

Solution sheet model 2 – Water turbine / hydropower

Topic task

1. The greater the height the water falls from, the greater the force of the water that can be used to generate energy. The relationship between the quantity of water (volume flow rate) and optimal alignment of the stream of water on the shovels of the water turbine also increase the rotational speed of the generator shaft in our model. The power it delivers should not be confused with the individual effectiveness of a turbine, which describes the efficiency of the turbine itself. The type of turbine and age of the turbine play a role here, among other factors. To achieve optimal performance, the design of the turbine must be adapted to the different fall heights and water flow quantities.
2. In water storage power plants, the energy of the water is stored when the water in a river is dammed up to create a reservoir. As needed, the water in the reservoir is fed through the hydropower plant to produce electricity. Electrical energy is stored in the form of the potential energy of surface water.

In pump storage power plants, the water is pumped to a greater height in the reservoir using energy (excess electricity). The water is used as the storage medium.

3. Water storage power plants are controllable, meaning they can be used exactly when electricity is needed.
4. A) Mountainous regions with large amounts of precipitation and significant slope differences are good locations for hydropower plants.
B) Large rivers with height differences (run-of-river power plants). Because the water flows continuously, electricity is generated 24 hours a day. However, in contrast to pump storage power plants, no water (no potential energy) can be stored.
C) Bays and river deltas in oceans and seas where tidal power plants can use the potential energy and kinetic energy of the water as it ebbs and flows to generate electricity.
5. Building hydropower plants can have major impacts on the landscape, people, and animals. Huge reservoirs must be created for storage power plants; in some circumstances, this may even require people to move from their homes. There may be native animal or plant species in the affected region whose habitat could be significantly impacted by the construction of a hydropower plant.

Experimental task

1. Voltage increases the higher the water jet is positioned above the turbine. You learned the reason for this in topic task 1. As the fall height of the water increases, the water pressure on the turbine increases, and thereby the rotational speed. This causes the output voltage on the generator to increase.

2. The LED becomes brighter, the more voltage is generated by the generator, and current can flow through the LED.