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Gravity storage power plant as a green energy facility

Abstract: Electricity is known to be consumed unevenly during the day. There are morning and evening peaks of consumption, when the power system is required to supply the maximum amount of electricity to the consumer. During the daytime and at night, the consumption level decreases significantly, which means that generating units have to be turned off. Such uneven consumption negatively affects the operation of the entire energy system as a whole. It is no coincidence that in the past the work of industrial enterprises was organized in three shifts. At the same time, an important technical task was solved – compaction of the daily load schedule, that is, uniform loading of the power system during the day.

One of the options to solve the problem of an uneven daily load schedule is to create storage devices that will accumulate electricity during the hours of decline in consumption and give it away during periods of maximum demand. Such devices are power plants that contain the necessary "capacities" for temporary storage of stored energy. The physical nature of such "containers" can be very diverse – large reserves of water in pumped storage power plants, chemical elements in batteries, various thermal carriers with high heat capacity, etc. The main requirements for such devices are the ability to accumulate sufficient energy and environmental friendliness. And if the first task can be solved by simply increasing the volume of energy storage, then the solution of the second task may be fraught with great difficulties and run counter to the solution of the first task. Thus, an increase in the volume of water reserves in pumped storage power plants will directly affect the climate in the region, and an increase in the number of chemical sources in batteries increases the likelihood of their depressurization and ingress of substances into the soil.

The proposed version of the gravitational accumulating power plant (GrAPP) allows you to use the ready-made infrastructure of mines that have exhausted their resources and have undergone conservation. Theoretical calculations have shown that the reserve of potential energy accumulated in cargoes lowered into mines and converted into electricity is enough to smooth out the morning and evening peaks of consumption in a small city. And loading the power system at night with electricity consumption for lifting loads to the surface will increase the uniformity of the load schedule, which will favorably affect the operation of the power system. At the same time, no damage is caused to the environment, since there is no equipment containing chemicals at the GrAPP and no landscape changes are made.

Thus, the proposed option of an accumulating power plant will allow solving both tasks: to align the load schedule of daily electricity consumption and at the same time not cause any harm to the ecology of the region.