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Renewable Energy Technologies: Recent Advances and Future Predictions

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Abstract: Energy is the most suitable way of filling the gap of economic, social and environmental factors to enhance human development across the globe. The energy production across the globe needs some amendments in order to reduce the environmental damage and accelerate the benefits of the renewable energy advancements. The advancements in renewable energy is a great way to bring the world out of crisis. The countries rich in renewable energy resources are said to be providing the largest amount of benefit to the world. Conventional energy resources despite providing a great economic benefit to the world are also responsible in creating environmental issues; hence, it is important to have advancements and a better future for renewable energy. This paper will further talk about the advancements and innovations that has occurred in the renewable energy technologies with the prediction of the successful future of such technologies for the world.

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Introduction

Renewable energy resources briefs the types of energy resources that can be recreated and renewed and the world cannot run out of them. The need of renewable energy technologies became necessary right after the civilisation. According to the studies in 1998, the 14 percent of energy needs of world were fulfilled by the renewable energy resources. The potential of the renewable energy technologies is so huge that it can fulfil almost half of the demand of the world. There is a dire need of economic and political stability in order to make advancements in a better future for renewable energy technologies. However, policymakers need to do much more than the stability to accomplish these technologies [1]. The advancements of renewable energies are dependent upon the successful diffusion to make them competitive with reduced costs and high developments. The addition of several aspects in the energy technologies have been discussed in this paper while evaluating the future of the renewable energy technologies.

Types of energy technologies

There are several types of energy technologies that exist in the world and are potential enough to address and solve all the energy crisis issues of the world. These energy technologies include biomass energy, hydropower, wind energy, solar energy, geothermal energy and marine energy. Among all the renewable technologies, biomass has gained higher level of acknowledged popularity and importance across the world due to its enormous usage

on small as well as large scale. The requirement of biogas is commercially enormous but it has not yet been matured in a way to fulfil the complete demand of the market. Another common renewable energy is the wind power. It is said to be widely available in the world but is diffused. Studies claim that it is the most useful matter for electricity production. All the natural renewable energies discussed above are shown in detail in the table below; the table also elaborates the conversion of all these energy technologies with respect to their applications [2].
All the electricity generated from the renewable energy technologies is also the major reason for reduction of Co2 emissions [3].

Figure 1 Renewable energy technologies.

Technologies	Energy Products	Applications
Biomass energy		
Combustion on domestic and industrial level.	Heat purposes and process heat, electric, steam.	Broadly applied
Gasification for fuel and power production.	Hydrocarbons, Methanol H2.	Demonstration and development phase.
Fermentation.	Ethanol	Commercial applications
Hydrolysis.	Ethanol	Commercial applications
Pyrolysis of liquid and solid fuels.	Bio oils and charcoal	Pilot phase and wide applications
Digestion.	Biogas	Commercial use
Extraction.	Biodiesel	Expensive use
Wind Energy		
Battery charge and Pumping of water.	Power of Movement	Smaller wind machines
Wind turbines (onshore)	Electricity	High commercial applications
Wind turbines(offshore)	Electricity	Demonstration and development phase
Hydropower	Electricity and power	Large and small scale commercial applications

Solar Energy **Solar thermal** **Photovoltaic conversation of solar energy.** **Solar energy use in low temperature.** **Passive Solar energy** **Artificial photosynthesis**	Electricity, steam and heat Electricity Heat (water and space heating, Cooking, drying) and cold. Cold, heat, light and ventilation. H2	Wide applications Commercial applications Demonstrations and applications; no active parts Commercial purposes
Geothermal energy	Heat, steam, electricity	Commercially application
Marine energy **Tidal energy** **Wave energy** **Current energy** **Ocean thermal energy conversion** **Salinity gradient /osmotic energy** **Marine biomass production**	 Electricity Electricity Electricity Heat, electricity Electricity Fuels	 Applied; relatively expensive Research, development, and demonstration phase Research and development phase Research, development, and demonstration phase Theoretical option Research and development phase

Recent Advancements in renewable energy technology

The world collectively is working on the advancement of these renewable energy resources, as there have been a lot of work done on these resources from late 90s until now. Start with the advancements in wind power it has seen great advancements since the early 90s until 1999 [4]. The operating capacity of wind power increased from 24 degrees to 33 degrees in a span of 5 years. In addition to this, the electricity that wind turbines generated in 1998 was 18 terawatts an hour, which later increased to 24 terawatts in 1999. This seem to be a huge advancement in the span of just one year. Twenty-nine countries are studied to be operating the active wind energy programs. In comparison to this, the photovoltaic went through tiny advancements as it just increased 15% year in the period of 16 years shown in the figure below. Later in 1995-1998 the demand of grid connections increased by 23 percent and they started becoming important in the market. The next most important renewable energy resource is the solar thermal electricity that is efficient enough to meet the requirement of two large electric markets. Which involves the great connected power and widely expanding markets. The studies and the research has shown that there are the chances of development of 10 to 80 kilowatts solar thermal energy in Australia, Egypt, Greece, India, Iran, Jordan, Mexico, Morocco, Spain, and the United States of America. Another renewable technology that has seen recent innovations is hydroelectric technology. Hydroelectric power is known as the mutual resource which does not have space for amendments and advancement yet there are some technological aspects of hydroelectric power that can be advanced. So in order to make it technological enhanced there have been some amendments

made in the roller compacted concrete dams. In these dams, the cement consumption is reduced leading to the cost reduction around $30 to $40 per cubic metre in the structure of the dam. Other than that Tunnel-boring and Underground water conduits are being installed in order to reduce the cost and protect the environment from disturbance. These technological advancements in the hydroelectric power are providing benefits to the economy and ecology of the environment. Moreover, the biggest renewable energy source is the geothermal power. In the recent advances, the production of geothermal has been increased by 40% and the reduction of cost from 0.02 - 0.10 dollars kilowatt per hour to 0.01 - 0.02 dollars. With the help of cost reduction techniques and other favourable situations, geothermal energy has seen the reasonable amount of advancements in terms of technology and cost. The huge increase in the photovoltaic energy has seen in the years 1998 and 1999 as the production increased to 800 megawatts from 200 megawatts. Another major renewable energy technology is marine energy. The tidal current energy is the most advanced form of marine energy. The most recent addition in marine energy is the application of multi technology. For instance. The cold water which it is rich in nutrients has been drawn from the oceans and further used for fish farming as it is found valuable in the followed aspect. In addition to this, the other advancement for marine energy is the use of cold water for cooling applications in the tropics. This includes the process of air conditioning.

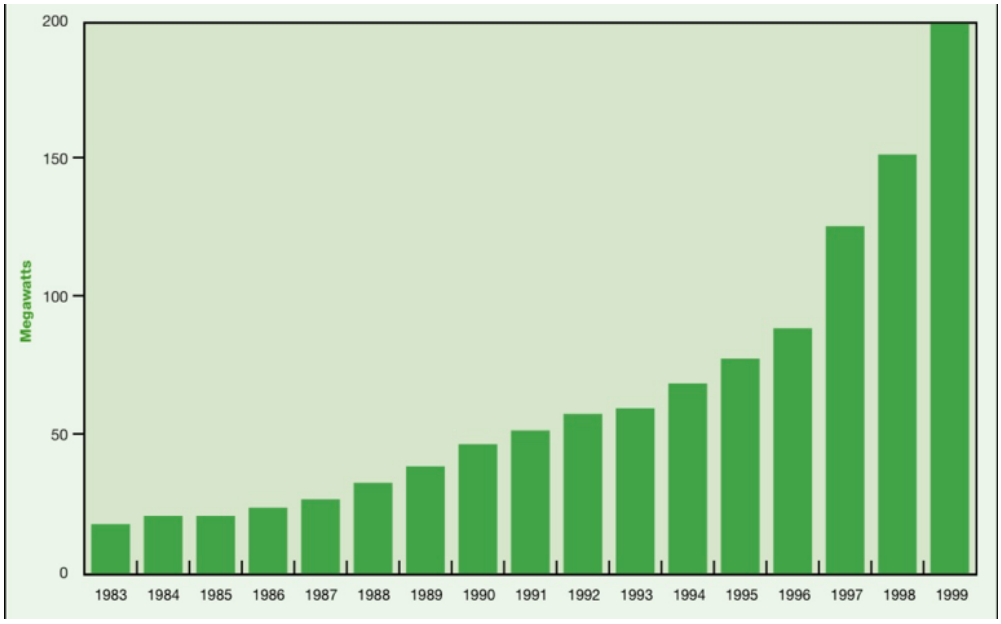

Figure1 Photovoltaic Shipments Source: Based on a Maycock. 1998: PVIR. 1999.

In the United States, past government endeavours have designated wind power innovation improvement through both innovation innovative work (supply-push) and market creation (request pull) approaches. Further upgrades in the innovation are important to make wind power monetarily cutthroat with traditional types of age [7]. In the arising cutthroat power market, the confidential area has nearly nothing, if any, impetus to put resources into wind turbine improvement. Consequently, government should keep on assuming a part in these endeavours. An assessment of the historical backdrop of government endeavours to propel the innovation and support its implementation can yield valuable bits of knowledge for future arrangement with some objectives.

Future predictions of renewable energy technologies

The studies have been conducted and it is apparent that according to the forecast, around 33% of the electricity by the year 2024 in world will be produced by renewable technology. It has also been evaluated that there will be a drastic increase in technology as the production cost would decrease making the world a better climatic place keeping global priorities into consideration. In addition to this, companies will also focus on environmental social governance policies that promote the renewable energies. It is also said to be the near future of renewables as the predictions forecast how this sector will change itself in a way that would help the world collectively. The nine major countries are proven the leaders of the renewable energy technology and this includes the United Kingdom, United States of America, Australia, France, Canada, Malaysia, New Zealand, South Africa and Portugal. In addition to this, it has been predicted that that renewable resources will play a major role in gaining energy mix on global levels. Renewable energy resources are considered as bigger and better approaches of energy mix in the world and are seem to be creating huge competition for the traditional energy sources. In respect to the individual renewable energy, potential of solar energy is increasing drastically and it is predicted that along with the increase

in the solar energy, the cost of solar energy would decrease to 50% by year 2024. The United States of America is also expected to double the total installations of solar panels to 4,000,000 by the year 2023. In addition to this, wind power has also increased its capacity that is being used on the larger scale and is expected to have boost by the increase of 57% that is all possible by the efforts of China and the United States of America. The offshore wind power is also expected to grow by 10% that is three times the current capacity. Geothermal power in Russian among all these renewable energy is the most popular. In the United States of America, it has been predicted that the market of geothermal energy would increase $22 billion by the year 2024 [8]. The Department of Energy has also given a forecast that geothermal power will provide solution to the 8.5% of electric problems of the country by the year 2050. Considering the collective growth according to IAEA renewable energy is predicted to reach 30% of the total world electricity production by the year 2024. It is apparent that the availability of renewable energy resources would become cheaper with high production that come along with several benefits. It has been claimed, world will survive 100% on the renewable energy in the future if every country in the world goes through the challenging transition that comes along. The constant changes and improvements in the renewable energy technologies are proven to be efficient and bring the positive and bright future for the renewable energy industry.

Benefits of renewable energy technology

The world can enjoy several benefits from the renewable energy technologies as they provide with benefits across the globe. It is known for the infinite supply, it also reduce the effects of global crisis, for example, flooding, storms and severe weather conditions. Moreover, it reduces the air pollution and greenhouse gas emissions [9]. In addition to this, the job opportunity is increased along with resilient supply and lower charges. The energy protection through energy effectiveness in the structure has procured prime significance everywhere. The four fundamental perspectives for energy effectiveness in a structure incorporate as a matter of some importance the almost zero energy detached building plan before genuine development, furthermore the utilisation of low energy building materials during its development, thirdly utilisation of energy productive types of gear for low functional energy necessity and finally joining of environmentally friendly power advances for different applications.

Desalination and Renewable Energy

Sustainable power sources for use in desalination processes incorporate breeze, sun oriented warm, photovoltaic and geothermal. Sustainable power driven desalination frameworks fall into two classes. The main class incorporates refining processes driven by heat delivered by the environmentally friendly power frameworks, while the second incorporates layer and refining processes driven by power or mechanical energy created by RES [10]. The most explored method of coupling among RES and desalination processes is the utilisation of direct sunbeams to create new water through sun-powered stills. Various endeavours to bridle sun oriented nuclear power for water refining have been done in many spots overall. There are several general audits of sustainable power controlled desalination. Since sun, based desalination is perhaps of the most encouraging innovation there are many surveys in the writing.

Many examinations have explored the impact of various plan boundaries on the general execution of sunlight-based stills. In this unique situation, Tunisia has been a trailblazer in investigating the chance of water desalination through single bowl sun oriented stills. Various desalination plants comprising of glass covered sun oriented stills have been built in many pieces of the country in the last part of the 1960s.

Various endeavours and examinations have been done all through the world trying to find reasonable coupling methods between desalination cycles and RES. The suit-capacity of a given sustainable power hotspot for controlling certain desalting processes relies upon both the necessities of such cycles and the type of energy that can be gotten from the thought about source.

Conclusion

All the advancements, future predictions and benefits of the renewable energy technologies discussed in the paper show that, how important it is for the world to have serious approach towards the development of projects. It is important to gain accessibility of renewable technologies across the globe. The projects in working of renewable energy technologies should be carried out in a smooth manner on consistent basis so that it becomes possible for the world to thrive on renewable energy technology rather than traditional technology of energy sources. Keeping all the factors discussed in the paper in mind, it has become important for every individual to play their part in the enhancement of renewable energy technology.

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