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Survey Paper

RENEWABLE POWER HARVESTING MECHANISM: SURVEY

Ajay B Devkatte[1] and Nitesh H Chavan[2]
Students Electronics Engineering ACE, Malad, Mumbai
E-mail: devkatteajay@gmail.com, nits365@gmail.com

Abstract: Energy harvesting techniques is a technology to generate electrical energy from natural energy resources. Today's world goes faster with their fast developing technology. Whole world depend upon their technology. The main base of technology depends on availability energy resources. Nowadays, important is the need to develop new energy resources. Many countries have started to install facilities that use renewable energy sources for power generation. This paper surveys about the power generation and harvesting.
Index term: Hydro power, Wind power, Solar power, CO_2, Energy harvesting.

1. INTRODUCTION

The process of acquiring the energy surrounding a system and converting it into electrical energy is called as energy harvesting. The increasing prices of fossil fuels and concerns about the environmental consequences of greenhouse gas emissions have renewed the interest in the development of alternative energy resources. The main component of greenhouse gases is carbon dioxide (CO_2).To avoid greenhouse gases the use of renewable energy resources important. The emission of greenhouse gases is global warming. The effect of global warming is ocean acidification, ozone depletion, smog pollution etc. The primary concept of energy technology is energy supply technologies, which refers to alternative sources of renewable energy e.g. wind and solar power.

2. GLOBAL WARMING

Greenhouse gas levels have been increasing since the start of the Industrial Revolution, but over the last few decades growth has been particularly fast. Total greenhouse gas emissions have increased by about 80% since 1970[1].

Global warming is harming the environment in several ways including [1]:

- Desertification
- Increased melting of snow and ice
- Sea level rise
- Stronger storms and extreme events

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(A) *Ocean Acidification*

Fig: 1 [8]

Increases in carbon dioxide levels have made the world's oceans 30% more acidic since the industrial revolution [2]. The ocean serves as a sink for this gas and absorbs about a quarter of human carbon dioxide emissions[3]which then goes on to react with seawater to form carbonic acid[4].So as the level of carbon dioxide in the atmosphere rises, the acidification of the oceans increases.

(B) *Ozone Depletion*

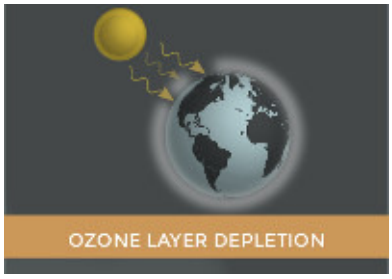

Fig: 2[8]

Nitrous oxide damages the ozone layer and is now the most important ozone depleting substance and the largest cause of ozone layer depletion [5]. This is because CFCs and many other gases that are harmful for the ozone layer were banned by the Montreal Protocol (MP) which has reduced their atmospheric concentration. Nitrous oxide is not restricted by the MP. so while the levels of other ozone depleting substances are declining, nitrous oxide levels are continuing to grow.

(C) *Smog Pollution*

Fig: 3 [8]

Over the last century, global background ozone concentrations have become 2 times larger due mainly to increases in methane and nitrogen oxides caused by human emissions [6]. At ground level, ozone is an air pollutant that is a major component of smog which is dangerous for both humans and plants [7] [8].

3. RENEWABLE ENERGY RESOURCES

The use of renewable energy is continuously increasing. The global energy sector increased the production of primary energy from 5.5 Btoe in 1970 to almost 13.8 Btoe in 2015. The installed capacity for electricity generation reached 6.2 billion KW in the year 2015 and Asia Pacific gained relevance, currently representing 46% of that capacity. Coal, oil and other fossil fuels still represent a sizeable share of the matrix, with renewable sources representing only 19.2% of consumption [9].

Below we present renewable energy supply technologies:

- Wind Power
- Hydro Power
- Solar Power

(A) *WIND POWER*

The terms "wind energy" or "wind power" describe the process by which the wind is used to generate mechanical power or electricity. Wind turbines convert the kinetic energy in the wind into mechanical power [10].

Fig: 4 [19]

Equation for Wind Power [11]**:**

$$P = \frac{1}{2}\rho A V^3$$

- **Wind speed**

The amount of energy in the wind varies with the cube of the wind speed, in other words, if the wind speed doubles, there is eight times more energy in the wind

($2^3 = 2x2x2 = 8$). Small changes in wind speed have a large impact on the amount of power available in the wind [12].

- **Density of the air**

The more dense the air, the more energy received by the turbine. Air density varies with elevation and temperature. Air is less dense at higher elevations than at sea level, and warm air is less dense than cold air. *All else being equal*, turbines will produce more power at lower elevations and in locations with cooler average temperatures [12].

- **Swept area of the turbine**

The larger the swept area (the size of the area through which the rotor spins), the more power the turbine can capture from the wind. Since swept area is $A=pir^2$,

where r = radius of the rotor, a small increase in blade length results in a larger increase in the power available to the turbine[12].

Each wind turbine could generate as much electricity as a conventional power plant.Wind energy has made its most significant contributions in China, the US and Germany, where the cumulative installed capacities are 62, 47 and 29 GW, respectively [13].

(B) *HYDRO POWER*

Hydropower is electricity generated using the energy of moving water. In the late 19th century, hydropower became a source for generating electricity [14].

Fig: 5 [19]

Hydroelectric power provides almost one-fifth of the world's electricity. Equation for calculating hydropower [15]:

P= (m×g×Hnet×η)

Where:

- **P** - Power, measured in Watts (W)
- **m**- Mass flow rate in kg/s (numerically the same as the flow rate in litres/second because 1 litre of water weighs 1 kg)
- **g**- The gravitational constant, which is 9.81m/s^2
- **Hnet**- The net head. This is the gross head physically measured at the site, less any head losses. To keep things simple head losses can be assumed to be 10%, so

Hnet=Hgross×0.9

- **h**- The product of all of the component efficiencies, which are normally the turbine, drive system and generator

The first hydroelectric power plant was built at Niagara Falls in 1879. In 1881, street lamps in the city of Niagara Falls were powered by hydropower. In 1882 the world's first hydroelectric power plant began operating in the United States in Appleton, Wisconsin [14].

(C) *SOLAR ENERGY*

Solar energy is the most readily available source of energy. It is also the most important of the non-conventional sources of energy because it is non-polluting and, therefore, helps in lessening the greenhouse effect [16].

The global formula to estimate the electricity generated in output of a photovoltaic system is [17]:

E = A * r * H * PR

Where

- **E** = Energy (kWh)
- **A** = Total solar panel Area (m^2)
- **r** = solar panel yield (%)
- **H** = Annual average solar radiation on tilted panels (shadings not included)
- **PR** = Performance ratio, coefficient for losses (range between 0.5 and 0.9, default value = 0.75).

Fig: 6 [19]

Government of India (GOI) has initiated many programs to achieve ambitious targets of producing over 1900 billion units of solar power annually, which is enough to meet the projected demand of entire country in 2030 [18]. Ministry of New and Renewable Energies (MNRE) of GOI is working effective energy conservation and transformation processes since 1981.

(D) *OTHER RENEWABLE SOURCES*

There are other types of renewable energy sources including biomass, ocean waves and tides. Biomass is defined as living plants and organic waste which are made by plants, human, marine life, and animals. Based on Tester (2005), the main advantage of biomass is availability, as it can be readily found in all places [13]. Many kinds of energy can be produced from biomass: electricity, cooking heat, chemical feedstock, etc [13]. As a feedstock, biomass has a lower sulfur content than coal and a lower emission is produced by combustion [13]. In early 2000, the United States had an installed capacity of 11 GW from biomass including the forest product and agricultural industry, municipal and solid waste industry, and other sources (Ngôand Natowitz, 2009)[13].

5. ENERGY EFFICIENCY TECHNOLOGIES

- Electric vehical
- Combined heat and power

- Virtual power plant

(A)*ELECTRIC VEHICAL*

Electric vehicles (EV, including the battery, fuel cell, and hybrid types) have the potential to be considered viable options for both electricity storage and power generation [13]. Ford (1995) examined the impact of the large scale use of electric vehicles in southern California and concluded that Southern California Edison (a power company in the area) was able to accommodate a large number of EVs with their existing capacity, particularly if the charging system was managed by smart control [13].

(B) *COMBINED HEAT AND POWER*

Cogeneration, or combined heat and power (CHP), is the use of heat and electric power together. It is expected to have a substantial gain in efficiency over each source separately.

Most power distribution companies supply only electricity, not hot water or steam [13]. Madiment and Tozer (2002) investigated the application of combined cooling heat and power (CCHP) for supermarkets in the UK and compared it to the energy savings/capital cost of conventional technology [13]. The results show that CCHP is able to provide a significant amount of primary energy while reducing CO2 emissions compared to conventional schemes, but it is also believe to be competitive with more efficient technologies in long term [13].

(C) *VIRTUAL POWER PLANT*

A Virtual Power Plant (VPP) is a cluster of distributed energy resources, such as micro-CHP, wind turbines, and solar photovoltaic panels, which are controlled and managed by a central control unit [13].

6. ECONOMIC IMPACTS

The emphases for economic impacts are job creation, industrial innovation and balance of payment. Renewable energy technologies could enable countries with good solar or wind resources to employ these energy sources to meet their domestic demand [13]. Also, renewable energy technologies may even enable these countries to utilize renewable energy sources with long-term export potential. A main economic driver to the enhancement of renewable energy technologies is their job creation potential [13].

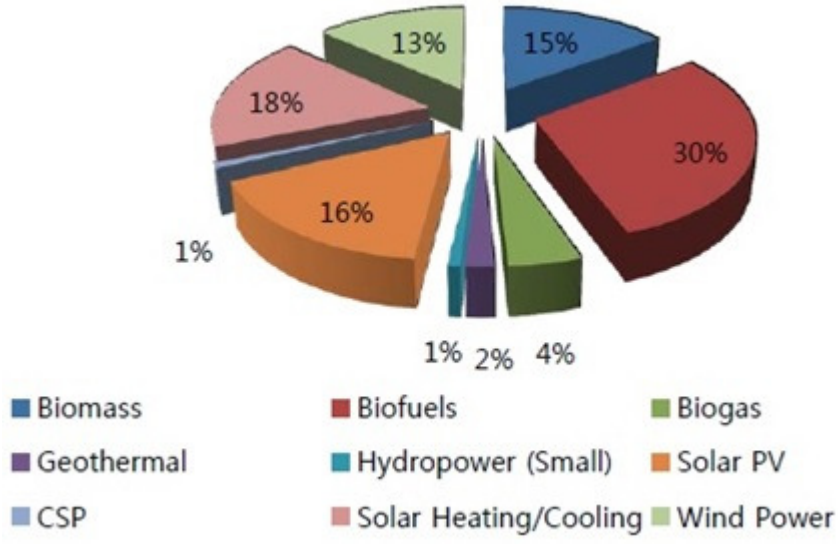

Fig: 7 Estimated jobs in renewable energy worldwide, by industry [13]

7. CONCLUSION

Renewable energy sources are very important for the future. Renewable energy technologies could reduce carbon dioxide emissions by replacing fossil fuels in the power generation transportation sector and Industry. Power generation using renewable energy resources should be increased in order to decrease the unit cost of energy. Hydroelectric power provides almost one-fifth of the world's electricity. Today electricity is very important we should not waste even a small resource of power. This renewable resources provide the idea of carrying electronic devices such as a portable radio and never worrying about when the batteries will need to be replaced could be far closer than one would think. This thought has caused the desire for self-powered electronics grow quickly it can become a reality. Renewable resources provide scalability to the technology and environmental benefits.

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