

# Energy and environment of Lithuania

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## 1. SYNOPSIS

This report describes main environmental problems in Lithuanian energy sector. The various elements of the environmental strategy are discussed.

## 2. ABSTRACT

A reliable and safe energy supply at acceptable social costs and with minimal environmental damage is one of the most important conditions for an effective operation of a modern economy.

Today technical and institutional structure of the Lithuanian energy sector inherited from the past does not ensure acceptable social costs and minimal environment damage. Two years analysis has led us to feel the need for optimal formulas and goals evaluating not merely economic but also some subjective factors related to the need to better utilise the generating capacities existing in Lithuania to avoid social and political problems, which could arise when decommissioning the first unit of the Ignalina State Nuclear Power Plant.

By Lithuanian energy strategy the most cost-effective measure for reducing generous emissions is to substitute natural gas in combined heat and power plants and condensing power plants. In addition, combustion controls and low NOx burners are recommended for the largest power plants and district heat/steam boilers, a considerable reduction of the share of heavy fuel oil in the forecasted Lithuanian energy balance, use of renewable energy and energy savings potential will soften the environment problems related with the energy sector. Desulphurisation of oil products at an upgraded refinery could serve as an important favourable inflame upon environment.

Upgrading of the monitoring network for radioactive discharges at the Ignalina NPP, environmental auditing at the Lithuanian Power Plant and larger combined heat and power are needed.

Realisation of Lithuanian National energy strategy, created by help of specialists analysts from developed countries will create conditions to verify their tools into development economy in transition.

## 3. THE NATIONAL ENERGY STRATEGY (NES)

At present, because of the distortion of traditional trade relations, after four years of transition the national Lithuanian economy is in a deep crisis. During this period the gross domestic product decreased more than 60 %, industrial production--more than 70 %. The National Energy Strategy was ordered at 1994 by Lithuanian Government. The main goals of energy stabilisation and reform are as follows: efficient, reliable and safe energy supply to domestic consumers, active energy and imported fuel saving policy, finding and rational use indigenous energy sources, diversification of energy import and export, regional co-operation, integration into European energy market, insuring Ignalina Nuclear Power Plant (NPP) safety, economic (legal, organisational, structural, financial) management of energy economy, attraction of domestic and foreign investment, solving environmental issues. The tasks and aims can be achieved in co-operation with the World's and European states as well as organisations, companies and firms only, with their scientific, technical and financial support. On other hand, these tasks can only be accomplished by closer and more effective co-operation among Governments to ensure that activities under their control do not damage the environment of other States or areas beyond their national jurisdiction following ratified international legally binding instruments.

Today with decentralisation and liberalisation of the national economy the main goals of the energy policy should be: preparation of laws, setting of priorities, control. More responsibilities are transferring to municipalities and private sector. Energy sector regulation and supervision, management of state owned enterprises, research and development, new plans and designs should be transferred in co-operation with independent regulatory institutions and private sector. The main functions of independent regulatory institutions will be protection of energy consumers interests and rights, implementation of the consistent pricing system, regulation of natural monopolies. A transparent, understandable and open information system will be created.

Today crude oil, natural gas, nuclear fuel and almost all coal are imported from Russia. Only 5% of energy is produced by indigenous resources of wood, peat, hydro and oil.

### 3.1. Energy demand

The estimates of future energy demand until 2015 of potential domestic needs are tabulated below. There are based on a comparison between present Lithuanian intensities and those in Western Europe.

*Table 1. Energy intensity by 2015 as a % of the 1990 value*

Scenarios		
A.	Low reforms/basic efficiency	71%
B.	Moderate reforms/high efficiency	51%
C.	Moderate reforms/basic efficiency	68%
D.	Fast reforms/high efficiency	49%

Environmental costs are included into the NES economical calculation.

Reduced energy demand gives for Lithuania excellent opportunity to rebuild an energy supply system related to the actual need and appropriate to a modern economy where debt is kept to a minimum. Reduced import from various sources, renewable energy investment, good insulation and a rationalised supply system combined with consumer control of use, direct sales and loss reduction could bring supply into line with demand.

### 3.2. Heat

80% of residential and commercial buildings of cities are connected to a district heating system. This is to be maintained with refurbished boilers, new substations in multifamily houses and replacement of failed pipes with insulated ones. The final goal is to change from the constant flow to a variable flow system to avoid overheating flats and improve the quality of the hot water supplied. A new system of prices and tariffs is needed to meter consumers and encourage individual insulation (today half of heat price is compensated by government for householders). Insulation of buildings is a future priority aim. To avoid heat loss between boiler, substations and consumer would require a different policy. For a comparison with proposed new boilers and pipe insulation, a feasibility study on supplying cold water to buildings, for heating on site is undertaken.

Future energy supply recommendations from NES are as follows:

- no additional capacity is needed until 2000 when combined heat and power plants should be placed where need is greatest at the time;
- to operate both units at Ignalina NPP, prognosis and decision for future will be presented at 1998 year; to rehabilitate the Lithuanian Power Plant to a minimal extent;
- to complete the fourth unit at the Kruonis pumped storage hydro plant;
- to modernise and rehabilitate the main equipment in the National electricity network;
- to pursue regional co-operation and secure realistic export prices.

The long term options at Ignalina NPP are to close it down or build new nuclear reactors jointly with Belarussia and Latvia.

These recommendations could change if a more radical, yet sustainable approach was taken.

#### 3.2.1. Oil

The planned oil terminal on the Baltic at Bûtینگė will improve the security of fuel supply. New storage facilities, meeting fire-preventative and ecological standards should be build. Rehabilitation of Mapeikiai refinery and Klaipėda Oil State Enterprise in co-operation with foreign investments is ongoing.

### 3.2.2. Gas

A new gas pipeline to the West is the long-term aim, but a secure supply is sought by increased storage and negotiated long-term contracts with Russia.

### 3.2.3. Renewable energy

Increase in the use of mini-hydro plants can be achieved by rehabilitation/modernisation of existing mini-hydro plants and new installations. Pilot projects and studies are desired for geothermal energy, wind, waste incineration/recovery etc.). There is currently continuing studies of renewable and domestic resources. A combination of raising the priority of a gas pipeline to the West and installing existing renewable energy technology would create an environmentally acceptable policy.

The new Energy Law will ensure the transition and development of the Lithuanian Energy sector in accordance with defined strategies and goals:

1. Energy efficiency and loss reductions.
2. Diversification of resources.
3. Promotion of renewable and domestic sources.
4. Reliability.
5. Environmental Improvement.

Commercialisation and enhanced efficiency will strengthen the Energy Sector.

## 4. THE ENVIRONMENT

Within a period from 1991 to 1993 the consumption of primary energy resources dropped by 51 %, i.e. twice, consumption of all forms of energy--by 53 %, oil refining--by 55 %, heat consumption--by 47 %. This also influenced the structure of electricity production: comparative weight has shifted in favour of nuclear and hydro energy, i.e. ecologically "clean" production, with a rise from 59 to 91 %. Consumption of the oven fuel has decreased by 47 %, natural gas--by 70 %, diesel fuel--by 53 %, petrol--by 50 %. We could call the situation a paradox, but a deep economic decline has led to a steep improvement of ecological situation problem in the energy sector. Consequently, the environmental aspirations have also declined, moving economical interests of society to the first place.

### 4.1. Main problems

#### *Ignalina State Nuclear Power Plant (NPP):*

- thermal pollution of the Drūk\_jai Lake, promotion of eutrofication development;
- radio nuclides pollution average ~ 0.2 Ciuri gets into the Drūk\_jai Lake every year;
- tritium concentration in underground waters exceeded the permissible rates up to several times in observation wells in the territory of the Ignalina NPP;
- there is no sewerage water treatment system from Visaginas settlement and power plant meeting the environmental requirements;

#### *Lithuanian State Power System:*

- constant atmosphere pollution from DH and CHPs, generating thermal water and steam, resulting in double peak during the winter heating or when Ignalina NPP blocks are stopped to carry out repair works;
- atmosphere pollution from energy utilities constitutes 1/5 of the country's pollution;
- there is no treatment equipment for SO<sub>2</sub> and NO<sub>x</sub>;
- no stationary devices for ecological control, boilers are poorly equipped with oxygen meters;
- there are no monitoring systems in either of the power stations;
- the cheapest type of heavy fuel oil is used for firing, sulfurousness of which does not meet the requirements of European standards for SO<sub>2</sub> emission into atmosphere.

#### *State enterprise "Lietuvos dujos":*

- unidentified gas leakage from Lithuania's gas pipeline network.

#### *State enterprise "Lietuvos kuras":*

- constant atmosphere pollution with hydrocarbon resulting from pouring and storing light oil products;

- threatening underground water pollution with oil products in Vilnius, Dvenionėliai, Alytus fuel supply enterprises and Klaipėda oil terminal.

*Mabeikiai Oil Refinery:*

- constant atmosphere pollution by hydrocarbon, sulphur and nitrogen combinations (Oil Refinery together with Mabeikiai CHP make about one half of all energy sector atmosphere pollution).

It is true that emissions of main greenhouse gasses--CO<sub>2</sub> were not included in our state statistical reports. Energy and Physics institutes for their purposes every year calculated CO<sub>2</sub> amount ( 1993 ~ 18 mill. tons from all pollution sources of Lithuania, 1994 in energy sector ~8 mill. t.).

The monitoring network for radioactive discharges from the NPP, environmental audit at the Lithuanian Power Plant and the larger heat and power plants is creating out. Many environmental problems can be solved by taking on overall environmental approach, but economical mechanism for these purposes isn't created out in country. Savings need to be made by rationalising and "greening" the energy supply to pay for safe decommissioning storage, continual monitoring and security costs at Ignalina NPP.

The high sulphur content (2-4%) of heavy fuel oil burned in power stations, CHP and DH plants in heating periods gives rise to very high SO<sub>2</sub> emissions. Control of SO<sub>2</sub> emissions is important in the context of protection of local human health as well as long-range transboundary problems of acid rain.

#### **4.2. Mitigation actions**

The most cost-effective measure for reducing gaseous emissions is to substitute natural gas in combined heat and power plants and condensing power plants. Combustion controls and low NO<sub>x</sub> burners are recommended. Localised SO<sub>2</sub> emissions will remain around plants burning heavy fuel oil and near the existing refinery until it is upgraded.

Urgent consideration should be given to the options to reduce emissions, including the installation of flue gas desulphurisation (FGD) or sulphuric acid plants at major emitters, or desulphurisation of the crude oil at the Mabeikiai refinery, import of low sulphur heavy fuel oil from sources other than Russia, and substitution of less polluting fuel or technologies. Improvements in energy efficiency and conservation would also bring about a corresponding reduction in SO<sub>2</sub> emissions.

Inefficient burners in small industrial boilers gives rise to excessive NO<sub>x</sub> emissions. Control of NO<sub>x</sub> emissions is important in the context of protection of local human health, acid rain and protection of the ozone layer.

Urgent consideration should be given to improving the combustion regime by using low-NO<sub>x</sub> burners in major boilers in order to both increase production efficiency and reduce NO<sub>x</sub> emissions. The installation of NO<sub>x</sub> abatement technologies should also be considered for major sources.

Particulate emissions from power stations in Lithuania are likely to be less significant than emissions of SO<sub>2</sub> or NO<sub>x</sub> due to the limited number of coal fired plants and the use of cyclones and/or electrostatic precipitators in major power plants. However, domestic coal fired boilers in some rural areas may give rise to significant local air quality problems. Consideration should be given to quantifying gaseous emissions and ambient levels of particulate in order to protect human health and to facilitate implementation the Convention of the Climate Change Directives.

Due to inefficiency of both supply and demand side activities, excluding Ignalina NPP, Lithuania relative burns more fossil fuel than necessary to generate each kWh of electric or heat energy. This inevitably results in correspondingly high CO<sub>2</sub> emissions. In addition to efficiency improvements as part of an overall energy policy, consideration should be given to the potential of renewable energy sources, and in the long-term to the potential introduction of a carbon tax in line with EEC policy.

Significant results could be achieved using Western technologies and experience. Today energy sector's emissions into atmosphere (~100 ths. t in 1994) are reduced from 1990 approximately twice because national product decreased dramatic comparing with 1990 year.

*Ongoing ways to reduce pollution to atmosphere from energy sector are:*

1. Rational and effective fuel and energy usage.
  - 1.1. Implementation National fuel and energy saving program (Government support this program from beginning of realisation at 1991).

- 1.2. To increase part of gas in fuel balance (long term project).
  - 1.3. Conversion for boilers (short term projects, beginning in 1994).
  2. Implementation of environmental protection measures.
    - 2.1. To reduce NO<sub>x</sub> emissions into the atmosphere 60 % by combustion control measures and by new low NO<sub>x</sub> burners (research carried out from 1992).
    - 2.2. Reduction of SO<sub>2</sub> emissions into the atmosphere by various methods:
      - a) fuel desulphurisation,
      - b) desulfurisation of effluent gases,
      - c) purchase of lower sulphur fuel oil at Mapeikiai refinery,
      - d) various combinations of a), b), c).
- The high cost of pollution abatement equipment for energy industry is a serious constraint on environmental protection in the short-term.
3. Increase payback fundings from pollution and environmental resources taxes policy.

However, there are numerous low and high cost measures (NEGAWAT policy, renewable energy, metering appliances and oth.) which could be taken to reduce pollution from the energy sector. Moreover, there are many initiatives in the field of energy efficiency and conservation which might be recommended as strategic goals for the energy sector which have the added advantage of significant reductions in emissions at no extra cost.

#### *Short term priorities.*

- creating of economic and legislation state regulation system on energy resources, energy production, consumption and saving;
- using of local and renewable energy resources;
- water, gas electricity and thermal energy metering equipment and system creation, implementation and metrological supply;
- restructurisation and modernisation of building materials production industry;
- renovation of existing buildings and design of new energy effective buildings.

*Technical assistance* from foreign countries is going fourth year in energy sector, including legal/institutional issues, as energy legislation, a technical, economic and environmental audits, creating thermal plant refurbishment and repowering programs, network equipment, system control and data acquisition upgrade programs, insulation of houses, metering of gas and heat supply, onshore oil development, rehabilitation of small hydro plants, renewables feasibility studies and other technical assistance to update and implement The National Energy Strategy, ecological monitoring and energy saving programs.

## **5. CONCLUSIONS**

We agree with UNEP/ECE, that we have inherited a badly damaged environment, energy and raw material intensive economies, and obsolete, polluting technologies. Furthermore, we are facing new constraints associated with the shift from a centrally planned to a market economy, such as mounting unemployment, high inflation, public deficits, protectionism, and the search for new markets for foreign trade following the collapse of the Council for Mutual Economic Assistance. It is, however, widely understood that the aim of the transition is not only to improve economic performance in the short and the long term but also to move towards sustainable economic development. In accordance with the Rio Declaration on Environment and Development, environmental concerns should form an integral part of the development process. This, in turn, calls for significant improvements in environmental planning and management and for the integration of environmental policy with energy policies. Our five year practice shows and confirms that energy and environmental authorities should make appropriate institutional arrangements to better co-ordinate and manage foreign assistance programs in order to avoid overlapping, duplication, and the inefficient distribution limited resources.

### **5.1. Personal development and training**

It is difficult to see how Lithuania, whose only natural resources are it's people, can trade in the European or World market. However we are looking to Denmark, Finland, Sweden, Norway and other developed countries as a models for our development.

Self-reliance, responsibility and working for one's own livelihood are new concepts for a whole generation. Time, education and training is needed to develop these social skills. A need is for Lithuanian administrators to visit their institution's counterparts in the West rather than gave foreign experts go there. A small project offering short training

programs with EU members Local Authorities has a huge cost-effective benefit. The Lithuanian community in developed countries might assist, particularly with translation and accommodation, reducing the dislocation and disorientation to the trainee.

## **5.2. Demand**

The present situation has created favourable conditions for the solution of environmental issues. Our main objective today is to implement the demand side management in such a way, that the future growth of economy would not be followed by the increase in the consumption of energy resources, especially organic fuel. Therefore a long term program has been developed for saving and rational use of the energy resources, the implementation of which forecasts a positive effect, also in the sphere of environment protection. Today we have a situation, where the energy resource imports are a very heavy burden for the trade balance, leading to the increase of hard currency loans portion. This issue could only be solved by trying not to increase the imports of energy resources, with simultaneous rise of economy and increase of the exports of products and services.

## **5.3. A nuclear free energy**

From time to time a question arises: could nuclear energy in Lithuania be replaced by the existing or future thermal plants using natural gas or heavy fuel oil? The answer from the point of view of economic feasibility would be a clear "no". According to the 1993 data, Lithuania's energy sector has purchased fuel for about 95 M USD, 25 M USD of which for organic fuel and 70 M USD--for nuclear fuel. The choice to replace nuclear fuel by natural gas and heavy fuel oil at an actual proportion of 60 percent of heavy fuel oil (which is cheaper) and 40 percent of natural gas, would raise the overall fuel costs to 212 M USD, i.e. 2.23 times. The inevitable rise of energy tariffs would lead to social complications, as multiple recent tariff increases, mostly related to fuel cost increases, have already made a huge impact on the society's living standards.

The installed capacity of thermal power plants would barely be sufficient today, during the economic decline phase. Hopefully, we will get over the decline, and will either need new capacities for the economic boost, or will have to import electricity from Russia, both of which seem unrealistic. Whereas if we continue operation of the nuclear power plant, new capacities will not need to be installed, and the replacement of existing facilities would be a problem of the distant future.

## **5.4. Proposals for discussion**

The current process of dramatic change in Europe is posing new and compelling challenges to regional co-operation in general and to co-operation in the field of the environment in particular. Development of the energy sector in Lithuania is a complex problem involving technical, economical and environmental issues, which have to be solved in the context of the multiple factors of the World's development. If there are global tendencies and recommendations in the energy sector development (let us not forget the "greenhouse effect"), Lithuania's energy experts would be glad to accept them, thus facilitating the public relations and the solution of environmental issues.

The primary goal of the present discussion could be establishment of general guidelines for the environmental policies in the energy sector. First of all an information exchange mechanism for environmental situation in various countries should be established. Secondly, procedures of appropriate recommendations and technical consultations worked out, and thirdly, means of their implementation discussed through a creation of a financing mechanism for environment protection activities in the broad sense. For that purpose, the Western countries could develop a special mechanism to support the countries of Central and Eastern Europe in overcoming environmental difficulties of the transitory period. We think it would be possible to organise international expert work-groups for the preparation of recommendations, which could be implemented by an ecological forum of the World Community.

## **6. ACKNOWLEDGEMENTS**

The above stated thoughts are the opinion of the author. This opinion is based on National energy strategy's part--environmental strategy, and analysis of works fulfilled by Lithuanian energy institute, as well as the other sources.

## 7. ENDNOTES

The view of this report will be detailed in Lithuanian environmental strategy , which will be finished in second half of 1995 and in the Lithuanian Climate Change Convention implementation strategy, which will be finished too in second half of 1995.

## 8. REFERENCES

1. *Republic of Lithuania. National Energy Strategy. Final Report*, Volume 1. December 1993. IC Consult, ERM Energy Limited, COWIConsult, Lithuanian Energy Institute.
2. *Review of Lithuania's Own Energy Resources and the Scope for Utilising them for Energy Purposes*. August 1994. CEC/PHARE Program Lithuania/ Energy sector, Vilnius.
3. *Republic of Lithuania. Wood Fuel and Conversion Study*. October 1994. EBRD/Carl Bro Group.
4. *Guidelines on Integrated Environmental Management in Countries in Transition*. 1994. UN, New York.
5. *Lietuvos gamtinė aplinka. Būklė, procesai, tendencijos*. 1994. Aplinkos apsaugos ministerija. (*Lithuanian environment. Situation, processes, tendencies*. 1994. Ministry of Environment Protection), Vilnius.
6. *The UN Bulletin in Lithuania*. February 1994, vol. 1, No. 3, Vilnius.

