4.10 Classification of hydropower schemes:

4.10.1 Classification of Hydro Power (By Size):

- Hydropower installations can be classified by size of power output, although the power output is only an approximate diversion between different classes. There is no international consensus for setting the size threshold between small and large hydropower.

Small hydro can be further subdivided into mini, micro and pico:

Mini(MH)	<1 MW	grid connected	specialknow how required
Micro	<100kW	partiallygrid con.	professionalknow how required
Pico(PH)	<10kW	islandgrids	smallseriesunitsproducedlocally; professionalequipmentavailable
Family(FH)	<~1kW	single households/clust ers	oftenlocally handmadesolutions; professionalequipmentavailable

4.10.2 Classification of Hydro Power (according to operation and type of flow):

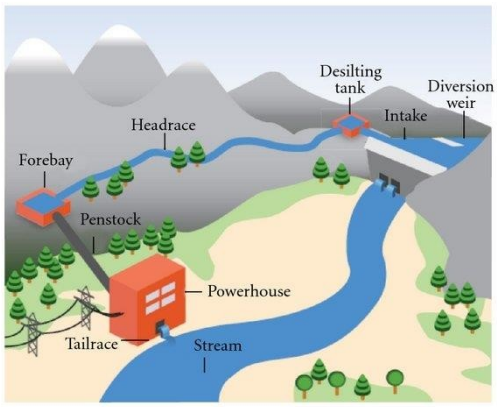
1. Run-of-river (RoR),

Small and micro hydropower utilizes water that runs of a river and avoids big environmental impacts.

2. Storage (reservoir)

3. Pumped storage hydro power plants (HPPs) work as energy buffer and do not produce net energy.

4. In-stream Hydropower Schemes use rivers natural elevation drop without to dam a river.



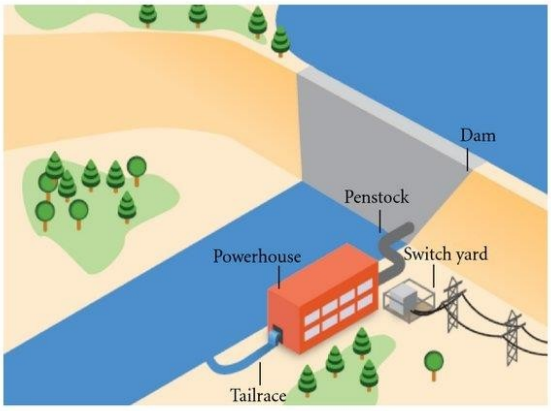
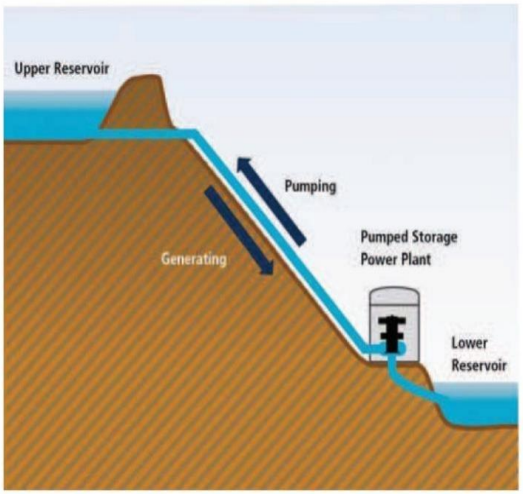


Figure 4.10.1 Run-of-river (RoR) **Figure 4.10.2 Storage (reservoir)**

[Source: "Renewable Energy Sources and Emerging Technologies" by D.P.Kothari, K.C Singal, Rakesh Ranjan, Page: 303]



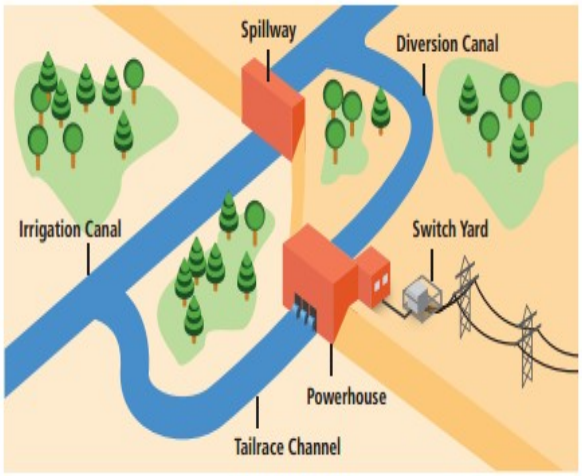


Figure 4.10.3 Pumped storage Hydro power plants

Figure 4.10.4 In-stream Hydropower Schemes

[Source: "Renewable Energy Sources and Emerging Technologies" by D.P.Kothari, K.C Singal, Rakesh Ranjan, Page: 303]

1. Run-of-river (RoR):

• RoR plant produce energy from the available flow and the natural elevation drop of a river

• It is suitable for rivers that have at least a minimum flow all year round.

• The water to powers th turbine is diverted and channeled into a penstock and then returned to the river

• RoR plants usually have no or only small storage, allowing for some adaptations to the demand profile.

• As bigger the storage capacity is as higher the environmental impacts are

• Power generation is dictated by local river flow conditions and thus depends on precipitation and runoff and may have substantial daily, monthly or seasonal variations

2. Storage (reservoir):

• Hydropower projects with a reservoir (storage hydropower) store water behind a dam for times when river flow is low

• Therefore power generation is more stable and less variable than for RoR plants

• The generating stations are located at the dam toe or further downstream, connected to the reservoir through tunnels or pipelines

• Type and design of reservoirs are decided by the landscape and in many parts of the world are inundated river valleys where the reservoir is an artificial lake

• Reservoir hydropower plants can have major environmental and social impacts due to the flooding of land for the reservoir

3. Pumped storage hydro power plants (HPPs)

• Pumped storage plants are not energy sources, instead they are storage devices

• Water is pumped from a lower reservoir into an upper reservoir, usually during off-peak hours, while flow is reversed to generate electricity during the daily peak load period or at other times of need

• Although the losses of the pumping process make such a plant a net energy consumer,the plant provides large-scale energy storage system benefits

• Pumped storage is the largest capacity form of grid energy storage now readily available worldwide

In-stream Hydropower Schemes

- Basically in-stream Hydropower functions like a RoR scheme, but the turbine is mostly built within the dam in the riverbed. Usually the river flow is not diverted.
- To optimize existing weirs, barrages, canals or falls, small turbines or hydrokinetic turbines can be installed
- At rivers close to the sea the technologies may operate bi-directional (tidal)

SIZES OF HYDROELECTRIC POWER PLANTS

Facilities range in size from large power plants that supply many consumers with electricity to small and micro plants that individuals operate for their own energy needs or to sell power to utilities.

Large Hydropower

Although definitions vary, DOE defines large hydropower as facilities that have a capacity of more than 30 megawatts (MW).

Small Hydropower

Although definitions vary, DOE defines small hydropower as projects that generate 10 MW or less of power.

Micro Hydropower

A micro hydropower plant has a capacity of up to 100 kilowatts. A small or micro-hydroelectric power system can produce enough electricity for a home, farm, ranch, or village.