Review of renewable energy Prospect in Bangladesh

Dr.Md. Kamrul Alam Khan, Shuva Paul, Md. Rashed Azad, Md. Anisur Rahman

Abstract— : From the very beginning of the civilization human searches for power and energy. Power and energy is the driving factor for all living being. So, endless supply of power and energy is one of the most desirable things in life. But the existing power and energy sources are limited in reservation. That is why there is probability of acute scarcity of power in near future. To solve this power crisis we must move to renewable energy sources. This paper aims to analyze the prospect of different renewable energy sources available in Bangladesh.

Index Terms— Solar Energy, Wind Energy etc.

1 Introduction

POWER and energy is the prime driving factor of the modern civilization. Without power and energy the world will not be able to stand even for a second. Without power the whole life become stand still, the industrial life become damaged. That is why power and energy supply is of great importance. The existing technology we are using to generate power and energy, actually the electricity is most often fossil fuel based energy sources. But the main fact is that the energy that is extracted from the fossil fuel based energy sources is not unlimited with supply. Because the reservation of these fossil fuel is very much limited and will be come to an end within a near future. That is why we must shift to the alternative source of energy. The most common reason for choosing the alternative sources of energy is their never ending supplies with fuel. Renewable energy is one of the greatest parts of the alternative energy sources. Renewable energy sources are becoming too much popular these days because of their availability and

2 Historical Background: Bangladesh

The people's republic of Bangladesh is located in South East Asia between latitudes 20˚34′ and 26˚34′ north and longitude 88˚01′ and 92˚31′ east. The country is bordered by India on the east, west and north and by the Bay of Bengal on the south. There is also a small strip of frontier with Myanmar. The land is a deltaic plain with a network of numerous rivers and canals.

The delta landmass compromises mainly of three mighty rivers the- Ganges, the Brahmaputra and the Meghna, with a network or numerous rivers and canals. The total area of the country is 147.57 thousand square km in which about 15% is forested. There are a few hilly areas in the southeast and the north east of the country.

Except the hilly regions in the northeast, some areas with high lands in the north and northwestern part, the country consists of low, flat and fertile land. The alluvial soil is thus continuously being enriched during the rainy season by heavy silts deposited by rivers. The country has about 2734 km of railroad, 17554 km of paved road and roughly 5968 of perennial and seasonal waterways.

Bangladesh is located in the sub tropical region with a strong dominance of monsoon with a hot and rainy summer and a pronounced dry season in the cooler months. January is the coolest month of the year, with temperatures averaging near 26˚ C and April the warmest month with temperature ranging between 33˚ C and 36˚ C.

The climate is one of the wettest in the world; most places receive more than 1525 mm of rain a year, and areas near the hills receive 5080 mm. Most rain falls during the monsoon (June-September) and a little during the dry season (November – February). The Padma- Jamuna- Meghna river system divides Bangladesh into two zones, east and west.

3 Energy In Bangladesh

Bangladesh has small reserves of oil and coal, but potentially very large natural gas resources. Commercial energy consumption is around 71% natural gas, with the remainder almost entirely oil (plus limited amounts of hydropower and coal). Only around 18% of the population (25% in urban areas and 10% in rural areas) has access to electricity, and per capita commercial energy consumption is among the lowest in the world. Noncommercial energy sources, such as wood, animal wastes, and crop residues, are estimated to account for over half of the country's energy consumption. Consumption of wood for fuel has contributed to deforestation and other environmental problems in Bangladesh. The World Bank has estimated that Bangladesh loses around $1 billion per year due to power outages and unreliable energy supplies.

Bangladesh's Ministry of Energy and Mineral Resources (MEMR) has overall responsibility for the country's energy sector, with policy formulation and investment decisions under its control. Within MEMR, the "Power Cell" acts as a single point of contact to facilitate the electricity reform and restructuring process, such as development of Independent Power Projects (IPPs)[www.geni.org].

Riverine Bangladesh is utilizing wind energy in the sailboats from ancient time. Electricity generation or water pumping system from wind turbine has not started yet. The Bangladesh Meteorological department has wind speed measuring stations in towns and cities. Data from earlier measurements and analysis of upper air data by CWET India show that wind energy resource of Bangladesh is not good enough (>7 m/s) for

grid connected wind parks. At present, several wind resource assessment program is ongoing in the country [1].

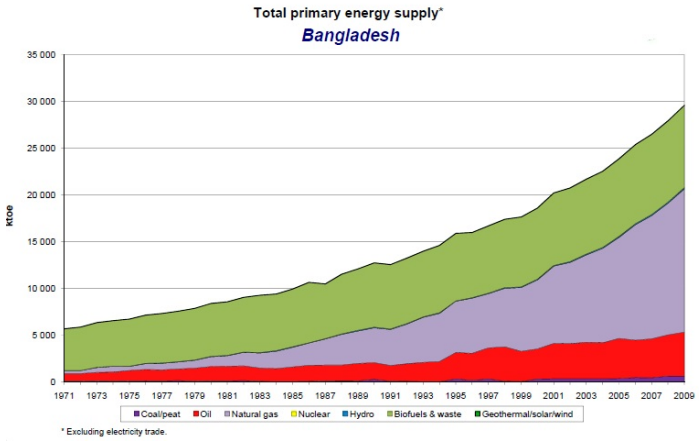

Figure 01: Total Primary Energy Supply in Bangladesh[2]

3.1 Tidal Energy

Bangladesh is a country with low use of electricity (per capita consumption of 95 Kw.hr) and considerable need for development along its coastal area. Current electrification is estimated at only 16% of the population, with rural access of less than 5% (BCAS, 1998). This places Bangladesh's electrification rates amongst the lowest in the world. Bangladesh has a long coastal area (710 km) with 2~8 m tidal height/head rise and fall (table-1, BIWTA, 1999). It also has some large tidal sites and many channels of low tidal range in a large number of deltaic islands, where barrages and sluice gates already exist. Therefore, the potential for tidal power to be harnessed is significant, because the barrages necessary for creating controlled flow through turbines (to tap tidal power) are also needed for flood control. This avoids the problem of high capital cost as the engineering is either already there or is needed for cyclone protection. Analysis of the following two tables indicate that Bangladesh has very good prospects for tidal energy, particularly in Sandwip. The island of Sandwip is located in the Bay of Bengal, adjacent to Chittagong and is a mere 15 km from the mainland. The population is around 330,000 on an area of 240 km2. The entire island is a mudflat created from the Ganges delta. A scoping visit to Sandwip was made in late November, 1999 by the Executive Agencies (Institute for Sustainability and Technology Policy (ISTP), International Centre for Application of Solar Energy (ICASE) and Tidal Energy Australia (TEA) assisted by the Rural Electrification Board and Grameen Shakti of Bangladesh. This island is not a tourist haven and is also rarely visited by Bangladeshi's. The 5 m tides experienced at Sandwip results in poor accessibility, with the island constantly surrounded by mud flats, except during high tides. The island is subject to flooding from cyclones and in 1991 over one thousand people were drowned. A flood control barrage exists around the entire island and contains 28 sluice gates. A short electricity grid is also available linking the main commercial areas on the island. Two diesel generators of 200 KW run for a few hours late afternoon/early evening supplying electricity, mainly for commercial use. Some households have batteries and some diesel generators are used for powering rice threshers. A photo voltaic (PV) system is used to maintain a fridge for vaccines in the health centre. The mud flats are composed of extremely rich soil, hence it is easy to grow a variety of food crops. The island is an exporter of rice and is largely self sufficient in vegetables and fruits. No aquaculture is conducted on the island, though shrimps are collected from the mud flats. None of the island's schools or colleges have electricity and opportunities for employment growth on the island are limited [3].

3.2 Solar Energy

The energy needs of Bangladesh are great not just because of limited supply; the issue is also mainly one of access. About 80% of the population resides in areas where electricity is akin to a dream. There are estimates that many parts of the country will still not acquire electricity from the national grid for another 30 years. The national grid covers at most 20% of households, but this statistic does not capture the infrequency of access and the resources needed to bolster it.

Solar energy therefore has significant potential for Bangladesh. Solar power does not require sophisticated technology or know-how. It does not require fossil fuels to function, and is highly reliable: it is an economically feasible energy source. There are studies that suggest that if solar energy is adopted, as much as 10,000 megawatts daily of solar electricity can be created in the short- and medium-runs – this is equivalent to twice the total amount of electricity produced and supplied on the national grid.

In 2008, at the Washington International Renewable Energy Conference, Bangladesh pledged that 5% of its total electricity generation would come from renewable sources. In 2009, the Bangladesh Bank set up a US$29m fund to promote solar power. Private commercial banks and state-owned banks signed an agreement with the central bank that allowed banks to draw money from this fund under a refinancing scheme with a low-interest interest rate of 5%. The banks could then lend the funds to borrowers from the solar power sector at a ceiling interest rate of 10%.

Although the Government of Bangladesh, along with the central bank, have made strong moves to bolster its solar power investment, in general, banks have not been interested because they do not find solar technology as profitable as other areas of business. The task at hand now is to make solar energy investment more attractive for lenders so that this area of renewable energy can be stimulated and grown [4].

Solar energy has been used in Bangladesh for centuries in a variety of economic activities such as drying of washed clothes, food grains, fish, vegetable, raw jute etc and evaporation of saline water for salt production. There are various activities in rural Bangladesh which totally depend on the use of solar energy if these could be performed more quickly and efficiently by using simple devices, it would increase productivity without making and demand on commercial energy sources. In Bangladesh research and development work to harness solar energy in the form of heat has been going on for many years at Dhaka University, Bangladesh Agriculture University, BUET, Solar Park of Dhaka College and BCSIR

Laboratories.

Monthly Global Solar Insolation at Different Cities of Bangladesh (in kWh/m^2/day)

Month	Dhaka	Rajshahi	Sylhet	Bogra	Barishal	Jessor
January	4.03	3.96	4.00	4.01	4.17	4.25
February	4.78	4.47	4.63	4.69	4.81	4.85
March	5.33	5.88	5.20	5.68	5.30	4.50
April	5.71	6.24	5.24	5.87	5.94	6.23
May	5.71	6.17	5.37	6.02	5.75	6.09
June	4.80	5.25	4.53	5.26	4.39	5.12
July	4.41	4.79	4.14	4.34	4.20	4.81
August	4.82	5.16	4.56	4.84	4.42	4.93
September	4.41	4.96	4.07	4.67	4.48	4.57
October	4.61	4.88	4.61	4.65	4.71	4.68
November	4.27	4.42	4.32	4.35	4.35	4.24
December	3.92	3.82	3.85	3.87	3.95	3.97
Average	4.73	5.00	4.54	4.85	4.71	4.85

Source : Dr. Shahida Rafique, Dhaka University, recorded from 1988 to 1998

Figure 02: Monthly Global Solar insolation at different cities in Bangladesh [5]

3.3 Wind Power

The long term wind flow in Bangladesh, specially in islands and in southern coastal belt of the country indicate that the average wind speed remains between 3 to 4.5 m/s for the month of march to September and 1.7 to 2.3 m/s for the remaining period of the year. There is a good opportunity in island and coastal areas for the application of windmills for pumping and electricity generation. A number of small wind generators have been installed by various agencies in coastal areas. These include wind generators installed by Grameen Shakti at its Chakaria shrimps farm, BRAC and GTZ (a German NGO). BRAC alone has installed 11 wind turbines at various coastal areas. These are small low cutting, DC operation type systems, supplying power to the target group to improve their quality of life.

Annual average wind speed of different sites of Bangladesh during 1961 to 1993 [Bangladesh Meteorological Department]

Site	Reference height (m)	Annual average wind speed (m/s)
Teknaf	5	2.16
Cox's Bazar	10	2.42
Patenga Airport	5	2.45
Kutubdia Island	6	2.09
Sandip Island	5	2.16
Hatia Island	6	2.08
Bhola Island	7	2.44
Khepupara	10	2.36
Comilla Airport	6	2.21

Figure: 03: Wind Energy in Bangladesh [5]

3.4 Nuclear Energy

Nuclear power is desirable in Bangladesh, due to its underdeveloped and mismanaged energy infrastructure, (See: Electricity sector in Bangladesh). With a derated capacity of around 5500 Megawatt (MW) on an installed rating of over 6000 MW, only around 4000 is actually available. With a maximum generation of 4500 MW in mid-2010 to 4700 MW in late 2010, the peak is anywhere from 5700 MW to 6000 MW and only about 40% to 48% of the total population have access to electricity. The per capita consumption of 218-230 kWh and the availability is the lower among any developing country in the world [6].

3.5 Natural Gas

In recent years, several trillion cubic feet (TCF) of natural gas have been added to the confirmed 10.5 TCF known as of 1996. Due to the fact that there has been comparatively little exploration to date, estimates of the total extractable natural gas resource in Bangladesh are uncertain and vary widely. An estimate of 20 TCF is gaining acceptance among experts, but some argue that experiences in comparable basins elsewhere in the world suggest that the ultimate recoverable resource could be as high as 50 TCF or even 100 TCF.

At the current rate of natural gas use in Bangladesh (1000 mmcfd), the current estimated proven reserves would last 45 years. Even if the present rate of use increases at 10 per cent per year, these reserves would last about 17 years. A reserve-production Reserves-to-production ratio of 17 is higher than that for most industrial countries heavily dependent on natural gas, examples being Norway, Canada, U.S., and U.K. Here only the R/P ratio of gas is being considered for comparison. Relative to Bangladesh, these industrial countries have more diverse indigenous energy sources such as coal, oil and nuclear. The U.S. still uses coal to produce more than half its electricity.

There are huge resources of gas in Bangladesh. Places where gas is commercially refines include: Titas, Habiganj, Bakhrabad, Narshingdi, Meghna, Sylhet, Kailashtilla, Rashidpur, Beanibazar, Fenchuganj and Salda Nadi[6].

Natural gas is Bangladesh's only significant source of commercial energy, with 1999 production of 319.6 billion cubic feet (Bcf). Bangladeshi natural gas production began in 1960 from the Chattak Field. There is much uncertainty and debate about the level of natural gas reserves in Bangladesh. Current Bangladeshi government estimates, based on a joint study conducted with the Norwegian Petroleum Direcftorate put net proven reserves at 16.3 Tcf. The US Geological Survey recently estimated that Bangladesh contains an additional 32.1 Tcf in additional "undiscovered reserves." Bangladesh may have the potential to become a major gas producer (as well as supplier to the vast potential market in neighboring India) at some point. Bangladesh also could use its natural gas resources to power vehicles (the government already has announced plans to convert government vehicles to compressed natural gas to help alleviate pollution problems in Dhaka, and also in response to high oil prices), to produce electricity, petrochemicals, and fertilizers, which it also could use both within the country as well as for export. Natural gas exports are controversial within Bangladesh, with many people feeling that Bangladeshi gas resources first should be used for domestic purposes (i.e., electric power generation, fertilizer production, transportation), and also that the size of the country's gas reserves remains highly uncertain, particularly in relation to future domestic demand projections. Both major political parties are officially committed to considering natural gas exports only if Bangladesh has proven reserves sufficient to cover 50 years of domestic demand. There was some indication that the new government of Prime Minister Khaleda Zia would be more favorably disposed to natural gas exports to India, and it created a panel in December 2001 to study the issue and recommend a decision. Unocal had submitted a formal proposal

for an export pipeline to India in November 2001, which would link the Bibiyana field to India's main natural gas backbone, the HBJ Pipeline. The Bangladeshi Supreme Court, however, issued an injunction later in December 2001 prohibiting any action on the issue for three months.

Petrobangla has approximately 20 natural gas fields nationwide, half of which are active. The main fields include: Bibiyana (discovered by Unocal in Block 12), Titas (the country's second largest natural gas field), Habiganj, Kailashtilla, Rashidpur, and Jalalabad, nearly all of which are located in the eastern part of the country, plus the Sangu offshore natural gas field (being developed by Cairn Energy, Shell, and Halliburton) in Block 16 of the Bay of Bengal, 30 miles southwest of Chittagong. Production from Sangu, Bangladesh's first offshore field (with estimated reserves of around 850 Bcf), began in June 1998. Sangu is one of Bangladesh's most important natural gas discoveries to date, and the first foreign-run natural gas field. In January 2000, Shell Bangladesh Exploration and Development -- SBED -- along with partners Cairn Energy and HBR Energy reportedly discovered a new natural gas field near Sangu (South Sangu-1). In August 2000, SBED announced that it had invested $40-$50 million in new offshore natural gas exploration projects in Bangladesh, including the Sandwip East 1 well in Block 15 (Bay of Bengal). Other possible natural gas fields include Shaldanadi (estimated reserves of 500-1,000 Bcf), Fenchuganj, Feni, Kumta, and Shahbajpur.

Major foreign energy companies active in natural gas exploration and development in Bangladesh include Shell, and Unocal, which operates in Bangladesh through its wholly owned subsidiary, Unocal Bangladesh, Ltd. In early 1997, Unocal acquired 50% interest in Occidental blocks 12, 13, and 14. Unocal also is involved in two PSCs with Petrobangla covering Blocks 12, 13, and 14. In 1998, Occidental-Unocal discovered an estimated 4.-5 Tcf of gas-in-place on Block 12. In May 1999, Unocal took over the assets and operations in Bangladesh of Occidental, which had experienced a major explosion and fire at one of its wells in the Sylhet area in 1997. Among companies placing bids since the country's second oil and gas licensing round began in 1997 are Cairn and Royal-Dutch Shell on Blocks 5 and 10, and Unocal on Block 7. In April 2000, Bangladesh signed a PSC with Unocal on Block 7. Blocks 5 and 10 were awarded to a consortium of Cairn Energy and Shell in July 2001. In April 2001, Bangladesh awarded rights to Block 9 to a consortium including ChevronTexaco and Tullow Oil.

Besides foreign energy companies, natural gas in Bangladesh is being produced by two subsidiaries of state energy company Petrobangla -- Sylhet Gas Fields Ltd. and Bangladesh Gas Fields Co. Ltd. These two companies produce natural gas for domestic consumption. More than 80% of the natural gas is consumed for power and fertilizer production, and the remainder by industry and households.

Bangladesh's natural gas demand is expected by some independent analysts to grow by around 6% annually over the next two decades. Potential uses for natural gas in Bangladesh include: petrochemicals, compressed natural gas (CNG) for vehicles, power generation, and fertilizer. Bangladesh also contains around 55 million barrels of natural gas liquids (NGLs), which could be used for petrochemicals production or as a cooking fuel to help reduce deforestation and pollution. Production of NGLs is currently only about 200 bbl/d.

Shahbazpur, discovered by Petrobangla subsidiary Bapex (Bangladesh Petroleum Exploration Company) in 1995, is estimated to contain 330-400 Bcf of recoverable natural gas. In September 1998, Unocal and Petrobangla initialed a PSC for development of Shahbazpur.

In July 1998, Cairn Energy reportedly made a large natural gas discovery in the Halda valley. Meanwhile, Unocal, along with Petrobangla, has developed the 1.6-Tcf Jalalabad field, which came onstream in 1999 and is currently producing 80 Mmcf/d. In late September 1998, Shell and Cairn said they had agreed to an alliance over natural gas development in Bangladesh (including the Sangu and Semutang fields), plus northeastern India.

In late November 1998, Bangladesh raised the price of natural gas by 15% as part of an effort to reduce government subsidies as recommended by international lending institutions and countries. Bangladesh has had relatively low natural gas prices by international standards, with electricity consumers, plus fertilizer plants and households, receiving around $600 million a year in direct subsidies and savings associated with their gas consumption [1].

4 Conclusion

Bangladesh is a country of natural beauty. Nature has decorated her with enormous beauty and natural resources. It is possible to harvest the energy resources of Bangladesh and make proper use of them. This study just summarizes the total energy scenario of Bangladesh.

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Authors Biography

Dr. Md. Kamrul Alam Khan: Dr.Md. Kamrul Alam Khan is now working as the Dean, Faculty of Science, Jagannath University, Dhaka,Bangladesh
Email: kakhan01@yahoo.com

Shuva Paul: Shuva Paul has completed his bachelor of science in Electrical & Electrical & Electronic Enginerring from American International University Bangladesh in year of 2012.
Email: paulshuva66@gmail.com

Md. Rashed Azad: **Md. Rashed Azad** has completed his bachelor of science in Electrical & Electrical & Electronic Enginerring from American International University Bangladesh

in year of 2012.
Email: rashed.azad@gmail.com
Md.Anisur Rahman: Md. Anisur Rahman is persuing his bachelor of science in Mechanical & Chemical Engineering from Islamic University of Technology(IUT),Bangladesh.
Email: anisrahman295@gmail.com