

ASSESSING THE PRESENT SCENARIO OF ALTERNATIVE ENERGY SOURCES IN BANGLADESH

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ABSTRACT

As part of its journey toward sustainable development, Bangladesh has been regularly examining its renewable energy (RE) resources using a range of technologies. One of the first renewable energy sources to show practicality was hydroelectricity at Kaptai, Rangamati. But since then, several RE technologies have been studied, including wind, solar, biomass, waste to energy, micro-hydro, wave, and tidal energy. Among these, biomass has a consistent potential, while wind energy has a few possible applications. The majority of prospective renewable energy projects appear to be focused on solar photovoltaics (PV), the most futuristic technology. This article discusses the variety of renewable energy resources currently implemented with various technologies within the geological and geographic setting of Bangladesh. It also provides details on projects that are already underway, ones that are planned, and feasibility studies that are still being considered for use in commercial development. The chapters explore possibilities of various technologies, identifies these potentials, evaluates them against ideal standards.

Keyword: Renewable Energy, Solar, PV, Biomass, Wind energy.

1. INTRODUCTION

Bangladesh is a young growing nation. Coal, gas, and petroleum are among the abundant natural resources of Bangladesh. Natural gas, which accounts for 24% of Bangladesh's energy needs, was expected to run out by 2020[1,3]. In this situation, renewable energy benefits the Bangladeshi people. People's unmet energy needs are significant and rising by 10% annually [1]. Bangladesh has a considerable renewable energy potential, and the natural accessibility of alternative energy presents growth chances in the power industry. Not only should technology be created to produce energy in an environmentally friendly way, but also adequate emphasis should be placed on energy conservation in its most effective form. In order to have power available throughout the nation beyond the year 2020, the government released its vision and policy statement in February 2000 [2]. It now consumes the least commercial energy per person in South Asia.

Natural gas accounts for around 51% of the energy utilized for commercial purposes in Bangladesh. Oil, coal, and biomass are a few more essential things. This nation produces and consumes less coal than it might, despite having a substantial stockpile. On the other hand, while having relatively little reserves, natural gas has the greatest production and consumption rates of any resource that is currently known. Energy is also obtained from imported oil and liquefied petroleum gas (LPG). The government has already begun importing LNG to fulfill the rising demand for gas. According to Energy Scenario Bangladesh 2018–19, biomass accounts for 27% of all primary energy consumed in Bangladesh. The requirement for electricity is also partially satisfied by the import of power from India.

Following Bangladesh's independence in 1971, the Bangladesh Power Development Board (BPDB) started operations with a built-in capacity of 200MW (BPDB, www.bpdb.gov.bd). Only around 3% of the populace at the time had access to electricity [4]. Currently, power is available to around 90% of the population. Currently, there are around 18,753 MW of installed capacity overall, including captive power generation and imported electricity (BPDB, www.bpdb.gov.bd). The installed power capacity in Bangladesh, broken down by owner and including imported electricity [5]. According to Father of the Nation, (<http://www.hcu.org.bd>), the total amount of electric energy produced during the 2019–2020 fiscal year was 59.68 mega tons of oil equivalent (Mtoe). Domestic natural gas makes up a large portion of the primary energy supply, followed by liquid fuels. The remaining energy comes from coal, hydropower, and imported electricity from a country close by, like India. According to Bangladesh (<https://www.iea.org>), the trend expands energy mix to generate power from fiscal years 2000-2001 to 2019-2020.

Natural resources such as renewable energy sources are essential for meeting Bangladesh's energy needs [6, 7]. Solar, biomass, wind, hydropower, and geothermal energy are the renewable energies that are now accessible in Bangladesh and have the ability to solve the country's energy crisis [8]. Hydro, solar, and wind energy each provide 3% of the nation's total energy consumption, or 60%, 39.5 %, and 5%, respectively. However, the fastest-growing renewable energy source in Bangladesh is solar energy [9]. There is also collection of renewable energy sources that are accessible in Bangladesh and the technologies that harness them [7].

2. SOLAR BASED ENERGY

A minor fraction of Bangladesh's energy need is partially met by solar photovoltaic (PV) systems, and the country is situated between 24° 0' 0" N and 90° 1' 0" E in terms of sun radiation [10,11]. However, Bangladesh produces 500 MW of solar energy annually, making up 39.5% of all energy use [8]. Over 13 million rural residents now have access to renewable energy thanks to Bangladesh's state-owned infrastructure development company limited (IDCOL), which has already built 3 million solar household systems (SHS). Bangladesh receives 4-5 kWh/m of solar energy on a daily average [12]. The Prime Minister's Power is implementing the new mega electricity project vision 2021. According to Global Post, Bangladesh installed over 50,000 SHS and has the world's fastest economic growth rate. The distribution of SHSs is most evenly distributed in Sylhet district and least evenly distributed in Dhaka district, which illustrates the estimated distribution of SHSs installation division-wise [13].

3. WIND ENERGY

In the field of wind energy, another renewable resource, things have been moving rapidly [14]. Wind energy is converted into electricity using turbines. At the Muhuri Dam area of Sonagazi in Feni and at the Kutubdia Island Wind Battery Hybrid Power Plant, Bangladesh produced 900 KW of wind power, while the Bangladesh Army, BRAC, IFRD, and Grameen Shakti installed a total of 19.2 KW at various coastal zones around the country [15]. Bangladesh has the longest coastline stretch in the world, stretching 724 km along the Bay of Bengal, and additional techno-economic analysis is required in Bangladesh before electrification from wind turbines is implemented. However, the Bangladesh Power Development Board (BPDB) has recently identified 22 sites for wind power generation and onshore Wind Power Plants along the coastline of coastal regions of Bangladesh. In addition, the BPDB has planned a 50-200 MW wind generation plant at Anawara in Chittagong, a 15 MW Wind Power Plant at Muhuri Dam Area of Feni, Mognamaghat of Cox's Bazar, at Kepupara of Borguna, and at Kuakata.

4. ENERGY FROM BIOMASS

For bioproduct, bioenergy, and biopower [16] production, biofuel is used. Biofuel produces environmentally friendly, renewable fuel oil that is mostly made from natural plant oils and is created from animal fats such as tallow, lard, white or yellow grease, chicken fats, or fish oils. Biofuel generation and oil obtained from crops are two terms used to describe the process of extracting gases and liquids from biomass [17]. In Bangladesh, biogas and biomass are more common. More than 350 potential oil-bearing crops, including *J. curcas*, sunflower, sesame, castor, cottonseed, and groundnut oils, are grown in Bangladesh. These crops are used to make biodiesel.

Leaf extracts are also used as a source of biomass energy [18]. *Bryophyllum pinnatum* leaf juice is used as electrolyte in Zn-Cu based electrochemical cell [19]. Different models of these type of electrochemical cells are very promising considering socio-economic condition and environmental perspective at the islands at the coastal areas of Bangladesh [20,21]. The procedure of electricity production is very simple that anyone with the basic ideas can have

a glance of electricity. Although currently, large amount of electricity cannot be produced but it is hopeful considering the present scenario of Biomass based research for electricity production [20].

5. HYDRO POWER

Water is used for the creation of electricity by the process of turning water head into kinetic energy, which causes the turbine propeller to revolve utilizing the force of the water flow [22]. Hydroelectricity is a naturally renewable form of energy. Bangladesh produces less hydroelectricity than the rest of the globe on average [23]; at the end of 2014, total hydroelectricity output was 879.0 MTOE, an increase of 2.0% over the previous two years and below the 10-year average of 3.3%. China consumed the most hydroelectricity globally in 2014 (406.83%), accounting for 27.4 percent of the total [24]. In contrast, Bangladesh's hydroelectricity production capacity in 2014 was 230 MW, and worldwide sharing is incredibly minimal. Other hydroelectricity plant has been proposed [24].

6. TIDAL ENERGY

There are two techniques to produce tidal energy: barrage production and tidal stream generators. Tidal generator electricity is often more ecologically benign and has less of an effect on already existing ecosystems. Many tidal stream generators revolve underwater and are powered by the quickly moving, thick water, much like a wind turbine. Tidal power, also known as Tidal energy, is a type of hydropower that uses the energy of the tides to generate electricity. Tides may be readily produced from shifting sea levels since they are easier to forecast than wind and sunshine. The tide rises and falls in Bangladesh's coastal region ranges from 2 to 5 meters [25]. Sawndip has the highest chance to produce tidal energy among these coastal regions with experienced 5-meter tides [25]. By utilizing Low head tidal movements and Medium head tidal movements, Bangladesh can produce tidal power from these coastal tidal resources. Low head tidal movements, which use tides with a height between 2 and 5 meters, can be used in regions like Khulna, Barisal, Bagerhat, Satkhira, and Cox's Bazaar, while height tidal movements, which use tides with a height We may thus conclude that this can be an excellent source of energy for Bangladesh if the tidal height is sufficient.

7. NUCLEAR POWER

The single nuclear reactor in Bangladesh is operated by the Bangladesh Atomic Energy Commission. Bangladesh's 2.4 GWe Ruppur Nuclear Power Station is a nuclear power plant that is still under construction. In the northwest of the nation, 87 miles (140 km) west of Dhaka, in Ruppur, abutting Paksey, in the Ishwardi Upazila of the Pabna District, on the bank of the stream Padma, a nuclear power station is being built. It will be the first nuclear power plant in the nation, and it is anticipated that the first of its two units would start operating in 2023 [26].

8. GEOTHERMAL

The most sustainable and pure energy is geothermal energy, which is heated by the earth's core. Bangladesh does, however, have the ability to harness geothermal energy, and she has a regional geothermal gradient from the south-east area ranging from 19.8 to 29.5°C/km to the north-west region ranging from 20.8 to 48.7°C/km with 110-153°C from 304 kilometers deep in the soil [30]. The primary geothermal energy sources are, however, the Thakurgaon warm water region, Kuchma and Bogra (60-125 km), Madhupur Clay (20 m), and Rangpur Saddle (700 m depth contour). The Bangladeshi government has previously announced plans to work with Anglo MGH to build a 200 MW geothermal power facility near Thakurgaon [27].

The possibility of exploring geothermal resources is evident in Bangladesh's northern areas. Both in urban and rural regions, there is a growing need for energy, but we are not producing any more of it. Geothermal energy may be used to provide enough electricity to meet the needs of rural areas. The power that was intended to be supplied to rural regions can later be used to satisfy the demand for electricity in metropolitan areas. Geothermal energy can equalize the amount of power used in these two locations. Anglo MGH Energy, a private firm with headquarters in Dhaka, has started a project to build the nation's first geothermal power plant with a capacity to generate 200 MW of energy at Saland in Thakurgaon district. They want to install 28 deep tube wells to raise hot steam, which will then be utilized to power a turbine that will then link to a generator to produce energy [28]. The information above makes it evident that geothermal energy may also be an eccentric option for Bangladesh to harness electrical energy.

9. CONCLUSION

34 TCF of natural gas have been shown to be stored in Bangladesh, where 82% of the country's present natural gas consumption is used for power generation. In contrast, just 3% of the world's electricity comes from renewable sources. However, due to the increased need for electricity, the Bangladeshi government has already released a master plan for future electricity generation. In order to significantly strengthen the power sector and rebuild the renewable energy resource, this plan places a strong emphasis on the nation's natural resource exploration and discoveries. To satisfy the demand in the near future, Bangladesh will need more advanced research facilities and a competent workforce for inland and offshore exploration. For the country's energy sustainability, the government must collaborate with innovative technologies from private sector and overseas. One potential replacement for conventional energy that is derived from fossil fuels is renewable energy. Due to environmental and financial concerns, there is currently a huge interest in the usage of renewable energy sources including solar, biomass, hydroelectric, geothermal, and wind. The government of Bangladesh has made major efforts and set a goal to build various renewable energy projects, which are also government-subsidized.

According to the Bangladeshi government's Vision 2021, the increase in renewable energy sources will be in line with these goals. We offered some recommendations for the growth of the renewable and sustainable energy industries so that the government's aim can be realized by 2021. Without competent governance, the objectives of long-term stability and prosperity cannot be met. To uphold the rule of law and create a society free from corruption is the core tenet of effective government. While putting development programs into action, these suggestions might be put into action. For the development of socioeconomic infrastructure, sustainable energy can provide more inexpensive, dependable, and more secure source of power. For a few further generations, fossil fuel-based electricity supply should be sufficient. To ensure the survival of our future generation, Bangladeshi officials can take the required steps to evaluate renewable energy sources for power generation.

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