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National Rooftop Solar Programme 2025

Review of Designing, Implementation, and Monitoring System

Khondaker Golam Moazzem
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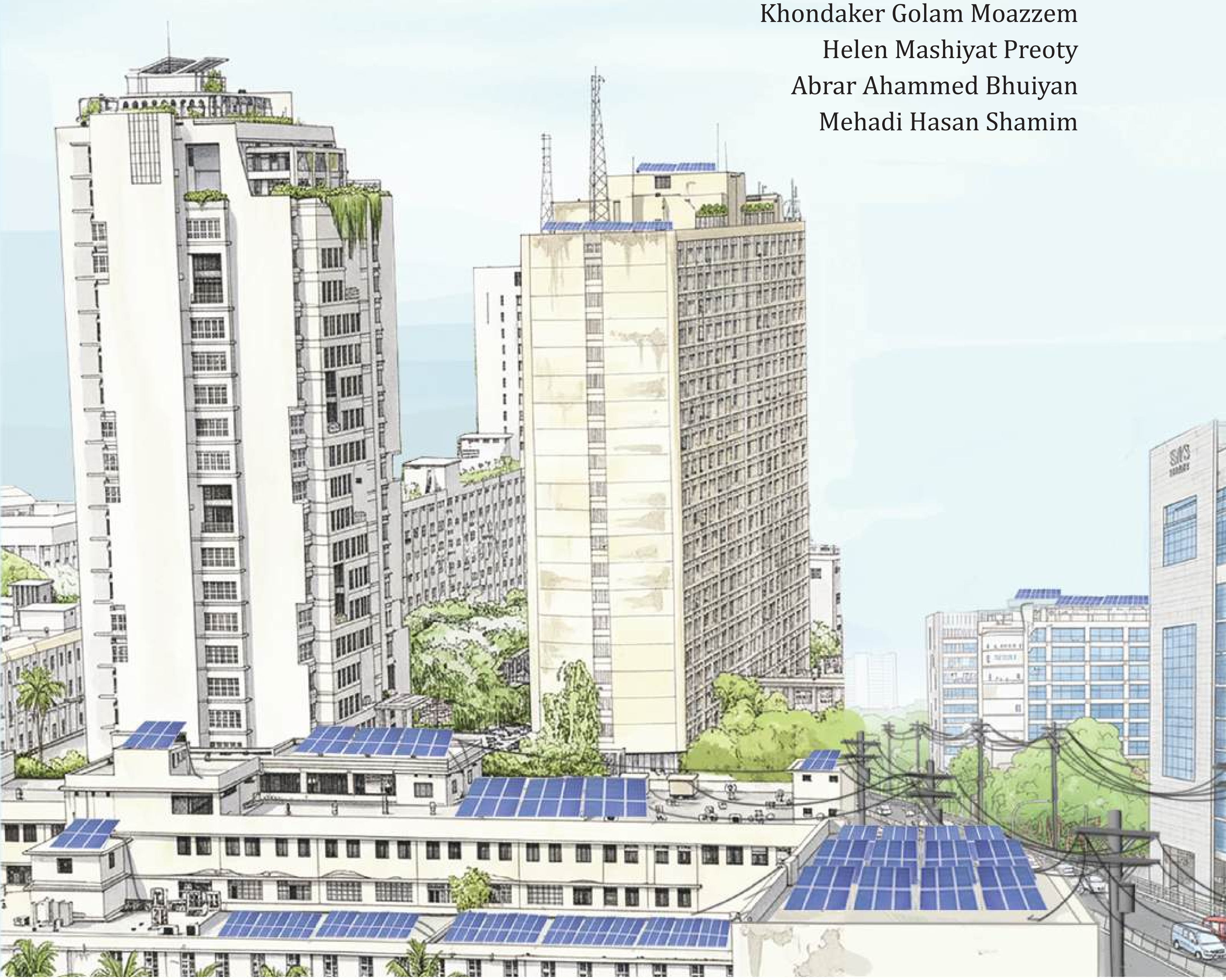

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Abstract

The National Rooftop Solar Programme, announced by Bangladesh's interim government in July 2025, sets a bold target of generating 3,000 MW of electricity from rooftop solar systems on government offices, schools, and hospitals, in line with the Renewable Energy Policy 2025 which aims to secure 20 per cent of electricity from renewable sources by 2030 and 30 per cent by 2040. Prepared by the Centre for Policy Dialogue (CPD) Power and Energy Study, this special report critically examines the programme's design, implementation, procurement, financing, and operation and maintenance (O&M) frameworks, whilst also drawing lessons from global experiences and Bangladesh's earlier rooftop solar initiative in Dhaka. The study identifies crucial risks, such as weak policy alignment, poor technical standards, limited institutional coordination, and the absence of effective monitoring systems, which, if left unaddressed, may undermine the initiative's sustainability. To ensure success, the report recommends phased piloting to test and refine approaches before nationwide deployment, independent verification of rooftop feasibility, transparent and performance-linked procurement processes, and comprehensive training programmes for facility managers and government operators. Equally important are robust O&M strategies, including digital monitoring tools, warranty-backed maintenance contracts, and clear accountability mechanisms, supported by financing models that balance both CAPEX and OPEX approaches. By aligning strong institutional arrangements with technical and financial rigour, the National Rooftop Solar Programme has the potential to accelerate Bangladesh's renewable energy transition, reduce dependence on fossil fuels, and establish rooftop solar as a reliable, distributed, and sustainable pillar of the national power system.

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Acronyms

BERC	Bangladesh Energy Regulatory Commission
BPDB	Bangladesh Power Development Board
BREB	Bangladesh Rural Electrification Board
CAPEX	Capital Expenditure
CPD	Centre for Policy Dialogue
DISCOM	Distribution Company
EPC	Engineering, Procurement and Construction
FiT	Feed-in Tariff
IEC	International Electrotechnical Commission
IoT	Internet of Things
MNRE	Ministry of New and Renewable Energy (India)
NEM	Net Energy Metering
O&M	Operation and Maintenance
OPEX	Operating Expenditure
PPA	Power Purchase Agreement
PV	Photovoltaic
RE	Renewable Energy
RESCO	Renewable Energy Service Company
SREDA	Sustainable and Renewable Energy Development Authority

01 Introduction

The interim government has announced a renewable energy initiative on 3 July 2025 titled *National Rooftop Solar Programme*. The target of this programme is to add 3000 MW of electricity from solar rooftops to be set on the government buildings, schools, and hospitals. The newly launched project is aimed at achieving the target of meeting 20 per cent of the total electricity demand from renewable sources by 2030 and 30 per cent by 2040 aligning with the Renewable Energy Policy 2025. The information of rooftop solar systems installation on the roof of government office buildings was circulating for quite some time. Even the previous regime announced such decisions but failed to follow through. Notwithstanding, the interim government has taken a timely resolution to declare the National Rooftop Solar Programme. Such bold decisions are appreciated, as it will help will Bangladesh achieve the renewable energy goals.

However, proper pre-planning, tailored designing, fair procurement, and effective implementation guidelines are essential for the successful implementation of the programme. Without such planning and preparation, like the previous initiative of Net Metering Rooftop Solar Program in Residential Buildings of Dhaka City, this programme is likely to turn into another failure, which has just become a national symbolic project. The failures caused because of the weak policy design, poor technical standards, limited user engagement, and lack in operation & maintenance mechanisms need to be cautiously avoided throughout the execution of the ongoing National Rooftop Solar Programme. Countries such as India, Pakistan, Vietnam, Germany and many more which have successfully implemented such programmes had a foolproof strategy including a comprehensive policy, tailored design, implementation roadmap, fair procurement process, financial strategies, and operation- maintenance plan.

In the prevailing context, CPD Power and Energy Study has undertaken this study titled *Designing, Implementation and Monitoring of National Solar Rooftop Programme in Bangladesh*. The main objectives of this study are as follows:

a) To present a design for the proposed National Rooftop Solar Programme;
b) To outline its possible monitoring and evaluation framework and
c) To suggest an operation and maintenance plan for sustainability of the programme.

02 Review of Rooftop Solar Programmes: Global and National Experience

2.1 Global Rooftop Solar Programmes: Lessons for Bangladesh

Globally and regionally several developing and developed countries have implemented similar rooftop solar programmes. These countries have developed robust rooftop solar programmes that integrate policy frameworks, financing options, technical standards, and monitoring mechanisms. Their experiences offer critical insights for Bangladesh as it designs and scales its own National Rooftop Solar Programme. The following country examples illustrate how diverse approaches can address sector-specific challenges and maximise the benefits of distributed solar energy.

India: India's National Solar Rooftop Programme, implemented by the Ministry of New and Renewable Energy (MNRE) in partnership with state-owned Distribution Companies (DISCOMs), combines Capital Expenditure (CAPEX) and Renewable Energy Service Company (RESCO) models to cater to varied institutional and financial capacities (Ministry of New & Renewable Energy, 2016). A centralised online platform (solarrooftop.gov.in) manages applications, subsidies, and performance tracking, ensuring transparency and standardisation. The programme uses MNRE-developed sizing and quality assurance tools, whilst targeted schemes like PM-KUSUM (focusing on agricultural feeders) (Ministry of New & Renewable Energy , 2025) and SRISTI (for residential solar adoption) expand reach to priority sectors. This multi-layered approach strengthens technical reliability, simplifies subsidy access, and fosters greater consumer confidence.

Sri Lanka: Sri Lanka's Soorya Bala Sangramaya (Battle for Solar Energy) is led by the Sri Lanka Sustainable Energy Authority (SLSEA) and supported by utilities such as the Ceylon Electricity Board (CEB) and Lanka Electricity Company (LECO). It primarily follows a CAPEX model, where systems are financed directly by owners or through concessional loans (Sri Lanka Sustainable Energy Authority - SLSEA, 2025). The programme targets the solarisation of all state buildings by 2025 and ensures strict compliance with net metering standards, inverter certification, and structural safety requirements. Utilities facilitate integration through bi-directional metres and streamlined grid connections, whilst SLSEA coordinates regulatory oversight. This prominent level of technical compliance and utility involvement helps ensure operational reliability.

Pakistan: Pakistan's rooftop solar adoption has accelerated through donor-supported initiatives, particularly the Pakistan Solar Energy Project (PakSEP) implemented under the Alternative Energy Development Board (AEDB). Whilst historically reliant on CAPEX funding, the country is now piloting RESCO and Energy Service Company (ESCO) models to promote private sector participation. AEDB provides technical guidelines for rooftop solar design, whilst a national digital monitoring platform is under development to enhance transparency. World Bank support has prioritised government buildings for installations, but scaling remains in the preliminary stages due to institutional and regulatory challenges.

Germany: Germany's rooftop solar sector is driven by the Renewable Energy Sources Act (Wikipedia, 2025) and the Mieterstrom (Tenant Solar) model, which combine policy stability with high technical standards. Operating under a Feed-in Tariff (FiT) system, Germany guarantees returns for exported solar electricity, which encourages long-term investment. The programme enforces rigorous installer accreditation, mandatory smart metres, and advanced monitoring systems, ensuring both performance and safety. The combination of strong regulation guaranteed income streams, and transparent performance data has made Germany one of the global leaders in rooftop solar integration.

Australia: Australia's Small-scale Renewable Energy Scheme (SRES), administered by the Clean Energy Regulator (Clean Energy Regulator, 2025) in coordination with state governments and utilities, has significantly expanded residential solar adoption. The scheme offers upfront rebates and mandates installation by accredited professionals. Pre-installation technical audits are carried out using government-approved tools, ensuring design accuracy and site suitability. Real-time digital monitoring by

Table 1 Summary of global rooftop solar programme examples

Country	Programme Name/ Policy	Key Implementing Agencies	Deployment Model	Key Features
India	National Solar Rooftop Programme (MNRE)	Ministry of New and Renewable Energy (MNRE), DISCOMs	CAPEX and RESCO	• Central portal (solarrooftop.gov.in) for application, subsidy, and tracking • Standardised tools for quality control • Key schemes: PM-KUSUM, SRISTI
Sri Lanka	Soorya Bala Sangramaya ('Battle for Solar Energy')	Sri Lanka Sustainable Energy Authority (SLSEA), Utilities (CEB, LECO)	CAPEX (self/loan-financed)	• Target to solarise all state buildings by 2025 • Compliance ensured for net metering, safety- Utilities provide bi-directional metering support
Pakistan	Rooftop Solar via PakSEP and AEDB guidelines	Alternative Energy Development Board (AEDB), World Bank	Donor-funded CAPEX; pilot RESCO/ESCO models	• Pilots supported by World Bank under PakSEP • Technical guidelines by AEDB • Digital monitoring platform under development
Germany	EEG (Renewable Energy Sources Act), Mieterstrom (Tenant Solar)	German Federal Network Agency, Utilities	Feed-in Tariff (FiT)	• Guaranteed returns for exports • Strong safety, performance, and certification frameworks- Mandatory smart metres
Australia	Small-scale Renewable Energy Scheme (SRES)	Clean Energy Regulator, State Govts, Utilities	Primarily Residential (rebate backed)	• Accredited installer network • Real-time digital monitoring • Pre-installation technical audits by govt tools • Transparent comparison portals

Source: Collected from various secondary literatures.

utilities enables continuous performance oversight, whilst public comparison portals foster market competition and consumer choice. Australia's combination of technical rigor and consumer empowerment provides a model for balancing policy incentives with accountability.

Table 1 illustrates that successful rooftop solar programmes balance technical standards, financing innovation, digital monitoring, and utility engagement. For Bangladesh, India's centralised digital platform offers a replicable model for transparent subsidy management and performance tracking. Sri Lanka's strict compliance with technical and safety standards highlights the value of utility-facilitated integration. Pakistan's experience with donor-supported pilots demonstrates the potential of blended finance and the importance of developing a national monitoring platform early in the programme. Germany's rigorous accreditation process for installers and mandatory smart metering provides a blueprint for quality assurance, whilst Australia's consumer-focused rebates and public comparison tools show how market competitiveness can be leveraged for adoption.

2.2 Global Rooftop Solar Programmes – O&M Examples

International rooftop solar programmes offer a range of structured O&M approaches that Bangladesh can adapt.

India: The National Solar Rooftop Programme mandates a 5-year O&M period under EPC contracts, extendable to 10 years in certain states. This includes remote performance monitoring via MNRE's Solar Monitoring System, third-party audits, and smart metre integration.

Sri Lanka: Under the Soorya Bala Sangramaya initiative, O&M rests with system owners, but utilities such as CEB and LECO support net-metered system monitoring. SLSEA is piloting local technician training for community-level maintenance.

Pakistan: The AEDB guidelines leave O&M largely to consumers, which has resulted in service gaps. Licenced installers are mandatory, and policy revisions are being considered to integrate warranty-backed O&M provisions.

Australia: The Small-scale Renewable Energy Scheme (SRES) promotes O&M through CEC-accredited professionals. Many projects have 10–25-year O&M provisions under PPAs, backed by government-issued consumer O&M guidelines.

Germany: Under the Renewable Energy Act (EEG), O&M is provided by regulated professional services. Systems must have smart meters, routine inspections, and strict compliance monitoring. Tenant solar models include bundled O&M responsibilities for landlords.

Table 2 highlights that structured O&M is essential for sustaining rooftop solar performance. India's mandatory EPC-linked contracts with remote monitoring ensure accountability, whilst Sri-Lanka emphasises utility support and local technician training to strengthen owner-led systems. Pakistan's consumer-dependent model reveals the risks of weak follow-up and the need for warranty-backed frameworks. Germany's regulated inspections, smart metres, and bundled O&M responsibilities set a benchmark for reliability, and Australia's accredited professionals, long-term PPAs, and clear consumer guidelines show how market mechanisms can secure sustainability. For Bangladesh, these global examples suggest that embedding mandatory O&M periods in rooftop solar contracts, developing accredited professional networks, and introducing warranty-backed provisions will be critical for scaling adoption.

Additionally, early investment in digital monitoring tools and technician training programmes can strengthen long-term system performance and address gaps in consumer-driven maintenance.

Table 2 | Comparative O&M approaches in global rooftop solar programmes

Country	Programme Name	Operation & Maintenance (O&M) Approach	Key O&M Practices
India	National Solar Rooftop Programme (Ministry of New and Renewable Energy – MNRE)	O&M is mandatory under Engineering, Procurement and Construction (EPC) contracts for 5 years (extendable to 10 years in some states)	• Remote data monitoring via Solar Monitoring System (by MNRE) for institutional/government systems • Third-party performance audits in states like Gujarat and Rajasthan • Smart meter integration by State Distribution Companies (DISCOMs)
Sri Lanka	Soorya Bala Sangramaya (Battle for Solar Energy)	O&M responsibility lies with system owners; technical support by Sri Lanka Sustainable Energy Authority (SLSEA)	• Net-metered systems monitored by utilities like Ceylon Electricity Board (CEB) and Lanka Electricity Company (LECO), though real-time digital tools are limited • SLSEA is piloting local technician training at community level
Pakistan	Net Metering Policy and Alternative Energy Development Board (AEDB) Guidelines	O&M is generally left to consumers; absence of formalised frameworks is a concern	• AEDB mandates the use of licenced installers • Inverter failures and poor service due to weak follow-up systems • Ongoing discussions to include warranty-backed O&M in new rooftop policies
Australia	Small-scale Renewable Energy Scheme (SRES)	O&M performed by Clean Energy Council (CEC)-accredited professionals	• Regular inspections, inverter checks, and panel cleaning promoted • Long-term O&M (10–25 years) through lease or Power Purchase Agreement (PPA) models (e.g., Sunwiz, Origin Energy) • Consumer-oriented O&M guidelines by government agencies
Germany	Renewable Energy Act (Erneuerbare-Energien-Gesetz – EEG) and Mieterstrom (Tenant Solar) Models	Professional and regulated O&M services are standard	• Routine inspection of inverter performance, panel degradation, and grid compliance • Tenant solar includes bundled O&M for operators or landlords • Mandatory use of data loggers and smart meters for performance tracking

Source: Collected from various secondary literatures.

2.3 Critical Review of Rooftop Solar Programme in Residential Buildings of Dhaka City: Lessons for National Rooftop Solar Programme 2025

Rooftop solar power holds significant potential to address Dhaka's rising energy demand whilst advancing Bangladesh's clean energy transition. Given the city's density and limited space for utility-scale renewables, rooftops offer a practical solution for distributed generation. However, earlier rooftop solar initiatives in

Dhaka city faced financial, technical, and institutional challenges that limited the success of this initiative. High upfront costs, lack of affordable financing, weak policy enforcement, and limited consumer awareness reduced adoption, whilst poor installation quality, inadequate monitoring, and insufficient O&M undermined the performance. Distribution utilities also played a minimal role in facilitating grid integration, further constraining uptake. Reviewing these shortcomings is essential to ensure that the National Rooftop Solar Programme 2025 avoids past pitfalls by embedding stronger financial incentives, robust regulatory frameworks, reliable O&M mechanisms, and consumer engagement strategies. A redesigned programme has the potential to unlock large-scale adoption in Dhaka and set a benchmark for Bangladesh's renewable energy transition.

2.3.1 Reasons Behind the Failure of Previous Rooftop Solar Initiative in Dhaka

Bangladesh already has past experience with rooftop solar systems in the residential buildings. Between 2010 and 2012, a rooftop solar policy was introduced in Dhaka. However, it failed to achieve the desired sustainable results. Understanding these shortcomings is important for shaping the new national rooftop solar programme.

Table 3 Reasons behind the failure of rooftop solar policy implemented in Dhaka around 2010–2012

Stages	Problem Area	Details
Pre- installation	Lack of Industry Standards	• Users ignored regular maintenance (e.g., cleaning panels, checking inverters) • Dust accumulation drastically reduced performance
	Misaligned Policy Objectives	• Blanket mandate ignored practical feasibility, especially in urban apartments or shaded roofs
	High Upfront Costs	• Cost of installation (BDT 3.5–36 lakh) was too high for many households and small businesses
	Battery-Dependent Design	• Early policy pushed for battery-backed systems, which increased cost, complexity, and maintenance needs
Installation	Misuse of Policy (Tick-box Installation)	• Many installed panels only to get electricity connections, not to use solar power • Once connected, they abandoned the systems
	Poor Quality of Equipment	• Many panels were low-grade and failed within 3–5 years, far short of their expected 20-year lifespan • Inverters and batteries also often failed early
	Weak Implementation of Net Energy Metering	• Net metering was introduced in 2018 but lacked clarity, support, and working metres • Even vendors could not explain it well
Post- installation	Lack of Awareness and Training	• Owners lacked basic knowledge about how solar panels work • They were unaware of simple upkeep practices
	No Centralised Oversight or Monitoring	• No systematic tracking of whether systems remained functional • No incentives or penalties for keeping systems active
	Lack of Maintenance	• Users ignored regular maintenance (e.g., cleaning panels, checking inverters) • Dust accumulation drastically reduced performance

Source: (Chowdhury & Aziz, 2023).

The failures described in the table 3 points to a combination of weak policy design, poor technical standards, and limited user engagement. For instance, the policy mandated installations without considering whether rooftops were actually suitable. Installation costs were extremely high, often beyond the reach of average households. Additionally, the early focus on battery-backed systems further increased cost and complexity. During the installation stage, many households saw rooftop solar as only a way to secure electricity connections and abandoned the systems afterward. Poor-quality panels and inverters, some of which failed within only 3–5 years, reinforced this problem. Net metering was eventually introduced, but its unclear design and lack of awareness meant even vendors struggled to explain it properly.

After installation, the situation worsened due to lack of awareness and oversight. Most owners did not know the basics of cleaning or maintaining their panels. Dust accumulation alone reduced efficiency significantly. In that initiative, no central monitoring system existed to ensure functionality, and there were no incentives or penalties for households to keep systems active.

2.3.2 Key Lessons from Rooftop Solar Programme in Residential Buildings of Dhaka City

The earlier rooftop solar programme in Dhaka offers several important lessons that are highly relevant to the national programme. The new solar programme must not repeat the same mistakes and take full advantage of the following lessons learnt.

Maintenance is equally essential- Regular cleaning of panels and routine checks on inverters and other components cannot be overlooked. Without consistent maintenance, dust accumulation and minor technical issues can drastically reduce system performance, regardless of how well the system was installed initially.

Net metering must be functional and user-friendly- It cannot exist merely as a technical or symbolic provision. Users need clear information on how to read their metres, track electricity generation, and manage energy use. If users do not understand how net metering works, they are unlikely to engage with the system effectively.

Awareness and training for system owners are critical- Users need to understand the basic principles of solar energy and the operational requirements of their rooftop systems. Without sufficient knowledge, even installed systems may fall into disuse due to neglect or misuse.

Tariff design plays a crucial role in adoption- The net metering tariff must be competitive and should not exceed the grid electricity rate. Otherwise, households and institutions will have little incentive to rely on solar power, and the financial viability of the programme will be compromised.

Tracking and monitoring must be mandatory- A centralised system is required to ensure that installed rooftop systems remain functional over time. This allows authorities to identify non-performing systems, support maintenance, and guarantee that the benefits of solar installations are realised.

Battery-based systems should not be mandatory- Whilst batteries can provide backup power, forcing their inclusion increases both cost and complexity. Unless there is a specific need, solar systems should remain grid-connected and battery-free, allowing for simpler installation, lower costs, and easier maintenance.

Taken together, these lessons highlight that technical quality, proper maintenance, user awareness, and effective monitoring are as important as installation itself. The Dhaka rooftop experience shows that a well-intentioned policy can fail if it does not address practical feasibility, financial accessibility, equipment quality, and user behaviour. The new national rooftop programme must avoid repeating these mistakes.

03 Overview of the National Rooftop Solar Programme 2025

3.1 Relevant Policy and Guidelines

The National Rooftop Solar Programme in Bangladesh is anchored in the Net Energy Metering Guidelines (NEM) (2018) (SREDA, 2018). At the time of launching the circular, the second revision of the NEM guidelines was also released, which made several major changes compared to the original document.

The guidelines now set out a structured process for installing rooftop solar systems in residential, commercial, and industrial buildings. Procurement for these projects will follow the Public Procurement Rules (PPR) 2008, ensuring that both the CAPEX (Capital Expenditure) and OPEX (Operating Expenditure) models are transparent and competitive. Under this framework, firms responsible for installation will be procured through government-approved procedures.

3.2 Proposed Design of the Projects

The NEM circular proposes a design of the full programme based on the NEM Guidelines 2018. The design of the programme has been separated into two major initiatives, reflecting the diverse needs of government institutions and social facilities such as schools and hospitals (Table 4). The installation process in the government building will follow CAPEX model, whereas in case of educational and health institutions OPEX model will be followed. In the CAPEX or Capital Expenditure model, the roof owner, who is also the consumer, bears the capital expenditure of the solar installation including equipment, installation, operation, and maintenance of the solar energy system. Whilst cost-intensive, the CAPEX model gives the consumer complete rights to their solar asset. This right comes with tax and depreciation benefits along with the ability to send the excess energy back into the grid and be compensated for it.

Table 4 | Strategic aspects of the programme

Initiative A (Government Offices)	Initiative B (Educational and Health Institutions)
• Installation of solar panels on the rooftops of all government-owned buildings (excluding rented ones) • Government will fund the entire project • A web-based application system has already been launched and is accessible via the Power Division website (https://powerdivision.gov.bd/) • This application will help determine electricity generation capacity based on rooftop area, required equipment, and estimated cost • A net metering system will also be in place to manage billing	• Solar installation in schools, colleges, madrasas, and hospitals through private investment • With no cost to the institutions • As a result, these institutions will benefit from reduced electricity bills • A web-based application system has already been launched and is accessible via the Power Division website (https://powerdivision.gov.bd/) • This application will help determine electricity generation capacity based on rooftop area, required equipment, and estimated cost • A net metering system will also be in place to manage billing

Source: NEM Guidelines 2018 (2nd revision).

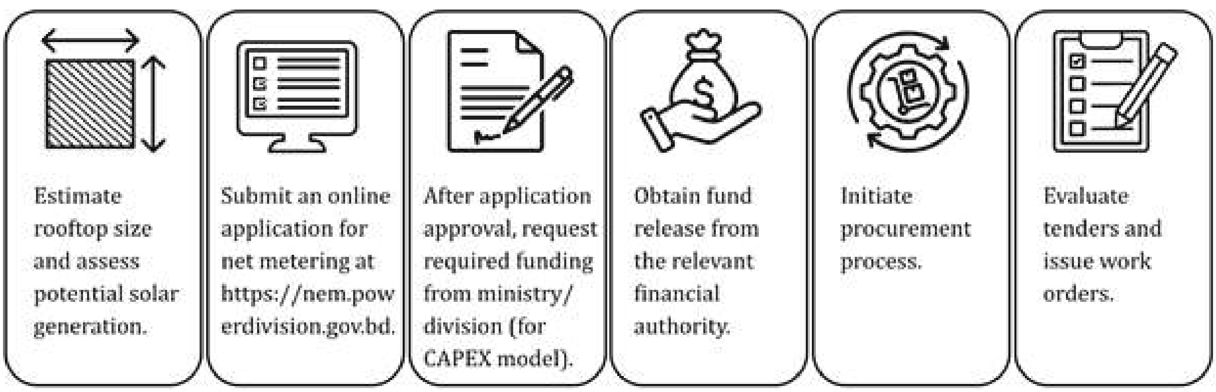
The OPEX or Operating Expenditure model shifts the responsibility of the solar plant to a third party for the installation who actually bears the capital expenditure of the solar installation including equipment, installation, operation, and maintenance of the solar energy system. The off takers without own investment can ask a Renewable Energy Service Company (RESCO) to set up a solar plant. The consumer provides the roof, and the developer invests in the equipment, installation, commissioning, and maintenance of the plant. This type of installation is also called a land lease model.

A web-based application system has already been launched and is accessible via the Power Division website (Power Division, 2025a). This application will help determine electricity generation capacity based on rooftop area, required equipment, and estimated cost. Additionally, a net metering system will also be in place to manage billing.

In short, the solar rooftop installation on government buildings will be fully government-funded. Installation of solar rooftops on the educational and health institutions will rely on private investment with direct benefits to schools and hospitals in the form of reduced electricity bills.

The designing under both the models in case of all the government, educational and health institutes will follow the same process (Figure 1). It will begin with estimating the rooftop area and assessing the potential for solar energy generation. Applicants will then submit an online application for net metering through the official portal (Power Division, 2025b).

Figure 1 **Designing Steps of the Rooftop Projects**

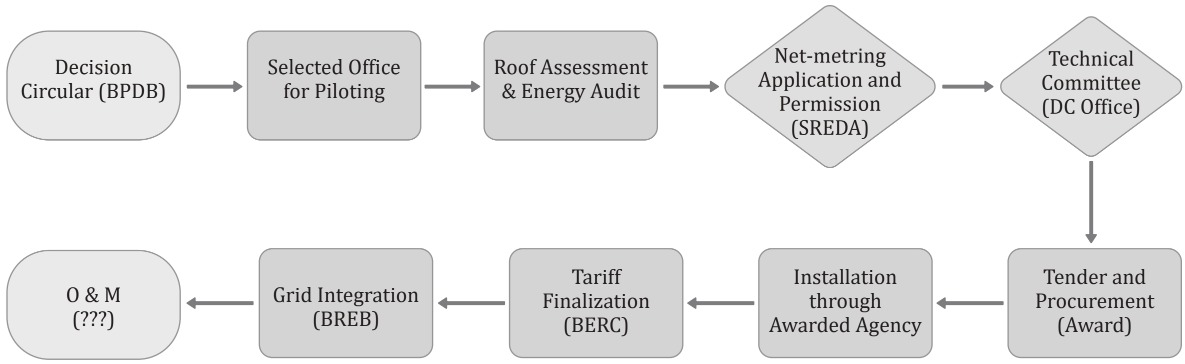


Source: National Rooftop Solar Program Circular (2025).

3.3 Proposed Implementation Process

The implementation process of the rooftop solar programme involves several key steps to ensure proper planning and execution as detailed in Figure 2. The first step of the process is already completed as the circular has been published. Now the authorities need to select the buildings for rooftop installation, followed by the roof assessment and energy audit. After assessing the area of roof, the off taker needs to apply for the NEM permission using the dedicated SREDA website. Once the application is approved, funding will be requested from the relevant ministry or division under the CAPEX model, and the financial authority will release the allocated funds. To implement the process at the district or Upazila level, technical committee under the District Commissioners office will be formed. After securing the budget, the procurement process will be conducted, which will include evaluating tenders and issuing work orders to the selected contractors. Under the same technical committee, tender will be floated, and the procurement committee will be awarded among the bidders. After completing the installation of solar PVs, the Bangladesh Energy Regulatory Commission (BERC) will determine the electricity tariff and will be integrated into the grid.

Figure 2 **Complete flowchart of the pre-, during- and post-implementation process**



Source: Authors' Illustration.

3.4 Proposed Procurement Process

The implementation process places responsibility at both central and local levels. The district commissioner will initiate procurement, supported by a technical committee to ensure that installations follow proper standards. This process aims to ensure consistency across different regions of the country.

Procurement for rooftop systems is expected to follow a transparent model. Whilst BPDB aims to purchase only top tier equipment from the Bloomberg list, SREDA has already developed a detailed specification list to guide selection. This combination seeks to balance international quality benchmarks with local compliance standards (Table 5).

Table 5 **Technical specifications and requirements for rooftop solar system components**

SL.	Component	Specification/ Standard
1	Module Capacity	• Between 10 kWp and 50 kWp
2	PV Module	• Single glass: 230V (±15%) • Double glass: 400V (±15%)
3	Mounting Structure	• Single or double rail system
4	Battery (if any)	• Lead-acid: 700–3500 Ah
5	PV Module Brand	• Tier-1 brands (e.g., JA, Jinko, Longi, Trina, Risen, REC, Canadian Solar, Astronergy, etc.) • Efficiency: Minimum 10 years warranty and 25 years power output warranty (at least 80% output)
6	Inverter	• Reputed brands (e.g., Solis, Growatt, Sungrow, Huawei, SMA, Fronius, Fimer, etc.) • Minimum efficiency warranty: 10 years- Minimum product warranty: 5 years

Table 5 contd.

Table 5 contd.

SL.	Component	Specification/ Standard
7	Monitoring System	• Remote monitoring system (RMS) must be included
8	PV Module Technology	• Mono PERC or advanced equivalent • Minimum product warranty: 20 years
9	AC Cable	• UV Protected type • Minimum product warranty: 20 years • Minimum service warranty: 5 years
10	DC Cable	• Locally reputed brand (e.g., BRB, BBS, Partex, RR, Bizli, etc.) • Minimum product warranty: 20 years • Minimum service warranty: 2 years
11	Energy Metre	• Must comply with national standards • All metres must be calibrated and certified • Must include RF/PLC-based communication option • Minimum service warranty: 3 years
12	Combiner Box & Junction Box	• Must be of reputed brand • Must comply with BSTI/IEC/IEEE standards • Minimum warranty: 1 year
13	Operation & Maintenance	• Comprehensive O&M manual must be provided

Source: SREDA Website.

The specifications highlight the government's intention to ensure durability and performance. For example, solar modules are expected to come with 25-year performance warranties, inverters must be sourced from reputed international brands, and all systems must include remote monitoring facilities. The installation process of the Net Energy Metering (NEM) system under the national solar rooftop programme is described in broad terms. Whilst the standards and sub-standards appear adequate, their effectiveness will depend entirely on strict adherence during implementation. If strictly followed, these requirements can guarantee reliability and long-term returns. However, clear guidance on pre-installation requirements is missing. The circular does not mention any mechanism for testing or evaluating equipment before or after installation, which is essential to guarantee system quality and reliability.

3.5 Proposed Financing of the Projects

In the circular, the financing models create a clear distinction, where government offices will adopt the CAPEX model, where the government provides the full budget through respective ministries. However, educational and health institutions will use the OPEX model, where private investors or NGOs carry the cost of installation, and the institutions benefit from reduced electricity bills (Table 6).

Table 6 | Proposed financing models

Government Offices	Educational and Health Institutions
• Implementation will follow CAPEX model (capital expenditure) through procurement as per PPR-2008 via respective ministries • The government will allocate budget for the national solar rooftop programme	• Implementation will follow OPEX model (operational expenditure) through electricity distribution companies, NGOs, or private service providers as per PPR-2008

Source: National Solar Rooftop Circular.

In both cases, procurement may bundle multiple institutions together to reduce costs, and systems will primarily be grid-connected and battery-less. In the project, net metering will be applied uniformly, and customers will receive bills every three months based on the power supplied to and drawn from the grid. Depending on rooftop size, solar systems are estimated to range from 10 kW to several megawatts. The CAPEX model is for those who have the required capital to make the full investment in solar power. With energy savings, consumers can recover this initial investment within 5-6 years. In case of OPEX model, the consumer enters into a Power Purchase Agreement (PPA) with the solar developer for a fixed tenure (between 15-25 years).

3.6 Proposed Operation and Maintenance (O&M)

Although operation and maintenance (O&M) is critical for ensuring the long-term performance and safety of rooftop solar systems, the circular does not provide specific guidelines on this aspect. Currently, the responsibility is vaguely assigned either to rooftop owners or to third-party contractors, leaving significant ambiguity in practice.

The circular does not define any specific mechanism for post-installation O&M. There is no framework to ensure that NEM systems remain fully operational over time. This includes the absence of monitoring systems or structured responsibilities to track performance and intervene when necessary.

For the CAPEX model, there is no mention of how operation and maintenance will be financed or who will bear these costs. In contrast, under the OPEX model, responsibility for O&M is clearer, as it falls for the service providers or investors.

Overall, this gap in O&M guidance represents a critical weakness in the programme design. Without clear procedures, responsibilities, and financing, even high-quality installations may fail to deliver sustained performance.

04 Critical Review of the Proposed Policy, Design, Implementation, Procurement, and O & M-related Issues

4.1 Critical Review of the Proposed Policy-related Issues Concerning the National Rooftop Solar Programme 2025

The newly announced national solar rooftop programme tries to align with the existing policy; plans acts and road maps, especially the Renewable Energy Policy 2025. As the new rooftop solar circular did mention in the Net Energy Metering Guidelines 2018 (Second Revision) for the implementation of the National Solar Rooftop Programme. Besides, it aims to follow Public Procurement Rules 2008 to complete procurement procedure. However, several policy instruments mentioned in this programme do not seem to complement the overall objective of the programme. Table 7 demonstrates CPD's observation regarding the policy provisions.

Table 7 | Observations regarding the provisions in the NEM guideline 2018

Issues	Provisions	Observation
Rooftop space utilisation	The prosumer can generate equivalent to their total electricity demand	The limit should be withdrawn enabling the full utilisation of the rooftop
Export limit	The export of the electricity is optional	Will complement
NEM capacity	In case of medium and high voltage NEM capacity cannot exit 80% of the cumulative capacity of the parallel transformers	Will complement
Settlement period	The prosumer will be paid in every three months against their cumulative credit	Will complement
Tariff structure	Tariff will be determined according to the tariff circular of BERC	No separate tariff structure for these two NEM schemes by BERC

Source: Authors' Observation.

The NEM guidelines restrict the full utilisation of the roofs by putting a bar on the electricity generation equivalent to the total electricity demand. If utilisation of the total rooftop capacity can help generate more electricity from solar, there should not be any binding on that. Similarly, the BERC will determine the power tariff according to the BERC tariff structure, however, a separate NEM tariff structure will help any further discrimination within the programme. Overall, the export limit, capacity and settlement mentioned in the NEM guidelines will complement the programme.

Another key observation regarding the national solar rooftop programme is the likelihood of failure if it is not cautiously planned. The national solar rooftop programme is said to kickstart together in all the 495 upazilas in Bangladesh. Doing so might cause a major fallback in the programme given the not so successful experience in the previous rooftop solar project in the residential areas.

Three government bodies who are the key stakeholders of the National Solar Rooftop Programme—(a) Bangladesh Power Development Board (BPDB), (b)Sustainable and Renewable Energy Development Authority (SREDA), and (c) Bangladesh Rural Electrification Board (BREB). However, coordination among these authorities have been noticed to be lacking. Different authorities have said to have distinct levels of information regarding planning, designing, timeline, business model, and execution. Table 5 represents the discrepancy noticed among the relevant authorities.

Table 8 | Coordination mismatch among the government authorities

Issues	BPDB	SREDA	REB
Statement regarding the piloting	The project will be commissioned in all the 495 upazilas at the same time	Some of the Upazilas will be selected for the piloting before going in with full scale	Some of the Upazilas will be selected for the piloting before going in with full scale
Policy guidelines and business model	SREDA is drafting a policy guideline along with a business model	SREDA is not informed regarding the policy guidelines	SREDA is drafting a policy guideline along with a business model
NEM Model	CAPEX- Government office Building OPEX- Schools/hospitals	OPEX/ CAPEX- Both are fine for Government office Building	OPEX- Government office Building OPEX- Schools/hospitals
NEM System Capacity	100% of the building electricity demands (may not utilise the full roof capacity)	OPEX- Schools/hospitals Full utilisation of the building roof	100% of the building electricity demands (may not utilise the full roof capacity)

Source: KII conducted with different authorities.

4.2 Critical Review of Design-related Issues Concerning the National Rooftop Solar Programme 2025

The successful design and deployment of rooftop solar photovoltaic (PV) systems for government buildings in Bangladesh require a strategic approach that goes beyond standard installation practices. The Power Division's 2025 circular rightly emphasises compliance with the technical standards approved by the Sustainable and Renewable Energy Development Authority (SREDA), but the practical success of the programme depends on how these standards are translated into site-specific designs that address the unique physical, operational, and climatic realities of each location.

Designing rooftop solar systems for public institutions demands a comprehensive understanding of several interlinked parametres. First, load demand assessment must accurately determine the building's actual electricity consumption patterns, ensuring the system size is neither oversized (leading to underutilised capacity) nor undersized (failing to meet demand). This must be paired with a structural feasibility assessment of the rooftop, considering weight-bearing capacity, available surface area, and potential obstacles such as water tanks, heat, ventilation and air conditioning (HVAC) units, or antennae.

Second, solar resource optimisation requires precise evaluation of annual irradiation levels, tilt and azimuth adjustments, and year-round shading analysis to maximise generation potential. Given Bangladesh's geographical diversity in solar exposure (higher in the south and south-west) design specifications should be location-sensitive rather than uniform.

Third, grid readiness to integrate the solar electricity is critical. In compliance with the Net Metering Guidelines, systems must be equipped with bi-directional metres and grid-compliant inverters to allow seamless energy export. The design must also anticipate technical challenges such as voltage fluctuations, reverse power flow, and harmonics, particularly in rural distribution networks managed by entities like the Rural Electrification Board (REB).

Fourth, financial model alignment, whether through a CAPEX model, where the government bears the cost, or an OPEX model, where third parties invest and operate is essential in determining long-term sustainability. Each model has different implications for ownership, performance accountability, and maintenance obligations, and therefore should be matched to the operational capacity of the institution.

Finally, embedded monitoring and maintenance systems are non-negotiable for sustaining system performance over decades. Designs should include IoT-enabled real-time monitoring, fault detection systems, and well-defined preventive maintenance schedules, with responsibilities clearly allocated to either in-house facility managers or third-party service providers. Without these built-in safeguards, systems risk rapid performance degradation, undermining the investment and the programme's credibility.

In essence, the programme's design phase is the foundation on which all subsequent stages such as procurement, installation, financing, operation, and others. A technically sound, context-specific design process, backed by strong institutional oversight, will be the difference between short-term installations and a sustainable nationwide rooftop solar network.

4.2.1 Critical Observations

The recent government circular for rooftop solar deployment in public buildings demonstrates a commendable commitment to standardisation and integration within the existing energy framework. It recognises the importance of adhering to SREDA-approved technical standards, which provides a baseline assurance for quality, safety, and compatibility. By explicitly mandating the use of bi-directional energy metres and aligning with the Net Metering Policy, the circular facilitates transparent monitoring and seamless export of excess generation to the national grid.

Design flexibility is another notable strength. The inclusion of both CAPEX and OPEX financing models allows government institutions to select an approach that aligns with their budgetary realities and operational capacities. Furthermore, the circular acknowledges the importance of site-specific planning, emphasising assessments of rooftop availability, structural safety, and load demand to ensure appropriately sized systems. Importantly, the inclusion of post-installation monitoring and regular reporting requirements reinforces the principle that solar PV systems should be managed as long-term infrastructure rather than one-off installations.

However, several design-related gaps remain that could undermine the programme's effectiveness if not addressed. The limitations are followings:

1. There is an absence of standardised sizing methodologies to guide optimal system capacity decisions based on load profiles, seasonal variations, and available rooftop space. This lack of clear guidance risks oversizing (leading to underutilisation) or under sizing (leading to unmet demand).
2. Whilst technical compliance is mentioned, the circular does not provide standard design templates for critical components such as PV modules, inverters, mounting structures, and wiring systems.

Such templates, coupled with performance benchmarks, could help maintain uniform quality across diverse locations and vendors.

3. Pre-installation energy audits, which is a critical step in accurately assessing demand and improving energy efficiency before sizing solar systems, are not mandated. This omission increases the risk of installing systems that do not align with actual consumption patterns.
4. There is limited guidance on structural feasibility assessments, such as evaluating load-bearing capacity and wind resistance, which are essential for rooftop safety, especially in cyclone-prone coastal regions.
5. Operation and Maintenance (O&M) considerations are insufficiently integrated into the design phase. Elements like inverter replacement cycles, access for panel cleaning, and built-in diagnostic tools should be part of the initial system layout to reduce lifecycle costs and performance losses.
6. The current approach appears to adopt a uniform design philosophy across building types, without differentiating between urban multi-story complexes, rural single-story offices, or specialised facilities like hospitals and schools. Each type has distinct load patterns, structural configurations, and accessibility constraints that require tailored design strategies.

Overall, whilst the circular lays a strong foundational framework, addressing these design gaps will be essential to ensure that rooftop solar systems in government buildings achieve their full technical, financial, and environmental potential.

4.2.2 Spatial Distribution of Government Infrastructure

Nationwide mapping has identified 46,654 government offices from the ministry level down to the union level, with the majority concentrated at Upazila and Union tiers. This decentralisation presents an opportunity for widespread, distributed solar generation in rural and semi-urban areas. However, it also poses operational challenges, particularly in Operation & Maintenance (O&M) at remote sites where logistical support, technical capacity, and timely servicing are more complex compared to urban centres. Table 9 presents the detailed breakdown of government offices, demonstrating the scale and scope of potential rooftop solar deployment.

Table 9 | Number of government offices (from ministry to union level)

Level	Description	Number of Offices/Websites
Ministry/Division	Total Ministries/Divisions	70
Directorates/Departments	Directorates and Departments	351
Divisional Level	Total Divisions – 8	8
	Divisional Level Offices (8 × 52)	416
District Level	Total Districts – 64	64
	District-Level Offices (64 × 68)	4,352
Upazila Level	Total Upazilas – 491	491
	Upazila-Level Offices (491 × 37)	18,167
Union Level	Total Unions – 4,554	4,554
	Union-Level Offices (4,554 × 4)	18,216
Total	**From Ministry to Union Level**	**46,654**

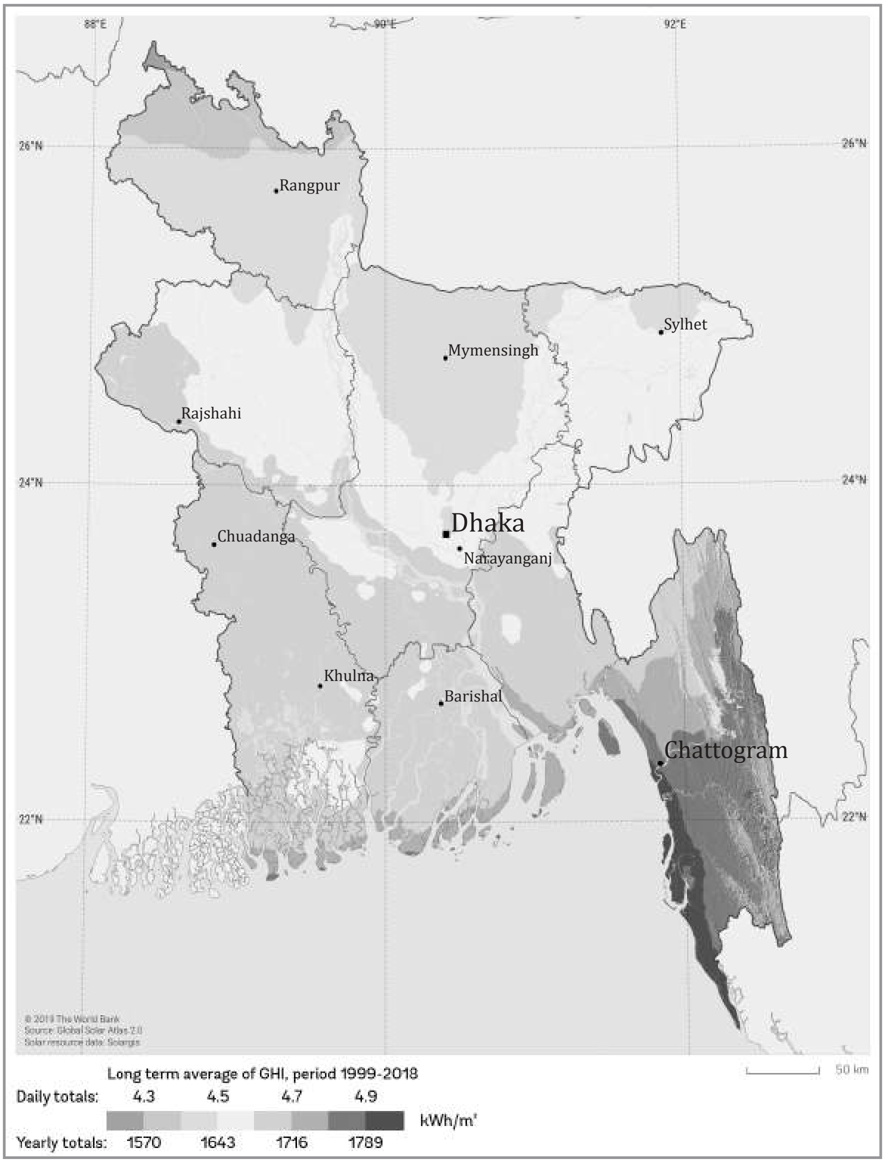
Source: Public Works Department.

Ministry and directorate-level offices are relatively small in number, while Upazila and Union-level offices account for over 78 per cent of the total, highlighting where the programme's primary impact could be realised.

4.2.3 Geographic Prioritisation-based on Solar Resource

Division-wise solar radiation analysis reveals higher irradiance levels in the Southern and South-Western regions of Bangladesh, such as Khulna, Barisal, and Chattogram. These divisions with high radiation may have higher possibility to maximise energy generation potential, improve project returns, and build demonstrative success cases before expanding nationwide. Figure 3 visually illustrates the spatial variation in solar resources, reinforcing the importance of geographic prioritisation in design and implementation planning (Solargis, 2025).

Figure 3 **Division-wise Solar Radiation: A Prerequisite for Design**



Source: Bangladesh Photovoltaic Potential: Solar Resource Map.

4.3 Critical Review of Implementation-related Issues Concerning the National Rooftop Solar Programme 2025

The National Rooftop Solar Programme outlines important technical standards, administrative processes, and financing models, reflecting the government's intention to scale up rooftop solar installations on public buildings. However, translating these policy provisions into ground-level implementation exposes a series of practical bottlenecks.

Current implementation challenges include institutional capacity constraints, inconsistent technical assessments, fragmented coordination between key stakeholders including the Power Division, SREDA, distribution utilities, and EPC contractors, and procurement and approval delays that hinder timely execution. These gaps risk slowing progress, reducing investor confidence, and undermining the programme's credibility.

4.3.1 Critical Observations

A key question in the implementation phase is who ensures the feasibility of rooftop installations. According to the standard purchase agreement, both the power producer (under the RESCO/OPEX model) and the purchaser (government entity) are jointly responsible for assessing the structural stability of the rooftop. The agreement allows for adjustments in system size if technical considerations demand it, provided both parties agree. However, there is no independent third-party verification mechanism to confirm the accuracy of these feasibility assessments.

This gap creates risks especially where generation projections are overestimated, oversized systems may be installed, leading to underperformance, inefficient investment, and unmet expectations. A formal third-party audit process could mitigate these risks by validating structural assessments, shading analysis, and system sizing before installation. From a grid integration perspective, rooftop solar deployment under net metering (NEM) introduces operational challenges as follows.

- **Power Factor Correction:** Solar generation can disturb grid voltage and reactive power balance, reducing efficiency if unaddressed.
- **Reverse Power Flow:** Excess generation exported to the grid can cause voltage fluctuations or damage if grid infrastructure is not prepared.
- **Grid Stability:** Without coordinated utility oversight, multiple distributed solar units can create voltage and frequency imbalances, jeopardising power quality, and reliability.

Although utilities such as REB and DPDC have expressed confidence in the grid's readiness to absorb additional distributed generation, there is insufficient clarity on whether these technical risks have been comprehensively assessed. Moreover, inconsistent interpretation of the Net Metering Guidelines across different utilities creates uncertainty for project developers and institutional users. A uniform, nation-wide interpretation of NEM provisions is essential to prevent disputes and ensure smooth project operation.

Pricing under the NEM for government buildings is another sensitive area. The programme estimates a generation cost of BDT 40/Wp (equivalent to BDT 4 crore per MW), whilst the NEM tariff for government offices is capped at BDT 5.50/kWh. To evaluate the competitiveness and sustainability of this pricing model, CPD has reviewed global and local approaches to solar tariff setting.

Table 10 compares three primary pricing mechanisms: Feed-in Tariff (FiT), Net Metering (NEM), and Merchant Tariff, highlighting their operational differences, revenue mechanisms, and associated risks. This comparison underscores that whilst NEM offers medium tariff security, it requires careful policy stability and consistent interpretation to remain viable for public-sector rooftop solar expansion.

Table 10 Comparative analysis of three major solar power pricing mechanisms FiT vs NEM vs merchant tariff

Feature	Feed-in Tariff (FiT)	Net Metering	Merchant Tariff
Definition	Sell all energy at fixed rate	Use solar first, export excess to grid	Sell to market at real-time prices
Customer Type	IPPs, large commercial	Residential, public buildings, SMEs	Large grid-connected generators
System Size	Medium to large (>1 MW)	Small to medium (1 kW – 1 MW)	Large-scale only (>5 MW)
Use of Power	100% sold to grid	Self-consumption + grid export	100% sold to grid
Tariff Rate	Fixed (e.g., BDT 10/kWh)	Variable credit (bulk/retail rate)	Market-based (varies hourly/daily)
Revenue Mechanism	Direct revenue from energy sale	Bill savings via credit	Revenue based on market spot price
Tariff Security	Very high (long-term PPA)	Medium (depends on policy stability)	Low (market-dependent, volatile)
Grid Dependency	Fully grid dependent	Partially grid dependent	Fully grid dependent
Risk Level	Low (guaranteed tariff)	Medium (tariff adjustments possible)	High (price fluctuations and no long-term PPA)
Common in	Feed-in based RE programs (e.g., Vietnam)	Rooftop solar policies (e.g., India, Bangladesh)	Deregulated electricity markets (e.g., USA)

Source: Authors' Assessment.

4.4 Critical Review of Procurement-related Issues Concerning the National Rooftop Solar Programme 2025

As the NEM circular mentions that PPR 2008 will be followed to procure quality solar panels, batteries, inverters and others, the concern regarding the fairness and transparency in the procurement process for solar instruments and equipment remains. The BPDB aspires to include the Bloomberg top tier equipment, panels (Modern Energy, 2025), inverters and battery, which may be more on the costly side (table 11). However, there may be resistance regarding the usage of more costly equipment resulting in opting more cheaper and lower-grade equipment. There is no clear monitoring mechanism to ensure whether the specification and the standard process is followed. Energy auditors trained by SREDA could be involved in the process. Whether BERC or SREDA be the regulatory and monitory authority of the full installation and operation process, it is not clarified in the relevant documents.

Table 11 | Bloomberg NEF Tier 1 solar panel ranking

Manufacturer/ Brand	Annual Capacity (MW/h)	Manufacturer/ Brand	Annual Capacity (MW/h)	Manufacturer/ Brand	Annual Capacity (MW/h)
Longi	120,000	ZNShine Solar	10,000	First Solar	15,200
Jinko Solar	120,000	Jollywood	10,000	Seraphim	13,000
JA Solar	100,000	Eging	10,000	Talesun / Taekmo	13,000
Trina	100,000	Solarsapce	10,000	Waaree	12,000
Tongwei / TW Solar	85,000	OSDA / Austa	6,560	Qcells / Hanwha Qcells	11,200
Canadian Solar	61,000	Renew Photovoltaics	6,400	ET Solar Inc / Elite Solar	3,000
Chint / Astronergy	56,000	HT-SAAE / HT-Solar	5,000	Sumec / Phono Solar	4,000
Risen Energy	48,000	Hanersun	5,000	BYD	4,000
DAS Solar	31,000	Renesola	5,000	Vikram Solar	3,500
DMEGC (Hengdian Magnetics)	21,000	Haitai Solar	5,000	Fellow Energy	3,000
Yingli	19,200	Adani / Mundra	4,000	YH Sunpro Power	3,000

Source: (Modern Energy, 2025).

4.5 Critical Review of Operation and Maintenance-related Issues Concerning the National Rooftop Solar Programme 2025

Operation and Maintenance (O&M) is the cornerstone of long-term performance, reliability, and safety in rooftop solar photovoltaic (PV) systems. Without a structured O&M framework covering panel cleaning, preventive inspections, fault detection, inverter performance checks, and monitoring, energy output can decline sharply, reducing the financial viability and overall lifespan of the installations. In some cases, inadequate maintenance can even lead to safety hazards such as electrical faults or structural instability.

As Bangladesh scales up its solar electricity through National Rooftop Solar Programme across a diverse range of public buildings, the absence of standardised O&M guidelines introduces significant risks of system degradation, early equipment failure, and user dissatisfaction. The Power Division is considering multiple pathways to address this challenge, including engaging specialised third-party O&M service providers; training in-house technical teams within public institutions; and delegating maintenance responsibilities to entities like REB in exchange for financial incentives.

Whilst these options indicate intent, a comprehensive and enforceable O&M framework backed by institutional accountability, performance-linked contracts, and transparent monitoring, remains critical to ensuring sustainability.

4.5.1 Critical Observation

Under the current circular, responsibility for O&M varies depending on the financing model. In OPEX models, the power producer is contractually obliged to operate and maintain the plant, coordinating with subcontractors as required. In the CAPEX model, the ownership and thus O&M responsibility transfers to the public institution hosting the system.

A review of the circular reveals key challenges:

- Absence of clearly assigned O&M authority in public institutions often leads to neglecting post-installation.
- Inadequate monitoring frameworks limit the ability to detect underperformance or equipment faults promptly.
- Limited budget allocation for long-term maintenance in the CAPEX model increases the risk of system downtime.

The programme does offer minimum O&M activities (Table 12), such as cleaning panels every 7 days, conducting quarterly visual inspections, and testing electrical systems monthly. However, compliance with these frequencies is not systematically enforced. Furthermore, there is no clear provision for integrating REB or other utilities into the O&M process, which could be particularly valuable in remote locations with limited institutional capacity.

Table 12 Proposed O&M activities under the circular

Activity	Frequency
Panel cleaning	At least once every 7 days
Visual inspection	Every 3 months
Electrical system testing	Every 1 month
Mounting structure inspection	Every 6 months
Inverter inspection	At least once a year

Source: National Solar Rooftop Programme Circular.

05 Conclusion and recommendation

Given the timeliness and significance of the project, it is fair to say that the interim government deserves applause for initiating the National Solar Rooftop Programme. But the success of the initiative will depend on the robustness, fairness and sustainability of the project starting from the designing to maintenance of the project lifetime. The key recommendations regarding the overall project, policy aspect, designing, implementation, procurement, financing, operation, and maintenance are as follows.

5.1 Piloting of the Programme on an Urgent Basis

The programme should kick start with the piloting of the selected areas instead of going full swing. A total of 400-450 building roofs should be converted into a solar rooftop on a pilot basis. Such piloting should be done on union, upazila, district and division levels consisting of government ministries and divisions, educational institutions, and hospitals (Table 13). The piloting sample should be selected based on the major criteria such as radiation impact, available finances in different divisions, grid readiness, major load shedding areas, and the presence of REB.

Table 13 | Piloting sample for the programme

Location	Govt office buildings	Educational Institutions	Hospitals
Union	Fifty-seven (57) ministries/ divisions	Twenty-five (25) Educational institutes (including primary schools, secondary schools, colleges, universities, madrassas	Thirty (30) hospitals
Upazila	Fifty-seven (57) ministries/ divisions	Twenty-five (25) Educational institutes (including primary schools, secondary schools, colleges, universities, madrassas	Thirty (30) hospitals
District	Fifty-seven (57) ministries/ divisions	Twenty-five (25) Educational institutes (including primary schools, secondary schools, colleges, universities, madrassas	Thirty (30) hospitals
Division	Fifty-seven (57) ministries/ divisions	Twenty-five (25) Educational institutes (including primary schools, secondary schools, colleges, universities, madrassas	Thirty (30) hospitals
Sub- Total	228	100	120
Total Piloting		**448**	

Source: Authors' Proposals.

5.2 CPD's Recommendations on Policy-related Issues

5.2.1. Shifting from Compliance-Oriented to Performance-Oriented Procurement

Many residential systems were installed as a formality to access grid connections or subsidies, not to actually generate solar power. This 'tick-box' culture must be prevented in public buildings by designing policies that tie budget disbursement to actual energy generation, not installation. Contracts should link milestone payments to post-installation energy output over 12–24 months, and not just physical completion. This requires installing smart metres and integrating building load data to measure actual solar contribution to power consumption.

5.2.2. Building Capacity of Facility Managers and Government Operators

A core challenge in the residential sector was the lack of user awareness. In public buildings, although direct users are not householders, the building managers (utility officers or facility engineers) often lack basic knowledge of how solar PV works. It is essential to conduct mandatory capacity-building workshops during the commissioning phase for designated government staff. Training must include hands-on maintenance, basic troubleshooting, and interpretation of performance dashboards, as public buildings will increasingly host these systems across ministries.

5.3 Recommendations on Design-related Issues: Strategic Siting for Rooftop Solar in Bangladesh

To maximise the impact of the National Rooftop Solar Programme, the site selection process must be strategically guided by the spatial distribution of government infrastructure and solar radiation potential. CPD emphasises that a location-specific, data-driven approach is essential to ensure both technical performance and financial viability across Bangladesh's diverse geographic and climatic conditions.

5.3.1 Equipment Standards and Financing Mechanisms

To safeguard quality and ensure system longevity, all installations must comply with Bangladesh Standards and Testing Institution (BSTI) and International Electrotechnical Commission (IEC) standards for photovoltaic modules, inverters, batteries, and mounting systems. From a financing standpoint, CPD recommends adopting a dual-model approach keeping both the CAPEX and OPEX options open for the off takers to decide. A structured financing framework must be developed for each model, incorporating clear payment schedules, performance-based disbursements, and built-in cost recovery mechanisms.

5.3.2 O&M Strategy and Financial Support

Long-term success of the programme hinges on a robust O&M framework with clearly defined responsibilities:

- **CAPEX Projects:** EPC contracts must include mandatory multi-year O&M clauses (minimum 5–10 years) to ensure sustained vendor engagement and timely fault resolution.
- **OPEX Projects:** Vendors should commit to generation-linked performance guarantees with penalties for underperformance.

CPD also proposes the creation of a central O&M fund or a revolving maintenance facility dedicated to public-sector rooftop solar assets. This facility would cover routine servicing costs, emergency repairs, and ensure operational continuity, particularly in remote areas where institutional budgets and technical resources are limited.

5.4 Recommendations on Implementation-related Issues

To bridge the identified gaps, CPD proposes the following implementation reforms.

5.4.1 Ensure Independent Feasibility Verification

All rooftop solar projects should undergo third-party technical audits to validate structural integrity, shading analysis, and solar resource potential. Independent verification will reduce risks of over/under-design and help avoid costly performance shortfalls.

5.4.2 Strengthen Grid Readiness and Utility Coordination

Before granting installation approval, utilities must conduct readiness assessments addressing power factor correction, reverse power flow, and voltage/frequency stability. Local grid upgrades should be prioritised in high-deployment areas. Furthermore, all distribution utilities should adopt a uniform interpretation of the NEM policy, coordinated through the Power Division or SREDA.

5.4.3 Standardise Tariff Interpretation under Net Metering

A national guideline should clearly define how NEM tariffs and credit mechanisms are applied to government-led projects. This will reduce uncertainty, improve financial planning, and encourage broader participation.

5.4.4 Institutionalise Comprehensive Feasibility Studies

Mandatory feasibility studies should cover rooftop dimensions, structural load capacity, detailed shadow mapping, and irradiation data. Standardized design templates and cost benchmarks such as the BARD (BARD, 2021) case study should be adopted to ensure transparency, cost efficiency, and scalability.

5.5 Recommendations on Procurement-related Issues

5.5.1 Enforcing Industry Standards Through Vendor Accreditation

Many installation failures stemmed from poor workmanship, lack of standards, and subpar components. To ensure quality in public buildings, only pre-qualified, accredited vendors should be allowed to bid. SREDA and BSTI should jointly enforce installation guidelines, and all vendors must provide as-built documentation, system testing reports, and project commissioning certificates. Importantly, penalties for performance failures and blacklisting of vendors who fail quality checks must be enforced. All the service providers must hold the membership of Bangladesh Sustainable and Renewable Energy Association (BSREA).

5.5.2 Ensuring High-Quality Equipment Through Procurement Standards

To avoid premature system failure, common in past residential installations due to substandard panels and inverters, the National Program must adopt strict technical specifications in line with SREDA guidelines, embedded within the tendering and procurement process. Since public buildings operate under government CAPEX budgets, all suppliers should be required to meet international IEC/ISO certifications and offer a minimum year of performance warranties. Quality compliance should not be just a checklist, independent third-party quality audits should be mandatory before and after installation. Different renowned labs in the country should be entrusted with the testing of the equipment before and after installation.

5.6 Recommendations on Financing-related Issues

5.6.1 Tax and Duty Exemptions

To make rooftop solar more affordable and attractive, fiscal incentives should be provided for this programme. Specifically, all customs duties, import duties, VAT, and taxes on solar panels, batteries, and inverters should be fully exempted. Such exemptions would directly reduce project costs, making rooftop solar financially viable and accelerating adoption.

5.6.2 Bangladesh Bank Financing Instruments

Bangladesh Bank should play a catalytic role in ensuring access to finance for rooftop solar programmes. This can be achieved by introducing a refinance scheme or establishing a dedicated green energy fund specifically targeting rooftop solar installations on public buildings. For both CAPEX (capital expenditure) and OPEX (operational expenditure) models of rooftop solar projects, a sovereign guarantee (issued by the Ministry of Finance or another central authority) or a bank guarantee mechanism should be institutionalised. These mechanisms would provide assurance of timely payments and contract enforcement, thereby reducing risks for investors and enhancing private sector participation.

5.6.3 Government-backed Guarantee Fund

A government-backed Guarantee Fund should be created to support urgent repairs and critical maintenance of rooftop solar systems, particularly within public institutions operating under the CAPEX model. This is crucial since many such institutions have limited or no dedicated annual maintenance budgets. The Guarantee Fund would ensure continuity of operations, protect long-term system performance, and safeguard the public investment in solar infrastructure.

5.7 Recommendations on Post Commissioning O&M-related Issues

5.7.1 Independent Monitoring and Reporting Mechanisms

To address transparency concerns, CPD recommends third-party performance verification through accredited bodies such as BUET, SREDA-approved inspectors, certified engineering firms, or energy auditors. Annual audits should be mandatory, with quarterly reporting to the implementing agency and public disclosure to strengthen accountability.

5.7.2 Transparent Metering and Real-Time Monitoring

All rooftop solar systems should be linked to an Online Monitoring System capable of real-time data sharing with SREDA and the Power Division. A national solar dashboard should be developed to track generation, system uptime, and equipment health. This ensures data-driven decision-making and prevents manipulation of performance reports.

5.7.3 Strengthening O&M in the CAPEX Model

EPC contracts should include a 5–10-year mandatory O&M clause, with payments tied to performance metrics like annual energy yield. This approach maintains vendor accountability beyond commissioning and ensures sustained system output.

5.7.4 Establishing a Dedicated Guarantee Fund

A Government-backed O&M Guarantee Fund should cover urgent repairs in CAPEX projects, especially in public institutions with no dedicated maintenance budget. Disbursements should be contingent upon third-party verification.

5.7.5 Institutional Accountability in Public Buildings

Each government building should designate a Solar System Custodian (e.g., facility manager or engineering officer) responsible for routine checks, maintaining a solar logbook, and liaising with service providers.

5.7.6 Centralised Monitoring and Accountability Framework

SREDA should develop a centralised IoT-enabled monitoring platform linking all rooftop installations. Ministries should appoint Energy Focal Points to oversee plant performance and coordinate O&M interventions.

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Bangladesh has embarked on an ambitious journey to expand renewable energy through the National Rooftop Solar Programme 2025, which targets 3,000 MW of capacity on government, educational, and health sector rooftops. Whilst the decision is timely and commendable, the programme's success will depend on addressing critical challenges of design, financing, procurement, and long-term O&M. This special report by CPD Power and Energy Study offers a detailed review of global rooftop solar experiences, lessons from Dhaka's earlier initiative, and a critical analysis of the current programme's policy framework. It provides strategic recommendations for piloting, ensuring technical quality, standardising tariffs, introducing transparent procurement, and strengthening monitoring and accountability. The report serves as a roadmap for policymakers, development partners, and practitioners, highlighting how rooftop solar can become a cornerstone of Bangladesh's renewable energy transition if implemented with rigour, transparency, and sustainability.

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