

Types of Hydroelectric Facilities

Pumped Storage Facilities

- Use bodies of water [reservoirs] two different elevations.
- Water flows to lower body of water by gravity, generating power during periods of peak electrical use
- During off-peak hours, turbine generators are reversed and water is pumped back up to the upper body with electrical energy from fossil, wind, or nuclear plants.
- Pumped storage projects typically operate under high head (100-700m), generating 500-2,000 MW.

Conventional Facilities

- Typically operate with a low head (1-100m) and generate from a few kilowatts to several thousand MW for large projects.
- In Alaska, a number of conventional projects operate with high head.
- Powerhouse is usually located at the dam.
- In Alaska, it is common to have water brought from the dam to a separate powerhouse via penstocks.

Non-Conventional Facilities

- Typically operate with a low head (1-100m) and generate from a few kilowatts to tens MW for large projects.
- Examples are battery storage, hydrolysis storage or conversion, and direct tidal or river current turbines.
- Examples found in Alaska and the Pacific Northwest: Hydroelectric Power Without A Dam, on the Yukon River, by Vern Neitzer, Exec. Vice Pres. of Engineering, Alaska Power & Telephone (Eagle, Alaska, has been delayed by financing and development problems)
- AquaEnergy Engineering has developed an AquaBuoy floating generating system - manufacture and install a four-buoy 2 MW pilot farm off the coast of Washington in Makah Bay.

Water Power Operation Modes

Run-of-River

- Instantaneous outflow from the impoundment (as turbine discharge, spillage, directed releases, and/or leakage) is always equal to the instantaneous inflow into the impoundment.
- Storage level of the impoundment is not permitted to fall below the crest of the dam except in the case of emergency situations or maintenance shutdowns.
- Impoundments may be quite small, with no regulated storage.

Storage-and-Release

- Instantaneous outflow from the impoundment (as turbine discharge, spillage, directed releases, and/or leakage) is not always equal to the instantaneous inflow into the impoundment.
- Storage level of the impoundment does fluctuate on some temporal basis (e.g. hourly, daily, weekly, or monthly or annually).

Water Power Operation Types

Pulsing or Block Loading

- Operates on available flows and turbine head design.
- Facility commences operation when the maximum impoundment storage level is attained and ceases operation when impoundment is drawn down to some lower storage level (associated with the head capacity).
- This mode does not attempt to maximize the revenue-generating aspects of hydropower.

Peaking or Load Following

- Operates on available flows, turbine head design, and in coordination with the system load requirements.
- Facility commences operation in order to meet an increase in demand for the system above base-load when the maximum impoundment storage level is attained and ceases operation with impoundment is drawn down to some lower storage level (associated with the head capacity).
- This mode does attempt to maximize the revenue-generating aspects of hydropower.