Green Investment in Bangladesh

Opportunities and Challenges

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EXECUTIVE SUMMARY

1. Bangladesh has made significant progress on several economic and social indicators by fulfilling most of the Millennium Development Goals (MDGs) during 2000-2015. Following the success, Bangladesh has set 40 (39+1) national priority targets to achieve Sustainable Development Goals (SDGs) to achieve an inclusive and sustainable development. One of the critical priorities of SDGs is to promote green growth to ensure inclusive development which also coincides with one of the Multi-annual Indicative Programme (MIP) priorities ('green inclusive development') of the European Union (EU) for Bangladesh during 2021–2027. Under SDG 7, Bangladesh has already ensured access to electricity for all citizens. However, the recent energy crisis has put the country's macroeconomic stability under pressure. This crisis is associated with the consequences of excessive dependence on import-driven fossil fuel-based electricity generation. Thus, achieving SDG priority targets such as transitioning from fossil fuel-based electricity generation into renewable source-based generation will have important implications for Bangladesh's development. In addition, Bangladesh's graduation from the least developed country (LDC) status in 2026 will call for a more efficient management and utilisation of both production and consumption of ecosystem to maintain global competitiveness. On all counts, to achieve green inclusive development, Bangladesh will need to invest substantially in green projects.

2. The key objective of the study is to identify opportunities and challenges of green investment in Bangladesh by—(i) reviewing existing supportive measures (including incentives) and policies for making investment in green projects, (ii) identifying opportunities and implementation challenges for investing in green projects, and (iii) making an estimate of the green investment required for electricity generation from renewable energy sources. In the policy discourse, it is hoped that the findings of the study will narrow the knowledge gap and contribute towards holistic measures by the government to promote investment in green projects by engaging private sectors and financial institutions (FIs). The study findings are also expected to support development partners such as the EU in taking focused and strategic advocacy decisions on 'green growth' in Bangladesh.

3. Bangladesh Bank through its refinancing schemes and policy guidelines is playing a leading role in engaging banks and FIs to other real economic sectors to promote financing for green investment projects. For example, Bangladesh Bank has already adopted a taxonomy on green financing as well as identified 68 green products/sectors. Moreover, from September 2020 onwards, it has set a 5 per cent green finance target of the total funded term loan disbursement/investment for all banks and FIs. However, non-performing loan (NPL) ratio is significantly lower for funds disbursed in green projects than other traditional projects. Hence, the central bank should encourage banks and FIs more to promote financing for green projects. Apart from the above initiatives, a number of fiscal incentives are available for: private (sector) participation in the power sector, investors making investment in renewable energy projects, 'prosumers' (consumers who are producers) for adopting net-meter based solar system, export-oriented industries to establish green buildings for production, and investors for making green investment in leather and leather goods development.

4. There are a few challenges in stimulating green financing projects through key informant interviews (KIIs) and field research. These are as follows: (i) banks and FIs often receive

applications from small-scale local enterprises (such as cottage, micro, small and medium enterprises, or CMSMEs) which are not able to submit required documents to comply with financial regulations; (ii) businesses for green financing often fail to come out of the pilot phase and finally go for a sustainable revenue generating business model; (iii) due to delay in implementation of the pilot phase, businesses often make significant revisions in original project profiling which creates further delay in reassessment, fund mobilisation and project financing; (iv) usually green projects require higher maturity period than other loanable schemes in terms of payback, which often discourages the investors from investing in green projects; (v) green projects, which need high initial cost, fail to arrange funding and some of the low-scale green entrepreneurs even fail to prove creditworthiness; (vi) the technology used in green projects are relatively new in Bangladesh; and in absence of robust backward supply chain, it results in poor handling leading to poor governance of the projects, (vii) a number of clients are availing corporate social responsibility (CSR) funds from multiple banks which is difficult to identify due to the lack of integrated database on borrowers of CSR funds; and (viii) underdeveloped bond markets and an immature capital market are impeding the potential growth of financing in green projects.

5. Currently, Bangladesh's energy sector is heavily dependent on fossil-fuel based sources. As of June 2022, Bangladesh has 25,528 MW installed capacity for electricity generation. Of which, only 3.5 per cent are from renewable sources including solar, wind, hydro power, biogas and biomass. According to Renewable Energy Policy (REP) 2008, a target was set to produce 5 per cent electricity from renewable sources by 2015 (MPEMR, 2008). Even though it was not achieved in 2015, while publishing Power System Master Plan (PSMP) 2016, the Government of Bangladesh (GoB) was optimistic about setting a target to achieve 10 per cent electricity generation from renewable sources by 2020 (MPEMR, 2016). Unfortunately, the revised target was also not achieved. It suggests that, although electricity generation from renewable energy is a priority in the policy documents but progress is rather slow in attaining the targets. Despite past failures, according to Power Sector Analysis 2021 based on MCPP 2030, the GoB plans to generate 40 per cent of its electricity from renewables by 2040 (GoB, 2021; IDCOL, 2021). With this aspiration, as per the current plan and initiative of the GoB, the future of electricity generation from renewable sources is likely to be dominated by the solar energy. According to our estimation, to stimulate the projected green energy transition in Bangladesh by 2041, roughly USD 19.2 to USD 37.2 billion investment will be needed alone in order to develop the required installed capacity from renewable energy sources.

6. The government should consider renewable source-based projects as fast track projects and the EU and other development partners may contribute towards the institutional capacity building of Sustainable and Renewable Energy Development Authority (SREDA) to achieve green and inclusive development. Besides, scaling up of interventions such as 'net meter' based solar system solutions will be critical. Therefore, 'net meter' based pilot projects should receive high policy priority by involving all sectors/industries given it demands for 'no' or 'little' land preparation cost. Rural settlements should be included in pilot interventions to promote 'net meter' based solar system solutions and the EU may provide funds to design a feasibility study. In addition, the GoB should rationalise tax structure further for promoting renewable energy and the margin of fiscal incentives may be increased to promote green establishments. The size of Bangladesh Bank's refinancing scheme should be enhanced where the development partners may help to mobilise funds for green financing. Moreover, the GoB should put more emphasis on developing a robust bond market to finance future green projects, and development partners

including the EU may strongly advocate to stimulate the process. Finally, a better coordinated approach with policy consistency is needed from public organisations to encourage investment in green projects by engaging private sectors, commercial banks and FIs, and development partners.

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Abbreviations

ADB	Asian Development Bank
AIT	Advance Income Tax
BCCTA	Bangladesh Climate Change Trust Act
CMSME	Cottage, Micro, Small and Medium Enterprise
COP	Conference of the Parties
CSR	Corporate Social Responsibility
ERM	Environmental Risk Management
ESDD	Environmental and Social Due Diligence
ESRM	Environmental and Social Risk Management
ETP	Effluent Treatment Plant
EU	European Union
FDI	Foreign Direct Investment
FI	Financial Institution
GBCSRD	Green Banking and Corporate Social Responsibility Department
GED	General Economics Division
GoB	Government of Bangladesh
GTF	Green Technology Fund
HFO	Heavy Fuel Oil
HSD	High Speed Diesel
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IPP	Independent Power Producer/Plant
IREA	International Renewable Energy Agency
KII	Key Informant Interview
LEED	Leadership in Energy and Environmental Design
LLGDP	Leather and Leather Goods Development Policy
MCPP	Mujib Climate Prosperity Plan
MDG	Millennium Development Goal
MPEMR	Ministry of Power, Energy and Mineral Resources
MSMP	Power Sector Master Plan
NEM	Net Energy Metering
NPL	Non-Performing Loan
PDB	Power Development Board
PGCB	Power Grid Company of Bangladesh
PSPGP	Private Sector Power Generation Policy
QRRSF	Quarterly Review Report on Sustainable Finance
RE	Renewable Energy
REB	Rural Electrification Board
REP	Renewable Energy Policy
RMG	Readymade Garments
SDG	Sustainable Development Goal
SFD	Sustainable Finance Department
SHS	Solar Home Systems
SREDA	Sustainable and Renewable Energy Development Authority
SRF	Socially Responsible Financing

TDS	Technology Development Fund
UNFCCC	United Nations Framework Convention on Climate Change
USGBC	United States Green Building Council
VAT	Value Added Tax
WDI	World Development Indicator

SECTION 1: INTRODUCTION

Following the success in attaining the Millennium Development Goals (MDGs) during 2000-2015, Bangladesh has set 39+1[1] national priority indicators to achieve targets under the Sustainable Development Goals (SDGs) (SDG Tracker, 2022). One of the important goals of the Government of Bangladesh (GoB) is to transition from fossil fuel-based electricity generation to renewable source-based generation. Although only 3.5 per cent of total electricity is currently coming from renewable sources (SREDA, 2022), the GoB has declared to produce 40 per cent electricity from renewable energy by 2041 (GoB, 2021). To achieve this target and to attain affordable and clean energy (SDG 7: Ensure access to affordable, reliable, sustainable and modern energy for all), Bangladesh will need to make substantial investment in green projects. At the same time, integrating other green investment projects into the national development strategies will be critical for Bangladesh in meeting targets under a number of SDGs such as clean water and sanitation (SDG 6), sustainable cities and communities (SDG 11), responsible consumption and production (SDG 12), and climate action (SDG 13) by 2030.

According to the taxonomy adopted by the European Union (EU), an investment project will be termed 'green' if the project outcome meets the following three criteria. Firstly, the project must make a substantive contribution to achieve one of the following six environmental objectives: (i) climate change mitigation; (ii) climate change adaptation; (iii) sustainable use and protection of water and marine resources; (iv) transition to a circular economy; (v) pollution prevention and control; and (vi) protection and restoration of biodiversity and ecosystems. Secondly, the project cannot feature components that may cause significant harm to the other above-mentioned environmental objectives. Thirdly, the project must follow to meet minimum safeguards (EU Technical Group of Sustainable Finance, 2020). These above-mentioned criteria articulated in the EU taxonomy will help avoid the chances of greenwashing where companies give a false impression of their environmental impact or benefits (European Commission, 2022). In line with the EU taxonomy, Bangladesh Bank has developed its own 'Sustainable Finance Policy for Banks and Financial Institutions', and primarily listed 68 green products or projects or initiatives applicable for term finance (Bangladesh Bank, 2020).

Globally, both mitigation of climate related challenges and adaptation to the impact of climate change are important. Both types of climate actions require huge public and private investment. Developed countries pledged to provide nearly USD 43.2 billion to finance various types of adaptation and mitigation projects to tackle the challenges of global climate change (Climate Funds Update, 2022). However, till June 2022, only USD 10.7 billion has been disbursed. This is only 24.6 per cent of total

[1] In addition to 39 indicators, another indicator has been prioritised for localisation of the SDGs by 'leaving no one behind' (LNOB) in most possible short time, under the instructions of SDG Working Committee of The Prime Minister's Office.

pledged amount (Climate Funds Update, 2022). While developed countries need to be more proactive in disbursing pledged funds, governments of developing countries and the private sector must make strategic investment in green projects for the sustainability of economic progress. In fact, the major source of green investment funds is expected to come from the private sectors for their own interest while governments should introduce conducive policies and incentives (or penalties) to encourage investors to go green and bring efficiency in the production system by reducing wastage.

To tackle climate change related challenges and achieve a green and sustainable growth in Bangladesh, the GoB has developed a number of policies including Mujib Climate Prosperity Plan up to 2030 (MCPP 2030), National Solar Energy Roadmap (2021–2041), Energy Efficiency and Conservation Master Plan up to 2030, Clean Development Mechanism (CDM), and Renewable Energy Policy (REP) 2008. Additionally, to promote green technology, Bangladesh Bank has developed a number of refinancing schemes for supporting environment-friendly technologies such as renewable energy, energy efficiency, solid waste management, liquid waste management, alternative energy, and recycling and recyclable products. Till July 2022, 39 banks and 19 financial institutions (FIs) have signed a participation agreement with Bangladesh Bank to avail finance from these schemes. Although relevant policies are in place and several directives from Bangladesh Bank have been issued, it is generally observed that the private banks and FIs are still hesitant to approve loanable funds for green investment projects.

In the above context, this particular study is undertaken to identify opportunities and challenges of green investment in Bangladesh. The specific objectives of the study are to: (a) review existing supportive measures (including incentives) and policies in Bangladesh for making investment in green projects; (b) identify opportunities and implementation challenges for investing in green projects; and (c) present an estimation of green investment required in Bangladesh for electricity generation from renewable sources in view of different scenarios. Results of the study are expected to narrow the knowledge gap and contribute towards taking holistic measures by the government for leveraging green investment through the private sector's (including the financial sector) engagement. Findings of the study are also expected to help development partners to take more focused and strategic advocacy decisions on 'green growth' in Bangladesh.

This report is organised in the following manner. Following the introduction, Section 2 spells out the approaches taken by the research team to conduct the study and explains the method and data used in this paper. Section 3 informs existing supporting measures for investment in green projects in Bangladesh. Section 4 presents selected stylised facts on green investment in Bangladesh. Section 5 documents three case studies which highlight opportunities and challenges of green investment at the project level. Besides, it discusses existing challenges faced by commercial banks and FIs to promote

green financing despite policy guidelines in place by the Bangladesh Bank. This section also presents a brief discussion on the overall investment climate of Bangladesh. Section 6 presents an estimation of the investment requirement for producing electricity from renewable sources as per the national commitment. Section 7 provides a discussion based on the results of the study. Finally, section 8 makes a set of recommendations emanated from the study findings.

SECTION 2: RESEARCH APPROACH

The research report is based on the review of secondary resources. It has developed case studies using information collected through key informant interviews (KIIs), and analysed data from national and international sources on investment in green projects. Throughout this report, the research team used the definition of 'green project' which is in line with the taxonomy developed by the EU and which also reflects Bangladesh's own criteria of green projects.

The review of secondary resources includes reports, journal articles, and national policy documents dealing with the issues of investment in green projects and renewable energy in Bangladesh. To identify the existing policy supports and incentives for investment in green projects, this research has undertaken an extensive review of the following national policy documents: (i) MCPP 2030 (GoB, 2021), (ii) Power Sector Analysis 2030 based on MCPP (IDCOL, 2021), (iii) Draft National Solar Energy Roadmap (2021–2041) (SREDA, 2020), (iv) Energy Efficiency and Conservation Master Plan up to 2030 (SREDA and MPEMR, 2015), (v) Power System Master Plan (PSMP) 2016 (MPEMR, 2016), (vi) Private Sector Power Generation Policy (PSPGP) (Ministry of Energy and Mineral Resources, 2004), (vii) REP (MPEMR, 2008), (viii) Net Metering Guidelines (NEG) 2018 (SREDA and MPEMR, 2018), (ix) 8th Five Year Plan (8FYP) of Bangladesh from July 2020 to June 2025 (GED, 2020), (x) Bangladesh Climate Change Trust Act (BCCTA) 2010 (Ministry of Environment and Forest, 2016), (xi) Bangladesh Climate Change Strategy and Action Plan (BCCSAP) 2009 (Ministry of Environment and Forest, 2009), (xii) Bangladesh Delta Plan 2100 (GED, 2018), (xiii) Leather and Leather Goods Development Policy (LLGDP) 2019 (Ministry of Industries, 2019), (xiv) Sustainable Finance Policy for Banks and FIs 2020 (Bangladesh Bank, 2020), (xv) Quarterly Review Report on Sustainable Finance (QRRSF) from March 2013 to March 2022 (Bangladesh Bank, 2022); (xvi) Guidelines on Environmental and Social Risk Management (ESRM) for Banks and Financial Institutions 2017 (Bangladesh Bank, 2017) and (xvii) Nationally Determined Contributions (NDCs) 2021 (Ministry of Environment, Forest and Climate Change, 2021). Such an extensive review of the existing policies was imperative to identify the relevant and updated information which could be used in this study. The research team also reviewed national budget documents for fiscal year (FY) 2021–22 and FY2020–21 for analysing current tax and duty structure of green products developed by Bangladesh Bank. Existing

tax and duty structures are analysed with a view to identifying the supportive (contradictory) fiscal measures for enhanced investment in green projects.

The research team conducted eight KIIs involving 10 participants and one expert group meeting (EGM) involving seven participants. The detail list of participants is presented in Annex C (Annex Table 3). The information and suggestions received from the experts contributed significantly to design the study and substantiate the report. Furthermore, three case studies are developed from the information collected through the KIIs. These are: (i) investment opportunities and challenges for making a green factory in readymade garments (RMG) sector taking as an example of Cute Dress Limited, (ii) investment opportunities and challenges for establishing an independent power plant (IPP) based on the example of Spectra Solar Park Limited, and (iii) investment opportunities and challenges for environment friendly 'Brick Kiln' projects by using the refinancing schemes of Bangladesh Bank through an analysis of the case of First Auto Brick Limited.

The research team used both national and international database to conduct analyses relevant to the scope of this study. To conduct descriptive and meta-analysis and present it as stylised facts, the following sources of data have been used. Renewable energy related data in the context of Bangladesh are collected from the SREDA's national renewable energy database. Electricity capacity and generation related data are collected from the database of Power Development Board (PDB) under MPEMR, Bangladesh. Besides, Bangladesh 'green financing' related data are compiled from Bangladesh Bank's QRRSF from March 2013 to March 2022. Additionally, International Renewable Energy Agency (IRENA) database is used to predict the energy demand in Bangladesh by following linear and non-linear trend analysis. The research team also used Climatescope database developed by Bloomberg New Energy Finance (NEF) to conduct an econometric analysis on investment in clean energy (renewable energy). During this exercise, a number of control variables are compiled from the World Development Indicator (WDI) database developed by the World Bank. The detailed methodology of the econometric analysis is presented in Annex B.

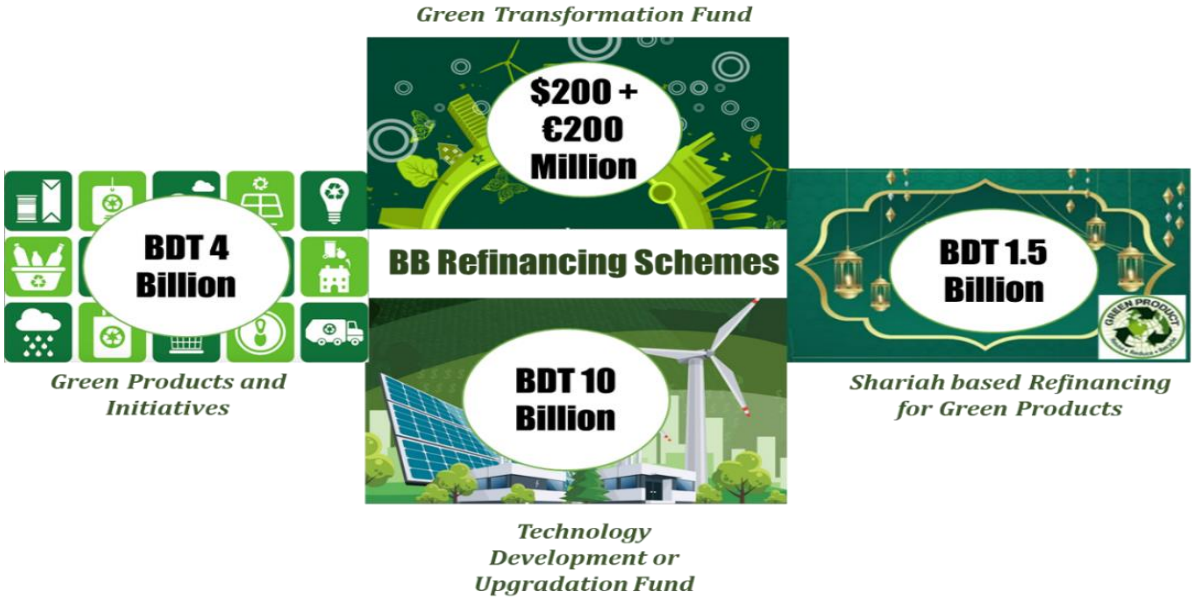
SECTION 3: SUPPORTIVE MEASURES FOR GREEN INVESTMENT IN BANGLADESH

Sustainable development is a holistic approach that promotes energy saving mechanism, pollution reduction, waste management, innovation of green products, efficient use of resources, and safe management of nature-based ecosystem (Olawumi and Chan, 2018). It underscores the importance of utilising resources by keeping a balance between production system and conservation of the resources. In order to facilitate sustainable development process, both public and private investment in green projects are essential. In this regard, creating incentives and disincentives (enforcing regulatory measures, and penalties among others) for businesses are critical for government to encourage private investors to invest in green projects. Globally, some of the notable incentives for green investments are green credit, green bonds, environmental compensation, environmental tax, regulatory instruments, and fiscal transfer schemes (Huang et al., 2019; Pigato, 2019). To encourage private investment in green projects, the GoB has introduced a number of supportive measures including direct incentives under various policies and institutional arrangements. Existing supportive measures (e,g., initiatives/incentives/instruments) for promoting investment in green projects are discussed below**.**

3.1 Bangladesh Bank Initiatives for Promoting Investments in Green Projects

Currently, Bangladesh Bank has four direct refinancing schemes for promoting investments in green projects (Figure 1). These are: (i) BDT 4 billion equivalent refinance scheme for investing in environment-friendly products or initiatives, (ii) BDT 1.5 billion equivalent refinance scheme for Islamic banks and FIs for investment in green products or initiatives, (iii) green technology fund (GTF) worth USD 200 million to import green machineries and 200 million EURO to import green machineries as well as industrial raw materials, and (vi) BDT 10 billion worth technology development or upgradation Fund (TDF) for 32 industrial sectors mentioned in Bangladesh Export Policy 2018–21 (Bangladesh Bank, 2022)**.**

Figure 1: Bangladesh Bank Refinancing Schemes for Promoting Green Investments



Source: Authors' compilation from Bangladesh Bank website.

In addition to the above-mentioned refinancing schemes, Bangladesh Bank has set following targets for other banks or FIs to accelerate the scale of financing for green investment projects. These targets are non-binding in nature. However, under ESRM Guideline 2017, banks and FIs receive certain benefits or incentives for meeting these targets (Bangladesh Bank, 2017).

- According to Bangladesh Bank's GBCSRD (the Green Banking and CSR Department) Circular No. 04/2014, from January 2016 onwards, the minimum target of direct green finance was set at 5 per cent of the total funded loan disbursement or investment for all banks and FIs.
- In 2015, through GBCSRD Circular No. 04/2015, banks and FIs were instructed to form a 'Climate Risk Fund' having allocation at least 10 per cent of their corporate social responsibility (CSR) budget.

Later, from September 2020 onwards the minimum target of green finance was set at 5 per cent of the total funded term loan disbursement/investment for all banks and FIs (Bangladesh Bank's Sustainable Finance Department (SFD) Circular Letter No. 05/2020).

3.2 Fiscal Incentives for Private Participation in the Power Sector

Given the scope of renewable energy in Bangladesh, the power and energy sector will require a significant amount of investment in green projects. To ensure private participation in the power sector, the GoB allowed private investors to build commercial power plants that comply with the existing environmental laws and regulations, and technical standards of grid interconnection and operation.

According to private sector power generation policy (PSPGB) of Bangladesh 2004, a number of fiscal incentives will be enjoyed by private investors, such as (i) corporate income tax waiver for 15 years; (ii) relaxed customs duties on a certain amount of import for 12 years; (iii) repatriation of equity along with dividends will be allowed freely; (iv) exemption from income tax in Bangladesh for foreign lenders; (v) the instruments and deeds required to be registered under local regulations will be exempted from stamp duty payments; and (vi) foreign investors will also enjoy tax exemption on royalties, technical know-how and technical assistance fees, interest on foreign loans, and capital gains from transfer of shares on investment. Alongside, several other fiscal benefits (for example, possibility of land lease support from the GoB) are on offer for private investors in the power sector (Ministry of Energy and Mineral Resources, 2004).

3.3 Incentives Proclaimed in Energy Efficiency and Conservation Master Plan

To provide the GoB a roadmap to improve efficiency in energy use, SREDA and the Power Division have jointly developed and published the Energy Efficiency and Conservation Master Plan by 2030 in 2015. According to the planned document, the GoB needs to provide incentives to attract private investment in renewable energy projects. Hence, the government has announced three types of incentives as follows (i) subsidies will be provided to investors for installing energy efficient equipment; it is expected to contribute in the diffusion of energy efficiency facilities and equipment in the country, (ii) investors will receive preferential taxation facility in the form of tax reduction or exemption to invest in energy efficient technologies and (iii) investors will also provide concessional loans at a discounted rate for energy efficiency and conservation related initiatives (SREDA and MPEMR, 2015). In the long-run, these supportive fiscal measures are expected to contribute significantly in attaining energy efficiency (including conservation of energy) in Bangladesh.

3.4 Incentives Proclaimed in Renewable Energy Policy of Bangladesh

The REP was developed in Bangladesh in 2008 by the Ministry of Power, Energy and Mineral Resources (MPEMR). The objective of the policy is to encourage the use of renewable energy and investment in renewable energy projects. Hence, a number of fiscal incentives have been proposed in the REP 2008, as follows: (a) 15 per cent value added tax (VAT) exemption on all renewable energy equipment and related raw materials in producing renewable energy, (b) renewable energy project investors from both private and public sectors will enjoy corporate tax waiver for first five years of operation, (c) an incentive tariff of 10 per cent higher than the highest purchase price of electricity by the utility from private generators may be considered for electricity generated from renewable energy sources (MPEMR, 2008). In addition, it is mentioned that SREDA will consider providing subsidies for installation of the renewable energy technology such as solar, wind, biomass and other renewable and

clean energy projects. Furthermore, a recommendation was made to facilitate micro-credit support system in rural and remote areas to provide financial support for the purchases of renewable energy equipment (MPEMR, 2008).

3.5 Introduction of Net Energy Metering Guideline and Incentives for Prosumers

Net energy metering guideline was introduced in Bangladesh in 2018 in order to encourage the consumption of renewable energy. In the policy, consumers were recognised as prosumers; this refers to a policy mechanism that allows consumers to connect their renewable energy systems to the national grid, and thus, consumers act as producers. Since consumption of renewable energy like solar energy is not widely popularised in Bangladesh, the GoB introduced net metering policy to stimulate a wider group of users including organisations and individuals to install more solar plants. The prosumers are incentivised to sell their excess amount of electricity produced from renewable energy sources or import the equal amount from national grid in exchange of green electricity. The consumer's bill will be calculated as an aggregated manner that will adjust the net amount of electricity. For example, if the amount of imported and exported electricity is equal, then the prosumer will pay only the demand charge and other fixed charges. According to the policy, the GoB is supposed to facilitate technical supports and metering arrangement (SREDA and MPEMR, 2018). Since 2019, till June 2022, a nearly 42.9 MWp install capacity is added to national grid through net metering arrangement and a total 1658 prosumers are currently availing benefit from this arrangement (SREDA, 2022).

3.6 Incentive for Green Buildings for Export-oriented Industries

In the budget speech FY2022-23, the Finance Minister of Bangladesh proposed to introduce 12 per cent tax rate for all other general industries exporting goods and services and 10 per cent for green ones (Ministry of Finance, 2022). Before that, it was only enjoyed by the RMG sector. With this new budget proposal, a wider pool of investors from all export-oriented sectors who are operating their businesses from green factory buildings will enjoy 2 per cent additional fiscal incentive in the form of lower tax rate. According to the United States Green Building Council (USGBC), till June 2022, a total 183 factory buildings from Bangladesh received Leadership in Energy and Environmental Design (LEED) green building certification, including 163 RMG factories along with factories from other export-oriented sectors. At the same time, 506 more buildings from Bangladesh are under assessment to be recognised as green buildings (USGBC, 2022). The new budget proposal is hoped encourage more investors to implant green building infrastructures in their factories.

3.7 Incentives in Leather and Leather Goods Development Policy

With an objective to promote export and clean production, the Ministry of Industries introduced the Leather and Leather Goods Development Policy in 2019. The policy encourages to invest in green technologies to reduce environmental pollution. For this, priority-based credit will be distributed to firms that will adopt effluent treatment plant (ETP). Moreover, prioritised incentive will be provided to the firms for adopting the environmental compliance introduced by the policy. The policy document has also mentioned about providing financial incentives to firms that are involved in clean production (Ministry of Industries, 2019). However, the policy does not clearly define 'clean' production' and this leaves a scope for confusion.

3.8 Investment Opportunities through the Climate Change Trust Fund 2010

The government developed and published BCCSAP in 2009 (Ministry of Environment and Forest, 2016). Under this action plan, the BCCTF is a unique national climate fund managed by the GoB since its inception in 2009 (Ministry of Environment and Forest, 2009). Since then, till FY2020–21, the government from its own resources financed more than USD 480 million to implement 732 projects of various types (adaptation, mitigation and research) and dimensions (BCCT, 2022). Of which, 377 projects are completed and 355 are still ongoing as of September 2021. These projects are being implemented by a number of non-government organisations (NGOs) across the country. Especially, under mitigation and research projects, investors can avail funds from the trust for investing in renewable technology with an aim to provide local climate change solutions.

The tax and tariff structure demonstrated in the national policy documents clearly suggests that the government is supportive towards promoting investment in green projects. While a number of dedicated refinancing schemes are introduced by Bangladesh Bank for promoting investment in green projects, a significant portion among these schemes is dedicated for export-oriented industries. It is also important to note that a number of refinancing schemes that are available for local industries 'not necessarily' green in nature; for instance, Bangladesh Bank's refinancing scheme for facilitating investment in ship breaking industry. In addition, a few tariffs-related decisions are not aligned with the GoB's comprehensive plan involving the promotion of renewable energy in the country. For example, although VAT exemption on solar panels and batteries exists, but there are no exemptions on solar inverter which is a crucial component of solar power plants. According to FY2021–21 budget proposal, total tax incidence was raised to 37 per cent on the import of solar inverters (HS 85044090) including 10 per cent customs duty (CD), 15 per cent VAT and 5 per cent advance income tax (AIT) (Ministry of Finance, 2021). Apart from these inconsistencies as observed, the majority of the government policies

aim at providing fiscal benefits to both private and public investors so that they can attract more investment including foreign direct investment (FDI) in green projects.

SECTION 4: STYLISED FACTS ON THE PROSPECT OF GREEN INVESTMENT IN BANGLADESH

This section will present statistical facts on select indicators to better illustrate the current status of green investment and its future prospect in Bangladesh.

4.1 Bangladesh Depends on Non-Renewable Sources for Electricity Generation

Bangladesh has 25,528 MW installed capacity for electricity generation as of June 2022. Of which, only 3.5 per cent are from renewable sources including solar, wind, hydro power, biogas and biomass (Table 1). It shows that Bangladesh's current electricity capacity is predominantly dependent on non-renewable sources like natural gas, and coal.

Table 1: Electricity Generation Mix in Bangladesh

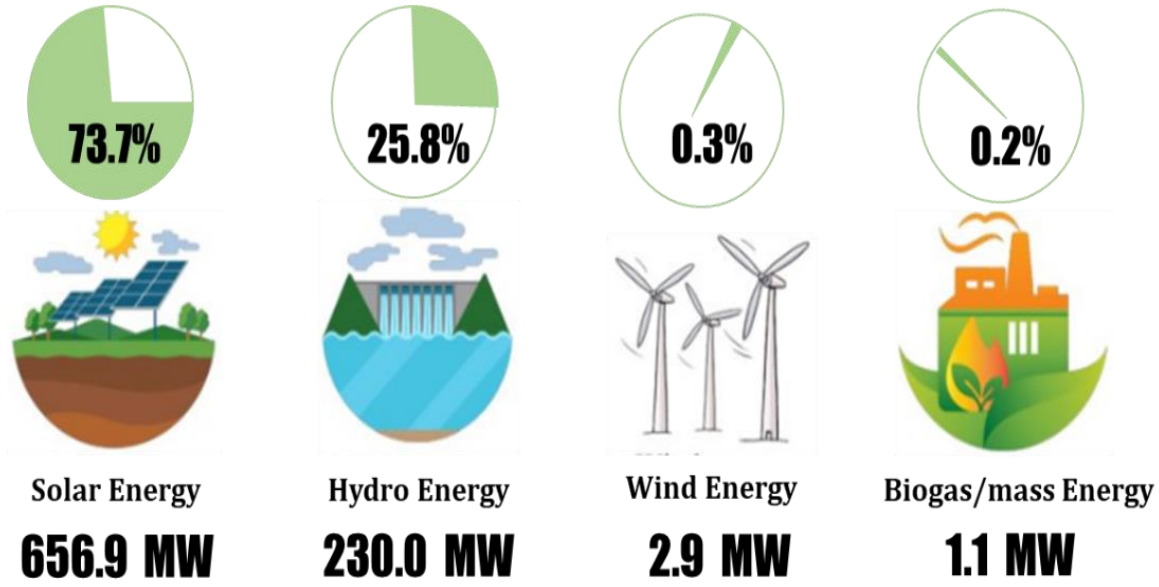
Fuel/Resource	Installed Capacity (MW)	Share (per cent)
Gas	11,330	44.4
Heavy fuel oil (HFO)	6,238	24.4
Captive	2,800	11.0
Coal	1,768	6.9
High Speed Diesel (HSD)	1,341	5.3
Imported	1,160	4.5
Renewable*	891	3.5
Total	**25,528**	**100.0**

Source: SREDA, 2022,

Note: * including off-grid solar plants

Figure 2 suggests that currently, 73.7 per cent of total renewable energy for electricity generation (of total capacity of 891 MW) is generated from solar, while 25.8 per cent is generated from hydro and 0.3 per cent comes from wind power. Only 0.5 per cent of electricity is converted from biogas and biomass. Among the existing solar plants, only 46.5 per cent of its capacity is connected to national grid while rest are off-grid in nature.

Figure 2: Renewable Energy Mix in Bangladesh



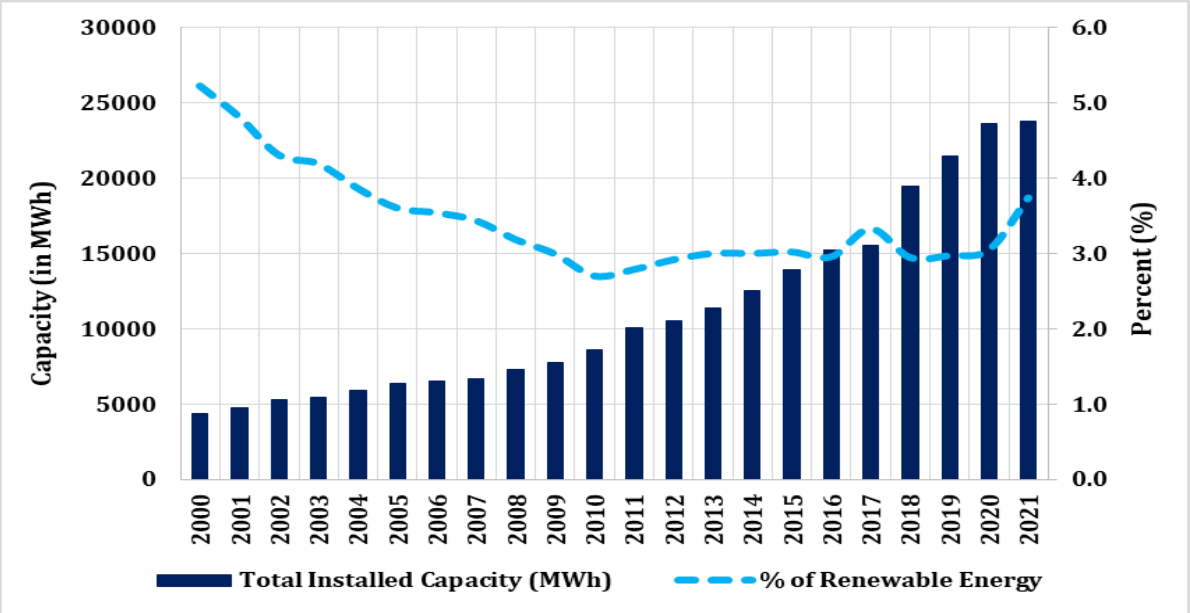
Source: SREDA, 2022.

Note: * including off-grid solar plants.

4.2 Slow Progress of Renewable Energy-based Electricity Generation

According to the WDI database, the access to electricity was only 32 per cent in Bangladesh in 2000. Since then, in the past two decades, Bangladesh has made remarkable progress in terms of ensuring electricity for its people. In fact, Bangladesh ensured 100 per cent access to electricity in 2021. During this journey, Bangladesh heavily relied on non-renewable sources of energy for improving its capacity to generate electricity. Electricity generation from renewable energy increased from 230 MW to 891 MW in 20 years. However, in terms of its share in overall installed capacity, electricity generation from renewable sources has stagnated since 2006 (Figure 3).

Figure 3: Trend of Installed Capacity for Electricity Generation in Bangladesh

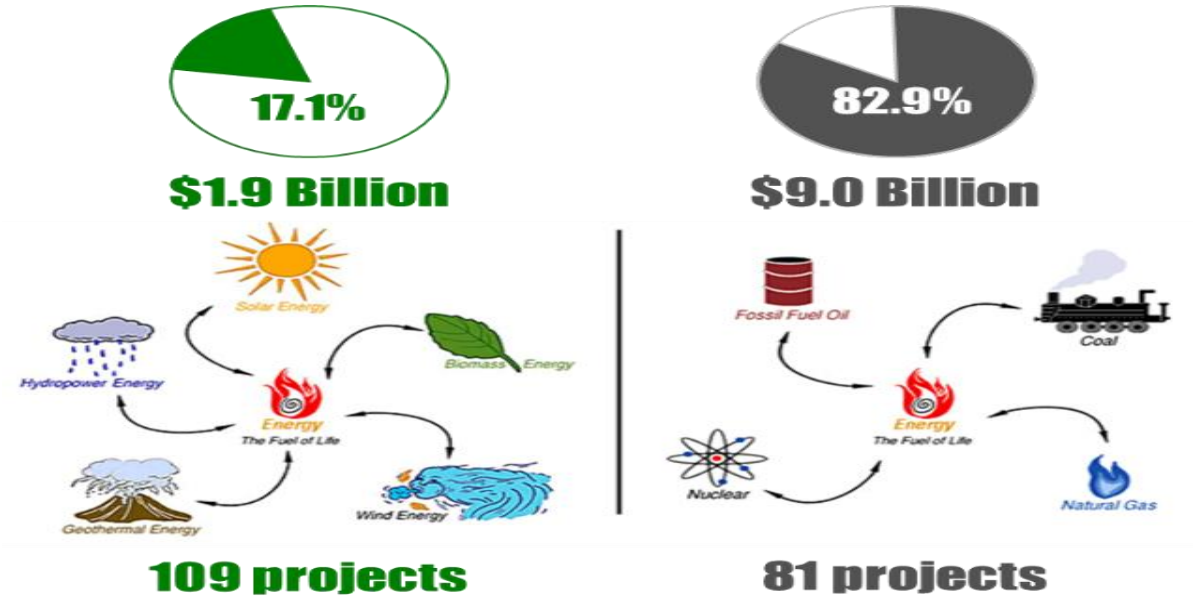


Source: IRENA, 2022.

According to REP 2008, a target was set to produce 5 per cent electricity from renewable sources by 2015 (MPEMR, 2008). The target was not achieved in 2015. However, the GoB was optimistic about setting a target while publishing PSMP 2016 to achieve 10 per cent electricity generation from renewable sources by 2020 (MPEMR, 2016). Therefore, although electricity generation from renewable energy is a priority in the policy documents, progress in attaining the targets is rather slow. Meanwhile, 81 non-renewable projects received USD 9.0 billion public flows[2] while it was only USD 1.9 billion for 109 renewable projects between 2000 and 2020 as shown in Figure 4 (IRENA, 2022).

[2] Public flows are the financial flows in the form of commitments originating from public institutions like governments, multilateral development banks and other public finance institutions. A commitment represents a legal contract to mobilise financial funds directed to one or more countries. These flows are corrected for currency exchange rates and inflation to a base year.

Figure 4: Public Flows to Energy Projects in Bangladesh from 2000 to 2020



Source: IRENA, 2022.

4.3 Future of Renewable Energy Likely to be Solar driven in Bangladesh

According to the Power Sector Analysis 2021 based on MCPP 2030, the government plans to generate 40 per cent of its electricity from renewables by 2040 (GoB, 2021; IDCOL, 2021). With this aspiration, as per the current plan and initiative of the GoB, the future of electricity generation from renewable sources is likely to be dominated by solar energy. In this connection, the government has already approved eight new solar parks. Upon full implementation of these ongoing projects, a total of 440.75 MW installed capacity will be added to the national grid. In addition, another 23 solar parks of total 1424.2 MW are now at the planning phase (Table 2). Apart from the establishments of solar parks, wider penetration of solar systems through 'net metering rooftop solar' is receiving high priority in the policy agenda alongside solar irrigation projects (SREDA, 2022).

At the same time, two wind power generation systems received approval from the GoB. The projects are underway. Upon full implementation of these projects, a total of 62 MW installed capacity will be added to the national grid from the renewable energy sources. Meanwhile, seven other potential wind power plants of total 295 MW are under review by SREDA. Besides, the government is planning to add nearly 49.9 MW renewable energy to produce electricity from biogas. In short, if the plans are fully executed, a total of 506.5 MW installed capacity would be added to the national grid in the next few years. At the same time, 1,769.6 MW more energy might be installed from renewable sources (SREDA, 2022). Therefore, to implement these renewable energy projects, a substantial amount of green

investment will be required from both private and public sector. This will need scaling up the size of the existing refinancing schemes of Bangladesh Bank to promote investment in more green projects.

Table 2: Current Planning on Electricity Generation from Renewable Sources

	Completed and Running		**Implementation Ongoing**		**Under Planning**	
Sources of Renewable Energy	Number of units	Capacity (in MW)	Number of units	Capacity (in MW)	Number of units	Capacity (in MW)
*Solar Park**	8	231.0	8	440.75	23	1424.2
*Rooftop Solar Except NEM***	117	39.4	3	0.576	1	0.852
Net Metering Rooftop Solar	1659	42.9	-	-	-	-
Solar Irrigation	2570	49.2	96	2.776	-	-
Solar Mini grid	28	5.8	-	-	-	-
Solar Nano grid	2	0.0	-	-	-	-
Solar Charging Station	14	0.3	-	-	-	-
Solar Drinking Water Systems	116	0.1	-	-	-	-
Others	-	7.7	-	-	-	-
Solar Home System	6037601	263.5	-	-	-	-
Solar Street Light	296861	17.1	-	-	-	-
Solar	***	**656.9**	-	**444.1**	-	**1,425.1**
Wind	**3**	**2.9**	**2**	**62**	**7**	**295**
Hydro	**1**	**230.0**	-	-	-	
Biogas**	**8**	**1.0**	**1**	**0.4**	**3**	**49.5**
Biomass	**1**	**0.4**	**1**	-	-	
All (Grand Total)	-	**891.2**	-	**506.5**	-	**1,769.6**

Source: SREDA, 2022.

Note: * Eight (8) solar parks proposals were rejected from the planning phase; ** 2 units of total 0.047 MW capacity are under maintenance while another 2 units were rejected from the planning phase; *** did not add all the units as there is large variance between different solar plants; ****by excluding 87,536 units of small biogas projects.

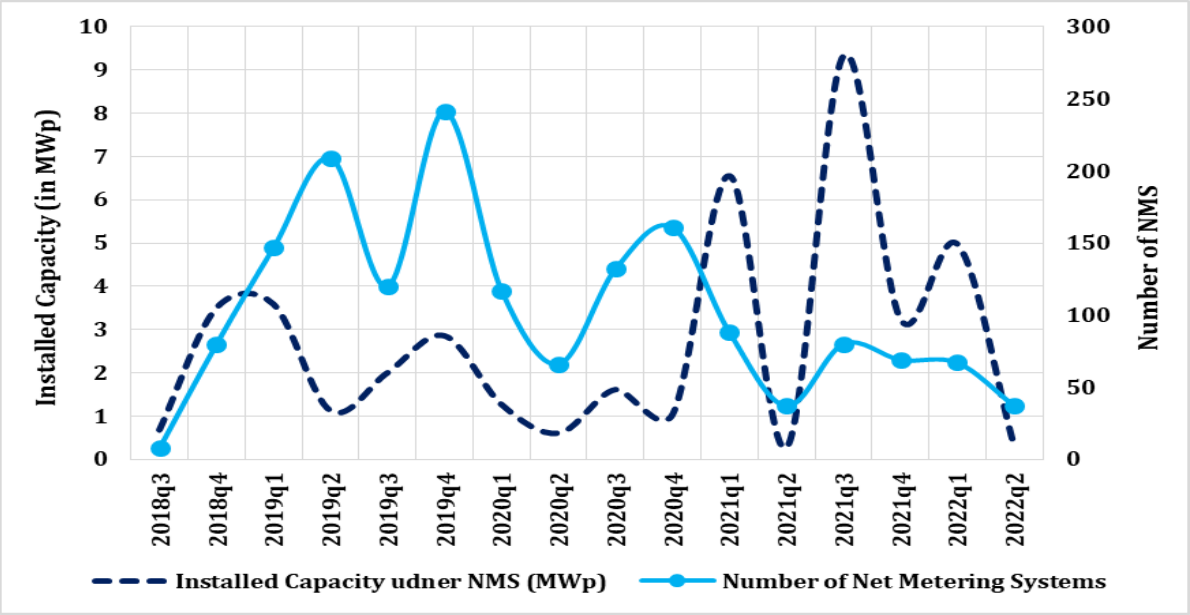
4.4 'Net Energy Metering' Programme is Yet to Gain Momentum

In the last decade, 117 rooftop solar home systems (SHS) were installed. Total capacity of these systems was 39.4 MW. A significant number of rooftop SHS were implemented by Infrastructure Development Company Limited (IDCOL) between 2003 and 2014. And, a majority of these systems availed refinancing from Bangladesh Bank under 'Refinance Scheme for Green Products/ Initiatives/ Projects'.

However, the rooftop solar home system did not receive much attention despite binding regulations from the concerned government agency.

Through KIIs, the research team of this study finds that these systems were not connected to the national grid at that time. Hence, consumers could not get the benefits originally envisaged the rooftop solar home system due to the lack of net energy metering (NEM). However, with the introduction of NEM guideline 2018, prosumers of SHS can now export the surplus electricity to the national grid and adjust the bill thereafter.

Figure 5: Quarter Wise NEM System Installation



Source: SREDA, 2022.

Figure 5 shows quarter-wise analysis of rooftop SHS with NEM facility from July 2018 to June 2022. So far, a total 1,659 NEM systems are installed, and a significant majority of these are installed on the factory rooftops (SREDA, 2022). The figure shows no specific pattern—neither for the number of installations nor for the capacity of the installed systems. However, it is roughly observed that the rate of installation has declined from the fourth quarter of 2020. Nevertheless, the installed capacity is higher now in terms of magnitude. The results of the analysis suggest that though NEM programme is making some progress it is yet to be adopted at the community level at a larger scale. One of the key reasons for lower adoption rate may be that it is technical in nature. To avail this facility, a potential prosumer needs '*a single three phase bidirectional smart meter*' while a significant number of old buildings even within Dhaka city may not have such arrangement installed (SREDA and MPEMR, 2018). Besides, prosumers often do not see the benefits of installing the NEM on paper. It is because the existing format

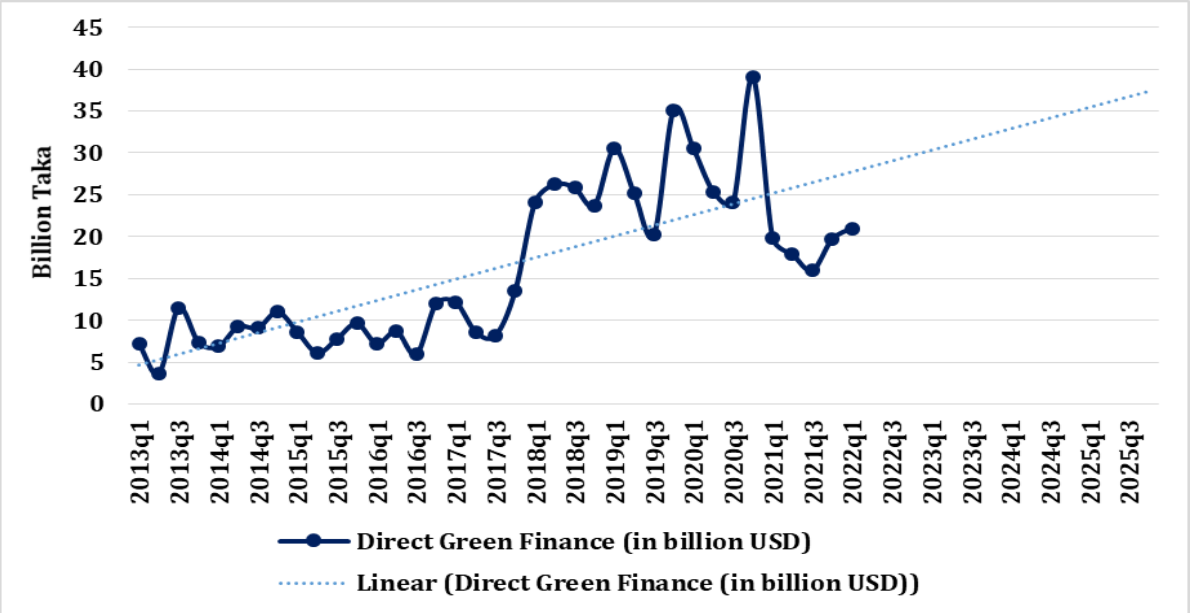
of ‘electricity bill’ does not show the adjustment in figure (invoice) and its potential benefit in value terms. It may require installation of additional meters, making it more problematic for consumers.

4.5 Bangladesh Bank’s Refinancing Scheme is Critical in Promoting Green Investment Projects

In 2011, Bangladesh Bank has developed environmental risk management (ERM) guideline. With the help of the guideline, Bangladesh Bank played a crucial role in integrating financial sector with other real economic sectors for promoting green projects. Later in 2013, Bangladesh Bank issued green banking policy guidelines for banks and FIs.

As part of sustainable finance initiatives, Bangladesh Bank primarily takes policy measures, monitors sustainable finance activities of banks and FIs, and operates refinance support to promote investment for green initiatives. According to the data compiled from various editions of QRRSF, funds worth nearly BDT 552 billion have already been disbursed as direct green finance (Bangladesh Bank, 2022). This amount is roughly 8 per cent of total disbursement made to projects that have some sustainability component in its scope. Figure 6 shows that the disbursement of direct funds for the implementation of green projects are gradually increasing. Given that a large number of green projects (including renewable energy projects) are now at implementation or planning phase, Bangladesh Bank is likely to experience an increasingly higher demand for new fund disbursement under this segment.

Figure 6: Disbursement of Direct Green Finance by Quarters



Source: QRRSF, from March 2013 to March 2022.

Figure 7 presents the percentage distribution of direct funds mobilised towards different projects by sectors. Since 2013, till March 2022, nearly 38 per cent of total direct green funds were disbursed for the establishment of green buildings. In addition, 19 per cent direct green funds were mobilised for the waste management (including both solid and liquid waste management) projects while another 12 per cent funds were channelled for clean brick kiln projects. Moreover, 9 per cent of funds were mobilised to the projects which manufactured recycling products and to the projects which installed energy efficient technologies in the production system. Besides, 7 per cent of total direct green finance employed for projects for generating electricity from renewable sources. Rest of the funds were disbursed for green agriculture, cottage, micro, small and medium enterprises (CMSMEs), and socially responsible financing (SRF) projects.

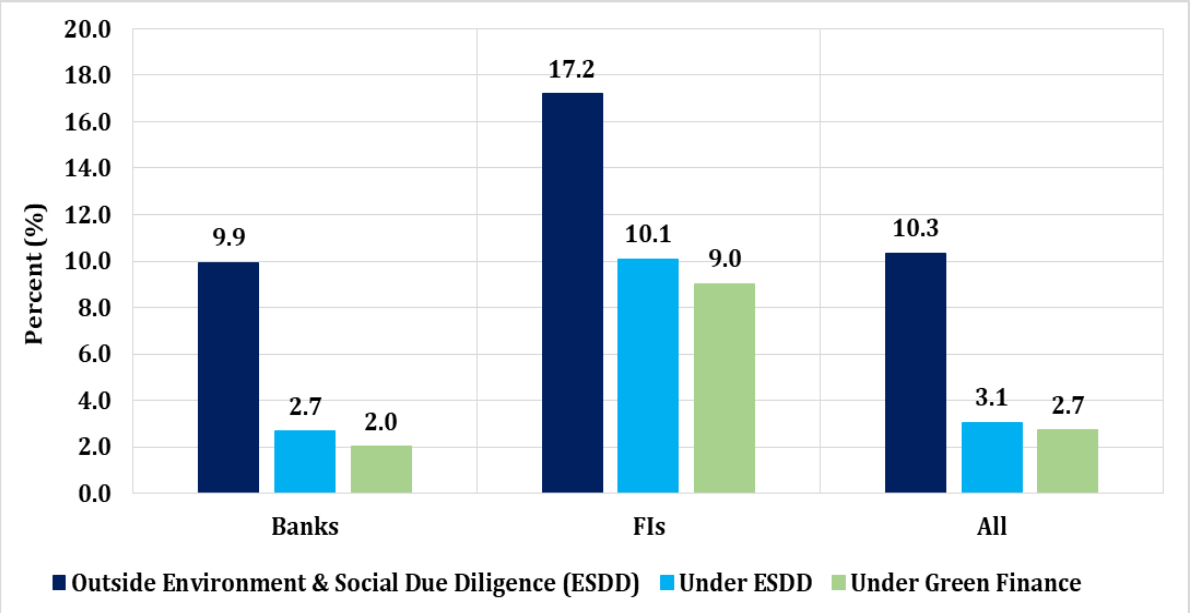
Figure 7: Percentage of Direct Green Funds Disbursed by Sectors

Source: QRRSF, from March 2013 to March 2022.

4.6 NPL Rate Significantly Lower for Projects under Green Financing

Non-performing loans (NPL) is a major concern for the financial management of the banking sector. According to Figure 8, while NPL rate on regular loan was nearly 10.3 per cent during July–September 2020, it was only 3.1 per cent for loans disbursed to the projects that went through environment and social due diligence (ESDD). The NPL rate was even lower for loans mobilised towards green projects; only 2.7 per cent till September 2020. Recent reports from the Bangladesh Bank's SFD suggests that it has decreased further since then. It illustrates that financing green projects which went through ESDD process is safer than financing any other projects. It should encourage both commercial banks and FIs to finance investment in green projects.

Figure 8: Status of NPLs till September 2020



Source: QRRSF, July–September 2020.

SECTION 5: EXPLORING OPPORTUNITIES AND CHALLENGES FOR INVESTMENT IN GREEN PROJECTS IN BANGLADESH

In this section, existing opportunities and challenges for investing in green projects in Bangladesh are discussed in following three phases:

(i) developing three case studies from three different sectors to portray the micro situation at project level,

(ii) highlighting observations from KIIs where stakeholders mentioned about the existing challenges for banks and FIs to promote green financing despite policy guidelines from Bangladesh Bank are in place, and

(iii) analysing overall investment climate in Bangladesh compared to (a) other lower middle-income countries, (b) EU countries, and (c) other emerging Asian countries (China, Cambodia, India, Nepal, Philippines, Singapore, Taiwan, Vietnam, Thailand) which are making significant investment in renewable energy projects.

5.1 Case Studies on Selected Green Investment Projects

In the following sections, three case studies are presented on various green investment projects in Bangladesh by collecting information through KIIs. The following three case studies are discussed below.

5.1.1 Case 1: Investing in green RMG factory establishment

Background

The Cute Dress Ltd. is one of the LEED-certified Platinum (green) RMG factories of Bangladesh. It was established in 2018, and the size of the factory is more than 8,100 square meters. The factory location is in Dhamrai, Savar Upazilla. In 2021, the firm produced nearly 1.6 million pieces of garments and earned an export revenue equivalent to USD 4.8 million. Around 524 people work in this factory including workers and staff.

Opportunities availed

The owner of the firm availed bank loan by utilising the window of Bangladesh Banks's refinancing scheme for environment-friendly green establishments.[3] If this arrangement was not in place, the owner would have to avail a regular term loan at market-determined interest rate. Due to the availability of Bangladesh Bank's refinancing scheme for green establishments, the owner availed the loan eventually by at least 2 per cent less than the then market interest rate. According to the owner, given the volume of the loan, even 1 per cent drop in bank interest rate proves to be much helpful in completing such a project.

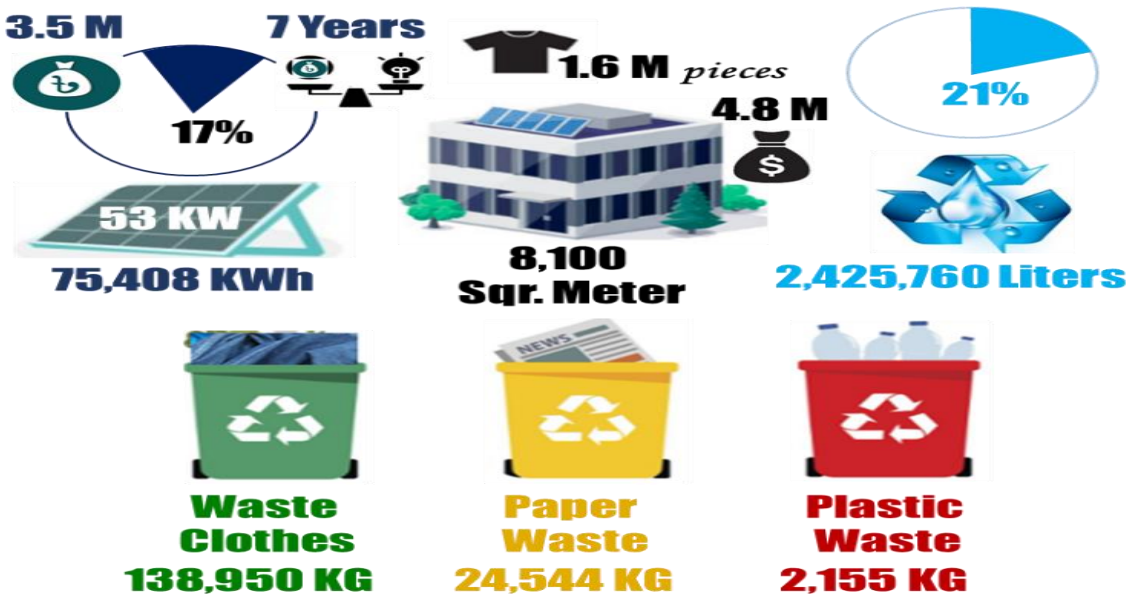
Besides keeping 40 per cent space free in the factory premise, installing technologies to ensure sustainable energy and water use are essential for fulfilling the LEED certification criteria set by the USGBC. In 2021, to produce 1.6 million pieces of garments, the Cute Dress Ltd. used nearly 11,301,670 litres of water; of which, nearly 21 per cent was recycled (2,425,760 litres to be precise) Figure 9). Given the current commercial rate charged by Dhaka WASA for water use, the firm saved nearly BDT 0.47 million by cycling ground water alone. However, it is important to note that currently there is no additional tariff charged for commercial use of the ground water outside Dhaka city.

Moreover, by investing BDT 3.5 million, a 53 KW solar capacity is installed in 2019 in the factory premise with 20 years of lifespan. In the last three years, on average, about 17 per cent of factory's total energy demand is met from installed solar system (Figure 9). In 2021 alone, a total of 75,408 KWh energy was used from installed solar system to produce 1.6 million pieces of garments production,

[3] Since 2014 till March 2022, Bangladesh Bank refinanced a total of nearly BDT 209.5 billion only for the establishment of environment-friendly buildings in Bangladesh.

which was roughly 17.5 per cent of total energy used for production purpose.[4] Given the industrial tariff rate of Bangladesh Rural Electrification Board (REB), in the last three years, the firm managed to save BDT 1.5 million by using solar energy from its own capacity. It suggests that it would take roughly seven years to pull off the initial investment required to install the solar energy system. As the installed solar system is supposed to sustain for 20 years, the firm is likely to get a net cash benefit for next 13 years by saving energy. However, the challenge is that the solar inverters delivered by commercial vendors are not performing as promised. Also, at this stage, servicing capacity of fixing solar panels and inverters in cases of troubleshooting is rather weak in Bangladesh. Hence, maintaining solar rooftop/home system itself is still a challenging task for its users.

Figure 9: Key Facts on Sustainable RMG Production



Source: Authors' illustration.

Besides, the firm recycled 138,950 kg of cutting room waste clothes, 2,155 kg of plastic waste and 24,544 kg of paper waste in 2021. In the absence of competitive by-product industry, the demand for these types of factory wastes is still naive. Hence, a number of factories dump such wastes in nearby places and pollute environment heavily.

Challenges faced

However, the owner of the firm reiterated that Bangladesh Banks's green financing facility at the end is a refinancing mechanism. Therefore, the firm requires their own financial capacity/strength to make

[4] The total energy used for production purpose was of 462,226 KWh in 2021.

a solid progress in the project implementation based on a term loan even before being eligible for applying for such refinancing scheme. For this reason, it will be challenging for a number of small factories which are currently operating in rented buildings/plots, to transition into green establishment and this may require additional funding. As LEED certification is not a compliance criterion at buyers end, even after such a makeshift investment towards establishment of green buildings and its maintenance, offer price remains the same. Hence, a number of RMG manufacturers, particularly the smaller ones, do not see much short-run marginal benefit of investment in green establishment projects.

5.1.2 Case 2: Investing in solar park as IPP

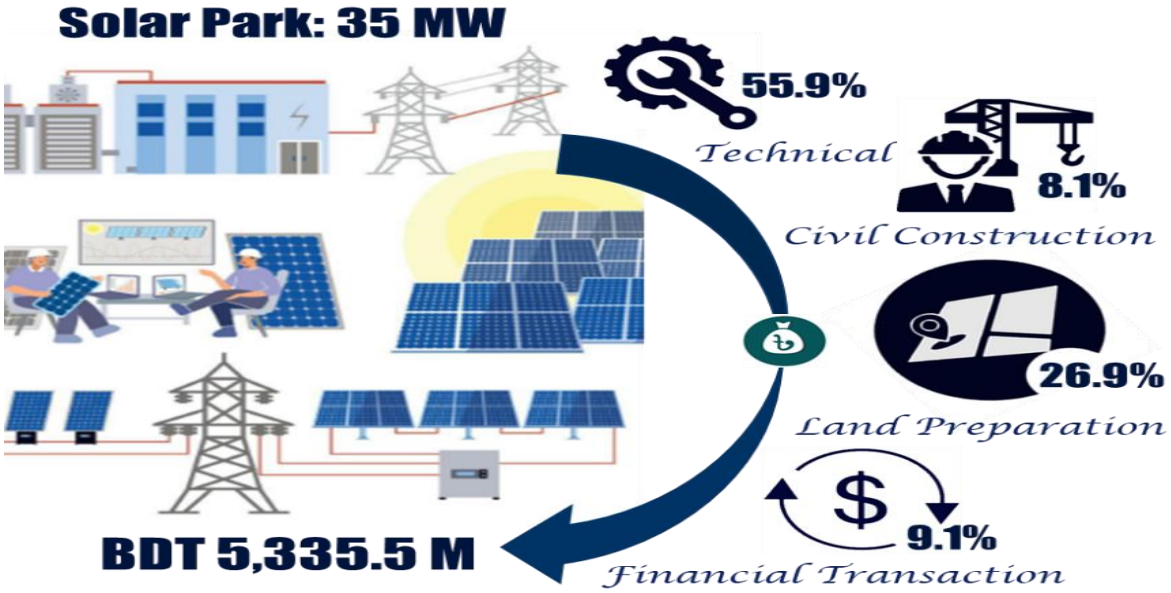
Background

The Spectra Solar Park submitted its first proposal to MPEMR in 2016. The location of the Solar Park is in Paturia, Shiboloy, Manikganj. Currently, the capacity of the plant is 35 MW with a contract period of 20 years. The total land area of the power plant is 140 acres with a total installed DC capacity of 45.38 MWp. The performance ratio of the power plan is 81.42 per cent. The estimated energy generation in the 1st year was 61,558,000 Kwh and the actual generation was 61,498,641 Kwh. It also reduced 40,493.4 tons of CO_2 emissions in the inaugural year.

Opportunities availed

The total project cost was BDT 5,335.5 million with 52 per cent equity and 48 per cent debt ratio. Initially, the firm received the approval from an international bank to get financing for the project operation. However, the financing agreement was not implemented due to administrative issues. Later, Bank Asia issued the entire term loan for a tenure of 10 years. Under this arrangement, loan repayment will be made in local currency. This particular modality of payment arrangement is critical for Bangladesh's forex exchange management since a number of solar park projects are at the planning phase. Initially, Bangladesh Power Development Board (PDB) will buy the electricity from the plant at a rate of USD 0.139 for per kwh on no electricity no payment basis.

Figure 10: Key Facts on Investing in a Solar Park in Bangladesh



Source: Authors' illustration.

Challenges faced

When compared to similar projects with other countries, the key investment challenge is to manage the high cost of land purchase and preparation. For example, in this particular project, nearly 26.9 per cent project cost is exhausted just to purchase and prepare the land to establish the power plant (Figure 10). The high cost of land preparation is also underscored in National Solar Energy Roadmap, 2021-2041 by citing an example from India "Under the Solar Park scheme launched by the Ministry of New and Renewable Energy (India), selection of location, acquisition and development of the land is carried out by the implementing agency, while in Bangladesh the project developer has to do all these by itself. This not only reduces the cost, but also makes the process more efficient and convenient" (SREDA, 2020).

Besides, a relatively higher technical cost is observed in developing solar parks in Bangladesh than other global practices. Lower availability of solar resources is often held responsible for that since Bangladesh's annual climate cycle is heavily influenced by a long monsoon period resulting in low and irregular solar insolation for several months in a row.

In addition, the delay in bureaucratic processes and project evaluation often forced businesses to bring multiple revisions in the original project profiling. Revisions in the project profiling create further delay and uncertainty in terms of availing finance from banks and FIs as per original settlements or understandings. Besides, to operate and manage such a solar park, investors still need to rely on foreign

expertise, given limited technical knowhow of local professionals from Bangladesh. However, the firm also benefited in several ways from Bangladesh Banks's refinancing scheme for environment friendly establishments and technology installation.

5.1.3 Case 3: Investing in clean brick kiln project

Background

The First Auto Bricks Limited started its planning to going for a clean (tunnel) auto brick project in 2013. To combat pollution produced by brick kilns, in 2014, the Ministry of Environment announced that no more local brick kilns will be allowed to operate after 2016. According to the owner of the firm, the declaration originally encouraged him to make an investment in clean auto brink project given its expected profitability. At the same time, Bangladesh Bank also started to fund for two types (Hoffmann and Tunnel) of green auto brick kiln projects in collaboration with Asian Development Bank (ADB) for eco-friendly brick manufacturers (ADB, 2022)[5]. First Auto Bricks Limited's tunnel-based brick kiln project is one of the projects that received refinancing facility under this ADB-Bangladesh Bank collaboration.

First Auto Bricks Limited's tunnel-based manufacturing unit is established in Shibpur Upazilla, Narshindi near Shitalakshya river bank. The area of project site is nearly 30-bigha and initial investment requirement was nearly BDT 2.5 million for per bigha land. The daily production capacity of the plant varies between 80,000 to 100,000 pieces of bricks and generates employment for 70 people under a relatively safe working environment. The total investment required was nearly BDT 700 million for this project.

Opportunities availed

On 15 July 2015, the firm submitted their project profile to a local bank, and on 21 September 2016, they received an approval from the bank. And, the firm received the first disbursement (LC for machineries) on December 14, 2016. Followed by that, in 2016, the owner applied for the green financing scheme of Bangladesh Bank. In 2018, the firm received green financing loan from the ADB through Bangladesh Bank under the 'Brick Kiln Efficiency Improvement Project'. The firm received a total BDT 350 million from four banks/FIs. The initial interest rate was 11 per cent. The firm was offered an 18-month grace period followed by an eight-year repayment schedule (it was originally for seven years but later received an extension for one-year). Under the Bangladesh Bank-ADB refinanced

[5] Under this arrangement, ADB financed a total USD 50 million to support 7 HHKs and 12 tunnel kilns, resulting in an increased annual capacity of 753 million bricks (ADB, 2022).

arrangement, finally, the firm could be able to avail the loan by 2 per cent less than the then interest rate of 11 per cent. However, it took nearly 2 years to start commercial operation for First Auto Brick Ltd. from the date of original submission of the proposal.[6] This delay in paper work and administrative processing created significant additional cost than the estimated project cost; for which businesses hardly can renegotiate with FIs/Banks for additional loan requirement based on the same proposal.

Challenges faced

The firm received a term loan of BDT 35 million as working capital at 9 per cent interest rate. However, given inputs like mud for producing brick kiln is needed to be purchased in bulk, the owner repeatedly mentioned the sanctioned loan for working capital is relatively low considering the plant's production capacity. For instance, in very three months, nearly 3.75 lakh 50 thousand square feet of mud in required; which roughly costs more than BDT 50 million. Besides, 11 tons of coal is required per day, at current market price (March 2022) the cost was BDT 22,000 per ton. Hence, nearly BDT 15 million operational capital is required for three months for the purchase of coals.

Apart from that, due to lack of by-product industry, the firm has to spend BDT 1 million for waste management alone. Although such tunnel brick kiln can produce nearby 350 days in a year while traditional firebricks can be produced for roughly about 150 days, the price margin in the market is not significant enough given high installation cost of clean brick kiln projects. A tunnel brick kiln projects requires nearly 20 times higher initial investment than that of traditional brick kilns. For instance, on average, a traditional fire brick kiln project needs BDT 35 million to set up the business and start operation.

Though the Ministry of Environment urged to stop, the traditional firebrick kiln projects are ongoing as 'business as usual' even after 2016. Hence, the anticipated return on investment for clean brick kiln projects has been significantly reduced. Lack of coordination between different government organizations is also discouraging investment in green projects in Bangladesh. For instance, while the Ministry of Industries declared clean auto bricks (such as tunnel brick kiln) as 'industry' in 2016, the Ministry of Environment and Forest urged to promote the use of cement blocks for the greater interest of the environment. The plan is to gradually phasing out of even clean auto bricks from 2025. Lack of coordination, weak implementation of regulation, and inconsistency in the government policy are the major bottlenecks for encouraging investors to invest for green projects. Investors are also experiencing rigidity from banks/FIs for getting loans (especially for working capital) for green projects as designing of viable 'financial product' is suffering from policy inconsistencies.

[6] Under this ADB-Bangladesh Bank refinancing scheme, on average, it took nearly 3 years and 4 months to start commercial operation for firms from the date of original submission of the proposal.

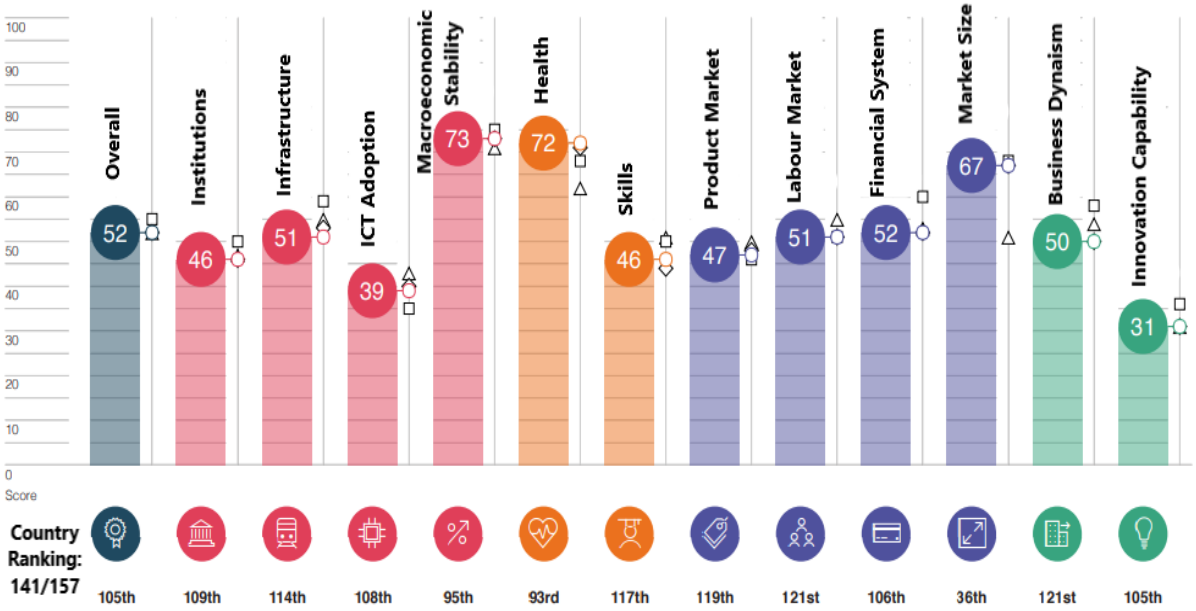
5.2 Challenges for Banks and FIs in Promoting Green Financing

Banks and FIs often receive applications from small-scale local enterprises, such as the CMSMES, which are not able to submit required documents to comply with financial regulations. As a result, a number of CMSMEs/small-scale businesses find it challenging to prove their creditworthiness to secure funding in the form of either equity or liability. Besides compliance related documentation issues, a few challenges were identified during KIIs conducted by the study team. These challenges are as follows: (a) businesses claiming for green financing often fail to come out of the pilot phase and finally go for a sustainable revenue generating business model; (b) due to the delay in implementation of the pilot phase, businesses often make significant revisions in original project profiling which creates further delay in reassessment, fund mobilisation and project financing; (c) high transaction cost prevails for banks and FIs to monitor green loans compared to other loanable schemes; (d) usually green projects requires higher maturity period than other loanable schemes in terms of payback, thus creating a gap between the maturity from the investors' perspective; (e) green projects and green financing are almost entirely dependent on the interventions from Bangladesh Bank; there is hardly any leadership among private banks and FIs to promote financing in green projects; (f) green projects requiring high initial cost fail to arrange funding, and some of the low-scale green entrepreneurs even fail to prove credit-worthiness; (g) technology used in green projects are relatively new in Bangladesh; and in absence of robust backward supply chain, it results in poor handling and governance of the projects; (h) a number of clients are availing CSR funds from multiple banks which is difficult to identify due to the lack of integrated database on the borrowers of CSR funds; and (i) underdeveloped bond markets and an immature capital market is impeding the potential growth of financing in green projects. All these factors are simultaneously impacting banks and FIs to engage themselves enthusiastically in promoting financing for green investment projects despite having a policy guideline to disburse a minimum of 5 per cent of the total loan portfolio to green projects.

5.3 Existing Business Competitiveness and Investment Climate in Bangladesh

According to 'Global Competitiveness Report 2019', Bangladesh ranked 141th among 157 countries in the world with an overall score of 52 out of 100. Despite low scores Bangladesh's performance is comparatively better in indicators such as macroeconomic stability, health and market size. However, in some other indicators—innovation capacity, information and communication technology (ICT) adoption, skills, institutions, product market and business dynamism—Bangladesh's competitiveness is rather subdued (Figure 11).

Figure 11: Bangladesh's Performance in indicators of Global Competitiveness Index



Source: Global Competitiveness Report, 2019.

Table 3: Bangladesh's Competitiveness in Terms of Business and Trade Operations

Indicators	Bangladesh	Lower Middle-Income Countries	Emerging Country (RE)	EU
Enforce a contract (months)	48.1	22.7	22.0	21.5
Get electricity Connection (months)	4.1	2.8	1.8	3.1
Register property (months)	9.0	2.3	1.0	0.8
Start a business (months)	0.7	0.8	0.8	0.4
Border compliance to export (hours)	168.0	69.8	35.4	7.5
Documentary compliance to export (hours)	147.0	61.0	36.8	1.7
Border compliance to import (hours)	216.0	110.3	41.3	1.6
Documentary compliance to import (hours)	144.0	71.7	49.0	0.6
Prepare and pay taxes (hours)	435.0	253.8	214.2	172.7
Resolve insolvency (years)	4.0	2.7	2.7	2.0

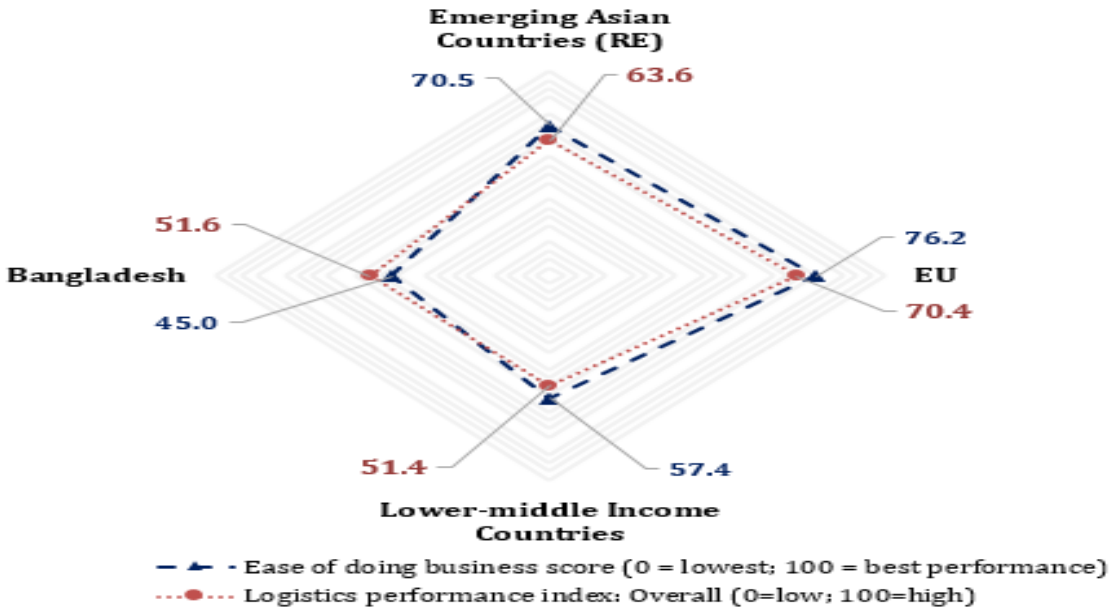
Source: World Development Indicators, 2021.

Moreover, Bangladesh is lagging behind in ensuring an enabling business and trade environment when compared to other lower middle-income countries, the EU countries and other emerging Asian countries. While the aforementioned case studies repeatedly informed about complex procedural due diligence at the project level, various indicators presented in Table 3 confirm that there is a synergy

between micro and macro context as regards operating business and trade in and from Bangladesh. For example, it takes double the time to enforce a business contract in Bangladesh compared to the above-mentioned countries. On an average, it takes nearly two years for above-mentioned countries to enforce a business contract whereas for Bangladesh it takes about four years. To get electricity connection, businesses have to wait for nearly four months in Bangladesh, while the waiting time is substantially lower for other middle-income and emerging Asian countries. Even to complete the border clearance and manage documentation as regards export and import, Bangladesh requires four to five-fold more time (in hours) than other emerging Asian countries that are making substantial investment in renewable energy projects.

Furthermore, Bangladesh's global competitiveness in ease of doing business is relatively poor compared to other lower middle-income economies as well as other Asian emerging countries. For instance, Bangladesh's score is 45 out of 100 in ease of doing business when the average score is 57.4 for lower middle-income countries. In case of logistics service performance while Bangladesh's competitiveness is on par with other middle-income countries, it is substantially lower than emerging Asian countries which have an average score of 63.6.

Figure 12: Bangladesh's Performance in Ease of Doing Business and Logistic Services



Source: World Development Indicators, 2021.

The above discussion on various challenges faced by Bangladesh indicates that there are several shortcomings existing in the business climate of Bangladesh. However, this also shows that the country has ample opportunities to improve efficiency in areas of business, commerce and trade. Improvement of efficiency will require both policy measures and higher investment on green and energy efficient

projects. This will help Bangladesh to make a green energy transition, and achieve inclusive and sustainable development.

SECTION 6: FUTURE INVESTMENT NEEDS TO MEET RENEWABLE ENERGY DEMAND

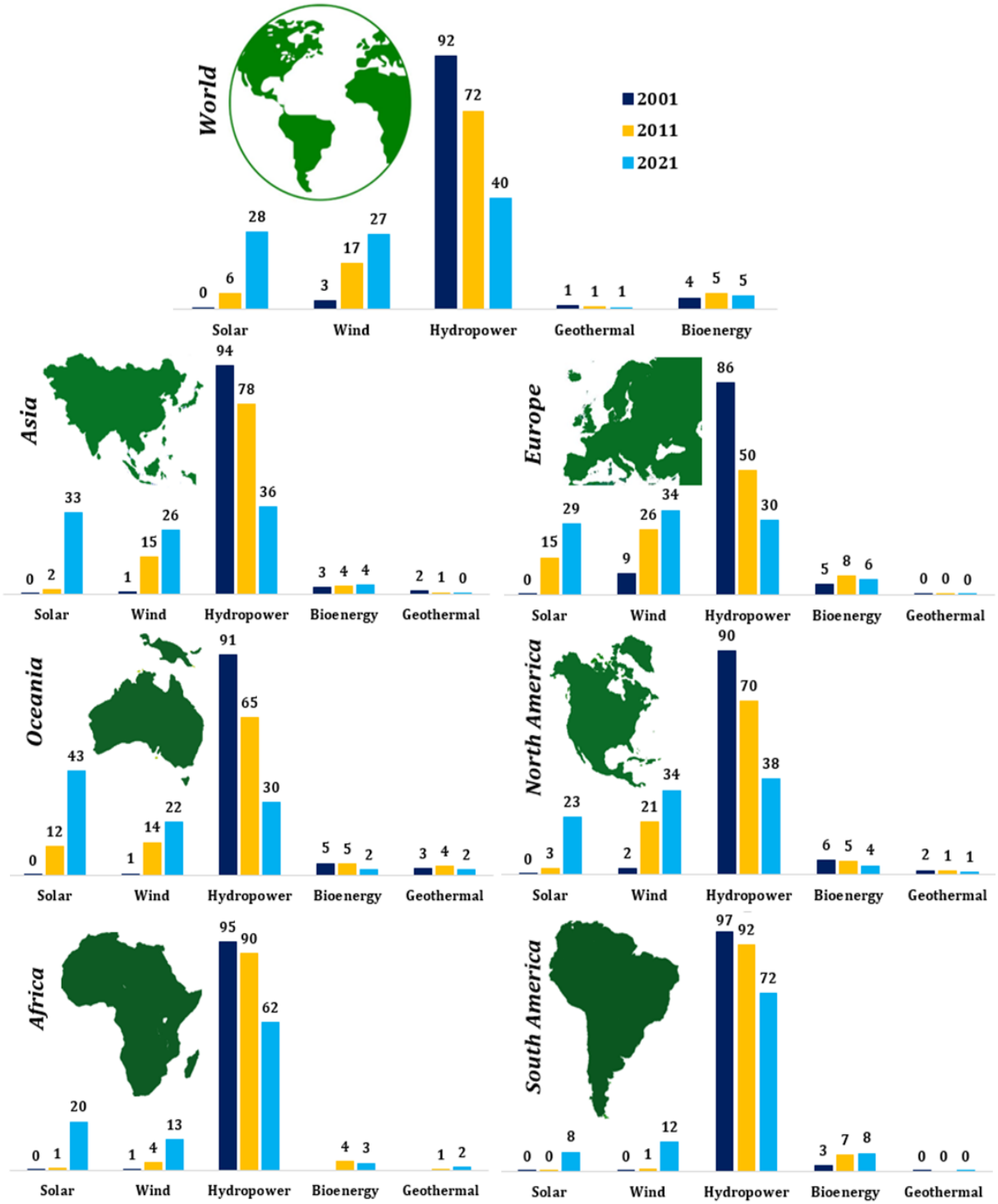
In the previous section, three different case studies in the context of Bangladesh were discussed. However, due to the lack of sector-wise data availability on green investment in Bangladesh, a comprehensive estimation is not possible within this study given its time and budget. Nevertheless, in this section following a trend analysis on global renewable energy mix, an attempt is made to estimate future investment requirement to meet the renewable energy demand as per Bangladesh's commitment to secure 40 per cent electricity generation capacity from renewable sources.

6.1 Global Trend of Renewable Energy Mix

Globally, the share of renewable energy from hydropower declined to 40 per cent in 2020 from 92 per cent in 2020. At the same time, the share of renewable energy from solar power increased from less than 1 per cent to 28 per cent and wind power increased from 3 per cent to 27 per cent. In fact, the rate of increase in share of renewable energy from solar power has recorded significantly higher than wind energy between 2011 and 2020 (IRENA, 2022). Besides, the share of renewable energy from bio-energy and geothermal is stagnated at 5 per cent to 6 per cent over last two decades.

From Figure 13, following observations can be made. Over last two decades—(i) the global share of renewable energy mix diverted towards wind and solar from hydropower; (ii) while solar projects have received more attention over wind projects in Asia and Oceania, wind based projects have received more priority than solar in Europe and North America; (iii) despite having a declining trend, hydropower projects still holds a major share of renewable energy mix in Africa and South America, and (iv) in the process of this transition, solar projects have gained better momentum in recent times.

Figure 13: Percentage Share of Renewable Energy Mix



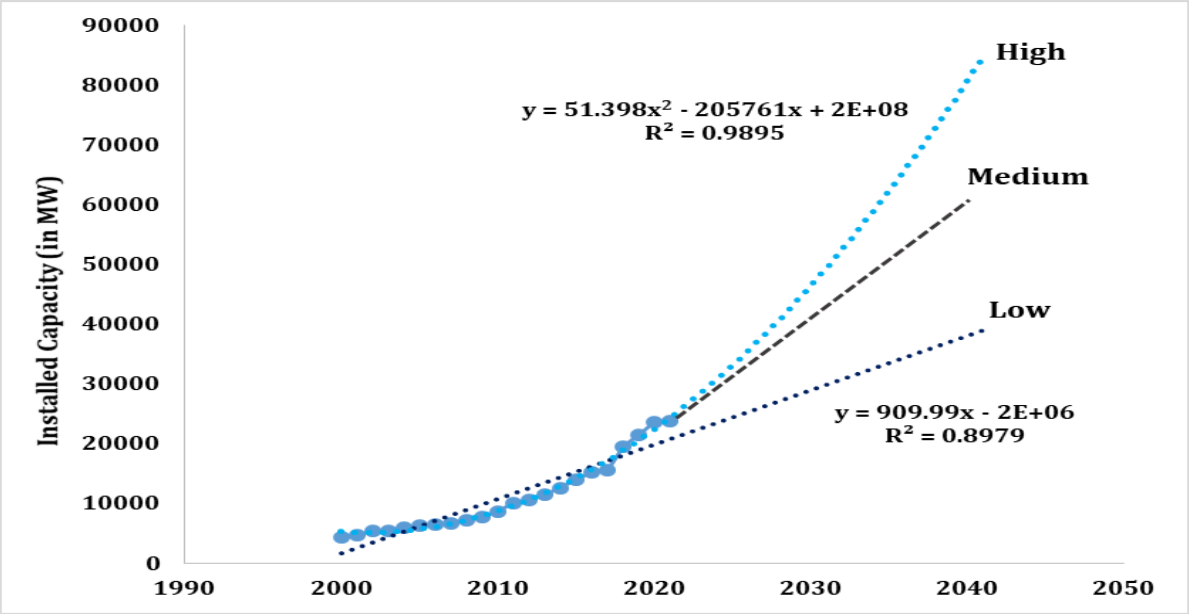
Source: Authors' illustration.

6.2 Expected Capacity for Electricity Generation in Bangladesh in 2041

By using data on installed capacity for electricity generation in Bangladesh from 2001 to 2021, the research team conducted a linear and a non-linear trend analysis. The linear trend analysis shows that,

by 2041, the predicted demand of installed capacity for electricity generation in Bangladesh will be slightly higher than 40,000 MW (Case I: low predicted value) (
Figure 14).

Figure 14: Projected Capacity for Power Generation in Bangladesh in 2041



Source: Authors' calculation.

On the other hand, a non-linear trend analysis shows that, by 2041, the predicted demand of installed capacity for electricity generation in Bangladesh will be a nearly 85,000 MW (Case 2: high predicted value) (
Figure 14). While 'low' predicted value captures a sluggish growth in power capacity generation during 2001–2010, the 'high' predicted value seems a highly optimistic case. Therefore, the research team took an average of 'low' and 'high' predicted value and computed a 'middle value' (Case III) that predicts a slightly higher than 60,000 MW installed capacity requirement for electricity generation in Bangladesh in 2041. In the Power System Master Plan (PSMP) 2016, a similar prediction (ranging from 60,000 to 82,000 MW) was made on the required installed capacity for electricity generation by 2040.

6.3 Potential Future Investment Demand for Renewable Energy Projects in Bangladesh

A meta-analysis is carried out to estimate the likely investment demand for renewable energy projects in Bangladesh to meet 40 per cent of energy demand for electricity generation from renewable sources under three different scenarios. The demand for Bangladesh's installed capacity for electricity generation are analysed under following three scenarios: (i) 'low' scenario (at 40,000 MW), (ii) 'medium' scenario (at 60,000 MW) and (iii) 'high' scenario (at 80,000 MW) by 2041.

Table 4: Estimated Investment Demand for Renewable Energy Projects

Renewable Sources	Investment demand under different scenarios (in billion USD)		
	Low (Capacity 40,000 MW)	*Medium (Capacity 60,000 MW)*	*High (Capacity 85,000 MW)*
Solar	15.8	24.4	35.2
Wind	3.9	5.9	8.5
Hydro	4.2	6.8	9.9
Other	0.0	0.1	0.1
Total	23.9	37.2	53.7

Source: Authors' calculation.

According to the result of the meta-analysis, an estimated demand for investment will be between USD 23.9 and USD 53.7 billion in Bangladesh by 2041 to develop the required installed capacity from renewable energy projects (see, annex A for detailed explanation). Of which, nearly 65.6 per cent investment will be required to implement solar-based projects. Another 15.8 per cent investment will be needed to finance wind-based power projects while 18.4 per cent will be required to finance hydro power projects. However, following challenges should be kept in mind before citing the above-mentioned estimation derived from the meta-analysis: (a) given its past trend, the price of solar panel and inverters are likely to decrease in future in the international market, (b) next technological breakthrough is likely to increase the efficiency of producing electricity from renewable sources, (c) the commitments made by countries during the COP26 are materialised and the process continues.

In addition, an ordinary least square (OLS) regression has been conducted to estimate the investment requirement for installing additional capacity required to meet the commitment of 40 per cent electricity generation capacity from renewable energy sources in 2041 (see details in Annex B). Based on the data from 57 countries which had at least renewable energy installed capacity of 290 MW back in 2014, the result of regression model suggests that an additional increase in investment on clean energy by USD 1 billion contributes to install 1,180 MW renewable energy capacity (Annex Table 2). Extrapolating this global estimate for Bangladesh case, assuming the country will attain the 'medium scenario' mentioned above in section 6.2, an additional 22,602 MW renewable energy capacity will be required. Hence, nearly USD 19.2 billion additional investment will be required to substantiate green energy transition in Bangladesh by 2041. Combining the results of meta-analysis and OLS regression, to stimulate green energy transition in Bangladesh by 2041, roughly USD 19.2 to USD 37.2 billion investment will be needed to develop the required installed capacity from renewable energy sources.

SECTION 7: DISCUSSION

As per its NDCs, Bangladesh aims to reduce greenhouse gas (GHG) emission by 6.73 per cent in 2030 unconditionally, i.e., without external support. It would enhance its GHG reduction target to 15.12 per cent if it receives financial and technical assistance from international sources. However, the attainment of targets is not automatic and will require a number of measures. These include: major structural shifts and subsequent investment in energy and power sector management, transportation, use of energy efficient technologies in various sectors including industrial sector, infrastructure development, agriculture, and water and waste management. According to MCPP 2030, nearly USD 80 billion additional investment will be made by the Bangladesh government to attain resilience in energy, water, transport and business supply chain management by 2030 (GoB, 2021). The International Finance Corporation (IFC) reveals that Bangladesh's climate-smart investment potential is about USD 172 billion during 2018–2030 (IFC, 2017). Factoring the aspiration of Bangladesh to become a 'high income country' by 2041, the potential investment requirement may exceed even the IFC estimate by two to three folds since policymakers will have to promote a circular economy.

The recent upsurge of crude oil price and liquefied natural gas (LNG) spot market price, amid 'Russia-Ukraine' war and COVID pandemic, created significantly high competition among countries to secure primary energy requirements for future. For instance, between May 2020 and July 2022, LNG spot market price increased eightfold while crude oil price increased nearly thrice. While it is a 'hit in the jackpot' for primary energy producing countries, others (importing countries) are struggling to secure minimum supply of primary energy demand by constantly worrying about its 'balance of payment' situation. Bangladesh being one of the importing countries of primary energy, the government is struggling to even use half of its installed capacity due to fuel shortage and high primary energy prices. And, now the government is forced to reintroduce 'load shedding' as a temporary solution despite having an overcapacity in power generation. This very situation highlights the importance of implementing projects and achieving national targets in a timely manner as pointed out in various planned documents such as MCPP 2030. For example, had the target of 10 per cent renewable energy been implemented in accordance to the target set in REP 2008, the government could have potentially avoided current power cuts with 2,500 MW produced from renewable energy by 2021.

After years of decline, despite the cost of clean energy technologies started to increase since 2020, the investment figure on clean energy exceeds USD 1.4 trillion in 2021 (IEA, 2022). It suggests that power generation from renewable energy sources are becoming more reliable to countries than it was even two years back. Increasingly high cost of producing electricity from fossil fuels-based primary energy resources forced countries to expedite its effort towards securing more energy independence which can

be achieved through renewable sources.[7] Nevertheless, Bangladesh's effort towards higher energy mix from renewable energy is rather limited. In fact, at current market price, the average cost of electricity generation from solar energy on a regular sunny day is half compared to the cost of producing power from furnace oil and diesel. In many other developed and developing countries, electricity generation from private power plant operators seeks guarantee of primary energy supply. The GoB, however, has made itself hold responsible to supply fuel and, now, during this crisis is paying capacity charges for idle power plants. This is not only inducing higher financial cost of operation with 'no benefit', but is also increasing the economic cost by limiting the government's ability to promote investment for green projects.

SECTION 8: RECOMMENDATIONS

Stable power generation is the pre-condition for investment in critical sectors such as transportation, infrastructure, agriculture, water, and waste management. The recent energy crisis has pushed the countries to develop tailored responses and achieve some level of self-reliance on power generation. It further reveals that energy crisis can lead to macroeconomic instability since energy is crucial for production and economic growth. However, growth which is not 'welfare-enhancing and inclusive' is not sustainable. Therefore, the government has to enhance investment in renewable energy which is beneficial for human health and the natural ecosystem. Since the EU MIP priorities 2021–2027 for Bangladesh puts emphasis on human capital development, green inclusive development, and inclusive governance, the EU can come forward in providing financial and technological support to Bangladesh in achieving these goals. Based on the findings and discussions, this study puts forward following recommendations.

1. Given the importance of energy security, the GoB should declare renewable energy based projects under SREDA as fast track projects and mobilise financial and technological assistance which can help improve the share of energy mix based on renewable energy. In this context, as part of MIP priorities, the EU may support Bangladesh in mobilising funds to improve the institutional capacity of SREDA.

2. 'Net meter' based pilot projects should receive high policy priority and all sectors/industries should be involved since it requires 'no' or 'little' land preparation cost. High cost of land preparation is the major concern for establishing solar parks in Bangladesh. Considering that 'net meter' based solar system has the potential to expedite installed capacity from renewable

[7] Globally, governments allocated USD 710 billion for long-term clean energy and sustainable recovery measures (IEA, 2022).

energy in relatively quick succession with 'no' or 'little' land cost preparation, it should receive high priority in policy agenda. In this regard, recent announcement by the policymakers to install rooftop solar systems in all educational buildings to feed additional power to the grid by the GoB is a welcomed decision. It should be executed fast. Similar interventions should be replicated for other buildings by industries/sectors. In this connection, the EU may extent technical support to SREDA and Power Grid Company of Bangladesh (PGCB) for improving efficiency in the transmission and distribution channels of the power sector.

3. Rural settlements should be included in pilot interventions to promote 'net meter' based solar system solutions. Currently, SREDA is promoting 'net meter' based solar solutions mostly in the urban areas. This is also limited to the settlements that are having three phase electricity connection. While several urban settlements share single rooftop in a high-rise building, rural settlements (mostly one or two storied structures) in Bangladesh offer more areas for solar panel installation in a relatively populated community. With required technical solutions, SREDA should focus more on rural areas for wider penetration of 'net meter' based solar systems in addition to its current initiatives. In the initial phase, SREDA may develop model networks within communities to encourage more 'prosumers' to participate in this 'net meter' based solar system solution. In this regard, the idea of 'Solshare' may be reviewed by SREDA to come up with technically and financially feasible solution so that more rural solar home systems are directly connected with the national grid. The EU may provide support for a feasibility study for net meter based solar system solutions in the rural areas.

4. The GoB should rationalise tax structure further in support of promoting renewable energy.

    - The GoB should fully implement the commitments made in REP-2008. Currently, VAT exemption on solar panels and batteries exists, but there are no exemptions on solar inverters. Moreover, the import duty on inverters (HS 85044090) was raised by 37 per cent in the budget of FY2021–22. An extensive policy that considers VAT exemption on all types of equipment for a renewable power plant, especially solar power plants, should be considered.
    - The environment protection surcharge of 1 per cent that was mentioned in the Finance Act of 2014 on goods produced by industries polluting the environment should be implemented.
    - The GoB should gradually phase out fossil fuel subsidies and redirect the funds to finance renewable energy-based projects.
    - The GoB should consider introducing a formal feed-in tariff policy exclusively for renewable energy needs. Although an informal form of the feed-in tariff policy exists,

current energy crisis in Bangladesh calls for a clearer and specific incentive package to encourage renewable energy producers regardless of their generation capacity.

5. The margin of fiscal incentives may be increased to promote green establishments. According to IEA (2022) global buildings sector investment in energy efficiency increased nearly 16 per cent from 2020 to 2021 and reached approximately USD 237 billion. It suggests that the global demand for energy efficient establishments is high. This is not different in case of Bangladesh. Currently, there are more than 170 certified green buildings in Bangladesh, and over 500 buildings are in the pipeline to be certified as green establishments. These are mostly commercial factory buildings. As mentioned in section 3.6, currently only 2 per cent additional fiscal benefit in terms of reduced tax are enjoyed by industries exporting goods and services. This may be extended up to above 3 per cent. Alternatively, the GoB may think of reducing a small portion of AIT for operating businesses from green factories. For instance, RMG exporters now pay 1 per cent AIT on exported value. For green factory operation, AIT may be dropped to 0.90 per cent.

6. The size of Bangladesh Bank's refinancing scheme should be enhanced and the development partners may collaborate towards mobilisation of more funds for green financing. Bangladesh Bank's refinancing scheme is central to the establishment of green buildings and private renewable energy plants in Bangladesh. Also, against the financing on green investment projects, the NPL rate is significantly lower than regular term loans. Hence, the size of Bangladesh Bank's refinancing scheme should be enhanced. However, it must be recognised that, under this refinancing arrangement, Bangladesh Bank is the implementation agency, and the fund is not primarily mobilised by Bangladesh Bank. Rather General Economics Division (GED) under the Ministry of Planning, Bangladesh mobilises these relatively low-cost funds by negotiating with development partners. As more global resources are shifting towards climate-smart funds from traditional development funds, developing synergy between development and climate projects are becoming critical to negotiate better with partner organisations. Since green and inclusive development is a priority area in Bangladesh under MIP '2021-2027', the development partners may extend financial support to further strengthen Bangladesh Bank's capacity to refinance green investment projects.

7. The GoB should put more emphasis on developing a strong bond market to finance future green projects. Current size of bond market in Bangladesh is roughly about USD 17.5 billion and dominated by government debt securities and capital bonds issued by banks and FIs. While bond market contributes significantly to support long-term financing for public sector projects in developed countries, Bangladesh's bond market currently lacks capacity to deal with the

long-term investment gap for development purposes including investment for green projects. Globally, bond market supports financing significantly for green establishment projects. Nonetheless, in the case of Bangladesh, green establishment financing is mostly reliant on Bangladesh Bank's refinancing scheme and bank's or FI's term loan. Recently, green bond is introduced in Bangladesh, but banks/FIs are only interested in financing small-scale projects under this initiative. Hence, the green bond initiative is yet to stir interest among investors as well as potential beneficiaries. On a welcoming note, Bangladesh Bank has taken a few initiatives to develop a green bond policy and once done, it is hoped to get the much-needed guidelines for banks/FIs to finance projects, tapping the avenues of green bonds.

8. A better coordinated approach with policy consistency is required from public organisations to encourage investment in green projects. Lack of coordination, weak implementation of regulation, and inconsistency in government policies are major challenges for investors in green projects. Investors also experience rigidity from banks and FIs in accessing loans (especially for working capital) for green projects. This should be removed through a more coordinated approach and policy consistency among various public organisations.

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ANNEXURE

Annex A: Detailed Explanation of Meta-Analysis

The detail explanation of meta-analysis is discussed below. Column ‘a’ shows sources of renewable energy e.g., solar, wind, hydro and biogas to produce electricity. Solar energy projects include solar park, rooftop solar, solar irrigation and floating solar (where, mini-grid, micro-grid etc. are included). Column ‘b’ shows a total 83.7 per cent renewable energy will be produced from solar power, whereas 7.0 per cent and 9.0 per cent will be from wind and hydro power respectively. Rest will be produced from biogas to electricity. In determining percentage share of sources of renewable energy, the research team followed the disaggregation mentioned in power sector analysis 2030 document that was developed based on MCPP. Column ‘c’ presents total installed capacity under renewable energy from existing and ongoing projects. Column ‘d’ highlights the potential installed capacity from projects that are currently in planning stage. As mentioned earlier in the section 6.2, three scenarios were developed to compute the analysis. Column ‘e’ to ‘g’ inform about the required installed capacity considering 40 per cent electricity will be generated from sources of renewable energy by 2041 under three different scenarios. Column ‘h’ to ‘j’ shows how much additional installed capacity in quantity will be required from renewable energy sources to fulfil the target. Column ‘k’ shows investment required for installing per MW capacity at project level under different arrangements. For instance, investment required to produce per MW capacity in solar parks is taken as an average value (from a priori information) from the following two projects: 134.3 MW Mongla Solar Park and 35 MW Spectra Solar Park project. Investment related information as regards capacity development under rooftop solar projects are collected from KIIs with officials of United General Electric Company Ltd. Later, the same value is also used for solar irrigation and floating solar projects. The caveat is, the prices of solar panels vary significantly with the level of efficiency. Investment related information as regards wind power is collected from the office of Siddhant Wind Energy Pvt Ltd. Investment related information as regards hydro power is used from similar projects that are under implementation in India. Finally, column ‘l to m’ reveals how much additional investment will be needed to installed the required capacity to ensure target of generating 40 per cent of Bangladesh’s energy from renewable sources by 2041.

Annex Table 1: Detailed Calculation on Investment Demand for Renewable Energy Projects

Sources of Renewable energy	per cent share of RE	EC+UI (MW)	UP (MW)	Low (L)	Medium (M)	High (H)	L	M	H	Investment in million USD per MW	L	M	H
				Required Installed Capacity (MW)			Additional Capacity Required (MW)				Additional investment (In billion USD)		
a	*b*	*c*	*d*	*e*	*f*	*g*	*h*	*i*	*j*	k	*l*	*m*	*n*
Solar Park	*40.0*	*672*	*1,424*	*6,400*	*9,600*	*13,600*	*5,728*	*8,928*	*12,928*	1.61	*9.22*	*14.37*	*20.81*
Rooftop Solar	*35.0*	*83*	*1*	*5,600*	*8,400*	*11,900*	*5,517*	*8,317*	*11,817*	1.00	*5.52*	*8.32*	*11.82*
Solar Irrigation	*5.0*	*52*		*800*	*1,200*	*1,700*	*748*	*1,148*	*1,648*	1.00	*0.75*	*1.15*	*1.65*
Floating Solar	*3.7*	*295*		*592*	*888*	*1,258*	*298*	*594*	*964*	1.00	*0.30*	*0.59*	*0.96*
Total Solar	**83.7**	**1101**	**1,425**	**13,392**	**20,088**	**28,458**	**12,291**	**18,987**	**27,357**	**-**	**15.79**	**24.43**	**35.24**
Wind	**7.0**	**65**	**295**	**1,120**	**1,680**	**2,380**	**1,055**	**1,615**	**2,315**	**3.66**	**3.86**	**5.91**	**8.47**
Hydro	**9.0**	**230**		**1,440**	**2,160**	**3,060**	**1,210**	**1,930**	**2,830**	**3.50**	**4.24**	**6.76**	**9.91**
Biogas	**0.3**	**2**	**50**	**48**	**72**	**102**	**46**	**70**	**100**	**1.00**	**0.05**	**0.07**	**0.10**
Grand Total	**100.0**	**1,398**	**1,770**	**16,000**	**24,000**	**34,000**	**14,602**	**22,602**	**32,602**	**-**	**23.94**	**37.17**	**53.72**

Source: Authors' calculation.

Note: EC (existing capacity installed), UI (under implementation), UP (under planning).

Annex B: Methodology of Empirical Model

An OLS regression analysis is carried out to estimate the investment demand to develop additional installed power generation capacity from renewable energy sources. The dependent variable is the 'change in installed capacity of electricity from RE sources' while the core independent variable is the 'change in investment on clean energy'. The relevant data is compiled from the Climatescope database developed by *Bloomberg New Energy Finance* (NEF) that keeps records on both installed capacity and investment figures on clean energy for 136 countries from 2015 to 2020. The dataset also contains information on the stock of installed power generation capacity till 2014 by countries. In addition, disaggregated information on installed power generation capacity by different RE sources are available in the abovementioned dataset. Besides, a number of other independent variables are compiled from the WDI database to conduct the regression analysis (World Bank, 2022). Based on the Cimatescope database, the median installed power generation capacity from RE sources was found to be 289 MW per country in 2014. At the same time, Bangladesh's installed power generation capacity from RE sources was roughly 377 MW (IRENA, 2022). Therefore, the regression analysis is carried out for countries that had installed power generation capacity above 289 MW in 2014. The general expression of OLS model conducted is as follows -

$$\Delta IC_{RE\ (t-(t-5))} = f(\Delta I_{CE(t-(t-5)}, \frac{RE_S}{RE_t}, \frac{RE_w}{RE_t}, \frac{RE_H}{RE_t}, PE, AE, CC, \sum_{i=1}^{n=t-6} RE) \text{ for } \sum_{i=1}^{n=t-6} RE > 289 \text{ MW}$$

Where, latest year, t=2020 and other expressions are as follows,

$\Delta IC_{RE\ (t-(t-5))}$	Change in installed capacity of electricity from renewable energy sources (in MW) during 2015–2020
$\Delta I_{CE(t-(t-5)}$	Change in investment on clean energy (in billion USD) during 2015–2020
$\frac{RE_S}{RE_t}$	Solar power capacity as per cent of total renewable energy: five years weighted average from 2016 to 2020
$\frac{RE_w}{\mathrm{RE}_t}$	Wind power capacity as per cent of total renewable energy: five years weighted average from 2016 to 2020
$\frac{RE_H}{RE_t}$	Hydro power capacity as per cent of total renewable energy five years weighted average from 2016 to 2020:
$\sum_{i=1}^{n=t-6} RE$	Installed power generation capacity from RE sources till 2014 by countries
PE	Population Density (per square kilometre) by countries
AE	Access to Electricity (per cent of population) by countries
CC	Categorical variable for country classification

Annex Table 2: Regression Results

Dependent Variable: *Change in Installed Capacity of Electricity from Renewable Energy Sources (in MW)*	
Independent Variables	(ii)
Change in investment on clean energy (in billion USD)	1,180*** (307.7)
Solar power capacity as per cent of total renewable energy	279.4 (209.0)
Wind power capacity as per cent of total renewable energy	414.8 (338.7)
Hydro power capacity as per cent of total renewable energy	86.92 (130.2)
Installed Power Generation Capacity from RE sources	-0.994*** (0.00741)
Population Density (per square kilometer)	125.0 (131.5)
Access to Electricity (per cent of population)	461.1 (762.3)
Country Classification (Low Income Countries =0)	
Lower-middle income countries (=1)	23,083 (27,415)
Upper-middle income countries (=2)	-5,666 (13,296)
High income countries (=3)	-24,058 (25,375)
Constant	-75,309 (88,097)
Observations	57
R-squared	0.954

Source: Authors' calculation.

Annex C: List of Participants in KIIs and EGM

Annex Table 3: List of Participants in KIIs and EGM

Sl.	**Interviewees**
1	**Mr Khondkar Morshed Millat**, *General Manager*, Sustainable Finance Department, Bangladesh Bank *
2	**Mr BN Dulal**, *Managing Director*, First Auto Bricks Limited
3	**Mr Malek**, *Executive Manager*, First Auto Bricks Limited
4	**Mr Mohammad Rashed Al Hasan**, *Senior Project Officer*, South Asia Department (SARD), ADB
5	**Dr Shah Md. Ahsan Habib**, *Professor and Director*, Bangladesh Institute of Bank Management
6	**Ms Tanzida Islam,** *Programme Manager Environment*, H& M
7	**Mahboob Sarwar-E-Kainat**, *Adviser*, Spectra Engineers Limited
8	**Ms Salma Islam**, *Head of Project*, Fundraising & Communication, Solshare
9	**Ms Aziza Sultana Mukti**, *Head of Operations*, Solshare
10	**Mr Sheikh HM Mustafiz**, *Managing Director*, Cute Dress Industry Limited
11	**Mr Md. Maruf Ur Rahman**, *Director Sales & Marketing*, United General Electric Company Ltd.
12	**Mr Hasan Mahmood Khurshid**, *Project Manager*, Sustainable Finance Unit, IPDC Finance Ltd.
13	**Mr Muhit Rahman**, *Managing Director and Head of Financial Market*, SCB
14	**Dr Afifa Raihana,** *Senior Environmental Specialist***,** International Finance Corporation (IFC)
15	**Ms Uzma Chowdhury,** *Director Finance*, PRAN-RFL Group
16	**Mr Md. Enamul Karim Pavel**, *Director (Loans) & Head of Renewable Energy Program***,** Infrastructure Development Company Limited (IDCOL)

Note: * participated both in KII and EGM

The key objective of the study is to identify opportunities and challenges of green investment in Bangladesh by—(i) reviewing existing supportive measures (including incentives) and policies for making investment in green projects, (ii) identifying opportunities and implementation challenges for investing in green projects, and (iii) making an estimate of the green investment required for electricity generation from renewable energy sources. In the policy discourse, it is hoped that the findings of the study will narrow the knowledge gap and contribute towards holistic measures by the government to promote investment in green projects by engaging private sectors and financial institutions. The study findings are also expected to support development partners such as the European Union in taking focused and strategic advocacy decisions on 'green growth' in Bangladesh.

Disclaimer

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