

Tidal waves Based Power Generation



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Abstract: Wave energy power generation is a clean energy mechanism. Wave energy assures to be renewable source of energy with zero emission. In this experimental outcome of a built in wave generator with some additional features are reported.

Index Terms: Renewable energy, prototype wave generator.

I. INTRODUCTION

Though innovations for using wave energy are numerous, limited efforts had been attempted to use the wave energy [1]. Waves occurring in ocean contain considerable power. It's a historical art to harness wave energy. Since 1890 attempts have been made in commercial scale to utilize the wave energy [2]. There are several research augments in progress spread over different countries [3]. The present work focuses on recovering energy from waves using a linear permanent magnet generator with other instrumentation and electrical accessories.

II. WAVE ENERGY CONVERTERS

It's crucial to harness energy in ocean. Utilizing a floating buoy the difference in height between wave top and bottom are measured to predict the power generation potential of energy converter [4]. An ocean wave with an altitude of 2m with time period of 10seconds has an ability to generate energy potential flux to a maximum of 70 kW/m width. The buoy which, floats on ocean surface replicas wave motion. The buoy which floats over ocean surface is connected to the generator, which is fixed on a foundation, at bottom of the bottom of the ocean (Fig.1)

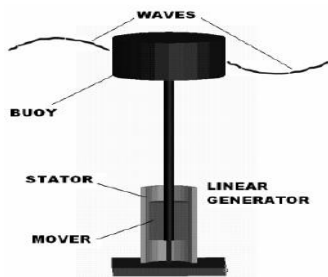


Fig.1. The floating buoy system

The classification of waves according to frequency ranging from < one second to > than 100,000s [5]. Its listed as below in Table 1.

Table 1. Wave Classification

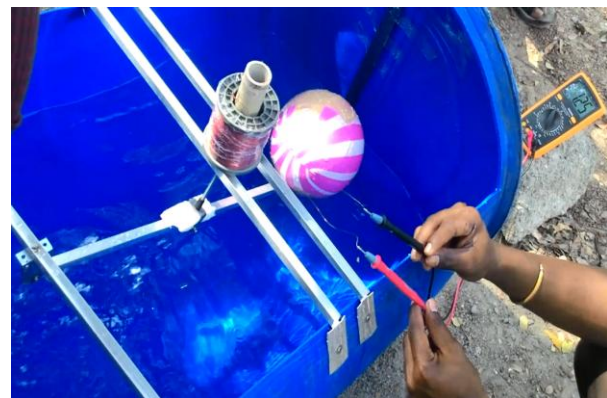
Waves	time period in Seconds (s)
Ripple	fractional seconds
Windchop	1 to 4 s
Fully developed	5 to 12 s
Swells	6 to 22 s
Surfbeats	1 to 3 mts
Tsunamis	10 to 20 mts
Tides	12 or 24 hrs

Table 2. Terminology

Terminology	Description
Crest	high point
Trough	low point
Wave height	Vertical distance
Wave length (l)	Horizontal distance
Wave period (p)	Time for a crest to travel a distance = to 1 wave length
Wave frequency	Inverse of p
Wave celerity	Ratio of l and p

III. EXPERIMENTAL INVESTIGATION

The built in experimental setup of the laboratory testing



scale wave energy based power generation with various accessories are pictured in Fig.2.

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Fig.2. Built in prototype plant with instrumentation.

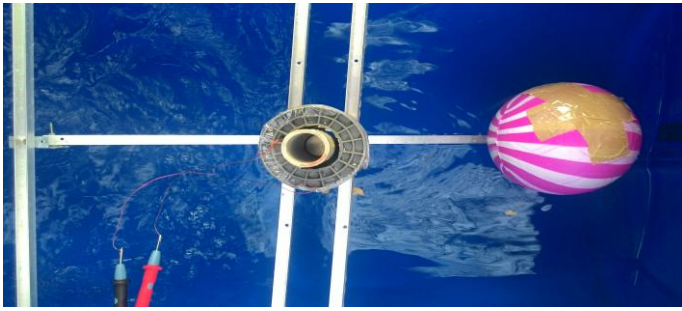


Fig.3. Built in prototype plant with Neodymium magnets.

Fig.3 depicts the side view of the built in laboratory testing scale wave energy unit with buoy. The magnetic generator is mounted to the movable arm that floats freely over the ocean surface. Fig.4 depicts the aerial view of the built in laboratory testing scale wave energy unit Fig.5. Depicts the instrumentation used for experimental works during wave power generation potential measurements. The major components of the laboratory testing scale wave energy unit employ magnets and a prototype tank. Buoy is a part of built in laboratory testing scale wave energy unit. It oscillates up and down over ocean surface. In this built in laboratory testing scale wave energy unit, emf is produced due to relative motion of the buoy to the permanent magnet over the shaft. For achieving this a cranking device is employed to produce rotary motion, which is later gets converted to a linear motion. This transmission of motion is achieved using a cam system. In this built in laboratory testing scale wave energy unit.

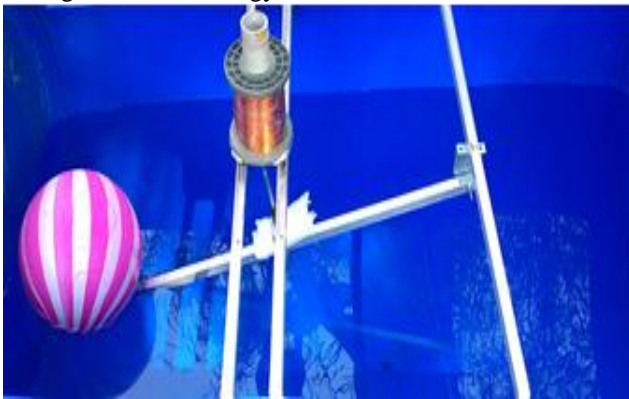


Fig.4. Built in prototype plant with float.



Fig.5. Instrumentation reading.

POWER GENERATED IN REGULAR WAVES

The experimental outcome using a single buoy in the built in laboratory testing scale wave energy unit is shown in table 3. The single buoy at a wave height is 0.1 to 0.3 m and the period is varied in the range of 2s to 4 s. During each run

in the single buoy laboratory testing scale wave energy unit applied damping is optimized to recover major energy in the built in laboratory testing scale wave energy unit with single buoy.

Table 3. Power generated in a single float

Test	H (m)	T (s)	Voltmeter reading (V)	P (W)
1	0.05	0.59	0.87	0.087
2	0.18	1.49	2.53	1.771
3	0.22	1.89	3.64	4.368
4	0.28	1.9	5.23	8.368
5	0.295	1.95	7.34	16.148
6	0.32	1.96	8.4	19.32
7	0.37	1.96	9.1	21.84
8	0.45	2.2	12.3	46.74

IV. RESULTS AND DISCUSSION

Experiments were carried out in a single buoy built in laboratory testing scale wave energy unit. It's investigated that when the wave period become too much longer then the power generation potential in ocean waves is found to increase drastically to a greater extent.

Its also investigated that the number of coils also plays a vital role in voltage.

Effect of Time Period and wave height

The experimental outcome using a single buoy in the built in laboratory testing scale wave energy unit is shown in in Fig.5 . The effect of height of ocean wave over power generation is shown in Fig.6 and Fig.7 shows the effect of wave period on power generated. Experimental results show that power output of the single buoy laboratory testing scale wave energy unit is dependent on the wave height. Its also observed that semi developed waves were found during the time span period ranging from 0.5 - 2s. Fully developed waves were observed during the time span ranging from 2- 3 secs.

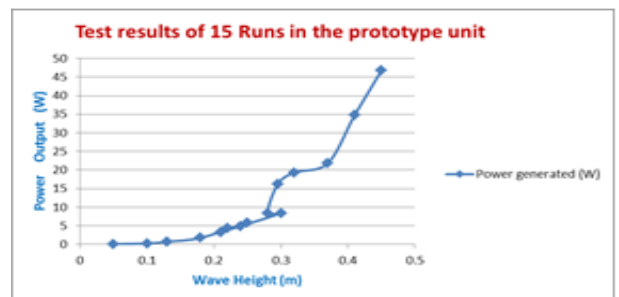


Fig. 5. Power production in regular waves of time.

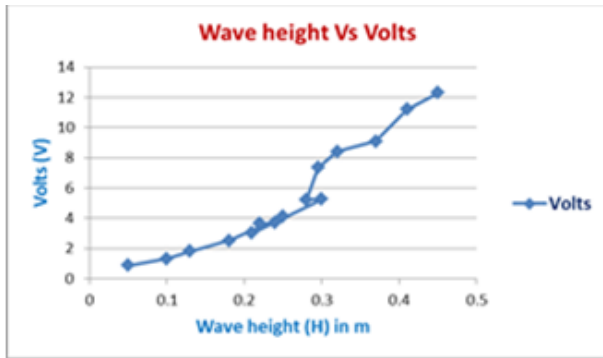


Fig. 6. Voltage distribution at different wave heights.

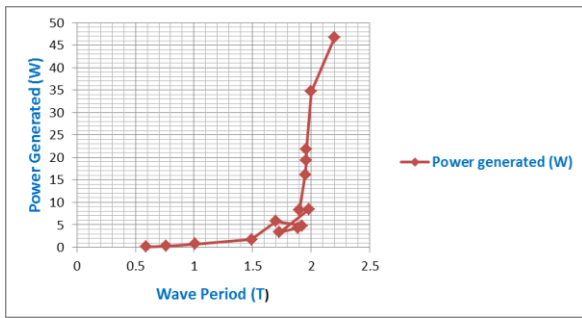


Fig. 10. Effect of Wave period on power generated.

V. CONCLUSION

Experiments were carried out in a in a single buoy built in laboratory testing scale wave energy unit. Operation and testing investigation details have been reported out. Experimental outcome of the present wok shows that it's capable to generate power on large scale. Laboratory testing scale wave energy unit assures to generate renewable energy with zero emission. There are also enormous methods to extract kinetic energy in waves. Experimental results are found to be promising to promote research in ocean waves.

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ABBREVIATIONS

- P is the power (W)
- D is the diameter (m)
- ρ is density (kg/m^3) 1020 kg/m^3
- g is acceleration due to gravity (m/s^2)
- His h-index is 2 in Google Scholar Citations.H is wave height (m)
- T is the wave period (s)

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AUTHORS PROFILE



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