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RENEWABLE ENERGY FINANCE IN BANGLADESH: PROSPECTS, CHALLENGES, RISKS AND DE-RISK MECHANISMS

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SUPPORTED BY Tara

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RENEWABLE ENERGY FINANCE IN BANGLADESH: PROSPECTS, CHALLENGES, RISKS AND DE-RISK MECHANISMS

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List of Abbreviations

Abbreviation	Full-form
ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
BCCT	Bangladesh Climate Change Trust
BDT	Bangladesh Taka
BERC	Bangladesh Energy Regulatory Commission
BOO	Build-Own-Operate
BPDB	Bangladesh Power Development Board
BSEC	Bangladesh Securities and Exchange Commission
BU	Billion Units equivalent to terrawatt hour (TWh)
BUILD	Business Initiative Leading Development
BWGED	Bangladesh Working Group on External Debt
CCF	Climate Change Fund
CDM	Clean Development Mechanism
CIF	Climate Investment Funds
CMSME	Cottage, Micro, Small and Medium Enterprise
COP	Conference of Parties
COP15/COP18/COP21	COP held in the year 2015/2018/2021
COVID	Coronavirus Disease
CPD	Centre for Policy Dialogue
DESCO	Dhaka Electric Supply Company Limited
DIB	Development Impact Bonds
DPDC	Dhaka Power Distribution Company
DPPA	Direct Power Purchase Agreement
ECA	Export Credit Agencies
EMDE	Emerging Markets and Developing Economics
ERD	Economic Relations Division
ESDD	Environmental & Social Due Diligence
ESG	Environmental, Social, and Governance
ESRM	Environmental & Social Management System
EVN	Electricity Vietnam
FCDO	Foreign, Commonwealth & Development Office
FDI	Foreign Direct Investment
FI	Financial Institutions
FY	Fiscal Year
FYP	Five Year Plan

G7	The International Group of Seven
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEC	Green Energy Corridor
GEF	Global Environment Facility
GHG	Greenhouse Gases
GW	Gigawatt
HFO	Heavy Fuel Oil
HSD	High-Speed Diesel
IDA	International Development Association
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IFC	International Finance Corporation
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IPEMP	Integrated Power and Energy Master Plan
IPFF	Investment Promotion & Financing Facility
IPP	Independent Power Producer
IRENA	International Renewable Energy Agency
JICA	Japan International Cooperation Agency
KII	Key Informant Interview(s)
KW	Kilowatts
LC	Letter(s) of Credit
LCOE	Levelized Cost of Energy
LDC	Least Developed Countries
LIS	Land Information System
LNG	Liquefied Natural Gas
MCCP	Mujib Climate Prosperity Plan
MDB	Multilateral Development Bank
MEMR	Ministry of Energy & Mineral Resources
MNRE	Ministry of New and Renewable Energy
MOIT	Ministry of Industry and Trade
MPEMR	Ministry of Power, Energy and Mineral Resources
MW	Megawatts
NBFI	Non-Banking Financial Institutions
NBR	National Board of Revenue
NDB	New Development Bank
NDC	Nationally Determined Contributions
NDF	Nordic Development Fund (NDF)
NSEFI	National Solar Energy Federation of India
NWPGCL	North-West Power Generation Company Limited
ODA	Official Development Assistance
PDB	Power Development Board
PPA	Power Purchase Agreement

PPF	Project Preparation Facility
PSMP	Power System Master Plan
PSMP2016	Power System Master Plan 2016
PV	Photovoltaic
Q1	Quarter 1
QRPP	Quick Rental Power Plants
RE	Renewable Energy
RECAI	Renewable Energy Country Attractiveness Index
REF	Renewable Energy Financing
RMG	Ready Made Garments
RPO	Renewable Purchase Obligation
RPP	Rental Power Plants
RSF	Resilience and Sustainability Facility
SEBL	Solar Electro Bangladesh Limited
SEDA	Sustainable Energy Development Authority
SPP	Small Power Plant
SREDA	Sustainable and Renewable Energy Development Authority
SREP	Scaling up Renewable Energy in Low Income Countries Program
TAP	Take and Pay
TIB	Transparency International Bangladesh
TOP	Take or Pay
UN	United Nations
UNDP	United Nations Development Programme
USAID	U.S. Agency for International Development
USD	United States Dollar
WB	World Bank

Executive Summary

Climate change is a major threat to human civilization, with two-thirds of global greenhouse gas emissions linked to burning fossil fuels for energy. The Intergovernmental Panel on Climate Change warns that any delay in global action on adaptation and mitigation could lead to missed opportunities for a habitable and sustainable future. Despite contributing less than 1% of global carbon emissions, Bangladesh is one of the most climate-vulnerable countries, and without changes, it would see annual economic costs equivalent to 2% of its GDP by 2050, widening to 9.4% by 2100. The country is currently reliant on fossil fuels for energy with gas being the primary source and with coal accounting for almost 7%. However, solar PV and onshore and offshore wind energy costs have dropped by up to 80% in the last decade, making renewable energy increasingly affordable. The government of Bangladesh has been compelled to cancel ten coal-based power facilities worth $12 billion due to adverse pressure on foreign exchange reserves and economic crises. The government has also spent almost 90 thousand crore BDT to private power companies without taking any electricity, while the Adani coal power plant will cost Bangladesh over Tk 1 lakh crore in capacity charges over the next 25 years, and power from the plant will be 56.2% more expensive than other imported power. Bangladesh is predicted to have an annual mortality of 150,000 and 55 million people impacted by climate change by 2030. Bangladesh's reliance on imported fossil fuels is not in line with global trends, and renewable energy is essential for energy security and to combat climate change.

Bangladesh has seen a significant increase in greenhouse gas (GHG) emissions, which rose by 59% from 1990 to 2012, with a 2% increase annually. As of 2019, Bangladesh emits around 237.70 million metric tons of carbon dioxide equivalent (CO2e). The government of Bangladesh submitted its Nationally Determined Contribution (NDC) in 2021 to meet the requirements of the Paris Agreement, and set targets to cut GHG emissions by 27.56 million metric tons of CO2e (6.73%) by 2030 in the energy, agriculture, and waste sectors. The government has also aimed to meet 40% of electricity demand from renewable energy sources by 2041. Bangladesh has a potential of 150 GW of utility-scale solar power plants and can install around 2 GW of rooftop solar PV systems on public buildings, railway stations, highways, industrial buildings, schools, colleges, and universities. According to a National Renewable Energy Laboratory (NREL) study, Bangladesh has a wind power gross potential of 30,000 MW, but more detailed feasibility studies are needed to determine the actual potential. China has saved $21 billion in additional coal and gas imports due to investing in solar energy. Bangladesh is expected to begin generating commercial wind power in 2023 and nuclear power by 2025.

Bangladesh needs USD 6 billion in the 15 months from April 2023 to meet the electricity demand, including an electricity import bill of USD 475 million from India this fiscal year and USD 52 million next year. Additionally, the import of furnace oil for IPP and rental power plants will require USD 890 million in the current financial year. However, the installation of 1 MW of solar power on a rooftop costs USD 0.80 million, while an IPP requires close to USD 1.4 million, and installing 1 MW of wind-powered electricity costs USD 3.66 million. If even one-third of the cost paid in imports is redirected to renewable energy, Bangladesh could have 6250 MW of rooftop solar, 3571 MW of solar IPP plant, and 1366 MW of wind power plant. Currently, Bangladesh is also facing issues with the payment of electricity import from India, with Adani electricity providing 760 MW, and the annual cost of importing electricity from India being approximately USD 659 million. PDB plans to take foreign loans to meet the obligation of forced electricity import. This is increase debt burden.

A paper on Bangladesh's energy mix shows that the demand for energy is on the rise and that renewable energy financing is essential for sustainable energy development. According to a report by

the International Trade Administration, Bangladesh's demand for power will be 50,000 MW in 2041 compared to 8,000 MW in 2015, which will require between USD 37.2 billion to USD 100 billion in investments between 2030 and 2050 to produce 40% of power from renewable energy. A survey conducted in 2017 shows that while 70% of respondents are interested in solar electricity, 64% of them believe that the service provided along with the product makes it difficult to opt for solar, and 55% blame the difficulty on the lack of availability. Despite the positive public perception of solar energy, social acceptance is a major factor in ensuring the success of renewable energy. The cost per kilowatt-hour of combined cycle electricity with gas available under long-term contracts is currently BDT 14-22, while the cost of fuel is BDT 12, whereas it is possible to get solar power within BDT 10 per kilowatt-hour, and the levelized cost of energy for utility-scale solar PV as of 2021 was USD 54/MWh or BDT 5.67/KWh, making it a more cost-effective option than traditional fossil fuels. However, lobbying from "vested interest groups" is preventing Bangladesh from prioritizing renewable energy over fossil fuels, and a lack of a roadmap for fund access from international sources is also hindering growth in the renewable energy market.

Objectives and Rationale

In light of the above facts, this study intended to a) Identify the current state of renewable energy financing, especially in the context of policies, international treaties and agreements, and short and long-term goals along with an assessment of what has been achieved so far; b) Specify the types of financial instruments and institutions involved in funding renewable energy projects; c) Analyze the risks in RE financing and barriers to enabling environment to investment in renewable energy; d) Suggest possible de-risking mechanisms and way forwards that are conducive to risk-averse financing; and e) In the long-term, to encourage stakeholders to take steps towards de-risking the investment climate for renewable energy.

The key rationales of the study are intensification of the dollar drainage and foreign reserve crisis; restriction on imports of capital machineries and fuels due to US$ crises led to frequent power outage and load shedding; escalation of the global energy price; Bangladesh Power Development Board is at risks of bankruptcy as compare to amounts in FY2020 the operating loss has been doubled in FY2021; and Dependency on foreign markets, import rose sharply from 1.5% in 2020 to 20.36% in 2021

Methodology

The study used a mainly qualitative approach and collected both primary and secondary data to analyze the state of renewable energy financing in Bangladesh. The study used a review of policies, articles, and reports linked to renewable energy and its finance, as well as key informant interviews with a range of stakeholders, including academicians, government representatives, multilateral funding entities, private sector representatives, policymakers, renewable energy specialists, finance specialists, and economists. The study also conducted a quantitative analysis based on a survey of thirty private sector representatives, who provided information on the risks and de-risking mechanisms for renewable energy finance in Bangladesh. The survey identified several risks, including power market risk, permits risk, social acceptance risk, hardware risk, developer risk, grid/transmission risk, off-taker credit risk, financing risk, currency risk, and sovereign risk.

Renewable Energy Finance: Demand-Supply Perspective

As of March 2023, Bangladesh has 25,782 MW of installed capacity for electricity generation, but only 3.7% of the capacity is from renewable energy (RE) sources. The country has failed to meet its policy targets for electricity generation from RE sources in 2015 and 2021. The government of Bangladesh

has undertaken initiatives to speed up the adoption of RE, but many of these have failed the feasibility test. Linear and non-linear trend analyses show that Bangladesh's estimated need for net energy generation by 2041 may reach 160,000 GWh. To meet the country's anticipated electricity consumption, Bangladesh would need 45,000 MW of installed capacity for energy generation, and approximately 18,000 MW of installed capacity from RE sources to fulfill the nation's pledge at COP26 to produce 40% of its power from renewable sources by 2041. The energy transition in Bangladesh is expected to be based on 85% solar and 15% wind power between 2025 and 2040. The total cost for the next 15 years would be approximately USD 26.5 billion if the energy mix is 15% wind, 30% NMS solar, and 55% IPP solar. Nonetheless, the cost of solar panels has decreased dramatically over the years, and it is anticipated that this trend will continue into the future. The Paris Agreement emphasizes developed countries' financial assistance to countries that are less endowed and more vulnerable, while grant-based climate finance is crucial to ensure climate justice.

Review of Bangladesh's renewable energy finance related policies and legal regime

The policy review chapter of this report includes the analysis of various policies related to renewable energy that have affected renewable energy finance. The Renewable Energy Policy of Bangladesh was published in 2008 and provided a regulatory guideline for renewable energy in Bangladesh. The policy set the target of 10% of all electricity from renewable sources by 2020. It is being revised, as of March 2023, and the areas of concern in the draft have been expressed in this report. SREDA, despite being the focal agency for renewable energy projects, seem to not be living up to their roles. Quick Enhancement of Electricity and Energy Supply (Special Provision) Act, originally enacted in 2010, is one of the major legal instruments that have enabled the unchecked growth of the fossil fuel industry in Bangladesh. The single-buyer model which was established through the Private Sector Power Generation Policy of Bangladesh has been looked at from a critical point of view. The Net Metering Guidelines document was released in 2018 and it emphasized the importance of rooftop solar as 1 MW of solar takes about 3 acres of land and Bangladesh has a land scarcity issue. In Bangladesh's NDC commitment as presented in 2021, the set target was 4.1 GW RE by 2030; this is quite ambitious as it is presently 0.5GW.

Moreover, the Mujib Climate Prosperity Plan (MCCP) envisages a renewables roadmap towards energy independence and outlined that Maximized Renewable Energy and Storage Infrastructure includes 30% variable renewable energy by 2030, setting the trajectory for low carbon growth towards 100% zero-carbon energy by 2050 and net-zero by 2050s. The Bangladesh Climate Change Strategy and Action Plan 2009, Bangladesh Delta Plan 2100, Perspective Plan 2021-2041, and The Eight-Five Year Plan has also been covered. The Sustainable Finance Policy for Banks and Financial Institutions has been reviewed extensively to identify the gaps in policy that are becoming bottlenecks for financing renewable energy projects. The policy's inclusion criteria and environmental objectives have limitations, and renewable energy is not a specific focus. Furthermore, the policy lacks a clear instruction on identifying funding sources and new technology financing, among other issues.

Enabling Environment in Promoting REF in Bangladesh

The chapter on Enabling Environment in Promoting REF Bangladesh discusses the progress and challenges in promoting renewable energy in Bangladesh. The 2016 Power System Master Plan sets a target of 2 GW of renewable energy capacity with 2,337 MW of installations by 2020, making up 10% of the overall generating mix. Wind-based energy is expected to grow the most as it only contributes 0.6% to the country's renewable energy-based generation. However, private sector finance for the renewable energy transition is still below the required amount. The revised 2016 Power System Master

Plan aims for a generation mix by 2041 of 35% gas, 35% coal, 15% cross-border imports, 10% nuclear, and 5% oil. From 2017 to 2020, renewable energy production capacity increased almost four-fold, from 501 MW to 1,971 MW. However, the country still relies heavily on coal and private investment is required for sustainable growth of the renewable energy industry. Bangladesh Power Development Board's operating loss has doubled in FY2021 compared to FY2020 due to a massive fiscal burden created by foreign exchange drainage from energy imports. Moreover, the country's dependency on foreign markets rose sharply from 1.5% in 2020 to 20.36% in 2021. There is a lack of coordination between government agencies and disproportionate energy subsidies for fossil fuel-based IPPs. The draft IPEMP should prioritize major investments in renewable energy supply to reduce potential macro-economic shocks. However, the IPEMP focuses on unproven technology for Bangladesh, which needs to be reconsidered. A blackout in October 2022 affected more than 130 million people and could have been avoided with a smart grid. The grid's digitization needs more financing to make it less susceptible to supply, price fluctuations, and other factors. Finally, due to the country's single-buyer model, the off-taker, BPDB, has a significant credit risk, which can leave IPPs without payment. According to data from the Land Ministry, the potential for renewable energy generation in Bangladesh is around 28,106 MW across the country, with higher potential (22,319 MW) in Chittagong, if 5% of the non-agricultural khash-land is used. However, this estimate may change slightly based on solar radiation and wind flow.

Therefore, the land acquisition process should be time-bound, and the accountability of the concerned officials should be ensured to meet the national target of generating RE-based power. Mapping is needed for renewable projects as 3.89% of Bangladesh's total land is barren, and land availability information is necessary for planning and setting up renewable energy projects. A Land Information System (LIS) is suggested for managing land-related information and keeping it up to date.

A section of the chapter is dedicated to IDCOL, which is the primary financial intermediary for renewable energy projects in Bangladesh. IDCOL is funded by development partners through bilateral or multilateral funding from development partners and multilateral financial institutions. However, its recent financial performance in renewable energy has declined due to factors such as the collapse of the Solar Home System (SHS) program and the government's introduction of free rival solar energy systems. The lack of a knowledge-based policy framework as well as immature and inefficient management have resulted in classified loans. To popularize RE projects, shared equity ownership among stakeholders could be a solution. More effective allocation of REF institutions is required, as well as transparent, better knowledge-based, and practice-oriented leadership.

Risks in RE Finance in Bangladesh: Investors' Experiences

The chapter discusses the importance of securing financing for investors involved in renewable energy (RE) projects. There are several green financing options available for enterprises willing to invest in the RE sector, supported by the government through IDCOL and other agencies. Bangladesh Bank is also operating four direct refinancing schemes for promoting investments in green projects, with a total worth of BDT 15.5 billion and a green technology fund (GTF) equivalent to USD 200 million. 'Sustainable Finance Policy for Banks and Financial Institutions' lists 68 green products, projects, or initiatives applicable for term finance. Enterprises in the PV assembly and manufacturing sector have received green financing support from the government and BB, with 66.7% receiving support from the government and 8.3% from BB. Additionally, 38.9% and 11.1% of power plant producers have received green financing support from the government and BB, respectively. The risks for Bangladesh's RE sector were analyzed based on twelve risk factors, including currency, labor, sovereign, permit, financing, off-taker credit, power market, land acquisition, social acceptance, developer, hardware, and grid/transmission risks. Currency risk, permit risk, and financing risk are the

top three factors influencing the cost of capital in Bangladesh's RE sector, according to the survey results. Additionally, 43.3% and 40.0% of enterprises mentioned land acquisition risk and power market risk, respectively, as major factors influencing the cost of capital. Market risks, financial risks, regulatory risks, and other implementation risks are perceived to be more critical to increasing the cost of capital than technological readiness and its associated risks.

Recommendations

The chapter, "Discussion and Way Forward" recommends what can be done to overcome the barriers in the path of renewable energy finance. The renewable energy and financing policies in Bangladesh need clear and actionable strategies to achieve their ambitious targets. Policies like the 8th five-year plan, NDC, and renewable energy policy set ambitious targets but lack an action plan or strategy. To address delays in permits, Bangladesh should adopt India's E-application portals and public grievance application. Establishing green banks and financial institutions in Bangladesh can revolutionize renewable energy financing mechanisms, providing the push that the private sector needs to make significant investments. Green banks use innovative ways to catalyze investments that lead to low-carbon and climate-resilience. Several national and international sources of RE finance and potential reforms in different policies can be used to access public funds, such as investing in government-owned assets like green bonds, Sukuk, and using capital subsidies, grants, and tariff-based mechanisms to attract private investment. Additionally, policymakers' lack of conviction in their plans, technical knowledge, and the lack of support from financial institutions are barriers to better policymaking. Bangladesh has an opportunity to invest venture capital in the renewable energy sector. India has set ambitious renewable energy targets and achieved remarkable success in producing renewable energy. The National Board of Revenue (NBR) and Sustainable Finance Unit of the Bangladesh Bank should work towards the government's renewable energy targets. The high customs duty on solar inverters and solar panels in Bangladesh is making setting up solar energy expensive, and NBR should revise the list of HS codes accordingly.

Multilateral development banks (MDBs) such as ADB and IFC play a significant role in financing renewable energy projects in Bangladesh, but progress is being hindered by the lack of concerted effort and the absence of short-term renewable energy goals from the side of policymakers. Solar irrigation pumps have a lot of potential, and it is important to invest in them. A solution suggested by an IFC specialist is for MDBs to act as energy auditors. Renewable energy financing in Bangladesh is increasing gradually, but private entities such as banks and non-banking financial institutions are not as active in the field as would be desirable. They perceive renewables as not being as lucrative as other investments. Trials and pilot projects are recommended to fully understand the practical implications of implementing renewable energy projects.

Recommendations include allowing land lease-based loan facilities to RE entrepreneurs and developing Virtual Power Purchase Agreements. The establishment of a harmonized, well-regulated energy market, long-term national transmission/grid plan, and transparent and fraudulence-free time-bound enforcement mechanism are necessary to address power market risk and permit risk. A program to promote awareness of policymakers and experts about the potential of RE and harmonized local content and industrial policy for hardware risk are needed. The promotion of competitive skilled labor and on-grid rooftop PV and aggregative financing models are needed to address developer and financing risk. Partial indexing of local currency tariffs in power purchase agreements and political risk insurance for equity holders are recommended to address currency and sovereign risk, respectively. Bangladesh's over-generation capacity needs to be reduced to align with international standards. Establishing green banks can revolutionize the renewable energy financing mechanism in

Bangladesh, and Bangladesh Bank must encourage investment in renewable energy through incentives. The National Board of Revenue must also reduce customs duty on solar panels and inverters, which are vital machines needed for the production of solar energy.

Cross-country experiences are focused on. Comparison with neighboring India, which has seen remarkable growth in renewable energy in the last 15-20 years, yielded several recommendations for mitigating the risks, including transparent and coordinated process when applying for project approval, technical training programs, competitive bidding process, energy risk management and insurance programs, increasing the percentage of green investment, incentivizing foreign investment, and reducing subsidies to fossil fuels.

Under the Policy and Legal category, the Speedy Supply of Power and Energy (Special Provision) (Amendment) Act 2010 should be abolished to open up the competitive bidding process for renewable energy (RE) investors, especially for attracting foreign direct investment (FDI) in the energy sector. The only allowed Power Purchase Agreement (PPA) should be based on competitive bidding. There is inconsistency in setting RE targets and vested interest groups have intervened unnecessarily. The Sustainable and Renewable Energy Development Authority (SREDA) should be more empowered to handle this issue. Legislative reforms should be implemented to enact well-designed and harmonized policies. Institutional and Technical Capacity is the second category and includes suggestions like: the government should establish research and development centers to drive innovation and competitiveness in the early-stage RE industries. Development banks should initiate financing campaigns to raise awareness of renewable energy and support community-based projects. SREDA should have a one-stop service to receive applications, show the progress of applications and provide project information to ensure a transparent process and timely response from the authorities. The government should allow land lease-based RE entrepreneurs to carry out power plant projects. According to the third category “Economic”, the government should create a transparent, long-term national RE strategy and targets to guide investment decisions. In accordance with the government target to generate 40% of power from RE by 2041, investment in renewable energy would reduce both the drain on foreign currency and fiscal burden. International funding should be aligned with the US$2 billion in the MCPP planned to be spent for both energy efficiency and renewable energy, 40% of which will be sourced from concessional or derisking tool or grant. Governance and Integrity measures include standard PPA, nation-wide mapping on RE potential and automated approval process.

Overall political commitment and effective implementation of National Integrity Strategy, the Right to Information Act and Whistleblower Protection Act are key instruments to ensure the transparency, competition and fair treatment of local and foreign investors in the RE investment. A REF strategy should be formulated soon to access the international finance for public and private investment to meet the upcoming energy and power crises.

Chapter 1: Introduction

1.1 Background

Climate change, now more than ever, is one of the biggest threats to the survival and stability of human civilization. We are only beginning to see the catastrophic effects that have been caused by global industrialization and climate inaction. According to the European Environment Agency, "two thirds of global greenhouse gas emissions are linked to burning fossil fuels for energy". (European Environment Agency, 2017) In this context, the Intergovernmental Panel on Climate Change's (IPCC) 2022 report states, "Any further delay in concerted anticipatory global action on adaptation and mitigation will miss a brief and rapidly closing window of opportunity to secure a habitable and sustainable future for all" (Pörtner, et al., 2022). The Nationally Determined Contributions (NDCs) are plans that signatory countries of the Paris Climate Change Agreement need to publish along with their plans to reduce greenhouse gas emissions. (Nationally Determined Contributions (NDCs), 2021). Though the government of Bangladesh has the option to reduce the GHG emission through drastic cuts in fossil fuels, but still, they are skeptical to fully focus on renewable energy based sustainable development, rather in the draft Integrated Power, Energy Master Plan (IPEMP) 2023 the policymakers are trying to shift focus from coal to hydrogen, hydrogen, ammonia, CCS (Carbon Dioxide Capture and Storage), the unproven and expensive technology[1].

The International Renewable Energy Agency defines renewable energy as "energy that can be used without reducing its availability in the future" (IRENA Renewable Energy Statistics Training, 2017). Bangladesh's Sustainable and Renewable Energy Development Authority (SREDA) Act includes the following in the category of renewable resources: "biomass, biofuel, bio gas, hydro power, solar energy, wind energy, hydrogen cell, geothermal, and low and high tide energy" (The Sustainable and Renewable Energy Development Authority Act, 2014). At present, the gas is the primary source of energy in Bangladesh, partially because of its high energy content and partially due to its availability. Though renewable energy generation is key to sustainable development but Bangladesh's power mix (SREDA - Electricity Generation Mix, 2023) is only 3.86% (BPDB website, accessed on 25th March, 2023).

Despite being one of the lowest per-capita emitters of the world (less than 1% of global carbon emissions) Bangladesh ranked seventh place in the global climate risk index in 2021. (Global Climate Risk Index 2021, 2021)Therefore, one of the best ways to combat climate change would be to use renewable energy as an alternative source of energy. However, the generation and use of renewable energy in Bangladesh comes with its own set of challenges, one of the main ones is its financing; even so, its prospect grows more and more likely by the day.

Solar PV costs reduced by 80% in the past decade, while onshore and offshore wind costs dropped by almost 45%. This means more capacity was added towards the end of the decade per dollar invested (IRENA, 2022). The economics of decarbonizing the world economy would be fundamentally different if not for the rapid decline in the cost of renewable technologies. This was driven by bold policy decisions. However, due to inflexible standard clauses in fossil fuel power purchase agreement (PPA), in the last eleven fiscal years, the government has given nearly 90 thousand crore BDT to the private power companies without taking any electricity for Bangladesh (Ahmed, 2022).

Considering the adverse impacts of fossil fuels on the public health, environment and climate change and overall economy of the already vulnerable countries like Bangladesh the eighth five-year plan of

[1] The Business Standard, 20th March, 2023

Bangladesh (8FYP) highlights that Bangladesh's renewable energy power supply has not grown, and reliance on imported fossil fuel is not commensurate with global trajectories. As a result, Bangladesh will have to pay more than Tk 1 lakh crore to the Adani coal power plant as a capacity charge over the next 25 years (BWGED, 2022) and also the power from Adani Godda will be 56.2 percent more expensive than other imported power. Besides, BPDB spent around 604.95 Crore BDT for coal purchase to generate electricity in FY20121-22, which could be fully saved if RE-based power could be replaced. Whereas, the global solar power price has fallen of 89% since 2010 and 18% coupled with inflationary pressure, and volatility of fossil fuel prices, Bangladesh will face higher economic burden in the coming days. The combined effect of climate change and carbon-intensive loss impacts may raise average annual mortality by 150,000 by 2030 and 55 million people impacted by climate change by 2030 (Mujib Climate Prosperity Plan, 2021)

Taking into account the future energy security, harnessing the potential of renewable energy resources and disseminating it to the people; and to enable, encourage and facilitate both public and private sector investment the Government of Bangladesh approved, the Renewable Energy Policy was published in 2008. Apart from the Renewable Energy Policy, other acts, policies and regulations also support the promotion of renewable energy in Bangladesh. SREDA has outlined a sector wise renewable energy roadmap (draft, yet to finalize), but they did not show evidence-based financing strategy. The Bangladesh Climate Change Trust has included low carbon and mitigation as one of the thematic pillars of climate finance. However, there is no integrated national funding window for the renewable energy.

The Mujib Climate Prosperity Plan (MCCP) 2021 mentions that renewable energy has, “an investment opportunity of at least USD 10 billion over the next decade in generation alone.”, public cost savings of at least USD 1.7 billion per year in fossil fuel subsidies by 2030, and creation of around 12,000 new jobs by 2025 and approximately 40,000 jobs by 2030”. For a highly ambitious transition to renewable energy, the prosperity plan proposes "Mujib Bongoposagor Independence Giga Array," a USD 7.2 billion hybrid renewable energy (wind) adaptation infrastructure project, which would undertake mangrove plantation along the coasts and raise funds through blue bonds to protect marine life. However, MCCP did not provide any roadmap or strategy to achieve the target to mobilize the required funds. After 2010, generation cost of RE has been reduced by up to 85% and expected further decline of the cost of RE production (Naran B. , et al., 2022) but that has not been considered in the revision of NDC or the MCPP, this report has claimed that a low-carbon trajectory could save Bangladesh a daily-adjusted life year cost per capita of US$2100 (at purchasing power parity), taking consideration both outdoor and indoor pollution. This is equivalent to averting losses of USD 2.3 billion a year.

Renewable energy financing may also be seen as a strategy to diversify the energy portfolio; dependency on fossil fuels exclusively may leave Bangladesh vulnerable to system shocks. It is, therefore, of utmost importance to look into how to support the growth of the renewable energy industry. “They are also required to acquire over 40 permits and approvals from different organizations in order to be able to start constructing these projects. Fossil fuel subsidies, such as extremely low gas prices to power generators, also distort the market’s perception of the true cost of electricity production, making it difficult for decision makers to compare with tariffs offered by private developers for renewable energy projects” (USAID, 2020). Apart from existing disruptions in Bangladesh’s power sector and identify the relevant de-risks strategies and actions for acquiring more private investments in renewable energy (RE) (BIPPA and PwC, 2018). Investment and facilitation of investment in renewable energy can pave the way to a secure energy future. Renewable energy financing can be broadly categorized into public, international, bilateral/multilateral donor organization and private funds.

The government has also established the Sustainable Renewable Energy Development Authority (SREDA) to oversee and promote the development of the sector. Public financing is provided by the

government and other public entities such as Bangladesh Power Development Board (BPDB). Private financing is provided by commercial banks, non-bank financial institutions and enterprises through their equity. The financial organization Infrastructure Development Company Limited (IDCOL) acts as an intermediary for a majority of the renewable energy investments in Bangladesh.

International development organizations such as the World Bank, Asian Development Bank, and the International Finance Corporation (IFC) have played a critical role in supporting renewable energy development in Bangladesh. In recent years, these organizations have provided significant financing for renewable energy projects, including grants, concessional loans, and technical assistance. There are several modes of financing available for renewable energy projects in Bangladesh, which are grants, concessional loans, commercial loans, equity investments, and foreign direct investment (FDI). Grants and concessional loans are typically provided by international development organizations and multilateral development banks, while commercial loans and equity investments are provided by private sector entities. Loans are often taken through asset financing through collateral and asset finance is the most common method of renewable energy financing in the world (Global Trends in Renewable Energy Investment, 2019) In the case of Bangladesh, there is one significant similarity between all the types of renewable energy financing. More accurately, there are several factors.

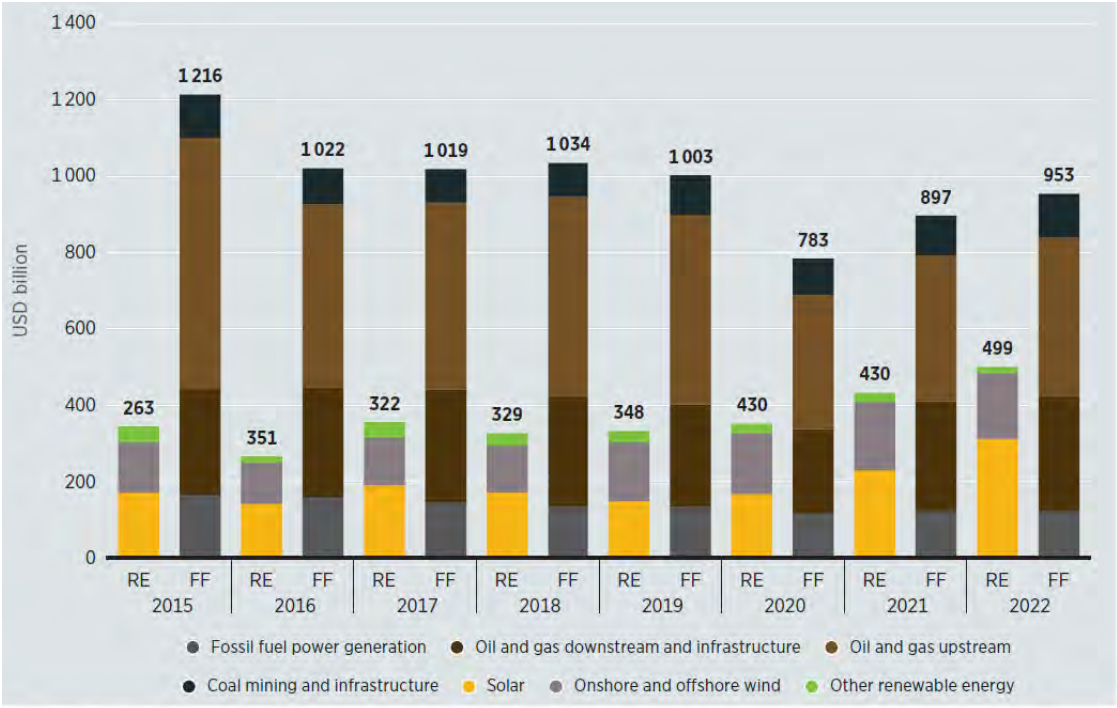
According to a paper on renewable energy financing in developing countries, "one of the biggest challenges…in developing countries is the perceived risk due to the inaccurate and sometimes misleading knowledge that some developing countries have regarding the cost and power generation of renewable energy" (Donastorg, Renukappa, & Suresh, 2017). According to the 2015 book "Renewable Energy Finance" by Donovan, as the renewable energy sector is relatively new, "a key task ahead is for the industry to generate a history of investment performance" (Donovan, 2015). Setting an example might be the very push the industry needs to propel it into faster expansion.

The current energy crisis may also be categorized as a result the addition to the fossil fuels. Renewable energy is the effective the solution to both economic and environmental crises, if we take the right steps to plan, finance and implement its development. Both climate change and the energy crisis have put Bangladesh in a vulnerable position and it is of the essence that Bangladesh steers its course towards renewable energy. Additionally, the Russia-Ukraine war of 2022 has brought the issue of energy security to the forefront and Bangladesh must be prepared to have self-sufficiency in energy if the country wants to withstand the fluctuations in the world market. However, the second Climate Vulnerability Monitor published in 2012 claimed that Bangladesh will face loses of up to 6.8% of GDP by 2030, with a carbon-intensive loses of 0.5% of GDP by 2030.

Energy Transition in Bangladesh

The growing global energy crisis has reinforced the need to shift toward renewable and sustainable energy to reduce the climate impacts of fossil fuels and energy insecurity.

Fossil fuel subsidies only represent a partial picture of all financial flows for providing support to high emissions and business-as-usual finance flows. Even then, "subsidies for 51 major economies amounted to USD 6.8 trillion between 2011-2020, according to OECD and IEA (2022), 40% more than climate finance. Global fossil fuel subsidies are projected to climb from USD 5.9 trillion (or 6,8% of global GDP in 2020) to 7.4% of global GDP in 2025 (IMF, 2022a), partly due to the current energy crisis." Though subsidies in the fossil fuel generation have been declining but gradually that has been diverting to another oil and gas downstream and infrastructure; subsidy to solar is increasing but onshore and offshore wind is deprived of getting subsidy (Figure 1).



Note: FF = fossil fuel; RE = renewable energy.
Based on: CPI (2022a) and IEA (2022b).

Figure 1: Annual investment in renewable energy vs. fossil fuels, 2015-2022 (USD bn)

Although short term interventions are understandable (i.e. providing energy security for the most vulnerable), but abrupt subsidy for both privileged and underprivileged have delayed the energy transition. However, solar power has helped seven Asian countries avoid $34 billion in fossil fuel import costs in the first half of 2022 (Edianto, 2022). Moreover, the current energy crisis reinforces the need for a longer term just transition strategy to drastic dependence on fossil fuel-based energy systems exposed to double exposures, high price volatility as well as higher environmental pollution leading towards health risks. It has been shown that due to RE or solar India would able to reduce the highest around 34% of fossil fuel subsidies could be avoided by 2030. Bangladesh has yet to formulate the roadmap to reduce the burden of fossil fuel imports and renewable energy finance in the coming days.

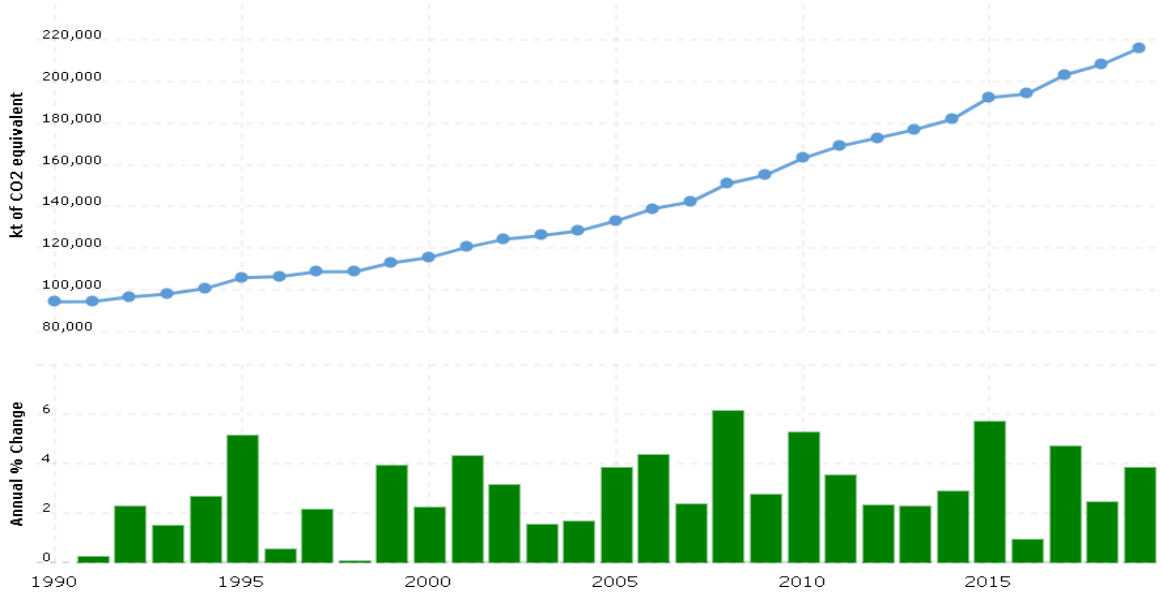


Figure 2: GHG emission and annual percentage change of GHG emission in Bangladesh

Aligning with the Paris Agreement the Government of Bangladesh has revised the INDC and submitted the NDC in 2021. Both mitigation and adaptation actions have been prioritized to implement by 2030. According to the "business as usual" (BAU) scenario, the total GHG emission in 2030 is predicted to be 409.4 Mt CO_2e, up 2.4 times from the base year of 2012 (NDC, 2021). CO2 emissions of Bangladesh increased from 3.5 million tons in 1972 to 106.9 million tons in 2021 growing at an average annual rate of 7.34%.[2] Regarding contributors of GHG, a total of 39% of emissions come from different agricultural sub-sectors. e.g. rice cultivation (32%), enteric fermentation (31%), and manure left on pasture (12%) of Bangladesh. The energy sector is the second highest emitter which includes different sub-sectors, e.g. electricity and heat production (46%), other fuel combustion (21%), manufacturing and construction (20%), and transportation (14%) (WRI CAIT, 2015).

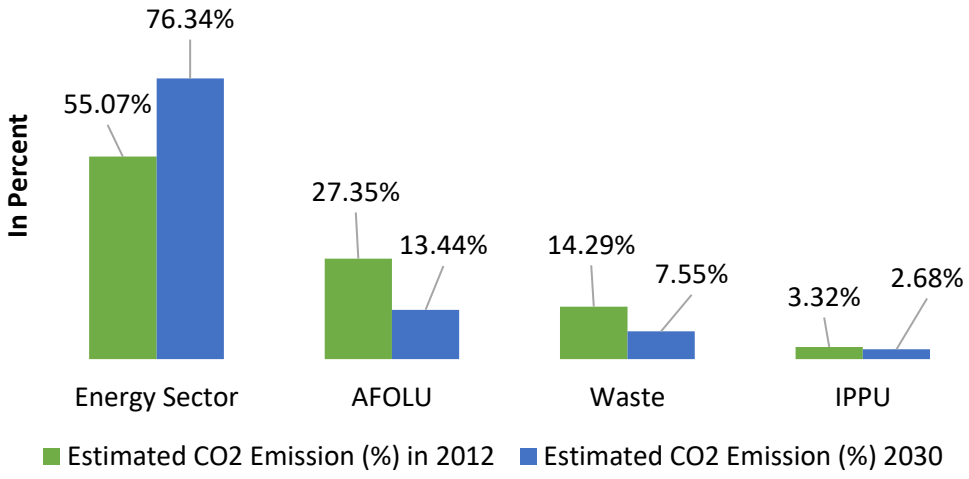
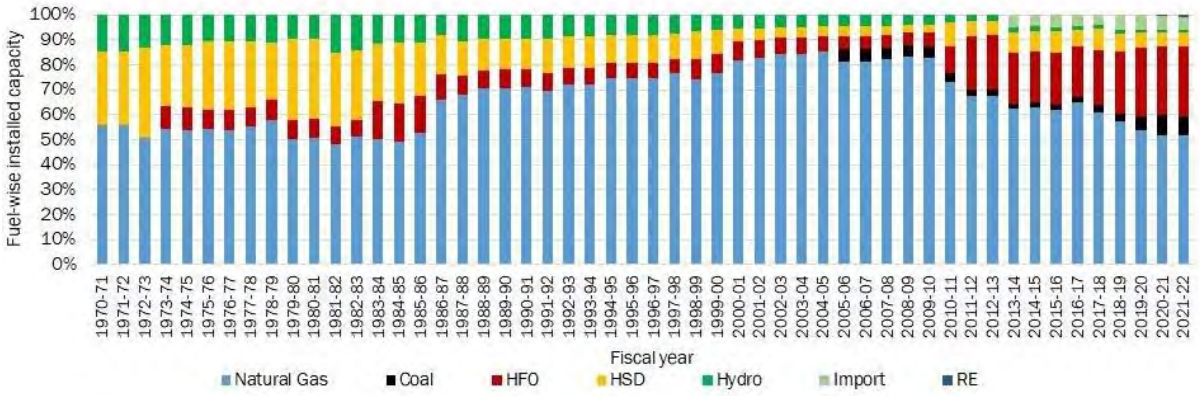


Figure 3: Sources of CO2 emission (%)

It has been estimated that in the energy sector, the total emission will be 312.54 Mt CO2e (76.34% of the total) in 2030. In the conditional approaches, mitigation measures will be implemented only if

[2] https://knoema.com/atlas/Bangladesh/CO2-emissions

Bangladesh receives any external financial/technology support. Moreover, the government has planned to meet the 40% of the electricity demand from renewable energy by 2041 (GoB, n.d.), and its draft national solar energy action plan proposes around 41 gigawatts of solar generation in the same time frame. At present, as of March 2023, Bangladesh has a total of 25,782 MW installed capacity for electricity generation. Of which, only 3.7% installed capacity is renewable in nature. Despite policy targets, in 2015 and 2021, Bangladesh failed to meet 5% and 10% of its electricity generation from RE sources (MPERM, 2008 and MPERM, 2016). Moreover, the contribution of RE in energy mix is still lowest one and the share of coal, HFO-based and import or energy trade is increasing over time (Figure 4). As a result, the country is still heavily relying on gas and other fossil fuels for power generation.



Source: Shahriar Chowdhury, 2023

Figure 4: Energy mix and transition towards RE in Bangladesh

As per Bangladesh's National Determined Contribution plan, updated in 2021, the country plans to implement renewable energy projects of 911.8 MW. This is an unconditional contribution, which means that Bangladesh has to deliver it by using own resources, without international support (Ministry of Environment, Forest and Climate Change, 2021). Bangladesh has abundant solar resources, making it an ideal location for solar power generation. In remote areas of the country where grid connectivity is limited, solar power can provide a reliable source of electricity. As per the graph above from the Ember Global Electricity Review 2022, countries like India, South Korea and China have made huge progress in 11 years from 2010 to 2021. It is possible for Bangladesh to make progress like this as well.

- According to the World Future Council (WFC), Bangladesh has the potential for 150 GW of utility-scale solar power plants. (Coastal Development Partnership, 2023)
- NREL Study says Bangladesh has Wind Power Gross Potential of 30,000 MW (for wind speed of 5.75-7.75 m/s), but detailed feasibility studies are needed to know the actual potential considering the social, economic, financial and technical aspects.
- Around 5,000 megawatts (MW) of electricity can be generated by installing solar panels on the rooftops of ready-made garment, textile and other industry buildings in the country.
- Existing building includes the followings, where around 2GW rooftop solar PV systems can be installed from all public offices including power sectors offices, existing and future EPZs and EZs; RMGs (knitting, spinning, textiles, denims, dying etc.), Bangladesh Railway, rooftops of railway stations, platforms and adjacent free lands, roadside and dividers of Highway, cold storages and storages, jute and paper mills and roofs of the industries; cyclone shelters, embankments, all schools, colleges and universities, se-ports, river, jetties stadium etc.

Bangladesh is expected to start generation from commercial wind park in 2023 and nuclear power by 2025. China saw the most significant savings, with solar avoiding $21 billion in additional coal and gas imports. Japan avoided $5.6 billion and India avoided $4.2 billion in cost of fossil fuel. (Waite & Garg, 2022) Bangladesh can learn from this scenario. Investing in renewable energy sources such as solar could help Bangladesh reduce its reliance on expensive and polluting fossil fuels, and in turn, reduce its fuel import costs.

The IPCC reported that Bangladesh will face significant losses in its GDP and displacement of people due to climate change. Earlier, Bangladesh Climate Change Strategy and Action Plan 2009 was released was prepared in 2009 that comprised 44 Programs among six thematic areas mitigation and low carbon development is one of the core focus to deal with adverse impacts of climate change as well as supporting low carbon economic growth (MoEF, 2009). The country needs climate finance to mitigate the effects of climate change and develop renewable energy. Moreover, the rising price of energy the in the global market required the government to allocate funds towards handling the crisis but if there should be some allocation for long-term solutions like renewable energy. This also signifies that private funds need to be utilized for renewable energy projects as it will not be possible for Bangladesh to solely develop the sector with public funds. Only solar mini grids are mentioned as projects which will be fully funded by sovereign funds.

In last 10 years, the Bangladesh has only made up around 3% of the national energy mix has been achieved so far last 50 years (ISLAM, 2020). To achieve the rest 37% of the target on average 2% of overall annual demand will have to generate annually and the emission target or global pledge will be complied with. A time-bound, forward-looking, transparent as well as competitive bidding, meaningful incentives, and power purchase action plan are required to fulfill the target.

To diversify the current mix of installed capacity by sources of RE, the government of Bangladesh has undertaken a number of programs and projects. However, a lot of these initiatives and projects to speed up the adoption of RE in Bangladesh failed the feasibility test. Currently, there are 959.6 MW of installed renewable energy electrical capacity in use, with over 75% of that being solar-based (SREDA, 2023). While 1,718.7 MW of new renewable energy-based electricity projects are currently in planning, another 617.2 MW are already in implementation stage (SREDA, 2023).

Table 1: Current Mix of Installed Capacity by sources of RE

	In Operation	**Implementation Ongoing**	**Under Planning**
	Installed Capacity (in MWp)		
Solar Park*	261.0	551.5	1374.2
Net Metering System (NMS)*	60.0	-	-
Rooftop Solar Except NMS	58.2	0.5	0.1
Solar Irrigation	51.3	2.8	-
Solar Home System	263.8	-	-
Other Solar Systems	31.3	-	-
Solar	725.6	554.8	1374.2
Wind	2.9	62.0	295.0
Hydro*	230.0	-	-
Biogas to Electricity	1.0	0.4	49.5
Total	959.6	617.2	1718.7

*Source: SREDA, 2023; Note: *On-grid*

1.2 Problem Statement and Rationales

Bangladesh has immense potential for renewable energy and several of the long term policies of the government of Bangladesh has set ambitious goals for renewable power generation; however, only 3%

of the power generated in Bangladesh is through renewable sources. This indicates a gap between long-term objectives and current actions and policies. Noted to be herein, World Bank claimed that in 2019 air pollution was the second leading cause of death and disability in Bangladesh in 2019 and cost the economy between 3.9 and 4.4 percent of its GDP (The World Bank, 2022). Moreover, the energy crisis triggered by the Ukraine-Russia conflict and economic slowdown due to the COVID-19 pandemic has brought the concern of energy security to the forefront. This has been exacerbated by the foreign reserve crisis Bangladesh is facing as importing energy has put more strain of it. Fossil-fuel based power generation and consumption have posed the BPDB into huge financial risks due to growing loses, it was around 1439.06 Crore BDT in FY2021-22 (BPDB report, 2021-22, page, 98). Specifically, in the fiscal year 2020-21, Bangladesh had the capacity to produce 192,991.6 gWh of energy but produced 80,422.5 gWh; generation was at 41% of the capacity. Idle power plants elicited an increase of USD 270.80 million in a year between fiscal years 2018-19 and 2019-20 (Mehedi & Ali, The Power Sector of Bangladesh 2021, 2022). Capacity charges paid by BPDB have been a huge financial burden and it is getting worse every year (Hossain E. , 2022). If even a portion of the capacity charge that is given to inactive power plants were diverted to renewable energy creation, it could contribute significantly to the cause.

Rapid and sustained inflation is one of the chief concerns of Bangladesh right now. As per a 2023 article, this risk will persist in the coming years (The Daily Star, 2023). By financing renewable energy projects, Bangladesh can reduce its dependence on non-renewable energy sources, which are often subject to price fluctuations and geopolitical tensions. Growing foreign debt has also been a cause of concern (The FInancial Express). A 2018 paper in the journal of Bangladesh Development Studies analyzes how much welfare is gained or lost by subsidizing fossil fuel; it is found that complete removal of fossil fuel subsidy would increase household welfare by 1.89%. The paper argues that these subsidies benefitting fossil fuels act as a hindrance to the development of the renewable energy market (Amin, Marsiliani, & Renstrom, 2018).

A 2021 IEA paper about financing clean energy transitions assessed a “financial system development indicator” for Emerging Markets and Developing Economics (EMDEs). The indicator for the growth of the financial system displays the average of the ratios of private credit to GDP and stock market capitalization to GDP over the previous five years; the average globally is weighed by GDP. The global average is 100% and Bangladesh falls somewhere below the 50% mark at around 40%. (International Energy Agency, 2021). Despite the increasing importance of renewable energy worldwide and its role in addressing climate change and promoting energy security, the deployment of renewable energy projects is often hindered by a lack of access to financing. Even though there is potential for foreign direct investment as well as grant allocation, Bangladesh may be falling behind in accessing it. Enabling policies as well as injection of investment into this sector has potential to trigger the multiplier effect and have a positive effect of the economy of Bangladesh as a whole. The purpose of this study is to identify the risks that are stifling the growth of the industry by directly or indirectly acting as barriers to finance, as well as the de-risking mechanisms that can encourage sustainable development.

> Accelerated climate action through the installation and management of energy efficiency and renewable energy provides more jobs and higher skills than technologies of the past such as oil, coal, and gas. Power sector modernization through energy efficiency and renewable energy consistent with the 1.5°C limit of the Paris Agreement could create twice the number of jobs by 2050, which is equivalent to a 68% net increase in jobs globally.[17] For Bangladesh, a recent study showed that modernization through renewable energy and energy efficiency could lead to 6 times more jobs than fossil fuel generation, that is up to 55,000 new jobs between 2016 and 2030.[18]

The long-term goal of this project is to influence the government policies to ensure adequate resources for RE projects in Bangladesh. Moreover, this study broadly looks into several areas related to renewable energy financing with the objective of encouraging policymakers and other stakeholders to develop a framework or mechanism to attract more investment for renewable energy promotion and growth. The factors that pose a risk for the industry are investigated as they ultimately prove themselves to be hindrances to financing potential; in addition, de-risking mechanisms are explored so that a way forward can be clearly planned. National policies of Bangladesh that are broadly relevant to energy and green financing are looked into as well and comparisons are drawn with policies of other countries as well to highlight areas of progress and identify gaps.

Ensuring adequate resources for financing renewable energy programs and projects is crucial for energy transition in Bangladesh. Several challenges and prospects exist in the industry. Campaigns and advocacy for promoting RE are being carried out by many but they have very little information about the present status of RE financing. The purpose of this study is to help others by bringing their attention to this important issue of financing. It is also important to bring the attention of policy makers to the fact so that they can develop a framework or mechanism to attract more investment for RE promotion and growth.

The key rationales of the study includes Intensification of the dollar drainage and foreign reserve crisis; Restriction on imports of capital machineries and fuels due to US$ crises led to frequent power outage and load shedding; Global energy price escalation; Bangladesh Power Development Board is at risks of bankruptcy as compare to amounts in FY2020 the operating loss has been doubled in FY2021; and Dependency on foreign markets, import rose sharply from 1.5% in 2020 to 20.36% in 2021.

1.3 Objectives

This study intends to:

- Identify the current state of renewable energy financing, especially in the context of policies, international treaties and agreements, and short and long-term goals along with an assessment of what has been achieved so far.
- Specify the types of financial instruments and institutions involved in funding renewable energy projects.
- Analyze the risks in RE financing and barriers to enabling environment to investment in renewable energy.
- Suggest possible de-risking mechanisms and way forwards that are conducive to risk-averse financing.
- In the long-term, to encourage stakeholders to take steps towards de-risking the investment climate for renewable energy.

1.4 Methodology

The study on “State of Renewable Energy Financing in Bangladesh: Prospects and Challenges” followed the following analytical framework along with the method and tools for data collection. This is mainly a qualitative study, both primary and secondary data was collected to conduct this research. Primary quantitative data was also collected.

a) Qualitative

Review of Literature and Policy Documents: For secondary information especially on the policy and legal regime, a comprehensive review of policies, articles, and reports linked to renewable energy and its finance were explored, e.g. Power System Master Plan, Renewable Energy Policy, SREDA

produced analysis, NDC, MCPP, ADB reports, Mujib Climate Prosperity Plan, Bangladesh Bank's Sustainable Finance Policy, Private Sector Power Generation Policy of Bangladesh, Perspective Plan of Bangladesh, 2021–2041 etc.

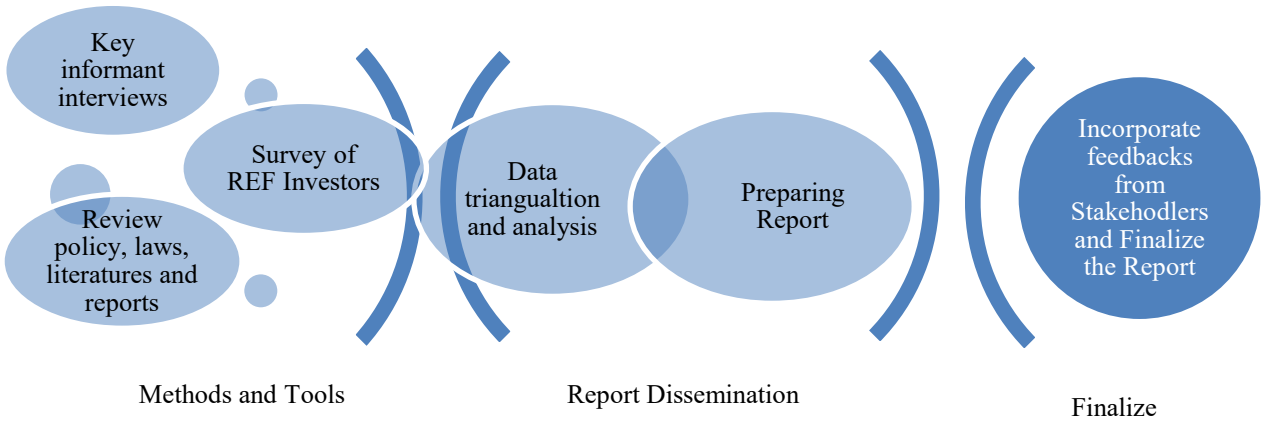


Figure 1 Methods and Data Sources

Key Informant Interviews: Information gathered from different key informant interviews, in-depth interviews and surveys were used after much deliberation and scrutiny. The data has been presented throughout the study in the form of qualitative insights and quantitative analysis. The primary research had Key Informant Interviews (KIIs) of 3 academicians, 6 Bangladesh government representatives, 5 multilateral funding entities, and in-depth interviews of private sector representatives (i.e. financial institutions including 3 commercial banks, 30 existing and potential investors and company owners etc.). The interviews also extended to former and existing policymakers, renewable energy specialists, finance specialists, economists etc. Reviews of relevant literature from laws, research reports, books and relevant websites were included in the report.

b) Quantitative

The quantitative analysis was conducted based on the survey of thirty representatives from the private sector or investors (existing and potentials) who provided information on the risks and de-risks mechanism for renewable energy finance in Bangladesh. We have considered the following risks in the context of financing and operating renewable energy projects:

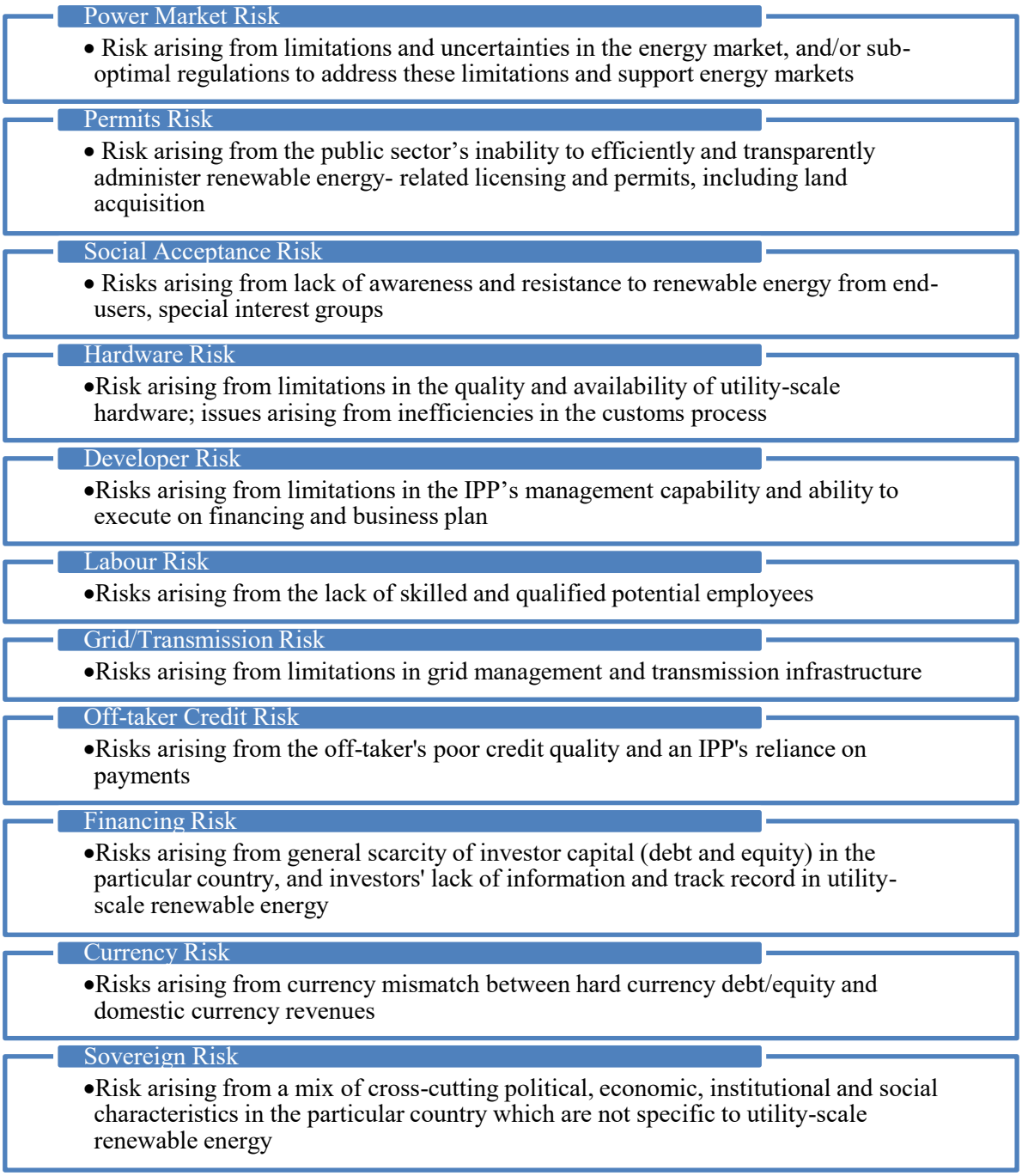


Figure 2: Risk Factors for Renewable Energy Financing

Method of the Risk Indexing

The renewable energy (RE) industry in Bangladesh is dominated by companies like solar photovoltaic (PV) assembler and manufacturer, solar, wind, biogas, and hydropower plant producers. In this study, a total of 30 enterprises were surveyed among these stakeholders. Of which, 60.0% of the businesses are producers of power plants (solar, wind, and biogas) and rest 40.0% of them engaged in PV assembly and manufacture (**Error! Reference source not found.**).

Table 2: Types of Renewable Energy Enterprise

Types	Number of Enterprises	Percent

PV Assembly & Manufacturing	12	40.0
Power Plant	18	60.0
All	30	100.0

Source: Change Initiative Renewable Energy Enterprise Survey, 2022

According to the survey results, two-thirds of enterprises that are involved in PV assembling and manufacturing made small-scale investments, while 16.7% of enterprises made medium- and large-scale investments in the RE sector. Among the power plant producers, 44.4% and 27.8% have made small and medium-scale investments, respectively, in the RE sector, while the rest, 31.3% have engaged in large-scale investment.

In this section, the "twelve' risk factors mentioned above were analyzed by their sub-indicators. In the structure survey questionnaire, respondents from enterprises were asked to rank among the sub-indicators between 1 and 5, where 5 is not at all risky and 1 is most risky. In order to construct indices whose values can range between 0 and 100, the minimum and maximum admissible values—also known as lower and upper bounds—are, respectively, 1 and 5. As respondents 'ranked' their preferences on a 1 to 5 scale, the basic formula for converting an indicator value (V) into an index score (I*) is:

$$I = 100 * \frac{V - \min\_value}{\max \text{value} - \min value}$$

$$I^* = 100 - I$$

Where,

min_value is the minimum admissible value (lower bound = 1) and,
max_value is the maximum admissible value (upper bound = 5).

Higher value of I* indicates higher the risk factor in renewable energy finance in Bangladesh.

1.5 Literature Review

Major risks in RE finance in emerging countries have been illustrated, cost of capital (CO) is increasing due to climate vulnerability in LDCs (UNEP, 2018). Moreover, high up-front costs for private investment, long time horizons for large infrastructure projects (IMF, 2022b) is also hindrance to mobilize investment. Besides, climate solution (high-quality) suffer from regulation uncertainty (cost overruns, delays, and permit risk); and DFI risk mitigation tools are applied at wider scale (to meet needs, the public investment and/or the ratio of public to private investment, must further increase). Mobilzing the adequate funds for RE in LDCs are restricted by subsidizing scarce public funding for the fossil fuel industries. Aside from those, several economic risks investors face in the LDCs, which are structural, e.g. exchange rate fluctuation, regulatory environments, and long term solutions (IMF, 2022b).

A paper on the current and future energy mix of Bangladesh (Das, Chakrabartty, Dey, Gupta, & Matin, 2020) shows the demand and supply trend of energy from the year 1995 to 2018 if we look at the trend, that it is on an upward rise and demand may begin to exceed installed capacity sometime in 2024-2025. According to the International Trade Administration, Bangladesh's demand for power will be 50,000 MW in 2041 (Bangladesh - Country Commercial Guide, 2022)compared to the 8000 MW demand in 2015 (Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh, 2016). Renewable energy may often be cited as being shrouded in uncertainties and high costs but any comparisons with fossil fuels should be made by keeping in mind that the latter are greatly subsidized and have been from the very start. A 2018 paper in the journal of Bangladesh Development Studies analyzes how much welfare is gained or lost by subsidizing fossil fuel; it is found that complete removal of fossil fuel subsidy would increase household welfare by 1.89%. The paper argues that these subsidies act as a hindrance to the development of the renewable energy market (Amin, Marsiliani, & Renstrom, 2018).

Renewable energy financing is a crucial component of the transition towards a sustainable energy future, as it provides the necessary funding for renewable energy projects. As per an article by The Third Pole, Nasrul Hamid, the minister for power, energy and mineral resources said that USD 80 to 100 billion is needed between 2030 and 2050 to produce 40% of power from renewable energy. (Begum, China the 'biggest player' in Bangladesh's energy transition, 2022) According to a CPD study this growth would need up to USD 37.2 billion in investments (New Age BD, 2022). However, it is not clear that those costs estimates have considered the potential decline of the RE related capital machineries. This study has shown both scenarios of the BAU and decline in the levelized-cost-of-electricity.

In Bangladesh, according to the BPDB, the cost per kilowatt-hour of combined cycle electricity with gas available under long-term contracts is currently BDT 14-22 including capacity charges, while the cost of fuel is BDT 12. A fixed capacity charge of BDT 40 per unit per day are paid irrespective of the number of hours it runs. On the other hand, each unit of gas from the 'spot market' at the current market rate costs BDT26-34 including gas price of BDT24, depending on the operation. Furnace running for 4 to 20 hours costs BDT15-23 per unit of electricity including oil of BDT13. The price of coal power is not less than BDT 15 per unit. This cost will increase by at least 10-20% if we take it as a 'carbon surcharge' announced at COP27. But it is possible to get solar power within BDT 10 per kilowatt-hour (Babu, 2023).

Levelized cost of energy (LCOE), unit of measurement for the average lifetime cost of energy for a generating asset, is used for comparing the costs of various power producing processes. LCOE is employed. Utility-scale solar PV, as of 2021, was USD 54/MWh or BDT 5.67/KWh, according to S&P

Global Commodity Insights. It is said to have a competitive edge over coal. At around USD 78/MWh in Bangladesh, the LCOE of combined-cycle gas turbine projects using LNG is predicted to rise to USD 93/MWh by 2050, a 20% increase in cost of generation as a result of the rising trend in Asian LNG prices (Chauhan, Wason, & Gupta, 2021). Choosing to opt for conventional power over solar, therefore, seems to be poor financial decision-making; any long-term financial planning related to energy investment, especially, should prioritize renewable energy. The power market risk of the prices of electricity generated from renewable energy sources not being competitive with those from traditional fossil fuel sources seem to be an outdated notion that is being perpetuated.

In 2017, a study (Tareq, 2017) claimed that 70% of the survey respondents claimed that they were interested in solar electricity, however, 55% blamed the difficulty on the lack of availability. Initial cost and lack of information were also said to be hurdles in their way by a vast majority. It can be inferred from this data that even though the public perception of solar is positive, they feel that due to various reasons they cannot choose it as their source of electricity. Social acceptance is a major factor in ensuring the success of renewable energy, especially in cases of off-grid stations which could directly supply to households. 70% of the survey-takers felt that more awareness was needed, clearly shows a need for knowledge dissemination. Regarding the enabling environment for RE expansion in Bangladesh, a study report (Masum, Mohiuddin, & Khan, 2020) claimed that "lobbying from vested interest groups" is preventing Bangladesh from giving renewable energy preference over fossil fuel". According to a CPD survey in Bangladesh in 2022, corruption has been identified as top "problematic factor" in doing business by private companies in Bangladesh (It's corruption that bites business harder: CPD, 2023). Bangladesh's public administration is often criticized for lack of accountability and transparency which lead to bureaucratic inefficiency. These systemic issues have made the process of obtaining necessary permits and approvals for renewable energy projects slow and cumbersome, leading to delays and added costs, as per this study's key informants.

Moreover, "due to oil and gas lobbying, there has been little success in regard to renewable energy growth; lack of a roadmap for fund access from international sources for the lack of access to international funds" (Op-ed of Babu M., Samakal, 29th January, 2023). This thought was reiterated by a 2022 Daily Star article which explained that capacity development of the private sector and an enabling environment was of the essence to capture the billions of dollars needed for the renewable energy sector (Sarker, Huq, & Andaleeb, 2022).

Additionally, the 1% customs duty on solar panels and more worryingly, the 37% customs duty on solar inverters have made setting up solar very expensive (Islam S. , 2021). The high duty on inverters on are levied as they are categorized as capital machinery and not given any special consideration for being a vital machine needed for production of solar energy. The 37% customs duty on solar inverters has made it expensive on top of all the quality issues. The risk associated with hardware or equipment is one that affects the suppliers and the consumers directly. In addition, the 2022 foreign reserve crisis of Bangladesh has been preventing businesses from opening Letters of Credit (LC) which has made importing anything, except non-essential items, difficult (Parvez, 2023). The fall in the value of Bangladesh's currency against US dollars has also driven up costs. The Diplomat reported in February 2023 that the falling value of BDT, the rising inflation, rising fuel prices, high foreign debt as well as worsening political conditions have all contributed to an unstable economy (Md. Mostofa, 2023).

The renewable energy sector in Bangladesh faces a shortage of skilled and knowledgeable employees, particularly in the areas of technical expertise. "Insufficient local human resources" is recognized as a challenge for solar IPPs by a UNDP paper on Solar IPPs (Chowdhury, Indicative Tariff for Utility-Scale Solar IPP in Bangladesh, 2018). A 2018 paper by Mazzucato and Semieniuk on Renewable Energy Financing states that, globally, there has been a shift towards private sector financing in recent

years, with a decrease in financing from public sources. The authors also found that renewable energy projects in developing countries are more likely to receive financing from development banks. (Mazzucato & Semieniuk, 2018)

All these can contribute to a hostile business environment especially for budding sectors like renewable energy. Land scarcity has been cited as a major hurdle towards the growth of renewable energy (Hossain I. , 2019). However, this claim needs to be examined under this study, particularly to identify the problem, whether availability or acquiring process. As per the Renewable Energy Country Attractiveness Index (RECAI), Bangladesh is not one of the top 40 countries with the most enabling environment for renewable energy (EY, 2021). The index prioritizes basic elements, including energy requirements, stable policies, successful project implementation (including access to capital), and the variety of natural resources. Bangladesh also did not rank as one of the top 30 countries for RECAI for corporate PPA (Renewable Energy Country Attractiveness Index Corporate Power Purchase Agreement , 2021). It is important for Bangladesh to learn from other countries, especially neighbors like India and Vietnam who have succeeded in making strides in renewable energy.

As previously mentioned, it costs USD 0.80 million to install 1 MW of solar power (with a 20-year lifespan) in a building or rooftop utilizing NMS. At the same time, an IPP needs close to USD 1.4 million (including 26% land preparation cost) to install 1 MW of solar capacity (with a 20-year lifespan). In contrast, installing 1 MW of wind-powered electricity producing capacity in Bangladesh costs just under $3.66 million. According to the draft RE Roadmap, roofto alone could generate around 6250 MW power and many MWs of each type of renewable power production is possible is even one-third of the cost paid in imports is redirected to renewable energy.

The cost of diesel-powered power plants in the private sector will cost 18 million dollars in capacity charge dollars this fiscal year. According to an article in Sharebiz (Ali, ১৫ মাসেই বিদ্যুৎ খাতে লাগবে ৬ বিলিয়ন ডলার, 2023), BPDB has estimated that US$ 6 billion will be needed in the 15 months from April 2023. The power sector alone will need about 6 billion dollars in 15 months, which includes an electricity import bill from India of 475 million dollars this fiscal year and 52 million dollars in 2024. In addition, the import of furnace oil for IPP (Independent Power Producer) and rental power plants will require 890 million dollars in the financial year of 2022-23, which will decrease next year after the commissioning of coal-based power plants. Coal import costs will increase due to the start of large coal-based power plants, and this will cost 573.5 million dollars in the current financial year, along with arrears of $220 million for coal import bills in two centers (Payra and Rampal). Considering the current financial situation in Bangladesh, shifting to renewable energy can help the country save a significant amount of money.

According another article (Ali, আদানির জন্য ভারত থেকে বিদ্যুৎ আমদানি ব্যয় বাড়বে ১৭৪%, 2023), Bangladesh is currently facing issues with the payment of electricity import from India. Adani electricity provides 760 megawatts of electricity, and with the second unit operational from July, Bangladesh will be able to import 1 thousand 496 megawatts of electricity daily. The annual cost of importing electricity from India has been approximately 659 million dollars, and Adani plans to spend 114 billion 39 million dollars a year on electricity import. PDB is in trouble with the payment of this electricity bill, and dollar crisis is currently delaying the payment of electricity bills imported from India. The concerned banks are not able to pay dollars, however, the Power Development Board (PDB) is in trouble with the payment of this electricity price. The company plans to take foreign loans to meet the obligation of forced electricity import. B PDB wants to take a medium or long-term loan of 1.8 billion dollars for one year to pay India's electricity bill. RE expansion can only save BPDB to be bankrupt. The capital market is especially lacking in case of renewable energy projects but there is

some progress as Bangladesh Bank launched a green bond policy in 2022 (Bangladesh Bank, 2022). Beximco became a pioneer earlier, in 2021, when they launched the Green-Sukuk Al Istisna'a bond worth BDT 30 billion to raise capital for the 200 MW Solar PV Plant in Gaibandha and the 30 MW Solar PV plant in Panchagarh..[3]

1.6 The Economics of RE Transition

According to an article in Sharebiz (Ali, ১৫ মাসেই বিদ্যুৎ খাতে লাগবে ৬ বিলিয়ন ডলার, 2023), BPDB has estimated that US$ 6 billion will be needed in the 15 months from April 2023. Considering the current financial situation in Bangladesh, shifting to renewable energy can help the country save a significant amount of money. The power sector alone will need about 6 billion dollars in 15 months, which includes an electricity import bill from India of 475 million dollars this fiscal year and 52 million dollars next year. In addition, the import of furnace oil for IPP (Independent Power Producer) and rental power plants will require 890 million dollars in the current financial year, which will decrease next year after the commissioning of coal-based power plants. Coal import costs will increase due to the start of large coal-based power plants, and this will cost 573.5 million dollars in the current financial year, along with arrears of $220 million for coal import bills in two centers (Payra and Rampal).

The cost of diesel-powered power plants in the private sector will cost 18 million dollars in capacity charge dollars this fiscal year. However, the contracts of the four centers will expire by next June, and the contracts of the other two centers will expire next fiscal year, which will reduce the cost of diesel-powered power plants. The next financial year will require only 77 million dollars.

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Type of Renewable Energy Production	Power Production Possibility (in MWs)
Rooftop Solar	6250
Solar IPP Plant	3571
Wind Power Plant	1366

According another article in ShareBiz (Ali, আদানির জন্য ভারত থেকে বিদ্যুৎ আমদানি ব্যয় বাড়বে ১৭৪%, 2023), Bangladesh is currently facing issues with the payment of electricity import from India. Adani electricity provides 760 megawatts of electricity, and with the second unit operational from July, Bangladesh will be able to import 1 thousand 496 megawatts of electricity daily. However, the

[3] https://www.beximco.com/storage/app/media/Reports/Beximco_Fact_Sheet_Green_Sukuk_al-Istisna%27a.pdf

Power Development Board (PDB) is in trouble with the payment of this electricity price. The company plans to take foreign loans to meet the obligation of forced electricity import.

The annual cost of importing electricity from India has been approximately 659 million dollars, and Adani plans to spend 114 billion 39 million dollars a year on electricity import. This implies that for Adani, the cost of importing electricity from India is increasing by about 174 percent. PDB is in trouble with the payment of this electricity bill, and dollar crisis is currently delaying the payment of electricity bills imported from India. The concerned banks are not able to pay dollars, and therefore, PDB wants to take a medium or long-term loan of 1.8 billion dollars for one year to pay India's electricity bill.

However, Bangladesh could partly save this cost if renewable energy was widely adapted.

Financial Implications of Renewable Energy Adoption:

Calculations for savings from the subsidy to fossil fuels import cost, capacity charge reduction, and environmental and public health damages.

1. Savings from Subsidy to Fossil Fuels Import Cost: Currently, the government of Bangladesh provides subsidies for the import of fossil fuels. According to the International Institute for Sustainable Development, in 2019, the total fossil fuel subsidies in Bangladesh amounted to around $1.7 billion. If the government shifts these subsidies towards renewable energy development, it can lead to significant cost savings in the long run. Assuming a gradual reduction of these subsidies:

Percentage	By year
25%	2025
50%	2030
75%	2035
100%	2040

Total Savings = $4.358 billion[4]

Therefore, the total savings from 2025 to 2041 from the subsidy to fossil fuels import cost is estimated to be around $4.358 billion.

2. Savings from Capacity Charge Reduction: The adoption of renewable energy sources can reduce the demand for fossil fuel-based power plants, resulting in a reduction in capacity charges. Assuming a capacity charge reduction of:

Percentage	By year
10%	2035
20%	2041

Total Savings = $1.872 billion[5]

(Source: (IRENA, 2019))

[4] Total Savings = $1.7 billion + $637.5 million + $318.75 million + $1.7 billion

(25% of $1.7 billion) + (50% of $1.275 billion) + (75% of $637.5 million) + ($1.7 billion)

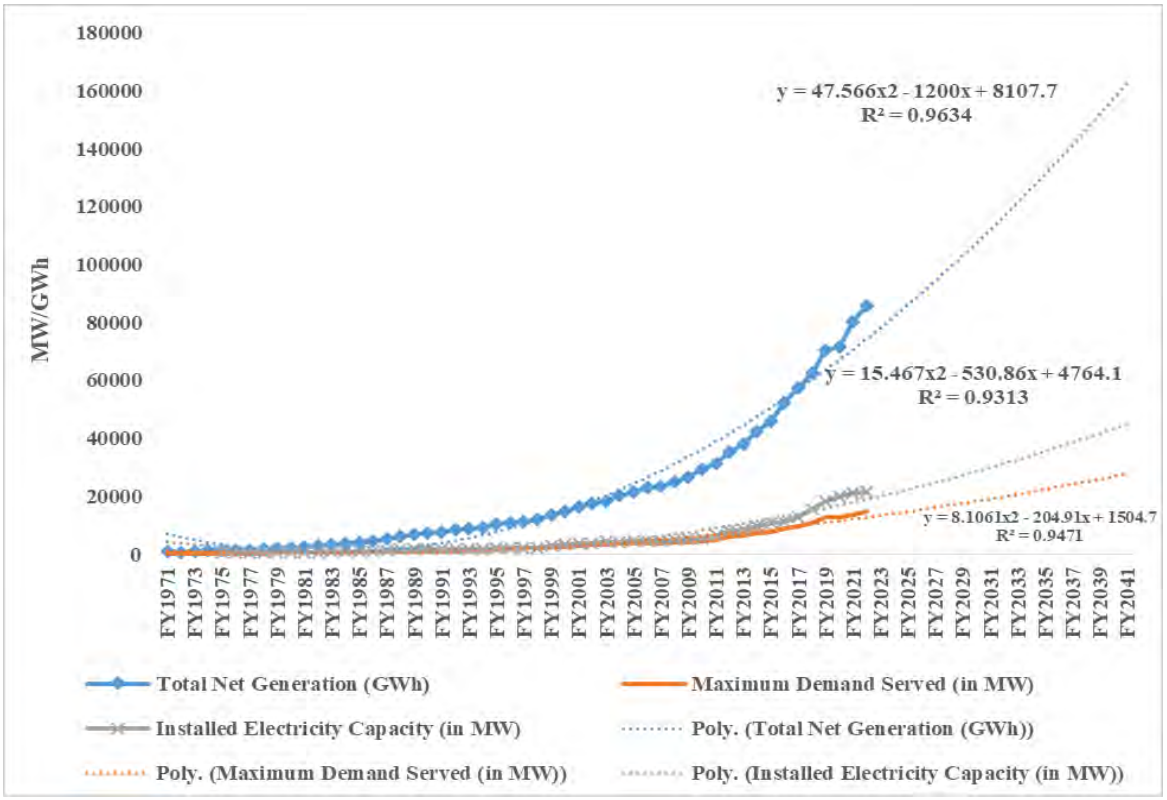
[5] Total Savings = (10% of $7.2 billion) + (20% of $5.76 billion) (Detailed calculation in shown in the Annex)

Chapter 3: Renewable Energy Finance: Demand-Supply Perspective

Bangladesh could partly save this cost if renewable energy was widely adapted. Renewable energy adoption in Bangladesh will have significant financial implications. The initial cost of building renewable energy infrastructure can be high, but the long-term benefits are substantial. Renewable energy sources such as solar and wind power have no fuel costs and minimal operating costs, resulting in lower energy prices in the long run. Furthermore, renewable energy sources can help reduce greenhouse gas emissions, leading to environmental and health benefits.

Estimated Demand for Electricity and Potential Role of RE in Bangladesh by 2041

Linear and non-linear trend analyses were conducted utilizing data on net power generation in Bangladesh from FY1971 to FY2022. According to the non-linear trend study, Bangladesh's estimated need for net energy generation by 2041 might reach 160,000 GWh. It is anticipated that Bangladesh would need roughly 45,000 MW of installed capacity for energy generation to meet the country's anticipated electricity consumption (after adjusting for capacity deration). It suggests that in order for Bangladesh to fulfill its pledge at COP26[6] to produce 40% of its power from renewable sources by 2041, it will need to create roughly 18,000 MW of installed capacity (Figure 5). Currently, RE has 593 MW of installed capacity, 617 MW are in the implementation stage, and 1,718 MW are still in the planned stage. This indicates that, in addition to the plants already under construction, an extra 17,000 MW installed capacity from RE sources will be required to fulfill the nation's 2041 goal.



Source: Authors' Computation

[6] Prime Minister of Bangladesh, 2022

Figure 3: Predicted Net Electricity Generation Demand/Installed Capacity Requirement in Bangladesh in 2041

It is projected that solar system-based technologies will generate the majority of this additional RE. It is now considered impracticable to generate electricity using hydropower going forward. It will therefore mostly rely on solar and wind energy. Given the current mix of energy sources being planned, Bangladesh's energy transition is expected to be based on 85% solar (30% by MNS + 55% based on IPP) and 15% wind power between 2025 and 2040.

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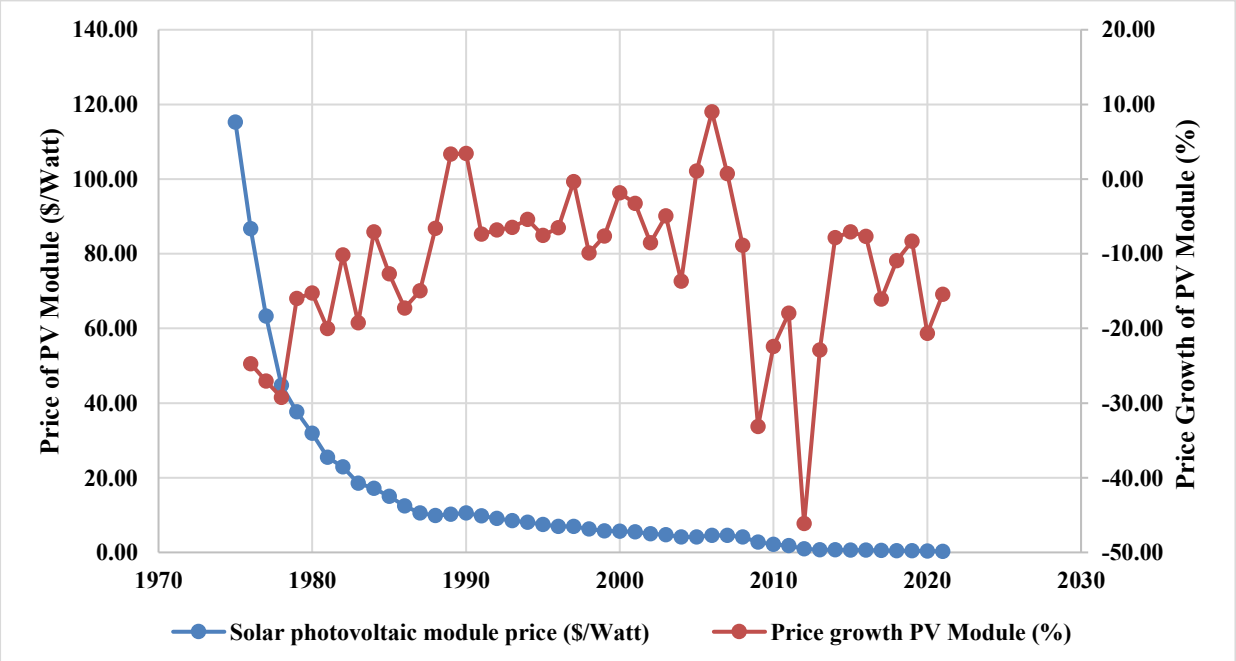
Currently, it costs USD 0.80 million to install 1 MW of solar power (with a 20-year lifespan) in a building or rooftop utilizing NMS. At the same time, an IPP needs close to USD 1.4 million (including 26% land preparation cost) to install 1 MW of solar capacity (with a 20-year lifespan). In contrast, installing 1 MW of wind-powered electricity producing capacity in Bangladesh costs just under USD 3.66 million (Khatun, Bari, & Kabir, 2022). In total, the next 15 years will require close to USD 26.5 billion if the energy mix is (15 percent wind, 30 percent NMS solar, and 55 percent IPP solar) (2025 to 2040). Nonetheless, the cost of solar panels has decreased dramatically over the years, and it is anticipated that this trend will continue into the future.

Figure 4: Price ($/Watt) trend of Solar PV Module and its price growth (%)



Source: Nemet (2009); Farmer & Lafond (2016); International Renewable Energy Agency (IRENA); Note: Data is expressed in constant 2021 US$ per Watt.

Considering price of solar PV module will further decrease and more innovative technologies will be discovered to tape wind power potential to generate electricity the aforementioned cost may drastically fall. The results of regression estimate based on 37 countries data on RE investment provides similar insights. Based on data from 37 countries which had at least renewable energy installed capacity of 250 MW back in 2014 as well as more than 40% of RE electricity generation from solar energy alone, the result of regression model suggests that an additional increase in investment on clean energy by USD 1 billion contributes to install 1,413 MW renewable energy capacity (see, Annex A for detail explanation).

3.1. Estimated Demand for RE Finance in Bangladesh

According to the results of OLS estimate that accounts both substitution and capital effect (due to shift in market structure, pricing strategies, policies and regulations) – to produce additional 17,000 MW installed capacity based on RE sources it may require roughly about USD 12.03 billion to invest. (Power Division, Ministry of Power, Energy and Mineral Resources, Government of the People's Republic of Bangladesh, 2016). Combining the results of meta-analysis and OLS regression, to stimulate RE transition in electricity generation alone in **Bangladesh by 2041, roughly USD 12.03 to USD 26.5 billion investment (per year $0.8 billion to $1.8 billion) will be needed alone to develop the required installed capacity from renewable energy sources.**

Table 3: Investment Requirement to Meet RE based Electricity Generation Target by 2041

	Investment Requirement (in billion USD)	
Periods	**With new PV technology in lower price**	**Business-as-usual**
2025-2030	5.00	9.00
2030-2035	4.00	9.50
2035-2040	3.03	8.50
Total	12.03	26.50

Source: Author's Recommendation; Note: given the historical trend of negative price growth PV solar module, it is expected that price will further fall and require less investment to burn to achieve to predicted demand of electricity in Bangladesh from RE sources

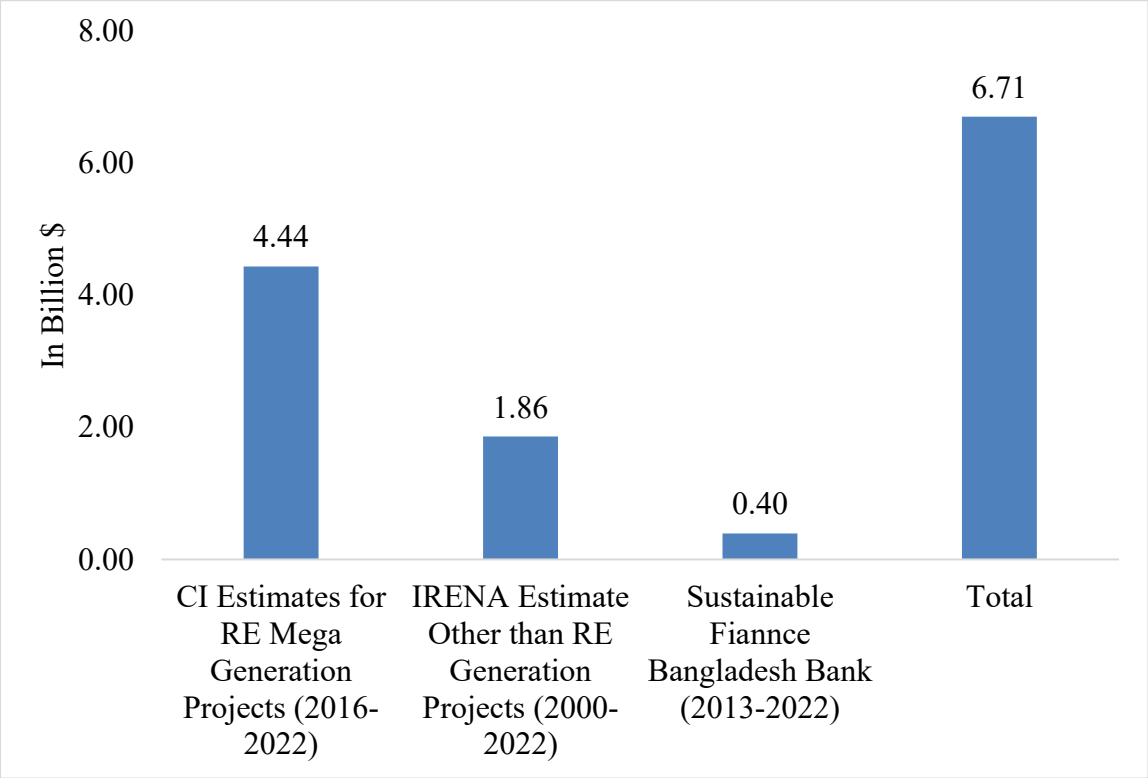
3.2. Supply of Renewable Energy Finance in Bangladesh

Developed countries had promised to provide USD 100 billion per year for climate finance but failed to meet the 2020 commitment. Existing and future priorities of major climate funding entities, financing instruments and potential for Bangladesh to implement its NDC prioritized and other projects to be implemented by 2030. Bangladesh's national budget for 2022-23 allocation USD 260 billion to the energy sector but there were no funds specifically allocated to renewable energy (National Budget 2022-23, 2022). The Mujib Climate Prosperity Plan targets 30% renewable energy by 2030 and 40% by 2041 (Mujib Climate Prosperity Plan Decade 2030, 2021). The 2016 Power System Master Plan targets renewable energy-sourced 3864 MW by 2041 (Power System Master Plan 2016, 2016) compared to 957.75 MW that exists as of February 2023 (SREDA, 2023). Targets have been set for grid connected solar and hydro as well as wind, much of which is dependent on foreign funds.

We can take a look at the different sources of national and international funding, both existing and potential. The 2021-22 Climate Budget of Bangladesh states that RE funded projects in Bangladesh are $75 million from Climate Investment Fund funded projects; $114 million as grants and $109 million as co-financing from Green Climate Fund. (Finance Division, Ministry of Finance, Government of the People's Republic of Bangladesh, 2021). Moreover, $1.0 billion was committed by the USA over 5 years for several key issues among which renewable energy and research was one (The Business Standard, 2022), in 2022, the US committed to provide to Bangladesh.

Traditionally, power projects in Bangladesh have been financed by a consortium of local banks, non-banking financial institutions (NBFIs), international financial institutions (debt or equity investments), export credit agencies (ECAs) and foreign investors. According to IRENA, as of July 2020 Bangladesh has had foreign investment of $1.873 billion on renewable energy sector including generation, transmission, capacity building.

Table 2: Estimate of Renewable Energy Financing in Bangladesh as of 2022 (Illustrated)



Source: Author's compilation from different sources, 2023

According to insights from key informants and the survey used in this study, it can be inferred that the private sector in Bangladesh is making strides in investments in renewable energy as they have identified a lucrative market but more support from the government is desirable in terms of co-financing. Mitigation measures like renewable energy are, therefore, of the essence. As a developing nation, it is next to impossible for Bangladesh to be able to solely use sovereign funds to fund the development of renewable energy. RE finance in Bangladesh from global and national sources have been illustrated below.

Bangladesh does this through intermediaries like IDCOL. These sources include the Global Environment Facility (GEF), which has received $160 million in grants and $1037 million in co-financing for 43 projects in the country. The Green Climate Fund (GCF) has granted Bangladesh $94.7 million for four projects. The Climate Investment Funds (CIF) has provided $110 million in grants and low-cost financing to improve the lives of 10 coastal towns in Bangladesh. There are also other bilateral and multilateral channels such as the World Bank, Asian Development Bank, and UNDP, which channel funds to Bangladesh.

> Accessing international climate finance is a challenging task due to the complex architecture and high standard fiduciary systems and environmental safeguards. There are global readiness programs offered by partners such as UNDP and GCF to

enhance institutional capacity and help countries access funds. Private funding from developed countries is also becoming a potential source of climate funding (Finance Division, Ministry of Finance, Government of the People's Republic of Bangladesh, 2021). In Bangladesh, most renewable energy financing is processed through IDCOL (IDCOL, 2014). More specifically, the contribution of different foreign funding is following.

Asian Development Bank (ADB) has also financed regional energy cooperation project (ADB, 2022), this shows that their long-term vision is in line with the vision of the Bangladesh government expressed in the 8th five-year plan. From 2008 to 2021, about $12 billion was invested by ADB in energy projects in Asia and the Pacific (Asian Development Bank). As per ADB's website, its renewable energy projects in Bangladesh are financed by its own funds as well as different international funds including ones funded by the governments of the following countries: China, Canada, Australia, Canada, Norway, Spain, Sweden, the United Kingdom, Japan and Denmark. (Asian Development Bank, 2020). Apart from the It is important for companies who are implementing the projects to know that they can access finance from MDBs like ADB.

World Bank (WB) approved US$185 million in 2019 to add up to 310 Megawatt (MW) in renewable energy generation capacity and also to provide support the Infrastructure Development Company Limited (IDCOL) with development of the Financing Facility and provide resources to the (SREDA) to build market capacity and develop a pipeline of renewable energy projects (Asian Development Bank, 2021). They have a specific project dedicated to mobilizing renewable energy finance, but the total cost for the project is yet to be stated (The World Bank, 2022).

International Finance Corporation (IFC) committed to fund a 35-50 MW solar power plant in Kushtia (Bangladesh, South Asia, IFC, 2021). As IFC has committed about $4.1 billion in renewable energy (IFC, 2020) across the world, there is great potential to access funding through them.

International Monetary Fund (IMF) recently approved Bangladesh to provide a $4.5 billion loan to the country (Byron, 2023) and among the $1.3 billion from the Resilience and Sustainability Facility (RSF) at east 50% can be directed towards investment on renewable energy. It would reduce both the drain of foreign currency as well as fiscal burden. Moreover, Asian Infrastructure Investment Bank (AIIB) is yet to directly sponsor renewable energy projects in Bangladesh but they have invested in grid development. They have also provided funds to IDCOL (Byron, $4.5 Billion Loan Programme: Dhaka agrees to 30 conditions of IMF, 2023). They have expressed interest in investing in renewable energy.

The New Development Bank (NDB), Bangladesh became a member of NDB in 2021, (Kamal, 2022) invested in India's renewable energy sector and could invest in Bangladesh as well (New Development Bank, 2023). Islamic Development Bank (IsDB) have invested in the energy sector before but the funds do not seem to have been earmarked for renewable energy. MDB list has been compiled as per the ERD (ERD, 2021).

Table--: Sources of International RE Finance in Bangladesh

Source of Fund	*Amount*	*Description*
International Monetary Fund (IFC)	USD 4.1 billion (IFC, 2021)	Committed for renewable energy worldwide

Asian Development Bank (ADB)	USD 17.7 million	Committed for Spectra Solar Park (35 MW)
World Bank (WB)	1. USD 185 million (The World Bank, 2019) 2. USD 293.04 million (The World Bank, 2022)	1. For 310 Megawatt (MW) in RE generation capacity in Bangladesh and also to provide support IDCOL with development of the Financing Facility and provide resources to SREDA. 2. Project dedicated to mobilizing renewable energy finance.
BADGE project, USAID	USD 17.2 million (Islam E. , 2022)	Technical assistance project launched in June 2021 to improve energy security and resilience in Bangladesh
FCDO, under the Bangladesh Climate Change and Environment Programme	GBP 47 million (Islam E. , 2022)	To conduct feasibility studies for renewable resources that allow commercial scale-up and integration of solar mini grids to the national grid, as well as testing and potential scale-up of other renewable energy sources and integration into the national grid

However, for Bangladesh to attain its dream to reach a renewable energy transition of 40% by 2041, a huge investment is needed to set up energy infrastructure. In support of its efforts, two major development partners—the United States Agency for International Development (USAID) and the United Kingdom Foreign Commonwealth Development Organization (FCDO)—declared their plans to support the Bangladesh government's energy transition for the next five years by enabling the deployment of advanced energy systems. For example, the Bangladesh Advancing Development and Growth through Energy (BADGE) project is a $17.2 million five-year technical assistance project launched by USAID in June 2021 that will improve energy security and resilience in Bangladesh. Similarly, the FCDO, under the Bangladesh Climate Change and Environment Programme, allocated a total of 120 million pounds from January 2022 to March 2027, including 47 million pounds to conduct feasibility studies for renewable resources that allow commercial scale-up and integration of solar mini grids to the national grid, as well as testing and potential scale-up of other renewable energy sources and integration into the national grid. (NBR, 2022)

Sources of Potential Finance for RE Expansion in Bangladesh

In Bangladesh, the public sector demands nearly 37.0% of electricity demand, while the rest is consumed by the private sector. If the current subsidies to fossil fuels and capacity charges paid to excessive power generation pants keeping them idle could be gradually phased out and inverted for RE generation that would be potential sources of RE finance in Bangladesh.

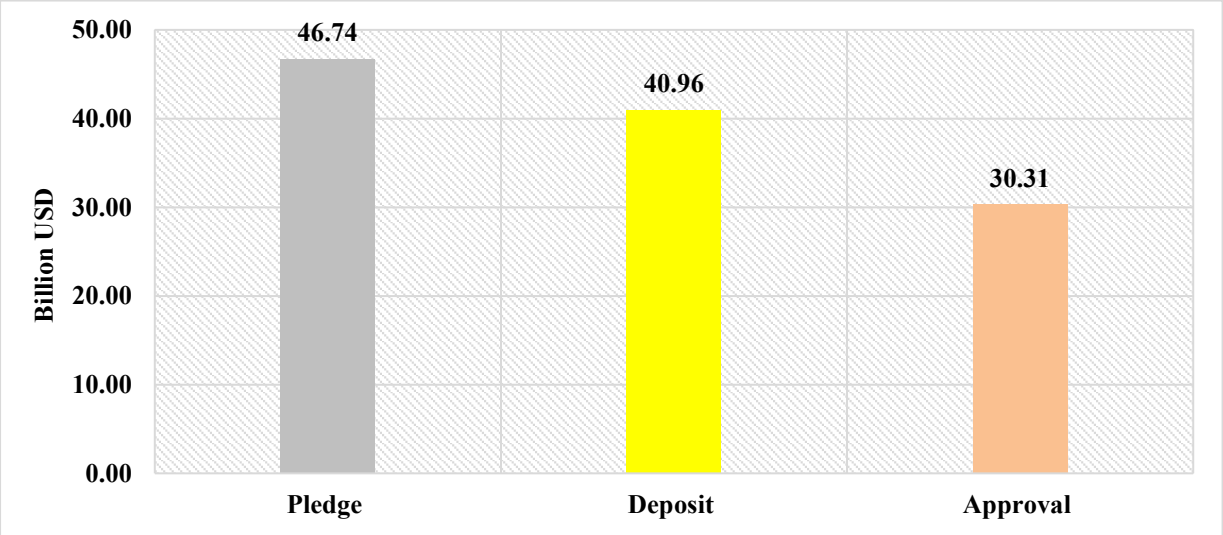
a) Global Flow of Finance

The Paris Agreement reaffirms that developed countries should take the lead in providing financial assistance to countries that are less endowed and more vulnerable, while for the first time also encouraging voluntary contributions by other Parties. Climate finance is needed for mitigation, because large-scale investments are required to significantly reduce emissions (UNFCCC, 2018). Vulnerable LDCs emphasis and demanded as well as grant-based climate finance, which is also crucial to ensure

the climate justice. In COP15, developed countries pledged to provide US$ 100 billion per year as 'new' and 'additional' to ODA as climate finance and in Paris Agreement this was extended to 2025 (Climate Finance and the USD 100 Billion Goal, 2022).

Figure 757 shows that as of February 2023, USD 46.74 has been pledged to the global climate fund. However, only USD 40.96 billion was really approved, only USD 30.31 billion was deposited.

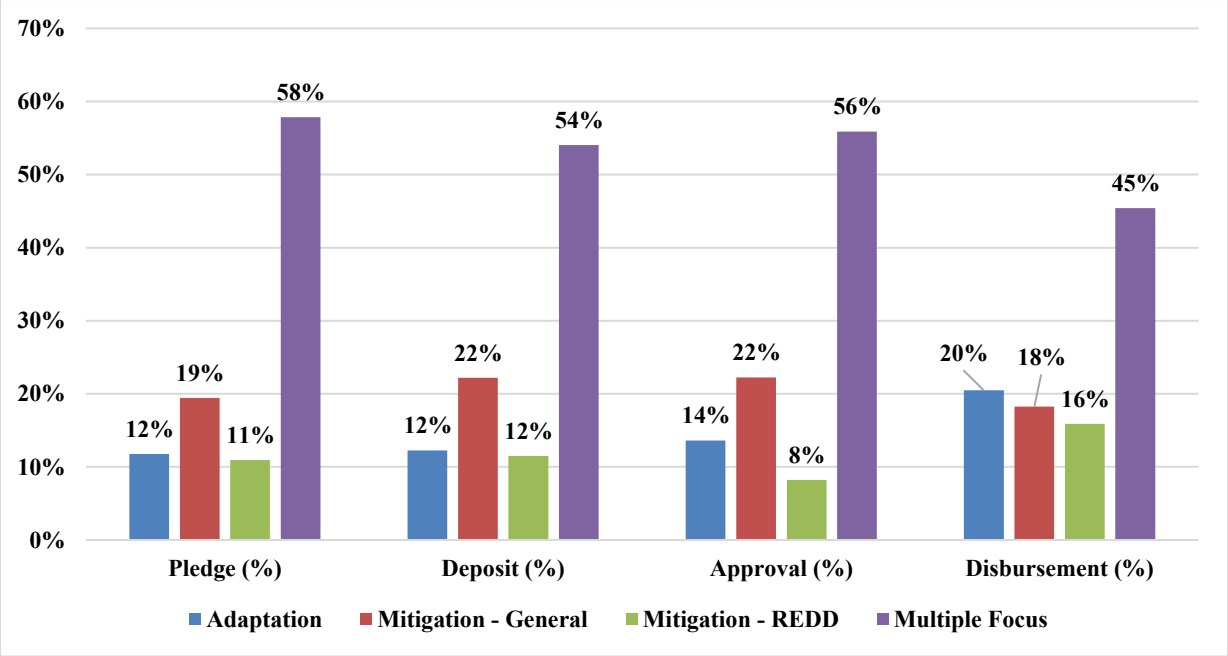
Figure 75: Current Status of Global Climate Finance (in billion USD)



Source: Climate Funds Update (2023)

Moreover, Figure illustrate the subsequent findings: (i) only 24.6% of total pledged funds have been actually disbursed; (ii) in terms of securing funding to address the challenges of climate change, mitigation projects and projects with multiple focuses gain more traction while only 12% of total pledged amounts are kept for adaptation projects; (iii) Nearly USD 16.4 billion in funds are still up for negotiation, of which USD 5 billion is designated for mitigation purposes alone). Thus, Bangladeshi officials should seek out negotiation channels to get money through this window to encourage investment in solar and wind power project installation. (Renewable Energy Policy of Bangladesh, 2008)

Figure 8: Percentage of Global Climate Finance by Types of Funds



Source: Author's Calculation from Climate Funds Update (2023)

As a part of Cancun agreements in 2010, nations made the decision to create a Green Climate Fund in order to boost financial assistance for technology cooperation, mitigation, and adaptation in developing nations. Developed nations were USD 17 billion short of the 2020 climate finance commitment. Most of the funds that have been provided so far were given as loans and not grants. (Rich countries fall $17bn short of 2020 climate finance goal, 2022). This will create further burden the developing nations so mainly providing grants should be in consideration.

By 2026, Bangladesh is anticipated to graduate from the group of least developed countries. Bangladeshi officials will have an additional three years to access Least Developed Countries Fund funding before they graduate from LDCs (LDCF). Bangladesh can also access the following international subsidies for small-scale solar irrigation projects: Special Climate Change Fund (SCCF), Pilot Program for Climate Resilience (PPCR) (The World Bank, 2019).Bangladeshi policymakers may also apply for funding from the Forest Carbon Partnership Facility - Carbon Fund (FCPF-CF), the Forest Investment Program (FIP), the UN-REDD Program, and the BioCarbon Fund Initiative for Sustainable Forest Landscapes (BioCarbon Fund ISFL) by developing proposals that emphasize reducing emission and carbon sequestration.

Table 4: List of Potential Sources of Global Funds for RE projects

Source of Funds	**Pledge Amount (Billion USD)**
Clean Technology Fund (CTF)	7.90
Scaling Up Renewable Energy Program (SREP)	0.78
Global Energy Efficiency and Renewable Energy Fund (GEEREF)	0.28
Partnership for Market Readiness	0.13
Green Climate Fund IRM (GCF IRM)	5.16
GCF-PPF	17.60
Global Climate Change Alliance (GCCA)	1.65
Global Environment Facility (GEF5)	4.93
Total	**38.44**

Source: Climate Funds Update (2023)

Approximately US$38.1 billion of blended finance from 2015-2020 was directed towards climate-focused opportunities. 80% of climate finance was provided in the form of debt or equity expecting market-rate returns on investment. US$0.7 billion of RSF-IMF should be utilized for RE projects. 10,000 MW RE Projects could generate revenue of US$30 million/year from the Carbon Market.[7]

These were mainly driven by corporates, National DFIs, and households investing in renewable energy and transport sectors in Western Europe, North America, and East Asia Pacific. Climate Policy Institute has claimed that global climate finance almost doubled in the last decade (2011-2020), or USD 480 billion annual average. However, while climate finance increased at a cumulative average annual growth rate (CAGR) of 7%, the current levels of increase are not on track to meet a 1.5C global warming scenario. We need at least CAGR 21% of annual finance flows by 2030 to avoid the worst impacts of climate change. The same report has also claimed that "there is enough liquidity in global financial markets (USD 200 trillion held by investors in 2020) but barriers impeding deployment exist".

Though it was expected that vulnerability-based equity would be ensured in climate finance however, around 75% of all climate finance was concentrated in the North America, Western Europe, and East Asia & Pacific, primarily led by China (CPI, 2022). It has been identified that China identify solar as a 'strategic industry' that has led to immense government investment in manufacturing capability. China's own Feed-in-Tariff policies have led to a 70% increase of installed solar capacity there since the beginning of the decade." It has been observed that regions where the majority of low-and middle-income countries are located received less than 25% of climate finance flows (Climatescope Emerging Markets, 2022). In South Asia including Bangladesh received only 57% of the international climate finance and major contribution is coming from the domestic sector. Major challenge to provide exact figure is across all regions, there is a lack of consistently collected data on domestic climate finance suggesting that countries do not systematically monitor climate expenditure against policy objectives (Khatun, Bari, & Kabir, 2022).

The Global Landscape of Renewable Energy Finance 2023 report states that the report also mentions that international public finance is very little and has only decreased since 2018; specifically, MDBs and such institutions have contributed a total of 3% to the global renewable energy investment. In the light of this, it is important to recognize both the real and perceived risks in the market and identify de-risking mechanisms to combat them. Identification of the aforementioned factors will also help the policymakers build a solution-focused roadmap.

Table 5: Major multilateral sources of Renewable Energy Finance and Disbursement Method

Major Multilateral Sources of RE Finance	Disbursement Method
Climate Investment Funds (CIF)-Scaling up Renewable Energy in Low Income Countries Program (SREP)	Grants, Contingent Grants, Concessional and Market-rate loans, Equity, Guarantees through MDBs and development aid (ODA)
Climate Investment Funds (CIF)	Grants, Contingent Grants, Concessional and Market-rate loans, Equity, Guarantees through MDBs (ADB, IFC, World Bank; and AIIB)
Climate Change Fund (CCF) by the Asian Development Bank (ADB)	Grants, Technical assistance, Direct Charge

[7] 1 MW = 1500 carbon credit generation. Per carbon credit price = $2.00.

Clean Energy Financing Partnership Facility (ADB)	Grants, Technical assistance
Green Climate Fund (GCF)	Grants, Loans, Equity Guarantees
Global Environmental Facilities	Grants, Concessional loans, Equity, Guarantees
Nordic Development Fund (NDF)	Grants, Concessional Loan, Equity; Co-financing
Special Climate Change Fund	Grants
USAID, UK-FCDO, KfW and JICA	Grants, Concessional loans, Equity, Guarantees

Source: Climate Funds Update, 2022

There are several modes of financing available for renewable energy, these include grants, concessional loans, commercial loans, equity investments, and foreign direct investment (FDI). Grants and concessional loans are typically provided by international development organizations and the Bangladesh government, while commercial loans and equity investments are provided by private sector entities. Among the financing instruments, the loan is dominating over grants and equity while climate specific funds are allocated However, concessional funding was primarily led by National and Bilateral DFIs and governments provided in the forms of debt or grant. Grant financing has been the lowest (only 5% of overall climate finance) but picking up gradually reaching almost USD 30 billion most recently.

Most grant was sourced by governments for agriculture, cross-sectoral, and transport sector projects, **not for RE sector**. Mitigation finance was dominated by renewable energy in the last 10 years, accounting for almost 70% of total finance. However, countries defined as LDCs by the IPCC attracted only 0.84% of renewable energy investment on average between 2013 and 2020.

With the current trend of global investment on renewable energy generation, in this study we have estimated that the overall investment for RE generation the investment would be increased by almost double ($456 billion) by 2030 compare to the same in 2011.

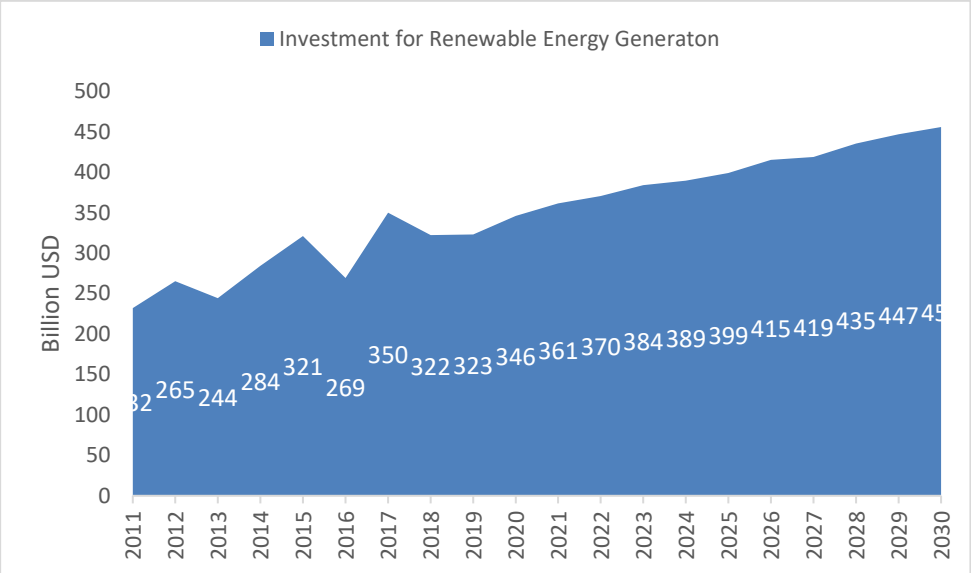


Figure 6: Predicted Flow of Global RE finance[8]

[8] *Source: Author estimated the predicted global flow of RE finance based on the data from the Climate Policy Initiative, 2021 (IRENA and CPI, 2023)*

CPI estimate shows that during 2013-2020, the majority of renewable energy investment in South Asia was made domestically e.g. funded through in-country sources. In South Asian countries, more than three-fourth (77%) of the investment has come from public sector. It clearly shows that comparatively Sub-Saharan and middle-eastern countries attracted more private investment in the RE sector through improved enabling environment. Bangladesh has high potential to attract more private investment provided that enabling environment is pro-FDI friendly.

According to Bangladesh's national budget for FY of 2021-22, the country has received funds from several key international sources to address climate change. However, from the BDT 230 thousand crore taka to be received by 2030 in order to fight climate change including mitigation or financing for the project on REs, *Bangladesh has only received 6% of the promised amount from international sources* (Mawla & Khan, 2020). Bangladesh needs to create more enabling environment for enhanced investment in the RE sectors.

- Global Landscape Study on RE Finance has revealed that compound annual growth rate of RE finance from 2013-2022 was around 8.5%. Regarding the share of different types of technology investment in solar PV is increasing and share of investment of onshore wind is around 30%.
- BloombergNEF's Climatescope ranked Bangladesh as the 5th most attractive emerging market for renewable energy in Asia Pacific (Demôro, Maia, & Aminoff, 2021).
- Bangladesh could raise up to $12.5 billion in additional financing in the medium-term for climate action. Financing options include budget prioritization, carbon taxation, external financing, and private investment (The World Bank Group, 2022).
- Third Pole report, ADB's Siddique Zobayer, "Almost 90% of energy projects in the pipeline are funded by China." (Begum, 2022)
- On the other hand, the European Union has also shown interest in being a development partner of Bangladesh by investing in the energy transition and renewable energy (Prothom Alo English, 2022).

b) National Sources of RE Finance in Bangladesh

The NDC of Bangladesh states that 4114.3 MW of renewable energy is a conditional contribution which means that it will be achieved with the help of international support. In terms of climate change mitigation especially for RE finance, we see a significant increase in budgetary allocation on the renewable energy sector from fiscal year 2020-21. BDT 1253.57 crore was allocated to renewable energy from national sources since FY2014-15. While it was just 66.88 crore taka in 2019-20, the allocation jumped to BDT 530.87 crore in 2020-21 and BDT 571.46 crore in 2021–22 (Finance Division, Ministry of Finance, Government of the People's Republic of Bangladesh, 2021). In the NDC roadmap where in 2021-22, of the BDT 4378.44 crore allocated for mitigation related projects, 13.05% for the RE development. One way to mitigate the risks associated with foreign currency is by promoting the provision of loans in local currency for development projects, which can be facilitated through intermediaries such as national banks or non-banking financial institutions (IRENA and CPI, 2023).

Apart from that, the government is investing in renewables through the Bangladesh Climate Change Trust (BCCT) (Bangladesh Climate Change Trust, 2023) and in 5 mega projects as per SREDA, 2 of which have been cancelled (SREDA, 2023). IDCOL, which is acting as the primary financial intermediary for renewable energy projects (IDCOL, 2014), is providing loans to finance mega projects as well as rooftop solar projects and mini grids. As per Bangladesh Bank's quarterly reports from 2013 to 2022. A total of BDT 41452.03 million has been given out by banks and financial institutions of

Bangladesh as loans to renewable energy related venture, this is only 1.48% of their total loaned out amount for green finance.[9]

- **Imposing Carbon Tax on Import of Fossil Fuels**: Bangladesh imports the huge petroleum products every year, and the value of the fossil fuels was $8.9 billion in financial year 2021-22. If government impose the carbon tax on the fossil fuel that will generate significant amount of revenue. If the NBR imposes 10% carbon tax the net revenue would be around $9.0 billion by which around 1200 MW power could be generated from solar sources. If the 25% CT is imposed on import of fossil fuels the revenue would be $2.23 billion by which around at least 3000 MW renewable particularly solar based power could be generated.
- **Withdrawal of Subsides to Fossil Fuels and Divert That for RE Expansion:** Currently, the government of Bangladesh provides subsidies for the import of fossil fuels. According to the International Institute for Sustainable Development, in 2019, the total fossil fuel subsidies in Bangladesh amounted to around $1.7 billion. If the government shifts these subsidies towards renewable energy development, it can lead to significant cost savings in the long run. Assuming the gradual reduction of the current subsidies will be a) 25% in 2025; 50% by 2030; c) 75% by 2035; and 100% by 2041. Therefore, *the total savings from the subsidy to fossil fuels imports is estimated to be around $4.358 billion*[10] *from 2025 to 2041.*
- **Savings from Capacity Charge Reduction:** The adoption of renewable energy sources can reduce the demand for fossil fuel-based power plants, resulting in a reduction in capacity charges. Assuming the decline of the capacity charge over the period by replacement of the RE generation, which are 10% by 2035 and 20% by 2041. Estimated total savings would be around **$1.872 billion**[11]**.**

Note here that solar PV and onshore wind continued to be the main recipient of renewable energy finance, attracting over 91% of all mitigation investment. Renewables were primarily financed through private capital, reflecting the sector's growing commercial viability. (Buchner, et al., 2021) Though PSMP 2016 is being revised but there is no indication on how the required investment demand and roadmap to mobilize the finance would be ensured to meet 40% energy demand from RE by 2040. We have examined below the performance of IDCOL in mobilizing RE finance in Bangladesh. Experts claimed that the potential of IDCOL has been degrading due to taking decision or influence of the public entities in the decision-making of corporate entity.

IDCOL- Is still a breakthrough to RE finance in Bangladesh?

Infrastructure Development Company Limited (IDCOL) was established to bridge the financing gap for developing large infrastructure, renewable energy, and energy efficiency projects. IDCOL's recent five-year financial performance of renewable energy has gradually decreased, and it is now in a backward stage. The collapse of the government-sponsored Solar Home System (SHS) program due to default loans and weak institutional framework, and the government's introduction of free rival solar energy systems, contributed to the decline in renewable energy financing and almost collapse of the SHS program. The method of financing systems is that IDCOL gets the funds from various development partners and then disburses it to the Partner Organizations (POs) based on their expansion schemes. The POs get refinancing from IDCOL only after SHSs are

[9] See Annex 1

[10] Total Savings = $1.7 billion + $637.5 million + $318.75 million + $1.7 billion
(25% of $1.7 billion) + (50% of $1.275 billion) + (75% of $637.5 million) + ($1.7 billion)

[11] Total Savings = (10% of $7.2 billion) + (20% of $5.76 billion) (Detailed calculation in shown in the Annex)

installed by them at the households. POs also make a contribution of their own in providing credit while they receive an institutional development grant. Households make down payments as well as installments. POs receive the credit from IDCOL at a 6% rate and pay back in 6-8 years. Households pay 12% interest and pay it back in 3 years. On the other hand, the grants POs receive are provided on a declining basis. As the number of installations rises, the rate of grant falls per unit.

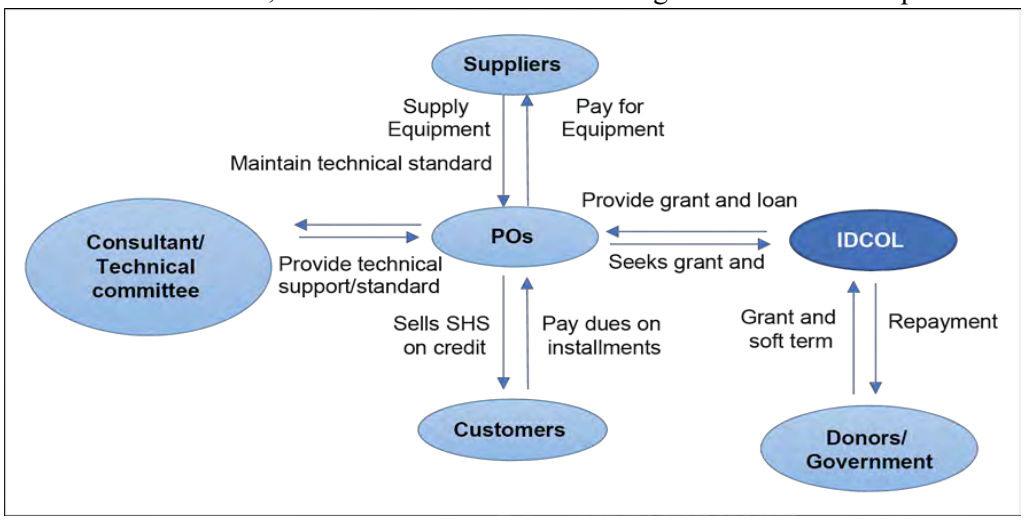


Figure 7: Structure of IDCOL's SHS Market

The government carried the foreign exchange risk while IDCOL in turn lent the funds to the POs who used it to finance SHS sales to customers. Customers in total paid $160 million in down payments plus additional millions more in loan interest payments, and $219 million in equity investments from POs (Game changer). The Partner Organizations (POs) were first supported by IDCOL in 2003 with a subsidy of $90 per SHS and an 80% loan at 6% annual interest for a period of ten years. By 2014, this was down to a $20 subsidy and a 70% loan spread over 5-7 years at a rate of 6-9% pa (NAE case study).

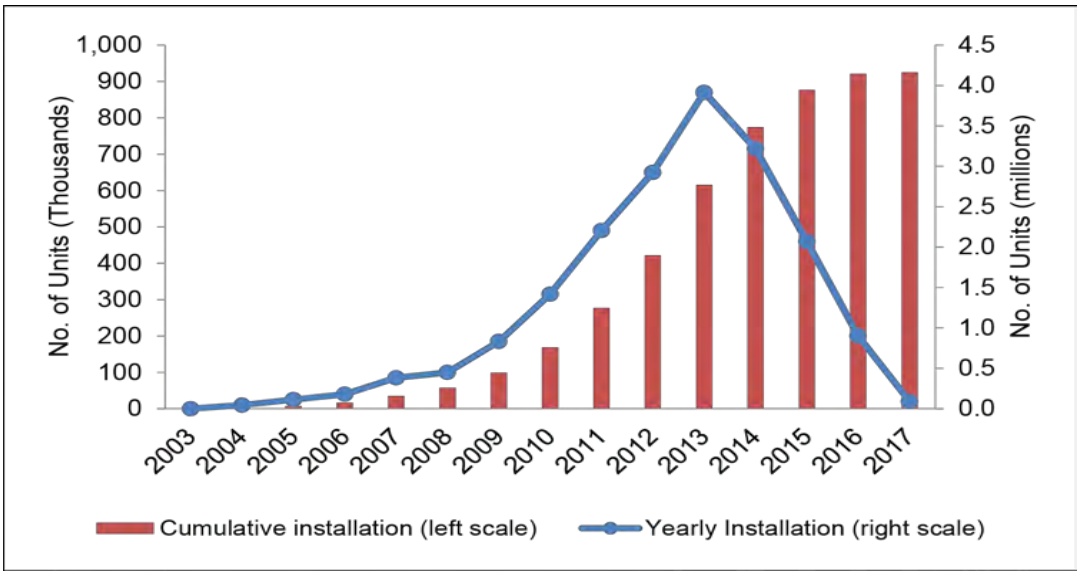


Figure 8: Number of SHSs Installed Over Time

IDCOL is the only well-known option to get accessibility to financing in REF in Bangladesh. Due to a lack of familiarity with the availability of financial facilities or the lack of

enthusiastic approaches of other Banks/FIs among the entrepreneurs/investors of REF. It makes a monopsony market of financing created through IDCOL in the REF. Short-term tunnel vision without any long-term strategy is causing IDCOL to fail in its efficiency. The lack of a knowledge-based policy framework and immature or inefficient management of SHS and commercial thinking of programs have stood said different personnel (classified loan owners) made it to the classified loan.

Despite these challenges, the market collapse, falling debt collection rates, and escalating field-level fraud caused collection and service expenses to increase from 15% to 50% of the SHS sales price, costing the POs money and depleting their financial reserves (GVEP International 2016). Interest rates for consumers remained constant despite increasing costs associated with collecting debt brought on by a greater proportion of smaller loans made to fewer, more dispersed customers, as well as an increase in loan defaults. With demand declining due to higher lending rates, POs and IDCOL would have had few or no viable options.

"The SHS project, however, has increasingly faced headwinds since around that time. When the IDCOL hit the two-million-dollar mark. As the market matured, the annual. Installation started to decline in 2013. The author (Fauzul Kabir) also points out various external factors that contributed to the decline, such as the rapid expansion of the national grid, the free distribution of SHS under the government's social safety net programs, and the emergence of an unregulated private SHS market. These factors are not undesirable from the perspective of economic development, but they underscore the importance of managing the wins and being free from past successful experience. (Fauzul Kabir Khan, Win:How public entrepreneurship can transform the developing world, 2021)".

The risk associated with developing RE projects has long been a significant barrier in countries like Bangladesh. Initiatives involving renewable energy frequently include some level of operational risk because they often incorporate new technology and have the potential to be commercialized. The IDCOL's SHS program argues that it becomes incredibly difficult to enforce guarantees in the case of customer defaults since small company owners that took on the risks of selling or producing green products are so financially vulnerable. The enhancement of the risk profile is another element if REF is vulnerable to policy changes. Given consumer demand and the significant risks associated with them, the challenge of popularizing RE projects could be partially resolved by shared equity ownership among stakeholders. As they implement their climate promise and begin an energy transition mix toward a more sustainable energy future, other emerging nations like Bangladesh will benefit from India's example.

It is obvious from the discussion above that IDCOL's REF is unquestionably unsuccessful with regard to RE initiatives. A more effective allocation of REF institutions is required, as well as management teams and leadership that are transparent, better knowledge-based, and practice-oriented. There is a need to create delivery models with accurate assessment that are specific to the environment. Government's considerable initiative in establishing supportive legal and policy frameworks. Collective efforts made by the GoB, state governments, NGOs, and foreign organizations to increase awareness and carry out capacity building.

Bangladesh Bank has established a Sustainable Finance Department to meet national targets to mobilize required funds for RE promotion. However, if we take a look at the Quarterly Review

Reports on Sustainable Financing, we can see what portion of funds were used by banks and financial institutions to finance renewable energy. The following graph uses 38 data points from every quarterly report from January-March 2013 to January-March 2022 (Bangladesh Bank, 2022) to show the trend of renewable energy financing as a percentage of total finance by banks and financial institutions in Bangladesh. We can see a sharp rise in renewable energy financing in the mid-2018 when it comes up to almost 8% and then again in 2020, and it reached its highest peak at 10% of total green financing in 2021.

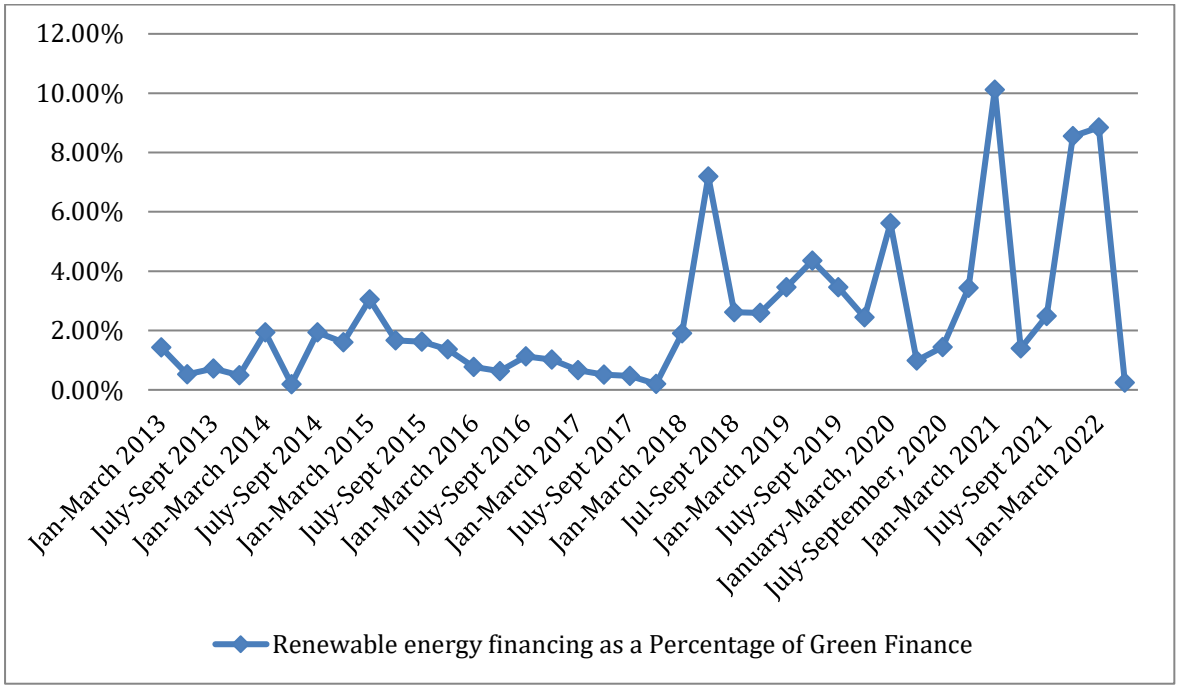


Figure 9: Renewable Energy Financing as a Percentage of Green Finance[12]

When Bangladesh Bank was asked about why renewable energy as a percentage of green finance is so low, less than 2%, they cited it to errors in reporting. They also said that they did not want to be too strict about these issues as they did not want to create a hostile situation. No explanation was provided regarding the fluctuations in the percentages.

All these factors indicate the tremendous potential for growth in the renewable energy sector in Bangladesh and signify that it is high time for Bangladesh to capitalize on these opportunities. Moreover, various green funds can be explored as financing options for Bangladesh as a developing country, to reduce greenhouse gas emissions and support resilience to climate change.

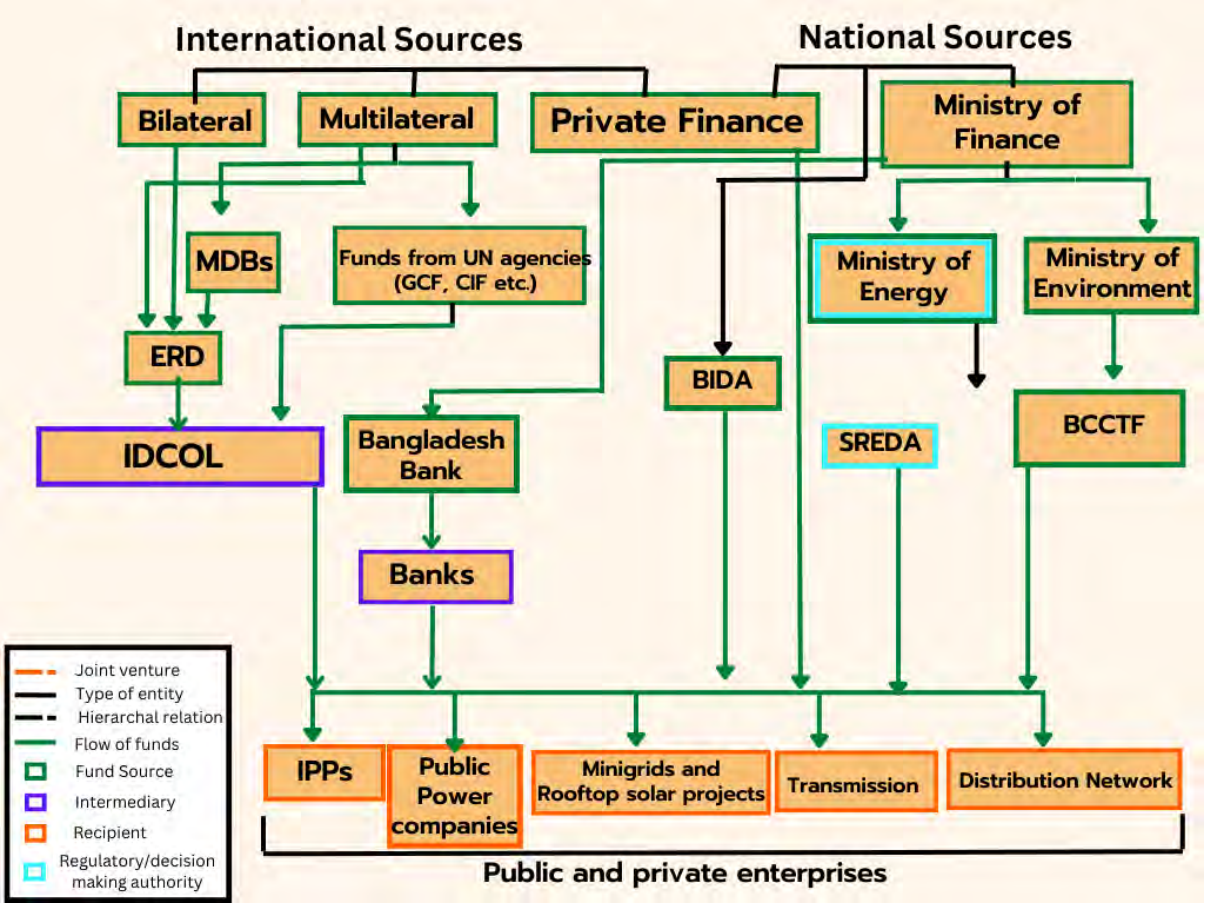
Since renewable energy is a high priority for mitigating climate change because it can reduce greenhouse gas emissions, provide sustainable energy, enhance energy security, and provide economic benefits, making it a key part of the global effort to address this critical issue. Therefore, a portion of climate change mitigation funds should specifically be earmarked for renewable energy financing.

[12] Refer to Annex 2

Chapter 4: Mapping RE Finance Stakeholders and Critical Review of Policies and Legal Regime in Bangladesh

In recent years, the government of Bangladesh has recognized the need for increased energy generation to meet the demands of its citizens and industries. As a result, the government has implemented policies to promote the use of renewable energy sources such as solar, wind etc. Additionally, the government has also tried to support the financing of renewable energy projects through some policies. This literature review will examine the past and current policies related to both renewable energy and renewable energy financing in Bangladesh and their impact on the development of renewable energy in the country. The review will also discuss the prospects and challenges facing the financing of renewable energy in Bangladesh. Below is a stakeholder map of Renewable Energy Finance in Bangladesh to aid understanding of the processes:

Flow Chart 1: Mapping of RE Finance Actors in Bangladesh



Source: Developed by authors of the study, 2023

- **Critical Review of RE and Finance Related Policy and Legal Regime**

In **Bangladesh's NDC commitment** as presented in 2021, the set target was 4.1 GW RE by 2030; this is quite ambitious as it is presently 0.5GW (Ministry of Environment, Forest and Climate Change, 2021). **The Mujib Climate Prosperity Plan (MCCP)** (Mujib Climate Prosperity Plan, 2021) envisages a renewables roadmap towards energy independence and outlined that Maximized Renewable Energy and Storage Infrastructure includes 30% variable renewable energy by 2030, setting the trajectory for low carbon growth towards 100% zero-carbon energy by 2050 and net-zero by 2050s. Moreover, the

MCPP states that Bangladesh will take advantage of all time low solar power prices through regional renewable energy auctions for better prices, competition and regional collaboration. The MCPP's Chapter 9 mentions two forecasts regarding renewable energy generation, the first of which is the "maximal" version or "MCPP-M Scenario" predicts 80% of capacity to be reached and the "MCPP-R Scenario" which predicts a more conservative outcome at 50%.

According to the plan the following sources will be used for financing the growth of renewable energy projects: international partners, national budget and contribution from the private sector. But no action plan has yet been formed to plan out how these funds will be mobilized.

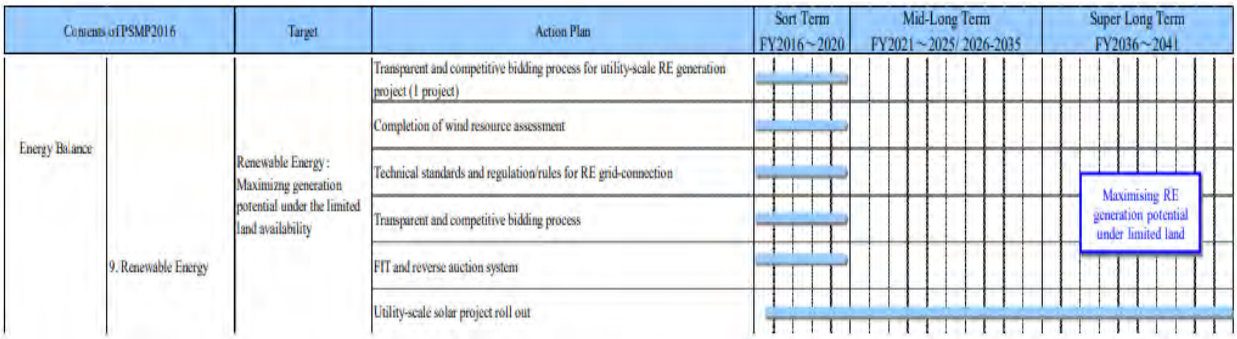


Figure 10 Excerpt of the "Roadmap for PSMP2016" from Power System Master Plan 2016

The Renewable Energy Policy of Bangladesh (Renewable Energy Policy of Bangladesh, 2008) provided a regulatory guideline for renewable energy in Bangladesh. The policy set the target of **10% of all electricity from renewable sources by 2020**.

Under Section 5 of the policy is titled "Investment and Fiscal Incentives", 5.6 that "Power Division of MPEMR/SEDA may assist in locating the project(s) and also assist in acquiring land for renewable energy project(s)". However, key informants from this study stated that it was their responsibility to find and buy land for projects. As acquiring land is one of the biggest challenges in building renewable energy plants, any help with it could greatly de-risk investment in the industry. Concerned stakeholders should be held accountable and policy should ensure that they are doing their part to meet the national renewable energy generation related targets. For example: Local DC should take the responsibility for land management and authority should lie with district authority or the revenue board. Moreover, under section 4.3, all power utilities as well as other concerned government agencies were supposed to form renewable energy development programs; even though, progress has been made by assigning a total of 73 focal points for renewable energy in different government agencies (SREDA, 2023), most of the agencies seem to be missing any such programs. The key informant from one such agency, DPDC informed that they had only just started to work with renewable energy and had set up their own small KW scale power generation micro grid in 2022. **It seems as though the phrasing of "may" was preferred over "will" or "shall" to evade accountability in several clauses.**

The policy also introduced the idea of introducing SREDA, 13 functions of SREDA are listed, among which the most relevant as per the purpose of this study is the development of "financing mechanisms and facilities by using grant, subsidy and/or carbon/CDM fund for public and private sector investments in all forms of sustainable energy". This scope has yet to be explored by SREDA; and also this does not mention the Sustainable Finance Policy's refinancing scheme specifically; this could be updated in the new policy for clarification. It could also go on to specifically mention funds that could be directly access for renewable projects. The Renewable Energy Policy 2008 is currently under revision and a draft version has been submitted by the assigned consultancy firm. The following table outlines observations made in regard to the draft:

Table 3: Observations Regarding the Renewable Energy Policy draft 2022

Section of the Draft Report	Observation
1.2 Scope of Policy	Mentions unproven technology such as Geothermal and Hydrogen or Synthetic Gas, can have unintended consequences like harm to the natural environment if incorporation of them into the policy is not evidence based.
	Should mention encouragement of public and private investment into the sector instead of only mentioning the "Performance Bank Guarantee"
	The role of SREDA is unclear in the approval and revision process in case of discrepancies
1.3 Legislative Framework for Policy	Should focus on how renewable energy should be nature-based
4.1.3 Rooftop Solar	The scope of installing solar in Bangladesh Railway should be mentioned
4.1.6 Solar Charging Stations	Private investment should be mobilized for greater growth
8. Allotment of Projects	Competitive bidding process for selection of RE companies is required. SREDA should engage multidisciplinary experts for selection of the projects. Virtual PPAs can allow required foreign companies to be brought on board.
8. Allotment of Projects	SREDA should be empowered any approval or rejection of RE projects and acts.
9. Land	Cabinet should be dedicated to this task. There should be a cell within the Ministry of Energy that will identify readily available land for proposed projects.
11.10 Investment Facilitations	Should specify multilateral, bilateral and MDB involvement as well as funds like grants, concessional loans, green bond and philanthropic funding. Investment planning is inadequate. REF strategy should be formed including financing total to be achieved. Joint coordination should be required which can be conducted through a cell including Bangladesh Bank, Ministry of Finance, ERD, IDCOL and Development Partners.
11.2 Fiscal Incentives	Reduced interest rate for RE should be provided. Transmission facilities should be provided by the government so costs would decrease for the implementing agencies. However, **the fiscal incentives e.g. tax rebate, cash incentive like RMG sector, tax holiday for less than 10 MW generators etc. and immediate enforcement of the fiscal incentives or progressivity needs to be mentioned properly.**

Moreover, in this revised RE policy the globally practiced tariff mechanism such as Feed-in-tariff, auction, TEC etc. should be included and enforced for all energy and power sector related agencies. This is echoed by the **Sustainable and Renewable Energy Development Authority Act of 2012.** However, most of the financing initiatives for renewable energy are taken by IDCOL (SREDA, 2021). It is unclear how much initiative SREDA takes to encourage or facilitate investment in renewables, especially as it is said to have been lacking funds itself for many years (Hashim, 2022). No Clean Development Mechanisms (CDMs) have been introduced by SREDA either, to push renewable energy forward. During a key informant interview, a SREDA official mentioned that the finance department of the organization is lacking and is currently not making any significant contribution.

Quick Enhancement of Electricity and Energy Supply (Special Provision) Act (Bangladesh Energy Regulatory Commission, 2008)**, originally enacted in 2010,** is one of the major legal instruments that have enabled the unchecked growth of the fossil fuel industry in Bangladesh. Even though it was originally implemented to combat a power crisis, it has been renewed time and time again despite various concerns related to integrity and fiscal burdens (The Daily Star, 2020). Worries have been expressed over how provisions made under this act are unsolicited offer to several RE related IPPs and PPA are not transparently signed. However, related officials are exempt from challenges as it can override other laws as per section 2.2.3 in the act. Due to this act "the power sector's per-unit purchase price and the Independent Power Producer cost model have remained beyond accountability" (The Business Standard, 2022). Consequently, the BPDB is struggling to pay the Independent Power Producers (IPPs) for their power generation due to a burden of losses from the non-competitive and unequal Power Purchase Agreements (PPAs) signed since 2010. This Act has eroded the competitive bidding process and left room for PPA at exaggerated tariff. Without discontinuation of the potential of RE will be lost. Experts suggest leaving power purchase to distribution companies and following a tender or competitive system to make pricing more competitive (Bappi & Taher, 2023)

Bangladesh has allowances in policy for submission of unsolicited proposals (Public Private Partnership Authority, Prime Minister's Office, 2018) and when projects are proposed and accepted through such uncompetitive practices, it may lead to contracts with unqualified and incompetent contractors (Siddique, 2017). In contrast, India's 1997 Policy for Expansion of Power Plants (Ministry of Power, Government of India, 1997) that enabled private sector participation explicitly states that proposals will only be approved through competitive bidding processes. This Act could be instrumental for speedy implementation of mega RE projects as it takes maximum 6-12 months to set up a RE generation project.

The Private Sector Power Generation Policy of Bangladesh was established in 1996 (Private Sector Power Generation Policy of Bangladesh, 1996). The policy mentions that the plan to establish a fund for private sector development in section 3.3c and this plan came into fruition with the creation of Investment Promotion and Financing Facility (IPFF) project by Bangladesh Bank (Bangladesh Bank). IPFF II was launched in 2017 and is supposed to close by 2024 by a World Bank loan. The project page states that a mere 4% has been allocated for climate change and 4% for mitigation. As climate change and energy security have become priorities in the recent years, more of the fund should be channeled towards funding renewable energy projects. USD 416.70 million is the total estimated cost of the project and allocation of even a small portion of that could go towards a power plant.

Section 4.4 of the policy stated "A mechanism shall be provided for the adjustments of certain tariff components to variations in Taka/ Dollar exchange rate, fuel price and inflation rates. In determining this adjustment/indexation, the issue of efficiency gains would be taken into consideration." However, since renewable energy power plants do not have a standardized contract and decisions are taken on a case-by-case basis, the mechanism is not necessarily provided to all. This mechanism is of the essence right now due to the BDT falling in value against the US dollar (Hossain M. , 2023). Moreover, Section 6.3 proposes the possibility of "green energy" tariffs, which would allow users to co-finance the growth of renewable energy sources through their power bills. Creative ideas like this can open up novel renewable energy financing sources but this idea is yet to be implemented even in 2023.

It is also important to look back and learn what has not worked out as well as it could have. The policy establishes the Independent Power Producers' (IPP) requirement to sell power to a single buyer. According to a World Bank paper (Lovei, 2000), "The single-buyer model has major disadvantages in

developing countries: it invites corruption, weakens payment discipline, and imposes large contingent liabilities on the government". Moreover, it may act as a deterrent to investment as plants with the capability to produce massive amounts of energy may be interested in having a diverse set of buyers. Additionally, the single-buyer model that is used in Bangladesh for renewable energy power plants do not have a standard set of guidelines, it varies from project to project. This leaves room for lapses caused by poor governance. Government officials in the power sector (BPDB) have defended the model by citing reasons like the need to monitor these projects and assure a reliable flow of cash. They also said that the government buys the power at a subsidized tariff which is why the model exists. They would not be very willing to subsidize projects that they were not overseeing or power they were buying for because of lack of reliability. An official from a government power company mentioned that single-buyer is essential but multi-buyer could be introduced on a case-by-case basis to see if it works.

According to USAID's 2021 report on the power sector in Bangladesh, "transitioning to a wholesale market makes more sense, especially in places where private generation already commands a good share of the market" (USAID, 2021), which is the case with renewable energy generation in Bangladesh. Electric Power Supply Association defines a wholesale electricity market as one where electricity is "competing generators offer their electricity output to retailers and the retailers then re-price the electricity and take it to market.". It resembles a free market system more strongly than the single-buyer system does. In the aforementioned report by USAID, they recommend a transition like this for Bangladesh.

Guidelines to set up solar irrigation was included in the **Guidelines for the Implementation of Solar Power Development Program 2013** a key informant suggested that there should be a mandate in the to give solar irrigation pumps preference over diesel-based pumps, to encourage business; to include agrovoltaic and floating solar, building mounting solar plants in a way to accommodate agricultural production on the land.

The **Net Metering Guidelines** (Net Metering Guidelines 2018) was released in 2018 and it emphasized the importance of rooftop solar as 1 MW of solar takes about 3 acres of land and Bangladesh has a land scarcity issue. After self-consumption, the electricity user will be able to export the excess power generated by the solar system set up in his home to the power grid. The consumer's power costs for such transferred electricity will be adjusted with their bill the following month and they will be able lower it. The CEO of a renewable energy company stated that when demand is high, you can buy from the power distributor and when demand is low, you can sell it to them. "You will buy at their set tariff which is higher than the tariff they buy your power with", Mr. Habib said. This creates an unfair situation, one which is unprofitable for the ones who set up the net-metering systems.

Investment in wind shows a lot of potential as there are wind power-based plants being built in Bangladesh (SREDA, 2023), but it has massive room for growth. A technical wind energy assessment was conducted by the USAID and the U.S. Department of Energy's National Renewable Energy Laboratory along with the government of Bangladesh in 2018 (Jacobson, et al., 2018). Additionally, a favorable regulatory environment, including policies that promote the development of the wind energy sector, is essential for attracting financing. This includes clear and stable regulations and policies on renewable energy, as well as access to financing and other incentives for renewable energy projects. Investors and financiers must be confident that the project can be built and operated without encountering significant risks. This requires a detailed risk assessment, which takes into account the technical, financial, and regulatory risks associated with the project.

Programme T5P4 of the **Bangladesh Climate Change Strategy and Action Plan 2009** (Ministry of Environment and Forests, Government of the People's Republic of Bangladesh, 2009) lists 4 actions to be taken in relation with renewable energy including investments for development of solar power as well research and investment for wind energy. Even though both were supposed to be acted upon within an "immediate" timeline, hardly any mobilization has occurred in case of wind energy. The investment in solar is appreciable but steps need to be taken to mobilize its funding through private investments and international grants.

The **Bangladesh Delta Plan 2100** (General Economics Division, Bangladesh Planning Commission, 2019)**,** which was released in 2018, sets a target of renewable energy being the source of 30% of all electricity production in Bangladesh. It mentions the necessity of both private and public investment in renewable energy for its growth.

The Eight-Five Year Plan (The 8th Five Year Plan, 2020) concretely discusses some import plans for renewable energy. There has been a PPA signed with Nepal and a MoU signed with Myanmar as well. Bangladesh, India and Bhutan have been discussing a collaborative investment on a renewable power plant as well.

The Sustainable Finance Policy for Banks and Financial Institutions (Bangladesh Bank, 2020), published in 2020, was formulated by Bangladesh Bank to mobilize funds towards the sustainable growth of Bangladesh. It builds on Bangladesh Bank's previous policies like Policy Guidelines for Green Banking for Banks (Policy Guidelines for Green Banking, 2011). The policy states it was created to align Bangladesh's banking with several long-term plans like the INDC, and Sustainable Development Goals. In passing, it mentions that new financial instruments are to be developed to attract grants. However, this is a broad plan and not an action plan. There have not been any follow-up guidelines released to instruct educational institutions to adopt the concept of renewable energy into their curriculum. Bangladesh Bank has, however, published a circular called Policy on Green Bonds for Banks and Financial Institutions (Bangladesh Bank, 2022) in 2022, in line with the Delta Plan.

Green bonds are an investment instrument for sustainable or green finance; they can be used to finance renewable energy projects. This is a major step towards growth of green investment. Beximco has become a pioneer in the field of using a green bond called the "Beximco Green-Sukuk Al Istisna" valued at 30 billion BDT to finance two solar power plants (Kibria, 2022).

- Section 3 mentions the "Inclusion Criteria" and section 3.2.1 lists green products that are eligible for Sustainable Finance. A key informant who works for a development partner organization felt that that it is too broadly defined. He stated that a renewable energy fund should be created separately.
- Section 3.3 mentions the refinancing scheme provided by Bangladesh Bank for renewable energy financing and other environmentally friendly projects. The policy mentions a total of BDT 4 billion in the fund.
- Section 3.3.1 in page 19 states that it has six environmental objectives, but none of them are the growth of renewable energy. Renewable energy is listed under section 3.2 titled "Identification of other Sustainable linked finance" (Bangladesh Bank, 2020) which affirms its position as a sustainable sector to be invested in but not necessarily to be focused on. Ideally, clean energy should be one of the objectives. Section 3.1.2 does not mention Renewable Energy CMSMEs, for example: solar based solutions, solar-support, aftermarket service entrepreneurship, mini-grid investments etc. It is also missing forest conservation, clean air, environmental health - all of which are related to producing clean energy. There is no specific focus on rooftop power generation, mini-grid; subcategories should be mentioned.

Furthermore, transmission and distribution facilities for renewable energy both go unmentioned as well.

- Section 3.2.2 constricts the definition of solar and new inventions and other innovative approaches do not have a space to grow under this policy as it does not specify financing new technologies as such. Bangladesh Bank needs to provide innovation grants if it intends to encourage the growth of the renewable energy sector.
- However, banks say that when they try to avail Bangladesh Bank's refinancing scheme, they pay the loan amount to the clients but their requests remain pending at the central bank for months. Bangladesh Bank categorically denies this; they say it never takes them more than a week or a week and a half. The time lag causes banks to opt for normal financing instead of refinancing. Enterprises are sometimes not even aware of this scheme; Bangladesh Bank is of the opinion that enterprises should research into these refinancing schemes themselves to avail them through banks. There is even taxonomy to prevent the time lag and Bangladesh Bank says they follow that.
- In section 3.3.2 Steps of Screening, the exclusion list may not be dynamic enough. In case of unproven technology that is brought on, a committee should be in charge of deciding whether it qualifies as a potential sustainable finance worthy project. The exclusion list should also be continuously updated so as to not finance any environmentally harmful or unproven technology. The policy does not clearly mention the source or rationale behind the inclusion or exclusion list. A multidisciplinary technical expert group should contribute to the formation of the inclusion and exclusion lists, and an independent review panel should screen it first. "Application of ESDD risk assessment tool as per ESRM guidelines along with Credit Risk Management guidelines issued by Bangladesh Bank" - should be reviewed by a list of credible technical experts to ensure that GHG use is reduced and funds are directed towards renewable energy.
- In section 3.5, the screening process that is mentioned is ambiguous; the roles of Bangladesh Bank and implementing institutions are not explicitly distinct. 3.2.3 mentions the inclusion list but it should have other allowances too as it seems to be rather limiting; moreover, there are no special allowances for innovations. The Sustainable Finance Unit should have a mandate to mobilize funds for new products and services as the renewable industry is making new inventions quite frequently.
- 3.5.2 mentions economic contribution, environmental contribution, social contribution and governance as sustainable factors to be linked with banks' vision, mission and objectives but none of them are defined which leaves room for confusion.
- Section 3.5.4 mentions the identification and evaluation of funding sources but there is no clear instruction as to how to identify this. Tools of financing should be defined and evaluated as well. Philanthropic funding may also be considered; i.e., as Bangladesh is a Muslim-majority nation, a large number of people allocate 2.5% of their wealth to donations as part of Islam-mandated zakat.

A time-bound action plan is mandated by section 3.5.5, but no accountability system is specified. An overview of the policy reveals that such is the case with many of the requirements of the Sustainable Finance Policy.

Chapter 5: Risks in RE Finance in Bangladesh: Investors' Experiences

A significant amount of investment in RE projects is employed as a fixed cost. Therefore, securing financing is the most critical for an investor to be involved in RE projects. At present, a number of green financings[13] options supported by the government (through IDCOL and other agencies) are available for enterprises willing to invest in the RE sector. In addition, at present, Bangladesh Bank (BB) is operating four direct refinancing schemes for promoting investments in green projects. These are: (i) a BDT 4 billion equivalent refinance scheme for investing in environment-friendly products or initiatives; (ii) a BDT 1.5 billion equivalent refinance scheme for Islamic banks and FIs for investment in green products or initiatives; (iii) a green technology fund (GTF) equivalent of USD 200 million to facilitate the export-oriented textile and leather sector of Bangladesh to import green machineries; (iv) a BDT 10 billion worth of technology development or upgrade fund (TDF) for the 32 industrial sectors mentioned in Bangladesh Export Policy 2018–21 (Bangladesh Bank, 2022). In 2020, the Bangladesh Bank (BB) developed its own 'Sustainable Finance Policy for Banks and Financial Institutions' and primarily listed 68 green products, projects, or initiatives (including RE-related initiatives) applicable for term finance (Bangladesh Bank, 2020). The existing projects are being financed by a variety of methods such as equity, concessional loans, syndicated loans, public investment and foreign private investment.

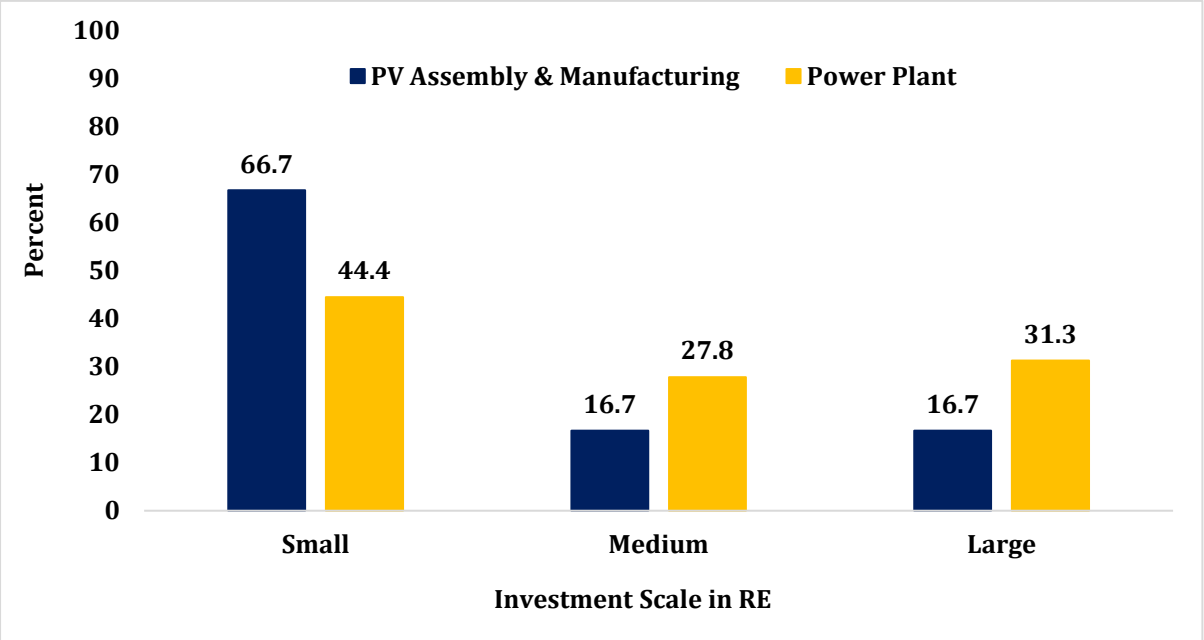


Figure 11: Investment in Renewable Energy by Scale and by Types of Enterprise

Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

[13] To qualify for a green investment project, it must (a) 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; (b) can't feature components that may cause significant harm to the other five environmental objectives mentioned above, and (c) must follow to meet minimum safeguards.

According to survey results, nearly 66.7% of enterprises involved in PV assembly and manufacturing have received green financing support from the government, while another 8.3% received green financing support from BB (**Error! Reference source not found.**). At the same time, 38.9% and 11.1% of power plant producers have received green financing support from the government and BB, respectively.

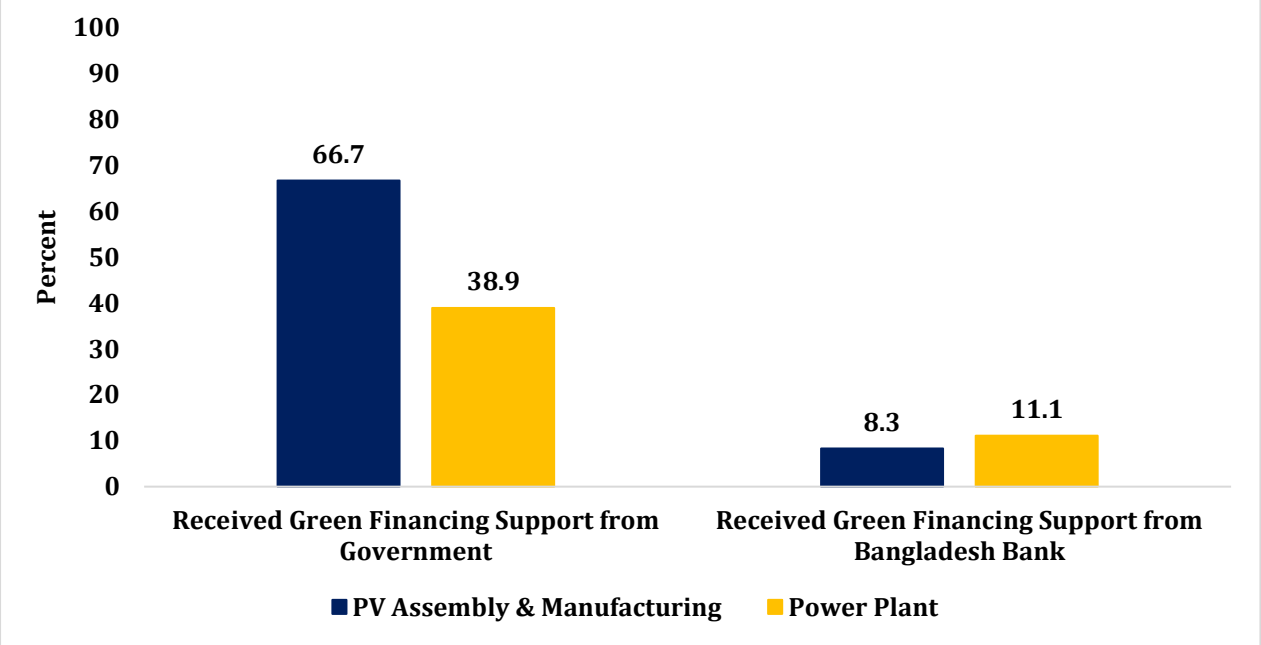


Figure 12: Green Financing Received by Types of Enterprise and by Source

Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

In this enterprise survey, major risks for Bangladesh's RE sector were analyzed on the basis of the following 'twelve' risk factors: These are: (i) Currency Risk: risks arising from a currency mismatch between foreign debt or equity and domestic currency revenues; (ii) Labor Risk: Risks arising from the lack of skilled and qualified potential employees; (iii) Sovereign Risk: Risk arising from a mix of cross-cutting political, institutional, and social characteristics in the particular country that are not specific to utility-scale renewable energy; (iv) Permit Risk: risk arising from the public sector's inability to efficiently and transparently administer renewable energy-related licensing and permits, including land acquisition; (v) Financing Risk: risks arising from the general scarcity of investor capital (debt and equity) in the particular country and investors' lack of information and track record in utility-scale renewable energy; (vi) Off-Taker Credit Risk: risks arising from the off-taker's poor credit quality and an IPP's reliance on payments; (vii) Power Market Risk: risk arising from limitations and uncertainties in the energy market and/or sub-optimal regulations to address these limitations and support energy markets; (viii) Land Acquisition Risk (I): risk arising from low land availability, complex land acquisition procedures, and high cost of acquisition; (ix) Social Acceptance Risk: risks arising from lack of awareness and resistance to renewable energy from end-users and special interest groups; (x) Developer Risk: risks arising from limitations in the IPP's management capability and ability to execute on financing and business plant; (xi) Hardware Risk: risks arising from limitations in quality and availability of utility-scale hardware; issues arising from inefficiencies in the custom process; (xii) Grid/Transmission Risk: risks arising from limitations in grid management and transmission infrastructure.

According to the survey results, the majority of enterprises mentioned that currency risk, permit risk, and financing risk are the top three factors influencing the cost of capital in Bangladesh's RE sector (**Error! Reference source not found.**). In addition, 43.3% and 40.0% of enterprises that participated in the survey mentioned land acquisition risk and power market risk, respectively, as major factors influencing the cost of capital to escalate. Overall, it is perceived from the responses of RE entrepreneurs that market risks, financial risks, regulatory risks, and other implementation risks are more critical to increasing the cost of capital than technological readiness and its associated risks.

Table 4: Risk Factors In RE Financing Across Different RE Enterprises

Risk Factors	PV Assembly & Manufacturing (%)	Power Plant (%)	All (%)
Currency Risk (M)	75.00	66.67	70.00
Permits Risk (R)	50.00	55.56	53.33
Financing Risk (F)	50.00	50.00	50.00
Land Acquisition Risk (I)	33.33	50.00	43.33
Power Market Risk (F)	33.33	44.44	40.00
Labour Risk (M)	16.67	33.33*	26.67
Hardware Risk (T)	16.67	33.33	26.67
Developer Risk (T)	8.33	38.89**	26.67
Sovereign Risk (M)	8.33	27.78	20.00
Social Acceptance Risk (I)	8.33	27.78	20.00
Grid/ Transmission Risk (T)	16.67	16.67	16.67
Off-Taker Credit Risk (F)	8.33	16.67	13.33

Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022; P-value: significance ** at 1%; *at 5% level. Note: M= market risk; R= regulatory concern; F= financial risk; I=implementation challenges; T=technical/technological risk

There were three power market sub-indicators: (i) market outlook; (ii) market distortion; and (iii) market access and prices. According to the index value, irrespective of PV assembler/manufacturer and power plant producer, it is felt that market access and price uncertainty are the riskiest factors in the context of the power market in Bangladesh, followed by market outlook and distortions.

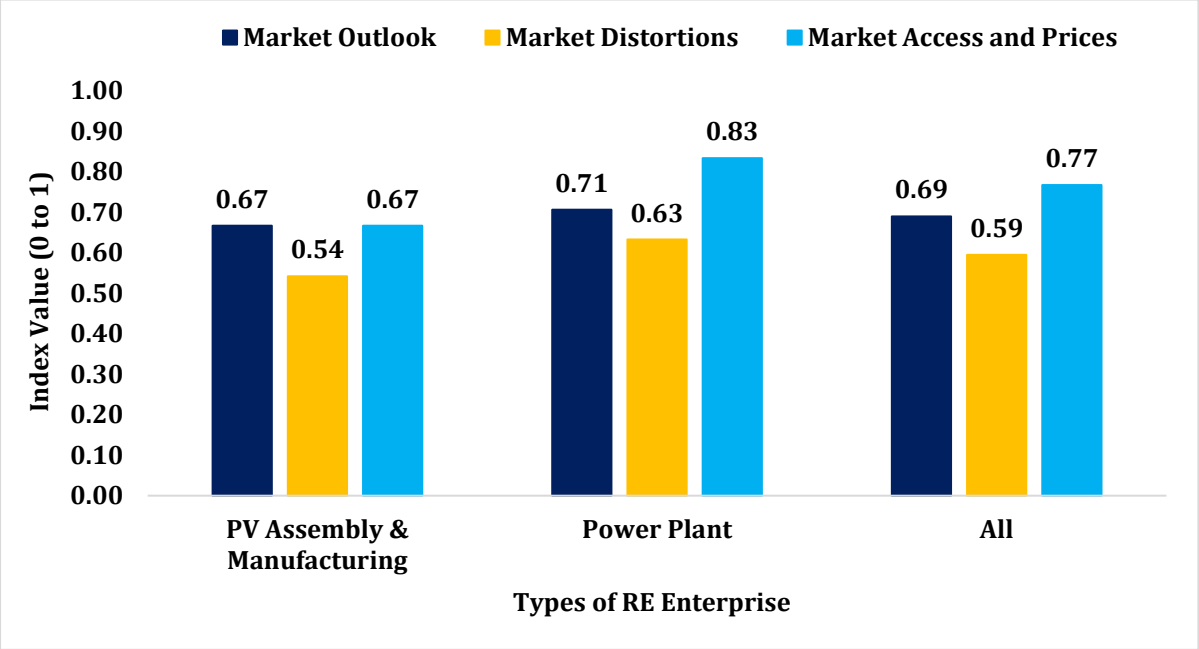
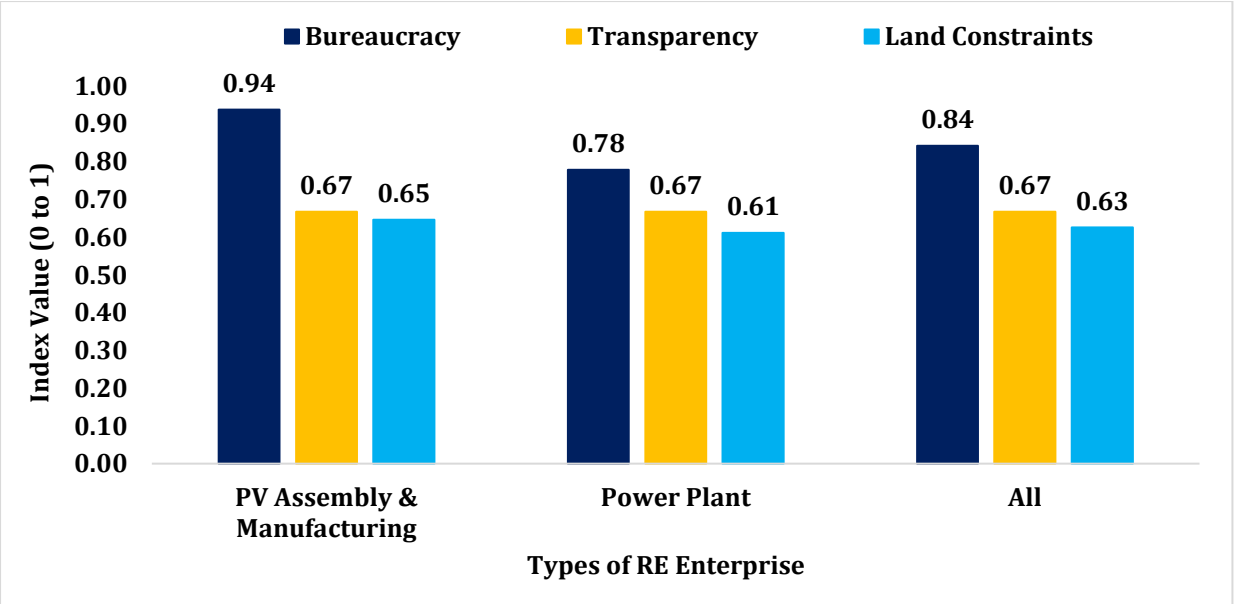


Figure 13: Power Market Indicators

Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Permit risk arises from the public sector's inability to efficiently and transparently administer renewable energy-related licensing and permits, including land acquisition. Three sub-indicators are evaluated under the permission risk indicator: bureaucracy, transparency, and land constraints. The complex and drawn-out nature of "bureaucracy," according to Bangladesh's RE sector businesses, ranks as the main regulatory barrier, followed by transparency and land restrictions (**Error! Reference source not found.**).

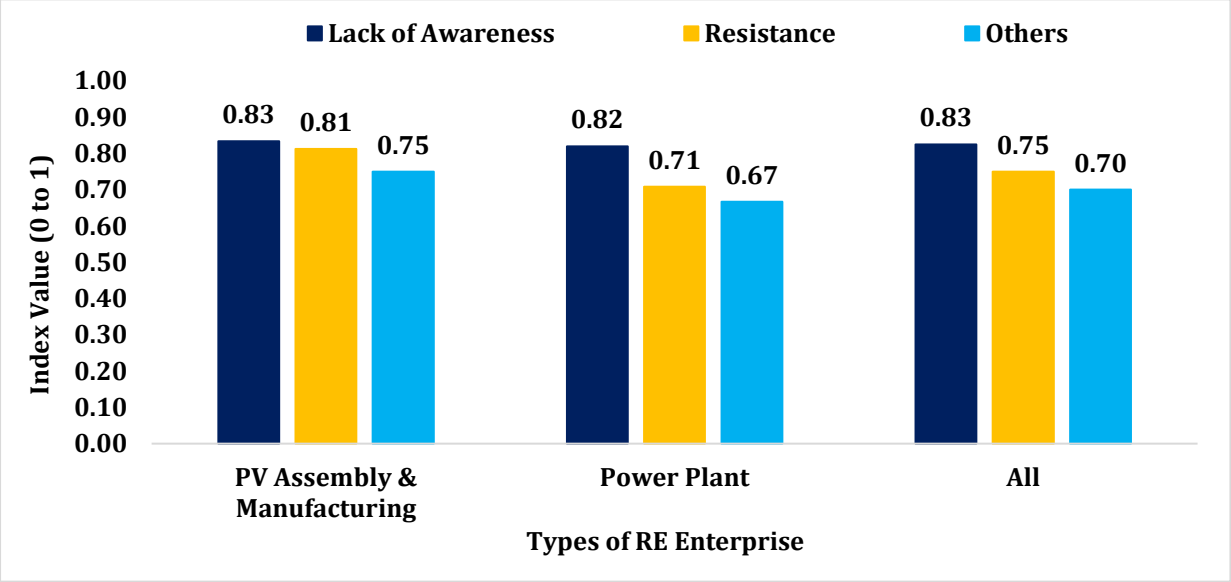
Figure 14: Permit Risks



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Social acceptance risk arises from a lack of awareness and resistance to renewable energy among end-users and special interest groups. In this survey, social acceptance risk is analyzed under the following three components: (i) lack of awareness among end users; (ii) resistance; and (iii) others. Index value analysis confirms that lack of awareness among end users induces ranked more risky than general inertia of acceptance to new technology—as defined resistance in this context (**Error! Reference source not found.**).

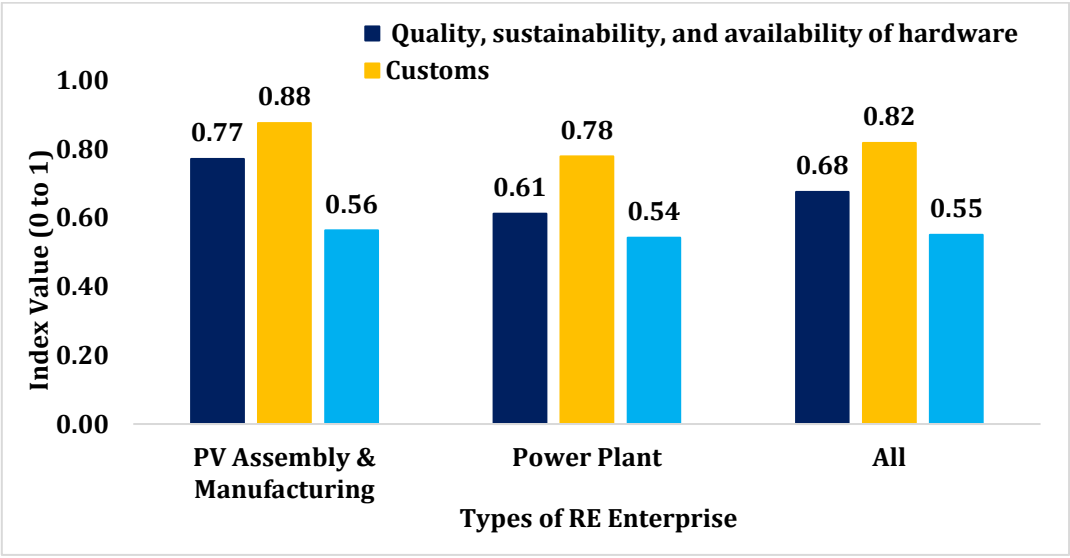
Figure 15: Social Acceptance Risk



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Hardware risks arise from limitations in the quality and availability of utility-scale hardware and from issues arising from inefficiencies in the custom process. This indicator is assessed under following three sub-indices (i) quality, sustainability and availability of hardware, (ii) customs procedures and (iii) local content requirements. Index value analysis reveals that local content requirements and tailored procedures pose the greatest risks to hardware management (Figure 16).

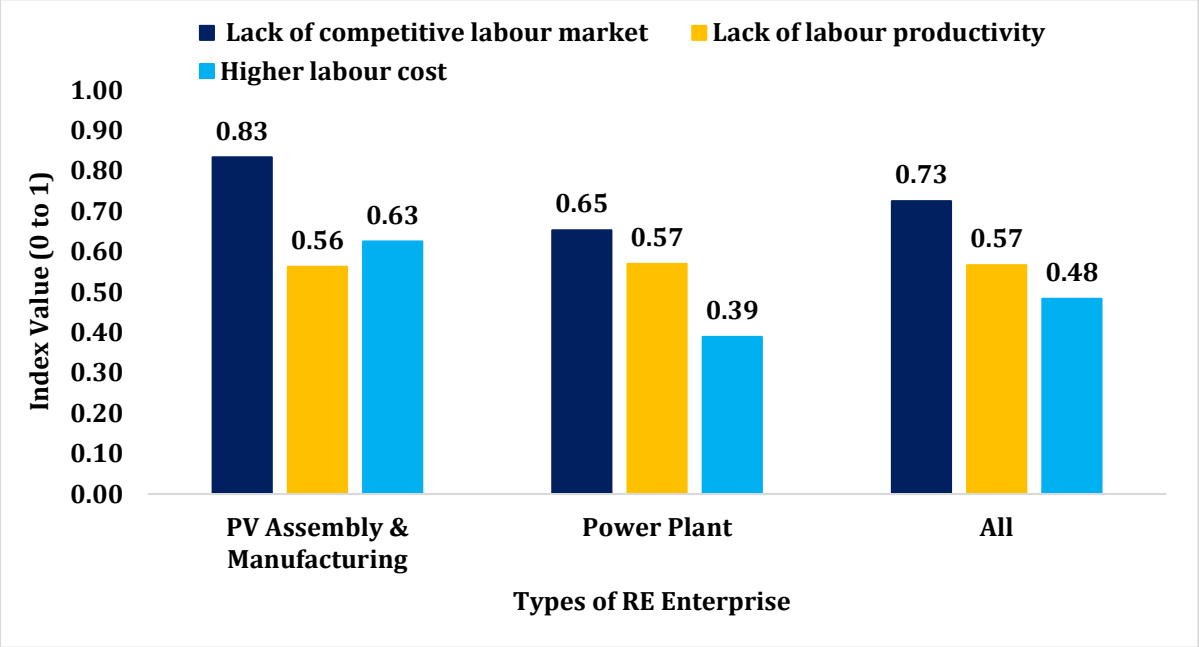
Figure 16: Hardware Risks



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Labour market risk is arising from the lack of skilled and qualified potential employees. During the survey, this indicator was assessed under the following three sub-indices: (i) structure of the labor market, (ii) level of labor productivity, and (iii) labor cost. Index value analysis underscores that a lack of competitive structure in the labor market is inducing higher risk for the RE sector in Bangladesh, followed by higher labor costs and a low level of labor productivity (Figure 17).

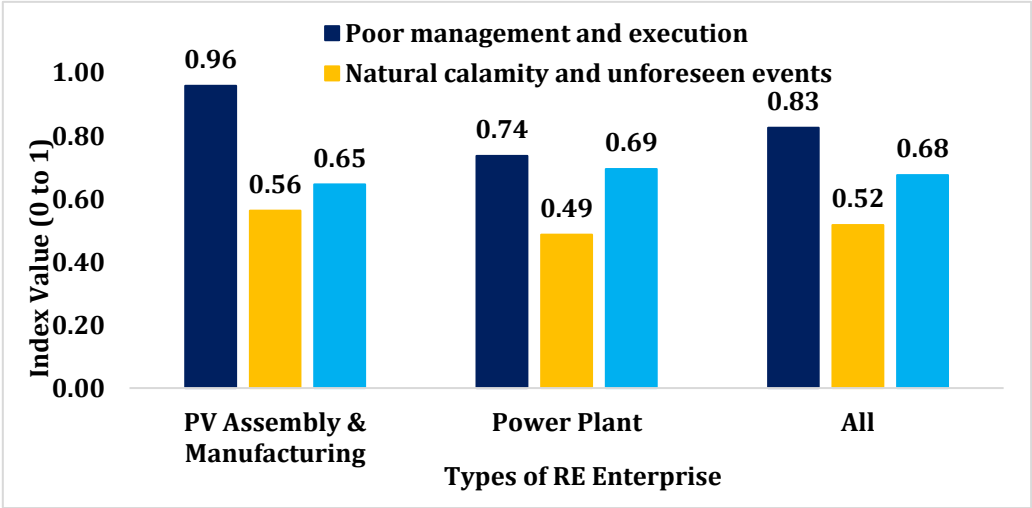
Figure 17: Labour Market Risks



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Developer's risk is arising from limitation in the IPP's management capability and ability to execute on financing and business plant. The sub-indices to determine a developer's risk are (i) poor management and execution, (ii) natural external shocks, and (iii) existing information asymmetry. According to index value analysis, it is found that poor management and execution are inducing more risk for developers than existing information asymmetry among parties involved and external shocks induced by natural calamities (Figure 18).

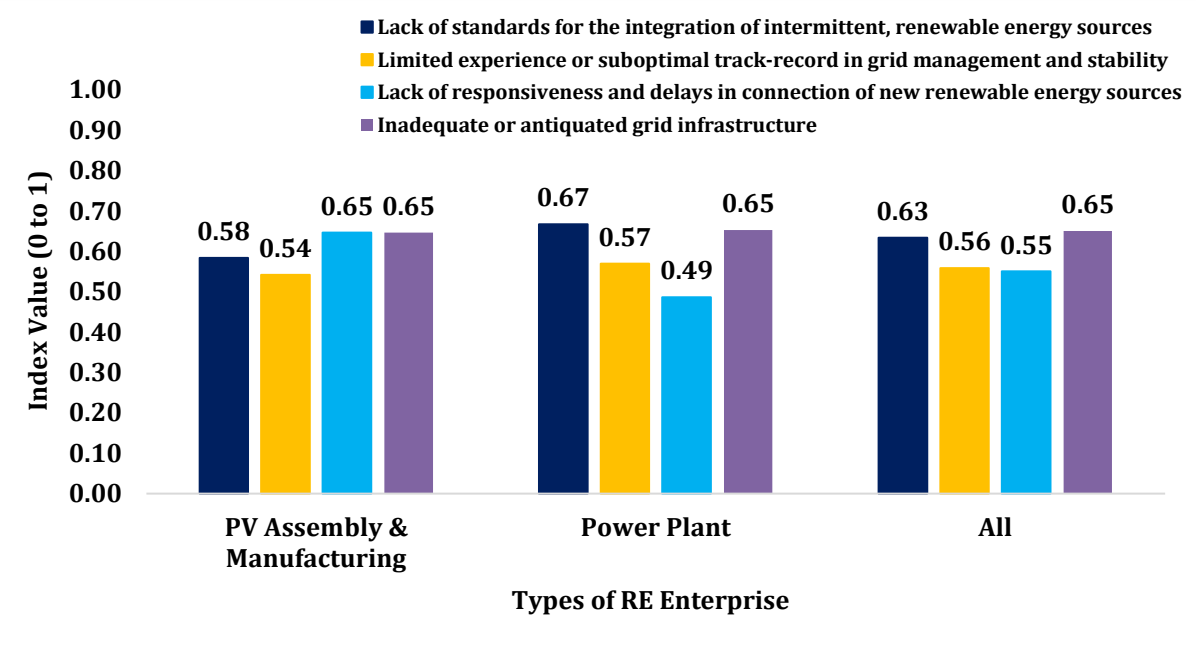
Figure 18: Developer Risk



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Grid and transmission risk arises from limitations in grid management and transmission infrastructure. Irrespective of PV assemblers/manufacturers and power plant producers, index value assessment highlights all four sub-indices: (i) lack of standards for the integration of intermittent RE sources; (ii) limited experience or suboptimal track record in grid management; (iii) lack of responsiveness and delay in connection of new RE sources; and (iv) inadequate or antiquated grid infrastructure, which are more or less equally held responsible for inducing grid/transmission-related risk in Bangladesh RE sector (Figure 19)

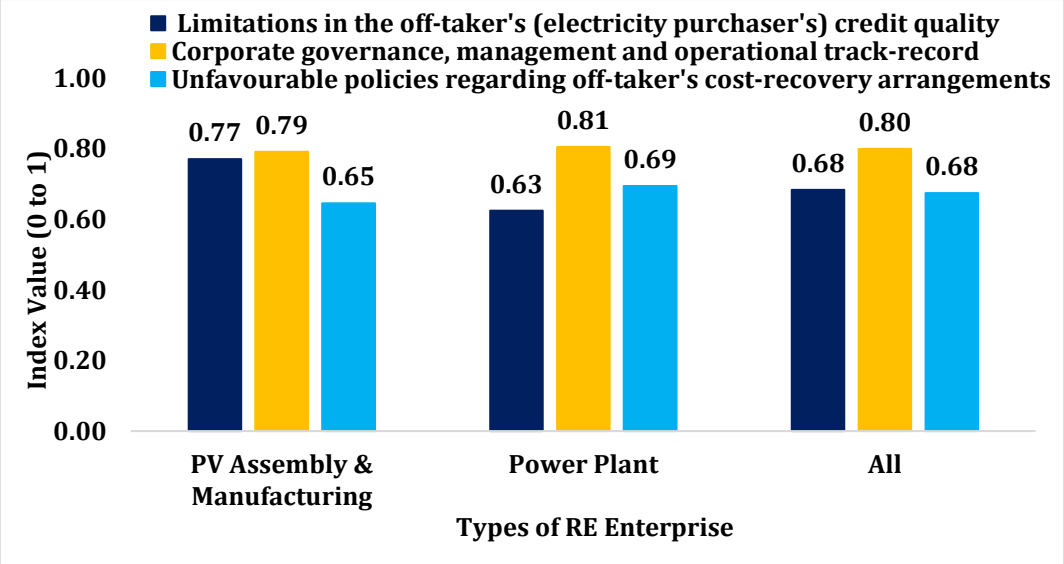
Figure 19: Grid/Transmission Risk



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Off-takers' credit risk arises from the off-taker's poor credit quality and an IPP's reliance on payments. For both PV assemblers and manufacturers and power plant producers, poor corporate governance, management, and operational track records are persuading higher risk (Figure 10). Following that, while limitations on off-takers credit quality are causing higher risk for PV assemblers and manufacturers, unfavorable policies regarding off-takers' cost-recovery arrangements are prompting more risk for power plant producers (Figure 20).

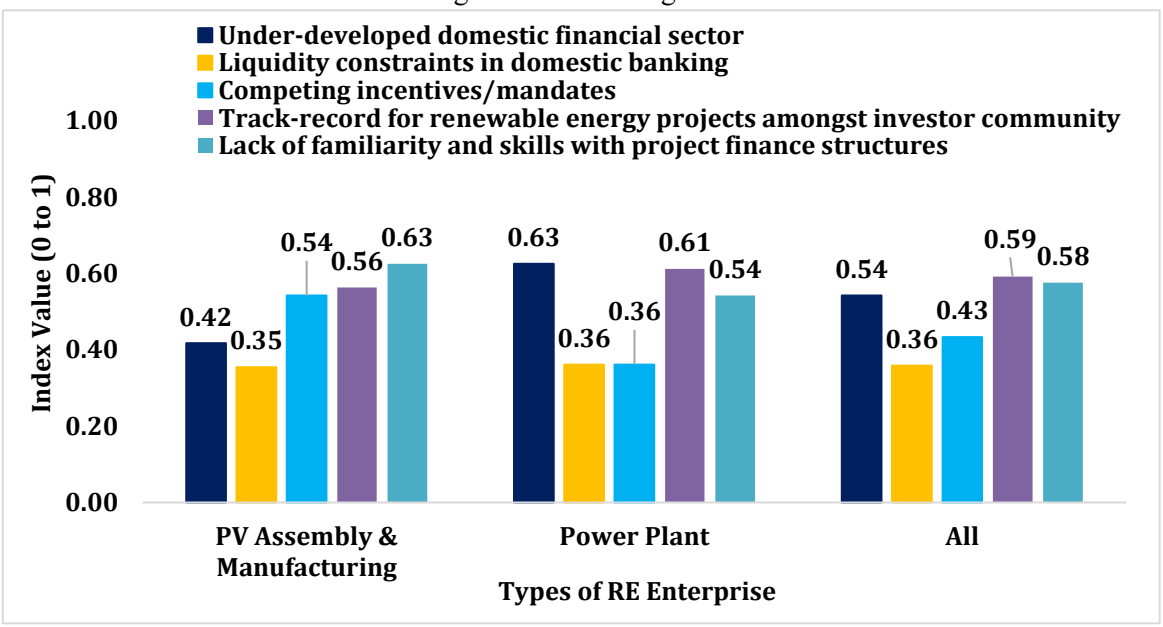
Figure 20: Off-taker Credit Risk



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Financing risk arises from the general scarcity of investor capital (debt and equity) in the particular country and investors' lack of information and track record in utility-scale renewable energy. Under this indicator, as per the index value assessment, for PV assemblers and manufacturers, a lack of familiarity and skills with project finance structures underscores the highest risk factor, followed by competing incentives and mandates. In contrast, for power plant producers, the under-developed domestic financial sector underscores the highest risk factor, followed by competing incentives and mandates (Figure 21).

Figure 21: Financing Risk

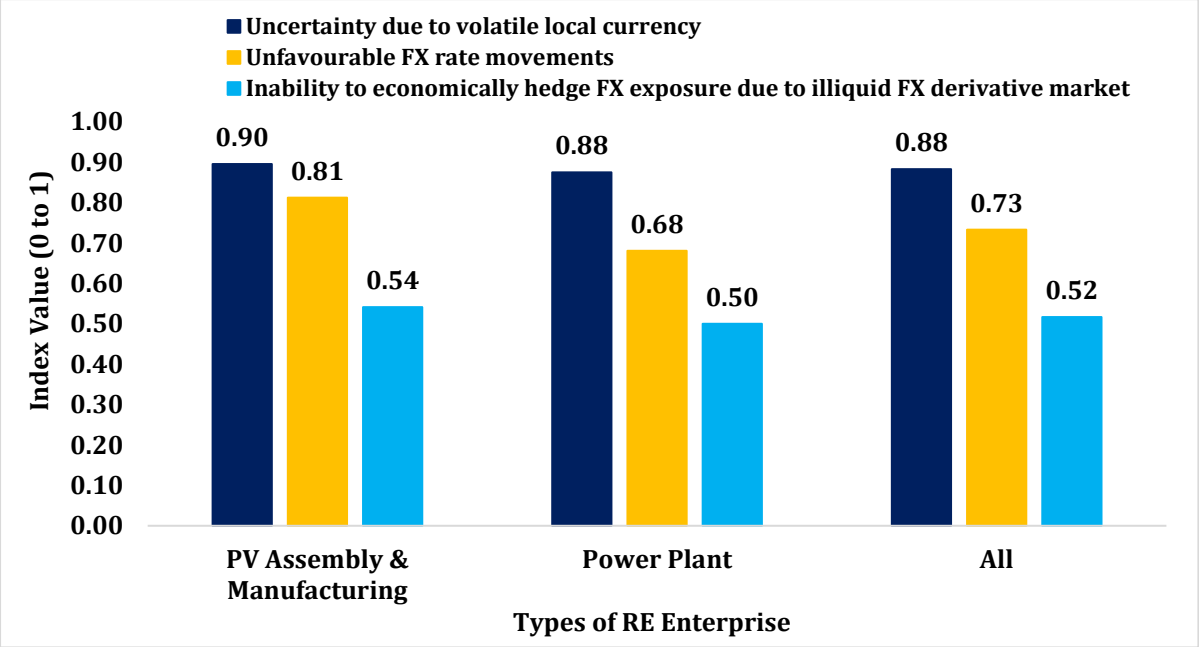


Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Currency risk is arising from a currency mismatch between foreign currency debt and equity and domestic currency revenues. Within the sub-indicators, uncertainty due to volatile local currency followed by unfavorable foreign exchange movements and the inability to economically hedge forex

exposure due to an illiquid foreign exchange derivative market are creating more currency-related risks for both PV assemblers and manufacturers and power plant producers (Figure 22).

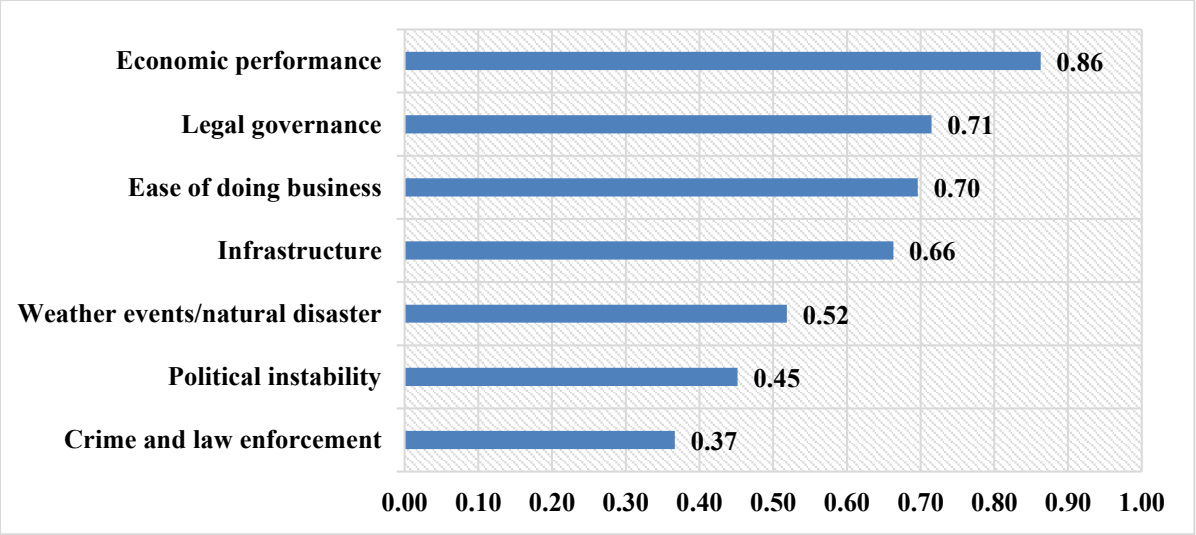
Figure 22: Currency Risk



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

Sovereign risk arises from a mix of cross-cutting political, institutional, and social characteristics in the particular country that are not specific to utility-scale renewable energy. In this study, sovereign risk was assessed based on 'ten' macroeconomic indicators. According to the results of the index value assessment, enterprises involved in the RE sector of Bangladesh ranked 'economic performance' as most critical to inducing sovereign risk, followed by legal governance, ease of doing business, infrastructural bottlenecks, climate-induced vulnerability and market shocks, political instability, and proper management of law and order conditions (Figure 23).

Figure 23: Sovereign Risk



Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022

De-risking instruments are arranged using the highest index value based on the responses collected in the structured survey (from the respective stakeholders). To draw conclusions, STATA (a statistical software) was used, and differences in responses were tested using a t-test by different types of enterprises. The analyses, therefore, are based on differences in responses from respective stakeholders in the following categories:

According to the index value assessment presented the top five de-risking instruments are as follows:

- Establish an online one-stop-shop for renewable energy permits with a timeline tracker.
- Streamlined, consistent, and facilitated customs procedures.
- Government support is needed to grow the early-stage industry.
- Ensure transparent and fraud-free time-bound enforcement mechanisms.
- Reduction of customs administrative steps, including possible online functionality public response timelines; effective and expedited recourse mechanisms.

Chapter 6: Enabling Environment and De-risk Mechanism in Promoting REF in Bangladesh

Draft IPEMP's emphasis on LNG import-based power generation may lead to higher fiscal burden as several experts have claimed that if proposed IPEMP 2022 would be adopted and "fossil-fuel including LNGs and 'green washing' HFO are introduced the BPDB would further strain on foreign reserves would be intensified; Bangladesh relies on LNG imports for 20% of its gas needs and has had to pay higher and higher prices for it in 2022 (Reynolds, 2022). Noted here that Bangladesh has purchased LNG at between US$30-37 per million British thermal unit (MMBtu) which is five times the cost in May 2021 and 10 times the cost in May 2020. Policymakers have yet to divert their focus or prioritize the RE as key sources of power.

Massive fiscal burden due to excessive dependence on the import of primary energy for power generation has been created due to foreign exchange (USD) drainages led to intensify foreign reserve crisis (Mavis, 2022), and restriction on imports of capital machineries and fuels due to US$ crises led to frequent power outage and load shedding (Jamal, 2022), global energy price escalation (IEA, 2022). Consequently, Bangladesh Power Development Board is at risks of bankruptcy as compared to amounts in FY2020 the operating loss has been doubled in FY2021. Dependency on foreign markets, import rose sharply from 1.5% in 2020 to 20.36% in 2021. (Energy and Power Sector in the National Budget for FY2022-23, 2022)

Moreover, disproportionate energy subsidy provided to fossil-fuel based IPPs (e.g. long-term tax break, waiver of duties and tax at import stage, lower corporate tax etc.); subsidies at both vertical and horizontal value chain (import of construction materials, generation, transmission and distribution stages) (Mujeri, Chowdhury, & Shahana, 2013) have created unabated scope of rent seeking in the name of capacity payments (more than 50% of the payments to IPPs); over-capacity. To reduce the potential macro-economic shocks the draft IPEMP should prioritize major investments on renewable energy supply as development of the industry requires policy support (Karim, et al., 2019). However, in the name of clean energy, IPEMP is focusing on unproven technology for Bangladesh. This should be reconsidered.

On 4th October, 2022, the national power grid of Bangladesh failed and caused more than 130 million people in Bangladesh to suffer through a blackout (The Daily Star, 2022). An energy expert stated that this incident could have been avoided if Bangladesh had a smart grid. He was of the opinion that more financing should be directed towards digitizing the grid (Rahman, 2022) Therefore, voltage and power fluctuation of renewable energy, particularly solar can further worsen grid management if proper infrastructure is not in place. Director of Renewable Energy, in BPDB said and NWPGCL Executive Engineer agreed that when Bangladesh is close to sourcing 10% of its national grid energy from renewable sources, it will have no choice but to develop the grid as it will become an urgent issue. Diversification of the energy mix is inevitable; it is important to make the grid less susceptible to supply, price fluctuations, and other factors.

The policies of Bangladesh which are related to renewable energy and its financing fall short of the expected standards. Even though many of the foundations which are needed for this industry to grow have been mentioned in policies, some of them have not been implemented. Some long-term plans, like the 8th five-year plan, and renewable energy policy, some commitments, like the NDC, set ambitious targets for it but do not have any action plan or strategy.

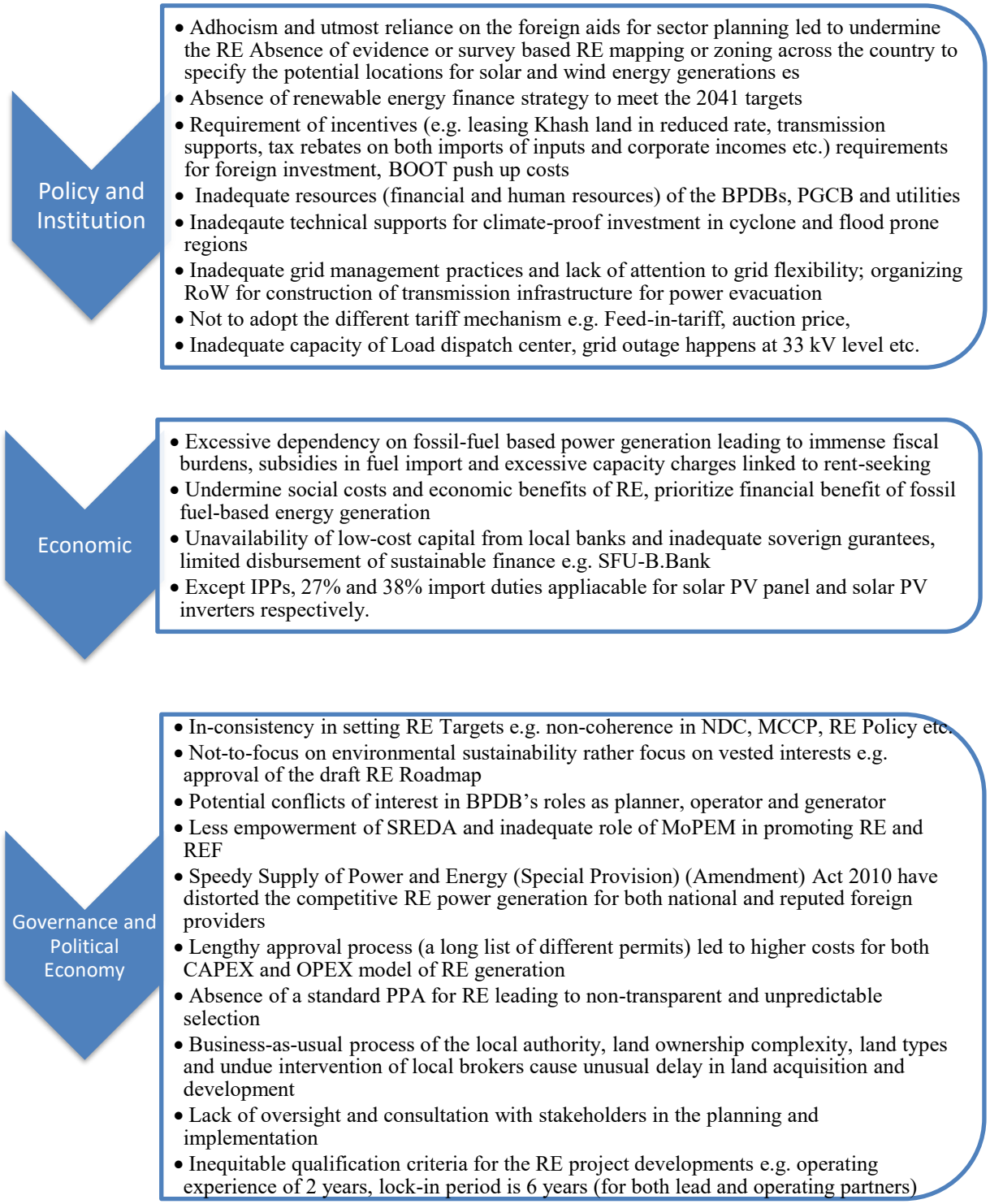


Figure 24: Barriers of enhanced RE Finance in Bangladesh

Bangladesh Power Development Board (BPDB) was contacted in the course of this study and they admitted that there is no nation-wide mapping that has been developed by them. They also said that they do not agree with the content and plans of the Mujib Climate Prosperity Plan as it was prepared without consultation from BPDB. This hints at an interagency disharmony between bureaus of the

government; this came up as a recurring issue in the key informant interviews with government officials as well as companies who have suffered due to procedural problems. Lack of coordination causes various policies to fail at the implementation stage.

Moreover, limited disbursement of sustainable finance for RE generation, e.g. investment into sectors that will have a supply crisis in the future as the source is not renewable (Das, Chakrabartty, Dey, Gupta, & Matin, 2020). Moreover, unsustainable finance may lead to further fiscal burdens in near future. A senior environmental specialist from IFC said that Bangladesh's central bank is one of the top central banks in terms of sustainable policy, including central banks of developed nations. It also has a dedicated sustainable finance department which is quite impressive. An ESRM guideline has also been set. Targets like, 5% of the portfolio being green finance and 20% being sustainable finance are quite good. If we compare Bangladesh Bank's finance mechanism for renewable energy with neighboring country India's central bank's one, we can see that the Reserve Bank of India firstly, considers renewable energy a priority sector (Reserve Bank of India, 2020).

Due to Bangladesh' single-buyer model, the off-taker or the buyer of the generated power is Bangladesh Power Development Board (BPDB). In August of 2022, it was reported that bills due to IPPs for April were yet to be paid in August. BPDB owed them a USD 1.6 billion approximately (Khan & Sajid, 2022). Off-taker's credit risk like this can leave the project without a reliable source of revenue. According to BPDB's annual report, they made a loss of BDT 32.33 billion in FY 2021-22 (Bangladesh Power Development Board, 2022). Their precarious financial position, therefore, puts renewable IPPs at risk. Moreover, due to absence of the competitive bidding process of awarding the RE projects to private sector is major hindrance of attracting more foreign investment.

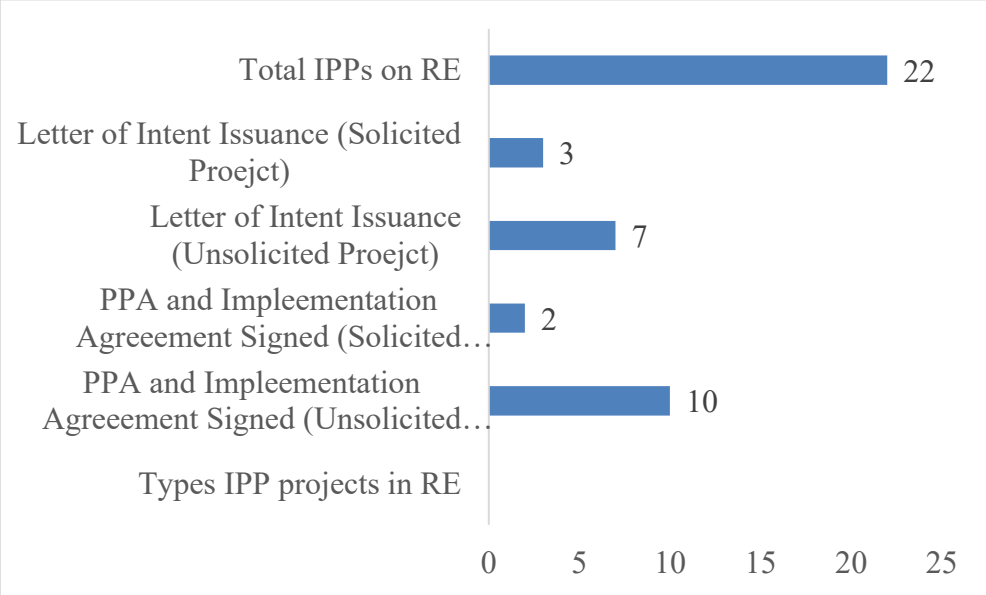


Figure 25: Progress of approved IPPs from a Meeting on 1st January 2023

Source: Minutes of the meeting on the progress on approved IPPs on RE sector, 1st of January, 2023

The Speedy Supply of Power and Energy (Special Provision) (Amendment) Act 2010 has created scope for collusive contracting with private power plants in Bangladesh that has resulted in high power prices that cost the taxpayer around U$1 billion in subsidies (Khan, Watkins, & Zahan, 2022). Moreover, this Act distorted the competitive bidding process and have created scope for rent-seeking and massive corruptions. Exceptionalism is a allowing implementation of power generation without the usual tendering process which is leading towards anomalies and corruption.

When we look at the policy as a whole, performance thresholds indicators seem unclear; they should be defined properly and be standardized. We can look at some of the Green GCF Investment Criteria and Indicators (Green Climate Fund, 2022) for inspiration, namely: impact potential, paradigm shift potential, sustainable development potential, and needs of the recipient and efficiency and effectiveness. If any of these are adopted, they should be further clarified in the context of Bangladesh.

To make progress in financing renewable energy in Bangladesh, it is crucial to establish clear and actionable strategies. This can include policies such as preparing climate finance strategies, encouraging foreign direct investments, and changing regulations to be more supportive towards renewable energy producers as well as encouraging better practices. To address the delay in approval or permits related risks, India introduced E-application portals that are available on the website of Ministry for Renewable Energy. There is also a public grievance application to address any issues. Bangladesh should apply that.

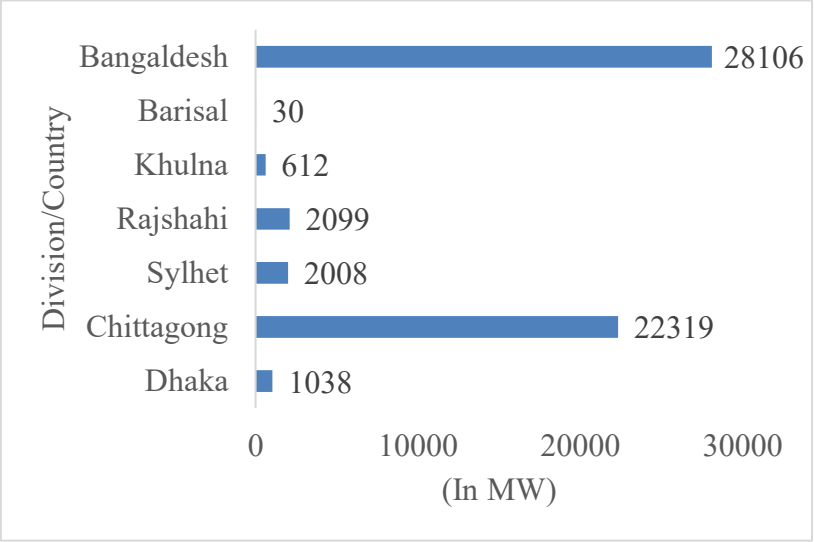
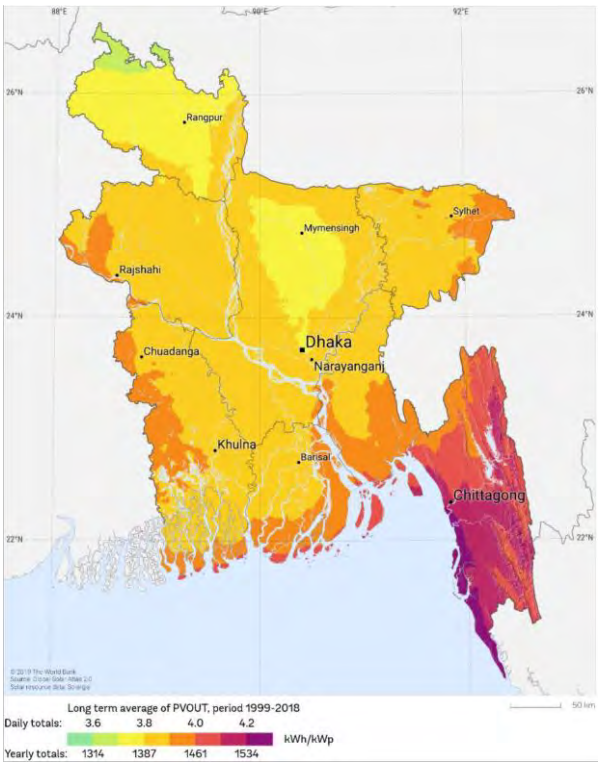


Figure 26:If 5% of the non-agriculture khash-land used the Potential of RE in Bangladesh (MW)

It has been claimed by policymakers and some fossil-fuel entrepreneurs that Bangladesh has immense land crises for agriculture production. Based on the Land Ministry (Ministry of Land, Government of People's Republic of Bangladesh, 1984) data considering the availability of total non-agricultural khash land of Bangladesh (1686354.00 acre) we have identified the potential of RE generation is around 28,106 MW across the countries and higher potential (22,319 MW) in Chittagong. Though considering the solar radiation and wind flow this figure might be slightly changed but the above estimate shows that the land acquisition process should be time-bound and accountability of the concerned officials should be ensured to meet the national target of generating RE based power.

An analysis of Land Use Land Cover for the districts of Bangladesh revealed that 3.89% of Bangladesh's total land is barren. Mapping is needed for renewable as land availability information is required to plan and set up projects. The land risk can be mitigated using mapping. A 2009 paper on land administration and management in Bangladesh suggests that Bangladesh should adopt a Land Information System (LIS) for managing land related information and keeping it up to date (Nahrin & Rahman, 2009).



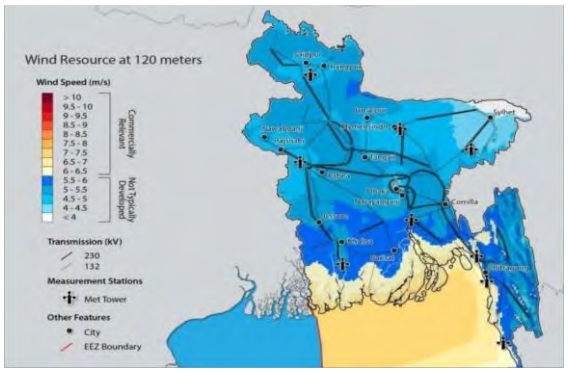


Figure 28: Wind-power potential in Bangladesh

Figure 29: Potential of Solar-energy in Bangladesh, 2022

Integrating policies focus on infrastructure and assets that support renewable energy integration. As Bangladesh considers climate change to be a planetary emergency and is taking drastic measures to fight and cope with climate change, establishing green banks may just be the way to go. The renewable energy financing mechanism in Bangladesh has the potential to be revolutionized by the introduction of green banks and financial institutions; they can provide the push that the private sector needs to make big investments in the industry. The concept of green banking is something the financial industry in Bangladesh is familiar with, green banks have not emerged yet in this landscape. By definition, green banks use innovative ways to catalyze investments that lead to low-carbon and climate-resilience. An ADB working paper on green finance mentions that the asset classes for green investment include venture capital, private equity, stock markets and asset finance for private sector. The report identified both national and international sources of RE finance and potential reform in the different policies that can be used to access public funds, deployment policies involve investing in government-owned assets e.g. green bonds, Sukuk, or using capital subsidies, grants, and tariff-based mechanisms to attract private investment. Enabling policies involve supporting long-term RE generation and financing planning, research, and development, as well as technical assistance. Structural change and just transition policies involve redesigning power markets and promoting social inclusion. Additionally, the importance of international collaboration and macroeconomic policies in delivering public funds towards the energy transition is also crucial.

An energy expert mentioned that as though the policymakers' lack of conviction in their own plans was a major reason behind the lack of success in this sector. Another energy expert, also agreed with that and emphasized to implement the existing policies properly before making new ones. An official from bi-lateral funding entity claimed that a lack of technical knowledge on RE potential among policymakers acts as a barrier to better policymaking. Bangladesh has an opportunity to invest venture capital into the renewable energy sector as there are innovative organizations that require funds. The public market so far has been explored by Beximco, owner is Business Advisor to Prime Minister,

through their Sukuk bonds but this opportunity should be opened for all investors irrespective of the connection with power. Since Bangladesh's renewable energy industry is expanding and is currently in its growth stage, therefore, all the asset classes have prospect. Philanthropy could be used as a tool to fund renewable energy in a similar way in Bangladesh, perhaps through Zakat as mentioned previously.

There are a few more potential sources of renewable energy:

1. Carbon Tax at 25% on $8.9 billion on import of fossil fuels (FY2021-22) could mobilize capital of generating additional around 3000 MW RE/year.
2. USD $ 0.7 billion of RSF-IMF can be utilized for RE projects.

There are also commitments that have already been made or spent:

1. In 2020 around US$11.855 billion was spent for RE from MDBs
2. US$2.9 billion (60 RE projects) approved from the GCF

Bangladesh's neighboring country India also has green banks that operate with the express purpose of financing sustainable projects. However, this study revealed that Sustainable Finance Unit of the Bangladesh Bank is not doing enough to work towards the targets set by the government, for example, the plan to generate 40% of electricity from renewable sources by 2041. Moreover, massive investment is unthinkable without support from the private sector, which in turn depends largely on banks and financial institutions to support their projects through financing instruments. If Bangladesh Bank, as the authority of all banks and financial institutions in Bangladesh, does not encourage investment in renewable energy through incentives, the government will find it difficult to make progress towards this goal.

The National Board of Revenue (NBR) of Bangladesh is also similarly falling behind. The more worryingly, the 37% customs duty on solar inverters have made setting up solar very expensive. The high duty on inverters on are levied as they are categorized as capital machinery and not given any special consideration for being a vital machine needed for production of solar energy. In terms of economic return of RE the government should exempt all duties on the import of all capital machineries and related items. NBR should closely work with SREDA to get the updated list of RE related materials and will revise the list of HS Codes accordingly. The government of Indianis promoting renewable energy and investment in it through a mix of policies, incentives, and financing mechanisms, including tax breaks, subsidies, and loans.

Table--: Incentives of India in Promoting RE Investment[14]

[14] https://mnre.gov.in/img/documents/uploads/94e402c36ee44fe29e2b96a6b1b69a30.pdf

Regulatory and policy support	Fiscal Incentives
• Capital cost reduction in RE through competition • Promotes RE by ensuring grid connectivity & sale of RE • Fix a minimum percentage energy purchase from RE sources (RPO) and to determine tariffs	• Accelerated depreciation • Generation based incentives • Viability gap funding • Concessional excise and customs duties • Capital subsidies for off-grid systems • Budgetary support for R&D and demonstration of technologies • Income tax holida

To enhance renewable energy financing in India, the government is working on improving the financing ecosystem, by setting up dedicated financing institutions, simplifying lending processes, and creating innovative financing models. For example, the government has recently launched a $2 billion Green Growth Equity Fund to provide equity financing for renewable energy projects, and has also introduced the KUSUM scheme to promote the installation of solar pumps and grid-connected solar power plants. These efforts are likely to attract more private investment into renewable energy and "On the list of sovereign entities are ENEL, CDPQ and Canada Pension Plan Investment Board (CPPIB), the largest global pension fund, as are GIC, Temasek, IFC, CDC, National Investment and Infrastructure Fund (NIIF) and, more recently, Norfund are potential sources of RE finance in India, so as for Bangladesh as well. Major investment has come from almost all the global PE players, among them Goldman Sachs, KKR, Global Infrastructure Partners (GIP), Actis, Morgan Stanley, ADIA and JP Morgan." A third set of investors (some of them more recent) includes oil and gas majors such as Total SE, Shell, Petronas and Malaysian and Thai fossil-fuel companies for which renewables provide a sustainable hedging solution as the world tries to go greener. Further investment has come from the national conglomerate majors like Tata and most recently Reliance Industries. Such variety and depth of investors bode well and already have driven aggressive growth."

India has set ambitious renewable energy targets, with a goal of achieving 450 GW of renewable energy capacity by 2030. In 2021, India's renewable energy production had gone up by 250% in just seven years, now stands 4th globally in renewable energy installed capacity, including large hydro, wind power capacity, and solar power capacity. The country is developing the *Direct Power Purchase Agreement (DPPA)* pilot program from 2021 to 2023 for a small scale of 1,000 MW in total to create fairer competition in the retail electricity market, contributing to the sustainable development of renewable energy sources. A Direct Power Purchase Agreement (DPPA) is a specific type of PPA that allows private renewable energy generators to sell clean electricity directly to private buyers through a contract for difference (CfD) or virtual PPA arrangement, bypassing the traditional utility or grid operator as an intermediary.

An innovative approach to green financing that is utilized in India is crowd funding. Moreover, while a large number of banking and non-banking institutions are financing renewable energy projects of India, the latter's commitment is growing significantly. Today, more than 48GW later, we have witnessed the most aggressive bids at less than Rs.2/kWh to Rs1.99/kWh (~US$0.03/kWh) to be precise. Instead of current business model, multi buyer model should be adopted. "By the virtue of its

social, environmental and economic impact, from the beginning RE has attracted interest from multiple long-term investors. Plainly, renewable projects are best handled by patient investors."

The United Nations Development Programme (UNDP) has launched a challenge to support the development of innovative finance solutions for small-scale clean energy projects in developing countries. "Vietnam's Renewable Energy Policies and Opportunities for the Private Sector," which outlines the country's renewable energy policies and the opportunities available for private sector investment in the sector. Vietnam is promoting a more diversified, transparent, and digitalized buying-selling mechanism in the electricity market, and is targeting foreign investors to participate.

Under the scheme, the generator and Electricity Vietnam (EVN) will enter into a PPA pursuant to which EVN will purchase from the generator physical electricity at the wholesale spot price. The off-taker will purchase physical electricity from EVN at the retail spot price. The off-taker and generator will enter into a CfD/virtual PPA mainly for the purposes of documenting a pre-agreed electricity purchase price. The Ministry of Industry and Trade (MOIT) of Vietnam has released several draft legislative instruments since 2020, with the DPPA pilot scheme expected to commence in Q1 2023.

Regarding the competitive tariff, in India commercial and Industrial consumers can buy green power from the grid if they want. Captive Consumers may avail green energy under Green Open Access. Renewable Purchase Obligations, which make it necessary for distribution companies to buy a specified percentage of renewable energy, are in place to ensure the growth of the sector. The Indonesian government has implemented a number of policies and initiatives to encourage investment in renewable energy, including feed-in tariffs, tax incentives, and a renewable energy fund. The main learning for Bangladesh is to move towards creating a dedicated renewable energy fund as it will be essential for growth of this sector.

Renewable energy financing in Bangladesh through private entities is gradually increasing due to the growing demand for clean energy and the government's favorable policies. The frontrunners are the enterprises who at least partially fund their own projects, as per primary research conducted for this study. However, private entities such as banks and non-banking financial institutions (NBFIs) are not as active in the field as would be desirable. According to an academician and energy expert such institutions are uninterested in investing in renewable energy projects as the return is low and payout time is long. If they were to invest in a fossil fuel based plant they would face much lower market risk as the power purchase agreement is protected by capacity payment too.

> A deputy director of renewable energy program of a public generation company that implements such projects mentioned that commercial banks do not seem interested as they perceive renewables as not being as lucrative as other investments. They do not want to invest sometimes if it is a relatively unknown company but they should give a chance to such enterprises. An expert claimed that innovations in finance can help cut down on transaction costs in case of small loans. As per the study's key informant interviews with government officials, most of them think that the sector is doing well enough and there is often not enough initiative from even the ones in charge of renewable energy to identify and solve the problems. She emphasized the importance of trials and pilot projects to fully understand the practical implications of implementing renewable energy projects.

Blended finance structures can attract private sector investment to clean energy projects and it can also reduce risks for investors. Development impact bonds (DIBs) can provide a new model for financing RE energy projects as it can align investor incentives with development outcomes. In DIBs, private investors provide upfront capital to implement a program aimed at achieving specific social outcomes. The program is managed by a service provider and supported by an outcome funder, which may be a philanthropic organization, a development agency, or a government. If the program achieves its predetermined social outcomes, the outcome funder pays the investors a return on their investment, which is typically higher than what they would receive from traditional aid or philanthropic grants. However, if the program fails to achieve the desired outcomes, the investors may lose some or all of their investment. DIBs are seen as a way to align incentives, promote innovation, and increase accountability in development programs. Innovative financing mechanisms such as these can help to address the financing gap for renewable energy projects.

Multilateral development banks (MDBs) play an important role in financing renewable energy projects in developing countries. MDBs provide financial and technical assistance to developing countries for the purpose of economic development. Some of the MDBs involved in renewable energy financing in Bangladesh include:

An energy specialist, key informant for this study, claimed that "their usual mechanism for renewable energy is to invest up to USD 200 million when requested by the government. They are also open to working with the private sector but the enterprises have to meet their strict criteria including sufficient bankability, environmental effects etc. Despite the positive attitude, progress is being hindered. Effort needs to be concerted, not sporadic. Policymakers need to accept the diagnosis before forming a treatment plan. ADB's energy specialist does not think it is possible to make a quick shift to renewables as there are old investments in gas that will still take years to recover costs and it is simply not practical to phase it out now. The volatility of the power market is a cause of concern, she also mentioned. Solar irrigation pumps have a lot of potential according to her and it is important to invest in them. Some steps that she suggested to be taken are to set short-term RE goals and provide incentives to solar power plants which would act like capacity charge, to level the playing field. IDCOL, which acts as an intermediary, has become more a hindrance than a facilitating agent. It is concerning that the institutions that fund projects through IDCOL, no longer think of it as a good liaison."

An Environmental Specialist from an MDB, who worked with the central bank and financial institutions for over a decade, thinks that "Bangladesh Bank is one of the best central banks in the world in terms of sustainable policy. And specific targets like 5% of the portfolio being mandated for green finance and 20% for sustainable finance are good targets. She identified inaccuracies in reporting, though, and the central bank's representative concurred. BB are willing to give better terms and conditions as well as support for compliant and green industries, as exemplified by RMG industries, but somehow due to some problems in the system this is not being properly reflected in the processes or it is not having the intended effect of working as the incentive that it is. Energy efficiency can be calculated easily which makes it easy to implement but more technical knowledge is needed to predict renewable energy impact accurately. The barrier with renewable energy is that it has a high initial cost and the return cannot be calculated as reliably. Which is why banks need training and understanding; this must be mandated."

As a solution, she suggested an approach that has worked with a few projects. The MDB acted as an energy auditor. Banks agreed to provide the loan at 4% interest rate, 20% of the entire finance was to be through grants, and the MDB had signed off as an energy auditor with financial forecasts about how much was to be invested. This model may work for renewable energy. "Banks cannot provide a

financial product and expect that to be the be-all and end-all of renewable energy financing; project has to include service providers and organizations that will vouch for how much investment is required and what return can be expected." She made a point that "Bangladesh Bank did as well. However, the renewable energy investments are not being captured in reporting because people have little idea about what renewables exactly entail. If you specifically ask them if they have financed solar rooftop projects, they will say yes but if you ask if they have invested in renewable energy, they will seem unsure. However, the situation is improving and some banks are definitely focusing on the needed training. It needs to become the norm."

"Regulator has done its part, banks have to comply and that enterprises are ahead of the game. Renewable energy has a booming market right now according to her entrepreneurs are organically entering the market. Banks have to take more initiative to finance renewables; they cannot take a passive approach. Renewable energy financing opportunities can open by marketing it right.

MDBs hinted at starting up discussions with the Bangladesh Securities and Exchange Commission (BSEC) regarding introducing labeled bonds in the Bangladesh market. These are bonds that have specific environmental, social or governance (ESG) and sustainability objectives. Green bonds as well as blue bonds are labeled bonds. According to them, regulatory authorities will in the coming years become stringent about reporting; this is necessary as it de-risks the possibility of green-washing. Transparency will become essential and monitoring will have to be strict as well.

"As long you are unable to show that Bangladesh is taking matters of climate finance and renewable energy seriously, it will keep affecting Bangladesh's image". Encouraging investment from MDBs as well as other foreign and national and both private and public financiers involves having a concrete plan for the projects. This is why a Project Preparation Facility can be advantageous.

Several entrepreneurs among the key informants raised the issue of banks being incompetent when it came to renewable energy projects. Since there is no technical support and not enough knowledge dissemination among the customer service staff, banks often seem either disinterested or ignorant about such investments. Even though, Bangladesh Bank has mandated Sustainable Finance Desks in banks to act as a focal point for inquiries like this, many banks still do not have any or enough such desks. India has a competitive bidding process which ensures that the best IPP is chosen; this mechanism does not exist in case of unsolicited projects in Bangladesh. Energy risk management and insurance programs exist to accommodate and compensate for such risks. Transmission access is allowed in India through open-access system, without an intermediary.

Finally, domestic investors' incentives for on-grid rooftop PV and aggregative financing models should be strengthened. An independent energy market regulator should be established to ensure fair market practices. In the case of illegally occupied land, the forest department can withdraw legal steps if the entity agrees to build a solar park and receives remuneration, with carbon pricing paid. SREDA holds awareness seminars to mitigate this risk . Alike Indian National Solar Energy Federation of India (NSEFI) national campaign should be carried out to cities and communities within them to encourage using solar energy. Energy literacy campaigns have been carried out.

In conclusion, the way forward for renewable energy financing requires a multi-faceted approach that includes comprehensive de-risking instruments, an enabling environment, and government support. By implementing these measures, renewable energy projects can attract the necessary financing and accelerate the shift towards a sustainable and low-carbon energy future.

The excessive dependency on fossil-fuel-based power generation has led to a significant fiscal burden for the BPDB, including massive subsidies in fuel imports and capacity charges to private power companies. The planning has been guided by the financial costs and benefits of fossil fuel-based energy rather than social costs and economic benefits of RE. Bangladesh incurs higher generation costs, including unauthorized payments. The country lacks local low-cost capital or investment, and the import duties on solar PV panels and inverters are 27% and 38%, respectively, apart from Independent Power Producers.

a) Policy and Legal

Realistic, Reliable and Reform (3R) towards RE Finance: The power sector master plan and policy of Bangladesh have been prepared entirely by foreign experts, leaving room for vested interests to undermine the promotion of renewable energy (RE). The planning has been ad hoc and not focused on realistic and environmental sustainability in power generation. For promoting RE Finance in Bangladesh, the target should be realistic, the policy, process and actions should be reliable and necessary reforms should be ensured to create new national RE funds under the jurisdiction of SREDA. The Bangladesh Power Development Board (BPDB), Power Grid Company of Bangladesh (PGCB), and utilities have inadequate resources (both financial and human) to provide technical support for climate-proof investment, especially in the cyclone-prone coastal region. Finally, the country has failed to adopt different tariff mechanisms, such as feed-in-tariff and auction prices, and the capacity of Load Dispatch Center is inadequate, leading to grid outages at the 33 kV level.

Abandon of the Speedy Power Generation and Supply Act 2010: This Act have distorted the competitive selection process, and purchasing cost-effective power from the private sector, especially from reputed foreign RE companies, has become difficult. The Speedy Supply of Power and Energy (Special Provision) (Amendment) Act 2010 should be abolished for opening the scope of the competitive bidding process for RE investors especially for attracting the FDI of the energy sector in Bangladesh. Only allow competitive bidding-based Power Purchase Agreement (PPA). There are potential conflicts of interest in BPDB's roles as planner, operator, and generator, which has left the Sustainable and Renewable Energy Development Authority less empowered.

Consistent targets from RE generation: In setting uniform RE targets, such as coherence gaps in the MCCP, BCCSAP, RE Policy, IPEMP, draft RE Roadmap should be approved soon with the consistent targets of RE generation. Establish an online one-stop-shop for all public and private projects.

Imposing Carbon Tax on Fossil Fuels Import and Uses: The Government of Bangladesh spent around US$8.9 billion for importing the fossil fuels in FY2021-22. Considering the current fiscal burden and crisis of foreign currency, if the Ministry of Finance impose 25% carbon or regulatory duty on this import the generated money could mobilize capital of generating additional around 3000 MW RE.

Attractive incentives for investors: To promote the growth of early-stage industries, government support is necessary. One such support mechanism is the establishment of research and development centers to drive innovation and competitiveness. Additionally, development banks should initiate financing campaigns to raise awareness of renewable energy and support community-based projects. Since the government plans to create 100 economic zones, a significant progress can be made even if only 20% of the power is mandated to be from renewable energy sources. SREDA should have a one-stop service that will receive applications, show progress of applications and provide project information. This will ensure a transparent process and ensure timely response from the authorities.

Establishment of dedicated Renewable Energy Finance Trust/Council, structure of the Aranyak Foundation that included both DPs and local officials, could be adapted. Proper identification for green prioritized projects on renewable energy.

Allowing land lease-based RE entrepreneurs: To attract investment, an enabling environment is essential. For companies with leases instead of ownership, the government should allow them to carry out power plant projects. In such cases, the Power Purchase Agreement (PPA) acts as a guarantee, and the value of electricity should be used as a basis for providing loans from financial institutions. To minimize risk, international insurance mechanisms should be established, with premiums provided by business institutions.

Promoting sustainable finance for RE: Enhance accountability and transparency in green or renewable energy related finance by both IDCOL and Bangladesh. Following recent G7 offer for Indonesia and Vietnam Bangladesh should adopt the time-bound, specific steps for phase-out of coal-based power generations. Moroever, at least 50% or US$0.65 billion of IMF's approved Resilience and Sustainability facility (RSF) for Bangladesh should be utilized for RE generation and transmission related projects. US$2.9 billion (60 RE projects) approved from the GCF. Moreover, 10,000 MW RE Projects could generate revenue of US$30 million/year from the Carbon Market.

b) Institutional and Technical Capacity

Nation-wide Mapping on RE Potential and designated areas for RE generation

Project Preparation Facility (PPF) is a time-bound facility that provides support to renewable energy projects in the early stages of development, typically through the preparation of project documents, technical and financial assessments, and other activities that are necessary to make the projects bankable and ready for financing. Bangladesh needs a PPF for renewable energy projects for several reasons: lack of technical expertise, access to financing, encouraging private sector investment, time-bound nature. Overall, the PPF is a critical tool for advancing the development of renewable energy in Bangladesh and achieving the country's renewable energy targets.

Virtual Power Purchase Agreement (VPPA): A Virtual Power Purchase Agreement (VPPA) is a multi-year bilateral financial renewable energy agreement between consumers and power producers where the producer (vendor) does not physically deliver the energy to the consumers. The contract does not include dispatch charges because power stations are not directly connected to the customer's power provider, but it still offers the benefit of obtaining Energy Attribute Certificates (EACs). For instance, under the VPPA, the electricity producer sells its electricity at the market price on the power exchange (such as corporate firms, factories etc.). In exchange for a predetermined VPPA contract price known as the strike price, the consumer only receives the EACs (green energy credits) connected with the traded electricity. The real pricing agreement between the consumer and the power producer, however, is based on the difference between the strike price and the wholesale market rate. The power producer pays the consumer the difference when the market rate is higher than the strike price. The consumer pays the difference when the market price is lower. Contracts-for-difference are a type of settlement arrangement. The accompanying green credits are subsequently transferred from the RE generator to its client. This process allows number of businesses globally to meet their renewable energy targets while operating their business.

In Bangladesh the provision of VPPA is missing currently. Although many may argue Bangladesh market is not yet ready to develop VPPA market mechanism but keeping its provision will allow Bangladesh to accelerate to meet 40% electricity generation target from RE sources by 2041. This

arrangement once ready may attract private investors to invest in the energy market to meet their commitment to produce sustainable products. It may also allow a number of industries to transform its 10% to 15% electricity demand from RE sources with relatively lower investment as it don't require any physical land preparation cost at individual level.

c) Economic

Renewable Energy Finance (REF strategy): A REF strategy to be formulated through transparent, long-term national targets and time-bound action plan that would include the sources, amounts and funding tools e.g. grant, FDI, concessional loan, bonds etc. Legislative reforms should be implemented to enact well-designed and harmonized policies. This should include the harmonization of local content and industrial policies and the establishment of an industrial policy for domestic manufacturing. In accordance with the government target to generate 40% of power from RE by 2041 , investment on renewable energy would reduce both the drain out of foreign currency as well as fiscal burden. In the long run, the energy security would also be achieved. International funding should be aligned with the US$2 billion in the MCPP has been planned to be spent for both energy efficiency and renewable energy, 40% of which will be sourced from concessional or derisking tool or grant .

Well-regulated RE market and currency market: Renewable energy financing requires a comprehensive set of de-risking instruments to enable businesses to obtain the necessary capital for projects. To establish a well-regulated energy market, it is important to reform land administration and develop a grid code for new renewable energy technologies. The government should provide support for long term development of liquid domestic FX derivative markets; and streamlined, consistent & facilitated customs procedures along with reduction of customs administrative steps, including possible online functionality; public response timelines; effective and expedited recourse mechanisms should be adopted immediately. Moreover, full cost-benefit economic assessment and benchmarking of tariffs; phase-out/down of punitive tariffs; introduction of import tariff holidays and VAT exemptions

Standard Power Purchase Agreement: There is no standard Power Purchase Agreement (PPA) focused on RE, leading to abrupt decisions, lengthy, complex, and unpredictable selection. The business-as-usual process, ownership complexity, lack of proper land type fixing, and undue intervention of vested interest groups have caused unusual delays in land acquisition and development. There is a lack of oversight and consultation with stakeholders in the planning process. Incentives, such as reduced leasing rates for Khash land, transmission support, and tax rebates on both imports of inputs and corporate incomes, are required for foreign investment, and Build-Own-Operate-Transfer (BOOT) push up costs. Additionally, the qualification criteria for RE project development, such as the requirement of 2 years of operating experience and a lock-in period of 6 years for both lead and operating partners, are inequitable.

Reduce risks of tariff discrimination: To address the tariff related discrimination, to provide a globally standardized capital expenditure cost for renewable energy projects, with a maximum of 10% of the decided cost. A ceiling on area-wise land prices should also be provided to justify project costs. The Bangladesh Regulatory Commission should increase its project limit to 50 MW, and economic zones and ports should allow up to 50 MW without the need for licenses.

Withdrawal of abrupt subsidy and undue incentives to fossil-fuel based energy generators: In accordance with the government target to generate 40% of power from RE by 2041 , investment on renewable energy would reduce both the drain out of foreign currency as well as fiscal burden. In the

long run, the energy security would also be achieved. And divert this funds for mobilizing to RE generators and distributors.

SMART Grid and Supports to RE as incentive: Inadequate grid management practices and a lack of attention to grid flexibility, as well as a failure to organize the right-of-way for transmission infrastructure construction for power evacuation, have also contributed to the problem. A long-term national transmission/grid plan should be developed and SMART Grid and Supports to RE as incentive should be added. The government should also provide support for the long-term development of liquid domestic Foreign Exchange derivative markets Develop a grid code for new renewable energy technologies.

d) Governance and Integrity

Nation-wide Mapping on RE Potential: Since the identification of such land has been made, SREDA with the help of Ministry of Land could map potential areas for renewable energy. Setting up a system like Land Information System (LIS) can massively help with locating appropriate locations for renewable energy projects. It is of the essence to have clear plans when approaching financiers as it will build credibility and minimize risks. There is an absence of evidence-based RE mapping or zoning across the country to identify potential locations for solar and wind energy generation.

Automated approval process: Time-bound E-application of both public and private RE projects should be introduced soon as existing any public or private RE projects is cumbersome and lengthy, with a long list of different permits, leading to higher costs for both capital and operating expenditures.

Designated RE locations and Speedy Land Acquisition: A national dedicated body led by SREDA would be formed for land management of the RE projects. Moreover, a nation-wide mapping on RE potential and designated areas for RE generation should be adopted soon.

Overall political commitment and effective implementation of National Integrity Strategy, the Right to Information Act and Whistleblower Protection Act are key instruments to ensure the transparency, competition and fair treatment of local and foreign investors in the RE investment. A REF strategy is to be formulated soon to access the international finance for public and private investment to meet the upcoming energy and power crises. The current economic crises should be tackled through RE adoption as much as possible. The state authority should prioritize the RE as key sources of power for reducing energy poverty, environmental sustainability and fiscal space.

Risk Areas	**De-risk Mechanism**			
	Policy and Legal	Economic and Commercial	Institution and Technical Capacity	Governance and Integrity
Overall	• Realistic, Reliable and Reform (3R) towards RE Finance in Bangaldesh	• Virtual Power Purchase Agreement (VPPA, multi-year bilateral financial renewable	• **REF strategy to be formulated through** transparent, long-term	

	• Abandon of the Speedy Power Generation and Supply Act 2010 and promote competitive bidding process • Consistent RE targets, such as coherence gaps in the NDCs, MCCP, BCCSAP, RE Policy, IPEMP • Allowing land lease-based loan facilities to RE entrepreneurs	energy agreement between consumers and power producers where the producer (vendor) does not physically deliver the energy to the consumers • **Attractive incentives for investors** e.g. at least 10 years' tax holiday for early-stage RE entrepreneurs, assurance on the provision of non-agriculture khash lands at a given time period, land lease consideration as collateral for financing, proactive development of offshore power grids, SMART Grid etc.	national targets and time-bound action plan that would include the sources, amounts and funding tools e.g. grant, FDI, concessional loan, bonds etc.	
Power Market Risk	▪ Establish transparent, long-term national renewable energy strategy and targets	- Establish a harmonized, well-regulated energy market to address price and market-access risk for renewable energy projects	-Develop and regularly update a long-term national transmission/grid plan to include intermittent renewable energy	
Land Acquisition	Reform of land administration		**Nation-wide Mapping on RE Potential and**	

			designated areas for RE generation	
Permits Risk	-Legislative reform to implement well-designed and harmonized policies		Establish an online one-stop-shop for renewable energy permits with a timeline tracker (**Automated approval process)**	-Ensure transparent and fraudulence free time-bound enforcement mechanism
Social Acceptance Risk			Promote awareness of policymakers and experts about the real potential of RE on nature, economy, public health and productivity	
Hardware Risk			Harmonized approach to local content and industrial policy	
Developer Risk			Programmes to develop competitive, skilled labour market in utility-scale renewable energy (all roles)	
Labour Risk				
Grid/Transmission Risk	Develop a grid code for new renewable energy technologies		**SMART Grid and Supports to RE as incentive**	
Off-taker Credit Risk	Financial products by development banks to assist IPPs to gain access to capital/funding			
Financing Risk	• -Establishing an industrial policy for domestic manufacturing and financial products by development banks to assist domestic manufacturers in gaining access to capital	- Balanced treatment across sectors and reform of fossil fuel subsidy Development banks financing campaigns to raise awareness & community-based projects	-Strengthen domestic investors' incentive for, familiarity with and capacity regarding on-grid rooftop PV and aggregative financing models	

	• **Withdrawal of abrupt subsidy and undue incentives to fossil-fuel based energy generators:**			
Currency Risk	Partial indexing of local currency tariffs in PPAs, so that IPPs are reimbursed for local currency depreciation of tariff	**Project Preparation Facility (PPF)**	-Government support for long term development of liquid domestic FX derivative markets -Streamlined, consistent & facilitated customs procedures -Reduction of customs administrative steps, including possible online functionality; public response timelines; effective and expedited recourse mechanisms -Full cost-benefit economic assessment and benchmarking of tariffs; phase-out/down of punitive tariffs; introduction of import tariff holidays and VAT exemptions	
Sovereign Risk			Provision of political risk insurance to equity holders covering expropriation, political violence, currency restrictions & breach of contract	

Aligning with international standards substantial reduction of over generation capacity as it reached 42.1% in FY 2022 (from 37.4% in FY2021) (Moazzem, Preoty, & Fariha, 2022).

The concept of green banking is something the financial industry in Bangladesh is familiar with, green banks have not emerged yet in this landscape. By definition, green banks use innovative ways to catalyze investments that lead to low-carbon and climate-resilience (OECD, 2016). Neighboring country like India also has green banks that operate with the express purpose of financing sustainable projects. As Bangladesh considers climate change to be a planetary emergency (Prothom Alo, 2019) and is taking drastic measures to fight and cope with climate change, establishing green banks may just be the way to go. The renewable energy financing mechanism in Bangladesh has the potential to be revolutionized by the introduction of green banks and financial institutions; they can provide the push that the private sector needs to make big investments in the industry.

Policies and reports indicate that Bangladesh Bank is not doing enough to work towards the targets set by the government, for example, the plan to generate 40% of electricity from renewable sources by 2041. Massive development of an entire sector is unthinkable without support from the private sector, which in turn depends largely on banks and financial institutions to support their projects through financing instruments. If Bangladesh Bank, as the authority of all banks and financial institutions in Bangladesh, does not encourage investment in renewable energy through incentives, the government will find it difficult to make progress towards this goal.

The National Board of Revenue (NBR) is also similarly falling behind. The 1% customs duty on solar panels and more worryingly, the 37% customs duty on solar inverters have made setting up solar very expensive. The high duty on inverters on are levied as they are categorized as capital machinery and not given any special consideration for being a vital machine needed for production of solar energy (Islam S. , Restoration of full customs duties for inverters hits Bangladeshi solar sector, 2021).

In 2021, the prime minister of India said that India's renewable energy production had gone up by 250% in 7 years (Business Standard, 2021). For the purposes of this study, it may be helpful to look at what changes were made in practice and policy. The table below illustrates the policy differences in Bangladesh and India regarding renewable energy and recommendations based on data collected for this study.

> An energy expert mentioned that he feels as though the policymakers' lack of conviction in their own plans was a major reason behind the lack of success in this sector. Another energy expert, also agreed with him; he said that it is important to implement the existing policies properly before making new ones. An official from bi-lateral funding entity claimed that a lack of technical knowledge among policymakers acts as a barrier to better policymaking.

Overall, the policies of Bangladesh which are related to renewable energy and its financing fall short of the mark. Even though, many of the foundations which are needed for this industry to grow have been mentioned in policies, some of them have not been implemented. Some long-term plans, like the 8th five-year plan, sideline renewable energy. Some commitments, like the NDC, set ambitious targets for it but do not have any action plan or strategy. To make progress in financing renewable energy in Bangladesh, it is crucial to establish clear and actionable strategies. This can include policies such as preparing climate finance strategies, encouraging foreign direct investments and changing regulations to be more supportive towards renewable energy producers as well as encouraging better practices.

Additionally, investments in research and development of renewable energy technologies can be allocated as it can play a key role in driving progress in this area.

The report discusses different types of policies that can be used to direct public funds towards the energy transition. Deployment policies involve investing in government-owned assets or using capital subsidies, grants, and tariff-based mechanisms to attract private investment. Integrating policies focus on infrastructure and assets that support renewable energy integration. Enabling policies involve supporting long-term energy planning, research, and development, as well as technical assistance. Structural change and just transition policies involve redesigning power markets and promoting social inclusion. Additionally, the article notes the importance of international collaboration and macroeconomic policies in delivering public funds towards the energy transition (IRENA and CPI, 2023).

> An ADB working paper on green finance mentions that the asset classes for green investment include venture capital, private equity, stock markets and asset finance for private sector (Azhgaliyeva, Kapsaplyamova, & Low, 2018). It is to be noted that Bangladesh has an opportunity to invest venture capital into the renewable energy sector as there are innovative organizations that require funds. The public market so far has been explored by Beximco through their sukuk bonds but there is a lot of opportunity for companies to sell green shares. Since Bangladesh's renewable energy industry is expanding and is currently in its growth stage, therefore, all the asset classes have prospect.

The United Nations Development Programme (UNDP) has launched a challenge to support the development of innovative finance solutions for small-scale clean energy projects in developing countries.

Cross-countries incentivization for RE promotion

The Ministry of New and Renewable Energy in India released its year-end review for 2022 in December (Press Informatio Bureau, India, 2022). India has installed a total of 172.72 GW of capacity from non-fossil fuel sources as of October 31, 2022, including 119.09 GW of renewable energy (RE), 46.85 GW of large hydro, and 6.78 GW of nuclear power capacity. Non-fossil fuel sources generate 42.26% of the total installed generation capacity in the country, which is 408.71 GW as of October 31, 2022. India stands 4th globally in renewable energy installed capacity, including large hydro, wind power capacity, and solar power capacity. During January to October 2022, 14.21 GW of RE capacity was added, and 151.94 BU were generated from RE sources. The Ministry has also developed a National Portal to simplify the implementation process for residential consumers to apply for rooftop solar. Other initiatives launched in 2022 include the Intra-State GEC Phase-II scheme, the Production Linked Incentive Scheme on 'National Programme on High Efficiency Solar PV Modules', and the National Bioenergy Programme.

> **An innovative approach to green financing that is utilized in India is crowd funding** (Sarang, 2018)**. Philanthropy could be used as a tool to fund renewable energy in a similar way in Bangladesh, perhaps through zakat as mentioned previously.**

The Indian government has launched several schemes to promote solar energy usage in the country. One of the schemes is the "Development of Solar Parks and Ultra Mega Solar Power Projects" aimed at facilitating large-scale grid-connected solar power projects. Another scheme aims to de-dieselize the farming sector and produce solar power to generate additional income for farmers. The scheme includes three components - installation of 10,000 MW of decentralized grid-connected solar power plants,

setting up 2000000 standalone solar-powered agriculture pumps, and solarization of 1500000 existing grid-connected agriculture pumps. The Indian government has also developed a national portal to simplify the implementation process for rooftop solar, and the Phase II of the rooftop solar programme has been extended until March 31, 2026. Additionally, the Off-grid Decentralized and Solar PV Applications Programme Phase III has been implemented to provide solar street lights, solar study lamps, and solar power packs.

The Green Energy Corridor project in India aims to develop renewable power evacuation and reshape the grid for future requirements. Wind energy capacity addition of 1761.28 MW has been achieved during January to October 2022. Furthermore, the Ministry of New and Renewable Energy (MNRE) is working on several bioenergy schemes. Lastly, the MNRE has released a strategy paper on offshore wind energy, aiming to achieve a 30 GW target by 2030.

India has set ambitious renewable energy targets, with a goal of achieving 450 GW of renewable energy capacity by 2030. The government is promoting renewable energy and investment in it through a mix of policies, incentives, and financing mechanisms, including tax breaks, subsidies, and loans. Private sector investment is playing a critical role in the growth of renewable energy in India, with companies such as Tata Power and Adani leading the way. To enhance renewable energy financing in India, the government is working on improving the financing ecosystem, by setting up dedicated financing institutions, simplifying lending processes, and creating innovative financing models. For example, the government has recently launched a $2 billion Green Growth Equity Fund to provide equity financing for renewable energy projects, and has also introduced the KUSUM scheme to promote the installation of solar pumps and grid-connected solar power plants. These efforts are likely to attract more private investment into renewable energy and help India achieve its ambitious renewable energy targets.

The National Bureau of Asian Research published an article in 2022 titled "Vietnam's Renewable Energy Policies and Opportunities for the Private Sector," which outlines the country's renewable energy policies and the opportunities available for private sector investment in the sector. Vietnam is promoting a more diversified, transparent, and digitalized buying-selling mechanism in the electricity market, and is targeting foreign investors to participate. The country is developing the Direct Power Purchase Agreement (DPPA) mechanism to create fairer competition in the retail electricity market, contributing to the sustainable development of renewable energy sources. The DPPA pilot program will be implemented nationwide from 2021 to 2023 on a small scale of 1,000 MW in total and only aims at projects approved in the revised PDP7.

A Direct Power Purchase Agreement (DPPA) is a specific type of PPA that allows private renewable energy generators to sell clean electricity directly to private buyers through a contract for difference (CfD) or virtual PPA arrangement, bypassing the traditional utility or grid operator as an intermediary.

> **Under the scheme, the generator and Electricity Vietnam (EVN) will enter into a PPA pursuant to which EVN will purchase from the generator physical electricity at the wholesale spot price. The off-taker will purchase physical electricity from EVN at the retail spot price. The off-taker and generator will enter into a CfD/virtual PPA mainly for the purposes of documenting a pre-agreed electricity purchase price. The Ministry of Industry and Trade (MOIT) of Vietnam has released several draft legislative instruments since 2020, with the DPPA pilot scheme expected to commence in Q1 2023.**

As per a paper on innovative finance by Deloitte (Deloitte, 2017), increased investment in clean energy is necessary to achieve climate goals but traditional financing methods may not be sufficient to meet this need. Blended finance structures can attract private sector investment to clean energy projects and it can also reduce risks for investors. Development impact bonds (DIBs) can provide a new model for financing RE energy projects as it can align investor incentives with development outcomes. In DIBs, private investors provide upfront capital to implement a program aimed at achieving specific social outcomes. The program is managed by a service provider and supported by an outcome funder, which may be a philanthropic organization, a development agency, or a government. If the program achieves its predetermined social outcomes, the outcome funder pays the investors a return on their investment, which is typically higher than what they would receive from traditional aid or philanthropic grants. However, if the program fails to achieve the desired outcomes, the investors may lose some or all of their investment. DIBs are seen as a way to align incentives, promote innovation, and increase accountability in development programs. Innovative financing mechanisms such as these can help to address the financing gap for renewable energy projects.

An article by Ashurst in collaboration with International Comparative Legal Guides discusses the legal framework and regulations for renewable energy in Indonesia in 2022 (Ashurst; International Comparative Legal Guides, 2021). The Indonesian government has implemented a number of policies and initiatives to encourage investment in renewable energy, including feed-in tariffs, tax incentives, and a renewable energy fund. The article also highlights the key legal considerations for investors looking to participate in Indonesia's renewable energy sector, including licensing and permit requirements, land acquisition, and environmental regulations. The article emphasizes that while there are opportunities for investment in the Indonesian renewable energy sector, there are also legal and regulatory challenges that must be carefully navigated by investors. The main learning for Bangladesh is to move towards creating a dedicated renewable energy fund as it will be essential for growth of this sector.

Renewable energy financing in Bangladesh through private entities is gradually increasing due to the growing demand for clean energy and the government's favorable policies. The frontrunners are the enterprises who at least partially fund their own projects, as per primary research conducted for this study. However, private entities such as banks and non-banking financial institutions (NBFIs) are not as active in the field as would be desirable. According to an academician and energy expert, such institutions are uninterested in investing in renewable energy projects as the return is low and payout time is long. If they were to invest in a fossil fuel based plant they would face much lower market risk as the power purchase agreement is protected by capacity payment too. A deputy director of renewable energy program of an organization that implements such projects mentioned that commercial banks do not seem interested as they perceive renewables as not being as lucrative as other investments. They do not want to invest sometimes if it is a relatively unknown company but they should give a chance to such enterprises. An expert said that innovations in finance can help cut down on transaction costs in case of small loans.

Multilateral development banks (MDBs) play an important role in financing renewable energy projects in developing countries. MDBs provide financial and technical assistance to developing countries for the purpose of economic development. Some of the main MDBs involved in renewable energy financing in Bangladesh include:

A MDB representative and a key informant for this study, said that their usual mechanism for renewable energy is to invest up to USD 200 million when requested by the government. They are also open to working with the private sector but the enterprises have to meet their strict criteria including sufficient

bankability, environmental effects etc. She said that despite the positive attitude, progress is being hindered. “Effort needs to be concerted, not sporadic”, she explained. She elaborated, “Policymakers need to accept the diagnosis before forming a treatment plan.” As per the study’s key informant interviews with government officials, most of them think that the sector is doing well enough and there is often not enough initiative from even the ones in charge of renewable energy to identify and solve the problems. She emphasized the importance of trials and pilot projects to fully understand the practical implications of implementing renewable energy projects.
ADB’s energy specialist does not think it is possible to make a quick shift to renewables as there are old investments in gas that will still take years to recover costs and it is simply not practical to phase it out now. The volatility of the power market is a cause of concern, she also mentioned. Solar irrigation pumps have a lot of potential according to her and it is important to invest in them. Some steps that she suggested to be taken are to set short-term RE goals and provide incentives to solar power plants which would act like capacity charge, to level the playing field. IDCOL, which acts as an intermediary, has become more a hindrance than a facilitating agent. It is concerning that the institutions that fund projects through IDCOL, no longer think of it as a good liaison.

A MDB representative, who previously worked with the central bank and financial institutions, thinks that “Bangladesh Bank is one of the best central banks in the world in terms of sustainable policy. And specific targets like 5% of the portfolio being mandated for green finance and 20% for sustainable finance are good targets. She identified inaccuracies in reporting, though, and the central bank’s representative concurred. B are willing to give better terms and conditions as well as support for compliant and green industries, as exemplified by RMG industries, but somehow due to some problems in the system this is not being properly reflected in the processes or it is not having the intended effect of working as the incentive that it is. Energy efficiency can be calculated easily which makes it easy to implement but more technical knowledge is needed to predict renewable energy impact accurately. The barrier with renewable energy is that it has a high initial cost and the return cannot be calculated as reliably. Which is why banks need training and understanding; this must be mandated.

As a solution, she suggested an approach that has worked with a few projects. The MDB acted as an energy auditor. Banks agreed to provide the loan at 4% interest rate, 20% of the entire finance was to be through grants, and the MDB had signed off as an energy auditor with financial forecasts about how much was to be invested. This model may work for renewable energy. “Banks cannot provide a financial product and expect that to be the be-all and end-all of renewable energy financing”, she said, “the project has to include service providers and organizations that will vouch for how much investment is required and what return can be expected.” She made a point that “Bangladesh Bank did as well. The renewable energy investments are not being captured in reporting because people have little idea about what renewables exactly entail. If you specifically ask them if they have financed solar rooftop projects, they will say yes but if you ask if they have invested in renewable energy, they will seem unsure. However, the situation is improving and some banks are definitely focusing on the needed training. It needs to become the norm.” She feels that the regulator has done its part, banks have to comply and that enterprises are ahead of the game. Renewable energy has a booming market right now according to her entrepreneurs are organically entering the market. “Banks have to take more initiative to finance renewables; they cannot take a passive approach”, she insisted. She feels that renewable energy financing opportunities can open by marketing it right.

Several entrepreneurs among the key informants raised the issue of banks being incompetent when it came to renewable energy projects. Since there is no technical support and not enough knowledge dissemination among the customer service staff, banks often seem either disinterested or ignorant about

such investments. Even though, Bangladesh Bank has mandated Sustainable Finance Desks in banks to act as a focal point for inquiries like this, many banks still do not have any or enough such desks.

MDBs hinted at starting up discussions with the Bangladesh Securities and Exchange Commission (BSEC) regarding introducing labeled bonds in the Bangladesh market. These are bonds that have specific environmental, social or governance (ESG) and sustainability objectives. Green bonds as well as blue bonds are labeled bonds. According to them, regulatory authorities will in the coming years become stringent about reporting; this is necessary as it de-risks the possibility of green-washing. Transparency will become essential and monitoring will have to be strict as well. "As long you are unable to show that Bangladesh is taking matters of climate finance and renewable energy seriously, it will keep affecting Bangladesh's image.", Ms. Raihana stated. Encouraging investment from MDBs as well as other foreign and national and both private and public financiers involves having a concrete plan for the projects. This is why a Project Preparation Facility can be advantageous.

Finally, domestic investors' incentives for on-grid rooftop PV and aggregative financing models should be strengthened. An independent energy market regulator should be established to ensure fair market practices. In the case of illegally occupied land, the forest department can withdraw legal steps if the entity agrees to build a solar park and receives remuneration, with carbon pricing paid.

In conclusion, the way forward for renewable energy financing requires a multi-faceted approach that includes comprehensive de-risking instruments, an enabling environment, and government support. By implementing these measures, renewable energy projects can attract the necessary financing and accelerate the shift towards a sustainable and low-carbon energy future.

Risk categories & subcategories included in the study survey	Bangladesh's Policy	India's Policy
Power Market Risk -*Risk arising from suboptimal regulations*	Speedy Supply of Power and Energy (Special Provision) which trumps other laws and enables fast and largely unsupervised growth of fossil fuel sources (Quick Enhancement of Electricity and Energy Supply , 2010)	No such act to enable fossil-fuel production.
Permits Risk[15]	Lack of transparent process when applying for project approval and no coordination between the different public entities that lead to time lags[16]	E-application portals are available on the website of Ministry for Renewable Energy. There is also a public grievance application to address any issues (Government of India).
Social Acceptance Risk	SREDA holds awareness seminars to mitigate this risk (Khan D. Z., 2020).	National Solar Energy Federation of India (NSEFI) in India conducted a national campaign where they reached out to cities and communities within them to encourage using solar energy.

[15] Risk arising from the public sector's inability to efficiently and transparently administer renewable energy- related licensing and permits, including land acquisition
[16] Insight from several key informant interviews for this study

Risk categories & subcategories included in the study survey	Bangladesh's Policy	India's Policy
		Energy literacy campaigns have been carried out (Times of India, 2022).
Developer Risk *-Government support to grow early-stage industry*	Only government-owned electric utilities (Power Division, MPEMR, 2019) are allowed to purchase electricity. No exceptions for green power.	Commercial and Industrial consumers can buy green power from the grid if they want. Captive Consumers may avail green energy under Green Open Access (PIB Delhi, 2022). Renewable Purchase Obligations (Ministry of New and Renewable Energy, India),which make it necessary for distribution companies to buy a specified percentage of renewable energy, are in place to ensure the growth of the sector
Hardware Risk[17]	1% custom duty on solar panels. Up to 37% tax on solar inverters (Abdullah, 2022). Quality assurance is currently sub-par as per the entrepreneurs who participated in this study.	25% custom duty on solar cells and 40% on imported modules.
Labour Risk *-Risks arising from the lack of skilled and qualified potential employees*	Key informants for this study have mentioned that there is a lack of technically skilled people in the industry. SREDA has training programs related to renewable energy (SREDA, 2021). but there have not been any new listings since 2018.	India has trainings hosted by the MNRE that are conducted by universities (IITR, 2020) and they have fellowships and programs assigned for renewable energy human resource development (Ministry of New and Renewable Energy, 2021).
Developer Risk *-Risks arising from limitations in the IPP's management capability and ability to execute on financing and business plan*	According to the key informants from power authorities, IPPs do not conduct sufficient resource assessment and do not present bankable documents in many cases. They also lack the technical knowledge for implementation of such projects.	India has a competitive bidding process (Ministry of New and Renewable Energy, 2020) which ensures that the best IPP is chosen; this mechanism does not exist in case of unsolicited projects in Bangladesh. Energy risk management and insurance programs exist to accommodate and compensate for such risks (Aon).
Grid/Transmission Risk *-Risks arising from*	Dependent on national grid (Asian Development Bank), especially after 100% electrification goal that	Transmission access is allowed through open-access system (Uttar Pradesh Power Transmission

[17] *Risk arising from limitations in the quality and availability of utility-scale hardware; issues arising from inefficiencies in the customs process*

Risk categories & subcategories included in the study survey	Bangladesh's Policy	India's Policy
limitations in grid management and transmission infrastructure	saw Solar Home Systems being replaced by on-grid electricity. Bangladesh Power Development Board is the single buyer of all generated power (Hossain M. , 2018)	Corporation Limited, India, 2010), without an intermediary.
Off-taker Credit Risk *-Risks arising from the off-taker's poor credit quality and an IPP's reliance on payments*	The off-taker in case of Bangladesh is Bangladesh government's Electricity Generation Company and North-West Power Generation Company Limited etc. Problems may arise as IPPs have to sell at the tariff set by the single-buyer. "You will buy at their set tariff which is higher than the tariff they buy your power with", a key informant mentioned.	According to a 2017 Stanford paper, India faces issues like up to 24 months of delay in paying IPPs and other inefficiencies. (Shrimali & Reicher, 2017)
Financing Risk *-Risks arising from general scarcity of investor capital (debt and equity) in the particular country, and investors' lack of information and track record in utility-scale renewable energy*	As per figure [Renewable finance as a percentage of total green finance by banks and FIs], banks and financial institutions invest a very small percentage of their total green on renewable energy. Several key informants from this study have pointed out that this is because bankers do not have a very good idea about renewable energy and such power plants. A 2019 journal article in Asia-Pacific Financial Markets on the correlation between foreign direct investment (FDI) and Renewable Energy Output ran regression and causality analysis and found that in the long run renewable energy output goes up; therefore, it is also important to incentivize foreign investment into the industry. (Murshed, Elheddad, Ahmed, Bassim, & Than, 2022)	The Indian MNRE has a bankers' module which is defined as training module for bankers and financing institutions (Ministry of New and Renewable Energy, India)
Currency Risk *-Risks arising from currency mismatch between hard currency debt/equity*	Bangladesh's foreign reserve and currency crisis has led to rising costs for entrepreneurs. A key informant who is a manager in a renewable company in Bangladesh	The appreciation of the US dollar has caused instability all over the world but the India rupee, in comparison with other currencies, has remained relatively stable (Times of India,

Risk categories & subcategories included in the study survey	Bangladesh's Policy	India's Policy
and domestic currency revenues	said that the prices of some imported equipment doubled within 2021 and 2022.	2022).
Sovereign Risk *-Risk arising from a mix of cross-cutting political, economic, institutional and social characteristics in the particular country which are not specific to utility-scale renewable energy*	Laws, regulations and practices such as the one providing subsidy to fossil fuel create an uneven playing field for renewables. Moreover, political instability can cause unpredictable market fluctuations. The foreign reserve crisis has become an issue as most of the equipment used in renewable projects are imported.	One key component of India's renewable energy policy is the National Solar Mission, which was launched in 2010. The mission aims to increase the share of solar power in India's energy mix and to make solar power more affordable and accessible. The mission has set a target of installing 100 GW of solar power capacity by 2022. National Biofuels Policy and the National Wind Energy Mission provide financial incentives, such as subsidies and tax breaks, to encourage the development of renewable energy projects.

The excessive dependency on fossil-fuel-based power generation has led to a significant fiscal burden for the BPDB, including massive subsidies in fuel imports and capacity charges to private power companies. The planning has been guided by the financial costs and benefits of fossil fuel-based energy rather than social costs and economic benefits of RE. Bangladesh incurs higher generation costs, including unauthorized payments. The country lacks local low-cost capital or investment, and the import duties on solar PV panels and inverters are 27% and 38%, respectively, apart from Independent Power Producers.

a) Policy and Legal

Abandon of the Speedy Power Generation and Supply Act 2010: This Act have distorted the competitive selection process, and purchasing cost-effective power from the private sector, especially from reputed foreign RE companies, has become difficult. The Speedy Supply of Power and Energy (Special Provision) (Amendment) Act 2010 should be abolished for opening the scope of the competitive bidding process for RE investors especially for attracting the FDI of the energy sector in Bangladesh. Only allow competitive bidding-based Power Purchase Agreement (PPA).

Consistent RE targets: There is inconsistency in setting RE targets, such as coherence gaps in the Nationally Determined Contributions and the Bangladesh Climate Change Strategy and Action Plan. Vested interest groups have intervened unnecessarily to approve the draft RE Roadmap. There are potential conflicts of interest in BPDB's roles as planner, operator, and generator, which has left the Sustainable and Renewable Energy Development Authority less empowered.

Attractive incentives for investors: To promote the growth of early-stage industries, government support is necessary. One such support mechanism is the establishment of research and development centers to drive innovation and competitiveness. Additionally, development banks should initiate

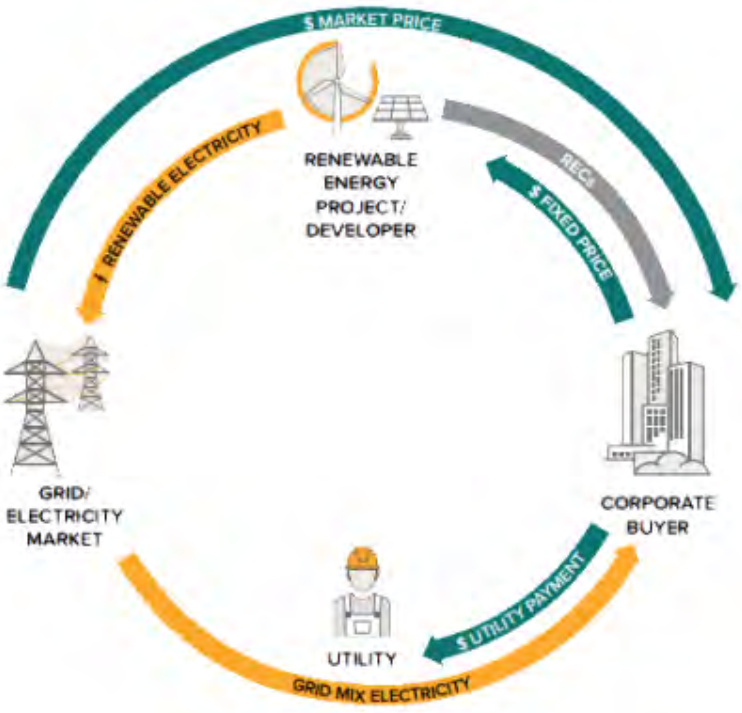
financing campaigns to raise awareness of renewable energy and support community-based projects. Since the government plans to create 100 economic zones (Mavis, 2021), a significant progress can be made even if only 20% of the power is mandated to be from renewable energy sources. SREDA should have a one-stop service that will receive applications, show progress of applications and provide project information. This will ensure a transparent process and ensure timely response from the authorities.

Allowing land lease-based RE entrepreneurs: To attract investment, an enabling environment is essential. For companies with leases instead of ownership, the government should allow them to carry out power plant projects. In such cases, the Power Purchase Agreement (PPA) acts as a guarantee, and the value of electricity should be used as a basis for providing loans from financial institutions. To minimize risk, international insurance mechanisms should be established, with premiums provided by business institutions.

REF strategy: Establish a transparent, long-term national renewable energy strategy and targets to guide investment decisions. Legislative reforms should be implemented to enact well-designed and harmonized policies. This should include the harmonization of local content and industrial policies and the establishment of an industrial policy for domestic manufacturing. In accordance with the government target to generate 40% of power from RE by 2041 (Chowdhury, National Solar Energy Roadmap Draft, 2020), investment on renewable energy would reduce both the drain out of foreign currency as well as fiscal burden. In the long run, the energy security would also be achieved (Ahmed S. R., 2022). International funding should be aligned with the US$2 billion in the MCPP has been planned to be spent for both energy efficiency and renewable energy, 40% of which will be sourced from concessional or derisking tool or grant (Mujib Climate Prosperity Plan Decade 2030, 2021).

Virtual Power Purchase Agreement (VPPA): A Virtual Power Purchase Agreement (VPPA) is a multi-year bilateral financial renewable energy agreement between consumers and power producers where the producer (vendor) does not physically deliver the energy to the consumers. The contract does not include dispatch charges because power stations are not directly connected to the customer's power provider, but it still offers the benefit of obtaining Energy Attribute Certificates (EACs). For instance, under the VPPA, the electricity producer sells its electricity at the market price on the power exchange (such as corporate firms, factories etc.). In exchange for a predetermined VPPA contract price known as the strike price, the consumer only receives the EACs (green energy credits) connected with the traded electricity. The real pricing agreement between the consumer and the power producer, however, is based on the difference between the strike price and the wholesale market rate (Figure 30). The power producer pays the consumer the difference when the market rate is higher than the strike price. The consumer pays the difference when the market price is lower. Contracts-for-difference are a type of settlement arrangement. The accompanying green credits are subsequently transferred from the RE generator to its client. This process allows number of businesses globally to meet their renewable energy targets while operating their business.

Figure 30: Complete Picture of VPPA Mechanism



Power purchase agreements, in which electricity producers sell their production to energy utilities or corporate end users for a set time, were launched by more than 137 firms in 32 different countries in 2021. According to the research company BloombergNEF, companies bought 31.1 GW of renewable energy through long-term contracts in the same year. Initiators of the movement are American IT firms. Following its commitment to run its operations entirely on renewable energy by 2030 and achieve zero carbon emissions by 2040, Amazon, for instance, has inked power purchase agreements with 44 renewable energy projects in nine different countries, with a combined capacity of 6.2 GW in 2021 alone.

In Bangladesh the provision of VPPA is missing currently. Although many may argue Bangladesh market is not yet ready to develop VPPA market mechanism but keeping its provision will allow Bangladesh to accelerate to meet 40% electricity generation target from RE sources by 2041. This arrangement once ready may attract private investors to invest in the energy market to meet their commitment to produce sustainable products. It may also allow a number of industries to transform its 10% to 15% electricity demand from RE sources with relatively lower investment as it don't require any physical land preparation cost at individual level.

b) Institutional and Technical Capacity

Realistic, Reliable and Reform (3R) towards RE Finance: The power sector master plan and policy of Bangladesh have been prepared entirely by foreign experts, leaving room for vested interests to undermine the promotion of renewable energy (RE). The planning has been ad hoc and not focused on realistic and environmental sustainability in power generation. The Bangladesh Power Development Board (BPDB), Power Grid Company of Bangladesh (PGCB), and utilities have inadequate resources (both financial and human) to provide technical support for climate-proof investment, especially in the cyclone-prone coastal region. Finally, the country has failed to adopt different tariff mechanisms, such as feed-in-tariff and auction prices, and the capacity of Load Dispatch Center is inadequate, leading to grid outages at the 33 kV level.

Project Preparation Facility (PPF) is a time-bound facility that provides support to renewable energy projects in the early stages of development, typically through the preparation of project documents, technical and financial assessments, and other activities that are necessary to make the projects bankable and ready for financing. Bangladesh needs a PPF for renewable energy projects for several reasons: lack of technical expertise, access to financing, encouraging private sector investment, time-bound nature. Overall, the PPF is a critical tool for advancing the development of renewable energy in Bangladesh and achieving the country's renewable energy targets.

c) Economic

Promoting sustainable finance for RE: Enhance accountability and transparency (Government should have invested heavily in renewable energy sources, 2022) in green or renewable energy related finance by both IDCOL and Bangladesh. Establishment of dedicated Renewable Energy Finance Trust/Council, structure of the Aranyak Foundation (Arannyak Foundation) that included both DPs and local officials, could be adapted. Proper identification for green prioritized projects on renewable energy. Following recent G7 offer for Indonesia and Vietnam (Energy Voice, 2022). Bangladesh should adopt the time-bound, specific steps for phase-out of coal-based power generations. Bangladesh Bank should withdraw the circular for favoring financing for coal-based power plants.

Well-regulated RE market: Renewable energy financing requires a comprehensive set of de-risking instruments to enable businesses to obtain the necessary capital for projects. To establish a well-regulated energy market, it is important to reform land administration and develop a grid code for new renewable energy technologies.

Reduce risks of tariff discrimination: To address the tariff related discrimination, to provide a globally standardized capital expenditure cost for renewable energy projects, with a maximum of 10% of the decided cost. A ceiling on area-wise land prices should also be provided to justify project costs. The Bangladesh Regulatory Commission should increase its project limit to 50 MW, and economic zones and ports should allow up to 50 MW without the need for licenses.

Withdrawal of abrupt subsidy and undue incentives to fossil-fuel based energy generators: In accordance with the government target to generate 40% of power from RE by 2041 (Chowdhury, National Solar Energy Roadmap Draft, 2020), investment on renewable energy would reduce both the drain out of foreign currency as well as fiscal burden. In the long run, the energy security would also be achieved.[18] And divert this funds for mobilizing to RE generators and distributors.

SMART Grid and Supports to RE as incentive: Inadequate grid management practices and a lack of attention to grid flexibility, as well as a failure to organize the right-of-way for transmission infrastructure construction for power evacuation, have also contributed to the problem. A long-term national transmission/grid plan should be developed and regularly updated to include intermittent renewable energy. The government should also provide support for the long-term development of liquid domestic Foreign Exchange derivative markets.

d) Governance and Integrity

Nation-wide Mapping on RE Potential: Since the identification of such land has been made, SREDA with the help of Ministry of Land could map potential areas for renewable energy. Setting up a system like Land Information System (LIS) can massively help with locating appropriate locations for renewable energy projects. It is of the essence to have clear plans when approaching financiers as it will

[18] https://cpd.org.bd/government-should-have-invested-heavily-in-renewable-energy-sources/

build credibility and minimize risks. There is an absence of evidence-based RE mapping or zoning across the country to identify potential locations for solar and wind energy generation.

Automated approval process: Existing any public or private RE projects is cumbersome and lengthy, with a long list of different permits, leading to higher costs for both capital and operating expenditures.

Standard Power Purchase Agreement: There is no standard Power Purchase Agreement (PPA) focused on RE, leading to abrupt decisions, lengthy, complex, and unpredictable selection. The business-as-usual process, ownership complexity, lack of proper land type fixing, and undue intervention of vested interest groups have caused unusual delays in land acquisition and development. There is a lack of oversight and consultation with stakeholders in the planning process. Incentives, such as reduced leasing rates for Khash land, transmission support, and tax rebates on both imports of inputs and corporate incomes, are required for foreign investment, and Build-Own-Operate-Transfer (BOOT) push up costs. Additionally, the qualification criteria for RE project development, such as the requirement of 2 years of operating experience and a lock-in period of 6 years for both lead and operating partners, are inequitable.

Overall political commitment and effective implementation of National Integrity Strategy, the Right to Information Act and Whistleblower Protection Act are key instruments to ensure the transparency, competition and fair treatment of local and foreign investors in the RE investment. A REF strategy should be formulated soon to access the international finance for public and private investment to meet the upcoming energy and power crises. The current economic crises should be tackled through RE adoption as much as possible. The state authority should prioritize the RE as key sources of power for reducing energy poverty, environmental sustainability and fiscal space.

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Annex

1. Data collected from Bangladesh Bank Sustainable Finance Quarterly Report (https://www.bb.org.bd/en/index.php/publication/publictn/2/39)

Quarter	Banks' total RE Financing Amount (in BDT Millions)	Bank and FIs' Total Green Finance Amount (in BDT Millions)
Jan-March 2013	1002.36	70,326.45
April-June 2013	452.77	86,848.83
July-Sept 2013	611.76	84,978.55
Oct-Dec 2013	416.33	84,978.55
Jan-March 2014	1528.57	78,693.82
April-June 2014	214	112,570.85
July-Sept 2014	2,136.49	110,357.75
Oct-Dec 2014	2,380.67	148,904.57
Jan-March 2015	2,644.77	86,861.60
April-June 2015	1,995.69	119,763.94
July-Sept 2015	1,690.87	104,233.36
Oct-Dec 2015	1,759.33	129,331.82
Jan-March 2016	972.03	126,445.26
April-June 2016	911.48	143,210.88
July-Sept 2016	1,272.81	112,318.00
Oct-Dec 2016	1,442.81	140,829.92
Jan-March 2017	903.97	135,618.28
April-June 2017	824.18	159,850.12
July-Sept 2017	654.76	139,475.02
Oct-Dec 2017	354.88	173,801.77
Jan-March 2018	458.04	24,092.40
Apr-June 2018	1,887.95	26,237.75
Jul-Sept 2018	674.35	25,819.91
Oct-Dec 2018	616.23	23,720.61
Jan-March 2019	1,054.57	30,493.61
April-June 2019	1097.26	25218.78
July-Sept 2019	701.4	20249.95
October-December, 2019	859.51	35,125.46
January-March, 2020	1,712.12	30,511.91
April-June, 2020	273.16	27,766.50
July-September, 2020	345.06	24,031.06
October-December, 2020	1,339.48	39,015.65
Jan-March 2021	2,008.88	19,865.82

April-June 2021	249.76	17,880.98
July-Sept 2021	397.61	15,963.80
Oct-Dec 2021	1,683.31	19,684.73
Jan-March 2022	1856.75	20,985.69
April-June 2022	66.06	26,710.12
Total	41452.03	2,802,774.07
Renewable energy financing as a Percentage of Green Finance:	41452.03/2802774.07*100	=1.478964375%

Conversion into dollars: 395.13318557 millions

2. Data collected from Bangladesh Bank Sustainable Finance Quarterly Report (https://www.bb.org.bd/en/index.php/publication/publictn/2/39)

Quarter	Renewable energy financing as a Percentage of Green Finance
Jan-March 2013	1.43%
April-June 2013	0.52%
July-Sept 2013	0.72%
Oct-Dec 2013	0.49%
Jan-March 2014	1.94%
April-June 2014	0.19%
July-Sept 2014	1.94%
Oct-Dec 2014	1.60%
Jan-March 2015	3.04%
April-June 2015	1.67%
July-Sept 2015	1.62%
Oct-Dec 2015	1.36%
Jan-March 2016	0.77%
April-June 2016	0.64%
July-Sept 2016	1.13%
Oct-Dec 2016	1.02%
Jan-March 2017	0.67%
April-June 2017	0.52%
July-Sept 2017	0.47%
Oct-Dec 2017	0.20%
Jan-March 2018	1.90%
Apr-June 2018	7.20%
Jul-Sept 2018	2.61%
Oct-Dec 2018	2.60%
Jan-March 2019	3.46%
April-June 2019	4.35%
July-Sept 2019	3.46%

October-December, 2019	2.45%
January-March, 2020	5.61%
April-June, 2020	0.98%
July-September, 2020	1.44%
October-December, 2020	3.43%
Jan-March 2021	10.11%
April-June 2021	1.40%
July-Sept 2021	2.49%
Oct-Dec 2021	8.55%
Jan-March 2022	8.85%
April-June 2022	0.25%

3. Financial Cost of Adopting Renewable Energy:

Detailed Calculation:

For the cumulative cost, we start with the initial cost of $1.5 billion in 2025 and then add the annual cost for each subsequent year up to 2041. The annual cost is calculated using the following equation:

Annual Cost = (Renewable Energy Capacity x Capacity Charge) + (Fossil Fuel Import Reduction x Import Cost) + (Environmental and Health Damage Reduction x Social Cost of Carbon)

Using the assumptions provided earlier, we can calculate the annual cost for each year from 2025 to 2041. For example, in 2025, the annual cost is:

Annual Cost = (2 GW x $50/kW/yr) + ($1.5 billion x 0.02) + (2 million metric tons x $125/metric ton) = $0.1 billion

We can then calculate the cumulative cost for each year by adding the annual cost for that year to the cumulative cost from the previous year. For example, the cumulative cost in 2026 is:

Cumulative Cost (2026) = Cumulative Cost (2025) + Annual Cost (2026) = -$1.5 billion + (-$1.3 billion) = -$2.8 billion

The same process is repeated for each year up to 2041, resulting in the cumulative cost values shown in the table.

For the cumulative benefit, we start with zero benefit in 2025 and then add the annual benefit for each subsequent year up to 2041. The annual benefit is calculated as:

Annual Benefit = Renewable Energy Generation x Electricity Price x (1 - Fossil Fuel Generation Share)

Using the assumptions provided earlier, we can calculate the annual benefit for each year from 2025 to 2041. For example, in 2026, the annual benefit is:

Annual Benefit = 8.4 TWh x $0.10/kWh x (1 - 0.98) = $0.2 billion

We can then calculate the cumulative benefit for each year by adding the annual benefit for that year to the cumulative benefit from the previous year. For example, the cumulative benefit in 2026 is:

Cumulative Benefit (2026) = Cumulative Benefit (2025) + Annual Benefit (2026) = $0 + $0.2 billion = $0.2 billion

The same process is repeated for each year up to 2041, resulting in the cumulative benefit values shown in the table.

Time Period	Cumulative Cost (in billions of USD)	Cumulative Benefit (in billions of USD)	Net Benefit (in billions of USD)
2025	-1.5	0	-1.5
2026	-2.8	0.2	-2.6
2027	-4.0	0.3	-3.7
2028	-5.1	0.4	-4.7
2029	-6.2	0.6	-5.6
2030	-6.8	0.9	-5.9
2031	-8.1	1.6	-6.5
2032	-9.5	2.6	-6.9
2033	-11.0	3.9	-7.1
2034	-12.5	5.3	-7.2
2035	-14.8	5.6	-9.2
2036	-19.3	7.9	-11.4
2037	-24.6	10.8	-13.8
2038	-30.8	14.5	-16.3
2039	-37.9	19.1	-18.8
2040	-45.8	24.6	-21.2
2041	-33.7	13.8	-19.9

The table shows the cumulative cost and benefit of the transition to renewable energy in Bangladesh from 2025 to 2041. The net benefit column shows the difference between the cumulative benefit and cumulative cost.

The cumulative cost initially starts out negative, indicating that the benefits are not yet sufficient to outweigh the initial costs. However, as the adoption of renewable energy increases, the cumulative benefit begins to exceed the cumulative cost, leading to a positive net benefit of around $13.8 billion in 2041.

4. *Table 5: Index Value by De-risking Instruments and by types of RE Enterprise*

De-risking Instruments	PV Assembly & Manufacturing	Power Plant	All
Establish an on-line one-stop-shop for renewable energy permits with a timeline tracker	0.77	0.67	0.71
Streamlined, consistent & facilitated customs procedures	0.75*	0.61	0.67
Government support to grow early-stage industry	0.69	0.63	0.65
Ensure transparent and fraudulence free time-bound enforcement mechanism	0.65	0.58	0.61
Reduction of customs administrative steps, including possible online functionality; public response timelines; effective and expedited recourse mechanisms	0.69*	0.56	0.61
Full cost-benefit economic assessment and benchmarking of tariffs; phase-out/down of punitive tariffs; introduction of import tariff holidays and VAT exemptions	0.69*	0.53	0.59
Balanced treatment across sectors and reform of fossil fuel subsidy	0.65	0.56	0.59
Setting up research and development centers	0.63	0.56	0.58
Reform of fossil fuel subsidy	0.63	0.50	0.55
Development banks financing campaigns to raise awareness & community-based projects	0.54	0.56	0.55
Programmes to develop competitive, skilled labour market in utility-scale renewable energy (all roles)	0.50	0.56	0.53
Establish transparent, long-term national renewable energy strategy and targets	0.56	0.49	0.52
Legislative reform to implement well-designed and harmonized policies	0.56	0.49	0.52
Setting up research and development centers	0.56	0.49	0.52
Financial products by development banks to assist IPPs to gain access to capital/funding	0.56	0.49	0.52
Establish a harmonized, well-regulated energy market to address price and market-access risk for renewable energy projects	0.58*	0.47	0.52
Establishing an industrial policy for domestic manufacturing and financial products by development banks to assist domestic manufacturers in gaining access to capital	0.54	0.49	0.51
Harmonized approach to local content and industrial policy	0.48	0.53	0.51

De-risking Instruments	PV Assembly & Manufacturing	Power Plant	All
Strengthen domestic investors' incentive for, familiarity with and capacity regarding on-grid rooftop PV and aggregative financing models	0.48	0.51	0.50
Establish an independent energy market regulator	0.44	0.51	0.48
Reform of land administration	0.48	0.49	0.48
Partial indexing of local currency tariffs in PPAs, so that IPPs are reimbursed for local currency depreciation of tariff	0.40	0.53*	0.48
Develop a grid code for new renewable energy technologies	0.50	0.42	0.45
Develop and regularly update a long-term national transmission/grid plan to include intermittent renewable energy	0.48	0.43	0.45
Government support for long term development of liquid domestic FX derivative markets	0.35	0.50**	0.44
Provision of political risk insurance to equity holders covering expropriation, political violence, currency restrictions & breach of contract	0.31	0.50**	0.43

Source: Author's Calculation from Change Initiative Renewable Energy Enterprise Survey, 2022; P-value: significance ** at 1%; *at 5%[19]

Methodology of Empirical Model

To determine the investment required to increase installed power generation capacity from renewable energy sources, an OLS regression analysis is conducted. The 'change in installed capacity of electricity from RE sources' is the dependent variable, and the 'change in investment on clean energy.

The relevant information is compiled from the Climatescope database, which was created by Bloomberg New Energy Finance (NEF) and keeps track of installed capacity and investment data for renewable energy for 136 nations from 2015 to 2020. The dataset also includes data on the installed power generation capacity by country as of 2014. The aforementioned dataset also contains disaggregated statistics on installed power generation capacity by various RE sources.

In addition, the WDI database is used to generate a number of additional independent variables for the regression analysis (World Bank, 2022). The OLS model's broad expression:

$$\Delta IC_{RE\ (t-(t-5))} = f(\Delta I_{CE(t-(t-5)}, \frac{RE_S}{RE_t}, \frac{RE_w}{RE_t}, \frac{RE_H}{RE_t}, PE, AE, GDP\ PC, \sum_{i=1}^{n=t-6} RE)$$

When, $\frac{RE_S}{RE_t} > 40\%\ and\ \sum_{i=1}^{n=t-6} RE > 250$ MW

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

[19] Bangladesh Bank (2020). *Sustainable Finance Policy for Banks and Financial Institutions.* Sustainable Finance Department: Bangladesh Bank. Retrieved from: https://www.bb.org.bd/mediaroom/circulars/gbcrd/dec312020sfd05.pdf
Bangladesh Bank (2022). *Quarterly Review Report on Sustainable Finance.* Sustainable Finance Department: Bangladesh Bank. Retrieved from: https://www.bb.org.bd/en/index.php/publication/publictn/2/39

$\Delta IC_{RE\,(t-(t-5))}$	Change in installed capacity of electricity from renewable energy sources (in MW) in between 2015 to 2020
$\Delta I_{CE(t-(t-5)}$	Change in investment on clean energy (in billion USD) between 2015 to 2020
$\frac{RE_S}{RE_t}$	Solar power capacity as % of total renewable energy: five years weighted average from 2016 to 2020
$\frac{RE_w}{RE_t}$	Wind power capacity as % of total renewable energy: five years weighted average from 2016 to 2020
$\frac{RE_H}{RE_t}$	Hydro power capacity as % 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 kilometer) by countries
AE	Access to Electricity (% of population) by countries
$GDP\ PC$	Per Capita GDP (in ppp constant 2017)

A similar exercise was carried out by Khatun *et. al.,* (2022) in recent past by using same data source. However, to appropriately capture the more feasible RE mix in the context of Bangladesh's RE transition following two conditions were made.

(i) In 2014, Bangladesh had only about 240 MW grid connectivity from RE sources (SREDA, 2023). So, regression analysis is conducted only for countries that had 250 MW and more installed RE power generation capacity in 2014.

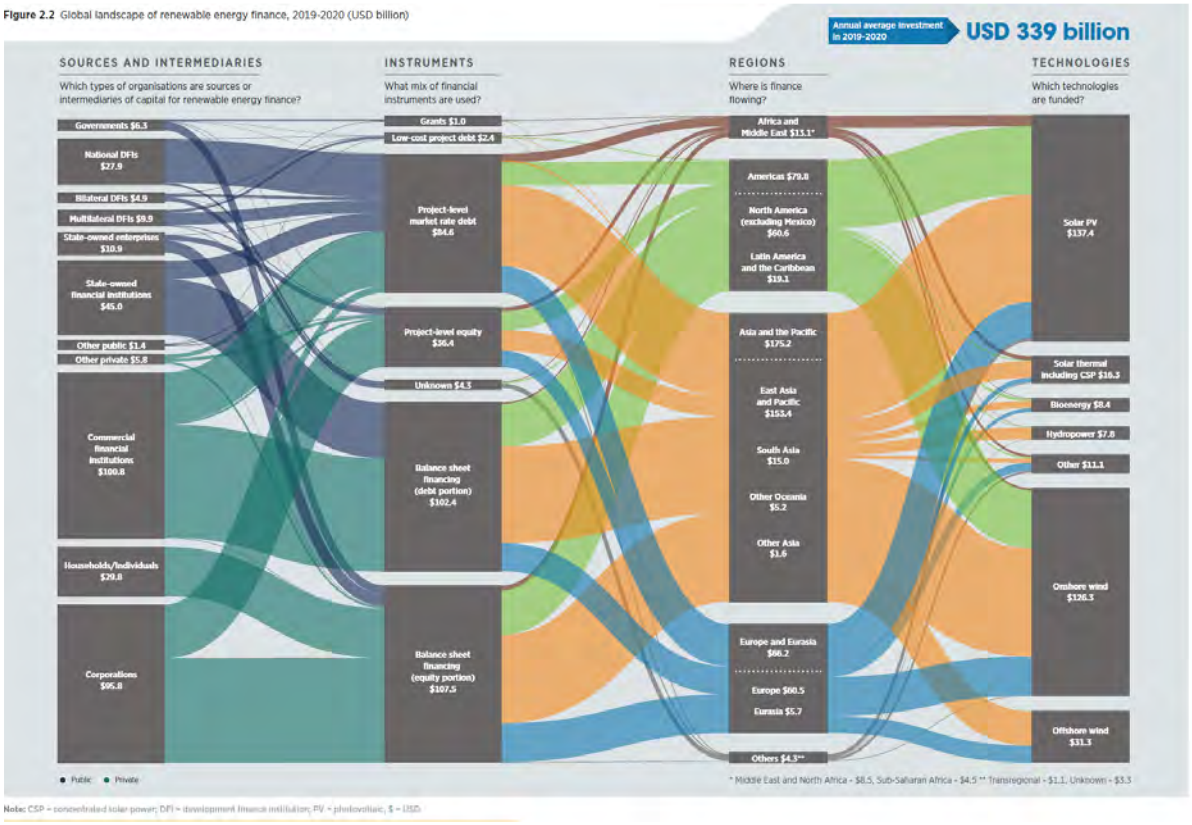
(ii) As well the future RE transition is likely to be solar dominant. Keeping that in mind, at the second tier, regression analysis is conducted only for countries that had more than 40% electricity generation capacity from solar systems alone in 2014.

Table 6: Regression Results

Dependent Variable: Change in Installed Capacity (in MW) for Electricity Generation from RE sources

Independent Variables	Coefficients
Change in investment on clean energy (in billion USD)	1,413** (537.8)
Solar power capacity as % of total renewable energy	957.6 (925.5)
Wind power capacity as % of total renewable energy	-143.6 (364.2)
Hydro power capacity as % of total renewable energy	-996.0 (1,238)
Installed Power Generation Capacity from RE sources	-1.013*** (0.0176)
Population Density (per square kilometer)	6.509 (9.132)
Access to Electricity (% of population)	-248.2 (1,723)

Per Capita GDP (in ppp constant 2017)	-1.256 (1.397)
Constant	5,351 (165,867)
Observations	37
R-squared	0.955



Source: Landscape of RE Finance from 2013-2022 (IRENA and CPI, 2023)