The World Bank

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PROJECT APPRAISAL DOCUMENT (QER STAGE)

ON A

PROPOSED IBRD LOAN
IN THE AMOUNT OF US$ 150 MILLION,

A PROPOSED CLEAN TECHNOLOGY FUND (CTF) LOAN
IN THE AMOUNT OF US$ 48 MILLION,

AND A PROPOSED CLEAN TECHNOLOGY FUND (CTF) GRANT
IN THE AMOUNT OF US$ 2 MILLION

TO THE

GOVERNMENT OF INDA

FOR

SHARED INFRASTRUCTURE FOR SOLAR PARKS (P154283)

DECEMBER 16, 2015

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ABBREVIATIONS AND ACRONYMS

ADB	Asian Development Bank
AIS	Activity Initiation Summary
AT&C	Aggregate Technical and Commercial
BOO	Build Own Operate
BOOT	Build Own Operate Transfer
CEA	Central Electricity Authority
CFA	Central Financial Assistance
CPS	Country Partnership Strategy
CTF	Clean Technology Funds
DFID	Department for International Development
DLI	Disbursement Linked Indicator
Discoms	Electricity distribution companies
ESSA	Environmental and Social Systems Assessment
FITs	Feed in Tariffs
FIL	Financial Intermediary Loan
FM	Financial Management
GEF	Global Environment Facility
GHG	Green House Gas
GoI	Government of India
GRPV	Grid connected rooftop solar PV
GW	Gigawatts
GRSPP	Grid-connected Rooftop and Small Power Plant
IBRD	International Bank for Reconstruction & Development
IPF	Investment Project Financing
IPP	Independent Power Producer
IREDA	Indian Renewable Energy Development Agency
JNNSM	Jawaharlal Nehru National Solar Mission
Kwh	Kilowatt-Hour
MNRE	Ministry of New & Renewable Energy
MOP	Ministry of Power
MW	Megawatts
NDMC	New Delhi Municipal Corporation
NAPCC	National Action Plan on Climate Change
OM	Operational Manual
O&M	Operate and Maintain
PAP	Program Action Plan
PDO	Program Development Objective
PforR	Program for Results
PIU	Program Implementation Unit
PPA	Power Purchase Agreement
PV	Photovoltaics
SBI	State Bank of India
SECI	Solar Energy Corporation of India
SERC	State Electricity Regulatory Commissions

SNA	State Nodal Agencies
TA	Technical Assistance
UNDP	United Nations Development Programme
UNIDO	United Nations Industrial Development Organization
WBG	World Bank Group

INDIA
SHARED INFRASTRUCTURE FOR SOLAR PARKS (P154283)

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PAD DATA SHEET

India

Shared Infrastructure for Solar Parks (P154283)

PROJECT APPRAISAL DOCUMENT

SOUTH ASIA

0000009260

Report No.: PAD1659

Basic Information		
Project ID P154283	EA Category B - Partial Assessment	Team Leader(s) Mohua Mukherjee
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]	
Project Implementation Start Date 01-Mar-2016	Project Implementation End Date 01-Mar-2021	
Expected Effectiveness Date	Expected Closing Date 01-Mar-2021	
Joint IFC No		

Practice Manager/Manager	Senior Global Practice Director	Country Director	Regional Vice President
Julia Bucknall	Anita Marangoly George	Onno Ruhl	Annette Dixon

Borrower: Department of Economic Affairs					
Responsible Agency: Ministry of New & Renewable Energy					
Contact:	Tarun Kapoor		Title:	Joint Secretary	
Telephone No.:	91-11-24360359		Email:	tarun.kapoor@nic.in	

Project Financing Data(in USD Million)					
[X]	Loan	[ ]	IDA Grant	[	Guarantee
[ ]	Credit	[X]	Grant	[ ]	Other

Total Project Cost:	400.00	Total Bank Financing:	150.00
CTF:	50.00		

Borrower:	200.00
Financing Gap:	0.00

Financing Source	**Amount**
Borrower	200.00
International Bank for Reconstruction and Development	150.00
Clean Technology Fund	50.00
Total	400.00

Expected Disbursements (in USD Million)

Fiscal Year	2016	2017	2018	2019	2020	2021	0000	0000	0000	0000
Annual	20.00	60.00	120.00	120.00	80.00	0.00	0.00	0.00	0.00	0.00
Cumulative	20.00	80.00	200.00	320.00	400.00	400.00	0.00	0.00	0.00	0.00

Institutional Data

Practice Area (Lead)

Energy & Extractives

Contributing Practice Areas

Cross Cutting Topics

[X] Climate Change
[ ] Fragile, Conflict & Violence
[ ] Gender
[ ] Jobs
[X] Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Transmission and Distribution of Electricity	80		100
Energy and mining	Other Renewable Energy	20		100
Total		100		

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes		
Theme (Maximum 5 and total % must equal 100)		
Major theme	Theme	%
Financial and private sector development	Infrastructure services for private sector development	80
Public sector governance	Other public sector governance	20
Total		100

Proposed Development Objective(s)

The proposed development objective is "to increase solar generation capacity through the establishment of utility-scale solar parks in the country." This will contribute to the achievement of GoI's target of installing 100GW solar power by 2022.

Components

Component Name	Cost (USD Millions)
Solar Park Infrastructure	198.00
Technical Assistance	2.00

Systematic Operations Risk- Rating Tool (SORT)	
Risk Category	**Rating**
1. Political and Governance	Low
2. Macroeconomic	Low
3. Sector Strategies and Policies	Substantial
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Substantial
6. Fiduciary	Substantial
7. Environment and Social	Moderate
8. Stakeholders	Moderate
9. Other	Not Applicable
OVERALL	Moderate

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ] No [X]
Does the project require any waivers of Bank policies?	Yes [ ] No [X]

Have these been approved by Bank management?	Yes [ ]	No [X]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [ ]	No [X]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	Yes	
Natural Habitats OP/BP 4.04	Yes	
Forests OP/BP 4.36	Yes	
Pest Management OP 4.09		No
Physical Cultural Resources OP/BP 4.11	Yes	
Indigenous Peoples OP/BP 4.10	Yes	
Involuntary Resettlement OP/BP 4.12	Yes	
Safety of Dams OP/BP 4.37		No
Projects on International Waterways OP/BP 7.50		No
Projects in Disputed Areas OP/BP 7.60		No

Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**

Description of Covenant

Conditions

Source Of Fund	**Name**	**Type**

Description of Condition

Team Composition

Bank Staff

Name	**Role**	**Title**	**Specialization**	**Unit**
Mohua Mukherjee	Team Leader (ADM Responsible)	Senior Energy Specialist		GEEDR
Jinan Shi	Procurement Specialist	Senior Procurement Specialist		GGODR
Swayamsiddha Mohanty	Procurement Specialist	Senior Procurement Specialist		GGODR

Neha Dhoundiyal Gupta	Financial Management Specialist	Financial Management Specialist		GGODR
Amit Jain	Team Member	Energy Specialist		GEEDR
Bipulendu Narayan Singh	Team Member	Energy Economist		GEEES
Joonkyung Seong	Team Member	CTF Specialist		GEEDR
Gaurav D. Joshi	Safeguards Specialist	Senior Environmental Specialist		GENDR
Kumudni Choudhary	Team Member	Program Assistant		SACIN
Mani Khurana	Team Member	Energy Specialist		GEEDR
Parthapriya Ghosh	Safeguards Specialist	Senior Social Development Specialist		GSURR
Pyush Dogra	Safeguards Specialist	Senior Environmental Specialist		GENDR
Sangeeta Patel	Team Member	Procurement Analyst		GGODR
Shanker Lal	Team Member	Senior Procurement Specialist		GGODR
Surbhi Goyal	Team Member	Energy Specialist		GEEDR

Extended Team

Name	Title	Office Phone	Location
Dinkar Sohony	Consultant-Technical		Hyderabad
Srinath Anekal	Consultant - Clean Development Mechanism		Bangalore
Vedamurthy Angadi Jayadevappa	Consultant – Procurement		Bangalore

Locations

Country	First Administrative Division	Location	Planned	Actual	Comments

Consultants (Will be disclosed in the Monthly Operational Summary)

I. STRATEGIC CONTEXT

A. Country Context

1. **India's power system needs to grow rapidly to fuel its economic growth and provide electricity to its growing population.** During the last decade, India's economy expanded at an average annual rate of 7.6 percent, placing it among the top 10 of the world's fastest growing nations; projections are for such high rates of growth to continue. The demand for power is expected to rise to support the growing manufacturing sector and meet the rising aspirations of its people. With about 275GW 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, and those who are, face frequent disruptions. Power shortages in FY2015 were equivalent to about 3.6% of total energy and 4.7% 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. The cost of un-served energy is high, placing an inordinate burden on households and industries. Lack of regular supply of electricity is also leading to diversion of resources into coping costs that could otherwise be used to support growth.

2. **The Government of India (GoI) wants a growing share of the country's electricity to come from renewable energy.** GoI has set an ambitious goal of providing uninterrupted power for all homes, industrial and commercial establishments and adequate power for farms by 2022. Currently, India relies largely on coal, both domestic and imported, for about 60 percent of its electricity generation requirements. India is the world's third largest emitter of carbon emissions behind China and USA, although per capita emissions are far lower. According to a recent World Health Organization report, 13 of the 20 most polluted cities in the world are in India. GoI recognizes that it must supplement non-renewable sources with cleaner and abundant renewable sources and has accordingly announced plans to quadruple India's renewable energy capacity from 35.8 GW (as in November 2015) to 175 gigawatts by 2022 , which is expected to require more than $150 billion in investments. To achieve these targets, GoI is using innovative public private partnership models and has doubled the clean energy cess levied on coal.

B. Sectoral and Institutional Context

3. **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. In rural areas, solar PV can offer significant health benefits by displacing

the use of kerosene for lighting. Energy efficient irrigation pumps running on solar panels can provide reliable cost effective irrigation for agricultural consumers.

4. **GoI has announced a bold target of installing 100GW of solar power out of the total renewable target of 175GW by 2022 – for solar power this represents about a thirty fold increase from 3.7 GW installed in 2015.** The total installed grid-connected solar capacity base of the country has reached 3.7 GW (or 3,700 MW) as of June 2015, from less than only 2 MW in 2009. The Government would like to significantly increase the pace of solar power deployment to meet its ambitious targets. The Government foresees that 60GW of the targeted installations will come from utility-scale ground mounted solar power plants.

5. **The development of utility scale solar power on this scale in such a short time frame presents significant challenges.** In particular, the following barriers to development of utility scale solar power have been identified in India:

- Availability of land. The availability of large tracts of suitable land at short notice continues to be a key barrier to the development of large scale ground-mounted solar power in India. Private sector developers (including foreign investors), in particular, continue to run into myriad legal and social issues with land acquisition, which serves to reduce the interest of investors in the solar power sector.

- Permits and Clearances. Private developers have to reach out to multiple departments and ministries to obtain permits and clearances for land, transmission evacuation, environment, which can cause delays in obtaining financial closure and increase costs and penalties.

- Availability of transmission and other infrastructure. Given the specific transmission requirements of solar power and the risk of stranded assets, private sector investors continue to see the availability of state of the art transmission infrastructure to connect their solar generation project to load centers across the country, as a precondition to major investment decisions.

- Capacity of sector institutions. The institutions tasked with overseeing the development of the solar power such as SECI, State Nodal Agencies (SNAs) for renewable energy, state transmission utilities, and some regulators are either very new to large scale renewable energy, or simply lack familiarity with specific requirements of the sector. They have mostly been dealing with small and low-key off-grid projects. They hence lack the capacity to deliver on their mandate to rapidly scale up solar energy, and require support from coordinating bodies in the sector.

- Cost of solar power. While there have been dramatic reductions in the cost of solar power in recent years, solar generation is still more expensive than thermal generation in financial terms. This means that there continues to be need for public support for solar power both in terms of regulatory support as well as the development of enabling infrastructure, to enable large amounts of solar power to be taken up in the grid.

- Variability of solar power. Cloudy conditions can cause the amount of generation from solar plants to vary significantly, requiring grid operators to maintain alternative generation capacities.

6. **GoI is taking action on multiple fronts to address these challenges.** The following are the main initiatives undertaken by GoI to facilitate development of large amounts of solar power:

- Cost of solar power. State Governments and the Central Government are using a number of mechanisms to lower the cost of solar power for off takers, including (i) reverse auctions for Viability Gap Funding; (ii) bundling of private sector generated solar power with cheaper public sector coal power. This has facilitated the discovery increasingly competitive solar power prices in India[1] together with a large investor turnout.

- Development of solar parks. Large solar parks have been developed in *Charanka* (Gujarat) and *Bhadla* (Rajasthan) with dedicated land and evacuation infrastructure for private sector developers.

- Regulation. Amendments currently being tabled in Parliament will increase Renewable Purchase Obligation (RPO) targets from 3% to 8% by 2019, introduce Renewable Generation Obligation (RGO) targets, and impose penalties on RPO and RGO non-compliance. In addition, amendments have also been proposed for the National Tariff Policy 2005, to socialize the cost of interstate transmission of renewable power, procurement of bundled solar power by DISCOMs from conventional power generators on a cost plus basis, easy pass-through of RPO compliance cost.

- Grid Integration of Renewable Energy. Grid integration issues are being addressed by the India Smart Grid Task Force (ISGTF), an inter-ministerial task force and the India Smart Grid Forum (ISGF), a public-private partnership initiative. The national transmission utility, Power Grid Corporation India Limited (POWERGRID) is taking the lead in implementing the Green Energy Corridor Project to facilitate evacuation of renewable energy across the country.

7. The Ministry of New and Renewable Energy (MNRE) has launched a 'solar park scheme' to facilitate the development of utility scale solar power in India. This scheme will use public private partnership arrangements to set up 20 solar parks with a cumulative installed capacity of about 60 GW of solar power by 2020. Within this total target of 60GW of ground-mounted solar capacity in solar parks, about 20GW is expected to come from investments by Public Sector Undertakings (PSUs) and 40GW from private investors. MNRE is providing Central Financial Assistance (CFA) of up to 30% of the project costs or INR 2 million per MW for the solar parks. This scheme internalizes the lessons of the Charanka and Bhadla solar parks in India as well utility scale solar power developments in other parts of the World[2]. Under the scheme, a joint venture

[1] Contracted tariffs have fallen from INR 17/kWh (or about 28 cents/unit) in 2010 to about INR 4.7/kWh (or about 8.4 cents/unit) in 2015, a decline of more than 70 percent in five years.

[2] The proposed project will draw on international experience with development of utility scale solar parks as well as India's experience with, and important lessons learned from other solar parks. In year 2009, Clinton Foundation initiated work on large scale solar parks in South Africa, Australia, USA and India. It signed a MoU with Gujarat and Rajasthan government in India to

(JV) company comprising of SECI, state utilities and in some cases the private sector is proposed to be set up in each state to provide specialized services and to be the owner of the park and its shared infrastructure, in order to incentivize solar power developers to invest in solar energy in the park (see Box 1 for more details on the scheme).

Box 1 - Ministry of New and Renewable Energy's Solar Park Scheme

The development of solar parks will streamline development of solar power generation projects with government agencies undertaking land acquisition or arranging for lease of a large parcel of land from private owners. The public sector (in this case the JV company) will be responsible for obtaining necessary permits, as well as providing common infrastructure such as site preparation and leveling, construction power, power evacuation and water infrastructure, access roads, security, and related services necessary to set up such power generation projects or plants.

The JV company will allocate space inside the park amongst solar power developers through a competitive bidding process. . The allotment price per meter square payable by developers for the plots inside the solar park will be specified by the implementing agency of the solar park, which is the JV company. Developers will be able to enter long term Power Purchase Agreements (PPAs) with buyers (mostly discoms or aggregators) inside and outside the state or they may develop solar power for captive consumption by selected industrial customers.

Either POWERGRID which is the national transmission utility, or the State Transmission Utility (STU) will set up a sub-station outside the solar park to feed power from one or more pooling stations into the National Grid or State Grid, respectively. In cases where state discoms are not willing to buy the entire power generated from such solar parks, POWERGRID is expected to be given the responsibility of setting up 400/220 kV or bigger sub-station right next to the solar park and ensuring its connectivity to the Inter State Transmission System (ISTS). The development of interconnection will be coordinated and prioritized to ensure the availability of the evacuation infrastructure to private sector developers well in advance of their plant commissioning date.

8. This proposed project is one in a series of three engagements requested by the GoI from the World Bank for US$1 billion of funding in the solar power sector[3] [4]. All three projects are expected to support achievement of the government's new solar targets, and to demonstrate important economies of scale in utility scale solar generation, push down equipment and transaction costs, and also increase efficiency while reducing unit costs of solar power. It is expected that the Bank-supported projects will create market confidence and will catalyze further support from other investor groups for the GoI to help with achievement of its ambitious target of installing 100GW of solar power capacity by 2022.

9. The MNRE Solar Park scheme will use IBRD funding to develop the enabling infrastructure for utility scale development of solar power, including common infrastructure such

set up solar parks. Solar parks in Australia and USA did not move forward because of the regulatory hurdles. Solar park in South Africa by ESKOM is under development. Gujarat (Charanka) solar park has been commissioned and Rajasthan (Bhadla) solar park is under construction..

[3] During their July 2014 and January 2015 meetings, Prime Minister Narendra Modi and President Jim Kim had agreed that the Bank would provide financing for Solar Parks in the country

[4] In particular, GoI requests have been received for all other Bank engagements to (i) support the establishment of grid connected rooftop PV; (ii) fund the construction of associated evacuation infrastructure from Bank-supported solar parks; and (iii) shared infrastructure for solar parks.

as large areas of land, power pooling sub-stations as well intra-park transmission infrastructure, access roads, common security arrangements. This will facilitate investment in solar power development by private or public sector developers, who may be able to shorten the time from contract award to commissioning from 20 months to less than 10 months. As an additional incentive, and to further increase the value proposition of these World Bank-supported solar parks as an investment destination, IBRD funding is also being made available (through a separate but related project implemented by PowerGrid) to provide transmission interconnections to the Inter State Transmission System (ISTS) at the border of the respective solar park. The ISTS provides direct access to the entire national power market, and will therefore allow solar developers from these parks to more easily sign PPAs with customers and off-takers anywhere in the country[5].

C. Higher Level Objectives to which the Project Contributes

10. *Alignment with GoI's National priorities:* The project is aligned with GoI's National Action Plan for Climate Change (NAPCC), which was issued in 2008 to enhance India's ecological sustainability and encourage sustainable energy sources. It is also consistent with the Jawaharlal Nehru National Solar Mission (JNNSM) that was launched in 2010 as part of NAPCC to promote the development of solar power in India. GoI has significantly scaled up the target of 20 GW of solar power in JNNSM to 100 GW by 2022. The proposed project is also consistent with GoI's 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. GoI has reiterated these commitments as part of its Intended Nationally Determined Contributions (INDCs) commitment to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030.

11. *Alignment with World Bank's India Country Partnership Strategy (CPS).* The proposed project is aligned with the India Country Partnership Strategy along its three pillars –integration, transformation, and inclusion. Under integration, the project will accelerate private investment in solar power in some of India's solar-resource rich states such as Karnataka and Madhya Pradesh. Under transformation, the project directly aims to reduce environmental pollution and GHG emissions, add clean power generation capacity, and foster innovative solar development through shared large-scale infrastructure. Under inclusion, the project offers the opportunity to increase access to electricity by increasing the availability of electricity generation in the system. In addition, the operation conforms to the emphasis of the CPS on GoI's "Finance-Plus" approach whereby the value-added by the Bank goes beyond financing and contributes to the transfer of knowledge and international best practices, reform of processes and systems, and strengthening of institutional capacity.

12. Furthermore, the proposed operation supports the World Bank Group's corporate commitment to increase renewable energy lending, and address climate change. The program is also aligned with the WBG's goal of reducing poverty and promoting shared prosperity.

[5] Until the Open Access system is made fully operational, this direct access to PowerGrid's network confers an additional benefit relative to exclusive dependence on the state transmission utility's network and the latter's possible reluctance to allow power to be sold outside of the state, contractual obligations notwithstanding

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

13. The proposed development objective is "to increase solar generation capacity through the establishment of utility-scale solar parks in the country." This will contribute to the achievement of GoI's target of installing 100GW solar power by 2022.

B. Project Beneficiaries

14. The direct beneficiaries of the project are (i) the people in the participating states and elsewhere who will benefit from the electricity generated in the solar parks and (ii) discoms which will be able to meet their Renewable Purchase Obligations (RPOs) with electricity generated from solar parks.

15. The indirect beneficiaries are people who will benefit from (i) avoided local environmental damage costs and (ii) additional growth and productivity due to improvements in the state's power supply situation.

C. PDO Level Results Indicators

16. The following indicators will be used to track progress in achieving the project development objectives:

- Investment mobilized in solar projects in solar parks under the project ($ Million)
- Installed solar generation capacity (MW)
- Avoided GHG emissions (thousand tons)

III. PROJECT DESCRIPTION

17. MNRE has requested World Bank's support for setting up solar parks in four states – Karnataka, Madhya Pradesh, Andhra Pradesh and Telangana, and has kept the option open for other states to join if they are able to meet the necessary conditions. To be eligible for funding under the project, solar parks will have to meet *Readiness Criteria* that include key milestones and deliverables identified as prerequisites, including techno-economic, environmental, and social and site clearance requirements. The main purpose of the Readiness Criteria is to ensure that the contracts, once awarded, are fully geared up for execution and not held up for slow implementation or lack of progress in preparatory activities such as, for example, delays in securing required statutory clearances or unencumbered worksites.

18. The process to establish Solar Parks is most advanced in *Pavagada* in Karnataka and *Rewa* District in Madhya Pradesh, with land having already been identified for parks with capacities of 2000MW and 750 MW, respectively. Additional parks may also be identified in these states during

the course of project preparation[6]. Further, solar parks are also being identified in other states, especially Andhra Pradesh (AP) and Telangana, under the MNRE solar park scheme, which could also be supported by the World Bank project in future.

19. In Karnataka, about eighty percent of the 2000MW planned capacity development is planned to be allocated to Public Sector Undertakings such as National Thermal Power Corporation (to fulfill its Renewable Generation Obligation), with the remaining portion allocated to private sector developers through competitive bidding or for captive consumption. 90% of the electricity generated in the *Pavagada* solar park will used inside the state of Karnataka, with 10% to be sent outside the state to ensure waiver of wheeling charges on the ISTS[7]. In Madhya Pradesh, the plan is to allocate the entire 750MW capacity to private sector developers through competitive bidding..

A. Project Components

20. **Component 1 - Solar Park Infrastructure (Estimated Cost - US$198 million, US$150 million IBRD, US$48 million CTF).** This will cover financing for shared infrastructure such as security, access roads, water supply and drainage, telecommunications, and pooling stations (with 220/66/33 kV or as may be suitable switchyard and respective transformers) inside the solar parks and transmission lines connecting these internal pooling stations to the external 400/220 kV sub-station at the border of the park, feeding into the national grid. The scope of investments covered under this project will depend on the particular modality and approach adopted by the state for developing the solar parks. While some states such as Karnataka are planning to provide a full range of infrastructure and services to private sector developers, others such as Madhya Pradesh are planning to only provide pooling stations to facilitate internal evacuation (see Table 1 for tentative allocation of funding to different states). In most solar parks, solar project developers will be responsible for the interconnection of each plot in the solar park with pooling stations through suitable voltage underground or overhead cable.

21. **Component 2 – Technical Assistance (Estimated Cost - US$ 2 million, US$ 2 million CTF).** This component will provide support for capacity building of SNAs and JVs across the participating States. Although the role and mandate of SNAs and JV is growing rapidly to meet GoI's ambitious renewable energy targets, they have limited capacity and experience to deliver on these mandates. Specifically, this component will provide TA to SNA's and JVs to strengthen and enhance core competencies of these organizations across functions such as human resource, business planning, project management and monitoring, procurement and contract management, operations and maintenance, financial management, enterprise wide IT systems, etc.

Table 1: Tentative allocation of funding to states

States	IBRD/CTF	Counterpart funding	Total

[6] For example, the state of Madhya Pradesh has expressed interest in receiving funding for two more solar parks: Neemuch (435 MW) and Agar (315 MW).

[7] Tentative project allocation of solar park: 600 MW to be owned and operated by private developers with electricity to be sold to NTPC through a PPA with NTPC; 400MW to be owned and operated by private developers with electricity to be sold to the state discoms through a PPA with each; and 1000 MW to be owned and operated by NTPC.

	US$ million	*US$ million*	*US$ million*
Karnataka	90	90	180
Madhya Pradesh	50	50	100
Other states	60	60	120
Total	**200**	**200**	**400**

B. Project Financing

22. The project will be financed through the Investment Project Financing instrument, which will cover the investments required for shared infrastructure in identified states. GoI has chosen to denominate the loan in USD. Total project financing requirements are estimated at US$ 200 million, comprising the World Bank IBRD financing of US$ 150 million and CTF financing of US$ 50 million. GoI has opted for variable spread option for the IBRD loan. **[WILL BE CONFIRMED AT NEGOTIATIONS].** MNRE will sign the project agreement with the Bank for the implementation of the project while GoI will sign the loan agreement with the Bank.

23. The CTF funding would comprise $50 million, of which $48 million will be extended under softer concessional terms and $2 million will be extended in the form of a grant. The CTF loan is offered with a service charge of 0.25% per annum on the disbursed and outstanding loan balance and 40-year maturity, including a 10-year grace period, with Principal repayments at 2% for Years 11-20 and at 4% for Years 21-40. Principal and service charge payments accrue semi-annually. A management fee equivalent to 0.45% of the total loan amount ($216,000) will be charged, to be capitalized from the loan proceeds, following the effectiveness of the loan.

24. Table 2 provides a breakdown of project costs and financing by component:

Table 2: Project Cost and Financing (US$ million)

Project Components	**Project cost**	**IBRD Financing**	**CTF Financing**	**GoI and State Government Financing**
Solar Park Shared Infrastructure	396	150	48	198
Technical Assistance for Capacity Building and Institutional Strengthening of SNAs and JVs	4	0	2	2
Total Project Costs	400	150	50	200

C. Lessons Learned and Reflected in the Project Design

25. The project builds on the lessons learned from GoI's experience with the implementation of *Charanka* and *Bhadla* Solar Parks in the states of Gujarat and Rajasthan, respectively. In particular, these experiences have highlighted the need to (i) keep the shared infrastructure costs of solar parks low to attract developers to the park; (ii) have access to the ISTS from the solar park to ensure linkage with the national market and (iii) closely co-ordinate the development of transmission interconnections to the park to ensure that assets of developers are not stranded. These lessons have been built into the design of the solar park scheme by MNRE. The project also incorporates lessons from the implementation of Bank financed power sector projects in India, which have shown that when implementing agencies with limited institutional capacity are looking for a significant increase in capital investment over a short span of time, it is important to have the support of a strong project management consultant and implementation agency to guide and handhold the utilities.

26. Another important lesson is how to successfully design and implement a project under the framework of a Centrally Sponsored Scheme (CSS). The past experience of implementing similar projects, which normally span multiple states, clearly underscored that project implementation is often adversely affected because of inadequate attention to a range of technical, institutional and regulatory issues in preparation. To avoid implementation delays, the project has to adopt a sub-project readiness criteria specifying the critical actions related to technical, environmental, and social aspects that need to be completed prior to contract award.

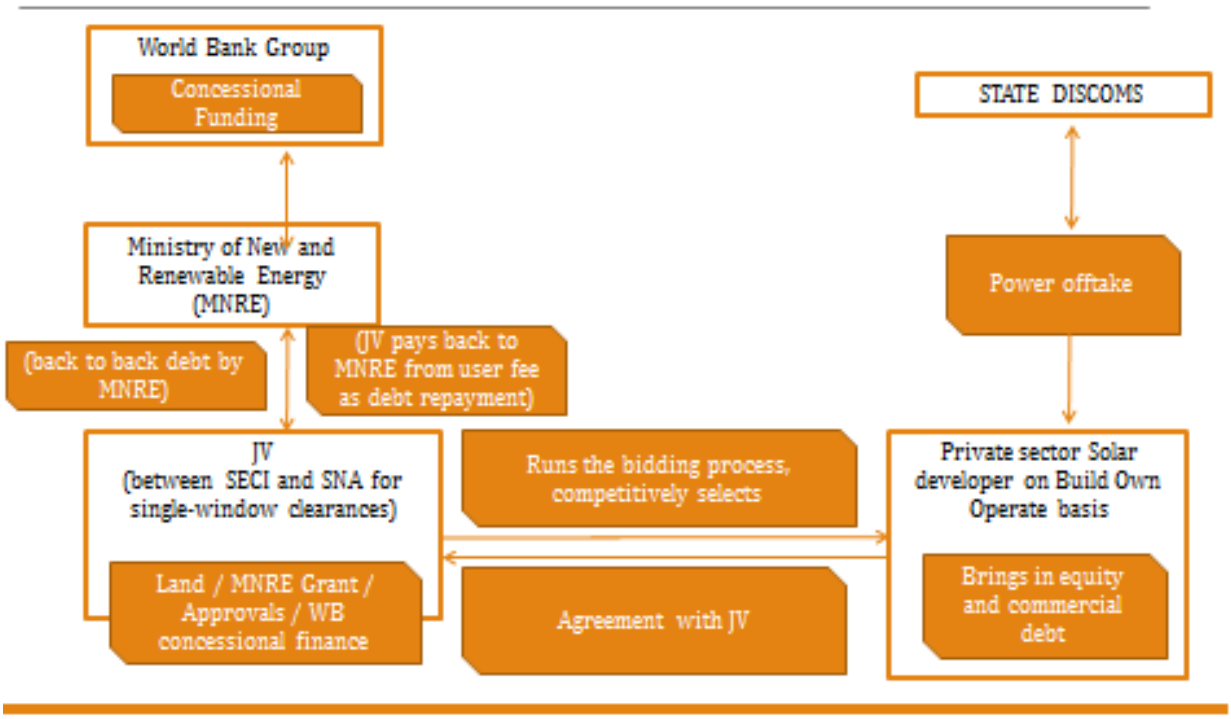
IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

27. Joint venture (JV) companies comprising SECI and the State Nodal Agency - Karnataka Solar Power Development Corporation Limited (KSPDCL) and REWA Ultra Mega Solar Limited (RUMSL) have been formed in Karnataka and Madhya Pradesh, respectively to manage the solar parks in these states. MNRE has designated these JVs as the Implementing Agencies (IA) to implement the project in close coordination with the respective state power utilities and departments. Similar JVs will be formed in other states that will receive funding from this project. As the borrowing agency, MNRE will pass on the Bank funds to JVs (see Figure 1 for the implementation and funds flow arrangements). Once the assets are created and commissioned, the JVs will operate and maintain these assets as per normal industry practices.

28. All the schemes under this operation are being supervised by JVs. Local and foreign contractors engaged through international competitive bidding will carry out the supply, installation and erection works. To ensure that the JVs develop the capacity required to operate and maintain the assets created through this project, STUs and SNAs in respective states may depute their staff to JVs to work alongside JV officials in implementing the schemes and thus develop an understanding of the technical requirements of the assets created. This will also enable enhancing the strengthening of the technical capacity in the JVs.

Figure 1. Fund flow structure for solar park scheme



B. Results Monitoring and Evaluation

29. JVs, as the implementing agencies, will provide the Bank with quarterly physical progress reports, interim financial reports, audited financial statements (within six months of the end of each financial year), and other such information as the Bank may reasonably require. Since the nature of these contracts will be Design, Supply and Installation, Monitoring and Evaluation (M&E) is linked to project targets upon completion of the standard milestones like delivery of material, erection and commissioning.

30. The PDO level results indicators of this project are: (i) investment mobilized in solar projects in solar parks under the project ($ Million); (ii) installed solar generation capacity (MW); and (iii) GHG emissions reduced (thousand tons). The intermediate results indicators are: (i) transmission lines constructed inside the solar park (in circuit km); and (ii) number of pooling stations constructed inside the solar park.

31. The project is not financing new household connections or last mile connectivity and is not directly contributing to expanding access in the participating states. However, the project is likely to have a significant indirect contribution to expansion of access to electricity, as a result of the increased availability of electricity in all project states, wherein the investments supported under the project are expected to lead to increased hours of supply to existing customers, and increased availability of electricity supply, which may enable utilities to connect and serve new customers.

C. Sustainability

32. There is strong ownership of the project at the highest levels of GoI, MNRE, the participating states, discoms and the JVs responsible for implementing this project. This commitment has been demonstrated through their intensive engagement and involvement during the project preparation. As mentioned in the preceding sections, GoI and state governments are pushing through with a number of policy and regulatory reforms, implementation mechanisms and incentives to ensure that there costs of solar power are kept low and there is sufficient demand for the offtake of solar power generated under the project. There has been strong response to solar parks in Rajasthan and Andhra Pradesh that have recently invited bids from the private sector. This trend is expected to continue for the "plug and play" solar generation plots that are being developed inside the park, which will help ensure the financial sustainability of the park.

33. In addition, the sustainability of the project will be ensured by the institutional strengthening of of the beneficiary JVs under Component 2. During the implementation period, the team will continue the dialogue with all key stakeholders of the sector on the implementation of measures that will further improve the performance of solar parks.

V. KEY RISKS AND MITIGATION MEASURES

A. Overall Risk Rating Explanation

34. The risk associated with "sector strategies and policies" is rated as substantial, on account of the financial situation of the discoms, which will be the main off takers of power generated from the solar parks The financial distress of electricity distribution companies (discoms) may discourage them from signing power purchase agreements with solar power developers. This could contribute towards limiting the interest of reputable private sector developers in setting up generation capacity inside solar parks. GoI has last year undertaken a debt restructuring scheme and given a framework to the States to help them to put the distribution sector's finances back on track. The team will also be discussing this aspect with GoI as part of the broader dialogue on the sector engagement. The reluctance of discoms to buy solar power due to their cash constraints must be weighed against the steps taken by GoI to reduce the costs of solar power and the new and increased renewable purchase obligations which the discoms will be subjected to following the ongoing discussion on the Amendments to the Electricity Act as well as following the introduction of the National Renewable Energy Act that is in draft stage and currently out for public comments.

35. The risk associated with "institutional capacity for implementation and sustainability" is rated substantial due to the involvement of newly formed entities in the implementation of the project. Project implementation involves a number of newly formed entities such as SECI and the JV companies (formed between SECI and the respective state nodal agencies) that have low capacity on project management, fiduciary (procurement, contract management, financial management, etc.), manpower availability, etc. In addition, significant co-ordination will be required among state and central agencies, private sector, state utilities, and the central transmission utility (POWERGRID) in order to implement the project. This could present significant risks to the timely and successful implementation of the project. To mitigate this, the

Bank plans to work with SECI and JV companies, in consultation with GoI, to strengthen their procurement and implementation capacity.

36. The risk associated with "technical design of the project" is rated substantial on account of the challenges of integrating a variable renewable energy source like solar power into the grid. The main technical risk include (i) grid instability resulting from large-scale solar generation at a single point; and (ii) the lack of availability of the grid in a timely manner to evacuate power from the parks. The Bank is working closely with relevant state and central agencies and utilities to address these concerns.

37. OVERALL: Given the (i) weak capacity of agencies involved in the implementation of the program; (ii) the financial situation of electricity distribution companies in the country who are the main off takers of solar power and (iii) policy and regulatory uncertainty on solar power, the risk is being maintained at "Substantial" during project preparation. The team expects that a close and intensive engagement with stakeholders during the pre-appraisal period will help to identify the gaps and accordingly prepare a suitable capacity building and action plan to address those gaps. In addition, it is also expected that a continuous dialogue with the GoI and MNRE will help to resolve uncertainty on regulatory and policy issues. Based on this, the risk is assessed at "Moderate" during project implementation.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analysis

38. A cost-benefit analysis consistent with recent Bank guidance on this topic[8] was carried out for the 2GW *Pavagada* Solar Park in Karnataka, which is the most advanced in terms of design of the solar parks covered under the project[9]. The economic analysis covers the entire package of solar park investments comprising of solar park investments, transmission investment, and solar generation plants installed by developers rather than just the Bank financed portions of the solar parks projects[10]. The economic analysis covers 28 years, including 3 years of construction and 25 years of operation. A discount rate of 12% was used for the calculation[11]. The analysis includes a consideration of the relevant negative global and local environmental externalities.

39. The economic analysis indicates that in India utility scale solar power is increasingly competitive with thermal generation using imported coal. The baseline economic return of *Pavagada* Solar Park against the "without solar park scenario" is 7% (NPV –US$ 386 million), which is below the 12% hurdle rate used for Bank projects (see Table 3). However, the solar park has substantial local and global environmental benefits and consideration of these benefits increases the ERR of the solar park significantly. The inclusion of avoided damage costs of local

[8] These include the 2015 World Bank guidance on the economic analysis of renewable energy projects and the 2014 "Operational Policy and Bank Procedure (OP/BP) 10.00, Investment Project Financing"
[9] Once design elements are firmed up, the team will carry out the economic analysis of additional solar parks
[10] This is consistent with the Bank's 2015 guidance on economic analysis of renewable energy projects.
[11] A review of discount rates used in Bank projects is currently underway. The economic analysis will revised once the new guidance on discount rate is finalized.

pollution in the economic flows, increases the ERR to 10% (NPV -US$163 million). The inclusion of avoided global environmental damage costs (using the Bank guidance on social value of carbon), increases the ERR to 18% (NPV $ 545 million).

Table 3 – Summary of Economic Analysis

Economic rate of return	Unit	**Values**
ERR	%	7%
ERR + local externalities	%	10%
ERR + local externalities + GHG	%	18%
Switching value, avoided GHG emission	$ /ton	$6
Composition of NPV		
Cost of Solar Park		
capital cost	$USm	1265
O&M	$USm	31
Benefits of avoided coal generation		
Avoided coal costs	$USm	824
Capacity credit	$USm	86
NPV (before environmental benefits)	$USm	-386
local environmental benefits	$USm	223
GHG emissions @$30/ton	$USm	708
NPV (including environment)	$USm	545
Lifetime GHG emissions undiscounted	Mtons CO2	69
Marginal abatement cost MAC	$/ton	5.6

40. **Reduction in GHG emissions.** The analysis indicates that the solar park will reduce GHG emissions by 69 million tons over the life of project compared to the thermal counterfactual. The marginal abatement cost of GHG emission for the Solar Park is $5.6/ton. The Solar Park will help avoid local and environmental damage costs equal to $931 million compared with the thermal counterfactual.

41. **Sensitivity Analysis.** The sensitivity analysis in Table 4 calculates the switching values for the important variables such as capital costs, Capacity Utilization Factor, PV generation capital costs, coal prices, capacity credit and discount rate.

Table 4 – Switching Values

Input	**Unit**	**Baseline Value**	**Switching Value**
Project Cost	$ Million	1296	910
CUF	%	19%	27%
PV Cost	$M/MW	1.06	0.70
Annual Increase Coal Prices	%	0%	5%

Discount Rate	%	12%	7%
Capacity Credit	%	19%	103%
Grid Integration Costs	%	0	-2.70%
Project cost overrun factor	Ratio	1	0.7

B. Technical

42. The key technical issue for the project is the availability of a sound internal and external evacuation system for solar parks. Based on Long Term Access (LTA) application from KSPDCL and RUMSL, POWERGRID has carried out detailed grid evacuation and grid impact studies and established augmentation/ additions needed to the existing network so that the generation can be absorbed without any adverse effect. These studies cover load flow analysis, reactive power flow patterns, and measures and corrective actions to be implemented by the partners in the Grid. The studies also assess the health of the consolidated system in case of outage of any network element of the grid including solar park generation. The findings of these studies are scheduled to be presented in the Standing Committee chaired by CEA in mid-November, for deliberations and clearance. There have been some changes in the share of generation of that is proposed to go out of the state for both the solar parks but POWERGRID is now aware of this and taking necessary steps to incorporate this into their planning and design.

C. Financial Management

43. The financial management assessment has been carried only for states and sites that have already been identified. For additional sites and states, separate FM assessment will be carried out at a later stage. Based on preliminary assessment, a broad framework for FM arrangements has been defined. The specific actions to meet the fiduciary requirements and the tentative timeline has been spelled out and going forward these will be re assessed and formalized. The summary is spelled below with details in Annex 6.

44. **At Centre level:** As immediate step, the project cost (ie the counterpart funding as well as Bank financing) needs to be incorporated into the GoI budget under identifiable budget line item each year, starting FY 15-16 through revised estimate (RE). The basis for initial allocation for FY 15-16 and future budgetary forecast for FY 16-17 will be based on the fund requirement for the two PIA's. ***(This is one of the readiness criteria and needs to be done before appraisal)***

45. **At State level:** KSDPCL (for Karnataka) and RUMSL (for Madhya Pradesh), the project implementing agencies (PIA's) at state level will be responsible for the procurement as well as for the financial management arrangements on the project. Both these agencies are relatively newly set up (incorporated in 2015), with Boards of Directors and a few staff on deputation (with additional charge) from the parent company as the key members. A preliminary assessment has been carried out and an action plan has been drawn for setting up the agreed FM arrangements by appraisal. The summary of the same is highlighted below with details in Annex 6.

46. **KSPDCL:** This will be KSPDCL's first major project as well as its first Bank funded project. KSPDCL is a Joint Venture (JV) between RECI, a central Public Sector Unit, and KREDL a state PSU. KSPDCL was incorporated on 12th March 2015 under the Companies Act 2013 initially as a private limited company and thereafter on September 20 2015 KSPDCL was converted into a public limited company. Apart from the Board members, KSPDCL has no other officials/ staff. This needs to be remedied urgently and KSPDCL needs core staff to be appointed in key positions including FM; develop appropriate management and functional structures with job descriptions; develop operational strategies, policies, systems, procedures and controls to facilitate project preparation and implementation to the satisfaction of the Bank. Till date KREDL officials have been supporting the Chairman in key areas of project preparation in an informal manner. These arrangements need to be formalized urgently by the JV which would be assessed by the Bank for readiness before appraisal.

47. **Rewa Ultra Mega Solar Limited (RUMSL)** is the implementing agency for this project which would be its first major project as well as its first Bank funded project. RUMSL is a Joint Venture (JV) between Solar Energy Corporation of India (SECI) a central Public Sector Undertaking (PSU) and Madhya Pradesh Urja Vikas Nigam Ltd (MPUVNL) a state PSU. RUMSL was incorporated on 10th July 2015 under The Companies Act 2013 as a private limited company. Being a new entity RUMSL is yet to develop an organization structure with plans for deployment of staff, infrastructure and resources. Currently RUMSL is being actively assisted by MPUVNL in its project preparation activities.

48. The first Board of Directors has four members – Chairman and Managing Director and three part time Directors all nominated by SECI and MPUVNL. There are no whole time functional directors on the Board. The first meeting of the Board was held on August 7 2015.

49. The proposed organization structure of the JV needs to be formulated. According to RUMSL the organization structure and staffing of the JV would be lean and compatible with its requirements. RUMSL proposes to hire a third party as the project management consultant for project supervision and management. However the JV would require an internal governance structure with adequate skills, infrastructure and resources for effective oversight and control of the project including fiduciary compliance. (This is not negotiable). Two senior finance and accounts officials deputed to the JV from MPUVNL with additional charge are already in place.

50. The JV would require operational plans, policies, delegation of financial powers, operating controls, systems and procedures manuals to be in place within a reasonable period of time. However in the context of the project, the JV needs to develop a project specific delegation of powers and FM systems and procedures manual vetted by the Bank before Appraisal. Statutory auditors of the JV would be appointed by the Comptroller and Auditor General of India (CAG). The JV needs to follow up and share with the Bank the status of appointment of statutory auditors. In addition, a system of periodic internal audit of the JV and the project would be necessary

51. **Corporate Governance aspects:** The applicability of mandatory code of corporate governance to the PIA's needs to be determined in due course. However in view of good practice as well as the fact that the systems, policies and procedures for the IA's are in the process of being laid down, the Corporate governance requirements are being spelt in the Annex for KSPDCL and

RUMSL for their review and incorporation as much as possible. The Bank proposes to hold discussions with them at an appropriate time in order to develop an agreed action plan for implementation by Appraisal.

D. Procurement

Pavagada Solar Park (Karnataka)

52. Establishment of the Shared Infrastructure for Solar Parks Project requires construction of pooling sub-stations, transmission lines for evacuation of power (internal and to the grid), integrated / individual control room(s), main road, connecting roads, (minimum for intra-park access) with the option for the power developer to further develop internal roads within his allocated plots, water supply and drainage, telecommunication, common facilities for the staff during the working hours, and a cleaning facility. A number of community development and benefit sharing (as well as skill building) investments are also proposed to be funded as part of the project costs.

53. It was agreed that the JV Company would prepare the long list of requirements, prepare the broad technical specifications/bill of quantities, and gather information related to similar procurements, in order to stipulate qualification criteria commensurate with the scope of works as well as appropriate packaging of the items to be procured in order to ensure adequate participation from suitably qualified bidders..

54. There is need to convert the generic requirements in the detailed project report (DPR) for Pavagada Solar Park into broad specifications and a bill of quantities. Essentially, these details will help the JV Company's procurement team prepare the bidding documents.

55. **Procurement Staffing:** The JV Company, KSPDCL, is yet to be fully staffed, and needs support to develop criteria for employee selection and to launch an employment / deployment plan. The new CEO, who is in charge of establishment of solar parks is familiar with the procurement of pooling stations and transmission facility (Supply and Installation on turnkey basis). He needs support with procurement document preparation and contract management of civil works. The procurement team needs dedicated staff with a procurement specialist (PS) and a shared facility development specialist who is experienced in development and maintenance of solar parks or similar parks.

56. **Procurement Training:** KREDL has identified and deputed two staff for the 3 day procurement training conducted at Delhi. They are familiar with the Bank's procurement procedure, however, they will still need handholding for the first few procurements they undertake.

57. **Procurement Capacity Assessment:** The procurement questionnaire was circulated with the client and discussed on Sep 7 after the meeting at Bengaluru; it was subsequently further refined during discussions on Oct 19 and Oct 20. The overall risk as measured during the preparatory mission is: **substantial.**

Rewa Solar Park

58. The procurement capacity of the JV Company, RUMSL, is expected to be augmented through a Project Management Consultant (PMC). RUMSL has appointed the state transmission utility, MPTCL, as their PMC. The formal arrangement between the MPTCL as PMC to RUMSL will be shared with the Bank. Duly considering this development, the mission and the client have agreed for procurement assessment of PMC. The assessment may be combined with the other task of providing brief orientation to the PMC officials on the Bank's procurement procedures and guidance to the preparation of the bidding documents.

59. **Procurement Staffing:** The RUMSL is presently working on the shared staff from MPUVNL and clear job description, organogram is in preparation. The procurement team needs dedicated staff with procurement specialist (PS) for coordination of procurement with PMC and to carry out related procurement for Shared infrastructure.

60. **Procurement Training:** The RUMSL has identified and deputed three staff for the 3 day procurement training conducted at New Delhi. They are familiar with the Bank's procurement procedure, however, clear designation / allocation of duties related to procurement is essential. The mission learnt that the PMC is having expertise in preparation of bidding documents for other multi-lateral funding agencies like ADB. The Chief engineer expressed the desire to have Bank's SBD, which was already shared with the members of the team who attended the procurement training. A reference bid document of similar procurement would be useful reference and the Bank team communicated that they will search the Bank's archive and share with the client, if located.

61. **Procurement Capacity Assessment:** The procurement questionnaire was circulated with the client and discussed on Sep 11 after the meeting at Bhopal, further discussed during preparatory mission on Oct 26. The client has agreed to send the compiled assessment questionnaire along with the supporting details by Nov 4, 2015. Based on the information provided (partially compiled questionnaire) and discussion had during Sep 11 and Oct 26, the overall risk is measured during the preparatory mission is: High.

E. Social (including Safeguards)

62. While the project is expected to benefit communities in terms of additional sources of livelihood generation and benefits of corporate social responsibility (CSR) investments, the implementation of project will lead to adverse social impacts. A Social Impact Assessment (SIA) is being conducted for the project. The baseline study has identified potential adverse impacts, and proposed the requisite measures for avoiding or mitigating them, which will be incorporated in the project design. Potential adverse social impacts include loss of land or structures, loss of access to areas for livelihood support and / or common property resources, noise and other disruptions, and public safety issues. Site selection could be locally controversial among directly affected people and other stakeholders.

63. In Rewa, the proposed site area of about 4994 ha, comprising of about 4811 ha private land and about 183 ha of government land. The land included under the project is nearly 50% of the total land under these villages. In Pavagada, KREDL has identified 1319 survey numbers owned by 1422 farmers in five affected villages. Nearly 48 % of land owners comes under the category of marginal and small farmers. Hence OP 4.12 on involuntary resettlement has been triggered. The

SIA is underway and site specific mitigations plan will be developed based on SIA results. Apart from site specific safeguard instruments, Social Management Framework (SMF) will also be prepared for the sub projects that are not known yet. The SMF to be prepared acknowledges these issues and integrates the measures for addressing them in the project implementation process.

64. **Resettlement and Land Acquisition.** According to the baseline analysis, there will be need for private land acquisition in Rewa, which will result in involuntary displacement and loss of livelihoods. The scale of involuntary resettlement is likely to be small. Even in Pavagada where land will be taken on 30 years of lease on consent basis, will have impact on landless farmers working on the land parcels that will be taken on lease. The SMF includes a Resettlement Policy Framework (RPF), which specifies the procedures, eligibility, entitlements, implementation mechanism and grievance redress mechanism and other measures to be followed in the event of resettlement and / or land acquisition. The project will also ensure that developers come up with corporate social responsibility plan and implement the same in the project area.

65. **Indigenous Peoples.** Baseline studies shows presence of indigenous community in both the proposed park areas. Hence OP 4.10 on indigenous peoples has been triggered. As part of the SMF, a Tribal Management Framework (TMF) will be prepared, with the objective of including tribal communities in the project in order to achieve the highest possible positive impact of the interventions to improve their quality of life.

66. **Gender.** Most of the women's status indicators (including those pertaining to health, literacy, work force participation,) show that gender equity and empowerment remain serious issues in the proposed sites. As part of the SMF, a Gender Development Framework will be designed which will help to analyze gender issues to design interventions to address women's needs. Gender analysis will be part of the social impact assessment.

67. **Grievance Redressal.** Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

68. Project will set up Grievance Redress Cell (GRC) at the district level where proposed parks have been planned. The mandate of the GRC will be to redress grievances of project affected persons (PAPs) in all respects, especially with regards to rehabilitation and resettlement assistance.

69. **Stakeholder Engagement.** The project will have tailor-made interventions to engage with local communities and key stakeholders to ensure their inclusion and participation in the planning and implementation stages.

70. **Institutional Arrangement:** In order to have smooth implementation of RAP and / or SMF, each state will established Social Development and Resettlement Cell (SDRC) managed by Project Head at the state level and supported by a Social Development Specialist. At project level, one social officer will be appointed / hired from the market. Project will contract a non-governmental organization (NGO) for implementation of RAP and IPP. The RAP / IPP will be implemented over a period of one year. The project will also establish a grievance redress cell. During the operation phase, each developer will appoint one community development officer who will be responsible for planning and implementation of CSR activities in consultation with project SD Specialist.

F. Environment (including Safeguards)

71. The project, supporting solar PV installation and providing ancillary infrastructure like internal collection infrastructure and substation, is likely to have limited impacts on the environment. Environmental Assessment is underway for the project, building on the baseline documentation already undertaken for currently identified sites. The project will develop an environmental and social management framework (ESMF) along with site specific environmental impact assessments and management plans, to assist the JVs and prospective developers to manage impacts in line with GoI requirements as well as Bank safeguards policies. These may include, in addition to Environmental Assessment (OP4.01), Natural Habitats (OP4.04), Physical Cultural Resources (OP4.11), and Forests (OP4.36).

72. At the currently identified sites, in Rewa, Madhya Pradesh and in Pavagada, Karnataka, important environmental issues relate to the use of water, leveling of land and any consequent alteration of local drainage patterns for the preconstruction phase. During construction and installation, occupational health and safety concerns for workers and residents of nearby habitations are likely along with handling hazardous material like defective solar panels and batteries. In the operation phase, in addition to the end-of-use aspects, occupational safety concerns would need to be addressed. Since there is possibility of chance-finds during earthworks, appropriate measures would be devised and included in the EMP. Natural Habitats may be encountered in some locations, though none have yet been identified in project areas. If required, the management plan for the same will be included in the EMP. Some area in the site may be designated forests, and project activities have the potential to affect their health. In line with GoI requirements and OP4.36 stipulations, suitable measures will be undertaken, including compensatory afforestation wherever required, by either JV or selected developers.

73. Stakeholder views were solicited during the collection of baseline data. These are being supplemented with stakeholder consultations, including public consultations, being undertaken for the impact assessment. These would help with identifying key environmental aspects that are valued by the local people and other stakeholders. In addition, consultations would continue during project implementation.

74. Implementation of the EMP will be undertaken by the JV as well as the selected developers depending in the stage at which impacts actually occur. The JV will implement the pre-selection impacts, including siting related aspects. The EMP will be integrated with the Contract for the development of (portions of) the park / installation of the panels. Specific requirements for the handling for hazardous material, including disposal in authorized locations/ with authorized handlers will be included in the Contract document(s) to be agreed between the JV and individual developers. A PMC with sufficient capacity to facilitate EMP implementation will assist the JV during project implementation.

Annex 1: Results Framework and Monitoring

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Country: India

Project Name: Shared Infrastructure for Solar Parks (P154283)

Results Framework

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Project Development Objectives

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PDO Statement

The proposed development objective is "to increase solar generation capacity through the establishment of utility-scale solar parks in the country." This will contribute to the achievement of GoI's target of installing 100GW solar power by 2022.

These results are at	Project Level

Indicator Name	Core	Unit of Measure	Baseline	Cumulative Target Values					
				YR1	YR2	YR3	YR4	YR5	End Target
Investment mobilized in solar projects in solar parks under the project		US$ million	0	0	1,000	2,000	2,750	3,500	3,500
Installed solar generation capacity		MW	0	0	1,000	2,000	2,750	3,500	3,500

GHG emission reductions		thousand tons CO_2 equivalent per year	0	0	1,374	2,748	3,778	4,809	4,809

Indicator Name	Core	Unit of Measure	Baseline	Cumulative Target Values					
				YR1	YR2	YR3	YR4	YR5	End Target
Transmission lines constructed under the project	X	Kilometers	0	0	5	10	20	30	30
Number of Grid substations constructed/upgraded		Number	0	0	3	6	9	12	12

Indicator Description

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Project Development Objective Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Investment mobilized in solar projects in solar parks under the project ($ Million)	This indicator measures the investment mobilized in solar projects in solar parks under the project.	Annual	Progress Report	Implementing Agency
Installed solar generation capacity (MW)	This indicator measures the installed solar generation capacity under the project	Annual	Progress Report	Implementing Agency

GHG emission reduction (thousand tons)	This indicator measures GHG emission reduced against a thermal counterfactual	Annual	Progress Report	Implementing Agency

Intermediate Results Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Transmission lines inside the solar park constructed under the project	This indicator measures the length of the transmission lines constructed under the project.	Annual	Progress Report	Implementing Agency
Number of Grid substations constructed inside the solar park	This indicator measures the number of 220/132 kV, 132/33 kV substations constructed under the project	Annual	Progress Report	Implementing Agency
Grievances received that are addressed within two months of receipt (percentage)	This indicator measures the grievances/ complaints received and percentage addressed within a period of two months from date of receipt	Annual	Progress Reports	Implementing Agency, State Power Utilities

Annex 2: Detailed Project Description

1. This proposed project is one in a series of three engagements requested by the GoI from the World Bank for US$1 billion of funding in the solar power sector[12] [13]. All three projects are expected to support achievement of the government's new solar targets, and to demonstrate important economies of scale in utility scale solar generation, push down equipment and transaction costs, and also increase efficiency while reducing unit costs of solar power. It is expected that the Bank-supported projects will create market confidence and will catalyze further support from other investor groups for the GoI to help with achievement of its ambitious target of installing 100GW of solar power capacity by 2022.

2. In particular, the proposed Shared Infrastructure for Solar Parks operation will support MNRE's announced "solar park scheme" for installing utility scale grid-connected solar parks by 2020, with a targeted, collective installed capacity of 20GW. The MNRE Solar Park scheme will use IBRD funding to develop the enabling infrastructure for utility scale development of solar power, including common infrastructure such as large areas of land, power pooling sub-stations as well intra-park transmission infrastructure, access roads, common security arrangements. This will facilitate investment in solar power development by private or public sector developers, who may be able to shorten the time from contract award to commissioning from 20 months to less than 10 months.

3. As an additional incentive, and to further increase the value proposition of these World Bank-supported solar parks as an investment destination, IBRD funding is also being made available (through a separate but related project implemented by PowerGrid) to provide transmission interconnections to the Inter State Transmission System (ISTS) at the border of the respective solar park. The ISTS provides direct access to the entire national power market, and will therefore allow solar developers from these parks to more easily sign PPAs with customers and off-takers anywhere in the country[14].

4. Presence of ISTS at the solar park border therefore allows India's solar-resource rich states to transfer solar energy to solar-resource poor states, whose distribution utilities nevertheless face renewable purchase obligations and must meet these by "importing" renewable energy from elsewhere. This is a nascent or not yet developed market, which will be supported by the implementation of the current project and a few more like it. These World Bank supported solar parks will be managed in most cases by a Joint Venture company comprising of Solar Energy Corporation of India (SECI) and the State Nodal Agency for renewable energy[15].

[12] During their July 2014 and January 2015 meetings, Prime Minister Narendra Modi and President Jim Kim had agreed that the Bank would provide financing for Solar Parks in the country

[13] In particular, GoI requests have been received for all other Bank engagements to (i) support the establishment of grid connected rooftop PV; (ii) fund the construction of associated evacuation infrastructure from Bank-supported solar parks; and (iii) shared infrastructure for solar parks.

[14] Until the Open Access system is made fully operational, this direct access to PowerGrid's network confers an additional benefit relative to exclusive dependence on the state transmission utility's network and the latter's possible reluctance to allow power to be sold outside of the state, contractual obligations notwithstanding

[15] However, MNRE's scheme does not preclude state-only or private-sector only or SECI-only solar parks, as valid alternative business models for construction and management of solar parks. It so happens that both of the solar parks that have sought World Bank assistance to date, are JVs between SECI and the state. Future solar parks under this project may have different ownership and management arrangements.

5. The JV Company will make available plots of minimum 50MW size inside the park, and offer them to solar power developers in return for user fees that are designed to gradually recover the cost of upfront investment in the shared infrastructure. The benefit of low-cost and long-term funding for the shared infrastructure will be passed on to the end consumer by reducing the initial investment cost for the developer. Developers will consequently be able to competitively bid for long term Power Purchase Agreements (PPAs) with distribution companies inside and outside the state; they will also have the option of generating solar power for captive customers (who are not discoms). The Central Transmission Utility, PowerGrid, or the State Transmission Utility will build the necessary evacuation infrastructure. Some parks will sell all the power outside the state, and others will seek to consume most of it inside the state. The project design allows for all the required flexibility.

6. Each of the participating States along with MNRE, which is the central ministry for the New and Renewable Energy sector in India have drawn-up a long list of candidate solar parks.

Table 1: Summary of planned long list of potential solar parks

S.No	State	Location & capacity
1	Gujarat	Banaskantha (700 MW)
2	Madhya Pradesh	Rewa (750 MW) Neemuch (435 MW) Agar (315 MW)
3	Telangana	Gattu, Mehboob Nagar (1000 MW)
4	Andhra Pradesh	Anantpur (1500 MW) Kurnool (1000 MW)
5	Karnataka	Tumkur (2000 MW)
6	Uttar Pradesh	Jalaun (370 MW) Sonbhadra, Allahabad & Mirzapur (230 MW)
7	Meghalaya	West & Esat Jayantia Hills (50 MW)
8	J&K	Leh & Kargil (7500 MW)
9	Punjab	Patiala, Fatehgarh Sahib, Ludhiana & Gurdaspur (1000 MW)
10	Rajasthan	Bhadla (1700 MW) & Jaisalmer (2000 MW)
11	Tamil Nadu	Ramanathapuram (500 W)
12	Odisha	Location not stated (1000 MW)
Total		22,050 MW

7. Out of this long list of potential/ candidate solar parks, solar parks which are being considered for financing and implementation under the project. MNRE has requested World Bank's support for setting up solar parks in four states – Karnataka, Madhya Pradesh, Andhra Pradesh and Telangana, and has kept the option open for other states to join if they are able to meet the necessary conditions. The process for establishing Solar Parks is most advanced in Tumkur

District, Pavagada in Karnataka and Rewa District in Madhya Pradesh, with land having already been identified for parks with capacities of 2000MW and 750 MW, respectively. (Table 2)

S.No	State	Location & capacity
1	Karnataka	Tumkur (2000 MW)
2	Madhya Pradesh	Rewa (750 MW)
		Neemuch (435 MW) &
		Agar (315 MW)
3	Telangana	To be confirmed
4	Andhra Pradesh	To be confirmed
5	Odisha	To be confirmed

8. Based on the above long list of projects, the following allocation of project costs and funding across states was established, and is presented in Table 2.

Table 3 Allocation of project costs and funding across states (excluding front end fees)			
States	**IBRD loan**	**Counterpart funding - GoI contribution** (MNRE grant)	**Total**
	US$ million	US$ million	US$ million
Karnataka	90	90	180
Madhya Pradesh	50	50	100
Other states	60	60	120
Total	**200**	**200**	**400**

9. **Readiness Criteria and Eligibility for inclusion of new solar parks:** Recognizing that flexibility under this project is needed to ensure maximum development impact, a specific provision is added to include new solar parks (outside of the long list of potential/ candidate solar parks) in various states as long as they meet the following Readiness Criteria (Table 4) that includes a combination of techno-economic, environmental, social requirements and secure the relevant clearances.

Table 4: Readiness Criteria

Departments /Agencies	Description/Output	Completed (yes/No) with Comments
Energy and other relevant department	Policy document , under which the renewable energy park will be developed	
Revenue department	Land lease/usage agreement for 25 years or more	
	Land status with non agriculture conversion	
Third party reports	Environment and Social Impact Assessment (ESIA)	
	Availability of ground water/Ground water assessment	
	Geo technical study reports	
Approval of Industrial commissioner	Covers the exact details of Khasra (plot) nos of project land	
	No Objection Certificate (NoC) from forest department for land usage	

Ministry of Environment and Forests (MoEF) /State forest department	NoC for plant/facility should not be within 10 KM radius of National Park/Wild life Sanctuaries /Eco sensitive zones	
NoC from irrigation department, if applicable	No irrigation canal/pipeline should be crossing through land	
NoC from concerned agency , if applicable	In case any oil/gas/water pipelines crossing nearby site land	
Local Gram Panchayat, as applicable	NoC – Land usage for development of RE park	
Local Nagar Parishad, as applicable	NoC – Land usage for development of RE park	
Town planning , as applicable	Permission/NOC	
State Transmission company Limited	Grid feasibility study report	
	In principal grid connectivity to substation	
	Grid connectivity agreement	
Power Grid	Agreement , in case of intrastate open access/3rd Party sale	
Central Ground Water Authority	Study for Ground Water availability by third party	
	Permission for Borewell and extracting ground water for required water usage	
State pollution control board	Consent to establish under Air and Water act Hazardous waste/water pollutants discharge etc.	

10. The project would be implemented over a five year period and has two components

Component 1 - Solar Park Infrastructure (Estimated Cost - US$198 million, US$150 million IBRD, US$48 million CTF). This will cover financing for shared infrastructure such as security, access roads, water supply and drainage, telecommunications, and pooling stations (with 220/66/33 kV or as may be suitable switchyard and respective transformers) inside the solar parks and transmission lines connecting these internal pooling stations to 400/220 kV sub-station. The scope of investments covered under this project will depend on the particular modality and approach adopted by the state for developing the solar parks. While some states such as Karnataka are planning to provide a full range of infrastructure and services to private sector developers, others such as Madhya Pradesh are planning to only provide pooling stations to facilitate internal evacuation (see Table 1 for tentative allocation of funding to different states). In most solar parks, solar project developers will be responsible for the interconnection of each plot in the solar park with pooling stations through suitable voltage underground or overhead cable.

Component 2 – Technical Assistance (Estimated Cost - US$ 2 million, US$ 2 million CTF). This component will provide support for capacity building of SNAs and JVs across the participating States. Although the role and mandate of SNAs and JV is growing rapidly to meet GoI's ambitious renewable energy targets, they have limited capacity and experience to deliver on these mandates. In this context, this component will provide TA to SNA's and JVs to enhance core competencies of these organizations across functions such as human resource, business

planning, project management and monitoring, procurement and contract management, operations and maintenance, financial management, enterprise wide IT systems.

11. The implementation agency, entrusted with implementing the program will get the land developed and provide necessary infrastructure like road connectivity, transmission infrastructure etc. Significant investments will also be made in the operation & maintenance of the solar park, employing staff and other activities like marketing etc. The entire cost of development including cost involved in acquisition of land will form the total cost for the project for which an estimate will be prepared beforehand by the nodal agency. Based on this estimate the implementing agency will formulate a recovery model to ensure the sustainability of the park. The implementing agency may raise the funds as follows:

(a) The implementation agency may sell/lease out the plots to prospective project developers. Lease period shall be of 30 years or as per State land policy. The Allotment Price per metre square (inclusive of all applicable taxes, duties, cess etc.) payable by the plot applicant for the applications must be specified in a transparent manner. The allotment price may be reviewed annually and an annual increment may also be specified. The maximum stretch of plot to be allotted will be decided as per the benchmarks finalized by the implementing agency.

(b) A one-time registration fee (per project or per MW) may be collected by inviting applications from the prospective buyers when the scheme is finalized, land identified and marked. An advance may be collected from the prospective buyers when 50% of the land is acquired. This advance will be 10% of the sale price or lease amount. Another instalment of 25% of the price of land or lease amount may be taken when full land is acquired. Further instalments may be collected while plot are being developed. Final 15% of the price of land or lease amount may be collected at the time of allotment of the plot to the buyer.

Annex 3: Economic Analysis

This annex discusses the rationale for public financing of the project, the valued added from the Bank support and presents the analysis of the project's development impact in terms of expected benefits and costs. Since the transmission and shared infrastructure investments (that are funded by the World Bank through two related projects) cannot have an economic return independent of the solar PV generation investments, the economic analysis covers the entire package of solar park investments of the *Pavagada Solar Park* in the state of Karnataka[16]. This economic analysis is consistent with the new Bank guidelines in Operational Policy and Bank Procedure (OP/BP) 10.00, Investment Project Financing and Social Value of Carbon in Project Appraisal.

Rationale for public sector provision/financing

The Government of India has announced a bold target of installing 100GW of solar power capacity by 2022 – a thirty fold increase from 3.7GW in 2015. 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 of both private and public investments to meet GoI's solar power targets**.** In particular, there is a strong justification for the use public financing to on the following grounds:

- Public financing can be used to provide services where the public sector has an advantage such as land acquisition, obtaining necessary permits, providing common infrastructure and interconnections from the solar park to the state and national grid. This helps remove or reduce the private sector's risk perception about solar power and increase the availability of private investment and financing for solar power.

- Public support and financing for solar parks infrastructure 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

GoI has requested Bank support for solar power at the highest levels[17]. India's push in solar power will increase the share of renewable energy in India's electricity generation mix and aid efforts to increase electricity access and meet the growing demand in the country. However, since solar power is intermittent energy source, this transition will have to be managed carefully

[16] The Pavagada Solar Park has been selected because it is the most advanced in design amongst the solar parks that Bank has been asked to finance as part of MNRE 20GW Solar Park Scheme.

[17] During their July 2014 and January 2015 meetings, Prime Minister Narendra Modi and President Jim Kim had agreed that the Bank would provide financing for Solar Parks in the country

and efficiently to be successful. The World Bank Group can play a valuable role in this transition by

(i) making long term concessional financing available for development of solar power;
(ii) sharing international knowledge and experience on how utility scale solar parks have been implemented across the world; and
(iii) providing technical assistance and capacity building support to key stakeholders
.

Pavagada Solar Park in India's Generation Mix

Assessment of the impact of a new generation source (in this case the solar park) is carried out jointly by the State Transmission Utility (KSTCL), the Central Transmission Utility (POWERGRID) and the Central Electricity Agency. These assessments help determine the required investments in transmission evacuation arrangements, future generation planning as well as any measures and investments that may be needed to manage the generation from the solar park.

For the Pavagada Solar Park, the implementing agency, Karnataka Solar Power Corporation Development Limited has filed a Long Term Access Application with POWERGRID. The LTA application indicates that up to 90% of the electricity from the park will be utilized inside the state, with the remaining power evacuated to consumers outside the state. Based on the LTA application, POWERGRID, STU and CEA have carried out assessments of the impact of the solar park on the grid and generation mix. These studies will be made available to the Bank once they have been presented at the meeting of the Standing Committee on Power System Planning in the Southern Region in the third week of November 2015.In absence of these studies, this economic analysis uses generation from imported coal (which is the marginal electricity generation source for India) as the counter factual to the generation from the *Pavagada solar park.*

The Project and its Rationale

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% of total energy and 4.7% 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 100GW of solar power by 2022.The proposed project is a key part of GoI's solar park scheme to install 20GW of utility scale solar power by 2020 and will help in meeting the rapidly growing electricity demand in an environmentally sustainable way/.

Cost Benefit Analysis of the Pavagada Solar Park

The economic viability of the project was assessed through a cost-benefit analysis. Net benefits for the *Pavagada Solar Park* was calculated by comparing total system costs and benefits for the "*with project*" and "*without project*" 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. 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.

Project costs

Capital costs

The total project (financial) cost excluding price contingencies and interest during construction is $1.9 billion (Table 1). This includes $87 million of shared infrastructure costs, $164 million of transmission costs and $1.7 billion of PV generation capital cost. The 2014 Central Electricity Regulatory Commissions (CERCs) benchmark capital cost for Solar PV is used as the basis for solar generation costs; a reduction of 10% per year is assumed through to 2017 when the actual investments are projected to take place. Subtracting taxes and duties from the base cost, one obtains an economic cost of $1.6 billion.

Table 1 – Total project cost

	Base Cost ($ Million)	Taxes and Duties ($ Million)	Economic Cost ($ Million)
Shared Infrastructure	87	22	65
Transmission	164	41	123
PV Generation	1668	278	1390
	1918	340.75	1578

Operating and Maintenance costs

The operation and maintenance (O&M) costs are estimated as 1% of the capital costs, which computes to $14 million per year.

Grid integration costs

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) the requirements of connecting generation far away sources to load centers through transmission lines; (ii) additional operation and maintenance costs of thermal plants if they have to operate at lower load factors that would otherwise be the case; (iii) the need for standby generation to provide power when there is no sunshine. It is generally agreed that these cost are negligible or very low at lower levels of penetration of variable renewable energy. This economic analysis

zero value for grid integration cost in the base case but then uses sensitivity analysis to calculate the impact of grid integration costs on the

Project benefits

Fuel costs of the thermal counterfactual using coal

Avoided fuel costs of thermal counterfactual (which is assumed to be coal in this economic analysis) constitutes one of the main economic benefits associated with solar power generation. These avoided costs are calculated based on the coal supply requirements of producing electricity equivalent to those produced from the Pavagada solar park. A capacity utilization factor of 19% is used the solar park based on the analysis that has been carried out in the Detailed Project Report of the solar park. The coal is valued at import price of coal from Australia, which is higher than the domestic price of coal in Australia.

Capacity credit of the solar park

A capacity credit equal to the forecast capacity factor of the solar park (19%) is used in the base case of the economic analysis. Sensitivity analysis is then used to analyze the impact of the capacity credit on the economic returns of the project.

Avoided global environmental damage cost

Avoided global externalities constitute another economic benefit of the Pavagada Solar Park, given that solar power replaces coal generation. Emissions of coal based generation displaced by the solar park estimated are using a emission factor of 830 tonnes/Gwh. 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 ($15 in 2015 increasing to $50 in 2050) and the high paths ($50 in 2015 increasing to $150 in 2050) for the social value of carbon suggested in the Bank guidance are used for sensitivity analysis.

Avoided local environmental damage costs

The emission factors and per unit damage costs for So2, Nox, and PM for coal generation plants in India from Cropper et al. (2012)[18] are used to compute the avoided local environmental damage costs of having the Solar Park (Table 2).

Table 2 – Emission Factor and Damage Costs

	Units	Nox	PM10	SO2
Emission Factor, coal	g/kwh	2.09	0.227	1.44

[18] 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

Damage costs, coal	USc/kwh	0.21	0.06	0.63

Non Quantified Benefits

The proposed Solar Park 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

Assumptions

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%, which is the rate used by past Bank financed power sector projects in India and is consistent with Bank guidance on this topic[19].
- Project cost phasing: as follows:

	2016	2017
Shared Infrastructure	40%	60%
Transmission	40%	60%
PV Generation		100%

- First year of operation: 2018

Results

The economic analysis indicates that in India utility scale solar power is increasingly competitive with thermal generation using imported coal. The baseline economic return of *Pavagada* Solar Park against the "without solar park scenario" is 7% (NPV –US$ 386 million), which is below the 12% hurdle rate used for Bank projects (see Table 3). However, the solar park has substantial local and global environmental benefits and consideration of these benefits increases the ERR of the solar park significantly. The inclusion of avoided damage costs of local pollution in the economic flows, increases the ERR to 10% (NPV -US$163 million). The inclusion of avoided global environmental damage costs (using the Bank guidance on social value of carbon), increases the ERR to 18% (NPV $ 545 million).

[19] The World Bank is presently formulating new guidance note for the choice of discount rate. If the guidance is available before project appraisal, the economic analysis will we revised accordingly.

Table 3 – Summary of Economic Analysis

Economic rate of return	Unit	**Values**
ERR	%	7%
ERR + local externalities	%	10%
ERR + local externalities + GHG	%	18%
Switching value, avoided GHG emission	$ /ton	$6
Composition of NPV		
Cost of Solar Park		
capital cost	$USm	1265
O&M	$USm	31
Benefits of avoided coal generation		
Avoided coal costs	$USm	824
Capacity credit	$USm	86
NPV (before environmental benefits)	$USm	-386
local environmental benefits	$USm	223
GHG emissions @$30/ton	$USm	708
NPV (including environment)	$USm	545
Lifetime GHG emissions undiscounted	Mtons CO2	69
Marginal abatement cost MAC	$/ton	5.6

Reduction in GHG emissions. The analysis indicates that the solar park will reduce GHG emissions by 69 million tons over the life of project compared to the thermal counterfactual. The marginal abatement cost of GHG emission for the Solar Park is $5.6/ton. The Solar Park will help avoid local and environmental damage costs equal to $931 million compared with the thermal counterfactual.

Sensitivity Analysis. The sensitivity analysis in Table 4 calculates the switching values for the important variables such as capital costs, Capacity Utilization Factor, PV generation capital costs, coal prices, capacity credit and discount rate.

Table 4 – Switching Values

Input	**Unit**	**Baseline Value**	**Switching Value**
Project Cost	$ Million	1296	910
CUF	%	19%	27%
PV Cost	$M/MW	1.06	0.70
Annual Increase Coal Prices	%	0%	5%
Discount Rate	%	12%	7%

Capacity Credit	%	19%	103%
Grid Integration Costs	%	0	-2.70%
Project cost overrun factor	Ratio	1	0.7

Sensitivity analysis using the low case (increasing from $15 per ton in 2015 to $50 in 2050) and high case (increasing from $50 per ton in 2015 to 150 in 2050) social values of carbon recommended by Bank guidance impacts the returns of the project significantly. There is 8% percent difference between the ERRs for low case and high case social value of carbon (Table 4). This suggests that the climate change and local pollution impacts are an important deciding factor in whether or not to go ahead with this project.

Table 4 – Sensitivity on Social Value of Carbon

Social Value of Carbon	**EIRR**	**NPV**
Low Case	412	14%
Base Case	751	18%
High Case	1233	23%

Annex 4: Financial Management

1. At central level, MNRE will be the implementing agency for the project. As MNRE is implementing another Bank funded project, it is well versed with the fiduciary arrangements on the project. MNRE will support the project by extending the budgetary support as well as the supervision oversight to the implementation at state level. However the PIA's (KSPDCL and RUMSL) will be responsible for implementation including procurement as well as compliance to agreed FM arrangements at the state level.

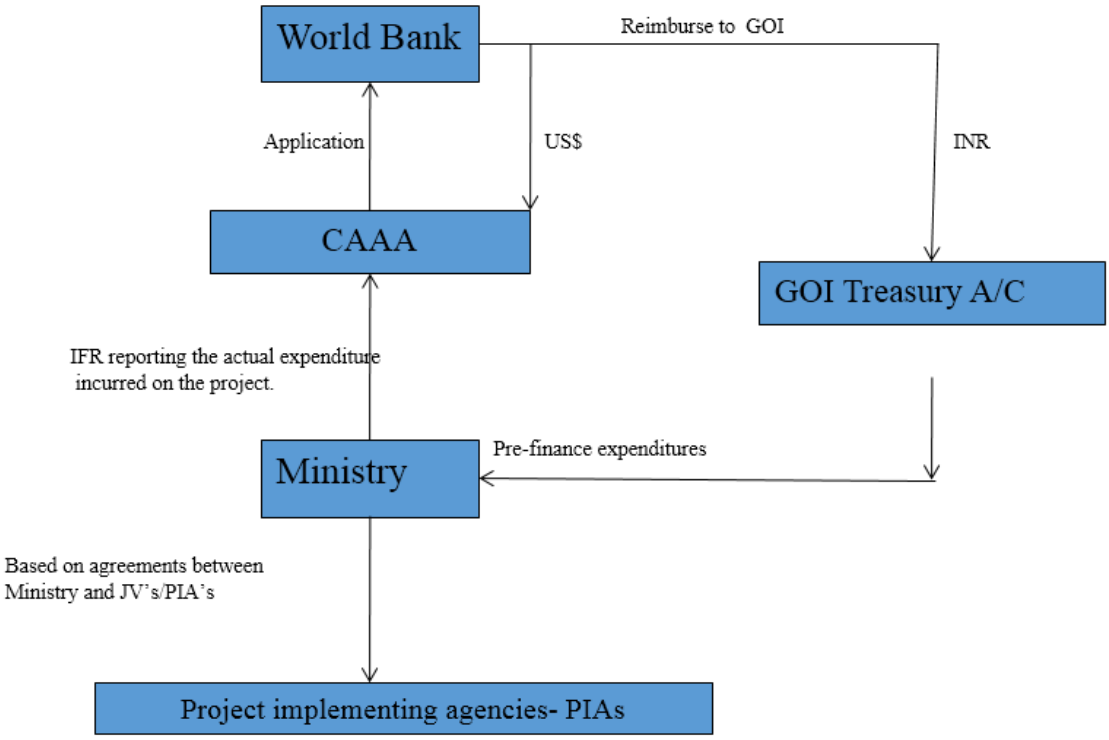
2. **Sources and application of funds**: The project size is USD 400 mn with USD 200 mn as bank funding and USD 200 mn as counterpart funding. The counterpart is expected to be met out of GoI[20] through the subsidy as well as private developers in form of user fees.

   The present project at Karnataka as well as MP[21] have a cost of USD ….. with requirement of Bank funding of USD ……

3. **Budget**: The project will follow the budgeting cycle of Government of India (GoI) ie April to March and the process will be completed when project's expenditure estimates (GoI as well as World Bank financing) are included in the Union government's budget presented and approved by Parliament. The responsibility of preparing the budget is with Divisional Heads (for this project it is Joint Secretary which is then approved by Secretary, MNRE. The project will be budgeted on the expenditure side at the Union (center) level, as externally aided project under an identifiable budget head item (demand no. 69) of the MNRE. The allocation for FY 15-16 needs to be made during the upcoming supplementary in December 2015. Detailed annual budget and work plans for the project as prepared by KSPDCL and RUMSL will be the basis for the budget provision for initial allocation for FY 15-16 and future budgetary forecast for FY 16-17 in the union budget

4. **Fund Flow:** The project will be prefunded by budgetary allocation. Each year, basis the budget approved under the dedicated EAP budget head, the funds will be drawn from Treasury (through the central government budget) and would pass through the MNRE Pay and Accounts Officer (PAO) to the state IA's ie KSPDCL and RUMSL dedicated bank account as grant in aid. Bank disbursement will be based on reimbursement of expenditures which will be report-based. Eligible expenditures will comprise: consulting and non-consulting services, goods, workshops and training, and other operating costs.

[20] Scheme name and date to be quoted.
[21] As per DPR



5. Fiduciary assessment: KSPDCL

The mission visited KSPDCL which is presently housed in KREDL premises in Bangalore and discussed[22] FM aspects of project preparation.

KSPDCL is the state implementing agency of the project to be located in Tumkur Karnataka. This project would be KSPDCL's first major activity which would be Bank funded. KSPDCL was incorporated on 12th March 2015 under Companies Act 2013 as a private limited company. Subsequently on September 20 2015 KSPDCL was converted into a public limited company. KSPDCL is a Joint Venture (JV) between RECI a central PSU and KREDL a state PSU each holding 50% of the share capital of KSPDCL. The paid up capital is INR one crore.

a. **Board of Directors (BOD):** The current Board of Directors comprises Chairman (part time) and three part time nominee directors. There are no full time functional directors on the Board. Mr Ravi Kumar past executive director of POWERGRID has been selected as the chief executive officer (CEO) of the JV. However the formal order is yet to be issued. The BOD needs to be strengthened in due course with full time functional director/s to provide required direction for successful

[22] Mr GV Balram, Chairman KSPDL, Mr Ganesh Financial Controller KREDL, C Sujatha AGM – Solar Park KREDL and Lata N Patil Technical Officer – Solar Park KREDL.

implementation of the project. The Articles of Association provides the structure of the Board. The mission would request that the JV strengthens its Board accordingly in a time bound manner and share its plans with the Bank. The mission requested KSPDCL to share with the Bank the revised Memorandum and Articles of Association. This revision was necessitated by the recent conversion of the JV from a private limited to a public limited company.

b. **JV Structure and staffing:** The only formal appointment in the JV is that of the Board members. Three KREDL staff and two retirees on contract with KREDL are assisting the Chairman full time with specific project preparation activities including FM. In addition, other officials of KREDL are providing assistance on need basis to the JV including finance and accounts department staff and the Company Secretary of KREDL. The JV needs to formally appoint qualified and experienced staff in all disciplines including FM in required numbers through recruitment and/ or deputation or engage as consultant, on urgent basis. Specifically for FM there is a need for appointing/ hiring before appraisal a senior level staff with finance and accounts background and at least 7-10 years of experience and an assistant level staff with at least 3-5 years of experience in finance and accounts. These personnel need to be trained in the Banks fiduciary requirements as well.

   The JV is in the process of developing formal organization structure, manpower requirements and job descriptions. These need to be completed and an early draft along with recruitment plan shared with the Bank for evaluating the capacity of the JV to manage the preparation and implementation of the Bank funded project.

c. **JV accounting:** Expenditures of the JV are being met by KREDL (i) from its own funds and ii) from the JV's own bank account with Vijaya Bank where the funds received by the issue of shares amounting to INR one crore has been deposited. KREDL is maintaining records of JV's expenditures met out of KREDL's funds in its own books. Records of cheques issued from the JV's bank account are manually maintained by KREDL in a separate register. The mission recommends that the JV commences its own accounting immediately with the assistance of KREDL. A possible way is that KREDL (i) segregate and list the expenditures of the JV appearing in KREDL's books as on a cut-off date and have them audited by KREDL's internal auditors; (ii) pass formal accounting entries in KREDL's books of accounts on the cut-off date showing amount/s recoverable from the JV; (iii) assist the JV in recording through suitable accounting entries all expenses in the JV's own books of accounts under proper heads and (iv) ensure that all subsequent expenditures of the JV are captured in the JVs own books of accounts accurately. The mission would request the project to share with the Bank by December 15 2015 the Balance Sheet and Profit and Loss Account of the JV as on Nov 30 2015 with adequate notes and schedules showing expenses till date and amounts due to the parent company KREDL.

   KREDL uses Tally accounting software for accounting purposes and its experience with the software has been good. The mission discussed the possibility of acquiring

Tally software for the JV and using this software to record all accounting data since its inception including the data that would be notified and transferred by KERDL. It was agreed that this exercise under the supervision and guidance of KREDL would serve as training for gaining proficiency in using Tally by JV FM staff in accounting and reporting on the Bank funded project in the future.

d. **Operations manuals:** Being a new company, the JV is yet to develop any operations manuals. Currently for its expenditures, KREDL's operational procedures and controls are being followed[23]. The JV would need a Project specific FM manual laying down procedures and controls for planning, budgeting, accounting, reporting and audits. The project manual would be reviewed and accepted by the Bank before appraisal. Specific FM personnel would be identified for the project.

e. **Action plan till appraisal:** The responsibility for FM activities of the project would lie with the JV. The FM manual would broadly cover the following areas:

- The projec**t** would initially prepare a **project plan** for the duration of the project which would be agreed with the Bank before the beginning of the project. The project plan would be revised in consultation with the Bank as and when required based on actual performance of the project and expected progress
- The project would prepare **annual project budget** prior to the beginning of the financial year and share the budget with the Bank. The annual project budget would provide expenditure estimates for contracts and activities that would be funded (i) by the Bank and (ii) through counterpart contributions. Actual performance against budget would be captured in quarterly project reports for monitoring and control. Midyear revision of budget would be carried out.
- Receipts of project funds from the Bank would be held in a separate, dedicated **project bank account** which would be opened to effectively segregate Bank funds from counterpart and JV's own funds. Periodic project bank reconciliation statements would be prepared and shared with the Bank along with the quarterly project reports.
- Expenditure out of project funds would be incurred strictly for the purposes intended as specified in the legal agreements and authorized in accordance with the **formal delegation of powers** (DOP) adopted for the project. The delegation of powers would be shared with the Bank before appraisal.
- Detailed **controls, systems and procedures** would be laid down in the manual to cover payments to contractors and others in accordance with contractual terms and conditions after proper verification of work and appropriate authorization. Compliance with laid down procedures and controls would be adhered to by the project and its compliance would be tested during Bank's supervision visits and external and internal

[23] The mission reviewed the audit report of statutory auditors for year ended 2014-15 and found no serious observations.

audits of the project. All ineligible expenditures will be disallowed and recovered by the Bank according to laid down procedures. Project accounting will be on cash basis and the project as well as the entity (JV) would follow Indian Accounting Standards specified under law. All project related documents including contracts, work orders, work verification, bills and vouchers and all other relevant documents, agreements, records and reports would be kept under safe custody of the project authorities during project duration and as per legal requirements.

- The project would submit to the Bank **quarterly interim unaudited financial reports (IFR)** in the prescribed format within 45 days of quarter end. These reports would cover summary of receipt and expenditure of funds under prescribed funds sources (Bank, counterpart) and by expenditure heads such as approved packages/ activities as prescribed in the legal agreements. The report would provide details for the quarter, year to date and project to date. The report would compare financial performance with budgets and analyze causes of major variances if any. The receipts and expenditure would be based on project accounts and comprise only eligible expenditures as defined by the project. In addition the IUFR would provide list of Bank funded contracts along with contract details and cumulative payments till date to monitor time and cost variances.
- The project would be subject to **independent audits** by CA firms in the form of (i) periodic internal audit of the project including FM and (ii) annual project audit of the project financial statement (PFS) and IFRs. The audits would be carried out in accordance with Indian Audit Standards specified under law. The audit reports containing audit observations would be shared with the Bank within the prescribed timeframe. The suggested TORs would be provided by the Bank as also the mode of appointment of the auditors. While the internal audit report will be shared with the Bank within the timeframe mutually agreed, the annual PFS and IFR audit report and the JV's entity audit report will be due for submission to the Bank within 9 months from year end (by end December).

Reports submission timeframe under legal covenant of the Bank is summarized below:

Name of Report	Timeframe for Submission	Responsibility
IFR	Within 45 days of quarter end	KSPDCL (JV)
Internal Audit Report	As prescribed in PAD	KSPDCL (JV)
Annual PFS Audit Report	Within 9 months of year end	KSPDCL (JV)
Annual Audit Report of KSPDCL	Within 9 months of year end	KSPDCL (JV)

f. Appointment of statutory auditors

Under law, KSPDCL is subject annual audit by auditors appointed by the CAG. The Bank would request KSPDCL to share with the Bank the name of the statutory auditors so appointed or the status of the appointment as on date.

Summary of actions to be taken by KSPDCL (JV) and the indicative timeframe are given below:

S.No	Action to be taken and shared with the Bank	Timeframe (By)	Responsibility
1.	Formalization of CEOs appointment	Mid November 2015	KSPDCL
2.	Revised Memorandum and Articles of Association	Mid November 2015	KSPDCL/ Co Secretary, KREDL
3.	Plans for strengthening BoD with functional directors	By Appraisal	KSPDCL
4.	Functional organization structure with JDs and plans for key recruitments	End November 2015	KSPDCL
5.	Recruitment of two FM staff	Mid November 2015	KSPDCL
6.	(i) Acquisition of accounting software by JV, (ii) update of JV books of accounts and (iii) JV Balance Sheet and Profit & Loss Account as on October 31 2015 duly certified as to its correctness	End November 2015	KSPDCL/ KREDL
7.	Delegation of Powers for JV and project	Before Appraisal	KSPDCL
8.	Project FM manual covering budgeting, accounting, reporting and audits as per agreed framework for Bank clearance by Appraisal	Draft by end November 2015	KSPDCL/ KREDL
9.	Details of appointment of Statutory Auditors of KSPDCL	Mid November 2015	KSPDCL/ Co Secretary, KREDL
10.	Agreement on Corporate Governance action plan	By Appraisal	KSPDCL/ Co Secretary, KREDL

6. Fiduciary assessment: RUMSL

The mission visited RUMSL which is presently housed in MPUVNL premises in Bhopal and discussed[24] FM aspects of project preparation.

RUMSL is the implementing agency of the SISP project to be located in Rewa, Madhya Pradesh. This project would be RUMSL's first major activity which would be Bank funded. RUMSL was incorporated on July 10 2015 under Companies Act 2013 as a private limited company. RUMSL is a Joint Venture (JV) between RECI (erstwhile SECI) a central PSU and MPUVNL a state PSU

[24] Discussions were held with Neelesh Nema (Controller Finance & Accounts MPUVNL deputed to RUMSL as Chief Finance Officer) and K L Gupta (Additional Accounts Officer MPUVNL deputed to RUMSL) and others.

each holding 50% of the share capital. The authorized capital of RUMSL is INR ten crore. The JV partners have each released INR one crore against share capital (the formal issue of shares by the JV is however pending). In addition RECI has released INR 7.5 crore as subsidy. The total fund received by RUMSL as on date of the mission was INR 9.5 crore.

a. Board of Directors (BOD): According to the Memorandum and Articles of Association (M&AOA) of RUMSL the total strength of the Board of Directors including part-time and whole-time directors would be not less than four (4) and not more than seven (7). Composition of the first BOD which is as specified in the M&AOA is as follows:

1. Manu Srivastava, CMD; (Mg. Director of MPUVNL);
2. Mridul Khare – Director; (Deputy Commissioner GOMP Renewable Energy Dept)
3. C. Kannan - Director; (Director Finance, SECI)
4. K. Remesh Kumar – Director; (SECI nominee)

First meeting of the Board was held on August 7 2015. Given the short timeframe for project preparation and implementation, RUMSL need to consider further strengthening of the Board with whole time functional directors and share its plans with the Bank along with a copy of the minutes of the first BOD meeting.

b. JV Structure and Staffing: Apart from the BOD, MPUVNL have deputed four officials through Government Order to RUMSL holding additional charges. Two officials have been deputed for finance and accounts function; one for discharging the duties relating to legal and administrative aspects of company formation, capital issue and liaison with external authorities etc; and one for general support duties. However teams of officials and consultants are also engaged in other technical and non technical areas relating to the project. The involvement of such officials needs to be formalized as soon as possible.

According to RUMSL the organization structure and staffing of the JV is expected to be lean and compatible with its requirements. RUMSL proposes to hire a third party as the project management consultants for project supervision and management. However the JV would require an internal governance and fiduciary structure with adequate skills, infrastructure and resources for effective oversight and control of the project including fiduciary compliance. The timeframe proposed by the JV for preparation and implementation of the project is short. Thus the JV which is about four months old needs to formalize its organization structure as soon as possible based on its proposed timeframe for project preparation and implementation and appoint qualified and experienced officials and staff in all disciplines including FM in required numbers through recruitment and/ or deputation or engage as consultant. From FM perspective the two deputed accounts officials with additional charge would be adequate in the short term but would require strengthening as activities pick up. FM personnel need to be trained in the Banks fiduciary requirements as well.

Therefore the JV needs to develop formal organization structure, manpower requirements and job descriptions along with recruitment plan and share with the Bank for evaluating the capacity of the JV to manage the preparation and implementation of the Bank funded project.

c. JV Accounting: The JV is maintaining its own accounts using accounting software (Tally) and the shared latest accounts statements with the Bank. The JV has received INR two crore from RECI and MPUVNL as contribution towards share capital and also received additional INR 7.5 crore from RECI towards subsidy. The JV has opened its own bank account with Punjab National Bank, TT Nagar Bhopal. The balance in this account as on date of the mission was INR 9.27 crore.

Expenses of the JV towards salaries etc of personnel involved in the project preparation are being borne by MPUVNL[25]. The mission recommends that all such expenses be segregated by MPUVNL, listed and scrutinized and entered in the JVs books as early as possible to properly reflect the expenditures of the JV. The mode of recovery of such expenses by MPUVNL from the JV would be mutually agreed between the parties. Suitable accounting entries would be passed in the books of both the JV and MPUVNL. The mission would suggest that all subsequent expenditure of the JV should be recorded in the JV's books. The mission would request that JV share with the Bank its accounts statements after completion of the above exercise as early as possible.

d. Operations Manuals: Being a new company, the JV is yet to develop any operations manuals. The JV needs to clearly set out its accounting policies, controls and procedures as early as possible. As per Bank requirements the JV would be required to develop a project specific FM manual laying down procedures and controls for planning and budgeting, accounting, reporting and audits.
The responsibility for FM activities of the project would lie with the JV. FM staff responsible for various functions under the project would be identified by the JV for interactions with the Bank during the project. The FM manual would broadly cover the following areas:

- The project would initially prepare a **project plan** for the duration of the project which would be agreed with the Bank before the beginning of the project. The project plan would be revised in consultation with the Bank as and when required based on actual performance of the project and expected progress.
- Each year, the project would prepare **annual project budget** prior to the beginning of the financial year and share the budget with the Bank. The project budget will be part of the overall JV budget for the year. The annual project budget would provide expenditure estimates for contracts and activities that would be funded (i) by the Bank and (ii) through counterpart contributions if any. Actual performance against budget would be captured in quarterly project reports for monitoring and control. Midyear revision of budget would be carried out and shared with the Bank.
- Receipts of project funds from the Bank would be held in a separate, dedicated **project bank account** which would be opened to effectively segregate Bank funds from counterpart and JV's own funds. Periodic project bank reconciliation statements would be prepared and shared with the Bank along with the quarterly project reports.

[25] JV's recorded expenses include payments to Powergrid for 750 MW project (INR 12 lakh); bank guarantee fee (INR 0.86 lakh); company formation expenses (INR 10.36 lakh); and other expenses (INR 0.21 lakh).

- Expenditure out of project funds would be incurred strictly for the purposes intended as specified in the legal agreements and authorized in accordance with the **formal delegation of powers** (DOP) adopted for the project. The delegation of powers would be shared with the Bank before appraisal. The project delegation of powers would be a sub-set of the JV's delegation of powers.
- Detailed **controls, systems and procedures** applicable to the project would be laid down in the project manual to cover payments to contractors and others in accordance with contractual terms and conditions after proper verification of work/ output, checking of bills with contracts etc and appropriate authorization. Laid down procedures and controls would be adhered to by the project and its compliance would be tested during Bank's supervision visits and external and internal audits of the project. All ineligible expenditures will be disallowed and recovered by the Bank according to laid down procedures. Project as well as the entity (JV) would follow Indian Accounting Standards specified under law. However reporting to the Bank will be on cash basis. All project related documents including contracts, work orders, work verification, stock statements, bills and vouchers and all other relevant documents, agreements, records and reports would be kept under safe custody of the project authorities during project duration and as per legal requirements.
- The project would submit to the Bank **quarterly interim unaudited financial reports (IUFR)** in the prescribed format within 45 days of quarter end. These reports would be prepared on cash basis and cover summary of receipt and expenditure of funds under prescribed funds sources (Bank, counterpart) and by expenditure heads such as approved packages/ activities as prescribed in the legal agreements. The report would provide details for the quarter, year to date and project to date. The report would compare financial performance with budgets and analyze causes of major variances if any. The receipts and expenditure would be based on project accounts and comprise only eligible expenditures as defined by the project. In addition the IUFR would provide list of Bank funded contracts along with contract details and cumulative payments till date to monitor time and cost variances.
- The project would be subject to **independent audits** by CA firms in the form of (i) periodic internal audit of the project including FM and (ii) annual project audit of the project financial statement (PFS) and IFRs. The audits would be carried out in accordance with Indian Audit Standards specified under law. The audit reports containing audit observations would be shared with the Bank within the prescribed timeframe. The suggested TORs would be provided by the Bank as also the mode of appointment of the auditors. While the internal audit report will be shared with the Bank within the timeframe mutually agreed, the annual PFS and IFR audit report and the JV's entity audit report will be due for submission to the Bank within 9 months from year end (by end December).

1. Reports submission timeframe under legal covenant of the Bank is summarized below:

Name of Report	Timeframe for Submission	Responsibility
IFR	Within 45 days of quarter end	RUMSL (JV)
Internal Audit Report	As prescribed in PAD	RUMSL (JV)

Annual PFS Audit Report	Within 9 months of year end	RUMSL (JV)
Annual Audit Report of RUMSL	Within 9 months of year end	RUMSL (JV)

Appointment of statutory auditors
As required by law, the JV would be subject to annual audit by auditors appointed by the CAG. The Bank would request the JV to share with the Bank the name of the statutory auditors so appointed or the status of the appointment.

Summary of actions to be taken by RUMSL (JV) and the indicative timeframe are given below:

S.No	Action to be taken and shared with the Bank	Timeframe (By)	Responsibility
1.	Share Copy of first BOD minutes	Mid November 2015	RUMSL
2.	Share Plans for strengthening BoD	By Appraisal	RUMSL
3.	Formalization of key appointments (management/ fiduciary) involved in project preparation	Mid November 2015	RUMSL
4.	Functional organization structure with JDs and plans for key recruitments	By Appraisal	RUMSL
5.	JV Balance Sheet and Profit & Loss Account as on October 31 2015 updated with all expenses pertaining to the JV	Mid November 2015	RUMSL
6.	Delegation of Powers for JV and project	Before Appraisal	RUMSL
7.	Share Project FM manual covering planning, budgeting, accounting, reporting and audits as per agreed framework	Before Appraisal	RUMSL
8.	Share Memorandum and Articles of Association (legal document)	End October 2015	RUMSL
9.	Details of appointment of Statutory Auditors of JV	By Appraisal	RUMSL
10.	Agreed action plan on Corporate Governance	By Appraisal	Bank/ RUMSL

Annex 5: Safeguards

A total of two sites have been proposed under solar shared infrastructure project namely (i) Rewa in the state of Madhya Pradesh and (ii) Pavagada in Karnataka. The ensuing paragraphs provides brief description of baseline of the proposed sites.

Proposed solar park site in Pavagada, Karnataka: The proposed solar park in Pavagada is spread over 12,171 acres across five villages in Pavagada taluk of Tumkur district. As per Census 2011, these villages consists of 2417 households with a population of 10,294 with an average household size of 4.26. The average sex ratio in these villages is 941. The Literacy Rate is quite low at 55.35% and during the consultations in the villages, it has been found that even amongst the literates, the level of literacy is quite low with hardly 1% of the population having a graduation degree. Over 40% of the population falls under the marginalised section of the society with nearly 22% falling under the category of Scheduled Caste and 18% under the category of Scheduled Tribe. During the consultations in the project villages, it has been found that though there is nearly 18% ST population but these are integrated into the mainstream. The landholding amongst SC and ST population is very minimal and fall under the category of marginal and small farmers including the landless. These sections are predominantly dependent on the agriculture labour requirements in the land belonging to large land owners. The Work Force Participation Rate in these villages is 54.32.

The total geographical area of the five villages in the project is about 10,333 Ha. As per the discussions with the local people, about 20% falls under the non-agricultural use including abadi, water bodies, roads, community facilities and other amenities and the balance area is under agriculture use, with only about 5% of the total area is being irrigated by tanks / bore well. The proposed site area of about 4994 ha, comprising of about 4811 ha private land and about 183 ha of government land. The land included under the project is nearly 50% of the total land under these villages. The average land holding in the proposed park area varies between 4 to 7 acres.

Proposed solar Park site in Rewa, Madhya Pradesh: The proposed park is situated in Gurh Tehsil of Rewa district at a distance of approximately 30 km east of Rewa city. The population of Rewa district is 2.36 million of which Gurh tehsil accounts for 0.13 million (5.4%). The five villages that comprises of the entire park area has a population of 10,000 with an average household size of 4.5. The sex ratio in the project villages is 962. The schedule tribe population in the affected villages accounts for 21% of the total population. The literacy rate is quite low at 54% and has huge gender gap in literacy level. The workforce participation rate is about 45 percent in the project villages.

The total proposed area under the park is 1500 ha across these five villages. Nearly 63% of the total land in the affected villages belongs to government including large share under forest department. The average size of land plots ranges between 0.11 ha to 0.73 ha. Nearly 31% of the land parcels in the proposed park area are rocky and barren whereas another 14% is fallow land. Crop land is only 15% of the total proposed area. Majority of the proposed private land is unirrigated and has very limited economic potential due to rocky strata. The land values in the proposed villages are quite low compared to other parts of the district due to poor irrigation facilities and lack of urbanization potential.

Land Acquisition / Lease

Proposed Pavagada Solar Park: KREDL has identified 1319 survey numbers owned by 1422 farmers in five affected villages. Nearly 48 % of land owners comes under the category of marginal and small farmers. Although land will be taken on lease, OP 4.12 has been triggered as there are several landless households depends on these land parcels taken on lease for livelihood. Many of these land owners have already given their consent for a 30-year term lease of their land for setting up of a solar park. Land owners in the vicinity of the proposed site have also expressed their interest in giving land on lease for solar power plant, which was confirmed during the consultations. Project information has been disseminated in the project area. The farmers will receive Rs. 21,000 per acres per year with 5 percent raise every alternative year. The lease amount and subsequent raise has also been disseminated in public meetings as well as through local newspapers. The identified survey numbers are under review. Out of 1319 survey numbers, 800 has clear ownership record where as others needs rectification either for land size or current ownership. Government of Karnataka has issued gazette notification for conversion of land use from agriculture to industrial. Every individual land owner will be requested to submit application for change of land use along with land records to the office of District Magistrate. The cost towards change of land use will be borne by KREDL. The detailed impact assessment is underway and based on impact assessment results, Resettlement Action Plan and Indigenous Peoples Plan will be prepared.

Proposed Rewa Solar Park: The social baseline for the proposed park area has been completed. The project is likely to have impacts on the livelihood for private owners who are losing their land. Project will be acquiring 164 ha of private land out of 1500 ha of land identified for proposed solar park across 5 villages in Gurh tehasil of Rewa district. As part of baseline study, data related to all government land parcels within the five villages in the proposed area was analyzed and parcels measuring 315 ha was excluded from the proposed park area as they were scattered and/ or were required to be left out to ensure easement rights. During baseline study, discussion with stakeholders clearly established that land proposed for acquisition has very limited agriculture potential in absence of irrigation facility. Majority of the land parcels are not even used for cultivation as they are very small and thus economically inviable. Certain extent of agriculture is limited in the marginal land parcels along the drainage network having topsoil and water retention is used for cultivation. The joint venture company is in the advance stage of hiring consultants to carry out social impact assessment and preparation of resettlement action plan and indigenous peoples plan.

The joint venture company has submitted the proposal to district magistrate of Rewa for land acquisition through consent policy of government of Madhya Pradesh. As per the policy, government will offer two times of the circle rate as land compensation. Office of district magistrate will publish notice for affected land parcels in local newspapers.

Grievance Redressal. Communities and individuals who believe that they are adversely affected by a World Bank (WB) supported project may submit complaints to existing project-level grievance redress mechanisms or the WB's Grievance Redress Service (GRS). The GRS ensures that complaints received are promptly reviewed in order to address project-related concerns. Project affected communities and individuals may submit their complaint to the WB's independent Inspection Panel which determines whether harm occurred, or could occur, as a result of WB non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the World Bank's attention, and Bank Management has been given an opportunity to respond. For information on how to submit complaints to the World Bank's corporate Grievance Redress Service (GRS), please visit http://www.worldbank.org/GRS.

For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

Project will set up Grievance Redress Cell (GRC) at the district level where proposed parks have been planned. The mandate of the GRC will be to redress grievances of project affected persons (PAPs) in all respects, especially with regards to rehabilitation and resettlement assistance.

Stakeholder Engagement. Sustainability of the priority investments will depend substantially on the meaningful participation and support of key stakeholders, especially local communities. A rapid assessment of stakeholder perceptions carried out during baseline survey indicates a high-level of demand at the grassroots level for greater transparency and for active involvement in the proposed operations. Therefore, in addition to overall strategic communication efforts, project will have tailor-made interventions to engage with local communities and key stakeholders to ensure their inclusion and participation in the planning and implementation stages. These interventions will include: (i) Information, Education, and Communications (IEC) campaigns; (ii) mobilization of local communities (particularly women and youth) around issues of sanitation, health, and hygiene; (iii) transparent consultations; (iv) dissemination of project information; and (v) participation in CSR plan preparation.

Communication Strategy. The project will have a communication strategy focusing on efficient and effective usage of print and electronic media, information boards, posters, and adoption of any other method suited to the local context, logistics, and human and financial resources available. The project communications plan includes dissemination of corridor-specific information through suitable local media. Communities will be engaged through stakeholder consultations in planning and implementation. The Social Officer at project level will be responsible for implementation of communication plan with assistance from contacted NGO.

Project will carry out third party evaluation of RAP implementation twice in the project cycle, once at mid-term and again at end term.

Annex 6: Appraisal Prior Actions

Pavagada Solar Park - Karnataka

Action	Responsible Agency	Timeline
Technical		
Grid evacuation/grid impact studies to be shared with World Bank	POWERGRID/KSPDCL	November 30 2015
KSPDCL to inform POWERGRID of updated plans to keep 90% of the solar park generation in the state	KSPDCL	November 4 2015
Financial Management		
Separate accounting systems with suitable software for KSPDCL	KSPDCL Board and Chairman	December 20 2015
Formal appointment of qualified and experienced staff for KSPDCL in all disciplines including FM	KSPDCL Board and Chairman	December 20 2015
Preparation of a Project Implementation Manual for the solar park	KSPDCL Board and Chairman	December 20 2015
Delegation of powers for the Project to KPSDCL	KSPDCL Board and Chairman	December 20 2015
Procurement		
Preparation of procurement plan	KREDL/KSPDCL	November 7 2015
Safeguards		
Completion of baseline data for solar park	KREDL/KSPDCL	November 1 2015
Completion of EIA/SIA for 600MW park área that will be developed by NTPC	KREDL/KSPDCL	December 20 2015
Consent to establish solar park from KSPCB	KREDL/KSPDCL	December 20 2015
Detailed development plans for solar park	KREDL/KSPDCL	December 20 2015
Appointment of consultants to carry out EIA of remaining 1400MW of solar park	KREDL/KSPDCL	December 20 2015

Rewa Solar Park -MP

Action	Responsible Agency	Timeline
Technical		
Submission of evacuation and grid impact studies of REWA to World Bank	RUMSL	October 31 2015
Financial Management		
Develop a project specific delegation of powers and FM systems and procedures manual	RUMSL	December 15 2015
Clearly set out staffing, organizational structure, accounting policies, controls and procedures as early as possible.	RUMSL	December 15 2015
Procurement		
Finalization of the Scheme of Pooling stations and preparation of the long list	RUMSL	November 14, 2015
Preparation of draft Procurement Plan for first 18 months – based on the template for PP	RUMSL	November 18, 2015
Publication of GPN – **Draft GPN to be shared with the client as reference** **Publication of GPN by the Client**	Procurement Team Bank RUMSL	November 14, 2015 November 18,2015
Preparation of Bidding document for procurement of pooling stations using Bank's SBD	PMC of RUMSL	November 21, 2015
Reference bid document for procurement of pooling station based on the Bank's SBD (if available in Bank's archive)	Procurement Team Bank	November 4,2015
Identification of Procurement Specialist with clear job description and reporting to coordinate with the PMC	RUMSL	November 4,2015
Submission of Compiled Procurement Assessment Questionnaire for RUMS with supporting documents	Mr. Anil Kumar Mishra and RUMSL	November 4, 2015
Submission of Compiled Procurement Assessment Questionnaire for STU as their PMC with supporting documents	PMC of RUMSL	November 14, 2015

Safeguards		
Hiring of ESIA Consultants	RUMSL	November 5 2015
Submission of progress report on ESIA	RUMSL	December 15 2015
Completion of ESIA	RUMSL	January 31 2015
Completion of land acquisition	RUMSL	January 31 2015

Annex 7: Clean Technology Fund (CTF) Annex

India: Shared Infrastructure for Solar Parks & Transmission for Power Evacuation from Solar Parks[26]

Key Indicators	CTF/World Bank-funded Project	*Scaled-up Phase:* Solar Park Scheme of the Ministry of New and Renewable Energy (MNRE) by 2020[27]
Installed solar PV generation capacity in supported solar parks (MW)	3,500 MW	22,050 MW
Tons of GHG emissions reduced or avoided - Tons per year [$mtCO_2eq/yr$] - Tons over lifetime [$mtCO_2eq$ / 25 years][28]	4.8 120.2	30.3 757.5
Financing leveraged through CTF financing (US$ million)	US$ 4,420 million - US$ 420 million by IBRD • US$ 150 million for shared infrastructure • US$ 270 million for transmission - US$ 500 million by the Government of India (GoI) and state governments • US$ 200 million for shared infrastructure • US$ 300 million for transmission - US$ 3,500 million by private and public sector for generation capacity in the solar parks	US$ 28.2 billion - US$ 420 million by IBRD - US$ 5.8 billion by GoI and state governments - US$ 22 billion by private and public sector for generation capacity in the solar parks
CTF leverage ratio	1 : 55.3	1 : 352.8

[26] This CTF Annex presents two World Bank-funded projects: i) Shared Infrastructure for Solar Parks; and ii) Transmission for Power Evacuation from Solar Parks. The results indicated in this Annex will be achieved by implementing two projects together.

[27] The *Scaled-up Phase* assumes that the proposed CTF-funded Project contributes to the achievement of the 'solar park scheme' launched by the Ministry of New and Renewable Energy (MNRE) to facilitate the development of utility scale solar power in India. The scheme will install utility scale grid-connected solar parks by 2020, with a targeted, collective installed capacity of 20GW.

[28] The lifetime of solar PV generation facilities was hereby assumed at 25 years.

Cost effectiveness - CTF cost effectiveness [$\$_{CTF}/tCO_2eq$ avoided over lifetime] - Total project cost effectiveness [$\$_{Total\ Project}/tCO_2eq$ avoided over lifetime]	0.67 37.42	0.11 37.36
Other co-benefits	- Support in meeting the electricity demand and contribute to the universal access agenda. - Increased opportunities of local employment. - Contribute to cost reduction in solar PV technologies. - Environmental co-benefit: reduced local air pollution of 74.8 kt of NOx, 51.5 kt of SOx and 8.1 kt of PM10 per annum after the *Scaled-up Phase.* - Gender co-benefit: interventions to be designed to address gender issues in the proposed solar park sites.	

I. Introduction

Background: country and sector context

1. India's power system needs to grow rapidly to fuel the country's economic growth and provide electricity to its growing population. During the last decade, India's economy expanded at an average annual rate of 7.6 percent; projections are for high rates of growth to continue. The demand for power is expected to rise to support the growing manufacturing sector and meet the rising aspirations of its people. Yet power quality is still poor and falls far short of demand. 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. Private investment in diesel generators as a coping mechanism against frequent power cuts is widespread, and estimates of installed diesel generation capacity are as high as 70 GW. Furthermore, local environmental pollution is a major issue in India. According to the World Health Organization, 13 of the 20 most polluted cities in the world are in India. 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.

2. The Government of India (GoI) announced its intention to increase its target for solar installed capacity from 20 to 100GW by 2022[29]. The total installed grid-connected solar capacity base of the country has reached 3.7 GW as of June 2015, from less than only 2 MW in 2009. The Government would like to significantly increase the pace of solar power deployment to meet its ambitious targets. The Government foresees that 60GW of the targeted installations will come from utility-scale ground mounted solar power plants.

[29] Government of India, 2015 (http://pib.nic.in/newsite/PrintRelease.aspx?relid=122566)

3. The development of utility scale solar power on this scale in such a short time frame presents significant challenges, including availability of land, permits and clearances, availability of transmission and other infrastructure, capacity of sector institutions, and cost and variability of solar power. To address these barriers, the GoI is developing large scale solar parks – concentrated zones of development of solar power generation projects – which provide private sector developers with dedicated land, evacuation infrastructure and other proper infrastructure. Two large solar parks have been so far developed in Charanka (Gujarat) and Bhadla (Rajasthan).

4. The Ministry of New and Renewable Energy (MNRE) has launched 'solar park scheme' to facilitate the development of utility scale solar power in India. This scheme will use public private partnership arrangements to set up 20 solar parks with a cumulative installed capacity of about 60 GW of solar power by 2020. Within this total target of 60GW of ground-mounted solar capacity in solar parks, about 20GW is expected to come from investments by Public Sector Undertakings (PSUs) and 40GW from private investors. MNRE is providing Central Financial Assistance (CFA) of up to 30% of the project costs or INR 2 million per MW for the solar parks. This scheme internalizes the lessons of the Charanka and Bhadla solar parks in India as well utility scale solar power developments in other parts of the World[30]. The scheme intends to attract significant investments from project developers in the States to enable them to meet Renewable Purchase Obligation (RPO) mandate and provide employment opportunities to local population to the extent possible. It aims to reduce the number of approvals required by developers to set up solar generation plants and hence attract private investments in such solar plants. The State will also reduce its carbon footprint by avoiding emissions equivalent to the solar park's installed capacity and generation. Further, the State will also avoid procuring fossil fuels to run conventional power plants. Under the scheme, a joint venture (JV) company comprising of the Solar Energy Corporation of India (SECI), state utilities and in some cases the private sector is proposed to be set up in each state to provide specialized services and to be the owner of the park and its shared infrastructure, in order to incentivize solar power developers to invest in solar energy in the park.

India's CTF Investment Plan

5. 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 100 GW of solar installed capacity by 2022. The Plan includes the following proposed activities (Table 1).

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

CTF Project/Program	MDB	CTF financing (US$ m)

[30] The proposed project will draw on international experience with development of utility scale solar parks as well as India's experience with, and important lessons learned from other solar parks. In year 2009, Clinton Foundation initiated work on large scale solar parks in South Africa, Australia, USA and India. It signed a MoU with Gujarat and Rajasthan government in India to set up solar parks. Solar parks in Australia and USA did not move forward because of the regulatory hurdles. Solar park in South Africa by ESKOM is under development. Gujarat (Charanka) solar park has been commissioned and Rajasthan (Bhadla) solar park is under construction. Experience from the earlier solar parks will be incorporated in the project during the preparation phase.

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**

Project Description

6. The objective of the proposed Project is: (i) to increase solar generation capacity through the establishment of utility-scale solar parks in India; and (ii) to evacuate power from the selected solar power generation parks to the Inter-state Transmission System. This will contribute to the achievement of GoI's target of installing 100GW solar power by 2022.

7. The World Bank has prepared two projects to support the development of solar parks in India. Under *Shared Infrastructure for Solar Parks* project, the World Bank will support for setting up solar parks in four states – Karnataka, Madhya Pradesh, Andhra Pradesh and Telangana, keeping the option open for other states to join if they are able to meet the necessary conditions. It will cover financing for shared infrastructure such as security, access roads, water supply and drainage, telecommunications, and pooling stations (with 220/66/33 kV or as may be suitable switchyard and respective transformers) inside the solar parks and transmission lines connecting these internal pooling stations to 400/220 kV substation. The project will also provide technical assistance for capacity building of state nodal agencies and JVs across the participating States (see page 7 of the PAD for Shared Infrastructure for more details).

8. Under *Transmission for Power Evacuation from Solar Parks* project, the World Bank will support Tumkur (Karnataka) solar park and Rewa (Madhya Pradesh) solar park that are in advanced stages, along with other solar parks under the scheme in the states of Karnataka, Madhya Pradesh and Telangana, which will be finalized upon obtaining approval from Central Electricity Authority (CEA) and/or Standing Committee on Power System Planning. This project will finance the establishment of 400/220 kV transmission substations at the park boundary and the linked transmission lines up to the existing transmission network (see page 8 of the PAD for Transmission for more details).

9. This proposed Project will mobilize US$ 1,000 million, including US$ 420 million from IBRD, US$ 80 million from CTF and US$ 500 million from the GoI and state governments. The solar parks supported by the Project are expected to mobilize additional US$ 3,500 million of private and public sector financing for solar PV generation capacity. The CTF funding would comprise US$ 78 million to be extended under softer concessional terms and US$ 2 million to be extended in the form of a grant.

10. Among the aforementioned US$ 1,000 million, US$ 400 million in total, a sum of US$ 150 million from IBRD, US$ 50 million from CTF and US$ 200 million from public sector will support *Shared Infrastructure for Solar Parks*, while the rest US$ 600 million will finance *Transmission for Power Evacuation from Solar Parks*.

II. Assessment of the Proposed Project with CTF Investment Criteria

Potential for GHG Emission Savings

11. **Emission reduction potential of investment.** The total emission reduction potential was estimated at 120.2 million tonnes of CO_2 equivalent over the lifetime of solar PV power generation facilities within the supported solar parks, hereby assumed 25 years. These estimates were based on the installation of 3,500 MW of solar PV power generation capacity with 18.9 percent capacity factor, displacing an equivalent of 5,795 GWh per year of "thermal-based" power in the baseline scenario. The baseline scenario assumes "thermal-based power generation" using imported coal. The emission factors under the baseline scenario was estimated at 830 kg/MWh[31], which is more conservative than the grid emission factor for India[32]. Using this emission factor, the CO_2 savings were estimated at 4.8 million tonnes of CO_2 equivalent per year. Savings have been calculated in accordance with CTF and World Bank guidelines[33].

12. **Technology development status.** The utility-scale solar PV generation is already technically proven and commercially viable. 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. 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. With the most recent bid of Rs 5.05/kWh for a utility-scale solar PV project in Madhya Pradesh, solar costs have fallen over 70% from 2010 levels. Since India lies in the high solar insolation region, declining cost trends in solar PV, along with innovations in energy storage technology, offer exciting opportunities for India to address its challenges in the energy sector.

13. The key technical issue for the Project is the availability of a sound internal and external evacuation system for solar parks. Based on Long Term Access (LTA) application from Tumkur (Karnataka) solar park and Rewa (Madhya Pradesh) solar park, Power Grid Corporation India Limited (POWERGRID) has carried out detailed grid evacuation and grid impact studies and established augmentation/additions needed to the existing network so that the generation can be absorbed without any adverse effect. These studies cover load flow analysis, reactive power flow patterns, and measures and corrective actions to be implemented by the partners in the Grid. The studies also assess the health of the consolidated system in case of outage of any network element of the grid including solar park generation. The findings of these studies are presented in the Standing Committee chaired by CEA, for deliberations and clearance.

[31] 830 kg/MWh for coal generation from supercritical plants
[32] 980 kg/MWh, from CO2 Baseline Database for the Indian Power Sector, Central Electricity Authority
[33] World Bank, Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, 2015

Cost-effectiveness

14. The cost effectiveness is 0.67 US$/tCO$_2$eq for CTF funding and 37.42 US$/tCO$_2$eq considering total funding for the Project. In the *Scaled-up Phase*, the cost effectiveness will improve to 0.11 US$/tCO$_2$eq for CTF funding and 37.36 US$/tCO$_2$eq when considering total funding.

15. **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*.

16. The MAC of the proposed Project based on the economic analysis of the 2GW *Pavagada Solar Park* is 5.6 US$/tCO$_2$eq. These calculations confirm that the MAC will not exceed the aforementioned US$100 threshold value per ton of CO2eq. The Project will help avoid local and environmental damage costs equal to US$ 931 million compared to the thermal counterfactual (see page 13 of either PAD for more details).

17. 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

18. *Scope of avoided GHG emissions through replication*. India's ambitious target calls for the installation of 60 GW of utility-scale ground mounted solar power plants by 2022. MNRE's solar park scheme aims at the development of utility scale grid-connected solar parks through public private partnership arrangement with a cumulative installed capacity of about 20 GW of solar power by 2020. The proposed Project will directly contribute towards these targets, therefore contributing to significant emission reduction. It is expected that CTF and IBRD support on the selected solar parks will create market confidence and will catalyze further support from other investor groups for the GoI to help with achievement of its targets. The expected emission reduction from achieving the *Scaled-up Phase* is estimated at 30.3 million tonnes of CO_2 equivalent per year, or 757.5 million tonnes over the 25-year lifetime of technologies.

19. *Transformation potential.* The proposed Project has high transformational potential as it will contribute to the accelerated development of utility-scale solar PV generation and the rapid increase in the share of renewable energy in the power sector of India. Developing solar parks will provide the enabling infrastructure for utility scale development of solar power, including common

infrastructure such as large areas of land, power pooling sub-stations as well intra-park transmission infrastructure, access roads, common security arrangements. This will facilitate investment in solar power development by private or public sector developers, who may be able to shorten the time from contract award to commissioning from 20 months to less than 10 months. MNRE's solar park scheme also aims to reduce the number of approvals required by developers to set up solar generation plants and hence attract private investments in such solar plants. In fact, there has been strong response to solar parks in Rajasthan and Andhra Pradesh that have recently invited bids from the private sector. This trend is expected to continue for the solar parks that are being developed inside the park, which will help solar parks make transformational impacts on the power sector.

Development Impact

20. **Support to bridge the supply gap of energy and contribute to 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 solar energy will have significant benefits in terms of the reliability and security of electricity supply to consumers. The Project is also likely to have a significant indirect contribution to expansion of access to electricity, as a result of the increased availability of electricity in all project states, wherein the investments supported under the project are expected to lead to increased hours of supply to existing customers, and increased availability of electricity supply, which may enable utilities to connect and serve new customers.

21. **Increased opportunities of local employment.** The development of large scale solar parks will attract significant investments from project developers which will generate employment opportunities to local population. Local contractors, engaged through international competitive bidding, will carry out the supply, installation and erection works. Joint ventures created under the scheme will develop the capacity required to operate and maintain the assets created through this Project, which would provide long-term employment opportunities.

22. **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 Project has substantial local environmental benefits. At local level, air pollutant emissions under the thermal counterfactual are estimated at 74.8 kt of NO_x, 51.5 kt of SO_x and 8.1 kt of PM10 per annum, which will be reduced by displacing imported coal in power generation with increased supply of electricity from the solar parks developed under the *Scaled-up Phase*. The local and global environmental benefits of the 2GW *Pavagada Solar Park* are estimated at US$ 931 million (see page 13 of either PAD for more details).

23. **Gender Co-benefit.** The Project is expected to bring positive gender co-benefits by incorporating gender impacts of this intervention. Most of the women's status indicators (including

those pertaining to health, literacy, work force participation,) show that gender equity and empowerment remain serious issues in the proposed solar park sites. As part of the Social Management Framework (SMF), a Gender Development Framework and a Gender Action Plan will be designed which will help to analyze gender issues and to design interventions to address women's needs. Gender analysis will be part of the social impact assessment.

Implementation Potential

24. The Project is aligned with GoI's National Action Plan for Climate Change (NAPCC), which was issued in 2008 to enhance India's ecological sustainability and encourage sustainable energy sources. It is also consistent with the Jawaharlal Nehru National Solar Mission (JNNSM) that was launched in 2010 as part of NAPCC to promote the development of solar power in India. GoI has significantly scaled up the target of 20 GW of solar power in JNNSM to 100 GW by 2022. GoI has reiterated these commitments as part of its Intended Nationally Determined Contributions (INDCs) commitment to achieve about 40 percent cumulative electric power installed capacity from non-fossil fuel based energy resources by 2030.

25. There is strong ownership of the Project at the highest levels of GoI, MNRE, the participating states, discoms and the JVs responsible for implementing this Project. This commitment has been demonstrated through their intensive engagement and involvement during the project preparation. As mentioned in the preceding sections, GoI and state governments are pushing through with a number of policy and regulatory reforms, implementation mechanisms and incentives to ensure that there costs of solar power are kept low and there is sufficient demand for the offtake of solar power generated under the project. There has been strong responses from the private sector to the bids to the solar parks that have been recently developed in Rajasthan and Andhra Pradesh, which proves that solar park modality will continue to work. It will help ensure the financial sustainability of the park.

26. POWERGRID's involvement is a reasonable assurance that project design and implementation will be of high standards. It has become a strong entity that is capable to ensure that the investments are made well in time and are not left stranded. Over the past decade, POWERGRID has acquired and developed skills required for successfully planning and implementing large scale capital investment programs, through their its mandate to develop the inter-state transmission network of India and also by acting as Consultant to some states to assist them to plan, design and implement their transmission and distribution networks. All the schemes envisaged under this operation are being designed, procured and implemented by POWERGRID. Since POWERGRID owns, operates and maintains the National Grid, it in association with POSOCO, takes all due measures required to ensure grid stability. In addition, environmental and social issues will be handled with adequate expertise and attention, building on POWERGRID's implementation track record of earlier World Bank funded projects.

27. **Leverage:** The total investment of the Project would be funded through the CTF (US$ 80 million), IBRD (US$ 420 million), Central and State governments (US$ 500 million) and public and private sector participation to solar PV generation facilities in the solar parks (US$ 3,500 million). The CTF leverage ratio will be 1 to 55.3. The CTF leverage ratio will increase to 352.8 when considering the *Scaled-up Phase* by 2020. The leverage effect is expected very high, as this

proposed Project will effectively mobilize large amounts of investment in generation capacity by utilizing public sector financing for the development of required infrastructure which is a relatively small portion of total investment but will reduce the risk of investment in generation capacity.

CTF Additionality

28. The use of CTF concessional financing under the Project is essential to develop solar parks that will enable large-scale deployment of solar PV generation in a short time frame. Solar parks can effectively address a number of challenges in accelerating the scale-up of solar PV generation capacity, which was committed by the GoI, but it requires public sector investment in transmission and other shared infrastructures within the parks. Given the specific transmission requirements of solar power and the risk of stranded assets, private sector investors continue to see the availability of state of the art transmission infrastructure to connect their solar generation project to load centers across the country, as a precondition to major investment decisions. By using concessional financing for the investment, the GoI will be able to establish the required infrastructure with a reduced cost of capital, which will be translated into a lower cost to private sector developers who will invest in generation capacity within the solar parks.

29. The economic rate of return of the solar park is calculated at 7%, which is lower than the hurdle rate of 12% (see page 12 of either PAD). This estimate is based on the baseline scenario before taking into account environmental externalities and can be affected by a range of risk factors. The use of CTF concessional financing to enable the establishment of transmission system and shared infrastructure in the solar parks is hence essential for fully capturing the local and global environmental benefits associated with this Project, which will raise the economic rate of return to 18% and make this Project economically viable.

Implementation Readiness

30. Among the long listed solar parks in Table 2, the two solar parks, Tumkur (Karnataka) and Rewa (Madhya Pradesh), are in the most advanced stage, followed by Neemuch and Agar (Madhya Pradesh). Based on Long Term Access (LTA) applications from two JVs of the first two solar parks, POWERGRID had already carried out a detailed evacuation studies. Since all the solar parks have not been finalized, investments under this Project will be taken up in a phased manner. The Government of India is keen to move this proposed Project forward to help achieve its ambitious target on solar generation capacity.

Table 2 –Planned Long List of Potential Solar Parks under MNRE Scheme

No	State	Location & capacity
1	Gujarat	Banaskantha (700 MW)
2	Madhya Pradesh	Rewa (750 MW) Neemuch (435 MW) Agar (315 MW)
3	Telangana	Gattu, Mehboob Nagar (1000 MW)
4	Andhra Pradesh	Anantpur (1500 MW) Kurnool (1000 MW)
5	Karnataka	Tumkur (2000 MW)

6	Uttar Pradesh	Jalaun (370 MW) Sonbhadra, Allahabad & Mirzapur (230 MW)
7	Meghalaya	West & Esat Jayantia Hills (50 MW)
8	Jammu and Kashmir	Leh & Kargil (7500 MW)
9	Punjab	Patiala, Fatehgarh Sahib, Ludhiana & Gurdaspur (1000 MW)
10	Rajasthan	Bhadla (1700 MW) Jaisalmer (2000 MW)
11	Tamil Nadu	Ramanathapuram (500 W)
12	Odisha	Location not stated (1000 MW)
Total		**22,050 MW**