Document of
The World Bank

FOR OFFICIAL USE ONLY

Report No: 104345-IN

PROGRAM APPRAISAL DOCUMENT

ON A

PROPOSED IBRD LOAN
IN THE AMOUNT OF US$500 MILLION

A PROPOSED CLEAN TECHNOLOGY FUND (CTF) LOAN
IN THE AMOUNT OF US$120 MILLION

AND A

PROPOSED CLEAN TECHNOLOGY FUND (CTF) GRANT
IN THE AMOUNT OF US$5 MILLION

TO THE

STATE BANK OF INDIA

WITH THE GUARANTEE OF THE REPUBLIC OF INDIA

FOR A

PROGRAM FOR RESULTS GRID-CONNECTED ROOFTOP SOLAR PROGRAM

April 21, 2016

Energy and Extractives Global Practice
South Asia Region
India Country Management Unit

CURRENCY EQUIVALENTS
(Exchange Rate Effective February 29, 2016)

Currency Unit = Indian Rupees
Rs. 66 = US$1

FISCAL YEAR
April 1 – March 31

ABBREVIATIONS AND ACRONYMS

ACG	Anti-Corruption Guidelines
ADB	Asian Development Bank
BOOM	Build-own-operate-maintain
BOOT	Build-own-operate-transfer
CAGR	Cumulative Annual Growth Rate
CAPEX	Capital expenditure
CAR	Capital Adequacy Ratio
CEA	Central Electricity Authority
CEO	Chief Executive Officer
CERC	Central Electricity Regulatory Authority
CFA	Central Financial Assistance
CO_2	Carbon Dioxide
CPPD	Credit Policy and Procedures Department
CPS	Country Partnership Strategy
CRAR	Capital to Risk-Weighted Assets Ratio
CTF	Clean Technology Fund
CUF	Capacity Utilization Factor
DC	Direct Current
Discom	Electricity distribution company
DLI	Disbursement-Linked Indicator
EA	Electricity Act
EHS	Environment, Health and Safety
ERR	Economic Rate of Return
ESSA	Environmental and Social Systems Assessment
FIT	Feed-in-Tariff
FM	Financial Management
FY	Financial Year
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIZ	Gesellschaft für Internationale Zusammenarbeit
GoI	Government of India
GRPV	Grid-connected Rooftop Solar Photovoltaic

GRS	Grievance Redress Service
GRSP	Grid-connected Rooftop Solar Program
GRSSPP	Grid-connected Rooftop and Small Solar Power Plant
IBRD	International Bank for Reconstruction and Development
ICICI	Industrial Credit and Investment Corporation Bank of India
IDBI	Industrial Development Bank of India
IDFC	Infrastructure Development Finance Company
IEC	International Electro-technical Commission
IFC	International Finance Corporation
INR	Indian Rupee
IT	Information Technology
IVA	Independent Verification Agent
JNNSM	Jawaharlal Nehru National Solar Mission
KfW	Kreditanstalt für Wiederaufbau
M&E	Monitoring and Evaluation
MAC	Marginal Abatement Cost
MNRE	Ministry of New and Renewable Energy
MW	Megawatts
NBFC	Non-Bank Financial Company
NDC	Nationally Determined Contribution
NPAs	Non-Performing Assets
NREL	National Renewable Energy Laboratory
O&M	Operations and Maintenance
OP	Operations Policy
PACE	Partnership to Advance Clean Energy
PAD	Program Appraisal Document
PDO	Program Development Objective
PforR	Program-for-Results
PIU	Program Implementation Unit
PM-10	Particulate Matter of less than 10 micrometers in diameter
PNB	Punjab National Bank
POM	Program Operations Manual
QA	Quality Assurance
QC	Quality Control
R&D	Research and Development
RBI	Reserve Bank of India
RESCO	Renewable Energy Service Company
RGO	Renewable Generation Obligation
RPO	Renewable Purchase Obligation
RSPC	Rooftop Solar Policy Coalition
SBI	State Bank of India

SECI	Solar Energy Corporation of India
SERC	State Electricity Regulatory Commission
SME	Small and Medium Enterprise
SNA	State Nodal Agency
SORT	Systematic Operations Risk-Rating Tool
SPO	Solar Purchase Obligation
T&D	Transmission and Distribution
TA	Technical Assistance
TERI	The Energy Research Institutes
TOR	Terms of Reference
UNDP	United Nations Development Program
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
UT	Union Territory
WB	World Bank

Regional Vice President:	Annette Dixon
Global Practice Vice President:	Laura Tuck
Country Director:	Onno Ruhl
Senior Practice Director:	Charles Feinstein
Practice Manager:	Julia Bucknall
Task Team Leaders:	Mohua Mukherjee/Mani Khurana

INDIA

GRID-CONNECTED ROOFTOP SOLAR PROGRAM

Contents

Page

PAD DATA SHEET

India

Grid-connected Rooftop Solar Program

PROGRAM APPRAISAL DOCUMENT

South Asia Region
Energy & Extractives Global Practice

Basic Information

Date:	April 15, 2016	Sectors:	Renewable Energy (100%)
Country Director:	Onno Ruhl	Themes:	Climate Change (P)
Practice Manager:	Julia Bucknall		
Global Practice Vice	Laura Tuck		
Program ID:	P155007		
Team Leader(s):	Mohua Mukherjee/Mani Khurana		

Program Implementation Period:	Start Date: May 2016	End Date: November 2021
Expected Financing Effectiveness Date:	May 2016	
Expected Financing Closing Date:	November 2021	

Program Financing Data

[X] Loan	[X] Grant	[ ] Other
[ ] Credit		

For Loans/Credits/Others (US$M):

Total Program Cost :	915	Total Bank Financing :	648
Total Cofinancing :	267	Financing Gap :	0

Financing Source	**Amount (US$M)**
BORROWER/RECIPIENT	2
IBRD/IDA	500
CTF	125
GEF (*Pending GEF Council Approval*)	23
Private or Public Funding through equity contribution	265
Total	915

Borrower: State Bank of India			
Contact: Mr. Krishan Singh Barguzar		Title: Project Coordinator, Grid-connected Rooftop Solar Program	
Telephone No.: +91-22-22740439		Email: dgm2.cppd@sbi.co.in	
Responsible Agency: Ministry of New & Renewable Energy			
Contact:	Mr. Santosh Vaidya	Title:	Joint Secretary
Telephone No.:	+91-11-24362288	Email:	santosh.vaidya@gov.in

Expected Disbursements (in USD Million)

Fiscal Year	FY17	FY18	FY19	FY20	FY21				
Annual	108	155	155	125	105				
Cumulative	108	263	418	543	648				

Program Development Objective(s)

The PDO is to increase installed capacity of 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.

Compliance

Policy

Does the program depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]

.

Does the program require any waivers of Bank policies applicable to Program-for-Results operations?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]

Overall Risk Rating: **SUBSTANTIAL**

Legal Covenants

Name:	Recurrent	Due Date	Frequency
Grievance Redressal Mechanism	Yes	6 months after effectiveness	N/A

Description of Covenant

SBI to establish, maintain and operate a grievance redressal mechanism for the processing of any complaint arising out of the implementation of the Program.

Name:	Recurrent	Due Date	Frequency
Anti-Corruption Reports	Yes	N/A	Quarterly

Description of Covenant

SBI to prepare reports detailing any complaints received from internal sources, supervisory bodies, the industry and/or general clients, regarding incidents of fraud and corruption , collusion, coercion, obstruction to investigation and/or any other reprehensible actions/conducts contemplated in the Anti-Corruption Guidelines.

Name:	Recurrent	Due Date	Frequency
Lender's Engineer	Yes	Prior to disbursing any amounts to the respective Sub-Loan Agreements	Throughout Program duration

Description of Covenant

For each individual Sub Loan equivalent to, or greater than USD 7.4 million, or overall GRPV investment costs equivalent to, or greater than, USD 14.8 million, SBI to engage and maintain (at least up to three months after commercial operation of the assets built) a lender independent engineer (or a panel of engineers) to assist SBI in ensuring sub-borrowers' compliance with all applicable regulations, government permits, and SBI's enabling policy framework, including the Program Operations Manual.

Name:	Recurrent	Due Date	Frequency
Program Operations Manual	Yes	N/A	Throughout Program duration

Description of Covenant

SBI to carry out the Program in accordance with the Program Operations Manual.

Name:	Recurrent	Due Date	Frequency
Annual Work Plans & Budgets	Yes	January 31st	Annual

Description of Covenant

Each year SBI to furnish to the Bank an annual work plan and associated budget covering the activities proposed for the following SBI's Fiscal Year by no later than January 31st of each year, commencing on January 31, 2017; and eventually carry out the Program in accordance with such work plan and budget agreed with the Bank.

Name:	Recurrent	Due Date	Frequency
GRPV Investments	Yes	N/A	Throughout Program duration

Description of Covenant

SBI to appraise, review and approve individual application for GRPV financing in accordance with the criteria, conditions and procedures set out in the Program Operations Manual.

Name:	Recurrent	Due Date	Frequency
Sub-Loan Agreements	Yes	N/A	Throughout Program duration

Description of Covenant

SBI to make the proceeds of the IBRD Loan/CTF Loan and/or CTF Grant available to its clients in accordance with eligibility criteria and procedures set out in Program Operations Manual. SBI will enter into Sub-Loan Agreements with each approved applicant client on terms and conditions acceptable to the Bank.

Name:	Recurrent	Due Date	Frequency
Program Action Plan	Yes	N/A	Throughout Program duration

Description of Covenant

SBI to implement the Program Action Plan agreed with the Bank.

Name:	Recurrent	Due Date	Frequency
Mid-Term Review	No	November 30, 2018	N/A

Description of Covenant

SBI to prepare and furnish to the Bank a mid-term review report, consolidating the results of the monitoring and evaluation of activities up to the date of such report, and setting out any measures recommended to ensure efficiency in the carrying of the Program and the achievement of the Program objectives.

Name:	Recurrent	Due Date	Frequency
Steering Committee	Yes	Within 3 months after effectiveness	Throughout Program duration

Description of Covenant

GoI to establish/maintain a Steering Committee chaired by a representative of MNRE to guide SBI in the coordination of capacity building activities of the Program.

Name:	Recurrent	Due Date	Frequency
DLI Validation	Yes	N/A	Throughout Program duration

Description of Covenant

MNRE will carry out the independent verification for confirming achievements of DLIs #1 and #6 of the matrix in the PAD. DLIs #2 and #3 will, in turn, be monitored and verified by one or more verification agents under terms of reference acceptable to the Bank.

Conditions

Source of Fund:	Name:	Type
IBRD Loan / CTF Loan / CTF Grant	SBI Act, SBI General Regulations & Applicable Policy/Regulatory Framework	Remedies

Description of Condition

GoI and SBI not to: (i) amend, suspend, abrogate, repeal or waive the SBI Act and/or SBI General Regulations in a way that would materially and adversely affect the ability of SBI to perform its obligations under the Program; and (ii) take an action nor adopt any policy or regulation which would render materially and substantially impossible for SBI to carry out the Program as per the Program Operations Manual, or that might reverse the measures taken by SBI under the Program Action Plan.

Source of Fund:	Name:	Type:
IBRD Loan / CTF Loan / CTF Grant	Co-financing (cross-effectiveness)	Effectiveness

Description of Condition

IBRD Loan, CTF Loan and CTF Grant, each to become effective upon the effectiveness of the respective co-financing instruments (i.e. cross-effectiveness condition).

Source of Fund:	Name:	Type:
IBRD Loan / CTF Loan / CTR Grant	Program Operations Manual	Disbursement

Description of Condition

SBI to prepare and adopt a Program Operations Manual acceptable to the Bank, including a pro-forma Sub-Loan Agreement detailing the environmental, social and safety standards applicable to all GRPV investments.

Team Composition in Alphabetical Order			
Bank Staff			
Name	**Title**	**Specialization**	**Unit**
Amit Jain	Renewable Energy Specialist	Energy	GEEDR
Bipulendu N. Singh	Energy Economist	Energy	GEEDR
Boonsri Prasertwaree Kim	Program Assistant	Energy	GEEDR
Gaurav D. Joshi	Sr. Environmental Specialist	Environment	GENDR
Gevorg Sargsyan	Program Manager	Energy	GEEDR
Joonkyung Seong	Energy Specialist	Energy	GEEDR
Kumudni Choudhary	Program Assistant	Operations	SACIN
Mani Khurana	Energy Specialist & co-Task Team Leader	Energy	GEEDR
Martin M. Serrano	Sr. Counsel	Counsel	LEGES
Mohua Mukherjee	Sr. Energy Specialist & Task Team Leader	Energy	GEEDR
Parthapriya Ghosh	Sr. Social Development Specialist	Social Development	GSURR
Pyush Dogra	Sr. Environmental Specialist	Environment	GENDR
Savinay Grover	Sr. Financial Management Specialist	Financial	GGODR
Subrahmanya Pulle Srinivas	Lead Financial Economist	Finance/Markets	GFMDR
Shaukat Javed	Program Assistant	Energy	GEEDR
Surbhi Goyal	Energy Specialist	Energy	GEEDR
Swayamsiddha Mohanty	Sr. Procurement Specialist	Procurement	GGODR
Victor Ordonez	Sr. Finance Officer	Finance	WFALN
Non-Bank Staff			
Name	**Title**	**City**	
G Srihari	Consultant-Social Development	New Delhi	
Hari Prakash	Consultant-Environment	New Delhi	
Peter Meier	Consultant-Energy Economist	Washington DC	
Ramola Bhuyan	Consultant-Financial Management	Kolkata	

INDIA

GRID CONNECTED ROOFTOP SOLAR PROGRAM

I. STRATEGIC CONTEXT

A. Country Context

1. **India's power system needs to grow rapidly to fuel the country's economic growth and provide electricity to its growing population.** Over the last decade, India's economy expanded at an average annual rate of 7.6 percent, placing it among the top five fastest growing nations in the world. The demand for power is expected to rise to support the growing economy. With about 275,000 megawatts (MW) of installed capacity (as of November 2015), the Indian power system is among the largest in the world, but per capita consumption of electricity is less than one-fourth of the world average. An estimated 300 million people are not connected to the national electrical grid. Even when connected, many face frequent disruptions. Power shortages in FY2015 were equivalent to about 3.6 percent of total energy and 4.7 percent of peak capacity requirements.

2. **In the coming decades, India will influence global energy demand and climate change trends.** The International Energy Agency, in its World Energy Outlook 2015, states that India will contribute more than any other country to the projected rise in global energy demand between 2015 and 2040, and its CO2 emissions are expected to triple. Yet, this would still leave the country's average per capita energy demand at 40 percent below the world average at the end of the period.

3. **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.*

B. Sectoral and Institutional Context

4. **A significant part of India's NDC will be delivered through the enhanced ambitions of the updated Jawaharlal Nehru National Solar Mission (JNNSM).**[1] In June 2015, the Cabinet approved a revision of cumulative targets under JNNSM from 20,000MW to 100,000MW. This includes an official target of 40,000MW of grid-connected rooftop solar photovoltaic (GRPV) generation capacity by 2022. The change was based on two factors: first, the rapid increase of

[1] The JNNSM was originally launched on January 11, 2010, by the Prime Minister.

installed solar capacity from 18MW to nearly 4,000MW between 2010 and 2015, which created confidence that India could exceed the original target of 20,000MW; and second, the decline in costs of solar energy by over 60 percent over the same period.

5. **Electricity generated from GRPV is becoming increasingly cost-competitive with electricity from the grid in many parts of India—**particularly for commercial customers, who pay a higher tariff for electricity because of the cross-subsidy surcharge imposed on them. GRPV has already achieved price parity with the grid for commercial customers in 20 states and for industrial customers in 18 states[2].

6. **Electricity distribution companies (discoms) will have a major role in expansion of GRPV together with the Ministry of New and Renewable Energy (MNRE), state electricity regulatory commissions (SERCs), and state nodal agencies (SNAs).** SNAs are public sector bodies responsible for coordinating all renewable energy activities in a particular state. Discoms will provide the grid connection, purchase the surplus generation, serve as the interface between the grid and customers, and carry out network upgrades necessary for GRPV. India's discoms range in financial health and in capacity to absorb GRPV.

7. **At the low levels of penetration, even after government targets are met, the discoms have an incentive to encourage GRPV.** Installation of GRPV systems will reduce income from some of the discoms' higher paying customers, but studies indicate that this has little effect on discoms' finances when GRPV is below about 20% coverage.[3] The participating discoms will also benefit in two ways. First, GRPV will enable discoms to meet their renewable purchase obligations (RPOs) and solar purchase obligations (SPOs) and will also allow them to avoid fines for non-compliance. Most discoms already face RPOs of about 3 percent of total purchases laid down by the state regulators. Once the revisions to the National Tariff Policy that were approved in January 2016 are implemented, discoms are likely to face SPOs equal to 8 percent of electricity consumption, excluding consumption already supplied by hydropower. Second, electricity from GRPV systems will help discoms manage daytime peak loads, which are projected to become more widespread as India's economy grows. Localized generation of power on urban rooftops will help meet daytime power requirements and avoid the need to buy power from expensive short term markets.

8. **Initial assessments indicate that tariff changes are unlikely to reduce demand for GRPV systems at this stage of market uptake.** Each discom has its own tariff structure approved by its state regulator. Residential customers in India generally pay less for electricity than the cost of service, and industrial and commercial customers pay more. Therefore, unless the tariff structure changes, industrial and commercial customers will be most likely to deploy GRPV. If tariffs increase, as is expected in most states, GRPV will become more attractive. If industrial and commercial tariffs go down, balanced by an increase in tariff for residential customers, demand for GRPV would be expected to shift to the residential sector. If tariffs go down across the board,

[2] According to Bridge to India, solar power has achieved price parity with commercial tariffs in 13 states and has done so in another 7 states with the consideration of the accelerated depreciation benefit offered by the government. Similarly, for industrial consumers, price parity has been achieved with the grid in 13 states and after considering accelerated depreciation benefit in another 5 states.

[3] Rooftop Solar Policy Coalition. 2016. Unleashing private investment in rooftop solar in India. New Delhi

it would reduce demand for GRPV, but this would run counter to government policy.[4] Meanwhile, the cost of rooftop solar power is expected to decrease as component costs continue to decline, or innovative low-cost materials are developed that can be used in place of today's panels; and therefore, price parity with the grid for residential customers may become possible in the near future.

9. **Market analysis of GRPV indicate that there is significant demand for GRPV.** A market analysis commissioned by MNRE estimates the market potential of GRPV in India at 124,000MW[5]. This estimate is based on a survey of a sample of potential residential, commercial and industrial customers of GRPV. The survey indicates that customers would like to install GRPV systems to reduce their electricity bills and reduce dependence on the electricity grid. More than 60 percent of commercial customers, 43 percent of industrial customers and 10 percent of residential customers surveyed use diesel generators as back-up supply to manage grid interruptions. The survey indicates that there will be increased interest if GRPV is commoditized and presented as a standard package that includes financing and Operations and Maintenance (O&M) options. The findings of the market survey were confirmed in a series of consultations organized by the World Bank with GRPV market participants. Kreditanstalt fuer Wierderaufbau **(**KfW) and Khemka Foundation have released studies in March 2016 confirming these estimates.

10. **There has so far been only a modest uptake of GRPV systems.** As of September 2015, only about 525MW of GRPV projects have been completed.[6] There has been limited success in developing scalable business models for GRPV except in Gujarat and a few other states. This reflects barriers to the deployment of GRPV systems in India on the following fronts:

- ***Limited debt financing.*** Given legacy issues arising from past exposure to the power sector, traditional financial institutions are highly risk-averse and unwilling to make large lending commitments to GRPV when there is no track record of technology performance available for banks to assess risks. Commercial lenders' reluctance to engage has led to a lack of easily available debt financing options for GRPV developers, installers, and aggregators. The only widely used business model is the "direct sale" model, in which the customers have to pay the solar system integrator or installer for the rooftop PV system in full, up front, and assume all risks.
- ***Skill and knowledge gaps.*** SNAs, SERCs and financial institutions lack capacity to provide sustained institutional and technical support for continued efforts to scale up GRPV, including in such areas as the certification and enforcement of the quality and technical standards of the GRPV equipment that have been set by the MNRE. Discoms do not have full understanding of the impact of GRPV on their business model and lack experience with net metering, gross metering, and Feed-in-Tariff (FIT)[7] systems. Discoms also need support in setting up application forms, procedures, data requirements, identification of staffing responsibilities, and

[4] Ujwal Discom Assurance Yojana also referred to as "UDAY"
[5] Reaching the Sun with Rooftop Solar, p. 60: http://shaktifoundation.in/report/reaching-sun-rooftop-solar
[6] Bridge to India
[7] FIT were used in the past to offer a premium to investors when solar PV equipment was much more expensive and solar producers needed an extra incentive in the form of a higher pre-agreed offtake rate per solar kWh. Now that solar PV is approaching "socket parity" (or cheaper) for the rooftop investor in at least a few tariff categories, feed-in tariffs are no longer needed to encourage investment.

service standards for responding to customer requests for a grid connection of their rooftop PV system.

- ***Weak coordination.*** There is lack of adequate coordination between central and state government agencies as well as between government agencies and private stakeholders that are involved in the implementation of GRPV. This is partly due to the fast pace of development of policy notifications in various states in the last six months since the rooftop target was added to the Government's National Solar Program.
- ***Lack of consumer awareness.*** Consumers lack awareness of costs and technical performance characteristics, rooftop structural requirements, economic benefits, financial options through various business models, and contractual O&M options.
- ***Financial situation of discoms.*** Some state-owned discoms are in financial distress. As mentioned before, assessments indicate that the financial impact of GRPV on utilities is modest at current levels of GRPV penetration. However, the set-up costs for GRPV implementation are sufficient to discourage the most financially stressed discoms from adopting net metering and other GRPV policies that have been announced by state governments and regulators.

11. **GoI and a growing number of state governments and SERCs are gradually putting in place the mechanisms necessary to support the large scale deployment of GRPV.** The Central Electricity Authority (CEA) has issued technical standards for GRPV and prepared a draft regulation on metering arrangements. So far, 19 states have issued solar policies, and the SERCs of 24 states have issued net metering regulations. MNRE has launched a Grid-connected Rooftop Solar and Small Power Plants (GRSSPP) Program, which will provide up to a 70 percent capital subsidy for installing GRPV in special category states such as Sikkim, Uttaranchal, Himachal Pradesh, Lakshadweep, Andaman and Nicobar Islands and 30 percent subsidy in the remaining states. The subsidies will be limited to residential buildings and not-for-profit service delivery institutions such as schools, colleges, clinics and hospitals. The remainder of rooftop PV projects will have no subsidy. Public sector financial support for rooftop solar PV under the GRSSPP program is consistent with the experience of other countries with large-scale rooftop PV programs such as Germany, Spain, USA, Japan, and Australia. Further details on international experience are provided in Annex 4.

12. **GoI has mobilized support for GRPV from a number of international development partners, for investment and technical assistance (TA).** KfW is providing bilateral funding of Euro1 billion to GoI to finance all solar related investments, including rooftop PV and ground-mounted PV. The Asian Development Bank (ADB) is preparing a US$500 million rooftop PV investment project to be deployed through the Punjab National Bank, which is second-largest public sector commercial bank in the country. The United States Agency for International Development (USAID) is supporting technical assistance to GoI with the Partnership to Advance Clean Energy (PACE) Program. PACE focuses on spurring low-carbon inclusive development by supporting deployment of clean energy, as well as research and development collaboration. The United Nations Development Program (UNDP) is partnering through TA with Indian Railways under a Global Environment Facility (GEF) funded project to accelerate the use of rooftop and ground-mounted solar PV systems.

13. **The World Bank Group has maintained a close engagement with GoI on solar power.** Building on several studies from the Bank and IFC,[8] the World Bank is currently preparing two lending operations in addition to this Program: (i) Shared Infrastructure for Solar Parks and (ii) Transmission for Power Evacuation from Solar Parks. These projects in the pipeline support the development of utility scale solar investments by financing the shared infrastructure and transmission investments that are necessary to attract investment in utility scale solar parks. The International Finance Corporation (IFC) is helping structure that private investment. In addition to debt and equity financing for investment projects, IFC has provided a wide range of services such as client risk management swaps, credit enhancements for capital market transactions, and advisory support to renewable energy businesses. IFC's public-private partnership advisory team helped the State of Gujarat to successfully develop that state's pioneering rooftop solar program, and this Program builds on that experience. IFC is considering equity investments in solar rooftops to demonstrate the viability of investments in the sector and to crowd-in investments.

14. **The proposed operation supports the Government's rooftop solar PV program.** By increasing the availability of debt financing and improving the capacity of institutions, it will expand uptake of GRPV in the country. The Program addresses the barriers to accelerated GRPV installation. It also allows the consumer to internalize the positive environmental externalities of solar power and thus encourages GRPV installation. As mentioned above, two other programs funded by ADB and KfW are also being launched with the objective of kick-starting installation through the debt market in the country. These funds will together help meet only a small share of the US$40 billion financing required for meeting GoI's 40,000MW target. These multilateral programs are expected to jointly provide a demonstration effect, apply various business models and create market confidence, as well as provide evidence and a track record of GRPV performance. All this is expected to help unlock a large volume of domestic debt and equity investment and lead to increased installation of GRPV.

15. **Climate finance has been used in this operation to buy down the interest rate of rooftop PV loans to early movers in the market.** The Clean Technology Fund (CTF) Committee has approved US$125 million to co-finance this proposed GRPV Program. The GoI has also applied for a GEF grant, specifically to (i) support an innovative risk mitigation mechanism to enable lending to small and medium enterprise (SME) commercial and industrial customers for GRPV, and (ii) to support strengthening of the investment climate and capacity building of the main stakeholders involved in the expansion of GRPV.[9] CTF and IBRD funds will enable the participating commercial bank (State Bank of India – SBI) to extend loans for GRPV at or near the Base Rate,[10]. Once the concessional funding from IBRD and CTF is exhausted, SBI can continue to fund the second phase of the program with its own resources and / or through syndication with other banks (subject to success of phase one of the Program and availability of creditworthy pipeline); and rates on the sub loans for GRPV can rise. This proposed operation,

[8] These include: (1) World Bank. 2011. *Report on barriers for solar power development in India*. Energy sector management assistance program. Washington, DC: World Bank; (2) Khanna, Ashish; Garg, Kanv. 2013. *Paving the way for a transformational future: lessons from Jawaharlal Nehru national solar mission phase one*. Energy Sector Management Assistance Program (ESMAP). Washington DC; World Bank Group. (3) World Bank. 2010. Unleashing the potential of renewable energy in India. Washington, DC: World Bank.

[9] The GEF grant will be processed as an additional financing to this operation upon approval by GEF Council.

[10] This is the regulated cost of funds of commercial banks and also represents the minimum interest rate that can be charged to customers as per Reserve Bank of India directives

therefore, has a unique financing structure, which leverages multiple sources of funding including IBRD, CTF and GEF.

C. Relationship to the CAS/CPF and Rationale for Use of Instrument

16. **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 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.

17. **Alignment with World Bank's India Country Partnership Strategy.** The proposed World Bank support to GRSSPP is consistent with the Country Partnership Strategy (CPS) for India (2013-2017). The CPS outlines Bank support to India under the three pillars of integration, transformation, and inclusion, with a cross-cutting focus on improving governance, environmental sustainability, and gender equality. The proposed Program is aligned with the transformation and inclusion pillars. The Program will directly help achieve one of the intended transformational outcomes of the CPS, which is to reduce Greenhouse Gas (GHG) emissions by using renewable energy. The Program will help achieve one of the goals under the inclusion by increasing access to electricity. In addition, the operation conforms to the emphasis of the CPS on GoI's "Finance-Plus" approach, whereby the Bank's value-added 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 innovative financing mechanisms.

18. **Alignment with other commitments and goals.** The proposed operation is consistent with the Sustainable Energy for All initiative and supports the World Bank Group's corporate commitment to increase renewable energy lending and address climate change, as presented in the Energy Directions Paper and Climate Action Plan. It is also aligned with the World Bank Group's corporate goal of promoting shared prosperity.

19. **Purpose of a Bank intervention.** A number of recent studies, including a 2014 IFC study,[11] have identified the unavailability of commercial loans to rooftop aggregators and developers as a major and binding constraint to the launch of private investment in GRPV. The Bank can help address the barriers to GRPV by (i) making long-term concessional financing available for the deployment of GRPV; (ii) sharing international knowledge and experience on how large solar rooftop investment programs have been implemented across the world; (iii) providing TA and capacity-building support to regulators, discoms and other state agencies; and (iv) using its policy dialogue to support reforms in the sector and in discoms.

[11] The 2014 IFC study "Harnessing Energy from the Sun: Empowering Rooftop Owners" recommends (i)"financial incentives targeted at the various segments of stakeholders, established to kick-start development of the sector, with a phasing out over time, backed by appropriate policies and regulations;" and (ii) "establishing innovative products, and attracting the commercial lending sector by implementing pilot projects with large third-party developers."

20. **Rationale for a PforR.** The proposed operation could be implemented as a financial intermediary loan under Operational Policy (OP) 10.00. However, the Bank's Program-for-Results (PforR) instrument is considered to be better suited for this operation as it would bring the following additional benefits:

- Providing a sharper focus on the results GoI wants to achieve—the establishment of a new rooftop lending program at the largest commercial bank in the country, and an increase in installed GRPV capacity and generation.
- Developing and expanding the participating bank's portfolio to support the solar rooftop initiative and clean energy and thus to contribute to the results-based solar power generation and emission reduction targets outlined in the government program.
- Using the relevant systems and procedures of the GoI and the participating bank, and reinforcing the institutional capacity needed for the Program to achieve its desired results, which will also ensure continuity of the Program once the World Bank's support is fully disbursed. The participating bank will provide leadership to other local commercial banks through its advisory services arm and/or syndication in Phase Two of the Program.
- Strengthening the participating bank's systems for output and outcome monitoring and evaluation, and executing an independent and credible verification system.

II. PROGRAM DESCRIPTION

A. Government Program

21. **In mid-2015, GoI announced GRSSPP program to support the achievement of GoI's GRPV targets.** Under the umbrella of the JNNSM, MNRE is coordinating the GRSSPP to facilitate the installation of 40,000MW of GRPV in the country by 2022. This target will require investments of more than US$40 billion. MNRE hopes to achieve this through action on multiple fronts: provision of subsidies,[12] creation of debt funds, development of business models, and creation of enabling environment for private investment at the state level, and raising consumer awareness.

22. **MNRE is partnering with financial institutions to increase the amount of debt financing available for GRPV in the country.** It has asked three financial institutions – State Bank of India (SBI), Indian Renewable Energy Development Agency (IREDA) and Punjab National Bank (PNB) - to set up debt funds for GRPV customers with the assistance of the World Bank, KfW and ADB, respectively. These three funds will together provide US$1.5 billion of financing to GRPV customers (see Table 1) while also helping mobilize another US$600 million in private and public financing, and central and state subsidies for GRPV. These funds will kick start the debt market for GRPV in the country by piloting new business models, establishing a performance track record for GRPV, and helping achieve economies of scale and reducing the costs of GRPV. The loan facility funded by KfW at IREDA was launched in late 2015 while the facility to be funded by ADB at PNB is currently under preparation. Since these debt funds have

[12] The amount allocated for CFA support to GRSSPP was raised from $90m to $770m in mid-January 2016. The CFA will be provided to residential and institutional customers of GRPV and will cover 70% of the cost of GRPV systems in special category states and up to 30% of the cost in the remaining states of GRPV system.

either just been launched or are still under preparation, there is currently little or no data on implementation and results.

Table 1: Funding for GRPV through Existing Partnerships among Financiers

Financial Institution	Partner Agency	Fund Size ($Million)
SBI	World Bank	625(*)
IREDA	KfW	340
Punjab National Bank	ADB	500
Total		**1,465**

(*) Additional financing of US$23 million is pending approval from GEF Council.

23. **The GoI program is applicable to all states of India.** It focuses on promoting GRPV to meet and supplement electricity requirements. The government program supports the installation of rooftop solar photovoltaic power generation plant for self-consumption as well as supply to the grid. Both program and project modes of implementation are eligible, with the former limited to systems of less than 50 kilowatt peak (kWp). Monitoring and evaluation of the government program is envisaged through a combination of data from system providers, field inspection reports, and impact assessment reports.

24. **The proposed IBRD-financed PforR Program supports the government strategy for enhancing and expanding its solar development targets.** This operation adds value to the MNRE's Grid-connected Rooftops and Small Solar Plants Program (GRSSPP) program by helping SBI establish lending for rooftop solar PV and making available IBRD financing for GRPV for all categories of customers. When these funds are exhausted, SBI will continue to operate the Program (subject to success of phase one of the Program and availability of creditworthy pipeline) with its own funding and will offer syndication opportunities to other local banks to encourage them to enter the rooftop PV debt market in a risk-mitigated manner, by learning from SBI's experience and expertise.

25. **The expected GEF funding for this operation will be used to mitigate the risk of lending for GRPV.[13]** GEF funds will help remove identified barriers to large-scale adoption of GRPV. This will be through adoption of business models, marketing, and enhancement of institutional capacity of discoms and other GRPV stakeholders. The proposal submitted to GEF by the GoI indicates that the funds will support improved performance by states under the Ease of Doing Rooftop Business Index to be carried out in 2017. Specifically, it will cover up-front TA in 2016 to discoms, SNAs, state power departments, and SERCs. Activities will include support to streamline applications for grid-connection of rooftop PV systems, to implement net-metering/gross-metering policies in the country and to increase consumer awareness about GRPV, as well as to assist with the creation of large numbers of trained and accredited rooftop PV certification agents. GEF funding will also incentivize SBI to lend to riskier categories of GRPV customers such as Non-Bank Financial Companies (NBFCs) and SMEs. This will facilitate the market development of GRPV and make it possible to deploy GRPV systems at the scale and pace envisioned by GoI for meeting its official targets. GEF support to the Program will help realize the GHG emission reductions benefits expected from this Program as thermal power is replaced

[13] Approval has been sought from the GEF Council.

by clean solar power. If the proposed GEF grant is approved by the GEF Council, the funds will be processed as additional financing to this Program.

B. Program Development Objective (PDO) and key results

26. The PDO is to increase installed capacity of GRPV and 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.

27. **Outcome indicators.** Two outcome indicators will be used to measure achievement of the PDO and PEO:

- *Rooftop Solar PV capacity connected to the grid (MW).* This indicator has been selected to align the Bank Program with GoI's GRPV program and target, and to facilitate measurement of this Program's contribution to the overall target. GoI would like the majority of rooftop solar PV systems installed in the country to be connected to the grid to ensure the optimal use of electricity generated from the GRPV systems.

- *CO2 emissions reduced (tons).* This indicator will help GoI measure the GHG emission reduction contributions of its rooftop solar program.

28. **Results indicators.** Two types of results indicators have been defined: (i) those that are linked to disbursements (Disbursement Linked Indicators - DLIs), and (ii) those that are not linked to disbursements ("other results indicators") (see Table 2 below for the detailed Results Chain of the Program and the link to DLIs). The Program expects to finance 600MW of GRPV orders. Of the 600MW, the Program expects that 500MW will be commissioned during the Program lifetime of 5.5 years[14]. This is reflected in the results framework. Because of time lag between commissioning and connection to the grid, the Program expects 250MW of GRPV systems to be connected to the grid during the Program lifetime.

29. **Disbursements.** CTF and World Bank disbursements will be made against achievement of a pre-agreed set of DLIs. The choice of DLIs is based on four factors: (1) the importance of the indicator that signals a critical action/output along the results chain; (ii) perceived need to introduce a strong financial incentive to deliver the result; (c) practical aspects of verifying achievement; and (d) capacity of SBI to achieve the DLI during the implementation period of the Program. CTF and IBRD loan funds will be disbursed directly to the SBI, based on the achievement of DLIs.

[14] To trigger full disbursement of the Bank financing under DLI 5, it has been agreed that 400MW must be installed and commissioned.

Table 2: Results Chain of the Grid-connected Rooftop Solar Program

PDO/Result Area	Actions	Intermediate Outputs	Outcomes	DLIs
Result Area 1: institutional capacity for GRPV	(a) establish GRPV credit department or unit; (b) set up internal credit procedures, and provide incentives to staff for making GRPV loans; (c) provide training to staff; and (d) implement the TA program for discoms, SNAs, SERCs etc.	Launch of Program Contract signed with consulting firm for the implementation of the TA and capacity building program for discoms, SNAs and SERCs. Different phases of the TA program completed.	Institutional capacity improved and GRPV lending mainstreamed at SBI, and institutional capacity of discoms, SNAs, and SERCs on GRPV improved.	**DLI 1** **Establishing a Rooftop Solar PV Program at the State Bank of India.** *Description: GRPV credit department in SBI corporate HQ is functioning; operations manual is finalized; IT systems are strengthened to track GRPV loans.* **DLI 2** **Technical assistance to key stakeholders for the implementation of MNRE's GRPV program** *Description: Contract signed with consulting firm for the implementation of the TA program; different phases of the TA program are completed.* **DLI 6** **Sustainability of GRPV program** *Description: Next phase of GRPV program from own resources and / or through syndication with other Banks is launched.*
Result Area 2: Market development of GRPV	a) undertake aggressive marketing and business development for deal origination; b) Introduce financing models and products tailored to industrial and commercial GRPV consumers;	Cumulative amount of lending approved by SBI (US$ million) and capacity(MW) of GRPV orders placed with SBI's borrowers Cumulative amount of additional financing mobilized by SBI (US$ million)	Number of GRPV market participants increased	**DLI 3** **Aggregate amounts of loans signed by SBI for the financing of solar (PV) rooftop power generation schemes.** *Description: Amount of GRPV lending approved by SBI.* **DLI 4** **Piloting new business models** *Description: Amount of GRPV lending to NBFCs and SMEs by SBI; GEF financing expected.*

PDO/Result Area	Actions	Intermediate Outputs	Outcomes	DLIs
Result Area 3: Expanding GRPV generation	Scale up of GRPV investments Install GRPV systems and connect them the grid	Capacity (MW) of GRPV installed GRPV capacity connected to grid (MW)	CO_2 emissions reduced (tons) GRPV electricity generated (MWh)	**DLI 5** **Megawatts of solar (PV) rooftop power generation installed and commissioned under SBI financing.**

C. Program Beneficiaries

30. **Program beneficiaries** include (i) GRPV customers who will benefit from electricity generated by GRPV systems under a variety of business models; (ii) discoms that will benefit from electricity passed on to their network through net metering or gross metering, and through the TA carried out under the program; (iii) SNAs and SERCs, which will benefit from TA and capacity-building activities in the Program; (iv) the residents of states where GRPV systems are implemented who will benefit from improved consumer education and consumer awareness as well as reduced air pollution and the resulting improved health impacts; (v) SBI and its branches across the country, which will benefit through strengthened institutional capacity; (vi) third-party aggregators, developers, and vendors of GRPV systems, who will benefit through access to debt that will allow their business to grow faster; (g) all economic agents engaged in the GRPV supply and delivery chain, particularly subcontractors for installation and other services, as well as O&M service providers; and (h) the global community, which will benefit from avoided GHG emissions.

D. PforR Program Scope

31. The proposed Program will support the implementation of MNRE's GRSSPP program, with a focus on mobilizing private sector equity investments and commercial lending, increasing deployment and uptake of GRPV through a variety of business models, and thereby contributing to the achievement of GoI's GRPV installation targets. The duration of the Program will be five and a half years, with a start date of May 2016 and end date of November 2021. The PforR Program will finance activities in three results areas on a countrywide eligibility basis, as outlined in SBI's Program Operations Manual (POM):[15] (i) strengthening institutional capacity for GRPV; (ii) market development of GRPV; (iii) expanding GRPV generation.

32. **Activities under Results Area 1: Strengthening Institutional Capacity for GRPV.** This includes:

- *Strengthening the Institutional Capacity of SBI*, through: (i) establishing a Project Implementation Unit (PIU) for the Program and mobilizing staff in other SBI departments and/or branches in support of its GRPVs business line; (ii) setting up SBI internal policies and procedures for loan origination, risk assessment and loan approval, (iii) providing training to SBI staff on GRPVs financing; (iv) providing incentives to SBI staff to undertake the

[15] The POM is being finalized by SBI and is expected to be ready by May 2016. Its completion, satisfactory to the World Bank, is a condition for disbursement.

promotion of GRPVs financing; (v) strengthening SBI's IT systems to track GRPVs transactions; (vi) carrying out public awareness and advertising campaigns promoting GRPVs financing products; (vii) internalizing lessons learnt during Program implementation and launching a second round of GRPVs financing; and (viii) setting up a loss-offsetting fund.

- *Strengthening the Institutional Capacity of DISCOMs, SNAs and ERCs to contribute to an improved investment climate for GRPV,* by coordinating the administration of a technical assistance program with the help of a program management consultant under the guidance of MNRE and the Steering Committee, which will be: (i) providing capacity building and technical assistance support to selected DISCOMs, regulators and other institutions in respect to solar rooftop power generation, trading and metering; (ii) facilitating the SNAs' communication and stakeholder awareness campaigns on GRPVs systems and the available financing therefor; and (iii) establishing training and accreditation programs for qualified rooftop PV technical inspectors.

33. **Activities under Results Area 2: Market Development of GRPV.** The Program will focus on: (i) developing and implementing market aggregation models for the financing of GRPV installers and rooftop owners; (ii) undertaking marketing and business development for deal origination; (iii) providing financing to SBI clients, eligible as per the POM, for the purchase, including inventory creation, and installation of, GRPVs; and (iv) piloting targeted lending to non-banking financial companies and small and medium enterprises.

34. **Activities under Results Area 3: Expanding GRPV generation.** Under this Results Area, focus will be on installing GRPV systems for aggregate generation capacity of at least 400MW including optional batteries for power storage in accordance with the technical standards issued by MNRE and/or CEA, as applicable. For Capital expenditure (CAPEX) and RESCO models funded through the project mode, GRPV power generation plants with a minimum capacity of 100 kWp per project or system will be eligible under the Program. For the RESCO model funded through the program mode, the aggregate capacity will have to be at least 1MW. SBI will appoint a Lender's Independent Engineer for sub-projects receiving loans equal to or above than US$7.4 million and for sub-projects with overall investment costs equal to or greater than US$14.8 million. For sub-projects below these thresholds, SBI will depute its staff to ensure that all installations comply with Program requirements and standards. In addition, the sub-borrowers of SBI will need to insure all installations to cover appropriate risks, including force majeure events both during and after the construction period, for as long as the loan is outstanding.

35. **Excluded Activities**: The following will be excluded from the Program:

- activities that are likely to have significant adverse impacts that are sensitive, diverse, or unprecedented on the environment and/or affected people;
- activities that involve the procurement of: (i) works, estimated to cost US$ 115 million equivalent or more per contract; (ii) goods, estimated to cost US$ 75 million equivalent or more per contract; (iii) non-consulting services and IT systems, estimated to cost US$60 million equivalent or more per contract; or (iv) consultants' services, estimated to cost US$30 million equivalent or more per contract.

E. Program Financing

36. **The expenditure for the PforR Program will be at least US$915 million,** to be financed by IBRD financing of US$500 million, CTF financing of US$125 million (US$120 million of loan on concessional terms, and US$5 million as grant), an expected GEF grant of 23 million, private and public sector financing of US$265 million (which represents a 30 percent equity contribution against US$625 million of debt), and SBI financing of US$2 million. Table 3 summarizes the first phase of Program financing, which will be supported by the World Bank. SBI will continue with a second phase of the Program with an expected contribution of approximately US$400 million of its own resources and / or through syndication with other banks, subject to success of phase one of the Program and availability of creditworthy pipeline.

Table 3: Phase 1 Program Financing

Source	Amount (US$ million)	% of total
IBRD	500	54.6
CTF (loan & grant)	125	13.7
GEF (grant—pending GEF Council approval)	23	2.5
Private & public sector financing	265	29.0
SBI	2	0.2
Total Program financing	**915**	**100.0**

F. Disbursement-Linked Indicators and Verification Protocols

37. Six DLIs, consistent with the PforR framework and based on the Program's Results Framework and results chain, have been developed in consultation with SBI. The World Bank will disburse against the achievement of these DLIs. They have been identified over five disbursement periods, corresponding to the launch and the five and a half years of the Program implementation period. The details of the DLIs, including the disbursement arrangements and verification protocols, are provided in Annex 3.

- DLI-1: Rooftop solar PV program established at SBI. This relates to Results Area 1, and will be triggered at the launch or establishment of a GRPV Program at SBI. This means SBI will have adopted a POM, satisfactory to the Bank; SBI will have appointed key staff responsible for Program implementation; SBI will have upgraded its information technology modules; and SBI will have advertised and launched the GRPV financing. This DLI responds to the critical need to have the necessary resources, policies, procedures, infrastructure and expertise in place before the Program is launched.

- DLI-2: Technical assistance arrangements for GRPV defined and in place. This relates to Results Area 1, and will be first triggered after SBI signs a contract with consulting firm to provide TA to key stakeholders under terms of reference agreed by the Bank. These include

discoms, SNAs, and SERCs. 24 of India's 29 states have GRPV regulations, but many of the relevant institutions are not able to implement them due to lack of experience or capacity. This indicator will track progress towards improving capacity in the states that will participate in this Program. Disbursement against this DLI in periods two and three will be against satisfactory completion of the first and second phases of the TA and capacity-building. SBI will coordinate the administration of the TA with the help of the consulting firm and make payments to all TA providers. The responsibility for oversight and quality control of TA delivery will rest with MNRE.

- DLI-3: Aggregate amount of loans signed by SBI for the financing of GRPV power generation schemes. This relates to Results Area 2, and will be triggered by loan thresholds described in Annex 3. This operation aims to achieve its goals by increasing availability of debt financing for rooftop owners, third-party aggregators, developers, installers, which is a constraint in India's GRPV market. Access to capital will allow qualified private sector developers and aggregators to buy the required inventory, acquire customers, and push for large-scale deployment of rooftop solar PV systems among customers using different business models.

- DLI-4: Piloting new business models. This also relates to Results Area 2 and will be triggered when SBI makes US$15 million in loans to NBFCs and SMEs for GRPV. NBFCs and SMEs are a riskier category of consumers, but they will be important for the rapid growth of the GRPV market in India. This is intended to be a "success fee" for introducing a new risk category of borrowers into SBI's rooftop portfolio.

- DLI-5: Megawatts of solar (PV) rooftop power generation installed and commissioned under SBI financing. This relates to Results Area 3 and will be triggered upon the verification of GRPV systems installed and commissioned with SBI funding. This is an important indicator for keeping track of the contributions of this Program toward meeting GoI's overall GRPV installation target. Any financing or refinancing of projects commissioned after October 2015 will also be eligible to be counted towards this DLI. Since there may be a lag of about a year between SBI approving a sub-loan and the panels being installed, disbursement of this DLI is expected to start from period 2 against verified GRPV installations from loans made in the prior year. If any capacity is installed prior to year 2, it will be counted towards the achievement of this DLI in year 2. A distinction has been made between the PDO indicator, which monitors the *Capacity of the GRPV Connected to the Grid* and this indicator; because there will be time lag between installation and connection of GRPV systems to the grid.

- DLI-6: Sustainability of the GRPV Program, related to Results Area 1, will be triggered when SBI designs, commits funds for, and announces the second phase program that is funded with its own resources or through syndication with other banks (to be verified as per authorization from competent authority or loans actually signed). The repayment from the sub-borrowers under the Program will be used only for further financing to renewable energy projects. GoI would like to ensure that the capacity developed in SBI through this Program is sustained. It would also like the knowledge that is generated to be replicated across the country. This DLI will incentivize SBI to internalize the lessons from the Program and launch a second phase on a much larger scale and with the possible participation of other commercial banks through syndication.

G. Capacity Building and Institutional Strengthening

38. **An important element of this operation is to enhance the capacity of SBI and to strengthen its internal systems and procedures for GRPV lending.** SBI will establish a PIU for the GRPV Program as a dedicated internal team which will design and implement an internal institutional structure and will develop appropriate policies and procedures for the identification, risk assessment, appraisal and approval of lending to eligible projects under the Program.

39. **SBI needs to develop innovative financial products that are tailored to meet the demand from the GRPV market, and manage risks at the same time.** In particular, SBI branches around the country need to be trained to make loans to the GRPV sector. SBI is preparing a POM that documents the policies and processes to be followed under the Program. As the Program proceeds, it will be updated to capture learning from implementation.

40. **The Program will finance technical assistance to public sector agencies whose performance is critical**. This includes discoms, SNAs, and SERCs that oversee policies, regulations, and processes for connecting rooftop PV systems to the grid. Support targeted to discoms will help them implement GRPV policies, including net metering and gross metering, through institution-wide capacity-building support. SNAs will be assisted to better implement their role of coordinating all renewable energy business in their state, and SERCs will be supported with a regular feedback loop on how the regulations are working in practice, and whether any updates are required. MNRE will lead the technical assistance program, and SBI will coordinate its administration with the help of a firm who will play the role of Project Management Consultant and ensure the delivery of all required support to the targeted agencies.

41. **SBI will contract a package of technical assistance, covering state-wise delivery of training in specific states, and hub-based training in other states, all to be delivered through a Project Management consultant.** The Project Management Consultant will provide a detailed report to MNRE and the World Bank at regular intervals. SBI will be responsible for appointment of the Project Management Consultant (based on TOR agreed with Bank) and payment to all TA providers as instructed by the MNRE-led Steering Committee.

42. **These capacity-building activities have been incorporated into the design of the PforR Program.** The relevant indicators are in the Results Framework under Results Area 1. DLIs 1, 2, and 6 link disbursements with the results of these activities. SBI has put in place procedures and systems to strengthen its in-house capabilities in results monitoring and evaluation, particularly verification of DLIs. SBI will also enhance its capacity to supervise and oversee the Program's environmental and social systems. Six discoms have already expressed interest in receiving support from the Program, and one state is already piloting GRPV. As part of the preparation of the Program, the Bank held a series of discussions with discoms in states with net-metering policies. Additional discoms (from other states) are expected to come forward in subsequent rounds, to signal their interest in receiving support with implementation of their net-metering policies.

III. PROGRAM IMPLEMENTATION

A. Institutional and Implementation Arrangements

43. **Government.** As the lead ministry responsible for GoI solar power targets and the GRSSPP program, MNRE will provide overall policy guidance. MNRE will also play a lead role in coordinating development partners (including coordinating with parallel GRPV programs supported by KfW and ADB) and in ensuring that the lessons from this Program are internalized in other government supported initiatives.

44. **State Bank of India.** SBI will be the borrower and implementing agency for the PforR component of this operation. Under this operation, SBI will lend to GRPV customers, developers, aggregators, and intermediaries that are qualified in terms of technical capacity, relevant experience, and creditworthiness, according to SBI's standards. This access to capital will allow qualified private sector developers and aggregators to buy the required equipment, aggressively acquire customers, and push for large-scale deployment of GRPV systems among customers using different business models. SBI will be responsible for identifying, appraising, and financing eligible investments that meet the criteria set out in the POM. The POM will outline detailed eligibility criteria, technical performance requirements, and appraisal guidelines. The POM is being prepared by SBI; and POM, which is satisfactory to the Bank, will be used for purposes of carrying out the Program.

45. SBI will coordinate the implementation of the TA with the help of a Project Management Consultant firm under the guidance of MNRE. SBI will be responsible for appointment of Project Management Consultant (based on TOR agreed with World Bank) and will make payment to all the TA providers as per the instruction of the MNRE-led Steering Committee.

46. SBI is India's oldest and largest financial services company. It has more than 16,000 branches in the country, 194 foreign offices in 36 countries, and an active customer base of 270 million. While the bank is majority-owned by the GoI, SBI shares are traded on the Bombay Stock Exchange and National Stock Exchange of India. Its Global Depository Receipts are listed on the London Stock Exchange. SBI's size and reach make it an ideal partner to roll out MNRE's GRSSPP program. SBI is interested in participating in the Program because it is an entry-point into an area with significant growth potential. SBI has assured MNRE that, if this Program is successful, it will continue its implementation on a nation-wide basis using its own resources. The Program will be implemented through SBI's branch network, including its Corporate Accounts Group, Mid-Corporate Group, and National Banking Group branches.

B. Results Monitoring and Evaluation

47. SBI, as the implementing agency, is responsible for results monitoring and evaluation (M&E) and arranging verification of the DLIs**,** based on the agreed verification methodology, protocols, and procedures outlined in Annex 3. SBI will engage an independent verification agent to measure the capacity of GRPV connected to the grid on the basis of a representative sample of installations under the Program. The independent verification agent will also estimate, in consultation with the World Bank, the GHG emission reduction as a result of the Program based on an internationally recognized methodology. The DLIs will be verified based on audited

financial reports of SBI and data collected by Independent Verification Agencies. This PforR Program adds value by strengthening M&E through an independent and credible verification system.

C. Disbursement Arrangements

48. **Advances.** The Bank will advance 25 percent of the IBRD and CTF financing, i.e. US$156.25 million, to SBI upon loan effectiveness. When the DLI(s) against which an advance has been disbursed are achieved, the amount of the advance will be deducted (recovered) from the total amount due to be disbursed under such DLI(s). The advance amount recovered by the Bank is then available for additional advances. The Bank requires that the borrower refund any advances (or portion of advances) if the DLIs have not been met (or have been only partially met) by the closing date.

49. **Program Expenditures.** The Program expenditures will include (i) disbursement of loans according to the criteria set out in the POM; (ii) Program establishment and operating costs including PIU costs; (iii) Program advertisement costs, including outreach to aggregators inside and outside India; (iv) SBI capital market fees for advisory services provided to the Program, including out of pocket expenses up to a level consistent with market norms; (v) training and capacity building of all key stakeholders; (vi) engagement of key staff required to operate the Program, various consultancies, dissemination materials, and operating costs; (vii) capitalization of a loss-offsetting fund (also referred to interchangeably as "guarantee facility for non-performing loans"); (viii) audit fee, legal fee and independent verification agent (IVA) charges; and (ix) incentive to staff.

50. Program sub-loans will be considered Program expenditures when SBI makes a disbursement on a sub-loan to its borrowers. There will be no direct transfer of Program funds to the recipients of the TA and capacity-building (such as discoms, SNAs, and SERCs). Program funds will only be transferred to sub-borrowers and consultants or service providers.

51. The eligibility of Program Expenditures of the funds contributed by SBI to the capitalization of the guarantee facility for non-performing loans would be subject to fiduciary arrangements agreed with the Bank, which shall include: (a) the fund should be included in SBI's financial reporting and audits; (b) the fund should be subject to SBI's regular controls; (c) SBI management should exercise satisfactory controls over the use of the fund; (d) the fund should not exceed the equivalent of US$10 million. These will be further detailed in the POM.

52. The amount of World Bank financing under the Program will be equal to or less than the total Program expenditures. If by the end of the Program, the cumulative World Bank disbursements (against DLIs) exceed the total amount of Program expenditures, SBI will be required to refund the difference to the World Bank. Reconciliation and reporting of expenditures in financial statements and reports will be in Indian Rupees (INR). The refund if any, will be made in the currency of the loan and at the exchange rate at which the disbursement was notionally converted into INR on a last-in-first-out (LIFO) method.

53. **Program expenditure before effectiveness.** Program Expenditures incurred after October 15, 2015 but before the date of the IBRD Loan Agreement are eligible, up to an aggregate amount of USD 25,000,000 of the IBRD Loan and USD 6,250,000 of the CTF Loan.

54. **Disbursement arrangements.** The loan funds will be disbursed to an offshore branch of the SBI, against which SBI will create a national account which will reflect credit of an equivalent amount in INR. All disbursements to the eligible projects will be reflected as debit to this account, and all currency of sub-loans will be in INR. The grant funds will be disbursed to onshore branch of SBI and will be converted to INR and credited to separate accounts.

55. SBI is responsible for verifying the achievements of the DLIs through IVAs, based on the agreed verification protocol described below. Disbursements will be made upon verification of the results of the DLIs. Since DLIs 3 and 5, are scalable, the actual disbursement will depend on the verified results.

56. **Verification protocol.** The verification protocol of DLIs builds on existing SBI systems whenever possible. The verification will be conducted annually (see Annex 3 for details).

- DLI-1: Rooftop solar PV program established at SBI. The verification of this DLI will be based on the POM and on other related internal documents announcing the establishment of the Program. MNRE will provide written confirmation to the World Bank that it has reviewed the underlying documentation submitted by SBI on the launch of the Program.

- DLI-2: The implementation of a TA and capacity-building program for discoms, SNAs and SERCs, and other relevant stakeholders. To ensure clarity on this DLI, SBI will agree with the Bank on the TOR for the TA and capacity building program (including the different phases). The verification of this DLI will be based on evidence provided by SBI that contracts for delivery of this program are in place in period 1 and that different phases of the TA are being implemented in the subsequent periods.

- DLI-3: The total value of loans for GRPV approved by SBI. This DLI will be verified annually on the basis of the audited financial reports of the Program. SBI has agreed to create a separate product code for this Program and each eligible sub-loan will use this product code. This will enable Program expenditures as well as outputs to be tracked through SBI's Information System. SBI will submit unaudited reports on expenditures and results on a semi-annual basis and an audited report for the same variables on an annual basis

- DLI-4: The amount of loans approved for NBFCs and SMEs by SBI. This information will be included in the unaudited semi-annual report provided by SBI and verified annually on the basis of the audited financial reports of the Program.

- DLI-5: Total capacity of GRPV installed and commissioned under the Program. This information will be included in the semi-annual report provided by SBI. In addition, an independent verification agent (IVA) to be hired by SBI under TORs agreed with the Bank will verify the installations on the basis of a representative sample.

- DLI-6: Sustainability of the GRPV Program demonstrated by SBI's initiation of the next phase of the Program using its own resources and/or in syndication with other commercial banks. This will be verified based on documents, indicating the commitment, and announcement of the next phase of the Program. MNRE will provide written confirmation to Bank that it has reviewed documentation submitted by SBI on the launch of the phase 2 of the Program that has been approved by a competent authority.

IV. ASSESSMENT SUMMARY

A. Technical (including Program Economic Evaluation)

57. **Strategic relevance.** Using solar energy to meet India's growing electricity demand while reducing pollution and carbon emissions is a top priority for GoI, which has announced an ambitious target of installing 100,000MW solar electricity generation capacity by 2022 (including 40,000MW of GRPV).

58. **Technical soundness.** The Program conforms to international experience and good practice in GRPV: (i) technical standards and specifications; (ii) grid integration of rooftop solar PV; and (iii) business models. The Program will finance technically proven and commercially viable GRPV investments. SBI's POM for the Program will include relevant standards such as the International Electro-technical Commission (IEC) for testing Potential Induced Degradation (which is particularly relevant for India), as well as for mounting structures, energy meters, monitoring, systems inspection, and storage. While the Program's technical qualification criteria could be further fine-tuned, they generally are in line with international standards and account for local regulatory, technical, and climatic conditions.

59. SBI has demonstrated experience and a proven track record in managing green energy programs. In areas such as environment and social management, for which SBI does not have the required skills and expertise, it will complement its own resources with external expertise. SBI will ensure that all investments under the Program are in compliance with GoI policies and regulations. The assessment shows that while the Program could negatively affect the financial situation of discoms, the impact is expected to be minimal in the early years. The proposed operation includes TA and capacity-building that will help discoms and other relevant institutions better manage GRPV. The economic evaluation shows that the proposed Program is economically viable after the consideration of local and global environmental benefits. Annex 4 contains a summary of the technical assessment.

60. **Expenditure framework.** The Program expenditure is expected to be US$915 million (see Table 4 below). This will be financed by: US$500 million from IBRD, US$125 million of concessional loan and grant funding from CTF, and US$23 million of grant funding (pending approval) from GEF, US$2 million equivalent of contributions by SBI, and US$265 million equivalent of equity contributions from public and private sector developers.

Table 4: Program Expenditure Framework

Program Expenditure	Cost (US$ millions)
GRPV system costs (Sub-loans to SBI GRPV clients, and public and private financing towards equity contributions)	890
Technical Assistance and Capacity Building	13
Capitalization of a guarantee facility for non-performing loans	10
Incremental operating expenditures	2
Total	**915**

61. All credit proposals received by SBI under the Program will be subject to due diligence consistent with SBI requirements. SBI will use its internal rating models to assess the acceptability of loan proposals, determine hurdle rates for taking additional exposure, and make pricing decisions.

62. **Efficiency of Program expenditures.** The costs of GRPV systems in India have declined dramatically over the last several years. As of 2015, the cost of large-scale GRPV installations without storage for industrial and commercial customers is in the US$1.1 to US$1.4/watt range,[16] and about 20-25 percent higher for stand-alone residential systems. This compares favorably with costs in other countries such as USA, Germany, and Australia. The market for GRPV in India is highly competitive. Small, medium, and large market players are active in the GRPV space. GRPV developers and aggregators who borrow under the Program will be subject to market pressures, which will help ensure efficient investments. SBI will also critically examine the costs of projects as part of its due diligence when making loans for GRPV under the Program.

63. **SBI Capacity.** SBI has extensive experience in financing utility scale renewable energy programs and has very high capacity, market reach and a strong track record. However, it is unfamiliar with the technical issues of rooftop PV, and with coordinating key stakeholders such as discoms, regulators, and nodal agencies. Therefore risks related to SBI have been rated as "moderate".

64. **Results Framework.** As noted before (see Table 2), the results framework tracks Program contributions to the achievement of (i) GoI's nationwide 40,000MW GRPV target and (ii) GHG emission reduction as part of GoI's NDC commitments. At intermediate levels, the results framework tracks indicators such as establishment of capacity at SBI, success in stimulating lending in the GRPV market, mobilization of additional financing for GRPV, capacity of GRPV orders, and the GRPV capacity installed and commissioned. SBI, as the implementing agency, is responsible for results monitoring and evaluation and arranging verification of the DLIs, based on the agreed verification methodology, protocols, and procedures that are outlined in Annex 3. SBI will pass on the data and information on outcome indicators to MNRE, which consolidates them at the national level.

[16] These cost estimates for large scale GRPV systems are low by international standards. These figures appear in MNRE's white paper on GRPV systems. In order to verify the accuracy and credibility of these figures, the World Bank team spoke to a number of market participants and solar rooftop developers. The cost figures were confirmed by them for large installations, and the additional information provided was that smaller rooftop systems such as residential ones, are about 25% more expensive.

65. SBI has robust internal systems and processes for keeping track of Program expenditures and results. It will create a separate product code for this Program and each sub-loan will use this product code. This will enable Program expenditures as well as outputs to be tracked through SBI's information system. SBI will submit unaudited reports on Program expenses and results on a semi-annual basis and an audited report for the same variables on an annual basis. In addition, DLI's will be verified by IVAs.

66. **Economic evaluation.** The proposed Program is economically viable. The baseline economic rate of return (ERR) against the "thermal generation scenario" (electricity supply using imported coal and diesel self-generation) is 17.5% and the NPV is US$88 million (at discount rate of 12%) (Table 5). These returns include local and global environmental benefits, which add 11 percentage points to the ERR and US$162 million to the NPV.[17]

67. The economic evaluation takes a conservative approach to the estimation of benefits of GRPV in India. In particular, it does not include benefits that are difficult to quantify—(i) energy security, (ii) peak demand management; (iii) macroeconomic benefits through the development solar manufacturing industries, and (iv) employment generation, etc. The analysis also uses conservative assumptions for the increase in coal prices[18] and reduction in GRPV costs.[19] It is hence likely that the ERR of the proposed Program would be higher than estimated if these additional benefits were considered.

[17] The economic analysis has been carried out for 400MW; and the corresponding analysis holds for additional GRPV systems installed.

[18] Assumed to stay at the same level in real terms through the life of the program

[19] Assumed to decline at 10% per year during the investment phase of the program—half the rate of decline seen in recent years.

Table 5: Summary of Economic Analysis

Economic rate of return		
ERR	%	17.5
Rate of Return (excluding global environmental	%	8.1
Rate of Return (excluding local and global environmental benefits)	%	6.5
Composition of NPV (discounted values over 25 year life of investments)		
Cost of Rooftop PV	US$ million	355
Capital cost	US$ million	*288*
O&M	US$ million	*44*
Grid integration costs	US$ million	*24*
Benefits of avoided coal generation	US$ million	
Avoided coal costs	US$ million	*111*
Capacity credit	US$ million	*42*
Benefits of avoided diesel generation	US$ million	
Avoided diesel costs	US$ million	*129*
Capacity credit	US$ million	*0*
NPV (before environmental benefits)	US$ million	**-74**
NPV (incl. local environmental benefits)	US$ million	-56
Value of avoided GHG emissions	US$ million	144
NPV (including environmental benefits)	US$ million	**88**
Lifetime GHG emissions undiscounted	Million tons CO2	13.1
Marginal abatement cost (MAC)	US$/ton	4.3

68. **Reduction in GHG emissions.** The analysis indicates that the Program will reduce GHG emissions by 13.1 million tons over the life of the Program compared to the thermal counterfactual. The marginal abatement cost of GHG emissions of the proposed Program is US$4.3/ton. The Program will help avoid local and environmental damage costs equal to US$162 million compared to the thermal counterfactual.

69. **Sensitivity analysis and risk assessment.** The sensitivity analysis calculates the switching values for important variables such as capital costs, Capacity Utilization Factor (CUF), coal prices, capacity credit, and discount rate at which the ERR of the Program would fall below the 12% hurdle rate (Table 6). The analysis shows that the Program ERR is robust to unfavorable outcomes of some variables such as capital cost, CUF, grid integration costs, and Transmission and Distribution (T&D) loss but less so to others such as the energy curtailment factor. The CUF would have to be 5 percentage points lower and grid integration costs three times higher than the base value for the ERR to fall below the hurdle rate. Likewise, if a quarter of the electricity that is generated by the PV systems cannot be used because of technical or regulatory reasons, the ERR would fall below the hurdle rate. Monte Carlo analysis has been undertaken to assess the impact of more than one input variables combining unfavorably and is presented along with the detailed economic analysis in Annex 11.

Table 6: Switching Values

Input	Unit	Baseline Value	Switching Value
CUF	%	19%	14%
PV Cost	US$/Watt	1.4	1.8
% Annual increase in coal price	%	0%	-61%
Discount Rate	%	12%	6.5%
Grid Integration Cost Factor	Ratio	1	3.0
Energy Curtailment	%	0%	25%

70. **Financial analysis.** The financial analysis of the Program was carried out by valuing the electricity generated from GRPV systems in financial terms (i.e. the prevailing electricity tariff of GRPV customers), adding taxes and duties to the Program costs used in the economic analysis and excluding global and environmental benefits from the Program benefit. This yields a Financial Internal Rate of Return (FIRR) of 22.5% for GRPV customers. The net financial benefits to GRPV customers is US$215 million. A distributional analysis of the Program was carried out by reconciling economic and financial flows of the Program. Details are presented in Annex 11.

B. Fiduciary

71. As per the requirements of Bank policy on 'Program-for-Results financing', a fiduciary systems assessment of the Program was undertaken to (i) assess the capacity of SBI to record, control, and manage all Program resources, and to produce timely, understandable, relevant, and reliable financial information for stakeholders; and (ii) determine the degree to which the planning, bidding, evaluation, contract award, and contract administration arrangements and practices provide a reasonable assurance that the Program will achieve its intended results. In particular, the financial management assessment focused on critical elements of the Program such as planning and budgeting, accounting and financial reporting, treasury management and funds flow, internal controls including internal audit and Program audit, and transparency. The assessment provides a reasonable assurance that the fiduciary arrangements at SBI for the Program are adequate for (i) ensuring the appropriate use of Program funds, (ii) safeguarding assets, and (iii) mitigating and handling risks of fraud and corruption.

72. **Financial management.** The IBRD, CTF, and GEF funds will be disbursed directly into SBI's accounts upon the achievement of the milestones in the DLIs (or as advance against DLIs). SBI will lend the funds to borrowers for GRPV, using its existing financial management (FM) systems, procedures, and controls. FM arrangements are documented in the POM. SBI will be responsible for repaying the loan to the World Bank and therefore assumes all financial risks. SBI will set up separate product codes for the Program within its existing systems to facilitate Program-

specific reporting, and will apply its existing internal and external auditing arrangements to the Program.

73. **Procurement.** Procurement under the Program will mainly be (i) GRPV systems, which consist of solar PV panels, inverters, module mounting structures, trackers, batteries, and charge controllers, and (ii) consulting services for the TA and capacity-building. Procurement will be undertaken by the private sector beneficiaries/aggregators, rooftop owners, and public sector undertakings, in accordance with local commercial practices and public sector procurement practices. They should meet the principles of economy and efficiency. The general rule for aggregators, rooftop owners, and public sector undertakings is to carry out formal/informal market analysis of available products/technologies/providers and then establish long-term mutually beneficial relationships with the providers. As part of the fiduciary systems assessment carried out by the Bank, the commercial practices of the private sector in India were found acceptable in terms of economy and efficiency. The POM will specify the procurement arrangements agreed with the Bank. SBI will require the following from its borrowers for GRPV under the Program: (i) borrowers must provide information on goods, works, and services, cost estimates, and time schedule of the project; (ii) procurement procedures must be in accordance with well-established private sector/public sector commercial practices in India; (iii) payment from SBI to the subproject must be in line with the signed contracts and evidence of project delivery; and (iv) compliance with the Bank's Anti-Corruption Guidelines (ACG) will be established within the aggregator/sub-loan beneficiary as a lending condition.

74. **Procurement risk rating and thresholds.** Based on the fiduciary assessment, the procurement risk rating of this Program is "Moderate." The thresholds for the Program are US$75 million for goods, US$115 million for works/supply and installation, US$60 million for IT systems/non-consulting services, and US$30 million for consulting services. Any individual contract financed by the Program should be equal to or less than the indicated thresholds; contracts of higher values are excluded from the Program.

75. **Governance.** SBI has robust systems that it relies upon to control fraud and corruption risks as defined by the ACG approved for PforR operations and revised in July 2015. Given SBI's critical position in the Indian financial system, it has systems that monitor for issues beyond those defined in the ACGs, and it has put in place systems that closely monitor its various operations in India and abroad. SBI expends significant resources to comply with relevant legislation and banking system regulations, and to assure its shareholders and clients that it is safeguarding its brand and reputation. In addition, SBI has robust staffing in place to handle its complaints and for risk-control systems. SBI can capably absorb the various measures outlined in the ACGs and observe its parameters during implementation of the Program without taking additional actions to address gaps, or requiring assistance from the Bank on this —apart from taking a collaborative approach if the Bank should need to undertake specific audits.

76. **Fiduciary Risk assessment.** Since the GRPV Program is SBI's first World Bank-funded Program, SBI is not familiar with the World Bank's requirements for a PforR loan. SBI is also not familiar with the GRPV sector. Furthermore, the Program will be implemented in multiple locations across the country, through many SBI branches and departments. These factors present challenges and risks to the Program. The following measures have been incorporated in the

Program design to mitigate these risks: (i) a central location for monitoring and control (the Credit Policy and Procedure Department - CPPD); (ii) a POM to ensure a common understanding of the Program boundaries, processes, and requirements; and (iii) development of a Program-specific code in SBI's IT system to keep track of all Program-related transactions and to facilitate financial reporting on the Program. These design features, along with SBI's institutional strengths—availability of skilled staff and good governance and risk management—considerably mitigate Program risks. Hence the fiduciary risk is perceived as "Moderate". The fiduciary risk rating will be reviewed during Program implementation and adjusted as necessary. Annex 5 provides further details on the integrated fiduciary assessment.

C. Environmental and Social Effects

77. An Environmental and Social Systems Assessment (ESSA) of the Program was undertaken by the Bank as per the requirements of Bank policy on 'Program-for-Results financing'. The objective of the ESSA was (i) identify and document potential environmental and social effects of the Program; (ii) review the environmental and social management rules and procedures and institutional responsibilities that will be used by the Program (iii) assess SBI's institutional capacity to manage potential adverse environmental and social issues under the Program; and (iv) recommend specific actions for improving the capacity of the SBI with regard to effective management of environmental, health and safety and social issues during implementation. The assessment concluded that while Program rules and procedures established by SBI are adequate to manage the environmental and social risks associated with the Program, SBI will need to strengthen its capacity to monitor the implementation of these requirements. This will be done by providing training and familiarization with a checklist to at least one staff member in every branch where the GRPV Program will be operated. Specifically, this training will need to be on the use of the screening checklist and capturing and recording the required data. It has been agreed that for projects valued at INR1 billion or above, or individual sub-loans of INR500 million or above, SBI will engage an external Lender's Independent Engineer, whereas for projects below this level, SBI branch staff will carry out the ESSA screening function.

78. **Environmental Effects.** Potential environmental and social impacts for investments to be financed under the Program are expected to be small or modest in intensity, of limited duration and extent, mostly completely reversible, and readily mitigated to acceptable levels with standard cost-effective measures that are commercially available in the country. In general, proposed investments are minor modifications of existing facilities with small and well-known incremental effects. No land acquisition is envisaged under the Program and no land or livelihood impacts are anticipated.

79. The environmental concerns or issues likely to arise from the installation and operation of the GRPV systems are limited and can be mitigated, except for the disposal of damaged or discarded panels, if these are not covered under the take-back policy with the manufacturer/supplier during replacement. If a take-back policy is not available or cannot be ensured throughout the life cycle, discarded or damaged panels will have to be disposed as per the applicable local laws for their safe disposal. Safety of personnel during installation and operation can be ensured through the measures described in ESSA.

80. **Social impacts.** The Program will benefit the areas where GRPV systems are installed through air quality improvement, and will also bring some economic growth and employment opportunities to the local communities. Since all PV panels would be installed on rooftops, the only negative social impacts could be restricted access to rooftop. Hence, a set of recommendations is presented to assess and mitigate any adverse impact.

81. **Environmental and Social Capacity Assessment.** The Program will be governed by national and state level policies that are specific to GRPV. Furthermore, the Program will be subject to the environmental and social requirements laid out in SBI's Green Energy Policy, Renewable Energy policy, and Business Responsibility Policy as well as the POM. While the environmental and social management requirements in these policies and the POM are adequate, SBI needs to strengthen its capacity to monitor the implementation of these requirements by Program beneficiaries. SBI can do this by either mobilizing its qualified staff or engaging additional external expertise.

82. **Stakeholder Consultations.** Stakeholder Consultations involved regular interactions with private aggregators, currently involved in setting up rooftop solar PV systems. The purpose of the interactions was to elicit their views in respect of their experience to date in this emerging business line. This included seeking their feedback on constraints or challenges faced, and interviewing them about their own approach to management of environment and social issues arising in their projects. Consultations were also held to inform the drafting of the ESSA. The ESSA was finalized based on the inputs and feedback received during the consultations.

83. **Gender.** The proposed Program is expected to provide equal opportunity to the entrepreneur in a gender-balanced way so that female-owned businesses and female employees benefit from the opportunities offered. Measures to be undertaken through the TA component that will complement the loan could include: (i) gender focused messages in advertisement campaigns to encourage participation of female owned companies in the Program; and (ii) training and workshops targeted at female GRPV entrepreneurs.

84. The Program will require SBI to establish gender grievance redressal systems consistent with the GoI's Vishakha guidelines. All items previously announced under the Vishakha guidelines have now been passed as an Act of Parliament named as *The Sexual Harassment of Women at Workplace (prevention, prohibition, redressal) Act, 2013*. The Program will follow the Act. To meet the Vishakha guidelines, and to now comply with the Act, SBI will (i) create awareness and communicate the guidelines; (ii) ensure awareness and orientation; (iii) constitute a Complaints Committee in every workplace; (iv) ensure Complaints Committees have both the skill and capacity to carry out their functions; and (v) widely publicize names and contact details of Complaints Committee members.

85. Women will also benefit from increased energy availability. The literature on gender and energy suggests that providing electricity to communities and homes for tasks considered women's work can promote gender equality, women's empowerment, and women's and girls' access to education, health care, and employment. Most gender benefits occur because women are able to carry out their household chores more productively with electricity. Electricity displaces more expensive, inefficient and dangerous candles and kerosene lamps, thereby reducing indoor air

pollution and fire and burn risks while providing higher quality light. Lighting and televisions help improve access to information, the ability to study, and extend the effective working day. Lighting also improves the productivity of many household activities, and has potential benefits for public safety and helps generate income generation opportunities for women. Annex 6 summarizes the ESSA.

86. **Grievance Redress Service (GRS).** Communities and individuals who believe that they are adversely affected as a result of a Bank-supported PforR operation, as defined by the applicable policy and procedures, may submit complaints to the Program grievance redress mechanism or the World Bank's GRS. The GRS ensures that complaints received are promptly reviewed and pertinent concerns addressed. Affected communities and individuals may also submit a complaint to the World Bank's independent Inspection Panel, which determines whether harm occurred, or could occur, as a result of the Bank's failure to comply with its own policies and procedures. For information on submitting complaints to the GRS, please visit http://www.worldbank.org/GRS. For information on submitting complaints to the Inspection Panel, please visit www.inspectionpanel.org.

D. Risk Assessment

87. The overall risk rating of the Program is "Substantial."

Table 7: Risk Assessment Summary

Systematic Operations Risk-Rating Tool (SORT)	
Risk Category	**Rating (H, S, M, L)**
1. Political and Governance	Low
2. Macroeconomic	Low
3. Sector Strategies and Policies	Moderate
4. Technical Design of the Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Moderate
7. Environment and Social	Moderate
8. Stakeholders	Substantial
OVERALL	**Substantial**

88. The overall Program risk is rated Substantial. The main risks to the achievement of the PDO and results and the corresponding mitigation measures are as follows:

- **The risk of the technical design of the Program is substantial.** The main technical risks result from GRPV being a relatively new technology in India and not having a long track record. Consumers lack awareness of GRPV, including of its technical requirements, performance characteristics and overall economics. In addition, the enabling environment for GRPV is not yet in place. The Program's full economic and financial returns depend on some factors outside the implementing agency's control, such as the discoms implementing new metering regulations. The Program includes activities to address these risks, such as consumer campaigns to increase demand for GRPV and capacity building for discoms and other stakeholders, but a substantial residual technical risk remains.

- **The stakeholder risk of the Program is substantial.** The full success of the Program depends on effective collaboration between the stakeholders including MNRE, SBI, GRPV developers and aggregators, industrial, commercial and residential consumers, discoms, state electricity regulatory commissions. Each stakeholder will have to play its role effectively for there to be large uptake of GRPV systems in the country. MNRE will have to administer government subsidies, SERCs will need to enforce net metering and gross metering regulations and discoms will need provide connections to the grid. Discoms that are financial distress in particular may not be willing to co-operate in the roll out of GRPV systems in the country. The Program proposes to address these risks through the establishment of an inter-ministerial Steering Committee and a substantial program of capacity building and awareness raising. Despite these risk management measures, residual stakeholder risk remains.

E. Program Action Plan

89. A Program Action Plan has been agreed with SBI to address the gaps identified in the technical, fiduciary, and environment and social assessments (see Table 8). These actions will improve implementation and help achieve the Program results. More information is provided in Annex 8.

90. SBI has already adopted the Bank's technical, fiduciary, and safeguard requirements in the proposed Program, and has agreed to prepare itself to adopt a few remaining recommended actions during implementation. A POM is being prepared by SBI, and is expected to be ready by May 2016. SBI will implement the Program in accordance with the POM. A POM acceptable to the World Bank is a condition of disbursements. The POM would comprise inter alia of:

- definition of the contours of the Program, including Program activities, results framework, overall budget and list of Program Expenditures;
- Program implementation arrangements, including the setup of a dedicated PIU, identification of key relevant staff, and the allocation of functions and responsibilities within SBI's cadres;
- technical specification of GRPV equipment eligible for financing, the various financing modalities therefor, and loan pricing;
- pro-forma Sub-loan Agreement, setting forth the terms and conditions for GRPV financing, including the technical standards, and applicable procurement thresholds, the Bank's Anti-Corruption Guidelines, and environmental, social and safety requirements consistent with the Program Fiduciary and Environmental and Social Systems and the ESSA;
- screening protocols and procedures for the assessment of clients and the evaluation of their GRPV financing application, including social compliance social, safety and environmental standards set forth in the ESSA;
- terms of reference for the Lender's Engineer;
- DLIs/DLRs verification protocols and arrangements, and the terms of reference for the independent verification agents;
- procedure for the preparation of annual work plans and budgets;
- format of the Program's Interim Unaudited Financial Reports (IUFRs);
- terms of reference for the external auditor preparing the Program's Financial Statements;
- protocols and procedures for the grievance redress mechanism; and

- Program monitoring and evaluation, and reporting requirements.

91. **Technical.** SBI has adopted MNRE's Quality Assurance and Quality Control requirements for this Program. SBI will review the implementation of these requirements, and prepare a report which will be with MNRE and used to inform mid-course corrections to the Program.

92. **Fiduciary.** To manage fiduciary risks, SBI will include the Program in existing Grievance Redressal System and publicize access of the same.

93. **Environmental and social safeguards.** To mitigate environmental and social risks, the POM being prepared by SBI will clearly specify environmental and social safeguard requirements and procedures. SBI will enhance its capacity to monitor the implementation of these requirements and procedures by either mobilizing its qualified staff or engaging additional external expertise.

Table 8: Summary of the Program Action Plan

Action Description	Due Date	Responsible Party	Completion Measurement**
Monitor compliance with MNRE's Quality Assurance and Quality Control requirements, as basic standards applicable to the market.	December 2019	SBI	SBI to (i) prepare and share report on the implementation of MNRE's QA/QC requirements with Bank during the mid-term review of the Program; and (ii) share the report with MNRE
Include the Grid Connected Solar Rooftop Program in the existing complaints handling mechanism of SBI	December 2016	SBI	Information on how to access the grievance mechanism for Grid Connected Solar Rooftop Program publicized on SBI's website
Implement the procedures identified in the ESSA to manage environmental and social issues and risks.	December 2016	SBI	SBI to share information with Bank during the first review mission of the Program

Annex 1: Detailed Program Description

India: Grid-connected Rooftop Solar Program

A. Introduction

1. The Program development objective is to increase installed capacity of GRPV and 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. This will be achieved by setting up a debt fund for GRPV at the State Bank of India (SBI) and implementing a technical assistance (TA) program to address the barriers associated with the adoption of GRPV by different categories of customers in India. The program is expected to contribute to the achievement of the Government of India's (GoI's) target of 100,000MW of solar generation capacity by 2022.

B. Government Program

2. **The Ministry of New and Renewable Energy (MNRE) is the lead ministry responsible for overseeing the achievement of GoI's 100,000MW solar power target.** Under the umbrella of the Jawaharlal Nehru National Solar Mission, MNRE is coordinating the Grid-connected Rooftop Solar Small Power Plants Program (GRSSPP Program) to facilitate the installation of 40,000MW of GRPV in the country by 2022. This target will require investments, both public and private, of more than US$40 billion. MNRE hopes to achieve this through action on multiple fronts: provision of subsidies[1], creation of three separate lending programs to provide rooftop loans through large public sector banks, development of multiple business models, creation of enabling environment for private investment at the state level, and raising consumer awareness.

3. **To promote the uptake of GRPV systems, MNRE is looking to partner with financial institutions in the country to increase the amount of debt financing available for GRPV in the country.** In particular, it has asked the SBI, Indian Renewable Energy Development Agency (IREDA) and Punjab National Bank (PNB) to set up large debt funds for GRPV customers with the assistance of World Bank, KfW and Asian Development Bank, respectively (see Table A1.1). These three debt funds will together provide US$1.5 billion of financing to GRPV customers. This loan volume from three programs only covers 70 percent of the total investment cost, since 30 percent is always required as equity contribution. This implies that the total investment cost to be mobilized with loans of US$1.5 billion, will be US$2.1 billion. The remaining 30 percent, or about US$600 million will be mobilized as equity, in the form of public or private or subsidy co-financing, for all three programs combined. These funds will kick start the debt market for GRPV in the country by helping to pilot new business models, establishing a performance track record for GRPV and helping to further reduce the costs of GRPV through economies of scale. The loan facility funded by KfW at IREDA was launched in late 2015 while the facility to be funded by ADB at PNB is currently under preparation. Since these debt funds have either just been launched or are still under preparation, there is currently little or no data on implementation and results.

[1] The amount allocated for CFA support to GRSSPP was raised from US$90 million to US$770 million in mid-January 2016. The CFA will be provided to residential and institutional customers of GRPV and will cover up to 30% of the cost of GRPV system.

4. In addition, at MNRE's request, all major public sector banks in the country have agreed to cover *residential solar rooftop PV systems in borrowers' home loan requests*. GRPV is now included among sectors that are eligible to be counted under the Priority Sector Lending targets applicable to commercial banks in India, as per the April 2015 directive of the Reserve Bank of India. Under this program, GRPV developers for residential rooftops may borrow up to INR150 million, and households may borrow up to INR1 million.

Table A1.1: GRPV Debt Funds mobilized for GRSSPP

Financial Institution	Partner Agency	Fund Size ($Million)
SBI	World Bank	625
IREDA	KfW	340
Punjab National Bank	ADB	500
Total		**1,465**

5. **The implementation of GRSSPP involves coordination with multiple central and state agencies:** State Nodal Agencies for Renewable Energy (SNAs), Solar Energy Corporation of India (SECI), financial institutions, public sector units, municipal corporations, private sector channel partners, and distribution companies (discoms). SECI, in particular, has been an important partner of MNRE in implementing this program and in channeling the available subsidies. SECI is implementing the program in 16 cities across the country, primarily on government-owned rooftops. It has completed the installation of 22MW of GRPV systems under this program (see Table A1.2) and has approvals to install another 900MW. It has used two business models:[2]

- ***The CAPEX model.*** Bidders bid in INR/$Watt_{peak}$ (Wp) with a ceiling of INR90/Wp. Bidding results to date indicate the lowest price discovery in the CAPEX model to be INR63/Wp for 1.5MW capacity in the state of Maharashtra, with a 30 percent capital subsidy to be provided on this cost.

- ***The Renewable Energy Service Company (RESCO, or third-party ownership) model.*** Electricity can be sold to interested consumers at a maximum levelized tariff of INR6.8/kWh, with an assured subsidy of INR27 million/MW from SECI. The lowest levelized tariff discovered is INR4.7/kWh, again in Maharashtra for a capacity of 1MW.

[2] Prayas. 2014. "Grid Integration of Distributed Solar Photovoltaics (PV) in India: A review of technical aspects, best practices and the way forward."

Table A1.2: Status of Grid-connected SPV Rooftop Projects Approved for States/UTs/SECI/public sector units and Other Government Agencies

	Projects approved under MNRE scheme to SNAs (MW)	National Clean Energy Fund by MNRE (MW)	In principle approval (MW)	Total sanctioned and approved in principle (MW)	Total achievement (MW)
States	51	54	310	415	73
SECI		150	750	900	22
Ministry of Railways	0	53	0	53	0
Public sector units	0	60	0	60	5
Total	**51**	**317**	**1060**	**1,428**	**100**

Source: MNRE 2015

6. **GRSSPP has successfully supported the customer-owned and third-party models of GRPV.** However, the scale of overall installations under the program has remained relatively modest at about 99MW as of August 2015, with another 1426MW currently at different stages of commissioning. The program offers up to a 70 percent capital subsidy for installing GRPV in special category states such as Sikkim, Uttaranchal, Himachal Pradesh, Lakshadweep, Andaman and Nicobar Islands and 30 percent subsidy for eligible customer categories in the remaining states. These subsidies are available to residential building and not for profit service delivery institutions such as school, colleges, clinics and hospitals. The remainder of rooftop PV projects would have no subsidies. However, a number of other incentives are available to commercial and industrial consumers to encourage investment in GRPV: (i) Accelerated Depreciation benefits for industrial and commercial buildings; (ii) customs duty concessions and excise duty exemptions on equipment; and (iii) 10 years of tax holiday.

7. **The proposed IBRD-financed PforR Program is closely linked with the Government program, and provides further value-added contributions.** To support MNRE's efforts to increase the availability of debt for funding GRPV, the World Bank has been requested to lend US$500 million of IBRD funding and US$120 million of CTF funding and also provide a US$5 million CTF grant to the State Bank of India (SBI). This proposed operation adds value to the MNRE's GRSSPP Program by providing concessional Bank funding for a lending program for rooftop solar PV that can target all categories of customers: commercial, industrial and institutional. In Phase Two, SBI will continue to operate the program with its own funding and/ or syndication with other banks (subject to success of phase one of the Program and availability of creditworthy pipeline) and will draw on the experience and expertise it has developed, to offer advisory services or syndication opportunities to other local banks to encourage them to enter the rooftop PV debt market. .

8. **Investments under the Program are required to conform to all technical requirements mandated by the state electricity regulatory commissions (SERCs) and India's CEA, the nodal national agency for setting up technical regulations in the country.** These requirements include (i) Technical Standards for Connectivity of the Distributed Generation Resources, Regulations 2013, issued by the CEA, which follows global best standards for power quality (DC injection, harmonics, and flicker) and safety in terms of anti-islanding; (ii) The 2013 draft

amendments to CEA's "Installation and Operation of Meters" Regulation 2006, which regulates metering standards for distributed solar generation; and (iii) CEA/MNRE specifications on the design qualifications and quality standards for both crystalline and thin-film modules.[3] Furthermore, the program requires that installation of all bidirectional meters be carried out in consultation with the distribution company.

9. **The program supports all the major business models of GRPV:**

- Customer-owned (CAPEX) models, in which the solar rooftop facility is owned, operated, and maintained by the consumer(s), or the facility is owned by the consumer but operated and maintained by a third party.

- Third-party-owned (operating expenditure) models, in which the customer incurs only operating expenditures and makes no up-front capital investment. This can be in two versions:
  - Build-own-operate-maintain (BOOM) model. The consumer does not invest in the PV system; the system belongs to a third party who meters and sells the electricity generated to the consumer. The third party enters into a power purchase agreement with the customer that covers the cost of the capital investment, a return on capital, and the operations and maintenance (O&M) expenditures incurred over time. The customer is able to lock in the cost of power over a long period, with most customers also buying some supplemental electricity from the discom. The third party charges a unit price that is lower than the discom's.
  - Build-own-operate-transfer (BOOT) model. The third-party investor makes the up-front investment in the rooftop system, and enters into a long-term agreement with a rooftop owner to sell the rooftop owner power for a certain number of years. However, the sale arrangement lasts for less than the life of the system; once the third party owner has recovered the cost of capital and a suitable rate of return, the third party owner transfers the ownership of the system to the rooftop owner at a pre-agreed price. Thereafter, the rooftop owner is responsible only for O&M and may choose to retain the services of the original third-party company or may find alternative arrangements for such O&M requirements.

- Rooftop rental model. The third party locates solar panels on a rented rooftop space. The third party sells all the output directly to the discom for an agreed rate per kWh on a long-term basis and under a gross metering model.

- Utility-owned model. The discom may install, own, operate, and maintain the system, or it may retain ownership but delegate the installation and O&M to a third party

- Non-bank financial company (NBFC) model. This involves a partnership of two separate third parties: first the NBFC, which has a license to make consumer loans, and second, a business that is looking to invest in solar panels. They work with rooftop installers to find customers interested in the BOOT model. The customers take a loan from the NBFC to buy the panels in installments over, say, 10 years from the investor. Small SMEs and micro-enterprises are

[3] Prayas (2014)

expressing interest in this model. They are already customers of the NBFC, which understands their risk and has made other loans to them to finance plant and machinery, for example, and they will not be able to qualify for loans from large lending institutions. This NBFC model is an attractive way to reach the lower-income (and much riskier) segments of the commercial and industrial customer base. The NBFC may present itself as an aggregator and approach the commercial lenders with a 1MW deal pipeline of SMEs and microenterprises to which it is willing to lend to for their rooftop PV systems. The NBFC takes the loan from the commercial lenders and passes it on to the SMEs, who then gradually buy their rooftop PV system from the NBFC's partner company, which is able to pay up-front for the panels and take a large tax benefit

C. PforR Program Description

10. The duration of the Program will be five and a half years, with a start date of May 2016 and end date of November 2021. The PforR Program will finance activities in three results areas on a countrywide eligibility basis: (i) strengthening institutional capacity for GRPV, (ii) developing a GRPV market, and (iii) expanding GRPV generation capacity.

Activities under results area 1, Strengthening Institutional Capacity for GRPV:

- *Strengthening the Institutional Capacity of SBI,* through: (i) establishing a PIU for the Program and mobilizing staff in other SBI departments and/or branches in support of its GRPVs business line; (ii) setting up SBI internal policies and procedures for loan origination, risk assessment and loan approval, (iii) providing training to SBI staff on GRPVs financing; (iv) providing incentives to SBI staff to undertake the promotion of GRPVs financing; (v) strengthening SBI's IT systems to track GRPVs transactions; (vi) carrying out public awareness and advertising campaigns promoting GRPVs financing products; (vii) internalizing lessons learnt during Program implementation and launching a second round of GRPVs financing; and (viii) setting up a loss-offsetting fund.

- *Strengthening the Institutional Capacity of DISCOMs, SNAs and ERCs to contribute to an improved investment climate for GRPV,* by coordinating the administration of a technical assistance program with the help of a program management consultant under the guidance of MNRE and the Steering Committee, which will be: (i) providing capacity building and technical assistance support to selected DISCOMs, regulators and other institutions in respect to solar rooftop power generation, trading and metering; (ii) facilitating the SNAs' communication and stakeholder awareness campaigns on GRPVs systems and the available financing therefor; and (iii) establishing training and accreditation programs for qualified rooftop PV technical inspectors.

Activities under results area 2: Market Development of GRPV.

- The Program will focus on: (i) developing and implementing market aggregation models for the financing of GRPV installers and rooftop owners; (ii) undertaking marketing and business development for deal origination; (iii) providing financing to SBI clients, eligible as per the POM, for the purchase, including inventory creation, and installation of, GRPVs;

and (iv) piloting targeted lending to non-banking financial companies and small and medium enterprises.

Activities under results area 3: Expanding GRPV generation.

- Under this Results Area, focus will be on installing GRPV systems for aggregate generation capacity of at least 400MW including (optional) batteries for power storage in accordance with the technical standards issued by MNRE and/or CEA, as applicable. For CAPEX and RESCO models funded through the project mode, GRPV power generation plants with a minimum capacity of 100kWp per project or system will be eligible under the Program. For the RESCO model funded through the program mode, the aggregate capacity will have to be at least 1MW. SBI will appoint a Lender's Independent Engineer or depute its staff, as per threshold of the investment size agreed as the cut-off point in ESSA, to ensure that all installations comply with Program requirements and standards. In addition, the borrower will need to insure all installations to cover appropriate risks, including force majeure events both during and after the construction period, for as long as the loan is outstanding.

11. **Technical Assistance.** The Program will support targeted TA to remove barriers to large-scale adoption of GRPV in the business models, marketing infrastructure, and institutional capacity of discoms (as noted under Results Area 1). The TA will be provided to the main stakeholders that are involved in the implementation of GRPV in the country—discoms, SNAs, state power departments, and SERCs—for the implementation of net-metering or gross-metering policies and to increase consumer awareness about GRPV, as well as to assist with the creation of large numbers of trained and accredited rooftop PV engineers and certifiers whose services lenders will require for the smooth functioning of the program.

12. **The proposed TA services are to be offered on five tracks.** (i) discom, (ii) SNA, (iii) state regulatory agency, (iv) communication to and awareness raising of various customer categories, and (v) technical rooftop certifier training. SBI will undertake all procurement and will make payments for TA and consultancy services delivered, as per instructions given by MNRE / Steering Committee.

13. **Detailed arrangements on the loss-offsetting fund (also called "guarantee facility for non-performing loans) will be documented in the POM.** The eligibility of Program Expenditures of the funds contributed by SBI to the capitalization of the guarantee facility for non-performing loans would be subject to fiduciary arrangements agreed with the Bank, which shall include: (a) the fund should be included in SBI's financial reporting and audits; (b) the fund should be subject to SBI's regular controls; (c) SBI management should exercise satisfactory controls over the use of the fund; (d) the fund should not exceed the equivalent of US$10 million.

D. Institutional and Implementation Arrangements

14. **Government.** As the lead ministry responsible for GoI solar power targets and the GRSSPP program, MNRE will provide overall policy guidance. MNRE will also play a lead role in coordinating development partners (including coordinating with parallel GRPV programs supported by KfW and ADB) and in ensuring that the lessons from this program are internalized in other government-supported programs.

15. **State Bank of India.** SBI will be the borrower and implementing agency of this operation. SBI is India's oldest and largest financial services company. It has more than 16,000 branches in the country and 194 foreign offices in 36 countries, and an active customer base of 270 million. While the bank is majority-owned by the GoI, SBI shares are traded on the Bombay Stock Exchange and National Stock Exchange of India. Its Global Depository Receipts are listed on the London Stock Exchange. SBI's size and reach make it an ideal partner to roll out MNRE's GRPV program.

16. Under this operation, SBI will lend to end users/intermediaries that are qualified in terms of technical capacity, relevant experience, and creditworthiness, according to SBI's standards. This access to capital will allow qualified private sector developers and aggregators to buy the required inventory, aggressively acquire customers, and push for large-scale deployment of rooftop solar PV systems among customers using different business models. SBI will be responsible for identifying, appraising, and financing eligible investments that meet the criteria to be set out in the POM. For projects, with total cost equaling or exceeding INR1 billion or with sub-loans equaling or exceeding INR500 million, SBI engage a qualified lender's engineer. For projects with total cost and loan below these thresholds, SBI staff will carry out inspection and reporting functions with a checklist. All installations will have to meet technical standards issued by MNRE and/or CEA, as applicable, which will be specified in the POM. SBI will also coordinate the implementation of TA to the main stakeholders that are involved in the implementation of GRPV in the country, with the help of a Project Management Consultant and under the guidance of MNRE—discoms, SNAs for renewable energy, state power departments, and ERCs.

Annex 2: Results Framework and Monitoring

India: Grid-connected Rooftop Solar Program

Program Development Objective: The PDO is to increase installed capacity of Grid-connected Rooftop Solar PV (GRPV) and 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.

PDO Level Results Indicators	Core	DLI	Unit of Measure	Baseline	Target Values					Frequency	Data Source/Methodology	Responsibility for Data Collection
					Yr 1	Yr 2	Yr 3	Yr 4	Yr 5			
PDO Indicator 1: Capacity of GRPV connected to the grid	☐	☐	MW	0	0	50	100	150	250	Annual	Report commissioned by SBI which will measure on GRPV connections based on a representative sample	SBI
PDO Indicator 2: Reduction of carbon emissions	☐	☐	thousand tons	0	0	100	300	700	1200	Annual	Report commissioned by SBI which will use an internationally recognized methodology to estimate GHG emission reductions	SBI
Intermediate Results Area 1: Improved institutional capacity for GRPV												
Intermediate Results Indicator 1: Launch of Rooftop Solar PV program at SBI and development of internal procedures for the identification, risk assessment, appraisal and approval of rooftop solar projects	☐	**X**		0	Done					One time	SBI	SBI

Intermediate Results Indicator 2: Implementation of TA and capacity building program for discoms, SNAs, SERCs etc.	☐	X		0	Contract signed with consultant	Phase 1 of TA completed	Phase 2 of TA completed			Annual	SBI	SBI
Intermediate Results Indicator 3: Phase 2 of SBI's Rooftop Solar PV program launched	☐	X		0	NA	NA	NA	NA	Phase 2 of SBI's program designed allocated and announced	Year 5 or upon completion of Program	SBI	SBI
Intermediate Results Area 2: Market development of rooftop solar PV												
Intermediate Results Indicator 4 : Amount rooftop solar loans approved by SBI	☐	**X**	(US$ million)	0	100	250	400	600	625	Annual	SBI	SBI
Intermediate Results Indicator 5: Amount of additional equity financing from private sources mobilized by SBI	☐	☐	(US$ million)	0	40	105	171	257	265	Annual	SBI	SBI
Intermediate Results Indicator 6: Capacity (MW) of GRPV orders	☐	☐	MW	0	75	150	300	450	600	Annual	SBI	SBI

Intermediate Results Area 3: Expanding GRPV generation												
Intermediate Results Indicator 7 : Capacity of rooftop solar installed and commissioned under the program (MW)[1]		X	MW	0		100	200	350	500	Annual	Independent Verification Agent	SBI

[1] The Results Framework target for GRPV installed and commissioned is not the same as DLI 5. This is because DLI5 does not reflect the full extent of capacity installations expected by Year 5.

Annex 3: Disbursement-Linked Indicators, Disbursement Arrangements, and Verification Protocols

India: Grid-connected Rooftop Solar Program

Disbursement-Linked Indicator Matrix

	Total Financing Allocated to DLI	As % of Total Financing Amount	DLI Baseline	Indicative timeline for DLI achievement				
				2016/2017 Year 1	2017/2018 Year 2	2018/2019 Year 3	2019/2020 Year 4	2020/2021 (up to Closing date) Year 5
DLI 1 Establishing a Rooftop Solar PV Program at the State Bank of India.			**N/A**	Rooftop Solar PV Program established at SBI				
Allocated amount (US$ Millions)	5.0	0.8%		5.0				
DLI 2 Technical assistance to key stakeholders for the implementation of MNRE's GRPV program[1]			**N/A**	Technical assistance arrangements for GRPV defined and in place	Phase 1 of the technical assistance for GRPV has been implemented	Phase 2 of the technical Assistance for GRPV has been implemented		
Allocated amount (US$ Millions)	13.0	2%		3.0	5.0	5.0		

[1] This DLI is expected to be financed out of the GEF Grant to be processed as an additional financing in support of the Program provided the proposal gets endorsed by the GEF Chief Executive Officer (CEO). The DLI shown in this table is provided for information purposes to evidence the complementarity of the Program co-financing support.

	Total Financing Allocated to DLI	As % of Total Financing Amount	DLI Baseline	Indicative timeline for DLI achievement				
				2016/2017 Year 1	2017/2018 Year 2	2018/2019 Year 3	2019/2020 Year 4	2020/2021 (up to Closing date) Year 5
DLI 3 Aggregate amounts of loans signed by SBI for the financing of solar (PV) rooftop power generation schemes.			0	Minimum US$ 50 million in loans for PV rooftop installations signed	Minimum US$ 10 million in loans for PV rooftop installations, over and above Year 1 loans, signed	Minimum US$ 10 million in loans for PV rooftop installations, over and above Year 2 loans, signed	Minimum US$ 10 million in loans for PV rooftop installations, over and above Year 3 loans, signed	
Allocated amount (US$ Millions)[2]	298.75	46.2%		100.0	75.0	75.0	48.75	
DLI 4 Piloting new business models[3].			N/A					[4]Minimum US$ 15 million in loans for PV rooftop installations to SMEs and/or NBFCs signed
Allocated amount (US$ Millions)	10.0	1.5%						10.0

[2] Amounts reflected are forecast estimates. For the applicable disbursement formula, see "Bank Disbursement Table" below.

[3] This DLI is expected to be financed out of the GEF Grant to be processed as an additional financing in support of the Program provided the proposal gets endorsed by the GEF CEO. The DLI shown in this table is provided for information purposes to evidence the complementarity of the Program co-financing support.

[4] This DLI is not allocated to any particular Year of implementation.

	Total Financing Allocated to DLI	As % of Total Financing Amount	DLI Baseline	Indicative timeline for DLI achievement				
				2016/2017 Year 1	2017/2018 Year 2	2018/2019 Year 3	2019/2020 Year 4	2020/2021 (up to Closing date) Year 5
DLI 5 Megawatts of solar (PV) rooftop power generation installed and commissioned under SBI financing.			0		Minimum 25MW installed and commissioned	Minimum 25MW capacity installed and commissioned over and above installed/commissioned capacity up to Year 2	Minimum 25MW capacity installed and commissioned over and above installed/commissioned capacity up to Year 3.	Minimum 25MW capacity installed and commissioned over and above installed/commissioned capacity up to Year 4.
Allocated amount (US$ Millions)[5]	300.0	46.4%			75.0	75.0	75.0	75.0
DLI 6 Sustainability of GRPV program								SBI has launched the second phase of the program
Allocated amount (US$ Millions)	20.0	3.1%						20.0
Total Financing Allocated:	**646.75[6]**	**100%**		**108.0**	**155.0**	**155.0**	**123.75**	**105**

[5]Amounts reflected are forecast estimates. For the applicable disbursement formula, see "Bank Disbursement Table" below.
[6] In addition to the Total Financing Allocated, front-end fee of US$1.25 million for IBRD Loan will also be financed by IBRD.

DLI Verification Protocol Table

#	DLI	Definition/ Description of achievement	Scalability of Disbursements. (Yes/ No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
1	Prior Result and/or Year 1: *"Rooftop Solar PV Program established at SBI"*	"Established" means: (i) SBI approved and adopted its POM; (ii) SBI appointed (i.e. identified, seconded or hired) the key staff responsible for Program implementation as per the approved POM. Key staff: are: Chief General Manager – CPPD, Deputy General Manager – CPPD, Assistant General Manager - CPPD. (iii) upgraded its IT modules for Program monitoring and evaluation. "Upgraded" means that the IT modules have capabilities to gather information covering the Program indicators, and are up and running; and (iv) advertised/launched the rooftop solar PV financing	NO	SBI	MNRE	MNRE to provide written confirmation to Bank that it has reviewed documentation submitted by SBI.
2	Year 1: "*Technical assistance arrangements for GRPV defined and in place"*	"Defined" and "in place" means that the contract between SBI and a consulting company providing for TA to key stakeholders under TORs agreed with the Bank (including clearly identified deliverables) has been duly signed.	NO	SBI / Consultancy Contractor	MNRE	MNRE to provide the World Bank with written confirmation of Consultancy Contract signed in accordance with acceptable TORs (vetted by MNRE). & contract review by Task Team.

#	DLI	Definition/ Description of achievement	Scalability of Disbursements. (Yes/ No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
	Years 2 & 3: *"Phase [X] of the technical assistance for GRPV has been implemented"*	*"Phase [X]…… implemented"* means that all deliverables for that particular *Phase [X]* of the technical assistance support, as the same were defined under the TORs for said consulting firm, have been dully achieved/performed/delivered to the satisfaction of the Bank and MNRE.	NO	SBI /Consultancy Contractor	MNRE	MNRE to provide the World Bank with written confirmation of satisfactory delivery of consultancy activities agreed for respective phase signed in accordance with acceptable TORs (vetted by MNRE). & contract review by Task Team
3	Year 1: *"Minimum US$ 50 million in loans for PV rooftop installations signed."*	Minimum threshold are pass/fail thresholds. Thereafter the DLI becomes scalable. Amounts of loans signed in the previous years shall not be considered, nor carried forward for future computation of disbursements (except those signed before in Year 1 will shall be consider for Year 1 minimum threshold and disbursements). *"above Year X"* means that for any Year Y, the amount of loan signed before and during the prior Year X, shall not be computed in the calculation of the new aggregate of additional loans. *"Year"* means the fiscal year of India, starting on April 1 of each year and concluding on March 31 of the next following year, corresponding to the financial cycle indicated in the respective DLR column.	YES	SBI	SBI External Financial Auditors	External Financial Auditors to carry out certification as part of their TORs (to be agreed with the Bank)
	Years 2, 3 & 4: *"Minimum US$ 10 million in loans for PV rooftop installations, over and above Year [X] loans, signed"*		YES	SBI	SBI External Financial Auditors	External Financial Auditors to carry out certification as part of their TORs (to be agreed with the Bank)

#	DLI	Definition/ Description of achievement	Scalability of Disbursements. (Yes/ No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
4	Anytime During Implementation: *"Minimum US$ 15 million in loans for PV rooftop installations to SMEs and/or NBFCs signed"*	*"*SMEs" means Small and Medium Enterprise as per the definitions provided by the Ministry of Micro, Small and Medium Enterprises of the Government of India. "NBFCs" means a Non-Banking Financial Companies which are registered under the Companies Act, 1956 and engage in the business of loans and advances, acquisition of shares/stocks/bonds/debentures/securities issued by GoI or local authorities or other marketable securities of a like nature, leasing, hire-purchase, insurance business, chit business, but does not include any institution whose principal business is that of agriculture activity, industrial activity, purchase or sale of any goods (other than securities) or providing any services and sale/purchase/construction of immovable property.	NO	SBI	SBI External Financial Auditors	External Financial Auditors to carry out certification as part of their TORs (to be agreed with the Bank)
5	Year 2: "*Minimum 25MW installed and commissioned"*	*"over and above the capacity installed and commissioned up to Year X"* means that for any Year Y, the solar (PV) rooftop power generation capacity installed and commissioned before and during the prior -- Year X shall not be computed in the calculation of the newly added generation capacity commissioned and installed during Year Y.	YES	SBI	Independent verification agent (IVA) to be hired by SBI under TORs agreed with the Bank	Audit will be carried out by the IVA on a representative sample basis as agreed on the TORs.
	Years 3, 4 & 5: "*Minimum 25MW capacity installed and commissioned over and above installed/commission capacity up to Years 2, 3 and 4 respectively."*		YES	SBI	IVA to be hired by SBI under TORs agreed with the Bank	Audit will be carried out by the IVA on a representative sample basis as agreed on the TORs

#	DLI	Definition/ Description of achievement	Scalability of Disbursements. (Yes/ No)	Protocol to evaluate achievement of the DLI and data/result verification		
				Data source/ agency	Verification Entity	Procedure
6	Year 5: *"SBI has launched the second phase of the program"*	*"launched"* means SBI has: (i) announced the continuation of the program beyond the financial support by the CTF/GEF and IBRD funding to: (A) its branches (through internal communication); and (B) the general public (through roadshows, or general publications/advertising); (ii) made any necessary adjustments to the POM to be utilized in the subsequent phase of the Program (not financed by the Bank); (iii) committed approximately US$400 million (whether of its own resources or in syndication with other banks and subject to success of phase one of the Program and availability of creditworthy pipeline) beyond the amounts facilitated by the IBRD Loan, the CTF Loan and/or the GEF Grant (to be proved as per authorization from competent authority or loans actually signed).	NO	SBI	MNRE	MNRE to provide written confirmation to Bank that it has reviewed documentation submitted by SBI.

Bank Disbursement Table

#	DLI	IBRD financing allocated to the DLI	CTF Loan/Grant allocated to the DLI	GEF Grant allocated to the DLI [30]	Of which Financing available for Prior results	Deadline for DLI Achieve-ment	Minimum DLI value to be achieved to trigger disbursements of Bank Financing	Maximum DLI value(s) expected to be achieved for Bank disburse-ments purposes	Determination of Financing Amount to be disbursed against achieved and verified DLI value(s)
1	Rooftop Solar PV Program established at SBI		US$5 million (Grant)		$5 million (Grant)	March 31, 2017	N/A	N/A	All/Nothing
2.	Technical assistance arrangements for GRPV defined and in place			US$3 million	N/A	March 31, 2017	N/A	N/A	All/Nothing
	Phase 1 of the technical assistance for GRPV has been implemented			US$5 million	N/A	March 31, 2018	N/A	N/A	All/Nothing
	Phase 2 of the technical Assistance for GRPV has been implemented			US$5 million	N/A	March 31, 2019	N/A	N/A	All/Nothing

[30] GEF Grant is pending GEF Council's approval and will be processed as additional financing if/when this is approved. The respective GEF DLIs are shown in this table for information purposes in order to evidence the complementarity of the Program's co-financing sources.

#	DLI	IBRD financing allocated to the DLI	CTF Loan/Grant allocated to the DLI	GEF Grant allocated to the DLI [31]	Of which Financing available for Prior results	Deadline for DLI Achieve-ment	Minimum DLI value to be achieved to trigger disbursements of Bank Financing	Maximum DLI value(s) expected to be achieved for Bank disburse-ment purposes	Determination of Financing Amount to be disbursed against achieved and verified DLI value(s)
3	Minimum US$ 50 million in loans for PV rooftop installations signed	US$198.75 million	US$100 million (Loan)		N/A	March 31, 2017	US$ 50 million equivalent in sub-loans	Approx. US$382 million to US$650 million equivalent in sub-loans	US$500,000 from CTF (Loan) and US$500,000 from IBRD per US$1 million equivalent of signed loans
	Minimum US$ 10 million in loans for PV rooftop installations, over and above Year 1 loans, signed				N/A	March 31, 2018	See DLI column		US$400,000 from CTF (Loan) and US$150,000 from IBRD per US$1 million equivalent of signed loans
	Minimum US$ 10 million in loans for PV rooftop installations, over and above Year 2 loans, signed				N/A	March 31, 2019	See DLI column		US$200,000 from CTF (Loan) and US$350,000 from IBRD per US$1 million equivalent of signed loans
	Minimum US$ 10 million in loans for PV rooftop installations, over and above Year 3 loans, signed				N/A	March 31, 2020	see DLI column		US$550,000 from IBRD per US$1 million equivalent of signed loans

[31] GEF Grant is pending GEF Council's approval and will be processed as additional financing if/when this is approved. The respective GEF DLIs are shown in this table for information purposes in order to evidence the complementarity of the Program's co-financing sources.

#	DLI	IBRD financing allocated to the DLI	CTF Loan/Grant allocated to the DLI	GEF Grant allocated to the DLI [32]	Of which Financing available for Prior results	Deadline for DLI Achieve-ment	Minimum DLI value to be achieved to trigger disbursements of Bank Financing	Maximum DLI value(s) expected to be achieved for Bank disburse-ments purposes	Determination of Financing Amount to be disbursed against achieved and verified DLI value(s)
4	Minimum US$ 15 million in loans for PV rooftop installations to SMEs and/or NBFCs signed			US$10 million	N/A	Closing Date	US$ 15 million equivalent in sub-loans	US$ 15 million equivalent in sub-loans	All/Nothing
5	Minimum 25MW installed and commissioned	US$300 million			N/A	March 31, 2018	25MW installed and commissioned	400MW installed and commissioned	$750,000 per MW installed and commissioned
	Minimum 25MW capacity installed and commissioned over and above installed/commission capacity up to Year N/A2				N/A	March 31, 2019	See DLI column		
	Minimum 25MW capacity installed and commissioned over and above installed/commission capacity up to Year 3				N/A	March 31, 2020	See DLI column		
	Minimum 25MW capacity installed and commissioned over and above installed/commission capacity up to Year 4				N/A	Closing Date	See DLI column		
6	SBI has launched the second phase of the program		$20 million (Loan)		N/A	Closing Date	N/A	N/A	All/Nothing

[32] GEF Grant is pending GEF Council's approval and will be processed as additional financing if/when this is approved. The respective GEF DLIs are shown in this table for information purposes in order to evidence the complementarity of the Program's co-financing sources.

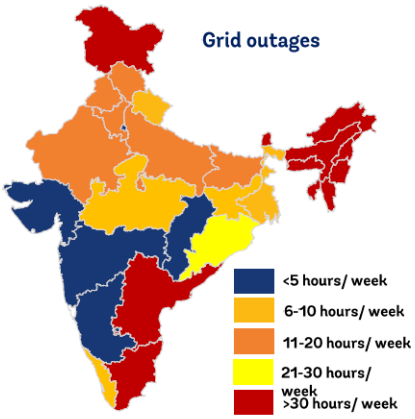
Annex 4: Technical Assessment

India: Grid-connected Rooftop Solar Program

A. Strategic relevance

1. GoI has set an ambitious goal of providing uninterrupted power for all homes, industrial and commercial establishments and adequate power for farmers by 2022 through its 24x7 Power for All program. The Government of India (GoI) wants a growing share of the country's electricity to come from renewable energy. Currently, India relies on coal as the fuel source for two thirds of its electricity requirements and is the world's third largest carbon emitter, despite relatively low per capita emissions. Consumers experience widespread grid outages in many parts of the country (Figure A4.1). Coal based electricity generation also causes local environmental problems. According to the World Health Organization, 13 of the 20 most polluted cities in the world are in India. Based on its massive energy requirements to match its economic growth aspirations, GoI recognizes that it must supplement non-renewable sources with cleaner and abundant renewable sources. Therefore, the GoI has announced plans to quadruple India's renewable energy capacity to 175 gigawatts by 2022, which is expected to require up to US$170 billion in investments in generation alone, Renewable energy is increasingly seen as an important contributor to meeting this energy demand in an environmentally sustainable way and to India's energy security.

Figure A4.1: Grid outages



2. Solar power is India's largest renewable energy resource. Solar PV has emerged as a promising long-term option to meet the growing energy demand in India while addressing the adverse environmental impacts of conventional fuels. Since India lies in the high solar insolation region, it is endowed with huge solar energy potential with most of the country having about 300 days of sunshine per year with annual mean daily global solar radiation in the range of 3.5-6.5 kWh/m2/day. Solar power can help India meet its growing electricity demand as well as foster energy security by reducing dependence on imported fossil fuel such as coal and diesel. The confluence of declining cost trends in solar photovoltaic (PV) power generation (mainly through dramatic declines in solar panel prices) and innovations in energy storage technology that are putting downward pressure on battery prices, offer exciting opportunities for India.

3. Aided by government policy and rapidly declining costs, the installed solar generation capacity in India has increased from less than 2MW in 2009 to about 5,000MW in 2015 (Figure A4.2 & A4.3). From 2009, successive bids under different central and state government schemes have helped bring down the cost of generation. With the recent most bid of Rs4.6 per unit for a utility-scale solar PV project in Andhra Pradesh, solar bids have fallen by more than 70 percent from 2010 levels. While this growth has mainly been driven by ground-mounted solar, GRPV is also increasingly gathering momentum. In general, GRPV is several years behind in terms of the maturity of ground-mounted solar in terms of the level of interest, comfort with the technology, availability of finance and the wider ecosystem.

FigureA4.2: Tariff for Solar PV projects determined by Central Electricity Regulatory Commission

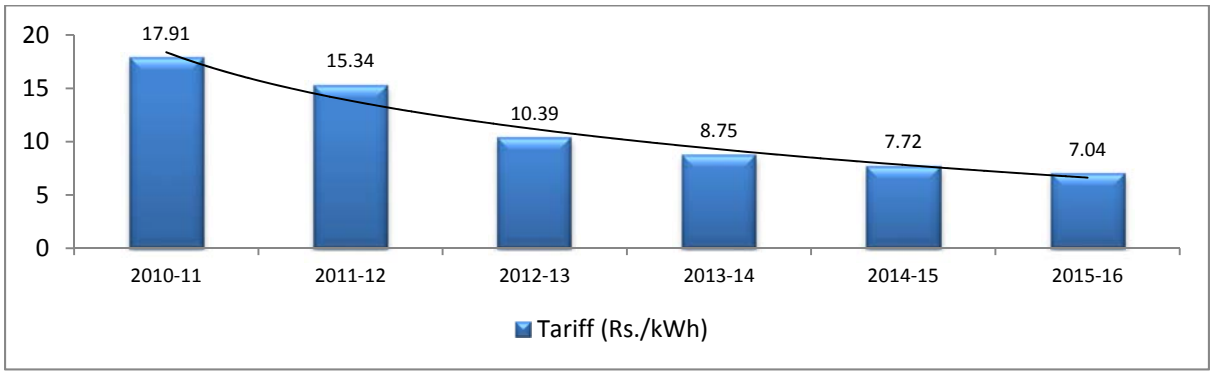
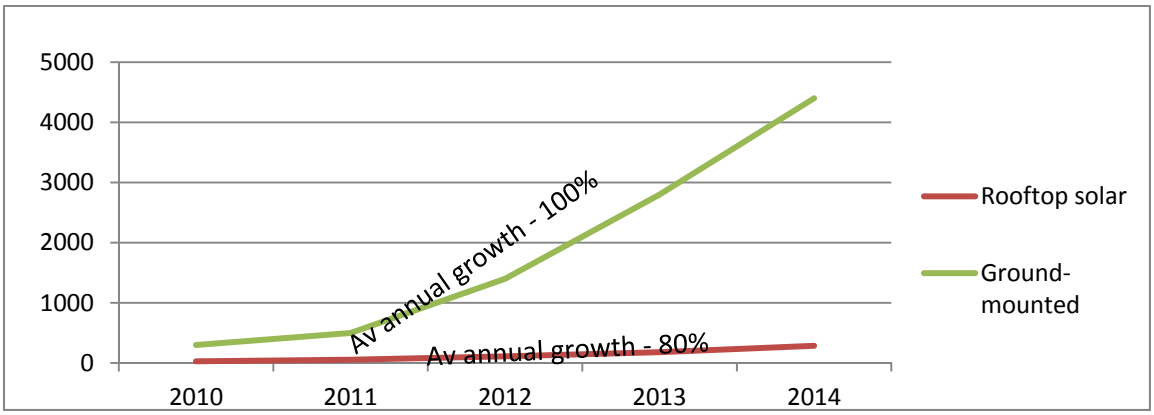


Figure A4.3 -Cumulative installed capacity for ground-mount and rooftop solar



Source: Rooftop Solar Policy Coalition (RSPC) 2015

4. With a market potential of 124,000MW[1], GRPV can make a significant contribution to India's energy generation mix. Going forward, if new technologies such as building-integrated PV enter the mainstream, this potential could go up further. Rooftop solar has particular advantages that make it a valuable energy source for India. It also has clear limitations (see Table A4.1 for advantages and disadvantages of rooftop solar).

[1] MNRE. 2015. "Reaching the Sun with Rooftop Solar."

Table A4.1: Summary of advantages and disadvantages of rooftop solar in India

Advantages	Disadvantages
Makes use of space that otherwise may be unused, avoids need for additional land dedicated to energy production	Intermittent energy source
Produces power near point of consumption, makes use of existing grid infrastructure	Solar makes only a small contribution to India's evening peak demand, so largely does not substitute for peak power requirements
Can grow organically, not dependent on risks to few big projects	Smaller systems mean higher unit costs than for utility scale, ground-mounted solar.
Helps reduce local and global environmental emissions	Rooftop solar creates two-way flows in grid network, requiring changes to grid management and infrastructure. This can also create safety concerns, requiring rooftop PV systems to be shut down when supply is cut in the distribution system.
Creates significant numbers of jobs	For utilities, net metered rooftop solar means some reduced demand growth with adoption by best customers first.
Will help drive progress towards a smarter grid (higher efficiency, lower loses, higher quality, greater real-time power management)	Rooftops often have multiple uses and trade-offs with other uses may be needed.

Adapted from RSPC 2015

5. **Government vision and roadmap.** As part of its push into renewable energy, GoI is aiming to install 100,000MW of solar power by 2022. This includes an official target of installing 40,000MW of GRPV by 2022. This target supersedes and significantly increases the previous targets of 20,000MW of grid-connected solar power that were set under the 2008 National Action Plan on Climate Change and 2011 Jawaharlal Nehru National Solar Mission (JNNSM). Together with large utility scale solar parks and ultra-mega solar projects, the government sees tremendous potential for generating decentralized and distributed solar power by utilizing the rooftops of industrial, commercial, residential and public buildings. Achieving the 40,000MW target will require increasing current capacity 114 times by 2022. This would exceed the 80 percent a year growth rate in mobile telephone subscribers between 2000 and 2009[2]. Achieving this scale of growth will be extremely challenging and will require co-ordinated action from both the public sector and private sector. Appropriate market conditions and incentives will have to be created by GoI and maintained all the way through to 2022.

6. GoI and a growing number of state governments and regulators are putting in place policy and regulatory arrangements necessary to support the large scale deployment of GRPV (Table A4.2 &A4.3). So far, 19 out of 29 states have issued solar policies and the SERCs of 24 states have issued net metering regulations. Amendments currently being tabled in Parliament could increase Renewable Purchase Obligation (RPO) targets[3], introduce Renewable Generation

[2] Telecoms Regulatory Authority of India, 2014 (http://trak.in/tags/business/2007/06/19/indian-telecommunication-story-from-10-million-to-150-million-mobile-subscribers-in-5-years/).

[3] SPO of 8 percent was introduced as part of the revisions to the National Tariff Policy in January 2016 but will have to now be implemented by the SERCs and Discoms

Obligation (RGO) targets, and impose penalties on RPO and RGO non-compliance. Other reforms are also included in these amendments such as separation of carriage and content, which may affect the financial performance of the sector, and the investment context for distributed solar generation in particular.

Table A4.2: Legislation, policy and regulation for rooftop solar

	Centre	State
Legislation	Electricity Act 2003 (EA 2003) - mandates state regulators to promote renewable energy by connectivity with grid, sale of electricity and purchase of electricity by distribution licensee	Mandates under the EA 2003 have resulted in various policy and regulatory measures promoting renewable energy at the state level, such as, determination of preferential tariffs for procurement of green power, RPO etc.
	Amendment of the Electricity Act 2003	Renewable Generation Obligation equivalent to 10% of the total thermal power installed capacity of the Generator The Act allows for exemption of renewable energy generators from paying open access charges
	Renewable Energy Act (draft) – potential assessment, creation of Centre and state level funds, implementation thrust to RPO	SERCs mandate yearly solar and non-solar Renewable Purchase Obligation for obligated consumers
Policies	Country-level target for setting up of 40,000MW of rooftop solar by 2022	Central government has suggested state-level targets in line with overall RPO targets. States may accept these targets.
	Fiscal and financial support (primarily capital subsidy and interest rate subventions)	Some of the states offer support to rooftop solar in the form of Capital subsidy or FIT
	Other special schemes or programs – for e.g. rooftop solar on govt. buildings	Institutions, government buildings, etc. are offered in some cases
Regulation	Forum Of Regulator guidelines - on business models, procurement of power,	These are state specific regulations that typically detail out guidelines for business models, eligibility of consumers, connectivity norms, penetration limits at the transformer level, buy back of surplus energy, if applicable, energy accounting and settlement etc.
	CEA – technical standards (e.g. for Connectivity of Distributed Generation Resources.	
	Installation and Operation of Meters' Regulation 2006 and amendments	
	Measures of Safety and Electricity Supply Regulations, 2010	

Source: Adapted from RSPC 2015

7. A number of recent studies, including a 2014 IFC study[4], have identified the absence of commercial loans available to rooftop aggregators and developers as a major and binding constraint to the launch of private investment in GRPV. In this context, the proposed operation

[4] An IFC study issued in 2014, "Harnessing Energy from the Sun: Empowering Rooftop Owners," recommends (a) "financial incentives targeted at the various segments of stakeholders, established to kick-start development of the sector, with a phasing out over time, backed by appropriate policies and regulations" and (b) "establishing innovative products, and attracting the commercial lending sector by implementing pilot projects with large third-party developers."

will help address the barriers to GRPV noted above by (i) by making long term concessional financing available for the deployment of GRPV; (ii) sharing international knowledge and experience on how large solar rooftop investment programs have been implemented across the world; (iii) providing technical assistance and capacity building support to relevant institutions. This Program can also have demonstration effects in other developing countries with solar resources.

B. Technical Soundness

8. The Program takes into account and conforms to international experience and good practice in GRPV including (i) technical standard and specifications; (ii) grid integration of rooftop solar PV and (iii) business models. The Program will finance technically proven and commercially viable GRPV investments. The SBI has demonstrated experience and proven track record managing green energy programs. In areas such as Environment and Social management where the SBI does not have the required skills and expertise, it will use external expertise as a complement to its own resources. The assessment shows that while the program could eventually negatively impact the financial situation of discoms (and hence their support for the program), the impact is expected to be minimal in the early years of the program. The proposed operation will help discoms and other relevant institutions to better manage GRPV through the implementation of a technical assistance and capacity building program. The economic evaluation shows that the proposed program is economically viable after the consideration of local and global environmental benefits.

I. Technical standards and specifications.

9. The CEA is responsible for setting technical standards for rooftop solar systems in India, which have been adopted by MNRE and SBI for this Program. SBI will appoint a Lender's Independent Engineer or depute its staff, to ensure that all investments undertaken as part of the Program meet at a minimum of these technical standards. These technical specifications, standards and certifications include a comprehensive list of existing IEC and Indian standards. These standards will serve as the reference for qualifying and certifying PV system components (i.e. modules, inverters, cables, batteries, switchgear etc.) to be used under the Program.

10. SBI's POM for the Program includes relevant standards such as International Electro-technical Commission for testing Potential Induced Degradation (which is particularly relevant for India), as well as for mounting structures, energy meters, monitoring, systems inspection, storage. While the Program's technical qualification criteria could be further be fine-tuned, they generally are in line with international standards and account for local regulatory, technical, climatic conditions.

11. Moreover, MNRE is partnering with The Energy Research Institute (TERI) to simplify and organize these technical requirements and introduce a focus on the quality of installations. TERI, in turn, receives support through a technical cooperation agreement with the German National Metrology Institute, one of the highest authorities in the sector. It is expected that TERI's recommendations will be accepted by MNRE and contribute to further improve minimum requirements and the technical quality of the projects.

12. The operation will use the grant-funded technical assistance and capacity building program to ensure that technical standards evolve to international best practices in this area, that there is consistency across different states in the implementation of these standards and effective dissemination of information allows the standards to be easy to comprehend and enforce. In particular, the following consideration will be taken into account.

- **Meters:** In the present context there is limited availability of bi-directional meters in India - so states continue to require multiple unidirectional meters which can be avoided by increasing availability of bidirectional meters. The ambition should be to bring the cost of bidirectional meters to the same or lower than existing unidirectional meters. This way, they can become standard making household meters rooftop ready and further reducing costs for all households.
- **Inverters:** Most inverters available in the Indian market include the following technical features – harmonic current injection, DC injection, flicker control, and anti-islanding. Additional features of reactive power support, low voltage ride through, and frequency regulation can also be easily added to the existing features of inverters without any significant extra cost to the consumers.
- **Deliberate islanding:** Designing rooftop solar systems to operate when the grid fails is known as deliberate islanding. The problem comes in designing so this happens when needed without endangering grid maintenance staff. The need is to find ways to both protect safety (which must be paramount) and to allow systems to operate during grid outages. This will help expand the market for grid-connected rooftop solar into areas outside the main metros and into smaller towns and cities that face power cuts.
- **Quality Assurance and control:** Technical risks can significantly be mitigated by establishing a quality assurance and quality control system during procurement, construction and operation of the plants. MNRE's minimum technical specifications and its efforts in establishing a system for monitoring and inspection of the plants go in this direction, yet the extent to which current plans are implemented, as well as possible gaps to be filled, need to be monitored and assessed during the course of the Program
- **System monitoring:** Monitoring is crucial for a correct operation and maintenance of PV systems. However, the use of accurate monitoring systems, pyrometers and other irradiance sensors makes economic sense only on larger scale installations (as a rule of thumb >1MWp). Thus while it is important to implement the highest standards in monitoring solutions, a revision of the guidelines and a relaxation of the specifications could be justified to meet practical criteria for smaller commercial installations.
- **Equipment warranties:** It may be important to increase and enforce the minimum warranty requirements for PV equipment financed in the Program. Module product warranty against defects in could be set at 10 years minimum in line with international practice. Similarly, inverter product warranty against defects in materials and workmanship could be set at 5 years minimum.

II. Long term challenges of integrating rooftop solar into the grid

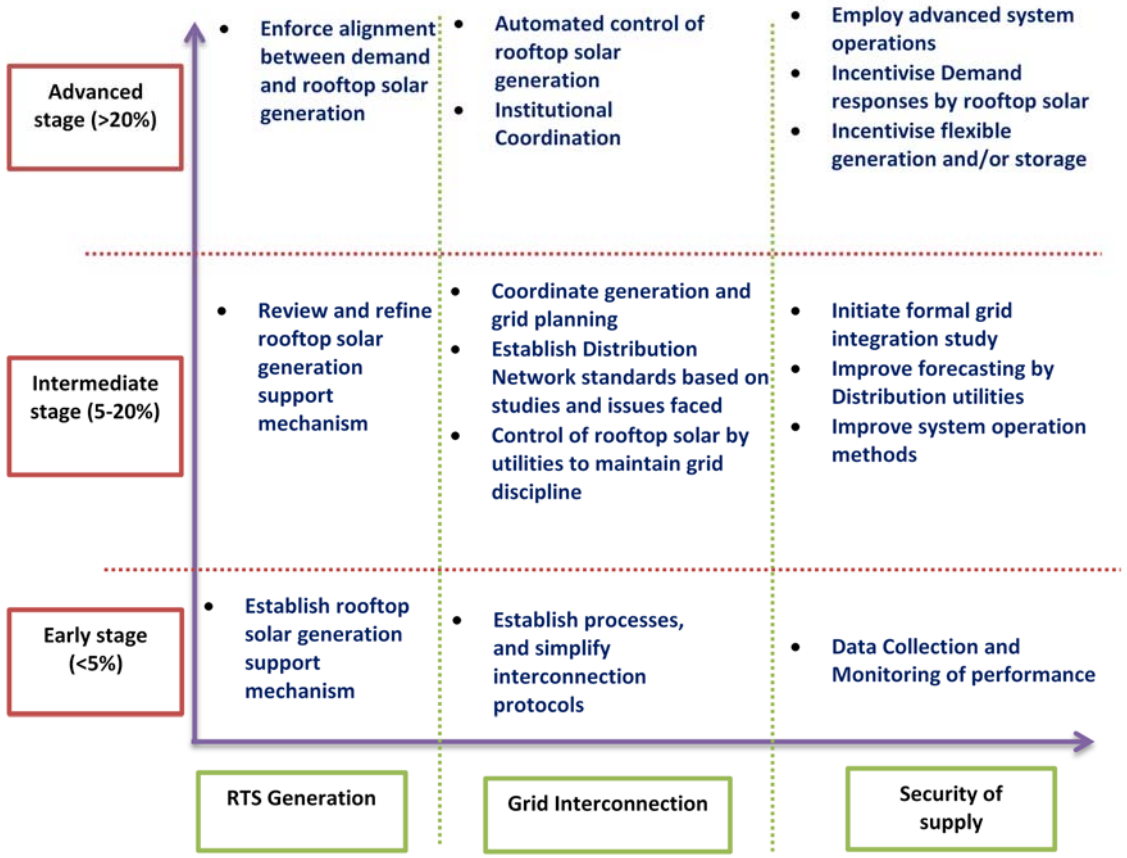
13. A recent study by the US National Renewable Energy Laboratory (NREL) suggests that energy integration of renewable energy does not pose any complex system integration issues at low levels of penetration. Even if the government target of 40,000MW of rooftop solar is achieved by 2022, only about 4 percent of India's power will come from rooftop solar. This level would not require significant change to infrastructure. However, rooftop solar will not be evenly spread and what matters is the level of rooftop solar at local level, not the national average. Therefore, utilities will need to plan for infrastructure change in some areas where rooftop solar is concentrated. The key technical challenges that rooftop solar can create for distribution utilities are[5]:

- **Variations in voltage:** Fluctuations in rooftop solar output can lead to voltage variations. This can be managed by good inverters. However, rooftop solar generation can also help support the voltage in the grid in long distribution lines. This can be particularly useful in rural areas.
- **Variations in frequency response:** Inverters are designed to trip if the frequency varies beyond specific limits. However this can cause cascading tripping of all the inverters connected to the grid, making it harder to maintain grid stability. Additional inverter features can be specified to avoid this problem.
- **Bi-directional power flow:** when rooftop solar systems export power to the grid, it creates reverse flows in the distribution network. This can be a problem as networks have been engineered to be one way only. Changes to the grid are required such as adjusting grid safety features and network controls, and upgrading transformers to handle such flows.
- **Variability of rooftop solar:** as for other variable renewable energy, rooftop solar can fluctuate quickly with cloudy conditions. This can cause the amount of generation from rooftop solar to vary significantly, requiring grid operators to maintain spinning reserve, requirements for which may be higher than when there is no variable renewables.

14. The technical challenges associated with GRPV are not without solutions. Design features such as On Load Tap Changer for MV/LV transformer, booster transformers along long feeders, and reactive power support through Static Volt-Ampere Reactive Compensators and revised protection settings for bi-directional flows could be incorporated in new design criteria. These changes should be introduced over time and integrated into routine maintenance or upgradation programmes to reduce costs. The proposed operation will engage with relevant institutions through the technical assistance and capacity build program to ensure that these considerations are taken in the future planning and development of the grid. Table A4.3 indicates the responses that will be needed to manage increasing levels of rooftop solar.

[5] Adapted from RSPC 2015

Table A4.3: Illustrative regulatory actions for increasing rooftop solar deployment



Source: RSPC 2015

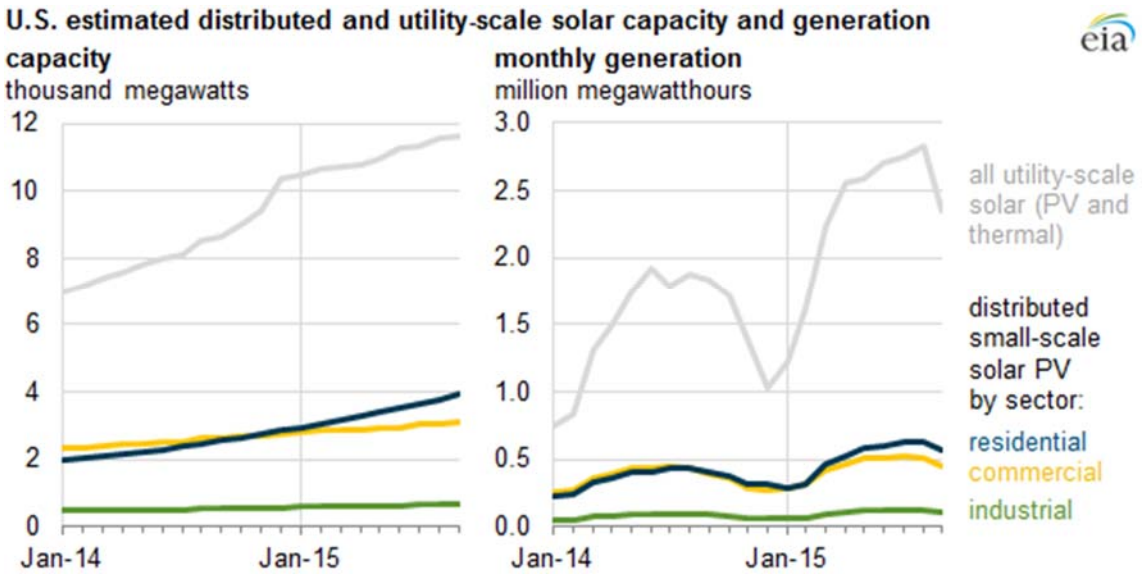
III. International Developments in Solar Rooftop PV

15. Clean energy investments increased to a record $329 billion in 2015, up 4 percent from 2014 and 3 percent over 2011's previous high. This included installations of 57,000MW of solar PV commissioned during the calendar year. China, Africa, the US, Latin America, and India all contributed to 2015's record investment numbers. The increase came despite falling oil, gas and coal prices.

16. The rooftop solar market in most countries has been driven by government policy and government subsidy. For instance, a 2004 Feed in Tariff (FIT) policy in Germany is widely credited with making Germany the largest solar market globally while tax credits in the US have helped increase market penetration of GRPV. In the US, while many customers opted to own their rooftop solar installations, companies have created business models to sell power from rooftop installations to customers and for that raised money from institutional investors who could then avail tax credits on their investments. This has contributed to increasing the growth of GRPV in the US.

17. In the US, GRPV installations have reached close to 8,000MW as of end 2015. Almost 40 percent of the distributed PV capacity in the United States is located in California, with the next nine states accounting for another 44 percent. The extent of GRPV adoptions in a state in the US is correlated with factors such as high electricity prices, strong solar resources, and state policies and incentives that support solar PV. In the early years of GRPV development in the country, installations in the non-residential sector dominated the growth, but in recent years the growth in residential installations has been stronger (see Figure A4.4). Likewise, after the dominance of customer owned models in initial years, there has been shift towards third party owned Solar PV systems. Growth contributing factors in the US include marketing strategies to partner with retailers to reach more customers, and new financial models including the securitization of residential solar assets.

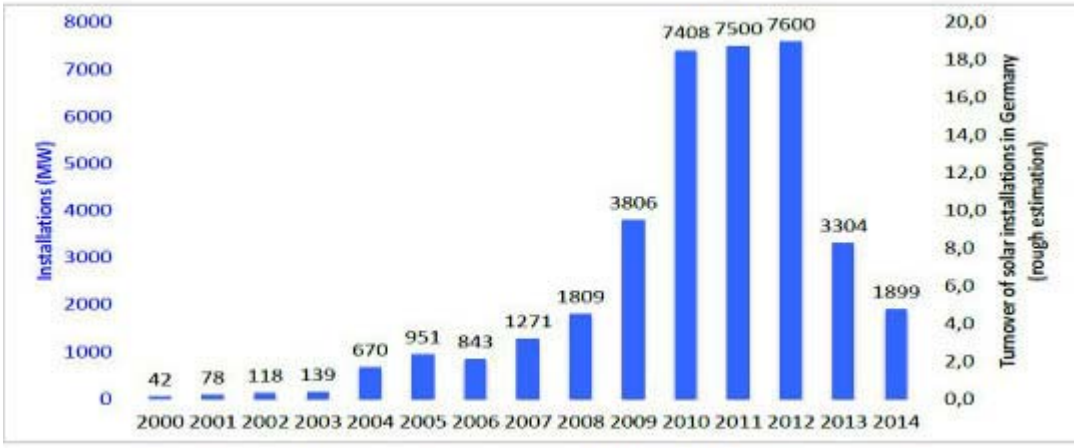
Figure A4.4: US GRPV Installations



Source: EIA 2015

18. In Germany, Solar PV installations have reached 40,000MW as of 2015, more than fourth fifth of which are GRPV installations on residential and non-residential rooftops. Solar PV comprised 7 percent of the country's overall electricity generation in 2014, although solar has contributed up to half the electricity demand on certain days. Solar power in Germany was initially driven by the country's generous FIT. However, the 2014 Renewable Energy Act has reduced FIT and set constraints on utility-scaled installations, limiting their size to no more than 10MW. This has reduced the growth of GRPV installations in the country, with annual installations falling to 1,400MW in 2015 from 3,304MW in 2013. Residential GRPV systems are more common in Germany than non-residential systems. Likewise, customer owned models more prevalent than third party owned models.

Figure A4.5: Germany installed capacity of Solar PV



Source: German Federal Network Agency 2015

19. A key element of this Program is to facilitate the development and implementation of third party models in addition to customer-owned models which are prevalent in India. This operation will enable SBI to lend to qualified intermediaries (qualified in terms of technical capacity, relevant experience, and creditworthiness as per SBI's standards). This access to loans will allow qualified private sector developers and aggregators to buy the required inventory and acquire customers, and push for large scale deployment of roof top solar PV systems among customers using different business models.

IV. Impact on Discom finances[6]

20. Discoms are critical to the success of rooftop solar. In India, discoms operate and maintain the network and also supply power to the retail consumers. Therefore, they are critical to interconnecting rooftop solar systems safely into the grid, managing the technical challenges of rooftop solar power and (in most cases) being the purchaser of solar power exported to the grid. Therefore, it is vital to ensure that utilities have the right incentives to support rooftop solar power and to carry out these functions effectively (see Table A4.4 for summary of costs and benefits of GRPV to discoms). Without the active support of utilities, it will be impossible to achieve the GRPV targets of GoI.

[6] Adapted from RSPC 2015.

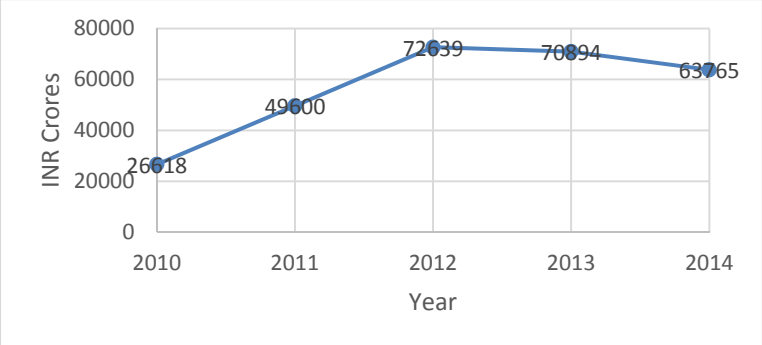
Table A4.4: Cost and benefit of rooftop solar PV to distribution companies

	Distribution Companies
Costs:	(i) Loss of revenue from the highest paying customer categories (ii) If rooftop program is not revenue neutral, it will mean higher tariffs for rest of customers or higher subsidy requirements from the government (iii) Cost for infrastructure if upgrades needed to integrated into the grid (iv) Program administration cost
Benefits:	(i) Avoided cost of energy (reduced purchase of alternative power) (ii) Avoided cost of infrastructure, where relevant (iii) Reduction in transmission and distribution losses (iv) Avoided distribution infrastructure (v) Reduction in RPO compliance cost

Adapted from RSPC 2015

21. The financial situation of discoms in India is weak. As a whole, discoms have been consistently making losses over the last decade. The aggregate losses of all the discoms in the country was INR726.39 billion in FY2012 (US$12 billion), INR708.94 billion (US$11billion) in FY2013, and INR637.65 billion (US$10 billion) in FY2014 (Figure A4.6). However, these losses are concentrated in a few states. Together, five poor-performing states – Uttar Pradesh, Tamil Nadu, Madhya Pradesh, Haryana and Rajasthan - account for 91 percent of the power sector's accumulated losses. In contrast, five states - West Bengal, Delhi, Uttaranchal, Sikkim, Gujarat, Punjab and Maharashtra - accumulated profits in FY2014.

Figure A4.6: Aggregate losses of discoms



Source:Power Finance Corporation 2014. 1 Crore = 10,000,000

22. Discoms that are under financial distress may be reluctant to support GRPV on account of the additional costs associated with it. However, the impact of will be negligible at low levels of GRPV penetration. Even at the 40,000MW target, the penetration of GRPV will be less than 5 percent. The financial impact of rooftop solar on utilities is modest until the penetration rises above 20%. Therefore, after 2022, as GRPV continues to increase, it will be important to prepare discoms for an electricity sector with much higher levels of penetration of GRPV through Technical Assistance and capacity building programs.

23. The biggest financial concern for discoms from GRPV arises from cross-subsidy rather than infrastructure or overheads. Discoms are mandated by law to provide power on demand and have universal service obligation to customers in rural and urban areas. Fulfilling this mandate is costly. If GRPV customers do not share this cost then a greater share will fall to non-GRPV customers. The government in the proposed amendments to the Electricity Act 2003 has recommitted to reducing cross-subsidy. More market-led pricing of electricity (with appropriate safety nets for the poor) will help rooftop solar and help utilities.

V. Distribution Company Incentives

24. In view of the challenges noted above, incentives for distribution companies to support GRPV is expected to come from the following:

a. **Renewable Purchase Obligations.** Discoms are currently obligated to purchase three percent of their energy requirements from renewable energy. Legislative amendments currently tabled in Parliament will increase Renewable Purchase Obligation (RPO) targets, introduce Renewable Generation Obligation (RGO) targets, and impose penalties on RPO and RGO non-compliance[7]. Discoms in the country consider GRPV to be one of their preferred methods for meeting these obligations.

b. Daytime Peak Loads. Daytime Peak Loads are anticipated to grow more widespread in 2017-2019 due to projected high rates of economic growth. Low income economies typically face only an evening peak in the demand for electricity, and some Indian states (particularly the lagging states) are currently in this situation. Higher income areas in India already experience a daytime peak. India's projected economic growth will propel increased daytime demand for electricity across the country, a growing number of discoms will start to face a daytime peak in addition to the evening peak. Any relief to the discoms that can come from their customers' self-supply of part of the load requirements, and thereby defer the need to enter into in-flexible long term power purchase contracts will be helpful to discom finances.

25. As part of preparation of this Program, the Bank held series of discussions with discoms in states with net-metering policies. Additional discoms (from other states) are expected to come forward in subsequent rounds, to signal their interest in receiving support with implementation of their rooftop policies.

[7] SPO of 8 percent was introduced as part of the revisions to the National Tariff Policy in January 2016 but will have to now be implemented by the SERCs and Discoms

VI. Market Assessment of GRPV

26. An assessment of the market potential for GRPV in the country was undertaken by MNRE as part of the preparation of its white paper on rooftop solar PV in the country. The assessment was based on a survey of a sample of potential residential, commercial and industrial customers of GRPV (see Figure A4.7). The market potential was estimated by overlaying these responses to the technical and economic potential parameters that were estimated separately under the study. The assessment indicated a market potential for rooftop solar PV in urban settlements of India of around 124,000MW.

Figure A4.7: Acceptance levels of GRPV

Score	Reaction	Residential (177)	Commercial (88)	Industrial (89)
1	Product and the associated idea are quite bad and there is nothing which can ever make it good.	0.00%	3.40%	2.20%
2	Don't think this product and the associated idea is good. At this stage, it requires much improvement to become acceptable.	0.60%	3.40%	2.20%
3	Unable to decide whether this product and the associated idea are good or not. The pros and cons almost match each other.	20.50%	34.10%	30.30%
4	Product and associated idea are quite good but may be improved further to increase its acceptance	38.60%	38.60%	40.40%
5	Product and idea are excellent and there is nothing in it which I can call as a drawback.	40.30%	20.50%	24.70%

27. The surveys founds that customers are drawn to GRPV by the promise of reduced electricity bills and reduced dependence on the electricity grid. More than 60 percent of commercial customers, 43 percent of industrial customers and 10 percent of residential customers in these cities use diesel generators as back-up supply to manage grid interruptions; the usage of inverter battery systems is also high. The surveys indicated that there would be more interest if rooftop solar power is commoditized and presented as a standard package that includes financing and O&M options to be handled by aggregators and developers. To start off, consumers would like to have easy financing options, so that they would not have to make high upfront payments. Commercial consumers are looking for rooftop SPV as an alternative to utility power and would be open to making the required investments under the right conditions.

28. Given these findings as well as the GoI's strong commitment to its 40,000MW GRPV target (which will help push the uptake of GRPV by public sector institutions)[8], it is likely that there will be sufficient demand for the US$1.5 billion in debt financing that is being made available under this Program as well as parallel programs led by ADB and KfW.

[8] Based on current system costs of GRPV, achieving the full market potential of GRPV in the country will require more than US$100 billion of investments, a majority of which will have to be debt financing. Likewise, achieving the GoI's 40,000MW of GRPV target by 2022 will require more than US$40 billion of investments.

VII. Impact of different types of subsidies on the GRPV market

Subsidies for rooftop PV

29. Under the GoI rooftop PV program, two categories of customers are entitled to a capital subsidy to reduce the cost of their up-front investment in rooftop PV: not-for-profit institutions (e.g., schools, hospitals, prisons), and residential customers. GoI provides a 30 percent capital subsidy only for residential and not-for-profit institutional investors, for as long as the funding lasts. Companies taking such subsidies from GoI are required to competitively procure their solar panels from Indian panel manufacturers only. Most sub-borrowers from SBI will not be in this category which receives subsidies. If they do receive a subsidy, it will simply reduce the upfront cost of capital and hence the size of the loan required from SBI. The non-subsidized portion will be financed 70% debt and 30% equity.

Tariff subsidies

30. There are hundreds of discoms throughout the country, each with their own tariff structure approved by state regulators through a Tariff Order. Residential customers in India generally pay less for electricity than the cost of serving them, and industrial and commercial customers pay more than the cost to the discom of serving them. This means that residential customers do not find it cheaper to invest in a rooftop PV system and take care of part of the load through self-generation. For a subsidized discom customer, it is nearly always cheaper to just buy from the discom.

Cross-subsidy surcharges.

31. Discoms rely on income from industrial and commercial customers to compensate for losses in the residential segment. The open access provision in the Electricity Act 2003 allows large industrial and commercial customers to not purchase all their power from the state-owned discom, but to contract directly with a generator. Furthermore, the Act provides that such a contract is bilaterally negotiated and outside the purview of the state regulator. In addition, the large industrial or commercial consumer has access to the national grid and pays a transparently determined wheeling charge to transport power. In practice, however, there have been challenges to implementing this provision of the Act. In particular, discoms have levied a surcharge on industrial and commercial customers that have wanted to purchase power from generators to discourage such arrangements. The cross-subsidy surcharge does not apply to a commercial or industrial consumers who invest in a rooftop PV since the electricity from the rooftop PV system is simply reducing the amount purchased from the discom without the need to use the discoms's network.

VIII. SBI Implementation Capacity

32. The SBI has demonstrated experience and proven track record managing green energy programs. In areas such as Environment and Social management where the SBI does not have the required skills and expertise, it will use external expertise as a complement to its own resources. SBI will engage independent verification agencies to verify some of the DLIs. SBI will appoint a

Lender's Independent Engineer or depute its staff, as per threshold agreed in ESSA, to ensure that all investments undertaken as part of the Program meet minimum these technical and environmental standards.

33. The SBI is interested in participating in the Program since it offers an entry-point into an area with significant potential for growth in the future but it will not do so without support and hand-holding from an international partner agency with domain experience, because it is (a) unfamiliar with the technical issues of Rooftop PV performance and (b) not in a position to take on the coordination role with state discoms, regulators and nodal agencies who are all key enablers and stakeholders in this program, but who have current performance limitations. However, SBI has assured MNRE that if a successful program is set up with World Bank support then it will continue the implementation of the program on a nation-wide basis using its own resources for lending to qualified parties in continuation of the previous experience.

C. Expenditure framework

34. The Program cost will be US$915 million, to be financed by US$500 million of debt funding sourced from IBRD, US$125 million from CTF (loan and grant) and US$23 million of grant funding expected from GEF, with balance made up of contributions of SBI and initial equity contributions from private sector developers and their customers. This funding is expected to support the installations of at least 400MW of GRPV systems[9].

35. The Program will be implemented through the vast branch network of SBI, including its Corporate Accounts Group (CAG), Mid Corporate Group and National Banking Group branches. The loan funds from the Bank will be disbursed in an offshore branch of the SBI (the grant funds will be disbursed to onshore branch of SBI), against which SBI will create a notional account with an equivalent amount of local currency. All disbursements to the eligible projects will be reflected as debit to this account. The projects to be approved under the Program will follow the benchmarks for Grid-connected Rooftop Solar Power Projects outlined in SBI's Renewable Energy Policy as well as the POM for this Program. All credit proposals received by the Program will be subject to due diligence consistent with SBI requirements including credentials and financial position of the borrower, purpose of the loan, working capital and capital expenditure requirement, loan servicing capacity and security offered etc.

36. SBI will use it internal rating models to assess the acceptability of loan proposals, to determine hurdle rates for taking additional exposures and to make pricing decisions. SBI will rely on its well-defined system to authorize and approve credit. It will classify all assets according to Reserve Bank of India guidelines.

37. *Efficiency of Program Expenditures.* As mentioned before, the costs of GRPV systems in India have declined dramatically over the last several years. As of 2015, the cost of large scale GRPV installations without storage for industrial and commercial customers (including BOS and overheads) is in the US$1.1 to US$1.4/watt range, with another 20-25% premium for standalone residential systems. This compares favorably with costs in other countries such as USA, Germany

[9] 400 MW is a conservative estimate of the expected installations under the program.

and Australia. The market for GRPV in India is highly competitive. Small, medium and large market players are active in the GRPV space. GRPV developers and aggregators who borrow under the Program will be subject to market pressures, which will be helpful in ensuring efficient investments. Furthermore, SBI will also critically examine the costs of projects as part of its due diligence when making loans for GRPV under the Program. Overall, hence, it is highly likely that efficiency of expenditures will be maintained under the Program.

D. Results Monitoring and Evaluation

38. Under this PforR operation, SBI, as the implementing agency, is responsible for results monitoring and evaluation and arranging verification of the DLIs, based on the agreed verification methodology, protocols, and procedures outlined in the section below. This PforR Program brings value added to strengthen the focus on results monitoring and evaluation through an independent and credible verification system, since the current M&E system under the MNRE's GRSSPP relies primarily on reporting from GRPV system providers and partner agencies rather than verification by independent third parties.

39. SBI has robust internal systems and processes for keeping track of Program expenditures and result. SBI will create a separate product code for this Program, which and each sub-loan will use. This will enable Program expenditures as well as outputs to be tracked through SBI's Information System. SBI will submit unaudited reports on Program expenses and results on a semi-annual basis and an audited report for the same variables on an annual basis (Table A4.5).

Table A4.5: SBI reporting format

Name of the Borrower / Particular of Expenses	Project / Expenses Details	Address	Total Capacity	Installed Capacity	Sanctioned Amount	Disbursed / Incurred Amount

E. Economic Justification

Please refer to Annex 11 for detailed economic evaluation.

Annex 5. Fiduciary Systems Assessment

India: Grid-connected Solar Rooftop Program

1. As part of the fiduciary systems assessment under PforR operations, the Bank's fiduciary staff (Financial Management, Procurement and Integrity) reviewed the Program's fiduciary implementation arrangements to assess the capacity of State Bank of India (SBI)--which is a Borrower and Implementing Agency for an important segment of the government's GRSSPP Program to

- record, control, and manage all Program resources under the P4R; and
- produce timely, understandable, relevant, and reliable financial information for stakeholders.

The review was also undertaken to determine the degree to which the planning, evaluation, contract award and contract administration arrangements and practices and governance arrangements provide a reasonable assurance that the Program will achieve intended results through its procurement processes and procedures.

2. The coverage of the fiduciary systems assessment is as per the nature and scope of the Bank funded GRPV Program. The financial management assessment focused on the following critical elements:

- Planning and budgeting – that an overall life-cycle Program Plan is prepared with objectives, activities and outputs/ outcomes of the Program which is revised according to ground realities; that annual Program budget which is based on the Program Plan is realistic, prepared with due regard to Program requirements and implemented in an orderly and predictable manner.
- Accounting and financial reporting – that adequate Program records are maintained and financial reports produced and disseminated for Program reporting, management and decision-making.
- Treasury management and funds flow – that adequate and timely funds are available to finance Program implementation based on budgeted activities.
- Internal controls (including internal audit) – that there are satisfactory arrangements to (a) monitor, evaluate, and validate Program results; and (b) exercise control and stewardship of Program funds.
- Program audit – that adequate independent audit and verification arrangements are in place, taking into account the nature and overall risk assessment of the Program.
- Transparency – that audited Program financial information shall be made available to the Bank.

3. SBI is the largest bank in India. In 2015, SBI was ranked 260 on Fortune's 500, up from 303 in previous year. It is a publicly traded company and the Central Government holds 60.20% of the shares (as on September 30, 2015). SBI's audit reports are clean, and its corporate governance practices which are mandated under law, are in compliance. SBI's FM systems,

procedures and controls are well established. It has strong risk management and internal control including internal audit systems.

4. The responsibility of implementing the GRPV Program across the country would rest with several administrative and operational units of SBI. CPPD (Credit Policy and Procedure Department) would be responsible for the overall coordination and monitoring of the activities carried out by the various units as well as interactions with the World Bank. The Program-specific fiduciary arrangements are being documented in the POM, which will be finalized by May 2016 and must be acceptable to the Bank before disbursements will be made.

5. The financial management systems assessment carried out by the Bank provides a reasonable assurance that the Implementing Agency's relevant planning, budgeting, accounting, internal controls, funds flow, financial reporting, and auditing arrangements are adequate and would ensure the appropriate use of Program funds and safeguarding of its assets.

6. An assessment of integrity systems, including those over fraud and corruption found that SBI has put redundant policies, procedures, and systems in place in an effort to ensure SBI has control over fraud and corruption risks in its various areas of operations, and these are not only reviewed on a periodic basis by key committees of SBI's Board, but are also continuously monitored by RBI, as well as by the Central Vigilance Commission and the Securities and Exchange Board of India (SEBI). These policies, procedures, and systems are also reviewed and upgraded to ensure compliance with international standards. In addition, SBI has robust staffing in place to ensure the various complaints handling and risk control systems that it runs, can in fact operate continuously, 24x7x365.

7. **Procurement Assessment:** The procurement assessment carried out by the Bank provides a reasonable assurance that the Implementing Agency's procurement review of the sub-loan beneficiary, complaint handling system, audit arrangements, internal controls, are adequate and found acceptable against the principles of economy and efficiency of procurement process and ensure appropriate use of Program funds. The extent of procurement assessment is based on the typical nature of a GRPV Program being implemented by a commercial lender, SBI. The procurement assessment focused on the following critical elements:

(i) Procurement Profile of the Program:

SBI is the implementing agency of the operation and will on-lend the Program funds through mobilization of large-scale private investment under both "Aggregator Model' (from an aggregator i.e. a third party owner of the panel relative to the owner of the rooftop) and 'Capex Model' (from Public or Private - Institutional/Industrial /Commercial establishments where the rooftop owner and the panel owner are the same). This will involve lending for financing grid connected rooftop solar PV investments in accordance with SBI's existing institutional arrangements, procedures and requirements for sub-loan application, eligible sub-projects, eligible sub-borrowers, appraisal and sanction of sub-project proposals, due diligence, supervision, and oversight arrangements under each sub-loan. The institutional arrangements, financing models and risk controls are included in the draft POM that was discussed with the World Bank, and found acceptable. The procurement under the Program would mostly include rooftop solar PV power plants which

consists of solar PV panels, inverters, module mounting structures, trackers, batteries and charge controllers. Based on a "Moderate" risk rating for Procurement capacity, the thresholds provided in the guidance on P4R and applicable for this Program are US$75 million for Goods, US$115 million for works/Supply and Installation, US$60 million for non-consulting services and IT systems, and $30 million for consultants' services,. These will be applicable for contracts under the Program. Any individual contract financed by the Program should be equal to or less than the indicated thresholds and hence contracts of higher values shall be excluded from the Program. For all practical purposes, aggregator/sub-loan beneficiaries will be in-charge of procurement which will be taken up in line with the broad procurement details shown in the sub-loan proposal agreed by SBI. The general rule for sub-loan beneficiaries is to carry out formal/informal market analysis of available products/technologies/providers, and then through a series of negotiations, try to establish long term mutually beneficial relationships with the providers. Procurement under the Technical Assistance and Capacity Building, would mostly include procurement of Consultancy services and will be done by SBI according to its procedures.

(ii) Procurement Processes:

Procurement under the Program will be undertaken by the respective private sector beneficiaries/aggregators who are approved for sub-loans; rooftop owners and Public Sector Undertakings, in accordance with the commercial practices in private sector and procurement practices of Public Sector Undertakings; that meet the principles of economy and efficiency.

(iii) Procurement Management:

SBI has prepared a draft POM, to be finalized and accepted by the Bank before disbursement can take place. The POM includes the program implementation and governance regulations for this PforR Program to ensure that the loan is being used for program objectives and to reduce the risk of corruption and fraud (refer to the Anti-corruption paragraph below). During the program implementation, the POM will be updated in line with the implementation needs. In order to better manage the project implementation SBI shall ensure that the following is received from the sub-loan beneficiaries:

- Procurement components of the sub-loans - As part of the sub-loan proposal/application, the sub-loan beneficiary shall provide broad break-up of the loan including cost estimates and time schedule.
- Methods and procedures - the sub-loan beneficiary will follow procurement methods which are accepted procedures are in accordance with well-established private sector/commercial practices in India, ensuring economy and efficiency of the procurement process.
- Compliance to the World Bank's Anti-corruption Guidelines : shall be established within sub-loan beneficiaries as a lending condition,
- Procurement records keeping – SBI shall request sub-projects to keep all procurement records for monitoring and supervision purposes. In addition, SBI shall allow the Bank to conduct supervision for some exceptional cases if needed.

8. *Risk Assessment:* Since GRPV Program is SBI's first World Bank funded Program, SBI would not be familiar with World Bank's procedures and requirements for a PforR loan. Also the Program and the Sector are new. The Program will be implemented in multiple locations through its Branches and various departments would be involved. These pose challenges/ risks for the Program. These challenges and risks are sought to be mitigated through the Program design which envisages (i) a central location for monitoring and control (CPPD at Corporate Centre), (ii) POM providing detailed descriptions of the Program, its management structure, procedures and controls for implementing, monitoring and controlling the Program and (iii) SBI will set up separate product code/s for the Program within its existing systems to facilitate preparation of Program financial statements and reports. (iv) SBI shall ask for broad break-up of loan in the loan application. (v) SBI or its independent engineers shall require aggregators/sub-loan beneficiaries to maintain the all procurement records and during World Bank's supervision mission, SBI shall provide information on the name of the supplier/contractor and amount of procurement; reflected in the Utilization Certificates. These design features together with SBI institutional strengths in availability of skilled manpower, good governance and risk management would considerably mitigate the challenges/ risks of the Program. Hence the Fiduciary risk is perceived as Moderate. The Fiduciary risk rating would be reviewed during project m implementation and adjusted suitably where necessary.

9. Anti-Corruption Guidelines: In summary, in order to operationalize implementation of the various areas covered in the ACGs, SBI agreed to:

a) maintain and compile a quarterly report of complaints that may be reported that are related to the Program and share this with the Bank (based on the agreed format incorporated in the POM);
b) incorporate the Bank's debarment list in the filter used by lending officers when they conduct due diligence. This list may be found in the following website: www.worldbank.org/debarr or http://web.worldbank.org/external/default/main?theSitePK=84266&contentMDK=64069844&menuPK=116730&pagePK=64148989&piPK=64148984
c) incorporate into the filter mentioned above the Bank's suspension list that will be compiled on a periodic basis by the WB team and shared with the SBI team; and
d) incorporate the ACGs in the lending document to be used by SBI for this Program, to ensure potential borrowers are aware of the applicability of the ACGs.

Annex 6. Environmental and Social Systems Assessment

1. A full Environmental and Social System Assessment (ESSA) was carried out between November 2015 and January 2016, culminating in a Stakeholder Assessment where the findings were shared with a number of Rooftop Developers for their feedback. This full assessment is available with the Info Shop and was disclosed on February 9th 2016.

2. The purpose of the Environmental and Social Systems Assessment (ESSA) is to: (i) review the environmental and social management rules and procedures and institutional responsibilities that are being used by the Program (ii) assess the implementing agency (SBI)'s institutional capacity and performance to date to manage potential adverse environmental and social issues under the Program; and (iii) recommend specific actions for improving the capacity of the SBI with regard to effective management of environmental, health and safety and social issues during implementation.

Key Program Implementation Entities

3. SBI is the implementing agency of this Program. SBI is India's oldest and largest financial services company, with more than 16,000 branches in the country, 190 foreign offices in 36 countries, and will be the borrower and implementing agency. In addition to its primary role of carrying out all the credit appraisals and sub-loan approvals to launch a debt market for rooftop investment, SBI will coordinate the administration of TA, under the guidance of MNRE, to improve the capacity of key institutional stakeholders such as discoms, SNAs and SERCs and other entities, as required, to promote and improve the investment climate for GRPV in the country.

Approach to ESSA

4. The ESSA is a World Bank document required for PforR operations. It is prepared by Bank staff with consultant support as necessary through a combination of reviews of existing program materials and available technical literature, and SBI staff, and consultations with key stakeholders and experts. The findings, conclusions, and opinions expressed in the ESSA document are those of the Bank. The methodology for preparation of the ESSA involved the following:

(i) a review of the systems proposed in the draft POM prepared by SBI to address potential environment and social issues including its review against the six core principles outlined in the Bank Policy on Program-for-Results Financing;
(ii) a desk review of the laws, regulations, requirements, and guidelines on the Environment Health Safety (EHS) and social management;
(iii) interactions with private aggregators who are involved in the business of setting up rooftop Solar PV systems;
(iv) based on any identified gaps, a Program Action Plan was devised;
(v) discussions held with SBI on suggested Program Actions and to finalize the draft ESSA; and
(vi) disclosure of the draft ESSA to a set of stakeholder for their inputs, followed by finalization of the ESSA report.

Stakeholder Consultations on ESSA

5. Stakeholder Consultations involved regular interactions with private aggregators, currently involved in setting up rooftop solar PV systems. The purpose of the interactions was to elicit their views in respect of their experience to date in this emerging business line. This included seeking their feedback on constraints or challenges faced, and interviewing them about their own approach to management of environment and social issues arising in their projects. These consultations took place on various occasions during project preparation, in order to inform the drafting of the ESSA, while also discussing other market perceptions and developments in the same meetings with these stakeholders. At the end of the process of ESSA preparation, however, a large dedicated meeting --for safeguards only--was held at the World Bank office with relevant stakeholders to disclose the draft ESSA and to solicit their inputs into the document prior to finalizing it for wider disclosure.

Potential Environmental, Health and Safety Concerns/Impacts

6. Potential environmental and social impacts for investments to be financed under the Program are not expected to be significant, since subprojects with high environment and social risks will not be included in the Program. Activities that are likely to have significant adverse impacts that are sensitive, diverse, or unprecedented on the environment and/or affected people will be excluded from the Program. As a result, all investments to be covered by the Program will have the following potential EHS characteristics: they are small or modest in intensity, of limited duration and extent, mostly completely reversible, and readily mitigated to acceptable levels with standard cost effective measures commercially available in the country. In general, proposed investments are minor modifications on existing facilities where the incremental effects are clearly identified to be small and are readily known. Potential investments will not encroach or degrade sensitive habitats, nor be located in sensitive areas of bio-diversity value, nor located in areas protected for physical cultural resources.

7. The environmental concerns or issues likely to arise from the installation and operation of the GRPV facility are limited and can be managed/mitigated, except for the disposal of damaged or discarded panels, if these are not covered under the take-back policy with the manufacturer/supplier during replacement. In case a take-back policy is not available or cannot be ensured throughout the life cycle, the discarded or damaged panels should be disposed of as per the local laws on the disposal of hazardous wastes. Safety of personnel during installation and operation will be ensured through measures in each rooftop developer's standard working protocol regarding safety equipment, which the developer will include as part of the loan application.

8. The Program will bring general social benefit for the region through air quality improvement, and employment opportunities to the local communities. Since all PV panels would be installed on rooftops, the only negative social impacts could be access restrictions to the rooftop. However, these will be part of a contractual arrangement and hence these are expected to be voluntary and agreed by consent amongst the parties.

Applicable laws and regulations -- National, State and World Bank

9. The Program would be governed by National, and State level policies that are specific to rooftop solar energy as applicable. Other laws and regulations at the National and State level would be applicable to the Program which are relevant for rooftop solar, in the context of environment and social issues.

10. In the context of Environment regulations, the Government of India through the Ministry of Environment and Forests (MoEF), is responsible for environmental policy and regulatory formulation, as well as overseeing implementation of these regulations. The State Governments are responsible for ensuring implementation and enforcement of national and state environmental legislations. The Central Pollution Control Board at the central level, along with its counterparts, the State Pollution Control Boards/Committees, are jointly responsible for implementation of legislations related to prevention and control of environmental pollution.

Assessment of Program Systems vis-à-vis Core Principles of the Bank Policy on Program-for-Results Financing

11. According to the Bank Policy on Program-for-Results Financing, assessment and comparison of the core principles of Bank Policy against the country legal system for EHS and social management should be conducted. The core principles are to:

- promote environmental and social sustainability in the Program design; avoid, minimize, or mitigate adverse impacts, and promote informed decision-making relating to the Program's environmental and social impacts;
- avoid, minimize, or mitigate adverse impacts on natural habitats and physical cultural resources resulting from the Program;
- protect public and worker safety against the potential risks associated with: (i) construction and/or operations of facilities or other operational practices under the Program; (ii) exposure to toxic chemicals, hazardous wastes, and other dangerous materials under the Program; and (iii) reconstruction or rehabilitation of infrastructure located in areas prone to natural hazards;
- manage land acquisition and loss of access to natural resources in a way that avoids or minimizes displacement, and assist the affected people in improving, or at the minimum restoring, their livelihoods and living standards;
- give due consideration to the cultural appropriateness of, and equitable access to, Program benefits, giving special attention to the rights and interests of the Indigenous Peoples and to the needs or concerns of vulnerable groups; and
- avoid exacerbating social conflict, especially in fragile states, post-conflict areas, or areas subject to territorial disputes.

12. SBI will follow a due diligence approach at each stage from pre-loan approval to monitoring. This due diligence approach will form part of the POM. Drafts shared with the World Bank have indicated adherence to all the core principles mentioned above. A finalized POM satisfactory to the Bank is a disbursement condition of the Program.

13. **Social impacts.** The Program will benefit the areas where GRPV systems are installed through air quality improvement, and will also bring some economic growth and employment opportunities to the local communities. Since all PV panels would be installed on rooftops, the only negative social impacts could be restricted access to rooftop. Hence, a set of recommendations is presented to assess and mitigate any adverse impact.

Gender

14. The proposed Program is expected to provide equal opportunity to the entrepreneur in a gender-balanced way so that female-owned businesses and female employees benefit from the opportunities offered. Measures to be undertaken through the TA component that will complement the loan could include: (i) gender focused messages in advertisement campaigns to encourage participation of female owned companies in the Program; and (ii) training and workshops targeted at female GRPV entrepreneurs. Apart from this, SBI is a leader among Indian commercial banks in gender-sensitive approaches to banking and has announced that at least one branch in each district of India will be a women-only branch. This will encourage financial inclusion and allow women from conservative backgrounds to benefit from banking services without having to interact with male non-relatives.

15. The Program will require SBI to establish gender grievance redressal systems consistent with GoI's Vishakha guidelines. All items previously announced under the Vishakha guidelines have now been passed as an Act of Parliament named as *The Sexual Harassment of Women at Workplace (prevention, prohibition, redressal) Act, 2013*. The Program will follow the Act. To meet the Vishakha guidelines, and to now comply with the Act, SBI will (i) create awareness and communicate the guidelines; (ii) ensure awareness and orientation; (iii) constitute a Complaints Committee in every workplace; (iv) ensure Complaints Committees have both the skill and capacity to carry out their functions; and (v) widely publicize names and contact details of Complaints Committee members.

16. Women will also benefit from increased energy availability. The literature on gender and energy suggests that providing electricity to communities and homes for tasks considered women's work can promote gender equality, women's empowerment, and women's and girls' access to education, health care, and employment. Most gender benefits occur because women are able to carry out their household chores more productively with electricity. Electricity displaces more expensive, inefficient and dangerous candles and kerosene lamps, thereby reducing indoor air pollution and fire and burn risks while providing higher quality light. Lighting and televisions help improve access to information, the ability to study, and extend the effective working day. Lighting also improves the productivity of many household activities, and has potential benefits for public safety and helps generate income generation opportunities for women.

Recommendations

17. This section presents recommendations that were shared with SBI to address any gaps identified in respect of Program capacity.

18. ***Due Diligence processes that will be followed for sub-loans:***

- Land, if any is required, (e.g. for constructing overhead mounted panels such as in a covered parking lot etc.) should already be in possession, with clear title at loan approval or pre-disbursement stage. Also, screening will be undertaken on such lands to assess adverse impacts, if any, and in case the land is encroached or encumbered, the site will not be considered for the sub-project.
- Loan approval conditions should stipulate that verification of the title deed and execution of a rooftop lease/rent agreement, wherever applicable, should be a pre-condition to disbursement.
- It should be confirmed that the roofing material does not include carcinogenic material such as asbestos.
- A generic guidance *checklist for addressing the EHS requirements* of the GRPV Program will be used for appraisal and periodic monitoring during installation and operation. An *additional guidance checklist for compliance* will also be used, to enable GRPV developers to understand the EHS requirements of the GRPV Program and comply accordingly**.**
- The Lender's Independent Engineer's scope of work should include monitoring of applicable EHS norms including fire safety clearance on the project site during construction and post-commissioning, until three months after the commissioning and operations date.
- In case of default on EHS requirements, SBI would need to agree on a time-bound risk mitigation and "restoration of compliance" plan with the sub-borrower, and if the non-compliance status is not reversed, it may lead to a huge penalty or need for prepayment of the facility.
- Facilitate operationalizing compliance with the law against sexual harassment of women among participating aggregators.

Monitoring

19. In respect of management of Environment and Social issues, upon a specific request from the World Bank, SBI will submit reports prepared by:

- **Independent Engineer (IE, third party)** if the sub-project cost is valued at INR1 billion and above, or if SBI's share of exposure is INR500 million and above) till the date of commissioning.
- **SBI's own staff** (if total project cost is less than INR1 billion and SBI's share of exposure is less than INR500 million)

20. For individual projects funded under the Program, the World Bank may specifically request reports on compliance with applicable Environment, Health and Safety norms including safety clearance on project sites both during construction and after commissioning.

Grievance Redressal Mechanism (GRM)

21. SBI's existing GRM is transparent and accessible. SBI would segregate and furnish reports related to the grievances that might arise under this Program, upon request from the World Bank.

Conclusion

22. In conclusion, the World Bank team is confident that the ESSA has been well understood by both SBI and relevant market participants, and that measures have been put in place at SBI in order to ensure compliance with national laws and regulations on ESSA, as well as to take into account the World Bank's recommendations as summarized above.

23. The POM, to be approved by the World Bank as a condition of disbursement, will contain the final write up for ESSA procedures to be followed under the Program and will allow the Bank team to check that the Program will be in compliance when it is launched. Subsequent compliance will be monitored throughout the implementation of the Program.

Annex 7. Systematic Operations Risk Rating (SORT)

Systematic Operations Risk-Rating Tool (SORT)	
Risk Category	**Rating (H, S, M, L)**
1. Political and Governance	Low
2. Macroeconomic	Low
3. Sector Strategies and Policies	Moderate
4. Technical Design of the Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Moderate
7. Environment and Social	Moderate
8. Stakeholders	Substantial
OVERALL	**Substantial**

Annex 8. Program Action Plan

1. SBI has already adopted the Bank's technical, fiduciary, and safeguard requirements in the proposed Program, and has agreed to prepare itself to adopt a few remaining recommended actions during implementation. A Program Operations Manual (POM) is being be prepared by SBI, and is expected to be ready by May 2016. SBI will implement the Program in accordance with the POM. A POM acceptable to the World Bank is a condition of disbursements. The POM would comprise inter alia of:

- definition of the contours of the Program, including Program activities, results framework, overall budget and list of Program Expenditures;
- Program implementation arrangements, including the setup of a dedicated PIU, identification of key relevant staff, and the allocation of functions and responsibilities within SBI's cadres;
- technical specification of GRPV equipment eligible for financing, the various financing modalities therefor, and loan pricing;
- pro-forma Sub-loan, setting forth the terms and conditions for GRPV financing, including the technical standards, and applicable procurement thresholds, the Bank's Anti-Corruption Guidelines, and environmental, social and safety requirements consistent with the Program Fiduciary and Environmental and Social Systems and the ESSA;
- screening protocols and procedures for the assessment of clients and the evaluation of their GRPV financing application, including social compliance social, safety and environmental standards set forth in the ESSA;
- terms of reference for the Lender's Engineer;
- DLIs/DLRs verification protocols and arrangements, and the terms of reference for the independent verification agents;
- procedure for the preparation of annual work plans and budgets;
- format of the Program's IUFRs;
- terms of reference for the external auditor preparing the Program's Financial Statements;
- protocols and procedures for the grievance redress mechanism; and
- Program monitoring and evaluation, and reporting requirements.

2. **Technical.** A quality assurance (QA) and quality control (QC) system during procurement, construction and operation of the plants is essential. MNRE has already defined minimum technical specifications (that SBI has adopted for this Program) and is establishing a system for monitoring and inspecting the PV plants in cooperation with TERI, with the intent to perform quality control on all government/institutional solar rooftops and provide full monitoring for all installations with capacity greater than 10kWp (partial monitoring will be performed on smaller installations). SBI will monitor compliance with MNRE's QA and QC requirements i.e., the extent to which current QA/QC plans are implemented, as well as possible gaps to be filled (see Table A8.1).

3. **Fiduciary.** To facilitate the better management and resolution of the complaints, SBI will include the Program in the existing complaints-handling mechanism, details of which will be included in the subproject application package and on SBI's website. Other key fiduciary actions by SBI under the Program include setting up of separate product codes related to the Program, and use of existing internal/external audit arrangements for the Program. Other key fiduciary actions

by SBI under the Program include setting up of separate product codes related to the Program, and use of existing internal/external audit arrangements for the Program.

4. **Environmental and social safeguards.** SBI has institutional systems that it will apply to the Program but that need strengthening for environmental management and monitoring. SBI will implement the procedures identified in the ESSA to manage environmental and social issues and risks. The ESSA report makes the following recommendations to address weaknesses in institutional capacity to manage environmental and social risks: (i) strengthening environmental and social impact management within the Program by specifying the requirements and procedures in the POM; and (ii) enhancing the capacity of the unit in SBI that is overseeing the Program by allocating staff and resources, as well as operating arrangements and coordination with other departments in the bank.

Table A8.1 - Program Action Plan for the India Grid-connected Rooftop Solar Program

Action Description	DLI*	Covenant*	Due Date	Responsible Party	Completion Measurement**
Monitor compliance with MNRE's Quality Assurance and Quality Control requirements, as basic standards applicable to the market.	☐	☐	December 2019	SBI	SBI to (i) prepare and share report on the implementation of MNRE's QA/QC requirements with Bank during the mid-term review of the project; and (ii) share the report with MNRE
Include the Grid Connected Solar Rooftop Program in the existing complaints handling mechanism of SBI	☐	☒	December 2016	SBI	Information on how to access the grievance mechanism for Grid Connected Solar Rooftop Program publicized on SBI's website
Implement the procedures identified in the ESSA to manage environmental and social issues and risks.	☐	☐	December 2016	SBI	SBI to share information with Bank during the first review mission of the Program

Annex 9: Implementation Support Plan

1. Implementation of this operation will require considerable focused support from the Bank team. This is the first PforR operation in the energy sector in India, it is expected that there will be a learning curve for the government and the implementing agency during the implementation period. This annex lays out the key activities that the Bank team will implement to appropriately mitigate the risks identified during operation implementation.

2. Bank implementation support will be focused on implementation quality and on making the results-based incentive system work to its full potential. This will include (a) reviewing implementation progress (including that of the Program Action Plan) and achievement of Program results and DLIs; (b) providing support on resolving emerging Program implementation issues and on building institutional capacity; (c) monitoring the adequacy of system performance, and compliance with fiduciary and safeguard requirements; (d) providing ongoing technical support. The key to effective implementation support will be providing timely support to planning and verification of results for payment request to the World Bank.

Implementation Support Plan

3. Formal implementation support missions and field visits covering all aspects of implementation will be carried out semi-annually during the early stage of implementation, complemented by occasional visits by small missions on an as-needed basis. Estimated inputs from different specialists at different stages of implementation are outlined below.

Table A9.1. Implementation Support Input Requirements

Time	Focus	Skills Needed	Resource Estimate	Partner Role
First twelve months	• Team and program leadership • Program design and technical implementation support • FM & Procurement • Safeguards implementation support • Results M&E and verification of DLIs • Capacity building	• Technical • FM • Procurement • Safeguards	6-7 staff, 2 trips per staff	NA

Time	Focus	Skills Needed	Resource Estimate	Partner Role
12-48 months	• Implementation support • FM, Procurement & Safeguards • Results M&E and verification of DLIs	• Technical • Safeguards • FM • Procurement	6-7 staff, 1-2 trips per staff annually	NA

Annex 10: Financial Intermediary Assessment on State Bank of India

A. Summary

1. This Financial Intermediary Assessment has been prepared as part of preparation of the Grid-connected Solar Rooftop PV Program. The objective of the review is to assess the financial performance, structure and corporate governance of the financial intermediary – State Bank of India (SBI) – with the aim of ensuring efficient implementation of the Program and maximizing the possibility of sustainable results. It is noted that the Government of India has asked that the Bank work with SBI in this Program.

2. The analysis has been conducted based on publicly available documents and data put out by SBI (given that SBI is a listed firm), documents containing sectoral analysis such as the Reserve Bank of India's (RBI) financial stability report for June 2015, Bank of International Settlement disclosures of banks, and discussions with SBI senior management.

3. The analysis finds that SBI is well suited to carry out this Program. The total proposed loan amount is a relatively small part of SBI's outstanding loan portfolio. SBI is a profitable, soundly managed public sector bank in India. It has the necessary experience and expertise as well as the branch network to undertake the Program per its Program Development Objective. While it does face challenges in terms of the quality of its overall loan portfolio – these challenges are in line with those being faced by other public sector banks in India. And SBI's management, as well as the Government (as the majority shareholder) and the RBI (as the regulator) are actively addressing these challenges.

4. This annex provides a summary of the review that supports this conclusion. It will be updated annually to review SBI's performance as a financial intermediary as regards the rooftop solar program; such periodic assessments and associated discussions would be helpful to ensure the financial sustainability of the program.

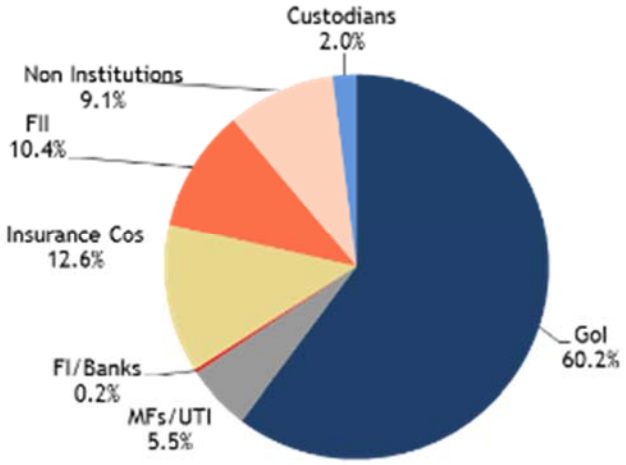
B. Background

5. State Bank of India (SBI) is India's largest commercial bank, with more than 16,000 branches in all states of India, 194 international offices in 36 countries and more than 256 million customer accounts SBI is one of largest employers in the country, with over 220,000 employees. SBI is rated Baa3 (outlook positive) by Moody's, BBB- (outlook stable) by Standard & Poor's, and BBB- (outlook stable) by Fitch. These are the same as the sovereign ratings by these agencies for India.

6. While SBI traces its origins back to the Imperial Bank of India, founded in 1806, in its current form, it was established in 1955 pursuant to the SBI act of the same year. The Reserve Bank of India (RBI) – India's central bank - owned a 60 percent equity stake in RBI till 2008, when the Government took over the entire equity from RBI to separate the ownership and

regulatory functions. The balance equity is owned broadly by domestic and foreign shareholders (Fig A10.1). SBI's shares are listed on the Bombay Stock Exchange and the National Stock Exchange in India and its Global depository Receipts are listed on the London Stock Exchange. State Bank of India has a market capitalization of over USD 31 billion.

Figure A10.1: SBI Shareholding

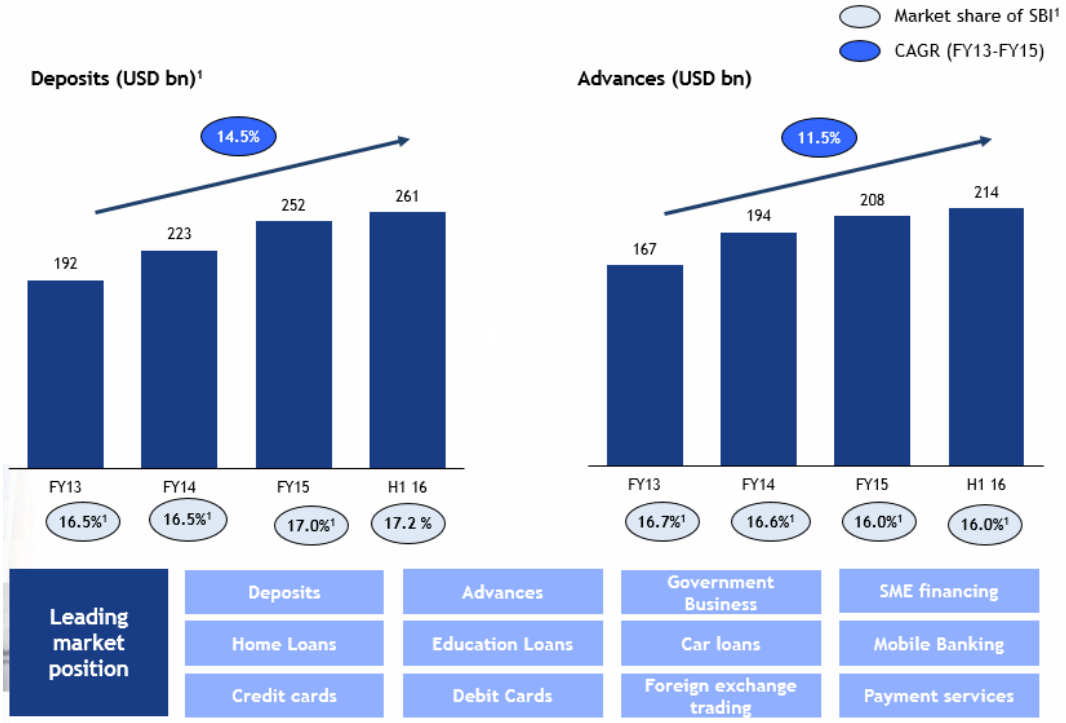


Source: SBI Investor Update September 30,2015

C. Portfolio and profitability overview

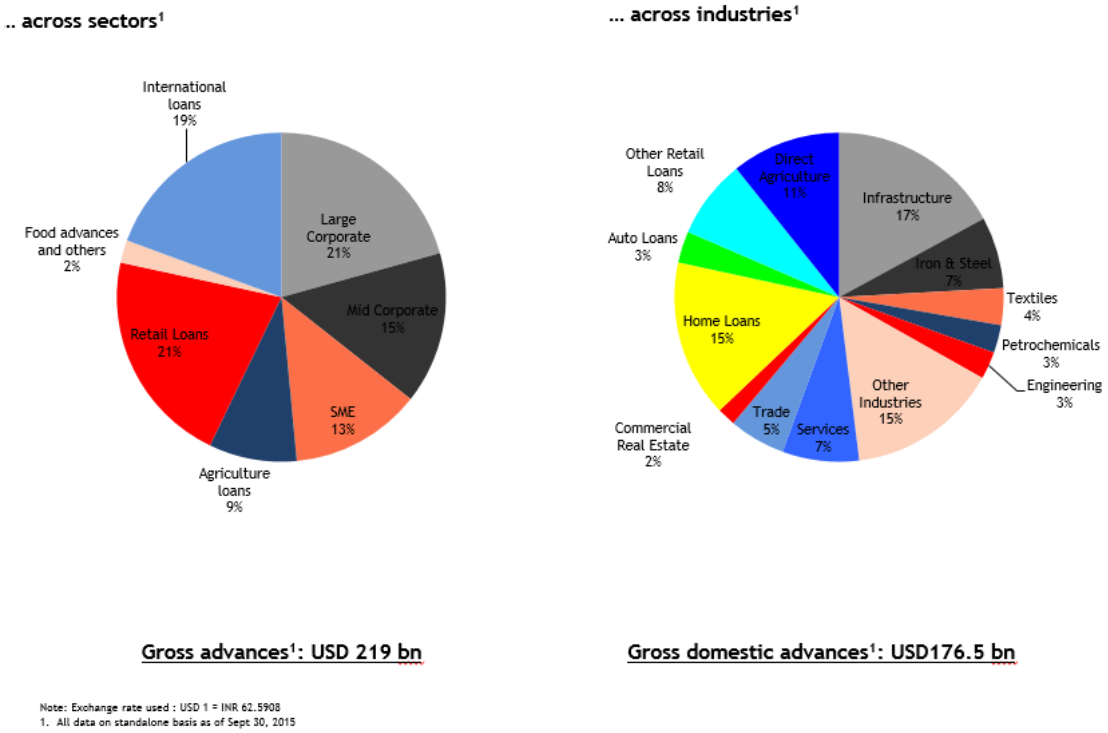
7. SBI had total loans outstanding of US$214 billion and deposits of US$261 billion, with a domestic market share of 16 per cent and 17.2 percent, respectively (Fig. A10.2). Since 2013 deposits have grown at a Cumulative Annual Growth Rate (CAGR) of 14.5 percent and loans at 11.5 percent. Of its total loan portfolio of US$214 billion, 81 percent (US$176 billion) were domestic loans. These are well diversified across both sectors and industries (Fig. A10.3). SBI is the largest corporate & retail lender in India, with continuing growth in all of the segments in which it operates including large and mid-corporate loans, home loans, agriculture loans, and auto loans. Reflective of SBI's strategy to focus on individual segments, it has a 26 percent market share in home loans and a 22 percent share in car loans.

Figure A10.2: SBI: Deposits and Loans



Note: Exchange rate used : USD 1 = INR62.5908, all data on standalone basis.
Domestic Market share based on RBI data and Bank data

Figure A10.3. Well diversified loan portfolio

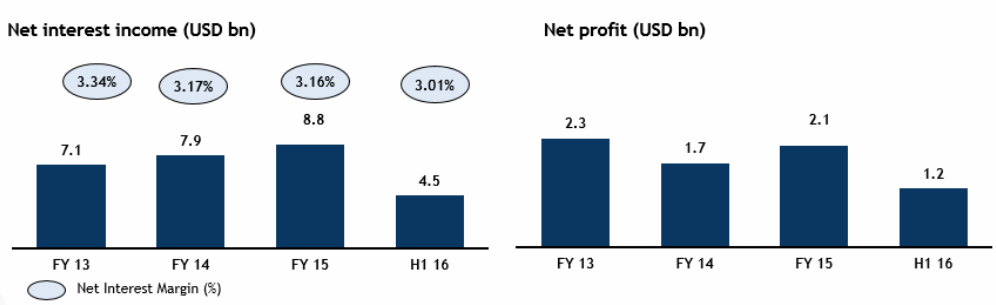


Note: Exchange rate used : USD 1 = INR 62.5908
1. All data on standalone basis as of Sept 30, 2015

D. Profitability

8. SBI's net interest margin has averaged about 3.2 percent over the past three years and it had a net profit of US$2.1 billion in the year ending March 31, 2015.

Figure A10.4: Consistent operating performance



Note: Exchange rate used : USD 1 = INR62.5908, all data on standalone basis
CASA[1] deposits and CASA ratio based on SBI's domestic deposits only

Table A10.1: Profitability of SCBs

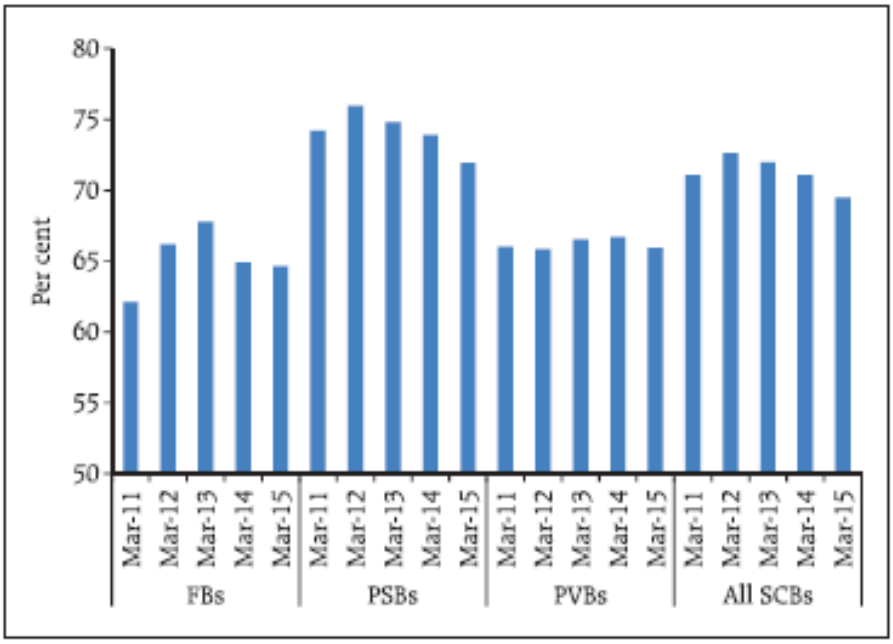
(per cent)

	Return on Assets	Return on Equity	PAT Growth	Earnings Before Provisions & Taxes Growth	Net Interest Income Growth	Other Operating Income Growth
Mar-11	1.1	13.6	23.6	21.7	34.6	0.5
Mar-12	1.1	13.4	14.6	15.3	15.8	7.4
Mar-13	1.0	12.9	12.9	9.9	10.8	14.4
Mar-14	0.8	9.5	-14.1	9.5	11.7	16.6
Mar-15	0.8	9.4	11.4	12.3	9.3	18.0

Note: RoA and RoE are annual figures, whereas the growth is calculated on a y-o-y basis.
Source: RBI supervisory returns.

[1] 'CASA' means ratio of deposits in current and savings accounts to total deposits

Figure A10.5: Net interest income to total operating income: Bank-group wise

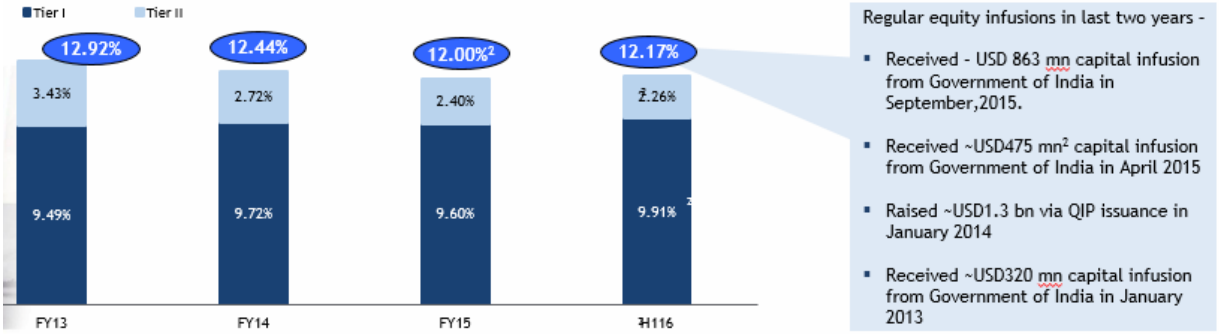


Source: RBI supervisory returns.

E. Capital

9. Based on the guidelines of RBI, SBI's Capital Adequacy Ratio (CAR) was 12.2%, of which 9.9% was Tier 1 common equity and the rest Tier 2 capital. This level has remained stable over the last three years. SBI received regular infusions of capital from the Government and raises equity on the markets. For example,: in the last 3 years SBI has received capital injection of US$1.28bn, US$500mm, and US$323mm from the Government in January 2014; and raised US$1.3 billion from the markets.

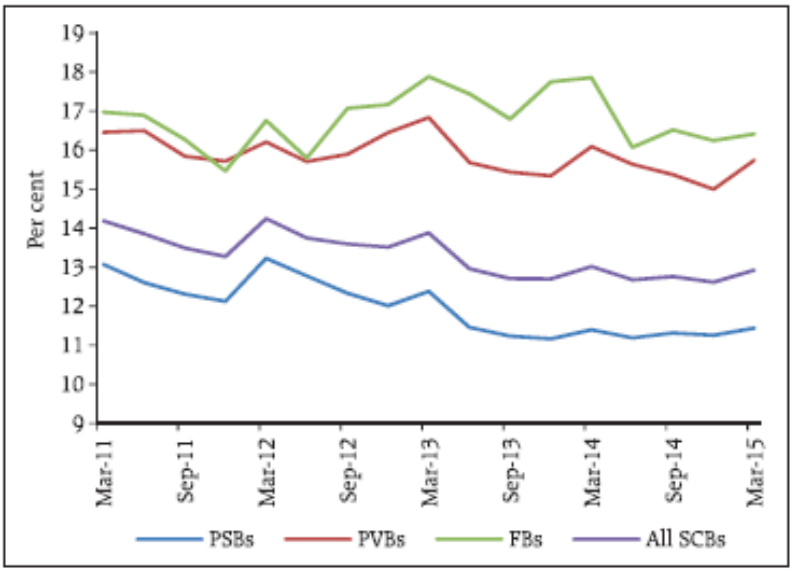
Figure A10.6: Capital Levels



Note: Exchange rate used : USD 1 = INR62.5908
All data on standalone basis as of September 30, 2015
Capital Adequacy ratios for March 31, 2015 do not include the recent equity infusion by Government of India in April 2015

10. RBI's Financial Sector Stability Report of June 2015 (based on data as of March 31, 2015) states that while the Capital to Risk-weighted Assets Ratio (CRAR) of all scheduled commercial banks in the Indian banking system was 12.8 percent, public sector banks (of which SBI is the largest) continued to record the lowest CRAR among the bank-groups. The decline in their soundness (measured in terms of CRAR) by 1.8 percentage points between March 2011 and March 2015 was the highest, followed by foreign banks at 1.5 percentage points and private sector banks at 1.1 percentage points. SBI's CAR at 12.2 percent is lower than the system-wide average.

Figure A10.7: Capital Adequacy –CRAR

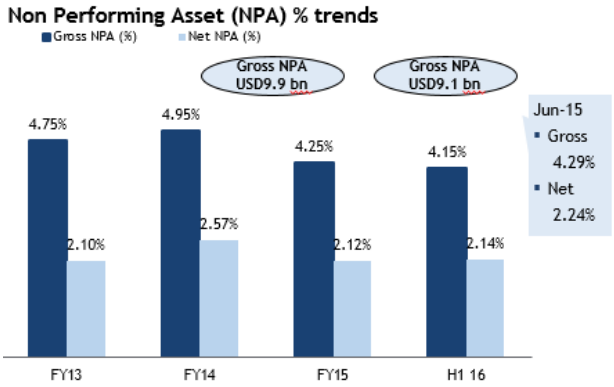


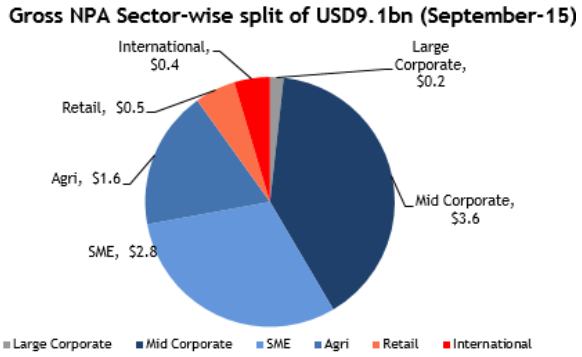
Source: RBI supervisory returns.

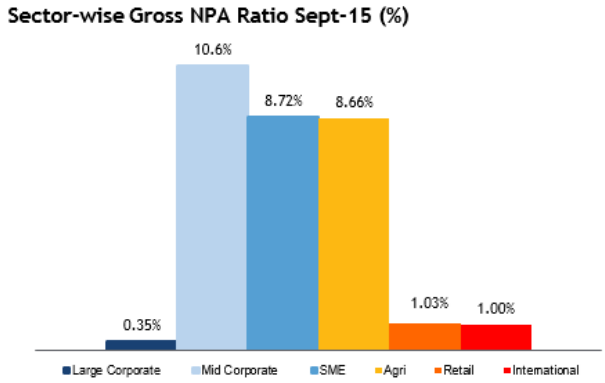
F. Portfolio quality

11. SBI's reported non-performing assets (NPAs) have been gradually declining and stood at 4.15 percent (gross) and 2.14 percent (net) as of September 30, 2015. Mid-corporate, SME, and agriculture are reported as sectors with the highest levels of gross non-performing loans.

Figure A10.8: SBI Asset quality







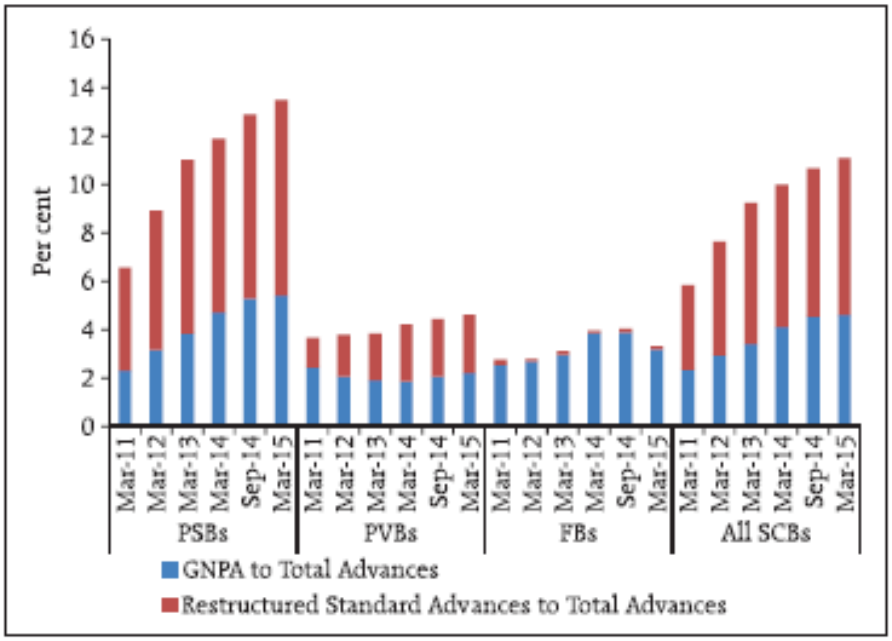
Details of Restructured Assets

Particulars (USDbn)	Standard	NPA	Total
Restructured Accounts as of Mar 31, 2015	8.9	2.5	11.4
Fresh restructuring	0.4	0.1	0.5
Upgradation to restructured category	0.0	0.0	0.0
Restructured advances upgraded to Standard Advances	-0.2	0.0	-0.2
Down grade to restructured	-0.3	0.3	0.0
Transferred to AUCA/Decrease in O/S and closures	-0.4	0.0	-0.4
Total Restructured accounts as of Sept 30, 2015	8.5	2.8	11.3

12. The bigger issue with SBI's portfolio is restructured loans. Under RBI guidelines SBI – and all other Indian banks - was allowed to restructure a portion of its NPAs. As of September 30, 2015, these restructured assets stood at US$11.3 billion (gross NPAs stood at US$9.1 billion). 2.8% of restructured assets went into NPA status. SBI's future strategy calls for a consistent focus on improving asset quality. SBI's main rationale for its NPAs is the recent slowing economic growth rate and slower off-take of projects. The Indian banking system overall has seen its NPAs increase in recent times and, in line with that, SBI as the largest lender in the country, has also seen its NPA ratios increase. Going forward, SBI is focusing on investment grade corporates for incremental exposure and is looking at each account individually for resolution and there is centralized follow-up of all stressed assets exceeding INR1 million.

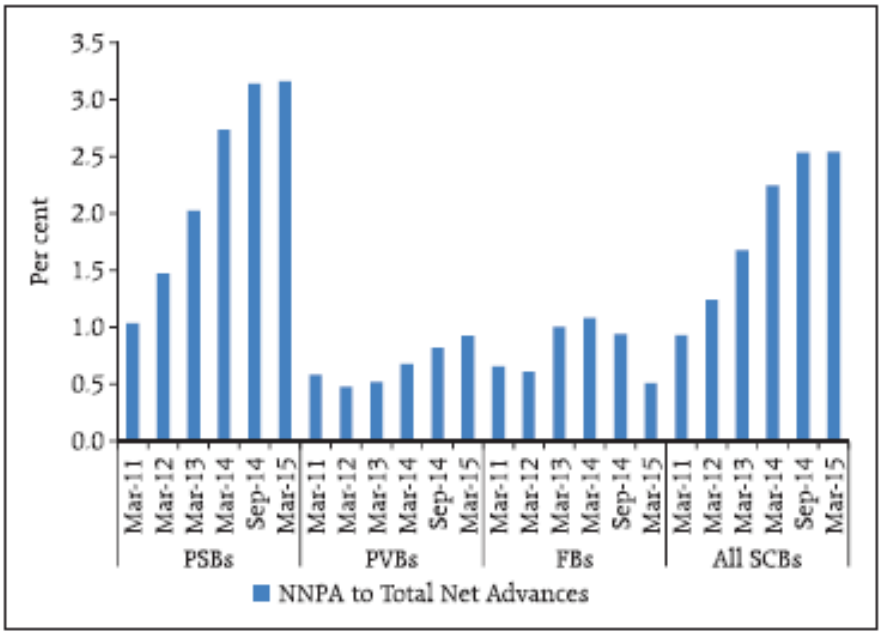
13. In its financial sector Stability report of June 2015, the RBI has raised concerns about the issue of the level of stressed advances in the banking system. The report states that the gross non-performing advances of scheduled commercial banks as percentage of gross loans increased to 4.6 per cent from 4.5 per cent between September 2014 and March 2015. The restructured standard advances during the period also increased, pushing up the SCBs' stressed advances to 11.1 per cent of the total advances from 10.7 per cent. The public sector banks – of which SBI is the largest - recorded the highest level of stressed assets at 13.5 percent of total advances as of March 2015, compared to 4.6 percent in the case of private sector banks.

Figure A10.9: Asset Quality of SCBs[2]



Source: RBI supervisory returns.

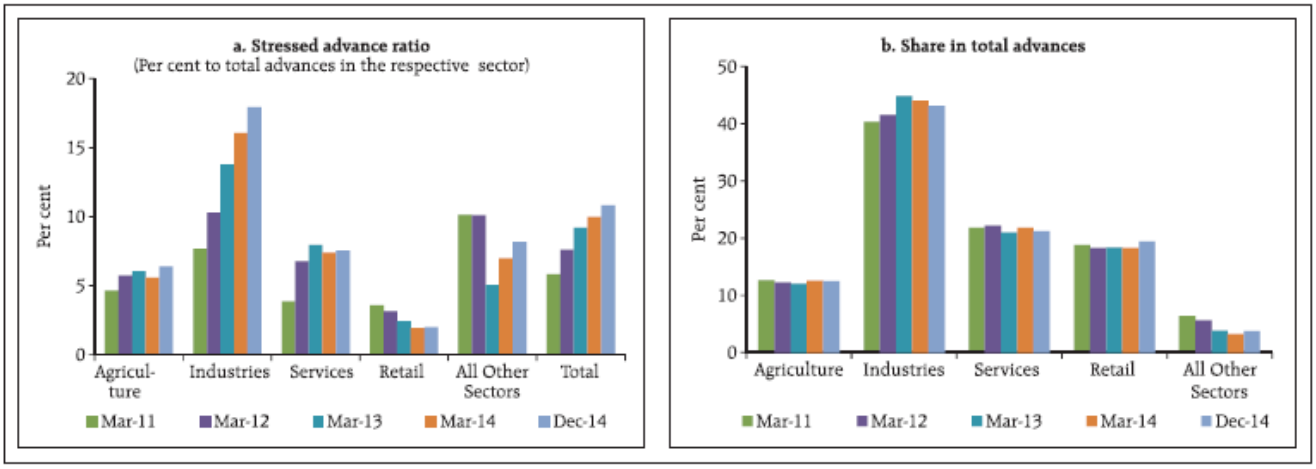
Figure A10.10: Net Non-performing Assets of SCBs



Source: RBI supervisory returns.

[2] PSB: Public Sector Bank, PVB: Private Sector Bank, FB: Foreign Bank, and SCB: Scheduled Commercial Bank

Figure A10.11: Stressed advances in broad



Source: RBI supervisory returns.

14. Sectoral system-wide data as of December 2014 indicates that among the broad sectors, industry continued to record the highest stressed loans ratio at 17.9 percent followed by services at 7.5 percent. Five sub-sectors, namely, mining, iron & steel, textiles, infrastructure and aviation, which together constituted 24.8 percent of the total loans of the scheduled commercial banks, had a much larger share of 51.1 per cent in the total stressed loans. Among these five sectors, infrastructure and iron & steel had a significant contribution in total stressed loans accounting for nearly 40 per cent of the total. Among the bank groups, public sector banks – of which SBI is the largest – were those which had the maximum exposure to these five sub-sectors, had the highest stressed loans.

Table A10.2: Contribution of stressed sectors to the loans as well as stressed loans (December 2014)

(per cent)

Sub-Sector		Public Sector Banks	Private Sector Banks	Foreign Banks	All SCBs
1. Mining	Share in Advances	1.7	0.4	0.4	1.3
	Share in Stressed Advances	1.4	1.1	0.3	1.4
2. Iron & Steel	Share in Advances	5.2	2.5	2.7	4.5
	Share in Stressed Advances	10.5	7.9	3.6	10.2
3. Textiles	Share in Advances	3.9	2.4	1.2	3.4
	Share in Stressed Advances	7.5	6.4	3.4	7.3
4. Infrastructure	Share in Advances	17.6	8.4	6.4	15.0
(of which)	Share in Stressed Advances	30.9	18.2	32.8	29.8
Power Generation	Share in Advances	10.1	3.8	1.1	8.3
	Share in Stressed Advances	17.3	7.3	0.0	16.1
Telecom	Share in Advances	1.7	0.9	3.2	1.6
	Share in Stressed Advances	1.8	3.1	19.7	2.2
5. Aviation	Share in Advances	0.6	0.1	0.6	0.5
	Share in Stressed Advances	2.7	0.4	0.0	2.4
Total of these five sub-sectors (1 to 5)	Share in Advances	29.0	13.9	11.3	24.8
	Share in Stressed Advances	53.1	34.1	40.0	51.1

Source: RBI supervisory returns.

15. The RBI report concludes that "…the level of risks continue to be a matter of concern. Further, concerns also remain over the already deteriorated asset quality and lower soundness as also the profitability which remained sluggish. Further deterioration in the asset quality, if any, could adversely affect the health of the banking system". All of these risks apply to SBI as well, as the largest state owned bank in the system.

G. Regulation and supervision

16. SBI is subject to regular supervision by RBI and meets all national requirements for banking in the country. It is audited on an annual basis by a panel of 28 audit firms and has consistently received unqualified audits.

H. Corporate Governance

17. State Bank of India is committed to the best practices in the area of Corporate Governance with its belief that good Corporate Governance is more than complying with legal and regulatory requirements. Its declared corporate governance objectives aim to protect and enhance shareholder value; protect the interest of all other stakeholders such as customers, employees and the society at large; aim to ensure transparency and integrity in communication and to make available full, accurate and clear information to all concerned; ensure accountability for performance and customer service and to achieve excellence at all levels; and to provide corporate leadership of highest standards for others to emulate.

18. SBI has a Central Board of Directors – constituted according to the SBI Act, which is the ultimate governing authority of the bank. It oversees the risk profile of the bank; monitors the integrity of its business and control mechanisms; ensures expert management; and aims to maximize the interests of its stakeholders**.** The Central Board is headed by the Chairman and four Managing Directors as full-time Directors. As on 31st March 2015, there were ten other directors on the Board including professionals and representatives of shareholders and staff of the Bank, nominee officials of Government of India and Reserve Bank of India. During the year 2014-15, twelve Central Board Meetings were held.

19. The Executive Committee of the Central Board as well as nine other committees – Audit Committee, Risk Management Committee, Stakeholders Relationship Committee, Special Committee of the Board for Monitoring of Large Value Frauds (Rs. 10 million and above), Customer Service Committee, IT Strategy Committee, Remuneration Committee, Board Committee to Monitor Recovery, and Corporate Social Responsibility Committee provide professional support in the conduct of Board level business in these key areas. While the Remuneration Committee approves, once in a year, payment of incentives to full-time Directors, based on Government of India guidelines, the other Committees meet periodically to deliberate on Policy issues and to review domain performance, as per the calendar of reviews approved by the Central Board. The Committees also call external specialists, besides drawing upon the services of top executives from the Bank, as and when needed. The minutes and proceedings containing brief reports on the discussions held at the meetings of the Committees are placed before the

Central Board. The composition, functions, and activities of these committees are disclosed in SBI's annual report.

20. SBI's annual report states that the bank has not entered into any materially significant related party transactions with its Promoters, Directors, or Management, their subsidiaries or relatives, etc., that may have potential conflict with the interests of the bank at large. It also discloses that SBI has complied with applicable rules and regulations prescribed by stock exchanges, SEBI, RBI or any other statutory authority relating to the capital markets during the last three years and that no penalties or strictures have been imposed by them on the bank.

21. As a listed company, SBI publishes its quarterly, half-yearly, and annual reports. The financial reports are prepared in accordance with Indian accounting standards. A panel of auditors has been auditing the accounts of SBI and its financial statements have received unqualified opinions.

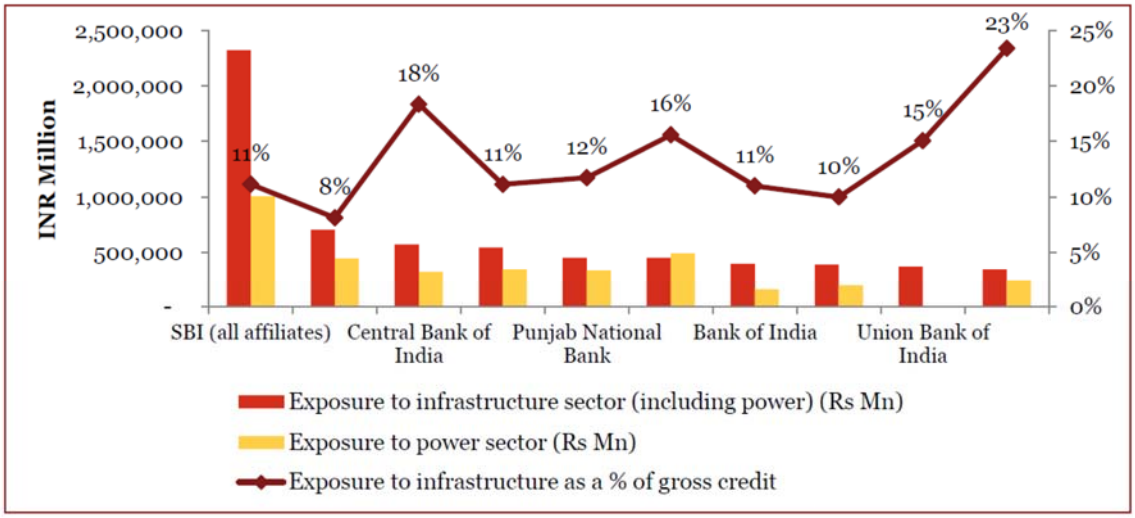
I. SBI's experience with Infrastructure financing

22. Infrastructure sector credit as a percentage of gross bank credit saw a rapid rise from 2 percent in 2001 to 13.5 percent in 2012. RBI classifies infrastructure lending under the 'industry' category. The trend of the deployment of gross bank credit shows an increase in the industry credit; both in terms of year-on-year growth as well as the share in total bank credit. The share of outstanding credit to industry has risen from 30 percent in 2009 to 34 percent in 2014.

23. Public sector banks dominate credit to the infrastructure sector. Almost three-fourths of the total bank credit to the infrastructure sector comes from only seven major commercial banks. In power sector financing, these seven public sector banks account for about 77 percent of the total gross loan to the power sector. SBI and affiliates account for a third of the total credit to infrastructure and a quarter of all public sector bank financing to infrastructure.

24. SBI has been a large lender to infrastructure with total loans of US$21.8bn outstanding. Of this, loans to the power sector stand at US$12.6bn, telecoms at US$3.5bn, and roads & ports at US$2.4bn.

Figure A10.12: Exposure of top lending banks to infrastructure sector as on March 31, 2013



Source: Banks' Basel Pillar III Disclosure

25. SBI has also been the dominant arranger-underwriter of project finance in the country (over US$100 billion) followed by IDBI, Axis Bank, Infrastructure Development Finance Company (IDFC) and Industrial Credit and Investment Corporation Bank of India (ICICI) (each with cumulative volumes averaging USD 24-16 billion). SBI was the #1 global arranger of project finance during three consecutive years, in 2009-2010-2011. SBI's share of the global market share peaked at 14.3% (in 2009), a very high percentage given that SBI only does project finance in its home country and has a smaller balance sheet than global project finance banks (Table A10.3).

Table A10.3: Indian banks ranked by Project Finance debt amounts arranged

Bank	Amount (in US$ billion equivalent)	Percent
State Bank of India	112	54%
IDBI	24	12%
Axis Bank	23	11%
IDFC	20	10
ICICI	16	8%
Other Indian banks	11	5%
Total	206	100%

26. SBI therefore has experience and expertise in lending to the infrastructure sector in general and the power sector in particular.

Annex 11: Economic Evaluation of the GRPV Program

1. This annex discusses the rationale for public financing of the Program, the valued added from the Bank support and presents the analysis of the Program's development impact in terms of expected benefits and costs. The economic analysis covers rooftop PV investments that will be undertaken under the India Grid-connected Rooftop Solar Program. This economic analysis is consistent with the new Bank guidelines on economic analysis of renewable energy projects 2015, and Social Value of Carbon in Project Appraisal 2014.

Rationale for public sector provision/financing

2. The Government of India has announced a bold target of installing 100,000MW of solar power capacity by 2022 – a twenty-fold increase from 5,000MW in 2015. Two fifths of this or 40,000MW is targeted to be achieved through Grid-connected Rooftop Solar PV (GRPV). The push in solar energy underpins GoI's *Power for All* program to supply 24x7 electricity to residential, commercial and industrial consumer by 2019 and is a key part of its efforts to reduce environmental pollution and greenhouse gas emissions. There is a need to significantly scale up both private and public investments to meet GoI's solar power targets**.** In particular, there is a strong justification for the use of public financing for this Program on the following grounds:

- **Market failure.** Public funding is necessary to provide debt financing options for GRPV developers, installers and aggregators. Given legacy issues arising from their past exposure to the power sector, traditional financial institutions are highly risk averse and are unwilling to make large lending commitments to GRPV where there is no track record of technology performance available for banks to assess (and assign prices to) a variety of perceived risks.
- **Externalities.** Public support and financing for solar rooftop is also necessary reduce the financial costs of solar power and to enable it to be competitive with thermal generation – so that the full externalities of solar power through avoided environmental and health damage costs can be captured.

Value added of the Bank's support

3. Since solar power is intermittent energy source, this transition will have to be managed effectively to be successful. The World Bank Group can play a valuable role in this transition by:

- making long term concessional financing available for development of solar power;
- sharing international knowledge and experience on how GRPV programs have been implemented across the world; and
- providing technical assistance and capacity building support to key stakeholders.

Counterfactual to the India Grid-connected Rooftop Solar Program

4. This economic analysis uses generation from supercritical coal plants and diesel generator sets as the counter factual to the generation from GRPV systems installed under the Program. This choice is justified as follows:

- Coal is responsible for more than 70 percent of India's electricity generation and is the marginal unit of thermal generation in India's grid. GoI has a stated policy goal of replacing coal generation with renewable energy, particularly solar (Figure A11.1).
- Commercial, industrial and institutional customers who are expected to be the main beneficiaries of the Program currently rely on diesel generation as back up to the grid. According to MNRE, these customers experience grid outages that average between 1 to 2 hours every day. This economic analysis assumes that about 15 percent of the electricity generated from GRPV systems would go towards displacing diesel generation.

5. An important assumption here is that the system has sufficient flexibility to absorb the variable output of PV systems through storage hydro, pumped storage, flexible gas generation (operating within whatever may be the limits of gas supply contracts), and part-load operation of thermal projects (that reduce aggregate plant efficiency and O&M costs) – all of which impose additional costs on the grid. These additional grid integration costs are discussed further below.

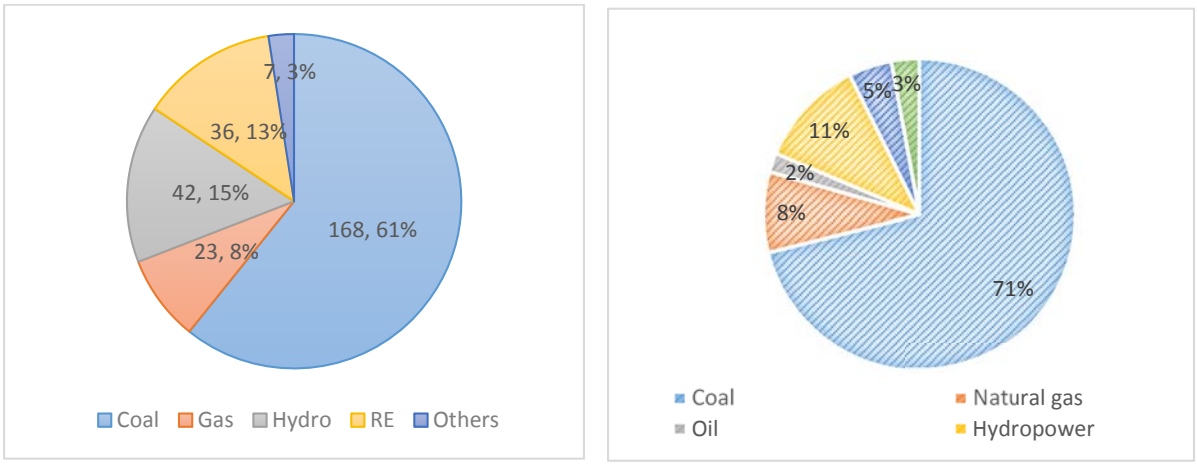
6. In urban areas growing air conditioning loads is causing a shift in the daily load curve from the traditional evening peak, so it may well be that coincident production from large scale PV may reduce the dispatch of intermediate load gas-generation rather than coal. While this would reduce the GHG emission benefits from coal generation, the benefits from thermal fuel substitution would increase (since at whatever level are international energy prices, on a cost per unit basis, gas will likely continue to be more expensive than coal in Asian markets). Such alternative counterfactuals are explored in the scenario analysis below.

The Program and its Rationale

7. An estimated 300 million people are not connected to the national electrical grid in India and those who are, face frequent disruptions. Power shortages in FY2015 were equivalent to about 3.6 percent of total energy and 4.7 percent of peak capacity requirements. To meet the power demand, industrial establishments and manufacturers have been relying on diesel-based back-up power supplies, which are significantly more expensive than grid-based electricity. Coal currently fuels two thirds of India's electricity generation. To avoid the global and local environmental damage costs associated with thermal generation, the Government of India (GoI) wants to install 100,000MW of solar power by 2022.The proposed Program is a key part of GoI's scheme to install 40,000MW of GRPV by 2022 and will help in meeting the rapidly growing electricity demand in an environmentally sustainable way.

Figure A11.1 - Source wise installed capacity and generation in India (1,000MW, 2015)

a) Capacity **b) Generation**



Cost Benefit Analysis of India Grid-connected Rooftop Solar Program

8. The economic viability of the Program was assessed through a cost-benefit analysis. Net benefits for the *Program* was calculated by comparing total system costs and benefits for the "*with Program*" and "*without Program*" scenario. A range of scenarios and sensitivities that meaningfully reflect the uncertainties of key input variables are evaluated. The analysis includes a consideration of the relevant environmental and social externalities. Distributional analysis has been carried out by reconciling the different financial flows of the Program to determine the main beneficiaries of the Program. Monte Carlo simulation, which assumes input assumptions are defined as probability distributions rather than as single "best estimates", is used to analyze the possibility of more than one input assumption combines unfavorably.

Program costs

Rooftop PV costs

9. The analysis uses the estimate of Rooftop PV system costs of Rs90/watt (US$1.4/watt) in 2014 for commercial customers[1]. These costs comprise of panel costs (55 percent), inverter costs (15 percent), installation cost (15 percent) and other balance of system costs (15 percent). A 10 percent reduction in cost per year is assumed through to 2019, which is the last year of investments under the proposed Program. The projected reduction in costs in consistent with Central Electricity Regulatory Authority's (CERC) projection of solar PV costs in India (Table A11.1).

[1] Reaching the Sun with Rooftop Solar: http://shaktifoundation.in/report/reaching-sun-rooftop-solar

Table A11.1 – Breakdown of cost

Item	US$/Watt	Share
Panel	0.77	55%
Inverters	0.21	15%
Installation	0.21	15%
Other BOS	0.21	15%
Total	**1.4**	**100%**

Operating and Maintenance costs

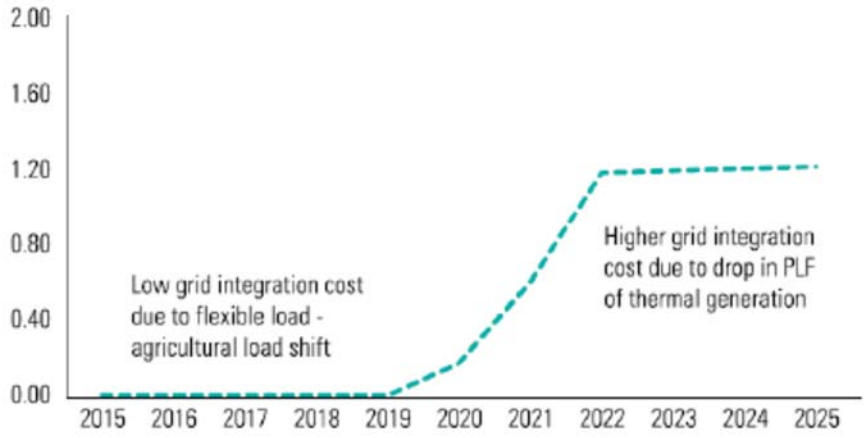
10. The operation and maintenance (O&M) costs are estimated as 1.0 percent of the rooftop PV system costs as per MNRE's white paper, which computes to US$3.8 million per year for 400MW of installed capacity[2].

Grid integration costs

11. Since the grid is not designed to manage intermittent sources of generation, solar power can impose additional coping costs on the grid. These include but are not limited to (i) additional operation and maintenance costs of thermal plants if they have to operate at lower load factors than would otherwise be the case; (ii) the need for standby generation to provide power when there is no sunshine; and (iii) grid augmentation and modernization costs to cope with increase in decentralized generation. Grid integrations costs increase with the level of penetration of solar power in the grid. In India, the grid integration costs can be expected to be low until 2020 because of the relatively low level of penetration of solar power in the grid and the availability of high level of flexible agricultural load[3]. Costs can be expected to increase thereafter as the share of solar power in the total installed capacity increases. Accordingly, this economic analysis uses grid integration costs that increase to about US$2.1 cents/KWh (INR1.30/KWh) in 2025[4]. These values have been adapted from estimates of grid integration costs in Pudjianto et. al.[5]

[2] Reaching the Sun with Rooftop Solar: http://shaktifoundation.in/report/reaching-sun-rooftop-solar
[3] KPMG 2015
[4] A multi-year grid integration study led by NREL and supported by USAID and the Bank/ESMAP that is currently underway is expected to shed more light on grid integration costs of solar power in India. This economic analysis will be updated to revise the findings of this study during Program implementation.
[5] Pudjianto, D., et al. "Grid integration cost of photovoltaic power generation: Direct costs analysis related to grid impacts of photovoltaics." *Munich, Germany: PV PARITY* (2013).

Figure A11.2 - Grid integration costs used in the economic analysis (INR/KWh)



Source: KPMG India based on *Direct Costs Analysis related to Grid Impacts of Photovoltaics, September 2013*

Program Benefits

Fuel costs of the thermal counterfactual using coal

12. Avoided fuel costs of thermal counterfactual constitutes one of the main economic benefits associated with solar power generation. These avoided costs are calculated based on the coal and diesel supply requirements of producing electricity equivalent to those produced from the GRPV systems installed under the Program. As mentioned above, the thermal counterfactual is assumed to be 85 percent coal and 15 percent diesel generation. A CUF of 19 percent is used. The coal is valued at import price of coal of US$58/ton in 2015 from Australia, which is higher than the domestic price of coal in India. In addition, sea freight costs of US$12/ton and rail freight costs of US$13/ton are added to the cost of coal. Coal price forecast through 2042 are based on the January 2016 World Bank commodity forecasts.

Reduced T&D losses

13. Since GRPV systems generate energy in the same building or locality as consumption (in almost all cases), transmission and distribution losses are much lower for GRPV systems than conventional thermal coal plants, which constitute the 85 percent of the counterfactual to this Program. This analysis assumes avoided T&D losses of GRPV of 12 percent. This estimate only includes avoided technical losses.

Capacity value of the solar power

14. Generation capacity value is the amount of central generation capacity that can be deferred or avoided due to the installation of PV plant. A capacity value equal to the forecast capacity factor of the GRPV systems (19 percent) is used in the base case of the economic analysis. In reality, the ability to avoid or defer generation capacity depends on a number of factor such as the underlying load growth, the timing, quantity, and geographic location of GRPV systems, and the coincidence of PV generation with system peak. Since the capacity value of solar PV is subject to significant

uncertainty, sensitivity analysis has been carried out on the chosen value to demonstrate the impact of different values on the ERR.

Avoided global environmental damage cost

15. Avoided global externalities constitute another economic benefit of GRPV systems, given that solar power replaces thermal generation. Emissions of coal based and diesel based generation displaced by GRPV systems are estimated are using a emission factors of 830,000tons/MW-hours and 650,000tons/MW-hours, respectively. Consistent with Bank guidance on the social value of carbon, carbon emission reductions are valued in the base case at US$30 in 2015 and increasing to US$80 in real terms by 2050. The low (US$15 in 2015 increasing to US$50 in 2050) and the high paths (US$50 in 2015 increasing to US$150 in 2050) for the social value of carbon suggested in the Bank guidance are used for sensitivity analysis.

Avoided local environmental damage costs

16. The emission factors for Sulphur Dioxide, Nitrogen Oxides, and Particulate Matter of less than ten micrometers in diameter (PM-10) for coal generation plants in India from Cropper *et al*.(2012).[6] Damage costs are from the latest version of the World Bank's Guidelines for Economic Analysis of Power projects (which are based on the 2015 Update of the Six Cities Study). The local environmental damage costs of coal are based on modern coal units with state-of-the art pollution control (and tall stacks). (Table 11.2). Damage costs from self-generation (in densely populated urban areas with no pollution controls and emissions near ground level) are indeed an orders of magnitude greater than from utility projects in more remote rural areas.

Table A11.2 – Emission Factor and Damage Costs

	Units	Nitrogen Oxides	PM-10	Sulphur Dioxide
Emission Factor, coal	g/kwh	2.09	0.227	1.44
Damage costs, coal	US$/ton	16	66	21
Damage costs, self-generation	US$/ton	575	2396	767

Non Quantified Benefits

17. The proposed Program is also expected to have a number of additional benefits which are either uncertain or difficult to quantify such as (i) energy security (ii) macroeconomic benefits through the development solar manufacturing industries; (iii) employment generation; (iv) learning and economy of scale benefits which can help facilitate further reductions in cost of PV. These benefits have not been included in this economic analysis.

Economic analysis

[6] Cropper, M., S. Gamkhar, K. Malik, A Limonov, and I Partridge, *The Health Effects of Coal Electricity Generation in India*, Resources for the Future, June 2012

Assumptions

18. In addition to the costs and benefits noted in the previous section, the economic analysis rests on the following additional assumptions:

- Discount rate for calculation of NPV: 12% as the rate used by the Central Electricity Authority for its planning scenarios.
- Program cost phasing as follows:

	2016	2017	2018	2019
PV Generation	20%	20%	30%	30%

- The resulting energy balance is shown in Table 11.3.

Table 11.3: Program Energy Balance

				NPV	2016	2017	2018	2019	2020	2021	2022	2023
[1	disursement	400	[MW]		0.2	0.2	0.3	0.3				
[2	installed capacity	year 1	[MW]		80							
[3]		year 2	[MW]			80						
[4]		year 3	[MW]				120					
[5]		year 4	[MW]					120				
[6]		*capacity factor*										
[7	energy	0.189	[GWh]		132.5	131.1	129.8	128.5	127.2	126.0	124.7	123.5
[8]		0.189	[GWh]			132.5	131.1	129.8	128.5	127.2	126.0	124.7
[9]		0.189	[GWh]				198.7	196.7	194.7	192.8	190.8	188.9
[10]		0.189	[GWh]					198.7	196.7	194.7	192.8	190.8
[1	total PV energy		[GWh]	4049	132.5	263.6	459.6	653.7	647.2	640.7	634.3	627.9
[1	displacing diesel self-gen	0.15	[GWh]	607	19.9	39.5	68.9	98.1	97.1	96.1	95.1	94.2
[1	displacing grid generation		[GWh]	3442	112.6	224.0	390.7	555.6	550.1	544.6	539.1	533.7
[1	avoided transmission energy	0.11	[GWh]	425	13.9	27.7	48.3	68.7	68.0	67.3	66.6	66.0
[1	displaced thermal grid energy		[GWh]	3867	126.5	251.7	439.0	624.3	618.1	611.9	605.8	599.7
	avoided diesel fuel		mLitres		6.0	11.9	20.7	29.4	29.1	28.8	28.5	28.3
	avoided coal		million toms		51	101	175	249	247	244	242	240

Results

19. The economic analysis shows that the economics of GRPV in India is improving rapidly and that the proposed Program is economically viable after the consideration of environmental externalities. The baseline economic return of proposed GRPV Program against the "thermal generation scenario" comprising of electricity supply using imported coal and diesel generators is 17.5 percent (NPV US$ 88 million) (Table A11.4). These returns are inclusive of local and global environmental benefits, which add 11 percentage points (NPV US$162 million) to the ERR.

20. The economic evaluation takes a conservative approach to the estimation of benefits of GRPV in India. In particular, a number of benefits of GRPV which are difficult to quantify such as (i) energy security (ii) macroeconomic benefits through the development solar manufacturing industries; (iii) employment generation; (iv) learning and economy of scale benefits which can help facilitate further reductions in cost of PV have not been included in the economic analysis.

The analysis also uses conservative assumptions for the reduction in GRPV costs[7]. It is hence quite likely that the ERR of the proposed Program would be higher than estimated results of this analysis.

Table A11.4 – Summary of Economic Analysis

				NPV	2016	2017	2018	2019	2020	2021	2022	2023
Costs												
cost/kW	0.9		[$/kW]		1304.1	1173.7	1056.3	950.7				
less import duty&tax	0.15		[$/kW]		-170.1	-153.1	-137.8	-124.0				
economic cost/kW			[$/kW]		1134.0	1020.6	918.5	826.7				
MW installed	400.0		[MW]		80.0	80.0	120.0	120.0				
investment cost			[$USm]	*287.6*	90.7	81.6	110.2	99.2				
cumulative			*[$USm]*		*90.72*	*172.37*	*282.59*	*381.80*	*381.8*	*381.8*	*381.8*	*381.8*
O&M Costs	0.01		[$USm]	*23.5*	0.0	1.3	2.3	3.3	3.8	3.8	3.8	3.8
Incremental transmisison investment			[$USm]	*0.0*								
O&M on transmisison			[$USm]	*0.0*								
VRE integration cost			[USc/kWh]			0.1	0.2	0.3	0.4	0.6	0.8	1.2
			[$USm]	*44.3*	0.0	0.3	0.9	1.9	2.5	3.7	4.8	7.2
total costs			**[$USm]**	***355.4***	**90.7**	**83.2**	**113.4**	**104.4**	**6.3**	**7.5**	**8.7**	**11.0**
Benefits												
self-generation(displaced oil)												
avoided variable costs			[$USm]	***111.0***	2.9	6.0	10.8	16.0	16.4	16.8	17.3	17.8
avoided capacity costs			[$USm]	*0.0*								
grid (displaced coal)												
avoided variable costs			[$USm]	*128.6*	4.2	8.4	14.6	20.8	20.6	20.3	20.1	19.9
avoided capacity costs	929	0.19	[$USm]	*41.8*	0	0	14.1	14.1	21.2	21.2		
total benefits			**[$USm]**	**281.4**	**7.1**	**14.4**	**39.5**	**50.8**	**58.1**	**58.4**	**37.4**	**37.7**
total economic flows			**[$USm]**	**-74.0**	**-83.6**	**-68.9**	**-73.9**	**-53.6**	**51.8**	**50.9**	**28.8**	**26.7**
ERR			[ ]	**6.5%**								
local environmental impacts												
diesel self-gen			[$USm]	*12.6*	0.0	0.5	0.9	1.4	1.4	1.5	1.6	1.7
coal			[$USm]	*5.1*	0.0	0.2	0.4	0.6	0.7	0.7	0.7	0.7
economic flows including local env.			[$USm]	-56.4	-83.6	-68.2	-72.5	-51.6	53.9	53.1	31.1	29.1
ERR including local env.			[ ]	**8.1%**								
avoided GHG emissions			[$USm]	*144.3*	3.7	7.7	13.8	20.1	19.9	20.9	21.2	21.6
econmic flows incl. global GHG benefits			**[$USm]**	**87.9**	**-79.9**	**-60.5**	**-58.8**	**-31.4**	**73.8**	**73.9**	**52.3**	**50.7**
ERR including global GHG			[ ]	**17.5%**							-3.8%	2.0%

21. Table 11.5 shows the summary of the calculations of the economic returns, for 12 percent discount rate.

[7] Assumed to decline at 10% per annum during the investment phase of the program, which is half the rate of decline seen in recent years.

Table 11.5 – Summary of Economic Analysis

Discount rate		12.0%
Economic rate of return		
ERR	[ ]	6.5%
ERR+local externalities	[ ]	8.1%
ERR+local+GHG@BankGuidanceValues	[ ]	17.5%
Levelized cost of solar PV	US$ cents/Kwh	9.0
Levelized cost of counterfactual	US$ cents/Kwh	12.2
Composition of NPV		
Costs		
capital cost	[$USm]	288
Integration costs	[$USm]	44
O&M	[$USm]	24
total costs	**[$USm]**	**355**
Benefits[avoided thermal generation]		
Avoided fuel costs: Selfgen	[$USm]	111
Avoided fuel costs: Grid	[$USm]	129
Capacity credit	[$USm]	42
total benefits	**[$USm]**	**281**
NPV (before environmental benefits)	**[$USm]**	**-74.0**
local environmental benefits: avoided self-generation	[$USm]	12.6
local environmental benefits: avoided grid generation	[$USm]	5.1
NPV (incl. Local environmental benefits)	[$USm]	**-56.4**
value of avoided GHG emissions	[$USm]	144.3
NPV (including environment)	**[$USm]**	**87.9**
Lifetime GHG emissions, undiscounted	mtons CO2	13.1
Switching value of GHG emissions	$/ton	15.7

22. Sensitivity analysis using the low case (increasing from US$15 per ton in 2015 to US$50 in 2050) and high case (increasing from US$50 per ton in 2015 to 150 in 2050) social values of carbon recommended by Bank guidance impacts the returns of the Program significantly. There is 10 percentage point difference between the ERRs for low case and high case social value of carbon (Table A11.6).

Table A11.6 – Sensitivity on Social Value of Carbon

Social Value of Carbon	NPV	EIRR
Low Case	18	13.2%
Base Case	88	17.5%
High Case	185	23.2%

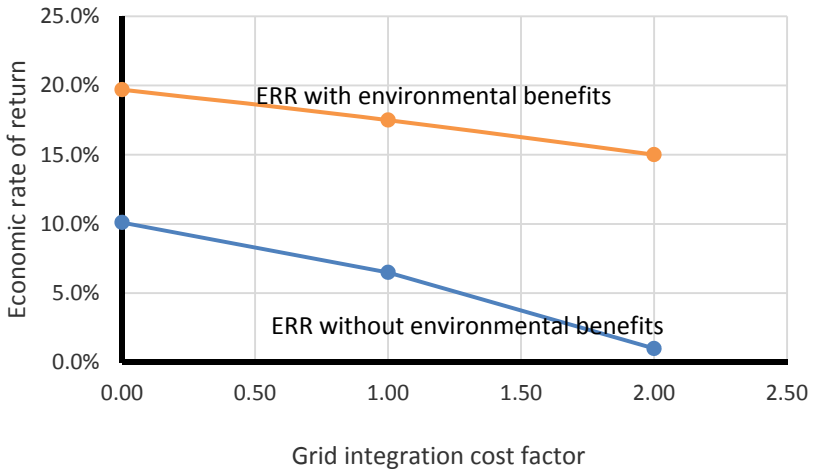
23. Sensitivity analysis on the discount rate used shows that the Program reaches positive net present value for discount rates below 17.5 percent. A discount rate of 12 percent results in NPV of US$88 million. A discount rate of 6 percent leads to a NPV of US$317 million.

Sensitivity Analysis

Grid Integration Costs

24. This economic analysis uses grid integration costs that are based on international benchmarks as indicated above i.e. cost increase to gradually to US$2.1 cents/KWh by 2025 and then remain at that level. Given the uncertainty around grid integration costs, sensitivity analysis was carried out on this variable to analyze the impact of this variable on Program ERR. Figure A11.3 shows that even if grid integration costs are as twice as high as the base case, the ERR of the program (with environmental benefit) only decreases to about 15 percent from 17.5 percent. The switching value for the grid integration cost factor is 3.0, implying that the grid integration costs would have to be three times as much as they are in the base case for the ERR to fall below 12 percent.

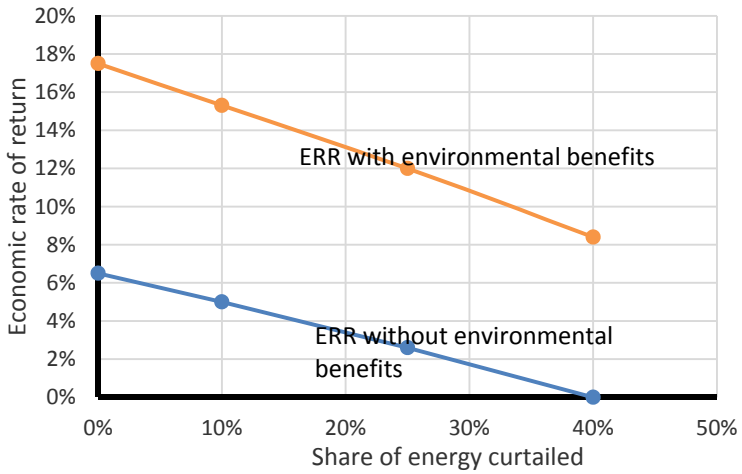
Figure A11.3 Grid Integration Costs Vs ERR



Energy curtailment

25. During times of power oversupply, unfavorable market conditions, or grid congestion power grid operators may curtail energy resources. Curtailment is an obvious forfeiture of energy and it increases the lifetime cost of electricity from curtailed generators. Curtailment has been a major factor for wind generation in Southern India and is a risk with solar power generation. Sensitivity analysis on this important variable shows that the ERR falls from 17.5 percent to 12 percent if one quarter of the electricity generation is curtailed (see Figure below). The switching value of this variable is 25 percent.

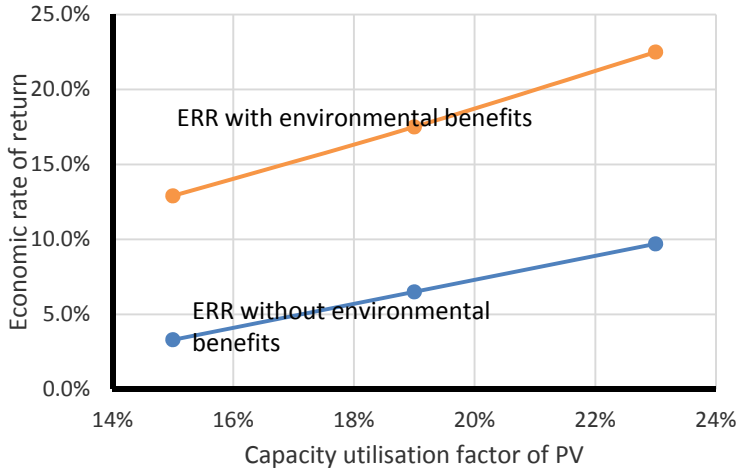
Figure A11.4 Energy Curtailment Ratio Vs ERR



Capacity Utilization Factor (CUF)

26. Figure A11.5 shows the sensitivity of ERR to different capacity utilization factors. A CUF of 15% results in an ERR of 12.9% while a CUF of 23% results in an ERR of 22.5%. The switching value of the CUF is 14.2%, which below the low end of expected values for this variable.

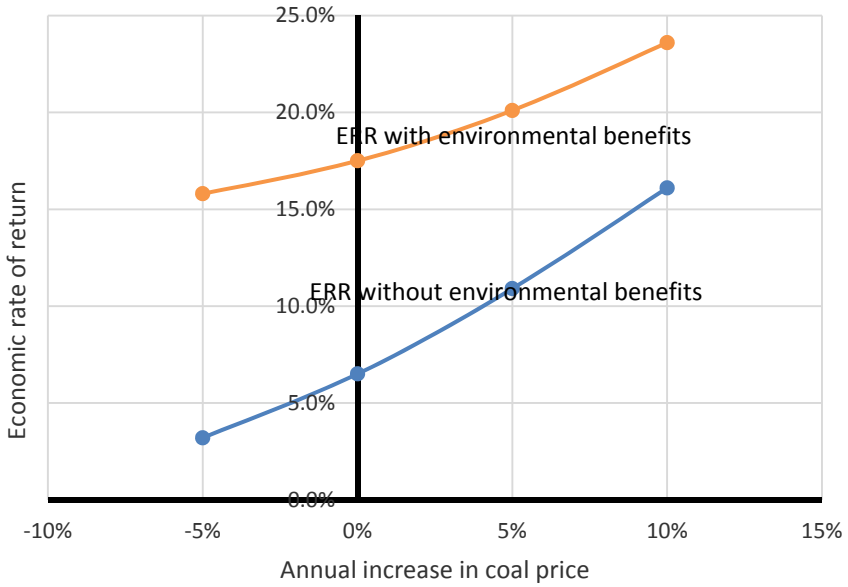
Figure A11.5 Capacity Utilization Factor Vs ERR



Growth rate of coal price

27. Figure A11.6 shows the sensitivity of ERR to different cumulative average growth rates (CAGR) of coal. Switching value is attained for -61% CAGR for coal, which is a highly unlikely scenario.

Figure A11.6 Annual increase in coal price Vs ERR

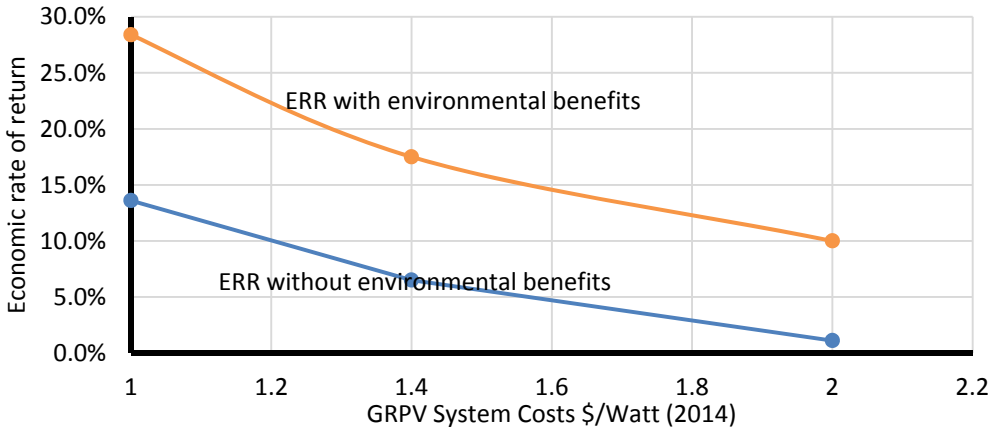


GRPV System costs

28. As mentioned above, this analysis uses the estimate of Rooftop PV system costs of Rs90/watt (US$1.4/watt) in 2014 as the base case together with a 10 percent annual decline in system costs through to 2019. Since solar power is relatively new area of development, there continues to be significant uncertainty on Program cost estimates. While the overall direction of costs has in recent years been on a downward trends, it is not clear if the recent rates of decline will continue to hold.

29. Figure A11.7 shows the sensitivity of ERR to GRPV system costs. The switching value at which the Program cost overrun factor causes the ERR (with environmental benefits) to decrease to the hurdle rate of 12 percent is 1.8. By contrast, GRPV system cost of US$1.0/watt would cause the ERR to increase to 28 percent.

Figure A11.7 GRPV system cost Vs ERR



Switching Values

30. The switching values analysis is summarized in Table A11.7.

Table A11.7 – Switching Values

Input	Unit	Baseline Value	Switching Value
CUF	%	19%	14%
PV Cost	US$/Watt	1.4	1.8
% Annual increase in coal price	%	0%	-61%
Discount Rate	%	12%	6.5%
Grid Integration Cost Factor	Ratio	1	3.0
Energy Curtailment	%	0%	25%

Financial analysis.

31. The financial analysis of the Program was carried out by valuing the electricity generated from GRPV systems in financial terms (i.e. the prevailing electricity tariff of GRPV customers), adding taxes and duties to the Program costs used in the economic analysis and excluding global and environmental benefits from the Program benefit. As shown in Table A11.8, this yields a Financial Internal Rate of Return (FIRR) of 22.5% for GRPV customers. The net financial benefits to GRPV customers is US$215 million. A distributional analysis of the Program was carried out by reconciling economic and financial flows of the Program.

Table A11.8 – Financial Internal Rate of Return

			NPV	2016	2017	2018	2019	2020	2021	2022	2023
Consumers											
benefits											
energy charge in the tariff		INR/kWh		7.15	7.15	7.15	7.15	7.15	7.15	7.15	7.15
Avoided electricity tariff		INRmillion			1601.9	2793.3	3972.9	3933.1	3893.8	3854.9	3816.3
		$USm	419		25.6	44.7	63.6	62.9	62.3	61.7	61.1
Avoided VAT	0.15	INRmillion			240.3	419.0	595.9	590.0	584.1	578.2	572.4
		$USm	63		3.8	6.7	9.5	9.4	9.3	9.3	9.2
Diesel, retail price		INR/litre		42.2	43.3	44.5	45.7	46.9	48.3	49.6	51.1
avoided diesel purchases		INRmillion			513.7	919.4	1344.3	1367.2	1391.6	1417.1	1443.7
		$USm	155		8.2	14.7	21.5	21.9	22.3	22.7	23.1
total benefits		$USm	637		37.7	66.1	94.6	94.2	93.9	93.6	93.3
costs											
PV system cost		$USm	288	90.7	81.6	110.2	99.2	0.0	0.0	0.0	0.0
Taxes onPV system	0.15	$USm	43	13.6	12.2	16.5	14.9	0.0	0.0	0.0	0.0
O&M on PV systems		$USm	23	0.0	1.3	2.3	3.3	3.8	3.8	3.8	3.8
net cash flows		$USm	215	-104.3	-57.5	-62.9	-22.8	90.4	90.1	89.8	89.5
aggregate FIRR		[ ]	22.9%								
DISCOMs											
benefits											
avoided wholesale purchase cost		INR/kWh		5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
		INRmillion			1258.7	1953.4	2778.2	2750.4	2722.9	2695.7	2668.7
		$USm	295		20.1	31.3	44.5	44.0	43.6	43.1	42.7

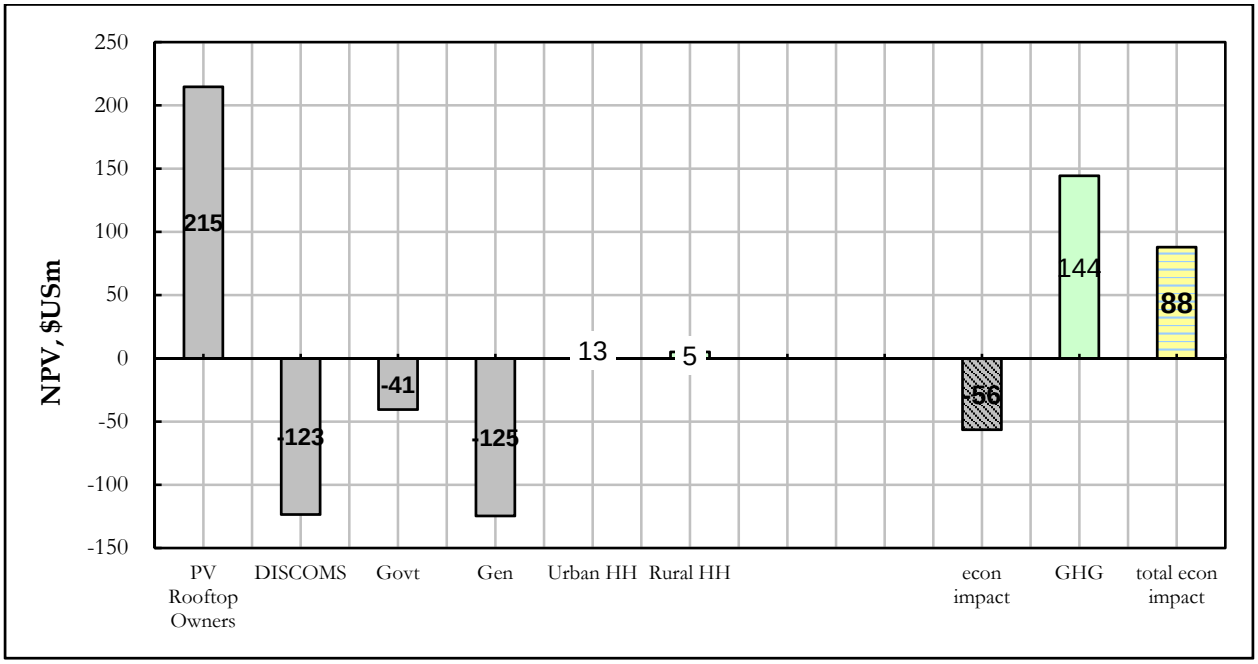
Distributional Analysis

32. A distributional analysis of the Program shows that the rooftop customers and/or developers benefit at the cost of discoms, the government, and thermal generators (Table A11.9 & Figure A11.8). If discoms cover these costs through higher tariffs, non-rooftop PV customers will be significant losers. There are also global benefits in the form of GHG emission reductions.

Table A11.9 - Distributional Analysis

	PV Rooftop Owners	DISCOMS	Govt	Gen	Urban HH	Rural HH			econ impact	GHG	total econ impact
	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]
PV system owners											
electricity purchases	374.2	-374.2							0.0		0.0
VAT on electricity purchases	56.1		-56.1						0.0		0.0
avoided diesel	138.6		-27.6						111.0		111.0
PV system costs											
Capital cost	-287.6								-287.6		-287.6
Taxes on capital cost	-43.1		43.1						0.0		0.0
O&M costs	-23.5								-23.5		-23.5
DISCOM											
grid integration costs		-44.3							-44.3		-44.3
wholesale electricity		295.1		-295.1					0.0		0.0
Generators											
avoided coal cost				128.6					128.6		128.6
avoided capacity costs				41.8					41.8		41.8
Environmental benefits									0.0		0.0
avoided GHG emissions									0.0	144.3	144.3
avoided local health damage costs					12.6	5.1			17.6		17.6
Net impact (NPV)	215	-123.5	-40.6	-124.7	12.6	5.1	0.0	0.0	-56	144	88
Discount rate:=	12.0%							ERRs>	8.1%		17.5%

Figure A11.8 Distribution of costs and benefits



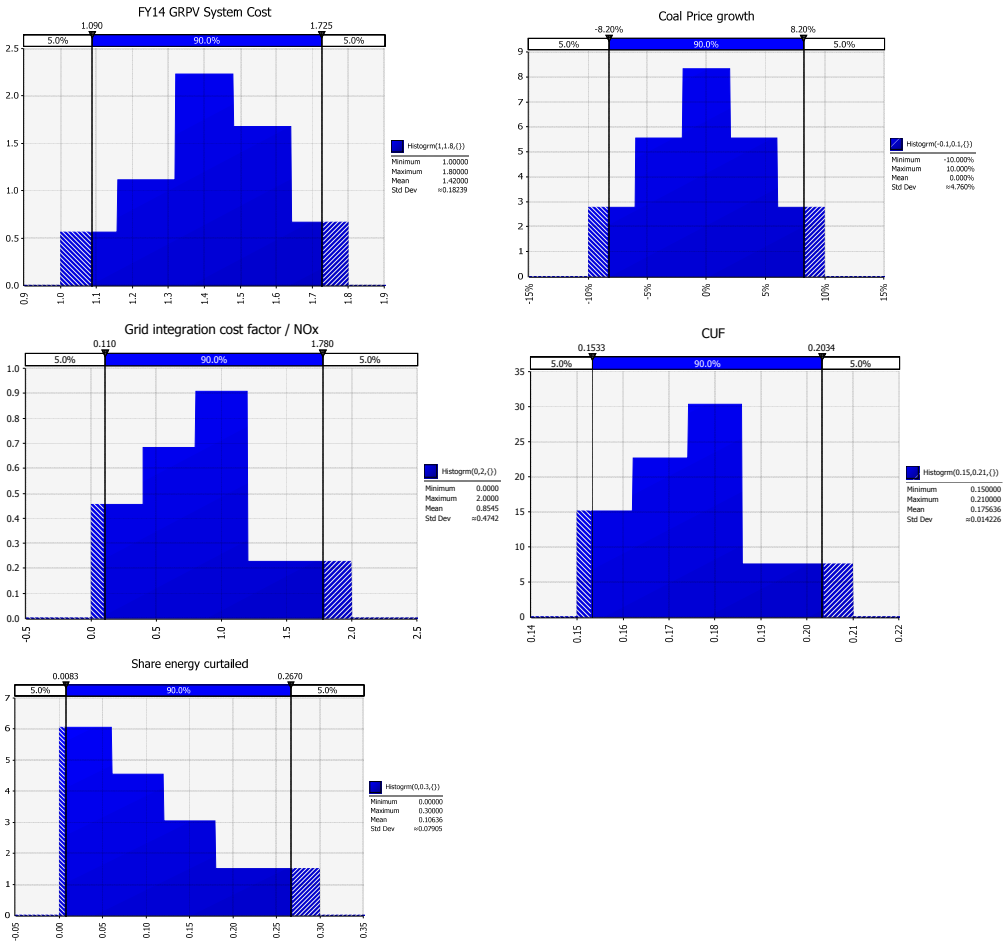
Risk assessment using Monte Carlo Simulation

33. The objective of risk assessment is to derive a probability distribution of economic returns. This is achieved by using Monte Carlo simulation, in which the input variables to the calculation of returns are specified as probability distributions rather than as single "best estimates". The ERR then is calculated for each random drawing from these probability distributions (repeated 5,000 times in this analysis), from which the probability distribution for economic returns follows. The following is the assumed probability distributions for the uncertainty in input assumptions as well as the rationale for the hypothesized distributions:

- Capital Cost: skewed to the right, given the experience that capital cost estimates tend to be higher than initial expectations.
- Energy curtailed: skewed to the right based on past experience with renewable energy projects in India, which have not always been able to evacuate all the electricity generated to the grid
- Capacity utilization factor: If operations and maintenance GRPV systems is poor, systems can find it difficult to maintain the planned capacity utilization factors. Likewise, if the number of hours of solar irradiation is lower than initially estimated, the CUF can turn out to be lower. Since the downside risk to CUF are higher, the probability distribution is skewed to the left.
- Growth of coal prices. The probability distribution of the projected annual increase of coal price is centered on the base case scenario with equal probability of the price being higher or lower.
- Grid integration costs. The probability distribution of grid integration costs is skewed to left because estimates are based on international benchmarks for solar PV in general;

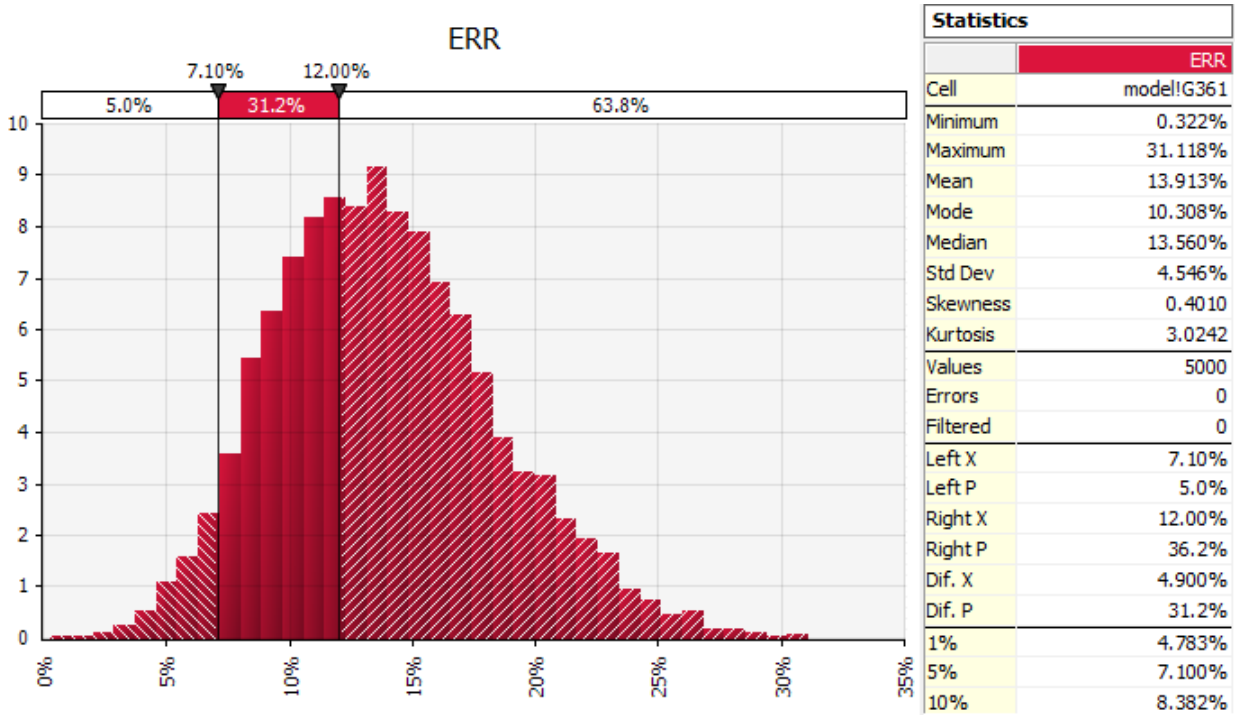
rooftop PV systems can be expected to lead to lower integration costs than other PV projects because GRPV systems are close to the load and don't have to be evacuated long distances like utility scale solar PV.

Figure A11.9 – Probability distribution of input variables



34. Figure A11.10 shows the results of the Monte Carlo simulation, shown as the probability distribution of economic returns. The probability that returns fall below the hurdle rate is 36.2 percent (i.e. the area under the curve to the left of 12%), indicating some risks to the achievement of the forecast returns. This also leads to the mean of the ERR probability functions (13.9%) being lower than the ERR based on "most likely" values (17.5%).

Figure A11.10 – Probability of distribution of ERR



Statistics	
	ERR
Cell	model!G361
Minimum	0.322%
Maximum	31.118%
Mean	13.913%
Mode	10.308%
Median	13.560%
Std Dev	4.546%
Skewness	0.4010
Kurtosis	3.0242
Values	5000
Errors	0
Filtered	0
Left X	7.10%
Left P	5.0%
Right X	12.00%
Right P	36.2%
Dif. X	4.900%
Dif. P	31.2%
1%	4.783%
5%	7.100%
10%	8.382%

Annex 12: Clean Technology Fund (CTF)

Key Indicators	CTF/World Bank/GEF-funded Grid-Connected Rooftop Solar Program (GRSP) Phase 1	*Scaled-up* CTF/World Bank/ GEF-funded Phase 1 and State Bank of India (SBI)-funded GRSP Phase 2 (Cumulative)[1]
Installed solar PV capacity for power generation (MW)	400MW	800MW
Tons of GHG emissions reduced or avoided - Tons per year [$mtCO_2eq/yr$] - Tons over lifetime [$mtCO_2eq$ / 25 years][2]	0.5 13	1.3 33
Financing leveraged through CTF financing (US$ million)	US$ 790 million - US$ 500 million by IBRD - US$ 23 million by GEF - US$ 2 million by SBI - US$ 265 million by private and public sector	US$ 1,375 million - US$ 500 million by IBRD - US$ 23 million by GEF - US$ 400 million by SBI - US$ 350 million by private and public sector
CTF leverage ratio	1 : 6.3	1 : 11
Cost effectiveness - CTF cost effectiveness [$\$_{CTF}/tCO_2eq$ avoided over lifetime] - Total Program cost effectiveness [$\$_{Total\ Program}/tCO_2eq$ avoided over lifetime]	9.4 60.5	3.8 45.3
Other co-benefits	- Increased percentage of renewable energy in overall generation mix. - Increased opportunities of local employment. - Reduction of distribution losses due to co-location of generation and consumption - Contribute to cost reduction in solar PV rooftop technologies.	

[1] The *Scaled-up Phase* assumes that the proposed CTF-funded Program Phase contributes to the further expansion of solar PV rooftop technologies through the launching of the SBI-funded GRSP Phase 2. The results expected in this scenario correspond to the installation of 800 MW of solar PV capacity, of which 400MW are installed through the CTF-funded Phase 1 and an additional 400MW through the SBI-funded Phase 2 of the Program. 'GRPV Program' and 'GRSP' are used interchangeably.
[2] The lifetime of solar PV rooftop technologies was hereby assumed at 25 years.

Key Indicators	CTF/World Bank/GEF-funded Grid-Connected Rooftop Solar Program (GRSP) Phase 1	*Scaled-up* CTF/World Bank/ GEF-funded Phase 1 and State Bank of India (SBI)-funded GRSP Phase 2 (Cumulative)[1]
	- Environmental co-benefit: 4,934t of Nitrogen Oxides, 2,583t of Sulphur Oxides and 397t of PM-10 to be reduced annually after the installation of the Phase 2. - Gender co-benefit: improved clean energy availability provides benefit to women and children on health, household work and education.	

I. Introduction

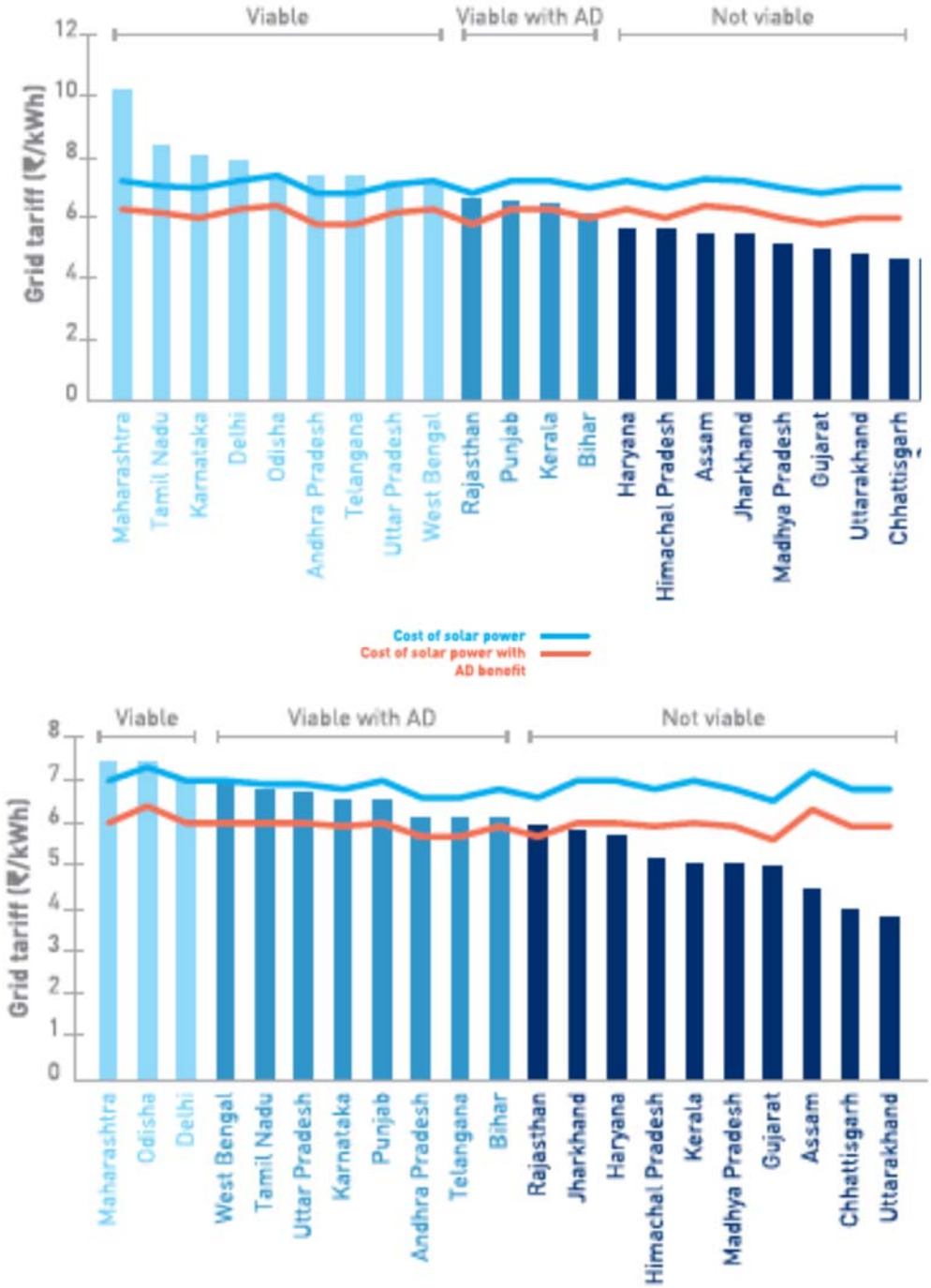
Background: country and sector context

1. India has a large and growing need for energy generation, both to support its economic growth aspirations as well as to deliver its unmet electricity needs to about 300 million people who still do not have first-time electricity access to the grid. In the coming decades, India will be a key influencer of energy demand trends and climate change. The International Energy Agency, in its World Energy Outlook 2015, states that India will contribute more than any other country to the projected rise in global energy demand, accounting for 25% of total demand, yet this would still leave the country's average per capita energy demand at 40% below the world average.

2. The Government of India (GoI) wants a growing share of the country's electricity generation to come from renewable energy, and in June 2015 it has established a 40,000MW target for rooftop PV which is to be achieved by 2022. 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 alone, 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*. GoI is keen to access concessional climate finance to accelerate the affordability and rollout of its renewable energy investments.

Figure A12.1 – Financial viability of rooftop solar power: grid tariff vs solar tariff

i) Commercial consumers ii) Industrial consumers



AD: accelerated depreciation
Source: Bridge to India 2015

3. Electricity generated from GRPV is becoming increasingly cost competitive with electricity from the grid in many parts of India, particularly for commercial and industrial customers who pay a higher tariff for electricity than others. GRPV has already achieved price parity with the grid for this class of customers in many states (Figure A12.1 above). Meanwhile price parity with grid for residential customers is likely to be achieved earlier than previously estimated, given that the cost of rooftop solar power is expected to decrease due to reduction in component costs and that Indian grid electricity prices are projected to increase by 15-20% in the next few years.

4. Market assessments of GRPV indicate that there is significant demand for GRPV in the country. A market assessment commissioned by MNRE estimates the market potential of GRPV in India at 124,000MW[3]. This estimate is based on a survey of a sample of potential residential, commercial and industrial customers of GRPV. The survey indicates that customers would like to install GRPV systems to reduce their electricity bills and reduce dependence on the electricity grid. More than 60% of commercial customers, 43% of industrial customers and 10% of residential customers in these cities use diesel generators as back-up supply to manage grid interruptions. The surveys indicate that there will be increased interest if GRPV is commoditized and presented as a standard package that includes financing and Operations and Maintenance (O&M) options. The findings of the market survey were confirmed in a series of consultations organized by the World Bank with GRPV market participants. KfW and Khemka Foundation have released studies in March 2016 confirming these estimates.

5. Yet there has so far only been a modest uptake of GRPV systems, even for commercial and industrial customers who could immediately save money through an investment in a rooftop solar system. As of end 2015, only about 525MW of grid-connected solar rooftop PV projects had been completed (this is slightly over 1 percent of the 40,000MW target). There has been little success in terms of developing scalable business models for grid-connected rooftop PV outside a few states such as Gujarat. Barriers to the deployment of GRPV systems include: i) lack of commercial loans available to rooftop aggregators and developers; ii) lack of capacity in a number of key stakeholder agencies such as State Nodal Agencies (SNAs, public sector bodies who are responsible for coordinating all renewable energy activities in a particular state), State Electricity Regulatory Commissions (SERCs), and distribution companies (discoms) who must provide the grid connection for a rooftop solar investment; iii) lack of adequate co-ordination among central government agencies, state government agencies and private stakeholders; iv) lack of awareness of cost and technical performance characteristics, rooftop requirements, economic benefits, financial options, and no information about business models offering a variety of contractual O&M options to consumers; and finally, v) financial stress of many state-owned electricity distribution companies (discoms) which makes them less interested in taking on new business areas such as connecting rooftop systems to their grid and committing to buy surplus energy from such systems.

6. The Ministry of New and Renewable Energy (MNRE) is leading the implementation of the Government's flagship rooftop program called "Grid-connected Rooftop and Small Solar Power Plants" Program (GRSSPP). This program has been designed to accelerate the adoption of GRPV. The program is proposed to be implemented in partnership with multiple central and state agencies, and is intended for all states of India. The program provides Central Financial Assistance (CFA)

[3] Reaching the Sun with Rooftop Solar, p. 60: http://shaktifoundation.in/report/reaching-sun-rooftop-solar

to selected customer categories (i.e. residential and government) that is equal to 30% of total rooftop solar PV system costs. Funding for this CFA subsidy is sourced from the National Clean Energy Fund, which is itself funded through a levy of INR200 (about US$3) on every ton of coal that is handled in the country. Commercial lenders require a 30% equity contribution which is often unavailable to a residential rooftop owner, as a condition for accessing a loan of 70% of the project cost. With the CFA, it becomes easier for the residential customers to afford the rooftop system since the commercial lender requires their own contribution to be much smaller and the subsidy essentially pays for the equity. The GRSSPP program covers both project and programmatic approaches and all business models of GRPV including the customer owned, third party owned and utility owned models.

7. The World Bank has been requested by Government of India to lend to the State Bank of India (SBI) and help it to set up and operate a Rooftop Program. This proposed operation adds value to the MNRE's GRSSPP by helping SBI establish a lending program for rooftop solar PV and making available a blended cost of CTF and IBRD financing for GRPV for non-subsidized customers, primarily in the commercial, industrial and institutional categories. GRPV is already financially viable for such customers without a subsidy, and supporting them with the availability of loans will enable significant scale up in order to reach GoI's ambitious GRPV target.

India's CTF Investment Plan

8**.** The CTF Investment Plan for India was originally endorsed in November 2011, and subsequently revised in August 2015, with a total indicative allocation of USD 775.0 million of CTF resources. The revised Investment plan aims to support GoI's ambitious target of solar installed capacity by 2022. The Plan includes the following proposed activities (Table A12.1).

Table A12.1 – Revised CTF Investment Plan of India, Indicative Financing Plan (US$ million)

CTF project/program	Multilateral development bank	CTF financing (US$ m)
Himachal Pradesh Environmentally Sustainable Development Policy Loan (HP DPL)	World Bank	100
Partial Risk Sharing Facility for Energy Efficiency (PRSF)	World Bank	25
Solar Park: Rajasthan	ADB	200
Solar Parks Infrastructure	World Bank	50
	ADB	50
Solar Parks Transmission	World Bank	30
	ADB	50
Solar Rooftop PV	World Bank	125
	ADB	125
Solar PV Generation by Solar Energy Corporation of India (SECI)	World Bank	20
Total		**775**

Program Description

9. The PDO is to increase installed capacity of GRPV and to strengthen the capacity of relevant institutions for GRPV. The proposed Program will support the implementation of MNRE's GRSSPP, thereby contributing to the achievement of GoI's GRPV installation targets of 40,000MW by 2022.

10. The GRSSPP Program will deliver financing through the World Bank's Program-for-Results (P4R) Financing, which disburses loans and grants on the basis of the achievement of key results (including prior results) under the Program. The proposed GRSSPP Program will be the first-ever CTF-funded project that uses an innovative financing instrument, P4R, combined with concessional funding from CTF, with a focus on supporting government programs and achieving outcomes.

11. This P4R Program will finance activities in three Result Areas on a country wide eligibility basis and subject to the achievement of 'disbursement-linked indicators' (DLIs) that are pre-agreed for each of the following Result Areas: (i) strengthening institutional capacity for GRPV; (ii) market development of GRPV; and (iii) expanding GRPV generation.. More details on the activities under each Result Area and the result chains from the Result Areas to 'disbursement-linked indicators' (DLIs) can be found in Table 2 and Annex 3.

12. World Bank and CTF assistance to the Government's GRSSPP Program is estimated to mobilize US$ 915 million, including US$ 500 million from IBRD, US$ 125 million from CTF, an amount of US$23 million pending approval from GEF Council, as well as US$265 million of private and public sector financing in the form of equity[4] and US$2 million of SBI financing. The CTF funding consists of a soft loan of US$ 120 million and a US$5 million grant. The Program will support capacity building in two forms. One is capacity building of key stakeholder agencies in order to improve the investment climate for the ease of doing rooftop business in states, and thereby promote higher rates of investment. The other is capacity building of SBI's risk appetite, in order to accept new categories of GRPV customers such as Small and Medium Enterprises (SMEs) into its customer base. A loss-offsetting fund (interchangeably referred to as a guarantee facility for non-performing loans) will be set up, and is intended to encourage SBI to take on these riskier loans. Disbursements (from GEF) will be released to SBI under DLI-4 when it demonstrates that it has made US$15 million of new loans to SMEs and thereby altered the risk profile of its rooftop portfolio. Detailed information on DLIs, disbursement arrangements, and verification protocols can be found in Annex 3.

II. Assessment of the Proposed Program with CTF Investment Criteria

Potential for GHG Emission Savings

13. **Emission reduction potential of investment.** The total emission reduction potential was estimated at 13 million tonnes of CO_2 equivalent over the lifetime of GRPV technologies, hereby

[4] The amount of equity mobilized from external sources is calculated based on the 30:70 ratio of equity and debt. If the total value of projects to be funded has a debt component of $625 million and this is 70% of the cost, then the 30% equity component is $265 million.

assumed 25 years. These estimates were based on the construction of 400MW of GRPV with 18.9 percent capacity factor, which generates 662,000MWh in the first year but degrades its generation output by one percent each year. The baseline scenario assumes "thermal-based power generation" using a combination of imported coal and diesel generation sets, based on the fact that consumers tend to use diesel self-generators for one to two hours in average out of eight hours of electricity use per day. As a result, under the baseline scenario, 15 percent of the displaced electricity is assumed to come from diesel self-generation, with the emission factor of 650kg/MWh and the rest to be supplied by coal plants through the grid, with the emission factor of 830kg/MWh, after incorporating 12 percent of technical losses in the transmission and distribution system. Using these emission factors, the CO_2 savings were estimated at 0.5 million tonnes of CO_2 equivalent at the first year, with the degradation by one percent every year over the lifetime. Savings have been calculated in accordance with CTF and World Bank guidelines[5], and this estimate is more conservative than what is calculated with the grid emission factor of India, 980 kg/MWh[6]. In the Phase 2 of the Program, the annual emission reduction, taking into account the total installed capacity of 800MW under both Phase 1 and 2, was estimated at 1.3 million tonnes of CO_2 equivalent, which is translated to 33.0 million tonnes of CO_2 equivalent over the 25-year lifetime of GRPV technologies.

14. **Technology development status.** The GRSP Program will finance technically proven and commercially viable GRPV investments. Over the past ten years, solar power has grown rapidly driven by government policy and rapidly declining costs, propelling the solar industry into the mainstream of energy policy (Figure A12.2). From 2009, the Jawaharlal Nehru National Solar Mission and state policies, especially in Gujarat, Karnataka, Rajasthan, and Tamil Nadu helped bring down the cost of generation, as reflected in the graph below. With the most recent bid of Rs 4.63/kWh for a utility-scale solar PV project in Andhra Pradesh, solar costs have fallen over 70% from 2010 levels. As Figure A12.3 shows, ground-mounted solar has driven this growth and grown faster both in volume and percentage terms. Rooftop solar is perhaps 3-5 years behind in terms of the maturity of ground-mounted solar in terms of the level of interest, comfort with the technology, availability of finance and the wider ecosystem. The Program is expected to promote the further expansion of the GRPV market, and therefore help reduce technology cost as experienced with ground-mounted solar PV.

[5] World Bank, Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, 2015
[6] 980 kg/MWh, from CO2 Baseline Database for the Indian Power Sector, Central Electricity Authority

Figure A12.2 – Tariff for Solar PV projects determined by the Central Electricity Regulatory Commission, CERC

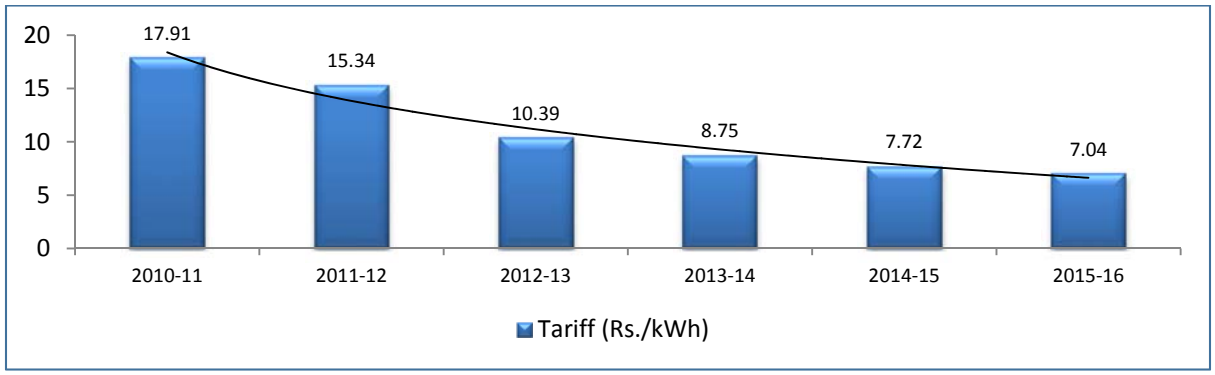
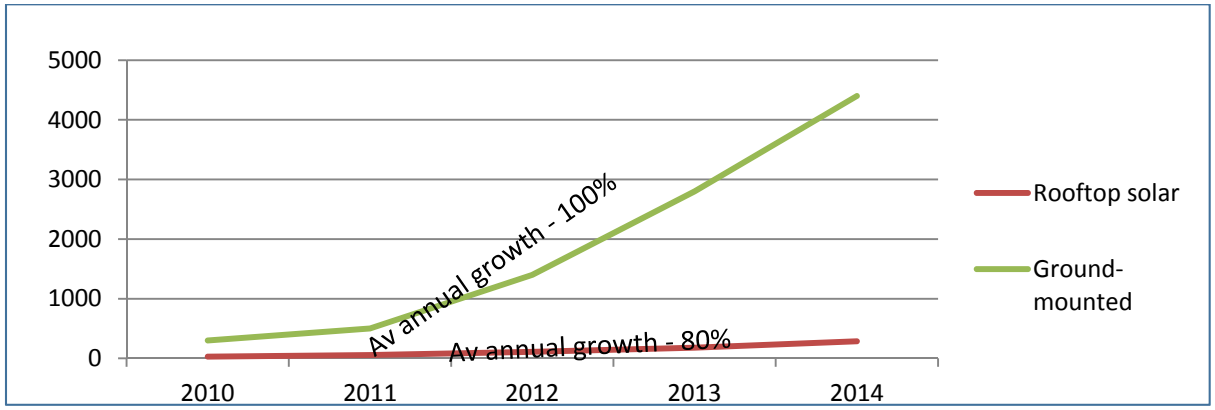


Figure A12.3 – Cumulative installed capacity for ground-mount and rooftop solar



15. The specified technical requirements and quality standards for grid-interactive solar PV power plants and systems, inverters, meters, cables, mounting structures and other balance of systems specified by CEA and MNRE for GRSSPP will also be used for this operation. Standards will also be set for after-sales service of PV systems in India. SBI will engage a Lender's Independent Engineer for investments of INR1 billion and above, to ensure that all investments undertaken as part of the Program meet these minimum technical standards. For smaller investments, sub-borrowers will be informed in the loan documentation about the minimum technical performance criteria that must be met. The advantage of the third-party ownership model that SBI is planning to promote heavily in its rooftop program, is that the burden of ensuring that high quality items are procured, rests with the sub-borrower whose incentives are aligned to selling electricity. MNRE and SBI will ensure that the investments are in compliance with Indian policies and regulations.

Cost-effectiveness

16. The cost effectiveness is 9.4 US$/tCO$_2$eq for CTF funding and 60.5 US$/tCO$_2$eq considering total funding for the GRSP Program. In the *Scaled-up Phase*, the cost effectiveness will improve to 3.8 US$/tCO$_2$eq for CTF funding and 45.3 US$/tCO$_2$eq when considering total funding.

17. **Marginal abatement cost.** In October 2013, the CTF Trust Fund Committee suggested providing information on the estimated marginal abatement cost (MAC) for projects for which the marginal abatement cost is likely to exceed US$100 per ton of CO2eq. This decision draws from the CTF criteria which specifies that CTF co-financing will not be available for investments in which the marginal cost of reducing a ton of CO2eq exceeds US$200, which reflects the lower-end estimate of the incentive needed to achieve the objectives of the BLUE Map Scenario as indicated in the *International Energy Agency's Energy Technology Perspectives 2008 Report*.

18. The MAC of the proposed Program based on the economic analysis is 4.3 US$/tCO$_2$eq. These calculations confirm that the MAC for the Program will not exceed the aforementioned US$100 threshold value per ton of CO2eq. The Program will help avoid local and environmental damage costs equal to $162 million compared to the thermal counterfactual.

19. The marginal abatement cost is computed as the project's NPV divided by lifetime CO2eq (LCO2) avoided emissions:

$$MAC = \frac{NPV}{LCO2},$$

where NPV stands for Net Present Value and LCO2 stands for Lifetime CO2eq emissions.

Demonstration Potential at Scale

20. *Scope of avoided GHG emissions through replication*. India's ambitious target calls for the installation of 40,000MW of GRPV by 2022. The proposed GRSP Program will directly contribute towards this target, therefore contributing to significant emission reduction. The GRSP Program also directly support the launch of the SBI-funded GRSP Phase 2 by having it as one of the DLIs. The GRSP Phase 2 will support the installation of at least 400MW of GRPV technologies. The expected emission reduction of both Phase 1 and 2 is estimated at 1.3 million tonnes of CO_2 equivalent per year, or 33 million tonnes over the 25-year lifetime of GRPV technologies.

21. *Transformation potential.* The proposed Program has high transformational potential as it will enable and contribute to the large-scale deployment of rooftop solar PV technologies in India. First, the GRPV Program will help establish the GRPV market in India through the provision of lending products for customers and the establishment of a dedicated unit for GRPV lending in SBI. While crowing in commercial financing to the GRPV market, the proposed GRPV Program will improve SBI's understanding of technical and financial risks of the GRPV market and improve its capacity to extend loans to potential beneficiaries. The P4R design of the Program will incentivize SBI to internalize the lessons of the proposed GRPV Program and launch the Phase 2 on a much larger scale. SBI will continue to operate the dedicated unit with its own funding and will offer syndication opportunities to other local banks in order to encourage them to enter the rooftop PV debt market in a risk-mitigated manner, by working with SBI which will have developed the necessary experience and expertise by that time. Second, the GRPV Program will lay the foundation to further integrate rooftop solar into the grid. A recent study by NREL suggests that the integration of up to 5% of variable energy sources does not pose any major issues to the operation of the energy system. Even if the government target for rooftop solar is achieved by

2022, only about 4% of India's power will come from rooftop solar. However, rooftop solar will not be evenly spread and what matters is the level of rooftop solar at local level, not the national average. Therefore, utilities will need to plan for infrastructure change in some areas where rooftop solar is concentrated. This Program will engage with relevant institutions through the technical assistance and capacity build program to ensure that key technical challenges that a high penetration of GRPV can create for distribution utilities are taken into consideration in the future planning and development of the grid.

Development Impact

22. **Support under GRSSPP is expected to slow the growth of the supply-demand gap of energy and contribute to faster achievement of the universal access agenda.** Power shortages in FY2015 were equivalent to about 3.6% of total energy and 4.7% of peak capacity requirements. An estimated 300 million people are still not connected to the national electrical grid, and those that are connected face frequent disruptions. Meeting the growing energy demand of a rapidly growing economy while reducing air pollutants and carbon emissions through solar energy is a top priority for GoI, particularly given the high costs of unserved electricity demand in the country and growing energy imports. The development of distributed solar energy generation will have significant benefits in terms of the reliability and security of electricity supply to consumers.

23. **Increased opportunities for local employment.** Scale-up of the GRPV market will boost opportunities of local employment and strengthen the foundation for sustainable development. By supporting a wide range of business models, beneficiaries would include third party aggregators, developers, and vendors of GRPV systems as well as economic agents engaged in the GRPV supply and delivery chain, particularly sub-contractors for installation, O&M and other services. Furthermore, encouraging SBI, and subsequently other local commercial banks, to expand their lines of business into the GRPV market will promote the expansion of local financial institutions and also support job creation. With the installation of many new rooftop systems will come the demand for regular maintenance services on each one, which will call for a sharp increase in trained technicians. In many cases the solar developers and aggregators themselves will be required to train such maintenance technicians in large numbers, in order to remain competitive in terms of their after sales service or their trouble-free operation in case they are the third-party owner who is selling solar kWh to rooftop customers.

24. **Environmental Co-benefits.** Currently, India relies on coal as the fuel source for two thirds of its electricity requirements and is the world's third largest carbon emitter. Private investment in diesel-based back-up power supplies is widespread. The energy sector also causes local environmental problems. The Program has substantial local environmental benefits. At local level, air pollutant emissions under the thermal counterfactual are estimated at 4,934t of Nitrogen Oxides, 2,583t of Sulphur Oxides and 397t of PM-10 per annum, which will be reduced by displacing coal and diesel in power generation after the installation of the Phase 2 is completed. The local and global environmental benefits are estimated at US$162 million.

25. **Gender Co-benefit.** The Program is expected to have positive gender co-benefits. The roll-out of GRPV systems will improve the quality and reliability of electricity supply, which will disproportionately benefit women and children in terms of household work and school work.

Similarly, the reduction of local environmental pollution from substitution of diesel generation with GRPV generation will yield positive health benefits for women and children, as they tend to spend more time outdoors in transit for various chores and activities. During consultation and assessment with beneficiaries, surveys and interviews will be designed in a gender-sensitive way to ensure that women are given equal opportunities. For eligible sub-borrowers, guidelines will be developed to ensure that women-owned companies will not be discriminated against. Overall, the Program intends to increase awareness about existing legislation addressing anti-sexual harassment policies, and to increase compliance with such legislation on the part of various stakeholders who will take part in this Program.

Government Support

26. The Proposed Program is strategically relevant and aligned with GoI's priority to increase the share of the country's electricity to come from renewable energy, to address both energy security and environmental issues. The Government is supportive of this Program as it makes long term concessional financing available for the deployment of GRPV and it strengthens capacities of institutions, stakeholders and market participants to enable scale-up of the GRPV market beyond what is financed through the Program.

Leverage

27. The total investment of the Program under Phase 1 would be funded through the CTF (US$ 125 million), IBRD (US$500 million), GEF (US$23 million), SBI (US$2 million) and public and private sector equity contributions (US$265 million). The CTF leverage ratio will be 1 to 6.3. At the end of this Program, SBI will launch the Phase 2 of the Program, which comprises an expected commitment of US$400 million of its own resources and an additional US$85 million from public and private sector sources. The CTF leverage ratio will increase to 11.0 when considering Phases 1 and 2 combined. Further, this Program would facilitate continued expansion of the GRPV market that would invite more private sector investments and local commercial banks to achieve the ambitious target.

CTF Additionality

28. The use of CTF concessional financing under the Program is essential to address the prevalent barrier hindering the development of the GRPV market, namely the lack of availability of commercial financing for GRPV. The concessional cost of CTF funding blended with IBRD funding allows SBI to offer a competitive market rate to its eligible sub-borrowers. IBRD funding alone, after taking account of the hedging cost from US dollars to Indian rupees, would not have been concessional enough to ensure rapid uptake. CTF support will not only provide the currently unavailable concessional long term debt financing, but will also encourage SBI to mobilize its expertise in commercial lending, to engage in the GRPV market with a competitive product. The CTF concessional loan and grant in combination with IBRD funding allows SBI to receive support and hand-holding from an international partner agency with global experience in rooftop PV. This is essential, given that SBI is (a) unfamiliar with the technical issues of rooftop PV performance and (b) not in a position to take on the coordination role with state discoms, regulators and nodal agencies who are all key enablers and stakeholders in this Program, but who have current

performance limitations. It has been clearly established in dialogue with SBI that without the CTF and IBRD combination of funding, they would not have been interested in taking on the GRPV agenda. They would have only confined themselves to the ground-mounted utility scale solar sector, where their risk perception and need for specialized knowledge, as well as their level of transaction cost, would all be lower.

29. The economic rate of return of this Program excluding environmental benefits is calculated at 6.5%, which is lower than the hurdle rate of 12%. The use of CTF concessional financing will be essential to scale up GRPV by recognizing the value of low carbon technologies and improving the economic rate of return of the proposed Program beyond the hurdle rate.

Implementation Readiness

30. As the lead ministry responsible for GoI's solar power targets and the GRSSPP program, MNRE has full ownership of this Program and will provide overall policy guidance as well as regular monitoring and supervision of progress. MNRE will chair a steering committee comprising of relevant agencies, and will liaise with other government agencies to pursue policy and regulatory reform necessary for the GRPV Program to be successful. MNRE will also play a lead role in development partner co-ordination (including with parallel GRPV programs supported by KfW and ADB) and in ensuring that the lessons from this program are internalized in other government-supported programs.

31. SBI will be the borrower and implementing agency for this Program, and will need to present a detailed Program Operations Manual (POM) that is satisfactory to the World Bank, before disbursements can begin. Preparation of the POM is at an advanced stage and it is expected to be ready by May 2016. SBI is a sophisticated organization, and its size and reach make it an ideal partner to roll out MNRE's scheme for the grid-connected solar rooftop PV program. SBI is India's oldest and largest financial services company and has more than 16,000 branches in the country as well as 190 foreign offices in 36 countries. It has an active customer base of 270 million. While the Bank is majority owned by the GoI, it also has a large number of private domestic and international shareholders, as shares of SBI are traded on the Bombay Stock Exchange and National Stock Exchange of India. Its Global Depository Receipts are listed on the London Stock Exchange. This Program will enable SBI to lend to qualified intermediaries (qualified in terms of technical capacity, relevant experience, and creditworthiness as per SBI's standards). As noted above, SBI will be responsible for identifying, appraising, and financing eligible investments that meet the criteria in its Program Operations Manual (POM). The detailed eligibility criteria, technical performance requirements and appraisal guidelines will all be outlined in the POM, and agreed between the SBI, MNRE, and the Bank.

32. SBI has demonstrated extensive experience in financing energy efficiency, clean energy, and pollution abatement technologies, and has adopted most of the Bank's technical, fiduciary and safeguard requirements in the proposed Program. Under the SBI Program, its capacity in results M&E and verification of DLIs will be supplemented by engaging independent verification agencies who will confirm the achievement of agreed milestones. SBI has assured MNRE that once a successful program is set up with up-front World Bank support in Phase 1, it will be happy to continue the implementation of the program on a nation-wide basis using its own resources for

lending to qualified parties in continuation of the previous experience. Here again the CTF funding plays an important role in encouraging early-adopters of rooftop PV. SBI will make it clear that the concessional and highly competitively priced loans are for a limited time only, while concessional resources are available, and that cost of funding will increase in Phase 2 which will be funded by SBI's own resources raised from depositors in the local market.