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PROJECT OF NPP POWER UNIT WITH AN ELECTRIC CAPACITY OF 1250 MW WITH DRY COOLERS

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Currently, energy is an important factor in the development of society [1]. In recent decades, population growth and economic development in many countries have accelerated the growth of fossil fuel consumption [2]. As a result, there was a serious threat to the environment – global warming [3]. Therefore, in order to protect the environment, it is necessary to optimize the energy structure in order to ensure the possibility of obtaining clean energy and at the same time not have a negative impact on the economic growth of countries, their development and well-being [4]. In comparison with traditional carbon energy, nuclear energy is considered to be clean and relatively inexpensive, and also plays an important role in reducing emissions of hazardous substances into the atmosphere, which mitigates the effects of global warming [5–6]. At the same time, it should be noted that at traditional nuclear power plants, cooling tower are used to cool water from the condenser. In the process of their operation, they are a source of water vapor emissions into the atmosphere. If a nuclear power plant is located near a city or forest, an additional source of humidity in the atmosphere can negatively affect people or animals. The solution to this problem is the use of a dry cooling tower at a nuclear power plant. Therefore, the purpose of the work is the project of a nuclear power plant with a dry cooling tower. A nuclear power plant with a VVER-type reactor was chosen as a prototype of the power unit. The prototype of the projected NPP is 1250 MW.

The initial data for the calculation are presented in table 1.

Table 1. Initial data

Name	Symbol	Value
Electrical power	N_e , MW	1250
Initial pressure	p_0 , MPa	6.27
Initial temperature	t_0 , °C	t_{sat}
Final pressure	P_c , kPa	5
Number stages of Superheater	-	Double-stage
Feed water temperature	t_{fw} , °C	220
Deaerator pressure	p_d , MPa	0.58
Number high pressure heater	NHPH	-
Number mixing low pressure heater	NMLPH	-

The main elements of the projected NPP:

- 1) Nuclear power reactor;
- 2) Steam generator;
- 3) Thermal scheme of the NPP;
- 4) Condensation plant;
- 5) Dry cooling tower.

The schematic diagram of the projected nuclear power plant with a dry cooling tower is shown in figure 1.

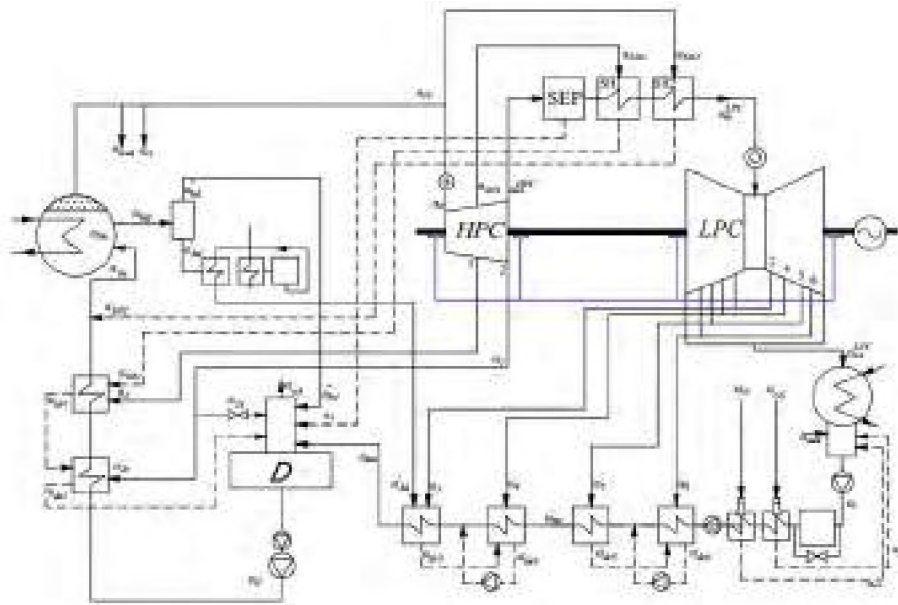


Fig. 1. Schematic diagram of the power unit

As a result of the project, the following most significant characteristics of the power unit were obtained:

- Thermal power 3750 MW;
- Absolute EFFICIENCY 33,2 %;
- The burn-up rate of nuclear fuel is 27,4 tons/year;
- Specific consumption of conventional fuel $17,01 \times 10^{-6}$ Kg/(kW·hr);
- A dry cooling tower is designed.

The calculations performed on the project can be used as input data for a more detailed and expanded design of nuclear power plants with dry cooling towers.

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