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ECOLOGICAL PROBLEMS OF POWER ENGINEERING

ЕКОЛОШКИ ПРОБЛЕМИ ЕНЕРГЕТИКЕ

***Popova, V. Lyudmila*[1]**

Сажетак

Плански развитак било које државе нераскидиво је везан са енергетским потребама. До почетка XX века, као основни енергетски извор служило је дрво, а затим у производњи енергије доминира угаљ, а у другој половини XX века највећи значај имају нафта и гас. Крајем XX века потребе за енергијом дуплирале су се сваких 13 година.

Енергетска криза 70-их година XX века указала је на ограниченост енергетских ресурса у свету, на неравномерност њиховог распрострањења и коришћења, као и на разнолико располагање њима. Данас се највећи део енергије добија из термоелектрана (око 60%), затим из хидроелектрана (око 23%), а најмање из атомских централа (17%). Међутим, очигледно је да досадашња енергетска делатност има доста штетних утицаја на околину, а уз то извори су ограничени, те се све већа пажња мора посвећивати алтернативним енергетским изворима као што су енергија ветра, био-гас, геотермална енергија, енергија сунца итд.

Кључне речи: *Еколошки проблеми, енергетика*

Summary

"Energetic crisis" of 1970s showed the world its limits of stock of fuel resources and wasteful character of its consuming. But at present thermoelectric power stations keep dominating in the world in energy production (approximately 60% of all energy), though the share of atomic power stations has increased (approximately 17%). Two types of electric power stations can have a negative influence upon the environment: thermoelectric power stations – presumably chemical pollution of the atmosphere, and atomic power stations – radioactive pollution during accidents and burial of the exhausted fuel.

[1] *Др Људмила Попова, Међународни независни еколошко-политолошки универзитет - Еколошки факултет, Москва*

As exit of electrical energy on 1 gram of nuclear fuel is great, atomic energy will keep developing. At the same time mankind widens usage of alternative sources of energy (wind power, biogas, geotermal, sun power etc).
Key words: *Ekological problems, engineering*

Introduction

The industrial development of any country is indissolubly connected with the consumption of energy. Prior to the beginning of the XX century the main energy resource was basically the wood. Then its value began to fall, the first «power transition» to wide usage of coal was noticed. It was dismissed by the era of petroleum and gas. The era of petroleum promoted intensive development of economy (1950-1970), that has required, in turn, the increase of production of mineral fuel. For this period the amount of energy, made on the planet, has increased by 3 times, and then every 13 years the requirement for energy doubled.

About the necessity to take into account the limitation of combustible minerals mankind started to think after an energy crisis of 1970. The relative insufficiency of petroleum resources in the period between 1973 and 1979 was caused by several reasons. First - fast economic growth in 1960s, stimulated by the low prices for petroleum. Second - growing dependence of the United States and other advanced countries on import of petroleum. The third factor was that in the period of 1973-1979 the OPEC countries could control volumes of production, sale and price for petroleum. In 1973 the OPEC countries made 56% of all petroleum in the world and provided 84 % of requirements in it of other countries. Since then is observed a constant rise in prices on petroleum though it has its own jumps. So, in 1973 the USA paid $2 for a barrel of petroleum, and in 1981 -$ 37, now price changes from $22 up to $30 for a barrel.

"The energy crisis" has shown the world the limitation of stocks of sources of energy in nature, and also a prodigal character of consumption of the most scarce energy carriers. During the decade of 1980s many advanced countries have carried out technological reorganization of all economy by introduction of energy saving technologies and reduction of dependence on import of petroleum at the expense of construction of Atomic Energy Power Stations, Hydroelectric Power Stations and development of alternative sources of energy production (solar energy, wind force, geothermal water, biomass etc.).

Now as basic sources of energy production («three whales» of world power) remain TPS (thermoelectric power stations), HPS (hydroelectric power station) and AEPS (atomic energy power stations). TPS still dominate in energy production in the world (around 60%), HPS make around 23% of world energy, and AEPS - about 17%. However in many countries, especially in European, the percentage ratio in the ways of energy reception considerably differs from the world ones.

Thermoelectric power stations (TPS)

TPS work on mineral organic fuel: coal, petroleum, gas, peat, combustible slates, at which burning is formed a steam thermal energy. In the steam turbine steam energy passes into mechanical energy, which turns into electrical in a turbogenerator. The efficiency of a usual TPS makes ~ 37-39%. Thus, about 2/3 rests of fuel dissipate in an environment, causing harm to all the environment.

What are then the advantages of TPS? They are possible to be built in any point of the planet, the only necessary thing required is the uninterrupted deliveries of fuel. It is possible to change easily the capacity, and the cost price of the electric power is insignificant. In Russia besides electrical energy is also actively used thermal power (combined use). Therefore is heat and power plants are constructed near cities and large enterprises.

But they have very significant lacks. It is chemical and thermal pollution of the environment, and also the threat limitation of the mineral fuel. So, according to the forecasts of "the optimists" the world stocks of petroleum should suffice for 200 years, but "the pessimists" count only for 60-80 of years. The stocks of natural gas should suffice for 100 years, and coal, by various ratings, - for 160-300 years. Increase of production of minerals turns out not only into economic, but also into ecological problems (infringement of natural ecosystems, reduction of a bio-diversity, pollution of air, water and soil). It is counted up, that TPS with the capacity of 1.000 Megawatt of water per year consumes 2.500.000 tons of coal (the data of Frantishek Yannoukh), thus every day can be spent for steam cooling more than 7mln.of cubical meters and thus there is a thermal pollution of a reservoir - cooler. The TPS of such type per year throws out about 43.000 tons of ashes, 220.000 т oxides of sulfur (SO_2), 36.000 - 40.000 т oxides of nitrogen (NOx) and 2.500.000 т of carbonic gas (CO_2). Thus, the emissions of CO_2 in the world every time grows and for the date of 30. 03. 2001 there are following data on discharge of CO_2 by the various countries:

India - 0,5 т CO_2 per person per one year;

China - 3,5 т CO_2 per person per one year;

Europe - 8,2 т CO_2 per person per one year;

USA - 20,5 т CO_2 per person per one year.

To preserve natural ecosystems it is impossible to pass a barrier of 3 tons of CO_2 per person per one year. Chemical and thermal pollution of the environment caused by the TPS, cause a number of negative ecological consequences, the largest of which are – strengthening of the greenhouse effect and formation of acid rains.

Hydroelectric power stations (HPS)

The HPS has its advantages: there is no thermal and chemical pollution, the high technologies are not necessary for their construction, the cost price of the electric power on average by 4 times is lower, than on TPS, and they also protect territories from floods. Therefore many countries of the world rich by hydro-resources actively develop water-power engineering. So, in Norway - 90% of all energy of the country is developed on HPS; in Brasil - 87% of all energy; in Canada - 67%, and in Sweden - 47%.

But the HPS also create ecological problems. Especially they appear at the construction of HPS on the flat rivers. It is - flooding of fertile grounds at construction of reservoirs; infringement of natural migration of fish; development of putrefying processes and flowering of water, if the territory is flooded without preliminary clearing; there is a change of a hydrological mode of territory – bogging up, landslips. All these negative processes make even rich by hydro-resources countries think about the development of other kinds of power. In Russia the water-power engineering is especially advanced only in the upper reaches of the Yenissey (Sayan HPS and Krasnoyarsk HPS) and Angara (Bratsk HPS).

Atomic energy power stations (AEPS)

In the reactor of the AEPS the thermal energy is discharged at the expense of free up of the energy of connection of neutrons and protons at the division of nucleuses of the U-235 under the influence of neutrons. If at burning of 1 gram of coal is discharged 7 kilocalories of heat, at processing of 1 gram of nuclear fuel - 20 million of kilocalories. It is approximately ~ by 3*10 in 6 degrees times more. The installation of AEPS is possible in any place, where there is enough of water to cool the reactor, where there is no serious seismic danger, and also is absent precipitation of the ground and there is no threat of destruc-

tion of the building of the APS as a result of any external reasons. Therefore atomic engineering since 1970 (since the moment of the "power" crisis) has developed by very intensive rates and has reached the best peak in 1980-1985. However in subsequent years after Chernobyl catastrophe (1986) there begins obvious recession in world atomic engineering. Some countries have begun reconsideration of the policy in relation to atomic engineering. These are Sweden, Italy, Austria, Germany. Now no country in Western Europe, except France, is being conducting the construction of new reactors. Nevertheless for 1997 there were 432 nuclear power blocks working in 31 countries of the world. Thus in a number of the countries AEPS are the basic sources of production of the electric power. So, in France AEPS make 73% of all energy of the country, in Belgium - 60%, in Sweden - 47%, in Swiss - 40%, Spain, Finland and Japan – by 30%, in USA ~ 23%.

A normally working AEPS creates the following ecological problems: necessity of processing and burying of the used radioactive fuel (URF); dismantle and burying of the reactors (the term of their service is 30-40 years); necessity of burying of the liquid radioactive wastes (heavy water used for reactor cooling). The most terrible consequences can arise as a result of failures on the AEPS at emissions of radioactive elements into the environment. Depending on a doze of influence the ionizating radiation can result in the instant death, cancer diseases, mutations in posterity. The influence of small dozes of radiation on alive organisms is investigated on a small scale.

The forecast for the future

There are some ways of a choice before mankind:

- Reduction of consumption of energy (even at the expense of energy saving);
- Further development of atomic engineering;
- Introduction of new technologies – thermonuclear reactors;
- Further intensive coal burning;
- Use of alternative sources of energy (wind power, biogas, solar energy, geothermal energy, tiding wave, thermal energy of the ocean, etc.). But it is necessary to remember, that their use also can create ecological problems, though on the enough small scale.

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