Improving energy efficiency in economies in transition: The Lithuanian case

Vidmantas Jankauskas, Lithuanian Energy Institute

1. SYNOPSIS

Evaluation of the first year achievements and obstacles in implementation of the National Energy Efficiency Programme in Lithuania is given. Impact of a rapid increase of energy prices on energy conservation is reviewed.

2. ABSTRACT

Lithuanian economy is similar to the other former centrally planned economies: strongly biased in favour of heavy industry with energy used inefficiently in all the sectors. At the end of 1991 the National Energy Efficiency Programme was prepared and approved by the Government. It determined the main areas of inefficient energy supply and use, and identified the main directions in implementation of the Programme. In present paper we evaluate the first achievements and clarify the obstacles in implementation of the Programme. The huge and rapid increase of energy prices together with the deep economical crisis caused a situation in which industrial managers are fighting only for survival of their enterprises and pay a little attention to increased energy efficiency, especially if it needs some investments. Introduction of energy meters is proceeding in all the sectors of national economy as it provides simple and measurable reductions in energy bills. Incentives were also given by the Government as a major share of meters cost is covered from the state budget. But residents of multifamily apartment buildings can not introduce heat meters as the district heating systems do not allow their installation. There were no changes in the output of the building materials industry as they produce low thermal resisitivity materials.Householders tried to increase insulation of their houses and flats putting insulation on windows, glazing balconies and installing double doors. Further insulation (outer walls, roofs)requires capital investments, and the Governmental support is needed.

3. NATIONAL ENERGY EFFICIENCY PROGRAMME

3.1. Energy conservation potential

The Lithuanian economy is highly energy intensive. Primary energy consumption peaked in 1988 at about 600 PJ (or 160 GJ per capita), with electricity production at 29 TWh (or almost 8 MWh per capita) and consumption at about 17 TWh (4.6 MWh/cap). These indicators are among the highest in Europe, higher even than those of neighbouring Eastern European countries.

It is hard to obtain valid indicators of economic activity for Lithuania because it was totally integrated into the Soviet economic system. The World Bank international comparisons for 1990 gives a GDP value for Lithuania 2000 $/capita. This figure is from 6 to 12 times lower than in the West-European countries. If one compares some secondary indicators (like car and telephone ownership per capita), he finds Lithuania at similar levels to those of other Eastern European economies. Levels of ownership are substantially lower than in Western economies, although the relationship is of the order of one to three or four, rather than one to ten as in the case of the GDP figures (Jankauskas and Krakauskas 1992).

The analysis indicates that in Lithuania, and Eastern Europe in general, huge amounts of energy have been wasted. Indeed with a very low price of energy and a lack of incentives for energy saving all attempts to produce energy saving measures under the supervision of planning and control boards were in vain. Among the reasons for the high level of energy consumption is the relatively high share of industry in national income. This is combined with the fact that many of Lithuania's industries are energy intensive, a problem

which is also common to many other centrally planned economies. Over the last 3 decades a huge refinery has been built, the synthetic fibres and mineral fertilizers industries have been introduced and rapidly developed, and the building materials industries (cement, bricks, ferro-concrete) have been developed. Lithuania is now one of the European leaders in cement and mineral fertilizer production (per capita) (Jankauskas and Krakauskas 1992) and these two leading branches of industry account for about one half of total energy consumption in the industrial sector and 20% of the national income (Table 1).

Table 1. ***Primary energy consumption in Lithuania in 1990***

	PJ	%
1. Industry	241	40,1
a) oil refinery	36	6,0
b) industrial chemicals	54	9,0
c) machinery	26	4,3
d) paper and pulp	15	2,6
e) building materials	47	7,8
f) light industry	12	2,0
g) food industry	19	3,2
h) other industries	32	5,2
2. Construction	11	1,7
3. Transport	91	15,1
4. Agriculture	51	8,4
5. Residential	180	29,8
Losses	29	4,8
Total	602	100,0

One of the problems with these industries is that they have been developed using obsolete technologies. They need significantly more energy and other raw materials per unit of output than competetive producers in the West. The other problem is that the large share of energy is wasted in heating and ventilation systems of industrial plants. Losses in these systems, as evaluated, significantly exceed the corresponding losses in Western European countries.

In the domestic sector there is also a substantial amount of energy loss. This is caused by the poor construction of buildings (a low thermal insulation quality), and a lack of metering and regulatory devices. Most urban dwellers are connected to district heating networks and the poor quality of some of these systems (with pipe corrosion, poor maintenance and control) also threatens the reliability of the heat supply. These deficiencies wipe out many of the advantages of what in principle should be an energy efficient system of providing for domestic heating. Our analysis indicates that domestic heat consumption could be halved by technical and economical measures and new standards.

In the agriculture sector there is a high energy consumption in the drying of grass, grain and flax and also by fuel-intensive machinery of fuel--by heavy and inefficient tractors and harvesters. The total potential for energy conservation in agriculture was estimated to be about 30% (*National Energy Efficiency Programme* 1991).

3.2. Demand for energy metering and control devices

The most urgent task in increasing energy efficiency is to solve the energy metering problem. Without metering it is impossible to implement energy conservation measures and to create a suitable economic mechanism. The number of devices needed, given in table 2, shows the complexity of the task and the amount of investment needed.

In the National Energy Efficiency Programme (*National Energy Efficiency Programme* 1991) it was shown that a payback period for investments in the introduction of metering and regulation devices is only about 2.5 years (evaluating only fuel savings). The return of investments is three times higher in industry than in the residential and service sector of the national economy and the average payback period in industry is only slightly more than one year.

3.3 Energy conservation in buildings

Energy losses in buildings could not be reduced rapidly with an implementation of some technical measures. Energy conservation requires an essential reorganization of the building materials industry, construction practice the introduction of new building codes and economical incentives to increase insulation of existing buildings.

According to the Programme it was planned to create an economic and legal frameworkforthe building industry: new building codes, the optimal energy consumption limits for building materials as well as a state expert commission and state inspection to assure the implementation of the building codes. It was also planned torestructure the building materials industry in order to produce more of insulation materials and materials with better thermal resistivity.

At present, an average thermal resisitivity of walls is R=1 m .deg/W. According to the Programme there was planned to increase this indicator to R=3. Evaluation of the expenses needed to save 1 tonfuel in buildings for the investments allocated toincrease wall insulation gives the payback period equal to 10 --12 years.

Table 2. ***Demand for main metering and regulatory devices***

Destination of the device	Number needed, mln.
1. Heat meters of size	
a) 100 - 10 000 kW	0.025
b) 30 - 1 000 kW	0.03-0.04
c) 3 - 150 kW	0.08-0.10
2. Individual heat meters	1.8-2.0
3. Hot tap water meters	0.6-0.65
4. Regulators for heaters	2.2
5. Multitariff electric meters	0.5
6. Individual gas meters	0.6
7. Heat regulators	0.05-0.06

3.4. Plan of implementation

The implementation of the energy conservation measures was planned by application of economic and administrative measures coordinated by the State Energy Conservation Commission established in the spring of 1992. The main functions of the Commission are the following:

- to form the investments fund for implementation of the energy conservation measures,
- to create the database of energy conservation measures,
- to reform the investments policy,
- to create the framework for theintroduction of an energy pricing system stimulating an efficient energy consumption.

4. FIRST YEAR AFTER THE ADOPTION OF THE PROGRAMME

4.1. Impacts of new energy prices

In 1992 there was a drastic increase in energy prices, which reached the international level. The impact of such an increase was very serious for all the branches of national economy.

The energy price increase was especially high for industrial consumers and raised the energy share of total production costs significantly. Some industrial products and manufacturing goods became non-competitive with respect to the former Soviet market, as Russian internal energy prices were still many times lower. As a result the industrial output of high energy intensive industries was reduced significantly. Production of cement, mineral fertilizers and oil products decreased by 40-50% only during the the first half of 1992 (Jankauskas 1992).

Many industrial enterprise managers simply were looking upon the increased energy prices as an increased share of production costs to be passed on to the consumers. On the other hand, industrial consumers were forced to pay for thermal energy not only covering its production costs but also subsidizing residential

consumers. Therefore heat supply from the district heating system to industrial consumers was charged with tariffs significantly exceeding international prices and equal to cost of heat produced by autonomous heaters!

Table 3. ***Changes in retail energy prices in 1992 (in USD according to the official exchange rate)***

Sector	Fuel	Unit	Jan	Nov
Transport	Petrol	litre	0.03	0.3
Industry	Heavy fuel oil	tonne	10	70
	Natural gas	th. c. m.	7	80
	Electricity	MWh	2.5	20
	Thermal	Gcal	2	22
Residential	Thermal	Gcal	0.3	1

It is easy to understand that such an energy price shock (with also increased prices of raws materials) determined a sharp decrease of industrial output--51.6% in 1992.Residential consumers were significantly subsidised or cross-subsidised and their retail prices for natural gas, coal or thermal energy were too far from those of the international market . But even these modest prices laid as a heavy burden to many consumers and share of unpaid energy bills reached about one third of all the urban dwellers.

4.2. Putting into practice energy conservation measures

Allthough 1992 was an extraordinary year for the energy system and the energy price shock changed many previous plans, some planned energy conservation measures were put into practice.

4.2.1. Energy meters

Increase of energy prices was a rather serious stimulus to install energy meters. Industrial consumers installed multitariff electricity meters (especially after introduction of a different tariff system with low electricity prices during night period), and demand for these meters exceeded their supply. Local producers of the meters established a joint German-Lithuanian venture to start production of modern electronic multitariff electricity meters. Also several foreign producers of electricity meters were looking for markets for their production.

Demand for heat meters was also increasing but not in the residential sector as the existing configuration of the district heating systems doesn't allow to install neither valves nor meters for individual consumers. Industrial consumers were installing heat meters or taking even more radical steps--switching off from the district heating pipelines and installing their own boilers in order to get rid of cross-subsidies to the other groups of consumers.

Especially urgent was a demand for natural gas meters in industry as well as in the domestic sector. Householders were queing for installation of the meters as there was a lack of qualified workers able to install the meters. Thelast trend was caused not only by the rapid increase in natural gas prices but also by incentives given by the Government--80% of the meters price was covered from the state budget in 1992, and 70% in 1993.

4.2.2. Conservation in buildings

In the building materials industry plans for introducing materials with increased insulation characteristics were not put into practice in 1992. For the first half of 1992 production of low thermal resisitivity claydite and ferro-concrete materials was stable and production of insulation materials as foam polystyrene was even reduced. In the second half of 1992, the increase in energy prices had a serious impact on the price of building materials as their production requires a lot of energy.

According to the Programme it was planned to establish a system of incentives to reduce taxes and provide favourable credits to producers of insulation materials. The system of incentives was prepared though it wasn't put into practice.

Very high heating prices created serious incentives to increase the insulation of dwellings. Owners of detached cottages made extra efforts reducing heated space, putting insulation on windows, doors and even walls. All that had a direct payback in reduced bills for energy. But dwellers of multifamily apartment buildings were in the worse conditions as all their efforts to increase thermal insulation didn't affect the energy bills. Still some improvements were made (double doors, increased window insulation, glazed balconies) as all these improvements lead to an increased comfort in apartments when district heating systems reduced the heat supply keeping an average temperature in dwelling houses only about 13 C.

5. FINANCIAL AND INSTITUTIONAL POLICY IN ENERGY CONSERVATION

The State Energy Conservation Commission established in 1992 didn't show serious signs of action. The Directorate of the Energy Conservation Programme was later established in order to enforce administrative measures in putting into practice energy conservation measures.

During the first year it became evident the need for an information system on energy consumption, production, distribution as well as on energy saving measures. The system is planned to be created in the nearest future.

In order to stimulate implementation of energy saving measures a special financial institution--a bank--should be created. It will enable to accumulate funds, to provide an investment policy, to allocate funds for the radical reconstruction of the energy system.

6. CONCLUSIONS

1. The rapid and huge increase in energy prices together with the state subsidies on energy meters created very good incentives for installation of electricity and natural gas meters. Unfortunately technological constraints of the existing district heating systems did not allow to install individual heat meters.

2. There were no planned changes in reconstruction of the building materials industry. Householders were putting all the possible efforts in increasing insulation of their dwellings. Serious state support was badly needed there.

3. Institutional, financial and economical incentives are to be created without delay in order to increase energy efficiency and put into practice energy conservation measures.

REFERENCES

Energy Conservation Potentials in Lithuania and Latvia. 1992.

National Energy Efficiency Programme. Vilnius, Lithuanian Ministry of Energy, 1991.

Jankauskas, V., 1992. Improving Energy Efficiency in Lithuanian Industry: Difficulties of Transition. Proceedings of IAEE East-European Conference, Kaunas, Lithuania, p. 178-183.

Jankauskas, V. and Krakauskas, M. 1992. How to Improve Energy Efficiency in Lithuania. - Coping with the Energy Future: Markets and Regulations. - -Proceedings of the 15th Annual International IAEE Conference, Tours, France, p. C1-C8.

Riso-M-2941(EN), Riso National Laboratory, Roskilde, Denmark.