



**Economic and Social  
Council**

Distr.  
GENERAL

ENERGY/GE.1/1999/9/Add.1  
2 September 1999

Original : ENGLISH/RUSSIAN

ECONOMIC COMMISSION FOR EUROPE

COMMITTEE ON SUSTAINABLE ENERGY

Second session, 8-9 November 1999

Item 5(c) of the provisional agenda

THE MAIN TENDENCIES OF THE UKRAINIAN COAL AND  
HEAT POWER INDUSTRY DEVELOPMENT

(Submitted by the Government of Ukraine) \*/

---

\*/ Prepared by Messrs. A. Shidlovsky, Vice-President, National Academy of Sciences of Ukraine and G. Pivnyak, Academician, National Academy of Sciences of Ukraine.

## 1. Introduction

The main share of the electric power generated in Ukraine, falls at thermoelectric plants (160% in 1994; 58,4% - in 1995).

The share of coal among other power resources used to generate electric power and heat, makes up 32-34% (34% in 1995).

Ukrainian power industry is a highly developed branch of the country's national complex with full technological cycle of design work, generation, distribution and marketing of electric power.

The determined power of electric power stations of the country's united electric system is 52 mln KWt, including thermoelectric plants power – 31 mln KWt (61%), atomic plants – 12,8 mln KWt (25%), hydroelectric power plants – 4,7 mln KWt (9%).

During the last years thermoelectric plants' demand for organic fuel makes up 30-35 mln of tons of coal, 13-15 billion of m<sup>3</sup> of natural gas and 3-4 mln of tons of furnace fuel oil.

During the last years the heat power industry installations are being used with the decreasing load. The real absence of increase of the electric power consumption in combination with the ecological problems determine insufficiently strict demands for exploitation fresh power capacities. However, in perspective electric power generation will increase. By this period, the substantial part of the functioning equipment will have

been exhausted. Therefore, the task of providing power industry with finances assumes special urgency.

At present time the power industry transformation and the reform of relationships in the sphere of property in the industry are taking place in Ukraine.

Under the economical circumstances one of the tasks of the power industry development is the attraction of foreign investments on rational scales and on mutually beneficial conditions. For this it is necessary:

- to create the effective price policy;
- to create the stable law environment attractive for investors;
- to improve the contract-agreement basis of intergovernmental relationships.

The power industry enterprises of Ukraine continue to function in the conditions of organic fuel shortage and mass non-payment for the supplied electric power. This has significantly influenced the reliability and safety of Ukraine's power system functioning. The problems in power consumption management have come into existence. The insufficient quantity of maneuvering capacities, which are necessary to meet the demand for electric power in the hours of the maximum load is typical for the structure of Ukraine's fresh power capacities. The high share of atomic power plants in power balance forces to exploit power-generating units of thermoelectrical plants in off-design maneuvering conditions.

Difficult situation is at thermoelectric plants, concerning the state of the main power-generating plant. The substantial part of the equipment has served its specified life and become obsolete.

For this reason the thermoelectrical plant functions with very poor efficiency and reliability, and the effluents of harmful substances into the atmosphere exceed the admissible indices. The rehabilitation of the existing thermoelectric plants with the help of introduction of new technologies of the Ukrainian coal burning is necessary.

Conclusion can be made according to the state of affairs in power industry. The most important problems, the efforts have to be directed to, are the following:

- introduction of fresh power capacities;
- mastering power conservative perspective technologies;
- creation of new type electrical equipment;
- improvement of power consumption, application of modern computer systems of control.

Coal-mining industry is known to define power supply in Ukraine. It preserves national security of the country and its independence. It is also dictated by the tendencies of the world power generation development: coal remains one of the main sources of power generation and its significance will increase in future.

Coal is a dominating source of power generation and provides 40 % of it in Europe and 44 % in the world. World prospected resources of coal are 5 times as large as those of oil and gas. The potential resources of coal are 15 times as large as those of oil. The economical factor of the advantages of coal usage is also important.

The cost of coal in the world (European) market is about one-second of the cost of natural gas. The second factor is the political one connected with the power independence of countries. The experience of the leading countries witnesses: power policy

is to be built taking into account national resources. The main power-generating raw material in the depths of Ukraine is coal, and methane, which is an associate of coal.

## **2. Peculiarities of fuel and power generation complex**

Coal is strategically important resource of Ukraine and its reserves are sufficient to meet the demands in this type of fuel. The real potential of coal-mining industry is estimated as 100 mln of tons a year. New technologies of coal mining and usage are to play an important role in coal-mining industry conditions progress. The main source of satisfying Ukraine's requirements in natural gas its import. Under the existing economical conditions, while generating power, coal is more competitive compared with the natural gas.

Coal is the only power resource which exists in Ukraine in quantities necessary to meet the demands in this type of fuel. This factor defines the strategic role of coal in the development of both power generation and the economy of the country in the whole. There are different types of coal on the territory of Ukraine: from black coal and brown coal to anthracite coal.

But in spite of such a powerful resource base coal production in Ukraine decreases from year.

Since 1990 till 1998 it decreased from 164,8 to 76,2 mln of tons a year, that is one-second of its previous amount.

The crisis situation in Ukraine's coal-mining industry has formed because of the number of reasons. Mainly it is explained by the investment policy of the former USSR,

which was directed toward the reduction of coal production in Donbass and toward the cheaper coal mining in the Eastern regions of Russia.

Labour productivity in coal-mining industry in 1996 was 15,8 tons a month, in 1997 – 18,2, in 1998 – 19,8 ; the load for breakage face was 244 tons a day, 289 and 312 tons a day correspondingly; the load for face with complex mechanization was 357 tons a day, 421 and 463 tons a day correspondingly.

There were 642 faces with complex mechanization in 1990, 634 in 1991, and beginning from 1992 the number has halved and is about 370-330 (in particular, 337 in 1998). The number of breakage faces is being constantly reduced (606 in 1998, as against 1426 in 1990).

The service term of about 40 % of the functioning mines is more than 50 years, and 14,9 % of mines have been functioning more than 70 years. More than 35% of mines have productive capacity about 300 000 tons a year, that is lower than the productive capacity of one modern powered mining complex a year.

Less than 10 % of coal is mined at about 90 non-efficient mines of Ukraine. One-fifth of the workers, engaged in branch, work there, and these mines use about 20 % of the state supporting 62 mines from 211, which functioned in 1998, mined more than 7,8 mln of tons of coal in excess of the plan, and 149 mines underfulfilled plan by 16 mln of tons of coal.

A conclusion can be made: the increase in coal-mining industry can be reached if non-efficient mines are closed down, financial and material resources are directed toward the equipment of highly remunerative mines and open-pit mines.

In 1998 the ash content of coal which was mined in Ukraine was about 35,7-36,4%, the ash content of the concentrated output, supplied for the consumers was 23,3-25,3%.

Henceforth, the production of the finished commodity output, but not the coal extraction as rock mass, will become the main index, the work of the industrial enterprise is to be estimated according to.

The reason of high coal cost price is in high exploitation expenditures and poor technical equipment of the greatest part of the industrial enterprises.

The specific consumption of fuel by Ukraine's thermoelectric plants is one-fourth higher than that in the countries of Western Europe, the USA, and Japan. Such a situation may be explained by the number of reasons.

About 70% of thermoelectric plants equipment have served their term, and the wear of the rest of the equipment makes up 40-90%. The power-generating units physical aging and wear causes the efficiency to become much lower compared with the designed level. The average efficiency of the thermoelectric plant constitutes about 32%.

The steam-and-gas turbine power units are the most efficient from the point of view of capital investments and maintenance costs as they need natural gas for their operation. That is why coal is to be taken as the main type of fuel, but the natural gas is to make up 50%.

Natural gas consumption in 1997 constituted 80 billion of  $m^3$  and its production runs 18,1 billion of  $m^3$  a year. Thermoelectric plants consumed 12,8 billion of  $m^3$  of natural gas. Gas production in Ukraine will grow negligibly. That's why the power industry of the country is forced to orient toward the natural gas import.

The main aim of power generation industry modernization is increase of power-generating units efficiency (reducing specific fuel expenditures).

In spite of the intention to use natural gas in power generating industry modern power stations are characterized by high technical and economical indexes.

Coal more competitive because the cost of 1 kWh is mainly determined by the cost of fuel component, and in consequence of the absence of components from capital investments and costs for desulphuring in amortization costs. With the existing thermoelectric plants efficiency the competitiveness of coal in comparison with natural gas remains 54,3 dollars for ton, including transport and other costs.

Power generation at the electric power stations of Ukraine using coal for the operation is not ecologically pure process. To provide steady burning of fuel, characterized by high ash content, it is necessary to use imported natural gas and fuel oil. In this connection it is necessary to work out new power technologies, which provide ecological norms observance, which are more effective economically, and exclude the dependency of the branch upon the imported raw material.

All ecologically and technical problems mentioned above are actual not only for Ukraine, but for all developed countries of Western Europe, the USA, Japan, and for some others. Certain experience in working out such technologies has already been accumulated.

These technologies from the basis of ecologically pure coal-mining technologies, are worked out and introduced into power-generating industries of developed countries.



Taking into account modern level engineering and technology it is necessary in future to implement the design of power-generating units with the efficiency 43-47%, gas and oil units with the efficiency 45-50% and steam-and-gas turbine plants with the efficiency 55-60%.

### **3. Tendencies of the development**

The problems of coal-mining industry may be solved only under the condition of state law and financial support. The way out of the crisis situation is to be found with the help of the Branch Complex Programme of coal-mining industry enterprises reformation and financial normalization.

The Programme is based on the supplying the country with the competitive coal-mining industry products, on lowering the country's economy dependence upon fuel and power resources import and on reaching the needed of Ukraine's power security. The Programme foresees the initiating of using sources of raising the efficiency of its functioning. The state must support the branch in a proper level as well as power consumers.

The following tasks are to be solved on a state level:

- working out state standards on the coal-mining industry products and these products certification in accordance with the power-intensive indexes as the basis for quality improvement;
- integration of legal, organization and technical base of lowering the power intensity of the mine fund and the coal-mining industry products;

- redistribution of the investment resources to provide support for the development of industrial functions at 40 mines, which annual output is 800-1000 thousand tons;
- organization of coal-mining, which is characterized by the improved consumers qualities;
- interbranch structures of wasteless power resources processing are to be reorganized into the components of final products (mine – dressing plant – electric power station);
- using the technologies of passing and unused power resources conversion (selective extraction of coal, slurry, methane, adaptable to streamlined production methods power accumulators);
- creation of the coal market under the patronage of the state;
- use of the effective mechanism of unexpensive power-saving measures realization;
- introduction of boilers with fluidized bed to use all types of coal under the conditions of power stations reconstruction;
- improvement of the technologies of power resources consumers relative to the specific power consumption.

The realization of the Programme will make it possible to increase the production of the finished marketable coal products in 1999 up to the level 62,7 mln of tons, but in 2000 it will reach the level of 66,4 mln of tons, which is correspondingly 11,7% and 18,3% more, compared to the production level in 1998. The growth of the output, modernization of mining equipment, the development of coal dressing processes and

other measures will provide the needed economical effect, which, in its turn, will influence greatly the fulfillment of the Power Programme in Ukraine in the whole.

Methane production and industrial utilization will help us to solve the task of raising the efficiency of coal-mining operations safety, the improvement of ecological conditions and the environment in the region.

According to different estimations, done by the specialists, the prospected reserves of methane in the coalfields of Ukraine constitute 2,5 – 3,7 trillion of m<sup>3</sup>. The American experts consider these reserves to be much greater (25-27 trillion of m<sup>3</sup> of methane). That is why coalfield may be rightly related to the coal-and-gas deposit.

Home and foreign experience convince us in the expediency of methane production from the coalfields. The use of modern and perspective technologies of methane production will make it possible to produce 10-15 billion of m<sup>3</sup> of gas by the year 2005 (over 20% from the needed quantity, and during the following years (by the year 2010) Ukraine will produce 25-30 billion of m<sup>3</sup> of methane (about 43% from the needed quantity).

Complex utilization of the depths of the earth under the mining of coal deposits, the introduction of untraditional technologies of coal extraction and processing, the creation of small heat-and-power complexes to provide the combined production of heat and electric power – all these measures are aimed at raising the competitiveness of the mining enterprises products.

Coal-mining industry as a part of the fuel-power complex participates in the power market of Ukraine. Control for the branch operation is realized at three levels:

state industrial development policy, interbranch state control and control on the side of the form. Methods of control and efficiency criteria are different at different levels.

State industrial development policy defines the development and the structure of heat-and-power complex. Contemporary industrial development policy of Ukraine presupposes coal mining industry preservation and maintenance in the minimum needed quantity, as coal is the only primary power resource, which the country has in needed quantity.

To control the branch with the aim of raising its competitiveness, it is possible to use both administrative-organizational and economical methods, which may be realized with the help of the legal base in the form of legislative acts.

The Programme of coal-mining industry reformation is realized with the aim of raising the efficiency of coal-mining industry functioning in Ukraine, and forming the atmosphere of competition in the conditions of market reforms, which take place in the country. The Programme presupposes realization of the strategy, aimed to help the viable base of the branch to survive. The branch will be able to produce coal of the best quality and the cost of a unit of products will be 20% lower than the cost of coal, mined nowadays. The growth of labour productivity will be provided due to the structural reconstruction and improvement of the technology, including automation and computer facilities application.

The international experience of coal-mining industry reformation in the main coal-mining countries (Germany, Great Britain, France, the USA, Poland) has become the basis of structural transformations in coal-mining industry of Ukraine. These trans-

formations are defined first of all by the necessity of our country's transition from the planned economy to the market one.

The restructurization includes the direct change of the structure by means of closing the mines which do not operate efficiency enough. The rest of the mines are to be transported into highly efficient and new coal-mining enterprises are to be built. Coal-mining industry reformation will result in cutting down the need in subsidies by means of raising labour productivity and solving a number of urgent social problems. The increase of labour productivity and lowering consumption of the electric power by the coal-mining industry enterprises may be reached by means of mining machines and equipment modernization as well as by means of modernization the technologies of coal-mining and processing.

The work in nature conservation sphere of the branch is aimed at: the lowering of the negative influence of coal-mining industry enterprises upon the environment due to the cutting down the quantities of mine waters discharge which are insufficiently cleaned; at the extinguishing of burning waste dumps; at the recultivation of the damaged soil and inefficient waste dumps; at the use of mineral resources, which are associated with and wastes of coal-mining industry; at the lowering of harmful effluents out of the departmental boiler houses and power stations, including wide utilization of boilers with fluidized bed of the other coal-mining branch enterprises; at the accompanying methane production and use.

Privatization of coal-mining industry enterprises is the further step of structural reformation of the coal-mining industry.

The measures done may give the possibility to cut down the costs for coal products, to create the competitive service atmosphere of the additional production enterprises and different social services.

Physical liquidation of twelve mines, according to the Programme, was completed in 1998, and it is possible to complete the liquidation of some more 20 mines.

Ecologically pure technologies of coal usage in power generation will help us to make coal ecologically admissible resource characterized by high ecological indexes, and to raise Ukrainian power-generation industry competitiveness. It predetermines the perspective of the solid fuel power industry development in Ukraine.

The maintenance costs of all coal-power technologies are roughly the same. The costs for the power stations, which burn natural gas are connected with fuel.

Among the technical aspects, which define the possibility of coal power technologies introduction, it is necessary to mention the ability to utilize certain type of fuel; the needed power of power-generating unit, created according to certain technology; specific features, connected with concrete conditions of its introduction.

Wastes utilization in power generating industry is also a perspective factor. We mean over 180 mln of tons of wastes, obtained in the process of coal dressing (yearly growth is 5-6,5 mln of tons). Preliminary preparation and delivery of waste dressing products to the electric power stations could provide the additional receipt of 6-8 mln of tons of solid fuel a year during the period of time 15-20 year. Thus, we provide putting into operation of 10-12 additional power-generating units with the capacity in 200 MWt.

It seems expedient to realize new concept concerning differential consumption of coal and the products of its dressing depending on their quality. The coefficient of coal consumption is used as a criterion, which makes it possible to estimate quantitatively the efficiency of coal processing and burning.

#### **4. Conclusion**

A majority of countries rely on solid fuel as the main source of power. A number of countries consider coal to make a great contribution into the world we live in and it will influence our life for centuries, especially in the development countries.

According to the forecasts, for a long period of time in future coal will play an important role as a fuel for power generation in number of countries of the world, and in particular, in countries of Central and Eastern Europe. Vast reserves of coal, low price and the existence of a great number of supply sources, which are less influenced by political factors at the world market of power resources compared to some other, are the main factors, which make the use of coal preferable from the point of view of receiving cheap electric power and providing systematic supply of power sources.

The growth of demand for electric power in European countries with the economy of transitional period and in some other countries may be met, in the first place, by means of home and imported coal supplies. However new strategies and policies are necessary, which consider changes, taking place in coal-mining and power-generating sectors. As for as, according to the forecasts, the expanding process of liberalization, privatization and globalization will result in strengthening of market competition of power sources, in improvement of control practice, as well as organization and property

structures, in more perfect process of ecological control in coal mining and fuel burning, agreed methods of approach to the formation of policy in the sphere of stable power generation realization are of great importance.

Only consistent global power generation policy will make it possible to name coal as a constituent part of this policy and an equal partner of a power market. Coal-mining industry closing may bring the country to the situation, when the access to coal reserves becomes too expensive and even impossible.

The use of coal in Ukraine is dictated both by the necessity to provide state independence and by possibility to reach high level technologies of coal usage in power generation industry taking into account modern demands to the environment protection. It forms the basis of the concept of solid fuel power generating in Ukraine.

In future it is expedient for Ukraine to develop electric power generating industry on the basis of using coal and natural gas in modern power generating technologies.

The main efforts of Ukraine in its power generation policy are directed to increasing the share of home power resources and further diversification of the sources of their import.