A Comprehensive Study on Future of Renewable Energy

Shikha Parashar

SOEIT, Sanskriti University, Mathura, Uttar Pradesh, India

Email Id- shikha.soet@sanskriti.edu.in

ABSTRACT: ***Our civilization relies on energy to maintain our standard of living and to underlie all other aspects of our economy. Renewable energy technologies promise to collect clean, plentiful energy. Sun, wind, and earth are all self-renewing resources.as well as plants. Almost every part of the United States and the world having one or more types of renewable resources that are renewable. Currently, they account for roughly 10% of total energy use. The majority of this comes from hydropower and conventional sources in the United States. Wind, solar, biomass, and geothermal technologies are becoming more cost-effective in a growing number of markets, and they are making significant progress toward broader commercialization. Each renewable energy technology is in a different level of research, development, and commercialization, with varying present and future projected prices, current industrial base, resource availability, and possible greenhouse gas emissions. The technological state, pricing, and applications of important renewable energy technologies will be examined, as well as the consequences for greater renewable energy adoption. This paper elaborates the applicability of the renewable energy and its applicability in various sectors to solve the existing problems***

KEYWORDS: Energy, Hydropower, Renewable Energy, Solar Power, Wind Energy.

1. INTRODUCTION

Renewable energy is defined as energy generated from a wide range of resources that are all based on self-renewing energy sources such as sunshine, wind, flowing water, the earth's internal heat, and biomass such as energy crops, agricultural and industrial waste, and municipal garbage. These resources may be utilized to generate energy for all economic sectors, transportation fuels, and heat for buildings and industrial operations, among other things [1]. Renewable energy now accounts for the same percentage of total energy output in the United States as nuclear power (10%). The development and commercialization of each renewable energy technology is at a distinct level. Some technologies, at least in some contexts and applications, are already commercially available [2]. Hydropower accounted for 55% of all renewable energy utilized in the United States in 1998, followed by biomass including municipal solid waste at 38%, geothermal at 5%, solar at 1%, and wind at 0.5 percent. When compared to traditional energy sources, renewable energy technologies provide significant advantages. Renewable energy supplies are plentiful; the sun sends out 1000 times more energy to the earth's surface than all fossil fuels combined emit now. Renewable energy supplies, like fossil fuels, are not evenly dispersed throughout the globe[3]. Every region, on the other hand, has some renewable energy resources. Most renewable energy systems are modular, providing for load expansion flexibility. Renewable energy technologies are now available in a variety of industries, ranging from specialized niche markets to centralized energy generation. Renewable energy systems, when compared to competitive conventional technologies such as natural gas combined cycle power plants, are more capital demanding for centralized energy production [4]. After initial expenditures, however, the economics of renewable energy systems improve in contrast to traditional technologies since operating and maintenance expenses are lower than those paid when utilizing conventional fuels. Renewable energy sources produce very little waste or pollutants that contribute to acid rain, urban pollution, and health issues, and they don't require environmental cleaning or trash disposal expenses [5]. The newest environmental worry is potential global climate change, which is produced by excess carbon dioxide and other gases in the atmosphere; systems powered by solar, wind, and geothermal energy do not emit any carbon dioxide. Indeed, today's renewable energy sources assist the US save roughly 70 million metric tons of carbon emissions per year that would have been produced if the power had been generated using fossil fuels. Different types of renewable energies are illustrated in Figure 1.

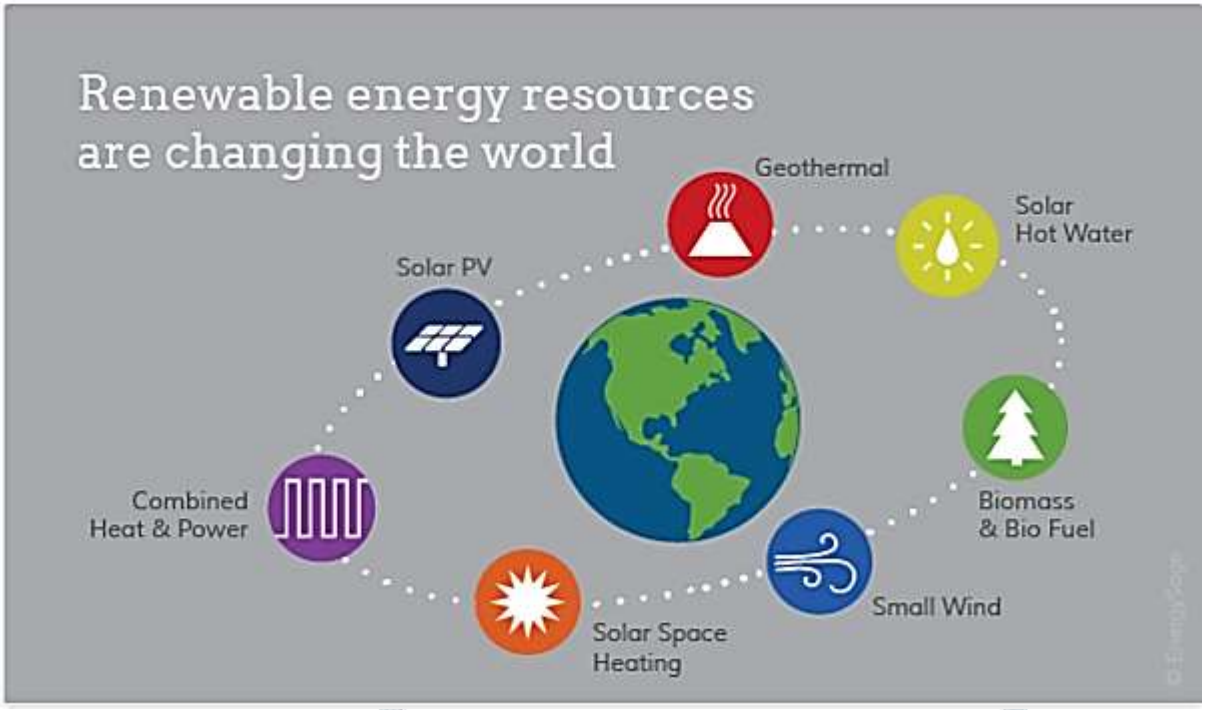

Figure 1: Illustrates the types of renewable energy in use all around the world for replacing conventional source of energy [6].

When biomass is turned to energy, it emits carbon dioxide, but because biomass absorbs carbon dioxide as it grows, the entire process of growing, utilizing, and growing biomass emits very little to no carbon dioxide. Although humans have used the energy of the sun and wind for millennia, current renewable energy technologies have only been under significant development for approximately 20 years. The cost, performance, and dependability of renewable energy sources have all improved dramatically over that era of research and development investment by business and government [mainly the US Department of Energy (DOE)]. An overview of these advancements is provided below; many good evaluations of renewable energy technology advances over the last two decades are available. Photovoltaic devices convert sunlight to energy using semiconductor materials such as silicon. They don't have any moving components and don't emit any pollutants when they're running. Photovoltaic devices are extremely modular and may be utilized in tiny cells, panels, and arrays. Photovoltaic systems have an average lifetime of around 20 years and require little service or maintenance. Researchers from the government, universities, and industry are collaborating to reduce manufacturing costs through the National Center for Photovoltaics. They are concentrating their efforts on creating more efficient semiconductor materials and device designs, as well as growing production capacity, boosting production rates, and enhancing product quality. Photovoltaic panel capital prices have dropped from more than $50 per watt in the early 1980s to around $5 per watt today, while energy costs have dropped from approximately $0.90 per kW hour in 1980 to about $0.20 per kW hour today. Although this is still more expensive than conventional base load electricity, commercial markets for remote telecommunications, remote lighting and signs, remote homes and recreational vehicles are booming in developed countries, while remote power for village homes, clinics, and other uses is booming in developing countries. Another fast-expanding field is the incorporation of solar devices into roofing materials for generating power on structures. A new form of photovoltaics is on the horizon, with the first commercial items in the works. As previously stated, conventional solar photovoltaics create electricity using the energy of light. Thermo photovoltaics create electricity using the energy of heat, or infrared radiation, having the benefit that a generator may run at night or when the sky is cloudy, obviating the need for batteries. Though a fuel, such as natural gas, is required to produce heat, employing semiconductors rather than traditional diesel generators provides in greater fuel-to-electricity conversion efficiency, flexibility, low pollution, silent operation, and high dependability. Small power units are being developed to provide electricity in isolated regions or for military forces; a US business is also intending to commercialize a thermal photovoltaic generator to power sailboat electrical equipment. Thermo photovoltaics might eventually be used to produce power from waste heat in hybrid electric vehicles or industrial operations. The kinetic energy of the wind is converted into other types of energy, such as electricity, through wind generating systems.

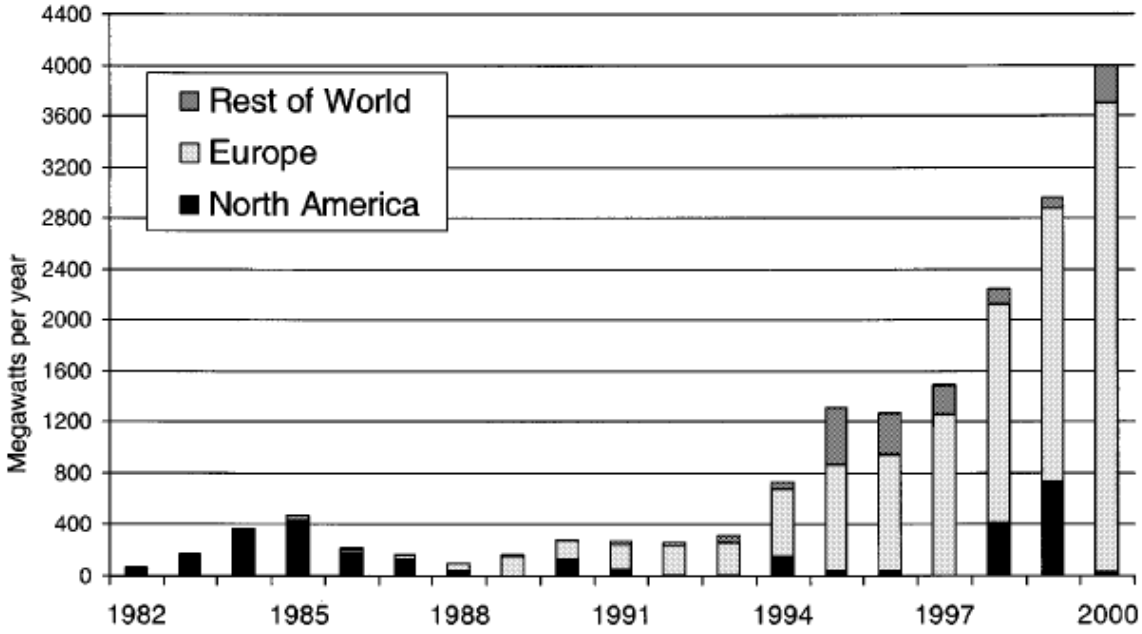

Figure 2: Illustrates the year wise consumption of the energy in rest of world, Europe and north America [7].

Wind energy is abundant all around the planet. In the United States, 34 of the 50 states have adequate resources. North Dakota's wind resources, for example, could provide up to 36 percent of all power consumed in the lower 48 states. Except for Enron's acquisition of one large wind business, the US wind sector is undercapitalized; there have been two recent bankruptcy cases. Europe has twice as many wind manufacturing and development businesses as the United States; some have already established North American production facilities and are attempting to break into the American market [8]. Agricultural and forest product wastes, as well as crops produced particularly for energy production, are used to create electricity in biomass power plants. Coffering replaces coal in existing coal-fired boilers; gasification converts biomass to a fuel gas that may be replaced for natural gas in combustion turbines; direct-combustion systems burn biomass in a boiler to create steam that is expanded via a turbine/generator to produce electricity. Figure 2, Illustrates the year wise consumption of the energy in rest of world, Europe and north America.

2. LITERATURE REVIEW

To fulfil a market, need of more than a billion gallons of gasoline per year, ethanol is manufactured from maize kernels using classic fermentation methods. Because maize takes a lot of energy to produce as fertilizer and farm machine fuel, renewable energy research has concentrated on making ethanol from corn waste, waste newspaper, rice straw, forest thinning to prevent wildfires, and energy crops like grasses and trees. The biological generation of ethanol begins with the hydrolysis of fibrous biomass using enzymes or acid catalysts to produce soluble sugars, which are then converted to ethanol by microbes [9]. Due to technological advancements, such as genetic engineering of specific enzymes and microorganisms, the cost of producing bioethanol has reduced from $3.60 per gallon in 1980 to around $1.20 now. The ultimate aim is for bioethanol to be priced competitively with gasoline. The research focuses on low-cost enzyme manufacturing, improving microorganism performance, producing appropriate energy crops, and demonstrating ethanol generation from a range of biomass feedstocks. Biomass may provide a variety of fuels in addition to ethanol. In the United States, around 1.2 billion gallons of methanol, now produced from natural gas, are sold each year, with about 38% of that utilized in transportation. Thermochemical gasification can also be used to generate methanol from biomass. Diesel fuel, which is now made from petroleum, is also made in small quantities from soybeans, but research has revealed that it can also be made from less expensive and more abundant sources, such as natural oils found in algae and biomass pyrolysis [10]. Another biomass-based fuel that can be used to replace diesel is dimethyl ether. The federal government has recently highlighted its support for research on biomass-derived methanol and diesel fuels in order to focus financial resources on ethanol. The Biomass Research and Development Initiative, which involves a number of federal agencies, has prompted researchers to look for ways to speed up the development of bioenergy and bio-based goods. The development of multiproduct pathways, also referred to as a bio refinery, is a major component of the approach. Biomass can benefit from

a strategy similar to how petroleum has evolved from a single commodity to a multiproduct business. The idea is to produce a variety of products from the bio refinery, such as fuels, chemicals, polymers, energy, and heat, in order to make the most of the biomass feedstock and increase the economic value of the products, therefore increasing the viability of this renewable resource.

3. DISCUSSION

3.1.Applications of Renewable Energy as Different Sources:

Dry steam, hot water, hot dry rock, magma, and ambient earth heat are all examples of geothermal resources. Dry steam, hot water, hot dry rock, magma, and ambient earth heat are all examples of geothermal resources. Commercially established steam and water resources for power generation, and ambient ground heat is used commercially in geothermal heat pumps; techniques for harnessing the remaining resources are being researched. Geothermal heat pumps do not create energy; instead, they use heat exchangers and the constant temperature of the soil several feet beneath the ground to heat or cool interior air, reducing electricity usage. The market for geothermal heat pumps has been quickly expanding, and it is expected that they will soon be installed in over 400 000 homes and commercial buildings every year. Solar thermal systems, also known as concentrating solar power, use the sun's heat to meet a variety of needs, including generating electricity, heating water for industrial processes, domestic water supplies, or community swimming pools, preheating ventilation air, and direct heating of building interiors. Since the mid-1980s, nine commercial concentrating solar power facilities in California have been operational with a total producing capacity of 354 MW. Rows of highly reflecting parabolic troughs make up these systems. Each trough concentrates and focuses sunlight on a central tube loaded with heat-absorbing fluid that generates energy.

Table 1: Illustrates the consumption of different renewable source of energy with their application and cost [9].

Resource	Application or Technology	Current Cost[56] (¢/kWh)	Next Generation Cost[56] (¢/kWh)	Grid-connected Generating Capacity, 1998 [57] (MW)
Photovoltaics	All types	20–30	15 or less	10
Concentrating Solar Power	Dish-Stirling	10–15	4–6	0
	Trough	10–12	7–9	354
	Power Tower	6–9	3–5	0
Biopower	Direct Combustion	7–15	4–6	7,500
	Cofiring	2–3	2–3	500
	Gasification	8–10	4–5	0
Wind Energy	All types	4–6	2–4	2,500
Geothermal Energy	Steam and Hot Water	5–8	3–5	3,000

Electricity towers and dish-Sterling devices are two more methods for concentrating solar power. Power towers use a tall, fluid-filled tower as the focal point of a huge array of mirrors to generate significant quantities of power. Table 1, Illustrates the consumption of different renewable source of energy with their application and cost, in which solar energy is predominant among others. Solar water heating is one of the most common applications of solar building technology. Since the 1970s, significant progress has been made in increasing the dependability and durability of these systems. Flat-plate collectors are utilized in homes, whereas more expensive parabolic-trough systems are used to move huge volumes of water in hospital laundries, institutional kitchens, swimming pools, and industrial operations. Hydrogen is now generated from natural gas for a small number of industries, but it can also be made from renewable sources and has the potential to make significant contributions to global energy supply in the long run. Hydrogen is the most plentiful element in the universe, as well as the most basic chemical fuel, which is basically a hydrocarbon without the carbon, and is a highly efficient, clean-burning energy carrier. It has the potential to fuel zero-emission vehicles, provide process heat for industrial processes, provide domestic heat through cogeneration, assist in the production of electricity for centralized or distributed power systems, and serve as a storage medium for electricity generated from renewable sources.

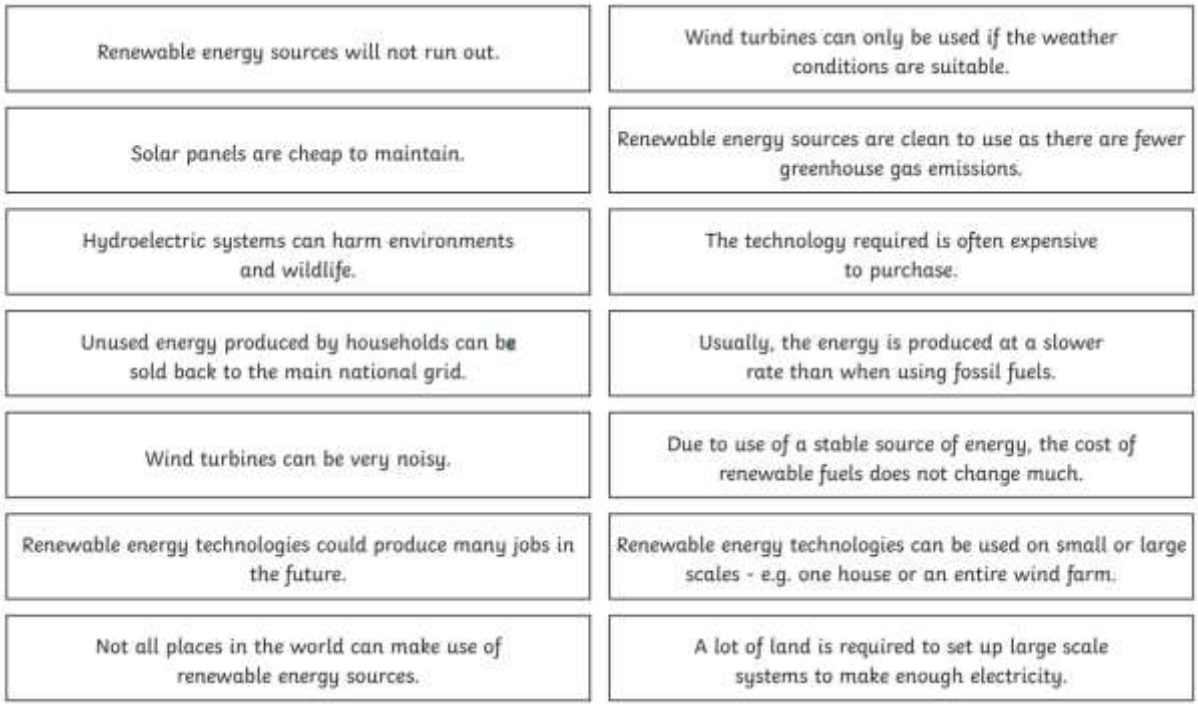

Figure 3: Illustrating the Different Advantages of Renewables Sources of Energy

Figure 3 is illustrating the different advantages of renewables sources of energy. Cost-effective, energy-efficient manufacturing methods, as well as safe, cost-effective storage and transportation systems, are among the research issues. Major advancements in hydrogen generation and storage technology have recently happened. Researchers have quadrupled the efficiency of hydrogen production from water and achieved significant advancements in carbon nanotube storage technology. Fuel cells promise to be a safe and efficient way to utilize hydrogen in cars and power plants. With no combustion, fuel cells transform hydrogen—as hydrogen gas or as hydrogen reformed within the fuel cell from natural gas, alcohol fuels, or other sources—directly into electrical energy. Major manufacturers are demonstrating solid-oxide fuel cells as possible cogenerates in commercial and multifamily residential buildings. Hydrogen currently regenerated from methanol proton exchange membrane cells are being researched for both transportation and power purposes. Despite the fact that NASA uses hydrogen fuel cells on a regular basis for space missions, terrestrial applications are still in their infancy. Two of the most significant barriers to commercialization, particularly in the transportation industry, are the lack of a cost-effective hydrogen generation technology and appropriate storage technologies. Developing technologies to produce hydrogen from sunlight, water, and biomass; developing low-cost and low-weight hydrogen storage technologies for both stationary and vehicle-based applications, such as carbon nanotubes and metal hydrides; and developing codes and standards to enable widespread use of hydrogen technologies are all part of the research goals. Modular electric generation from relatively modest producing systems ranging from less than a kilowatt to tens of megawatts, placed at or near consumer sites, is known as distributed power. Grid-connected or grid-independent distributed systems are both possible. The objective of proponents of distributed power is to reimagine the power grid such that, rather than producing electricity solely at big, central facilities and sending it in one way, customers would have some energy independence and the system would be accessible to millions of tiny providers. For the past 20 years or more, developing-country energy demand has outpaced that of developed-country demand, and this trend is expected to continue, particularly in China, India, and other fast rising Asian countries.

4. CONCLUSION

Some of the many technologies that make up renewable energy are already making significant strides in the marketplace. Other technologies, which may be the most useful to a sustainable future, are still in the early stages of development. Most, on the other hand, are advancing at a faster rate than ever before; there are no technological roadblocks in the way of renewable energy. Renewable energy is a force now and will be a big force in the future of America—the only issue is when. Only the American people's desire for clean energy—or the next great political upheaval in the Middle East—will determine the outcome. Although there has been conducted extensive research in the sector of renewable energy but this domain is not limited and more research is demanded to explore the full potential of the renewable energy.

REFERENCES:

[1] A. S. Kydes, "Impacts of a renewable portfolio generation standard on US energy markets," *Energy Policy*, 2007, doi: 10.1016/j.enpol.2006.03.002.

[2] T. Michaels, "2014 ERC directory of waste-to-energy facilities," *Energy Recover. Counc.*, 2014.

[3] T. Report, E. Efficiency, P. Alto, E. A Demeo, and G. Group, "Renewable Energy Technology Characterizations," *US Dep. Energy*, 1997.

[4] N. Martin, N. Anglani, D. Einstein, M. Khrushch, E. Worrell, and L. K. Price, "Opportunities to Improve Energy Efficiency and Reduce Greenhouse Gas Emissions in the U . S . Pulp and Paper Industry," *Ernest Orlando Lawrence Berkeley Natl. Lab.*, 2000.

[5] B. H. Deitchman, "Changing the state of state-level energy programs: Policy diffusion, economic stimulus, and new federalism paradigms," *Strateg. Plan. Energy Environ.*, 2014, doi: 10.1080/10485236.2014.10819705.

[6] N. Lenssen and C. Flavin, "Sustainable energy for tomorrow's world," *Energy Policy*, 1996, doi: 10.1016/0301-4215(96)00060-2.

[7] F. Muhammad-Sukki *et al.*, "Feed-in tariff for solar photovoltaic: The rise of japan," *Renew. Energy*, 2014, doi: 10.1016/j.renene.2014.03.012.

[8] A. M. Barnett, "Solar electric power for a better tomorrow," 1996, doi: 10.1109/pvsc.1996.563935.

[9] J. D. McMillan, "Bioethanol production: Status and prospects," *Renew. Energy*, 1997, doi: 10.1016/0960-1481(96)00081-x.

[10] K. Urbaniec, H. Mikulčić, N. Duić, and R. Lozano, "SDEWES 2014 - Sustainable Development of Energy, Water and Environment Systems," *J. Clean. Prod.*, 2016, doi: 10.1016/j.jclepro.2016.04.062.