Research and Reviews: Journal of Ecology and Environmental Sciences

e-ISSN: 2347-7830
P-ISSN: 2347-7822

Energy Resources of Pakistan: Issues and Crises

Rehana Baloch*

Department of Environmental Science, Sardar Bahadur Khan Women's University, Quetta, Pakistan

Research Article

Received: 26-Oct-2020; Manuscript No. RRJEAES-20-21178; **Editor assigned:** 29-Oct-2020; Pre QC No. RRJEAES-20-21178(PQ); **Reviewed:** 12-Nov-2020; QC No. RRJEAES-20-21178; **Revised:** 24-Aug-2022(R); QI No: 21178Manuscript No. RRJEAES-20-21178; **Published:**22-Sep-2022, DOI:10.4172/23477830.10.06.004

***For Correspondence:**
Rehana Baloch, Department of Environmental Science, Sardar Bahadur Khan Women's University, Quetta, Pakistan
E-mail: rehanabaloch12@gmail.com

Keywords: Energy resources; Electricity; Environment; Nuclear reactors

ABSTRACT

Industrial revolution is totally dependent on energy resources, energy is essential for life to survive; human beings are totally dependent on energy for their daily life purposes. Pakistan depends on energy which import from outside, because the power generation processes are not as much good as they have to be that's why Pakistan is dependent on outside energy resources. Economic growth of Pakistan and its development is based on energy sectors advancement. Developing countries have higher growth rate instead of developed ones. Pakistan facing electricity shortage problems hardly, Pakistan can generate 50000 MW through nuclear reactors. The current observations, based on the revision of the geological structure, of the geographical position, reveal that there are good exploitation methods for various renewable resources of energy, the resources such as hydal, biogas, wind, solar and other solid waste, use of low levels of canals sea waves and tides and geothermal energy etc. These renewable energy sources are good to utilize to decrease rate of poverty and to maintain a harmless environment in Pakistan. As Pakistan is an agricultural country and most of its population lives in rural areas, electricity generated from renewable sources will also improve rural life, thereby reducing urban migration which is taxing cities' ability to cope with their own environmental problems.

INTRODUCTION

A nation's socio economic growth and its development are based on its energy sectors advancement. But where the energy resources are used to enhance the economic growth on the other hand this sector is being harmful for the environment and for human too. The main cause of climate change today is the harmful greenhouse gases

e-ISSN: 2347-7830
p-ISSN: 2347-7822

Emissions from fossil fuels which are used for energy producing purposes. Current economic growth in all over the world based on energy resources. There will be no survival without energy resources in developing countries. Developing countries have higher growth rate instead of developed once. Most of the population in developing countries is rural who have low living standards having fewer sources of commercial fuels used to fulfil their energy requirements by using traditional sources of energy. Today Pakistan facing electricity shortage problems hardly, In 1997 Pakistan was known to produce 60 MW electricity to fulfil the need of electricity for 31.5 million people. Demand of electricity has been increased 4000 MW in 2008. Some natural resources produce energy which is called the renewable energies, natural resources such as sunlight, wind hydro power. Some countries having nuclear industries use nuclear energy as an energy producer which contain uranium, it can be considered as a renewable energy in case of not producing harmful gases. Pakistan has also some nuclear reactors. Nuclear plants need more costs to fulfil the uranium requirements; nuclear energy can reduce the carbon emissions. Pakistan has to improve its nuclear resources facilities to overcome its dependency on import energy resources. A current estimation about Pakistan was that Pakistan can generate 50000 MW through nuclear reactors. About 20 percent of the world's energy requirements fulfil by hydro power generations, and Pakistan generate energy of 45000 MW by hydro powers. With the development of recent era the global environment is getting harmful effects due to the more use of non renewable energy sources for power generation purposes. Gas, oil and coal are main concerned natural resources which are responsible for the environmental depletion. Pakistan consists of number of natural reservoirs but lacks the employment, focus, policies, planning have to make solutions to improve the energy crises. Increasing energy crisis in Pakistan pushing the policy makers to make such type of policies that overcome these crises. The total worldwide population of Pakistan is estimated as 2.56%, and it is known as the world's sixth most populous country. About 8 hours to 10 hours of load is shedding experiences the urban areas regularly, on the other side rural areas experience average load shedding in 20 hours. According to a report the renewable energy sources for the sake of electricity generation will be less than 1% in 2010. Major energy consumption sectors are residential and commercial sectors because of indoor electricity appliances. Current situation of energy issues in Pakistan indicates that energy resources are less to fulfil the increasing energy demands [1].

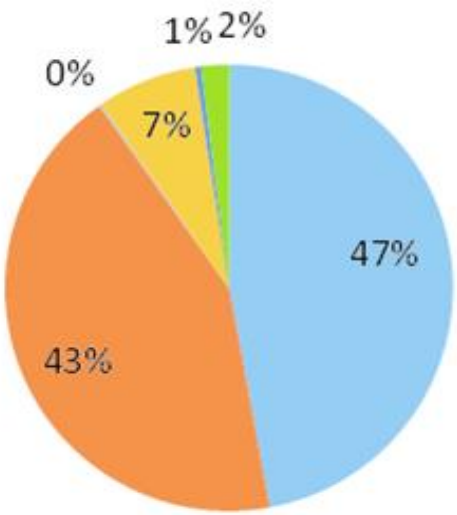
MATERIALS AND METHODS

Non-renewable sources of energy or are petroleum, coal, and gas are known to be the more effective drivers of economic growth, but on the other hand these are responsible for the depletion of environment and with the same time are considered as harmful for the human health too. Pakistan is a well-known developing country for importing oil. There are very less oil reserves in Pakistan because of the increased demands and prices. The Ministry of Petroleum and Natural Resources says that the oil which originating naturally called indigenous crude oil fulfil 18 percent of total demand while the other 82% met through imports of crude oil, high speed diesel, and fuel oil. Pakistan was to produce 66079 barrels per day in 2004-2005. With the passage of time price is increasing continuously with the increment of governmental policies to switch over natural gas for power generation, the oil demand is increasing. The highest companies of oil in Pakistan are Oil and Gas Development Company Limited "OGDCL", Pakistan Petroleum Limited "PPL", and Pakistan State Oil "PSO" are national ones. British Petroleum

e-ISSN: 2347-7830
p-ISSN: 2347-7822

"BP", Austrian mineral oil authority "OMV", Orient Petroleum International "OPI", Petronas and Tullow are the international oil companies of Pakistan (Figure 1). Pakistan is rich to produce about 27 million barrels of oil resource. From about 13 companies work for the production of crude oil from 133 fields of oil. The more oil was being consumed by the transportation sector from about 2010-2011 which was estimated as 48.9%.

Figure 1. Energy year book of oil consumption 2012 Pakistan. **Note:** : Transport; :Power; : Agriculture; : Industrial; : Domestic; : Other Govt.



The natural gas firstly originated in Pakistan, which is the biggest gas reservoir of the country. There were no new reserves were introduced to produce natural gas, it would last for just 22 years only. The consumption of natural gas by power sector in 2004-2005 was 43.7%, industrial consumption was 19.5%, domestic 14.8%, fertilizer 12.9%, commercial 2.3%, transport 2.1% and cement industry 1.2%. The more use of gas making a shortfall for the supplement of gas for domestic and industrial purposes. According to an estimation that Pakistan can be going to face a shortage of natural gas in nearby future, demand for gas was set to rise from 31.2 bcm in 2008 to 39.2 bcm in 3013 which needs import of 1.2 bcm. It can be result as a gas shortage during winter due to the more consumption. Pakistan has about 282 trillion cubic feet of reserves of natural gas.it is producing about 4 billion cubic feet of natural gas. The total working companies are fifteen for the production of gas from about 190 gas fields, 44 are reservoir of natural gas with deposits of petroleum and other 146 reservoir are without the deposits of crude oil.

Coal

Pakistan consists of extent coal producing reserves and that coal mines are huge ones. According to the estimation that Pakistan contains 185 billion tons of coal reserves which are equal to minimum 400 oil barrels according to Dr. Akram sheikh. The total utilization of coal energy decreased from about 8.3% to 5.5% in 1977 to

e-ISSN: 2347-7830
p-ISSN: 2347-7822

78 after the origination of gas. Gas and oil take the place of coal due to the lack of well-developed plans for the coal production and its transportation process. Power generation by coal needs preference in Pakistan like other countries of Asia such as India and china. Thar is en rich for the generation of power of 50000 MW by coal. Heating value for coal reserve is 6223 Btu to 10288 Btu. Coal is mostly utilized by the cement sector and by brick kiln industry. Coal is a most rich naturally producing fuel, produce in many countries. China is known as the biggest coal consumer and may its consumption of coal will more increases in coming 2030. Coal is the main source for the emissions of harmful carbon than any other fuel, and the released CO_2 is not possible to dispose. The reserves of coal in that was rich in ignite from 2003 to 2011. The generation of energy increases about 6.5% to 7.6% by coal. Pakistan can generate about 100000 MW electricity from coal [2].

Nuclear power

In the year of 2009 there was only one nuclear power plant in Pakistan Chashma-1. The nuclear plant was operated by Pakistan Atomic Energy Commission "PAEC". A second nuclear power plant was being establish named as Chashma 2 with the contribution of China National Nuclear Corporation which was have 325 MW of installed capacity and were to be completed with the end of 2009. The nuclear power plants of Pakistan are operated by Pakistan Atomic Energy Commission "PAEC". According to the recent information about the power plants in Pakistan Chashma Nuclear Power Plant 1 and 2 and the Karachi Nuclear Power Plant contains 787 MW of working capacity. Direction given by government to the Pakistan Atomic Energy Commission to enhance ability to produce energy of 8800 MW by 2030.

Renewable energy sources of Pakistan

Pakistan is facing many serious problems of energy same as other developing countries. Pakistan consists of a huge range and high capability of renewable-energy sources production, which have not been diagnosed, accomplished or developed. Today supply of energy primarily does not fulfill and support the present demand. A huge part of the rural areas lack electricity facilities because they are too costly to connect to the national grid. Many renewable resources of Pakistan are technologically having bright prospects for commercial exploitation such as solar, water, wind. Wastes, geothermal and others. Pakistan can be benefited from these as substitute energy in areas where these renewable energy sources exist.

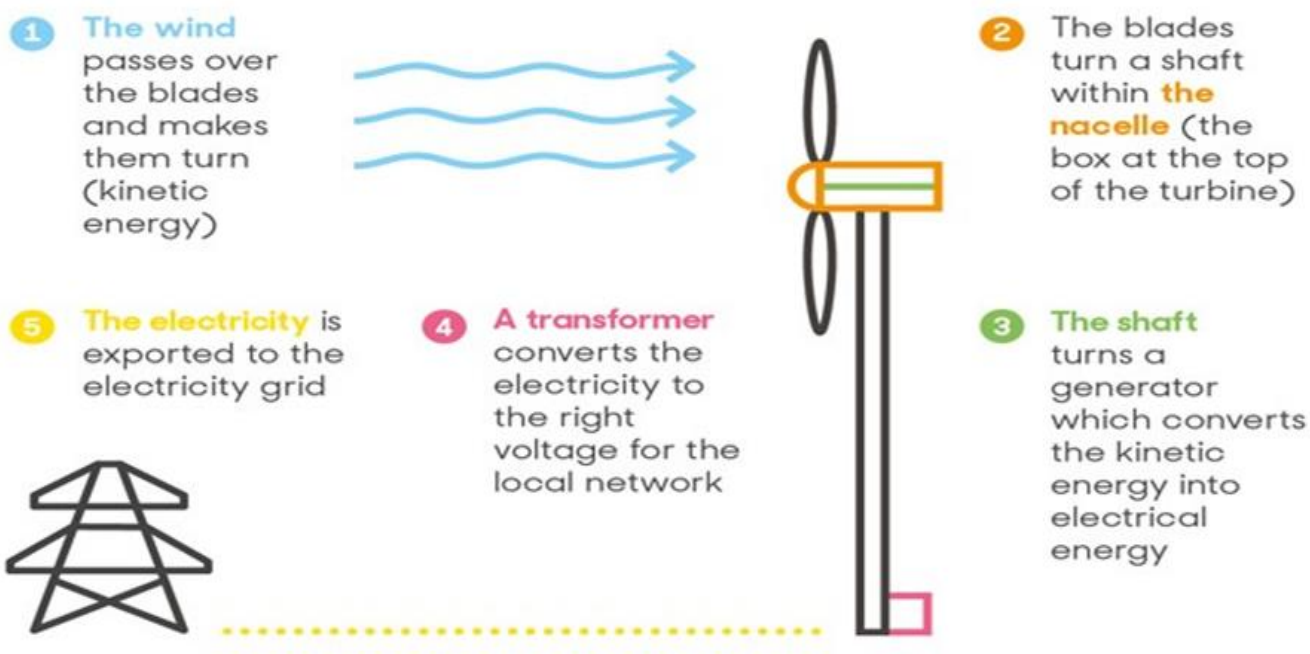
Wind

The production of electricity by wind is a rapidly increasing technique on a commercial scale. Pakistan has the ability to produce electricity by wind but due to the lack of facilities wind power generation process does not exist in the country. The coastline of Pakistan is 1000 km long which can be used as wind farms like as other foreign countries. In 2001 to 2002 The Ministry of Science and Technology has provided funds to the Pakistan metrological department for the formation of chain of wind masts near by the coastal areas. A project was established by the PCRET to install small stand and alone type of turbines for the generation of power in the south

e-ISSN: 2347-7830
p-ISSN: 2347-7822

coastline areas of Sindh and Baluchistan. New Zealand Official Development Assistance has also provided funding for the establishment of wind turbines in poor villages. According to estimation the coastal areas of Sindh and Baluchistan has the gross potential of about 43000 MW by wind electricity while 11000 MW is estimated as the exploited energy production capacity. In many areas of Pakistan about 30 windmills were inserted to pump water, but because of cheap qualities of mills and infrastructure the experiment flopped. A turbine can run 3 km^{-4} km/sec which is the minimum range of wind velocity. Pakistan's speed of wind is examined as 6 m/sec-7.5 m/sec which cindered as the run speed for a turbine (Figure 2).

Figure 2. How a wind turbine works?

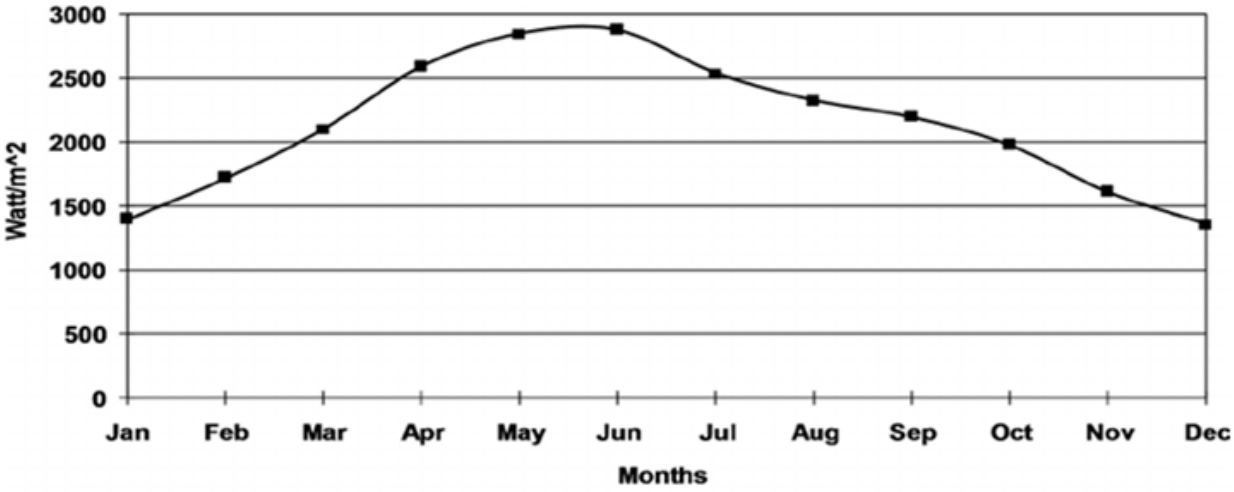


Solar

From the last 20 years solar energy techniques development were least in Pakistan. According to recent studies Pakistan is using the solar technologies in many household, official, technical and commercial sectors. Solar water pumps were inserted by public health department for water in many areas of the country. The photovoltaic techniques are increasing rapidly by the help of private and public sectors in the country. The manufacture of components of photovoltaic systems is being applied by many of companies of the country. Thermal energy can be used in saline water for the desalinization. Pakistan has a good capacity of solar energy, its average amount of insolation ranges as 5.3 kWh per cubic meter. South western areas of Baluchistan has the best environmental conditions for the solar energy production because the sun shines ranges from 8 hours to 8.5 hours daily in these areas or can be says as 3000 hours per annum (Figure 3)[3].

e-ISSN: 2347-7830
p-ISSN: 2347-7822

Figure 3. Average annual solar radiation intensity W/m^2 /day in Pakistan during 1971 to 2000. **Note**: –■– ; Solar raditions.



RESULTS AND DISCUSSION

Pakistan comes in ranges of the area with the 15.5 × 1,014 KWh of solar radiation. People living in rural areas having no supply of electricity like other remote areas so for those regions solar energy is the most available source for the population of these areas. About 13 solar panels with the capacity of 26.5 KW were inserted by the Pakistan Council of Renewable Energy. Today Pakistan is known as the country which is rich for the solar insolation. Pakistan is known as the 2nd high country receiving solar radiations, annual average of solar irradiance is of 1900 kWh to 2200 kWh per cubic meter. According to an estimation the generated solar energy is 8084.72 TW bahawalpur receives energy from the sun is maximum 3300 hours in a year while the minimum amount of energy is received by Gilgit and Chitral is 24 hours in a year.

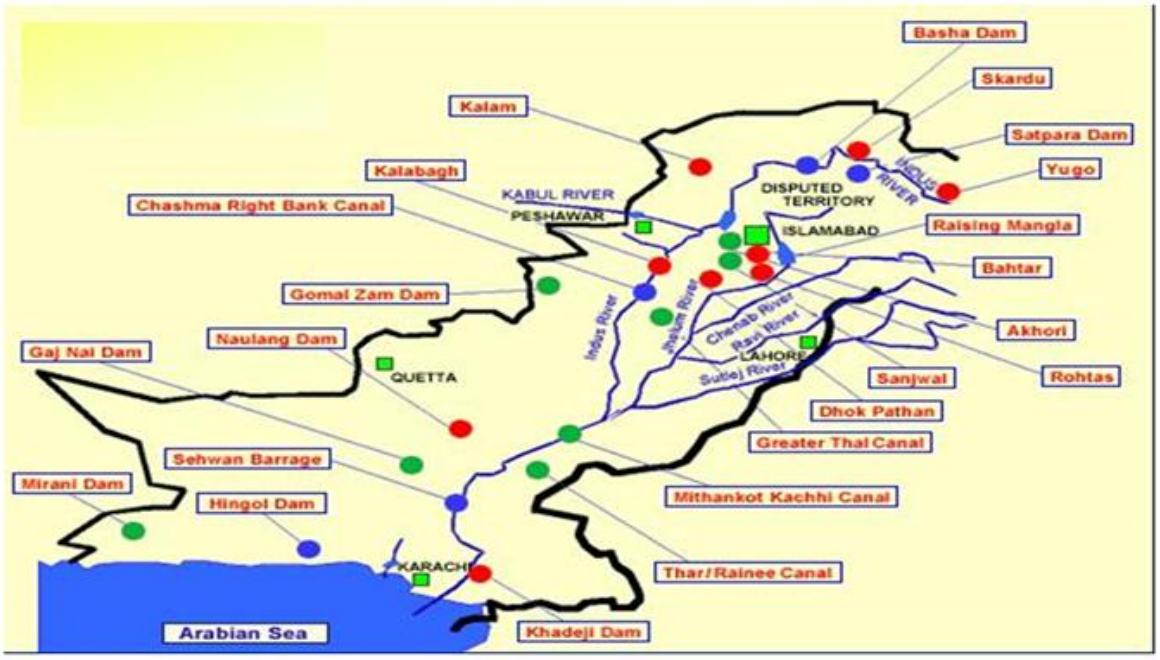
Hydroelectric

Source of energy by water is not rare in Pakistan, the capacity of hydropower according to estimation is about 50,000 MW from which 4800 were become advance during past 50 years. The areas of the north part of the country are richer for the generation of hydropower. The northern areas of Pakistan are consist of many small streams and water falls which have a little capacity to generate electricity by micro hydroelectric power plants. The major irrigation system was developed in the upper and middle parts of Indus basin which use water from Indus and its nearby small water falls for irrigation. Pakistan has 3 big reserves Terbela, Mangla and Chashma, and a huge canal system. Canal system has a higher hydropower capacity which ranges from 1 MW to more than 10 MW and can be used for the development of little hydropower stations. Hydropower is renewable resource, it is not

e-ISSN: 2347-7830
p-ISSN: 2347-7822

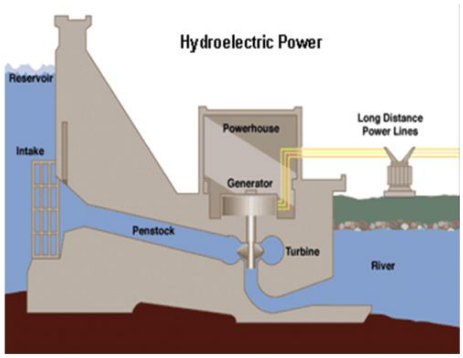
expensive to produce electricity and do not cause pollution to the environment, furthermore it can be reuse. Hydropower play an essential role for the reduction of greenhouse gases[4]. Small hydro plants are the plants that are less than 10 MW, 2 MW, and 100 KW. For the generation of electricity the total hydropower share was 70% in 2004 to 2005 (Figure 4).

Figure 4. Pakistan's hydroelectric power development April 04, 2009. **Note:** ● : Phase 1 (2001 to 2006) ;● : Phase 2 (2006 to 2011); ● : Phase 3 (2011 to 2025); ■ : Cities.



Economic utilization for the hydropower potential in Pakistan is relatively 20,000 MW. Many hydropower plants have been developed at various areas of Pakistan in 1998 of about 4,825 MW, at Warsak 2,40 MW, at Tarbela 3,478 MW, at Mangla 1000 MW as well as small hydropower plant on Canals with capacity 107 MW (Figure 5).

Figure 5. Hydroelectric power generation system.

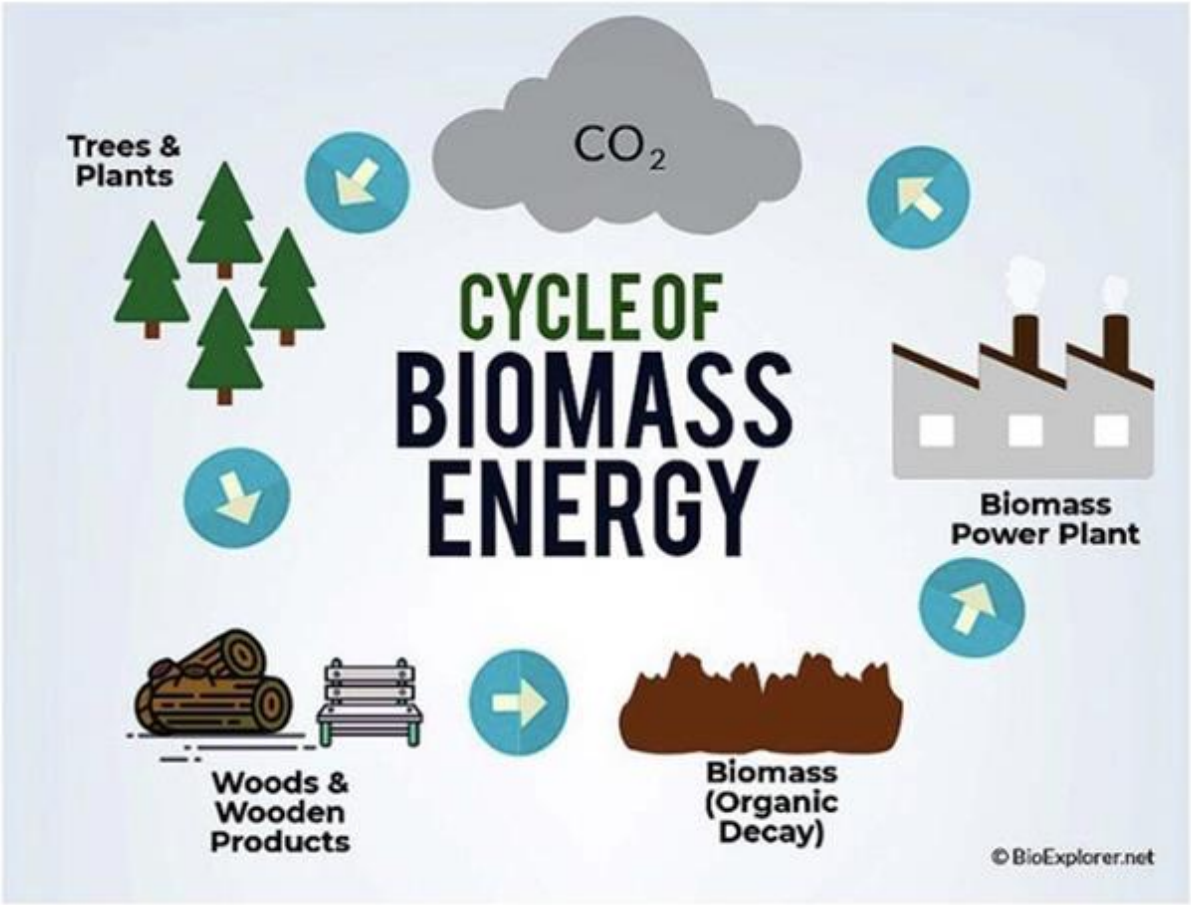


e-ISSN: 2347-7830
p-ISSN: 2347-7822

Biomass

A renewable resource naturally occurring by residues of plants, trees, fuel wood and dung. Most of the population of Pakistan lives in rural areas and depends on fossil fuels for house hold purposes. Biomass is considered as the 4th biggest resource of energy in the globe, has a demand of 14% all over the world. It has the ability to store energy itself, by the use of many techniques it is able to convert onto solid, liquid and gas. In Pakistan mostly produced biomass are cotton stalk, wheat straw and rice husk. About 225,000 tons of crop residues are being produce. The deforestation of forests for housing, utilization of wood for burning and many other fuel based purposes increases the demand and price of wood [5]. Use of cheap type of wood is harmful to health of people relay on biomass causing many respiratory problems and other health hazards. Annual production of energy in Punjab is 15.777 TWh by use of biomass of about 27.86 million tons. Pakistan contains 72 million animals in number, 785 million birds, 81 million tons per year plant wastes. Animals are known to produce approximately 360 million kg of 50% dung per day, birds' 39.2 million kg of 50% and crops 27.5 million cubic meters produce energy of 1900 MW (Figure 6).

Figure 6. Cycle of biomass energy.

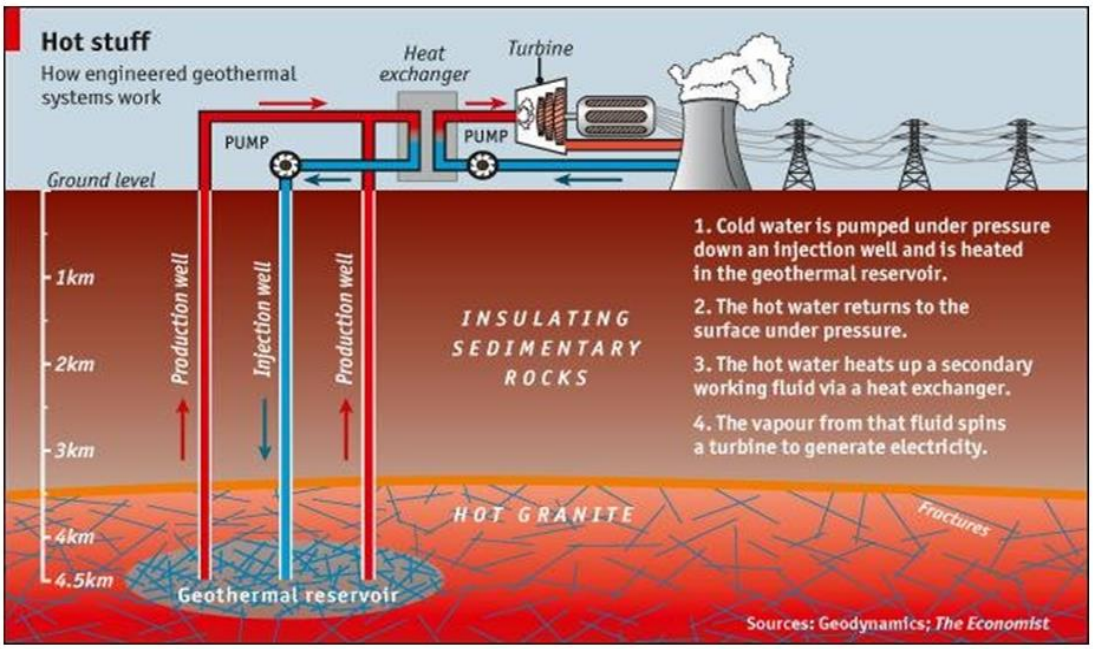


e-ISSN: 2347-7830
p-ISSN: 2347-7822

Geothermal energy

The energy arise from the core of the earth is called the geothermal energy. Geothermal energy has been used in many ways by people as healing and physical therapy, household, and other. Geothermal resources have been used by human at first about 10,000 years ago. Geothermal resources are related to the seismic belts with weak crustal zones. Pakistan has a global seismic belt passes towards it. The geothermal energy resources were introduced which indicates about 600 surface, estimated capacity of 800,000 KW. The manifestations of geothermal energy in Pakistan found along with 3 geothermal environments such as the geo pressurized systems related to basin subsidence, the seismic tectonic or suture related systems, and the systems related to Neogene Quaternary volcanism[6]. According to estimation electricity can be produce by geothermal source in Pakistan is of about 240 GW. Pakistan consists of with ranging temperature of 30 degree to 170 degree many of the geysers, hot springs and mud volcanos. There is lack of locality, lack of attempts in Himalayan range for the utilization of geothermal energy in Pakistan. Further Pakistan lacks the power plant for geothermal energy. It's the duty of both the private and public sectors of Pakistan to make practical implementation of geo-thermal power plants to overcome the energy crisis (Figure 7).

Figure 7. Geothermal energy process.



Tidal energy

Tidal energy forms due to the tidal currents, tidal currents results when the moon is pulled due to the gravitation, that's why the tide goes in and out at seaside. Barrages are biggest structures may built to use for the generation of energy. Tidal energy has a process of capturing the water at high tide and releasing at low tide and high tides would be trapped in a reservoir, the tide drops and the water than flows by a power containing turbine,

e-ISSN: 2347-7830
p-ISSN: 2347-7822

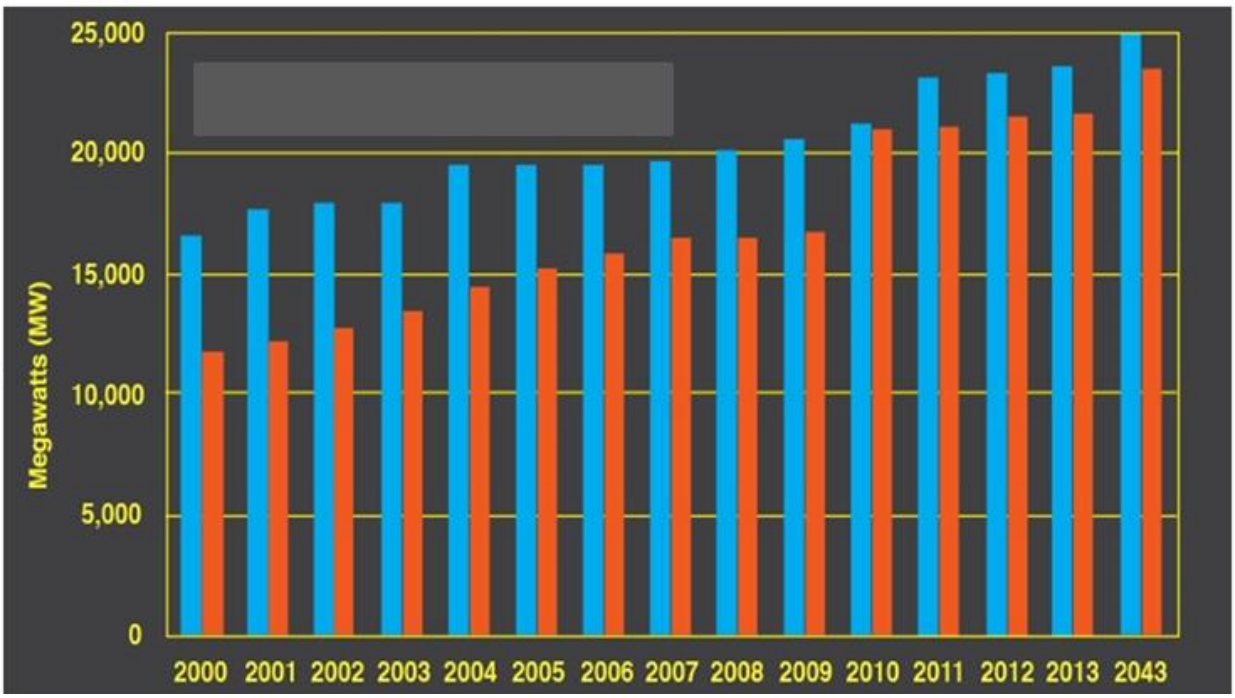
electricity will produces. Tidal streams are a diffuse form of energy and the purpose of the barrage is to concentrate tidal flow, this also means that large numbers of turbines, spread over relatively large areas of seabed, are required if significant amounts of energy are to be extracted. The creek system of Indus delta extends over an area of 170 Km. Tidal water flows in these creeks with high velocity during flood. In Pakistan areas of delta creek are able to generate relatively 900 MW of electricity by tidal currents. A survey by the National Institute of Oceanology estimate that the potential of tidal energy is highest in the creeks that are spreading from Korangi Creekto Kajhar Creek near the Pakistan India border. The heights of tidal waves are from two to five meters. The Kalmat khor and Sonmiani khor creeks of Baluchistan are considered as good sources of tidal energy in Pakistan[7].

Energy crises in Pakistan

Today energy is being essential for the survival of life it is the first priority to increase any country's economic condition. For the sake of successful achievements a country needs the proper use of energy resources. As Pakistan is an undeveloped country, so that's why for the sake of more development to increase its industrialization sector purposes for supporting its population's needs there is a need of more amount of energy resources. Pakistan facing energy shortage problems, the supply of energy is least, a huge gap has been taken place in between the supply and demand of energy during past few years as a result of this power supply has been completely closed from about 10 hours to 12 hours in urban areas and 16 hours to 18 hours in rural areas. Pakistan's economic sectors such as industrial, transportation, agricultural, domestication and also the power producing ones have been effected because of the energy shortages for long time as a result of this country is experiencing more economic loss. Country is more dependent on non-renewable energy resources, which are the source of many environmental effects such as greenhouses gasses emissions results in greenhouse effect, carbon emissions, global warming, and changes in weather patterns. Demand of energy is rising of about 9% in a year in Pakistan. According to estimation that the demand of energy in Pakistan may raise 8-fold to the upcoming future in 2030 and 20-fold in 2050. Energy crises in Pakistan purely shows that the dependency of economic sectors on fossil fuels is the main reason for the crises of energy in Pakistan because first these resources are more expensive and second are too short to supply. The share of hydropower has been reduces recently. About 0.3% of the country's energy demand fulfil by renewable power generation resources. The agency of international energy estimated that by the end of 2017 the solar energy potential was 402 gigawatts. Pakistan is located at the Sun Belt in the earth absorb a great quantity of energy from the sun in a year, to control energy crises in recent era it is necessary to accomplish the solar energy resources. Due to the over use of energy resources, oil has been decreased of about 80 percent, if the resources of oil continuously been used as the same way so it's a huge concern that the oil resources would be available only for 32 years. The dependency on fossil fuels for power production is not significant for the globe[8]. Oil is being supplied to all over the world mainly by Iran, Qatar and Russia, if they stopped the supply of oil to the globe the dependent countries would face energy crises. World is facing the global hazards due to the fossil fuel emissions to the atmosphere, people are working to prevent the effects by the replacement of non-renewable energy resources with the renewable ones[9]. Utilization of solar and wind energy is the best way to overcome the energy crises but the problem is that these resources are not as available as we need (Figure 8).

e-ISSN: 2347-7830
p-ISSN: 2347-7822

Figure 8. Installed capacity and maximum demand for electricity in Pakistan (Dawn news 5 Aug, 2016)
Note: : Installed capacity; : Max demand.



The potential of power plants to generate electricity is of about 22,957.4 megawatts while energy demand in the country is least as 17000 MW. If it's true so here some questions arise that than why Pakistan is suffering from energy crises, what are the reasons for the load shedding and less power supply in Pakistan, why the generation of electricity is so less if there is capability of power production of about 17000 MW. If it's true so there should not be the crises of power in Pakistan otherwise these statements are known to be fake or assumed, not adequate.

CONCLUSION

The economic growth of a nation and its development is based on its energy sectors advancement. But as a nation needs to grow its economy it should be careful for the crises which may arise due to the activities the nation done. Pakistan is rich in production of energy resources but there is less capabilities to completely take benefits by resources due to lack of implementation, norms, principles, management and monitoring. On the other hand the nonrenewable resources are becoming more harmful for the environment and human beings and other livestock's, because of the harmful emissions in to the environment. So, keeping in mind that the demand of energy have to be discouraged and guidelines should be provide to aware the consumers and sellers about energy crises, there is need for establishment of a law, should be made and implemented around the globe that no country can emit greater than a limited amount of harmful gases that cause pollution, greenhouse effect and environmental changes.

e-ISSN: 2347-7830
p-ISSN: 2347-7822

REFERENCES

1. Memon HU, et al. Analysi of the power generation sources in pakistan.
2. Latif A, et al. A review of renewable energy resources in pakistan. J Glob Innov Agric Soc Sci. 2014;2:127-132.
3. Shakir M, et al. Alternate energy resources for pakistan: Sustainable solutions for fulfilling energy requirements. World Appl Sci J. 2014;31:718-723.
4. Baloch MH, et al. Hybrid energy sources status of pakistan: An optimal technical proposal to solve the power crises issues. Energy Strategy Rev. 2019;24:132-153.
5. Qureshi MN. Energy crisis in pakistan: A threat to national security. Islamabad: ISSRA 2009.
6. Kanwal S, et al. Infrastructure of sustainable energy development in pakistan: A review. J Mod Power Syst Clean Energy. 2020;8:206-218.
7. Irfan M, et al. Solar energy development in pakistan: Barriers and policy recommendations. Sustain. 2019 ;11:1206.
8. Bint Faheem J. Energy crisis in pakistan. Int J Technol Eng. 2016;3:1-6.
9. Rafique MM, et al. National energy scenario of Pakistan–Current status, future alternatives, and institutional infrastructure: An overview. Ren Sustain Ene Rev. 2017;69:156-167.