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A Potential Review on Green Energy of Bangladesh and its Prospects

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***Abstract*— To become a developed country by 2041, Bangladesh needs enormous improvement in the field of energy and power sectors. The development of a country can be facilitated by power sector. Urbanization and industrialization are completely dependent on electrification. The previous status of power in this country was not satisfactory. The quality and quantity of energy and power infrastructure are needed to be developed for long-term economic development. The current energy source of Bangladesh is mainly fossil fuels and today or tomorrow it will be declined which will hinder our overall development. Human should think for their next generation before finishing all of fossil fuels. In future the world will be helpless having no useful energy. Emissions by fuels into the environment are discouraged by many environmental organizations like International Union for Conservation of Nature (IUCN). That's why looking for green renewable energy has become a challenge. Global carbon emission to the atmosphere, considered a threat throughout the whole world, can be reduced by introducing it. The current energy scenario including renewable energy and its prospects in Bangladesh is discussed in this paper.**

Keywords*— *Renewable energy, Fossil fuels, Natural gas, Solar energy, Wind energy, Bio energy, wave energy, Tidal energy, Geothermal energy, Ocean thermal energy, Government.

I. INTRODUCTION

Modernization of a country depends upon power. Compared to the advanced world, energy production of Bangladesh per capita is lower. Natural gas, coal, oil etc. are the main fossil fuels of generating power in the country. Maximum gas fields are located at the eastern portion of the country [1]. Through a great victory of ocean Bangladesh has gained a number of undiscovered gas fields [1]. The amount of domestic natural gas is insufficient compared to the demand. Natural gas is being used as fuel of various automobiles and for cooking in every cities. Shortage of natural gas is created by unconscious use of this. An estimation is that the country will be served next 20 years by the reserved natural gas [2]. For that Bangladesh needs to depend on other countries for both fuels and power. Now time has come to think about self-dependency in the power sector. Government provides subsidy on energy sector but it affects the national economy as the price of primary fuel is increasing. Implementing the concept of renewable energy may be a proper solution in this case.

Japan International Cooperation Agency (JICA) sponsored a master plan known as Power System Master Plan (PSMP) 2016 for Bangladesh which will help to attain sustainable development in power sector [3]. JICA introduced renewable energy as green energy as having no conflicting effect on nature. "To maximize green energy and to promote its introduction" is now a policy vision of PSMP 2016 [3].

Renewable energy is that energy which will not be finished. No fuel is used here for achieving energy. It has no negative impact on environment. Sun is related to all forms of renewable energy directly or indirectly. Solar, Wind, Biomass, Wave, Biogas, Geothermal and ocean thermal energy are the sources of renewable energy. Research on the renewable energy sector is now a breakthrough for the development of Bangladesh. Many research groups are working on that sector with self-interest or under project. Government of Bangladesh also encourages every power sector to produce a significant portion of the total power generation using renewable energy.

II. CURRENT ENERGY SITUATION

Electricity generation in Bangladesh is rising year to year. The country gained 35,107 GWh from public sectors and 28,640 GWh from private sectors in FY 2019. The remaining 6,786 GWh was imported [4]. Renewable energy sector has provided only 39 GWh. It is only 0.05% of the total electricity generation [4]. According to the annual report (2018-19) of Bangladesh Power Development Board (BPBD) the total install capacity was about 18,961 MW and the country import 1160 MW power from India [4].About 70% of the total power is generated from natural gas.

Table 01: Sources of total power, achieved in FY 2019[4]

Sources of Power	GWh	Percentage (%)
Hydro	725	1.03
Natural Gas	48,306	68.49
Furnace Oil	11,426	16.20
Diesel	2,022	2.87
Coal	1,230	1.74
Renewable Energy	39	0.05
Power Import	6,786	9.62
Total	70,533GWh	100%

PSMP 2016 has provide a benchmark of the total power generation against demand up to 2041.

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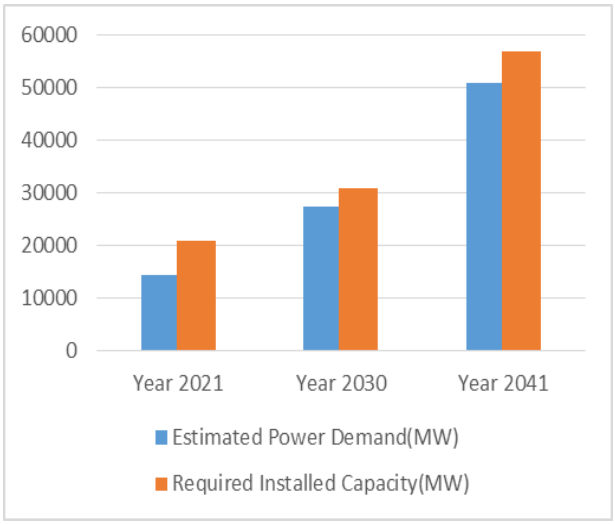

Fig 01: An estimated power demand and corresponding required installed capacity till 2041 [4]

From this figure it is clear that, at 2041 the country will produce 57000MW power which will support all of technological and infrastructure development [4]. JICA also showed the probable source of energy. This plan will reduce the use of natural gas compared to coal.

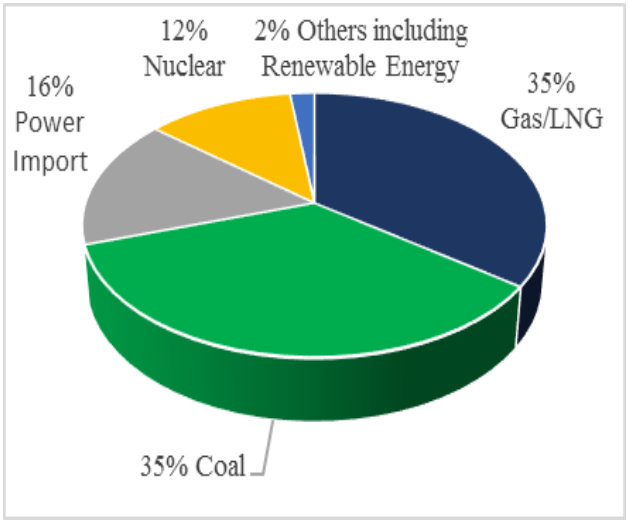

Fig 02: Target energy sources to fulfil the power demand in 2041[4].

This scenario has shown that renewable energy has a low impact on overall energy generation. The conventional energy sources are being declined with time. The government of Bangladesh has given emphasis on Renewable energy for energy security. Solar, wind, bio, wave & tidal energy are the potential sources of renewable energy of Bangladesh [5]. The harnessing technology and the meteorological condition of the country are unfavorable to achieve energy. By the way, the government of Bangladesh encourages both private and public sectors to emphasize on utilizing renewable energy. The country has a target to attain 2,470MW by 2021, and 3,864MW by 2041 by renewable energy [3].

III. SOLAR ENERGY

Solar energy, the most available renewable energy is totally green energy having no effect on the atmosphere. Location of Bangladesh is in-between 20°34' and 26°39' north by latitude and in-between 80°00' and 90°41' east by longitude which is ideal for achieving solar radiation [6]. The south-eastern portion of the country has higher solar potential compared to others. Most solar energy is acquired in the summer because radiation directly hits the northern tropic. In Bangladesh the solar radiation is about 4-6.5 kWh/m2 [6].

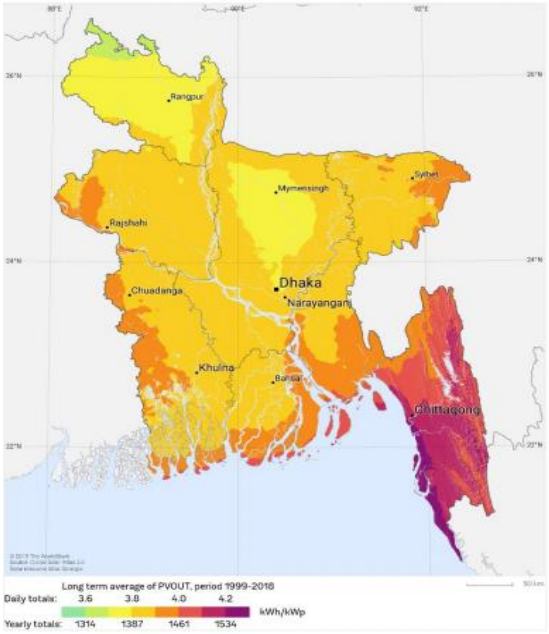

Fig 03: Intensity of solar radiation at different regions of Bangladesh [3]

Anik deb, et al. [7] has given a good suggestion to recharge electric vehicles like auto rickshaw using solar energy. These vehicles take a huge amount of power from the national grid and create an energy vacancy. He suggested that PV cells may be installed on the roof of different filling stations. Then those stations can recharge battery based automobiles and reduce electricity consumption. The initial investment is higher for this installation but an analysis is shown that if the selling price is 12 taka per kWh then the payback period will be about 6 years [7]. After this period the station will promise a great energy security for Bangladesh. Another major suggestion is the use of solar energy for irrigation and cooking. A major portion of the agricultural activities are off-grid and depends upon fossil fuels for irrigation and on-grid cultural activities use electricity from the national grid. So, it will be fruitful for the country to invest on a regional basis for solar plants for irrigation.

Government of Bangladesh has encouraged both public and private sectors to pay importance to harnessing solar energy. BPDB has taken a good initiative by installing a solar panel of 295.67 kW [4]. Nowadays many non-governmental organizations (NGOs) provide solar panels to the people

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with a charge which adds value to the total power generation.

IV. WIND ENERGY

Bangladesh is producing only 3MW wind power from wind turbines located at Maheshkhali and Muhuri Dam [8]. Direction of wind in Bangladesh is mainly from southwest to northeast. But there exist some irregularities in air flow which affect the installation of wind turbines. Wind power is very much dependent on the wind speed. Maximum average wind speed in Bangladesh is about 3m/s to 6m/s [8] and is found March to August [9]. Parvez Mahmud and Farjana [9] conducted an analysis on the wind speed in different coastal regions and found that at day wind speed is about 6.5m/s which is a potential source of wind energy. They also said that wind speed is about 7.15m/s at a height of 40 and has shown an increasing trend of wind speed depending on the turbine installation height.

Tanjin Amin [8] has shown that the electricity cost per kilowatt hour is about BDT 2.90 at Kuakata at a height of 50m. He has conducted experiments at different heights and graphically shown that higher power can be harnessed at higher height for both Kuakata and Saint Martin. At different lower wind speed regions, an estimation is that this cost is about BDT 6.00 [8].

From those studies, it is uncovered that harnessing wind energy will be a promising source of energy for Bangladesh one day. The potential sources are needed to find out and the government of Bangladesh should install some wind projects to facilitate it. At low wind speed regions, less energy may be produced but this will be applicable to the irrigation system of the country to reduce pressure on diesel. Wind turbines may be installed at the rooftop of many long buildings to meet some energy demands of the building.

V. WAVE ENERGY

The Bay of Bengal is the only source of wave energy for Bangladesh. In 2012 & 2014, a greater part of the sea had been achieved from Myanmar and India which has increased the potentiality. This victory facilitates both gas sectors and wave sectors. Wave is created due to the flow of air over the surface of sea water. Oscillating Water Column, Pelamis and Archimedes Wave Swing are the three technologies to harness wave power. Md. Salimullah, et al. [10] suggested to use Oscillating Water Column technology for onshore wave power production and pelamis technology for offshore. Using prototype simulation they showed that wave power increased with wave height and concluded that for wave height of 0.02m the extracted power was about 1.5volt. Practically the wave height is more than this data at many locations of Bay of Bengal.

Wave energy is available all time throughout the year. Bangladesh has no wave power plant yet. Government needs to pay attention to this sector as it promises 24 hour green energy.

VI. BIO ENERGY

The concept of biogas is not totally new for Bangladesh. There are thousands of biogas plants throughout the country. Waste materials from human's daily life and animals are the elements of biogas plants. A large part of the total population is engaged in agriculture. Major portion of energy demand at the rural area is fulfilled by biomass such as firewood and crops residues. The crops residues are mainly from rice, sugarcane, wheat, jute and coconuts. These are used mainly for cooking.

Ershad and Martin [11] conducted an analysis that up to 2015 there were 77,500 biogas plant in Bangladesh. Most of the plants were installed by Infrastructure Development Company Limited (IDCOL) and Bangladesh Council of Scientific and Industrial Research (BCSIR). Recently Local Government Engineering Department (LGED) of Bangladesh has been developing a lots of biogas plant throughout the country.

VII. TIDAL ENERGY

For electrification of the south-grid region of Bangladesh, tidal energy can be used effectively. Despite the fact that the southern part of the country is covered by the sea, the country still has no tidal power plants. The average tidal height in Bangladesh is feasible for energy gain. Md. Alamgir et al. [12] showed Sandwip as a potential source of tidal power. He suggested e project at Sandwip that will serve the country with 16.49MW at a cost of $10.37 million.

Mongla, Cox's Bazar and Teknaf are the other sources for tidal power. About 53.2MW power can be produced in Bangladesh using tide [12]. Although the capital expenditure is very high, after a certain period of time it will provide power without any cost. Which is more than the total electricity production using renewable energy. Therefore, tidal power should be given attention in Bangladesh.

VIII. GEOTHERMAL

Geothermal heat is used here to produce steam so, there is no fuel cost. The worldwide geothermal power install capacity is increasing day by day specially in USA. Asif et al. [13] discussed about the potentiality of underground liquid as the liquid temperature is enough to use at any geothermal power plant. He focused on the northwestern part of the country.

The capacity factor of geothermal power plant is high. Geological energy can always be acquired throughout the year. Government should understand the importance of this zero running cost energy and install some geothermal power plants to increase neat electricity generation.

IX. OCEAN THERMAL ENERGY

Temperature difference between the surface water and the deep water in the sea is used to maintain a power cycle in Ocean Thermal Energy Conversion (OTEC) technology.

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Like wave and tidal energy, Bay of Bengal has a potentiality of having ocean thermal energy but there is no ocean thermal power plant here. Shifur Rahman, et al. [14] has shown that the temperature difference between the surface water and deep water (1 km below the surface) is about 20°C to 22°C. They also proposed Cox's Bazaar, Kuakata and St. Martin Island as the potential place for this energy.

Along with the conversion ocean thermal energy, compound project may be implemented with wave energy. Then the project will be more economical and supportive to the remote region electrification of Bangladesh.

X. CONCLUSION

The energy crisis will be a disaster in the next few decades. So, people should be aware of the use of energy. For the energy security of human's children's children, the one and only option is to look for renewable energy. Natural sources of energy is available in Bangladesh. There are some technical shortcomings in achieving this energy. In addition to PSMP16, the government should focus specifically on the renewable energy sector by implementing some special project on exploration and extraction of renewable energy. The government may add some research teams and manpower to the project. Though the initial investment is much, after the installation it has no running cost. And after the payback period, it will add completely free energy to our total power generation. Along with government, the private sectors should come forward to increasing the power generation with economical support. Small contributions should be made by the general public with personal interest such as the installation of solar panels on the roof. By using the proper use of all renewable energies Bangladesh will not only fulfil the domestic demand but also export energy in future.

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