

A  
Seminar report  
On

**Tidal Energy**

Submitted in partial fulfillment of the requirement for the award of degree  
Of Computer Science

**SUBMITTED**

**TO:**

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## Preface

I have made this report file on the topic **Tidal Energy**; I have tried my best to elucidate all the relevant detail to the topic to be included in the report. While in the beginning I have tried to give a general view about this topic.

My efforts and wholehearted co-corporation of each and everyone has ended on a successful note. I express my sincere gratitude to .....who assisting me throughout the preparation of this topic. I thank him for providing me the reinforcement, confidence and most importantly the track for the topic whenever I needed it.

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## **Introduction**

Tides are the waves caused due to the gravitational pull of the moon and also sun(though its pull is very low).

The rise is called high tide and fall is called low tide. This building up and receding of waves happens twice a day and causes enormous movement of water. It is so powerful that it has caused many mishaps and resulted in sinking of ships.

Thus tidal energy forms a large source of energy and can be harnessed in some of the coastal areas of the world. Tidal dams are built near shores for this purpose. During high tide, the water flows into the dam and during low tide, water flows out which result in turning the turbine.

## What is Tidal Energy?

Tidal energy is the utilization of the variations in sea level caused primarily by the gravitational effects of the moon, combined with the rotation of the Earth.

## History



- Tidal power buildings were built as early as the 9<sup>th</sup> Century throughout Europe.
- This building was built in Ohalo, Portugal circa 1280.

## How Does Tidal Energy Work

Tidal energy is energy obtained from changing sea levels (the tide moving from high to low and vice versa.) This renewable energy source has great potential as tides are much more predictable than wind power and solar energy which are not at all consistent (seasons, bad weather, etc...)

There are three main ways to harness tidal power, these are:

### Tidal Turbines

Tidal turbines use similar technology to wind turbines, although their blades are much shorter and stronger. So a good way to think of them is as underwater windmills. Basically the water currents turn the turbines, which in turn activate a generator that produces electricity. These systems work best where there are very strong tidal zones (Norwegian and British coastlines.) and although it is still in its infancy it does show great promise.

The upfront cost of these tidal stream systems is very high and also installation and maintenance is difficult. But it's still cheaper and has less environmental impact than another tidal system which uses barrages.

### Tidal Barrages

Tidal barrages are very similar to the Dams in hydroelectric plants, except that they are much larger as they are built across an estuary or bay. The tidal range (difference between high and low tide) needs to be in excess of five metres for the barrage to be workable. As the tide comes in, water flows through the dam into the basin. Then when the tide stops the gates are closed, which traps the water in the basin/estuary.

As the tide goes out gates in the dam which contain turbines are then opened and the flowing water passes through the turbines, thus generating energy.

Tidal barrages have very high infrastructure costs and are very damaging on the local environment. Also construction of such dams is a very lengthy project. A good example of this is the La Rance barrage in France which took over five years to build (it's the largest tidal power station in the world.)

### Tidal Lagoons

Tidal Lagoons are similar to barrages but have a much lower cost and impact on the environment. They are self contained structures cut off from the rest of the sea.

It works in pretty much the same way as a tidal barrage as when the tide rises the lagoon fills and when it falls the water is then released through the turbines.

## Application

- Tidal energy is derived from the motion of the Earth-Moon system. Due to the rotation of earth, the bulges of tides are always ahead of the position on earth right under the moon.
- The gravitational force between this portion of water and moon generates a torque that decelerates the rotation of earth.
- On the other hand, this force helps to accelerate the orbital movement of moon around earth.
- As a consequence, without other interference, the rotational period of earth will finally be equal to the orbital period of moon.
- The utilization of tidal energy, which will inevitably reduce the tidal currents, takes advantage of the angular dynamic energy of earth in the similar way.
- However, the process of tidal acceleration is extremely slow, and the phenomena of tide can be expected to last until the vaporization of the ocean on earth billions of years later.

## Tidal Energy Generation

Energy can be harnessed from the tides in two ways: using the change in height of the tides (potential); and using the flow of the water (kinetic).

Tidal power is very sensitive to speed. The power output varies as the cube of the speed. In other words, if the water flows twice as fast, it makes eight times the power.

Also, tidal turbines do not have to spin as fast as windmills to generate power, because water is roughly 800 times more dense than air.

Tidal power technology is constantly evolving. However, the most common technology today can be classified into three main categories:



- **In-Stream Devices** make use of the kinetic energy of moving water to power turbines, in a similar way as windmills use moving air. This method is gaining in popularity because it's removable, it can be scaled up gradually (from one device, to an array, to a larger farm), and has lower potential costs and ecological impact (compared to barrages).
- **Barrages** make use of the potential energy in the difference in height – or head – between high and low tides. They are essentially dams across the full width of a tidal estuary – or the mouth of a river that has a free-flowing connection to the ocean. Barrages have very high costs, a worldwide shortage of viable sites and associated environmental concerns.
- **Tidal Lagoons** are similar to barrages but can be constructed as self-contained structures not extending fully across an estuary. Some suggest this may reduce both costs and overall impacts. They can be configured to generate continuously, which is not the case with barrages.

## Advantages of Tidal Energy

- 1) It is an inexhaustible source of energy.
- 2) Tidal energy is environment friendly energy and doesn't produce greenhouse gases.
- 3) As 71% of Earth's surface is covered by water, there is scope to generate this energy on large scale.
- 4) We can predict the rise and fall of tides as they follow cyclic fashion.
- 5) Efficiency of tidal power is far greater as compared to coal, solar or wind energy. Its efficiency is around 80%.
- 6) Although cost of construction of tidal power is high but maintenance costs are relatively low.
- 7) Tidal Energy doesn't require any kind of fuel to run.
- 8) The life of tidal energy power plant is very long.
- 9) The energy density of tidal energy is relatively higher than other renewable energy sources.

## Disadvantages of Tidal Energy

- 1) Cost of construction of tidal power plant is high.
- 2) There are very few ideal locations for construction of plant and they too are localized to coastal regions only.
- 3) Intensity of sea waves is unpredictable and there can be damage to power generation units.
- 4) Influences aquatic life adversely and can disrupt migration of fish.
- 5) The actual generation is for a short period of time. The tides only happen twice a day so electricity can be produced only for that time.
- 6) Frozen sea, low or weak tides, straight shorelines, low tidal rise or fall are some of the obstructions.
- 7) This technology is still not cost effective and more technological advancements are required to make it commercially viable.
- 8) Usually the places where tidal energy is produced are far away from the places where it is consumed. This transmission is expensive and difficult.

## Uses

Tidal Energy is one of the many forms of Renewable Energy like Solar, Wind and Geothermal Energy. Tidal Energy is derived from the movement of Waves or Tides due to the Gravitational Attraction of the Earth and the Moon. Tidal Energy is a form of Gravitational Energy which can be used to do Work or be converted in other forms of Energy.

Tidal Energy is still an immature technology with advancements in Tidal Energy not as rapid as other forms of Renewable Energy. While esoteric and path breaking approaches are being developed to harness the freely available renewable wave and tidally energy, the full commercial development is still some way away.

On the other hand, Tidal Barrages is a mature technology though its development too has been slow because of high investment and long building time. Here are the uses of Tidal Energy.

**Tidal Electricity** - Like other forms of Energy, the main usage of Tidal Energy is in the generation of Electricity. Tidal Energy is being used in France to generate 240 MW of Tidal Electricity at very low costs. There are other smaller plants in operation in Canada, China and Korea as well. DOE has located 40 places in the world where the differences between the low and high tides is big enough to generate commercial levels of Tidal Electricity. Note the Power generated from Tidal Energy is reliable as Tides are uniform and predictable in nature.

**Grain Mills** – Tidal Energy has been used for hundreds of years. Just like Wind Mills, Tidal Energy was used for the mechanical crushing of grains in Grain Mills. The movement of Turbines due to Tidal Energy was used in the crush Grains. However with the advents of Fossil Fuels, this usage of Tidal Energy has become quite low.

**Energy Storage** - Tidal Energy can also be used as a store of Energy. Like many of the hydroelectric dams which can be used a large Energy Storage, so Tidal Barrages with their reservoirs can be modified to store energy. Though this has not been tried out, with suitable modifications Tidal Energy can be stored as well though costs may prove to be high.

**Provide Protection to Coast in High Storms** – Tidal Barrages can prevent Damage to the Coast during High Storms and also provide an easy transport method between the 2 arms of a Bay or an Estuary on which it is built.

## Environmental Effects

- Studies to date suggest that local environmental impacts are likely to be minor, but further research is required into device-environment interactions, particularly the impact of tidal stream energy generators on flow momentum.
- Although the generators create no noise audible to humans, they do create “modest” noise underwater. Manufacturers maintain that this is important to help marine wild-life have an awareness of the presence of the turbine.
- MCT’s information for the project in Northern Ireland notes that, “rigorous and detailed environmental impact studies, carried out by independent consultants, suggest that the technology is most unlikely to pose a threat to fish or marine mammals, or the marine environment in which they live. A major monitoring programme is already under way for the SeaGen device installed in Strangford Narrows which will build upon this work.”

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## Current Legal Issues Regarding Proposed Tidal Plants in the US

- Section 4(e) of the FPA directs the Commission to give equal consideration to the purposes of power and development, energy conservation, fish and wildlife, recreational opportunities, and preservation of environmental quality “in deciding whether to issue a *license*.”
- (National Wildlife Federation).
- Similarly, sections 10(a) and 10(j) are prefaced with the direction that “all *licenses* issued under this subchapter” shall include the conditions required by sections 10(a) and 10(j).

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## **Conclusion**

Tidal energy is a kind of renewable energy with large potential. It has many advantages over solar and wind energy. For example, the availability of tidal energy is highly predictable and not subject to the impact of weather condition.

The energy density of tides is also higher than solar and wind energy. However, the high demand in technology and capital investment has hindered the development of tidal energy so that the tidal energy projects are much less than those of solar and wind energy.

With the development of innovative tidal turbine system and coastal infrastructure, the popularization of tidal energy worldwide can be expected.

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## References

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