

Wave Energy: New Technology in the Field of Renewable Energy Sources in India

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ABSTRACT

Electricity is the most important energy source all over the world. Electricity has always been an important part of homes & industries. Now a day, without electricity cannot complete our day to day worked. Lots of industries are running by electricity only. People are busy on making electrical vehicles. As per requirement, electricity is generating through renewable and non-renewable sources. Thermal power plant is the non renewable source for generated electricity. But Non renewable sources are going to extinct. So we moved to renewable sources. We know that renewable sources for generating electricity are hydro (from river sources), wind, Solar (sun light), Geothermal, and Wave Energy (Ocean Energy). Accept wave energy, other sources are not available every time for generating electricity. We required lots of unit of electrical power for our day to day life. Wave energy gets 24 hour also Oceans cover 70 percent of the earth's surface. It is suitable source for generating electricity for India. India has a long coastline from Gujarat to west Bengal. The best method is available to convert wave energy to electrical energy. In this paper, discuss about some wave energy conversion mechanisms and wave energy impotents and benefits for developing country like India where lots of sea sources are available.

KEYWORDS: Wave energy, Energy conversion, Wave energy Benefit, India electricity demands, Wave energy importance in India

I. INTRODUCTION

Renewable energy technologies present alternatives to fossil-fueled to generation of electricity. It is essential step towards dropping the dependence on fossil fuels. A huge amount of Renewable energy present in our earth. One of the best renewable energy is wave energy. Wave energy gets 24 hour also Oceans cover 70 percent of the earth's surface. Other renewable sources for generated electricity are hydro (from river sources), wind, Solar (sun light), Geothermal, and Wave energy (Ocean Energy). Wave energy is suitable source for generated electricity for India. India has along coastline from Gujarat to west Bengal. The best method is available to convert wave energy to electrical energy.

In this paper discussed about wave energy and there conversion and electricity demand in India with what are the benefit with wave energy for produced electricity.

II. WAVE ENERGY

Ocean waves are produced by fast moving air in surface of the water. The air molecules and the water molecules are collapsed. Collapse produce friction and wind energy converted into wave energy. This causes waves to form.

A. Wave Conversion Mechanism

Wave Energy is in order to extract this energy, wave energy conversion devices must create a system of reacting forces, in which two or more bodies move comparative to each other, at least one body touch with the waves. The waves pass through the device which converted wave energy to electrical energy.

1. Hydraulic mechanism: Wave passes through the body then Starts to move hydraulic Arms which couple with body. Hydraulic arm connected with piston which couple with high pressure fluid rectifier. That rotates the hydraulic motor. Motor is couples with generator who generated the electric power.

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- Air or turbine mechanism: It works like piston. Whenever the waves come to the arrangement chamber it applied force as air pressure to turbine

for rotation. Rotation is maintain by arrangement for one direction, and rotates the electric generator which couple with that arrangement.

B. Power Conversion Block Diagram

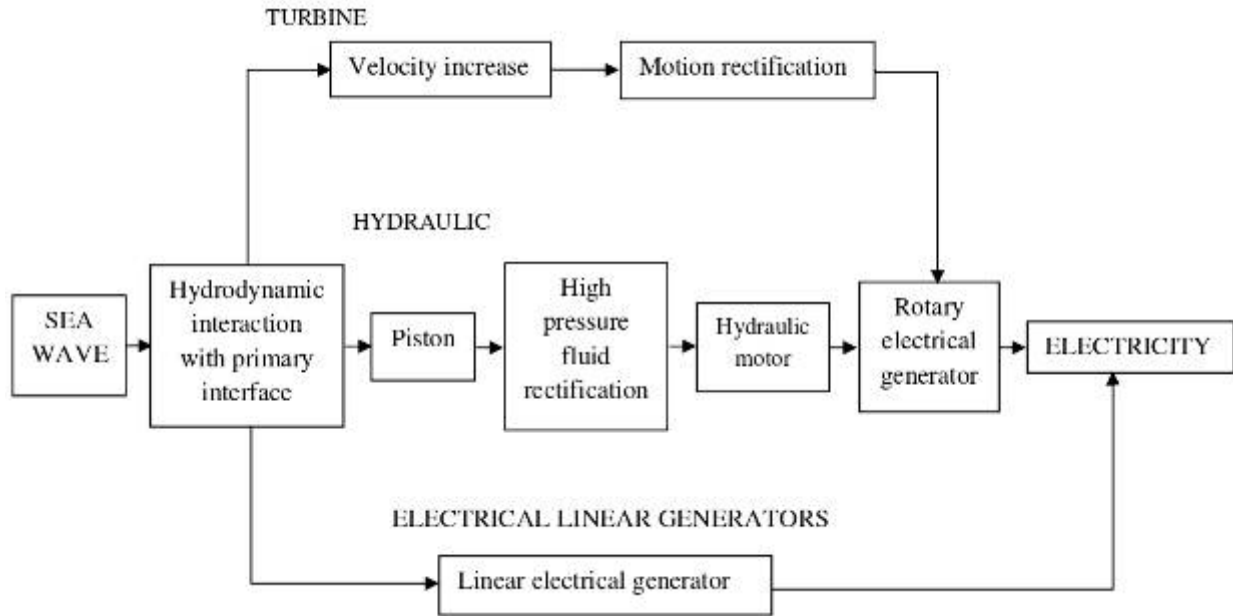


Fig. 1 Block diagram of wave energy conversion [1]

A huge number of people gave deferent concept on the wave conversion. Here is explanation about very popular and easy method and conversion techniques, which are placed in deferent part of sea in deferent wave length and power.

C. Deferent Wave Energy Level

Shoreline is edge of land at edge of large water body. Wave power present in three deferent parts of Sea with deferent energy level, According to the Wave length and power position of Sea, There are:

- At the shoreline
 - Near the shoreline
 - Off-shore
- At the shoreline: This position is in the bank of the sea. Where wave length is maximum, the power of the wave is minimum.
 - Near the shoreline: This position is beyond the bank of the sea. Wave length is short than bank of the sea. Power is less than off shoreline, because wave travel a distance.
 - Off shoreline: It is in deep sea, where wave was produced. Wave length is too short and has maximum power in the waves. It is the best part for conversion of the wave energy to electrical energy.

D. Wave Conversion Method

There are some methods for conversion of the wave energy to electrical energy. Those are:

- Attenuator
- Oscillating water column
- Point absorber

1. Attenuator: The Pelamis wave farm is the example of Attenuator. It is established in Portugal in October 2008.

Attenuator device is placed parallels with ocean wave in same direction. It is placed in off shoreline. This structure is like a snake.



Fig. 2 Pelamis wave farm

Wave passes through the attenuator, move the hydraulic arms and that arm move the hydraulic motor which coupling with arms. Hydraulic arms are pontoon. Hydraulic motor connected with rotary electrical generator, produces electricity.

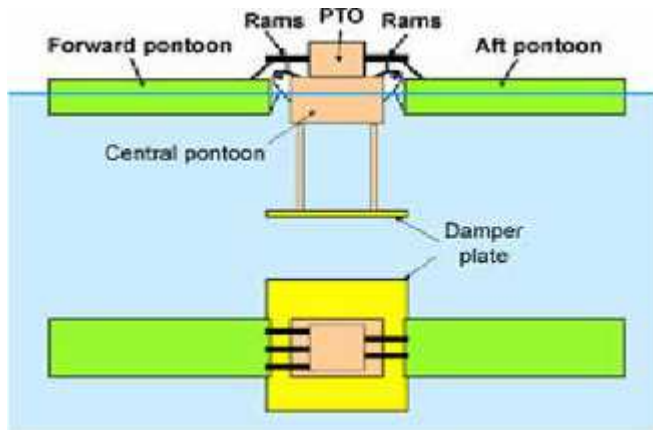


Fig. 3 Attenuator mechanism

2. Oscillating water column: The Limpet is the example of Oscillating Water Column. It is established in Australia, Scotland in February 2010.



Fig. 4 Oscillating water column

An Oscillating Water Column (OWC) contains a swamp structure that one side of the structure open below the water surface. This structure is called a wave collector. This is placed in at the shoreline.

Oscillating water column works on turbine mechanism. It works like piston. Whenever the waves come to the arrangement chamber it applied force as air pressure to turbine for rotation. Rotation is maintain by arrangement for one direction, and rotates the electric generator which couple with that arrangement.

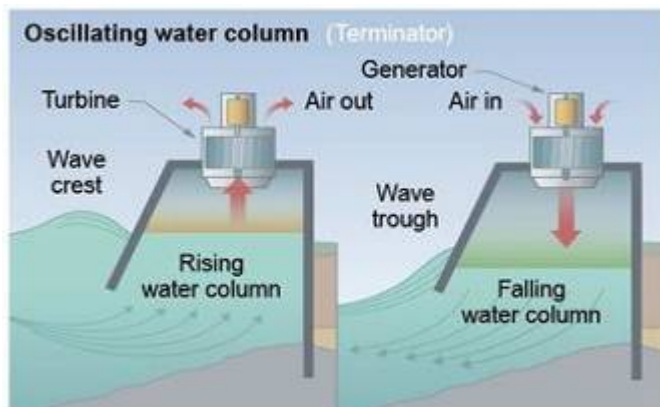


Fig. 5 Oscillating water column mechanism.

3. Point absorber: The OPT Power buoy is the example of Point Absorber. It is established in Denmark in February 2012. This is placed in both near shoreline or off shoreline.

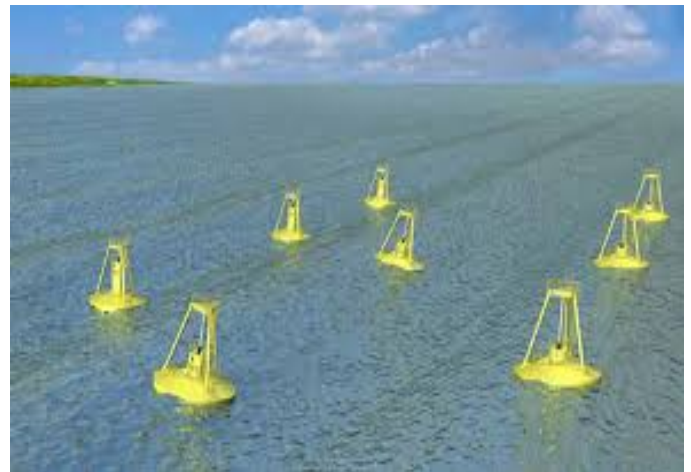


Fig. 6 Point absorber

A point absorber is a small dimensional device. The floating structure of the device move up and down on the surface of the water and hydraulic pressure arm move that rotated the generator. This device is to small size that wave direction is not affected to convert energy.

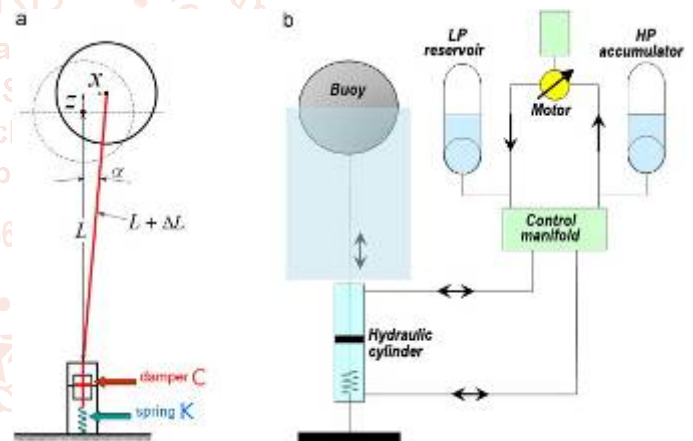


Fig. 7 A point absorber mechanism

E. Benefit of Wave Energy

Wave energy is the energy which produced in the surface of ocean and this energy convert to electrical energy for used to any useful work. It is a clean and renewable energy source and its potential is huge. It is a renewable energy source which is pollution free. Ocean waves have a huge amount of energy that density among renewable energy sources. Wind blow in water surface and formed friction between water and air that friction generated the wave. Solar energy intensity of typically 0.1–0.3kW/m² horizontal surface is converted to an average power flow intensity of 2–3kW/m² of a vertical plane perpendicular to the direction of wave propagation just below the water surface [1]. Waves can travel large distances with little energy loss. There is required land for installation. It is Eco friendly.

F. Limitation of Wave Energy

It is a problem to transmit the power from shore to destination. It is a problem for marine. Corrosion occurs in metal by salty water.

G. Challenge of Wave Energy [3]

1. Risks during project development
2. Risks during construction/installation
3. Risks during operation(technical & political)
4. Availability of debt
5. Project length
6. Due diligence costs
7. Bankable warranties

III. INDIAN ELECTRICITY

A. Indian Electricity History

The first electric light was demonstration in Calcutta on 24 July 1879 by P.W. Fleury & Co. On 7 January 1897.[6] In the year of 1947, after independent electricity demand in India is 1362 MW. Generation plants are thermal with coal and renewable sources with hydro are 508MW. Now demand is increasing day by day because of population. India is second most populated and polluted country. With the rate of demand we need very suitable and eco friendly renewable sources. According to Central Electricity Authority (CEA) electricity required in 2018 is 1,205 billion KWh. India exported 5,798 GWh from neighboring countries.

B. Electricity Demand in India

Shown in the fig. 8 then understand how much demand increase in sixty years. In future it will be increase more than this. Day by day for the shortage of land and other problems installation capacity decrease but demand will be going to increase.

India has exported electricity from neighboring countries. Shown in figure 9. For Hydro, Thermal power plants want a huge amount of land. Its need a specific area, otherwise is harmful for anyone. Second most populated country needs land for living and other work. But electricity generation is the most important for our day to day life. For that wave energy converted to electricity is a good solution.

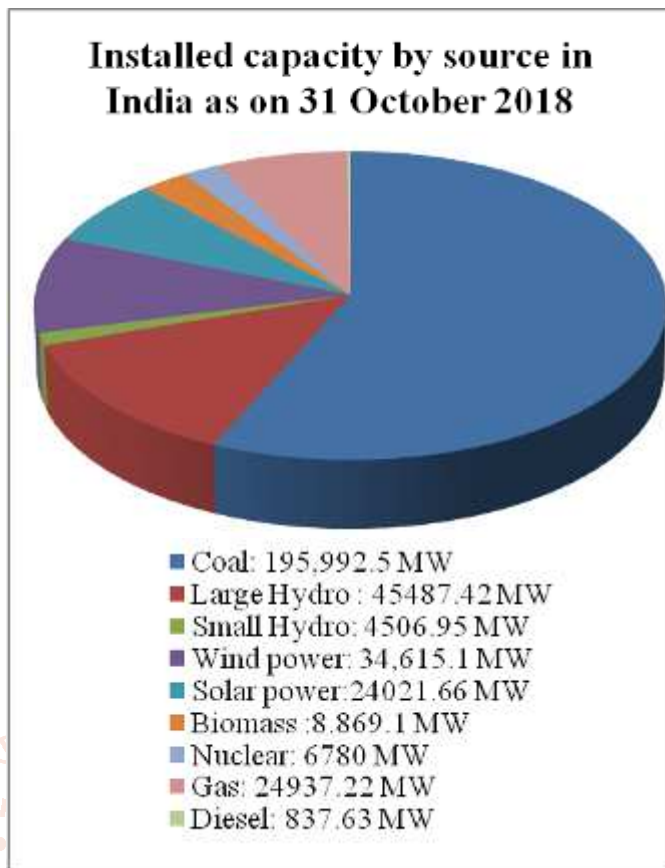


Fig. 8 Installation capacity in India 2018 [6]

Table 1: Below show the installation capacity since independence in India

Installed Capacity As on	Thermal (MW)				Nuclear (MW)	Renewable (MW)			Total (MW)
	Coal	Gas	Diesel	Total		Hydro	Other	Total	
31-Dec-1947	756	-	98	854	-	508	-	508	1362
31-Dec-1961	2436	-	300	2736	-	1917	-	1917	4653
31-Mar-1974	865	165	241	9058	640	6966	-	6966	16664
31-Mar-1990	41236	2343	165	43764	1565	18307	-	18307	63636
31-Mar-2002	62131	11163	1135	74429	2720	26269	1628	27897	105046
31-Mar-2018	197171	24897	838	222908	6780	45293	69022	114315	344002

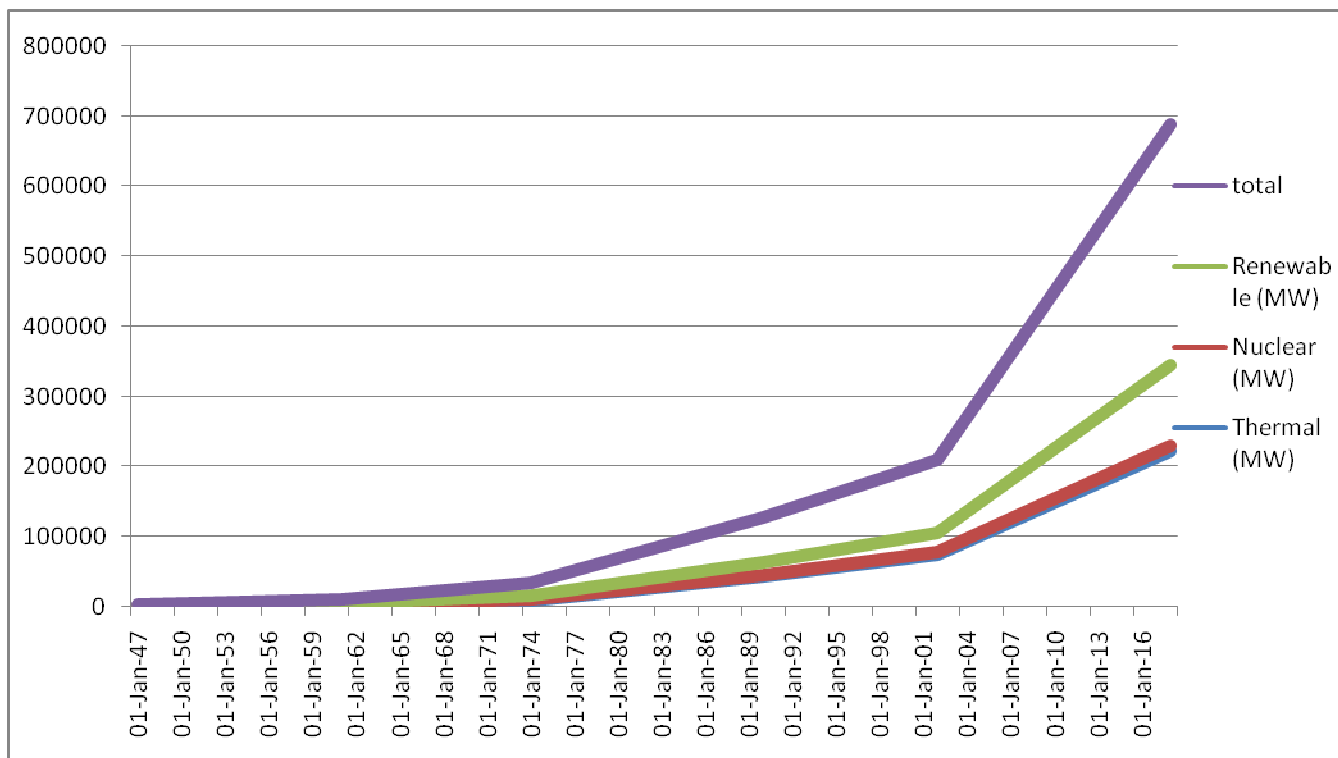


Fig. 9 Installation capacity in India in graphically

C. Wave Energy in India

We need a good alternative source for generating electricity. It is not possible to fulfill the demand by hydro, wind, Solar As per requirement. Solar is present only day time. Wind did not blow continuously. For that demerit need a power source which produced continuously electricity. So the wave energy is the best source for fulfill our required. India has 1715 KM coastline from Gujarat through Kerala to West Bengal. It is a great opportunity to India that easy to collect the wave energy. The development of commercial array of tidal current technologies is still in the demonstration phase, so level of cost of electricity are in the range of € 0.20-0.50/KWH[2].

Show the figure 10 then understand the benefit of utilizing wave energy generation plant in India. It is easily covered the whole India. India has 1715 KM coastline.

IV. RESEARCH IN WAVE ENERGY

The first patent to use to convert ocean waves to electrical energy on the year of 1799. It was filed in Paris by Girard and his son. An early application of wave power was constructed a device on the year of 1910 by Bochaux-Praceique to light and power his house at Royan, near Bordeaux in France. It appears that this was the first oscillating water-column type of wave-energy device. Only UK patents 340 devices between the year of 1855 to 1973 [7]. Included India with Other developed country like USA, CANADA, and China are researched in wave energy.

A. India Research in Wave Energy

Research and information institute like Indian Institute of technology-Madras, Indian national center for ocean information services. The Ministry of New and Renewable Energy (MNRE) made and assessment of potential of tidal energy in the country. The study of indicated an estimated potential of about 8000 MW with 7000 MW in the Gulf in Kambhat, 1200 MW in the Gulf of Kutch in Gujarat and 100 MW in the Gangetic Delta in Sunderbans in Westbengal.[2] Primary estimates of wave energy in the coast of Indian ocean, potential is around 5-15 MW/m. the potential comes around 40-60 GW.



Fig. 10 Indian coastline area [3]

Table 2: Display, Research about tidal energy by different country [2]

Country	Capacity (MW)	Power Generation (GWH)
France*	240	540
Korea	1320	2410
UK	8640	15600
Philippines	2200	4000
Russia	87000	200000

*France operating this project. Not completed.

V. IMPORTANCE IN INDIA

One of the best renewable energy is wave energy. Wave energy gets 24 hour also Oceans cover 70 percent of the earth's surface. India has 1715 KM coastline. It is easy to generated and transmission the power. It is helped in economic.

VI. CONCLUSION

In the paper, discussed about wave energy and there conversion method, Wave energy get in three deferent sea shorelines. There are: At the shoreline, Near the shoreline, and Off the shoreline. Wave energy convertors are: Oscillating Water Colum, Attenuator and a point Absorber. Study about benefits, disadvantage, and challenges. There are challenges for technical with huge benefits. Show the about table we understand the demand of electricity. Land is important for every work or living being. So a huge amount of solar plat is installed in the land then where human being and animal are lived. So wave energy is the best way for generating the Electricity where no land required. Some country included India research in ocean waves. The average amount of power

generated by waves in per month is 15GW which can supply power to nearly 10,000 homes.[2]

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