

Current Energy Crisis and Renewable Energy Sources in Pakistan

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ABSTRACT: Pakistan is suffering through an energy crisis. The demand for primary energy has increased considerably since the year 2000. Current power shortage has been estimated approximately 3,000 MW and would predicted to increase about 5,300 MW by 2010. This research was carried out to identify the importance and potential of renewable energy sources such as hydropower, wind energy, solar energy and biomass energy to overcome energy shortage, strengthen the economy and maintain the current growth rate. Currently, thermal energy has 63 % share in total energy production and carries very high cost of production i.e. \$0.05/KWH, which is 15 times higher than hydropower that is \$0.0033/KWH to produce. The identified hydropower potential in the country is approximately 41,722 MW. It is also suggested how and where to expand the existing energy resources and exploration of new sources in consistent with future forecasting demand.

Keywords: Hydropower, Pakistan, energy demand, renewable energy, solar energy, wind energy, thermal energy

1. INTRODUCTION

Energy played a vital role to boost the socio-economic activities of a country. Pakistan is an energy deficient country and highly dependent on thermal energy which has high cost as compare to other electricity producing technologies. So, it is necessary to identify economical and environmental friendly resources to meet the energy demand and strengthen the economy.

The current energy crisis in Pakistan is going to worsen by the end of 2008, in terms of electricity, as a 50-% increase in demand as well as a slow improvement in the supply is expected. The power shortage that has been estimated to be 3,000 MW this year and would increase to about 5,300 MW by 2010. Overall Pakistan's total energy requirement is expected to be around 80 million tons of oil equivalents (MTOE). In 2010, up by about 50% from previous year's

54 MTOE and by 2030, the nation's requirement will reach 361 MTOE that is 7 times larger than the current requirement [2]. The electricity demand is projected to grow with an annual compound growth rate (ACGR) of 7.9% during the Medium Term Development Framework 2005–2010 of the Government of Pakistan, and increase from 15,500 MW in 2005 to 21,500 MW in 2010 [1] as shown in Fig. 3. During peak demands there is a power outage 3-4 hours in major cities and 4-8 hours in rural areas per day. Because of this, the country has been suffering a decline in annual growth, as many industries have been shut down or have cut down their production. The difference between the normal supply and a peak demand is estimated to be at 5,529 MW by 2009-10 when the normal electricity supply will stand at 15,055 MW against the peak demand of 20,584 MW [3]. The current power demand in Punjab is about 7,027 MW which is expected to rise to 29,103 MW in 2024-25 under the most conservative growth rate of 6.1% [4-5]. The current power demand of 2,642 MW in Sindh is expected to rise to 10,993 MW in 2024-25. The current power demand of 1,697 MW in NWFP is expected to rise to 7,018 MW in 2024-25. The current power demand of Balochistan is 474 MW and is expected to rise to 1,964 MW in 2024-25 as shown in Fig.1. The total installed generation capacity of thermal and hydro is 17938 MW per day as mentioned in Table 2. Countries such as Pakistan could not depend solely on thermal energy as a major source of power in order to sustain its current growth.

Renewable energy potential such as hydropower, wind, and solar is substantial, although presently this potential remains largely untapped. Escalating petroleum prices in recent years have given Pakistan an additional incentive to invest in renewable energy technologies and the survival in term of economy would also demand to use renewable energy sources.

1.1 Hydropower

Hydropower is the most economical way to generate electricity today. No other energy sources, renewable or non-renewable, can match it. The average cost in the year 2000-01 of hydropower generation in Pakistan was 19.95 paisa = 0.03325 cents per kilowatt-hour [6]. Currently, Pakistan generates 6,599 MW, which is 34% by hydropower while the rest from other sources as shown in Fig. 2. The identified hydropower potential in the country is 41,722 MW [1-7]. One of the major pending project is the Kalabagh Dam, with its installed capacity of 2,400 MW (ultimate 3,600 MW), which would add to the system a very large amount of cheap hydropower [12]. In an average year, 11,413 million kilowatts hours of electricity would be generated at Kalabagh [8]. To put these figures in perspective, if Kalabagh was in operation today, there would have been no load-shedding in Pakistan. The energy generated at Kalabagh would be equivalent to 20 million barrels of oil per year [9]. Another mega hydropower project is the Bhasha dam. The Bhasha dam would have a

storage capacity of 7.3 MAF and a power generation capacity of 4,500 MW [8-10], but there is a need to start work on these projects and should not be politicized like the Kalabagh dam. Another project is the Munda dam with 660 MW power and has a storage capacity 1.01 MAF. Beside these, there are many places in the country where small capacity hydropower plants with about 70 to 150 MW could be installed. [10-11]

1.2 Wind Energy

As Pakistan's energy needs are immediate, thermal and large hydro-electric plants may not be the solution because such projects may take 4-12 years to become operational. In order to meet the energy requirements, the best option is to exploit wind energy because wind power projects can start generating electricity within two years. This is why wind energy is the fastest-growing source of power in the world and its globally-installed capacity has risen from 20,000 MW in 2001 to 70,000 MW in 2006 [13]. USA alone is installing 4,500 MW per year, and China plans to install 20,000 MW by 2020. The cost of electricity from utility-scale wind systems has dropped by more than 80% over the last 20 years [14]. Pakistan has considerable potential for wind energy in the coastal belt of Sindh and Balochistan as well as in the desert areas of Punjab and Sindh [15]. This renewable source of energy has, however, not so far been utilized significantly. As per the collected data, the coastal belt of Pakistan is

blessed with a God gifted wind corridor that is 60 km wide (Gharo ~ Kati Bandar) and 180 km long (up to Hyderabad). This corridor has the exploitable potential of 50,000 MW of electricity generation through wind energy [16]

1.3 Solar Energy

Among renewable resources, solar energy is one of the best suited technologies to help, in an affordable way, mitigate climate change as well as reduce the consumption of fossil fuels. Using solar energy, many water desalination plants are in operation in a remote area of Pakistan for the purpose of producing drinking water [17] as shown in Table 1. Pakistan being one of the warmest countries in the south Asia can take advantage of solar energy. A daily average of global irradiation falling on horizontal surface is about 200–250 W/m. This amounts to about 6,840–8,280 MJ/m in a year. The Baluchistan province is particularly rich in solar energy. It has an average daily global irradiation of 19–20 MJ/m a day with the annual mean sunshine duration of 8–8.5 h. These values are among the highest in the world [18]. Such conditions are ideal for photovoltaic (PV) and other solar energy applications. Currently solar technology is being used, in Pakistan, for stand-alone rural telephone exchanges, repeater stations, highway emergency telephones, refrigeration for vaccine and medicines in the hospitals, etc. The Public Health Department has installed about 20 solar water pumps for drinking

purposes in different parts of Baluchistan [16].

1.4 Bio Gas

Pakistan is abundant with animal waste that is used to produce biogas as the major product and fertilizer as a by product. The Government of Pakistan started a comprehensive biogas production scheme in 1974 and commissioned 4,137 biogas units by 1987 throughout the country [19]. The units were designed to provide 3,000 and 5,000 cubic feet of biogas per day for cooking and lighting purposes. This program was developed in three phases. Though these plants are not utilizing for electricity production but there is a need to use animal waste to produce electricity by firstly converting the waste into biogas and then biogas to electricity. In the world, there is 9 % of energy that is being produced by Bio mass [20].

2.1 TABLES AND GRAPHS

Location	Capacity
Vajuto (Tharparker)	250 gpd
Gwadar	6000gpd
Manbai-Jo-Tar (Tharparker)	250gpd
Mithi (Tharparker)	250gpd
Islamkot (Tharparker)	250gpd

Table 1: Solar water desalination Plant

Organization	Thermal	Hydro
WAPDA	5120	4825
KESC	1801	
KANUPP	137	
CHASHMA NUCLEAR	325	
PAKISTAN STEEL	165	
IPPs	5565	
Total	13113	4825
Grand Total	17938 MW	

Table 2: Installed generation capacity
2.2 Illustration and Photographs

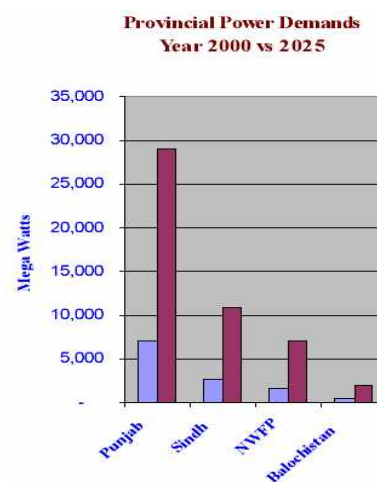


Fig. 1

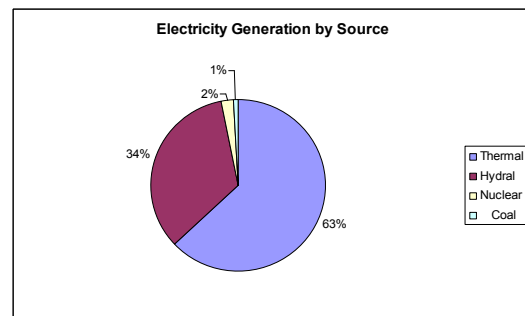


Fig. 2. Electricity generated by sources

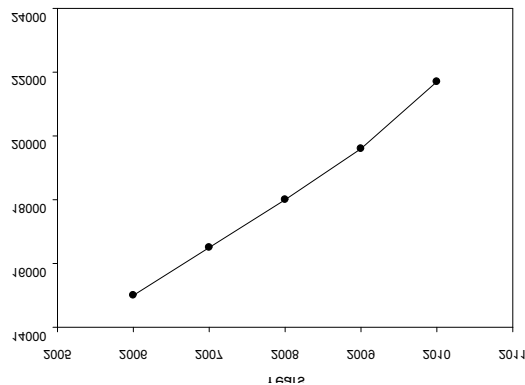


Fig. 3. Electrical Power demand up to 2010. [1-3]

3. CONCLUSION

Hydropower, wind energy, solar energy and biogas are clean and cost effective alternatives of thermal energy and can provide an immediate solution of the current energy crisis. There is much potential to produce energy from the discussed resources, but there is a need to initiate work on both short-term and long-term projects so that Pakistan could take advantage of many abundant, cheap, environmentally friendly and renewable sources of energy, which are remained untapped.

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