

Financing Distributed Solar Energy In Tamil Nadu

The current state of grid-connected rooftop solar financing

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EXECUTIVE SUMMARY

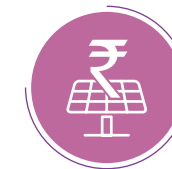
The Government of India has committed to install 40 GW of grid-connected rooftop solar systems by 2022, in efforts to reduce carbon emissions and increase energy security and access. One of the key ways that would facilitate meeting this target, at state and national level, is by overcoming the sector's initial financial and market barriers. Thus, this report aims to discuss and describe the current state of grid-connected rooftop solar financing in the country, specifically in Tamil Nadu.

The Indian Government has sought concessional loans and funds under climate financing from multilateral and development banks. Major programs funded with the help of international credit lines include:



Grid-connected Rooftop Solar Program (GRP)

World Bank (WB), Clean Technology Fund (CTF), and Global Environment Facility (GEF) extended 648 USD million to the State Bank of India (SBI) in 2016. As of July 2020, 264.19 MW of rooftop solar have been commissioned under this program in the country.



Solar Rooftop Investment Program (SRIP)

Asian Development Bank (ADB) and CTF extended 505 USD million to the Punjab National Bank (PNB), commencing in 2016. As of March 2020, 20 MW rooftop solar have been commissioned under this program in the country.



German-Indian Solar Partnership

The Kreditanstalt für Wiederaufbau (KfW) committed a total of EUR 1 billion equivalent to USD 1.11 billion¹ to several Indian financial institutions, mainly to the Indian Renewable Energy Development Agency (IREDA), SBI, and the Bank of Baroda (BoB). As these lines of credit are relatively new (starting 2017, and 2019), projects are yet to be commissioned.

All these financing programs are working on increasing the availability of loans for the sector, and have put in place technical assistance programs for the Indian intermediaries. Although the programs aim to accommodate all electricity consumer categories, they primarily target the commercial and industrial consumers as their electricity tariff rates are higher than other consumer categories. Therefore, the transition to rooftop solar would result in a higher rate of returns for these consumers.

Under the MNRE's Rooftop PV and Small Solar Power Generation Programme (RPSSGP), a solar generation based incentive (GBI) was provided to project developers through IREDA - the implementing agency. In Tamil Nadu, 6 MW of rooftop solar were installed under this programme, from 2012 to 2019, and SBI and PNB have provided loans for a total installed capacity of 75 MW and 20 KW under their respective programs, as of April 2020.

¹ Average conversion rate in 2015 (year of signing the deal): EUR 1 = USD 1.11 (European Central Bank, 2020).

Based on our insights gained over interactions with the relevant international and national financial institutions, the following key challenges as experienced by these banks for rooftop solar financing emerged:

- Lack of awareness amongst consumers about the economics and business models available for rooftop solar
 - Lack of experience by the banks in financing the rooftop solar segment, especially under different business models
 - Lack of knowledge on the performance of the solar systems
 - Challenges in obtaining approvals from the utilities and increasing its involvement to fulfill its role and responsibilities as one of the important stakeholders
 - Application of new policies and guidelines on ongoing projects that were commissioned prior to the implementation of these new guidelines (this affects future investment scenarios and induces lack of confidence in investors; for example the Government's decision to apply a 20-25% customs duty on imported solar equipment could financially affect the current ongoing projects)
- Other issues related to the repayment of the banks such as: 1. dispute amongst third parties i.e RESCOs or developers and consumers; and 2. delayed payments from utilities may interfere with loan repayment to the banks.

The risks associated with loan repayment to the banks push the sector into higher financing risk categories, which result in more stringent loan terms, such as higher interest rates and collateral. Due to these overall key challenges, the uptake of loans for rooftop solar systems is relatively slow compared to the targets set

These international financing programs are also working to develop viable business models, such as the RESCO model, rooftop rental, and utility-based models to allow various consumer categories to adopt rooftop solar, however, in Tamil Nadu loans so far have only mainly been taken up under the CAPEX model. By developing and implementing other business models (for example such as the lease model) and financing instruments, the banks could push forward the rooftop solar sector in Tamil Nadu, where the potential for this sector is enormous. The consumer categories that have a strong access to debt financing for rooftop solar are mainly the commercial and industrial consumers, and residential consumers to a certain extent - as they can access loans through various Indian banks, under corporate, housing or house improvement, and personal loans.

The lack of a dedicated segment or loan product for rooftop solar in some of the banks makes it difficult to track the progress of the rooftop solar sector. The sector is still perceived as new by the banks. Some of the financing risks outlined by the banks include evolving policies and guidelines, lack of experience amongst certain solar developers and the lack of technical knowledge such as the technical performance of the rooftop solar plants. As a result of this perception and factors, the interest rates or collateral tend to be still high. Parallely, the Government's efforts to increase the deployment of rooftop solar is relatively recent, as the dedicated programs for rooftop solar have been introduced only in the previous decade. Thus, the sector still faces early market related barriers and challenges as mentioned above. Nonetheless, the recently extended international credit lines, the increasing commitment for addressing climate change by the Indian Government and its continued efforts to promote rooftop solar are a positive signs for the growth of the sector.

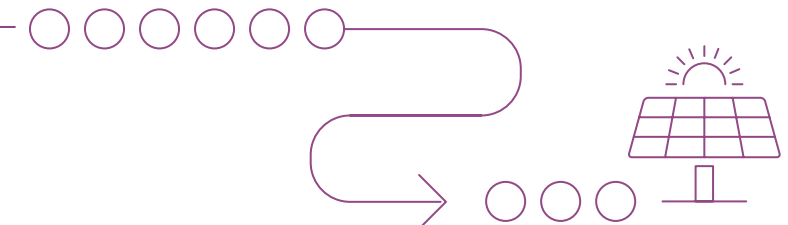


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1. INTRODUCTION

Why would overcoming financial barriers significantly help solar deployment?

For the mobilisation and scaling up of distributed solar projects, overcoming financial barriers and risks play a key role. Due to the high capital and relatively low operational costs of distributed solar, providing long-term financing or debt financing, is one of the ways marketing and financial barriers may be overcome for greater adoption (Hussain, 2013). Though much progress has been made in terms of creating an enabling financing, market and regulatory environment for utility scale systems in India, rooftop solar will require more financing instruments in order to reach India's ambitious rooftop solar energy target of 40 GW by 2022. For grid-connected rooftop solar in India, and particularly for Tamil Nadu, which is the focus of this report, the key financing barriers for its uptake were identified as the lack of access to debt financing, high capital costs and perceived performance risk (Gupta et al, 2016).

Why are international credit lines needed? Which are the international lines of credit available?

A way to open up the possibility of long-term debt financing is through international credit lines. International financial institutions were called to participate in a global effort to mitigate greenhouse gas (GHG) emissions and to provide credit lines of concessional loans and funds to developing countries. Lending institutions offering

concessional funds/loans can give the intermediary commercial financing institutions the necessary support to make available long-term debt financing for solar rooftop projects. The Government of India (GoI) had set a solar energy target of 100 GW by 2022, of which 40 GW is to come from rooftop solar (SECI, 2020). To carry out this mission and to establish and acquire the overall necessary financing infrastructure, physical resources, human resources, large investments and sector-specific financing will be required.

Hence, the GoI has sought green credit lines to avail of concessional loans/funds to overcome financial barriers and accelerate the deployment of grid-connected solar and other renewables. These programs are mainly expected to benefit commercial and industrial sectors. The Grid-connected Rooftop Solar (GRPVS) Program by the World Bank (WB) implemented by the State Bank of India (SBI) (World Bank, 2015), and the Solar Rooftop Investment Program (SRIP) by ADB implemented by the Punjab National Bank (PNB) (ADB, 2016b), began in 2016. Under the Indo-German Solar partnership established in 2015 (KFW, 2020a), Kreditanstalt für Wiederaufbau (KFW) has extended credit lines to Indian public sector banks (PSBs) and other institutions such as the Indian Renewable Energy Development Agency (IREDA), corporations and utilities. The advantages of such programs also include sharing of international experience and knowledge, and assisting nation-level capacity building on a long-term basis.

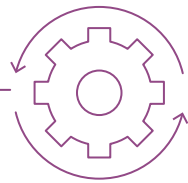
What are the expected outcomes through this?

The expected outcomes of these solar financing programs by multilateral development banks are:

- Increased installed capacity of rooftop solar in India, and thereby working towards meeting its clean energy goals.
- Reductions in GHG emissions.
- Strengthened and improved institutional capacity of national financial institutions and other Government bodies such as - utilities, state nodal agencies (SNAs) and state electricity regulatory commissions (SERCs).
- Increased participation of grid-connected rooftop solar stakeholders.
- Strengthened energy security.
- Ease the financing for the solar rooftop sector

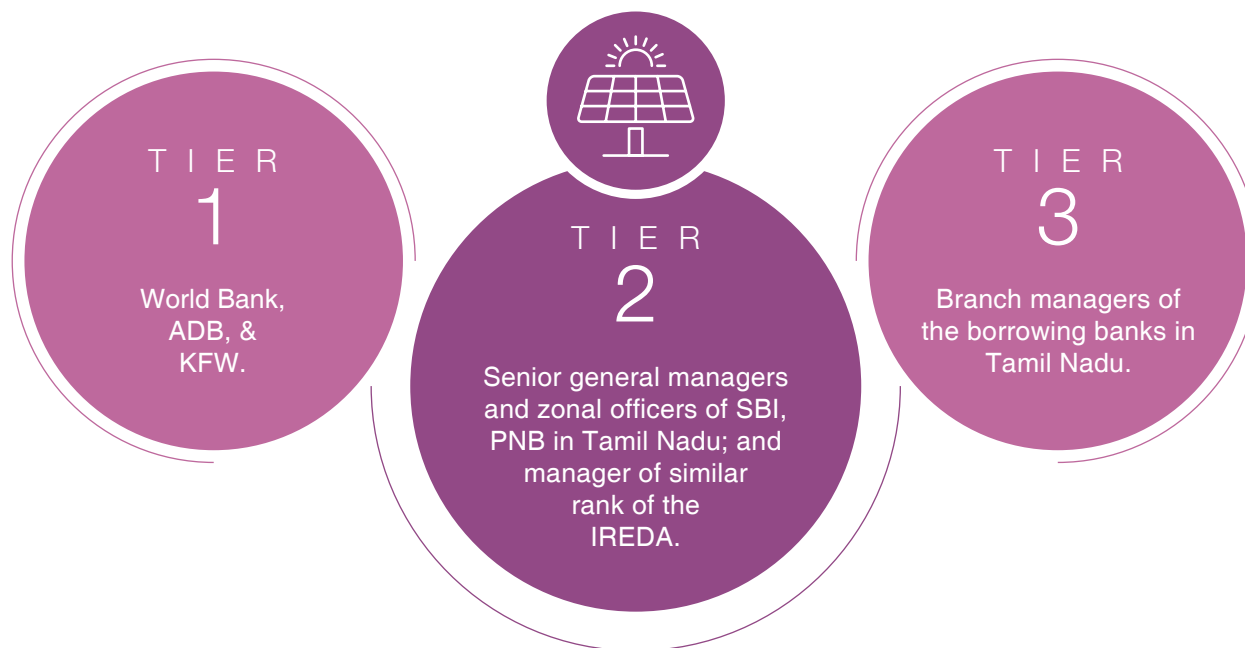
What does this briefing paper aim to do? And how? This briefing document attempts to understand the current state of grid-connected rooftop solar financing broadly at national level and particularly for the State of Tamil Nadu. It evaluates the state of the international lines of credit, its implementation at state level (for Tamil Nadu), and the availability and accessibility of the financial support. Through this, the document aims to identify possible gaps and challenges existing today in financing rooftop solar.



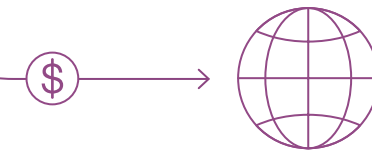


2. METHODOLOGY

An initial research was conducted to identify the source of fundings available for this technology in the country. The lines of credit from the WB, ADB and KFW for rooftop solar, were chosen for this assessment. To evaluate these credit lines and their impact on rooftop solar in Tamil Nadu, information at three levels or tiers of the credit lines were sought:



Questionnaires were designed based on the tier identified and then customized for each financial institution (please see Annexure I). Questions for the World Bank, ADB and KFW were formulated in line with their results areas and expected outputs. A similar format was maintained for the borrowing banks.



3. INTERNATIONAL FUNDING

The implementation and evaluation of ongoing international lines of credit are discussed in this section.

3.1. Program Aims & Objectives

The World Bank (through IBRD - International Bank for Reconstruction and Development), ADB, and KFW have designed their respective programs with the aim to accelerate energy development by increasing grid-connected rooftop solar uptake in the country, in line with the Government's targets. The Clean Technology Fund (CTF) and Global Environmental Facility (GEF) additionally support the GRPV and SRIP programs. Program objectives of these programs are similar, they all aim to increase the availability of debt financing to Public Sector Banks and focus on capacity building (refer to Table 1). At the consumer end, the programs are primarily targeted at industrial and commercial customers (ADB, 2016b), (World Bank, 2016).



Table 1 Program objectives of the international funding institutions for the World bank GRPV program, the ADB SRIP program, and the KFW programs.

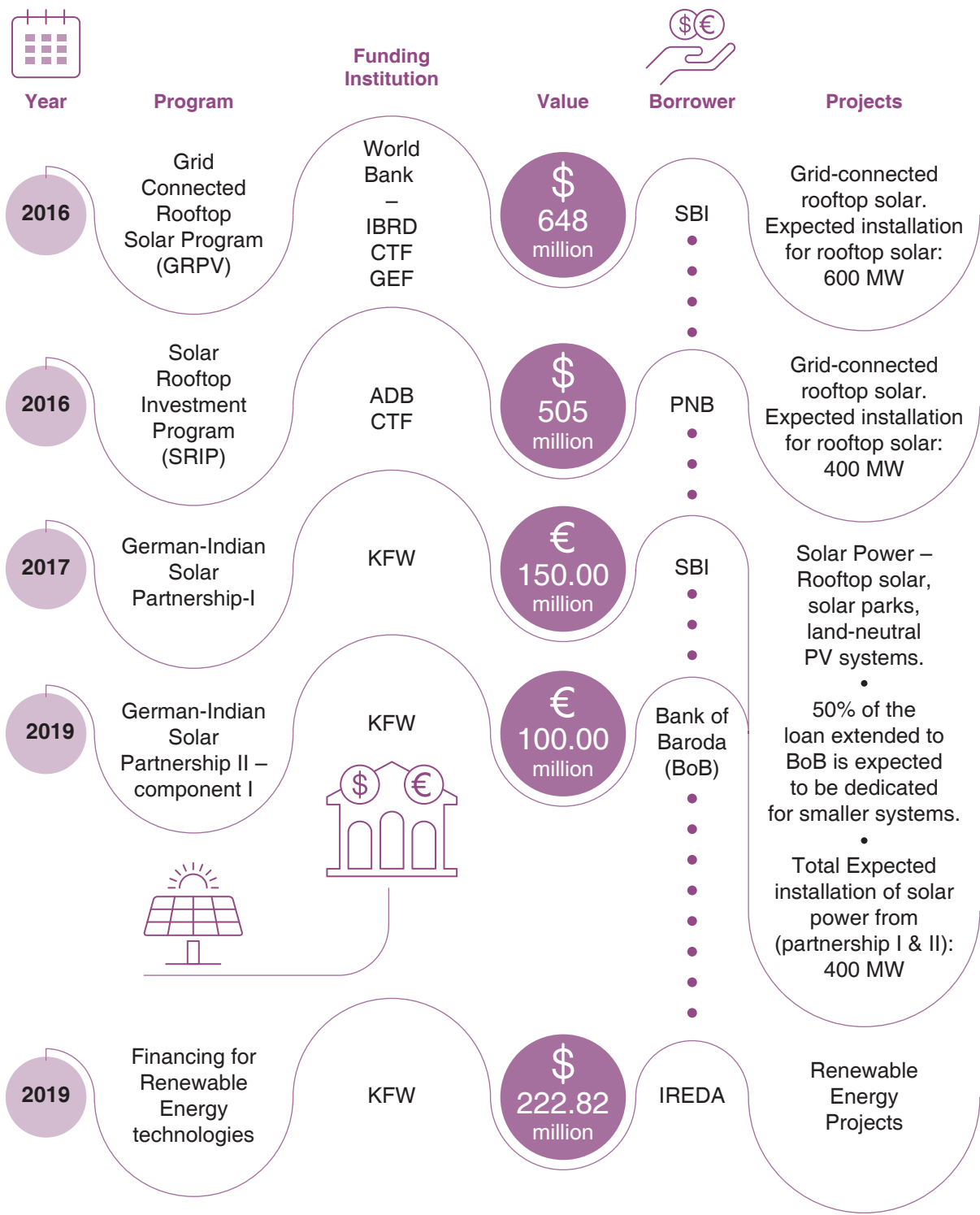
GRPV Program (WB)	SRIP Program (ADB)	Programs funded by KFW
Increase the installed capacity of grid-connected rooftop solar in all States.	Develop renewable energy technology through grid-connected solar rooftop installation.	Increase the RET deployment in the country, which includes solar PV power plants, land-neutral solar systems and grid-connected rooftop solar technologies
Address the lack of debt financing availability in India by providing concessionary funds.	Build energy security through sustainable technology.	Reduce GHG emissions.
Develop and promote new business models to increase rooftop solar deployment.	Increase the availability of debt funding for the sector to overcome financial and market barriers	Expand the solar power use across the country.
Provide funds for technical assistance for capacity building and training for key stakeholders who will directly deal with GRPV	Reduce GHG emissions.	Develop the market for the solar sector by addressing marketing barriers such as the low participation of micro, small and medium enterprises (MSMEs).
Lower the interest rates for early movers to the grid-connected solar rooftop market.	Develop pipeline for the solar rooftop sector through technical assistance and capacity building programs.	Enable smoother grid integration of solar power into the transmission and distribution network.
Provide GRPV financing to riskier consumer categories such as MSMEs, that can impact the GRPV market.	Increase energy access across the country.	Include all key stakeholders in the transition to solar power and in its market development.
Reduce the country's GHG emissions by supporting GRPV systems.	Accommodate all types of rooftop solar projects across the program period.	

Source: (ADB, 2016b), (KFW, 2017, 2020b, 2020c, & 2020d), (World Bank, 2015 & 2016).

3.2. International lines of credit

The funding from the international banks (refer to Table 2) are provided to 4 Indian financial institutions. The total resources available for the GRPV program by WB is USD 915 million, of which approximately 29% is to come from national sources, and USD 2 million is contributed by SBI. Similarly, the total project cost of the SRIP by ADB is USD 1,005 million, of which almost 50% is contributed by local sources such as commercial banks, private and public sector, and in addition other grants and equity. KFW has been a long-standing funding institution for IREDA. One of the first lines of credit dates back to the 1990s. The German-Indian Solar Partnership that commenced in 2015 aims to promote rooftop solar and solar park generation with investments of EUR 1 billion (KFW, 2020c).

Table 2 International lines of credit for grid-connected rooftop solar.



Sources: (ADB, 2016b), (Bank of Baroda, 2019), (IREDA, 2019c), (KFW, 2017, 2020b, 2020c, & 2020d), (World Bank, 2016).

3.3. Program Implementation & Evaluation

The Ministry of New and Renewable Energy (MNRE) acts as the coordinator for all these programs, therefore lessons learned from one lending program can be more easily transferred to other programs.

World Bank (WB): The WB – IBRD is providing a loan of USD 500 million, the CTF- USD 125 million as loan and grants, and the GEF – USD 23 million in the form of grant. This grant supports funding opportunities for commercial and industrial small and medium enterprises (SME) for adopting rooftop solar, and increasing the ease of future businesses in the sector through technical assistance programs. The program duration is from 2016 to 2021 (World Bank, 2016).

SBI is the borrowing and implementing bank. Being one of the oldest banks established in the country, it has the capacity of reaching out to a large area through its network of branches. SBI is responsible to identify, appraise and finance investments that meet the eligibility criteria prepared with the approval of WB. Developers, customers, aggregators and intermediaries in accordance with the requirements set out by SBI, can avail loans under various business models. SBI is responsible to coordinate and develop technical assistance programs, and along with MNRE it conducts the program monitoring and evaluation (World Bank, 2015).

The program is structured on a result-based financing (or program for results) framework, where disbursement of credit is linked to the previous outputs of the project. This framework is meant to strengthen the incentive for the implementing banks to meet the set targets and to provide clarity and transparency for the implementing institutions. The disbursement linked indicators (DLIs) are based on three result areas (refer to Table 3). SBI assesses the performance of the program based on DLIs, and reports it to the funding institutions for the release of further funds.

46.3% of the allocated funding is dedicated for the installation of rooftop solar, and another 47.7% is dedicated for developing the market. Thus, equal priority is given to develop the market for GRPV and to increase the installed GRPV capacity.

Table 3 The results areas of the GRPV program and the DLIs associated with specific result areas.

Results Area 1	Disbursement linked indicators (DLI)
Strengthening Institutional Capacity for GRPV:	DLI 1 - Establishing a Rooftop Solar PV Program at the State Bank of India: DLI 1 ensures the establishment of all the resources and set-up, such as policies, infrastructure and procedures necessary before the GRPV program commences. This includes SBI having a Programs Operation Manual in place, key staff are appointed for the program implementation, tracking and technical systems are upgraded, and advertisements of GRPV financing are launched.
The institutional capacity of SBI is strengthened by:	Period applicable: 2016/17
Implementing a program to systematically train the SBI staff of various branches on GRPV financing	Amount allocated: USD 5 million
Establishing internal policies and procedures for loan approval and risk assessments	DLI 2 - Technical assistance to key stakeholders for the implementation of MNRE's GRPV program:
Fortifying the IT systems for tracking GRPV transactions	DLI 2 relates to a contract agreement with a consulting firm for implementing the technical assistance program to 14 utilities, SNAs, and SERCs, to ensure capacity building and skill development. This will be financed through the GEF grant.
Promoting GRPV through public awareness campaigns and advertisements	SBI will provide payments to those conducting the technical assistance programs, while MNRE will be responsible for quality assurance of the programs.
Establishing a fund for offsetting loss	Period applicable: 2016/17 - 2018/19
Monitoring and evaluating the program to identify areas for improvement.	Amount allocated: USD 13 million
The institutional capacity of SNAs, SERCs and utilities can be strengthened with the MNRE and a Steering Committee by:	DLI 6 - Sustainability of GRPV program:
Implementing capacity building and technical assistance support programs regarding GRPV power generation, trading and metering	DLI 6 ensures the second phase of the program, where SBI is prepared to begin funding with its own resources or along with other national banks. It is expected that this program has provided experience in dealing with GRPV financing to the bank and the acquired can be shared and further applied.
Facilitating the SNAs' role of promoting GRPV systems to stakeholders and raising awareness on the available financing	Period applicable: 2020/21
Establishing programs for accreditation and training for technical inspectors.	Amount allocated: USD 20 million

Results Area 2	DLIs under Results Area 2
Market Development of GRPV:	DLI 3 - Aggregate amounts of loans signed by SBI for the financing of solar (PV) rooftop power generation schemes: This DLI aims to provide the lacking debt financing to developers, aggregators, installers, and rooftop owners, under various business models. This will widen the scope and opportunities to trigger off large scale GRPV systems.
This will be achieved by:	Period applicable: 2016/17 - 2019/20
Generating GRPV financing opportunities through aggregation models for installers and rooftop owners	Amount allocated: USD 298.75 million
Lending to non- banking financial companies and small and medium enterprises.	DLI 4 -Piloting new business models DLI 4 targets the inclusion of NBFCs, and SMEs in the program through loans from SBI. This will be financed through the GEF grant. As the SMEs are considered a riskier category to finance but can contribute significantly to the overall GRPV target, their participation in this program can help in overcoming barriers such as lack of awareness, and lack of debt financing for this consumer category. Period applicable: 2020/21 Amount allocated: USD 10 million
Results Area 3	DLIs under Results Area 3
Expanding GRPV generation:	DLI 5 - Megawatts of solar (PV) rooftop power generation installed and commissioned under SBI financing The rationale for this DLI is to help keep track of the commissioned and installed capacity of GRPV during the program. The time-lag between commissioning and installation has been into account.
This will be achieved by:	Period applicable: 2017/18 - 2020/21
Increasing the investments in and the installed capacity of GRPV systems.	Amount allocated: USD 300 million

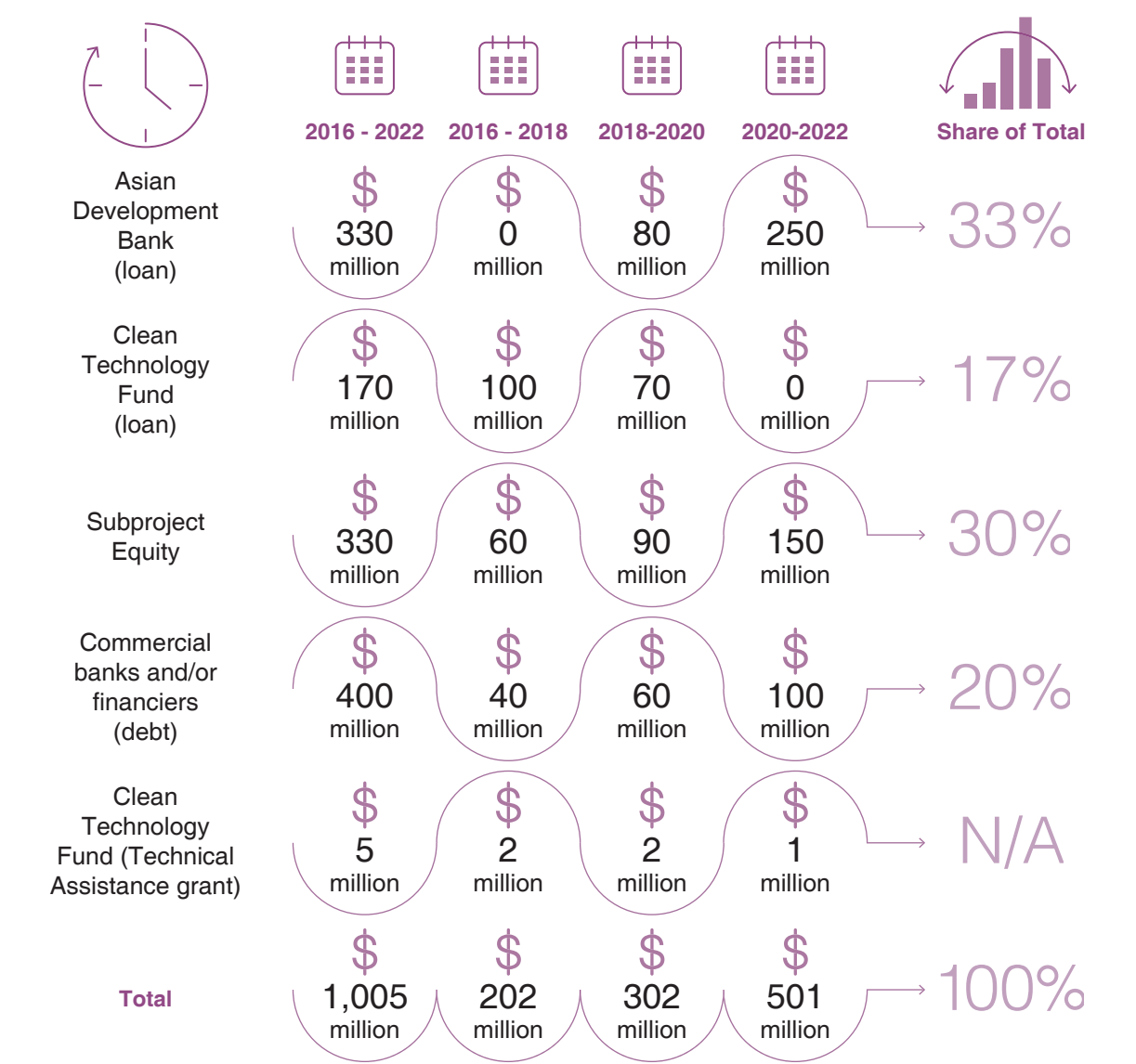
Source: (World Bank, 2016).

Asian Development Bank (ADB):

For the 5 and a half year Solar Rooftop Investment Program, a loan of USD 330 million is provided from ADB (ordinary capital resources), USD 175 million is lent from CTF, of which USD 5 million is specifically allotted for technical assistance to strengthen the capacity of the relevant stakeholders and develop the market (ADB, 2016b). Funds will be made available in three parts tranches, based on the program’s

multi-tranche financing facility (MFF) model. The disbursements will be based on ADB’s handbook of loan disbursement (ADB, 2016a) (refer to Table 4). Throughout the program, almost 50% of the contribution is maintained from national sources (e.g. contributions from commercial banks and equity from developers) in all tranches. The program ensures from the very beginning a substantial participation from local sources and working on capacity building and market development.

Table 4 Summary of the sources, timeline and allocated amount per tranche of the SRIP program.



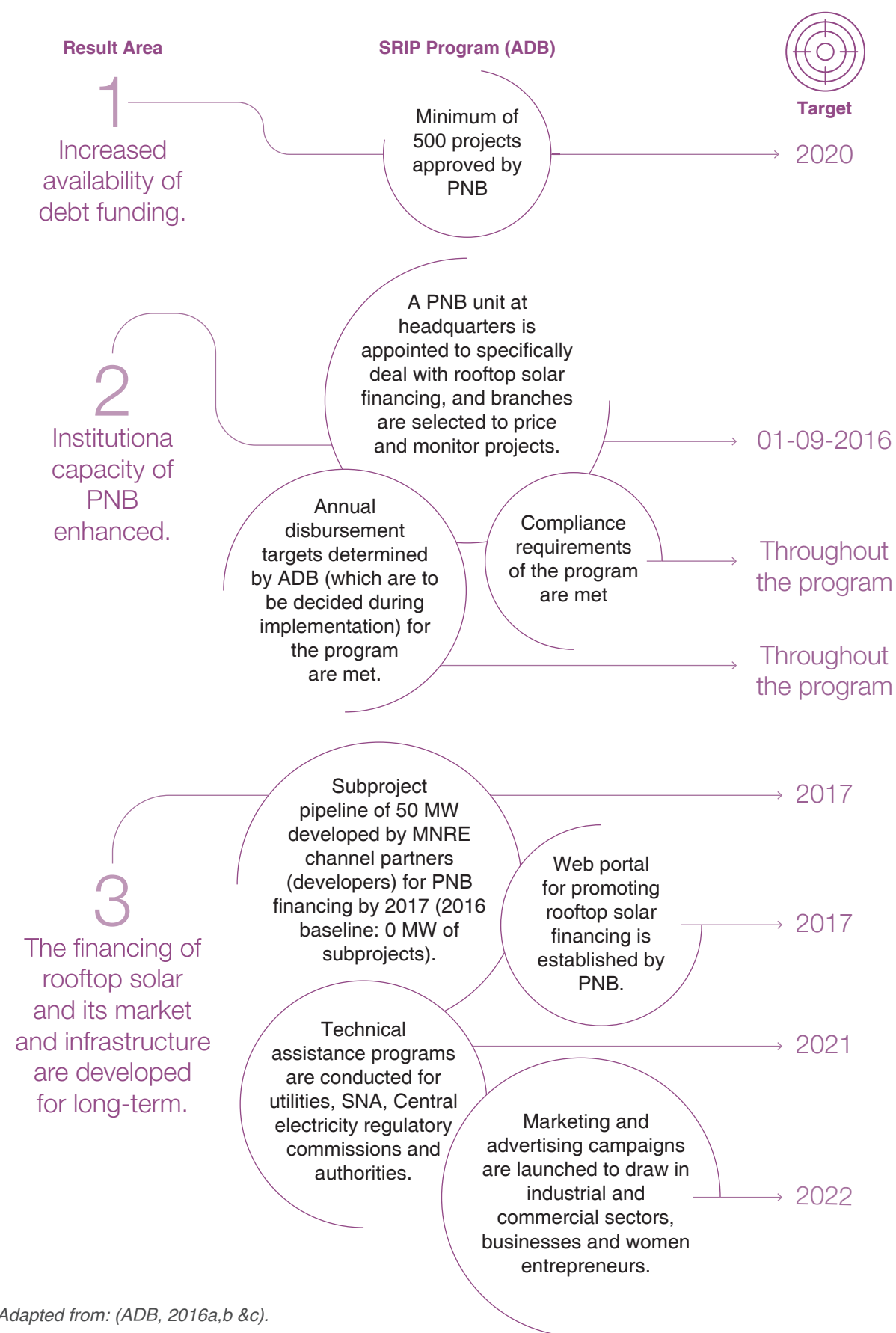
Adapted from: (ADB, 2016a), (ADB, 2016b).

MNRE and PNB are responsible for implementing the technical assistance programs for stakeholders such as utilities, SNAs and electricity commissions and authorities (ADB, 2016c). The three components of the technical assistance programs are:

- Capacity building and training for PNB
- Market development, which includes developing marketing programs and online tool kits, building dedicated websites and, training and involving technical analysts,
- Awareness campaigns to various stakeholders using multimedia platforms.

The SRIP is mainly aimed to finance large-scale solar rooftop systems for the industrial and commercial sector, under an aggregate and/or standalone basis. PNB is responsible for determining the conditions under which customers may avail loans. As PNB has a wide reach throughout the country, it could have a significant impact in developing the market for rooftop solar. Evaluation of the program based on disbursements, institutional capacity building and other factors are carried out by ADB at halfway through the program and during the final tranche to identify challenges and areas of improvement (refer to Table 5). With the efforts of the program, an installed capacity of grid-connected rooftop solar of 400 MW funded by PNB is expected by 2023, which is 1% of the country’s rooftop solar target.

Table 5 Result areas or outputs, performance indicator and targets of the program.



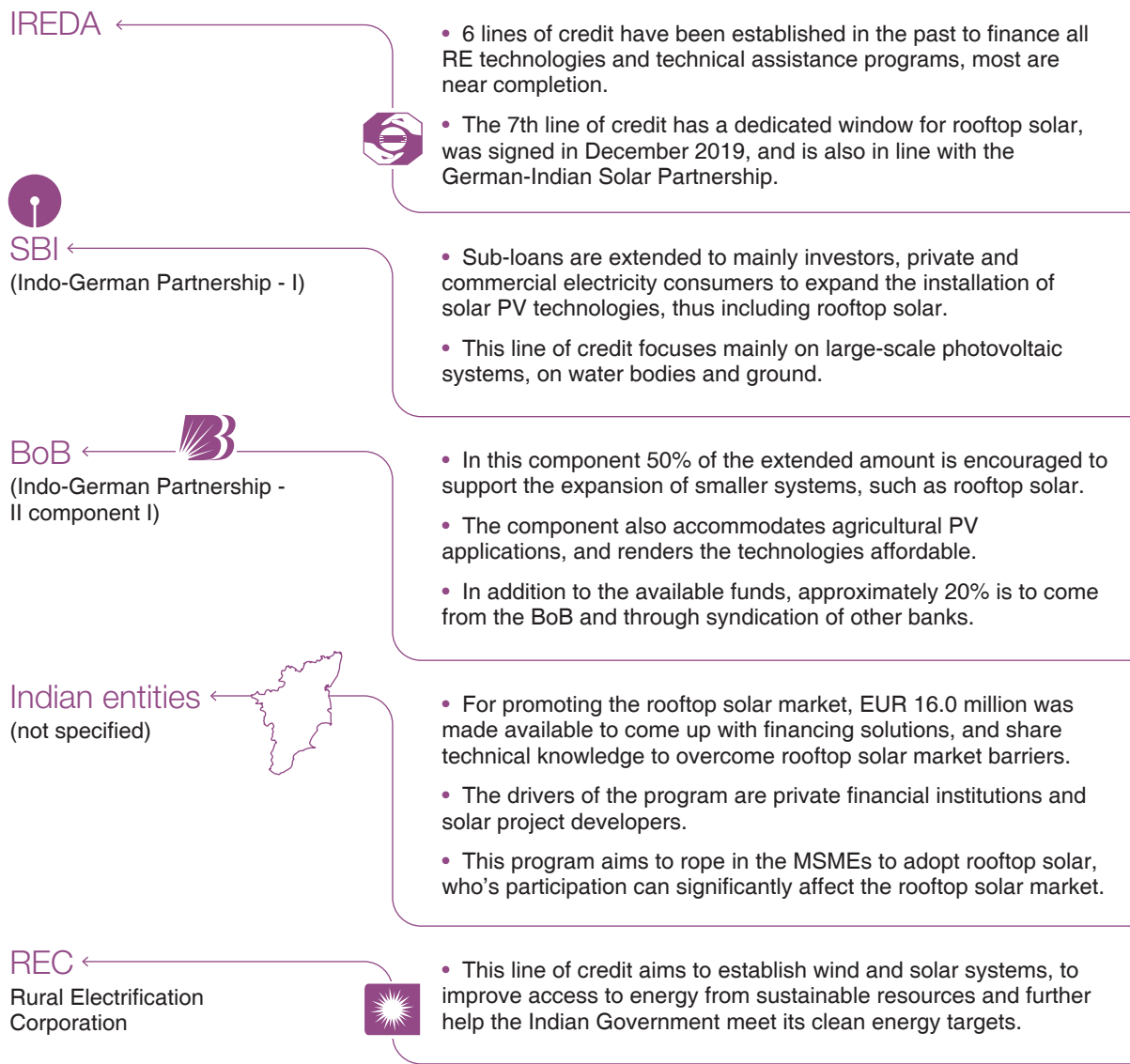
Adapted from: (ADB, 2016a,b &c).

KFW: The KFW has a long-standing partnership with India. It has extended lines of credit to financial institutes, corporations, utilities, and companies to improve energy accessibility, energy efficiency and develop the market for renewable energy technologies. Evaluation of the KFW programs are conducted from the concept stage all through to the end.

For expanding the solar power sector, a total of EUR 1 billion (USD 1.11 billion) is to be made available by KFW with two credit lines, on behalf of the German Government under the German-Indian solar partnership, for five years starting from 2015 (KFW, 2017) (refer to Table 6). The technologies to be funded are photovoltaic centric, which include large-scale solar power plants, ground-neutral and rooftop solar systems. The partnership is ideally to enable at least 400 MW of solar power. The first line of credit is carried out by SBI. The second line of credit has two components, of which the first, established end of 2019, will be carried forward by the Bank of Baroda (BoB). The second component of the partnership is yet to be designed (KFW, 2020d). The Ministry of Finance, MNRE, and IREDA are also active participants in the partnership.

The partnership also considers the larger systemic requirements for the expansion of grid-connected rooftop solar such as the technical and market-related components for this sector. Through the 'Green Energy Corridors' program, concessionary loans of EUR 1 billion are made available for financing inter-state and intra-state transmission lines and infrastructure. The Power Grid Corporation of India Limited and the Indian Ministry of Finance are the borrowers (KFW, 2020f). The State level implementers are the State Transmission utilities. As of December 2019, Tamil Nadu Transmission Corporation Ltd. (TANTRANSCO) was able to put in place 906 ckm (circuit kilometers), against its target of 1,068 ckm (MNRE, 2019). In line with the UDAY program for the state utilities, EUR 203.5 million was lent to Power Finance Corporation Ltd. The purpose of this line of credit was to facilitate the integration of solar power into the grid, and improve energy efficiency in the grid network (KFW, 2020g). A line of credit of USD 228 Million for RE projects was also extended to the Rural Electrification Corporation, which was signed in 2018.

Table 6 Programs inclusive of rooftop solar supported by KFW line of credits.



Sources: (BoB, 2019), (IREDA, 2019b,c), (KFW, 2020a,b,c,d,e), (REC, 2018).

3.4. Progress & Achievement

This section presents the set versus achieved targets for the lending programs of the three international banks.

WB: As of March 2019, the IBRD, CTF, and GEF have jointly disbursed (which includes advances), almost half the total allocated amount, to SBI (refer to Table 7. However, the total credit line that was unlocked against the performance of the DLIs (that is discounting the advances) amounted to only close to a quarter of the allocated total - USD 157.08 million (Stolp, 2019). This indicates that the program is facing delays in relation to meeting some of the DLIs.

In April 2019, the IBRD proposed extending the disbursement schedule linked to DLI 3, the aggregate amount of loans signed by SBI for the financing of rooftop solar generation schemes, by a year. The SBI and WB identified that factors such as lack of clarity in policies, development of pipeline, and slow demand by project developers affected the pace of the program. The extension will provide the opportunity to also set in place other aspects of improvement for long-term benefit. The allocated amount for DLI 1 has been fully disbursed, and about 66% of the allocated amount for technical assistance programs (DLI 2) has been released. Disbursements for DLIs 4 and 6 are planned for 2020 and 2021, provided the earlier DLIs are met (Stolp, 2019).

Table 7 Allocated and Disbursed amounts in USD million including advances by IBRD, CTF and GEF in relation to DLIs (March 2019).

DLIs	Allocated Amount (USD million)	Disbursed Amount (USD million)			
		IBRD loan	CTF Loan	CTF Grant	GEF grant
1 Establishing a Rooftop Solar PV Program at the State Bank of India	5.00			5.00	
2 Technical assistance to key stakeholders for the implementation of MNRE's GRPV program	13.00				8.67
3 Aggregate amounts of loans signed by SBI for the financing of solar (PV) rooftop power generation schemes.	298.75	68.99	56.20		
4 Piloting new business models	10.00				5.00
5 Megawatts of solar (PV) rooftop power generation installed and commissioned under SBI financing.	300.00	180.20			
6 Sustainability of GRPV program	20.00				
Total	646.75	249.19	56.20	5.00	8.67
Total Allocated Disbursement		646.75			
Total Disbursement achieved in 2.5 years		319.06			

Adapted from: (Stolp, 2019).

The program implementers believe 600 MW installation capacity of GRPV can be achieved with the allocated funds. However, 500 MW is the expected capacity to be commissioned during the program period, of which 250 MW is expected to be grid-connected and functioning. This difference is due to the time-lag between commissioning and installation. As of December

2019, the implementation status of the project by the World Bank (refer to Table 8), shows that so far about half the expected commissioning is achieved. As the GRPV program progressed, the program's risk factor which was initially rated as having substantial risk, has now been brought down to having moderate risk (Jain, 2019).

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Table 8 Summary results and status of the GRPV program implementation as of data pertaining to September 2019.

Indicator	Status / Result
Overall progress towards achieving program development objectives and implementation progress:	Satisfactory
Technical Assistance Program	A Project Management Consultant is currently assisting SBI and working with the MNRE to strengthen their sector-related skills and knowledge. Capacity building and training programs on policy, regulation and demand aggregation for SNAs, utilities and SERCs for 17 states is underway.
Percentage of IBRD loan disbursed	67%
Percentage of CTF grant disbursed for DLI 1	100%
Percentage of CTF loan disbursed	63%
The amount of solar loans approved by SBI	USD 211.44 million (out of USD 625 million)
Capacity of GRPV systems commissioned and installed under the program	218 MW

Source: (Jain, 2019).

Based on a source from SBI, the latest certificate from an Independent Verification Agency (IVA) states that the total installed capacity is 264.19 MW, as of July 2020. The IVA is an agency hired by SBI to verify the installed systems before the next disbursements from WB are released. The technical assistance program initiated by WB, MNRE and SBI for 17 States is known as the Sustainable Partnership for Rooftop Solar Acceleration in Bharat (SUPRABHA) program. The States include: Assam, Haryana, Andhra Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, Tripura, Bihar, Jharkhand, Odisha, Madhya Pradesh, Chhattisgarh, Rajasthan, Chandigarh and Delhi (SUPRABHA, 2020

ADB: The main area of risk identified by ADB is the limited experience of the grid-connected rooftop solar market and development in the country,

and that the rooftop solar sector was perceived as high credit risk by commercial banks, at the beginning of the program. The MFF modality and involvement of all the electricity stakeholders are expected to mitigate this risk. The performance of the SRIP tranche-I reported as of March 2020, (refer to Table 9) indicates that less than 10% of the installed capacity and subproject targets are met in the past 4 years, while the remaining needs to be achieved in 2 years (ADB, 2020a).

As the second phase of the MNRE rooftop scheme is limited to the residential sector (for capacity upto 10 kW), and additionally as the RESCO model is still a relatively new market model, PNB identifies these factors as the main hurdles for not being able to develop the desired pipeline to implement the program. (ADB, 2020a).

Table 9 Summary of the SRIP-tranche-I performance status.

Indicator	Target (for 2022)	Current Status (2020)
Rooftop solar installation	Installation: 400 MW Subprojects to finance: 500	Installation: approval for 20 MW Subprojects financed: 43
Technical Assistance Program	Build PNB's institutional capacity, develop market for rooftop solar. The States/UT allocated to ADB for technical assistance training include: Kerala, Goa, Karnataka, Tamil Nadu, Puducherry, Andaman & Nicobar, Lakshadweep (the eight State/UT was not mentioned).	Efforts in implementing technical assistance programs commenced in 2017. Capacity building, and development program for rooftop solar portal, began in December 2018 and are underway in 8 states/UT, including Tamil Nadu, with the involvement of Individual consultants and consultancy firms.
Disbursement	Total: USD 500 million	USD 25 million was provided as an advance to PNB in Dec 2017, of which only USD 5.8 million has been liquidated till date.

Source: (ADB, 2018a,b),(ADB, 2020a), (ADB, 2020b).

KFW: Most of the lines of credit provided to IREDA and others such as the one to REC are almost disbursed. Of the credit lines extended to the financial institutions (IREDA, SBI, and BoB), IREDA and BoB have a dedicated window, or financial instrument segment or target for developing the rooftop solar sector. Since the programs are still very new, particularly

IREDA and BoB which were established only in 2019, details on the program structures, their performance evaluation and installed capacity are not yet available in the public domain. However, information about the status of the rooftop solar sector and its past development supported by KFW was gathered from email correspondences and calls with the KFW.

Box 1 Past development programs by KFW with IREDA.

IREDA

Seven lines of credit were extended by KFW to IREDA. The initial focus was on large scale solar systems. The funding of solar rooftop systems was first started during the 5th line of credit in 2015. Under the 7th and current line of credit, which introduced a dedicated segment for rooftop solar, no solar rooftop projects are sanctioned as of June 2020. IREDA has a wide range of available schemes which accommodate mainly borrowers from the commercial and industrial sector.

Source: Telephone Correspondence with KFW.

Currently, solar PV projects are being implemented in 14 Indian States, with a cumulative installed capacity of 1.5 GW (AC), of plant sizes varying from 1 MW to 150 MW. From the variety of solar technologies supported, ground-mounted utility scale systems have been a particular success in terms of its mobilisation in the market. Some of the challenges faced by the rooftop solar sector, as identified by the KFW are the low demand of investors due to the associated risks, the lack of clarity in definition of rooftop solar systems, and the difficulty in tracking the loans provided for this sector as the loans are given under different loan agreements, such as corporate loans. The borrowing banks face challenges in meeting the technical, social and environmental guidelines or requirements to provide for this sector.

KFW is also challenged by certain requirements set by the Government for international lines to fund projects in India, such as the solar modules need to be made in India and not imported. Criteria such as these may restrict the efforts of international financial institutions. When it comes to the design of the loan structure, the bank takes the lead in the structural aspect, such as the interest rates and the procedural decisions as

they are the primary risk takers. The international funders help co design the loan in terms of criteria relating to technical, social and environmental requirements. These criteria remain similar for all the international lines of credits.

In conclusion:

- The international banks are providing concessional loans and funds to Public Sector Banks and other borrowers to overcome the initial market and financial barriers of grid-connected rooftop solar. Only large-scale solar systems have been supported so far. The programs stress on increasing the installed capacity of rooftop solar and on technical assistance programs equally.
- The risks and challenges identified by Tier 1 financing institutes include lack of clarity amongst the stakeholders on defining rooftop solar and related policies, lack of experience in dealing with the sector by key stakeholders (such as developers, financiers, and utility), and low demand from the consumers. These issues may be mitigated by the technical assistance programs that include institutional capacity building for various stakeholders and market development.



4. CURRENT STATE OF ROOFTOP SOLAR FINANCING IN TAMIL NADU

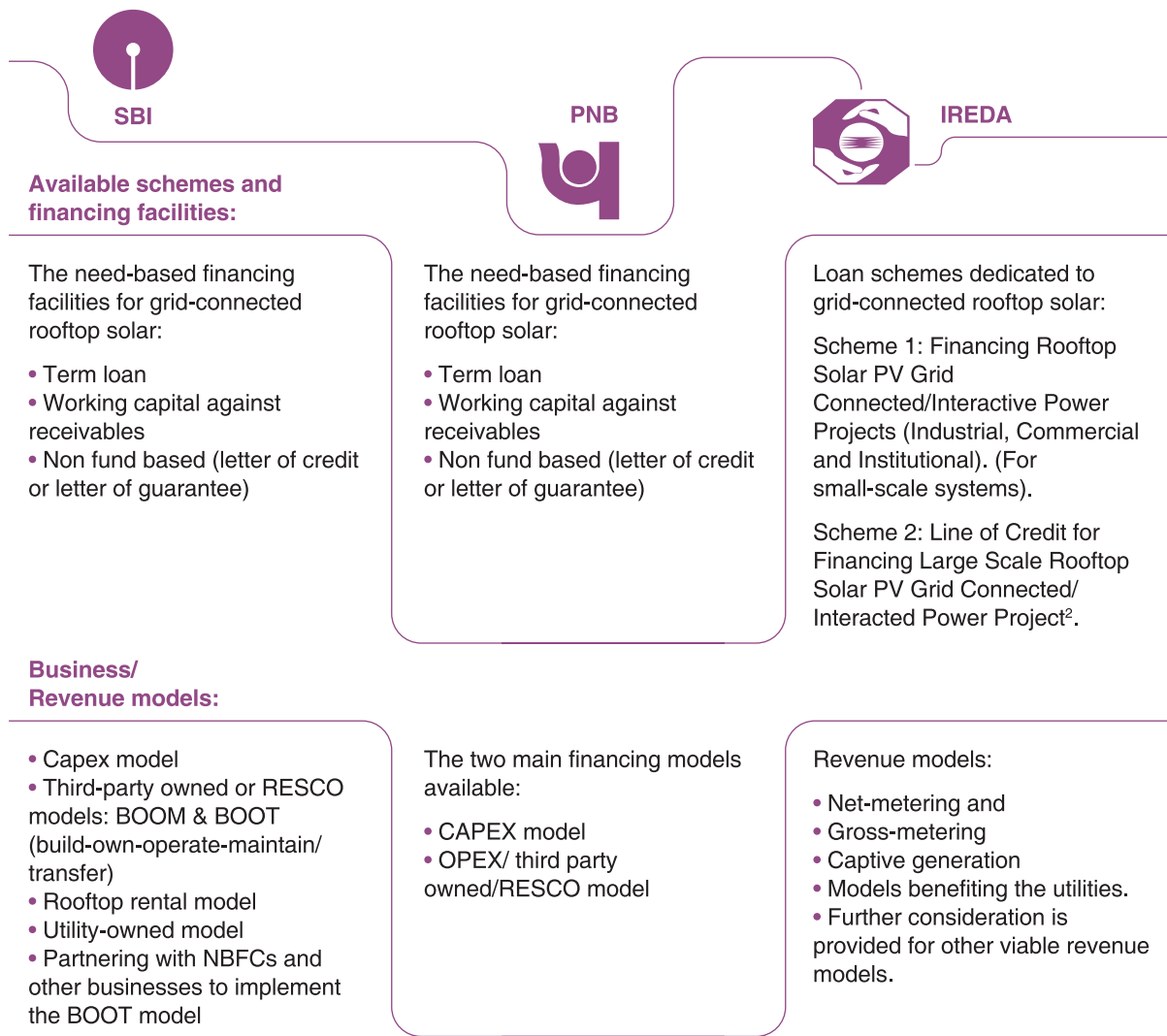
Renewable energy is considered the priority lending sector by the Reserve Bank of India (RBI) since 2015. For large-scale projects such as biomass, solar, wind and hydro systems and other electrification projects, bank loans of up to INR 15 Crore can be borrowed. For small-scale systems, such as for houses, individual borrowers may avail loans of up to INR 10 lakh (RBI, 2015). Prioritising the sector would help create and enable the market and financing facility for the renewable energy sector, which includes grid-connected rooftop solar, for residential and non-residential consumers. This section aims to shed light on the implementation of the international lines of credit by the SBI, PNB and IREDA in Tamil Nadu, and discusses the overall availability and accessibility to rooftop solar financing by considering other banks that offer this financial assistance. The current status of the programs' implementation and their progress in Tamil Nadu was evaluated based on available documentation, surveys and telephone interviews.

4.1 Program Implementation in public sector banks in Tamil Nadu (Tier 2&3)

Loan structure for rooftop solar

SBI and PNB provide similar business models, schemes, eligibility criteria, and eligible consumer categories to finance grid-connected rooftop solar (refer to Table 10). IREDA has relatively higher interest rates, however the rates set by the public sector banks vary monthly, depend on the project risk, and also require strong collateral. The eligible entities and criteria of the banks and NBFC suggest that these loans mainly cater to the industrial and commercial sector.

Table 10 Rooftop solar loan structure of SBI, PNB and IREDA



Eligibility criteria:³

The borrowing categories eligible:

1. Sole proprietorship
2. Partnership firm
3. Corporate/Special Purpose Vehicle (SPV)/NBFC

The eligibility criteria for availing of loans:

- A minimum of 1 year experience/ past track record in the power sector in the case of a RESCO borrower;
- Internal rating of SB-10 or better and/or External Credit Rating (ECR) of Investment grade for SPV borrower or its sponsor;
- ECR is mandatory for exposure of Rs.10 crore and above.
- The maximum exposure, or the credit risk for the sole proprietorship and the partnership firm is INR 50. Crore. No defined credit risk cap for corporate/SPV/NBFC is mentioned.

The target borrowers:

- Sole proprietorship firms,
- Limited Liability Partnership (LLP),
- Limited Companies,
- Private Limited companies,
- Trusts, Associations,
- Special Purpose Vehicle (SPV),
- NBFCs and
- Registered Societies.

Based on ADB's Facility Administration Manual:

- Sub-loans will be provided for the preparation, design, installation, operations, and maintenance of electricity generation from on-grid and off-grid pv systems.
- The systems will be set-up on clearly defined conventional buildings and comply with the environmental standards.
- The subprojects are required to follow ADB and PNB's Financing Norms.

The generally eligible borrowers:

- Private Sector Companies/ firms/LLPs
- Central Public Sector Undertaking (CPSU)
- State Utilities/ Discoms/ Transcos/ Gencos/ Corporations
- Joint Sector Companies

Specific to Scheme 2: Projects based on PPA with the Government, utilities, institutions, hospitals, trusts and other entities with relatively high demand.

Loan amount, tenure & Interest rates:

- Maximum loan amount: 75% of the project cost.
- Maximum loan repayment period: 15 years.
- Interest rate: One Year Marginal Cost of Funds Based Lending Rate (MCLR) + 20 bps to 50 bps depending on the borrower's risk rating. Thus, the effective rate is between 7.20% to 7.50%, as of June 2020⁴.

- Maximum loan amount: not mentioned.
- The loan tenure is 15 years (inclusive of installation, moratorium and repayment period).
- Interest rate: One year MCLR + 30 to 50 bps based on the risk rating of the borrowing firm/company. Thus, the ballpark rate is between 7.75% - 8.25% (May 2020).
- For MSMEs: loans of up to 10 lakhs will require no collateral security, as per the Government guidelines⁵.

- Minimum loan amount: INR 50. Lakhs.
- Maximum loan amount: 70%-75% of the project cost.
- Loan tenure: 10 - 15 years.
- Interest rate based on grade of risk:
- Scheme 1: 9.80% - 10.70%
- Scheme 2: 9.50% - 10.40%

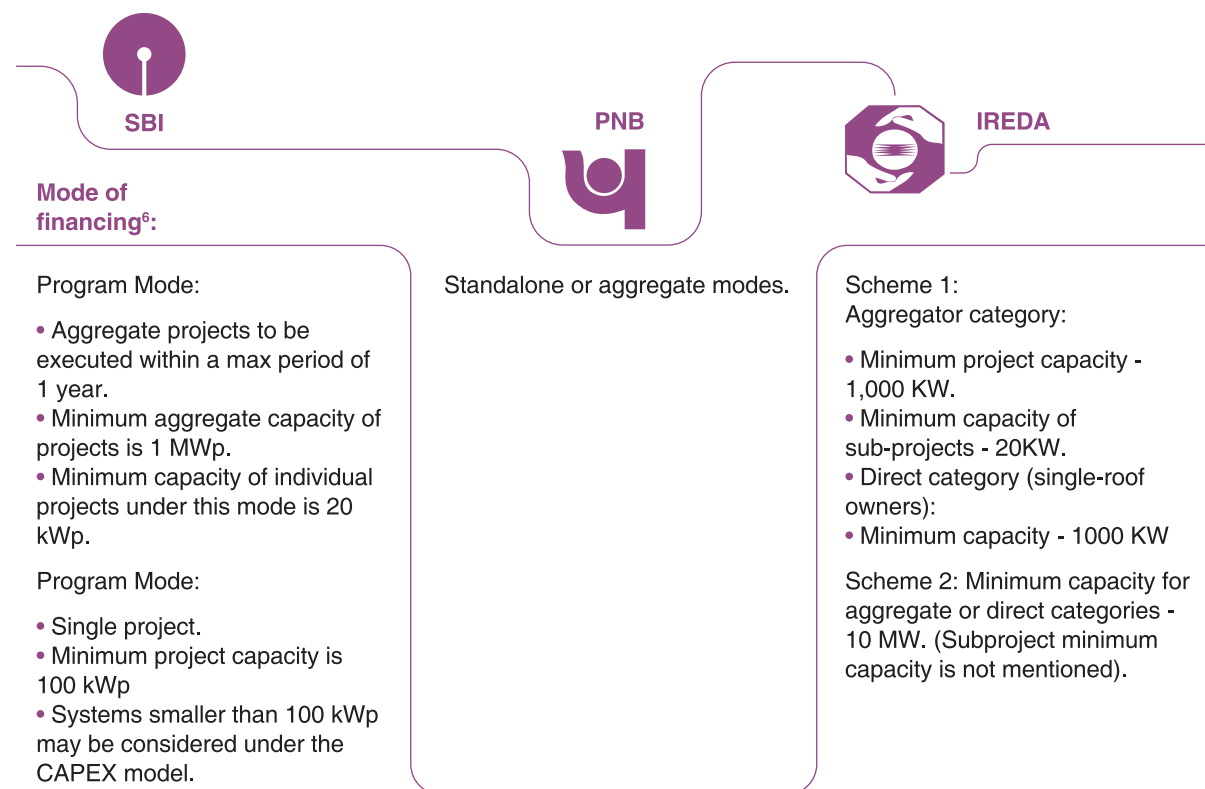
A special discounted interest rate of 15bps = 0.15% is provided for Government and public sector undertakings buildings.

² Other possible schemes for rooftop solar include: Project Financing, Equipment Financing, Guarantee Scheme, Credit Enhancement, Short Term loan, Manufacturing loan, Bill discounting of Energy bills, Securitization of future cash flows.

³ Other criteria to be met for financing grid-connected rooftop solar include the fixed asset coverage ratio, debt service coverage ratio, interest coverage ratio, and details on the primary and collateral securities as defined by banks (PNB, 2017), (SBI, n.d).

⁴ The MCLR varies monthly. It is an internal lending rate and is dependent on the RBI's base rates. Additionally, the interest rates may vary further from project to project, based on the project's risk assessment. Same applies for PNB.

⁵ This addresses the major market barrier of the MSMEs' participation in the sector.



Sources: (ADB, 2016c), (PNB, 2017), (IREDA, 2020a), (IREDA, 2020b), (SBI, n.d), (Survey Response by SBI, 2020), (SBI, 2020b), (Survey Response by SBI, 2020).

Challenges and Risks

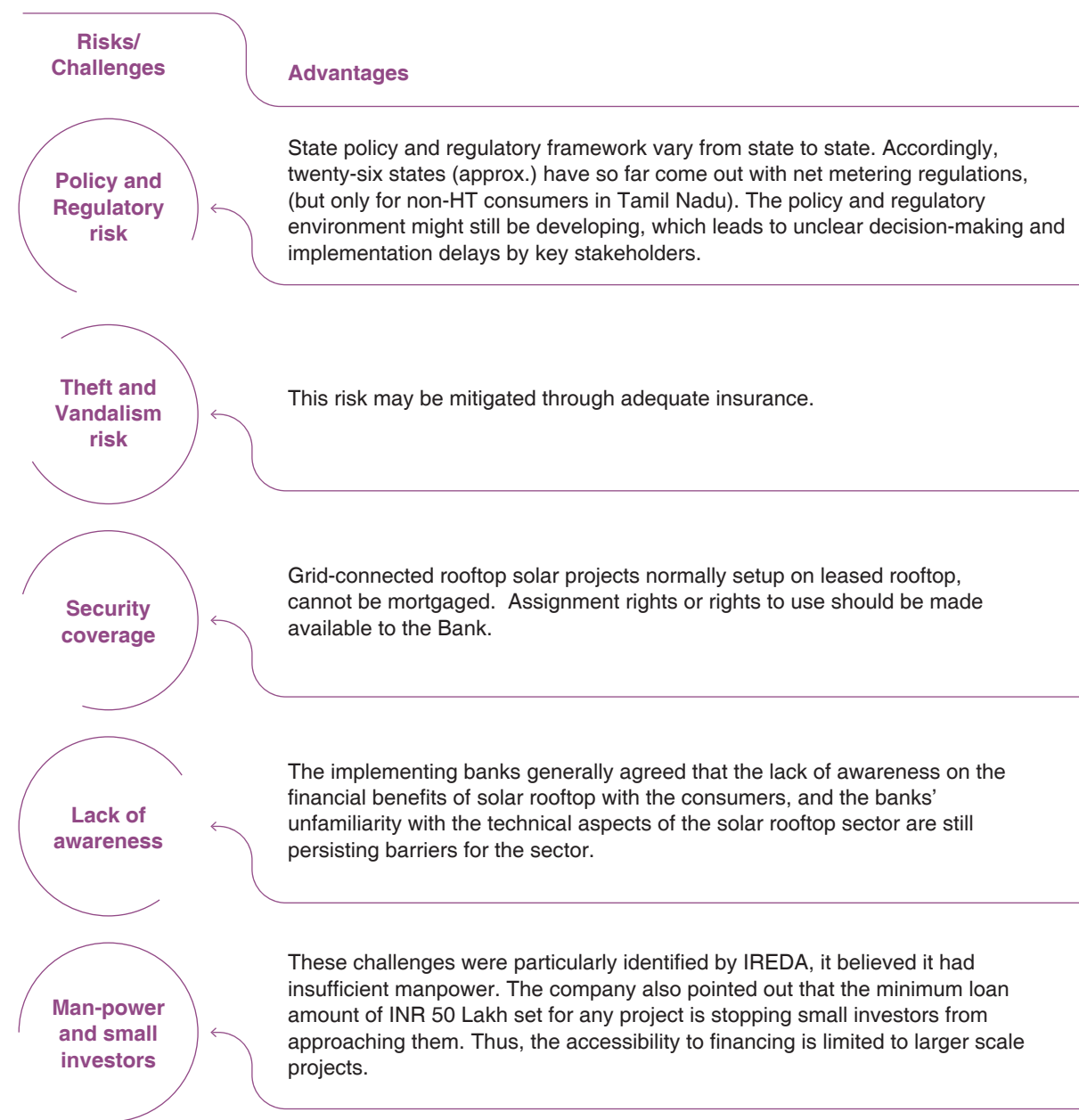
While implementing the program, some of the major difficulties or challenges were identified by the Tier-2 level financing institutes in Tamil Nadu, and these challenges are perceived as risks (refer to Table 11). Several technical aspects are potential barriers for financing rooftop solar such as performance of the solar panels and the system's energy generation. Additionally, the risks

posed to banks involve multiple stakeholders, such as developers, manufacturers, technical experts and the utility. Thus, technical assistance programs and sharing the necessary technical rooftop solar PV related knowledge would play an important role in equipping the members of the bank to make informed decisions and reduce doubts.

Table 11 Risks and challenges identified by Tier-2 level in Tamil Nadu in the implementation of grid-connected rooftop solar financing.

Risks/Challenges	Advantages
Developer/Promoter risk	<p>The lack of experience amongst developers and promoters pose a risk. As a result, an in-depth evaluation of their track record, technical and financial capability is a necessary part of the process before approving loans.</p> <p>In the best-case scenario, the developer is to have undertaken RE projects from beginning to end, and also have an experienced team of manpower who are familiar with the entire process of the project, including obtaining the necessary documentation for clearances and approvals for the installation.</p> <p>Technology risks: The track record of this sector is shorter than the life-time of the PV modules - which is usually 25 years. Thus, there is limited knowledge on their actual performance for the banks to assess.</p> <p>Mitigations:</p> <ul style="list-style-type: none"> Usage of high-quality system components from well-established manufacturers Warranty/guarantee for life of the panels and performance degradation by the manufacturer Banks and developers can collaborate to set in a place a rating system for developers, to identify trusted developers.
Solar resource data risk	<p>Site-specific solar data and generation performance is obtained from solar PV assessment sources such as Meteonorm and PVSyst. The results may be further verified by external Consultant/ LIE.</p> <p>Resource availability is assessed at different probability levels i.e. P50, P75 and P90. P90 would signify the best-case scenario. It would interpret as: there is a 90% probability that the level of annual electricity generation forecasted will be met or exceeded; there is only a 10% probability that the forecast will not be met. P75 and P50 are interpreted similarly.</p> <p>Lower the P-value, higher the uncertainty, which means higher the risks. This in turn affects interest rate and DSCR of the projects.</p>
Generation risk	<p>The actual generation may be less than that expected theoretically. Factors that may further affect generation include the shadow factor of the site, and in case of net metering projects, linkage to a back-up system or the grid needs considering. General power outages in the project location is also assessed.</p>
Operations and Maintenance risk	<p>Solar panels need to have assured quality and trustworthy manufacturing companies need to be identified. The installation process must be conducted by experienced installers, and other construction material used must ensure solidity and durability. The panels also require regular maintenance, as dusty panels lower the generation. Lack of proper maintenance could affect the consumers gains.</p>
Power off-taker risk	<p>The financial impact on the utility due to power off-take under Gross Metering/Net metering with (FiT) is considered.</p> <p>The credibility and the contractual agreements under PPA (power purchase agreement) is evaluated before sanctioning loans.</p>

⁶The program or aggregate mode accommodates large scale rooftop systems, which includes installation on several rooftops owned by multiple owners. The project or standalone mode supports smaller systems.



Source: (ADB, 2016d), (Committee on Public Undertakings, 2018), (Survey Response by SBI, 2020).



It may also be observed that different business models give rise to specific hurdles or issues that are related to the repayment to the bank, which again inhibit banks to participate in novel implementation methods. For example, there is an issue with security or mortgage for the bank under the rooftop rental model as the ownership of the solar PV assets and the area leased do not belong to the same party. Under the RESCO model for example, a disagreement between the power procurer and purchaser may result in the bank not getting its payment. Thus, a rigorous framework for assessment, experience and knowledge may help the bank gain confidence in applying different models. The current international funding program aims to buffer such issues and aid the banks with technical assistance.

From surveys and interviews with the public sector banks, it was gathered that generally there are no issues regarding repayments so far. The main bottleneck is the lack of awareness on the loan products, and therefore not many proposals are received. Further, the challenges in obtaining approvals for the rooftop solar systems from the utility and other barriers relating to the Tamil Nadu electricity policy, could be looked into. There are no specific targets set for providing solar loans at this stage. Additionally, high tension (HT) consumers, including commercial and industrial consumers cannot have a net feed-in arrangement. Consequently, the sector becomes unattractive to HT consumers. From the perspective of the multilateral banks, certain domestic guidelines or the nation's political direction, such as promoting national products and services, results in limiting their aid.

As for the NBFC, based on a discussion between the Committee on Public Undertakings, IREDA and MNRE, it was gathered that some of the challenges observed are that customers who have applied for subsidy are not receiving them on time even though the Government has released them as per schedule. The IREDA also pointed out that customers hesitate to pay INR 80,000 per kW upfront (Committee on Public Undertakings, 2018). The rooftop solar loans for the residential sector are not directly financed by them and they are mainly supported by banks through home/home improvement loans, and by the Government subsidy of 30% of the benchmark cost, as of January 2018. With the availability of new funds, the NBFC has stated that it is making efforts to support all sizes of projects (Committee on Public Undertakings, 2018).

With national public sector banks and the NBFC promoting rooftop solar, the competition between the financing institutions is expected to increase, however at this stage, they may be able to complement each other in the effort to first develop the market for the sector, as their respective challenges and advantages are different (refer to Table 12).

Table 12 Advantages and challenges by type of financial institution funding grid-connected rooftop solar.

	Advantages	Challenges
 Public Sector Banks (SBI and PNB)	<ul style="list-style-type: none">• Wide network of branches may enable better reach to consumers.• Higher possibility of financing different sizes of systems. For example: accessibility to finance residential sector can be increased by lending for small-scale rooftop systems.	<ul style="list-style-type: none">• Technical assistance, and training programs required.• Addition of dedicated units to support RE specific financing.• Increase in already existing responsibilities.
 NBFC dedicated to RE (IREDA)	<ul style="list-style-type: none">• Being a specialized intermediary, dedicated to RE, Government funds can be obtained with relative ease.• Has the necessary financial schemes and models in place to cater to various stakeholders (such as manufactures, developers, Government bodies, etc...).	<ul style="list-style-type: none">• The minimum sanctioning amount is too high (as in the case of IREDA) to draw in small-scale projects or developers.• Requires employees with a specific skill-set and training, for a yet developing market.• Main income is only through loan repayments from a yet developing industry, and may need to depend on other financial resources until the market for RE strengthens.




Sources: (Committee on Public Undertakings, 2018), (Hussain, 2013).

Implementation Progress

SBI and PNB have sanctioned loans for a cumulative capacity of 75MW and 25kW respectively, in Tamil Nadu as of April 2020, and mainly under the CAPEX model (SBI, 2020a), (PNB, 2020). An additional source from the SBI however mentioned that about 80% of the lending for this sector across the country is under the RESCO model, thus it is likely that this model is also implemented in Tamil Nadu. Hence, the status of the implementation of RESCO model in Tamil Nadu remains inconclusive at present, further research on this point is required. IREDA has provided loans to various developers, under the Rooftop PV and Small Solar Power Generation Programme (RPSSGP) for a cumulative capacity of 6 MW between 2012 and 2019 in Tamil Nadu (refer to Table 13). This solar generation- based incentive (GBI) scheme set by MNRE promotes smaller scale rooftop systems that have an upper connection limit of 33 kV level, and allows for net feed-in; IREDA is the appointed implementing agency (IREDA, 2019a).

Tamil Nadu has 37 districts (Government of Tamil Nadu, 2020), with 1,556 SBI branches in 34 districts (Askbankifscscode, 2020b). The availability for rooftop solar financing by SBI stands almost at 1 in 60 branches, that is 1 in 60 branches are equipped to deal with rooftop solar financing. WB identified 11 SME branches in Tamil Nadu at the start of the program (SBI, n.d), each in a different district. Against this target of 11 SME branches, the SBI has been able to more than double the number of branches, i.e 26 branches, dealing with rooftop solar financing from the start of the program. IREDA has a total of 5 offices across the country, of which one is in Tamil Nadu, Chennai (IREDA, n.d). Hence, the availability to rooftop solar for the entire State is covered by a central office.

Table 13 Implementation progress of SBI, PNB and IREDA for rooftop solar financing in Tamil Nadu.

	 SBI 26/1,556	 PNB No data available/2027 ⁷	 IREDA 1/1
Branches with a dedicated department for solar/ total branches			
Availability of solar financing in Tamil Nadu	1 in every 60 branches.	No data available	1 and only branch in 37 districts.
Stakeholder engagement	SBI believes to have sufficient engagement with stakeholders, such as TANGEDCO and TEDA for implementing debt financing for rooftop solar.	No data available	No data available
Promotion	Awareness campaigns through print media and awareness programs conducted.		No data available
Technical Assistance Programs and Institutional Capacity	Training is conducted by an expert institution for the staff. Procedures, policies, and the operational manual for rooftop solar are in place. Policies and schemes to continue funding grid-connected rooftop solar after the WB program is also in place.	Capacity development: accreditation programs and training programs on net and gross metering policies are being conducted for utilities, SNAs, State Power Departments and SERCs. Web portal: IT experts and solar rooftop specialists are developing a State-specific web portal to connect consumers to the utility and SNA, to aggregate demand and process applications online	N/A in Tamil Nadu
Loan amount signed	INR 198.06 crore	INR 10.00 lakh	No data available
Capacity installed	75 MW	20 KW	6 MW
Business models	CAPEX model RESCO model Loans to NBFCs/SMEs (not yet applied) Rooftop rental (not yet applied)	CAPEX model RESCO model (not yet applied) Loans to (not yet applied) NBFCs/SMEs (not yet applied) Rooftop rental (not yet applied)	No data available.

Source: (ADB, 2016e), (ADB, 2018a,b), (ADB, 2018a,b),(ADB, 2020a), (Askbankifscscode, 2020a,b), (IREDA, 2019a),(PNB, 2020), (SBI, 2020a).

⁷All large corporate branches, mid corporate branches, exceptionally large branches are the branches identified for financing rooftop solar. Twenty-five Chennai SME branches were contacted, 10 branches responded, of which 3 branches have had previous experience in dealing with rooftop solar loans.

Box 2 Details on institutional capacity building by PNB.

PNB

With respect to institutional capacity building, technical analysts are appointed in the headquarters and chosen branches of PNB. The analysts will handle the several stages of solar rooftop projects including reviewing, pricing, approving, administering, and/or monitoring the projects. Training for trainers in 30 PNB regional centers specifically for the SRIP are planned. Through this, more than 60,000 loan officers will be trained with external experts when required, at the headquarter and branch/zonal level. Additionally, a RESCO is to aid the SRIP by linking the sub-borrowers to PNB for financing, while it takes care of the operational aspects of these projects. However, specific details on the implementation of this component in Tamil Nadu are not found in the public domain.

Source: (ADB, 2016e)

It is only recently that India has taken significant steps to establish the rooftop solar market, and thus a lag in progress may be expected. Parallely, the growth for the risk appetite to finance solar rooftop projects by the banks may also be expected to increase slowly.

4.2. Availability and Accessibility of Rooftop Solar Financing

Apart from SBI and PNB, two other Indian banks have a scheme to finance rooftop solar (refer to

Table 14), and Bank of Baroda has set in place a program in late 2019. Nine Public Sector Banks (including SBI and PNB) had signed a commitment with the Ministry of Finance to finance rooftop solar (Ministry of Finance, 2014). Amongst these banks, few have set up dedicated loan schemes for grid connected rooftop solar. Other banks, such as Indian Overseas Bank and Central Bank of India have dedicated schemes for other solar products, such as solar pumps and off-grid systems.

Table 14 Indian Banks currently financing rooftop solar in Tamil Nadu as of May 2020.

Indian Financial Institution	Scheme/Facility	Consumer Category Targeted/Eligible	Interest rate/other criteria	Loan tenure	Total number of branches in Tamil Nadu
Syndicate Bank	Syndicate Bank Synd Solar - Retail Loan: Installation of solar rooftop systems on houses.	Existing /New housing loan customers availing loan for independent house construction. House owners who intend on installing a solar rooftop system who have not availed housing loan with any bank can also be covered.	One year MCLR +0.10%	To coincide with the housing loan, tenure is subject to a maximum of 10 years. Reasonable moratorium shall be provided for installation and construction.	273
Indian Bank	IND-SURYA SHAKTI-Term Loan: solar power plants for captive consumption.	All MSMEs, Mid Corporate & Large Corporates.	Yet to be decided, as the scheme is recently introduced.	Door to Door Tenor: 15 year.	801
Axis Bank	Green Bonds: all RE systems, inclusive of rooftop solar.	Large and Mid-Corporates, MSME, Agriculture and Retail Businesses.	Data not available in the public domain.	Data not available in the public domain.	175
Industrial Development Bank of India (IDBI)	Green Bonds: all RE systems, inclusive of rooftop solar.	Industrial and commercial sector.	Data not available in the public domain.	Data not available in the public domain.	74
National Bank for Agriculture and Development (NABARD)	Scheme is by IREDA, and is implemented by NABARD. NABARD helps in releasing subsidy and loans for consumers.	Self-help groups (SHGs), joint liability groups (JLGs), NGOs and farmer's club.	40% of the project cost is eligible for subsidy. 60% of the entire project cost is eligible for loan.	Upto 5 years.	29

Source: (Axis Bank, 2017), (Climate Bonds, 2020), (Economic Times, 2019), (IDBI, n.d), (Indian Bank, 2020), (Indian Bank Location, 2013), (Myloancare, 2020), (NABARD, 2017), (Syndicate Bank, 2018).

Unlike the other banks providing loans, NABARD is a facilitator to IREDA's scheme on solar PV systems. The manufacturer or supplier and the specific models are to be part of MNRE's empanelled list for the release of the 40% subsidy. The applicant for the subsidy would require having an existing account with a regional rural bank or commercial bank. 60% of the entire cost is eligible for a bank loan. The loan term is up to 5 years according to the interest rates set by the RBI (Economic Times, 2019).

As of now, only 5 banks and 1 NBFC have dedicated schemes for rooftop solar. The accessibility to rooftop solar increases as more numbers of distributed branches finance the sector. Additionally, as more types of consumer categories are able to access loans for rooftop solar, the sector will expand and the financial and market barriers can be overcome. Rooftop solar financing in Tamil Nadu is currently accessible through dedicated schemes mainly to commercial and industrial consumers, the residential sector can avail loans through housing or personal loans, the agricultural sector has financial assistance from NABARD and Axis Bank, and the Government has financing support from IREDA. Banks also provide rooftop solar financing through personal, corporate or home loans, and not necessarily through a specific scheme for the technology. However, as a result of this, data of details such as the installation capacity, consumer categories, business and financial models of solar rooftop projects, are difficult to keep track of. These data could help provide insight and identify specific gaps in terms of availability and accessibility for each consumer category in Tamil Nadu.

In conclusion:

- There are dedicated schemes for rooftop solar for the small and large commercial and industrial consumers by multiple banks, and additionally for the residential, agricultural, and Government consumers. Banks are also financing rooftop solar under different loan and business model options. On the other hand, the number of branches equipped to deal with rooftop solar financing are limited and sparse. Therefore, although the banks have made this financing facility accessible to all consumer categories, the availability is restricted to only a few branches.
- The risks and challenges faced by the implementing banks largely include the lack of knowledge on the technology and the issues related to their returns. The latter involves the lack of experience and participation of key stakeholders such as developers and the utility. Lack of awareness amongst the consumers on the financing availability and financial benefits of rooftop solar was identified as a challenge from all the tiers of the credit lines. Hence, further stress on the implementation of technical assistance programs and promotional activities can overcome the current identified risks and challenges.



5. CONCLUSION

The Indian Government aimed to facilitate the financing and develop the market for grid-connected rooftop solar by increasing the availability of debt financing with international lines of credit. The progress of the GRPV and SRIP programs are considered satisfactory so far by WB and ADB. As of September 2019, SBI has signed for little over 50% of 500 MW which is the expected commissions during the project period, across the country. In contrast PNB has signed only 20MW. The slow uptake of loans by developers and the lack of clarity in the relevant policies were identified as some of the challenges to the sector by the WB. However, the risk level of the program has been reduced as the GRPV program advanced. The ADB reported similar hurdles with the SRIP implementation. Additionally, it identified the limited availability of MNRE subsidies as a reason for the slow uptake of loans by the eligible consumer categories. KfW has extended lines of credit to various Indian banks and IREDA. The most recent ones were signed in late 2019. From their experience, they identified that one of the challenges of the implementing banks is in meeting the required environmental and technical standards. Loans for rooftop solar are also sanctioned under personal, housing and corporate loans, therefore it is hard to keep track of their progress. A dedicated window or segment would address this latter issue.

Some of the challenges identified by the financial institutions are the lack of awareness amongst the consumers on the financial benefits, the availability of financing under suitable business models, the lack of strong coordination amongst stakeholders, and the required skills and knowledge amongst the key stakeholders such as SNAs, Electricity Regulatory Commissions and authorities, utilities, and the financing institutions. These challenges are being addressed through technical assistance programs, market development strategies and promotional campaigns. For further improved coordination, in a survey response by SBI it was suggested that an officer may be designated by TANGEDCO to serve as a one-point contact

to all the rooftop solar stakeholders such as developers, investors, banks, etc. This would allow the stakeholders to share their suggestions for financing, administrative and policy improvements of the rooftop solar sector (Survey Response by SBI, 2020).

In Tamil Nadu, 75 MW, 20KW and 6MW, were commissioned under loans from SBI, PNB and IREDA, respectively. The public sector banks have the advantage of having more branches all over the state, including the rural areas. However, there may be knowledge, skills and capacity gaps to deal with solar lending. IREDA, on the other hand being a dedicated company to promote the RE sector, has the advantage of obtaining large Government and international development funds for this specific purpose. However, its current restriction on financing with a minimum loan amount of INR 50 lakhs attracts large-scale projects. It is currently making efforts to also include small scale rooftop solar generation.

Totally 5 banks - SBI, PNB, IREDA, Syndicate Bank & Indian Bank, have a dedicated scheme for rooftop solar. Other Indian banks may also be providing financing for rooftop solar, but under housing loans, corporate loans and personal loans. Increasing the number of branches equipped to deal with rooftop solar financing, will increase the availability to these financing facilities, which at present is low. Loans for rooftop solar can be accessed by industrial and commercial, agricultural, residential and Government related entities through dedicated schemes. At present the accessibility is easiest for the commercial and industrial sector. The financing for the sector is also being made available by various business models, especially by PNB, SBI and IREDA, however the uptake of the loans so far are exclusively under the CAPEX and RESCO model. The challenges and risks identified by the banks can be mitigated with regular and consistent technical assistance programs involving all key stakeholders, and with more development on promotional activities for creating awareness amongst consumers.



6. ANNEXURE

Tier 1- Questionnaire - Grid connected Rooftop Solar Financing in Tamil Nadu

- Has a dedicated grid-connected rooftop solar PV (GRPV) credit line been established in select branches in Tamil Nadu? This includes having program manuals and procedures in place, updating of the IT infrastructure (to track the credit segment) and trained staff.
- How many branches have been covered in Tamil Nadu?
- Is there sufficient engagement with other stakeholders (including the electricity utility, TANGEDCO, and TEDA) for successful implementation of debt financing of rooftop solar in the state? (Yes or No; please provide details, if any)
- Currently financing from international development organizations is helping implement the rooftop solar program in banks in India. Has the borrowing bank also been able to put in place a program for using its own funds for rooftop solar loans for the next phase of the program?

Which of the following business models have been covered in the loans given till date?

Business models	Yes	No
CAPEX (consumer-owned rooftop system)		
RESCO (third-party owned)		
Loans to NBFC/SMEs		
Rooftop rental		

- Has the borrowing bank conducted awareness campaigns (through different local media such as newspapers, and others) for rooftop solar financing products available to customers? Have any other outreach programs been conducted? (Yes or No; please provide more details, if possible)
- What is the total approved rooftop solar orders (MW) in the Tamil Nadu?
- What is the aggregate loans (INR) signed under the program, segregated by the different business models (if possible)?

Business models	Loans signed (INR)
CAPEX (consumer-owned rooftop system)	
RESCO (third-party owned)	
Loans to NBFC/SMEs	
Rooftop rental	
Total	

- What is the total capacity of rooftop solar installed and commissioned through financing under the program?

Business models	Capacity installed (INR)
CAPEX (consumer-owned rooftop system)	
RESCO (third-party owned)	
Loans to NBFC/SMEs	
Rooftop rental	
Total	

Tier 2 - RTI to SBI (The same was sent to PNB)

Please provide data on the following:

- What is the total approved orders (MW) for grid-connected rooftop solar (GRPV) in Tamil Nadu?
- Which of the following business models have been covered in the GRPV loans given by SBI in Tamil Nadu

Business models	Yes	No
CAPEX (consumer-owned rooftop system)		
RESCO (third-party owned)		
Loans to NBFC/SMEs		
Rooftop rental		

- What is the aggregate loans (INR) signed by SBI for GRPV in Tamil Nadu, segregated by different business models (if possible)?

Business models	Loans signed (INR)
CAPEX (consumer-owned rooftop system)	
RESCO (third-party owned)	
Loans to NBFC/SMEs	
Rooftop rental	
Total	

- What is the total capacity of GRPV installed and commissioned in Tamil Nadu through the financing provided by SBI?

Business models	Capacity installed (INR)
CAPEX (consumer-owned rooftop system)	
RESCO (third-party owned)	
Loans to NBFC/SMEs	
Rooftop rental	
Total	

Please provide following information:

- Has a dedicated grid-connected rooftop solar PV (GRPV) department been established in select SBI branches in Tamil Nadu? This includes having program manuals, policies and procedures in place, updating of the IT infrastructure and trained staff.
- How many SBI branches have been covered in Tamil Nadu?
- Has there been sufficient engagement with other stakeholders (including the electricity utility, Tangedco, and TEDA) for successful implementation of debt financing of GRPV in the state?
- (Yes/No; please provide details, if any)
- Has SBI conducted awareness campaigns (through different local media such as newspapers, and others) for rooftop solar financing products available to customers in Tamil Nadu? Have any other outreach programs been conducted? (Yes/No; please provide more details, if possible)

Currently financing from international development organizations is helping implement the rooftop solar program at SBI. Has the bank also been able to put in place a program for using its own funds for rooftop solar loans in Tamil Nadu for the next phase of implementation of GRPV financing?

Tier 3 - Questionnaire - Branch level

- Has a dedicated grid-connected rooftop solar PV (GRPV) department been established in your branch in Tamil Nadu? This includes having program manuals, policies and procedures in place, updating of the IT infrastructure and trained staff. (Yes/No)

Please answer following question if your answer to the above is Yes.

- What are the financial products available with your bank for grid-connected rooftop solar PV (GRPV), if any?
- If customers have availed subsidies, would they be subjected to different loan terms? If so, would these terms be more favourable to the customers?
- What are the eligibility criteria and mechanisms to avail of GRPV loans for different consumer categories? (residential/institutional/commercial/industrial/government/social sector)
- Would you say that GRPV loans have been successful so far? Could you please give details on why/why not?
- Where do you believe are the major difficulties in financing solar?
- Do you have yearly targets for solar loans? If yes, have you been able to meet them?
- Have you faced issues in repayment for the solar loans signed so far?
- Do you think there is additional training required for staff working with GRPV loans?
- Have there been any recent developments/changes in the bank policies and procedures regarding signing solar loans? Has there been any change in the products you have to promote solar?
- What is the total approved grid-connected rooftop solar (GRPV) capacity (MW) you have sanctioned loans for?
- For which of the following business models have you sanctioned the GRPV loans:

Business models	Yes	No
CAPEX (consumer-owned rooftop system)		
RESCO (third-party owned)		
Loans to NBFC/SMEs		
Rooftop rental		

- What are the aggregate loans (INR) you have signed for GRPV in Tamil Nadu, segregated by different business models?

Business models	Loans signed (INR)
CAPEX (consumer-owned rooftop system)	
RESCO (third-party owned)	
Loans to NBFC/SMEs	
Rooftop rental	
Total	

14. What is the total capacity of GRPV installed and commissioned in Tamil Nadu through your financing?

Business models	Capacity installed (INR)
CAPEX (consumer-owned rooftop system)	
RESCO (third-party owned)	
Loans to NBFC/SMEs	
Rooftop rental	
Total	

15. Has there been sufficient engagement with other stakeholders (including the electricity utility, TANGEDCO, and TEDA) for successful implementation of debt financing of GRPV in the state?
(Yes/No; please provide details, if any)
16. Have you conducted awareness campaigns (through different local media such as newspapers, and others) for rooftop solar financing products available to customers in Tamil Nadu? Have any other outreach programs been conducted? (Yes/No; please provide more details)
17. Currently financing from international development organizations is helping implement the rooftop solar program at Public Sector Banks. Has your bank been able to put in place a program for using its own funds for rooftop solar loans in Tamil Nadu for the next phase of implementation of GRPV financing?



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