Analysis of the Current Development of Renewable Energy Technologies in Bangladesh

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Abstract: - Bangladesh's electric energy needs are expanding rapidly as a developing nation. Thus, renewable energy has become a crucial solution to the energy problem and environmental issues by replacing fossil fuels. The Bangladeshi government is pursuing large-scale renewable energy projects and heavily promoting renewable energy to increase its utilization. Therefore, this study aims to examine the existing condition and future potential of renewable energies in Bangladesh and the opportunities and difficulties associated with its progress. This review summarizes Bangladesh's renewable energy policy framework. The results show that Bangladesh has considerable potential for renewable energy growth to achieve environmental sustainability and energy efficiency. Bangladesh has undertaken various renewable projects to meet rising demand. The article proposes policies and strategies to increase funds for renewable energy production, energy efficiency, and environmentally friendly technology innovation to increase renewable energy consumption.

Key-Words: - Energy; Renewables; Policy; Innovation; Economics; Sustainable development.

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1 Introduction

In recent decades, there has been a growing concern regarding the energy crisis, with a noticeable increase in everyday energy consumption, [1]. Furthermore, the global concern of climate change is a significant matter of utmost importance on a global scale, alongside the ever-increasing demand for energy, [2]. The primary contributors to global warming include carbon dioxide (CO₂) emissions

from fossil fuels, halocarbons, methane emissions, tropospheric ozone, and nitrous oxide emissions, The resolution of air pollution and global [3]. warming issues necessitates substantial modifications to the energy sector, as these problems predominantly arise from the emissions resulting from the burning of various forms of energy sources, including liquid, solid, and gaseous fuels, during their production and utilization, [4]. However, as a consequence of the swift deterioration of traditional energy sources and the escalating global energy demand, there has been a notable surge in primary energy consumption worldwide, [5]. Oil, coal, and natural gas have supplanted alternative energy sources as the predominant way of fulfilling the need for energy, [6]. Large corporations and electric vehicles utilize fossil fuels, resulting in the rapid emission of greenhouse gases (GHGs) such as CO₂ into the atmosphere, [7]. This process contributes to the escalation of global temperature, [8]. The increase in global climate impact and the rising concentration of CO₂ in the atmosphere, attributed to human activities, have led to a significant escalation in GHGs and the greenhouse effect in recent years, [9]. Hence, transitioning towards renewable energy sources can aid in the achievement of our primary goals of reducing GHG emissions, thereby mitigating the potential consequences of severe climate and weather fluctuations, while also providing reliable, expeditious, and cost-effective energy provision, [10].

This is especially visible in European countries, where a change towards renewable energy is visible. However, there are countries such as Poland where it is very difficult to give up coal, which is influenced by many factors such as mining policy and traditions, [11]. However, it must be clearly stated that the priority for the whole world is to change energy policy from fossil fuels to renewable energy, [12], [13]. Investments in renewable energy can yield substantial benefits for the enhancement of energy security, [14].

Figure 1 (Appendix) illustrates several forms of energy sources. Solar, geothermal, hydro, biomass, and wind, among other examples, represent several types of renewable energy sources that are universally recognized for their emission-free characteristics, [15]. Renewable energy technologies are widely regarded as the optimal choice due to their capacity to substantially augment global energy generation while concurrently mitigating the emission of GHGs, [16]. Renewable energy sources possess the characteristic of being inexhaustible, meaning they do not deplete over time, [17]. These sources may be replenished continually and are derived from naturally occurring resources such as sunlight, biomass, flowing water, wind, ocean tides, waves, the interior heat of the Earth, and replacement fuel derived from plants, [18]. Renewable energy sources have the capacity to generate electrical power, which can then be transported and stored for utilization in residential, commercial, and industrial settings, [19].

Bangladesh is a fast-emerging nation in the South Asian region, with significant promise in the realm of renewable energy resources. Biomass and biofuel serve as the primary forms of renewable energy in Bangladesh, fulfilling the energy needs for both cooking and electricity generation, [20]. Solar energy is a significant energy resource in Bangladesh, with the utilization of solar photovoltaic (PV) cells being prevalent in rural, mountainous, and coastal regions of the country, [21]. Bangladesh boasts a rich historical background in the realm of hydroelectricity generation, having successfully implemented micro-hydro and tiny hydropower initiatives inside its borders, [22]. Wind energy is a notable example of a renewable resource in Bangladesh, where there are accessible places for little and micro wind generation aimed at electricity production, [23]. Renewable energy sources have the potential to serve as a feasible alternative for Bangladesh in addressing energy scarcity, ensuring energy security, and formulating sustainable longterm energy strategies, all while mitigating greenhouse gas emissions and adhering to climate change objectives, [24]. There are several compelling justifications for considering Bangladesh as an exemplary case study for emerging nations: The country in question is classified as a developing nation and exhibits a significant reliance on fossil fuels for its power production. Furthermore, its future energy strategy demonstrates a propensity towards the importation of fossil fuels. Furthermore, the location of this region is characterized by a significant solar potential, so indicating that a substantial portion of its future energy supply will be derived from solar PV sources. Furthermore, the inclusion of the monsoon season and the limited availability of electricity generation alternatives, aside from solar power, provide significant challenges in the implementation of a completely sustainable energy system.

Given the current global trend towards affordable, eco-friendly, and efficient energy systems, it is crucial to enhance our understanding of the relationship between energy and the advancement of sustainable development, [25]. Therefore, the main aim of this study is to conduct a brief review of the present state of renewable energy in Bangladesh and provide a strategic path for the creation of policies related to renewable energy. These policies should be designed in a way that they can significantly contribute to the achievement of sustainable development goals (SDG 7). This study begins by providing a concise overview of the energy demand and energy scenario in Bangladesh. Moreover, this review offers an overview of the status and future prospects of renewable energy advancement in Bangladesh. The novelty of this study is that it includes an analysis of government policies, obstacles, incentives, and the influence of renewable energies on the country's economic growth. In contrast to existing alternative reviews and public documents, this evaluation identifies the gaps in the field of renewable energy technology development and suggests ways to address the issues. The outcomes of this study have the potential to assist in the development and implementation of appropriate policies aimed at promoting the renewable energy sector in Bangladesh while achieving affordable and clean energy for all (SDG 7). Furthermore, these policies can contribute to the mitigation of emissions and the realization of climate targets (SDG 13) by promoting the uptake of renewable energy sources, so advancing progress toward the attainment of sustainable development.

2 Energy Usage in Bangladesh

The inception of the Water and Power Development Authority (WAPDA) and the development of the 80 MW Karnafuli Hydropower Plant in 1962 signified the initiation of Bangladesh's shift towards contemporary power utilities, [22]. The Bangladesh Power Development Board (BPDB) commenced its operations in May 1972, boasting a production capacity of 200 MW, [26]. Subsequently, there has been a notable augmentation in the generation capacity, with the total installed capacity reaching 22,612 MW by 2022, [27]. However, it is worth mentioning that the maximum power output achieved was only 13,525 MW, [28], [29]. The current energy generation mix of Bangladesh illustrated in Figure 2 shows that natural gas is the leading source of current electricity generation in Bangladesh. Besides, Figure 3 shows the existing capacity for renewable generation in Bangladesh. In addition, Table 1 presents a comparison of nonrenewable and renewable energy resources in the context of Bangladesh. There are 29 gas fields and 5 coal fields in the country providing non-renewable energy supplies alongside furnace oil and diesel. Moreover, the country's renewable energy capacity is dominated by solar, hydro, and wind.



Fig. 2: Bangladesh's current electricity generation mix, [28]



Fig. 3: The current state of Bangladesh's renewable energy production, [28]

Table 1. Comparison of Bangladesh's renewable and	L
non-renewable energy	

	non rene waon	e energy		
	Impact on the environment	Resource potential/ capacity/ reserve	Land use (km ²)	
Renewable ene	ergy resources			
Hydro	Eco-friendly	2228 MW	-	
Solar	Eco-friendly	40,000 MW	670	
Wind	Eco-friendly	30,000 MW	20,000	
Other	Minimum impact	1848 MW	-	
Non-renewable energy resources				
Natural gas	Minimum impact	28.69 TCF	29 fields	
Furnace oil	Minimum impact	1.399 MMT	-	
Diesel	Carbon emission	5.5 MMT	-	
Coal	Carbon emission	3100 MT	5 fields	
Adapted from [2]] and [29]				

The electricity sector in Bangladesh has been affected by challenges related to gas accessibility and the imperative for expeditious economic development, [30]. The existing scarcity of fuel is presently resulting in a significant disparity, hence leading to frequent occurrences of power outages. Moreover, the inherent deficiencies in the transmission infrastructure hinder individuals from accessing and utilizing energy resources, [31]. The overall losses in the electricity transmission and distribution system exhibited a decline from 14.73 percent in the fiscal year 2010-11 to 9.54 percent in the fiscal year 2021-22. Despite notable advancements in reducing this damage, there substantial potential for further remains improvement. The energy demand in Bangladesh is experiencing a significant increase. It is projected that Bangladesh's energy demand will reach 33,708 MW by the year 2030, [27]. The current focus in Bangladesh is on the investment in renewable energy as a means to tackle the aforementioned issue.

3 Current Renewable Energy Scenario in Bangladesh

Bangladesh exhibits significant prospects for many renewable resources, encompassing wind, biomass, hydro, solar, biofuel, geothermal, biogas, waste-toenergy, and ocean energy. The utilization of renewable resources has the potential to fulfill the increasing energy requirements inside the nation, [28]. In the month of July 2021, the electrical generation breakdown was as follows: natural gas accounted for 45.08 percent, followed by heavy fuel oil (HFO) at 24 percent, high-speed diesel (HSD) at 5.12 percent, renewable energy at 3.04 percent, captive energy at 11.11 percent, coal at 7.02 percent, and imported energy at 4.60 percent. The proportion of electricity generated from renewable sources in Bangladesh is rather low, [21]. Table 2 (Appendix) presents the current status of Bangladesh's installed renewable energy capacity derived from several sources. The total installed capacity of renewable energy sources amounts to 766.49 MW, [28]. Among these sources, solar energy contributes the largest share, accounting for 532.5 MW or 69.50% of the total capacity. Hydropower follows with 230 MW, representing 30% of the overall capacity, [28]. The remaining capacity of 3.99 MW is derived from other sources, including 0.69 MW (0.09%) from biogas, 2.9 MW (0.37%) from wind, and 0.4 MW (0.05%) from biomass.

Bangladesh is endowed with a substantial abundance of biomass resources, [32]. In addition to its application in culinary practices, biomass resources are also utilized for the purpose of energy generation. The favorable geographic location of the nation allows for the efficient utilization of solar energy, hence presenting an attractive solution for addressing energy requirements, [33]. As a result, solar energy has become increasingly favored in rural and off-grid areas. Contrary to solar and biomass, wind and hydropower are not extensively utilized inside the country, [34]. The progress of hydropower development in this country has been impeded by the absence of suitable topographical conditions, such as flat areas and accessible streamheads, [15]. The absence of sufficient data hinders the accurate estimation of wind power, [35].

According to the data presented in Figure 4, it is evident that the renewable energy sector in Bangladesh has exhibited consistent growth since 2015. This growth is characterized by an incremental expansion of generation capacity, which has been driven by the need to meet varying levels of demand over time. Based on statistical data, it is observed that the most substantial expansion in generation capacity transpires in the year 2021, exhibiting a growth rate of around 170 MW. The subsequent notable increments are witnessed in 2020 and 2022, with growth rates of 64.77 MW and 54.12 MW, respectively. However, the period from 2015 to 2019 witnessed the construction of a mere 50 MW of energy capacity. An annual increase of approximately 19 MW was observed throughout the period from 2015 to 2017. Lastly, it is worth mentioning that the increase in capacity between the years 2018 and 2019 amounted to around 40 MW and 43.73 MW, respectively, [22].



Fig. 4: Bangladesh's renewable energy installed capacity annual growth, [22]

As of the conclusion of 2017, the reserves of coal and natural gas amounted to 323 million tons and 6.3 trillion cubic feet (TCF) respectively. There has been a notable rise in the utilization of coal and

natural gas since 2007, with an increase of 7.35 percent and 0.8 percent, respectively, [36]. Furthermore, there has been a notable rise in the demand for natural gas specifically within the power generation sector, with power plants accounting for approximately 40% of the total generation, [37]. A governmental mandate has been issued, stipulating that a minimum of 10 percent of the total electricity generated should be derived from renewable sources, [36].

4 Bangladesh's Prospects for Renewables

Bangladesh is endowed with a substantial reserve of renewable resources, and the effective utilization of these resources holds the potential to fulfill the country's energy requirements, [38]. One of the primary sources of renewable energy now accessible within the nation is biomass. Its utilization has the potential to reduce reliance on non-renewable energy resources, [21]. The considerable potential of solar energy is attributed to the nation's advantageous geographic location, characterized by a substantial influx of sunlight, [28]. It is crucial to note that the rural and coastal regions of Bangladesh have had positive outcomes from the implementation of solar panels, [39]. Despite the country's limited suitability for wind and hydropower as sources of electricity generation, several governmental and non-profit entities have undertaken multiple efforts aimed at providing electricity through the utilization of small-scale wind turbines and hydro facilities, [38]. To provide energy security, the utilization of renewable resources such as biomass and solar power has been suggested, [33]. Table 3 (Appendix) presents a compilation comprehensive of noteworthy forthcoming projects in the domains of solar, wind, hydroelectric, and hybrid power.

In the country of Bangladesh, the BPDB assumes responsibility for overseeing a variety of ongoing and prospective solar initiatives, [40]. Bangladesh possesses a sufficient amount of solar energy resources to facilitate the production of power. Approximately 94% of the land in Bangladesh is exposed to sun radiation of a magnitude that is deemed adequate for the utilization of solar technology, [41]. Both public and commercial entities have previously made financial commitments towards the development and implementation of solar energy technologies. Despite the typically diminished solar radiation throughout the winter and monsoon seasons, its potential influence on Bangladesh's electricity generation capacity cannot be underestimated. Solar energy technologies, particularly solar home systems (SHS), have had a surge in popularity, [39]. Additionally, the utilization of grid-connected PV systems has demonstrated notable efficiency, which can be attributed to Bangladesh's impressive capacity to generate 50,174 MW of power through these means. The implementation of a 500 kW gridconnected solar PV system has the potential to reduce GHG emissions by approximately 658 tons, [23].

Currently, а significant proportion of individuals residing in rural areas of Bangladesh depend on biomass resources in order to meet their fundamental electricity requirements, [21]. Although the current utilization of biomass stands at a modest 44.52 TWh, it possesses a substantial capacity to generate around 312.608 TWh. The biogas sector in Bangladesh has experienced substantial expansion, [42]. Nonetheless, there exist biomass resources that are currently not in use, such as solid waste, which possesses significant potential for generating electrical power. The suitability of coastal places in Bangladesh as possible locations can be attributed to the presence of strong summer winds, [23]. The region's electricity needs can be satisfied by the utilization of wind energy. Hydropower can also serve as a means to fulfill energy requirements in Bangladesh, [43].

The above discourse indicates that Bangladesh possesses substantial access to renewable resources. Despite the global trend of adopting renewable the nation continues to energy technology, encounter substantial obstacles in effectively harnessing these resources. Table 4 (Appendix) presents an overview of the potential for renewable energy development in Bangladesh. It is imperative to prioritize the advancement of various renewable energy efforts, encompassing the comprehensive exploration and utilization of biomass resources, the establishment of solar and wind energy programs, and the implementation of geothermal energy projects. The feasibility of harnessing energy from hybrid renewable energy systems, which integrate multiple renewable energy generation technologies with power energy storage technologies such as hydro-pumped storage and batteries, has been demonstrated, [23].

5 Bangladesh's Energy Policy

The government of Bangladesh has implemented various policies aimed at promoting sustainable development in the nation's energy sectors, [44]. The Power Sector Master Plan (PSMP) is a policy that aims to achieve the desired gross domestic product (GDP) growth rate of 7.3% in the Sixth Five-Year Plan by utilizing a combination of conventional and renewable sources to transport power to the state energy infrastructure. During the period from 2011 to 2015, the GDP of Bangladesh experienced a growth rate of 6.3 percent. The establishment of the Sustainable and Renewable Energy Development Authority (SREDA) through the enactment of the SREDA Act confers upon it the role of the primary regulatory body responsible for overseeing and administering various initiatives and endeavors pertaining to sustainable and renewable energy resources. The Energy Efficiency and Conservation Rules, implemented in March 2015, aim to achieve a renewable energy production rate of 15% in Bangladesh by 2021 and 20% by 2030, [28]. The implementation of the PSMP has been undertaken with the objective of enhancing the diversification of main fuel sources. According to projections, Bangladesh is anticipated to have a total electricity demand of 33.7 gigawatts (GW) by the year 2030. In order to sustain the burgeoning economy of the nation, the government of Bangladesh has formulated plans to augment its power generation capacity to 40 GW by the year 2030, surpassing the projected demand. There have been five established ideas for generating a substantial amount of power in the PSMP, which are as follows:

- The enhancement and increased adaptability of energy import infrastructure is necessary.
- The efficient development and utilization of resources within a domestic setting.
- Establishing a robust and high-quality network.
- The objective is to optimize the utilization of renewable energy sources and promote their widespread acceptance.
- Improving the capacity of human resources and systems to ensure a consistent and reliable energy supply.

6 Future Challenges and Recommendations

6.1 Future Challenge

Bangladesh exhibits substantial prospects for harnessing renewable energy sources. Nevertheless,

there exist certain impediments that hinder the worldwide expansion of auspicious renewable energy technology. Figure 5 illustrates the various obstacles encountered within the renewable energy sector of Bangladesh, which will now be expounded upon in further detail.

- One of the primary issues associated with renewable energy systems is the relatively high initial installation cost that accompanies these technologies. In order to facilitate the widespread adoption of renewable energy sources, it is imperative that technology becomes more cost-effective compared to fossil fuels. The advancement of production processes and the reduction of waste products, such as through biomass treatment, are vital.
- The cost of renewable energy technologies is experiencing a significant decline, leading to a rapid expansion of the global market for renewable energy systems. In order to sustain the increasing rate, it is imperative to incorporate distinctive breakthroughs in the materials employed, enhanced designs, and technologies that are both extremely reliable and productive.
- Due to the intermittent nature of power generation from renewable energy sources, except hydro, these technologies may not be suited for applications that necessitate a constant load. To provide the required consistency in electricity supply, it is imperative to utilize them in conjunction with the utility grid or an appropriate energy storage system.
- The current demand for renewable energy generating systems is mostly influenced by tax incentives and government subsidies. The primary appeal of renewable energy technologies lies in their capacity to prioritize greener sources of energy generation.
- Although the utilization of these energy technologies does not result in the emission of GHGs or the contamination of the atmosphere and water bodies, it does have certain secondary implications on the natural surroundings.
- The emergence of smart grids, innovative communication technologies, and energyefficient and intelligent equipment by private firms has the potential to provide novel market opportunities. The integration of smart grid technology facilitates the substitution of conventional energy sources with renewable energy sources. The implementation of a smart grid system is beneficial to the environment due to its ability to efficiently distribute renewable energy sources. The implementation of a smart

grid presents a tangible opportunity for achieving substantial environmental enhancements.



Fig. 5: Various challenges in the renewable energy sector of Bangladesh, [34]

6.2 Recommendations

In order to address the escalating energy demand, Bangladesh must transition from its reliance on natural gas to renewable energy. The existing power system is associated with economic inefficiencies resulting in financial disadvantages. The optimization of energy utilization necessitates the implementation of comprehensive measures encompassing policy formulation, system enhancement, and infrastructure development. The government's strategic plan for 2021 places significant emphasis on the utilization of renewable energy sources. The subsequent section presents the proposals for the advancement of renewable energy in Bangladesh.

- In order to develop an effective generation expansion plan, it is imperative to take into account the increasing demands emanating from several industries.
- The prudent utilization of energy resources should be prioritized by governmental entities.
- The connectivity of the power transmission network must be designed to ensure optimal redundancy. Furthermore, it is imperative to ensure that the transmission and distribution network is strategically constructed to facilitate the division into distinct zones, hence mitigating the risk of widespread power outages at a national level.

- In order to address the need for energy, it is imperative to find suitable sites for the exploitation of wind and solar energy.
- The coordination of expansion plans for the generation, transmission, and distribution sectors is crucial.
- There is a need for increased infrastructure development to support diverse energy sources for electricity generation in remote regions.
- After evaluating various sources, it is imperative to increase the proportion of renewable energy generation.
- The responsibility for managing and recycling waste should be shared between governmental and non-governmental bodies.
- The objective is to establish a comprehensive energy sector in Bangladesh that will function as the primary driver of a sustainable economy.
- Efforts should be undertaken to raise awareness among the rural population and provide them with the necessary training to effectively utilize these energy sources.
- The long-term generation expansion master plan must be amended at least every five years.
- The tax exemption of machinery pertaining to the importation of renewable and sustainable energy is necessary.
- The diversification of renewable energy sources is necessary in order to provide rural communities with energy access.

In spite of Bangladesh's advantageous geographical positioning for harnessing solar energy, the country's limited land availability hinders its ability to do so on a substantial scale. In order to address this matter, it is recommended that the government consider implementing subsidies to support the establishment of biogas facilities, microhydro plants, and offshore windmills in different regions of the country.

7 Conclusions

The energy situation in Bangladesh represents a significant challenge, necessitating the harmonious integration of both conventional and unconventional energy sources as a potential solution. This analysis provides a concise overview of the current state of renewable energy in Bangladesh. The implementation of small and medium-sized renewable energy systems presents a viable and sustainable resolution to Bangladesh's energy predicament, encompassing both urban and rural regions. The enhancement of renewable energy technology within this nation is subject to some impediments that must be addressed. Extensive investigation has been conducted on the current advancements in research and development pertaining to renewable energy technologies in order address the aforementioned obstacles. to Consequently, a number of recommendations have emerged from these endeavors. The imperative for the government of Bangladesh to proactively enact effective policies aimed at mitigating the nation's energy crisis, precipitated by the depletion of natural resources, is evident. Bangladesh currently exhibits a substantial dependence on a combination of renewable and non-renewable energy sources, which are effectively harnessed through the utilization of advanced technology and diligent endeavors undertaken by diverse agencies and organizations. In order to optimize outcomes within the renewable energy sectors, it is imperative for the government to adopt cutting-edge technology for resource extraction and enact legislation that is conducive to the industry's growth.

Declaration of Generative AI and AI-assisted Technologies in the Writing Process

During the preparation of this work the authors used QuillBot in order to rewrite and paraphrase text for reducing the similarity index. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

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APPENDIX



Fig. 1: Energy sources

Table 2. Current status of renewable energy capacity instance in Dangiadesh, [20].						
Renewables	Technology	Quantity	Off-grid capacity (MW)	On-grid capacity (MW)	Total capacity (MW)	Capacity (%)
	Solar Hama System	6022622	262.75	(101 0)	$\frac{(10100)}{262.75}$	
	Solar Home System	0023032	202.75	0	202.73	
	Solar Park	7	0	130.23	130.23	
	Solar Irrigation	2127	44.26	0.03	44.29	
Solar	Rooftop Solar Except for NEM	114	14.20	25.13	39.33	
	Net Metering Rooftop Solar	1395	0	24.74	24.74	
	Solar Street Light	296861	17.07	0	17.07	
	Solar Powered Telecom BTS	1933	8.06	0	8.06	69.50%
	Solar Minigrid	27	5.66	0	5.66	
	Solar Microgrid	0	0	0	0	
	Solar Nanogrid	2	0.001	0	0.01	
	Solar Charging Station	14	0.27	0.02	0.28	
	Solar Drinking Water System	82	0.1	0	0.1	
	Total Solar	6326194			532.5	
Hydro	All hydro projects	1	0	230	230	30%
Wind	All wind projects	3	2	0.9	2.9	0.37%
Biogas	Biogas to electricity	7	0.69	0	0.69	0.09%
	Biogas plant	83431	0	0	0	0%
Biomass	Biomass to Electricity	1	0.4	0	0.4	0.05%
Total		6409637	355.45	411	766.49	100%

Table 2. Current status of renewable energy capacity installed in Bangladesh, [28].

Danamahlan	Ongoing		Under planning		
Kenewables	Location	Capacity (MW)	Location	Capacity (MW)	
	Sunamgonj	0.65	Bidyut Bhaban, Dhaka	0.04	
	Rangamati	8	WAPDA Bhaban	0.03	
	Sharishabari	3	Barkal Upazilla Sadar	0.01	
	Kurigram	30	Rajashahi (IPP basis)	1	
	Solar street-	0.41	Swandip Upazilla	0.5	
Solar			Chandpur (IPP basis)	0.5	
			Thanchi Upazilla	0.5	
			Rangunia	60	
			Bangabandgu Bridge	45	
			Ishwardi	2-3	
			Jhenaidaha	112	
	Muhuri Dam, Feni	15			
	Kepupara, Borguna	15			
Wind	Mognamaghat, Cox's Bazar	15	Parky Beach, Chittagong	50-200	
	Kuakata, Patuakhali	15			
	Parky Beach, Chittagong	15			
Hydro	Mirersorai, Chittagong	0.06			
	Barkal Upazila, Rangamati	0.05			
Hybrid	Hatiya island, Noakhali	7.5	Kutubdia island	1	

Table 3. The forthcoming renewable energy initiatives in Bangladesh [23].

Table 4. The potential for renewable energies in Bangladesh [23].

			0	
Renewables	Current investment	Benefits	Future prospect	Barriers
Solar	Private and government	Available, environment friendly	Bright	Low winter radiation, availability of land
Biomass & Biogas	Private and government	Available, cheap recycling waste	Bright	Carbon emission
Wind	Private and government	Environment friendly	Limited to coastal areas	Low wind speed in winter
Hydropower	Government	Reliable, safe	Limited to a few locations	Environment concerns
Nuclear	Government	Minimal pollution	Under investigation	Sustainability and maintenance concerns
Geothermal	None	Excellent for cooling and heating	To be investigated	Maintenance and expensive concerns

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