Financial Feasibility and Bankability of Utility-scale Renewable Energy Projects

A Case Study of a Small-scale Power Plant

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CENTRE FOR POLICY DIALOGUE

CPD
Power and Energy Study
Towards Carbon Neutral Economy

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Published in July 2026 by

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Copyediting
H M Al Imran Khan

Page lay-out and typesetting
Md Shaiful Hassan

Citation: Moazzem, K. G., and Jannat, N. Y. (2026). *Financial Feasibility and Bankability of Utility-scale Renewable Energy Projects: A Case Study of a Small-scale Power Plant*. Centre for Policy Dialogue (CPD).

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Abstract

This study evaluates the financial feasibility and bankability of a utility-scale solar photovoltaic (PV) project in Bangladesh through a detailed case analysis of a 3 MW grid-connected power plant. Using a combination of techno-economic simulation via the System Advisor Model (SAM) and Discounted Cash Flow (DCF) modelling, the study evaluates key financial indicators including Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI), and Debt Service Coverage Ratio (DSCR). The findings reveal a clear divergence between operational viability and financial performance. Although the project is operationally cost competitive with its levelised cost of LCOE significantly below the contractual tariff, the financial indicators are weaker. The project yields a slightly negative NPV, an IRR below the WACC and a marginally weak DSCR, indicating constrained profitability and debt servicing capacity. These results are primarily driven by adverse financing conditions, including high capex, high interest rates and a compressed debt repayment period. One-way sensitivity analysis confirms that tariff levels and capital expenditure are the dominant determinants of financial viability, while interest rate variations mainly affect debt servicing capacity. Additionally, two-way sensitivity analysis shows how a supressed interest rate closer to concessional finance pushes the NPV to a positive figure, while simultaneously making the DSCR reach the conventional benchmark. To support this finding, a recalculation has been made which accounts for the deferred cash flows and project specific working capital changes, further bolstering the institutional bottleneck effects. Lastly, a comparative assessment with a representative HFO-based power plant further indicates that the financial performance gap between solar and fossil fuel projects is narrower than commonly perceived, with differences driven more by financing structures than operational efficiency. The study, therefore, concludes that although utility-scale solar projects in Bangladesh are operationally sound and technically efficient, their bankability is undermined by unfavourable financing terms and institutional weaknesses. This case highlights the need for improved financing mechanisms and risk mitigation frameworks to unlock investment in the renewable energy sector.

Acknowledgement

This study has been conducted by the Centre for Policy Dialogue (CPD).

The authors would like to express their sincere gratitude to the officials concerned of the studied power plant for their generous cooperation in providing primary data, technical information, project documentation, and valuable insights that formed the foundation of this study.

The authors are also thankful to *Mr Avra Bhattacharjee*, Additional Director, Dialogue and Outreach, CPD, and *Mr HM Al Imran Khan*, Publication Associate, CPD, for their valuable support in bringing the report to completion.

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Acronyms

ADB	Asian Development Bank
BDT	Bangladeshi Taka
BERC	Bangladesh Energy Regulation Commission
BOO	Build-Own-Operate
BPDB	Bangladesh Power Development Board
CAPEX	Capital Expenditure
CFADS	Cash Flow Available for Debt Servicing
COD	Commercial Operation Date
DCF	Discounted Cash Flow
DPP	Discounted Payback Period
DSCR	Debt Service Coverage Ratio
EGCB	Electricity Generation Company of Bangladesh
EPSMP	Energy and Power System Master Plan
ERP	Equity Risk Premium
FDI	Foreign Direct Investment
HFO	Heavy Fuel Oil
IDCOL	Infrastructure Development Company Limited
IEEFA	Institute for Energy Economics and Financial Analysis
IEPMP	Integrated Energy and Power Master Plan
IPP	Independent Power Producer
IRR	Internal Rate of Return
KII	Key Informant Interview
LC	Letter of Credit
LCOE	Levelised Cost of Electricity
MDB	Multilateral Development Bank
NPV	Net Present Value
NWC	Net Working Capital
NWPGCL	North-West Power Generation Company Limited
O&M	Operation and Maintenance

OPEX	Operating Expenditure
PPA	Power Purchase Agreement
PR	Performance Ratio
RE	Renewable Energy
ROI	Return on Investment
SAM	System Advisors Model
SREDA	Sustainable and Renewable Energy Development Authority
USD	United States Dollar
WACC	Weighted Average Cost of Capital

1

Introduction

Despite strong policy commitments to expand renewable energy deployment, investment in utility-scale renewable energy projects in Bangladesh has progressed more slowly than anticipated. One of the key barriers limiting the scale and pace of renewable energy development is the perceived financial risk associated with these projects. Investors, lenders, and policymakers often lack access to detailed project-level financial evidence demonstrating profitability, cost competitiveness, and debt servicing capacity of operational renewable energy plants. In the absence of such empirical analysis, renewable energy projects are frequently evaluated using theoretical cost benchmarks or international comparisons that may not fully reflect Bangladesh's regulatory, financing, and market conditions (Alam & Jena, 2025). As a result, uncertainties regarding financial viability and bankability continue to constrain investment flows into the sector (Hossen, 2026).

Assessing the financial performance and bankability of operational renewable energy projects is therefore essential for mobilising greater investment in Bangladesh's renewable energy sector. By systematically evaluating key financial indicators, including Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI), and Debt Service Coverage Ratio (DSCR), project-level analysis can provide critical insights into the economic feasibility and risk profile of solar power investments within the domestic power market. Such evidence is particularly important for financial institutions, policymakers, and private investors seeking to better understand the commercial dynamics of renewable energy projects under existing policy and tariff structures.

Taken together, these dynamics underscore an objective predicament: while Bangladesh has articulated and claimed aggressive renewable energy targets and introduced multiple enabling frameworks, the realised percentage share of renewables in the sector remains low, while the financing hurdles to scaling up remain high. There is also a noteworthy knowledge gap regarding the ex-post financial performance and techno-economic reality of existing Independent Power Producers (IPPs). Policy discussions continue to expand on projected ex-ante indicators rather than granular operational data following commercial commencement. This lack of transparency further raises the difficulty of regulators when it comes to providing oversight for potential investors to assess true risk-adjusted returns.

Against this backdrop, the Centre for Policy Dialogue (CPD) is conducting a study focusing exclusively on the financial viability of utility-scale renewable energy projects, moving beyond theoretical projections and providing ex-post evidence. This sector currently comprises 15 operational solar plants and 1 wind plant. In this regard, the present study addresses the existing knowledge gap and contributes to the broader policy discourse by examining the financial viability and bankability of a utility-scale solar power project in Bangladesh, with the objective of generating empirical evidence that can support improved financing frameworks and accelerate renewable energy investment in the country. Another central component of this analysis is the evaluation of cost-competitiveness, determined by calculating the Levelised Cost of Energy (LCOE) and comparing it against approved tariffs to establish the operative margins necessary to attract both international and domestic financiers. Finally, the study further benchmarks and compares the performance metrics of said solar plant with an operational fossil fuel based (HFO) plant to gauge the financial differences between both plants.

Research Objectives

This study aims to provide a comprehensive, evidence-based assessment of the financial feasibility of the current operational solar IPPs in Bangladesh from the viewpoint of a representative case of a 3MW Solar Power Plant. Specific objectives include:

1. Assessing the project-level financial profitability, cost competitiveness and bankability of a selected representative utility-scale solar IPP by using standard project finance metrics.
2. Evaluating how sensitive the plant's profitability and bankability are to variations in key financial parameters.
3. Providing evidence-based insights and policy recommendations to mobilise investment in utility-scale renewable energy projects in Bangladesh.

2

Overview of Utility-scale Projects in Bangladesh

2.1. Definition and Characteristics of Utility-scale Solar Power Plants

A utility-scale project is a large power plant that feeds electricity directly into the grid and sells it to an electric utility, typically at capacities above 1–5 MW. Utility-scale solar projects are designed to generate bulk power for the public electricity system, not predominantly to serve a single building or facility (Wolfe, 2018). They are directly connected to transmission or distribution networks, and they sell electricity under a power purchase agreement (PPA) with a utility or other large buyer (Wolfe, 2018; Heeter, 2022).

The exact cutoff varies by country and study, but typical definitions are:

≥ 1MW of Capacity
>5MW and ground-mounted in many technical and market assessments (Heeter, 2022).

These plants often integrate renewable energy sources such as solar photovoltaic (PV) and wind, sometimes combined with energy storage systems, forming hybrid power plants that enhance grid flexibility and reliability.

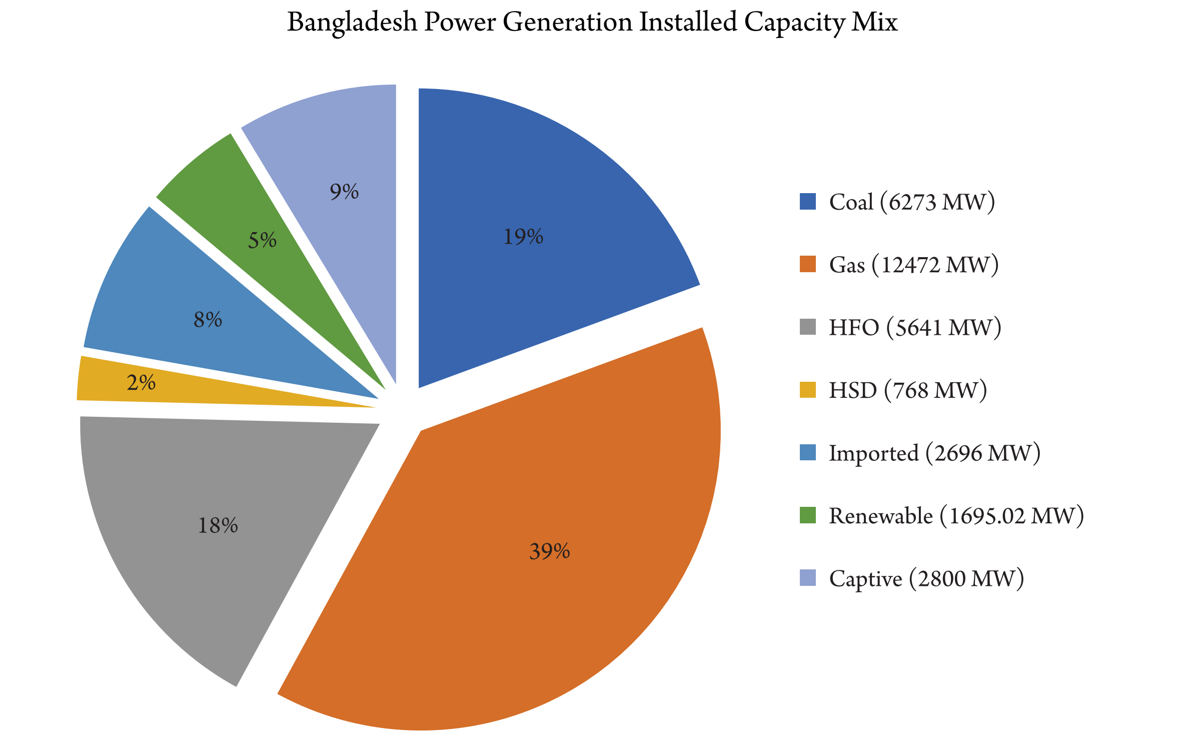
2.2. Current Status of Utility-scale Renewable Energy Projects in Bangladesh

While global trends skyrocket in terms of green energy adoption, Bangladesh's national grid still experiences substantially low percentage contributions from Renewable Energy (RE) despite its high ambitions and technical potential. As of March 2026, RE accounts for a mere 5.24 per cent of the total grid connected installed power generation capacity of 32,345 MW (SREDA, 2026). Figure 1 highlights a discrepancy between the nation's claimed rhetoric and the operational reality of its power sector which remains largely dominated by natural gas (38.56 per cent), heavy fuel oil (17.44 per cent), and coal (19.39 per cent).

The strategic direction for Bangladesh's energy sector has been defined by a series of high-level frameworks that have frequently shifted in target and scope, creating a complex and often uncertain regulatory environment for investors. The Renewable Energy Policy (2025), gazetted on June 16, 2025, outlines ambitious new targets, aiming to generate 20 per cent of electricity from renewable sources by 2030 and 30 percent by 2040 (Begum, 2026). These goals sit alongside the Integrated Energy and Power Master Plan (IEPMP) 2023, which outlines a 40 per cent clean energy target by 2041. While the interim government attempted to streamline these visions through a drafted Energy and Power System Master Plan (EPSMP), the lack of a detailed roadmap omitting specific fuel-mix breakdowns, source-specific projections, and clear timeline for the retirement of fossil fuel plants has left stakeholders and private developers in a state of strategic ambiguity.

As of now, solar energy has positioned itself as the core contributor within the renewable energy mix and is regarded as strategically crucial for the country's energy security. By reducing reliance on imported fossil fuels, solar power aids in preventing the immense fiscal pressure associated with power subsidies. Recent studies on Bangladesh's energy market have inferred that by reducing oil-based power generation to 5% from 10.73%, supported by solar power, Bangladesh can reduce the subsidy burden by 23.3% (Hossen, 2026). In FY2023–24, oil-fired peaking plants produced the most expensive power at an average cost of BDT 26.4/kWh (USD 0.216/kWh), whereas

Figure 1: Installed Capacity Mix in Power Generation



Source: SREDA, 2026.

the combined average cost for solar and wind plants stood at BDT 16.4/kWh (USD 0.134/kWh) (Alam & Jena, 2025). Despite these figures, solar energy currently generates only 1.3–1.6GW, highlighting that the nation's solar potential remains largely untapped and its contribution share is yet quite modest.

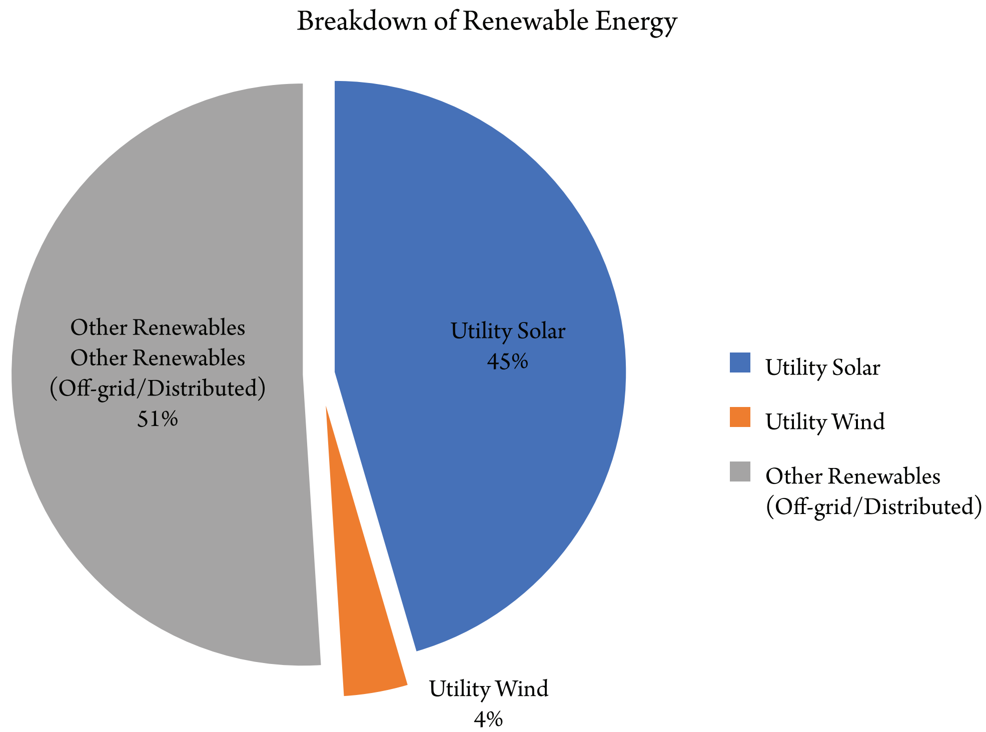
The investment needed to bridge the gap between this modest present capacity and stated policy goals is colossal. Recent projections suggest that Bangladesh will require approximately USD 40 billion in cumulative investment over the next 15 years to achieve a 30 per cent share of renewables in the energy generation mix. This translates into a required build-out of over 35GW of renewable installed capacity where solar would be the most significant contributor. Given the scale of these funds, government support alone is insufficient; the mobilisation of private capital, Foreign Direct Investment (FDI), and concessional financing from Multilateral Development Banks (MDBs) is crucial. While the interim government eventually approved 12 solar projects with a combined capacity of 918MW, financing challenges remained exacerbated by a lack of implementation agreements and a downgrade in Bangladesh's credit rating by Moody's (Alam, 2026).

Moreover, structural and institutional roadblocks continue to erode investor confidence. Recent sector analyses indicate that procurement terms and tender designs often discourage participation due to rigid qualification criteria, weak risk mitigation measures, and a lack of sovereign guarantees in Power Purchase Agreements (PPAs). Beyond procurement, physical and technical bottlenecks such as land acquisition difficulties and a lack of grid-readiness remain persistent.

2.3. Capacity Contribution (%) of Utility-scale Power Plants

Of the total 1,695.02 MW renewable capacity, utility-scale projects account for 830.72 MW, which is further dominated by solar (770.72 MW) compared to a nascent wind contribution (60 MW). As illustrated in the streamlined breakdown in figure 2, utility-scale solar now constitutes 45.5 per cent of the total renewable capacity, while wind remains a small fraction at 3.5 per cent.

Figure 2: Percentage Share of Renewables and Their Breakdown



Source: SREDA 2026. 2.4.

2.4. Project Portfolio of Utility-scale Power Plants in Bangladesh

Currently, there are 16 utility-scale solar power plants operational in Bangladesh among which 6 are state owned: 2 directly owned by BPDB and 4 owned by its subsidiaries Electricity Generation Company of Bangladesh (EGCB) and North-West Power Generation Company Limited (NWPGCL) and 9 owned by Independent Power Producers (IPPs) (Table 1). The portfolio comprises projects ranging from small-scale installations such as the 1 MW Barisal plant and 2.71 MW Sarishabari plant to large-scale facilities including the 200 MW Teesta Solar Ltd project in Lalmonirhat and multiple 100 MW plants such as Mongla Orion and Pabna Solar.

Most projects operate under the IPP frameworks with AC capacities ranging from 1 MW to 200 MW. The commissioning trend indicates a gradual scale-up post-2020, with larger capacity additions occurring between 2021 and 2025, signalling Bangladesh's increasing, though still modest, commitment to utility-scale solar expansion.

Table 1:Project Portfolio of Operational Utility-scale IPPs

Project	Derated Capacity	Parent Company	COD	Location
Spectra Solar Park	35 MW	Spectra Solar Park Ltd	Mar- 2021	Manikganj
Teknaf 20MW	20 MW	Teknaf Solartech Energy Limited, under Joules Power Limited (JPL)	Sep- 2018	Cox's Bazar
Kaptai 7.4MW	6 MW	BPDB	May- 2019	Rangamati
Sonagazi 75MW	75 MW	EGCB	Apr- 2024	Feni
Sarishabari 3 MW	3 MW	Engreen Ltd	Aug- 2017	Jamalpur
Sutiakhali 50MW	50 MW	HDFC Sinpower Limited	Nov- 2020	Mymensingh

(Table 1 Contd.)

(Table 1 Contd.)

Project	Derated Capacity	Parent Company	COD	Location
Mongla Orion 100MW	100 MW	Energon Renewables	Dec- 2021	Bagerhat
Barisal 1MW	1 MW	BPDB	Jun- 2024	Barisal
Pabna 64MW	60 MW	NWPGCL	Jun- 2025	Pabna
Sirajganj 68MW	68 MW	NWPGCL	Jul- 2024	Sirajganj
Sirajganj 6.55MW	6.01 MW	NWPGCL	Mar- 2021	Sirajganj
Pabna Solar 100MW	100 MW	Dynamic Sun Energy Private Limited	Oct- 2024	Sirajganj
Sympa Solar 8 MW	8 MW	Paragon Group	Jul-2019	Pabna
Teknaf 20MW	20 MW	Teknaf Solartech Energy Limited, under Joules Power Limited (JPL)	Sep- 2018	Cox's Bazar
Kaptai 7.4MW	6 MW	BPDB	May- 2019	Rangamati
Sonagazi 75MW	75 MW	EGCB	Apr- 2024	Feni

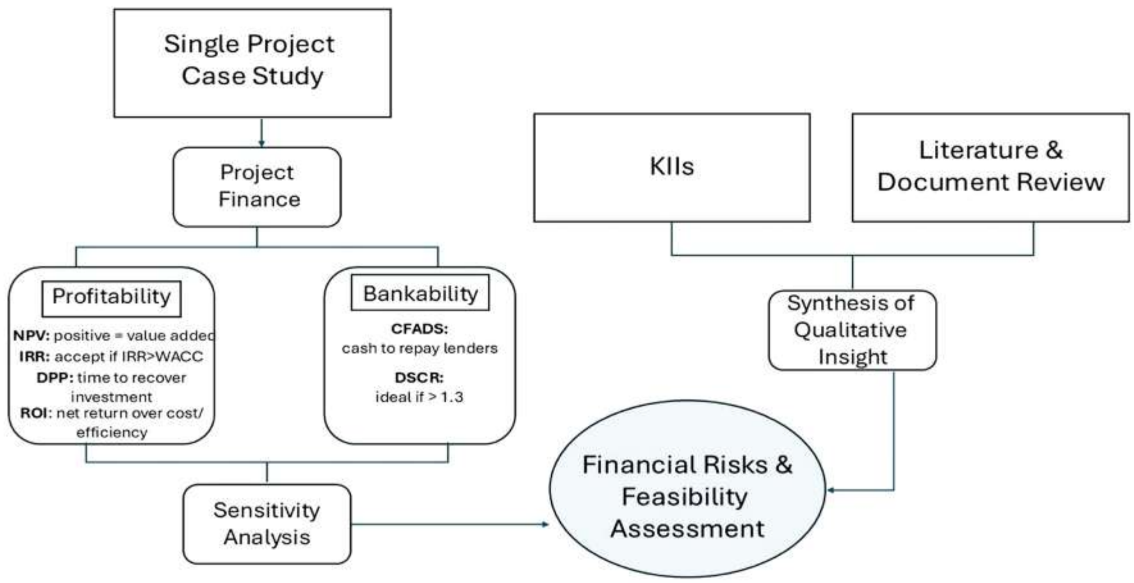
Source: BPDB Annual Report 24-25, SREDA 2025.

3

Analytical Framework

The study adopts a mixed multi-method approach combining quantitative and qualitative analysis to assess the financial feasibility of utility-scale renewable energy in Bangladesh. As shown in figure 3, the quantitative component is conducted through a single-project case study, applying standard project finance Discounted Cash Flow (DCF) methods to estimate profitability and bankability indicators. The qualitative component complements this analysis through Key Informant Interviews (KIIs) and a review of relevant literature and policy documents, enabling the study to contextualise financial outcomes within the broader institutional and regulatory environment.

Figure 3: Integrated Analytical Framework



Source: Prepared by authors.

4

Methodology

4.1. Research Design

This study adopts a case study based mixed-method research design to assess the financial feasibility, bankability, and risk sensitivity of a selected utility-scale solar photovoltaic (PV) power plant in Bangladesh. Owing to limited public disclosure and unsuccessful attempts to obtain primary financial data from multiple IPPs operating under the PPAs with the Bangladesh Power Development Board (BPDB), the research focuses on a single project for which reliable technical and financial inputs are available, allowing for deeper analytical precision. The quantitative component integrates techno-economic simulation using the System Advisor Model (SAM) with a comprehensive discounted cash flow (DCF) model to estimate key project finance indicators. This is complemented by qualitative insights from KIIs conducted with plant owners to comprehensively analyse renewable energy appraisal and come to evidence-driven policy inference.

4.2. Data Collection and Case Selection

The study conducts a case study analysis of a 3 MW solar PV project as a representative of the utility-scale IPPs under Bangladesh's regulatory framework, using it to generate detailed financial and bankability insights. While the plant manager provided project-specific primary quantitative inputs such as loan agreements, PPA documents, technical specifications, project finance records, and actual generation data, the research situates these findings within the broader national context. Secondary data from Bangladesh Bank, BPDB, the Sustainable and Renewable Energy Development Authority (SREDA), the International Renewable Energy Agency (IRENA) and the National Renewable Energy Laboratory (NREL) alongside complementary grey literature are incorporated to benchmark figures, assess solar resources, and contextualise macroeconomic and sectoral conditions.

4.3. Techno-Economic Simulation Under System Advisors Model (SAM)

Scope of SAM

The System Advisors Model or SAM is used to derive technically consistent estimates of energy generation and operating performance. It simulates annual energy generation, capacity utilisation factors, performance degradation, system losses and benchmark operation and maintenance (O&M) cost estimates over the economic life of each project. The Detailed Photovoltaic Model with Single Owner financial model template is configured for the representative power plant. Input parameters utilised in the simulation are outlined in table 2.

Input Parameters for SAM

Table 2: Input Parameters in SAM

Input Category	Parameter	Value to Input in SAM
Location	Weather Data	Fetch TMY (Typical Meteorological Year) for Sarishabari, Jamalpur (24.771454, 89.84341)
System Design	DC Nameplate Capacity	3,300 kWdc (3.3 MW).
System Design	DC to AC Ratio	~1.1 (Calculated: 3.3 MWdc / 3 MWac).
Module	Module Type	Mono-crystalline Silicon.
Module	Module Model	SolarWorld Sunmodule Plus SW 285 Mono.
Inverter	Inverter Model	SMA Sunny Tripower 25000TL (123 units total).
Array	Tracking / Tilt	Fixed Tilt (set to 24 degrees to 30 degrees for optimal results) or Manual Seasonal (5 degrees in summer, 24 degrees in winter)
Array	Azimuth	0 degrees (Facing South).
Losses	Performance Ratio	Set losses to achieve a 70-71% PR (accounts for soiling, temperature, and grid losses).

Source: Authors' compilation (Babu & Basher, 2024; Islam & Al-Mamun, 2023; Mollik & Rashid, 2025).

4.4. Profitability Analysis

The profitability indicators assessed via DCF modelling are outlined in table 3, along with their formula and decision criteria.

Table 3: Profitability Indicators

Criteria	Formula	Decision Criteria
Net Present Value (NPV	NPV= -I0 + Σ(CFt)/(1+r)t	NPV>0: The project adds value to the firm
Internal Rate of Return (IRR)	0=-I0 + Σ(CFt)/(1+IRR)t	IRR>WACC: The project's return exceeds the cost of capital.
Return on Investment (ROI)	ROI = (Net Profit/Initial Cost)*100	Higher % is preferred: Comparison against industry average ROI.
Discounted Payback Period (DPP)	DPP= A+(B/C) where A: Last period with a negative cumulative discounted cash flow. B: Absolute value of cumulative discounted cash flow at the end of period A. C: Discounted cash flow during the period after A.	DPP<Project Life: Shorter periods indicate lower risk and faster liquidity.

Source: Authors' compilation (Brealey et al., 2020; Damodaran, 2012).

The discounting factor would be the weighted average cost of capital (WACC) calculated as: WACC = (E/V*) Re) + ((D/V)*Rd * (1-Tc)) (Brealey et al., 2020; Damodaran, 2012).

Where,

E = Market value of equity
D = Market value of debt
V = Total value of capital (E + D)
Re = Cost of equity
Rd = Cost of debt
Tc = Corporate tax rate

4.5. Cost Competitiveness

LCoE will be derived via SAM output and benchmarked against PPA tariff. It will be calculated as:

$LCOE = \left(\sum (t=0)^n (I_t + M_t + F_t)/(1+r)^t\right) / \left(\sum (t=1)^n (E_t)/(1+r)^t\right)$ (Corporate Finance Institute, 2020)

4.6. Bankability Analysis

Table 4 outlines the bankability indicators assessed using DCF modelling.

Table 4: Bankability Indicators

Criteria	Formula	Decision Criteria
Cash Flow Available for Debt Service (CFADS)	CFADS = EBITDA – Taxes –CAPEX	CFADS>0: Must remain positive to ensure debt can be serviced
Debt Service Coverage Ratio (DSCR)	DSCR = CFADS/Debt Services	DSCR≥1.30: Standard requirement for utility-scale bankability

Source: Brealey et al., 2020; Damodaran, 2012.

4.7. Sensitivity Analysis

Financial and operational vulnerability will be assessed via one-way sensitivity analysis varying key parameters by ±10 to ±20 per cent. Parameters used will be capital expenditure (CAPEX), Tariff Rate, interest rate Weighted Average Cost of Capital (WACC). The resulting impacts on Net Present Value (NPV), Internal Rate of Return (IRR), Return on Investment (ROI) and Debt Service Coverage Ratio (DSCR) will be visualised through tornado diagrams. Further, a two-way sensitivity analysis will be conducted to assess the combined impact of tariff and interest rate on NPV and DSCR. Based on sensitivity analysis rankings and qualitative assessment of the overall RE sector, critical vulnerabilities will be mapped to provide targeted policy recommendations. These include tariff design, concessional finance mechanisms, debt restructuring and risk mitigation strategies.

4.8. Limitations and Rationale for a Case-study Approach

The present research adopts a single-project case study methodology to examine the financial feasibility and bankability of a utility-scale solar IPP in Bangladesh. This methodological choice arises from both analytical considerations and practical data constraints. Although multiple solar IPPs operate under long-term power purchase agreements (PPAs) with the BPDB, repeated attempts to collect primary financial data from project sponsors and operators were unsuccessful, as most IPPs do not publicly disclose detailed capital structure, debt servicing schedules, or plant-level cash flow information due to commercial confidentiality. The absence of standardised financial transparency across projects renders cross-sectional comparative analysis methodologically weak and dependent on unverifiable secondary approximations. In contrast, focusing on a single project for which reliable financial and technical inputs are available enables rigorous DCF modelling, accurate estimation of weighted average cost of capital (WACC), and credible assessment of debt service coverage ratios (DSCR), thereby strengthening the internal validity and analytical depth of the study.

5

Case of a Utility-scale Power Plant

5.1. Project Overview

The representative plant holds a distinguished position in the nation's energy history as one of the first grid-connected utility-scale solar PV projects. The facility was commissioned in late 2017. It serves as a successful Proof of Concept for the private-sector-led IPP model in the Bangladeshi renewable energy landscape.

Strategically situated on approximately 8 acres of land, the project operates under a 20-year Build-Own-Operate (BOO) agreement with the BPDB (Energy Transition Bangladesh, n.d.). The plant's design is optimised for the tropical climatic conditions of Northern Bangladesh, featuring a total DC capacity of 3.3 MWp and a contracted AC capacity of 3.0 MW. The plant currently supplies electricity to the BPDB-owned 33/11 kV sub-station at a rate of 0.1897 US cents per unit, equivalent to BDT 14.74.

The project represents an important case within Bangladesh's solar IPP portfolio because of its relatively early commissioning date and its operation within the evolving regulatory and tariff environment of the country's renewable energy sector. During the early phase of solar development in Bangladesh, projects were typically negotiated through bilateral agreements rather than competitive auctions, resulting in comparatively higher tariff levels intended to incentivise private sector participation and offset perceived investment risks associated with a nascent renewable energy market. Given its relatively modest scale compared to recently commissioned large-scale solar projects exceeding 100 MW, this plant offers a useful analytical benchmark for evaluating the financial dynamics of early solar IPPs in Bangladesh. Smaller projects, such as this, often face higher per-unit capital costs due to limited economies of scale, making financial feasibility particularly sensitive to tariff structures, financing conditions, and operating performance. Consequently, examining this plant's techno-economic characteristics provides valuable insights into the cost competitiveness, profitability, and investment viability of utility-scale solar projects within Bangladesh's emerging renewable energy market.

5.2. Financing Structure of the Plant

The total capital investment amounted to BDT 54.22 crore, established with a debt-to-equity ratio of approximately 55:45. This comprised BDT 24 crore in project owner's equity and a BDT 30 crore debt facility. The debt component underwent significant upward adjustments in interest obligations during the procurement phase. While a German development bank (KfW) initially intended to provide highly concessional financing at a 2.4 per cent interest rate, commercial financing was led by Bank Asia, which acted as the primary lender.

However, the project was burdened by high spreads, with reports indicating that the bank overcharged by a significant margin (9 per cent) above the standard market risk premium. This high-interest environment, combined with the project's operational cash flow constraints owing to BPDB payment delays, led to an unsustainable debt-service coverage ratio. Consequently, the project was unable to maintain its interest obligations, leading to the forced closure of the loan after only 7 years of operation. Post loan closure, the plant continued operations by utilising internal funds sourced from other operational assets under the same ownership.

6

Technical Configuration and SAM Inputs

To ensure that the techno-economic simulation reflects realistic operating conditions, the System Advisor Model (SAM) was calibrated using location-specific environmental parameters and system performance assumptions relevant to the solar PV plant. Solar resource data were obtained from the National Solar Radiation Database (NSRDB), which provides Typical Meteorological Year (TMY) weather files used to estimate annual solar irradiance and potential electricity generation.

In addition to solar resource conditions, several performance-related loss factors were incorporated into the model to approximate real-world plant operation. These include environmental losses such as dust accumulation on module surfaces, module degradation over time due to thermal and humidity stresses, and short-term efficiency reductions caused by light- induced degradation (LID) in mono-crystalline photovoltaic modules. Operational parameters such as system availability were also specified to account for routine maintenance downtime and potential grid interruptions that may affect plant output.

Together, these parameters allow the simulation to capture the gap between theoretical photovoltaic output and actual electricity generation under field conditions. The key environmental and system performance inputs used in the SAM simulation are summarised in Tables 5 and 6.

Table 5: System Design and Configuration

Technical Parameter	SAM Input	Comments
Solar Module	SolarWorld SW 285 Mono	
Inverter Model	SMA STP 25000TL-30	3-phase string inverters; 98.3% efficiency.
DC System Size	3,300.3 kWdc	Product of 11,580 modules*285W.
AC System Size	3,075.0 kWac	Aggregate capacity of 123 inverters.
Fixed Tilt Angle	24°	
Azimuth	180°	

Source: Authors' compilation (Babu & Basher, 2024; Islam & Al-Mamun, 2023; Mollik & Rashid, 2025).

Table 6: Performance and Loss Inputs

Parameter	SAM Input	Comments
Global Irradiance	1814/kWh/m2/yr	
Soiling Loss	7%	Heavy dust buildup in dry season (Nov–Mar).
Degradation Rate	0.7% per year	
Availability	98.5%	
LID Loss	1.5%	Initial light-induced degradation for mono-Si.

Source: Authors' compilation (Babu & Basher, 2024; Islam & Al-Mamun, 2023; Mollik & Rashid, 2025).

7

Financial Modelling Assumptions and Justifications

Table 7 outlines the assumptions made while doing the financial modelling:

Table 7: DCF Assumptions and Rationale

Metric	Value	Rationale
Revenue	Capacity*Tariff	Modelled on a Take-or-Pay basis where the BPDB pays for the available capacity, ensuring revenue stability regardless of minor grid fluctuations.
Risk Free Rate (Rf)	7.5%	Based on the 10-year Bangladesh Government Treasury Bond yield at the time of project commissioning (2017/18).
Equity Beta (β)	0.95	Reflects the systematic risk of a first-of-its-kind infrastructure project in a frontier market
Equity Risk Premium (ERP)	6.67%	Standard ERP for the Bangladesh power sector, accounting for country risk and sectoral volatility.
Cost of Equity (Re)	13.84%	Computed via CAPM: Rf + β*ERP
Corporate Income Tax	30%	Standard for Energy Projects during 2017-18
Inflation	6%	

Note: '*' denotes multiplication.
Source: Calculated by the authors.

The Weighted Average Cost of Capital (WACC) is used to discount cash flows in order to find the NPV. The detailed computation is presented in table 8.

Table 8: WACC Computation

Component	Value	Weight	Cost	Weighted Cost
Equity	BDT 240M	44.4%	13.84%	6.15%
Debt	BDT 300M	55.6%	6.30% (after tax)	3.5%
Total (WACC)	BDT 540M	100%		9.65%

Source: Calculated by the authors.

8

Results and Discussions

8.1. Key SAM Simulation Results

The following section highlights the generation profile and unit costs produced by the simulation run in SAM.

- AC Generation in Year 1: 5,238,150 kWh represents the first-year generation sent to national grid.
- DC capacity factor in Year 1: 17.5%
- Performance ratio in Year 1: 0.78
- LCOE Levelized cost of energy nominal: BDT 11.20/kWh representing the break-even cost.
- LCOE Levelised cost of energy real: BDT 9.85/kWh adjusted for inflation.

8.2. LCoE vs Tariff Comparison

The Levelised Cost of Electricity (LCOE) represents the average lifecycle cost of generating electricity from the solar PV plant. It is calculated by dividing the present value of total project costs over the plant's operational lifetime by the total electricity generated during the same period.

Using the technical outputs derived from the SAM simulation, the LCOE of the solar plant is estimated and subsequently benchmarked against the tariff specified in the Power Purchase Agreement (PPA). This comparison allows the study to determine the project's cost competitiveness and the effective margin available for covering operating expenses, servicing debt, and generating investor returns.

Table 9: Summary of LCoE Analysis

Contractual Tariff	LCoE	Operational Margin (Tariff – LCoE)	Cost Competitiveness
BDT 14.74/kWh	BDT 9.85/kWh	BDT 4.89/kWh	Strong margin (>30%) ensures healthy debt service.

Source: Calculated by the authors.

The contractual tariff of BDT 14.74/kWh exceeds the estimated LCoE of BDT 9.85/kWh, yielding an operational margin of BDT 4.89/kWh (Table 9), which indicates that the project can comfortably cover its generation costs while generating a stable surplus for debt servicing and investor returns.

8.3. Profitability Assessment

To assess the profitability from the perspective of an investor, standard project finance metrics are used to compute the financial performance of the plant.

Revenue is calculated as: Generation × Tariff = 5238150 × 14.74 = 7.72 crore BDT
Using SAM benchmark Operating Cost is calculated as 1.2% of 54.22 (CAPEX) = BDT 0.65 crore
EBIDTA is yielded as Revenue – O&M = 7.72 -0.65 = BDT 7.07 crore
Straight line depreciation over 20-year plant life = 54.22 ÷ 20 = BDT 2.71 crore

EBIT = EBIDTA – Dep = 7.07-2.71 = BDT 4.36 crore
Tax = 30% of EBIT = BDT 1.31 crore
Net Income = 4.36 – 1.31 = BDT 3.05 crore
Free Cash Flow = Net Income + Depreciation = 3.05 + 2.71 = BDT 5.76 crore per year

Net Present Value (NPV)

Discounting 20-year project cash flows at WACC = 9.65%, NPV = 49.0 – 54.22 = BDT -5.2 crore

The slightly negative NPV indicates that the project just falls short of recovering its full capital cost when discounted at the sector WACC. However, the margin is relatively small, implying that minor improvements in tariff escalation, financing cost, or plant performance would shift the project into positive value territory.

Internal Rate of Return (IRR)

IRR amounts to approximately 8.4 per cent to yield an NPV of zero.

The IRR is below the WACC of 9.65 per cent, suggesting that the project generates returns slightly below the required cost of capital. This outcome reflects the relatively high upfront capital cost and the financing conditions under which the plant was developed. However, given the small difference between IRR and WACC, the project remains near the threshold of financial viability.

Return on Investment (ROI)

ROI = Net Income ÷ Initial Investment = 3.05 ÷ 54.22 = 5.6% annually.

For renewable infrastructure projects in emerging markets, ROI levels between 5–10% are generally considered acceptable.

Discounted Payback Period (DPP)

As the project has a negative NPV, calculation of DPP is not applicable.

However, we can rationally assume a DPP of 17-18 years indicating the project recovers its capital investment within the 20-year of project life, although the relatively long payback period indicates significant exposure to financing and operational risks during the early years.

8.4. Bankability Assessment

In the case of this project the loan of BDT 30 crore had to be closed early making the tenure 7 years. Interest on the loan amount was a total of 9 per cent.

Cash Flow Available for Debt Services (CFADS)

Lender typically approximately CFADS as EBIDTA amount. So, the CFADS = BDT 7.07 crore

Debt Service Coverage Ratio (DSCR)

The project carried a commercial loan of BDT 30 crore at an annual interest rate of 9 per cent, repaid over a 7-year amortising schedule. Assuming equal annual debt service payments, the annual debt obligation is estimated using the standard annuity formula:

$$= \frac{\mathrm{Pr}}{1-(1+\mathrm{r})^{-\mathrm{n}}} = \frac{30 \times 0.09}{1-(1.09)^{-7}} = \mathrm{BDT}\ 5.93$$

Annual Debt Service $=Pr/(1-(1+r)^{(-n)})=(30\times0.09)/(1-(1.09)^{(-7)})=$ BDT 5.93 crore

DSCR = CFADS ÷ Debt Service = 7.07 ÷ 5.93 = 1.19

Although positive, the DSCR falls below the standard bankability threshold of 1.30, indicating that the project had limited financial cushion for servicing debt obligations. This helps to explain why the project struggled to maintain its loan obligations and ultimately closed the facility after only seven years.

The need to repay the BDT 30 crore loan within seven years increased annual debt servicing obligations to nearly BDT 6 crore, compressing the Debt Service Coverage Ratio and limiting free cash flows to equity investors. As a result, although the plant remains operationally cost- competitive, the altered financing conditions reduced overall project bankability and investor returns.

8.5. Summary of Financial Performance and Critical Insights

Table 10: Summary of Findings

Indicator	Calculated Value	Benchmark	Comments
NPV (BDT crore)	-5.2	>0	Near Breakeven
IRR (%)	8.4	>WACC of 9.65%	Slightly Below
ROI (%)	5.6	5%-10%	Moderate
DPP (years)	N/A (presumably 17-18)	<20	Moderate
DSCR	1.19	≥1.2-1.3	Weak

Source: Calculated by the authors.

Critical Financial Insights

Table 10 summarises the project's key financial indicators against their respective benchmarks. The primary driver of financial underperformance is the abnormally high cost of land and debt imposed during project financing. Despite access to initially intended concessional financing, the project ultimately faced elevated interest spreads from commercial lender, significantly increasing annual debt servicing obligations. This inflated cost of capital directly suppressed the Internal Rate of Return (IRR) below the WACC and compressed the DSCR. Such a ratio provides minimal buffer against revenue volatility or payment delays.

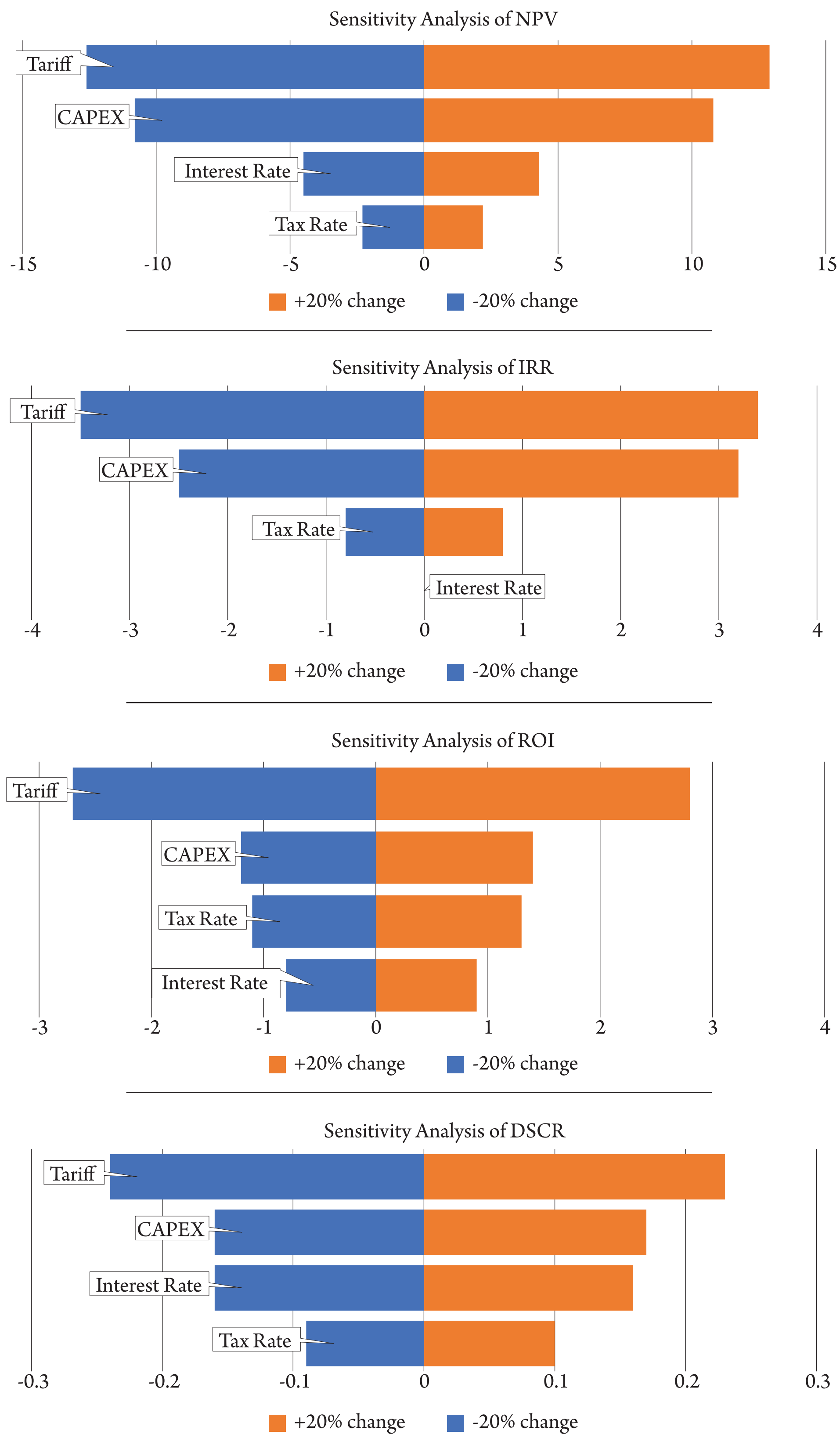
The results suggest that the principal constraint affecting project viability is not solar technology performance but rather financial and institutional risk factors, including interest rate spreads, debt tenor compression, and payment reliability from the off-taker. It is important to note that the project maintains a positive ROI because it generates an accounting surplus; however, the negative NPV arises because the Internal Rate of Return (8.4 per cent) is lower than the Hurdle Rate (WACC of 9.65 per cent), signalling that the project's yields are insufficient to cover the opportunity cost of capital. Consequently, while the asset is operationally profitable, it is considered value-destructive in a DCF framework as the present value of future inflows fails to offset the initial capital outlay.

8.6. Sensitivity Analysis

The sensitivity analysis in figure 4 highlights the extent to which key financial variables influence the profitability and bankability of the 3 MW solar power project. Across all four indicators: NPV, IRR, ROI, and DSCR, the results demonstrate that the project's financial outcomes are most strongly driven by the contractual tariff and the initial capital expenditure (CAPEX), while variations in interest rates and tax rates have comparatively smaller impacts.

The Net Present Value (NPV) calculation exposes a structural fragility as the project's baseline is already in the red (BDT -5.2 crore). The extreme sensitivity to tariff fluctuations is the most prominent risk. A 20 per cent drop in tariff does not just reduce profit, it creates a catastrophic NPV of BDT -18.04 crore and a DSCR of 0.93. This sub ratio is a default signal, indicating the plant would be unable to generate enough cash to pay its debt. In

Figure 4: One–Way Sensitivity Analysis via Tornado Diagram



Source: Prepared by authors.

the regulatory landscape of Bangladesh, where payment delays from the government are common, this lack of a financial buffer is a critical vulnerability.

The CAPEX analysis suggests that the project was likely to be overcapitalised at its inception. It is the only variable where a 20 per cent reduction swings the NPV into positive territory (+5.64 crore). This points to a broader systemic issue in the Bangladeshi renewable sector: high initial land and technology costs and premiums that burden early projects with debt levels that the subsequent revenue streams can barely support.

Finally, while Interest Rate changes show a smaller swing in NPV, their impact on the DSCR (1.14) is significant. In a high-interest-rate environment, the project's inability to re-finance or absorb cost-of-capital increases explains why the loan was forced into an early closure.

Two–way Sensitivity Analysis on NPV via Heatmap

Table 11: Two-way Sensitivity Analysis on NPV

NPV Sensitivity: Tariff vs Commercial Interest Rate

		Tariff (BDT/kWh)				
		13.27	14.00	14.74	15.48	16.21
Interest Rate (%)	6.0%	-12.3	-6.09	0.20	6.49	12.70
	7.2%	-14.46	-8.25	-1.96	4.33	10.54
	8.0%	-15.90	-9.69	-3.4	2.89	9.10
	9.0%	-17.70	-11.49	-5.2	1.09	7.30
	10.0%	-19.50	-13.29	-7.00	-0.71	5.50

Source: Calculated by the authors.

Table 12: Two-way Sensitivity Analysis on DSCR

DSCR Sensitivity: Tariff vs Commercial Interest Rate

		Tariff (BDT/kWh)				
		13.27	14.00	14.74	15.48	16.21
Interest Rate (%)	6.0%	1.06	1.18	1.31	1.44	1.56
	7.2%	1.01	1.14	1.26	1.39	1.51
	8.0%	0.98	1.10	1.23	1.36	1.48
	9.0%	0.94	1.06	1.19	1.32	1.44
	10.0%	0.90	1.02	1.15	1.28	1.40

Source: Calculated by the authors.

The previous one-way sensitivity analysis reveals that the project's negative NPV of BDT -5.2 crore is a function of high capital costs meeting a restrictive hurdle rate. Table 11 shows that the most resilient scenario occurs when both levers are moved; a combination of a slightly higher tariff and concessional financing (below 7.5 per cent) yields an NPV exceeding BDT +5 crore, transforming the project from value-destructive to value-creative.

Table 12 shows the two-way sensitivity analysis on DSCR.

From a lender's perspective, the base DSCR of 1.19 is weak, offering little cushion against payment delays. The sensitivity analysis indicates that reducing the interest rate by 30 per cent (to 6 per cent) improves the DSCR to 1.31, surpassing the standard bankability threshold of 1.30. This suggests that the primary constraint on debt serviceability is not the plant's operational performance, but the high interest spreads.

8.7 Deferred Cash Flow Analysis

To reflect the operational reality of delayed payments from the BPDB, the base-case cash flow model was adjusted to incorporate a revenue collection lag. While revenue is recognised on an accrual basis under the Power Purchase Agreement, actual cash inflows were deferred by 6-9 months, resulting in a build-up of receivables. Consequently, key financial metrics deteriorate relative to the base case, highlighting the material impact of payment delays on project performance (Rahman, 2026).

In addition, following the early closure of the loan, the plant continued operations through internal fund transfers from another project owned by the sponsor. In the adjusted cash flow model, this support is treated as a change in net working capital, reflecting the injection of liquidity required to sustain operations in the absence of external financing.

The use of internally generated funds from another operating asset introduces an implicit opportunity cost that is not captured in conventional project-level cash flow analysis. These funds could have been deployed in alternative investments yielding a market-based return, and their diversion to support the solar plant represents a foregone return. As a result, while the adjusted cash flow may indicate operational continuity, the economic profitability of the project is overstated unless this opportunity cost is explicitly considered.

Modelling Adjustments:

1. **Deferred Tariff Revenue (BPDB Payment Delay)**
   Revenuet+1=Generationt × Tariff
   T+1 is adjusted for the typical 6-9-month lag of BPDB
2. **Working Capital Adjustment (Post Loan Closure)**
   After year 7 (loan closure), plant survives by: Injecting funds from another plant modelled as
   ΔNWCt = External Cash Support

The adjusted calculations are summarised in table 13 below:

Table 13: Adjusted Cash Flow Analysis with Deferred Revenue and Working Capital Changes

Indicator	Baseline	Deferred Cash Flow	Deferred Cash flow with NWC Adjustment
NPV (Crore BDT)	-5.2	-8.41	-8.7
IRR (%)	8.4	7.59	7.52
ROI (%)	5.6	5.1	5.06
CFADS (Crore BDT)	7.07	6.45	6.35
DSCR	1.19	1.09	1.07

Source: Calculated by the authors.

The introduction of deferred tariff revenue, reflecting a 6–9 month payment delay, significantly reduces project value. As shown in Table 11, Net Present Value (NPV) declines from BDT -5.2 crore to BDT -8.41 crore, while the Internal Rate of Return (IRR) falls from 8.4 per cent to 7.59 per cent. This deterioration is driven entirely by the timing mismatch between revenue recognition and actual cash inflows, which reduces the present value of earnings without affecting underlying operational performance. Cash Flow Available for Debt Service (CFADS) decreases from BDT 7.07 crore to BDT 6.45 crore, leading to a reduction in the Debt Service Coverage Ratio (DSCR) from 1.19 to 1.09 (Table 11). This compression increases the project's financial vulnerability even in the absence of operational inefficiencies.

The addition of working capital adjustments further weakens financial performance. NPV declines to BDT -8.7 crore and IRR to 7.52 per cent, while CFADS and DSCR fall to BDT 6.35 crore and 1.07, respectively (Table 11). Although the incremental impact appears smaller, it reflects a deeper structural issue. The reliance on internal fund transfers from another plant does not generate value but instead signals a persistent funding gap, with operations sustained through implicit borrowing rather than internally generated cash flow.

Importantly, this mechanism introduces an unaccounted opportunity cost. The funds diverted from another asset could have earned market-based returns, and their use in supporting the project represents a foregone investment opportunity. Consequently, even the adjusted metrics in Table 11 may overstate the project's true economic performance.

Overall, the findings indicate that the project's financial stress is not driven by technical or cost inefficiencies, but by liquidity timing and payment uncertainty. The combined effects of delayed revenue and reliance on working capital support significantly undermine bankability, underscoring the importance of payment reliability in ensuring the financial viability of renewable energy projects.

9

Comparative Financial Performance of Solar vs Fossil Fuel (HFO) Power Plant

The financial arc of Bangladesh's power sector has historically been dominated by the perceived bankability of fossil fuel (FF) Independent Power Producers (IPPs). To contextualise the performance of the 3 MW Solar Plant, this study conducts a comparative assessment against a listed 50 MW Heavy Fuel Oil (HFO) Plant - a benchmark project that secured the nation's first World Bank IPFF foreign currency loan. While HFO plants have traditionally enjoyed contractual superiority, a deep dive into their project finance metrics reveals a growing vulnerability to systemic risks that solar projects are inherently shielded from.

The stated HFO plant operates under a 15-year Build-Own-Operate (BOO) agreement since May 2014 and within the conventional Bangladesh IPP framework characterised by a two-part tariff system (capacity + energy payment) and a fuel cost pass-through mechanism, thereby ensuring revenue stability even under partial utilisation conditions (~60%).

9.1. Comparison of Financial Indicators

When these empirically derived fossil fuel metrics are compared with the 3 MW solar plant, the resulting gap is significantly narrower than conventional narratives suggest (Table 14).

Table 14: Financial Performance Comparison: Solar vs HFO

Indicator	3 MW Solar Plant	50 MW HFO Plant
NPV (BDT Crore)	-5.2	+6
IRR (%)	8.4%	10%-11%
ROI (%)	5.6%	8%-10%
DPP (years)	~17-18 years	~11-12 years
DSCR	1.19	~1.2-1.35

Source: Calculated by the authors.

9.2. Revenue Structure and Cash Flow Stability

The observed financial differences are largely explained by divergent revenue structures rather than technological efficiency (Table 15).

Table 15: Revenue and Cash Flow Differences

Dimension	3 MW Solar Plant	50 MW HFO Plant
Revenue Composition	Energy Based	Capacity + Energy
Capacity Payment	Limited	Significant
Fuel Cost Risk	None	Passed Through
Utilisation Sensitivity	Moderate	High

Source: Prepared by the authors

The HFO plant's ability to generate stable cash flows despite ~60% utilisation is attributable to capacity payments, which guarantee revenue irrespective of dispatch levels. In contrast, solar projects rely more directly on generation-linked income, although variability is mitigated by predictable solar irradiance patterns. Moreover, every 5 per cent depreciation in the Bangladeshi Taka (BDT) increases the variable costs for the HFO based plant due to fuel imports, whereas the solar plant's fuel (solar irradiation) is immune to such inflationary pressures, effectively making its real-term IRR superior over a 20-year horizon.

For the fiscal year ending on June 30, 2025, the HFO plant reported a staggering negative Net Operating Cash Flow Per Share (NOCFPS) of BDT 9.05. This negative trajectory is a direct consequence of the arrears crisis where a lesser amount is received from the BPDB, coupled with the surging costs of opening Letters of Credit (LCs) for imported fuel in a dollar-scarce environment. In contrast, the solar project avoids this liquidity trap. With near-zero variable Operating Expenses (OPEX), every kilowatt-hour generated contributes directly to debt servicing, providing a superior Cash Flow Available for Debt Service (CFADS) stability that fossil fuel plants, burdened by fuel-import dependencies, can no longer guarantee.

9.3. Operational Efficiency and Intrinsic Margins

A fundamental distinction between the two plants lies in the origin of their margins. The 3 MW solar plant achieves profitability through intrinsic cost efficiency, with an LCOE of BDT 9.85 /kWh against a tariff of BDT 14.74/kWh, generating a margin of BDT 4.89 /kWh. This margin is independent of external inputs such as fuel.

By contrast, the HFO plant's profitability is structurally dependent on:

- Fuel cost pass-throughs that transfer price shocks to the consumer.
- Capacity payments that penalise the state for idle assets.
- Frequent tariff adjustments to offset foreign exchange losses.

Thus, while the HFO plant exhibits higher nominal returns, these are contractually engineered rather than operationally derived.

9.4. Subsidies and Transmission Reliance of Fossil Fuel Based Plants

The narrative of fossil fuel bankability ignores the hidden costs to the state. In recent years, the government continued to shoulder a heavy capacity-payment burden to sustain fossil-fuel IPPs which acts as a direct structural cost. Without this subsidy, the Levelised Cost of Electricity (LCOE) for HFO would soar to over BDT 22.40/kWh, compared to the solar plant's stable BDT 9.85/kWh (Alam & Jena, 2025). Additionally, while centralised HFO plants contribute to high distribution losses (avg. 12.5%) through long-distance transmission, the solar IPP connects directly to a local 33/11 kV sub-station. This distributed generation reduces the wheeling burden on the BPDB, offering a systemic financial benefit that far outweighs the modest scale of the plant.

When financing conditions are aligned by extending debt tenors and reducing interest rates, the 3 MW solar power plant's financial performance improves significantly, approaching parity with HFO plant. This demonstrates that the financial gap is not inherent, but rather a function of institutional financing disparities.

9.5. Critical Implications for Mobilising Investment in Solar IPPs

Comparative evidence indicates that the perceived financial superiority of fossil fuel-based IPPs such as the 50 MW plant is significantly overstated when examined at the project level. While the 50 MW HFO plant benefits from contractual revenue guarantees and structured financing, its financial performance remains moderate and, in some periods, unstable as evidenced by DSCR fluctuations below unity.

In contrast, the solar project exhibits strong operational fundamentals, including cost competitiveness and stable cash flow generation, yet is constrained by financing inefficiencies and institutional limitations. The relatively narrow gap in financial indicators suggests that solar PV projects in Bangladesh are already near the threshold of full bankability.

From a policy and investment perspective, this finding is particularly significant. It implies that large-scale renewable energy deployment does not require fundamentally superior economics, but rather a reconfiguration of financing structures and risk allocation mechanisms. With modest improvements in these areas, solar projects such as the 3 MW solar plant can achieve financial performance comparable to, or exceeding, that of fossil fuel-based IPPs.

10

Key Challenges in Financing Utility-scale Renewable Energy Projects

10.1. BPDB's Weak Payment Capacity

The BPDB is currently going through a fiscal crisis as it owes IPPs over BDT 27,000 crore, causing severe delays. Payment delays take up to 6–9 months creating major liquidity pressure on the IPPs (Hossen, 2025). This fiscal gap is caused by high generation costs from imported fuels, gap between generation costs and tariffs, limited foreign currency reserves and excess installed capacity.

The payment delays have had cascading effects across the sector, power producers said. Without timely settlements, IPPs struggle to open LCs for fuel imports, leaving suppliers unpaid and banks unwilling to extend further credit. Such was the case for the 3 MW plant as well where cash flow stability was significantly weakened by delays from the BPDB, which further strains debt servicing in an already tight DSCR environment.

10.2. Commercial Lender Pricing is Significantly Above Concessional Benchmark

Although concessional financing at ~2.4% from KfW was initially expected, the project ultimately relied on commercial lending from Bank Asia with substantially higher interest spreads. This overpricing of debt relative to concessional benchmarks materially increased financing costs and eroded project viability.

10.3. High Cost of Debt Compounded by Opaque Pricing and Spreads

The lending terms reportedly included margins above standard market risk premiums, suggesting inefficiencies in domestic credit pricing for renewable projects. This inflated the cost of capital beyond what project fundamentals would justify.

10.4. Near-threshold Profitability Despite Strong Operating Margins

Even with a substantial tariff-LCOE margin (BDT ≈4.89 /kWh), the project generated a negative NPV and IRR below WACC, indicating that operational efficiency alone was insufficient to offset financing burdens.

10.5. Scale Disadvantage of a Small (3 MW) Plant

The project's limited size led to higher per-unit CAPEX and weaker economies of scale compared to modern 50–100 MW plants, directly depressing IRR and extending payback periods.

10.6. Sensitivity to Tariff Shocks and Limited Financial Buffer

Sensitivity analysis shows that a 20 per cent tariff reduction would push DSCR below 1 and significantly worsen NPV, highlighting structural fragility and dependence on tariff stability. Alongside that, there is a currency mismatch between BDT denominated tariff payments and United States Dollar (USD) denominated CAPEX or loans which farther creates a forex risk given BDT devaluation.

11

Concluding Remarks and Recommendations

The analysis presented in this study demonstrates that utility-scale solar power projects in Bangladesh possess fundamentally sound operational and economic characteristics yet remain constrained by financing inefficiencies and structural limitations within the broader power sector. While the case study highlights near-viable financial performance under existing conditions, it also reveals how key variables such as tariff design, capital cost, and debt structuring critically influence project profitability and bankability. The comparative context further underscores that many perceived advantages of conventional power projects stem from institutional arrangements rather than intrinsic efficiency. Taken together, these findings suggest that improving financial architecture and risk allocation mechanisms is central to unlocking renewable energy investment. Accordingly, the following recommendations are proposed to address these systemic barriers and strengthen the investment environment for utility-scale renewable energy projects in Bangladesh:

Shift to Corporate PPAs

Instead of relying on BPDB as the sole off-taker, the new merchant power policy 2025 can be utilised by financing projects that sell directly to creditworthy industrial clusters such as special economic zones (SEZ) for the readymade garment (RMG) sector. Generators can use the grid to transmit power, paying a wheeling charge while BERC can regulate the prices.

Partial Credit Guarantees

The government can arrange a credit enhancement mechanism via partial credit guarantees from Multilateral Development Banks (MDBs) like the World Bank or Asian Development Bank (ADB) to act as a cushion against default risk and crowd in private investors.

Escrow Accounts

Mandate the creation of a Payment Security Mechanism where a portion of BPDBs revenue from high-paying industrial consumers is directly transferred into an escrow account for debt reservicing.

Introducing Oversight or Benchmarks for Lending Spreads in RE Projects

The observed overcharging by the commercial lender suggests inefficiencies in domestic credit markets. Regulatory or policy benchmarks for interest spreads can improve pricing transparency and protect project viability.

Strengthening Tariff Structures

Since tariff is the most sensitive variable affecting NPV and DSCR, incorporating escalation clauses or inflation indexation in PPAs can stabilise long-term project returns.

Strategic Land and Infrastructure Planning

Small-scale projects should be integrated into designated economic zones to share costs for land and grid connectivity, helping to reduce the high initial CAPEX that currently burdens individual early-stage projects.

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Bangladesh's renewable energy ambitions depend not only on technological progress but also on projects that are financially attractive to investors. This study examines the financial feasibility and bankability of a 3 MW utility-scale solar power plant through a detailed case study, combining techno-economic simulation using the System Advisor Model (SAM) with discounted cash flow (DCF) analysis. By evaluating and analaysing key financial metrics, the study reveals that while the plant is operationally efficient and cost-competitive, its financial viability is constrained by high financing costs, elevated interest rates, compressed debt tenors, and payment delays. The findings demonstrate that institutional and financing structures, rather than technical performance, are the primary barriers to scaling utility-scale renewable energy in Bangladesh. By moving beyond theoretical projections to provide ex-post empirical evidence from an operational solar IPP, the study offers valuable insights for policymakers, financial institutions, and private investors. It concludes with actionable recommendations on concessional finance, risk mitigation, and financing reform to improve project bankability and accelerate private investment in the country's clean energy transition.

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