Tidal Wave Energy

Abstract 1

Cited resources:

Wang, kelin et al., Limits of tidal energy dissipation by fluid flow in subsea formations, 1999, geophys. J. Int. 139, pp 763-768

Abstract

The study consists of measuring theoretical energy creation if a mechanism were to be placed in the sea flow below tidal areas. Tidal loading causes fluid to move within the sea floor, this theoretically can be made into electricity, by means of turbines. They considered the gas flow as well as simple fluid flow, and give expressions to find calculated energy creations. Though this energy may not be able to be obtained all of the time, only favorable conditions will be able to create enough electricity. Base on current understandings, tidally induced flow in subsea formations appears to make little contribution to the observed global tidal energy dissipation.

Abstract 2

Harnessing The Waves

Abstract

After several prototypes federal regulators have approved the Arlington, Virginia-based Verdant Power’s Plan. In which six underwater turbines are to be placed in New York City, in an attempt to produce pollution free electricity. These turbines, powered by the speed of six miles an hour from the East River should produce enough electricity to power a supermarket. If all goes as planned the turbines should one day produce from five to ten megawatts, enough to power 4,000 homes. “Each project must be extensively researched, tested, sited, and licensed requiring time and millions of dollars of start up capital.” The New York turbines are to be completed sometime this year.
Abstract 3

Growing concern over the threat of global climate change has led to an increased interest in research and development of renewable energy technologies. The ocean provides a vast source of potential energy resources, and as renewable energy technology develops, investment in ocean energy is likely to grow. Research in wave energy and tidal energy has led to promising technologies and in some cases, commercial deployment. These sources have the potential to help alleviate the global climate change threat, but the ocean environment should be protected while these technologies are developed. Renewable energy sources from the ocean may be exploited without harming the marine environment if projects are sited and scaled appropriately and environmental guidelines are followed.

Abstract 4

Tidal Energy or tidal power is the power achieved by capturing the energy contained in moving water mass due to tides. Two types of tidal energy can be extracted: kinetic energy of currents between ebbing and surging tides and potential energy from the difference in height between high and low tides. The former method - generating energy from tidal currents - is considered much more feasible today than building ocean-based dams or barrages, and many coastal sites worldwide are being examined for their suitability to produce tidal energy.

Tidal power is classified as a renewable energy source, because tides are caused by the orbital mechanics of the solar system and are considered inexhaustible within a human timeframe. The root source of the energy comes from the slow deceleration of the Earth's rotation. The Moon gains energy from this interaction and is slowly receding from the Earth. Tidal power has great potential for future power and electricity generation because of the total amount of energy contained in this rotation. Tidal power is reliably predictable (unlike wind energy and solar power). In Europe, Tide Mills have been used for nearly 1,000 years, mainly for grinding grains.

Work Cited

Introduction: Wave and Tidal Energy

There are basically two methodologies for creating tidal power: the use of tidal dams or ocean currents. Dams are based on using a barrage at a bay or estuary with a large tidal range. Power is generated primarily at ebb tides as the barrage creates a significant head of water, much like a hydroelectric dam. This technology is very well established at La Rance, France where a 240MW plant has operated since 1966. A 20MW facility has also been present in Annapolis, Nova Scotia since 1984. However, estuaries are amongst the world’s most productive and sensitive ecosystems, and the flooding by these barrages causes a great disruption to their natural processes.

The sources of tidal power production are fast flowing tidal currents. The gravitational pull of the moon causes water to flow in from the ocean twice a day on the flood tides, and outward during ebb tides. Additional monthly and annual lunar cycles vary the strength of these currents. Narrow and shallow constrictions produce the fastest and most powerful movements of current, whose energy can be harnessed using ocean turbines. This energy source is independent of weather and climate change and follows the predictable relationship of the lunar orbit that is known many years in advance.

Our experiment was to calculate the number of revolutions of a turbine in a simulated environment using the barrage method. The fish tank is blocked off in the center with an all purpose wood and with the use of all purpose glue, the cracks were sealed to prevent leakage. We fabricated a gate to block to the opening of the fan to hold the separated water between the dam before release. We tested the fan’s revolution by increasing and decreasing the amount of water on the opposite side (ocean side) to simulate different amounts of current throughout the day. We used a camera with frame capture software to slow the recordings down to count the amount of spins. The fan is marked with an indicator that we used to base our counts on.
Scientific Method

1. Question

What level of water will give us the most revolutions of our fan?

2. Hypothesis

Out of our 6 different trials (different levels of water), our highest level of water will create the most fan revolutions, this level being 30 cm.s

3. Observations/Measurements

We found that as the water rushed from one side of the tank to the other, it would create an imbalance the other way around, and would sometimes push water back thorough the tank reversing the fans movements, for a very short time.

Graph of results:

This is a graph of our raw data, our trials, our heights, and our fan revolutions.

<table>
<thead>
<tr>
<th>Trial</th>
<th>height (cm)</th>
<th>Fan revolutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>7.5</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>20</td>
<td>3.5</td>
</tr>
<tr>
<td>3</td>
<td>22.5</td>
<td>5.25</td>
</tr>
<tr>
<td>4</td>
<td>25</td>
<td>7.5</td>
</tr>
<tr>
<td>5</td>
<td>27.5</td>
<td>9.25</td>
</tr>
<tr>
<td>6</td>
<td>30</td>
<td>11</td>
</tr>
</tbody>
</table>

As you can see from the graph below, as the water level of one side was risen, it created more revolutions of the fan.

4. Method

Materials:
- Fish tank
- Wood
• Hot glue
• All purpose wood / glass binding glue.
• Plastic electric fan (disconnect wiring)
• Water source
• Measurement in cm
• Movie camera, with slow motion ability (preferably high speed camera, or frame by frame ability)

Our procedure consisted of building a model of a mechanism to capture tide energy. As The tides come in, if it is blocked off by some wall, then the water level on one side will rise. A fan was built into the wall, and a method to temporarily block off incoming water was added. As it comes to high tide time, the blockade is released, letting water poor though the open hole consisting of the fan, causing the fan to spin, however if added contraptions are available, this can create electricity, thus is representing tidal energy.

Our method is similar, we used a fish tank, and blocked off half of it with wood (binding it using the special wood / glass all purpose glue). Added a fan in the wood, and calculated the number of times the fan spun when the blockade is released. Before releasing the blockade, we filled one side of the fish tank with water, and the other with just enough to cover the fan (if we didn’t do that, there would be white water rushing through, making it impossible to count the number of revolutions of the fan). Our heights used were, in cm, 17.5, 20, 22.5, 25, 27.5, 30.

5. Conclusion

Our hypothesis was correct, the 30cm mark made the fan revolve more times than the other 5 trials.

We concluded that the more water that is added to the “ocean” side of the tank, the more the fan revolved once the blockade is released into our controlled area side of the tank.

6. Revised Hypothesis and Future Research

New research is to figure out how much electricity can be generated (by adding such mechanisms to detect this) using a single water level. And find out at what placement on the wall would be best for placing the fan for maximum electricity gain (when tides move in and when tides move out). Hour hypothesis is that placing the fan at the lowest point possible in the wall will create the best energy gain possible since it fully utilized the in and out movement of the water, at the lowest level possible.