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Wave Energy Harvester

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***Abstract*: The conventional energy resources which we are consuming presently are replenishing at a much faster rate than expected. As there are many non-renewable source of energy, our project helps us to harvest energy from the waves that occur in ocean. As it is a renewable source of energy and the proposed way of harvesting has abundant resource in the nature. This involves in a non-destructible way of harvesting energy from the nature. Depletion of fossil fuels has created a great desire in searching for alternative energy sources. Harvesting of alternative energy is a quite difficult and challenging task, most importantly for harvesting wave energy. The established ways of wave energy harvesting is very minimum and requires huge capital. but our project helps us to make it simple.**

***Keywords*: Wave energy, simple pendulum, floating chamber, oscillation motion.**

1. Introduction

The oceans of the Earth represent vast source of renewable energy. Generally, ocean energy is categorized into six different types: wave energy, tidal range energy, tidal current energy, ocean thermal energy, salinity gradient [12]. The kinetic energy of the air which interacts with the ocean surface is transmitting the kinetic energy which it possesses, to the water surface. Now the transmitted kinetic energy is turned into waves in the ocean surface [1]. The energy which causes the waves is known as wave energy. Wave Energy is an "alternative energy" that can also be classed as a "Renewable energy source", as the Earth uses the gravitational forces of both the moon and the sun every day to move vast quantities of water around the oceans and seas producing waves.

As the Earth, its Moon and the Sun rotate around each other in space, the gravitational movement of the moon and the sun with respect to the earth causes millions of gallons of water to flow around the Earth's oceans creating periodic shifts in these moving bodies of water. These high and low shifts of water are called "waves".

The main big advantage of this is that the waves are therefore perfectly predictable and regular unlike wind energy or solar energy, allowing miles of coastline to be used for wave energy exploitation and the larger the wave influence, the greater the movement of the water and therefore the more potential energy that can be harvested for power generation. Therefore, Wave Energy can be considered as a renewable energy source as the oceans energy is replenished by the sun as well as through wave influences of the moon and suns gravitational forces.

2. Previously existed methods

There are some ways are currently in use. Those methods are,

- Point absorber buoy
- Surface attenuator
- Oscillation wave surge converter
- Oscillating water column
- Overtopping device
- Submerged pressure differential

These above methods are at the initial stage of development and not yet commercialized [11].

A. Mechanism used

The mechanism used in our project is "oscillation of a simple pendulum". Due to the motion of the waves the entire system obtains the same wavy motion. So, the pendulum placed in the middle of the model is trying to sustain its position due to its self-weight. This cause the pendulum to move front and back. This front and back motion is converted into electric energy [2].

B. Components used

In our model, very minimum number of component is used. Due to that the entire weight of the model is also reduced drastically. The basic and primary components used in our models are,

- Gear and pinion
- Dynamo
- Frame
- Simple pendulum
- Floating chamber
- Battery

C. Way of working

First the model is placed over the surface of the ocean. Then, the kinetic energy present on the oceans in the form of wave are transmitted to the structure. And here structure plays a major role to transmit the energy from wave to the simple pendulum. At the initial condition the floating chamber and the simple pendulum are in a same position. But when the energy transmitted to the structure the floating chambers are fixed rigidly and simple pendulum gives a front and back motion. And here floating chamber becomes the basic structure which bearing the entire weight of the model and makes it to float. The pendulum is rigidly attached to the gear. To convert the oscillating motion of the simple pendulum into a rotary motion.

In our model, we try to harvest the energy from every action. Energy obtained from the front motion and the backward motion is converted in to energy.

Fig. 1. Wave energy harvester

D. Environmental effects

The basic environmental issues associated with wave energy development is,

- The marine mammals get struck by the blades and turbines of the device which we use.
- The noise emitted by the energy harvesting device may disturb the living beings.
- The motion of the device may hit the sea creatures and make them ill.
- And sometimes the sea birds may get struck into the pendulum.
- As the device floats it may strike the boats and ships that sail near to where the device is placed.

E. Challenges

- There is a high impact on the marine environment. For example, it could have negative impact if not examined at regular intervals, the noise of each design vary greatly.
- Other biophysical impacts to flora and fauna. Due to that the lifecycle of the marine creatures is affected [3].
- In case of developing a new wave farm in selected sites can cause the fishermen to displace from the productive fishing grounds [4].
- Waves generate around 2,700 giga watts of power. From this enormous amount of power, only 500 giga watts can be harvested with the current technology [2].
- Some solutions are suggested for the problems encountered during the usage. It is found that the oceanic usage process is optimized based on cost, time efficiency and safety [5].

F. Fabrication

Fabrication process is based on three stages

1) Welding process

In our project our frame is made up of galvanized steel. The welding proposed in this project is TIG (Tungsten Inert gas) welding to bear entire load of the components.

2) Adhesives

Adhesives are used for additional strength at the joints.

3) Bolt and Nut

Bolt and nuts are used to connect the floating chamber to the frame.

3. Conclusion

Many researches are currently going on around the world, based on wave energy harvesting.

- From our studies about energy conversion technologies, no one really made it to large commercial stages compared to wind and solar energy.
- There is progress in theoretical studies, but in experimental and model testing of Wave Energy Converter is very difficult.
- The developments in the methods for wave resource potential characterizations have been very encouraging.
- There are wide varieties of methods available for conversion of wave energy. So it is tedious process to compare the different wave energy converters [11].

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