DEVELOPMENT OF WORKS ON THE UTILIZATION OF ATOMIC ENERGY IN THE REPUBLIC OF BELORUS*

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The transition from centralized distribution to a free market in fuel-energy resources on the territory of the former Soviet Union is causing prices to increase up to worldwide levels. In the Republic of Belorus, where only 12% of the total consumption is covered by its own resources, this will lead to a sharp increase in the cost of production in almost all sectors of the economy and it will increase the dependence of the republic on the political and economic conditions in the exporting countries. Moreover, the electricity deficit at peak loads is 40% (1.7 million kW). These factors, as well as the increase in the ecological strain in almost all regions of the republic, including as a result of contamination of the environment by products of combustion of fossil fuels, make it necessary to develop alternative measures to restrict the dependence of the economy of Belorus on the importation of resources and lowering the ecological action of power plants on the environment, man, and objects of man's economic activity. The situation is exacerbated by the fact that in the period up to 2010 heat and power plants with a total capacity of 1.23 million kW will have to be removed from operation because of obsolescence.

These problems can be solved by means of energy conservation, importation of electricity, partial covering of the deficit of electricity and heat by nontraditional sources of energy, and the development and updating of the traditional fossil-fuel-based power plants.

In spite of the enormous importance of energy conservation as an obvious and necessary condition for further development of the economy (1% of the electricity consumption in the Union of Independent States is equal to the yearly increase in the production of electricity), there are enormous difficulties in implementing such a program. First of all, implementation of such a program does not solve the fundamental problem of the deficit of energy resources. Energy conservation is a factor which decreases the required rates of growth of power production, but it by no means removes the need for such growth, which is dictated by the requirements of economic development. Moreover, full-scale energy-conservation measures require enormous investments of capital and radical restructuring of most segments of industry, the economy, communal services, and so on. Even with an optimistic forecast, the implementation of such measures will require years and decades. Experience in industrial development of countries has shown that such work, which started during the first oil crisis in the mid-1970s, is still far from completion.

The development of power production in the Republic of Belorus by importation of electricity from sources located on territories of the border states is the most ecologically clean method of supplying energy. In spite of its attractiveness, it solves only part of the problem of supplying energy for all needs of the republic, since not more than 25% of the fuel-energy resources are used for the production of electricity in Belorus, and the rest of the resources are required for production of heat. Moreover, in this case the economy becomes more dependent on the political and economic conditions in the countries supplying the electricity. For this reason, one possible path for solving the problem of supplying energy in Belorus could be the development of a domestic nuclear power capability.

It is well known that the nuclear power program in Belorus was curtailed after the Chernobyl catastrophe. The construction of the Minsk nuclear heat and electric plant and design work on the Belorussian nuclear power plant stopped. A research reactor is being shut down. The Chernobyl accident also showed that its consequences are of a global character, which does not depend on the location of the reactor. In other words, an accident outside Belorus turned out to be a catastrophe for the republic itself. Thus the existence of nuclear power plants around Belorus presents a hypothetical danger that is no less than a nuclear power plant located on the territory of the republic itself. Moreover, the construc-

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TABLE 1. Electricity Consumption in the Republic of Belarus, billion kW·h

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<tbody>
<tr>
<td>1st</td>
<td>48.8</td>
<td>50.0</td>
<td>55</td>
<td>62</td>
<td>66</td>
</tr>
<tr>
<td>2nd</td>
<td>48.8</td>
<td>38.5</td>
<td>41</td>
<td>47</td>
<td>54</td>
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<tr>
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<td>48.8</td>
<td>33.5</td>
<td>31.3</td>
<td>32.2</td>
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Note. 1992 - 44 billion kW·h for all variants.

TABLE 2. Required Power-Plant Capacity, Million kW

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<tbody>
<tr>
<td>1st</td>
<td>9.91</td>
<td>10.90</td>
<td>15.09</td>
<td>13.09</td>
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<td>2nd</td>
<td>7.65</td>
<td>8.15</td>
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<tr>
<td>3rd</td>
<td>6.70</td>
<td>6.21</td>
<td>6.39</td>
<td>6.74</td>
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Note. 1992 - 7.02 million kW·h for all variants (account).

tion of the most modern nuclear power plant under the control of organizations of the republics and with their participation can best guarantee plant safety. Other factors which must be taken into consideration in assessing the role of nuclear power plants in the strategy for increase of power production in the republic in the near and distant future are also present.

Justification for Nuclear Power in the Structure of the Fuel and Power Complex. To substantiate the need for nuclear power and to determine its place in the fuel and energy complex, a technical-economic analysis of the energy complex and possible scales of its development in the near future (up to 2010) was performed, the ecological effect of power plants of different types was estimated, and a technical-economic analysis of different variants of the development of energy systems was made.

Three possible variants of the change in the demand for electricity up to 2010 under present economic conditions were considered:

first variant (maximum variant) — gives up to 2010 the modern average European level of energy consumption per capita (this variant is a computational variant in the national energy program of the Republic of Belorus);
second variant (average variant) — takes into account a decrease of industrial production up to 1995-1996, stabilization of energy consumption up to 1996-1997, and subsequently a yearly increase by 2-3% (taking into account the adoption of energy-conserving technology); according to estimates by specialists, this variant is most realistic; and
third variant (pessimistic variant) — assumes energy consumption will continue to decrease up to 2000 and then stabilizes during the next ten years.

The dynamics of energy consumption for the three variants considered and the power-plant capacity required to meet the demand for electricity are presented in Tables 1 and 2.

Five possible scenarios of the development of the energy system of the republic have been developed taking into account the real situation in the fuel and energy complex of the Republic of Belorus (rapid aging of operating equipment). These scenarios make it possible to compare the cost-effectiveness of different possible technical approaches.

1. Scenario 1 (Gas). Steam-turbine equipment is completely replaced by steam-gas plants (SGP) as the operating heat and power plants reach the limit of their service life.

In all other scenarios, as the service life is exhausted, the equipment at operating heat and power plants reach the service life.

In all other scenarios, as the service life is exhausted, the equipment at operating heat and power plants is updated and the service life is extended by 15 yr.

This path for technical re-equipping requires less capital, but it does not eliminate the problem of replacing obsolescent equipment in the period after 2010.

To cover the increase in the demand for electricity the following scenarios are introduced:

2. Scenario 2 (Gas). New condensation steam-gas electric power plant (CEPP SG).

3. Scenario 3 (Coal). A new coal condensation electric power plant (CEPPco) with new types of ecologically clean power-generating units, equipped with boilers with a circulating fluidized bed.