5.2 TIDAL POWER BASIN

- The basin system is the most practical method of harnessing tidal energy. It is created by enclosing a portion of sea behind erected dams. The dam includes a sluice that is opened to allow the tide to flow into the basin during tide rise periods and the sluice is then closed.
- When the sea level drops, traditional hydropower technologies (water is allowed to run through hydro turbines) are used to generate electricity from the elevated water in the basin. From tidal power Equation (P = 0.226AH), we can observe that the tidal power varies as the square of the head and since the head varies with the tidal range, the power available at different sites shows very wide variation.
- In order to overcome this wide variation in availability of tidal power, various tidal basin systems have, therefore, been developed. They are discussed in the following sections.

5.2.1 SINGLE-BASIN SYSTEM

- This is the simplest way of power generation and the simplest scheme for developing tidal power is the single-basin arrangement as shown in Figure 5.3.1.
- Single water reservoir is closed off by constructing dam or barrage. Sluice (gate), large enough to admit the water during tide so that the loss of head is small, is provided in the dam.

The single-basin system has two configurations, namely:

1. **One-way single-basin system:**

- The basin is filled by seawater passing through the sluice gate during the high tide period. When the water level in the basin is higher than the sea level at low tide period, then power is generated by emptying the basin water through turbine generators.
- This type of systems can allow power generation only for about 5h and is followed by the refilling of the basin. Power is generated till the level of falling tides coincides with the level of the next rising tide.

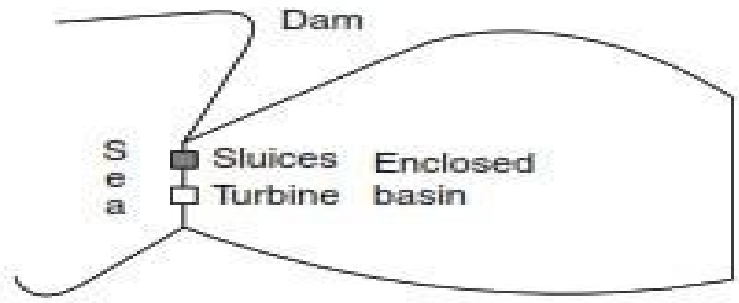

Fig. 5.3.1. Single basin System

[Source: "Solar Photovoltaics: Fundamentals,Technologies andApplications" by ChetanSingh Solanki, Page: 378]

2. **Two-way single basin:**

★ This system allows power generation from the water moving from the sea to the basin, and then, at low tide, moving back to the sea. This process requires bigger and more expensive turbine.

★ Single-basin system has the drawbacks of intermittent power supply and harnessing of only about 50% of available tidal energy.

5.2.2 TWO-BASIN SYSTEMS

- An improvement over the single-basin system is the two-basin system. In this system, a constant and continuous output is maintained by suitable adjustment of the turbine valves to suit the head under which these turbines are operating.
- A two-basin system regulates power output of an individual tide, but it cannot take care of the great difference in outputs between spring and neap tides. Therefore, this system provides a partial solution to the problem of getting a steady output of power from a tidal scheme.
- This disadvantage can be overcome by the joint operation of tidal power and pumped storage plant. During the period, when the tidal power plant is producing more energy than required, the pumped storage plant utilizes the surplus power for pumping water to the upper reservoir. When the output of the tidal power plant is low, the pumped storage plant generates electric power and feeds it to the system. This arrangement, even though

technically feasible, is much more expensive, as it calls for high installed capacity for meeting a particular load.

- This basic principle of joint operation of tidal power with steam plant is also possible when it is connected to a grid. In this case, whenever tidal power is available, the output of the steam

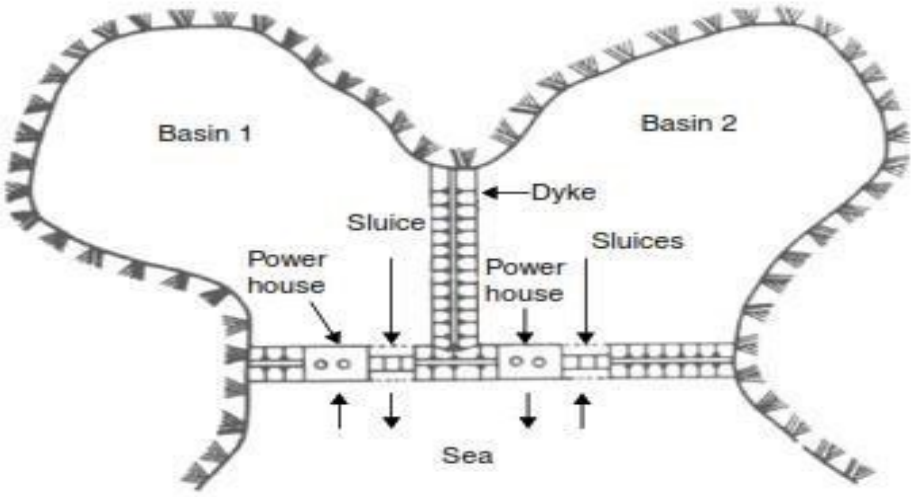

Fig 5.3.2 Two Basin Systems

[Source: "Solar Photovoltaics: Fundamentals,Technologies andApplications" by ChetanSingh Solanki, Page: 379]

plant will be reduced by that extent that leads to saving in fuel and reduced wear and tear of steam plant.

- This operation requires the capacity of steam power plant to be equal to that of tidal power plant and makes the overall cost of power obtained from such a combined scheme very high. In the system shown in Figure 5.3.2 the two basins close to each other, operate alternatively.
- One basin generates power when the tide is rising (basin getting filled up) and the other basin generates power while the tide is falling (basin getting emptied). The two basins may have a common power house or may have separate power house for each basin. In both the cases, the power can be generated continuously.
- The system could be thought of as a combination of two single-basin systems, in which one is generating power during tiding cycle, and the other is generating power during emptying.

5.2.3 ADVANTAGES & DISADVANTAGES OF TIDAL POWER:

The following are the advantages of tidal power:

1. About two-third of earth's surface is covered by water, there is scope to generate tidal energy on large scale.
2. Techniques to predict the rise and fall of tides as they follow cyclic fashion and prediction of energy availability is well established.
3. The energy density of tidal energy is relatively higher than other renewable energy sources.
4. Tidal energy is a clean source of energy and does not require much land or other resources as in harnessing energy from other sources.
5. It is an inexhaustible source of energy.
6. It is an environment friendly energy and does not produce greenhouse effects.
7. Efficiency of tidal power generation is far greater when compared to coal, solar, or wind energy. Its efficiency is around 80%.
8. Despite the fact that capital investment of construction of tidal power is high, running and maintenance costs are relatively low.
9. The life of tidal energy power plant is very long.

DISDVANTAGES OF TIDAL POWER:

The following are the disadvantages of tidal power:

1. Capital investment for construction of tidal power plant is high.
2. Only a very few ideal locations for construction of plant are available and they too are localized to coastal regions.
3. Unpredictable intensity of sea waves can cause damage to power generating units.
4. Aquatic life is influenced adversely and can disrupt the migration of fish.
5. The energy generated is not much as high and low tides occur only twice a day and continuous energy production is not possible.
6. The actual generation is for a short period of time. The tides only happen twicea day so electricity can be produced only for that time, approximately for 12 h and25 min.

7.This technology is still not cost effective and more technological advancements are required to make it commercially viable