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# Paving towards Strategic Investment Decision: A SWOT Analysis of Renewable Energy in Bangladesh

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**Abstract:** Bangladesh, being a developing country, needs an uninterrupted electricity supply to sustain and expand economic growth. The government's strategic vision of 2021 and the international commitment under the Paris Agreement has meant to attract new capital investments for renewable electricity generation by diversifying energy blends, ranging from natural gas to more reliable coal technologies and renewable energy. To understand the practical implementation of such policies, this paper explores the key factors of the renewable energy (RE) sector of Bangladesh. This research has adopted the strengths, weaknesses, opportunities, and threats (SWOT) analysis method to examine the RE market and to understand the determinants of foreign direct investment (FDI) to attract new investments. For the analysis purposes, data were collected from extant literature and semi-structured interviews from the RE experts in Bangladesh. This study bears significance as it empirically reflects the government's vision and strategy on RE development and analyzes its challenges and recommends accordingly. The analysis of the study reveals that the regulatory framework, tax haven/exemption, higher tariff, and presence of government guarantee are the major strengths to draw foreign investment. On the contrary, land acquisition, lack of coordination and collaboration among government authorities, administrative procedures, corruption, and access to local finance turns out to be the key weaknesses to consider while investing in this sector. In terms of the external factors, increasing energy demand, increasing global awareness of climate change, and decreasing cost of RE setup equipment act as potent opportunities; while the dominance of fossil fuel and discontinuity of energy policies should be taken as threats that can hinder the flow of investment in this sector. Hence, in order to attract sustainable FDI in the RE sector, several key areas need to be strengthened in the short, medium, and long-term. These are: (i) regulations on non-discriminatory treatment to foreign investors; (ii) control of corruption; (iii) protection of intellectual property rights; and (iv) coordination and collaboration between ministries.

**Keywords:** foreign direct investment; renewable energy in Bangladesh; SWOT analysis; sustainable energy policies

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## 1. Introduction

In order to ensure sustainable economic development, the availability of clean, reliable, and less expensive energy sources is essential. Research has shown a definite link between reducing poverty and securing cheap energy supply [1]. The developing industries act as an instrument of progress for every economy, requiring an uninterrupted electricity supply to sustain and expand. Due to a high unemployment rate, a part of the Asian population barely survives underneath the poverty line, especially in the rural regions [2]. Bangladesh, being a developing economy in South Asia, has been suffering from an acute energy crisis for many years. However, Bangladesh has managed well to sustain the economic shift into industrialization and urbanization. Nevertheless, the government requires enough energy support for policies to succeed into economic advancements. The country is further internationally obliged to produce clean energy under the Paris Agreement [3].

To comply and live up to the commitment, the strategic vision of 2021 was launched for major infrastructure development programs in partnership with the private sector, especially for the power and energy sector. Such strategic partnership vision was initiated with a vision to attract foreign direct investment (FDI) in the field of renewable energy (RE). The government's detailed policy in energy industries includes drawing capital investments in order to generate, transmit, and deliver electricity while diversifying into a much cleaner energy mix, energy conservation, and making sure the proper usage of the capacity to secure a long-term stable and sustainable energy market [4].

The construction of RE systems involves substantial capital investment along with sophisticated technologies. Due to the mounting energy needs stemming from the rapid industrial export-led growth, Bangladesh will require an investment worth \$40 billion by 2021 and an additional \$42 billion by 2030 for the sake of new electricity generation, distribution, and transmission [5]. Thus, the government promotes FDI inflows in the RE sector through policies and incentives (e.g., royalty exemption, technical know-how and technical assistance fees, and foreign loan rates). FDI in the power sector has spiked from \$30 million to \$208 million (10% increase of total FDI flow) within 2004–2005, followed by a 22% increase (up to \$588 million) in 2017–2018 [6]. Hence, this study critically acclaims the necessity to analyze the critical factors of inward FDI in the RE sector in order to help the policymakers and investors to better understand the perks of RE sector investment in Bangladesh. Subsequently, to sustain economic growth and fulfill the commitment toward clean energy production, the government of Bangladesh must need FDI and new scalable investments to expand the country's existing RE industry.

This paper explores the key factors from a country perspective that affect foreign investor's decision-making concerning Bangladesh's RE sector. To achieve that aim, this research has adopted the SWOT analysis tool to examine the strengths, weaknesses, opportunities, and threats of the RE sector in Bangladesh. For the analysis purposes, data were collected from both the extant literature and semi-structured interviews conducted on the RE experts (industry, multilateral, government, and academic) in Bangladesh. As an outcome of the findings, this study signifies and contributes by empirically reflecting the government's vision and strategy on RE development by analyzing its perks and challenges with proper recommendations. Even though energy specialists' estimations of RE are very persuasive, unfortunately they often have neglected the regulatory, social, political, and ethical dilemmas regarding the generation of RE. Moreover, numerous thesis, reports, and books are written by the advocates of RE, primarily focusing on the scientific assessment of electricity generation and they have nearly missed to address the regulatory and social phases of energy decision-making. Therefore, this research attempts to provide an in-depth SWOT analytical perspective on the generation of RE in Bangladesh by avoiding any unsubstantiated assertions, which makes this study undoubtedly stand

out as a major reference work on the subject. Hence, this study would be a tremendously helpful guideline for investors to grasp the complete scenario of the RE sector in Bangladesh.

## 2. Outlook of the Renewable Energy Sector in Bangladesh

Bangladesh's fossil fuel sources are still the principal reservoirs for the output of fundamental electricity [7]. Bangladesh's electricity demand grew dramatically from 0.4 to 1.38 quadrillion between 1997 and 2016 [8]. As previously stated, the country could not provide 100% of the electricity because of insufficient energy sources [9]. The total coal reserves in Bangladesh are only 1063 million tons, although according to the 2013 figures, the natural gas reserve has shown its availability at a volume of 9.7 trillion cubic feet (TCF) [10]. Besides, Bangladesh imports almost 1.2 million tons of crude oil per year and 2.6 million tons of refined petroleum products to supply fuel to different industries, including the electricity sector [11]. In 2017, Bangladesh consumed about 2.4 million tons of coal [12], 14.6 million tons of oil [12], and 26.59 billion cubic meters of natural gas [13].

The country's energy application has dramatically increased, and the development is majorly focused on non-RE sources. Rapid industrial and economic development has resulted in a rising natural gas deficit in Bangladesh over the past ten years. Around 40% of all-natural gas used between 2012 and 2014 was utilized by the manufacturing industry alone [14]. Reduced supply of gas and other natural resources for power generation resulted in frequent and sustained power failures throughout the country, especially in the summer months [15]. This has adversely affected the production of both agriculture and small and medium-sized enterprises by leaving them without an alternative energy source.

Moreover, energy output contributes nearly 40% of the country's absolute CO<sub>2</sub> emissions [16]. In 2018, Bangladesh produced 7418 MW of electricity, compared to 11,534 MW of demand. This disparity between supply and demand impedes the nation's financial growth. From this point on, Bangladeshi policymakers have officially taken steps to build and elevate sustainable power tools to mitigate the climate's destructive changes.

Bangladesh still produces most of its electricity from fossil fuel sources. The increasing economic developments illustrate their continued dependency on imported fossil fuel to meet the expanding demand for electricity will remain the same unless and until they achieve the RE policy that has been designed in 2008. Strong reliance on the import of gas, coal, and oil would not only put Bangladesh under economic pressure but pose essential questions about its long-term energy security. Moreover, as one of the most vulnerable countries in the world to be affected by the threat of the rising sea levels [17], burning fossil fuels has placed the country in a more vulnerable position to achieve its commitment preached under the Paris Agreement.

Renewable energy, worldwide, has been regarded as the answer to fight against the growing concerns on climate change. Technologies relating to RE resources have also been significantly developed in recent times [18]. These aspects have brought a positive perspective on RE in the future. Renewable technologies can be a feasible option for Bangladesh to combat electricity scarcity, protect energy, and have long-term energy planning with decreased emissions of greenhouse gases (GHGs), thus fulfilling the climate change objectives. Bangladesh, being one of the Asian tiger economies, should be geared towards the utilization of its RE resources [19]. Additionally, the country is gifted with high potential of RE resources; hence, a substantial share of electricity can be produced by utilizing the RE technologies.

Ensuring energy efficiency has become a concern for the policymakers; therefore, the government's vision relating to RE emerged as a viable alternative to maintain economic development. The government is focused on different industries with the scope of enhancements toward energy efficiency, they are mainly textiles, ready-made garments, frozen food, and stainless steel [20]. Manufacturers from these industries were provided support to develop energy management and information systems, provide company staff with project experience, and to grow corporate energy management policies, plans, performance targets, and financial and staffing commitments. The government has also addressed the

banking sector and energy service companies by developing a dedicated energy efficiency funding pool, a pipeline of bankable projects, and by conducting outreach, training, and capacity building activities [21]. Nevertheless, experts believe that there remain certain challenges to achieve the set goals for energy efficiency. Hence, the policymakers are suggesting to reevaluate the RE sources and utilize the best of it.

Bangladesh contains a large number of RE sources, which can effectively meet the increasing need for energy. Figure 1 offers a preview of numerous sustainable power supply developments and electricity generation accessible properties in Bangladesh [22]. In Bangladesh, RE sources include vitality for solar, wind, biomass, geothermal, and hydropower and dismiss conventional nuclear energy out of the equation. It is important to note that Bangladesh is also going to produce nuclear energy to fulfill its huge energy demand and adhere to sustainable developments.

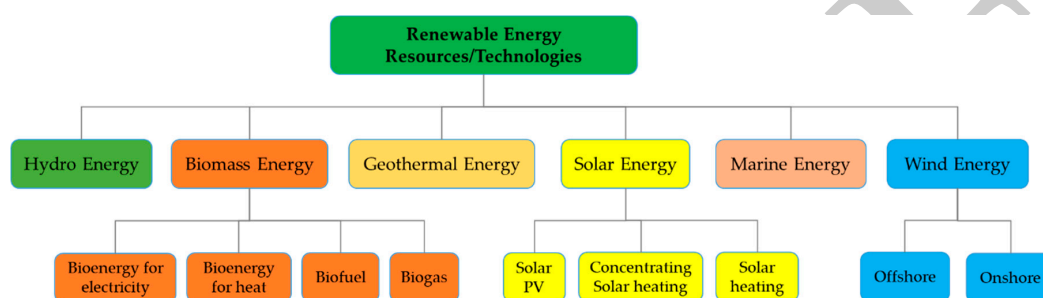


Figure 1. An outline of renewable energy sources.

The above discussion demonstrates that enormous amounts of RE sources are available in Bangladesh. Biogas, biomass, and solar potential in Bangladesh are considered possible, beneficial, and efficient RE production sources. While RE sources and corresponding technologies have globally become a trend, Bangladesh is still striving to use these resources effectively. Table 1 offers an analysis of Bangladesh’s RE capital and potential [16].

Just 1% of the country’s cumulative electricity production comes from RE resources, but the RE figures include about 19% of global cumulative power supplies [23]. Nevertheless, in 2020, Bangladesh has plans and policies to increase RE output applications up to 10% [24].

Table 1. Renewable energy potential in Bangladesh.

Renewable Energy Sources	Potential Future	Entities Involved
Solar	Tremendous	Public and private sector
Biogas power plants based on Cattle waste	350 MW given that 0.752 m <sup>3</sup> of biogas consumption per kWh	Mostly by the private sector
Hydro	Latent prospect for micro or mini-hydro (max. 5 MW) are limited. Anticipated hydro potential approximately 500 MW	Predominantly by the public entities
Wind	Wind mapping is further required to gauge the potential	Mainly via PPP
Rice husk-based biomass gasification power plant	300 MW given that 2 kg of husk consumption per kWh	Mostly by the private sector
Domestic biogas system	8.6 million m <sup>3</sup> of biogas	Both the public and private sector

### 2.1. Biomass

The amount of biomass assets in Bangladesh is enormous. The assets include the rice coat, animal waste, sediment, wood, city waste, jute stock, sugarcane residual, and additional sources, including the ecological and biological wastages. Moreover, practically 70% of people in Bangladesh rely immediately or discursively on the vitality of biomass [25]. Nonetheless, about 2.6 billion people on the planet rely on biomass for purposes like heating or cooking [26].

Apart from biomass, biogas is provided by anaerobic processing, which has the potential to be used to manufacture fish feed, fertilizer, and power production. Bangladesh has an immense prospect generating biogas from existing accumulations and waste. A study revealed that Bangladesh's 2.91 billion m<sup>3</sup> of biogas is the conceivable number. In 2012–2013, such a biogas reserve is equivalent to 1.455 billion liters of diesel [27].

The production of organic fuel in Bangladesh remains an embryonic phase in which ten pyrolysis plants have been established to supply bio-oil from diverse sorts of biomasses [28]. However, due to insufficient funding and advanced technologies, the plants do not function properly [29].

Bangladesh's REP 2008 policy aims to harness the possibilities and spread of RE resources, including biomass gasification and the promotion of clean vitality while exchanging fossil fuel properties. Clean biomass vitality can result in less carbon emanations than dependence on fossil fuel. Hence, Bangladesh has a thriving potential in biomass to obtain the goal toward a cleaner environment.

## 2.2. Solar

Solar-powered electricity is one of the most fascinating, effective, and unlimited sources of energy that is universally adored and accepted. Concentrating solar power (CSP) and the solar photovoltaic (PV) are prospective developments as a solar-based home system delivers electricity from solar radiation. In Bangladesh, the possibilities for the use of solar radiation are enormous since it is located in the topographical zone [30]. In the daytime, she receives typical sun-oriented radiation of 4–6.5 kWh/m<sup>2</sup> which can produce around 1018 J. Month by month sun-based radiation from some selected locations of the country is shown in Figure 2.

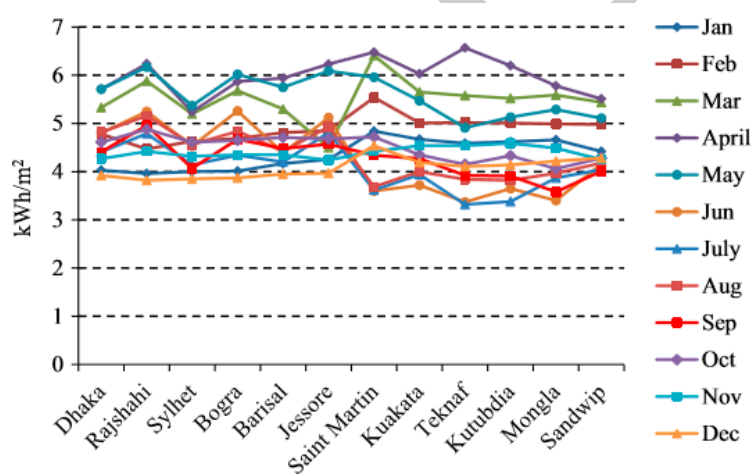


Figure 2. Solar radiation of some selected areas [7].

Bangladesh has already had some progress and efficient use of solar-based energy generation technologies [31]. The country has almost 234 MW of energy potential produced by sunlight-based home frameworks [32]. Bangladesh has 50,174 MW of power generation from solar PV [33]. However, the nation generates and delivers just three MW from the PV panels to the national grid. Nonetheless, the Bangladesh Power Development Board seeks to implement additional solar power plants and LED road lighting to reduce electricity demand.

## 2.3. Hydro

Hydro energy includes a form of renewable source of energy that uses water stream power to produce electricity. The considerable water flow converts its energy into electric power. Bangladesh is blessed with many rivers and streams, and the country has a good range of hydropower extraction possibilities. The Bangladesh Power Development Board (BPDB) and the Bangladesh Water Development Board (BWDB) have identified some suitable production facilities for micro-hydro power in Bangladesh.



#### 2.4. Wind

Wind energy is well acknowledged for its environmental friendliness and recognized as the cleanest form of renewable sources toward a more sustainable future for energy. Here, electricity is produced by the wind propelling the turbine shaft with kinetic energy.

Bangladesh's geographical location makes it ideal for small wind turbines [34]. At the Muhuri dam area in Feni, BPDB has introduced four primary wind turbine units with a capacity of 0.90 MW. In 2008, BPDB launched a further 1 MW wind turbine on Kutubdia Island that comprises 50 wind turbines, each with a 20 kW cap [35].

Furthermore, separate government and non-government establishments have adopted cross-over initiatives to set up more wind based power plants [36]. The government has also agreed to enter into an agreement for a joint project with US DK Green Vitality (BD) Ltd. to seek assistance from the United States and Denmark to implement Cox's Bazar's largest-ever wind control system with a maximum of 60 MW [7].

#### 2.5. Additional Renewable Resources

Bangladesh has the potential to generate tidal, oceanic, and geothermal energy in the future [7]. However, these assets' potential is still under scrutiny, and critical efforts are required to acquire the environment-friendly options for Bangladesh. However, due to the lack of sufficient human resources, local innovation, and technical developments in Bangladesh, these assets still have to be evaluated [37]. In this regard, the government attaches great importance to assess the sources and how they can take on a role in the country's sustainable power source segment.

### 3. Methodology and Analytical Factor

The famous SWOT analysis is an amazing strategic analytical toolkit useful to evaluate the internal strengths and weaknesses of a project/business and the opportunities and future threats stemming from external factors. SWOT is an essential tool helpful for managers and investors to systematically strategize the decision-making which is dynamic enough to use at the country level too. SWOT analytic results help businesses build on their strengths, explore new opportunities, and work to reduce or remove any potential market risks [38].

For energy researchers, the SWOT analytical tool is generally recognized as an effective method to understand the overall scenario of a country's energy industry. For instance, to test Nigeria's nuclear exploration agenda, Ishola et al. [39] resorted to SWOT as an instrument. Kamran et al. [40] also used SWOT to analyze Pakistan's RE sector. Besides, an exhaustive evaluation was performed using the SWOT analytical method in the light of the possible developments of green energy technology in the East Asian economies; namely, Taiwan, Japan, and South Korea [41]. Research using SWOT analysis has also been carried out to test solar PV power in Africa as opposed to China [42]. SWOT analyses were also used in another study to test Macedonia's national energy sector [43]. A SWOT review was performed to draw investors in the Tunisian RE market to infer the main issues and considerations to assist the sector to grow [44]. Very recently, a SWOT analysis was performed to understand the policymaking of nuclear energy generation in Ghana [45].

This analytical method has several advantages: it comes with little to no cost—anybody understanding the particular area in use will use it. It also focuses on the crucial factors that may impact the smooth execution of a project or company. It may further be helpful to generate ideas but not of much help while choosing the optimal idea [46]. This study is the pioneer in the domain of FDI and RE of Bangladesh, which would be helpful to strategize building and making an informed decision while investing in this sector.

The study is qualitative in nature and a qualitative approach is better suited to understanding complex problems in cases such as this, hence, the semi-structured interview is used as the data collection technique due to its distinctiveness compared to the others [47]. Implementing the interview

is proven to add heightened flexibility to the process; further, Painuly [48] emphasized the importance of interacting with the experts in order to skim out or extract the determinants/factors, which is later on used by Keeley and Matsumoto [49] in the very same domain of RE.

Since it is possible for the experts to offer diverse interpretations from the same data [50], numerous studies have relied on 'expert opinion' due to scarce data on a central database or the difficulty of collecting data from the existing literature or secondary sources [51]. Hence, the rationale for this study to use semi-structured interviews was to document the experts' judgments as the reflection of the renewable energy sector (Bangladesh), practitioners' viewpoints, and verify/support the significance of the SWOT factors comparing with the extant literature review.

In light of the discussion, it is vital for the study to answer the question "Who are the experts?". In general, 'expert' is referred as a person with specialized knowledge on a particular domain obtained from experience or practice [52], whereas Morales-Ramirez et al. [53] defined the term in a simpler way, stating that the stakeholders with key knowledge to contribute on a given topic should be called as an expert.

In this study, the RE experts, namely, power purchase agreement (PPA) signed solar and wind companies (4), multilaterals (2), government bodies (2), academics (1) who have active participation in implementing renewable projects in Bangladesh are taken as experts for interview. The total number of experts in this study is 9. Hence, we have a sample frame of 9 RE experts for this study. The sample size of the study is substantiated since it is already established that only 5 interviewees are sufficient to conduct a study [54].

Using a semi-structured interview with SWOT format has achieved the objectivity of the study. While conducting the open-ended interviews, this study has asked the experts to answer freely on the topic of FDI inflow in the renewable energy sector in Bangladesh, which is guided by the SWOT format. Here, each SWOT dimensions and underlying factors identified via the literature was explained in-depth to the interviewees following the interview material (see Appendix A) in order to create a common understanding. The study of Hoff et al. [55] found the SWOT interview to be more sensitive and effective, rather than the conceptualizations of the respondents. Although the nature of the SWOT questions plays a vital role in the sensitivity of the answers from the respondents. During the SWOT interview sessions, the experts (industry, academic, and multilateral) were encouraged to reflect on the strengths, weaknesses, opportunities, and threats imminent to the RE sector and to explain how these factors might impact the FDI or investment decision of a foreign company. Since SWOT analysis does not specify a special set of answers, it rather limits the respondents to reflect along the three dimensions of positive-negative, past-future, and internal-external [56]. This study has selected a total of 9 experts to carry out the semi-structured SWOT interview, where 4 of the experts were from the industry (the top management decision-makers of the successful RE companies with FDI) whose feedbacks we took to extract the internal factors of the SWOT and the external experts are the rest of the 5 experts from academic and multilateral. Hence, this study has ensured that comparison on the experts' view on the FDI inflow in the RE sector from three dimensions, namely internal-external, past-future, and positive-negative, would be presented on the discussion section. Hence, this semi-structured interview guided by SWOT format has fulfilled the objective of the study in order to promptly reflect and explore the factors stemming from SWOT analysis on behalf of the topic.

The experts as interviewees include two chairmen, one managing director, two senior manager/engineer, one deputy general manager, one professor, and one director. Notably, most of the interviewees are directly or indirectly involved in research or academia or policymaking or strategic investment decision making in the industry. In order to reduce the cognitive bias, the experts are selected and interviewed with good care, keeping the following key areas into consideration: (1) experience in investment in terms of financing (local and foreign), (2) scalability of the project, (3) role in decision making, (4) experiences in commissioning or implementation, and (5) experiences in policymaking. In Table 2, the detailed description of the profile of the experts is tabulated. Considering the sensitivity of the issue and personal data protection, the names of the expert interviewees are kept anonymous.

Table 2. Expert Profile.

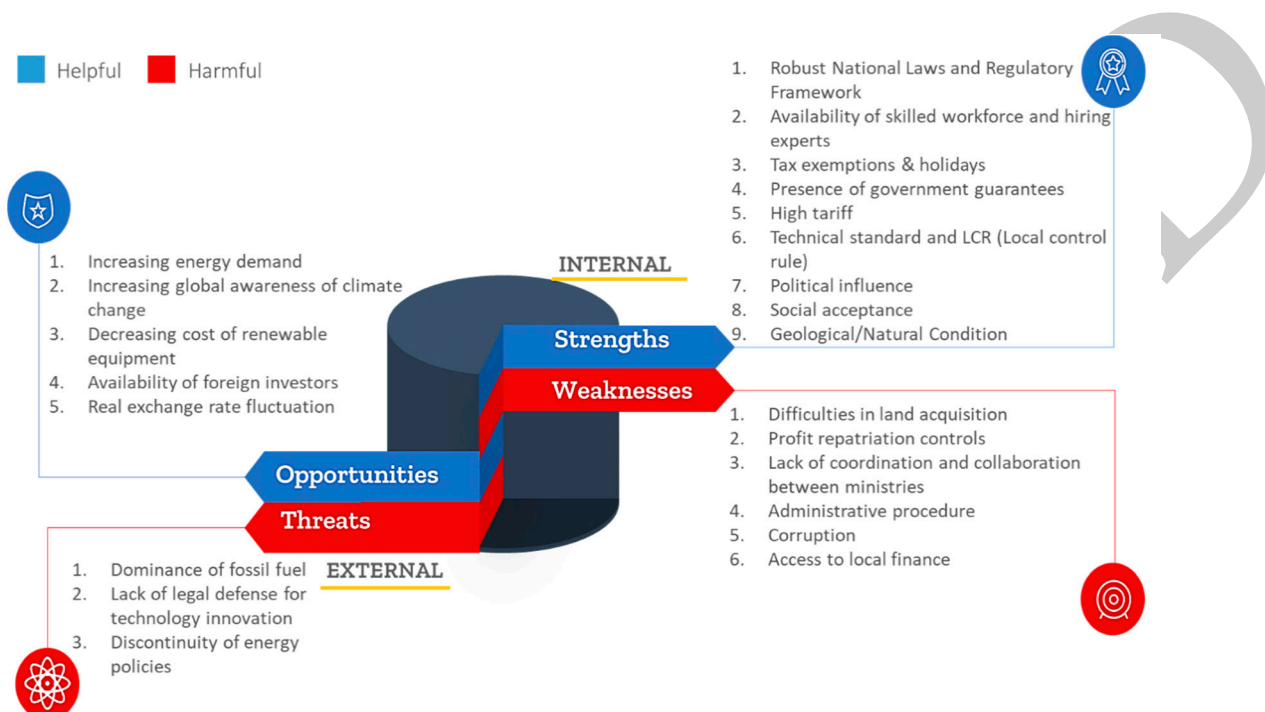
Experts Field	List of Experts	Designation of the Expert	FDI Source or Headquarter	Sector or Experience	PROJECT SIZE	Interview Date
Industry	Expert A	Managing Director	United Kingdom	Solar	28 MW	4 August 2020
	Expert B	Chairman	Singapore	Solar	50 MW	20 July 2020
	Expert C	Senior Engineer	China	Wind	60 MW	27 August 2020
	Expert E	Deputy General Manager	China	Solar	35 MW	27 July 2020
Multilateral	Expert A	Director	USA	Solar and Wind—Multilateral Financial Organization	NA	20 August 2020
	Expert C	Senior manger	Bangladesh	Solar and Wind—Local Non-Bank Financial Institution	NA	12 August 2020
Government	Expert A	Chairman	Bangladesh	Solar and Wind—Regulatory and Policy Making Authority	NA	29 July 2020
	Expert B	Deputy Director	Bangladesh	Solar and Wind—Green Financing and Policy Making Authority	NA	29 August 2020
Academic	Expert A	Professor and Director	Bangladesh	Solar and Wind—Academic and Institutional Researcher	NA	3 September 2020

NA = not applicable.



## 4. Results and Discussion

An in-depth analysis of the SWOT factors is illustrated here, synthesizing and skimming the gist of the semi-structured interviews; further, Figure 3 graphically represents the summary of the main SWOT factors that are elaborated in subsequent sections with relevant literature support.



**Figure 3.** Strength, Weakness, Opportunity, and Threat (SWOT) analysis for the renewable energy in Bangladesh.

### 4.1. Strength Analysis

#### 4.1.1. Robust National Laws and Regulatory Framework

In order to encourage and improve RE technologies, the regulatory system plays a critical part in the energy structure, which makes the regulative system have profound objectives to provide the energy market with a competitive edge. Such a regulatory structure is also critical since stakeholders need to adhere to the regulations ordained to invest and run business in the energy industry. Any shortcomings in the regulatory structure may threaten the process of market liberalization. The regulatory system should also make the public more informed of RE innovations and incentive programs to encourage RE investment.

The government of Bangladesh has serious concerns related to energy diversification through RE. The government has therefore formulated different policies and adopted regulatory measures. In 2008, the National Renewable Energy Policy was adopted to encourage RE by supporting distinctive private and public RE-investment platforms. Since then, research, innovations, preparations, and developments in the domestic RE industry have accelerated, although it still needs a systematic plan to gain adequate commercial benefits. Consequently, the Sustainable and Renewable Energy Development Authority Act, 2012, Scaling Up Renewable Energy Program for Bangladesh, 2015 (SREP Bangladesh), and Bangladesh Energy Regulatory Commission (Tariff for Roof Top Solar PV Electricity) Regulations, 2016 (Draft), etc., was adopted to promote the RE sector.

Foreign investors usually prefer the 'rules of the game' to remain reliable, not modified. It is a major red flag to the investors if the government makes amends to those rules as per its convenience, especially when investors have already made the decisions following the rules. This is particularly true in the case of the government honoring contracts and regulatory rules [57–59]. However, there are

instances when contracts have not been honored in many countries. This was seen most vividly in the Asian financial crisis of 1997, where a large number of independent power producer (IPP) contracts were renegotiated either through mutual or unilateral negotiations in countries such as Thailand, Philippines, Indonesia, and Pakistan [60]. In addition, when the government makes a pledge regarding the stability of policies and rules, there is sometimes a tendency to behave opportunistically ex post, after the capital has already been deployed [61].

All the experts have unanimously agreed that this factor simply forms the guiding principles by honoring the contractual commitments, securing turnovers, and building the trust that the investors' interests will be preserved. The experts further have come to a consensus that Bangladesh has an outstanding track record honoring the IPPs and there has not been a single case of payment default up until its liberation from Pakistan.

Under the Protection of Foreign Investors Act 1980, Bangladesh is committed to providing non-discriminatory treatment to foreign investors, and FDI companies are to enjoy full protection and security in the country. The act also inclusively assures the full repatriation of capital by FDI entities [62,63].

Almost all the experts agreed to the principles of this act, which lay down the legal foundations for foreign investment in Bangladesh. However, some of the experts (academic) also suggested that the act is very vague or outdated and does not clearly define the rules of engagement for foreign multinationals in the local context. This could be attributed to the fact that at the working level, from the experience of foreign investors, it has been found that the country is not as open to FDI as the act broadly suggests.

All experts opined that in order to get the PPA (power purchase agreement) passed from the government, each project has to meet the environmental regulatory standards relevant to the RE plants. This issue is currently more stringent for the biogas, biomass, solar, and wind power companies as they have to acquire environment clearance certificates (ECC). Moreover, there are additional regulations on the import, handing, and storing of technologies (such as PV) for the renewable power plants.

The Bangladesh Labor Code 2006 delineates detailed guidelines on the minimum standards for health, hygiene, and workers' safety to be followed on plant premises. This entails requirements for cleanliness, proper ventilation and temperature conditions, exposure to dust and fumes, disposal of waste, lighting, drinking water, and safety issues [64]. Our experts reveal that proper health, hygiene, and safety conditions are not strictly followed in most of the private power companies due to the lack of awareness of such issues and a tendency for companies to cut supplementary costs. However, countervailing evidence also suggests that Western multinational enterprises (MNEs) and joint venture solutions (JVs) give consideration to these regulations by either enforcing them directly as part of their global compliance requirements or at least having them adequately ensured through their local counterparts.

#### 4.1.2. Availability of Skilled Workforce and Hiring Experts

As far as the latest statistical report of the International Renewable Energy Agency (IRENA) goes, some 137,400 jobs have been generated in Bangladesh's solar home systems, accounting for 80% of total installed solar power [65]. In terms of employment, Bangladesh is the fifth-largest renewable-energy workplace. China has 2.2 million jobs and half of the world's jobs are covered by Japan, the United States, and India [66]. The report notes that most of the energy sector jobs have been in distribution, installation, and repair of the technologies in Bangladesh [67]. Around 10,000 employees still work under the RE projects. In the country, about 327.14 megawatts of electricity are generated by 5.8 million solar-home systems [68]. Jobs in the field of renewables have shown greater incorporation and gender diversity compared to fossil fuels [1].

Further, all of the experts (industry) have mentioned that getting skilled engineers (both locally and internationally) for the commissioning of the projects are not a challenge, in terms of, both cost and availability. Hence, most of the partnering FDI companies would source the international

skilled workforce from either their mother company or via third party EPC (engineering, procurement, and construction) companies. However, some experts (industry) have expressed their concern that locally there is a scarcity of specialized professionals when it comes to people management and managerial skills. Additionally, there are no legal bindings on hiring foreign manpower in order to establish the renewable projects.

#### 4.1.3. Tax Exemptions

Almost every expert (industry, government, and multilateral) has emphasized the tax incentive and mentioned this factor as a key determinant to attract FDI and other investment/financing companies to the power sector since the power companies and RE firms are exempted from corporate income tax for 15 years and 10 years, respectively. Bangladesh allows avoidance of double taxation for foreign investors investing in the power sector on the basis of bilateral agreements. It also provides unilateral relief of taxes paid abroad on foreign sources of income [69]. Moreover, FDI firms are exempt from port import duties (importing equipment) to set up renewable plants. This eventually works as a great motivation for the FDI companies, since this exerts an increase in after-tax cash flow for the FDI companies that operate in the RE sector in Bangladesh, which is acknowledged by the experts (academic and industry).

Most of the experts (industry) ranked this factor very favorably as a prelude to attracting investment in the power sector. However, some respondents also reported that not all foreign companies are enjoying this incentive due to a lack of such treaties with their home countries. In addition, many respondents reported that the procedure itself is time-consuming, and often the National Board of Revenue (NBR) does not quickly recognize and act on it.

#### 4.1.4. Presence of Government Guarantees

In Bangladesh, sovereign guarantees were allowed for IPP projects in the initial launch of the program in 1996 to increase the much-needed capacity and attract foreign capital. It has been argued that in subsequent stages, sovereign guarantees have been given to a number of IPPs, especially those facing serious challenges in importing machinery and other related logistics to set up the power plants. According to an industry expert *"The unique part of the projects is state or sovereign being the offtaker, the guarantee lies that there will be no issue with payment on time even if the political atmosphere gets unstable"*. Hence, there are no distribution cost, no marketing cost, and no offtake hustle (political or economic shocks) to consider since the state is the offtaker. This is a huge incentive for the foreign investors and local investors to come and invest in renewable sector. However, such moves were widely criticized due to the allocation of such guarantees to companies who supposedly lacked the experience to implement the expected power projects [70].

#### 4.1.5. High Tariff

Among all other factors as strength, high tariff turns out to be the most unique and significant decision-making factor for the foreign investment companies to invest in the RE sector in Bangladesh. Our experts pondered the fact that when the government first started issuing PPA (power purchase agreements), many companies settled with an unnaturally high tariff for those RE projects. For instance, some experts from the industry stated that they are enjoying a tariff around USD 17 to 13 cents per KW, whereas the average tariff around the world is around USD 3 to 5 cents [71]. Due to this, many FDI companies came rushing like a moth to the flame; however, as time passed and more and more FDI companies started coming, the tariff rate is now hovering around USD 8 to 7 cents (expert from the government), which is still considerably higher than that of the international market. Hence, getting a hyper tariff compared to the global market for 20 years turns out to be the key decision-making factor for many FDI companies to partner with local solar and wind power plants. According to several experts (industry and academic), low production hours, lower irradiation, high cost of debt and equity, high cost of land and evacuation to grid, inefficient logistics support and cost (road networks,

transmission line, port discharge etc.), infrastructure, and diseconomies of scale, altogether makes the tariff hit the roof.

#### 4.1.6. Technical Standard and LCR (Local Control Rule)

In order to invest in a developing country, checking and making sure the technical standards are up to the mark is very crucial for renewable power companies. The majority of our experts (government and industry) state that Bangladesh meets the high requirement standards established for solar and wind power plant installation. Moreover, since the renewable power sector is growing, a local supplier market has also developed to support the RE installation (supporting industry for the steel frame, supporting machinery, local workforce, etc.). In order to make sure the renewable companies are complying with the technical standards, the Sustainable and Renewable Energy Development Authority (SREDA) has established set standards for the installation of these projects following the requirements by the International Electrotechnical Commission (IEC) as a quality benchmark.

To make this even better, the absence of local content rules becomes a blessing in disguise. Many countries put a strict condition that a particular percentage of the project or some specific components and equipment need to be sourced from the local market [72]. The good news in Bangladesh is there is no hard and fast rule as such or no requirements to follow the “local content rule”; hence, as per their comfort, the FDI companies can import equipment and bring in specialized labor (project engineers/specialists) from abroad.

#### 4.1.7. Political Influence

Political risk is probably the most common decision-making determinant that is checked by any foreign investment firm while investing in the power sector. Past literature shows that in different countries, power projects were subjected to political risks during the change of governments. However, our expert opinion has confirmed that Bangladesh is immune to this common weakness since there was not a single case where the new government either closed or renegotiate the terms and conditions with the FDI power projects [73]. Hence, renewable power plants that are implemented via direct negotiations have been indemnified by the law, and therefore, are not subject to any renegotiations. This gives good confidence to foreign investors.

#### 4.1.8. Social Acceptance

For an overly populated country like Bangladesh, establishing a land-intensive renewable project may lead to some social acceptance issues [3,74]. However, our experts’ opinions (industry, government, and academic) have confirmed that mass people have a positive attitude and mindset toward these projects due to the fact that they will get access to cheaper electricity and employment will be created from the projects. However, some of the experts (multilateral and academic) have highlighted their concern that if the land is acquired professionally, there is no pending court cases or dispute on the land, and the landowners are well compensated, then there should be no social issues to hinder these project. To clarify why land is connected to the social acceptance, one expert vividly mentioned that in an overly populated and corrupted country like Bangladesh, the ownership of the lands are micro-fragmented, while he elaborated his painstaking attempt to settle a land issue for 3 years. One piece of land can have so many owners, including fake owners with fake documents. For instance, for a solar project that has acquired 200 acres of land, it may have more than thousands of landowners or shareholders; hence, if the deals with these landowner goes south, that will have an adverse social impact via imminent dissatisfaction in the community. Moreover, if there are lawsuits and unsettled legal issues, the project will never see the light of commissioning up until these are resolved. However, the majority of the industry experts do not want to take this social acceptance connected to land factor as a weakness, rather they opined that by offering above the market price to these landowners, the projects/companies are easily resolving social acceptance issues from emerging. Additionally, these projects go through a strict environment impact assessment (EIA) for approval from the local environmental agency. Overall,

most of the Bangladeshi citizens have good support toward RE projects as they see it as a source of clean and cheaper energy.

#### 4.1.9. Geological or Natural Condition

Past literature has focused on the impact of natural conditions/resources (geological or climate condition) on the location decision of FDI which found a positive relationship between the natural resource and FDI [75]. For Bangladesh, the prospect of solar energy is immense since it receives an average of 4–6.5 kWh/m<sup>2</sup> of solar irradiation daily [76]. The maximum solar radiation is received during March–April and the minimum in December–January due to the winter season. Khan et al. [77] considered cloud coverage limits, sunlight hours, and the amount of solar radiation received to study the prospect of solar energy in Bangladesh. They found that although the radiation falls during the monsoon season, the average annual sunlight hour and radiation is good enough to run solar projects in most of the areas of Bangladesh. Plus, being a semi-tropical country in the northeastern part of South Asia, the country receives a profuse amount of sunlight around the year. The experts (industry and academic) in this study also are aligned with the literature; they mentioned the ample amount of solar radiation and duration as the latent strength to develop solar projects in this region. In addition, the reflection is there in the market where the vast majority of upcoming RE companies are solar companies. However, the natural condition of wind is still a grey area since there is a lack of both wind energy experts and projects in this country. This is reflected in this study, as we were able to collect data from only one wind project company, and the expert of that company stated that they are still working on the wind mapping to understand the impact during a storm or natural disaster. However, the expert (industry) also stated *“I personally does not think that during cyclone when the wind blows above 80–90 km speed onshore, any modern turbine can hold that amount of pressure and survive”*.

#### 4.2. Analysis of Weaknesses

##### 4.2.1. Difficulties in Land Acquisition/Rent/Lease

All the experts highly emphasized the ‘availability of land’ or “land acquisition” as the single most important issue while establishing a RE company in Bangladesh’s power sector. Findings from the expert opinions (industry experts) postulate that procuring land is costly, time consuming, and risky. Prior studies also support that land acquisition is one of the major challenges of FDI inflow in developing countries [78,79]. The findings of this study are aligned with one of the contemporary seminal studies of Keeley and Matsumoto [49] that states that land procurement restrictions, slow administrative process, and forced to go for partnership with the local firm may make the commissioning of the project infeasible, especially for wind and solar projects in developing economies. Adding to the literature, this study finds that most plots of land have multiple titles of ownership; therefore, investors are subject to costly litigation when procuring such land for setting up power plants, especially when it comes to solar and wind-based power plants that require large tracts of land in one stretch (all experts). For instance, one expert (industry) stated *“It took us more than two years just to obtain the land for our 28 MW solar project, while we had to negotiate and manage a large number of stakeholders that incur us intermittent cost, it was never-ending negotiations and the shareholders of the land kept popping up from everywhere”*. Moreover, renewable companies need to take into account the rehabilitation and settlement of the affected people living on these lands with adequate compensation when procuring such land [70]. As it is mentioned in the previous section (Section 4.1.8) that some potent social issues may arise if the payment settlement is not satisfactory to those landowners, which is not the bigger problem. Rather, the settlement of land issues with thousands of owners makes the land acquiring a tedious, painful, and immensely time-consuming process that hinders the prospect of the project and eventually letting in the FDI.



#### 4.2.2. Profit Repatriation Controls

Though Bangladesh allows full repatriation of profits for foreign investors to attract foreign investment, as widely promulgated in its investment promotion policies, in reality, it exerts a relatively strict control over foreign exchange transactions [80].

All the experts (especially the industry experts) unanimously agreed that foreign investors could fully remit their profits outside the country, although they expressed certain concerns. One respondent revealed that there are additional procedural delays and costs each time the company transfers profits outside. For example, the central bank levies a 5% tax deduction at the source for each transfer of profits. In addition, it is compounded by additional bureaucratic delays by the off-taker and the central bank through lengthy verification processes and paperwork, which does not bode well for foreign investors.

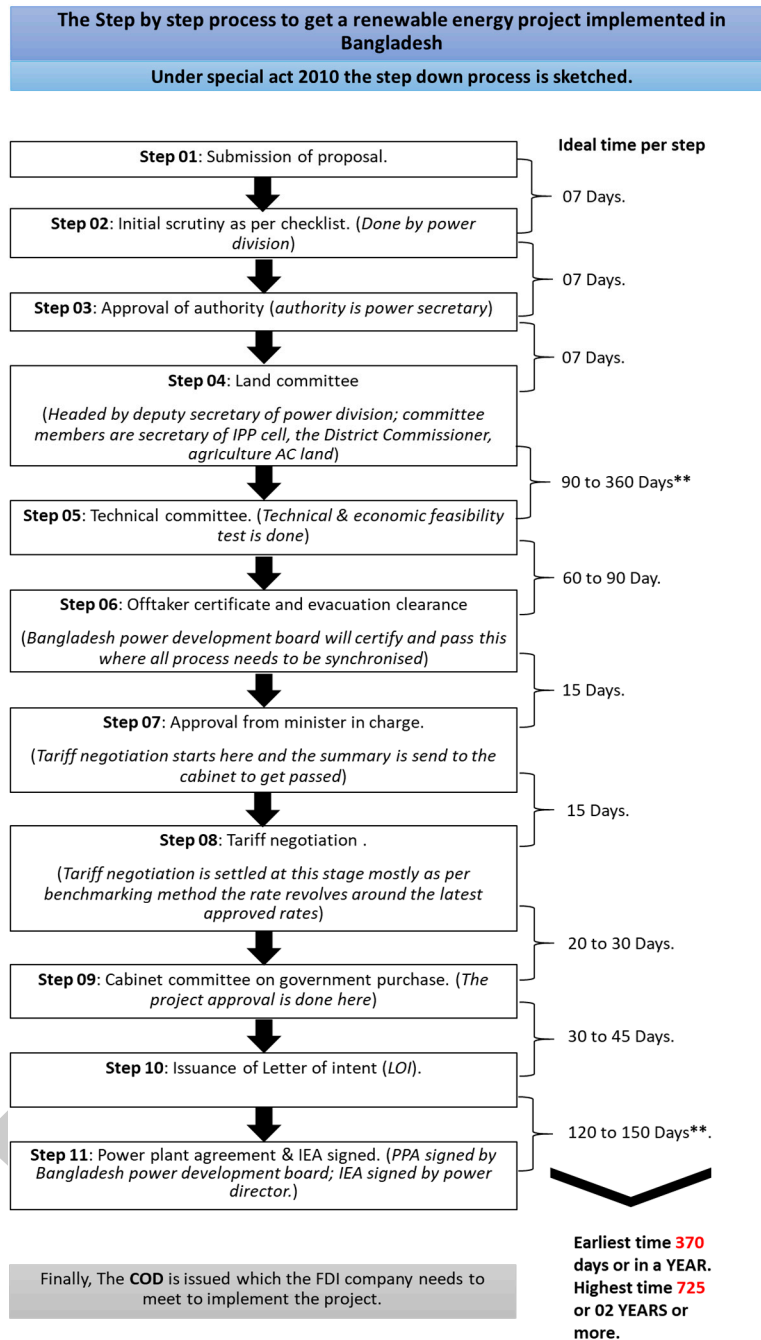
#### 4.2.3. Lack of Coordination and Collaboration between Ministries

It is found that effective collaboration and coordination is greatly lacking within the ministries, government departments, and several other offices that govern the power sector. For instance, almost all the experts (except the government experts) lamented on the sluggish and uncooperative nature of services of the Bangladesh Board of Investment (BOI) and other bodies, which are deemed to ensure easing the business set-up by facilitating the foreign investors. This issue is especially prominent in the approvals of licenses and permits for setting up power plants [81].

Bangladesh's bureaucracy and the lack of coordination between ministries are highly characterized by an uneven distribution of power and a large power distance. This inconsistent hierarchical power practice developed long ago due to societal roots. This uneven practice has now become a part of the administrative culture of Bangladesh. Although all of our experts expressly said on this issue, while many literature [70,82–85], both empirically and with historical analysis, proved how the lack of coordination between ministries and bureaucracy is hampering Bangladesh's economic growth.

This has significant bearings on the time, preparedness, and the costs of foreign investors. Normally, the construction of a power project goes through different stages before the commercial operations start. In Bangladesh, the typical procedure from the achievement of financial closure to the start of commercial operations is about 1–3 years for repeated projects and 2–4 years for large complex projects. The below Figure 4 illustrates this weakness vividly.

Most respondents identified that once the power purchase agreement (PPA) is signed, the project has to pass through certain formal procedures, of which securing a timely financial close and meeting the official commercial operations date (COD) are extremely important. However, many experts have shown their concerns with respect to securing financial closure on time, as they had to secure loans both from local and foreign sources, and the expediency and efficiency of their workers to complete the construction on time.



**Figure 4.** Step by step process of a Renewable Energy (RE) plant implementation in Bangladesh. Note: \*\* steps are the most critical steps where the bottleneck is severe and may hinder the project.

4.2.4. Administrative Procedure

According to several experts (industry), there are problems of lagging starts with the related institutions and their institutional framework, for instance, while importing equipment, Statutory Regulatory Order (SRO) issuing by National Board of Revenue (NBR) on time seems like moving mountains (for one industry expert, it took them 90 days to release equipment from port since SRO was not issued). The finance ministry, central bank, ministry of environment, customs are super inefficient, full of mismanagement and the port/stamp duty exemption is delayed to discharge equipment. Most of the time, the local partner of the FDI investor firm needs to go all the way to the higher authority to speed up the process, otherwise, the project gets stuck and takes forever to get approved.

Additionally, the property registration process in Bangladesh is very slow. According to the World Bank's Doing Business Report 2019, Bangladesh ranks 183 out of 190 economies in registering property, and typically, it takes 270 days compared with 69 days in India, 27 days in Indonesia, 53 days in Vietnam, and 9 days in Thailand [86].

Most of the experts (industry, academic, and multilateral) agreed that it takes on average a year to register property in Bangladesh, especially for acquiring newly purchased land from private sources. However, for those companies leasing land from the government for setting up their power plants, the registration time was shorter, taking approximately one month on average. Most experts (industry) agreed that having a lease from the government is the best option for registering property, but most often, these are allocated to companies who nurture strong political ties with the government. One of the pioneer experts in solar companies stated that *"BEZA has hustle free land for industrialization, which is equivalent to 70,000 acre. Only a 5–10% of this land is enough to create SOLAR PARK where FDI can come with an ease if no land acquisition issues to consider and invest targeting projects bigger than 500 MW"*.

Hence, a foreign firm does not have either that reach or the patience to go that far and fight against the system all the time. Bureaucratic red tape and administrative inefficiency/delay is the last thing an FDI company wants.

#### 4.2.5. Corruption

The experts from industry, multilateral, and academia have pointed out corruption as a major impediment toward investing in Bangladesh's power sector from abroad. Irregularities during the procurement stage are considered critical stumbling blocks. Besides, irregularities in procurement have led to persistent problems in accountability with the World Bank, especially concerning large projects involving multilateral partners [87]. Besides, it became apparent that companies have invested significant time and money to develop informal, personalized relationships with government officials in the illegal form to gain improper support. Such partnerships also help to prevent fines and any lack of supply by preserving a good record.

#### 4.2.6. Access to Local Finance

Infrastructure Development Company Limited (IDCOL) and Bangladesh Bank are the primary sources of funding RE projects. According to the experts (academic and multilateral), Bangladesh lacks a well-functioning capital market along with a limited number of venture capitalist funds that the FDI companies can access in order to cultivate substantial funds to fund their renewable power projects. Hence, the local banks and financing corporations are hesitant to dispense large loans for renewable projects set up due to lack of awareness about green projects, project risks, too much paper works and bureaucratic red tapes, disability to grant long-term loans (over 8 years), and not but the least, high interest.

### 4.3. Analysis of Opportunities

#### 4.3.1. Increasing Energy Demand

In recent years, energy demand has increased in the region, due to the growing population (average 2% annual growth), industrialization, and urban growth (average 4% between 1980 and 2013) [88]. In the industrial, commercial, and residential sectors, electricity demand rose at an annual growth rate of more than 10% over the last decade [89]. This has put pressure on the production of electricity. The nation's unrestrained high demand and growth rate of energy was 44% and 100%, respectively, between 2000 and 2009 [90]. The commercial and residential sectors have seen the highest rate of growth. This can be attributed to higher per capita incomes, enhanced internet connection, technological development, and increased revenues. A significant number of Bangladeshis still lack access to clean and cost-effective energy sources. Integrating domestic RE supplies like solar PV or biomass technology can rapidly change their lifestyles.

#### 4.3.2. Increasing Global Awareness of Climate Change

RE has become a global necessity. All policymakers worldwide are seeking ways of producing electricity with fewer harmful environmental effects for current and future generations. This opened up debates on the incorporation of RE into the energy mix of different countries. Therefore, several Asian countries are working to achieve RE [91]. Bangladesh is no exception; by promoting nuclear and RE sources, the government has worked hard to minimize emissions.

#### 4.3.3. Decreasing Cost of Renewable Equipment

There were some reports showing that in the past 2–5 years, the cost of PV modules and other main renewable equipment has reduced 40–50% [92]. Since in Bangladesh a project takes 2–3 years or more to implement, the equipment is usually ordered at the end of the project when the PPA is confirmed. Hence, at the proposal state or when the tariff is settled, the companies still have 2 years or more to source these equipment when the price eventually gets down. Here, due to the bureaucratic red tape and administrative procedural inefficiency, the delay of projects works as an opportunity for the renewable company to source in a cheaper rate but they enjoy the high tariff since the tariff was set 2–3 years back based on that time's market cost and everything. Many foreign investors see this as an opportunity and come to invest.

#### 4.3.4. Availability of Foreign Investors

Bangladesh has drawn interest of numerous nations which are on the quest for RE in its energy mix. According to The Minister of Science and Technology, countries, namely France, Russia, China, and USA, have expressed interest in expanding their renewable horizon. They are all involved in working together with the Bangladeshi government to introduce effective renewables projects.

#### 4.3.5. Real Exchange Rate Fluctuation

The real currency exchange rate either attracts or deters FDI based on the depreciation or appreciation of the host country currency [93]. Hence, the exchange rate volatility is an important macroeconomic factor that may deter attracting FDI in a developing nation [94]. One of the most recent seminal work of Keeley and Matsumoto [49] has opined exchange rate stability to be the most significant factors for FDI inflow in terms of RE investment in developing economies since the solar and wind projects have a very long-term payback period.

In this study, most of the industry experts have acknowledged the real exchange rate as an important factor but not as an external threat to the RE industry or FDI inflow. As most of the RE projects (i.e., wind and solar) are indexed in the USD while some are indexed in the local currency. Hence, the projects for which the payment is indexed in US dollars are subjected to exchange rate exposure when remitting their profits abroad. Therefore, exchange rate is not a risky or threat factor, rather it will act as an opportunity since Bangladesh's central bank maintains a stable exchange rate against the dollar and most importantly, it adopts a true-up accounting policy as an incentive to foreign sponsors by absorbing any fluctuations in the exchange rate when foreign investors remit profits abroad (academic expert).

### 4.4. Analysis of Threats

#### 4.4.1. Dominance of Fossil Fuel

The energy policies of Bangladesh still heavily promote the use of fossil fuels, which tend to prevent the entrance of renewable and cleaner alternatives. For instance, the government of Bangladesh subsidizes its citizens for fossil fuels. However, to minimize the adverse environmental effects of greenhouse gas (GHG) resulting from fossil fuel's continued use, countries must switch from the use of fossil fuels to clean energy. According to the Bangladesh government, the phasing-out of fossil

fuel subsidies could lead to a 5% decrease in GHG emissions by 2020 [95]. Carbon subsidies change economies and impede the evolution of sustainable renewable energies, contributing to a decline of capital expenditure opportunities. Politicians and policymakers prefer to concentrate more on short-term economic growth than sustainable long-term development, discouraging investors and business leaders from looking at alternative paths.

#### 4.4.2. Lack of Legal Defense for Technology Innovation

Patent information can provide valuable insights into the renewable energy sector as new technologies arise and markets continue to evolve. Analysis of renewable energy technology patents, for example, can reveal which countries and innovators are most active in inventing technologies, the potential markets where technologies need to be protected, technological development trends in certain fields of technology over time, trends in technology transfers from one country to another, and patterns of international research and co-operation, as indicated by co-invention and co-ownership [96].

As a developing country, Bangladesh is facing many challenges in the field of Intellectual Property Rights. The tapping of human potential and the development of industries are interrelated. Technological innovations and developments are key factors to cope with the new challenges for the overall development and growth of the renewable energy industry in Bangladesh.

#### 4.4.3. Discontinuity of Energy Policies

While several Asian countries have formulated a number of policy areas for developing their respective energy sector, their successful and consistent implementation is at risk due to domestic and international influences. The complexities surrounding policy implementation resulting from changes to the political regime also threaten considerable investments in the RE sector. This is a major problem in Bangladesh because many projects launched by previous governments across the country are left to rot when the political power shifts. It also raises the risk of funding significant investments that frighten investors.

### 5. Conclusions and Policy Implications

This study investigates the key factors that determine the decision-making process of firms considering direct investments in Bangladesh's renewable power sector. The results show that, on average, regulatory aspects are the most influential factors in this regard, followed by the economic, political, and social aspects.

In terms of individual factors, the government's commitment to contracts is the most influential in conducting investments, followed by land acquisition and tax exemptions. To attract sustainable investments in the power sector, there are several key areas that need to be strengthened in the short, medium, and long-term. In the short and medium-term, the focus should be on a number of factors. These are: (i) regulations on non-discriminatory treatment to foreign investors; (ii) control of corruption; (iii) protection of intellectual property rights; and (iv) coordination and collaboration between ministries. The long-term focus should be on land acquisition/rent/lease.

For example, for regulations under the Protection of Foreign Investors Act 1980 to provide non-discriminatory treatment to foreign investors, the government must ensure that the FDI companies are to enjoy full protection and security in the country. The government should also hold periodic checks to ensure that private power companies are actively complying with the national regulatory standards, including keeping licenses, certificates, and permits up to date. Additionally, strengthening energy policy requires diversification and localization of RE technologies. Inputs from the stakeholders are essential tacit knowledge to promote collaborative innovation activity in the energy innovation system [97]. The other policy variables are durability and stability. Policy durability and stability are linked to innovation outcomes related to RE developments [97]. In the case of increasing foreign



investments in the renewable energy industry, the government must also adopt policies to respond to the rapidly changing innovation environments.

For skilled labor, to mitigate a shortage of technically-skilled workers, more emphasis should be placed on linking academic curricula with industry or having appropriate accreditation procedures built into the curricula in compliance with industry norms and practices to help graduates acquire the necessary skills and training to make them readily employable [98].

For the control of corruption, there is a need for a transparent and competitive selection process, so that the companies selected are the best-suited, technically, financially, and commercially, for project awards. The government should not support certain parties that quote very low tariffs that block better parties from moving to the final stages of the contract award process [99]. This type of behavior functions to the detriment of private power procurement and also raises suspicions about transparency, accountability, and consistency in the procurement process.

For the protection of property rights, though Bangladesh is a member of some of the leading global conventions (i.e., World Intellectual Property Organization [WIPO] and several other intellectual property related bilateral and multilateral treaties), priority should be given to the effective enforceability of intellectual property rights, which is currently lacking due to weaknesses in different government agencies, including law enforcement and the justice system entrusted to protect against intellectual property rights violations and penalize offenders who commit [100]. The country has no adequate laws to cope with the new concepts of Intellectual Property Rights. There are some challenges that need to be addressed. Geographical Indications of Goods (Registration and Protection) Act, Prevention of Unfair Competition Act, Utility Model Law, and New Plant Varieties Act are the new legal documents that need to be enacted to promote RE technology innovation within the country.

For coordination and collaboration between ministries, it is recommended that the government give sufficient empowerment to the Bangladesh Investment Development Authority (BIDA) so that any decisions or concessions offered by BIDA are honored by the other relevant line ministries for facilitating investments in the power sector. In this regard, when any FDI is proposed through BIDA, the government should also engage senior representatives of other line ministries such as customs and immigration authorities, the National Board of Revenue, and the Bangladesh Bank so that a decision can be unanimously agreed for the facilitation of business and services. These decisions should be approved and documented in government gazettes for the formalization of these services for FDI recipients.

Finally, for long-term planning, land acquisition is a major problem for foreign investors due to the scarcity of land and the difficulty and complexity in owning large tracts of land in one place. Therefore, the use of power hubs can go a long way to effectively solve the problem as it would provide a one-stop solution to set up power plants in a dedicated specialized zone, which would ensure access to fuel supply, transportation and delivery services, cooling water for power plants, and access to the power evacuation system. The government can offer land leases in these hubs to the foreign companies to attract large scale FDI into these zones.

## 6. Practical and Managerial Implications

The result of this study could be generalized to similar middle-income economies, which are at an early stage to opening up their economy toward more renewable energy investment. The discussion part (Section 4) of the study will be immensely helpful for the upcoming FDI companies to make up their mind on whether to invest in the RE sector or not. Further, this study provides in-depth insights both at the firm level and country level (since the SWOT factors cover expert opinions from both internal and external stakeholders), which is very beneficial for the existing and upcoming local and FDI companies to understand the rule of the game better. In fact, one of the multilateral experts (external) has opined that since Bangladesh is at the nascent stage where only 2–3 companies are in the market who have successfully implemented their projects with foreign investment, there lies a big gap for both the local and prospective FDI companies to figure out the rule of the game. She also

elaborated that any document that points out the determinants with a structured framework such as the SWOT matrix would be the ultimate guideline for these firms to comprehend the rule of the game and become successful by cooking up short-term to long-term strategies. This study delivers that guideline. In order to go for any RE project in the future and being able to sketch up a formidable investment and project implementation strategy, to become successful is vital, since a perfect strategy can help to evade the underlying threats and work on the weaknesses in advance. Here, the in-depth explanation of the RE sector strengths (9), weaknesses (6), opportunities (5), and threats (3) summing up 20 salient factors will help the global managers or policymakers to extrapolate the threats and opportunities and analyze if they can eliminate these threats with the strengths or how bad the threats would be given the current weakness. Hence, it will be helpful for the FDI firm to come up with better offensive and defensive strategies. Finally, from the strength and weakness points combined with the opportunities and threats, they will be able to formulate strategies to enhance the opportunities with current strengths and turn the weakness into strength with the opportunities. At least, further analyzing these SWOT factors with real data from the field, any FDI company planning to invest in the Bangladesh RE sector will now be able to come up with the most important decision—whether they are going to partner with a local company and bring in the funds or not.

## 7. Limitations and Direction for Future Research

This study is particularly important as it provides an opportunity to revisit research concerns on the topical subject of investment decision-making determinants in the renewable energy industry which, paradoxically, has not been thoroughly addressed in Bangladesh and makes fresh and original scholarly contributions that add to the corpus of knowledge in the renewable energy field globally. It extensively and exhaustively deals with both prongs of the investment possibilities in the nuclear energy sector of Bangladesh by aptly analyzing the current status. Nevertheless, this study is subject to some limitations.

First, this study examines the factors that are influencing FDI decision-making in the RE sector of Bangladesh from a single-buyer model perspective, where IPPs sell their power directly to state-owned power companies through long-term power supply contracts. However, a more dynamic, open system, such as a power pool where multi-buyers and multi-sellers compete in the market, could offer different results. A new set of factors could emerge through the interplay between IPPs of long-term contracts and merchant power plants and in the presence of new FDI attracted by the changing dynamics of market competition. Second, due to the unavailability of a long-term quantitative data series, an econometric analysis was not performed. In addition, the interview has its limitations too in terms of ranking and showing the significance of the explored SWOT variables/determinants of FDI. With a view to overcome the shortcoming of the interview method and verify and clarify the significances of the explored factors from the experts' opinion, some impactful recent studies (on renewable energy domain) further took data from these experts using questionnaires and analyzed the data utilizing the analytical hierarchy process (AHP) [101,102]. The study of Pušnik and Sučić [103] also supports this approach by stating that an integrated methodical approach is needed to thwart the limitations of the interview, particularly for those studies using SWOT as the analytical tool.

Future research could shed more light on how such a system could unfold for the private power companies. The results of this study could be generalized for those countries that currently have a single buyer model and are looking to transition to a more dynamic open system (i.e., multi-buyer and multi-seller model) in the future. Additionally, this study has only interviewed experts from solar and wind energy and could not manage to interview experts from other renewable energy sources, e.g., hydro, geothermal and biogas. The research could not involve face-to-face encounters with participants of the industries mentioned above because there is a shortage of experts in that relevant field in the Bangladesh context.

Nevertheless, the research makes original and up to date scholarly contributions concentrated on Bangladesh that measure up to the body of knowledge in the renewable energy domain and

the recommendations are believed to be similarly applied for every other RE sources. The study is particularly important not only for the researchers on renewable energy development in Bangladesh, but for future research on overall energy scenario of Bangladesh that should be carried out by scientists, engineers, sociologists, and economists.

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### Appendix A. An Example of the Expert Interview Report

Participant: Mr. XXX (confidential)

Company: XXXXX (confidential)

Project: 28 MW solar project (2018)

Position: Managing director

Date of interview: 4th August 2020.

**Interview Questions: [we provided open questions and not in exact sequence as below, based on the flow of the interview we guided the interviewee to talk about below points]**

1. What is the basic profile of your company? Included but not limited to firm's size, firm's ownership wholly owned subsidiary, equity joint venture, minimum equity participation, number of employees, business strategies and goal, competencies, type of investor, (namely, IPP developer, strategic investor or a combination), industry segment (in Bangladesh's context specifically the generation segment for private investment).
2. How important (economic benefit) do you think FDI in Bangladesh's renewable energy sector?
3. What are the strategic factors (as strength, weakness, opportunity, and threat) that are influential to make investment decision in Bangladesh's renewable energy sector?
  - a. At what extent you think the Institutional environment (smooth administration procedure/guidelines, political stability, rule abidance or law enforcement) factors influences the FDI decision? Which one among these is the most advantageous and the most disadvantageous in your opinion and why?
  - b. At what extent you think the Macro-environment (Exchange rate fluctuation, access to local finance, cheap labor) factors impact the FDI decision? Which one among these is the most advantageous and the most disadvantageous in your opinion?
  - c. At what extent you think the Natural resources/condition (Sunshine, duration of sun, proper wind, access to land) factors impact the FDI decision? Which one among these is the most advantageous and the most disadvantageous in your opinion?
  - d. At what extent you think the Regulatory support (guarantee access to grid, absence of local requirement, Tech standards) factors impact the FDI decision? Which one among these is the most advantageous and the most disadvantageous in your opinion?
  - e. At what extent you think the Political Support (renewable target, solid development plan, social acceptance) factors impact the FDI decision? Which one among these is the most advantageous and the most disadvantageous in your opinion?

4. What are the potential barriers/threats and opportunities you think that are inhibiting sustainable FDI generation in Bangladesh's renewable energy sector from both internal and external stakeholders?
5. What are some of the renewable energy development policies (incentives, for example feed-in-tariffs, affordable land, i.e., solar parks, etc.) afforded by the government that are helping to strengthen and sustain new investment in the renewable energy sector?

**TRANSCRIPT: [it was a 2.5 h ZOOM session on record; we synthesized the information relevant to the study topic below]**

#### **Company profile, background, and Ownership:**

XXX power established the first solar based IPP project in Teknaf, it was a 20 MW (AC), 28 MW (DC) capacity on grid power plant. Total investment size was \$35 million, they received the PPA 4 years ago and was able to implement the first solar based renewable power plant in Bangladesh. He said the scenario was so different on that time, it was a blank page per se. CAPEX was 60% higher on that time and the reason why their tariff or tariff was at double digit on that time (13–17 cents). So, their investment cost was 60% then that of now, also he explained that 40% or more of the project cost comes from the PV modules and 4–5 years back they bought each PV modules at 40–45 cents per watt, however, at present those modules cost is down to 20 cent or lower which shows a 50% decline in setup cost and overall 20% drop of overall project cost. This has a direct effect on the tariff getting lower each day goes by. Therefore, due to these factors out of many they are enjoying a tariff of 13.90 cents, which is just the double, compared to what is offered now. They had a Chinese partner (joint venture) with 20% share as the operating partner; they had to keep the foreign firm since it was a government requirement that a firm has experience on implementing solar power plant. Hence, the project cost was around \$20 million.

#### **Why investing in renewable in BD is a risk free investment?**

In a utopian scenario where land is acquired, transmission line is perfect, right of way is established, so on and so forth, the standard tariff would be not more than 7.5 cents. When the IRR is 18% or above the companies are interested to engage anything below that would not create a win-win for both the company and state. The unique part of the projects are state or sovereign being the offtaker, the guarantee lies that there will be no issue with payment on time even if the political atmosphere gets unstable. Also, up until now BD has the perfect track record of defaulting any contracts. Hence, there are no distribution cost, no marketing cost, and no offtake hustle (political or economic shocks) to consider since the state is the offtaker. This is a huge incentive or confidence providing matter for the foreign investor and local investors to come and invest in renewable sector. The power sector in BD is completely shielded from the adversaries that other sectors such as FMCG, RMG or Banking industry face.

#### **Why majority cases have 80% or more share from the FDI partner and these, are Chinese or Korean EPC firms?**

If the local firm doesn't have a good financial backbone, the local partner just become the errand boy for the FDI or EPC company. The local company maintains the logistics support such as purchasing and give support to buy out the lands, local coordination, licensing, office set up etc. anything that the FDI firm cannot do being an outsider. This is why the most of the local companies have 10–15% share only which is not serving the purpose of the FDI since majority of the profit will be pumped out of the economy.

#### **Do you think FDI in renewable sector will be beneficial for the country?**

He says at current cost any local company with renewable energy know how can implement a 20–50 MW project easily since it will cost only 34–40 million USD where no FDI is necessary.

Hence, he believes Foreign direct investment will not make much of a difference unless the project is significantly large (unlike current 20–100 MW projects) so that a huge funding is needed from abroad. In fact, big groups like summit power, confidence has the capability to easily set up 800–2000 MW projects and even fund on their own. Interestingly enough these behemoths are not coming to invest in renewable sector, the question arises WHY? Main issue again related to land acquisition. Companies like Summit will never go for a project below 500 MW and for that in solar or renewable they have to acquire at least 2000 acre land which is a nightmare for anyone, until unless they get the land from government and just pay for it. Arranging 2000 acre land in one stretch will take them forever. BEZA has hustle free land for industrialization, which is equivalent to 70,000 acre. Only a 5–10% of this land is enough to create SOLAR PARK where FDI can come with an ease if no land acquisition issues to consider and invest targeting projects bigger than 500 MW. In fact, if this land can be used or given by the government for renewable energy investment, the goal to achieve 10% green energy as per the SDG commitment, would have been easily achieved by now. Since, to achieve 10% or 2000 MW power from renewable energy government has to allocate only 7000–8000 acre land from BEZA which is unutilized for now and god know for how long it will remain like this. Hence, the weak development policy for renewable is acting as one of many hindrances which is why this sector is not growing.

#### **Why tariff is unnaturally higher in BD then rest of the world? Justification of higher tariff:**

First, take example of Dubai, having the lowest tariff in the world which is below 02 cents and compare out 8–10 cents tariff rate difference analysis.

(1) Compared to others (India/Dubai) our irradiation is much lower, seasonality impacts her too (2) Compared to others our generation time is half that is in average 3.7 h per day round the year totaling to 1500 to 1700 h of active generation; whereas, it should be 7000 h. (3) In Europe or Dubai the country credit rating is AAA or AA which show a risk free investment for the investors and to get funding the cost of debt is below 01 which is very low so is the cost of equity; whereas, our credit rating of Bangladesh Bank is –B. Hence, if the state has such low credit rating the local firms are even lower. That's why when our local firm goes for foreign loans they are considered as a very risky entity and their cost of debt gets very high and compared to UAE or others in BD the cost of financing becomes 4 to 5 times higher, this eventually impacts the tariff to go 4 to 5 times higher subsequently. (4) Economies of scale: when a project is scalable or so big from 1 GW to 10 or 20 GW the manufacturers are able to give a good discount and the economies of scale is achieved, the costliest part of the project which is equipment cost drags down which directly affects the cost of project to go down and eventually the tariff goes down too.

However, the renewable sector is not saturated yet in BD, when the sector will hit 01 GW production or more only then global investors or FDI companies and financers will find their confidence to invest big and treat this market as a stable one to come and invest freely. On that time the tariff will be saturated and catch up with the global standard.

Therefore, low production hours, lower irradiation, high cost of debt and equity, high cost of land and evacuation to grid, inefficient logistics support and cost (road networks, transmission line, port discharge etc.) and infrastructure and diseconomies of scale altogether makes our tariff hit the roof.

#### **What is the major problem/s operating renewable power plants that impact profit?**

The intermittent nature of this sector turns out to be the "Achilles hill" while operating. In a country like BD where rain, haze, sudden fog or other weather factors are common to cause a sudden blockage of sun, in this case, the capacity hits the bottom in an instance and affects the grid frequency to mismatch that cause the plant to "strip". To make a big power plant online takes hours, hence, if it takes more than 02 h to fix it then the whole day production is practically gone.

Solution: SAMRT grid with good battery storage to give a buffer for 2–3 h to stabilize the grid during these intermittent and disruption times. During this time the conventional power plants can



match the load factor and management to keep the flow stable so that the entire system doesn't strip. Once BD reach 2000 MW connected to grid renewable the buffer plans or smart grid system will be a must.

### **Specific factors or SWOT determinants of FDI in renewable in BD:**

#### **Land acquisition/availability\*\*\*:**

He talked a lot about this in above in different dimensions on above. He ranked this as one of the top issues or bottleneck.

#### **Tariff as first mover or fast follower advantage\*\*\*:**

The FDI companies comes with a very low 1–2% cost of financing and the rate of return into risk free sectors as this one in Europe is at best 3–5% whereas, in BD the rate of return or IRR is 20% or above. Hence, they are overjoying since this is a huge motivation for investment in BD renewable energy sector. It will take the foreign investors to invest in 4 to 5 projects to make the same amount of profit that they will easily make from just one project in BD. After 4–5 years the tariff is just half now and dropping, he stated that even if the tariff drops and gets fixed around 6 or 5 cents still the IRR will be in double digit and double compared to rest of the world. Also he believes in energy sector was always a bit higher and in renewable energy the tariff will get settled and hover somewhere around 5–6 cents which is still a very good rate to attract FDI in future. Hence, even in future with a lower tariff the factor "higher tariff" will be the most important determinant to attract investment in BD. [56:00 to 59:00 possible policy and future aspect of FDI].

#### **Administrative Procedure\*\*:**

First, power division is very efficient when comes to processing. Even in pandemic the loan issues or admin processes like bill submission and getting payment are not affected at all. However, the problems or lagging starts with the related institutions and their institutional framework, such as while importing equipment, SRO issuing by NBR on time is moving mountains (it took him 90 days to release from port since SRO was not issued), finance ministry, central bank, ministry of environment Bangladesh bank, the customs (inefficient and harassing, filled with corruption and mismanagement) and port/stamp duty exemption delay (in paper but from past 02 years not in effect) and discharge equipment etc. where, most of the time firm needs to go all the way to the higher authority to speed up the process, otherwise, the project gets stuck forever (Y at DC office a file takes 2 years to get approved??). Hence, a foreign firm doesn't have either that reach or the patience to go that far and fight against the system all the time. Bureaucratic red tape is the last thing a FDI company wants. [1:00:0 to 1:05:00].

#### **Firm level inefficient management or lagging:**

[1:07:00 to 1:10:10] He stated that compared to the inefficiency at government level the firm level inefficiency is the lesser evil to allow and no big FDI or investment related hitch up happens due to this. He mentioned that right before the PPA get signed the PPA vetting needs to be done from ministry of Law, and after the LOI is issued the firms sometimes does some lagging and don't sign the PPA, because, they buy some time to run their errands (banking payment issues, equipment order LC, bank and regulatory process >> all these takes at least 60–90 days) meanwhile to get the project started so that they can be able to commission the plant on time. This is done because they don't want to wait and loose time after PPA signage which will affect the COD date. Also sometimes some firms delay for around a year, which is not acceptable, and they do it intentionally since they know by this time the cost of PV modules and equipment would fall down.

### Access to local finance:

[1:10:20 to 1:120:10] The procedure of IDCOL is super cumbersome, they think adding or complicating process is the way to bring more security or perform better. This is not helping the private firms to get easy local finance. In fact, the main local financing body dedicated for solar couldn't fund the first ever solar PP in BD, that is saying something. When instead of using IDCOL or local finance he got a foreign fund with liber plus 2 rate (4% cost of finance), which local finance institutions can never compete as their interest rate is 6% or above. Even the problem is these local financial institutions questions the government contract and ask for so many extra documents that makes the life of the local companies difficult, and this is absurd since IDCOL itself is part of an autonomous government body. Sometimes, they even don't agree with the technical feasibility of the contract and want to re run the technical feasibility by their preferred syndicated group, and this is again cumbersome and pointless for the companies to do. Being a government agency IDCOL cannot ask the feasibility of the technical standard of PPA passed project is like asking if your parents are legitimate? There's a lot going under the table. This is why in BD the local finance is very shaky, inefficient, and not forthcoming to help the renewable energy projects.

### Tech. standard:

The lower the standard the easier for the private sector to engage. BD standard is internationally accepted, it is there. BD is absolutely fine in this spectrum for IPP sector. Hence, FDI attraction is not going to be a big issue regarding this factor. The PV modules are sourced based on the Bloomberg tier 01 list and no foreign investors would invest if this criterion is not met. In terms of expertise, in solar we are good, but not for wind. In wind the expert is scarce.

### Policy support: development plan and target:

The single most important thing that investors are looking into here is 'continuity' of the plans and working on the target. A solid development needs to be in place, that gives the investor an idea how much the market is going to grow and based on that they can formulate investment strategy and funding budget based on the demand plan or even if investors see the development plan is not forthcoming the FDI will not come. Hence, a stable policy is needed, so it is very important determinant. However, he stated this is highly connected to the administrative policies or procedure, the admin process needs to be supportive to the regulatory and policies too. *Policy stability is extremely important!!* Hence, changing the policies all of a sudden will also make the investors discouraged to invest or attract.

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