

8(a). with the help of diagram, explain pumped hydroelectric energy storage system.

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Pumped hydroelectric energy storage (PHES) is a type of energy storage system that utilizes the potential energy of water to store and generate electricity. It involves two water reservoirs situated at different elevations and connected by pipes and turbines. Here is a description of a pumped hydroelectric energy storage system:

1. Upper Reservoir: The upper reservoir is situated at a higher elevation and acts as the storage location for the potential energy. It can be an existing natural or artificial water body, such as a lake or a dammed river.
2. Lower Reservoir: The lower reservoir is situated at a lower elevation and serves as the receiving location for the water returning from the upper reservoir.
3. Penstock: A penstock is a large pipe or conduit that connects the upper and lower reservoirs. Water flows downward from the upper reservoir to the lower reservoir through the penstock.
4. Powerhouse: The powerhouse is located near the lower reservoir and contains the turbines and generators. When electricity needs to be generated, water from the upper reservoir is released into the penstock, flowing downward with significant force.

5. Turbines: As the high-pressure water flows through the penstock, it drives the turbines. The turbines convert the kinetic energy of the flowing water into mechanical energy.

6. Generators: The mechanical energy produced by the turbines is transferred to generators. The generators convert this mechanical energy into electrical energy, which can then be used to supply power to the grid.

7. Pumping Station: When excess electricity is available in the grid or during periods of low demand, the process is reversed. The turbines are used as pumps, which draw water from the lower reservoir and pump it back up to the upper reservoir.

8. Reversible Turbines: The turbines used in pumped hydroelectric energy storage systems are designed to be reversible, allowing them to function as both turbines and pumps.

9. Control Systems: Control systems are employed to manage the flow of water and the operation of the turbines and generators. These systems ensure efficient operation and balance the supply and demand of electricity.

The process of pumped hydroelectric energy storage involves storing excess electricity by using it to pump water from the lower reservoir to the upper reservoir. When electricity demand increases, the stored water is released back to the lower reservoir, passing through the turbines to generate electricity.

