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THE HYDROPOWER PLANTS ROLE IN PROVIDING A CAPACITY RESERVE IN THE TAJIKISTAN ELECTRIC POWER SYSTEM

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Ensuring reliable energy system operation is one of the important conditions for the economy stable development, as well as ensuring the Tajikistan Republic energy security.

Tajikistan has quite large energy reserves. Hydropower resources occupy a special place in this context. The potential for their generation is 527 billion kW·hour / year, which are currently used only 4-5% [1]. The main hydropower potential is concentrated in the Vakhsh and Pyanj river basins.

Hydroelectric power plants (HPPs) prevail in Tajikistan electric power system, accounting for 87.6% of the total electricity generation structure. Three thermal power plants (TPPs) operate in the basic mode of the Tajikistan electric power system, although their capacity is not enough to fully ensuring a steady and stable regime. More and more renewable energy sources (RESs) are being commissioned at present: solar photovoltaic stations, wind power plants, geothermal plants, small hydropower plants and others. This is especially true for covering the active power deficit in autonomous regions. The share of electricity generation by using RESs is less than 1%, but it has great prospects for further development, as shown by the data in Table. 1. [1]. The total installed capacity of power plants in the Tajikistan Republic is more than 5757 MW.

Table 1 - The RESs resources in Tajikistan, standard fuel million tons [1]

Resources	Gross potential	Technical potential	Economic potential
General hydropower	179.2	107.4	107.4
Including small HPPs	62.7	20.3	20.3
Solar power	4790.6	3.92	1.49
Biomass energy	4.25	4.25	1.12
Wind energy	16.3	10.12	5.06
Geothermal energy	0.04	0.04	0.04
Total (without large HPPs)	5020.595	38.63	27.95

The daily load schedule of Tajikistan electric power system is uneven. The electricity consumption structure for the Tajikistan Republic is presented in Fig. 1. Effective coverage of the energy system consumers needs the requires a

corresponding change in generation during the day. In addition, the power system generating capacity the is insufficient to meet the estimated peak load due to the low water level in rivers during peak demand in the winter months.

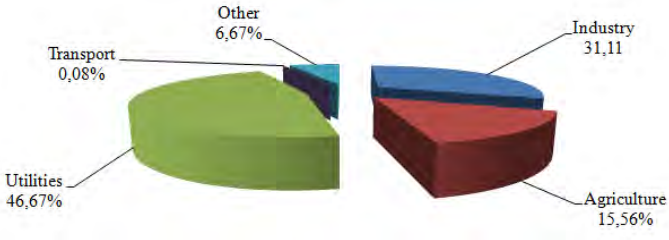

Figure 1 - The electricity consumption structure for the Tajikistan Republic

It is HPPs that act as maneuvering stations when covering the Tajikistan electric power system load schedule. They (except for the Nurek HPP) operate in the natural river regime and face a low inflow level in the winter period. It should be noted that the base capacity deficit and the insufficient reservoirs number forces the HPPs to operate in the basic mode as well, which was not initially envisaged. Such an approach to ensuring a capacity maneuverable reserve makes HPPs a very important element in the Tajikistan energy sector structure and requires special attention to ensure the reliability and efficiency of their functioning.

The largest HPPs in the Tajikistan Republic are the Nurek HPP on the Vakhsh river with a capacity of 3000 MW, the Baipazinskaya HPP with a capacity of 600 MW, the Sangtuda-1 HPP with a capacity of 670 MW, the Sangtuda-2 HPP with a capacity of 220 MW. In addition, a Vakhsh HPPs cascade with a total capacity of 285 MW was built and successfully operating on the Vakhsh river, a Varzob HPPs cascade with a total capacity of 25 MW on the Varzob river, a 126 MW capacity Kayrakkum HPP on the Syrdarya river, and a Pamir HPPon the Gunt river and the Pamir-1 HPP with a total capacity of 37 MW and others.

HPPs have high maneuverability and a large adjustment range, high load change rates, minimal time to gain power, start and stop units that perform the difficult task of covering the most complex peak and half-peak parts in the load schedule. The need to increase attention to the HPPs operation should be noted, given these HPPs characteristics, general trends in the global energy development, as well as priority areas for the Tajikistan Republic development [2].

The following measures adoption is advisable to increase the HPPs effective functioning in ensuring the energy balance of the Tajikistan electric power system:

- further hydropower potential development of Tajikistan large and small rivers;

- the automation tools introduction for the process of regulating the electric energy generation by HPPs, which will optimally load units, which will provide improved HPPs operational characteristics during their operation in the energy system;

- the using of energy storage systems to provide power accumulation with its subsequent use as balancing power;

- government stimulation of RESs development, including small HPPs.

Thus, the above measures will improve the using HPPs efficiency in balancing capacity while meeting the load demand in the Tajikistan Republic electric power system.

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INCREASING OF THE ELECTRIC TRANSPORT EFFICIENCY

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Railway efficiency is an important topic worldwide for transportation ministers of fiscally strained governments and railway managers operating in competitive markets. On the one hand, railways are under pressure to keep costs low, often because of market pressures or because of the unavailability of public funds as a result of competing national priorities. On the other hand, increases in railway usage for passenger and freight have occurred after decades of decline, which necessitates additional investment in track infrastructure and rolling stock. Under pressure to reduce costs while improving rail's level of service and expanding rail capacity, railways and governments continue to look for ways to improve efficiency (International Transport Forum, 2013).

The EU enlargement, combined with globalization and growing competition, is driving the need for a better use of resources in the expanding transport sector. There