Role of a PSP Plant in Development of Solar Energy in Ukraine

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At present time Ukraine endures increase of interest to development of solar power. We have already a significant experience in construction of on ground photovoltaic power plants (PV) with power from one to tens MW. Since 2015 roof PV systems are actively being built. At the start of 2017 the total power of PV in Ukraine exceeded 650 MW. Average annual potential of insolation in the country reaches 1235 kWh/m^2. In the south regions of Ukraine PV systems can be operated with a power exceeding 50% of installed capacity during 9 months a year. This predetermines further active development of PV plants in the south of Ukraine. However, connection of PV systems to a power grid system is a challenge. Power grid system of Ukraine has acute shortage of maneuverable capacities, and also problems with fossil fuel sypply and a high share of NPP generation. Therefore, the nondispatchable generation of PV systems is a barrier to its integration into Ukraine power industry. In Ukraine, as well as around the world, use of pumped storage power plant can become a solution of this problems. At present time there are 3 powerful PSP in Ukraine: Kiev PSP – 111/136 MW, Tashlyk PSP – 302/422 MW and Dniester PSP – 972/1263 MW. The new Kanev PSP (1000 MW), the second stages of the Dniester PSP (4x324/421 MW) and Tashlyk PSP (4x151/211 MW) are also designed. Smoothing of the the Ukrainian NPPs load curve was main task of these PSP initially. But current trends of renewable power development set new task for them, in particular, it is compensation of power fluctuations in PV systems. In article the prospects of use of Dniester PSP for support of solar power development in the southwest region of Ukraine are considered. The plant is a part of the Dniester hydro system located in a southwest of Ukraine which also has the largest potential for development of solar power. In this region there is an opportunity to place PV plants with a total power about 1-2 GW by the most modest estimates. It is promoted by existence of developed power lines, and also big design capacity of Dniester PSP. The volume of the upstream water of Dniester PSP is desiged to operatie seven power units. Now in operate there are only 3 blocks and construction of the fourth is planned. Usually these blocks operate 6 h at night in the pumping mode and 4 h in morning and evening peaks in the generating mode. The stock of volume of upstream water will allow to operate additionally in the pumping mode in the afternoon, in the period of the maximum insolation, and in the generating mode during peak loads. Overall performance of PSP in such intensive modes of a charge/discharge directly depends on efficiency of power units. On Dniester PSP Francis turbines are used which have dependence of efficiency on change of a pressure. It is possible to increase overall performance of the Dniester PSP unit by means of the asynchronized generator-motor and a mode with rotational variable frequency. Such symbiosis of renewable power plants of different types will provide them active further development, increase Dniester PSP capacity utilization and also ensuring the sustainability of Ukraine's energy.