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# Design and Experimental Analysis OFA Floating Type Sea Wave Energy Harvester with Permanent Magnet Fixed Circular Disc

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***Abstract:* — Energy has its own important role in building up the economy of a nation. Nowadays, the concern about the depletion of fossil fuels and the environmental effects caused due to various energy sources are getting more rated. As a part of it, researchers have started concentrating towards the renewable and especially on green energies. Among the various forms of renewable energy sources available, sea wave energy is a less concentrated area while comparing with that of the others of such kind and is because of high expenses related to that for harvesting energy from sea. Through this article, a new simple (Floating type) system for converting the energy from sea waves into electricity has been introduced. In this system, a specially attached part containing circular disc with unbalancing mass and permanent magnets capable of oscillating, plays a major role in energy conversion. This paper addresses the design, construction and working of such a simple, sea wave energy harvester.**

***Key words*: sea wave energy, clean energy, green energy, renewable energy, ocean energy, buoy, oscillating energy, permanent magnet generator.**

## I. INTRODUCTION

Research on harvesting, clean and safe energy from renewable sources has become more important due to concerns towards the current energy crisis and growing environmental awareness. Commonly considered renewable energy sources include solar, wind, hydroelectric, sea waves, etc.Among them,solar and wind power are not a hope to specific geographic regions. But,sea wavesare especially the best source to hope;asocean covers three fourth of the world's surface. As per the estimations made, it has been specified that sea waves have energy as much as which world consumes today [1]. It is believed that the entire planet can be powered by utilizing just about 0.2 percent of the energy in ocean waves [2] .In thiscentury, research on several technologies has been made to get energy from the sea [2].The potential of the wave power which we obtain will be based on harnessing the long wavelengths; long period and deep-water ocean waves [1].There are many different types of wave power harvesters.Wave power devices convert the sea wave energy into electrical energy by various techniques based on their principle of operation. Throughout the world and particularly in Japan, UK, and Norway there were several government funded projects on this aspect [1].In this article; design, construction and working of a simple floating type sea wave energy harvester with permanent magnet fixed circular disc is introduced.

## II. WAVE ENERGY POTENTIAL:

According to the data released at the Inter-governmental Panel on Climate Change (IPCC) Scoping Conference on Renewable Energy in2008, the theoretical reserves of wave energy worldwide is 8000–80,000TWh/year [6].The estimated technically exploitable resource by means of the current device designs is capable toproducebetween140 and 750TWh/yrofelectricity [5]. By improving the performance of these devices it is estimated that, this rate may rise to 2000TWh/yr [5].Globally,wavepoweraveragesto 8kW/m(incomparison,windorsolarenergydensitiesare <500W/m), thus wave energy can be considered to be as ahighdensityrenewableenergysource[5].In India, Indian Institute of Technology, Madras in 1982 ,at the Ocean Engineering Centre started the research and development activity for exploring wave energy [3]. 5 MW to 15 MW per meter is the primary estimate on the annual wave energy potential along the Indian coast, thus our coast line may nearly have a potential of about 6000Kmand it works out to

40000-60000 MW approximately. But, considerably less will be the realistic and economical potential [3].

## III. EXPERIMENTAL SETUP:

Experimental arrangement of our simple floating type sea wave energy harvester is shown in figure 1.Itconsists of three different units, namely: The floating unit, specially designed Energy conversion unit and the Energy saving unit. Each of the above mentioned units have their own role in the system and are explained under the region working, given below.

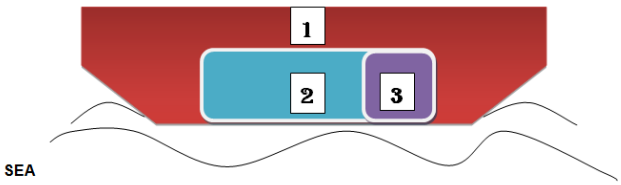


***Figure 1. Simple experimental setup***
***1. Floating unit 2. Energy conversion unit 3. Energy saving unit***

### *1. The Floating Unit*:

As the name represents, it is a floating unit which holds all the other units in it. It will be a closed, tightly bounded boat like structure which fulfills all the following important properties like: capable of withstanding heavy load, corrosion resistive, less weight, high durability, water resistant etc. This will be the base for the whole system.

Energy conversion unit is the core part of this device i.e., the heart of the system. A simple sketch of inner components of this energy conversion unit along with the energy saving unit is shown in the figure 2.The major components included in this energy conversion unit are: two circular discs of equal diameter, diagonally magnetized permanent magnets (e.g.: Neodymium magnets or ferrite magnets), copper coils, unbalancing mass, etc. In this unit two circular discs will be aligned closer to each other one above the other with a small gap between them at the same vertical axis. Inner surface of the disc at the top will be fixed with permanent magnets and of the other will be fixed with coils. At one point in the outer surface of the upper disc, an unbalancing mass will be fixed for creating instability. The disc at the upper region can rotate free on its axis; on the other hand the lower disc is stable. The shaft holding upper disc is fixed with larger pulley and that will be liked with the energy saving unit.

### *2. Energy saving unit:*

This unit plays a role of reducingthe wastage of energy. Major elements of this unit are: Two circular discs of same dimensions, gear arrangements, sprocket arrangements etc.In this case, the pulley at the conversion unit will be linked with a smaller pulley in this unit. There will be special gear and sprocket arrangements for conversion of various aspects related to that of the motion which occurs there and the end of the connection will be attached to the rotatable disc. Two discs will be placed as same as that in the conversion unit with a small difference that in this case the discs will be at horizontal axis. The face of the rotatable disc facing the fixed disc will be having permanent magnets as that in the previous case and coil will also be there in the fixed disc.

## IV. WORKING:

The total structure will be made to float at the surface of sea.At the time of occurrence of waves this floating device will be getting a disturbance and as a result of that the unbalancing mass present over the rotatable disc makes the disc either to revolve about its own axis or it may results in an oscillatory motion and will be purely based on the condition of wave.Thus the disc with permanent magnets gets revolved. During that occasion the magnetic field will be cut by the coils present in the stable disc and it results in creation of electromotive force and thus the sea wave energy will be converted into electrical energy.On the other hand the energy available at the oscillated (rotated) circular disc will be utilized by sending it through various systems to multiply the rotation, which includes conversion of angle of rotation too and the disc at the energy saving unit will be working as a flywheel and here the process of cutting of magnetic field happens and thus EMF will be induced and thus the process keeps on repeating.

## V. CONCLUSION:

This paper introduced an innovative design, construction and working of a light weighted, floating type, sea wave energy harvester with permanent magnets at the circular discs. The power conversion rate of this device will be purely based on the character of the wave. As per various factors associated with the wave, which causes the convertor to get operated, the amount of electricity obtained will also be getting changed. As it was the initial stage of designing it is very sure that, by further research on this we could design more effective methods for tapping sea wave energy. More focus on its research will bring its cost further down to be compared with wind and solar energy. New proposal is also promising, however more detailed analysis is required before this device can be made available for commercial power generation.

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