Systematic study of renewable energy–resource potential in Pakistan

Qasim Rauf1, Yanpin Li1 and Anam Ashraf1

1 North China University of Water Resources and Electric Power, Henan, China
E-mail: anamashraf100@yahoo.com

Abstract. Earth does not have an equal distribution of energy sources. Electricity performs a major contribution in the socio-economic improvement and national development of nation. Energy is essential for all financial exercises. In 2008 the government of Pakistan paid almost 9 billion USD to fulfill the energy demand by importing the crude oil. After this Pakistan’s national economy effected badly. Now Pakistan is facing and going through its most bad period of energy crisis. The sustainability of the energy sector is directly proportional to the economic sustainability of the country. The important task of this paper is to highlight the perspective of renewable energy in Pakistan. This paper contains the current situation and future plans of renewable resources like Solar, Wind, Hydel, Biogas, Geothermal energy. The total current capacity of operational projects is solar 100 MW, Wind 308 MW, Biogas 145 MW, 98 MW micro hydel. While the many projects are in different stages of the development like solar 856MW, wind 1146 MW, biogas 297 MW and micro hydel 2638 MW. This paper is also presenting the review about the renewable energy resources potential available in the country that is not exploited yet for the steady and reliable energy supply. This paper contains the information regarding the renewable energy which will be helpful for the government as well as for the stake holder of private sector, those who wants to invest in Pakistan for the renewable energy. The renewable energy resources are abundant and have great potentials that shows, Pakistan can minimize the energy gap between demand and supply in the future and overcome the energy crisis. This paper will be helpful for the government as well as the stake holders of national and international level.

1. Introduction
In this era of globalization the demand of energy is increasing rapidly. Energy performs a major role in the advancement of country. The dependency of countries on electricity indicates us that the energy will be the biggest problem in coming years so we must find some alternative sources that fulfill over energy demands. Pakistan is a developing country and requires more energy to fulfill the requirement of households, industrial and agricultural needs. Pakistan is facing the worst problem of energy shortage and going through the periods of energy crisis. The energy crisis in Pakistan is due to the lack of planning for the future development at country level. It will be great referred to reality that the technological and the industrial advancement is heavily depends upon the fossil fuel. The major portion of energy all over the world still relies on the fossil fuel. According to (Odum and Odum 2001), the world is running on 60 % non-renewable resources. “It’s expected that worldwide energy demand will be increase by two thirds in 2001-2030 (IEA, 2002a).” These conventional energy resources have not huge reservoirs and these reservoirs are decreasing day by day because demand of energy increasing with the rate of advancement and the rate of population as well. These reservoirs will not last very long. “It is predicted that fossil fuels can only meet the world's energy demand just for three decades more (IEA, 2002a).” Because of the excessive use of non-renewable energy resources the climates changes rapidly, which is mainly caused of global warming by the emission of greenhouse gas emission from energy generating systems.
For energy Pakistan uses conventional sources highlighted below.

1.1. Conventional sources:
   a. Thermal Energy
      - Coal
      - Oil
      - Natural Gas
   b. Nuclear Energy

1.2. Renewable energy and primary energy consumption in Pakistan
Pakistan has enormous resources of renewable energy that can be used for the generation of electricity. The northern areas of Pakistan have huge ranges of mountains and glaciers that can be used for the hydropower projects of different sizes. Following 1970’s oil crisis, the issues from claiming "security of vitality supplies" and "sustainable utilization of vitality sources" need get exceptionally imperative approach issues. Starting with then, the issue of using alternative source of energy becomes very popular and the non-oil producing countries and the developed countries faced the immense supply of oil problem. At that time they created a financial recession in all over the world by raising the oil prices. After the green rising movement the agenda of environmental problem was become dominant.

As far as the fossil fuels are concerned its still important in the world as main energy supplier. The 60% of the total energy comes out from fossil fuels. The utilization of fossil fuels is more than the earth capacity to generate it. So, the reservoirs of oil are depleting out exceptionally quick and it is anticipated that, “the remaining reservoirs can only meet the world's energy demand just three decades more (IEA, 2002a)”. In addition, the environmental issue that is caused of non-renewable energy resources is another huge peril with in future. Along with environmental issues, climate alters too made financial and social misfortune. Since of these reasons, the energy generation from renewable resources has been picked up in the energy policy agenda [1].

Pakistan has huge potential and resources of renewable and non renewable energy sources, which are unexplored. So, as a result fossil fuels cannot meet the demand of electricity; the price of per unit is almost 12 to 18 PKR per unit. Moreover, very huge part of the rural areas and villages didn’t have the facilities of electricity because either its cost is too high or these areas are too far from the national grid and the country is facing the huge problem of economy because of electricity shortage. If we consider the Pakistan textile industry it is also affected badly.

In current energy supply of country the ratio of Oil is (30%) and gas is (48.5%). Pakistan is full of natural resources, but the resources that are reasonable, affordable, reliable and have shining prospect to be assumed commercially are(Solar (PV, thermal), Water (mega & local macro-micro-hydel), Wind, Wastes/Biomass (animal waste) and Geothermal energy. The conventional resources cannot fulfill the demand of energy in the country. Pakistan is not a developed country and has the issue of economy as well. Therefore, the development is very important in this field to meet the challenges of the country. [2]

1.3. Potential of renewable energy resources and current development status in Pakistan

1.3.1. Solar power
The energy which obtained from the sun radiation is known as Solar Energy. Solar Energy is classified into two categories first one is “solar photovoltaic (PV)” and second one is “solar thermal conversion”. In solar photovoltaic (PV) the PV cell directly convert radiation into heat. This procedure is not new one. People are using solar radiation for heating, cooking, drying animal skins, clothes, drying crops, evaporating seawater for extracting salt from years. In community level people using PV cell for vaccine refrigeration, heating water, purification and rural electrification. Pakistan government gives the Solar Photovoltaic plate to the students of schools that convert directly sun radiation into electricity. The second type is “solar thermal conversion”, In solar thermal
Conversions; the thermal collectors generate a stream by heating the liquids and works like a standard stream turbine. Solar energy has picked up acknowledgement around the world; this innovation is encountering a stunning development. According to European Photovoltaic Industry Association (EPIA)[3], over the last decade, the solar photo voltaic (PV) has seen the most noteworthy development of 28%. According to economic Survey 2017-18 revealed that Pakistan’s installed capacity to generate electricity has surged up to 29.573MW by February 2018 which stood at 22.812MW in June 2013, showing the growth of 30 percent [4]. We may be racing down the pathway towards a 100% renewable electricity future, but when it comes to heating, cooling and transport, we are coasting along as if we had all the time in the world. Sadly, we don’t. [4] The total potential of solar power in Pakistan is 2.9 million MW. Pakistan has the 9 hours of sunshine per day is real condition for solar power generation [5]. Pakistan is located in the sunny belt and luckily has high irradiance of sunshine and high insolation level by which can get high advantages of solar technologies. According to the solar mapping survey of National Renewable Energy Laboratory (NREL), USA in collaboration with USAID, Pakistan has ideal conditions for Solar Potential as shown in figure 1.

![Annual average mean daily Solar Radiation, kWh/sq. m](image_url)

**Figure 1. Ideal for Solar Energy [6]**

Pakistan can take advantages and improve the condition of people living in rural areas. According to the calculation approx. 40,000 remote villages can be electrified by using the solar energy [7]. Those areas where the installation of transmission lines is expensive solar energy can be used. Solar technologies have broad scope like on grid and off grid applications as mentioned below.

- **Electricity to Villages**
  Those villages that are so far from the grid and it will be very expensive and not feasible to extend the grid toward these areas. These villages are the best candidates for the solar power energy system. These houses are almost 40,000 [7].

- **Solar Pumps**
  Solar pumps have wide and open market for the investment in Pakistan. Because there is only 22% of people have excess to natural gas.

- **Solar street lights**
Pakistan has total street lights of over 500,000, which used almost 40 MW power. It’s a very good that we replace these lights with solar lights for saving the electricity.

- **Solar fans**
  Solar fan is very helpful and reliable for those who haven’t the excess of electricity.

- **Power project using solar thermal conversion technology**
  Solar thermal conversion technology is pretty similar with the steam turbine. In steam turbine the coal or oil is used in the furnace for making the steam but in solar thermal conversion the sunlight used for the heating the water to make the steam.

Pakistan has five provinces and every province has the huge potential of solar energy. The average irradiance in Pakistan is about 200 to 250 Watt per meter square (W/m^2) per day over a plain surface. The sum is 1.9 to 2.3 MW hour per meter square(MWh/m^2)[8]. In 2003, Pakistan established Alternative Energy Development Board (AEDB) is the sole representing agency of Federal Government [9]. Pakistan governments start so many small and mega projects like this. The mega Project started by Government of Pakistan (GOP) first one of this type, which will produce electricity from photovoltaic (PV) solar on commercial basis. Quaid-i-Azam is the mega project is which based on solar energy, the capacity of this project is to produce the 100MW in start, However this capacity will be increased up to 1000MW with the cooperation of public and private sector [8].Quaid-i-Azam solar plant, look for to attain the socio-financial success and sustainability for the country, for the planet, a higher and for the much better future [9].

1.3.2. **Wind power**

Wind is created as a result of monster convection streams within the earth’s environment, which is driven by the heat energy from sun. It’s implies that kinetic energy in wind is a resource of renewable energy, the wind turbines captures the kinetic energy and convert into mechanical energy and used for power generation. Wind is a type of solar energy, so until the sun exists the wind will exist as well. Wind energy contributes in the total electricity production in the country of almost 0.1% [10]. According to the survey China and India have fourth and fifth place in the largest installation of wind turbines. China and India has almost 45,000 MW (megawatt) potential of wind energy and much larger surface area while Pakistan has 50,000 MW (megawatt) wind potential. Pakistan luckily has everything which most of the countries donot have, like the wind speed is very high near Islamabad the wind speed is from 6.2 to 7.4 m/s (between 13.8 and 16.5 miles per hour). The range of wind near Karachi is between 6.2 and 6.9 (between 13.8 and 15.4 miles per hour) [11].

The two province of Pakistan, Balochistan and Sindh have enough potential of wind energy. Because at there exist a corridor between Gharo and KetiBandar that could alone produce between 40,000 MW to 50,000 MW of electricity. In recent years, the government of Pakistan has completed numerous projects that proves the potential clearly and practically of wind energy in the country. Just the 85 micro winds turbines are installed in Mirpur Sakro which gives electricity to 356 homes, 40 small turbines are installed in Kund Malir which have the capacity to give the electricity to 111 homes. The Alternative Energy Development Board (AEDB) has moreover procured 18,000 acres of land for the establishment of more wind turbines [12].“The Chief Executive Officer of the AEDB, Amjad A. Awan, stated that the total installed wind energy capacity in the country is currently 255.4 MW, but is expected to increase rapidly. Currently 28 projects with a cumulative capacity of 1,396.4 MW are under construction, of which nine have achieved financial closure and 14 are under various stage of project development. Awan did not give details about the balance 1-1.5 GW capacity that the Board expects to be added by 2018[13].”From last few years Pakistan increases the activities in the renewable energy field because the short fall of electricity is increasing day by day. So many European countries are looking for the investment; they announced plans and they are willing to invest in the renewable energy sector. China is the major investor in all sectors of energy in Pakistan[14].

The Alternative Energy Development Board (AEDB) has great efforts and contribution in the development of the energy sector and to minimize the energy crisis of the country. For the collection of data, forty-two stations are installed for wind energy potential data in northern areas at different
heights including the Swat, Dir, Chitral, Gilgit etc. The northern areas are not very suitable and attractive for wind potential energy. In 2007, the yearly Khungi payan power (Dir/NWFP) and Shaheed Gali (AJK) was remained 27.49 W/m² and 208.19 W/m² and with highest wind speed of 2.61 m/s and 6.53 m/s respectively [15,16]. These areas are categorized as low potential wind areas with respect to coastal areas of Sindh. The coastal areas of Sindh indicates the high potential of wind, “The annual average of wind speed at 50 m height has given 8.5 m/s, 7.0 m/s, 7.0 m/s, 6.7 m/s and 6.6 m/s at Jamshoro, Katibandar, Nooriabad Thatta and Gharo respectively [17].” The Corridor of Wind of the Sindh covers an area of 9700 Sq. Kms. The total potential of Sindh corridor area is 43,000 MW but due to the utilization constraints and some other reasons, the area which is available for the production of the electricity is estimated more than 11000 MW [18].

1.3.3. Geothermal energy
The heat that stored beneath the surface of the solid earth in the form of energy is called geothermal energy. Geothermal has large amount of potential in all the provinces of the Pakistan. However there is no exact evaluation about the potential of this source of energy. Geothermal is still one of unexplored energy resource for the production of electricity. Pakistan can solve the issues of energy crisis at a noteworthy level by using the resource of geothermal resource. Pakistan exists in the seismic belt, and majority of the hot springs and mud volcanoes exists in this belt of Pakistan [19]. Geothermal energy comprises around the 2% of the renewable energy [20]. The natural resources like solar, wind are unlimited, but these resources are expensive resources and relatively complex control scheme is required to attain energy for grid stations as compared to geothermal energy. According to the geologist’s survey, the structural study confirms that Pakistan lies on the junction of tectonic plates, that’s why it has abundant reservoirs of geothermal energy including high, medium, low temperature to support energy sector at a significant level [21]. The continuous decaying of 20% fossil fuels and 80% radioactive minerals creates heat inside the earth [22]. This energy is the best cleanest, reliable, abundant, renewable resource of energy. This resource produces less emission of carbon as compared to oil, gas and coal. The best thing about geothermal energy is the 24 hours availability, while solar can produce electricity in the daylight, wind turbine can produce electricity at coastal areas in the favorable wind speed [23]. The setup of geothermal energy is controlled by the geodynamic and tectonic. The fold belts and plates boundaries, including foreland and sub basins, inner deep tensional fracture zones at the anticline axis and the boundaries of graben structures, which considered as heat controlling features [24]. This resource is analysed by four ways namely hydrothermal, geo- pressured, hot rock, dry rock. Due to the flexibility the foremost investigated frame of investigation is hydrothermal resources [25].

1.3.4. Hydrothermal energy
Hot springs or steam springs, geysers or fumaroles are types of hydrothermal energy resources which are continuously flowing in many areas of the Pakistan. The Northern areas of Pakistan namely Chitral, Gilgit, Baltistan and Kashmir have the geothermal resources with the temperature ranging from 80°C to more than 180°C. There are many hot springs in all the provinces of Pakistan.

1.3.5. Deep geothermal resources/enhanced geothermal resources
The geological, tectonics, the active seismic zones and abundant deep oil and gas well with high temperature shows us those deep geothermal resources are available in different areas that could be develop by Enhanced geothermal resources technologies. These resources can produce approx. 30,000 MW electricity [26,27]. Pakistan is producing more than 80% electricity by the fossil fuels (coal, gasoline, oil). While 15% electricity produced by the solar, wind and hydropower resources. Presently the co-produced hot waters from the oil & gas wells are being drained out in dry streams, or re-injected in the wells or evaporated after heating using natural gas. The potential of geothermal energy is huge in Pakistan, the power generation has been estimated 100,000 MW.

1.3.6. Biomass
For the energy security of future and environmental problems is main driving force to increase the utilization of biomass all over the world especially in the developing countries like Pakistan. In the renewable energy the developed countries utilize for the energy production for the feedstock of energy system is waste streams but the Pakistan and the other developing countries are lagging behind and these countries are looking for the correct methods and execution of biomass as an alternative source of renewable energy. The total of global energy nearly 18% of energy comes from the clean energy resources including solar, wind, geothermal, biomass and hydropower [28]. The developing nations are confronting the issue of separate energy crisis driving to antagonistic social and long term financial problem [29]. From thousands of years the biomass energy has been used as primary source of energy for power generation; IEA states that, “biomass as any organic, decomposable matter derived from plants or animal available on renewable resource basis [30].” Biomass includes wood, agricultural crops, waste and manure and herbaceous [31]. Biomass is mostly used for energy; in 2014 the biomass contributes 10% total global supply of primary energy [32]. In the future the use of biomass energy increases up to reach 3000 TW h by 2050 [33].

Pakistan’s 62% of total population lives in the villages and rural areas [34]. The major population of Pakistan’s directly or indirectly involves with the agricultural profession. The traditional biomass fuels like fuel woods, cow dung and agriculture residues are the principal source of energy generation in the rural and villages areas[35]. Biomass is one of abundant resource which is growing and being used with pace. Till now, the 5357 biogas plants have been installed by the Pakistan Council of Renewable Energy Technology (PCRET) (with a net generation capacity of 12-16 millions m/day) on a cost sharing premise [36]. The Alternating Energy Development Board (AEDB), cooperate with distinctive organization from the USA, Denmark and Germany has evaluated the potential of biomass for power generation in Pakistan. This estimate shows the potential of 1800 MW biogases and 500 MW from waste [37]. So, it’s true that considering the quality, quantity and availability of the resources is nothing in front of the current development [38].

1.3.7. Hydro power

Pakistan’s Water and Power Development Authority (WAPDA) publish report, Pakistan has potential of hydro electric power is 100,000 megawatt (MW) with identified sites of 59,000 megawatt [39] but annual flow of rivers could store just 13%. In 1960 the approx. 70% of the energy generation came out from hydel electric power [40]. The hydel power is already well established worldwide, 87% energy generated from renewable resources comes out from hydel [41].

Pakistan’s total capacity of electricity generation is 23,000 megawatt(MW), 6500 megawatt (MW) is produced from the hydro, which is 34% of the total capacity of electricity generation [42]. Pakistan is facing the worst period of energy crisis because the Pakistan’s depends upon the fossil fuels. The main reason of energy crisis is due to price fluctuation and over dependence on imported fuels for the thermal power plant. The country’s power sector in hydropower was once under pinned in 1991 accounting for 45% of power generation, but this contribution reduce to 28% due to short term planning preferred to thermal power [43]. The public and private sector has installed 300 micro-mini hydroelectric plants in the areas but these plants are not connected with national grid [44]. The Khyber Pakhtunkhwa government took the initiative and installed 1000 micro hydro electric power plants with the support of Asian Development Bank. The expected total capacity is 100 MW [45] These power plants designed to support rural areas and off-grid communities by giving them reliable and affordable electricity. The main Potential sources of hydro power are on the rivers of Indus, Jhelum, Chitral and Swat. Some public sectors projects are under construction, include Goln Gol (106 MW), Neelum-jhelum (969 MW), Dasu (4320 MW) and “Tarbela Dam” extension under the supervision of WAPDA. The Tarbela Dam is located on the river Indus, after fourth extension its capacity will be lift up to 4,888 MW from 3,478 MW. The largest earth filled dam in the world is Tarbela Dam [46]. Moreover, In 2025 Water and Power Development Authority(WAPDA) has planned to generate at least 16,000 MW of electricity from hydel[47]. The total micro hydel potential in the Pakistan is 3010 MW as shown in table 1.
Table 1. Small Hydro Potential in Pakistan [48]

| S.No | Area                | No. of Potential Sites | Potential Range (MW) | Total Potential (MW) | Remarks                      |
|------|---------------------|------------------------|----------------------|----------------------|------------------------------|
| 1    | Khyber Pakhtunkhawa | 125                    | 0.2 – 32             | 750                  | Small / Micro based on Natural Falls Flow |
| 2    | Punjab              | 300                    | 0.2 – 40             | 560                  | Canals                       |
| 3    | Gilgit – Baltistan  | 200                    | 0.1 – 38             | 1300                 | Natural Falls                |
| 4    | Sindh               | 150                    | 5 – 40               | 120                  | Canals Falls                 |
| 5    | Azad Jammu & Kashmir | 40                  | 0.2 – 40             | 280                  | Natural Falls                |
|      | **TOTAL**           |                        |                      | **3010**             |                              |

2. Comparison of renewable energy potential for South Asian Countries

Energy is critical directly or indirectly, to the entire process of advancement, development and for the survival of the human being. Energy plays an imperative role in the socio-economic development of the country. South Asian countries are blessed with huge potential of renewable energy. The South Asian countries are Pakistan, India, Bangladesh, Afghanistan, Bhutan, Maldives, Sri Lanka and Nepal. These countries collectively called as SAARC (South Asian Association for Regional Coorporation). SAARC providing the affordable reliable, easily accessible and low to zero carbon electricity in the developing countries, this will be the aim of electricity generation in the next decade [49]. South Asian Countries are taking initiative towards the alternating sources of energy to reducing the overdependence on the fossil fuels. These countries have huge gap between energy supply and demand, to overcome the energy demand they must going towards renewable energy sources [50]. Energy Supply is the major challenge on the street to advancement in the South Asian Nations.

2.1. Analysis of electricity consumption of South Asian Countries

2.1.1. Energy consumption of South Asian Countries per capita

Table 2 shows the comparison of energy consumption of South Asian Countries per capita India have the highest consumption of per capita electricity
Table.2. Total Consumption of energy per capita [51]

2.1.2. Electricity consumption and uses of SAARC

Electricity consumption and uses are showed in below table.

| South Asian country | Per capita electricity consumption in kWh |
|---------------------|------------------------------------------|
| India              | 644                                      |
| Sri Lanka          | 636.3                                    |
| Pakistan           | 457                                      |
| Afghanistan        | 119.8                                    |
| Bangladesh         | 278.1                                    |
| Nepal              | 454.1                                    |

Table.3. Electricity Consumption and Uses [52]

2.1.3. Dependency of SAARC on fossil fuels

Table 4 shows the how South Asian Countries rely on the fossil fuels for the electricity production. Pakistan and India has overdependence on fossil fuels. Five countries have less than 5% of their total energy in renewable energy.
Table 4. Electricity Production [53]

| Country   | Electricity production (kWh billion) | Coal (% of total) | Natural gas (% of total) | Oil (% of total) | Hydropower (% of total) | Renewable energy (% of total) | Nuclear power (% of total) |
|-----------|--------------------------------------|-------------------|--------------------------|-----------------|------------------------|-------------------------------|----------------------------|
| India     | 1052.3                               | 67.9              | 10.3                     | 1.2             | 12.4                   | 5                             | 3.2                        |
| Sri Lanka | 11.6                                 | 8.9               | 0                        | 50.2            | 39.7                   | 1.2                           | 0                          |
| Pakistan  | 95.3                                 | 0.1               | 29                       | 35.4            | 29.9                   | 0                             | 5.5                        |
| Afghanistan | –                                  | –                 | –                        | –               | –                      | –                             | –                          |
| Bangladesh| 44.1                                 | 1.8               | 91.5                     | 4.8             | 2                      | 0                             | 0                          |
| Nepal     | 3.3                                  | 0                 | 0                        | 0.1             | 99.9                   | 0                             | 0                          |

Table 4. Electricity Production [53]

2.1.4. Renewable energy potential of SAARC

Table 5 shows the Solar, Hydro, Wind Power potential in South Asian Countries. These resources are unlimited if countries use these natural sources and reduce the overdependence on fossil fuels, they can provide the cheapest, reliable and affordable electricity to their nation.

| Country   | Solar power potential (kWh/m²/day) | Hydro power potential (MW) | Wind power potential (MW) |
|-----------|-----------------------------------|---------------------------|---------------------------|
| India     | 5.0                               | 150,000                   | 102,778                   |
| Sri Lanka | 5.0                               | 2,000                     | 24,000                    |
| Pakistan  | 5.3                               | 59,000                    | 131,800                   |
| Afghanistan | 6.5                              | 25,000                    | 158,000                   |
| Bangladesh| 5.0                               | 330                       | –                         |
| Nepal     | 4.0                               | 83,000                    | –                         |

Table 5. Renewable Energy Potential [54]

3. Agenda of Pakistan Council of Renewable Technology (PCRT)

In May 8, 2001, The Pakistan Council of Renewable Technology (PCRT) was founded by the alliance of National Institute of Silicon Technology (NIST) and Pakistan Council of Appropriate Technology (PCAT) [55]. According to the survey almost 85 to 90 % efforts of PCRT are directed towards the improvement of existing and cost effective renewable energy resources and remaining 10 to 15 % for the new research based concepts and technologies [56].
The main agenda of PCRT is as follows:

1) PCRT is to do research & development in the field of sustainable energy technologies for the county’s socio-economic development

2) Promote the existing and new technologies to reduce the gap of energy supply & demand.

3) The environmental polluting resources replace with the clean energy resources

4) To promote the research, develop and spread the energy training services or workshops to those people, who are not familiar with renewable energy, those who are living in rural areas, introduce the new trend of renewable energy among them.

4. Objectives of Pakistan renewable energy society

1) For the country’s development, organize the training workshops, seminars, exhibitions and practical projects about the renewable energy.

2) Reduce the poverty in the farther regions implement the different projects of renewable energy.

3) To make great strides and develop the market industry of RE.

4) Public awareness with the help of electronic media like the advertisement etc

5) Make Evaluation and Monitoring Team, who monitors and evaluates the system program & activities that how’s going and implemented system successfully

6) PCRT in dominating in research and development of RE, Research institutes can also plays vital role by revised the topics and introduce new technologies.

7) New technologies can be useful source of employment like new technologies needs skilled men, services installation and maintenance & operations.

8) Provide financial incentives to the individual level like India.

5. Purpose of Study

The whole above discussion is about that how much the potential of Pakistan has in the field of renewable energy. There are so many reasons that is why author wants to write and propose the solution. The total population of Pakistan is 201 million [57]. The statistics of Outlook World Energy, at least 27% or 51 million peoples of Pakistan haven’t the excess of electricity. Infect, they haven’t the basic necessities like clean water, refrigerator etc. Pakistan has total 125,000 Villages and almost 95,000 villages have the excess of electricity and 30,000 villages haven’t excess. Even some villages are connected with grid but they have no reliable excess of electricity and they face the load shedding of 10 to 12 hours per day. In Pakistan 50% of the total population living in the rural areas and they are using the traditional biogas technique for the cooking purposes. They used the animals dung, fire woods and agriculture waste as a fuel. The use of animal dung as fuel for cooking inside the houses cause serious health problem. According to the report of WHO [58] death of more than 50,000 premature occur per year in Pakistan because of the inside air pollution. Especially the children and women are affected most. The main purpose of this study is to highlight the renewable energy resources of Pakistan to make them utilize; if the government of Pakistan reduces the over dependency on fossil fuels and policymakers make the policies for betterment of the people future than we can overcome the electricity shortage which is more than 5GW. There is need to be consider the following points :–

1) Try to rely on the existing natural resources of the Renewable energy.

2) Give the awareness to the public, provide financial incentives and organize the training sessions and workshops about the importance of renewable energy. Public investing so much
on the solid fuels, kerosene oil, batteries, LPG, fire woods, Gas cylinder etc. They can save that money if they use the solar heater, solar lights, solar fans etc.

3) Pakistan government should give the solar power or biomass power to those rural areas where the excess of grid is not feasible, they are candidates for solar energy.

4) Give the awareness about the small biogas plants and provide the opportunities for development of the future otherwise Pakistan will be in the top 5 countries with highest proportion of people living without the electricity.

6. Conclusion
Pakistan has a huge potential in every sector of renewable energy. Its large potential is lies already in well established hydro power industry. Pakistan has also enormous potential in Solar, Wind, Geothermal and Biomass. The government of Pakistan needs to stop over dependence on fossil fuels and accelerate the development towards the clean energy sources. These sources can provide clean, cheap, reliable and low to zero carbon electricity, which is helpful for the global environment as well. These resources are natural and unlimited. Pakistan is taking several initiatives towards alternative source of energy, Alternating Energy Development Board (AEDB) working hard and trying to reduce the overdependence on fossil fuels but yet huge unexploited potential remains. Pakistan must generate only 10% of energy demand from the renewable resources. If Pakistan use the available renewable resources with proper planning and implement the ideas, the country could have surplus energy to supply and overcome the energy crisis permanently. In future we can extend our research by providing a proper road map for the utilization of renewable energy resources in Pakistan to improve the shortage of electricity in our homeland.

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