

5.3 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.

5.3.1 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.

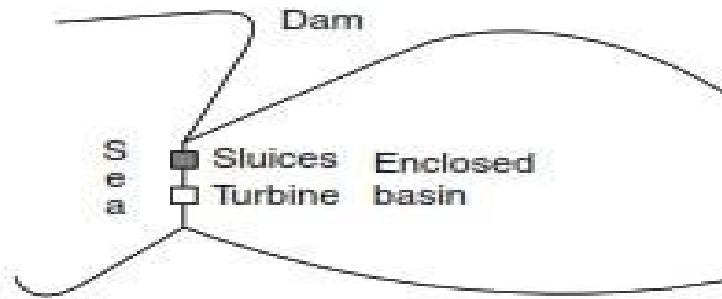


Fig. 5.3.1. Single basin System

[Source: "Solar Photovoltaics: Fundamentals, Technologies and Applications" 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.

5.3.2 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

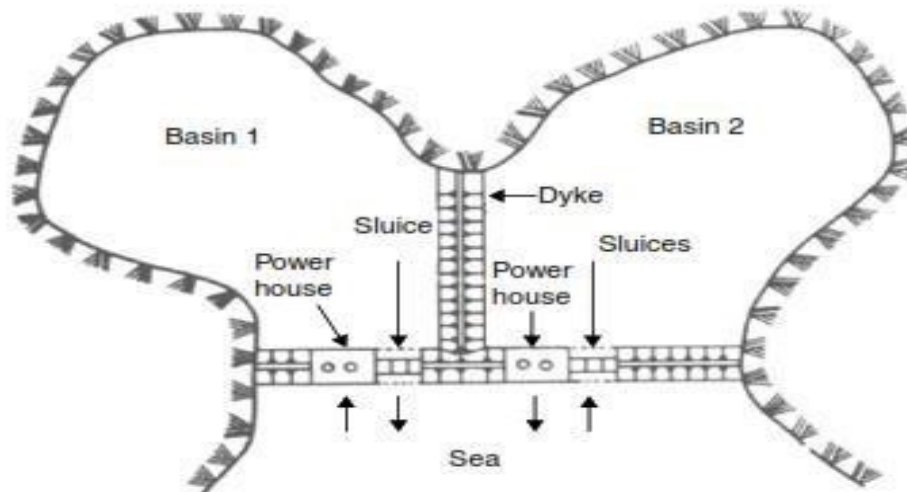


Fig 5.3.2 Two Basin Systems

[Source: "Solar Photovoltaics: Fundamentals, Technologies and Applications" 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.