

OCEAN ENERGY

Energy is required for the evolution of life forms on earth. However, a significant portion of the energy which we use today is obtained from the non-renewable sources. This implies that once they are used up, they cannot be replenished. The most important source of non-renewable energy used extensively is the fossil fuels which have taken millions of years to be formed. Thus, it is important to use them judiciously. This requires us to look for alternate sources. We know that energy exists in different forms in nature and that it cannot be created or destroyed. But it can be transferred from one form to another. The energy from nature- the sun, the wind, waves, tides, etc. can be converted into a usable form. One of these renewable sources of energy is the tidal energy.

Turning the energy of the ocean's waves and tides into power that we can use is a new and unproven technology. However, the potential is there for a significant renewable and environmentally clean energy source.

What is wave energy?

Wave energy is energy harnessed from the waves of the ocean. Waves are formed by wind moving across the surface of the ocean. A large amount of energy is stored in waves.



What are Tides?

The gravitational forces of the sun and the moon combined with the rotation of the earth result in an alternate rise and fall of the sea levels. At one particular place, it usually occurs twice on a lunar day. The rise of the sea level is called the high tide, whereas the fall is called the low tide. When the earth and moon's gravitational field are in a straight line, the influences of these two fields become very strong and causing millions of gallons of water flow towards the shore resulting in the high tide condition. Likewise, when the moon and earth's gravitational fields are perpendicular to each other, the influences of these fields become weak causing the water to flow away from the shore resulting in a low tide condition.

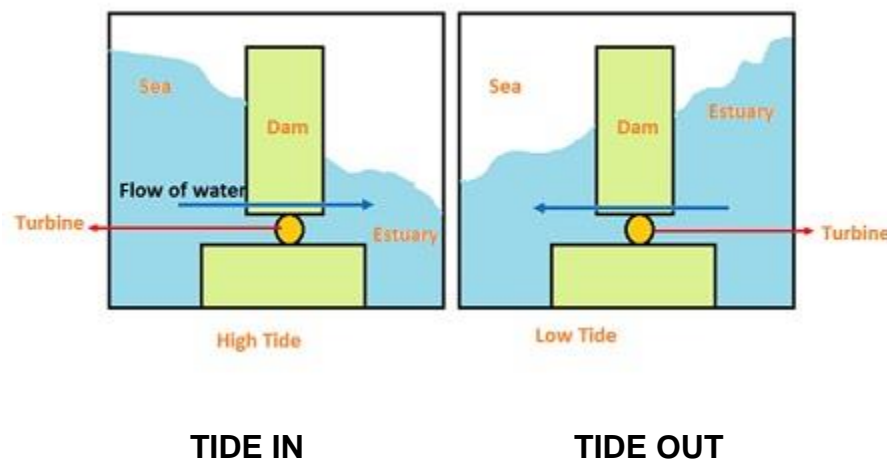
When the moon is perfectly aligned with the earth and the sun, the gravitational pull of the sun and the moon on the earth becomes much stronger and the high tides much higher and the low tides much lower during each tidal cycle. This condition occurs during the full or new moon phase. Such tides are known as spring tides. Similarly, another tidal situation emerges when the gravitational pull of the moon and sun are against each other cancelling their effects. This results in a smaller difference between the low and high tides due to the smaller pulling action on the sea water, thereby resulting in weak tides. These weak tides are known as neap tides. Neap tides occur during the quarter moon phase.

What is Tidal Energy?

Tides are a regular phenomenon. They can be predicted over months and years in advance. This is why the energy from this massive movement of water can be harnessed and converted into a usable form of energy.

The energy obtained from the rise and fall of tides is called the tidal energy.

Tidal barrages or dams are constructed across a narrow opening to the sea. Water rushes into the dam when the sea level rises. This moves the blades of the turbines which are attached at the opening of the dam. This results in the generation of electricity.



DEFINITION –

Tidal energy is energy produced by the tides of the ocean. Tides are produced by the pull of gravity from the Moon as well as the spin of the Earth. There is a lot of energy in the movement of that much water.

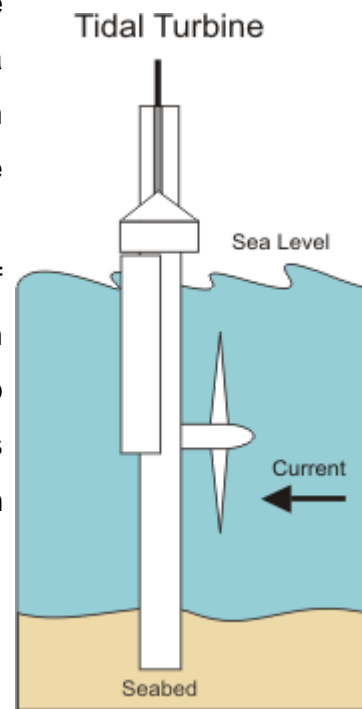
Renewable Energy

Wave and tidal power is considered renewable energy because we don't "use up" anything when we convert their energy to something usable like electricity.

How do we get power from the tides?

There are three main ways that scientists think we can capture the power of waves:

- Surface devices - These devices gain power from the waves moving them up and down on the surface of the ocean.
- Underwater devices - These devices range from balloon type objects attached to the ocean floor to long tubes that stretch over a long distance. When the waves cause them to oscillate, they move a turbine and create electricity.
- Reservoir - These devices take advantage of the waves moving water into a reservoir on the coastline. As water moves back out into the ocean it is forced down a tube and turns the blades of turbine. The turbine then converts the energy into electricity.



Types of Tidal Energy -

There are also three main ways that tidal energy is harnessed:

- Tidal Barrages - A tidal barrage works like a dam. When the tide goes high, the reservoir fills up. When the tide drops, the dam lets the

water out. In both directions the moving water can spin the blades of turbines to create electricity.

- Tidal Fences - These are smaller structures than a barrage. A number of vertical turbines form a fence between two land masses. When the tide moves in or out, the turbines spin and generate electricity.
- Tidal Turbines - These are individual turbines placed anywhere there is a strong tidal flow.

History of Wave and Tidal Energy

Concepts for wave energy have existed since the 1800s, however modern wave technology began in the 1940s with the experiments of scientist Yoshio Masuda. Funding into wave energy technology has recently increased due to the need for renewable energy sources. The first wave power plant in the world opened in 2008 at the Agucadoura Wave Farm in Portugal.

Tidal power to turn water wheels and grind grains was used as far back as Roman times and the Middle Ages. The idea of using tidal power for electricity is fairly recent, but the costs have been too high to make it a major energy source. Recent technological advances have shown that it could become a competitive and viable source.

List of Advantages of Tidal Energy -

1. It is renewable.

Tidal energy's source is a result of the effects of the sun and moon's gravitational fields, combined with our planet's rotation around its axis, which result in low and high tides. With this in mind, the power source of tidal energy is potentially renewable, whether we are talking about tidal barrages, stream generators or the more recent technology, dynamic tidal power (DTP). Compared to nuclear reserves and fossil fuels, the sun and moon's gravitational fields, as well as the Earth's rotation around its axis, will not cease to exist any time soon.

2. It is green.

Aside from being renewable, tidal energy is also an environmentally friendly energy source because it does not take up a lot of space and does not emit any greenhouse gases. However, there are already some examples of tidal power plants and their effects on the environment. Important studies and assessments are being conducted on these things.

3.It is predictable.

Sea currents are highly predictable, developing with well-known cycles, which makes it easier to construct tidal energy systems with the correct dimensions, since the kind of power the equipment will be exposed to is already known. This is why both the equipment's installed capacity and physical size have entirely other limitations, though tidal turbines and stream generators that are being used are very similar to wind turbines.

4. It is effective at low speeds.

Water is a thousand more dense than air, which makes it possible to produce electricity at low speeds. Based on calculations, power can be generated even at 1 minute per second, which is equivalent to a little over 3 feet per second.

5. It has a long lifespan.

So far, there is no reason to believe that tidal energy plants are not long lived. This means an ultimate reduction of the money spent on selling the electricity, making this energy source a very cost-competitive one. As an example, the La Rance tidal barrage power plant was constructed in 1966 and is still generating large amounts of electricity up to this day.

6. It reduces foreign importation of fuel.

By harnessing tidal energy on a large scale, we can help reduce foreign fuels importation and enhance energy security, as people would no longer have to rely much on foreign fuel import to satisfy the growing energy demand.

7. It serves as coastal protection.

Small dams and barrages, which are used to harness tidal energy, could protect ship ports and coastal areas from the dangerous tides during storms and bad weather conditions.

List of Disadvantages of Tidal Energy

1. It still has some environmental effects.

As previously mentioned, tidal power plants are suspected to have some environmental effects, but are yet to be determined. As we know it, these facilities generate electricity with the use of tidal barrages that rely on ocean level manipulation, thus potentially having the same environmental effects as hydroelectric dams. Also, the turbine frames may potentially disrupt the natural movement of marine animals, and the construction of the whole plant may also disturb migration of fish. Nevertheless, technological solutions are now being developed to resolve these issues.

2. It is an intermittent energy source.

Tidal energy is considered as an intermittent source of energy, as it can only provide electricity when the tide surges, which happen about approximately 10 hours per day on average. This means that tidal energy can only be considered as reliable when accompanied with effective energy storage solutions.

3. It should be close to land.

Tidal energy facilities need to be constructed close to land, which is also the place where technological solutions that come with them are being worked on. It is hoped that in a few years we will be able to use weaker tidal currents at locations further out to sea. In addition to this disadvantage, the areas where this energy is produced are far away from the exact locations where it is consumed or needed.

4. It is expensive.

We should know that the method of generating tidal energy is relatively a new technology. It is projected that it will be commercially profitable by 2020 in larger scales with better technology. Also, the plants that harness this type of energy are linked to higher upfront costs that are required for construction. Thus, tidal energy displays a lack of cost-effectiveness and efficiency in the world's energy market.

5. It is not cost-effective.

The tidal energy technology is not that cost-effective, as more technological advancements and innovations are still needed to make power commercially viable.

6. It is still considered a new technology.

Still a more theoretic source of power, tidal energy is limited in real life to just a few prototype projects because the technology has just begun to develop and needs plenty of research and huge funds before it reaches the commercial status.

7. It requires long gestation time.

The time and cost overruns can be huge for tidal power plants, which led to some of them being cancelled, such as UK's Severn Barrage. In fact, some tidal power stations, like the one being planned in Russia, will never be realized because of very long gestation time.

Conclusion

By weighing down the advantages and disadvantages of tidal energy listed above, you can gain a clearer realization on its over-all impact. On your end, do you think that this type of power source is more helpful to society, or not?