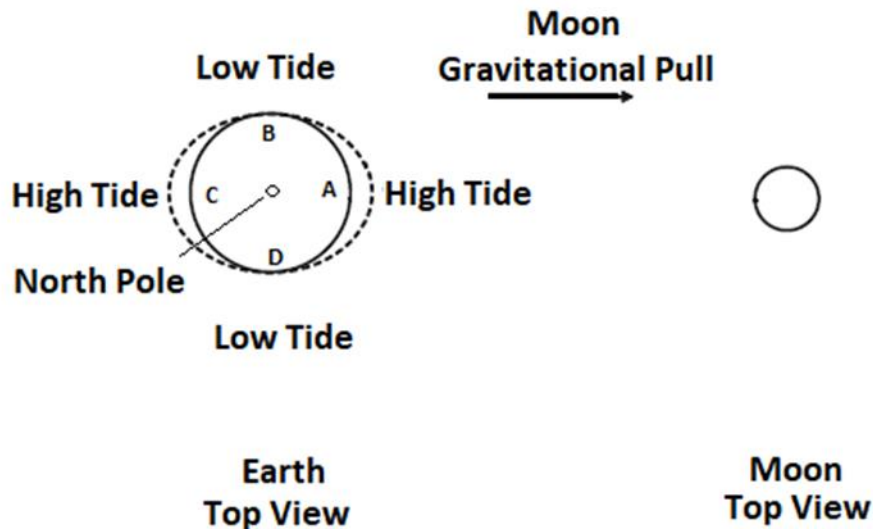


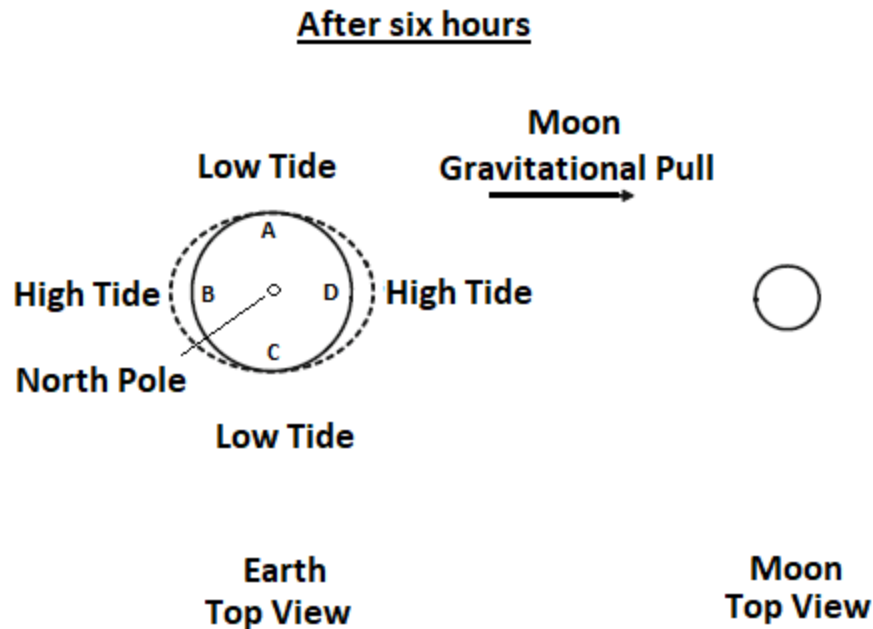
Tidal Energy

More than two thirds of the earth's surface is covered by water, and power may be obtained from both the surface water and the deep oceans. Hydroelectric, tidal, ocean current and wave power installations are among those that may convert the power of the water directly to electricity. These renewable energy sources are either continuous or predictably variable. Tides are created because of the gravitational and kinematic effects due to the position and the combined motion of the earth, the moon and the sun. The moon, even though it has much smaller mass than the sun, plays major role in the creation of tides because it is significantly closer than the sun. Effects of the gravitational potentials of the earth and the moon on the surface of the earth's ocean may be made with the help of Fig. given below, which shows the combined effect of the moon's gravity on the surface of the ocean and the rotation of the earth around its axis. There are two types of tides: high tide and low tide. During the high tide water level rises and during the low tides water level reduces.

Tides occur because moon's gravitational force pulls the water from the earth towards itself. To understand the mechanism of low and high tides let divide the earth into four parts: right part is A, top part is B, left part is C and bottom part is D. Let say because of earth's spin the moon is on the right half (A) of the earth. So the moon gravitational force pulls the water on the right half (A) of the earth towards itself. So countries on the right half (A) of the earth will experiences a high tide. That is water there will be pulled towards the moon, leading in rise in water level. If water is getting pull to form the high tides in the right half (A) so the water is getting push from the top and bottom half (B and D) of the earth towards the other two half (A and C) to compensate this. The water level will decrease at the top and bottom half (B and D) and earth experiences the low tides at the top and bottom half (B and D) of the earth. So right half (A) that is facing the moon experiences the high tide and top and bottom half (B and D) experience the low tide. To compensate that water flow by pushing the water towards the other two sides (B and D). And what is the water level on the left half(C) there is also high tide.



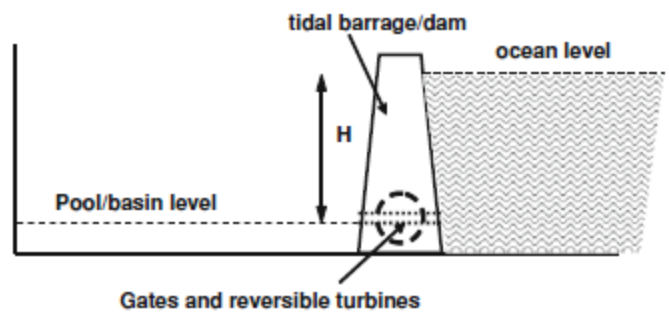
And in the next six hours the earth's position changes and countries on the right half (A) of the earth are now on the top half and experiences the low tide (next figure on next page). Countries on the bottom half (D) are now on the right half and facing the moon and experience the high tide. So given place on the earth experiences as high tide followed by low tide. Every six hours. So in short, the moon's gravitational force pulls the water from the earth towards itself. This gives high tide on the earth on the side facing the moon and opposite to it. And low tide on the other two sides. Due to rotation of the earth every sides changes it position relative to moon in every six hours. So given side experiences a high tide followed by low tide every six hours.



Systems for Tidal Power Utilization

From the above discussion it is clear that, the sea level is expected to rise and fall with a period of approximately 12 hours. Therefore, tidal power is a predictably variable, renewable energy source. Electric power may always be produced from tides in a predictable way.

A simple system to utilize the tidal power is the tidal barrage or single pool tidal system that is shown schematically in the Fig. The tidal barrage is essentially a dam that separates the ocean from a basin, which is typically a gulf or an estuary. Gates are located close to the bottom of the barrage and lead to hydraulic turbines. The latter operate at low pressure heads and are reversible. This implies that they produce power when the water flows in either direction. The gates are closed with the pool empty until the tide reaches the highest level, which is equal to the tidal range, H . At this instant the gates open, the turbines operate producing electricity and the pool fills with water.



Environmental Effects of Tidal Systems

Tidal power may produce a significant amount of electricity, thus replacing fossil-fuel power plants and avoiding the pollution effects associated with them. Tidal power is renewable, clean and does not emit any pollutants. There are some adverse environmental effects of tidal systems, which are described here:

1. For the building of the pool systems, significant construction is required, which uses a great deal of materials, especially cement.
2. Dams and barrages pose an environmental hazard because they obstruct the passages of fish and other marine life.
3. Because the tidal systems are constructed in coastal environments, they invariably interfere with fish spawning and have an adverse effect on the populations of the fish and other aquatic life.
4. Local navigation of boats and recreational watercraft is adversely affected by the construction of barrages, dams and locks.

On the positive side, the construction of a tidal system may have multiple purposes to add to the quality life in the surrounding communities. For example:

1. The upper surface of a barrage that connects two sides of an estuary may be paved and used as a road that connects communities.
2. Recreational activities, such as sailing, boating and swimming may be promoted within the enclosed estuary.