

# “A REVIEW – GENERATION OF COMPRESSED AIR USING WAVE ENERGY”

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## ABSTRACT

*Generation of compressed air using wave energy” a unique hydro kinetic energy system that relies on "vortex induced vibrations" and not on conventional energy forms like waves, tides, turbines or dams. The equipment used to harness this energy is called “Generation of compressed air using wave energy”.*

*It works in flows moving slower than 2 knots (about 2 miles per hour.) Most of the Earths currents are slower than 3 knots. Turbines and water mills need an average of 5 or 6 knots to operate efficiently. Generation of compressed air using wave energy uses the physical phenomenon of vortex induced vibration in which water current flows around cylinders inducing reciprocating motion. The energy contained in the movement of the cylinder is then converted to electric energy by suitable mechanism like piston and cylinder.*

**Keyword** – *compressed air, piston-cylinder, wave energy, vortex induced vibration*

## INTRODUCTION

In recent times, many scientific studies have pointed out to the effects of global warming and climate change caused by the greenhouse gasses, there is an increasing need for environmentally friendly, low cost renewable energy technology to help reduce these emissions resulting from fossil fuel consumption. At present, 72% of the total amount of usable energy is obtained by coal, oil and natural gas respectively. With only 4.7% of the world’s population, the United States itself consumed approximately 25% of the total fossil fuel used each year at an annual cost of \$65 billion (Data from iteejournal.org).

A recent study estimated, the current fossil fuel reserves to be depleted by 2042, presented an urgent need to develop and validate an alternate form of energy which has low life cycle cost and as a result is environmentally friendly. The challenge of meeting the demands of fossil fuels due to its heavy consumption has now been the focus of many large corporations, state and federal governments as well as federal research agencies. The three commonly known resources of alternate energy are solar, wind and biomass.

According to the power projections by Annual Energy Outlook 2011 early release overview, the primary energy production from hydropower, biomass and other renewable energy sources accounts for 15.2 (quadrillion Btu) in the year 2035 which shows promising contribution to the energy needs of the future. But however, according to the Annual Energy Outlook 2011, the total US energy consumption was 94.6 quadrillion Btu out of which only 8% was based on renewable energy. As shown in Figure 1.1, fuels obtained from fossils e.g. petroleum, coal and natural gas accounted for a total of 83% of the total energy usage.

Even though petroleum (37%) and coal (21%) remain the main source of power supply in the United States, the projections over the next 24 years show an increase in the usage of renewable energy to ~ 10% (see Figure 1.2). However, total coal consumption, which was 22.7 quadrillion Btu in 2007, increases from 19.7 quadrillion Btu

(1,000 million short tons) in 2009 to 25.2 quadrillion Btu (1,302 million short tons) in 2035. Also the total net generation in 2009 was 3,953 billion kWh out of which ~ 70% of energy is obtained from fossil based fuels. This shows huge dependency on fossil reserves for our energy need.

According to Electric Power Research Institute (EPRI), wave and current energy in the US have the potential to meet nearly 10% of the national demand which estimates to nearly 55GW of renewable energy in US by the year 2020. Although there is a rapid growth of renewable energy, fossil fuel would still provide 78% of the U.S energy use in 2035. Hence to further decrease the dependence on fossil fuels, new and improved technologies have to be introduced to augment the present technologies so that the energy needs of the future are met without excess dependence on fossil fuels. Figure 1.1 shows the present U.S Energy supply, while Figure 1.2 shows the future U.S primary energy consumption.

## LITERATURE SURVEY

Author **W. B. Wan Nik** have published the research paper on “**Ocean Wave Power Extraction; the primary interface**” -Future Trends in **2009** on the basis of that they have concluded “The wave energy resource is extremely large and offers the possibility of environmentally benign energy at moderate cost. There are a range of wave energy concepts which could produce modest and substantial amounts of power. Shoreline devices are already viable in certain locations and could be exploited in many others. Further improvement is needed on wave energy data and data collection methods. On the basis of currently available empirical information, the environmental impacts are expected to be small; however, efforts should be made on environmental effects by wave energy projects. This could be essential to sustainable development of wave energy. Government of Malaysia must increase their support for wave energy research in achieving a balanced energy future. ....[1]

Author **Md. Mahbubur Rahman, Nirupom Paul, Md. Saiful Islam Md.Safi Rashed & Shahriar Ahmed** have published research paper on “**Power Generation from Sea Wave: An Approach to Create Renewable Energy**” in **2013** on the basis that they have concluded using The technology of ocean wave is still juvenile. It has been fairly possible to demonstrate a power generation plan in this paper. It has been manifested that the proposed plan of power generating from wave has some favorable distinct features which makes it possible to be renewable and eco-friendly process.....[2]

Author **Sajjad Mehrangiz** have published research paper on “**Various Technologies for Producing Energy from Wave**” in **2014** on the basis of that they have concluded that The wave energy systems for generation electricity in the last few years had been growing rapidly and also energy utilization in other parts of the world has been developing quickly. The testing under real sea condition is final stage of modeling wave energy converts. In almost every system, optimal wave energy absorption includes some kind of resonance, which implies that the geometry and size of the structure are linked to wavelength. For these reasons, if pilot plants are to be tested in the open ocean, they must be large structures.....[3]

Author **B Drew, A R Plummer, MN Sahinkaya** have published research paper on “**wave energy converter technology**” in **2009** on the basis of that they have concluded that The potential for generating electricity from wave energy is considerable. The ocean is a huge resource, and harnessing the energy in ocean waves represents an important step towards meeting renewable energy targets.....[4]

Author **Jidai Wang, Kunpeng Lu, Lan Ma** have published research paper on “**Compressed Air Energy Storage and Technology Development**” in **2014** on the basis of that they have concluded that The paper explained the operation principles of CAES and provided comprehensive information on CAES technology development. The paper provided the essential and critical information for CAES plant planning, design, investment and building. The updated review of current CAES plants under planning and construction evidences the importance of CAES and demonstrated confidence for its future development. Compared with previously published overviews of CAES, this paper covers the most up-to-date materials and knowledge in CAES development, projects and efforts in recent years. The key technology development recommendation can shape the focus of industry and research. This should provide a foundation and valuable references for researchers and developers for the coming years.....[5]

Author **Suraj soni, Suprabhat mohod, archana gaikwad** have published research paper on “**Electricity generation by tidal waves**” in **2016** on the basis of that they have concluded that Tides are very important factor in the formation of global climate. Also tides are future source of clean and renewable energy for future of human being’s upcoming generations. Since the conventional power plant technology is being well established and they are continued to be in the main stream, tidal power plants have yet to gain commercial acceptance in our world. But one day the conventional fuels are going to be vanish. So better to be late we start using tidal waves as our new energy sources. ....[6]

Author **Seifeddine Benelghali, Mohamed Benbouzid, Jean Fr ed\_eric Charpentier** have published research paper on “**Marine Tidal Current Electric Power Generation Technology**” in **2016** on the basis of that they have concluded that the state of art of marine tidal turbines. The emphasis has been put on tidal turbine concepts. Indeed, it has been described the strength and the weakness of the major tidal turbine technologies. Moreover, attempts have been made to highlight current trends and alternative issues for generator topologies.....[7]

Author **Arshit Ambalia1, Jay Dolar, Mehul Koladiya, Shahnawaz Ansari, Prof. Zaid Ansari** have published research paper on “**Generation of Electricity from Ocean Waves**” in **2016** on the basis of that they have concluded that In this mechanism the loss in transmission is less since the generator unit is situated onshore. Thus we can get clean electricity using wave energy. A huge amount of electric power can be abstracted from waves than from the wind. If we analyze the power concentrated in a wave energy to the corresponding area having wind energy then we will find that wave energy is 10 times larger than wind energy ....[8]

Author **Yoshikazu Tanaka, Takuya Oko and Hidemi Mutsuda** have published research paper on “**Wave Power Generation Using a Flexible Piezoelectric Device**” in **2016** on the basis of that they have concluded that This paper presents an experimental study of wave power generation using flexible piezoelectric devices (FPEDs). Two methods for wave power generation are proposed. In the first configuration, the FPEDs are installed transversally into the wave, parallel to the seabed. In the second configuration, the FPEDs are installed vertically, perpendicular to the seabed.....[9]

Author **Hosna Titah-Benbouzid, Mohamed Benbouzid** have published research paper on “**Evaluation of Wave Energy Converters**” in **2016** on the basis of that they have concluded that This paper has proposed an up-to-date review of the most recent trends regarding main wave energy converter technologies with respect to overviews already published in the past years. In addition, mooring has been discussed and has been shown to be a key feature behind massive deployment of wave energy converters. Finally it has been highlighted some challenges that needs to be overcome to enlarge the vision of large-scale commercial arrays of wave energy converters. ....[10]

Author **Bharat Raj Singh, Onkar Singh** have published research paper on “**Compressed Air Storage System as Clean Potential Energy**” in **2016** on the basis of that they have concluded that v Apart from all other options of storage of energy, the compressed air energy storage (CAES) is the option to improve upon the peak hour requirement of electric power generation.....[11]

Author **mukrimin sevket guney** have published research paper on “**wave energy conversion systems**” in **2017** on the basis of that they have concluded that One of the most promising sustainable sources is wave energy. Moreover, wave energy presents different options for energy conversion. However, a lot of these options are in their development phase. Hence, some difficulties, which must be eliminated, appear in initial phases. Many of these existing technologies seem to be very complex and expensive devices with a poor mass to output power ratio. In most cases, they are difficult to scale down or use offshore and on shorelines. The potential environmental impacts must be investigated within a broad frame. Furthermore, it is difficult to keep it safety in extreme weather conditions such as storm and typhoon. Despite all these, if the designs may achieve the disposal of the possible environmental impacts and installation difficulties, utilization of wave energy can open the clean and renewable way of the relatively and substantially cover of world energy deficits. ....[12]

## LITERATURE CONCLUSION

- In present time the use of the non-renewable energy sources usage is increase day by day. So from the upper given research papers we conclude that we have to decrease that usage of non-renewable energy sources.
- So to decrease that use we are using the largest amount of renewable energy sources which is tidal power of sea water.
- And in general case to use the power of tidal energy the converter are use is in rotary motion but we are using reciprocating motion converter by which we can adjust the distance of converter as per the energy of waves. So, if we adjust the attachment between the sea water and converter we can generate the more compressed air.

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