Program Information Documents (PID)

Appraisal Stage | Date Prepared/Updated: 03-Jan-2020 | Report No: PIDA208678

BASIC INFORMATION

A. Basic Program Data

Country	Project ID	Program Name	Parent Project ID (if any)
India	P171750	Rooftop Solar program for Residential sector	P155007
Region	**Estimated Appraisal Date**	**Estimated Board Date**	**Practice Area (Lead)**
SOUTH ASIA	20-Jan-2020	19-Mar-2020	Energy & Extractives
Financing Instrument	**Borrower(s)**	**Implementing Agency**	
Program-for-Results Financing	State Bank of India	State Bank of India	

Program Development Objective(s)

The PDO is to increase installed capacity of Grid-connected Rooftop Solar Photovoltaic (GRPV) and to strengthen the capacity of relevant institutions for GRPV. The Program Environmental Objective (PEO) is to achieve reductions in GHG emissions through the displacement of thermal energy with solar energy.

COST & FINANCING

SUMMARY (USD Millions)

Government program Cost	1,000.00
Total Operation Cost	490.00
Total Program Cost	490.00
Total Financing	490.00
Financing Gap	0.00

FINANCING (USD Millions)

Total World Bank Group Financing	245.00
World Bank Lending	245.00
Total Government Contribution	245.00

B. Introduction and Context

Country Context

1. **The Government of India (GoI) wants a growing share of the country's electricity generation to come from renewable energy.** In its Nationally Determined Contribution (NDC), approved by the Union Cabinet, India announced at the Conference of Parties (COP) 21 in Paris that it aims to increase to 40 percent the share of installed electric power capacity from non-fossil-fuel-based energy resources by 2030. This includes plans to quadruple the country's (non-hydropower) renewable energy capacity to 175,000MW by 2022, which will require up to US$170 billion in investments in generation, as well as substantial complementary investments in strengthening the transmission network to absorb this variable power. This push in renewable energy also underpins GoI's ambitious goal of providing uninterrupted power for all homes, industrial and commercial establishments through its *24x7 Power for All program*.

Sectoral and Institutional Context

2. A significant part of India's Nationally Determined Contributions (NDC1) will be delivered through the enhanced ambitions of the updated Jawaharlal Nehru National Solar Mission (JNNSM).2The JNNSM was launched on the January 11, 2010 by the Prime Minister of Government of India (GoI) with a then-ambitious target of deploying 2O Giga Watt (GW) of grid connected solar power by 2022. Earlier in 2015, the government revised the target of Grid Connected Solar Power Projects, significantly upwards, from 20 GW to 100GW by the year 2021-22. Under these targets, the grid-connected rooftop solar installation target was set to 40 GW. As of September 2019, the overall installed grid connected solar capacity stands at 29.72 GW. The installed capacity of Rooftop solar systems stands at 5.25 GW.

3. The estimated rooftop solar potential in residential sector is around 60GW.[3] The potential considers both the multi-apartment group housing societies and individual homes. There has so far been only a modest uptake of GRPV systems in the residential sector[4] due to limited success in developing scalable business models for GRPV in the residential sector. This can be attributed to several market challenges:

a. **Residential consumers** face financial and operational challenges in installing rooftop solar systems. The capital investment is high considering the relatively lower purchasing power of consumers. Limited to no access to collateral-free finance at low-interest rates makes it more difficult for residential consumers to own a rooftop solar system. Furthermore, there is limited information available to consumers regarding the rooftop solar systems, including – economic benefits, technical performance characteristics, financial options through various business models, rooftop structural requirements, and operational and maintenance of the systems.

b. **Developers**: The residential solar system is associated with higher transaction costs for developers, as these systems are characterized by smaller rooftop solar system sizes, which are inherently fragmented. The third-party owned/ renewable energy service company (RESCO) model, which has widely been used by C&I

[1] India aims to reduce the emissions intensity of its Gross Domestic Product (GDP) by 33 to 35 percent by 2030 from 2005 level. One of the measures includes increasing the share of non-fossil fuel-based electricity to about 40 percent by 2030.

[2] The JNNSM was originally launched on January 11, 2010, by the Prime Minister. The Mission had set the ambitious target of deploying 20,000 MW (20 GW) of grid-connected solar power by 2022. The aim was to reduce the cost of solar power generation in the country—through (i) long-term policy; (ii) large-scale deployment goals; (iii) aggressive research and development; and (iv) domestic production of critical raw materials, components, and products—and as a result, to achieve grid tariff parity by 2022. The Mission also aimed to create an enabling policy framework to achieve this objective and make India a global leader in solar energy.

[3] The residential rooftop solar accelerator, Climate Policy Initiative, 2018

[4] India Solar Rooftop Map, March 2019, Bridge to India

consumers, hasn't made a mark in case of residential consumers due to the smaller system size and payment security risks perceived by the developers.

c. **Lenders**: The lack of information on the creditworthiness of both the developers and consumers is a major concern for financiers. The risks generally result in increasing the lending rates and less favorable terms for borrowers.

d. **DISCOMs** are apprehensive in promoting rooftop solar due to perceived revenue loss. The existing tariff design cross-subsidizes tariffs of residential and agriculture consumers by inflating the tariffs of C&I consumers. The average cost of supply across the country is around 9 US cents/kWh, whereas the average residential tariff is around 4-6 US cents/kWh and for C&I, tariff can vary from 12-18 US cents/kWh.[5] Promoting GRPV in residential consumers can therefore help DISCOMs reduce their cross-subsidy requirement, which in turn enables them to remain a cost-competitive supplier of power.

4. **The original Grid-Connected Rooftop Solar Program (P155007) (the 'parent Program') includes a total amount of US$648 million.** On May 13, 2016, the World Bank (WB) Board approved a Grid-Connected Rooftop Solar Program comprising of US$500 million International Bank for Reconstruction and Development (IBRD) funding, US$ 125 million Clean Technology Fund (CTF) funding (US$120 million loan and US$5 million grant) using the World Bank's Program for Results (PforR) instrument. The parent Program disburses concessional loan from the World Bank to SBI based on the results achieved under the parent Program. SBI enables achievements of these specific results by providing loans for rooftop solar projects in commercial and industrial sectors. Later on, November 15, 2016, the parent Program was complemented by an additional amount of US$23 million as a grant from the Global Environment Facility (GEF). As part of the PforR program, the GEF grant is disbursed to SBI against results in implementing the Technical Assistance (TA) activities in GRPV sector and in piloting new business models by lending to the riskier category of GRPV customers, such as non-banking financial institutions (NBFCs) and small and medium enterprises (SMEs). The parent Program aims to support the GoI rooftop solar PV program, by increasing the availability of debt financing and improving the capacity of all stakeholders, leading to expansion of the uptake of GRPV in the country.

5. **The proposed additional financing Program supports the Government's Rooftop Solar PV Phase-II program**. The GRPV system in the residential sector was not considered under the parent Program, however, the AF will provide the concessional loans to SBI against the results achieved in the residential sector.

Rationale for additional financing

6. **The proposed Program with the AF will disburse against the results achieved in the residential sector, which faces even higher barriers than solar rooftops in C&I sector. These results will be defined as uptake of rooftop solar and battery storage in the residential sector across the country**. The proposed AF will add ***Result Area 4: Market development and expanding GRPV generation in the residential sector*** to the parent Program. The disbursements will be made to SBI against the achievement of results in: The disbursements will be made to SBI against the achievement of results in: (i) *Aggregate amount of loans signed by SBI for the financing of GRPV power generation schemes in the residential sector*; and (ii*) Megawatts of solar (PV) rooftop power generation installed and commissioned in the residential sector under SBI financing*. These results will capture expansion of GRPV generation in the residential sector and *market development of GRPV* schemes including battery energy storage in the residential sector. As discussed in earlier, although the potential for residential solar rooftops is large and policy

[5] Internal estimation based on tariff orders for several states

targets ambitious their uptake faces significant barriers . The AF shall address these barriers in several ways:

a. **Provide concessional debt for strengthening the economics of GRPV for the residential consumer.** To incentivize residential consumers to adopt GRPV, GoI is providing subsidies to residential consumers. However, even with subsidies, it isn't making an economic case for a wide set of residential consumers to adopt GRPV. This is primarily due to the high interest rates on debt for GRPV systems for residential consumer–none of the IFIs have a concessional line of credit for GRPV in residential sector. The prevalent interest rates vary between 14-16 percent for residential consumers, due to the perceived technology and repayment risks by financiers. It is imperative to lower the interest rates to below ten percent, which is similar to interest rates under the parent Program, so that residential rooftops can become attractive for residential consumers.

b. **Financing results in battery energy storage through Global Public Good (GPG)[6] grant funds together with financing results in the residential rooftop solar system from the IBRD funds.** Conditions for a sustainable market for rooftop solar with battery storage are ripe in India. Most parts of the country, particularly Tier 2 and Tier 3 cities, face challenges with power reliability. Residential consumers in these areas rely either on power inverters with low-capacity lead-acid battery storage or diesel generator sets, for their power back-up requirements. The market is already huge—approximately 13 Giga Watt hour (GWh) of battery storage capacity is in operation through inverter back-up systems—potentially making these consumers receptive to advanced batteries. Coupling advanced battery systems with the solar rooftops could be a win-win for both consumers and DISCOMs. Consumers can meet their back-up power needs through clean energy and save energy costs; meanwhile DISCOMs would benefit from the ability of battery storage to smooth the consumer's demand curve and mitigate peaks.

c. **The AF will support innovative business models to address the challenge of high transaction costs due to fragmented market and small system sizes**. The existing capital expenditure (CAPEX) and RESCO models[7] find limited acceptance with residential consumers, due to the non-availability of concessional debt in case of former and high transaction cost, and operation and maintenance (O&M) costs in case of the latter. The AF Program addresses both these challenges by providing concessional debt through SBI; and supporting utilities under the TA of the parent Program on designing and operationalizing utility-led business models to reduce the customer acquisition costs.

7. **Following the success of the parent Program, the GoI has requested the WB to expand the original Program to include the financing of GRPV projects in the residential sector.** To this effect, on July 1, 2019, the Department of Economic Affairs (DEA) of the Ministry of Finance, requested that the WB provide additional financing of US$245 million to promote the uptake of rooftop solar in the residential sector. This Additional Financing program is being prepared responding to DEA's request.

8. **The additional financing to the parent Program would finance results against GRPV uptake in the residential sector across the country including battery energy storage systems**. The institutional and implementation arrangements of the Program would remain the same. The proposed Program with AF will be implemented by SBI, including the associated technical assistance program. SBI is well positioned with a dedicated rooftop program management team in place. SBI has the largest retail branch network

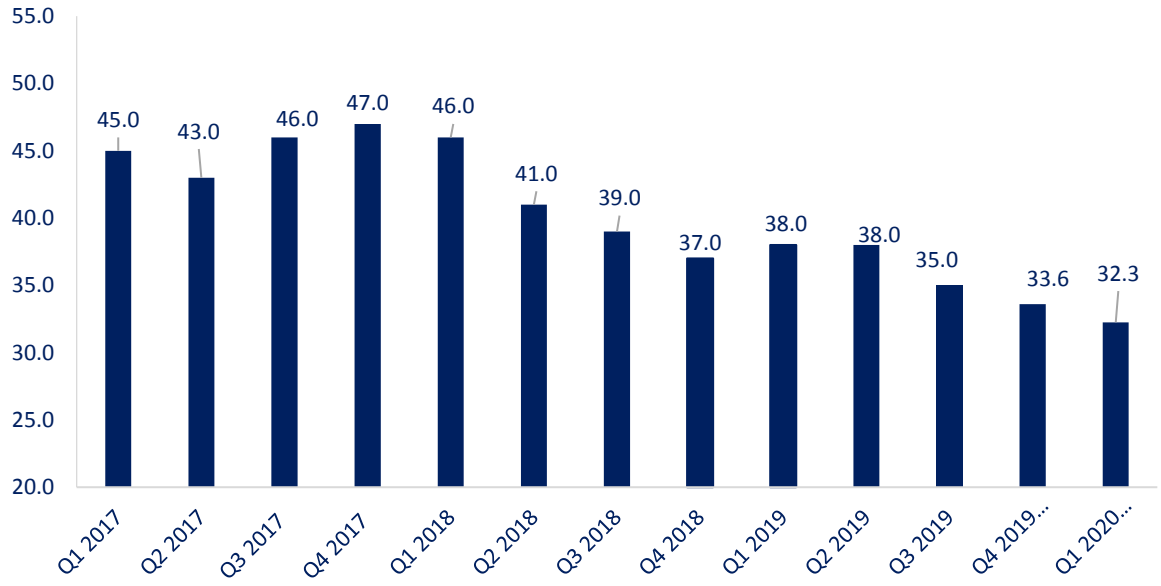
[6] The Program is awaiting the approval of Global Public Goods (GPG) grant of [US$ 15 million] by [end of January 2020]. If the GPG grant is approved, the loan required from IBRD would correspondingly reduce. The GPG grant will be blended with the IBRD loan to provide needed concessionality to reduce perceived market and borrower risks associated with these increasingly economic technologies.

[7] As explained in ANNEX 2

of 24,000 branches and 420 million retail consumers across the country.[8]

9. **Since the launch of parent Program in 2016, the commercial case for residential sector has strengthened** because of the reduction in Engineering, Procurement and Construction (EPC) cost of GRPV systems–approximately 10 percent year-on-year (YoY), refer figure 1 below. With the capital costs reductions, the financing costs forms a major proportion of overall system cost for consumer–studies attribute 50-65 percent of the system costs to financing cost in case of renewable energy projects. The economics of GRPV system for a residential customer is linked with the electricity tariffs. There is a strong business case for residential consumers paying higher grid tariffs (>INR 5-6/kWh) to adopt residential GRPV system with Levelized Cost of Electricity (LCOE) between INR 4-5/kWh.

Figure 1: India Rooftop Solar EPC Cost Index, INR/ Wp[9]



10. **There would be mainly three sets of sub-borrowers of SBI under the AF:**

a. **Existing and new RESCO developers:** The existing RESCO developers have launched several products customized to needs of residential consumers and are seeking concessional debt to scale-up these products. There are new RESCO developers, with smaller balance sheet as compared to existing RESCO sub-borrowers, who specifically target niche but high potential residential sector. Since under the parent Program, residential sector was excluded these RESCO players didn't benefit from concessional debt and instead were depended on venture capital and other foundations funding. Now to scale-up their operations they are seeking commercial debt at concessional rates.

b. **Distribution utilities:** Few of the progressive DISCOMs are implementing utility-led models, where they intend to own GRPV assets as the cost of GRPV generation (INR 4-5/kWh) is lower than their average cost

[8] https://sbi.co.in/web/personal-banking/home

[9] Bridge to India, Rooftop Solar EPC Cost Index, 2019

of supply (INR 7/kWh). [10]So far there are two types of utility-led business models which have already been approved by the state electricity regulators – Solar asset ownership by utility (in case of Kerala) and solar asset ownership by consumer (in Andhra Pradesh). In both the models the consumer aggregation is done by the utility – since they interface with consumers. The Program is business model agnostic and would facilitate financing of both these models. In case of asset ownership by utility, the assets are owned by utility itself or by a third-party RESCO player while the consumer gets a certain percentage of solar energy generated as energy credit, towards compensation for roof rent. In case of asset ownership by consumer, the utility has tied-up with banks to provide finance to consumers. The utility continues to collect the monthly electricity payments from the consumers which includes the Equated Monthly Installment (EMI) of debt repayment, which is collected by the utilities, and passed on to the lending banks.

c. **Retail residential consumers:** The residential consumer consuming higher units will be interested to install GRPV as they pay higher tariff due to slab-wise tariff structure–wherein the more you consume the higher rates are applied which in several cases are like tariffs in commercial & industrial consumers. There are also multi-apartment buildings where the common lighting, elevators, motors loads, billed at higher tariffs due to higher consumption, can be easily served by GRPV reducing the overall electricity costs. There may exist potential legal and administrative barriers for installation of GRPV in multi-apartment buildings. It may be difficult for the owner's association to take loans as some banks may not consider them as a legal entity. However, we have seen, for instance in Delhi, that such multi-apartment buildings have installed rooftop solar mainly in RESCO mode, wherein the RESCO developers ensure its payment security by taking 3-6 months equivalent of receivables in form of a Bank Guarantee. The apartments have also installed systems in CAPEX model, where the cost of the system is shared by the consumers and taken as one-time payment or spread over a period of 4-6 months. Furthermore, there is precedence where financial institutions, for instance Delhi Housing Finance Corporation, are lending to housing societies at relaxed security requirements. In these cases, share of debt financing has increased beyond the usual 70 percent and the lender considers the rooftop solar plant as security and takes an under-writing from members of the society that they are willing to take this collective loan.

11. There is already a tangible pipeline for financing residential solar systems

a. *Solar Power Program of State of Kerala (SOURA)* : SBI is in discussion with Kerala State Electricity Board Limited (KSEBL) for financing projects under rent-a-roof/roof lease model, following the ambitious rooftop solar scheme – SOURA which targets 500 MW of rooftop solar capacity addition by 2022. In the first phase KSEBL has tendered 200 MW system capacity, segregated in two components 50 MW (assets owned by utility) and 150 MW (assets owned by third party RESCO). It received 278,000 consumer applications, of these 76 percent consumers prefer to install the system in rent-a-roof/roof lease model, where the electricity is bought by the utility and 10 percent of solar energy generated is given to the consumer as energy credit.

b. *Delhi, Madhya Pradesh and Bihar*: World Bank under the rooftop solar technical assistance Program under the parent program is supporting Delhi, Madhya Pradesh and Bihar for an aggregated project capacity of 52 MW in the residential sector, which is expected to be commissioned in the next 15 months.

[10] The average cost of supply is approximately INR 7/kWh in 2015-16 and has been steadily increasing at an average rate of approximately 6 percent per year for the past 3–5 years. Reference: http://www.prayaspune.org/peg/publications/item/download/892_2d5b1ca58ed382a4ef554ba04f6515dc.html

c. *Gujarat state 1600 MW GRPV scheme*. Gujarat targets to add 1.6 GW in over 0.8 million households by 2022.[11] In September 2019, Gujarat Urja Vikas Nigam Limited (GUVNL) the nodal agency, launched the tender for 600 MW capacity under the CAPEX model. Since in the CAPEX model, consumer or owner of the system has to self-invest, there is a substantial requirement received by GUVNL—through an online form—from the residential consumers to avail debt financing for the rooftop solar system.

d. *Innovative models by Private Sector*: Several developers have innovative business model, beyond the existing RESCO or CAPEX, to address the specific needs of residential consumers. For instance, one of the RESCO developer has launched an EMI model with 3-4 years repayment period to match the needs of the residential consumers for shorter duration of power purchase agreements, compared to typical 20-25 years under the RESCO model. The developer facilitates the consumer for availing loans from the banks with a guarantee to buy-back the rooftop solar assets in case of default by the consumer–this is a crucial intervention as this would eventually lead to creating secondary market for solar (PV) systems. It estimates a capacity addition of 100-120 MW per annum following this model. On similar line another leading developer has launched a Build Own Operate and Transfer (BOOT) model with EMIs spread over 9-10 years to match the EMI amount with monthly bills–again to meet the needs of certain residential consumers, who do not wish to increase their monthly outflow towards electricity bills. Several developers estimate the market size of residential rooftop solar at approximately 5000 MW until 2024-25. This was echoed by developers in the *Brainstorming Session on the Financing Needs and Challenges for Rooftop Solar in Residential Sector* with developers and Engineering, Procurement, and Construction (EPC) companies, organized by World Bank on December 6, 2019 in New Delhi.

12. **The proposed Rooftop Solar Program for Residential Sector expects to put in place the market and institutional foundation to make residential solar rooftop attractive without subsidies (and without concessional finance**) **by the end of the Program**, particularly as solar PV and battery costs continue to decline. The proposed Program would lead to the commoditization of rooftop solar combined with or in isolation of battery storage. The objective would be for these energy solutions to be available through a competitive market of suppliers and developers, and potentially off-the-shelf product coupled with financing options. A competitive market would drive down costs and further spur innovation as suppliers and developers seek to distinguish themselves. This proposed Program would build market capacity and consumer/DISCOM confidence around a sustained residential solar rooftop market in India, with potential to reach over a million households and to serve as a model for solar rooftop growth in other developing countries.

Relationship to the CAS/CPS

13. **Alignment with GoI's national priorities.** The Program is aligned with GoI's National Action Plan on Climate Change, prepared in 2008 to enhance India's ecological sustainability and encourage sustainable energy sources. It is also consistent with the JNNSM that promotes the development of solar power in India. GoI has reiterated these commitments as part of its NDC commitment to achieve 40 percent cumulative electric power installed capacity from non-fossil-fuel-based energy resources by 2030.

14. **Alignment with World Bank's India Country Partnership Framework.** The proposed World Bank support to GoI's program is consistent with two of three focus areas identified in the Country Partnership

[11] Gujarat: Solar rooftop subsidy scheme targets 8 lakh homes in 3 years, The Indian Express, September 10, 2019

Framework (CPF) for India (2018-2022)- Promoting resource-efficient growth through increasing access to sustainable energy and enhacing competitiveness and enabling job creation. The proposed Program will focus on all the four catalytic "Hows' – leveraging private financing, engaging a Federal India, strengthening public sector institutions, and supporting a Lighthouse India. By demonstrating success business cases for GRPV systems in the residential sector and facilitating installation of around 700 MW of residential GRPV, the AF Program is expected to catalyze investments in the range of US$2.8 billion in this sector. These investments are needed for meeting GoI's 4 GW target.[12] The AF is aligned with the parent Program–strengthening of institutional capacities of the key stakeholders across 17 states; and the broader Government of India Program–to substantially increase the renewable energy capacity addition in fulfilment of its NDC goals and increased energy security. The AF is not directly facilitating the expenditure program for TA; but will benefit from the support extended by the parent Program for the sector. In this regard, the AF value-add goes beyond financing and contributes to the transfer of knowledge and international best practices, reform of processes and systems, strengthening of institutional capacity, and exploration of the innovative financing mechanism.

PforR Program Scope

15. The AF will disburse against the two proposed DLIs specific to the AF. These DLIs correspond with the intermediate outputs and PDO level outcome the AF Program as listed below and described in the (Section IX). The AF Program will disburse against results achieved on a countrywide eligibility basis, as outlined in SBI's amended Program Operations Manual (POM) for the AF Program[13].

a. The result indicators remains similar to the parent Program, but with a focus on achievements under the residential sector.

   i. **PDO Indicator 1:** Capacity of GRPV connected to the grid in the residential sector, with target of 700 MW

   ii. **PDO Indicator 2:** Reduction of carbon emissions due to GRPV in residential sector, with target of 1043,000 tons/year

b. The Result Area 4 is being introduced for the AF and following intermediate result indicators have been defined for the AF.

Result Area 4: Market development and expanding GRPV generation in the residential sector.

i. **Intermediate Results Indicator 1**: Amount of rooftop solar loans signed by SBI in the residential sector, with target of US$245 million.

ii. **Intermediate Results Indicator 2**: Amount of additional equity financing from private sources mobilized by SBI, with target of US$ 98 million.

Program Development Objective(s)

16. The PDO is to increase installed capacity of Grid-connected Rooftop Solar Photovoltaic (GRPV) and to strengthen the capacity of relevant institutions for GRPV. The Program Environmental Objective (PEO)

[12] Assuming the AF Program would support GoI in achieving its 4000 MW capacity addition target in the residential sector. The mobilizing amount is calculated considering $700,000 as capital cost per MW for GRPV.

[13] The POM is being finalized by SBI and is expected to be ready by June 2020.

is to achieve reductions in GHG emissions through the displacement of thermal energy with solar energy.

Environmental and Social Effects

17. Since the activities being financed by SBI are not changing, no substantial change of impacts is anticipated. However, the potential locations are likely going to be closer to more uninformed people, including possibly children and the elderly, and with less expertise – unlike commercial or industrial establishments. With the recent change in definition, some ground-mounted installations are also possible[14]. Therefore, an addendum to the Environmental and Social Systems Assessment (ESSA) has been developed through a review of existing facilities created under the parent Project and interaction with SBI staff implementing the parent Program and other stakeholders.

18. The findings highlight the relative ease with which the potential impacts can be managed. However, it also finds that the reporting on the progress, with specific reference to SBI inspected[15] projects, should be improved so that it can be assured that the implementation has complied with the requirements of the checklists included in the parent ESSA. It also recommends the use of information dissemination to residents where solar installations are coming up on residences, in advance of the installation, to help them understand and avoid any adverse impacts. These actions would be included in the Program Operational Manual (POM).

Financing

19. The expenditure for the PforR Program will be at least US$ 490 million, to be financed by IBRD financing of US$230 million, an expected GPG grant of [US$15 million], and private and public sector financing of US$245 million (which represents approximately 20 percent equity contribution and 30 percent public contribution, against US$245 million of debt). The below table summarizes the Program financing, which will be supported by the World Bank.

Program Financing

Source	Amount (US$ million)	% of total
IBRD	230	47
GPG (grant—pending IBRD/World bank approval)	15	3
Private & public sector financing	245	50
Total Program financing	**490**	**100.0**

.

[14] On September 5, 2019, MNRE clarified the definition of Rooftop Solar projects: The rooftop solar power plant is a solar power plant installed on the roof of the residential/institutional/commercial/industrial building and/or on the appurtenant land up to an area equivalent to two time the total super built up area of the residential/institutional/commercial/industrial building. The super built up area shall include all residential/institutional/commercial/industrial structures being used for these activities and shall also include store, covered parking etc. as determined by the appropriate State Authorities. The appurtenant land shall be contiguous to the residential/institutional/commercial/industrial structure.'

[15] The assessment did not find issues with reporting on projects inspected by Lender's Independent Engineers

CONTACT POINT

World Bank

Name :	Amit Jain		
Designation :	Senior Energy Specialist	Role :	Team Leader(ADM Responsible)
Telephone No :	5785+47626	Email :	amitjain@worldbank.org
Name :	Mani Khurana		
Designation :	Senior Energy Specialist	Role :	Team Leader
Telephone No :	5785+47759	Email :	mkhurana@worldbank.org
Name :	Simon J. Stolp		
Designation :	Lead Energy Specialist	Role :	Team Leader
Telephone No :	5720+13731 /	Email :	sstolp@worldbank.org

Borrower/Client/Recipient

Borrower :	State Bank of India		
Contact :		Title :	
Telephone No :		Email :	

Implementing Agencies

Implementing Agency :	State Bank of India		
Contact :	K. P. Baiju	Title :	Deputy General Manager
Telephone No :	91-22-22740955	Email :	dgm1.cppd@sbi.co.in

FOR MORE INFORMATION CONTACT

The World Bank
1818 H Street, NW
Washington, D.C. 20433
Telephone: (202) 473-1000
Web: http://www.worldbank.org/projects