

Renewable Energy Sector in overcoming Energy Crises: A Review

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Abstract: This paper gives an overview of electricity generation resources. Now the nations are trying to keep their resources in safe side and moving towards the option which can produce low cost electricity providing no harm to environment as well as to the natural reserves. Pakistan has got all the natural renewable resources which if properly used can be a better option not only to overcome the energy crises but also to raise its economic growth. Pakistan has to import oil which is the major source of electricity generation and this is the reason that tariffs of electricity are so high. This paper is a short review about renewable sector of Australia and Pakistan.

Keywords: Energy, Renewable, Solar, Wind, Water

1. Introduction

No one now days can expect to survive without television, mobile phones, computers, lightening system in our homes and work places. There has been tremendous development in almost all aspects of life to provide better solutions to human care like information and Communication Technology [1], health care[2], [3],[4], [5], [6], transportation[7]and energy sector[8].

Any country which needs to develop needs to have a sustainable and affordable supply of energy. Electrical energy system has a major importance towards the socioeconomic growth and life line of the modern society towards reshaping it. Almost all activities of daily life are impossible without electricity and we now have become dependent on energy sector. All the gadgets we use in our daily life like cell phones, laptops, iPod, wearables and others depend on electrical energy either via through supplies or through batteries. Increase in the consumption of electricity in increasing day by day and this has led to decrease in energy sources available. One of the major reasons towards increase in consumption is race towards modernization and growth in development which has increased per capita requirement of energy [9]. Table 1 shows list per capita consumption of some countries [10]

Table 1: Per capita electricity consumption

Country	Per Capital Electricity Consumption in kWh
USA	13361
France	7756
Germany	7217
China	2942
Turkey	2474
Sri Lanka	636.3
Pakistan	457

But as the requirement of the energy consumption is increasing the resources are decreasing. Fossil fuels are used for 85% electricity generation in the world.

Economically accepted fuels are oil and natural gas are said to be exhausted in approximately 30 to 50 years. Coal, natural gas and oil are used mostly fossil fuels for electricity generation. It's time to decide the value of renewable energy resources also called "clean energy" on a very high scale. Renewable energy mans that the resources provided to us by Mother Nature be utilized to generate electrical energy. There are two factors for researchers to focus on the renewable energy sector as: (i) increasing energy crisis and (ii) impact on environment. People on the world are dependent on energy and energy is dependent on fossil fuels. When fossil fuels are used as sources to energy development then there is huge amount of pollution is created. Traditional and conventional sources of energy do generate pollution so there is a need to emphasize on renewable energy sector [11].

Further this paper is organized as section 2 discusses renewable energy and its resources, Australia's renewable energy sector is briefed in section 3 , section 4 is the renewable sector of Pakistan and section 5 concludes the paper.

2. Renewable Energy and Resources of Renewable Energy

The resources which are refilled continuously are known as renewable resources. Renewable energy sources are very environmentally friendly but still they are not able to fulfill growing requirements. Renewable energy can be obtained from several resources out if them some are as listed [12]:

- i. Wind Energy
- ii. Solar Energy
- iii. Bio Gas
- iv. Hydro Power

2.1 Wind Energy

Windmills and wind turbines are used which harness wind energy and convert it into electrical energy. The wind turbines are reacting as transducers. The kinetic energy of

wind is converted to mechanical energy. This converted mechanical energy is then converted to electrical form [13].

2.1.1 Limitations of Wind System

It is dependent on wind speed. If wind speed is less then power generation will also be less. Maintenance is required on regular intervals. If more users are needed to be served then more turbines have to be installed.

2.2 Solar Energy

It is a radiant energy which is emitted from the sun. Sun light is utilized in this type. Solar Photovoltaics (PV) are used which are placed in the areas which are directly exposed to sunlight. The PVs convert sun light into electrical form to the storage systems i.e. batteries for further use. Solar energy conversion system is shown in figure 1. Sun light falls on the solar PV panels which convert this heat in to electrical form and send it to the charge controller. Charge controller then utilizes this energy to charge the battery for later use. This energy is DC so if AC components are required to be operated directly on solar energy then a converter may be used. Now DC components are also available which operate directly on the solar energy so no need to have a battery usage in the presence of sun light [14].

2.2.1 Limitations of Solar System

If there is a cloudy or foggy weather then there may be low voltages and that can cause the components operating on it directly may malfunction and the battery may take more time to charge. The solar PV panel's life can be reduced by rain.

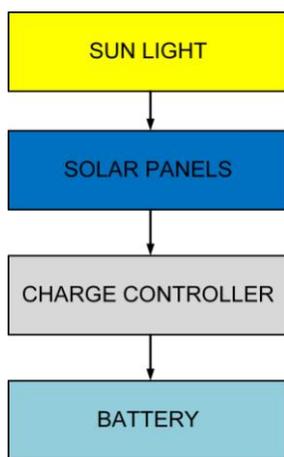


Figure. 1: Solar Energy Stages

2.3 Bio Gas

When organic matter is fermented then methane is produced which is used in energy conversion. Combustion heat or burning waste, wood or other wastes of bio mass energy or bio gas energy [15].

2.3.1 Limitations of Bio System

Environmental polluting gases like carbon mono oxide and carbon dioxide are released. Bio gas power plants may produce dirty odor that can create air pollution and can create panic in surrounding areas.

2.4 Hydro Power

From its movement kinetic energy is harnessed. For hydro power energy dams are needed to be built. This is because water is kept stored and when needed it is allowed to flow down of the dam gates. At the basement of the dam there are generators and turbines. When the turbine is hit by the pressure of the water it rotates in high speed. Water has huge mass when it falls down due to gravity. The kinetic energy is converted to mechanical energy and then converted to electrical form by the generator [16].

2.4.1 Limitations of Hydro System

If there is less water pressure then there will be less speed of turbine rotation which in turn causes less production of electricity. So continuous management of spill ways is performed and also water is needed to be in the dam for good pressure. Table 2 represents all the above discussed energy sectors with their dependability and limitations

Table 2: Energy Sector with their dependability parameters and limitations

Sector	Dependent on	Limitations
Wind	Availability of Pressure of wind	Wind pressure is needed all the time and maintenance is needed
Solar	Availability of Intensity of sun light	Sunlight be present for stable voltages
Bio Gas	Availability of Organic material	Dirty odor creating air pollution
Hydro	Availability of water and Water pressure and	Water pressure is needed for stable voltages

3. Renewable Energy Sector of Australia

In Australia two renewable sectors are vastly developing that are solar energy and wind energy. Almost one third of the Australia's renewable generation is through Wind. Wind is also one third of the total generation in South Australia. Biogas and Solar Photovoltaics (PV) have presented their impact by 17 and 23 percent respectively. The usage of biogas mainly is towards in heat generation (for food or kitchen) and industries. In the year 2017-15 renewable energy sector had 5.8% of the total energy as shown in Table 3 [17].

Table 3: Australia Energy Sector by Fuel type

Sector	PJ	Percentage of Share
Coal	1907.8	32.2
Oil	2237.4	37.8
Gas	1431	24.2
Renewables	343.3	5.8
Total	5919.6	100

4. Renewable Energy Sector of Pakistan

In Pakistan there are approximately 50 million people without access of electricity which makes a percentage of 27%. Figure 2 shows the energy sector of Pakistan. The conventional method of making electricity still rules and has most of the part. 35.2 % electricity is generated by oil, 29 % by gas, 29.9 % by water, 5.8 % electricity is generated by nuclear and imported power plants and coal has 0.1 % share[18].

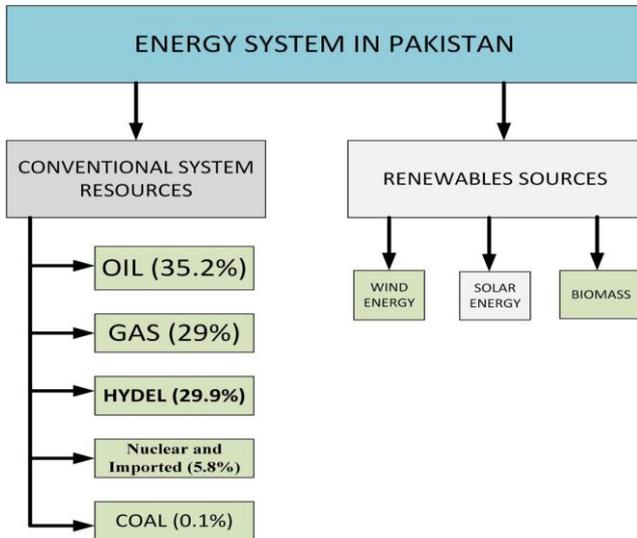


Figure. 2: Energy System of Pakistan

Table 4[19] depicts the projects list of power plants completed and are operational with their fuel type. It can be observed in table 4 that most of the projects are based on renewable energy sources like solar energy and wind energy.

4.1 Pakistan Solar Energy Perspectives

Pakistan has huge potential for solar sector s it lies in a region where there is 15.5 x 1014 kW-h of solar radiation. Nearly 8 to 10 hours per day there remains sun light in most areas of Pakistan. Solar radiation in Pakistan is shown in Figure 3[20].

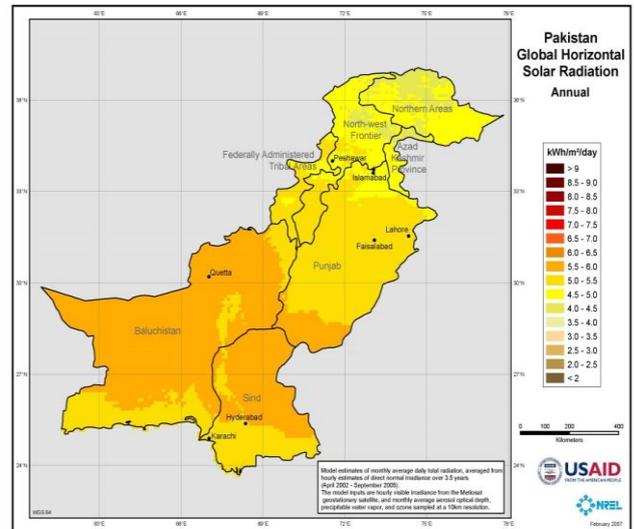


Figure. 3: Pakistan Radiation Statistics [15]

4.2 Pakistan Bio Energy Perspectives

Annually it is predicted that Pakistan has 8.8 to 17.2 billion cubic meters of biogas production [21]. There are 1200 units of bio gas energy installed and other 10000 are under construction which will add up to 27 % of the total electricity generation

Table 4: Electricity Projects of Pakistan [14]

Project	Fuel	Year	Capacity in MW	Total
RYKML	Bagasse	2014	30	717 MW
FWEL-I	Wind	2014	50	
QUAID E AZAM	Solar	2014	100	920 MW
NANDIPUR	Furnace Oil	2014	425	
SAPPHIRE	Wind	2014	50	
CHINIOT	Bagasse	2014	62	
APOLO SOLAR	Solar	2015	100	
BEST GREEN SOLAR	Solar	2015	100	
CREST ENERGY SOLAR	Solar	2015	100	
YOUNUS	Wind	2015	50	
METRO	Wind	2015	50	
TAPAL	Wind	2015	30	
MASTER	Wind	2015	50	995 MW
TENAGA	Wind	2015	50	
GUL AHMED	Wind	2015	50	
CHASHNUPP-III	Nuclear	2015	340	
FATIMA	Coal/Bagasse	2016	120	
HAMZA	Bagasse	2016	15	
BHIKI	Gas	2016	760	
DAWOOD WIND	Wind	2016	50	
SACHAL WIND	Wind	2016	50	
TOTAL				

5. Conclusion

In this paper we have tried to sketch the details of possible solutions to energy crises situations. Fossil fuels are a gift to us but we may need to be careful as they will be ended if consecutively used. Electricity is the demand which will never decrease because life without it will come to an end. In this paper two countries are selected to present the study between a developed country and a developing country. Pakistan is growing up and thanks to China Pakistan Economic Corridor (CPEC) that new projects are also involved. Pakistan is located in a region where it has almost all the renewable energy resources. It is blessed with a very bright sun light at day time which has led people to opt for this solution for domestic uses. Pakistan has vast coastal region which can be utilized for wind energy and in future wind turbines can be planted in the sea which is in Pakistan's region. Pakistan has 4 rivers and plenty of water but lacks infrastructure which is why dams are not built on most areas of the country. Water reservoirs are mainly needed for electricity generation and can be refilled by rain. Pakistan has a monsoon season as well which can refill the rivers as well as the dams.

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