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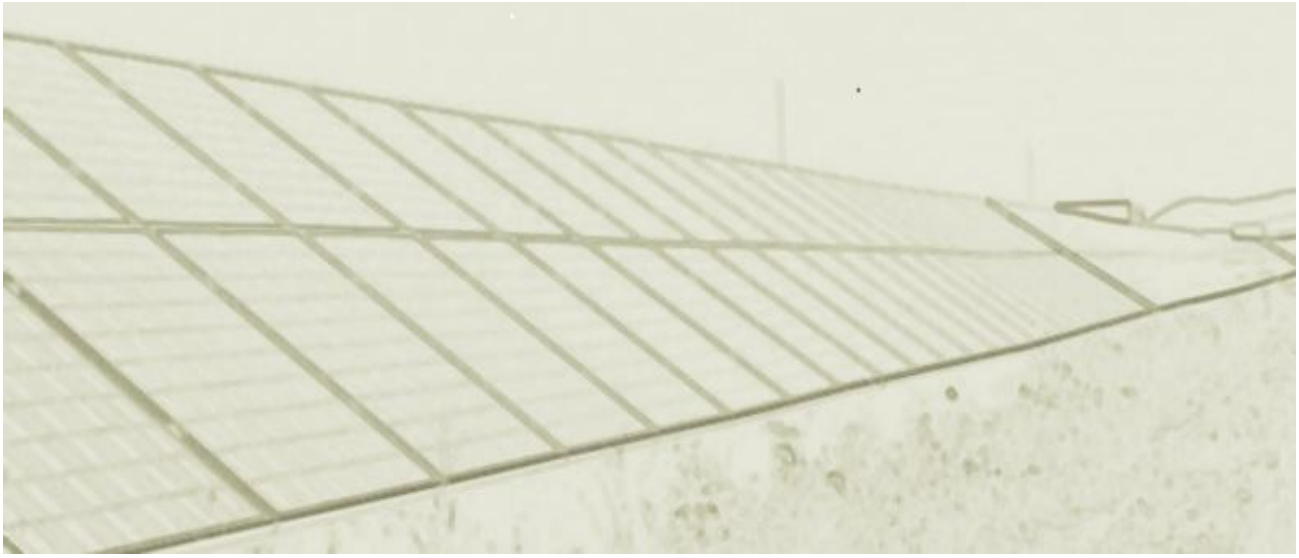
Gap Analysis of Rooftop Solar Under Net Metering in Bangladesh



Submitted by

8.2 Renewable Energy Experts Hamburg

November 2022

As a federally owned enterprise, GIZ supports the German Government in achieving its objectives in the field of international cooperation for sustainable development.

Published by:
Deutsche Gesellschaft für
Internationale Zusammenarbeit (GIZ) GmbH

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On behalf of
German Federal Ministry for Economic Cooperation and Development (BMZ)

As at:
November 2022, Bangladesh

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List of Abbreviations

a	Year
A	Ampere
AC	Alternating Current
ARE	Alternative and Renewable Energy (Policy)
BERC	Bangladesh Energy Regulatory Commission
BESS	Battery Energy Storage System
BEPZA	Bangladesh Export Processing Zones Authority
BEZA	Bangladesh Economic Zones Authority
BREB	Bangladesh Rural Electrification Board
BGCCI	Bangladesh-German Change of Commerce and Industry
BSTI	Bangladesh Standards and Testing Institution
CAPEX	Capital Expenditures
CE	Conformité Européenne (European conformity label)
DC	Direct Current
DISCOM	Distribution Company (i.e. grid operator of a distribution grid; also called utility)
DPV	Decentralized PV (i.e. PV connected to the LV and MV distribution grid, which are mostly rooftop plants)
EE	Energy Efficiency
EPC	Engineering, Procurement and Construction (also sometimes referring to the EPC *contractor*)
EPZ	Export Processing Zone
ESCO	Energy Services Company
ESS	Electrical Energy Storage
FiT	Feed-in tariff
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
GHI	Global Horizontal Irradiance
GoB	Government of Bangladesh
h	Hour
HV	High Voltage
I	Electric Current
IDCOL	Infrastructure Development Company Limited (Bangladesh)
IEC	International Electrotechnical Commission
IRR	Internal Rate of Return
ISO	International Organization for Standardization
kV	Kilovolt
kVA	Kilovolt ampere
kW	Kilowatt
kWh	Kilowatt hour
kWp	Kilowatt-peak (for solar power installed capacity)
LCOE	Levelized cost of electricity
LED	Light-emitting diode
LV	Low Voltage
MFI	Microfinance Institution
MG	Mini-Grid
Mtoe	Mega-tonnes of oil equivalent (toe) (for emissions)
MV	Medium Voltage
MVA	Megavolt ampere
MVArh	Megavar-hour
MW	Megawatt
MWh	Megawatt hour
MWp	Megawatt-peak (for solar power installed capacity)
NEC	National Electric Code
NEM	Net Metering
NEPRA	National Electric Power Regulatory Authority

NGO	Non-governmental Organization
NOC	No-Objection Certificate (provided by BSTI during NEM application process after equipment has been tested or otherwise approved)
OPEX	Operational Expenditures
O&M	Operations and Maintenance
PAP	Policy Advisory for Promoting Energy Efficiency and Renewable Energy
PPA	Power Purchase Agreement
PR	Performance Ratio
PV	Photovoltaic
RE	Renewable Energy
SCADA	Supervisory control and Data Acquisition
SDG	Sustainable Development Goals
SLD	Single Line Diagram
SQF	Solar Quality Foundation
SQP	Solar Quality Passport
SRO	Statutory Regulatory Order
SREDA	Sustainable and Renewable Energy Development Authority
ToT	Training of Trainers
UPS	Uninterruptible Power Supply
USAID	U.S. Agency for International Development
V	Volt
W	Watt
WB	The World Bank
Wh	Watt hour
Wp	Watt-peak (for solar power installed capacity)

A. Introduction

Net metering (NEM) for solar rooftop in Bangladesh has been in place since 2018. Besides ground-mounted large-scale PV plants (the scope of which is limited in Bangladesh, however, due to scarce area and strong land usage conflicts), PV rooftop under NEM is currently one of the main paths of the Government of Bangladesh (GoB) to achieve more generation from renewable sources and a higher degree of energy self-sufficiency.

The GIZ project "Policy Advisory for Promoting Energy Efficiency and Renewable Energy" (PAP), scheduled from August 2021 to July 2024, aims to, among others, "improve the political and regulatory framework for increasing the share of renewable energies and energy efficiency in the power sector" and "improve the cooperation between public and private institutions in the power sector for the development of the RE and RES market." 8.2 Renewable Energy Experts Hamburg (REEH) was selected as the lead consultant for this project.

During 14th to 23rd of September 2022, Ralf Reek and Tobias März, experts of 8.2 REEH, visited Dhaka to interview a variety of stakeholders of the PV rooftop and net metering sector to gain an overall picture of the situation. The interviews had a focus on distribution companies (DISCOMs) which were interviewed separately in their respective headquarters, while potential clients (for NEM in the commercial sector) were convoked and interviewed together in the Bangladesh-German Chamber of Commerce and Industry (BGCCI).

The interview partners were:

- All six distribution companies (DISCOMs)
- Two university labs
- Four solar companies (EPCs / ESCOs)
- Six potential clients interested in own PV operation or purchase of PV-produced electricity (building owners of textile companies and others)
- Bangladesh Standards and Testing Institution (BSTI)
- Sustainable and Renewable Energy Development Authority (SREDA)

B. Overview

Based on the findings from the interviews, an overall picture of the solar rooftop sector was obtained and current gaps or scope for improvement within the solar rooftop net metering process were identified. The following figure gives an overview of the different players and the gaps identified:

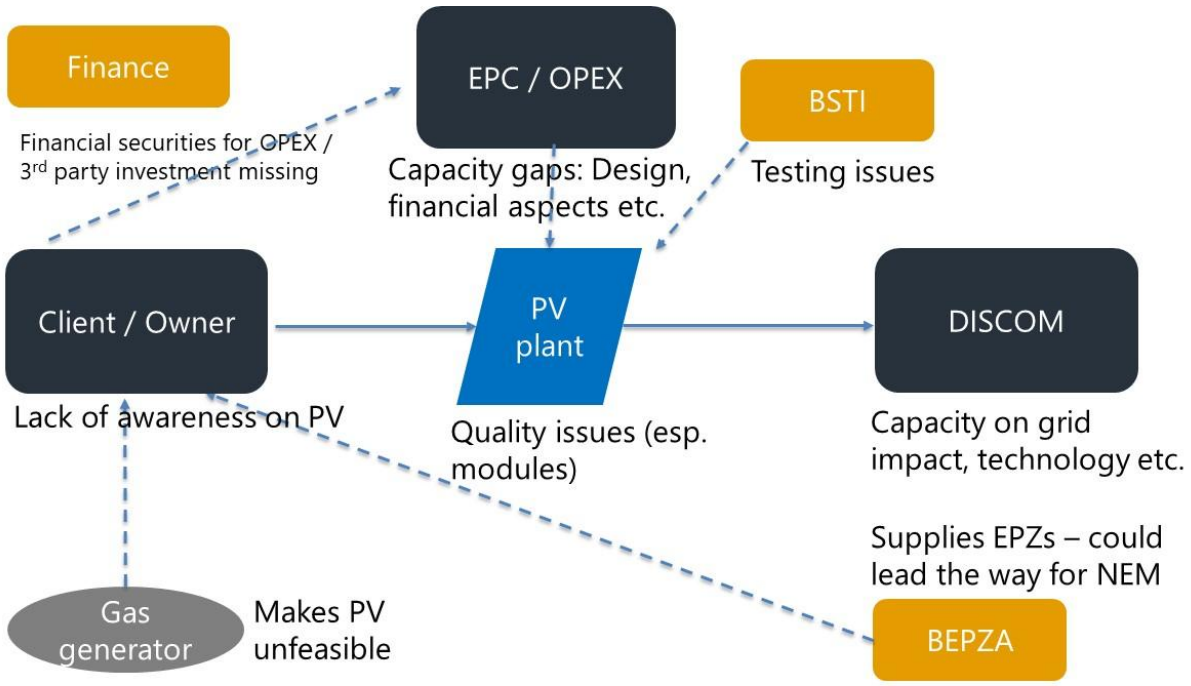


Figure 1: Identified issues in net metering / solar rooftop implementation in Bangladesh

The issues include many different levels:

- **Technical aspects,** like the lack of quality (or lack of quality awareness and/or assessment) of installed PV rooftop systems
- **Procedural and capacity aspects,** like missing processes or missing knowledge for processing net metering applications for PV rooftop systems by DISCOMs or for PV components by BSTI
- **Infrastructure aspects**, such as missing lab facilities; time-bounded NOC process
- **Financing challenges**
- **"Soft" aspects**, such as lack of trust into the technology or lack of customer awareness about potential benefits
- **Reputation** of earlier implemented mandatory rooftop solar implementation

The following chapters look at these challenges one by one and propose solutions – or, where solutions would be premature, a possible path to reach solutions further down the lane.

C. Gaps in the Solar Net Metering Market – Findings

C.1. Client Awareness

Client / Owner

On the client side, one main issue is a general lack of awareness about the benefits of PV solar rooftop and of available financing schemes; in some cases, even doubts about the technology. One reason for this is a scheme from the past that made it mandatory for building owners to put up a certain percentage of PV on the rooftop before receiving a new electric connection. This scheme has partly led to lots of systems which were built at minimum cost and without any or limited quality standards with the sole aim of getting the connection done; these systems often stopped working very soon, which obviously did not contribute to the reputation of PV rooftop in Bangladesh. Besides this, some interview partners mentioned that the market is very price-driven, incentivizing substandard equipment and systems, leading again to poor reputation. However, there is also a notion that the quality of recently installed plants under net metering (which are bigger in size and typically by corporate owners) is much better. Still, it seems to be yet a challenge to establish a functioning market where the technology has a good reputation among consumers and building owners are aware of the benefits of PV rooftop systems.

The awareness issue could partly be resolved with time through an increasing number of well-functioning PV rooftop systems. Just like the solar home system market has become very successful in Bangladesh during the last decades, solar rooftop can also achieve this success and reputation.

Additionally, targeted awareness campaigns can help to raise consumer awareness. SREDA is already planning and executing such campaigns.

Targeted stakeholder events could also help to improve the situation; for example, the garments industry in Bangladesh is very strong, has both high demand and access to capital, and is organized in associations. So, by engaging with these associations and organizing events where success stories are shared and quality EPCs present themselves and the business case of solar PV, a quick uptake could be achieved.

C.2. EPC Capacity Gaps

EPC / OPEX

There is a wide range of PV EPCs in Bangladesh. Although established players with a real track record for solar rooftop of commercial size (i.e. with more than ten projects of reasonable size) are probably less than ten, the total number of registered companies offering solar rooftop in Bangladesh is beyond 100. This also means that one cannot talk about "the EPCs" in general. Rather, some EPCs have standardized procedures, use professional design, are organized in departments and use international standards, while others are small and medium size enterprises (SMEs) with a small team starting their learning curve or with experience of installing solar home system only. For a functioning market, it is important that there is a sufficient number of EPCs of considerable size and well-established quality so that the demand for new plants can be catered for. It is also important that all EPCs

maintain at least certain minimum standards in components, design and workmanship that ensure performance and safety of the PV rooftop systems and a lifetime of 25 years and above.

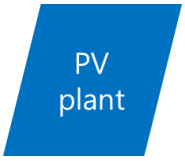
In terms of training and capacity building for EPCs, the following are the highest needs that have emerged from the stakeholder interviews:

- Professional design for commercial systems based on professional software intending high yields (i.e. high-performance ratio, low losses)
- Correct application of standards and focus on quality for equipment selection and installation
- Financial evaluation of PV rooftop systems - for clients and investors

Within this project, a compact training module is planned for EPCs. A close coordination with SREDA is planned; SREDA has already held one-day workshops and should continue these kinds of workshops. It would be helpful to build up a pool of qualified trainers so that trainings can be repeated for new EPC engineers who have to come on board throughout the next years. Based on such a pool of trainers, ultimately, a vocational training could be established via schools/universities or engineering associations.

- Training:
    - Training technicians is important
    - There might even be a "SREDA training center" – at some point mandatory. Especially for safety.
    - For all phases of project (design, installation, maintenance)

C.3. PV Plant Quality and Safety



When talking about the PV plant quality, there are basically two sides to this: The standard of the components and the standard of the workmanship.

Whether mandatory standards of the components of the PV plant equipment as defined in the regulations are fulfilled in new PV plants is to be checked by the DISCOMs during the application procedure. However, the task of actually checking the equipment is not performed by the technical assessment of the DISCOMs themselves; rather, the DISCOMs only check whether a no-objection certificate (NOC) has been issued by BSTI for the specific equipment which certifies that the equipment of the specific plant complies with BSTI standards. For this, BSTI is supposed to perform technical tests on the modules and inverters before permitting them; however, BSTI faces several issues regarding testing at the moment which are discussed in the next section. Resolving the issues around standardized component testing to achieve quality components is a crucial factor to enable PV plant quality.

On the other hand, SREDA needs to ensure that the database of approved components on their website is kept up to date; this requires close communication with BSTI. Right now, there is a time delay (2-3 weeks) between the approval date and the day of enlistment on SREDA website due to delay in notification to SREDA from BSTI. This database contains those components (i.e. specific module and inverter models) that BSTI has already approved. SREDA also needs to stay in

communication with and supervision of the DISCOMs on this topic and make sure that they adhere to this list.

Unprofessional electric installations pose a safety risk to users and technicians. Workmanship quality of net metering plants is supposed to be ensured by the DISCOMs during acceptance inspection in terms of safety and grid-impact related issues. However, the DISCOMs' expertise regarding these checks seems to be yet very limited – which is not surprising, given that this is a task completely new to them. Preparing the DISCOMs (or third-party inspectors that the DISCOMs can make use of) for this task and establishing adequate procedures including safety checks is highly important. As described also in the next section, capacity building and adequate staffing and structuring is deemed essential so that safety of these installations can be ensured on the long run.

Plant performance, on the other side, is not checked by DISCOMs. The responsibility lies with the EPC and therefore ultimately with the client who needs to enforce plant quality upon purchase of the system and control during installation. As long as the market is still premature and awareness among clients low, it would also be an option to involve the DISCOMs in this kind of checking. Such a step would have to be decided by SREDA together with the Power Division. In any case, it is doubtful whether this arrangement would work out well. Another option would be that the DISCOMs offer these additional services at a specific charge; if and how this is viable depends very much on the market and customer situation as well as the DISCOMs' internal processes.

Another option that other countries have employed to establish a white list for EPCs for solar PV rooftop systems under net metering. The easiest way to do this is to add a clause to the net metering regulation which defines that only companies listed with SREDA are permissible for installing solar rooftop systems which are supposed to go for net metering. SREDA would then have to establish the criteria for being part of this white list (such as proven track record (e.g. a certain amount of kilowatts installed), financial statement of the company, commitment in writing to adhere to the respective standards, participation in certain trainings etc.). The white list should be divided into different size categories (e.g. A, B and C for systems up to 10 kW, 100 kW and 1 MW). A new company would then have to accomplish a certain number of smaller systems (A) before being accepted for larger systems (B and finally C) and the commercial sector. SREDA should also regularly monitor the quality, workmanship and performance of newly installed systems through sample checking to maintain an overall picture of the status of the market.

From Mission 2 (Feb'23): Price dumping due to big companies importing & installing their own solar systems:

- Large companies – especially textile – apparently import their own equipment (supposedly at 1% import tax only) and get it installed by any low-cost installer, leading to price and quality dumping. More investigation is necessary.
- Solutions to be explored:
    - Explore a practical way for some kind of PR guarantee for SRT
    - EPC whitelist by SREDA
    - O&M mandatory

- BSREA membership should be the quality criterion (Recommended by BSREA)
    - However, no clear entry criteria ensuring the quality
    - BSREA got its professional feedback in 2019 from BSW – so far it seems recommendations were not implemented
    - BSREA comes from the SHS/off-grid companies: little experience with large-scale solar

C.4. BSTI Testing

BSTI is the entity providing the NOC for PV solar rooftop components; therefore, its competence, testing equipment and capacities are crucial for ensuring quality on the PV plants (see last chapter). However, at this point, BSTI does not have its own testing equipment for this purpose yet and the third-party labs which it is using at the moment (Rahimafrooz, UIU, BUET) also have only incomplete or outdated equipment which does not cater for the current modules sizes; for inverters, there is virtually no testing equipment. This means that BSTI currently has to run the NOC process without being able to test the equipment according to professional standards. This basic testing is certainly better than nothing but not a satisfying long-term solution. Apart from that, it is also questionable if BSTI should completely (re-)test all components especially if they have already been tested and certified by a reputable and accredited international test laboratory.

For the future, BSTI even plans to check all PV equipment coming to the country at the entry port (government rule in process according to BSTI), which is of course positive in terms of component quality in the market but on the other side further increases the need for standardized and automated testing.

BSTI should adopt a long-term and a short-term solution to address this gap:

In the long run, BSTI needs access to standardized state-of-the-art testing equipment – either owned by itself or by third parties. BSTI has filed an application for purchase of all required equipment with the government; however, all parties agree that this process can take a lot of time or be stalled at some point. If donor budget can be availed for purchasing even some parts of this testing equipment, this would of course be beneficial; however, this option is also uncertain at this point. An official letter to the Ministry of Industry (which has mandated BSTI to perform these tests in the first place) would help to clarify the situation: Will the ministry ensure the required funding for the equipment for BSTI in the foreseeable future, or should BSTI seek to perform these tests through third party labs for the next years (which would mean that the equipment that those labs needs to be upgraded)?

The testing equipment needs to be certified for measuring the specific ISO/IEC standards for modules and inverters respectively; however, the official ISO accreditation of BSTI and the testing lab for these tests, although beneficial, is not necessarily required. As long as BSTI has access to the correct equipment and staff who is trained to operate the equipment and produce reproducible test results, this will be sufficient for the NOC process of the local market.

Secondly, the possibility to test equipment locally also allows confront foreign suppliers in case of substandard equipment delivery: Premature PV markets such as Bangladesh run the

risk of receiving low-performing or even substandard equipment which is not declared by the suppliers as such, simply because the market is so small that it matters less to those suppliers and at the same time has no means of defending itself. Here, having standard testing equipment allows to identify such cases and to confront importers and suppliers accordingly.

In the short run, however, another strategy needs to be implemented: As long as now adequate testing equipment is available, it is still possible to work with official equipment certificates. Today, virtually all standard PV module and inverter suppliers obtain third-party certificates for the equipment that certifies that a specific model complies with the applicable IEC norms. There is still a margin for fraud or error, like using falsified certificates or obtaining certificates and later on producing the same product based on lower-quality sub-components – or simply being lax about maintaining proper standards in the production process. However, with some basic knowledge on the testing process, testing standards and certified testing bodies, the better portion of this kind of fraud or error can be identified.

Therefore, it makes a lot of sense to train customs officials and BSTI staff on these standards and their checking. This is technology-specific knowledge that needs to be understood – and once understood, it makes a huge difference in identifying false or correct test certificates. Such training arrangement would involve coordination between ministries and could be led by SREDA.

C.5. DISCOMs

DISCOM

DISCOMs play a crucial role for the deployment of PV rooftop under net metering, as they have to inspect the systems and pass the applications. If DISCOMs are slow in processing applications, give inconsistent feedback to applicants or even deny applications for dubious reasons, this can be very critical for the market. On the other side, if DISCOMs are proactive and make their customers aware of the benefits of solar power and try to resolve any problems that might arise in plant construction and permitting, this can on the contrary contribute strongly to a functioning market. It is therefore a core puzzle piece for the net metering market that DISCOMs and their staff are capable and motivated to support this process, including having some dedicated staff for net metering specifically.

C.5.1. Institutional aspects

The DISCOMs still show gaps in their institutional and staff-wise capacities that are required for a smooth rollout of net metering, and they are aware of it. This was the result of the *Capacity Needs Assessment* performed by a GIZ team in early 2021[1] and was verified in the interviews in September 2022. To directly address these gaps, training activities are planned in the ongoing PAP project. As the total staff of all six DISCOMs is huge, it is the goal to perform a "Training of Trainers"

[1] "Capacity Needs Assessment for the smooth implementation of Rooftop Solar under Net Metering Guidelines", February 2021 - see excerpt in the annex

(ToT) training that can later on be replicated. 8.2 REEH will prepare the modules based on the assessed gaps and impart the ToT training in the first half of 2023.

As part of the training activities with the DISCOMs, it would be beneficial to establish some common procedure documents like especially a protocol for installation checks. These common procedures and documents can help the DISCOMs to work along the same lines and not to forget important steps of the process. Especially for the technical inspection to ensure safety and no negative grid impact of solar rooftop plants (as part of the NEM application procedure), trained staff (typically electrical inspectors with training on solar rooftop technology) is very much required.

An independent RE unit would help each DISCOM to build specific expertise and monitor its net metering and other RE activities. The mentioned report by GIZ from 2021 already mentioned this as a strategic goal, however, during the interviews in September 2022, only two DISCOMs had specific RE units – which were still in their very initial phase, with a staff number of only one or two. Also, knowledge in terms of large-scale PV and wind plant deployment, should be built up within the DISCOMs as a centralized expertise to cope with requirements of future development. For training needs of the DISCOMs, a separate report is being prepared.

C.5.2. Operational: DISCOM Targets

The government has been pushing DISCOMs to help building more RE and specifically solar rooftop in their grids; this had led to a poor-performing mandatory PV rooftop scheme for new electricity connections during the last years. Under this scheme, all new building owners only got their electric connection after installing a certain amount of PV power on their roof. Although apparently there is no official instruction by the ministry on this scheme, the DISCOMs have stuck to this rule throughout the last years. However, the quality and performance of the PV systems built under this scheme has not been a success (based on the information received): Many of the plants do not generate power as projected or are even disconnected from the grid. This is understandable, considering that it is easy in Bangladesh to purchase a "pro-forma" PV system made of poor components at a low cost – sufficient to obtain the desired connection by the DISCOM. This has been aggravated due to the fact that many of the new buildings in the major cities are high-rise residential buildings, where the individual parties have little interest to understand and maintain a small PV plant which they have to share and run together. All in all, the scheme has led to a significant number of PV capacity but with a rather questionable performance which harmed the perception of the technology in the market. This mandatory scheme should therefore not be amended and be replaced by a more quality- and performance-oriented approach.

On the other hand, the government has recently, as part of the initiative to address the supply-demand gap under rising international fuel prices, instructed the DISCOMs to install and finance five PV rooftop plants on clients' roofs (thereby becoming a 3rd-party provider/ESCO themselves) so that they get themselves more exposed to technical and economic aspects of solar rooftop implementation and operation. The DISCOMs interviewed were quite active on this new approach and some were interested to expand this kind of business – although there was some unclarity on whether this was permissible to them under the current tariff rules of BERC applicable for distribution utilities. The ministry could set more targets like this:

- X MWp of PV rooftop to be installed by each DISCOM (e.g. within the remaining -year)
- A certain number of net metering applications per month
- A certain number of public events on net metering in suitable areas (e.g. economic zones) where the DISCOMs are present

It is within the DISCOMs hands to achieve such targets through outreach programs, information campaigns and the like. The setting of such targets through the ministry, accompanied by a regular information exchange between DISCOMs, SREDA and the ministry would motivate them to do this.

As a first step, the ministry should monitor and evaluate the mentioned "5 PV plants" scheme in order to identify what worked and what didn't at the DISCOM level so far.

From Mission 2 (Feb'23):

- Online performance monitoring of plants is to be tendered out (first as a pilot) by SREDA. GIZ/8.2 REEH support to identify suitable ToRs, goals and tender process
- Other issues in rural areas:
    - Meter shortage @ DISCOMs: creates time delay between completion and COD
    - Internal DISCOM processes time-consuming when unclear

C.5.3. Rollout facilitation

Besides the above-mentioned targets for the DISCOMs, there are other activities that can help to facilitate the rollout of solar PV under net metering in the country, such as regular meetings between DISCOM representatives to monitor the progress of net metering. Such meetings should be led by SREDA, while GIZ, together with 8.2 REEH, can facilitate such regular roundtables. In other countries, it has been found that a regular exchange between stakeholders helps them to rethink their own processes and challenges, to support each other and to come up with solutions for the problems which they share in the implementation. These kinds of forums also allow SREDA and the ministry to get a direct insight into the current state of affairs in terms of net metering rollout. GIZ and 8.2 REEH will propose a way of operating based on a tentative time-line for the formation of such regular meetings with the DISCOMs.

In terms of internal motivation of staff, the DISCOMs could also set up certain internal targets for their employees to accomplish the area of net metering - similar to the mentioned targets (e.g. in MW installed) for each DISCOM. However, as the roles of different staff are quite different in terms of their impact on the rollout of net metering, it might be difficult to translate the overall net metering goals to staff-specific targets. This would need some more consideration.

On the long run, some consideration needs to be given on the financial sustainability (i.e. non-loss) of NEM for DISCOMs. Work has been done by different institutions on the value and cost of decentralized solar power for DISCOMs; considering this work and the specific conditions for Bangladesh (technology costs, irradiation level), a suitable export tariff and maybe minor grid charges could be established. However, this analysis and coming to an agreement between authorities and stakeholders requires some time and should not stop the current rollout of NEM.

C.6. OPEX Securities

Securities for OPEX / 3rd party missing

The 3rd-party / ESCO model (in Bangladesh often called "OPEX model") holds a high potential for rolling out solar PV rooftop in Bangladesh quickly but so far faces some challenges that needs to be addressed. This model, in which an investor pays for the investment of the plant instead of the building owner and electricity consumer (which would be the simple EPC or CAPEX model), can lead to a much quicker rollout of solar PV rooftop because the owner does not have to invest in capital and rather pays for the PV plant over time through a per-kWh tariff to the investor. This has been proven to be successful in other countries such as the US. Both EPCs or solar companies in general and the DISCOMs are well aware of this financing model, and both see the current challenges.

Currently, there is a lack of securities for the OPEX provider – if the off-taker at some point stops to pay or goes bankrupt, the OPEX provider has no means of recovering its investment. In an environment where going to court is cost- and time-intensive and has an uncertain outcome, this is not a viable option for providing security; apart from this, it is also very unclear if a court decision would lead to a reactivation of the revenue stream. In the latest version of the net metering regulation, it is foreseen that the DISCOM, OPEX provider and off-taker into a tri-party agreement which stipulates that for the case of payment default by the off-taker, the DISCOM would disconnect its electricity connection as a sanction. However, DISCOMs almost unisono declared that entering such an agreement is by no means in their own interest and could even be against their official mandate (according to the interpretation) to provide electricity connection to customers. These are the reasons that so far, this tri-party agreement apparently has not been put in place for any metering case so far, and there is a general consensus that this agreement is not a practical solution.

One option would be if the Bangladesh Bank gave this kind of security instead of the DISCOMs, i.e. the Bangladesh Bank (through a program) would pay to the OPEX providers any default by the clients. However, it can easily become cumbersome for the OPEX providers to credibly demonstrate such a payment default (especially if there is a dispute with the client or the client does not communicate on the matter) and obtain the corresponding money from the ministry fund through official processes.

Another much more practical option would be an adaptation of the net metering regulation such that in such cases, the DISCOM would take off the electricity from the OPEX provider at the national bulk purchase rate. This would still be a loss for the OPEX provider compared to the negotiated tariff with the client which he would normally receive (e.g. receiving 5 BDT at bulk purchase rate instead of 7 BDT negotiated with PPA client) but it would be much better than having no guaranteed compensation at all and would allow them to bring their own risk calculations for new projects to an acceptable level (e.g. the risk of achieving breakeven of the project after 12 years instead of 8 years, rather than the risk of losing the investment completely).

For the cases of client bankruptcy or the client moving their facilities unexpectedly, it would be quite straightforward to have the DISCOM change the NEM agreement to a bilateral power take-off agreement with the OPEX provider. In cases where there is a dispute between the client and

the OPEX provider on electricity supply and payments, some kind of third party would be required to solve the case by checking the accounts and electric meters installed. In the extreme case that the third party can show that the electricity provided by the PV plant is consumed by the client, but the client still refuses to pay for it, the DISCOM would have to add these units to the bill of the client and remunerate the OPEX provider at the bulk rate accordingly. Such cases will of course create some additional effort and inconvenience for all involved but will probably be very small in number overall and provide the needed security to 3rd party providers. The authority governing such cases would be BPDB. As mentioned, the number of such cases should remain limited in any case.

The GoB could pave the way for more 3rd-party / OPEX projects to materialize by tendering out PV rooftop PPA / lease contracts for government buildings, i.e. a 3rd party / EPC would install a PV rooftop plant on government buildings such as universities or public offices which would take off the produced electricity at an agreed tariff. Such an initiative would help to generate projects and would help the market to grow and establish itself.

From Mission 2 (Feb'23): Options for OPEX projects & securities (focusing on government projects) / access to finance:

- Develop standard tender docs and PPA contract for governmental institutions for easy tender
- An agreement with government is a good collateral for IDCOL or banks – allows finance entry; like this, the OPEX market can slowly build confidence and grow.

C.7. Gas tariff

Gas deserves a specific mention in Bangladesh because many of the important manufacturers, especially in the export-oriented textile factories, are covering their electricity needs to a large extent through their own gas generators which run on very cheap gas rates. Bangladesh has some home gas reserves, this is why the government granted this source of power at very economic rates to important parts of their manufacturing industry. However, considering the energy markets in 2022 and considering the fact that Bangladesh is now short on gas and fossil fuels in general and has seen significant supply demand gaps this summer, it is very likely that these cheap gas rates will be raised by the government within the near future. A few days of lack of pressure in the gas network leading to the shut-down of private gas generators throughout last months have already made the gas consumers aware that relying on cheap and "always-available" gas is not a viable strategy for the future. Furthermore, GoB is currently already purchasing gas at higher price and industries agreed to pay up to 30% more for their gas, starting November 2022. There were even discussions to increase the gas price further in February 2023, which, however, did not happen yet[2].

However, in the current situation, gas is still the main source of power for lots of manufacturing facilities, especially in the textile sector. Given the low prices that these industries pay

[2] https://www.prothomalo.com/bangladesh/spukd9ga3i

for gas, the supply of electricity is very cheap, in fact much cheaper than the regular grid tariffs. This environment makes it very difficult for NEM applications to compete and leads to a situation in which a large part of the manufacturing industry – especially those manufacturers who have stable cash flows and would therefore be the most interesting clients – is not really interested in solar PV rooftop as it is not financially attractive for them – at least at current energy tariffs.

Therefore, to roll out solar PV under net metering, government should prepare a plan for a (probably stepwise) price increase of gas tariffs. This would not only improve the business case for solar but would also lead to a more just allocation of resources and would possibly free gas for dedicated gas plants that feed the national grid, thus improving the overall electricity supply situation. Addressing this issue is therefore not just a measure in favour of solar net metering but is rather a much-needed step for the sustainability of the power sector in Bangladesh in general, especially with rising gas prices.

From Mission 2 (Feb'23):

- Electricity generated from gas now will go up from about 4.5 BDT to 8.5 BDT per kWh[3]

C.8. BEPZA

Bangladesh has several "economic zones" that provide an attractive environment for large-scale industries and which are run by specific agencies such as BEZA and BEPZA which also provide the electric power to the industries in these zones, effectively becoming the DISCOMs for those zones. As these zones host very important industrial clients with often high electric demand profiles and at the same time large unused rooftop areas, these areas are very relevant for achieving a quick rollout of solar rooftop.

Therefore, BEZA, BEPZA and other similar authorities should be included in the same way as the DISCOMs in the solar rooftop rollout process, e.g. through having them participate in the above proposed stakeholder meetings and through assigning them targets of solar rooftop installations as for the DISCOMs.

BEZA and BEPZA are allowed to charge an additional 15% on their electricity sales (compared to normal tariffs in Bangladesh) to their customers so they can cover their own costs for supplying electricity in these areas. They might therefore be even more concerned on their customers turning to solar rooftop and in fact, so far, they have not allowed for the installation of NEM in these areas (partly also based on other concerns like the short term of typical land lease contracts in these areas where the industry clients are rather tenants than landlords). In order to bring these organizations on board, the above discussed "OPEX model" seems to be the easiest option where they themselves to invest into solar and be part of the business. This option should be discussed and implemented with BEPZA and the other authorities.

[3] Compared to 6-6.5 BDT per kWh for PV approximately (early 2023)

From Mission 2 (Feb'23): Options for BEZA/BEPZA zones

- There is potential in these zones. IDCOL already studied 300 factories in 1.5 months – 70 MWp potential in total. IDCOL recommended that BE(P)ZA implements own PV systems as OPEX provider

C.9. Finance and duties

Finance

C.9.1. Finance

Finance is a crucial aspect for the solar PV rooftop rollout. Only if the solar companies (for the OPEX model) and the clients (for the EPC/CAPEX model) have sufficient access to capital can this new sector expand and eventually contribute in a significant way to the national power supply.

The options for finance that solar companies and clients have availed so far are own finance sources (CAPEX model; only for sufficiently liquid companies with own resources or good banking conditions), finding an investor (for OPEX providers), bank loans (refinancing schemes at favorable rates are available from the Bangladesh Bank but not yet very common at commercial banks[4]) or a loan from IDCOL.

IDCOL financing

IDCOL (Infrastructure Development Company Limited) provides loans for solar rooftop projects. However, EPCs complain that the conditions for availing these are not practical for them: IDCOL typically has a bank guarantee requirement of 50% of the loan amount at minimum. This for the EPC leads to a requirement of 20% equity, 40% with bank (deposited in account at 100% for bank guarantee) to avail the remaining 40% from the IDCOL, i.e. a an overall leverage of 60 : 100. The offered interest of 5.5% is favorable and much better than for commercial bank loans at 9-10% interest (which also require a bank guarantee for new EPCs) and approximately in line with the inflation rate (5-6%).
IDCOL has a total rooftop solar portfolio of 49 MW, built up during the last 2 to 3 years. For comparison, the solar home system (SHS) portfolio where IDCOL is coming from has 4.3m systems by now with a total of 200-300 MW in rural Bangladesh.

Clients (mostly EPCs) complain that IDCOL loans are too much paperwork; these requirements come from the securities IDCOL requires so it can pay back to donors (which are IMFs like kfw); the IDCOL board oversees these securities and risks. In IDCOL's perspective, these problems by clients come from a lack of understanding on part of the clients and their own challenges in paperwork, like getting the land ownership papers right; they admit, however, that the bank guarantee might be the most difficult issue for the clients. IDCOL states that the total procedure does not take more than two months.

[4] E.g. loans of the GTF (Green Transformation Fund) and TDF (Transformation Development Fund) provided by BB to commercial banks at around 2% interest are passed on to C&I clients at 5% interest.

IDCOL is well-equipped with funds and wants to scale up their portfolio; this can be a great facilitator for the market if the operational challenges and entry hurdles for the clients can be overcome. To achive this, IDCOL recommends a good structuring of the loan by the EPCs through securing good, reliable clients, building relations between clients and EPC/OPEX provider etc.

Bangladesh Bank (BB) financing

There is a „sustainable finance" re-financing scheme by the BB under which the commercial banks can avail loans at concessional rates. However, this scheme includes all kinds of items eligible for financing, like energy-efficient boilers and other large-scale industrial equipment. Solar power and especially solar rooftop (equivalent to 100 kWp only!) are a very small portion of the total small portion of the total „sustainable financing".

A main reason for this is that the main incentive for commercial banks to go for this „sustainable finance" at all is their rating: if they don't do anything in this regard, the ultimately receive lower rating marks (e.g. in the CAMELS rating). Now in order to comply with the „sustainable finance" requirements in the rating schemes, it is much less hassle and risk for them to finance one large-scale energy efficiency project for any large company (e.g. an electric boiler that uses 10% less energy than the benchmark and costs millions of dollars) rather than to go into solar rooftop which is small and new to the banks.

Furthermore, the green re-financing scheme is not commercially interesting for the banks at it allows them a low interest margin: the BB re-financing is offered to banks at 3% while they may charge clients not more than 5 or 5.5% according to the requirements; for typical commercial loans, the bank typically pays 5 or 6% while they can charge up to 9% which is much more interesting to them.

The re-financing in any case is designed by the BB as an „entry support", not as a „full-market" tool.

As a result, commercial banks are not eager to pursue this sustainable finance scheme for solar rootop and typically do so only on insisting by the clients i.e. EPCs. As a consequence, EPCs (and building owners) have so far not used this scheme very much and rather revert back to either commercial loans or IDCOL financing.

From Mission 2 (Feb'23):

- **IDCOL has good expertise and staff. It has the potential to scale up the NEM sector:**
  - Streamlining and simplifying the IDCOL loan application process would help make financing more accessible. Providing targeted training and guidance on the application procedure for developers and companies could further reduce procedural barriers.
  - The current bank guarantee requirement for IDCOL financing is relatively high and can be restrictive. For large and financially sound companies with adequate collateral, the required bank deposit could be reduced or made more flexible to ensure a more practical and user-friendly financing mechanism.
  - While IDCOL has strong technical expertise, it may not be able to process all rooftop solar loan applications on a scale. Exploring collaboration with commercial banks could help address this limitation, with banks handling loan processing and disbursement while IDCOL provides technical appraisal and quality assurance support.

- **Partnerships:**
  - One solution is if a small EPC joins with a more established company (SPV) to do a project
  - Large power companies such as Maximco, Summit, and Confidence can be actively engaged through structured participation in policy dialogue, pilot projects, and investment frameworks related to rooftop solar and energy transition initiatives.

C.9.2. Duties on PV components

More balanced import duties for PV equipment would avoid artificially increasing the costs of this very cost-effective source of power: A specific aspect on the financial side are the duties that apply to PV components. These duties impact directly the cost of PV plants and therefore their financial viability, which is the crucial factor for a large rollout of PV rooftop under NEM. In Bangladesh, a very low import duty of 1% applies for large-scale IPP projects including utility-scale PV plants, together with tax holidays of 5% – on the other side, for solar PV rooftop projects, high duties apply, such as 37% for inverters, 11% for modules, 60% for DC cables and aluminum[5]. Solar PV rooftop plants provide power such as thermal IPP projects and have the same specific benefits as large-scale PV projects yet face a higher per-unit cost due to lower scales. Here, a more balanced duty scheme that does not penalize PV rooftop (e.g. below 10% on average) would help to bring about a quick rollout and at the same time do more justice toward this decentralized, small-scale form of power generation.

From Mission 2 (Feb'23):

- Secretary Energy will take the duties issue up with NBR

Access to Finance / Banking issue:

- Explore and showcase escrow account arrangements involving DISCOMs and clients' banks to ensure secure and timely payments to OPEX service providers.
- Review and document international experiences and best practices on security mechanisms and risk mitigation frameworks used in similar business models.
- Position the OPEX model as a key focus of the next working group meeting, including presentation of sample cases, practical insights, and policy or regulatory recommendations.

[5] Information from EPC interviews

D. Conclusion

The following table summarizes the recommended measures to address the gaps mentioned in the report. These measures should be implemented by the respective responsible stakeholders, supervised by SREDA and the Ministry of Power (MPEMR) through the Power Division.

It is planned to establish a working group consisting of the respective stakeholders, facilitated through GIZ and SREDA with the help of 8.2 REEH, to follow up on this process throughout the course of 2023. Within this working group, these topics should be discussed and pushed forward.

When these topics are addressed adequately, PV rooftop under NEM in Bangladesh should experience a significant growth throughout the next months and years, with corresponding benefits for the country.

Table 1: Summary of recommended measures

Area / actor	Topic / gap	Measure	Responsible
Client	Client awareness	Targeted awareness campaigns Targeted stakeholder events	SREDA SREDA
EPCs	EPC capacity building	EPC training Training for technicians requested by EPCs	GIZ/8.2/SREDA
PV plant	PV plant quality	Whitelist for EPCs managed by SREDA Keep investigating in implementational issues and how to solve them: like issue of companies importing components by themselves and have low-cost installers put them onto roof	SREDA
Testing	BSTI testing	Short run: Training on document handling Long run: BSTI improve its lab equipment and capacities (through dedicated practical training)	GIZ/8.2/BSTI BSTI
DISCOMs	Institutional	DISCOM training Special focus on safety!	GIZ/8.2/DISCOMs/BPMI
DISCOMs	Operational	Evaluate “5 plants” program Establish DISCOM NEM targets Online monitoring under planning	PD/SREDA PD/SREDA
DISCOMs	Rollout	Regular stakeholder meetings with DISCOMs, SREDA, EPCs (as well as client associations, BERC and BPDB as per requirement) DISCOM internal targets	DISCOMs/SREDA DISCOMs
OPEX model	OPEX securities	Adaptation of NEM regulations (DISCOM offtake in case of default) Government projects as option to start up the OPEX market	PD/GIZ/8.2
Gas	Gas tariffs	Gas tariff increased strongly by Feb’23 – now PV cheaper than gas	PD/GoB
BEPZA	BEPZA engagement	Include BEPZA into DISCOM targets and stakeholder meetings	PD/SREDA

Finance	Facilitate smooth finance options	Continue to engage with banks and IDCOL to find solutions. IDCOL would be an experienced player with very good loan terms to facilitate finance.	GIZ/8.2
Duties	Balanced import duties	Reduce import duties on PV to more balanced levels Secretary Energy will take the duties issue up with NBR – follow up on this	PD/Ministry of Commerce

E. Annex

E.1. Extract on DISCOM capacity building action plan – table from CNA report by GIZ 2021

The capacity needs assessment report by GIZ, 2021[6], includes the following task elements, which are very much in line with the findings of this report.

Table 2: Action plan as per GIZ CNA Report 2021

Capacity	• Establishing dedicated rooftop solar unit for all utilities.	SREDA to initiate and monitor	Distribution Utilities	1 year
	• Developing unified installation protocol with clear standards	SREDA	SREDA	1 year
	• Technical training on proposal, installation standards, inspection and monitoring.	SREDA with utilities for all level of utility personnel	SREDA to Implement	1 year
	• Training on feasibility; design, planning and project proposal for utilities/ service providers	SREDA with distribution utilities	SREDA to Implement	1 year
Motivation for Utilities	• Incentivize utilities to support rooftop solar projects with strong motivation	Power Division with SREDA	Power Division	6 months to 1 year
	• Inclusion of point system in Annual Performance Evaluation of the utility staffs	Utilities	Utilities	6 months

[6] "Capacity Needs Assessment for the smooth implementation of Rooftop Solar under Net Metering Guidelines", February 2021