OCEAN ENERGY

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INTRODUCTION

Ocean energy refers to the power of the ocean to produce energy thru movement, kinetic energy or energy in motion. Wave energy systems use the water's movement to make electricity. There are multiple devices to use and store the power of waves. Some make use of the ocean swell, others use the pressure of waves near the ocean floor. But all have the same goal: convert wave energy into electrical energy. That electricity can be used to power the *electric grid*. That's the network of cables that transmits electricity to homes and buildings so we can use it.

Humans obtain some of the energy from burning fossil fuels, half of all fossil fuels are burned to provide electricity and heat; the big users of fossil fuels are manufacturing and transportation which produce high amounts of carbon dioxide (CO2). Responsible for 63 percent of global warming over time, and 91 percent in the last 5 years, this gas is produced from burning fossil fuels, such as coal and oil. It also occurs naturally as it flows in a cycle between oceans, soil, plants and animals.

In the search of more clean efficient energy sources and with oil fuel prices increasing Ocean Energy has expanded interest on a bigger development.

1. Ocean Energy Resources- Thermal Energy and Mechanical Energy. Thermal energy is produced from the sun's heat, and mechanical energy from the tides and waves. Oceans cover more than 70% of Earth's surface, making them the world's largest solar collectors. The sun's heat warms the surface water a lot more than the deep ocean water, and this temperature difference creates thermal energy. The vapor expands and turns a turbine, then activates a generator to produce electricity. Ocean mechanical energy is different from ocean thermal energy, tides movement is driven by the gravitational pull of the moon, and waves are driven by the winds. As a result, tides and waves are irregular sources of energy, while ocean thermal energy is constant. Tidal energy is converted into electricity by forcing the water thru turbines, activating a generator. For wave energy conversion, there are three basic systems: channel systems that funnel the waves into reservoirs; float systems that drive hydraulic pumps; and oscillating water column systems that use the waves to compress air within a container. The mechanical power created from these systems either directly activates a generator or transfers to a working fluid, water, or air, which then drives a turbine/generator.
2. Advantages of Ocean Energy - By using renewable energies like ocean and tidal energies would greatly benefit us and the health of our earth. All renewable energies are unlimited sources, humans would never run out of these renewable energies to create electricity unlike fuels that we have been using which can

eventually run out. Also, it's been proven that since the Covid-19 pandemic began where people have been forced to stay home, the pollution in the air has decreased notoriously. Ocean energy doesn't produce greenhouse gases or waste products, unlike fuels and coals. They don't require much maintenance and will last longer than traditional power plants. Once the technology is built, it doesn't require any more costs. If using tidal energy, it is very predictable and It does not have a big environmental impact, it just has to be built in a sustainable way, in harmony with the marine environment. Also, this renewable energy can be so accessible to the coastal communities with a high population. Renewable energy will be vital in reducing Global Warming.

3. The Future of Ocean Energy- Since the 1800's there have been attempts on how to manipulate ocean energy, Monsieur Girard built the first patent for wave energy. But it wasn't until 1966 when the first tidal station was built, the Rance Tidal Power Station in France. In the last decade there has been a huge interest in the use of renewables and multiple countries are now becoming involved in technology research and development. The European Ocean Energy reports the biggest source of renewable energy where the potential hasn't been utilized. Over the past 7 years, $827 million have been invested in ocean energy. Taking the lead, United Kingdom has by far the largest concentration of marine power companies in the world. More than 10 MW of ocean-going devices are installed in European waters. China's investment increased to $67 billion, while Japan saw investments increase 73% to $16 billion. Waves crash onto shore morning, noon and night generating consistent energy year around 24/7 and now scientists are figuring out how much energy waves can offer; this will decrease the price of renewable energy and promote job growth.

THE CHALLENGE

The Office for Coordination of Humanitarian Affairs (OCHA) mobilize and coordinate effective and principled humanitarian action in partnership with national and international actors in order to alleviate human suffering in disaster and emergencies. OCHA declares some of the challenges on different aspects that the world faces.

Humanitarian. Food crisis, population growth, water shortage, global warming and energy supply are some of the challenges humanity faces day to day. The basic essential human needs are far from met; especially during a catastrophe. The focus is usually on shelter and food but not on energy though it has been proved the energy is also essential in a disaster, primarily, during and recovery. Nearly one third of the world's population has no access to electricity. For the most part this is in poor communities where access to energy services has physical and financial limitations. It is important to have access to a basic energy service, and it is crucial to secure energy to assist humanity through global emergencies.

Environmental. Global warming is the origin of the climate change threats; causing heavier rainstorms and more frequent droughts, decreased average rainfalls, environmental degradation and deforestation, and, the contamination of our water reserve where our oceans play the most important part.

Financial. The challenges of developing sustainable energy sources rely on political, legal, demographic, environmental and economic investments making it very complex to develop and fund these operations or have access to afford such a basic energy service.

Health. According to OCHA, nearly 1.3 million deaths due to indoor biomass waste from cooking on open fires from wood and organic waste occur. This biomass waste creates indoor air pollution leading to respiratory diseases that can result in premature death especially in rural areas. Also, through natural disasters and global crises, the lack of energy is a deadly threat to people with illnesses who had survived the disaster but not after the fact. During the 2008 Central Asia energy crisis in Tajikistan and Kyrgyzstan, energy was not sufficient enough causing emergency arrangements on fuel and generators. People were exposed to subzero temperatures increasing respiratory infections and hospital dependency on generators did not allow for taking care of the most critical patients.

PROPOSAL

Electricity is used every day in our daily lives, and the more our cities grow the more the demand for energy grows. John Carrington, CEO of Stem Inc. wrote in a Green Tech media article, “Experts predict the demand [for energy] will double by 2025, with fossil fuels providing 75% of the supply for the population. The current rate of consumption of fossil fuels will deepen in the next couple decades.” In the Philippines, coal reserves are expected to run out in 33 years and gas reserves in 27 years. In Indonesia, oil reserves are expected to run out in 9 years. With this rapid rate on demand increasing, it is necessary to increase demand on renewable energy sources through social global awareness, education, and, integrating corporations, agencies and organizations to provide a voice in persuading governments to fund ocean renewable energy.

There are multiple renewable energy sources; solar, wind, hydraulic energy, geothermal energy, and, tidal energy. According to the National Renewable Energy Laboratory (NREL), Tidal Ocean Energy can be the best alternative due to the unlimited potential and cost for development compared to the other energy sources. Tidal power is one of the major renewable energy sources due to predictable frequency and power. The high and low tide is cyclical and is easier for engineers to design efficient systems according to their predictions. Tidal energy is also known as a green energy source due to emitting zero greenhouse gases.

There are multiple ways to get to energy; tidal energy, wave energy, current energy and salinity gradient and temperature gradient. Environmental Impact Assessment (EIA) provides a full explanation on Tidal Power or Tidal Energy.

Tidal energy is extracted from vertical difference between high and low tides called tidal range. As water flows through a dam this motion rotates a turbine which is connected to a generator converting the energy to electricity. The tides carry with them another abundant energy source, currents.

Tidal current is generated by the changes of tides. In Southeast Asia, these currents are harnessed for energy using tidal in-stream devices best used in narrow channels or where water flows quickly to turn the blades of a turbine connected by a shaft to a generator. For regions with large waves, wave energy is the best option.

There are a variety of devices that have been designed to harness wave energy, one of which is the oscillating water column waves. Waves cause the column to move up and down within a chamber creating an airflow which moves the turbine thus producing power. Another potential source is found in harnessing salinity gradients in the ocean, which are differences in the salt content of water. Support from government and stakeholders is necessary to finance research and development to fully understand the potential of ocean tidal energy.

So why has Ocean Tidal Energy not exploded to its potential? To commercialize the industry big investments from private sectors are required but there are multiple challenges and barriers for the investors to be interested in the commercialization of Tidal Energy. According to the U.S. Bureau of Ocean Energy Management, the Electric Power Research Institute (EPRI) did a recent analysis of the wave energy potential estimate for the United States. The total wave energy resource potential estimated along the outer continental shelf to be 2640 TWh\yr, considering that 1 TWh\yr energy will supply about 93,850 average U.S. homes.

While wave energy is available and abundant the development relies on numerous factors:

- Approaches and restrictions due to regulation and institutional framework
- Economical and technical viability
- Length and time required to build this technology
- Uncertainty on the performance
- Technology risk
- Funding
- Low public awareness
- Lack of information
- Lack of skilled personnel or knowledge

Even though there are concerns for investors including the lack of information, knowledge and funds regarding wave energy, the immeasurable reliability and endless supply from this powerful energy source will always be present.

Yale Environment 360 states that, “the wave energy field is filled with small companies picking off small amounts of government funding where they can, the expansion of wave energy

requires the participation of some large companies but those companies may be waiting for the technology to sort itself out before investing."

In the report, "Powering the Blue Economy" cites that though the U.S. does not have one of the highest total tidal energy resources in the world, some areas have potential for significant generation. Alaska contains more than 90% of the U.S. tidal resource, which provides an extensive clean energy potential. Tidal hot spots in Washington and Maine also provide good locations for large scale projects, but elsewhere in the U.S. the utility is lower.

The U.S. has been interested in wave and tidal resources for some time, and though utility scale devices are ready for large scale deployment, project permitting has been the primary obstacle for U.S. projects. Environmental and process uncertainties also present significant blocks along with a lack of experience in ocean energy from responsible agencies and unwillingness to accept some of the potential risk associated with new technologies. Another obstacle is the electricity market. The cost of energy from the first ocean energy plants will be high and it will take time for technology, installation experience and economics of scale to allow the project cost to drop.

CONCLUSION

The evolution on wave energy can be a challenge due to the development, testing, and refining of designs taking multiple iterations. The long cycles of working with large devices in the ocean which for the assessment of one design can take years, is a problem for technology advancement where government can't fund such a long and expensive study.

The expansion of ocean energy in every aspect is on rapid growth. The unlimited possibilities that the ocean can offer have pushed the technology, industries, organizations to analyze the potential market opportunities where tidal energy holds an important value for the economy and society.

The more efficient wave energy becomes, the more affordable it will be, and that alone is more than enough for most people to invest in it. The Water, Power, and Technologies Office (WPTO) for offshore energy supports foundational science at an early stage to improve performance and reduce the cost of energy generation technologies. Aligning innovation and technology on ocean energy could provide industries to emerge and meet their economic, social and environmental goals.

Meanwhile, humanity definitely has to rely on further research and development and understanding of how tidal energy can be the most unique, reliable and sustainable innovation.

RESEARCH SOURCE

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