modernize the production of endocrinal preparations, medical herbs; methanol, maleic anhydride, chemicals for hide processing shoeware industry.

Food industry. Foreign capital investments are needed for the purchase of new equipment, processing lines and advanced technologies and their utilization in the existing enterprises. This would allow to expend food production from local products for the domestic market and exports to the USSR, Eastern and Central Europe and other countries. Priority industries: production of sugar, cooking oil, milk powder, meat products; meat processing; mixed feed production for livestock, poultry and fish; fruit, berry and mushroom processing; production of vaccines and biopreparations. Expansion of the above branches also necessitates the production of packaging materials and containers.

APPENDIX E
Enterprise Offered for Privatization for Hard Currency

LIST OF ENTERPRISES OFFERED FOR PRIVATISATION FOR HARD CURRENCY

Name of enterprise	Address	Sphere of activity
MANUFACTURE OF FOOD PRODUCTS AND BEVERAGES		
1. Alytus Butter Plant	Putinų str.33, 4580 Alytus, tel 354 58, fax: 581 31	Milk processing
2. Klaipėda Dairy Plant	Šilutės rd. 33, 5800 Klaipėda, tel. 554 27	Milk processing
3. Marijampolė Canned Dairy Plant	Kauno str.114, 4520 Marijampolė, tel. 714 20	Milk processing
4. Mažeikiai Dairy Plant	Skuodo str.4, 5500 Mažeikiai, tel. 653 41	Milk processing
5. Utena Dairy Plant	Pramonės str.8, 4910 Utena, tel. 515 70, fax: 565 38	Milk processing
6. Vilnius Dairy Plant	Saltoniškių str.9, 2664 Vilnius, tel. 751 131, fax: 738 549	Milk processing
7. Kaunas Confectionery Factory	Taikos str.88, 3031 Kaunas, tel. 751 285	Confectionary products
8. Kėdainiai Sugar Plant	Pramonės str.6, 5030 Kėdainiai, tel. 507 60	Sugar production
9. Marijampolė Sugar Plant	P. Armino str.65, 4520 Marijampolė, tel. 506 75	Sugar production
10. Panevėžys Sugar Plant	Įmonių str.22, 5319 Panevėžys, tel. 620 07	Sugar production
11. Pavenčiai Sugar Plant	Ventos str.79, 5420 Kuršėnai, Šiauliai region, tel. 344 59	Sugar production

Name of enterprise	Address	Sphere of activity
12. Vilnius Oil and Fat Production Enterprise	Panerių str.62/1, 2600 Vilnius, tel. 630 788, fax: 662 721	Production of oils, fats and soaps
13. Klaipėda Tobacco Factory	Bangų str.7, 5800 Klaipėda, tel. 145 49	Tobacco products
MANUFACTURE OF TEXTILES		
1. DROBĖ Wool Company	Jonavos str.60, 2002 Kaunas, tel. 262 917, fax: 262 474	Production of wool and carded wool
2. Enterprise AUDĖJAS	Zarasų str.24/1, 2600 Vilnius, tel. 627 477, telex: 261115 AUD, fax: 614 676	Spinning, weaving, fabric finishing
3. Kudirkos Naumiestis Flax Plant	Kibartų str.1, 4482 Kudirkos Naumiestis, Šakiai region, tel. 524 68, fax: 51 475	Textile fibre processing, weaving, production of fabrics
4. Lentvaris Carpet Enterprise	Klevų al.46, 4200 Lentvaris, Trakai region, tel. 582 83	Production of various types of carpets
MANUFACTURE OF WEARING APPAREL		
1. Enterprise UTENOS TRIKOTAŽAS (UTENA KNITWEAR)	Basanavičiaus str. 122, 4910 Utena, tel. 514 45, fax: 693 58	Production of knitwear clothes and fabrics
2. Knitted-Wear Company VILIJA	Polocko str.26, 2007 Vilnius, tel. 612 143	Manufacturing of knitwear
3. Fashions Factory	Laisvės 59, Kaunas, tel. 741 931*	Household service trade

* City Privatisation Office telephone

Name of enterprise	Address	Sphere of activity
4. Sewing Shop No. 5	Kauno str.21, Klaipėda, tel. 128 01*	Personal services
MANUFACTURE OF FOOTWEAR		
1. Mažeikiai Foot-Wear Factory	Pramonės str.27, Mažeikiai, tel. 321 31**	Production of summer foot-wear for men and women
PRINTING ACTIVITIES		
1. Šiauliai Printing Plant TITNAGAS	Vasario 16-osios str.52, 5419 Šiauliai, tel. 334 73	Printing services
MANUFACTURE OF RUBBER AND PLASTIC PRODUCTS		
1. Vilnius Polymer Products Plant	Kirtimų str.45, 2028 Vilnius, tel. 640 943	Production of linoleum, adhesives and rubber goods
MANUFACTURE OF BRICKS, PANELS AND CONCREATE PRODUCTS		
1. Matuizos Construction Materials Plant	Matuiza region, 4630 Varėna, tel. 406 10, 406 35	Production of lime-and-sand bricks and heat insulating materials
2. Enterprise NAMŲ DETALĖS (UNITS FOR HOUSING CONSTRUCTION)	Gamybos str.4, 5419 Šiauliai, tel. 401 06	Manufacturing of large size panels for housing construction
3. Vilnius 1st Ferroconcrete Plant	Žarijų str.6, 2028 Vilnius, tel. 628 687*	Manufacturing of ferro-concrete products
MANUFACTURE OF METAL PRODUCTS		
1. Kaunas Enterprise METALAS	Juozapavičiaus str.82, 3002 Kaunas, tel. 740 195	Production of heating and plumbing fixtures and consumer goods
MANUFACTURE OF GENERAL HARDWARE		
Panevėžys Enterprise METALISTAS	Šermukšnių str.19, Panevėžys, tel. 238 93	Furniture accessories, iron-mongery for construction, locks

* City Privatisation Office telephone

** Regional Privatisation Office telephone

Name of enterprise	Address	Sphere of activity
MANUFACTURE OF HOUSEHOLD LUMINAIRES		
1. Panevėžys Enterprise	Kranto str.36, 5319 Panevėžys, tel. 238 93*	Production of household luminaires
MANUFACTURE OF COMPUTING MACHINERY		
1. Vilnius Computer Machines Enterprise	Kalvarijų str.125, 2648 Vilnius, tel. 356 181, fax: 356 181	Production of computers, electronic games machines and communication equipment
2. Telšiai State Computer Plant	Sedos str.30, 5610 Telšiai, tel. 515 17, fax: 531 90	Production of computers and communications equipment
3. Panevėžys Precision Tools Enterprise	J.Janonio str.3, 5319 Panevėžys, tel. 638 33, telex: 287 425	Winchester memory equipment, magnetic discs
MANUFACTURE OF ELECTRICAL EQUIPMENT		
1. Mažeikiai Electrical Engineering Plant	Laisvės str.216, 5500 Mažeikiai, tel. 324 48	Manufacturing of household electrical equipment
2. Utena Laboratory Electric Furnace Plant	Basanavičiaus str.114, 4910 Utena, tel. 512 38	Production of furnaces for laboratories and welding equipment
MANUFACTURE OF RADIO, TELEVISION AND COMMUNICATION EQUIPMENT AND APPARATUS		
1. Microelectronic Scientific-Industrial Amalgamation VENTA	Ateities str.10, 2057 Vilnius, tel. 775 939, telex: 261 169 VENTA, fax: 261 169	Assembly of microchips, manufacturing of equipment
2. Enterprise ALMA	Pramones str.14, 4063 Alytus, tel. 581 33, fax: 348 69	Production of household electronic equipment, tape-recorders, and computers

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** Regional Privatisation Office telephone

Name of enterprise	Address	Sphere of activity
3. Panevėžys Enterprise EKRANAS	Elektronikos str.1, 5319 Panevėžys, tel. 634 50, telex: 261 124 ZKE, fax: 23415	Manufacturing of TV tubes
4. Šiauliai Enterprise NUKLONAS	Architektų str.1, 5420 Šiauliai, tel. 522 35, telex: 296 426 META, fax: 535 04, 502 80	Assembly of microchips for electronic equipment
	WHOLESALE TRADE	
1. Shop No. 2	Sėlių str.54, 2004, Vilnius, tel. 751 658	Retail trade
2. Shop No. 53	Valakampių 2nd beach 2016 Vilnius, tel. 744 471	Retail trade
3. Shop MADA	Viršuliškių str.40, 2000 Vilnius, tel. 427 545	Retail trade
4. Shop No. 100	Parko str.14, 2000, Vilnius, tel. 628 687*	Retail Trade
5. Shop No. 101	Minties str.58, 2051 Vilnius, tel. 358 346	Retail trade
6. Shop DRABUŽIAI IR TRIKOTAŽAS (CLOTHES AND KNITWEAR	Antakalnio str.95, 2040 Vilnius, tel. 744 230	Retail Trade
7. Shop TAURAS	V. Krėvės str.13, 3000 Kaunas, tel.741 931*	Retail trade
8. Trade firm BUITIS	Vytauto str.32, 3000 Kaunas, tel. 741 931*	Retail trade
9. Shop PIARNU	Vytauto str.137, 5400 Šiauliai, tel. 254 65	Retail trade

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Name of enterprise	Address	Sphere of activity
10. Shop LAUKTUVĖS	Kranto str.2, 5300 Panevėžys, tel. 686 27	Retail trade
11. Shop PUŠAITĖ	Kęstučio, Palanga, tel. 537 38*	Retail trade
12. Shop LAKŠTUTĖ	Jūratės str., Palanga, tel. 537 38*	Retail trade
13. Household and Chemical Goods Shop	Požėlos str., Palanga, tel. 537 38*	Retail trade
	REPAIR OF CLOTHES	
1. Clothes Repair Shop No. 8	Taikos str.47, 5802 Klaipėda, tel. 128 01*	personal services
	HOTELS, RESTAURANTS, BARS AND CANTEENS	
1. Restaurant PALANGA	Vilniaus str.10/16, 2001 Vilnius, tel. 622 401	Public catering
2. Cafe and Ice-Cream Bar	Antakalnio str.66, 2040 Vilnius, tel. 744 220	Public catering
3. Canteen and Confectionary Shop	Karoliniškių str.21, 2000 Vilnius, tel.444 162	Public catering
4. Snack Bar VAIVORYKŠTĖ	Perkūno str.2, 2050 Vilnius, tel. 456 859	Public catering
5. Hotel BALTIJA	Vytauto str.71, 3000 Kaunas, tel. 221 292	Hotel service
6. Restaurant ŽALIAS KALNAS	Savanorių str.111, 3005 Kaunas, tel. 223 375	Public catering
7. Cafe EKSPRESAS	Vytauto str.15, 3000 Kaunas, tel. 741 931*	Public catering
8. Restaurant REGATA	Buriuotojų enbankment, 5800 Klaipėda, tel. 125 06	Public catering

Name of enterprise	Address	Sphere of activity
9. Shop in Smiltynė	Smiltynė, 5800 Klaipėda, tel. 126 37	Public catering
10. Cafe KLEVAS	Recreation and Culture Park, 5799 Klaipėda, tel. 137 29	Public catering
11. Bar No. 17	Girulių beach, 5817 Klaipėda, tel. 128 01*	Public catering
12. Public Catering Center BALTIJA	Vilniaus str.166, 5400 Šiauliai, tel. 232 52, 267 85	Public catering
13. State Hotel ŠIAULIAI	Draugystės str.15, 5419 Šiauliai, tel. 245 54	Hotel service
14. Cafe JAUNISTĖ	Draugystės str.14, 5400 Šiauliai, tel. 246 34	Public catering
15. Bar ŠALTINĖLIS	Kranto str.2, 5300 Panevėžys, tel. 238 93*	Public catering
16. Restaurant SEKLYČIA	Laisvės al. 1, 5319 Panevėžys, tel. 357 54	Public catering
17. Grill bar	Laisvės al. 4, 5300 Panevėžys, tel. 238 93*	Public catering
18. Hotel NEVĖŽIS	Laisvės al. 26, 5300 Panevėžys, tel. 238 93*	Hotel service
19. Hotel RAMBYNAS	Respublikos str.32, 5319 Panevėžys, tel. 610 07	Hotel service
20. Hotel DZŪKIJA	Pulko str.14/1, 4580 Alytus, tel. 52 587	Hotel service
21. Hotel SŪDUVA	Basanavičiaus str.8, 4520 Marijampolė, tel. 503 45	Hotel service

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Name of enterprise	Address	Sphere of activity
22. Building, Housing Repair and Maintenance Company	Jaunimo str.2, 4520 Marijampolė, tel. 707 58	Trade center, restaurant or pub
23. Restaurant VASARA	S. Neries str.27, Palanga, tel. 537 38*	Public catering
24. Canteen VASARA	S. Neries 27, Palanga, tel. 537 38*	Public catering
25. Canteen GUBOJA	Palanga, tel. 537 38*	Public catering
26. Canteen VAIVA	Jūratės str.22, Palanga, tel. 537 38*	Public catering
27. Canteen MEDVĖGALIS	Palanga, tel. 537 38*	Public catering
28. Hotel NEMUNAS	Algirdo str.5, 4490 Birštonas, tel. 563 45	Hotel service
29. Canteen/Cafe DAINAVA	Laisvės al. 2, Druskininkai, tel. 517 77*	Public catering
30. Canteen RATNYČĖLĖ	Čiurlionio str.48, Druskininkai, tel. 517 77*	Public catering
31. Hotel PUNTUKAS	A. Barausko str.4, Anykščiai, tel. 535 84**	Hotel service
32. Hotel JURBARKAS	Dariaus ir Girėno str.98, Jurbarkas, tel. 554 45**	Hotel service
33. Hotel MĖGUVA	Mėguvos str.3, Kretinga, tel. 519 05**	Hotel service
34. Community Service Center	Vytauto str.135, Kretinga, tel. 519 05**	Public catering, retail trade, baths

* City Privatisation Office telephone, ** Regional Privatisation Office telephone

Name of enterprise	Address	Sphere of activity
35. Hotel ŽIBINTAS	Nepriklausomybės str.3, Lazdijai, tel. 512 60**	Hotel service
36. Motel LAZDIJAI-ROADTEL	Kučiūnai district, Lazdijai rg., tel. 512 60**	Public catering, hotel service
37. Hotel APUOLĖ	Dariaus ir Girėno str.3, Skuodas, tel. 512 56**	Hotel service
38. Hotel ŠEŠUPĖ	Kęstučio str.2, Šakiai, tel. 529 46**	Hotel Service
39. Hotel EGLĖ	Vilniaus str.6, Švenčionys, tel. 527 97**	Hotel service
PHOTOGRAPHIC ACTIVITIES		
1. Photo shop	Kalvarijų 59, Vilnius, tel. 733 665	Personal services
SPORTING ACTIVITIES		
1. Alytus Sports Hall	Naujoji str.52, Alytus, tel. 357 42*	Personal service
MOTION PICTURE PROJECTION		
1. Cinema DAINAVA	Rotušės str.11, Alytus, tel. 357 42*	Entertainment
2. Cinema ELDIJA	Palanga, tel. 537 38*	Entertainment
3. Birštonas Cinema/Video Center	Jaunimo str.1, Birštonas, tel. 564 72*	Entertainment
4. Cinema TURISTAS	Ateities str.23, Ignalina, tel. 543 01**	Entertainment
WASHING, CLEANING AND DYEING OF TEXTILE		
1. Feather Cleaning Workshop	Tuskulėnų str.35, 2051 Vilnius, tel. 358 794	Personal services

* City Privatisation Office telephone, ** Regional Privatisation Office telephone

Name of enterprise	Address	Sphere of activity
2. Dry-Cleaning Workshop No.2	Sluckio str.3/6, 2005 Vilnius, tel. 754 286	Personal services
3. Kaunas Cleaning and Dyeing Plant SNAIGĖ	Pramonės str.23, 3031 Kaunas, tel. 755 272	Cleaning and dyeing of clothes
4. Dry-Cleaning Shop	Smėlio str.10, 4580 Alytus, tel. 538 70	Personal services
HAIRDRESSING		
1. Hair-Dresser's Salon	Vytauto str., Palanga, tel. 537 38*	Personal services
2. Hair-Dresser's Salon	Basanavičiaus str., Palanga, tel. 537 38*	Personal services
FUNERAL AND RELATED ACTIVITIES		
1. Ritual Services Bureau	Vilniaus str.47, Švenčionys, tel. 527 97**	Ritual services, shop and office premises
OTHER SERVICE ACTIVITIES		
1. Family Celebrations Center	Šeiminiškių str.5, 2005 Vilnius, tel. 731 964	Personal services
2. Health Center DELFINAS	Juozapavičiaus str.3, 2000 Vilnius, tel. 756 058	Personal services
3. Public Service Center	Kęstučio str.41, 2004 Vilnius, tel. 754 211	Personal services
4. Bath House	Aido str.16, 5400 Šiauliai, tel. 205 25*	Personal services
5. Community Service Center	Aido str.16, 5400 Šiauliai, tel. 205 25*	Personal services
6. Baths Center	Taikos str.10, Sniečkus, tel. 543 01**	Personal services

* City Privatisation Office telephone, ** Regional Privatisation Office telephone

Name of enterprise	Address	Sphere of activity
7. Community Service Center	Lentvario str.2, Grigiškės, Trakai rg., tel. 516 39**	Personal services
8. Pilviškiai Workshop for 12	Pilviškiai village, Pilviškiai district, tel. 527 58**	Sewing, hair-dressing salon, dry cleaning, watch repair shop, laundry
9. Smalininkai Community Service Center	Smalininkai, Jurbarko rg., tel. 554 45**	Personal services
10. Plateliai Shop	Plateliai, Plungės rg., tel. 512 30**	Personal services

* * *

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APPENDIX F
RISO Report - The Energy System in Lithuania

5.6 Cooperation with Nordic Countries

It would be desirable to establish cooperation between Latvia and the Nordic countries in many fields in the energy sector, some of the fields could be:

- energy efficiency in all sectors
- exploration for oil and gas in Latvia
- application and research in wind turbines
- application and research in small scale hydro power
- equipment for incineration of waste
- energy planning
- small scale natural gas fired CHP-plants
- flue gas cleaning equipment for SO_2 etc.
- lead free fuel and 3-way-catalyst for cars
- regulation equipment and meters for heating systems
- technologies for the use of biomass in the energy sector.

6 The Energy System in Lithuania

6.1 Preface

Lithuania is the largest of the three Baltic states, with borders to Latvia, Byelorussia, Poland and Kaliningrad (Koenigsberg) region. It's area 65,000 km^2, with about 3.7 million of inhabitants.

Lithuania is not rich in mineral resources: We have some lime, clay, gypsum and dolomite. These materials are used to produce building materials, glass and pottery. Domestic energy resources are negligible (wood, peat, hydro, some oil), therefore fuel is mainly imported from the USSR.

On the other hand, Lithuania produces many high energy consuming products (cement, mineral fertilizers) and wastes much heat due to lack of regulation equipment and meters in district heating systems.

In this chapter we discuss energy consumption in all branches of the national economy, describe in details consumption of different energy resources in the industry, agriculture, transport and residential sectors. We investigate consumption of electricity, heat and fuel in all the branches of national economy, and consumption of different fuels in various types of vehicles. We give the main data on power plants, combined heat and power plants and the main boilers.

The electric network and the gas supply scheme are also presented. We evaluate the contribution of power to the total emissions of various pollutants and list the main polluters.

We reveal the main problems which the Lithuanian energy systems faces now and possible solutions. We show also the urgent need for cooperation with West European countries, first of all, with the Nordic ones in reconstructuring the existing energy systems and improving their efficiency.

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6.2 Energy Consumption

The present dynamics of energy consumption is the result of integrating all the branches of the Lithuanian economy into the united USSR economy system. This system was based on central planning and allocation of all the material and energy resources. Lithuanian planning bodies were permitted to allocate only about 20% of the fuel resources. The plans were made for five years ahead, so even energy and economy data is reliable only at the end of every five year period. The energy and fuel budget may be analysed on three aspects:

1) on the destination of energy consumption (fuel to produce electricity and heat, direct consumption of fuel in technologies, transport and residential consumption, consumption of fuel as raw material)
2) according to the economy branches (industry, agriculture, transport, construction, residential)
3) on different types of primary energy resources.

Lithuania consumes energy per capita as an average European country (Table 6.1). This index for Lithuania is even larger than ones for such developed countries as Austria, Italy or Denmark. It also consumes large amounts of electricity (per capita) but slightly less than developed European countries.

Table 6.1. The main energy and economy indicators in 1985(all numbers per capita)

	Consumption of:			Production of:			
	Energy. kg ce	Electr. kWh	Fertil. kg	Cement kg	Meat kg	Milk kg	Cars in use
Lithuania	5500	4200	208	950	141	850	0.103
Latvia	5100	3600	65	305	111	605	0.086
Estonia	9100	6280	157	750	140	805	0.120
Byelorussia	*	3960	595	230	118	750	0.046
Moldova	*	2600	*	562	80	355	0.039
Ukraine	*	5820	99	460	84	476	0.053
USSR	6390	5580	130	490	68	377	0.050
Poland	4700	3744	68	430	82	410	0.099
Austria	4024	5688	42	650	100	480	0.335
Belgium	5577	5790	113	580	125	370	0.335
CSFR	6260	5520	64	600	102	450	0.176
Denmark	5330	6015	*	370	306	950	0.293
Finland	5823	10708	107	370	77	610	0.377
France	3880	5800	79	420	108	610	0.379
FRG	5670	6774	66	430	93	420	0.436
Hungary	3735	3610	104	400	167	270	0.135
Ireland	3556	3369	*	290	168	1240	0.201
Italy	3211	3681	31	650	62	*	0.376
Holland	7200	4774	133	200	188	870	0.328
Norway	6618	23706	138	512	53	480	0.365
Sweden	4893	15980	37	304	75	430	0.377
Romania	4483	3218	148	430	87	270	*
UK	5363	5366	*	204	67	270	0.305

* data unavailable.
Kg ce = kilo coal equivalent

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So the level of development is not caused by a high energy consumption level and the high energy consumption does not give high level of life. In the major East European countries energy resources were consumed inefficiently. For example, the USSR consumes more energy resources per capita than any other European country (except Holland) and have a GNP per capita 3-4 times smaller. Similarly, Lithuania consumes the same amount of energy resources as Denmark, Sweden of FRG and have a GNP slightly larger than USSR but less than Spain, Ireland or Italy which consumes from 2 to 3 times less energy resources (all numbers per capita).

The main trend in the Lithuanian economic development since the world war two was its fast industrialisation. with the development of the building materials industry and the traditional light-, food-, and wood-industries. Many qualified labour demanding industries such as radio engineering, machine tool construction, agriculture machines engineering were created. Also such energy consuming industries as industrial chemicals, oil refining were rapidly created and developed.

So the main energy consumer in Lithuania is its industry. It consumes about 48% of all the energy resources, 49% of electricity, more than half of heat and almost one third of directly technology-used fuel (Table 6.2-6.5). The most energy consuming are cement and mineral fertilizer producing plants. We are producing huge amounts of these products, and there we are consuming huge amounts of electricity, heat and fuel. Lithuania produces about 950 kg of cement (per capita) and takes the second place in Europe, behind Greece (Table 6.1). Due to the high energy consumption and air pollution production of cement was reduced in major European countries. Besides the greater part of cement in the West is produced by the dry method that enables to reduce energy consumption. In Lithuania we use only the wet method.

Table 6.2. Primary energy consumption in Lithuania

	1980 mill. kg ce	%	1985 mill. kg ce	%	1990 mill. kg ce	%
1. INDUSTRY	7700	43.5	10073	47.7	8260	40.1
a) oil refinery	371	2.1	1373	6.5	1230	6.0
b) industrial chemicals	2125	12.0	2375	11.3	1850	9.0
c) machinery	862	4.9	894	4.2	890	4.3
d) paper & its products	514	2.9	578	2.7	530	2.6
e) building materials	1872	10.6	2180	10.3	1600	7.8
f) light industry	486	2.7	495	2.3	420	2.0
g) food industry	825	4.7	870	4.1	660	3.2
h) rest of industry (plus auxiliaries in power plants)	646	3.6	1308	6.2	1080	5.2
2. CONSTRUCTION	460	2.6	539	2.6	360	1.7
3. TRANSPORT	2870	16.2	3247	15.4	3109	15.1
4. AGRICULTURE	1363	7.7	1748	8.3	1740	8.4
5. RESIDENTIAL	4896	27.6	5027	23.8	6151	29.8
LOSSES	425	2.4	468	2.2	1000	4.8
TOTAL CONSUMPTION	17715	100	21100	100	20620	100
Per capita (kg ce)	5330		5930		5513	

Table 6.3. Consumption of electricity in Lithuania

	1980 GWh	%	1985 GWh	%	1990 GWh	%
PRODUCTION	11665		20963		28405	
1. INDUSTRY	5500	47.6	7210	48.9	8040	48.9
a) oil refinery	50	0.4	250	1.7	460	2.8
b) industrial chemicals	1280	11.1	1460	9.9	1190	7.3
c) machinery	1030	8.9	1170	7.9	1250	7.6
d) paper & its products	460	4.0	530	3.6	560	3.4
e) building materials	810	7.0	850	5.8	900	5.5
f) light industry	520	4.5	600	4.1	610	3.7
g) food industry	330	2.9	440	3.0	480	2.9
h) rest of industry	1020	8.8	1910	13.0	2580	15.7
(includes auxiliaries in power plants)	* 882		1440		2108	
2. CONSTRUCTION	210	1.9	260	1.8	260	1.6
3. TRANSPORT	230	2.0	250	1.7	250	1.5
4. AGRICULTURE	1790	15.5	2300	15.6	2700	16.4
5. RESIDENTIAL	** 2460	21.3	3140	21.3	3640	22.2
LOSSES	1370	11.9	1560	10.6	1550	9.4
TOTAL CONSUMPTION	11560	100	14740	100	16430	100
Per capita (kWh)	3480		4145		4393	

* numbers according to Figure 6.3.
** for more detailed information about the residential sector, see Table 6.6.

Table 6.4. Heat consumption in Lithuania

	1980 PJ	%	1985 PJ	%	1990 PJ	%
1. INDUSTRY	67.44	54.5	80.29	55.2	68.90	48.2
a) oil refinery	1.46	1.2	5.94	4.1	7.24	5.1
b) industrial chemicals	11.72	9.5	14.06	9.7	12.22	8.5
c) machinery	10.13	8.2	10.67	7.3	9.63	6.7
d) paper & its products	8.08	6.5	9.38	6.5	7.70	5.4
e) building materials	10.13	8.2	10.63	7.3	9.25	6.5
f) light industry	8.00	6.5	7.87	5.4	5.53	7.9
g) food industry	10.21	8.3	13.81	9.5	11.01	7.7
h) rest of industry (plus auxiliaries in power plants)	7.70	6.2	7.91	5.4	6.32	4.4
2. CONSTRUCTION	4.10	3.3	6.03	4.1	3.14	2.2
3. TRANSPORT	1.88	1.5	3.01	2.1	1.72	1.2
4. AGRICULTURE	8.96	7.2	10.63	7.3	8.00	5.6
5. RESIDENTIAL	41.36	33.4	45.42	31.3	55.25	38.6
LOSSES					6.03	4.2
TOTAL CONSUMPTION	123.70	100	145.34	100	143.04	100
Per capita (MJ)	36.17		40.34		38.25	

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Table 6.5. Direct consumption in Lithuania

	1980 mill. kg ce	%	1985 mill. kg ce	%	1990 mill. kg ce	%
1. INDUSTRY	1934	25.4	2440	28.7	2151	28.4
a) oil refinery	93	1.2	278	3.4	746	9.8
b) industrial chemicals	82	1.1	255	3.0	104	1.4
c) machinery	138	1.8	109	1.3	96	1.3
d) paper & its products	51	0.8	44	0.5	57	0.8
e) building materials	1228	16.1	1502	17.6	964	12.7
f) light industry					22	0.3
g) food industry	318	4.2	180	2.1	74	1.0
h) rest of industry (plus auxiliaries in power plants)	24	0.3	72	0.8	88	1.1
2. CONSTRUCTION	221	2.9	220	2.6	154	207
3. TRANSPORT	2307	30.3	3050	35.8	3017	39.8
4. AGRICULTURE	687	9.0	637	7.5	639	8.4
5. RESIDENTIAL	2454	32.3	2170	25.5	1617	21.3
TOTAL CONSUMPTION	7607	100	8517	100	7578	100
Per capita (kg ce)	2290		2395		2026	

Lithuania also produces large amounts of mineral fertilizers, less only than Byelorussia (per capita). Instead of it the grains fertility is only about 2.5 t/ha. Sweden gets about 4 t/ha using half as much mineral fertilizers. Major European countries are decreasing production of this product due to high energy consumption and pollution of environment.

Lithuania traditionally was an agrarian country. Having in mind even the very low prices of agricultural products in 1988 the share of Lithuania's agriculture in the national income was 32%. The main part of this income was in cattle-breading (about 65%) and the rest in plant growing. Labour productivity and production efficiency in Lithuanian agriculture was 2-3 times higher than in the USSR. In 1989 Lithuania produced 144 kg of meat, 873 kg of milk, 883 kg of grain per capita. These figures are among the best in Europe. But there are many energy inefficient tractors and harvesters in our agriculture. The agriculture's share in Lithuanian energy balance exceeds 10% (including transport in agriculture). The main fuels here are diesel oil and gasoline. There also is a high electricity consumption in our agriculture. It is used in technological processes (treatment, drying, preservation of production) also for heating. So more than 21% of total electricity is consumed in agriculture. Complex mechanisation in agriculture has reached 90% of all poultry farms, 80% of pig farms, and 60% of cattle farms. The installed capacity of electric engines in the agriculture reached the same level as in the industry. An important trend in agriculture was the concentration of it's production in big farms. It increased fuel consumption in big boilers.

Residential energy consumption has been stable for the last 10 years but it's structure changed due to increase of electricity and heat consumption and decrease of direct consumption of fuel. In this area energy resources are used mainly for heating and cooling and hot water supply. Enormous demand in this area was caused also by enormous losses. These losses were caused by construction of new buildings with low heat resistance and an inefficient fuel and energy consumption in the heating and hot water supply systems. Devel-

opment of district heating systems was backed upon economy of material and energy resources. But consumers have no meters and regulators, and heat supply system workers weren't seeking for economy of energy resources. One can evaluate overconsumption of fuel comparing it's consumption in district and house heating systems. It shows that for heating and hot water supply in the district heating systems 1.5-1.7 times more fuel is consumed per square meter. In Table 6.5 one can find the direct consumption of fuel for house heating (residential).

Electricity use in the residential area isn't very intensive (1030 kWh/cap in towns and 800 kWh/cap in the country). And only about 42% of electricity used in the residential sector is consumed for households in towns and 61% in the country (Table 6.6). We lack domestic electric appliances: in 1985 washing machines possed by only 64%, vacuum cleaners 48%, and refrigerators 91% of all Lithuanian families.

Vehicles in Lithuania consume about 37% of directly consumed fuel. The main part of fuel was consumed in the road transport (about 60%), 19% in water transport, only 5% in railway transport (Table 6.7). The main fuel was gasoline 47%, diesel oil 32%, heavy oil 6% and other oilproducts 16%. Consumption of diesel oil is increasing due to an increasing number of vehicles with diesel engines. It enables to decrease total fuel consumption in transport. One could also notify an increase in the consumption of LPG in vehicles, but its share is negligible until now. The other important trend in transport is its electrification.

Table 6.6. Residential consumption of electricity

	1975 GWh	%	1980 GWh	%	1985 GWh	%	1990 GWh	%
URBAN AREA	1306	100	1809	100	2377	100	2668	100
Includes:								
Household	456	35	632	35	871	37	1163	44
Institutions, establ.	565	43	751	42	911	38	822	31
Street lighting	51	4	61	3	82	4	100	4
Water supply and sewerage	189	14	302	17	414	17	436	16
Other	44	3	61	3	99	4	147	5
RURAL AREA	412	100	607	100	766	100	977	100
Includes:								
Household	336	82	454	75	513	67	599	61
Public services	77	18	154	25	253	33	378	39

Table 6.7. Consumption of fuel in transport

	Year	Heavy oil th.t.	Heavy oil %	Diesel oil th.t	Diesel oil %	Gasoline th.t.	Gasoline %	Other* th.t.	Other* %	Total th.t.
Railway	1980	4	2.4	154	92.2	-	-	9	5.4	167
	1985	-	-	172	100	-	-	-	-	172
	1990	-	-	170	100	-	-	-	-	170
Water	1980	392	56.8	272	39.4	-	-	26	3.8	690
	1985	207	31.9	405	62.4	-	-	37	5.7	649
	1990	180	29.0	405	65.3	-	-	35	5.7	620
Road	1980	-	-	236	18.1	1062	81.4	7	0.5	1305
	1985	-	-	322	19.0	1355	80.2	13	0.8	1690
	1990	-	-	420	22.0	1470	77.0	20	1.0	1910
Total**	1980	396	17.2	667	28.9	1089	47.0	159	6.9	2307
	1985	207	6.8	919	30.1	1373	45.0	551	18.1	3050
	1990	180	5.6	1020	31.9	1490	46.6	510	15.9	3200

* includes kerosene, aviation gasoline, motor fuel, LPG
** includes also air and pipeline transport

6.3 Consumption of Primary Energy Sources

The fuel-mix of the primary energy consumption in Lithuania changed rapidly. In 1960 the main fuel were solid fuels (coal, peat, wood), their share was 70%, and about a half of the energy demand was met by domestic fuels. Oil and its products were used mainly for vehicles, their share was 22% (Figure 6.1). In the next 30 years energy demand in Lithuania rised 4 times and in 1989 we consumed 21 mill. tons of fuel (coal equivalent). Consumption of coal remained at the same level and now it equals only 6% of the total energy consumption. Domestic energy resources do not exceed 4% of total resources (Table 6.8). Untill the year 1985 the increase in energy demand was met by increasing consumption of oil products. Heavy fuel oil became the main type of fuel in the major large industry plants and factories, first of all in power plants, boilers, and cement works. Such a fuel structure was caused also by the development of district heating systems which enables efficient burning of solid and liquid fuel. An embargo of the oil supply to Lithuania from the Soviet Union side may easy paralyse the Lithuanian economy, because of the importance of this oil in our energy balance.

Since 1961 Lithuania has imported natural gas. But very slow construction of pipelines (main lines and distribution lines) hindered an increase of gas consumption. Besides, the major part of natural gas was supplied to the large consumers. So more than 80% of natural gas now is consumed in Lithuanian industry. Only few region centres are connected to the gas pipeline and only about a half of urban residents. Gas is mostly used for food preparing and only negligible amount are used for heating. This unreasonable fuel structure is brightly illustrated in Figure 6.2. One may see that natural gas is first of all used in large boilers whereas individual boilers uses coal. In decentralised heating system gas meets only less than 10% of total demand. We are looking for an increase of the natural gas share in the Lithuanian fuel budget. It will enable to supply this fuel mostly to small consumers.

Table 6.8. Primary energy consumption in Lithuania

	1980 mill. kg ce	%	1985 mill. kg ce	%	1990 mill. kg ce	%
1. COAL	1366	7.7	1159	5.5	1040	5.0
2. NATURAL GAS	3642	20.6	5163	24.5	6680	32.4
3. HEAVY FUEL OIL	7144	40.3	7149	33.9	4650	22.6
4. LIGHT FUEL OIL	426	2.4	494	2.3	600	2.9
5. DIESEL OIL	1874	10.6	1780	8.4	1630	7.9
6. GASOLINE	1557	8.8	1490	7.1	1470	7.1
7. LIQUIFIED GAS	173	1.0	203	1.0	210	1.0
8. OTHER IMPORTED FUELS	610	3.4	1752	8.3	1990	9.7
9. DOMESTIC ENERGY RES.	644	3.6	606	2.9	480	2.3
includes PEAT	157	0.9	81	0.4	30	0.1
WOOD	186	1.0	196	0.9	180	0.9
OTHER	301	1.7	329	1.6	270	1.3
10. HYDRO	153	0.9	124	0.6	120	0.6
11. WASTE HEAT	126	0.7	210	1.0	260	1.3
12. NUCLEAR	-		970	4.6	1490	7.2
TOTAL	17715	100	21100	100	20620	100

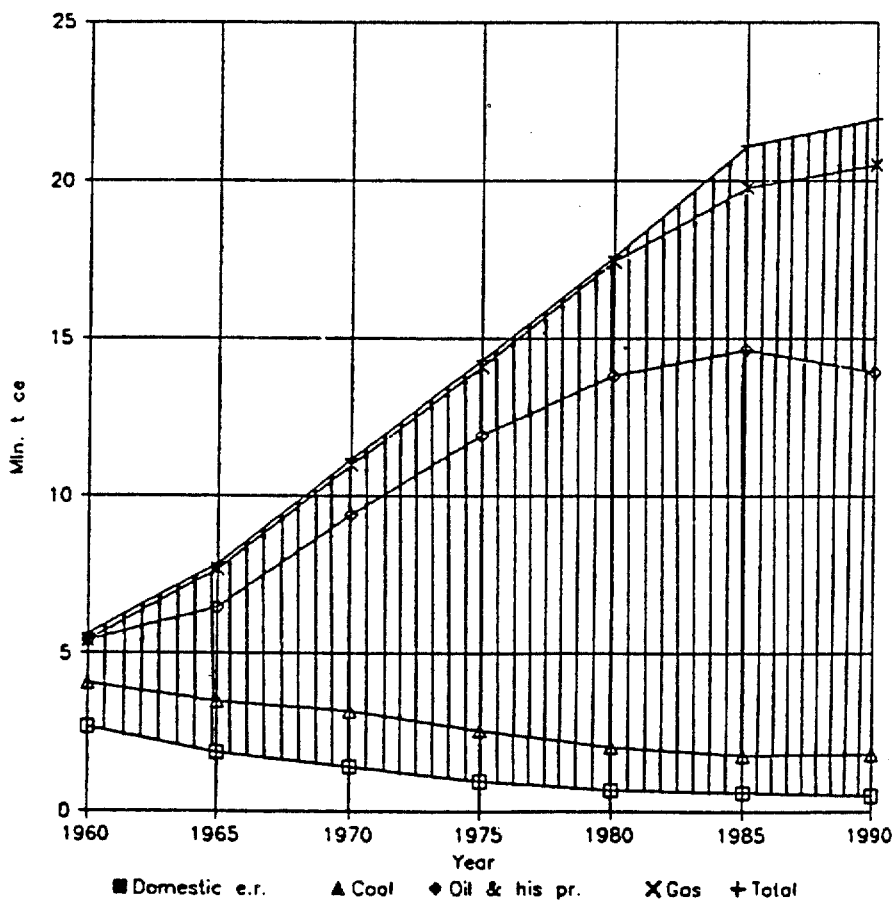

Figure 6.1. The primary energy consumption 1960-1990.

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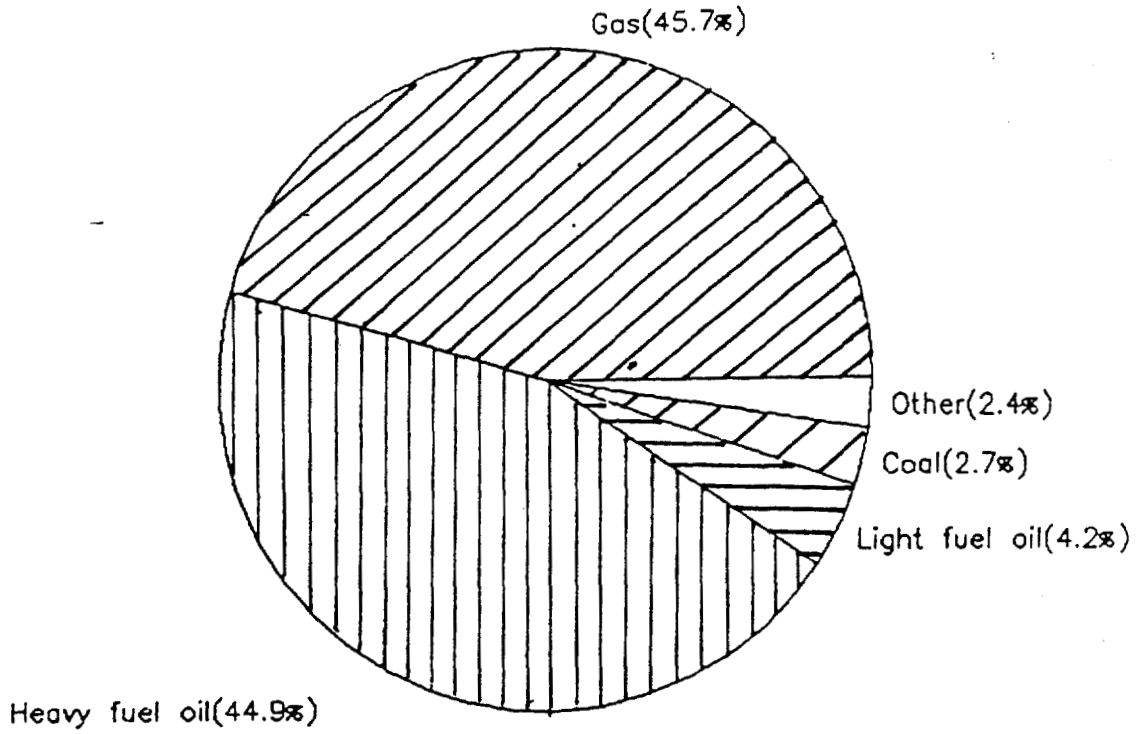

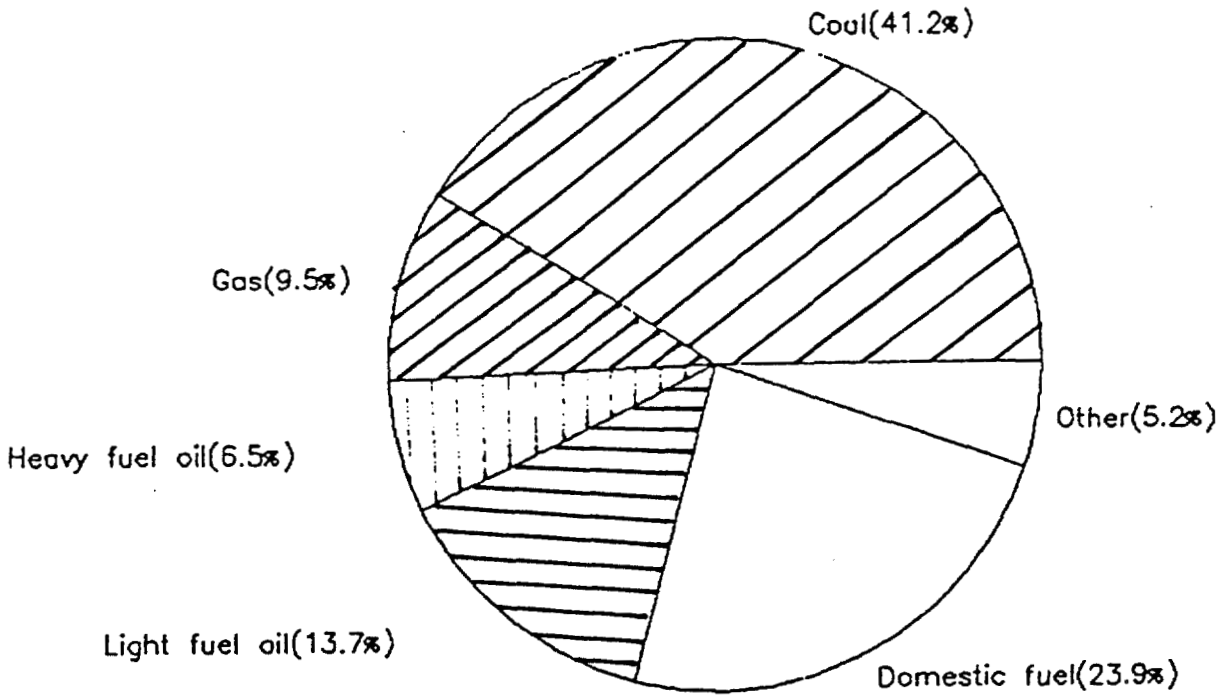

Figure 6.2. The structure of fuel consumption in centralized (above) and decentralized (below) heat and hot water supply. Total consumption of primary energy resources will not reach the planned level due to the consequences of the embargo from the USSR during the spring 1990. Stabilization of energy consumption and even its decrease in future is connected with serious restructuring of our economy.

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6.4 Production of Electricity and Heat

The most dynamic changes in Lithuania faces the electric power production and supply system. The most important are the Ignalina nuclear power station recently built, the Elektenai thermopower plant and the 4 combined heat and power plants (Table 6.9). The share of hydropower and small power plants in the Lithuanian power budget is decreasing. Construction of huge power plants in Lithuania was based on economy of expenditures and central planning for all the North-West region of the former USSR. So Lithuania always had overcapacity of electricity, in 1988 we exported 9.2 TWh (Figure 6.3). More than half of this export was to the East (Byelorussia) and the other part to the Kaliningrad region. The existing tariff system did not allow to get any additional income or even compensation for the environment pollution. This export also worsened economical indices of our energy system due to the huge share of losses and auxiliaries in power plants up to 26.6%.

Additionally the pumped storage power station near Kaunas is nearly completed. Its planned capacity 1.6 GW was based on the planned overcapacity of nuclear power at night and the need to store this electricity. After the total failure of the nuclear power programme in USSR the need for this power plant vanished and its possible capacity will not exceed 400-800 MW.

Overcapacity of power plants in Lithuania enabled also to create high energy consuming industries and to contruct large industrial plants. Ten of the biggest industrial plants consumes more than 40% of total electricity consumed in the industry.

There are 4 types of sources for heat and hot water supply in Lithuania:

1) combined heat and power plants.
2) boilers at industrial plants.
3) boilers for district heating.
4) other boilers.

More than 30% of the total heat consumption in Table 6.4 is produced in combined heat and power plants and about one third of it is consumed at industrial plants. For the other part of urban people connected to district heating systems heat is supplied from boilers (Table 6.10). These boilers produces 38% of the total consumption. Boilers in the biggest towns belong to the company »Lithuanian State Energy System« (formerly called »Litovener-

Table 6.9. Lithuanian power plants

Name	Capacity MW
Ignalina nuclear power station	2500
Elektrenai thermopower station	1800
Vilnius combined heating plant	384
Kaunas combined heating plant	190
Mazeikiai combined heating plant	210
Klaipeda combined heating plant	11
Kaunas hydropower station	101
Small hydropower plants	5
Other	51
TOTAL	5252

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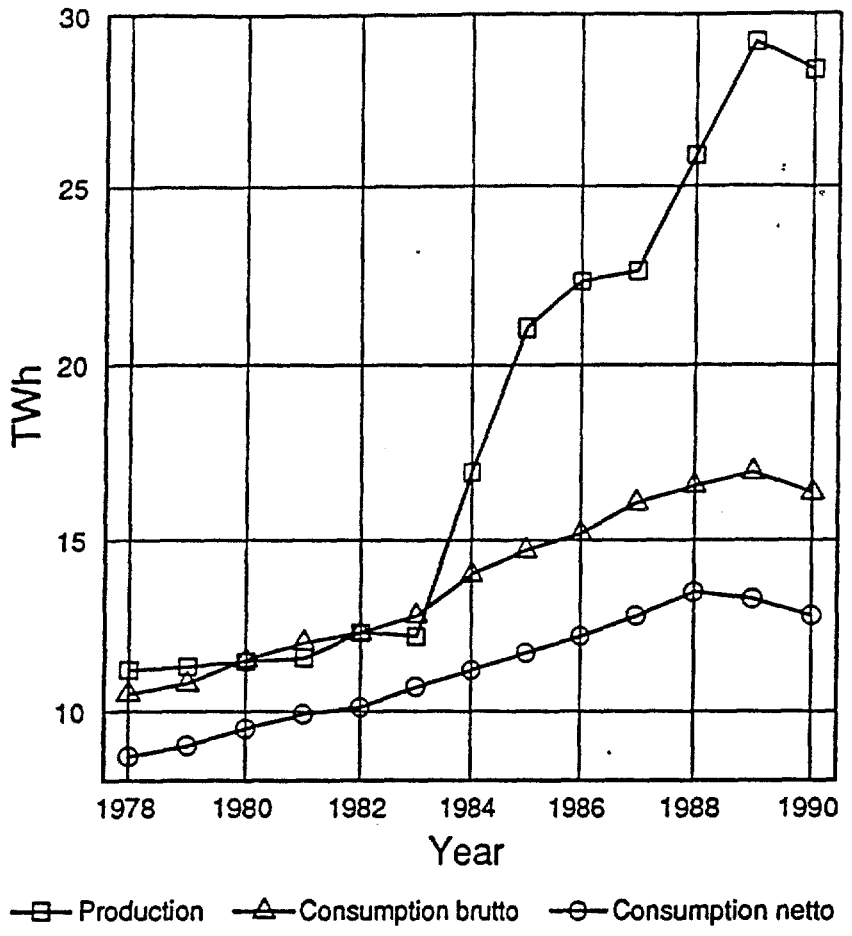

Figure 6.3. Electricity production and consumption including (brutto) and excluding (netto) network losses and auxiliaries used at power plants. Unit: TWh.

go«). Boilers in the region centres and other towns belong to the company »Siluma« (heat). The rest of boilers are distributed over all the Lithuania. They supply heat strictly to industrial plants, construction and agriculture enterprises.

The Mazeikiai refinery started to produce gasoline, diesel oil, heavy fuel oil and LPG in 1980. Now it also produces light heating fuel, kerosene and heavy fuel oil for export. From the waste gasses containing a sulphur hydrogen sulphur is produced. Two oil refining units and a bitumen producing unit are operating . A new equipment for a deeper refinement of raw oil has newly been installed. A production of gasoline without lead started last year. The total capacity of the Mazeikiai refinery is 12-13 mill. tons of crude oil per year which is now supplied by a pipeline from the former USSR. The refinery meets all the vehicles demand for fuel in Lithuania and also exports gasoline, diesel oil, heavy fuel oil and other products to Latvia, Estonia and the Kalinigrad region.

6.5 Local Energy Resources

The share of domestic energy resources in the contemporary budget of primary energy resources is only about 4%. The possible hydro power resources is more than 400 MW but we are using only about a one fourth of them.

Preservation, reconstruction and modernisation of small hydro power plants is needed. It is possible to arrange about 40 small hydro power plants at the existing ponds and 15 at the planned ponds. Their total capacity may be about 23 MW, with the total production of electricity about 115 GWh. It is

Table 6.10. List of district heating boilers

	Capacity GJ/h	Production TJ	Type of fuel
1. Vilnius	5108	10441	gas, heavy fuel oil
2. Marijampole	1215	2521	–
3. Kaunas	793	2143	–
4. Druskininkai	571	1184	–
5. Jonava	512	1382	–
6. Utena	1211	2456	heavy fuel oil
7. Alytus	2137	4434	gas, heavy fuel oil
8. Klaipeda	2462	6735	–
9. Varena	566	1174	heavy fuel oil
10. Taurage	352	963	–
11. Siauliai	2740	5081	gas, heavy fuel oil
12. Radviliskis	337	626	–
13. Mazeikiai	557	1034	heavy fuel oil
14. Panevezys	2545	5164	gas, heavy fuel oil
15. Kedainiai	404	820	–
16. Rokiskis	411	833	heavy fuel oil
17. Birstonas	96	199	gas
18. Palanga	511	1153	–
19. Neringa	54	102	light heating fuel
20. Birzai	205	380	heavy fuel oil
21. Ignalina	102	156	light heating fuel
22. Joniskis	114	238	–
23. Jurbarkas	200	193	heavy fuel oil
24. Kaisiadorys	178	309	gas
25. Kelme	88	140	light heating fuel
26. Klaipeda's reg.	142	228	gas, light heating fuel
27. Kretinga	84	212	gas
28. Kupiskis	28	2	light heating fuel
29. Lazdijai	135	110	gas, heavy fuel oil
30. Moletai	149	152	–
31. Pakruojis	96	121	light heating fuel
32. Pasvalys	63	101	–
33. Plunge	164	362	gas, light heating fuel
34. Prienai	168	250	light or heavy fuel oil
35. Raseiniai	130	164	light heating fuel
36. Skuodas	91	140	–
37. Sakiai	85	152	light or heavy fuel oil
38. Salcininkai	115	285	gas, light heating fuel
39. Siauliai's reg.	62	118	–
40. Silale	102	168	light heating fuel
41. Silute	179	445	light or heavy fuel oil
42. Sirvintos	126	257	gas
43. Svencionys	67	108	light heating fuel
44. Telsiai	195	438	gas, light heating fuel
45. Trakai	83	135	–
46. Ukmerge	162	367	gas
47. Vilkaviskis	145	245	light or heavy fuel oil
48. Vilnius' reg.	55	54	light heating fuel
49. Zarasai	107	163	–
Total		54638	

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also possible to install about 200 of micro hydro power plants at small ponds with total capacity from 5 to 10 MW. The main problem is lack of modern equipment for small and micro power plants.

Only about 100 mill. tons of peat is economically reasonable for exploitation. Due to the decrease of these resources peat is not supplied to power plants and boilers. It is used and should be used in future as raw material in Lithuanian industry and agriculture. About 60,000 tons of peat are also exported.

Forests cover about 28% of total area. But wood for fuel are used only in rural area. To increase consumption of fuelwood modern technologies are needed.

In the western part of Lithuania and on the sea shelf some limited oil resources are available. Economic evaluations suggest a possibility of pumping out about 1 mill. tons of oil per year. This oil is of very high quality and seems to be better suited for production of lubricant oil, since its price on the world market is significantly higher than for normal oil products.

Renewable energy resources in Lithuania entirely are not used at all. There are experimental wind mills, solar heating equipment and heat pumps. Resources of geothermical energy are also found.

6.6. Energy and Environment

The main environmental burden now are caused by industries, energy systems and transport. The Lithuanian environmental protection department claims more than 2 mill. tons of various emissions into the atmosphere due to fossil fuel burning. More than 75% of this amount are emissions from various vehicles and the rest is emissions from industry and power plants. The number of polluting plants exceeds 40 thousand. All these plants produce about 2 mill. t of pollutants, but the greater part of them are caught by cleaning equipments. The rest (about 20%) is emitted directly into the atmosphere. The total amount of emission from point sources in 1989 was 431 thousand tonnes. The main share of emission was sulphur dioxide 188 tonnes, CO 99 thousand tonnes, NOx 44 thousand tonnes, hydrocarbons 37 thousand tonnes, solid particles 41 thousand tonnes, and 23 thousand tonnes of other gas and liquid emissions (Table 6.11). The existing cleaning equipments remove 96% of solid particles. But only about 13% of nitrogen oxides and 5% of sulphur dioxide are removed.

Among stationary polluters the most polluting are power plants and boilers. They contribute more than 1/3 of all emissions into the atmosphere. The sulphur dioxide share from these sources in 1988 was 137 thousand tons, i.e. more than 65% of all the sulphur dioxide emitted. Emissions of nitrogen oxides were 24,000 tons (about 55% of total).

The emission from each power plant are shown in Table 6.11. The main fuel in power plants and big boilers is heavy fuel oil containing more than 2% of sulphur. It causes huge amounts of emissions. The biggest thermopower station in Elektrenai is burning about 2 mill. t of heavy fuel oil per year. It causes emissions consisting of 66,000 t of sulphur dioxide, 13,000 t of nitrogen oxides, 1,200 t of hard particles and other toxic products of combustion. A serious negative impact on the North-West region of Lithuania poses the Mazeikiai refinery. It emittes into the atmosphere 29,000 t of hydrocarbons, 14,000 t of sulphur dioxide, 5000 t of other liquid and gas pollutants (Table 6.11). The maximum permitted emissions of bensol, phenol, phormaldehyde and other toxic gases are also exceeded.

Table 6.11. Emissions to the air from point sources in Lithuania in 1989

1989 Tonnes	SO_2	NO_x	CO	CH	Solid Particles	Other Substances
Total point sources	188204	43720	98931	36661	40591	23030
Power plants total	98836	20396	126	1745		
– Elektrenai	66021	13040	–	–	1200	–
– Vilnius CHP	15774	3053	–	–	143	–
– Kaunas CHP	3722	2286	126	–	58	–
– Mazeikiai CHP	10980	1804	–	–	304	–
– Klaipedu CHP	2339	213	–	–	40	–
Mazeikiai oil refinery	13521	1994	1403	28748	80	3064
Boilers & industry	75847	21330	97400	7913	38766	19966

The Ignalina nuclear power station consists of two RBMK type reactors (like in Chernobyl, even more powerfull). Imperfections of these reactors design causes real danger of accidents. Geologists have found tectonic breakes a valid reason for earthquakes up to 7 grades by Richters scale. Also seriously affected is the largest Lithuanian lake which is cooling the reactors. The lake is overheated, some sorts of fish are starving and vanishing. Very serious is public discontent and fear of this station. In order to guarantee normal operating of the station and to calm people the scientific stations for seismic research and radioactivity monitoring are necessary. Spent fuel is stored inside the power plant and lack of room may create problems in the near future.

The mostly polluted areas are the cities Jonova, Mazeikiai, Kaunas, dangerous pollution level is in Vilnius, Klaipeda, Elektrenai and Kedainiai (Figure 6.4).

An improvement of environmental situation in Lithuania is possible with a planned increase of natural gas supply from the former USSR. The main pipeline Minsk-Vilnius is already built (additional line), but will the gas exploration in Yamal peninsular be succesful? If not, we badly need technologies for reducing sulphur and nitrogen emissions from oil. The best of all to introduce desulphurisation in the oil refinery. If such technologies are not available or too expensive then desulphurisation of effluent gases in power plants and boilers is urgent.

6.7 Import and Export of Energy and Fuel

Ties between Lithuanian energy systems and the ones of neighbour countries are very strong. They can be illustrated on electricity network (Figure 1.2). The main part of liquid and solid fuel is imported from the former USSR by railway. Some amount of coal (sometimes less, sometimes more) is imported from Poland. The ties in electricity production with the United North-West electrical system of the former USSR are very important. After establishing normal economical relations it will be possible to export electricity and to explore the existing power plants in an efficient way.

Natural gas is imported from the former USSR by pipelines and with the increasing consumption rises the problem of gas storage. It is possible to

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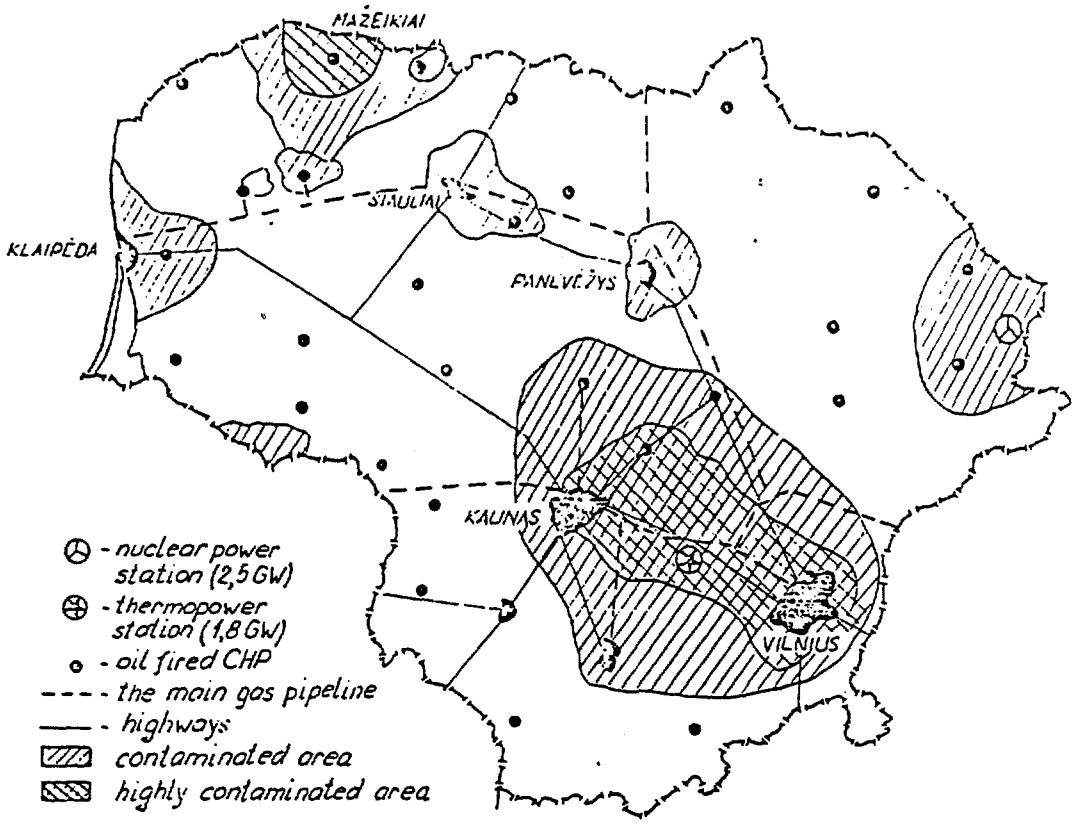

Figure 6.4. Map of the most polluted areas in Lithuania.

solve this problem in collaboration with Latvian colleagues because there are geological structures suited for the gas storage in latvia.

Now we are importing about 34 mill. tce. of energy resources, including 17 mill. tce of oil, 6.8 mill. tce of natural gas, 1.4 mill. tce of coal, 1.5 mill. tce of heavy fuel oil, 5 mill. tce of nuclear fuel. And we are exporting 9 TWh of electricity, 1.8 mill. tce of diesel oil, 2 mill. tce of gasoline, 0.6 mill. tce of heavy fuel oil.

6.8 Energy Prices

Some parts of energy systems are not operating in an efficient way, and some are unprofitable.

The newly created tariff system is based on the profitableness principle for the whole energy systems. After 35% profit reduction every plant would be guaranteed an average 15% profitableness. Such profitableness would enable a reliable fuel and energy supply to all the consumers. However, the new tariff system will significantly increase energy and fuel prices. So there arises a very serious problem of not worsening the level of life for the most of people.

6.9 The Main Energy Problems

Lithuania is seeking to reconstruct its economy and to preserve economic relations with the former USSR. It would be possible to import crude oil from the West to the Mazeikiai refinery if a pipeline from Klaipeda or Ventspils (in Latvia) was build. Natural gas is available only from the East.

In order to reconstruct our economy we need to seriously increase the efficiency of our energy systems. In the industry we have old and energy inefficient technologies which should be replaced. We may even have to diminish the production of high energy consuming products such as mineral fertilizers.

There are many problems in the heat and hot water supply systems: no meters, no regulators, huge losses in district heat supply systems, very bad insulation and building materials with low thermal resistance.

The share of renewable energy sources (wind, solar, wood) should also be increased.

Reduction of emissions from power plants is urgent. If possible oil products without sulphur should be produced at the Mazeikiai refinery.

Reliability of the nuclear power station should be increased and the possibility of its development analysed.

6.10 Cooperation with Nordic Countries

Lithuania is not able to solve its energy problems without foreign help. First of all, we are eager to know how energy systems operate in the Western countries, first of all, in the Nordic ones due to similar conditions.

We should learn to improve insulation of buildings and to apply new building materials. We need to establish joint ventures or to acquire technologies for production of heat meters and heat regulation systems, to acquire technologies for building materials with higher thermal resistance. The experience of Nordic countries may be very useful for us.

We are also investigating the possibilities of increasing the share of renewable energy resources in the total energy budget. The Danish experience in this field may be very useful for us.

We also are planning to install dozens of small and micro hydro power plants. Norway and Sweden may help us with their experience in this field. We also need modern equipment for these power plants.

Swedens experience in nuclear power may also be useful when improving reliability of the Ignalina nuclear power station.

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APPENDIX G
Energy Balances

ENERGY BALANCES

(Millions tons of oil equivalent) Lithuania

Oil 7.6
NG 4.8
12.4
@ $130/ton

Transactions	Total				
	1970	1975	1980	1985	1990
1. Primary production	1.104	0.855	2.699	10.774	13.447
2. Net trade	6.511	9.103	9.598	1.757	2.336 ⇒ $3.4x10^6
2.1. Imports	7.003	17.247	15.085	14.026	13.526 ⇒ $1.76x10^9
2.2. Exports	-0.464	-8.155	-5.484	-12.526	-10.901 ⇒ $1.45x10^9
2.3. Stock changes	-0.029	0.011	-0.003	0.257	-0.290
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	7.615	9.958	12.297	15.531	15.783
4. Electricity and heat generation	-1.370	-1.549	-2.015	-3.173	-3.844
4.1. Electricity generation	-1.062	-1.175	-1.523	-2.563	-3.267
4.2. Heat generation	-0.308	-0.374	-0.492	-0.610	-0.577
5. Other consumption	-0.450	-0.494	-0.504	-1.136	-1.255
6. Non-energy use	-0.297	-0.475	-0.875	-1.020	-0.901
7. Final consumption	5.498	7.442	8.901	10.202	9.783
7.1. Industry	1.592	2.727	3.247	4.112	3.636
7.2. Construction	0.194	0.225	0.230	0.223	0.205
7.3. Transport	1.187 ~~1.187~~	1.389 ~~1.202~~	1.749 ~~1.495~~	1.823 ~~1.535~~	1.714 ~~1.372~~
7.4. Agriculture	0.395	0.550	0.789	0.796	0.871
7.5. Households	0.964 ~~1.045~~	1.156 ~~1.343~~	1.487 ~~1.741~~	1.524 ~~1.810~~	1.993 ~~2.335~~
7.6. Other consumers	0.985	1.397	1.398	1.733	1.368

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ENERGY BALANCES

(Millions tons of oil equivalent)

Crude oil and oil refinery balances in Lithuania

Transactions	1980	1985	1989	1990
1. Primary production	-	-	-	0.004
2. Net trade	2.176	11.687	12.790	9.522
2.1. Imports	2.204	11.622	12.790	9.510
2.2. Exports	-	-	-	-
2.3. Stock changes	-0.028	0.064	-	0.012
3. Gross consumption	2.176	11.687	12.790	9.527
3.1. Other consumption	-	0.008	0.005	0.004
4. Oil refinery	2.176	11.679	12.785	9.522
5. Production				
5.1. Heavy fuel oil	1.156	5.647	5.626	3.195
5.2. Light fuel oil	-	0.018	0.322	0.424
5.3. Diesel oil	0.553	2.591	2.582	2.146
5.4. Jet kerosine	-	0.971	1.066	0.671
5.5. Gasoline	0.313	1.656	2.111	2.086
5.6. Liquified gas	-	0.197	0.272	0.264
6. Total liquid product	2.022	11.079	11.980	8.787
Share of %	92.92	94.86	93.70	92.28
7. Other product of oil and loss	0.155	0.600	0.805	0.737
share of %	7.12	5.14	6.30	7.73

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ENERGY BALANCES

(Millions tons of oil equivalent)

L i t h u a n i a

Transactions	Liquid fuels 1970	1975	1980	1985	1990
1. Primary production	-	-	2.036	11.119	9.372
2. Net trade	4.315	6.482	6.049	-2.166	-2.096
2.1. Imports	4.457	13.310	10.250	9.224	7.555
2.2 Exports	-0.154	-6.878	-4.237	-11.557	-9.336
2.3. Stock changes	0.011	0.050	0.036	0.166	-0.316
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	4.315	6.482	8.085	8.953	7.276
4. Electricity and heat generation	-2.004	-3.297	-4.293	-3.902	-2.533
4.1. Electricity generation	-1.503	-1.834	-2.345	-1.934	-0.885
4.2. Heat generation	-0.501	-1.463	-1.948	-1.968	-1.648
5. Other consumption	-0.152	-0.252	-0.179	-0.660	-0.705
6. Non-energy use	-0.006	-0.001	-0.004	-0.180	-0.230
7. Final consumption	2.153	2.932	3.608	4.210	3.808
7.1. Industry	0.475	0.915	1.100	1.564	1.192
7.2. Construction	0.097	0.129	0.147	0.150	0.096
7.3. Transport	1.255 ~~1.174~~	1.348 ~~1.151~~	1.674 ~~1.429~~	1.765 ~~1.171~~	1.652 ~~1.319~~
7.4. Agriculture	0.254	0.352	0.415	0.345	0.380
7.5. Households	0.032 ~~0.113~~	0.045 ~~0.232~~	0.087 ~~0.341~~	0.143 ~~0.437~~	0.281 ~~0.523~~
7.6. Other consumers	0.030	0.143	0.185	0.242	0.207

BEST AVAILABLE COPY

ENERGY BALANCES

(Millions tons of oil equivalent) Lithuania

Transactions	Solid fuels				
	1970	1975	1980	1985	1990
1. Primary production	0.978	0.710	0.477	0.461	0.360
2. Net trade	1.276	1.136	1.010	0.848	0.789
2.1. Imports	1.317	2.133	1.915	0.758	0.763
2.2. Export	-0.001	-1.008	-0.966	-0.001	-
2.3. Stock changes	-0.040	-0.039	-0.039	0.091	0.026
2.4. Marinc bunkers	-	-	-	-	-
3. Gross consumption	2.254	1.845	1.487	1.299	1.149
4. Electrisity and heat generation	-0.457	-0.304	0.216	-0.161	-0.102
4.1. Electrisity generation	-0.024	-0.005	-0.008	-0.006	-0.003
4.2. Heat generation	-0.433	-0.299	-0.208	-0.155	-0.099
5. Other consumption	-0.093	-0.033	-0.028	-0.019	-0.052
6. Non - energy use	-0.124	-0.087	-0.048	-0.055	-0.029
7. Final consumption	1.550	1.422	1.194	1.063	0.957
7.1. Industry	0.245	0.135	0.102	0.060	0.050
7.2. Construction	0.040	0.015	0.005	0.001	0.006
7.3. Transport	0.003	0.005	0.006	0.004	0.004
7.4. Agriculture	0.089	0.080	0.058	0.086	0.041
7.5. Other consumers	0.461	0.542	0.414	0.364	0.274
7.6. Households	0.742	0.644	0.606	0.548	0.592

BEST AVAILABLE COPY

ENERGY BALANCES

(Millions tons of oil equivalent)

L i t h u a n i a

Transactions	Gaseous fuels				
	1970	1975	1980	1985	1990
1. Primary production	-	-	-	-	-
2. Net trade	1.107	1.530	2.548	3.610	4.672
2.1. Imports	1.102	1.530	2.548	3.645	4.818
2.2 Exports	-	-	-	-0.004	-0.146
2.3. Stock changes	-	-	-	-	-
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	1.107	1.530	2.548	3.610	4.672
4. Electrisity and heat generation	-0.708	-0.756	-1.277	-2.191	-3.349
4.1. Electrisity generation	-0.070	-0.027	-0.078	-0.380	-1.315
4.2. Heat generation	-0.638	-0.729	-1.204	-1.811	-2.034
5. Other consumption	-0.040	-	-0.014	-0.070	-0.016
6. Non-energy use	-0.168	-0.387	-0.823	-0.755	-0.643
7. Final consumption	0.191	0.388	0.434	0.567	0.664
7.1. Industry	0.092	0.150	0.226	0.292	0.262
7.2. Construction	0.014	-	0.001	0.003	0.006
7.3. Transport	-	0.021	0.025	-	0.026
7 7.4. Agriculture	0.003	0.015	0.004	0.014	0.027
7.5. Households	0.038	0.075	0.106	0.147	0.220
7.6. Other consumers	0.034	0.126	0.072	0.111	0.123

BEST AVAILABLE COPY

ENERGY BALANCES
(Millions tons of oil equivalent)

L i t h u a n i a

Transactions	Nuclear energy				
	1970	1975	1980	1985	1
1. Primary production	-	-	-	1.974	3.4
2. Net trade	-	-	-	-	-
2.1. Imports	-	-	-	-	-
2.2. Exports	-	-	-	-	-
2.3. Stock changes	-	-	-	-	3.452 -
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	-	-	-	1.974	3.4
4. Electrisity and heat generation	-	-	-	-1.974	-3.4
4.1. Electrisity generation	-	-	-	-1.974	-3.4
4.2. Heat generation	-	-	-	-	-0.0
5. Other consumption	-	-	-	-	-
6. Non-energy use	-	-	-	-	-
7. Final consumption	-	-	-	-	-
7.1. Industry	-	-	-	-	-
7.2. Construction	-	-	-	-	-
7.3. Transport	-	-	-	-	-
7.4. Other consumers	-	-	-	-	-
7.5. Agriculture	-	-	-	-	-
7.6. Households	-	-	-	-	-

BEST AVAILABLE COPY

ENERGY BALANCES
(Millions tons of oil equivalent)

Lithuania

Transactions	Electricity				
	1970	1975	1980	1985	1990
1. Primary production	-	-	-	-	-
2. Net trade	-0.187	-0.044	-0.009	-0.535	-1.029
2.1. Imports	0.122	0.224	0.372	0.429	0.390
2.2. Exports	-0.309	-0.268	-0.381	-0.954	-1.420
2.3. Stock changes	-	-	-	-	-
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	-0.187	-0.044	-0.009	-0.535	-1.029
4. Electrisity and heat generation	0.633	0.773	1.003	1.803	2.443
4.1. Electirsity generation	0.633	0.773	1.003	1.803	2.443
4.2. Heat generation	-	-	-	-	-
5. Other consumption	-0.092	-0.120	-0.174	-0.260	-0.339
6. Non-energy use	-	-	-	-	-
7. Final consumption	0.354	0.609	0.819	1.008	1.075
7.1. Industry	0.212	0.358	0.416	0.496	0.486
7.2. Construction	0.006	0.009	0.018	0.022	0.022
7.3. Transport	0.009	0.015	0.020	0.021	0.021
7.4. Agriculture	0.036	0.080	0.154	0.193	0.232
7.5. Households	0.044	0.068	0.093	0.120	0.152
7.6. Other consumers	0.047	0.079	0.118	0.151	0.162

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ENERGY BALANCES

(Millions tons of oil equivalent)

Lithuania

Transactions	Hydro and geothermal energy				
	1970	1975	1980	1985	1990
1. Primary produkction	0.098	0.082	0.100	0.082	0.083
2. Net trade	-	-	-	-	-
2.1. Imports	-	-	-	-	-
2.2. Exports	-	-	-	-	-
2.3. Stock changes	-	-	-	-	-
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	0.098	0.082	0.100	0.082	0.083
4. Electrisity and heat generation	-0.098	-0.082	-0.100	-0.082	-0.083
4.1. Electrisity generation	-0.098	-0.082	-0.100	-0.082	-0.083
4.2. Heat generation	-	-	-	-	-
5. Other consumption	-	-	-	-	-
6. Non-energy use	-	-	-	-	-
7. Final consumption	-	-	-	-	-
7.1. Industry	-	-	-	-	-
7.2. Construction	-	-	-	-	-
7.3. Transport	-	-	-	-	-
7.4. Agriculture	-	-	-	-	-
7.5. Households	-	-	-	-	-
7.6. Other consumers	-	-	-	-	-

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ENERGY BALANCES
(Millions tons of oil equivalent)

Lithuania

Transactions	Other forms of energy				
	1970	1975	1980	1985	1990
1. Primary produktion	0.028	0.063	0.087	0.148	0.180
2. Net trade	-	-	-	-	-
2.1. Imports	-	-	-	-	-
2.2 Exports	-	-	-	-	-
2.3. Stock changes	-	-	-	-	-
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	0.028	0.063	0.087	0.188	0.180
4. Electrisity and heat generation	-0.028	-0.063	-0.087	-0.148	-0.180
4.1. Electrisity generation	-	-	-	-	-
4.2. Heat generation	-0.028	-0.063	-0.087	-0.148	-0.180
5. Other consumption	-	-	-	-	-
6. Non-energy use	-	-	-	-	-
7. Final consumption	-	-	-	-	-
7.1. Industry	-	-	-	-	-
7.2. Construction	-	-	-	-	-
7.3. Transport	-	-	-	-	-
7.4. Agriculture	-	-	-	-	-
7.5. Households	-	-	-	-	-
7.5. Other consumers	-	-	-	-	-

BEST AVAILABLE COPY

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ENERGY BALANCES
(Millions tons of oil equivalent)

Lithuania

Transactions	Steam and hot water 1970	1975	1980	1985	1990
1. Primary production	-	-	-	-	-
2. Net trade	-	-	-	-	-
2.1. Imports	-	-	-	-	-
2.2 Exports	-	-	-	-	-
2.3. Stock changes	-	-	-	-	-
2.4. Marine bunkers	-	-	-	-	-
3. Gross consumption	-	-	-	-	-
4. Electrisity and geat generation	1.292	2.180	2.955	3.472	3.417
4.1. Electrisity generation	-	-	-	-	-
4.2. Heat generation	1.292	2.180	2.955	3.472	3.417
5. Other consumption	-0.073	-0.089	-0.109	-0.119	-0.145
6. Non-energy use	-	-	-	-	-
7. Final consumption	1.219	2.092	1.845	3.354	3.272
7.1. Industry	0.658	1.169	1.403	1.700	1.646
7.2. Construction	0.036	0.071	0.058	0.047	0.074
7.3. Transport	0.001	0.0001	0.024	0.033	0.011
7.4. Agriculture	0.002	0.023	0.157	0.143	0.191
7.5. Households	0.099	0.323	0.595	0.566	0.748
7.6. Other consumers	0.413	0.506	0.609	0.865	0.602

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APPENDIX H
Lithuania Energy Prices

LITHUANIAN ENERGY PRICES as of 1-Jan-1992

exchange rate (roubles/US$) = 120

FUEL TYPES	PRICES	
Electricity	Roubles/Kwh	$US/kwh
Residential:		
day rate	0.35	0.0029
night rate*	0.16	0.0013
Other:		
demand charge**	150	1.25
use charge	0.30	0.0025
Export to:		
Byelorussia	0.36	0.0030
Latvia	0.35	0.0029
Kaliningrad	0.35	0.0029

*Applied to metered residents between 11pm to 7am.

**In the units Roubles/KW*yr and $US/KW*yr

Thermal Energy	Roubles/GJ	$US/GJ
Residential:		
space & water	11.46	0.10
Enterprises and other consumers:		
state firm	85.76	0.71
state energy system		
demand charge*	1648.35	13.74
use charge	42.04	0.35
Greenhouses, garages and studios:		
state firm	85.76	0.71
state energy system	50.17	0.42

*In the units Roubles per month for 1 GJ/hour.

Oil Products

Retail:

	Roubles/litre	Dollars/litre
Gasoline*		
76 octane	3.5	0.03
92 octane	4	0.03
Diesel,40-62 cetane	3	0.03

	Roubles/tonne	Dollars/tonne
Reactive fuel	1957	16.31
Boiler Fuel w/ ash	1268	10.56
Oil fuel, low ash	1270	10.58
Stove fuel for home	1877	15.64

*gasoline and deisel prices include a road and value added tax.

Wholesale:

	Roubles/tonne	Dollars/tonne
Gasoline		
76 octane noneth	1857	15.48
92 octane noneth	3080	25.67
92 octane ethylized	2195	18.29
Diesel		
40 cetane high Q	1825	15.21
62 cetane high Q	1825	15.21
40 cetane low Q	1775	14.79
62 cetane low Q	1775	14.79
Reactive fuel	1860	15.50
Boiler Fuel w/ ash	1170.5	9.75
Oil fuel, low ash	1172.5	9.77
Stove fuel for home	1785	14.88

Liquid Gas		
Residential:	Roubles per resident month	Dollars per Resident month
with gas stoves and hot H20.	8.93	0.074
with gas stoves but no hot H2O	14.92	0.12
for hot H2O	16.82	0.14
	Roubles/m^2 of floor*month	Dollars/m^2 of floor*month
for space heat	3.02	0.025
for greenhouses	26.27	0.22
Retail Prices:	Roubles/GJ	Dollars/GJ
propane and butane		
0.3kg cap. tank	31.34	0.26
2.05kg cap. tank	31.22	0.26
	Roubles/litre	Dollars/litre
LPG for vehicles	1.85	0.015
	Roubles/GJ	Dollars/GJ
LPG for vehicles	75.2	0.63
	Roubles/tonne	Dollars/tonne
liquid gas from distrib stations	2130	17.75
	Roubles/GJ	Dollars/GJ
liquid gas from distrib stations	46.81	0.39
Wholesale Prices:	Roubles/tonne	Dollars/tonne
Propane-butane mix	1775	14.79
Technical Butane	1775	14.79
LPG for Vehicles	1785	14.88
Butane	1795	14.96
Isobutane	2350	19.58
Propane-propilane	1783	14.85

APPENDIX I
Net Material Product

LITHUANIA: NET MATERIAL PRODUCT
(in millions of roubles; base year)

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Total	5777.2	5741.9	6158.9	6384.2	6564.2	6907.1	7177.9	7465.4	8150.3	8853.4		
I. Personal consumption of material values and services	4.563.2	4.752.4	4.816.5	4.903.4	5.101.5	5.349.0	5.493.9	5.704.1	6.187.5	6.739.1		
Food, beverages and tobacco	2.428.1	2.589.2	2.690.4	2.759.9	2.848.5	2.916.7	2.959.3	3.161.1	3.695.4	3.978.5		
Clothing, foot-wear and haberdashery	1059.7	1129.9	1035.7	1036.7	1096.6	1149.8	1142.4	1206.2	1307.2	1421.1		
II. Paid services	403.0	418.8	440.0	460.4	486.3	512.9	548.2	589.2	663.5	741.7		
Housing	131.1	139.0	151.3	160.9	174.7	192.4	209.4	215.4	243.9	247.7		
Transportation	151.8	158.0	160.8	165.4	169.2	170.1	177.1	183.2	188.9	204.6		
Communication	29.0	30.6	38.6	36.0	39.9	41.7	42.5	46.6	54.1	61.4		
Education	22.6	22.8	23.5	23.2	23.3	24.7	24.7	26.9	25.5	27.3		
Other	68.5	68.4	65.8	74.9	79.2	84.0	94.5	117.1	160.1	200.7		
III. Unpaid services	911.0	850.5	902.4	940.4	976.4	1.045.2	1.135.8	1.172.1	1.299.3	1.372.6		

Table A1 Table 1

LITHUANIA: NET MATERIAL PRODUCT
(in millions of roubles at current prices)

	1970	1975	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Net material Product	4.204.5	5.368.5	5.867.0	6.463.9	7.011.4	7.240.6	7.424.1	7.513.7	7.922.1	8.279.9	8.912.5	9.549.8	9.997.2
By final use													
Consumption	2.930.2	3.934.2	5.166.4	5.373.8	5.492.3	5.632.3	5.868.3	6.189.3	6.378.7	6.551.7	7.173.5	7.759.6	
Of which:													
Personal consumption	2.726.8	3.501.8	4.553.2	4.752.4	4.816.5	4.903.4	5.101.5	5.349.4	5.493.9	5.704.1	6.187.5	6.739.1	
Social consumption	253.4	432.4	613.2	621.4	675.8	728.9	766.8	839.9	884.8	947.6	986.0	1.020.7	
Accumulation	1.261.9	1.516:6	1.149.0	1.543.1	1.825.0	1.682.7	[illegible]	1.829.0	2.186.5	2.064.8	2.642.1	2.301.4	
Net fixed investment	727.4	1.044.2	861.5	793.4	887.7	914.4	[illegible]	1.160.0	1.274.0	1.772.0	1.325.0	1.209.0	
Others	474.5	472.1	287.5	749.7	1.017.3	758.3	967.5	729.0	914.5	292.8	1.317.1	1.092.4	
Of which:													
Change in stocks	424.5	509.3	378.7	737.5	957.7	784.3	893.1	684.0	759.5	599.7	910.6	818.4	
Unfinished construction	50.0	-36.9	-91.2	12.2	59.6	-16.0	74.4	45.0	155.0	-306.9	406.5	274.0	
Foreign balance	10.9	125.3	499.5	515.5	375.4	163.1	449.5	620.8	751.5	549.7	1.017.1	625.7	
Exports of goods and non-factor services	x	x	x	x	x	x	x	x	x	x	x	x	
Imports of goods and non-factor services	x	x	x	x	x	x	x	x	x	x	x	x	
Losses on fixed capital and stocs	33.3	43.0	51.1	62.5	69.5	88.7	52.7	116.2	186.4	113.1	114.0	114.3	
Net material Product per capita (roubles)	1.336.0	1.623.0	1.715.0	1.878.0	2.022.0	2.071.0	2.106.0	2.113.0	2.206.0	2.281.0	2.429.0	2.577.0	

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Table A1. Lithuanin: National Accounts (Own Methodology)
(in millions of roubles at current prices)

	1970	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Material product produced													
I. Gross social product	9.578.5	15.564.7	16.507.3	17.924.4	18.623.1	19.546.6	20.169.1	21.139.6	22.214.6	23.588.7	24.835.8	25.097.1	34.006.8
Industry	5.183.5	9.335.5	9.755.4	10.629.9	10.509.4	10.776.5	11.074.3	11.782.3	12.558.7	13.053.5	13.892.7	13.554.1	23.346.9
Construction	947.8	1.449.7	1.458.5	1.600.2	1.717.2	1.941.4	2.065.0	2.102.7	2.446.4	2.502.2	2.567.6	2.536.8	2.003.9
Agriculture	2.644.4	3.039.9	3.399.3	3.686.4	4.331.6	4.683.4	4.775.1	4.985.7	4.939.3	5.564.5	5.917.9	6.335.1	5.390.0
Forestry	5.8	6.8	6.2	7.3	7.7	7.4	18.3	19.1	19.4	22.3	23.0	21.1	15.9
Transport and communication	258.2	506.0	530.3	584.2	588.0	595.9	715.9	770.7	765.4	830.0	865.3	988.4	985.7
Commerce and catering	221.3	431.3	452.9	450.1	461.6	485.2	506.2	528.6	541.1	605.3	672.4	760.1	1.259.1
Material-technical services	43.2	88.4	116.1	122.8	124.5	145.8	179.1	172.7	190.2	200.8	202.5	192.0	362.2
Purveyance	38.9	72.3	78.0	71.0	74.3	79.9	85.6	80.7	83.4	74.7	97.8	101.9	67.3
Other material production	62.5	71.5	72.7	78.0	78.6	78.7	84.6	83.6	86.1	180.0	138.8	230.2	269.3
Information-statistical services	-	-	-	-	-	-	33.0	31.2	36.6	42.7	57.1	75.0	62.0
Payments from Foreign Trade Organizations	172.9	563.3	645.9	694.5	730.2	752.4	631.4	582.3	548.0	512.7	400.7	302.4	244.5
II. Material inputs	5.374.0	9.697.7	10.043.4	10.913.0	11.382.5	12.122.5	12.655.4	13.217.5	13.934.7	14.676.2	15.286.0	15.099.9	18.865.9
Industry	3.669.9	6.662.1	6.923.2	7.628.6	7.884.8	8.383.1	8.627.4	9.002.3	9.499.5	9.980.2	10.411.9	10.147.4	14.316.0
Construction	516.1	773.7	761.3	850.2	926.9	1.030.2	1.039.4	1.088.2	1.273.0	1.277.6	1.317.1	1.198.5	992.7
Agriculture	1.030.8	1.913.8	1.995.1	2.035.9	2.180.8	2.299.5	2.452.8	2.563.9	2.560.1	2 754.6	2.889.2	3.004.8	2.671.2
Forestry	.7	.8	.7	.8	.9	.8	7.9	8.3	8.3	9.2	9.5	8.7	6.6
Transport and communication	93.3	226.6	235.8	255.7	244.4	253.8	348.7	367.6	381.4	395.5	404.7	402.5	275.1
Commerce and catering	40.2	78.7	82.7	88.5	90.8	96.3	104.8	109.9	128.7	133.9	142.0	161.5	378.8
Material-technical services	6.0	12.8	13.0	14.8	15.8	16.4	17.6	18.6	20.6	21.8	23.8	25.7	47.5
Purveyance	6.2	12.2	13.6	14.4	15.4	16.6	20.5	19.4	19.9	14.3	22.3	25.7	47.5
Other material production	10.8	17.0	18.0	24.1	22.7	25.8	26.7	28.3	29.6	72.3	44.1	84.3	125.8
Information-statistical services	-	-	-	-	-	-	9.6	11.0	13.6	16.8	21.4	37.4	32.9
Payments from Foreign Trade Organizations	-	-	-	-	-	-	.0	.0	.0	.0	.0	.0	.0
III. Net material product	4.204.5	5.867.0	6.463.9	7.011.4	7.240.6	7.424.1	7.513.7	7.922.1	8.279.9	8.912.5	9.549.8	9.997.2	15.140.9
Industry	1.513.6	2.673.4	2.832.2	3.001.3	2.624.6	2.393.4	2.446.9	2.780.0	3.059.2	3.073.3	3.480.8	3.406.7	9.030.9
Construction	431.7	676.0	689.2	750.0	790.3	911.2	1.025.6	1.014.5	1.173.4	1.224.6	1.250.5	1.338.3	1.011.2
Agriculture	1.613.6	1.126.1	1.404.2	1.650.5	2.150.8	2.383.9	2.322.3	2.421.8	2.379.2	2.809.9	3.028.7	3.330.3	2.718.8
Forestry	5.1	6.0	5.5	6.5	6.8	6.6	10.4	10.8	11.1	13.1	13.5	12.4	9.3
Transport and communication	164.9	279.4	294.5	328.5	343.[illegible]	342.1	367.2	403.1	384.8	434.5	460.6	585.9	710.6
Commerce and catering	181.1	352.6	370.2	361.6	370.[illegible]	368.9	[illegible]	418.7	412.4	471.4	530.4	598.6	887.[illegible]
Material-technical services	37.2	75.6	103.1	108.0	108.7	129.4	[illegible]	154.1	169.6	179.0	178.7	166.3	314.7
Purveyance	32.7	60.1	64.4	56.6	56.9	63.3	65.1	61.3	63.5	60.4	75.5	76.2	19.[illegible]
Other material production	51.7	54.5	54.7	53.9	55.9	52.9	57.9	55.3	56.5	117.7	94.7	145.9	143.5
Information-statistical services	-	-	-	-	-	-	23.4	20.2	23	25.9	35.7	37.6	29.1
Payments from Foreign Trade Organizations	172.9	563.3	645.9	694.5	730.2	752.4	631.4	582.3	548	512.7	400.7	302.4	244.5
Exports of goods & services													
Imports of goods & services													

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Table A1. Lithuania: National Accounts (Own Methodology) (Concluded)
(in millions of roubles at current prices)

	1970	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
IV. Settlement of accounts with other republics	10.9	499.5	515.5	375.4	163.1	449.5	620.8	751.5	549.7	1.017.1	625.7		
V. Total source of net material product (III+IV)	4.215.4	6.366.5	6.979.4	7.386.8	7.403.7	7.873.6	8.134.5	8.673.6	8.829.6	9.929.6	10.175.5		
Use of material product for consumption and accumulation													
VI. Personal consumption (non-production consumption)	2.726.8	4.553.2	4.752.4	4.816.5	4.903.4	5.101.5	5.349.4	5.493.9	5.704.1	6.187.5	6.739.1		
VII. Social consumption	253.4	603.2	621.4	675.8	728.9	766.8	839.9	884.8	947.6	986.0	1.020.7		
Cultural-household services	210.2	493.7	512.8	546.2	593.4	618.4	664.5	705.3	763.2	781.7	814.5		
Educational and government services	43.2	109.5	108.6	129.6	135.5	148.4	175.4	179.3	184.4	204.3	206.1		
VIII. Growth of fixed capital funds	727.4	861.5	799.4	807.7	914.4	985.1	1.100.0	1.274.0	1.772.0	1.325.0	1.209.0		
Industry	476.4	548.5	747.4	466.7	501.4	490.1	552.0	640.0	1.137.0	652.0	633.0		
Nonindustrial funds	257.0	313.0	319.0	341.0	413.0	495.0	548.0	634.0	635.0	700.0	576.0		
IX. Changes in stocks (material turnover funds and reserves growth)	474.5	287.5	749.7	1.017.3	760.3	967.5	729.0	914.5	292.0	1.317.1	1.092.4		
X. Losses	33.3	51.1	62.5	69.5	88.7	52.7	116.2	106.4	113.1	114.0	114.3		
XI. Total use of net material product (VI-X)	4.215.4	6.366.5	6.979.4	7.386.6	7.403.7	7.873.6	8.134.5	8.673.6	8.829.6	9.929.6	10.175.5		

Table 1. Lithuanina: Exports and Imports of Goods 1/
(In millions of rubles)

	Exports of goods to:			Imports of goods from:			Trade balance:		
	Republics 2/	Foreign Cntrys 3/	Total	Republics 2/	Foreign Cntrys 3/	Total	Republics 2/	Foreign Cntrys 3/	Total
1968									
1969									
1970									
1971									
1972	2767	254	3020	2750	508	3258	17	-255	-238
1973									
1974									
1975									
1976									
1977	3537	222	3759	3725	683	4409	-187	-461	-649
1978									
1979									
1980									
1981									
1982	4238	574	4812	4734	1148	5882	-496	-574	-1070
1983									
1984									
1985									
1986									
1987	5387	483	5870	5860	1103	6963	-473	-625	-1098
1988	5421	537	5959	6239	1249	7488	-818	-722	-1530
1989	5850	475	6325	5763	1563	7352	61	-1087	-1026
1990	5366	386	5772	5210	809	6019	176	-424	-247
1991*	4307	219	4526	3411	357	3768	896	-137	758
1991**	8194	345	8538	4819	---	---	3375	---	---

* 1st half 1991.

** 1st nine months of 1991.

1/ Both foreign and domestic trade figures include the effects of domestic taxes and subsidies.

2/ Including Latvia and Estonia.

3/ Exchange rate used to covert foreign currency into rubles:

1987 64.90k/US$
1988 60.81k/US$
1989 63.04k/US$
1990 58.47k/US$
1991 57.45k/US$

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APPENDIX J
Energy Conservation Decision-Making Survey Results

ENERGY CONSERVATION DECISION-MAKING SURVEY FOR LITHUANIA

VILNIUS, LITHUANIA

APRILL 1992

PREPARED BY: CONSULTING COMPANY NEGA W

JUSTINISKIU 36-7
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I. Executive Summary

Consulting Company Nega W is the technical assistance contractor for the Industrial Energy Efficiecy Component (IEEC) of the Resource Management Associates of Madison, Inc. (RMA) which works under U.S. Agency for International Development (USAID) designed the Eastern Europe Emergency Energy Program in Lithuania.

This report describes the energy conservation decision-making survey that was performed from April 20 to April 24, 1992 in four industrial plants in Lithuania. The plants:

- Vilnius Sweets Plant
- Vilnius Furniture Factory
- Alytus Wood Products Plant
- Kaunas Ceramics Factory

are judged to be typical energy users for this range of facility.

The survey was performed according questionary got from Team Leader Mr. Michael Ellis from Resource Management Associates of Madison, Inc. (RMA) and contain basically three components:

A. The raw data forms translated into English.

B. A summary of the responses prepared according to the sequential list of questions.

C. An analysis of what the responses indicate regarding potential Lithuanian government policy initiatives.

A. RAW DATA FORMS

Raw data forms are presented in complete:

- Vilnius Sweets Plant
- Vilnius Furniture Factory
- Alytus Wood Products Plant
- Kaunas Ceramics Factory

Name of Plant Vilnius Sweets Date APRIL 16, 1992
Name of Firm _____

ENERGY CONSERVATION DECISION-MAKING SURVEY FOR LITHUANIA
(for personal interview)

This survey is being conducted as part of the USAID Emergency Energy Program for Lithuania. The purpose of this survey is to understand what factors influence decisions to implement energy conserving measures in those plants where energy audits were conducted for this program and when appropriate in the entire firm. Therefore, questions in this survey that can not be answered at the plant level will be directed towards the appropriate person(s) at the firm level. (The distinction between plant and firm is intended to distinguish between management at the local level--i.e. plant management--and management at a higher level that may be located at some other part of the country or outside of the country--i.e. firm management. It is recognized that this distinction may not apply as easily to other industries.) Throughout this survey, "implementation of energy conserving measures" refers to both optimization of energy use through improved energy management practices and installation of energy conserving equipment.

1. Can you please tell me your name and title?

JUODKAZIS ALGIRDAS-ALEKSAS, TECHNICAL DIRECTOR

2. Briefly describe your job responsibilities.

TECHNICAL STATE OF THE PLANT

The first set of questions ask about this plant's characteristics.

3. How many full-time employees work at this plant? 755

4. Ownership. Which description best fits this plant?

- ✓ State Enterprise RULED BY MINISTRY OF AGRICULTURE
- __ Cooperative
- __ Private (Please describe ownership. Circle correct one below.)

Sole proprietor Partnership Subsidiary of foreign firm

Subsidiary of Lithuanian firm Investor-owned firm

5. How many plants are part of this firm?

TWO - CANDY AND BISCUT PLANT. BOTH LOCATED IN VILNIUS TOWN.

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6. **Approximately, what is the annual production quantity of this plant in Rubles and in physical units (if available) such as tons? What percent of production capacity does this represent? If this is less than capacity, why?**

1990 - 46602 THOUSAND ROUBLES, 18632 TONS - 78% OF CAPACITY
DUE TO THE LACK OF IMPORTED MATERIALS

7. **Approximately what percentage of your plant's total operating cost goes towards energy bills? (Operating costs include all labor, materials, capital depreciation, taxes and so forth)**

2.64% - NOW, 1.2% IN 1991

8. **Approximately, how much did this plant spend in Rubles in 1990 for the following sources of energy?**

Electricity 93800 ROUBLES
Fuel oil -
Coal -
Natural Gas 85000 ROUBLES
Thermal -
Coke -
Other (please specify) -

Please break electrical consumption into peak and off-peak consumption if available. Also, indicate any payments of penalties, indicating the type of penalties.

1100 KW FOR 3 HOURS, 800 KW FOR 13 HOURS. NO PENALTIES PAYMENT

This next set of questions asks about how you or other people in this plant receive information regarding energy conservation and how energy conserving measures were or could be implemented in this plant.

9. **How did or does this plant identify whether energy efficient measures could be taken in this plant?**
DO NOT GIVE LIST USE FOR PROMPTING ONLY

- V Through Energy Inspectorate audits TILL 1989
- V Through own plant monitoring by plant engineers NOW
- __ Through own plant audits
- __ Through outside engineering/consulting audits
- __ Through inspection by the firm's engineers or management
- __ Through own plant management's inspection
- __ All of the above
- __ Other (please specify)_____
- __ Do not know

10. **Are there persons in this plant who are responsible for implementing energy conserving measures in this plant? IF YES, indicate their name, title, and responsibilities.**

EDVARDAS ARLAUSKAS, CHIEF ENERGY MANAGER - ELECTRICITY
ALFREDAS SAMERDOKAS, CHIEF OF BOILER PLANT - THERMAL ENERGY AND WATER

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11. **From what sources does this plant receive information about energy conserving measures? (Please List)**
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Energy Inspectorate
__ Outside Engineering Firms
V Similar firms in the industry
__ Industry organizations
V Engineering/technical magazines
__ Other magazines
V Other (please specify) PREPARATION FOR WINTER SEASON REPORTS
__ Do not know

12. **Do you know if the government offers any incentives for conserving energy?**
IF YES... Please specify the types of incentives.
STRICTENING CODES FOR THERMAL RESISTANCE OF BUILDINGS

13. **Do you know of any government policies that would prohibit this plant from implementing energy conservation?**
IF YES ..... Please specify.
~~STRICTENING CODES FOR THERMAL RESISTENCE OF THE BUILDINGS~~
DIFFERENT TARIFFS FOR INDUSTRY AND RESIDENTIAL SECTOR FOR THERMAL ENERGY WITHOUT SUBSIDIES FOR FUEL

This next set of questions asks about your plant's actions to reduce energy use.

14. **Has this plant made any capital investments to reduce your energy costs within the last 5 years?**

(Yes)
No

IF "YES" ... CONTINUE TO NEXT QUESTION.
IF "NO" ..... GO TO FOLLOWING PAGE (PAGE 5, QUESTION 19.)

15. **What was the approximate total cost (including installation, financing, taxes, etc.) of these investments?**
500 000 ROUBLES - 3,3% ANUAL EXPENSES

16. **Which of these investments do you think have been most effective in reducing energy cost at this plant?**

Action 1: AUTOMATIC CONTROL OF COMBUSTION IN BOILERS
Action 2: AUTOMATION OF AIR COMPRESSORS WORK
Action 3: TECHNOLOGICAL IMPROVEMENTS

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17. **Were any of these investments part of a larger project?**
IF YES.... Which ones?

NO

18. **What were the main reasons why this firm invested in energy conserving equipment?**

IMPROVE WORKING CONDITIONS AND LOWER ENERGY COST, INCREASE RELIABILITY

IF ANSWERED "NO" TO QUESTION 14 ABOVE. START HERE.

19. **Please specify who would do (or did) the technical analysis for an energy conservation project in this plant?**

PERSONNEL OF THE PLANT DID, WITH SOME ADVICE FROM ENERGY INSPECTION, BOARD OF GAS SUPPLIERS, ASSOCIATION OF INVENTORS

20. **Please specify who would do (or did) the economic analysis for an energy conservation project in this plant?**

PLANTS TECHNICAL SERVICE IN COOPERATION WITH ECONOMICS SERVICE. RATIFICATES - SPECIAL COMMISSION.

21. **What economic analysis method(s) does this plant (or firm) use most when evaluating energy conservation projects?**

- ✓ Simple payback
- __ Discounted payback
- __ Internal rate of return
- __ Net present value
- __ Life cycle cost analysis
- __ Other (please specify) _____
- __ Do not know

22. **Do you have minimum economic criterion for any of the methods you mentioned above, which the project must meet in order to be approved?**
IF YES.....What are they?

✓ Simple payback - Number of years? 3-5
Discounted payback - What is the discount rate? ____
Internal rate of return - What is the rate? ____
Positive net present value - What is the discount rate? ____

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Other - Please specify ____

23. **If you were to (did) invest in an energy conservation project costing more than 10 million Rubles, how would (did) this plant usually pay for this?**
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Government pays for investment
__ Plant's cash flow
V Requires a loan from a bank or other lender
V Other (please specify) APPLY FOR THE FUNDING FROM CONSUMERS
__ Do not know

24. **Who or what department in this plant makes the final decision on energy efficiency investments?**

UP TO 500000 - TECHNICAL DIRECTOR, IF MORE - BOARD OF DIRECTORS. THEN GENERAL DIRECTOR RATIFICATES.

25. **Is this the same person or persons who make the final decisions on all other investments?**

YES

26. **Which of the following energy conserving technologies could be or has been installed in your plant?**
(Indicate Y = yes or N = no, or NA = not applicable)

	has been	could be
Combustion Control system	Y	Y
Waste Heat Recovery	Y	Y
Improvements to Steam Systems	~~N~~	~~Y~~
Insulation	Y	Y
Cogeneration System	NA	
Energy Efficient Lighting	Y	Y
Other (please specify)		
FREEZING CHAMBERS IMPROVEMENT		Y

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The next set of questions ask about the reasons why your plant did not or would not invest in energy efficiency projects.

26. Please tell me how important, on a scale from 1 to 5 where 1 is Very important and 5 is Not important, the following factors are in prohibiting this plant's investment in energy efficiency?

		Very Important				Not Important
1.	Lack of technical information.	1	(2)	3	4	5
2.	Lack of information on performance of new systems in other companies.	1	2	(3)	4	5
3.	Lack of information on performance of new systems in other countries.	(1)	2	3	4	5
4.	Lack of available energy efficient equipment in Lithuania.	(1)	2	3	4	5
5.	Lack of available technical expertise within this plant.	1	2	(3)	4	5
6.	Lack of available technical expertise in Lithuania.	1	(2)	3	4	5
7.	Lack of available capital (Rouble) to invest in energy-efficient equipment.	(1)	2	3	4	5
8.	Lack of government funds available for investment in conservation.	1	(2)	3	4	5
9.	Lack of information about future energy prices.	(1)	2	3	4	5
10.	Projects which do not meet economic acceptance criteria.	(1)	2	3	4	5
11.	Lack of time to evaluate potential projects.	1	2	3	(4)	5
12.	Uncertainty about availability of future energy supplies.	(1)	2	3	4	5
13.	Inability to interrupt production in order to make energy efficiency improvements.	1	2	3	(4)	5
14.	Lack of any real potential for additional conservation.	1	2	3	4	(5)
15.	Energy costs are only a small portion of operating costs.	1	2	(3)	4	5

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27. In your opinion, what barriers of those listed above have the most effect on prohibiting this plant from conserving energy? (List below)

LACK OF AVAILABLE ENERGY EFFICIENT EQUIPMENT IN LITHUANIA, LACK OF AVAILABLE CAPITAL, UNCERTAINTY ABOUT AVAILABILITY OF FUTURE ENERGY SUPPLIES.

28. What additional barriers to energy conservation do you think might exist in the future?

1. ~~NON~~ CURRENCY EXCHANGE RATE NOT GOOD FOR PURCHASI OF FOREIGN ENERGY SAVING EQUIPMENT
2. LACK OF RESERVE FUNDS TO INVEST IN ENERGY EFFICIENT EQUIPM
3. LACK OF PRIVATE OWNER

29. In your opinion, what government incentives and policies should exist to assist plants in conserving energy? Please specify.

WELL KNOWN LONG-TERM PRICING POLITICS FOR ENERGY CARRIERS

Use following only for prompting

- ___ Low interest loans
- X Grants for part of cost of energy conserving equipment
- ___ Tax holidays
- ___ Duty fee exemptions on energy efficient equipment

- MORE FLEXIBLE PRICING AND TARIFF SYSTEM FOR ENERGY.

30. In your opinion, what government penalties should exist to discourage plants from using more energy?

NO PENALTIES AT THIS MOMENT

31. In your opinion, what services should the emerging private sector firms provide in assisting other firms with energy conservation measures within Lithuania?

SERVICE COMPANIES MAKING ENERGY AUDITS BASED ON FAIR ECONOMIC ANALYSIS WHICH COULD GIVE ALL THE NEWEST INFORMATION ON ENERGY EFFICIEN USE AND EQUIPMENT

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Name of Plant Vilnius Furniture Date April 24, 1992
Name of Firm _____

ENERGY CONSERVATION DECISION-MAKING SURVEY FOR LITHUANIA
(for personal interview)

This survey is being conducted as part of the USAID Emergency Energy Program for Lithuania. The purpose of this survey is to understand what factors influence decisions to implement energy conserving measures in those plants where energy audits were conducted for this program and when appropriate in the entire firm. Therefore, questions in this survey that can not be answered at the plant level will be directed towards the appropriate person(s) at the firm level. (The distinction between plant and firm is intended to distinguish between management at the local level--i.e. plant management--and management at a higher level that may be located at some other part of the country or outside of the country--i.e. firm management. It is recognized that this distinction may not apply as easily to other industries.) Throughout this survey, "implementation of energy conserving measures" refers to both optimization of energy use through improved energy management practices and installation of energy conserving equipment.

1. Can you please tell me your name and title?

RADŽIUS STANISLOVAS-VYTAUTAS, TECHNICAL DIRECTOR

2. Briefly describe your job responsibilities.

PREPARATION OF PRODUCTION, TECHNOLOGY

The first set of questions ask about this plant's characteristics.

3. How many full-time employees work at this plant? 1764

4. Ownership. Which description best fits this plant?

- (State Enterprise) RULED BY MINISTRY OF ECONOMICS OF LITHUANIA
- Cooperative
- Private (Please describe ownership. Circle correct one below.)

Sole proprietor Partnership Subsidiary of foreign firm

Subsidiary of Lithuanian firm Investor-owned firm

PRIVATIZED 20% OF CAPITAL TILL 24 04 92.

5. How many plants are part of this firm?

PLANT IS A STOCKHOLDER OF JOINT BELGIUM-LITHUANIAN COMPANY „IPSOFACTUM" 1

6. **Approximately, what is the annual production quantity of this plant in Rubles and in physical units (if available) such as tons? What percent of production capacity does this represent? If this is less than capacity, why?**

1990 - 48930 thousand Roubles
1991 - 138423 " "
1992 1-st quarter - 81495 thousand Roubles (95% of capacity)

7. **Approximately what percentage of your plant's total operating cost goes towards energy bills? (Operating costs include all labor, materials, capital depreciation, taxes and so forth)**

IN 1991 - 2.5%, NOW - 5%

8. **Approximately, how much did this plant spend in Rubles in 1990 for the following sources of energy?**

Electricity 580000 Roubles
Fuel oil -
Coal -
Natural Gas -
Thermal 356560 Roubles
Coke -
Other (please specify) -

Please break electrical consumption into peak and off-peak consumption if available. Also, indicate any payments of penalties, indicating the type of penalties.

This next set of questions asks about how you or other people in this plant receive information regarding energy conservation and how energy conserving measures were or could be implemented in this plant.

9. **How did or does this plant identify whether energy efficient measures could be taken in this plant?**
DO NOT GIVE LIST USE FOR PROMPTING ONLY

__ Through Energy Inspectorate audits
V Through own plant monitoring by plant engineers
__ Through own plant audits
__ Through outside engineering/consulting audits
__ Through inspection by the firm's engineers or management
__ Through own plant management's inspection
__ All of the above
V Other (please specify) LAST YEAR ACCORDING THE RESTRICTIONS ISSUED BY ENERGY MINISTRY
__ Do not know

10. **Are there persons in this plant who are responsible for implementing energy conserving measures in this plant?**
IF YES, indicate their name, title, and responsibilities.

STANKŪNAS KAZIMIERAS, CHIEF ENERGY MANAGER RESPONIBLE FOR ENERGY SUPPLY TO THE TECHNOLOGY AND EFFICIENT ENERGY USE.

11. **From what sources does this plant receive information about energy conserving measures? (Please List)**
DO NOT READ LIST; USE FOR PROMPTING ONLY

- √ Energy Inspectorate TILL 1991
- __ Outside Engineering Firms
- __ Similar firms in the industry
- __ Industry organizations
- __ Engineering/technical magazines
- __ Other magazines
- √ Other (please specify) NOW - CHIEF ENERGY MANAGER REPORTS
- __ Do not know

12. **Do you know if the government offers any incentives for conserving energy?**
IF YES... Please specify the types of incentives. IN 1991 NOVEMBE THROUGH MINISTRY OF ECONOMICS SHORT-PERIOD LIMITATIONS OF 10%, LR

13. **Do you know of any government policies that would prohibit this plant from implementing energy conservation?**
IF YES ..... Please specify.
1. NOT PROPER TARIFF SYSTEM. PAYMENT FOR THERMAL CAPACITY ACCORDING TO THE DESIGN BUT NOT ACTUAL, WHICH IS TWO TIMES LOWER THEN DESIGNED ON 24.04.92.
2. PAYMENTS FOR ENERGY DECLARED IN ADVANCE NOT ACTUAL.

This next set of questions asks about your plant's actions to reduce energy use.

14. **Has this plant made any capital investments to reduce your energy costs within the last 5 years?**

Yes
No

IF "YES" ... CONTINUE TO NEXT QUESTION.
IF "NO" ..... GO TO FOLLOWING PAGE (PAGE 5, QUESTION 19.)

15. **What was the approximate total cost (including installation, financing, taxes, etc.) of these investments?**

500000 ROUBLES

16. **Which of these investments do you think have been most effective in reducing energy cost at this plant?**

Action 1: CHANGING LACQUER DRYING INTO ULTRA-VIOLET
Action 2: _____
Action 3: _____

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17. **Were any of these investments part of a larger project?**
IF YES.... Which ones?

NO

18. **What were the main reasons why this firm invested in energy conserving equipment?**
IT WAS GOVERNMENTAL POLITICS UNDER THE DIRECT CONTROL. RATES OF ENERGY IN PRODUCTION WERE PLANED FOR A YEAR, GIVEN TO PLANT AND ACCORDING TO ACHIEVED PLANED FOR NEXT YEAR.

IF ANSWERED "NO" TO QUESTION 14 ABOVE. START HERE.

19. **Please specify who would do (or did) the technical analysis for an energy conservation project in this plant?**
PERSONAL OF THE PLANT

20. **Please specify who would do (or did) the economic analysis for an energy conservation project in this plant?**
PLANTS ENERGY SERVICE IN COOPERATION WITH ECONOMICS SERVICES (PLANING AND BOOK-KEEPER OFFICE)

21. **What economic analysis method(s) does this plant (or firm) use most when evaluating energy conservation projects?**

__ Simple payback
__ Discounted payback
__ Internal rate of return
__ Net present value
__ Life cycle cost analysis
__ Other (please specify) COST OF PROJECT TO ACHIEVE LOWER RATE OF ENERGY IN PRODUCTION UNIT
__ Do not know

22. **Do you have minimum economic criterion for any of the methods you mentioned above, which the project must meet in order to be approved?**
IF YES.....What are they?

Simple payback - Number of years? ____
Discounted payback - What is the discount rate? ____
Internal rate of return - What is the rate? ____
Positive net present value - What is the discount rate? ____

Other - Please specify COST OF PROJECT NOT HIGHER THAN 500000 ROUBLES

23. **If you were to (did) invest in an energy conservation project costing more than 10 million Rubles, how would (did) this plant usually pay for this?**
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Government pays for investment
__ Plant's cash flow
✓ Requires a loan from a bank or other lender
__ Other (please specify)_____
__ Do not know

24. **Who or what department in this plant makes the final decision on energy efficiency investments?**

TECHNICAL DIRECTOR AFTER THE PROJECT IS VISED BY DIRECTOR OF ECONOMICS. THEN GENERAL DIRECTOR RATIFIES IT.

25. **Is this the same person or persons who make the final decisions on all other investments?**

YES, IN SOME QUESTIONABLE CASES - BOARD OF DIRECTORS

26. **Which of the following energy conserving technologies could be or has been installed in your plant?**
(Indicate Y = yes or N = no, or NA = not applicable)

	has been	could be
Combustion Control system	NA	NA
Waste Heat Recovery	Y	Y
Improvements to Steam Systems	~~Y~~	~~NA~~
Insulation	Y	Y
Cogeneration System	NA	NA
Energy Efficient Lighting	Y	Y
Other (please specify)		
PRODUCTION OF STEAM FROM WASTE WOOD	N	Y
IMPROVEMENTS TO TECHNOLOGY NOT IN NEED OF DECORATION (FINISHING)	N	Y
INCREASE PRODUCTIVITY	Y	Y

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The next set of questions ask about the reasons why your plant did not or would not invest in energy efficiency projects.

26. Please tell me how important, on a scale from 1 to 5 where 1 is Very important and 5 is Not important, the following factors are in prohibiting this plant's investment in energy efficiency?

		Very Important				Not Important
1.	Lack of technical information.	1	2	(3)	4	5
2.	Lack of information on performance of new systems in other companies.	1	2	(3)	4	5
3.	Lack of information on performance of new systems in other countries.	1	(2)	3	4	5
4.	Lack of available energy efficient equipment in Lithuania.	(1)	2	3	4	5
5.	Lack of available technical expertise within this plant.	1	2	(3)	4	5
6.	Lack of available technical expertise in Lithuania.	1	(2)	3	4	5
7.	Lack of available capital (Rouble) to invest in energy-efficient equipment.	(1)	2	3	4	5
8.	Lack of government funds available for investment in conservation.	(1)	2	3	4	5
9.	Lack of information about future energy prices.	1	(2)	3	4	5
10.	Projects which do not meet economic acceptance criteria.	(1)	2	3	4	5
11.	Lack of time to evaluate potential projects.	1	2	3	(4)	5
12.	Uncertainty about availability of future energy supplies.	(1)	2	3	4	5
13.	Inability to interrupt production in order to make energy efficiency improvements.	1	2	3	(4)	5
14.	Lack of any real potential for additional conservation.	1	2	3	4	(5)
15.	Energy costs are only a small portion of operating costs.	1	2	(3)	4	5

27. **In your opinion, what barriers of those listed above have the most effect on prohibiting this plant from conserving energy? (List below)**

LACK OF AVAILABLE CAPITAL TO INVEST IN ENERGY-EFFICIENT EQUIPMENT, LACK OF GOVERNMENT FUNDS, LACK OF AVAILABLE ENERGY EFFICIENT EQUIPMENT IN LITHUANIA

28. **What additional barriers to energy conservation do you think might exist in the future?**

NONSTABLE PRODUCTION WHICH COULD CAUSE INVESTMENTS NOT IN THE RIGHT PLACE.

29. **In your opinion, what government incentives and policies should exist to assist plants in conserving energy? Please specify.**

Use following only for prompting

- ✓ Low interest loans
- ✓ Grants for part of cost of energy conserving equipment
- ___ Tax holidays
- ___ Duty fee exemptions on energy efficient equipment

- MORE FLEXIBLE PRICING AND TARIFF SYSTEM FOR ENERGY WHICH CAN GIVE MORE INCENTIVES FOR ENERGY CONSERVATION

30. **In your opinion, what government penalties should exist to discourage plants from using more energy?**

NO PENALTIES

31. **In your opinion, what services should the emerging private sector firms provide in assisting other firms with energy conservation measures within Lithuania?**

SERVICE COMPANIES, WHICH COULD MAKE AN ENERGY AUDITS AND IMPLEMENT RECOMENDED MEASURES IN COMPLETE

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Name of Plant Alytus Wood Date APRIL 15, 1992
Name of Firm _____

ENERGY CONSERVATION DECISION-MAKING SURVEY FOR LITHUANIA
(for personal interview)

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1. Can you please tell me your name and title?

PIGAGA MINDAUGAS, TECHNICAL DIRECTOR

2. Briefly describe your job responsibilities.

QUALITY, WORK SAFETY, CARE OF TECHNOLOGICAL AND ENERGY EQUIPMENT, ORGANIZATION OF OPERATION

The first set of questions ask about this plant's characteristics.

3. How many full-time employees work at this plant? 3600

4. Ownership. Which description best fits this plant?

✓ State Enterprise RULED BY MINISTRY OF CONSTRUCTION
__ Cooperative
__ Private (Please describe ownership. Circle correct one below.)

Sole proprietor Partnership Subsidiary of foreign firm

Subsidiary of Lithuanian firm Investor-owned firm
PRIVATIZED 10% IN SHARES

5. How many plants are part of this firm?

FIVE PLANTS LOCATED IN THE SAME AREA

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6. **Approximately, what is the annual production quantity of this plant in Rubles and in physical units (if available) such as tons? What percent of production capacity does this represent? If this is less than capacity, why?**
1990 - 48.000.000 ROUBLES, WOOD PLATES - 10 MM m2, WINDOW FRAMES - 250 Th m
DOORS - 250 Th m2, PARQUET - 400 Th m2, MINERAL WOOL - 200 Th m3,
SECTIONAL ONE FAMILY HOUSES - 200 Th m2, SAWED LUMBER - 195 Th m3

7. **Approximately what percentage of your plant's total operating cost goes towards energy bills? (Operating costs include all labor, materials, capital depreciation, taxes and so forth)**

NOW 34 %

8. **Approximately, how much did this plant spend in Rubles in 1990 for the following sources of energy?**

Electricity 600 000 ROUBLES
Fuel oil -
Coal -
Natural Gas 228 000 ROUBLES
Thermal 2500 000 ROUBLES
Coke
Other (please specify) CONDENSATE NOT RETURNED 140 000 ROUBLE.

Please break electrical consumption into peak and off-peak consumption if available. Also, indicate any payments of penalties, indicating the type of penalties.

This next set of questions asks about how you or other people in this plant receive information regarding energy conservation and how energy conserving measures were or could be implemented in this plant.

9. **How did or does this plant identify whether energy efficient measures could be taken in this plant?**
DO NOT GIVE LIST USE FOR PROMPTING ONLY

__ Through Energy Inspectorate audits
__ Through own plant monitoring by plant engineers
__ Through own plant audits
__ Through outside engineering/consulting audits
__ Through inspection by the firm's engineers or management
__ Through own plant management's inspection
V All of the above
__ Other (please specify)_____
__ Do not know

10. **Are there persons in this plant who are responsible for implementing energy conserving measures in this plant?**
IF YES, indicate their name, title, and responsibilities.
ANUŽIS VALENTINAS, CHIEF ENERGY MANAGER, RESPONSIBLE FOR ENERGY UTILIZATION AND EQUIPMENT IN ALL THE PLANTS.
ENERGY MANAGERS IN EACH PLANT

11. **From what sources does this plant receive information about energy conserving measures? (Please List)**
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Energy Inspectorate
__ Outside Engineering Firms
__ Similar firms in the industry
__ Industry organizations
V Engineering/technical magazines
V Other magazines
__ Other (please specify)_____
__ Do not know

12. **Do you know if the government offers any incentives for conserving energy?**
IF YES... Please specify the types of incentives. ISSUED IN 29.11.92 DIRECTIVE FROM MINISTRY OF CONSTRUCTION TO SAVE FUEL AND ENERGY

13. **Do you know of any government policies that would prohibit this plant from implementing energy conservation?**
IF YES ..... Please specify.
NO

This next set of questions asks about your plant's actions to reduce energy use.

14. **Has this plant made any capital investments to reduce your energy costs within the last 5 years?**

Yes
No

IF "YES" ... CONTINUE TO NEXT QUESTION.
IF "NO" ..... GO TO FOLLOWING PAGE (PAGE 5, QUESTION 19.)

15. **What was the approximate total cost (including installation, financing, taxes, etc.) of these investments?**
~~200~~ 1,500,000 ROUBLES

16. **Which of these investments do you think have been most effective in reducing energy cost at this plant?**

Action 1: COMPUTERS TO DRY WOOD
Action 2: OPTIMIZATION OF DRYERS FILL UP
Action 3: _____

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17. **Were any of these investments part of a larger project?** NO
IF YES.... Which ones?

18. **What were the main reasons why this firm invested in energy conserving equipment?**
TO OBTAIN ECONOMICAL EFFECT THROUGH IMPROVEMENT OF PROCESS.

IF ANSWERED "NO" TO QUESTION 14 ABOVE. START HERE.

19. **Please specify who would do (or did) the technical analysis for an energy conservation project in this plant?**
CHIEF ENERGY MANAGER SERVICE DID, TECHNICAL DIRECTORS OF THE PLANTS - WOULD DO IN FUTURE

20. **Please specify who would do (or did) the economic analysis for an energy conservation project in this plant?**
INITIATOR OF THE PROJECT DID, TECHNICAL DIRECTOR OF THE PLANTS WOULD DO IN FUTURE

21. **What economic analysis method(s) does this plant (or firm) use most when evaluating energy conservation projects?**

- ✓ Simple payback
- __ Discounted payback
- __ Internal rate of return
- __ Net present value
- __ Life cycle cost analysis
- __ Other (please specify) _____
- __ Do not know

22. **Do you have minimum economic criterion for any of the methods you mentioned above, which the project must meet in order to be approved?**
IF YES.....What are they?

Simple payback - Number of years? ONE
Discounted payback - What is the discount rate? ____
Internal rate of return - What is the rate? ____
Positive net present value - What is the discount rate? ____

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Other - Please specify ____

23. If you were to (did) invest in an energy conservation project costing more than 10 million Rubles, how would (did) this plant usually pay for this?
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Government pays for investment
V Plant's cash flow EARLIER
__ Requires a loan from a bank or other lender
__ Other (please specify)_____
V Do not know NOW

24. Who or what department in this plant makes the final decision on energy efficiency investments?

TECHNICAL DIRECTOR - IF COST UP TO 100 000 ROUBLES,
BOARD OF DIRECTORS - IF COST IS HIGHER

25. Is this the same person or persons who make the final decisions on all other investments?

YES,

26. Which of the following energy conserving technologies could be or has been installed in your plant?
(Indicate Y = yes or N = no, or NA = not applicable)

	has been	could be
Combustion Control system	N	Y
Waste Heat Recovery	Y	Y
Improvements to Steam Systems	~~N~~	~~Y~~
Insulation	Y	Y
Cogeneration System	N	Y
Energy Efficient Lighting	Y	Y
Other (please specify)		

The next set of questions ask about the reasons why your plant did not or would not invest in energy efficiency projects.

26. Please tell me how important, on a scale from 1 to 5 where 1 is Very important and 5 is Not important, the following factors are in prohibiting this plant's investment in energy efficiency?

		Very Important				Not Important
1.	Lack of technical information.	1	2	3	4	5
2.	Lack of information on performance of new systems in other companies.	1	2	3	4	5
3.	Lack of information on performance of new systems in other countries.	1	2	3	4	5
4.	Lack of available energy efficient equipment in Lithuania.	1	2	3	4	5
5.	Lack of available technical expertise within this plant.	1	2	3	4	5
6.	Lack of available technical expertise in Lithuania.	1	2	3	4	5
7.	Lack of available capital (Rouble) to invest in energy-efficient equipment.	1	2	3	4	5
8.	Lack of government funds available for investment in conservation.	1	2	3	4	5
9.	Lack of information about future energy prices.	1	2	3	4	5
10.	Projects which do not meet economic acceptance criteria.	1	2	3	4	5
11.	Lack of time to evaluate potential projects.	1	2	3	4	5
12.	Uncertainty about availability of future energy supplies.	1	2	3	4	5
13.	Inability to interrupt production in order to make energy efficiency improvements.	1	2	3	4	5
14.	Lack of any real potential for additional conservation.	1	2	3	4	5
15.	Energy costs are only a small portion of operating costs.	1	2	3	4	5

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27. **In your opinion, what barriers of those listed above have the most effect on prohibiting this plant from conserving energy? (List below)**

LACK OF ENERGY SAVING PROJECTS AND TECHNICAL INFORMATION IN LITHUANIA

LACK OF GOVERNMENT FUNDS AVAILABLE FOR INVESTMENT IN ENERGY CONSERVATION

28. **What additional barriers to energy conservation do you think might exist in the future?**

CHANGES IN OWNERSHIP

FINANCIAL

LACK OF TECHNICAL INFORMATION

29. **In your opinion, what government incentives and policies should exist to assist plants in conserving energy? Please specify.**

Use following only for prompting

- ___ Low interest loans
- X Grants for part of cost of energy conserving equipment
- ___ Tax holidays
- ___ Duty fee exemptions on energy efficient equipment

30. **In your opinion, what government penalties should exist to discourage plants from using more energy?**

PENALTIES IF DEMAND INCREASE WITH THE SAME AMOUNT OF PRODUCTION

31. **In your opinion, what services should the emerging private sector firms provide in assisting other firms with energy conservation measures within Lithuania?**

ALL KINDS OF INFORMATION ABOUT ENERGY CONSERVATION, LONG-TERM ENERGY PROJECTS BASED ON ENERGY SAVING TECHNOLOGY, PICKING OUT THE EQUIPMENT WHICH FIT THE PLANT ACCORDING TO ECONOMICAL CALCULATIONS AND INSTALLATION WORKS.

Name of Plant Kaunas Ceramics Date APRIL 21, 1992
Name of Firm _____

ENERGY CONSERVATION DECISION-MAKING SURVEY FOR LITHUANIA
(for personal interview)

This survey is being conducted as part of the USAID Emergency Energy Program for Lithuania. The purpose of this survey is to understand what factors influence decisions to implement energy conserving measures in those plants where energy audits were conducted for this program and when appropriate in the entire firm. Therefore, questions in this survey that can not be answered at the plant level will be directed towards the appropriate person(s) at the firm level. (The distinction between plant and firm is intended to distinguish between management at the local level--i.e. plant management--and management at a higher level that may be located at some other part of the country or outside of the country--i.e. firm management. It is recognized that this distinction may not apply as easily to other industries.) Throughout this survey, "implementation of energy conserving measures" refers to both optimization of energy use through improved energy management practices and installation of energy conserving equipment.

1. Can you please tell me your name and title?

MARTINAITIS ANTANAS, TECHNICAL DIRECTOR

2. Briefly describe your job responsibilities.

TECHNICAL STAGE OF PROCESS, IMPROVEMENTS IN TECHNOLOGY AND ENERGY SECTOR

The first set of questions ask about this plant's characteristics.

3. How many full-time employees work at this plant? 647

4. Ownership. Which description best fits this plant?

✓ State Enterprise RULED BY MINISTRY OF CONSTRUCTION
__ Cooperative
__ Private (Please describe ownership. Circle correct one below.)

Sole proprietor Partnership Subsidiary of foreign firm

Subsidiary of Lithuanian firm Investor-owned firm

SIGNED 99.6% OF SHARES BUT STILL NOT RATIFIED BY GOVERNMENT

5. How many plants are part of this firm?

ONLY THE MAIN PLANT

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6. **Approximately, what is the annual production quantity of this plant in Rubles and in physical units (if available) such as tons?** What percent of production capacity does this represent? If this is less than capacity, why?

BRICKS - 30000000 (2639000 ROUBLES)
TILES - 2500000 (1430000 ROUBLES)
PELLETS - 405500 m³ (3663000 ROUBLES)
TOTAL 7732000 ROUBLE IN 1990

7. **Approximately what percentage of your plant's total operating cost goes towards energy bills? (Operating costs include all labor, materials, capital depreciation, taxes and so forth)**

FOR TODAY 70,8 %

8. **Approximately, how much did this plant spend in Rubles in 1990 for the following sources of energy?**

Electricity 478000 ROUBLES
Fuel oil 316700 ROUBLES
Coal -
Natural Gas 1644300 ROUBLES
Thermal -
Coke -
Other (please specify) -

Please break electrical consumption into peak and off-peak consumption if available. Also, indicate any payments of penalties, indicating the type of penalties.

This next set of questions asks about how you or other people in this plant receive information regarding energy conservation and how energy conserving measures were or could be implemented in this plant.

9. **How did or does this plant identify whether energy efficient measures could be taken in this plant?**
DO NOT GIVE LIST USE FOR PROMPTING ONLY

__ Through Energy Inspectorate audits
__ Through own plant monitoring by plant engineers
__ Through own plant audits
__ Through outside engineering/consulting audits
__ Through inspection by the firm's engineers or management
__ Through own plant management's inspection
__ All of the above
✓ Other (please specify) THROUGH PLANTS STAFF SUGGESTIONS
__ Do not know

10. Are there persons in this plant who are responsible for implementing energy conserving measures in this plant?
IF YES, indicate their name, title, and responsibilities.

MARTINAITIS ANTANAS, TECHNICAL DIRECTOR

11. **From what sources does this plant receive information about energy conserving measures? (Please List)**
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Energy Inspectorate
V Outside Engineering Firms
V Similar firms in the industry
__ Industry organizations
__ Engineering/technical magazines
__ Other magazines
V Other (please specify) SUGGESTIONS FROM STAFF IN CHIEF ENERGY MANAGER SERVICE
__ Do not know

12. **Do you know if the government offers any incentives for conserving energy?**
IF YES... Please specify the types of incentives. ISSUED IN 29.11.9: DIRECTIVE FROM MINISTRY OF CONSTRUCTION TO SAVE FUEL AND ENERGY

13. **Do you know of any government policies that would prohibit this plant from implementing energy conservation?**
IF YES ..... Please specify.

NO

This next set of questions asks about your plant's actions to reduce energy use.

14. **Has this plant made any capital investments to reduce your energy costs within the last 5 years?**

Yes
No

IF "YES" ... CONTINUE TO NEXT QUESTION.
IF "NO" ..... GO TO FOLLOWING PAGE (PAGE 5, QUESTION 19.)

15. **What was the approximate total cost (including installation, financing, taxes, etc.) of these investments?**

20% OF ANUAL EXPENCES

16. **Which of these investments do you think have been most effective in reducing energy cost at this plant?**

Action 1: WASTE HEAT RECOVERY IN BRICK ~~FURNIGES~~ KILNS
Action 2: OPTIMISATION OF CLAY DRYING IN ROTATING KILNS
Action 3: AUTOMATICAL BREAK OF COMBUSTION IN ZIG-ZAG KILNS

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17. **Were any of these investments part of a larger project?**
IF YES.... Which ones?

NO

18. **What were the main reasons why this firm invested in energy conserving equipment?**

TO INCREASE PRODUCTION. SOME TIMES TO SOLVE THE PROBLEMS OF PRODUCTION

IF ANSWERED "NO" TO QUESTION 14 ABOVE. START HERE.

19. **Please specify who would do (or did) the technical analysis for an energy conservation project in this plant?**

PLANT STAFF

20. **Please specify who would do (or did) the economic analysis for an energy conservation project in this plant?**

DEPARTMENT OF ECONOMICS

21. **What economic analysis method(s) does this plant (or firm) use most when evaluating energy conservation projects?**

__ Simple payback
__ Discounted payback
__ Internal rate of return
__ Net present value
__ Life cycle cost analysis
__ Other (please specify) _____
V Do not know

22. **Do you have minimum economic criterion for any of the methods you mentioned above, which the project must meet in order to be approved?**
IF YES.....What are they?

Simple payback - Number of years? ____
Discounted payback - What is the discount rate? ____
Internal rate of return - What is the rate? ____
Positive net present value - What is the discount rate? ____

Other - Please specify ____

23. **If you were to (did) invest in an energy conservation project costing more than 10 million Rubles, how would (did) this plant usually pay for this?**
DO NOT READ LIST; USE FOR PROMPTING ONLY

__ Government pays for investment
__ Plant's cash flow
__ Requires a loan from a bank or other lender
__ Other (please specify)_____
✓ Do not know

24. **Who or what department in this plant makes the final decision on energy efficiency investments?**

DEPARTMENT OF ECONOMICS. GENERAL DIRECTOR RATIFIES.

25. **Is this the same person or persons who make the final decisions on all other investments?**

YES

26. **Which of the following energy conserving technologies could be or has been installed in your plant?**
(Indicate Y = yes or N = no, or NA = not applicable)

	has been	could be
Combustion Control system	Y	Y
Waste Heat Recovery	Y	Y
Improvements to Steam Systems		
Insulation	Y	Y
Cogeneration System	N	NA (DO NOT KNOW)
Energy Efficient Lighting	Y	Y
Other (please specify)		

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The next set of questions ask about the reasons why your plant did not or would not invest in energy efficiency projects.

26. Please tell me how important, on a scale from 1 to 5 where 1 is Very important and 5 is Not important, the following factors are in prohibiting this plant's investment in energy efficiency?

		Very Important				Not Important
1.	Lack of technical information.	1	2	3	4	5
2.	Lack of information on performance of new systems in other companies.	1	2	3	4	5
3.	Lack of information on performance of new systems in other countries.	1	2	3	4	5
4.	Lack of available energy efficient equipment in Lithuania.	1	2	3	4	5
5.	Lack of available technical expertise within this plant.	1	2	3	4	5
6.	Lack of available technical expertise in Lithuania.	1	2	3	4	5
7.	Lack of available capital (Rouble) to invest in energy-efficient equipment.	1	2	3	4	5
8.	Lack of government funds available for investment in conservation.	1	2	3	4	5
9.	Lack of information about future energy prices.	1	2	3	4	5
10.	Projects which do not meet economic acceptance criteria.	1	2	3	4	5
11.	Lack of time to evaluate potential projects.	1	2	3	4	5
12.	Uncertainty about availability of future energy supplies.	1	2	3	4	5
13.	Inability to interrupt production in order to make energy efficiency improvements.	1	2	3	4	5
14.	Lack of any real potential for additional conservation.	1	2	3	4	5
15.	Energy costs are only a small portion of operating costs.	1	2	3	4	5

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27. **In your opinion, what barriers of those listed above have the most effect on prohibiting this plant from conserving energy? (List below)** UNCERTAINTY ABOUT FUTURE ENERGY SUPLIES, LACK OF GOVERNMENTAL FUNDS, LACK OF INFORMATION ABOUT FUTURE ENERGY PRICES, LACK OF AVAILABLE ENERGY EFFICIENT EQUIPMENT IN LITHUANIA

28. **What additional barriers to energy conservation do you think might exist in the future?**
LACK OF LONG-TERM ANALYSIS WOULD THE PRODUCTS FIT IN BUILDING AND CONSTRUCTION REFORM INITIATED BY GOVERNMENT

29. **In your opinion, what government incentives and policies should exist to assist plants in conserving energy? Please specify.**
ENERGY PRICING AND TARIFF SYSTEM LETING TO USE MONEY GOT FROM MAKING POWER SYSTEM DEMAND MORE EVEN TO PURCHASE ENERGY SAVING EQUIPMENT

Use following only for prompting

__ Low interest loans
__ Grants for part of cost of energy conserving equipment
√ Tax holidays
__ Duty fee exemptions on energy efficient equipment

30. **In your opinion, what government penalties should exist to discourage plants from using more energy?**
PENALTIES FOR OVERDRAWING ENERGY RATES ANNUALLY CALCULATED WITHIN THE PLANT

31. **In your opinion, what services should the emerging private sector firms provide in assisting other firms with energy conservation measures within Lithuania?**
ADVERTISE AND SELL RELIABLE METERING AND CONTROL DEVICES

A. SUMMARY OF RESPONSES TO THE QUESTIONS

I. Plant's characteristics.

Question	Sweets	Furniture	Wood	Ceramics
1. Name & Title	Mr. Juodkazis Algirdas-Aleksas	Mr. Radzius Stanislovas-Vytautas	Mr. Pigaga Mindaugas	Mr. Martinaitis Antanas
2. Job Rsp	Technical Director	Technical Director	Technical Director	Technical Director
3. Employees	755	1764	3600	647
4. Ownership	State Enterprise	State Enterprise	State Enterprise, Stockholder of Joint Belgium-Lithuanian Company IPSOFACTUM	State Enterprise (still on the date of survey)
Share of privatized capital in percents		20	10	99.6
5. How many Plants	2	1	5	1
6. Annual Production in Physical Units	13,000 tons candy; 6,000 tons biscuits	30,000 tons of raw materials utilized to produce 20,000 tons of finished furniture components	10 million m2 wood fiberboard; 300,000 m2 window frames; 250,000 m2 doors; 400,000 m2 parquet; 200,000 m3 mineral wool; 200,000 m2 sectional one family houses 195,000 m3 sawed lumber	30 million bricks; 2,5 million tiles; 400,000 m3 ceramic pellets

Question	Sweets	Furniture	Wood	Ceramics
Total Production, R/yr(1990)	46,000,000	49,000,000	48,000,000	8,000,000
USD/yr		140,000	2,000,000	
Percent of Capacity	78 due to lack of materials	95 due to lack of materials	80 due to lack of materials and market restrictions	82 due to decrease of market
7. Energy Cost R/yr	179,000	940,000	3,470,000	2,440,000
% of plant oper cost				
1991	1.2	2.5	9	12-15
1992 1st qv.	2.64	5	34	70.8
8. Energy Cost Breakdown:				
Electricity R/yr	94,000	580,000	600,000	480,000
% of total energy	52	62	17	20
Fuel Oil R/yr				312,000
% of total energy				13
Ntrl Gas R/yr	85,000		230,000	1,645,000
% of total energy	47		7	67
Thermal R/yr		360,000	2,500,000	
% of total energy		38	72	
Condensate not returned R/yr			140,000	
% of total energy			4	

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II. Next set of answers indicates how plants receive information regarding energy conservation and how energy conserving measures were or could be implemented in the plants surveyed.

9. Of the four plants surveyed, three indicated that energy efficient measures last three years were identified principally through suggestions by their own technical staff. Two of them also remembered Energy Inspectorate Audits. The fourth plant which operates like firm also identified measures by consulting with technological university in Kaunas.

10. Of the four plants surveyed, three indicated that persons responsible for implementing energy conserving measures in the plants are chief energy managers responsible as well for the energy supply to the process within the plant and maintenance of energy consuming equipment. One of them, which operates their own boiler plant, divides this responsibility into thermal - chief of the boiler plant and electrical - chief energy manager. The fourth plant technical director indicated himself as a person responsible for implementing energy conserving measures.

11. The plants surveyed receive information about energy conserving measures from engineering/technical magazines, similar firms in the industry and through chief energy managers staff suggestions. Two of them also indicated some regulations received from energy inspectorate and energy suppliers till 1991.

12. None of the plants surveyed knew of specific government incentives, but three of them indicated some regulatory in form letters from Ministry of Construction. The fourth plant mentioned Ministry of Economics which transferred the order to limit energy consumption 10% in short-term and 25% in long-term.

13. To the question what government policies prohibit plants from implementing energy conservation answered only two plants. Both of them indicated energy tariff system as main factor prohibiting plants to implement energy conservation. The tariffs for thermal energy were set by government so that plants have to pay according to thermal capacity not actual but designed, not dependent were or would be any measures lowering actual thermal capacity implemented or not from the date the design was made. Plants producing thermal energy not only for their own uses but also for residential sector face inequality with the big power plants to which energy is main product to sell for residential sector in lower prices then operating cost to produce that energy without any subsidies from the government.

III. Plant's actions to reduce energy use.

14. All the plants surveyed indicated that they have made investments to reduce their energy costs within last 5 years.

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15. The approximate total cost of these investments differ from 500,000 Roubles to 1,500,000 Roubles and from 3 to 20 in percents of annual expenses.

16. The measures reducing energy cost that were most effective in plants within last 5 years:

Sweets plant

1. Automatic control of combustion in boilers.
2. Air compressors work automation.
3. Technological improvements.

Furniture plant

1. Changing lacquer coating dryers into ultra-violet.

Alytus wood products plant

1. Computers to control wood drying process.
2. Optimization of dryers fill up.

Ceramics plant

1. Automatization of combustion break up in zig-zag kilns.
2. Waste heat recovery in brick kilns.
3. Optimization of clay drying in rotating kilns.

Two last actions seems to be done after energy survey was done by experts from Resource Management Associates, U.S.A. in January 1992.

17. Nor the actions to reduce energy cost, neither investments to implement them were indicated as parts of larger projects.

18. Three of the plants surveyed indicated that the main reasons they invested in energy conserving equipment were to increase production, improve working conditions, increase reliability and safety and lower energy cost. The fourth indicated that such was governmental politics in planed economy where energy rates in production were planed for a year according to achieved results of former year.

19. All the surveyed plants indicated that plant technical staff did and would do technical analysis for an energy conservation projects. One of them also identified measures by consulting with energy inspection, suppliers and association of inventors.

20. Of the four plants surveyed, three indicated that the economic analysis for an energy conservation project did plants technical staff (initiator or responsible for the implementation of the project) in cooperation with economics service of the plant. The fourth plant indicated department of economics within the plant

which have to do economic analysis of an energy conservation project.

21. None of the plants surveyed knew of other economic analysis methods when evaluating energy conservation projects, but cost of project and simple payback.

22. The minimum economic criterion are the cost of the energy conservation project has not to exceed 500,000 Roubles for the Furniture Plant "Vilnius" and simple payback which varies from one year - Alytus Wood up to five years- Vilnius Sweets plant.

23. All the plants surveyed indicated that till the 1989 if they were to invest in an energy conservation project costing more than 10 million Roubles they were asking for funding from their ministries, now only two of them indicated possibility to require a loan from a bank or other lender, or apply for funding to consumers. The others do not know.

24. Final decision on energy efficiency investments in two of plants surveyed makes technical director if the price not exceeds cost limit up to which was agreed with board of directors, otherwise - board of directors. In other two plants general director makes the final decision.

25. The same structure indicated in surveyed plants for the final decisions on all other investments.

26. Following energy conserving technologies has been/ could be installed in surveyed plants (Y = yes, N = no and NA indicates not applicable)

Technologies	Sweets	Furniture	Wood	Ceramics
Combustion Control System	Y/Y	NA/NA	N/Y	Y/Y
Waste Heat Recovery	Y/Y	Y/Y	Y/Y	Y/Y
Improvements to Steam Systems Insolation	Y/Y	Y/Y	Y/Y	Y/Y
Cogeneration System	NA/N	NA/NA	N/Y	N/NA
Energy Efficient Lighting	Y/Y	Y/Y	Y/Y	Y/Y
Production of Steam Burning Waste Wood		N/Y		
Improvements to Freezing Systems Operation	Y/Y			
Improvements to Upholstering Technology		N/Y		
Increase of Productivity		Y/Y		

IV. Barriers prohibiting plants to invest in energy efficiency projects.

27. Importance of the following factors, varying on a scale from 1 to 5 where 1 is Very important and 5 is Not important, were indicated by plants in prohibiting investments in energy efficiency:

Factor[1]	Sweets	Furniture	Wood	Ceramics
1. Lack of technical information.	2	3	1	3
2. Lack of information on performance of new systems in other companies.	3	3	2	3
3. Lack of information on performance of new systems in other countries.	1	2	2	1
4. Lack of available energy efficient equipment in Lithuania.	1	1	2	1
5. Lack of available technical expertise within this plant.	3	3	1	3
6. Lack of available technical expertise in Lithuania.	2	2	1	2
7. Lack of available capital (Rouble) to invest in energy-efficient equipment.	1	1	3	1
8. Lack of government funds available for investment in conservation.	2	1	1	1
9. Lack of information about future energy prices.	1	2	1	1
10. Projects which do not meet economic acceptance criteria.	1	1	2	1
11. Lack of time to evaluate potential projects.	4	4	3	2
12. Uncertainty about availability of future energy supplies.	1	1	1	1
13. Inability to interrupt production in order to make energy efficiency improvements.	4	4	3	3
14. Lack of any real potential for additional conservation.	5	5	5	5
15. Energy costs are only a small portion of operating costs.	3	3	4	5

[1] Importance of factors varies on scale from 1 to 5 where 1 is Very important and 5 is Not important in prohibiting this plant's investment in energy efficiency.

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28. Three of the plants surveyed indicated that most effect on prohibiting plant from conserving energy has lack of governmental funds and available energy efficient equipment in Lithuania. Two of them mentioned uncertainty about availability of future energy supplies. Kaunas Ceramics factory also indicated lack of information about future energy prices as most important factor prohibiting plant from conserving energy.

29. As barriers to energy conservation which might exist in the future were indicated:
- hard currency exchange rate not allowing to purchase foreign energy saving equipment (Sweets Plant),
- lack of reserve funds to invest in energy conservation (Sweets Plant, Alytus Wood Products Plant),
- lack of private owner to inspire energy efficient use (Sweets Plant, Alytus Wood Products Plant),
- unstable production caused by market fluctuations which could cause investments in conserving energy not in the right place (Vilnius Furniture Plant, Kaunas Ceramics Plant),
- lack of energy conservation projects which could meet future economic analysis methods and lack of technical information within the plant if such projects would be accepted.

30. Three of the plants surveyed indicated more flexible and better adjusted to save energy pricing and tariff system and grants for part of cost of energy conserving equipment as government incentives to assist plants in conserving energy. One of them also added low interest loans and tax holidays the other. Based on economic acceptance long-term pricing politics for energy carriers should exist also to inspire plants create their own economic criteria to conserve energy.

31. Two of the plants denied government penalties should exist to discourage plants from using more energy in the nearest future. Two other plants indicated penalties limiting demand if production not increase (Alytus Wood Products Plant) and penalties if energy rates for production which the plant could set itself annually were exceeded (Kaunas Ceramics plant).

32. The answer to the question what services should emerging private sector firms provide in assisting other firms with energy conservation measures within Lithuania was different depending on confidence on chief energy manager service activities in the past and varied from dealer companies only advertising and selling reliable metering and control devices to service companies which could hold out newest information related to energy conservation, make long-term energy projects based on fair economic analysis and implement recommended measures up to the key.

C. ANALYSIS

Plant Characteristics - The surveyed plants range in size from 755 to 3600 employees and are judged to be typical energy users for this range of facility. All were aware of their in-plant usage, especialy after increase of prices on energy carriers, but lack sufficient metering capability to accurately monitor energy consumption at major energy users. The in-plant equipment and physical characteristics are not likely to be altered without major capital investment by the company. This investment is still driven first by production considerations, second by reliability, third by cost, and usually last by energy efficiency. There is great potential to increase effective energy utilization by modernization of plant facilities and characteristics, but lack of capital and access to modern technology are great barriers to this occurring in the near future. Rate of energy in plants operation cost doubled this year and it cuts the payback period of energy conservation measures but still it is long enough for bigger investments.

Access to Information - The surveyed plants are very limited in access to information regarding energy conservation which in past came mostly from East. Now information from the West meets language barriers. All the plants get information regarding energy conservation from their own staff mostly often related with problems that occur in technology. Information about energy in technical magazines access to which plant's energy managers had were orientated to energy supply side. Information from government agencies still has regulatory character. Dissemination of information through similar firms meetings of staff responsible for energy conservation were indicated to give good results.

Barriers to invest in energy conservation - In past, when energy supply and demand were planed and inspected from Center. In fear not to be punished, the hidden reserve always took place in negotiations between republics and Center as well as energy utilities and customers. The energy supply was planned according last years achievements and dispensed to energy supplying utilities to distribute to customers which tried to consume all the demand they indicated in contract, knowing that otherwise they should not get same demand next year. That hidden reserve has big potential to energy conservation but now creates a lot of problems when energy prices increased. One of them who will pay for that reserve. Regional electricity utilities still make most of their money by selling extra electricity and have very little incentive to tell their customers how to cut back on buying their product alongside customers still more interested not in buying kilowatts but in keeping warm, or running their appliances. New tariffs for thermal energy also has a load tariff portion of 10,000 Roubles per month for 1 Gigacalorie per hour installed thermal capacity. This payment is based on industrial plants designed capacity and not depend on

energy conservation measures were or would be implemented. This portion of tariff is from 7 to 10 percents of total thermal energy payments.

All the plants surveyed face uncertainty about availability of future energy supplies as well as stability of production due to market fluctuations and the increase in energy prices could be accepted if energy tariff system would be more flexible and adapted to energy conservation. Nothing was made to secure customers from utilities and government side.

None of the plants surveyed knew of other economic analysis methods when evaluating energy conservation projects but cost and simple payback. Plants lack trained staff to evaluate projects and create economic criteria system to fit plants needs for funding from suppliers or banks.

Staff responsible for energy were not interested economically to implement energy efficiency measures. Money saved went to pay premiums to all the employees, penalties if measures were not implemented had to pay initiator. That creates good conditions to work under the contracts for private companies implementing energy saving measures but also leaves measure of distrust and suspicion from employees which then could get lower premiums. Privatization was indicated to inspire energy efficient use.

Actions to save energy - All the plants surveyed indicated that they have made investments to reduce their energy costs. Nor the actions to reduce energy cost, neither investments to implement them were indicated as part of larger project. Nevertheless one of plants surveyed indicated governmental politics in the past which was driven under the direct control. Till 1989, implementation of energy saving measures were driven by Energy Inspectorate which now is one section of Energy Supply System and paid by utilities. Some positive competition were organized between similar plants to reduce energy use. The indicated approximate cost of these investments differ according energy rate in production and varies between plants from 3 to 20 percents of annual expenses. Lack of metering devices and governmental support do not insist plants to apply experimental tariff system for electricity based on peak and nonpeak consumption to make daily consumption more even.

Assistance from Government Agencies - All the plants surveyed had virtually no experience with effective assistance from government agencies. Past government actions tended to be regulatory in nature and not supportive of innovation and increased efficiency. All of the plant staff acknowledged that increased government assistance would be welcome and beneficial if the long-term pricing politics for energy carriers could be known. But there is still a measure of distrust and suspicion regarding government intervention. All of the plant staff acknowledged that emerging private sector firms could provide wide range of services in assisting plants or even

firms associated in similar production. It could be energy audits with economically evaluated short-term and long-term projects, technical consultance and information on performance of new systems in other countries, procurement of equipment and installation up to the key. Governmental Agencies should assist them in training, equipment for monitoring and providing rebates such as tax holidays and duty free exemptions on energy efficient equipment. Plants should be supported with grants for part of cost of energy conserving equipment which could be allocated from energy utilities still they are governmental and highly regulated. The aim is to allow utilities to recover the costs of investments that cut their customers' fuel or electricity bills or to allow the cost of such investments to be included in a utility's rate base.

Governmental agencies should insist electricity and fuel utilities first to decouple profits from sales volume, second to link energy efficiency to profits. That could be achieved through experiments allowing bids for energy saving alongside bids for generating new power in firms' boiler plants. That could create competition between consulting companies working in that field. Worries about "cream-skimming" could be allocated to former Energy Inspection. It could also ensure that efficiency investment is at least as profitable as erection new plants.

APPENDIX K
Law on Small Enterprises

LAW ON SMALL ENTERPRISES

Article 1. **Objectives of the Law**

This Law shall establish the basic principles of stimulating the activities of small enterprises.

Small enterprises shall function in pursuance of all laws regulating the activities of enterprises, with the exception of specific requirements provided for in this Law.

This Law shall not apply to state enterprises and state stock companies, as well as to the activities specified in the list approved by the Government of the Republic of Lithuania which are not liable to be stimulated.

Article 2. **Definition of Small Enterprise**

A small enterprise shall be an enterprise with the total number of employees not in excess of 100.

Article 3. **Tax reliefs**

For the period of two years from the entry into force of this Law or from the founding of a new enterprise, the rate of tax on profits imposed on small enterprises with rights of legal persons as prescribed by the Law on Taxes on Profits of Legal Persons, and the rate of income tax imposed on small enterprises with rights of natural persons as prescribed by the Provisional Law on Income Tax of Natural Persons shall be reduced by 70 percent, and, beginning with the third year, by 50 percent, provided the total number of employees in said enterprise is not is excess of 50, and the income received from productive activity amounts to not less than two-thirds of all income generated from the sale of goods and services.

For small enterprises whose income received from productive activity amounts to less than two-thirds of all income generated from the sale of goods and services, said tax rates shall be reduced by 50 percent.

In accordance with the norms specified herein, income tax of natural persons shall be levied on the portion of profits of operating small enterprises which is allocated for the payment of bonuses or other incentives; upon computing taxable profit, said amounts shall be deducted from balance profit.

Upon computing taxable profit or taxable income, all expenditures and investments related to scientific research, design and construction work, and introduction of new technology shall be deducted from gross income.

Article 4. **Tax Credit**

The payment of taxes on profits (income) prescribed by law, for small enterprises with the number of employees from 51 to 100 whose income from productive activity amounts to not less than two-thirds of all income generated from the sale of goods and services, shall be deferred (tax credit shall be given) for not longer than three years.

For other small enterprises with the number of employees specified above, the payment of taxes on profits (income) shall be deferred for one year.

An enterprise which has repaid not less than 50 percent of the given tax credit shall be entitled to a tax credit in the ensuing period.

Article 5. **Privileges for the Crediting Party**

Enterprises and banks of all types of ownership which give credit to small enterprises on easy terms, are entitled to a 30 percent reduction of the rate of tax on profits (income) equal to the amount of the credit given.

Article 6.

A simplified procedure of accounting of and accountability for the results of their productive activity shall be applied to small enterprises. The procedure shall be established by the Ministry of Finance of the Republic of Lithuania.