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Project Information Document/ Integrated Safeguards Data Sheet (PID/ISDS)

Concept Stage | Date Prepared/Updated: 10-Nov-2016 | Report No: PIDISDSC19599



BASIC INFORMATION

A. Basic Project Data

Country India	Project ID P160379	Parent Project ID (if any)	Project Name Innovation in Solar Power and Hybrid Technologies (P160379)
Region SOUTH ASIA	Estimated Appraisal Date Jul 20, 2017	Estimated Board Date Oct 26, 2017	Practice Area (Lead) Energy & Extractives
Lending Instrument Investment Project Financing	Borrower(s) Solar Energy Corporation of India Limited	Implementing Agency Solar Energy Corporation of India Limited	

Proposed Development Objective(s)

The Project Development Objective is to demonstrate large-scale innovative renewable energy technologies in India.

Financing (in USD Million)

Financing Source	Amount
Borrower	200.00
Clean Technology Fund	20.00
International Bank for Reconstruction and Development	180.00
Total Project Cost	400.00

Environmental Assessment Category

A-Full Assessment

Concept Review Decision

Track II-The review did authorize the preparation to continue

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Other Decision (as needed)



B. Introduction and Context

Country Context

1. Fueling India's economic growth and providing electricity to its rising population require accelerating the growth of its power system. India is placed among the world's top five, fastest-growing nations, having expanded its economy at an average annual rate of 7.6 percent over the past decade.¹ To support this economic growth, the country's demand for power is expected to rise. With over 300 gigawatts (GW) of installed capacity,² India's 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, mainly in rural areas, remain without a connection to the national electrical grid; once they are connected, many face frequent power disruptions.
2. In the coming decades, India will be a key player in influencing global energy demand and climate change trends. According to the International Energy Agency (IEA), between 2015 and 2040, India will contribute more than any other country to the projected rise in global energy demand; its carbon dioxide (CO₂) emissions are expected to triple over the period. Yet, by 2040, the country's average per capita energy demand would be 40 percent below the world average.³
3. The Government of India (GOI) has pledged to substantially increase the share of renewable energy (RE) in the country's electricity generation mix. In its Intended Nationally Determined Contributions (INDCs), submitted to the U.N. Framework Convention on Climate Change (UNFCCC) Conference of the Parties (COP21) held in Paris in 2015, India announced its aim of increasing installed electric power capacity based on non-fossil-fuel energy resources to 40 percent by 2030. This includes plans to quadruple the country's non-hydropower RE capacity to 175 GW by 2022, resulting in the abatement of 326 million tons of CO₂ equivalent per year. Meeting the 2022 target will require up to US\$160 billion in investments in generation, as well as substantial complementary investments in strengthening the transmission network to absorb this variable power.⁴

Sectoral and Institutional Context

4. In India, electricity is in the concurrent list of the Constitution of India. It means that both the Union/Central and State Governments can formulate policies and laws on the subject, but the responsibility of implementation rests with the States. Before enactment of the Electricity Act (EA) 2003, the Indian power sector was under government control with all major functions of generation, transmission and distribution to consumers predominantly done by state-owned companies and boards. After EA 2003, these companies and boards were encouraged to unbundle into generation, transmission and distribution sector to bring in efficiencies in operations. Amongst many other aspects, the Act specifically encouraged competition in the sector, de-licensed generation, recognized trading as a separate activity, introduced open access in transmission, promoted multiple licenses in the distribution sector, and setting up of independent regulatory commissions to fix tariff and promote development of the sector. Thus, electricity sector reforms have enabled a transition from a vertically integrated monopoly market structure to one of competitive wholesale and retail mechanism with introduction of marketplaces like power exchanges.
5. In generation, the development of India's RE has grown significantly over the past decade, with the implementation of major policy and regulatory measures for harnessing RE resources. As of July 2016, India had successfully added more than 44 GW of grid-connected RE (excluding 43 GW in large hydropower capacity). The major contributor to this achievement has been wind power (27.1 GW), followed by solar power (7.8 GW), bio-power

¹ The World Bank, <http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?end=2015&locations=IN&start=2005>

² See Central Electricity Authority, Monthly Report on Power Sector, July 2016.

³ *World Energy Outlook 2015*, http://www.worldenergyoutlook.org/media/weowebbsite/2015/IndiaEnergyOutlook_WEO2015.pdf

⁴ Ministry of Environment and Forests (MoEF), Government of India.



(4.8 GW), and small hydro (4.3 GW).⁵ Together, wind and solar power constitute nearly 80 percent of this added capacity. The rate at which this capacity addition has occurred is commendable, considering that total RE installed capacity was just 7.7 GW less than a decade ago (2007).⁶

6. Solar and wind power are likely to continue with the dominant share of RE in India for the foreseeable future. Their growth trajectory over the last decade and present level of installed capacity clearly indicate significant potential for both categories. This potential is also reflected in the GOI's 2022 target of 175 GW, which envisages 160 GW coming from solar (100 GW) and wind (60 GW). Recognizing the potential of solar energy to contribute to India's energy security, and taking advantage of falling solar photovoltaic (PV) prices, which increases the likelihood of more quickly reaching grid parity, the GOI enhanced cumulative solar targets from 20 GW to 100 GW in June 2015 under the Jawaharlal Nehru National Solar Mission (JNNSM).⁷

7. However, scaling up stand-alone solar and wind plants faces major constraints, including land scarcity, underutilized evacuation infrastructure, and variability of supplied energy. Land acquisition requirements for stand-alone solar and wind projects are estimated at about 5 acres per megawatt (MW) and 8–10 acres per MW, respectively.⁸ Furthermore, transmission lines and related infrastructure are inadequately utilized for stand-alone solar and wind projects; that is, solar electricity is available during daylight hours while wind electricity often picks up later in the evening. With a targeted increase in the share of variable RE, the grid integration cost will go up.

8. Introduction and scale-up of new technologies and applications—specifically, solar-wind hybrid systems, integrated energy storage for solar and wind, and floating solar technology—can help to overcome the above-mentioned bottlenecks. Solar-wind hybrid systems can provide increased efficiency, as well as greater balance in the energy supply. The complementarity of solar and wind electricity-generation patterns provides an opportunity to improve the utilization factor for the grid/transmission network, as well as better utilize scarce land.⁹ Such complementarity, along with integrated electricity storage, will also help reduce the intermittent nature of RE. Finally, floating solar PV panels can help ease pressure on land resources by placing the power plant on water bodies.

9. India has a vast RE potential. Several states are blessed with excellent wind and solar resources, together offering ideal sites for implementing utility-scale RE hybrid projects. To date, hybrid projects in India have been limited to small-scale and off-grid ones. Existing installations include a few kilowatt (kW) projects, while tendering for a 2.5 MW project at Kaza in Himachal Pradesh state is currently under way. To increase the uptake of hybrid technologies, the GOI recently issued a draft policy on hybrid systems that targets achieving 10 GW of generating capacity by 2022 through hybridization of solar and wind power projects.¹⁰

10. Given the intermittent nature of RE, energy storage is becoming increasingly important. While RE penetration up to 15–20 percent is relatively easy to integrate into the grid, higher levels may cause challenges. Electricity storage can help with load shifting to meet peak demand, grid stabilization, improved generation efficiency, and better utilization of transmission capacity. With falling prices and enhanced performance, energy-storage technology is gradually becoming competitive. With the launch of India's Smart Grid and Electrical Vehicle initiatives, along with the promotion of on-site solar energy and rural micro-grids, energy storage is fast evolving into a critical component of the country's energy strategy.

⁵ See Central Electricity Authority, Monthly Report on Power Sector, July 2016.

⁶ Comptroller and Auditor General of India,

http://www.cag.gov.in/sites/default/files/audit_report_files/Union_Civil_Performance_Renewable_Energy_Report_34_2015.pdf

⁷ The JNNSM was launched on January 11, 2010 by former Prime Minister Manmohan Singh.

⁸ On a footprint basis, however, the land acquisition requirements for wind are much lower.

⁹ A study conducted by the Reiner Lemoine Institute and Solarpraxis AG concluded that combining wind turbines and PV systems results in generating up to twice the amount of electricity across the same surface area, while shading losses caused by wind turbines amount to just 1–2 percent.

¹⁰ For details, see <http://mnre.gov.in/file-manager/UserFiles/Draft-Wind-Solar-Hybrid-Policy.pdf>



11. The GOI is also promoting floating solar technology, which has a large potential in the country. Preliminary studies suggest that utilization of just 10 percent of India's water bodies would allow for the development of about 300 GW of floating solar PV generation capacity.¹¹ This technology can not only reduce demand for land; in case of hydropower dams, it can help to optimize the utilization of existing evacuation infrastructure. Additional advantages of the technology include higher efficiency due to natural cooling; lower cleaning requirements; and potential positive externalities by reducing evaporation, controlling algae growth, and providing shade to fish and other marine life. To date, the uptake of floating solar technologies in India has been modest. The country's first floating solar plant, a 10 kW pilot built near Kolkata, was followed by two more 10 kW plants: one at Dhanas Lake in Chandigarh and the other in a cooling water pond of Vidharbha Industries at Nagpur. Also, a 100 kW plant is being built at Loktak Lake in Manipur. At present, India has no utility-scale, floating solar plants.

12. To scale up the development of innovative and demonstrable solar-energy technologies, the GOI formed the Solar Energy Corporation of India (SECI) in 2011 as one of the key implementing agencies for JNNSM. Recently, SECI's mandate was broadened to cover the entire gamut of RE sources. As a Central Public Sector Enterprise (CPSE) dedicated to the RE domain, with the twin objectives of technology and market development, SECI is responsible for finding appropriate technological and market-based solutions to overcome constraints currently faced by the RE sector.

13. The project promotes such innovative technologies in the renewable energy sector in the country by mitigating an early-mover risk perceived by the private sector. There are at least three barriers, which prevent private sector from financing such technologies: (i) opportunity cost of land is not always properly reflected in prices; (ii) commercial banks may not be comfortable with financing technologies, which haven't been tested in India and have limited track record globally; and, (iii) absence of proper tariffs, which will encourage deployment of these technologies. The project intends to apply existing tariffs for wind and solar for electricity generated by sub-projects, while in parallel engaging with the regulator on developing specific tariffs for these new technologies. The concessional financing of CTF is expected to be compensated by the learning curve for these technologies, reduced construction and performance risk, and technology specific tariffs to be developed throughout the project.

14. The investments under this project is expected to have both demonstration effect as well as contribute towards reducing costs given that the scale of the project is relatively large. For instance, 50 MW of floating solar PV will likely double the global installed capacity and help to drive down costs. Hence, the investments under the project are expected to crowd-in private investments in these technologies by: (i) addressing the technical risks involved with such new technologies; (ii) giving confidence to the financial institutions/commercial lenders that such technologies are capable of producing desired results; and, (iii) building on the lessons learned from these sub-projects. The project will also bring out approaches for successful implementation of such technologies through suitable risk mitigation strategies and prudent project design and implementation, not only within India but also in other countries.

15. The project is one amongst the US\$1 billion engagement sought by the GOI from the World Bank in the renewable energy sector.¹² In particular, the GOI requests have been received for three other Bank engagements to (i) support the establishment of grid connected rooftop PV (US\$648 million), (ii) fund the construction of associated evacuation infrastructure from Bank-supported solar parks (US\$300 million), and (iii) demonstrating innovative technologies in renewable energy sector, such as, solar-wind hybrid, energy storage and floating solar (US\$200 million). This project looks at pushing the technologies in the sector and hence compliments the support in renewable energy comprehensively.

¹¹ According to a preliminary assessment of Renewable Energy College, Kolkata.

¹² In particular, the GOI requests have been received for three other Bank engagements to (i) support the establishment of grid connected rooftop PV (US\$648 million); (ii) fund the construction of associated evacuation infrastructure from Bank-supported solar parks (US\$300 million); and, (iii) demonstrating innovative technologies in renewable energy sector, such as, solar-wind hybrid, energy storage and floating solar (US\$200 million).



16. The project provides support to the generation side of the energy value chain that supports the GOI in its climate change abatement strategy. The off-taker of the energy generated from such sub-projects will either be the electricity distribution companies (Discoms) or the bulk/captive consumers. The GOI acknowledges that the distribution sector is the most fragile segment of the Indian electricity supply chain and their financial distress may discourage them from signing power purchase agreement (PPA) with the solar power developers. Considering this, the GOI has last year undertaken a debt restructuring scheme (Ujwal Discom Assurance Yojana, UDAY) and given a framework to the States to help them to put the distribution sector's finances back on track. The reluctance of Discoms to buy solar power due to their cash constraints must be weighed against the steps taken by the GoI to reduce the costs of solar power and the new and increased renewable purchase obligations (RPO), which the Discoms will be subjected to, following the approval of proposed amendments to the Electricity Act 2003 as well as enactment of the National Renewable Energy Act.

17. The project is supporting SECI, which is the borrower as well as the implementing agency for the project, to achieve the desired results. The Ministry of New and Renewable Energy (MNRE) has given a mandate to SECI to promote renewable energy in the country and push the boundaries of the technologies being deployed to help the GOI achieve 175 GW of installed capacity under renewable energy. Thus, overcoming the constraints faced in the sector and deploying the alternate solutions is SECI's responsibility.

Relationship to CPF

18. The proposed project is aligned with the three pillars of the Country Partnership Framework (CPF) for India: integration, transformation, and inclusion. Under integration, the project will accelerate investment in innovative solar power and hybrid technologies. Under transformation, it aims directly to reduce greenhouse gas (GHG) emissions and local environmental pollution associated with the alternate coal-based thermal power generation, to be displaced by adding clean power-generation capacity and fostering innovative RE development. Under inclusion, it offers the opportunity to increase electricity access by increasing the availability of electricity generation in the system.

C. Proposed Development Objective(s)

Note to Task Teams: The PDO has been pre-populated from the datasheet for the first time for your convenience. Please keep it up to date whenever it is changed in the datasheet.

The Project Development Objective is to demonstrate large- -scale innovative renewable energy technologies in India.

Key Results (From PCN)

The following indicators will be used to track progress in achieving the PDO:

- Cumulative installed capacity of 250–400 MW
- RE power generation (in megawatt hours [MWh])
- GHG emissions avoided

D. Concept Description

19. The proposed project aims to support the GOI to promote large-scale deployment of innovative technologies in the RE sector, including solar-wind hybrid systems, integrated energy storage for solar and wind, and floating solar PV panels. This will be done in partnership with SECI, a central sector utility under the Ministry of New and Renewable Energy (MNRE). The proposed project will have the following two components:



Component A – Investments in Innovative Technologies (estimated cost: US\$398 million, including US\$150–180 million from the World Bank, US\$18–48 million from the Clean Technology Fund, and US\$200 million from SECI).

This component will finance the following:

- a. Large-scale solar-wind hybrid power plant(s), potentially with short-term energy storage, with a cumulative capacity of about 200 MW. The power plants will likely be located in Andhra Pradesh.¹³ Location of the plant sites will be finalized following detailed solar and wind resource assessments, along with technical due diligence of the site and ease of connecting the plant to the grid. Pre-feasibility studies for solar-wind hybrid plants at several potential sites are under way.
- b. Stand-alone plants for solar PV and wind with storage. Shorter duration (15–30 minutes) and longer duration (2–3 hours) energy storage will be further explored during the project preparation phase. This may include investments in capacity of about 150 MW.
- c. Large-scale floating solar PV power plants with a cumulative capacity of about 50 MW. The plants will likely be located in Andhra Pradesh and Kerala states. The sites initially identified have an estimated potential of 10 MW each. SECI is exploring water surfaces at various other locations to better understand the potential for floating solar PV plants and identify additional sites.

20. SECI will be the principal sponsor and owner of the proposed power plants. SECI will build power plants through a competitive bidding process for selecting Engineering, Procurement, and Construction (EPC) contractors. These plants will be grid-connected, and the state distribution companies and bulk consumers will purchase the electricity generated from these plants through a power purchase agreement (PPA).

Component B – Technical Assistance and Institutional Strengthening of SECI (estimated cost: US\$2 million from the Clean Technology Fund).

This component will finance the following activities:

- a. Capacity building and institutional strengthening to enhance SECI's core competencies across such functions as human resources, project management and monitoring, procurement and contract management, operations and maintenance (O&M), financial management, and implementation of enterprise-wide Information Technology (IT) systems.
- b. Conducting site selection and other studies to build the investments pipeline.
- c. Developing policy and regulatory proposals to support scale-up of innovative technologies.

21. The World Bank intends to contribute US\$200 million, representing 50 percent of the total project cost, estimated at about US\$400 million. Of this US\$200 million, the World Bank's own resources will cover about US\$150–180 million, while the Climate Technology Fund will contribute the other US\$20–50 million. SECI will provide the remaining 50 percent from its own balance sheet, as well as GOI subsidies for viability gap funding.

¹³ Plant locations and capacity have been specified, depending on the interest conveyed by the respective state-UT administrations; these may subsequently change, depending on the technical due diligence. Other locations will also be explored during the preparation phase to be funded under this project or used to build the pipeline for future investments.



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SAFEGUARDS

A. Project location and salient physical characteristics relevant to the safeguard analysis (if known)

Currently, the sub projects and exact locations are not known. However, these will be located across the country. Notwithstanding the benign sustainable energy nature of the investments to be supported by the project, given the novelty of some of the technologies and uncertainties on site selection, there is a risk that the project may cause adverse environmental effects. At this early preparation stage, a Safeguards Category A has been determined, reflecting a cautious approach to the assessments required. Nevertheless, as additional information becomes available, the safeguards category will be re-assessed and may be later determined as Category B.

B. Borrower’s Institutional Capacity for Safeguard Policies

The borrower for the proposed operation is SECI under the administrative control of MNRE. It is for the first time that SECI will engage with the World Bank and therefore is not aware of the Bank policies. As of now SECI has only one in-house Environmental Expert. There is no in-house expertise in managing social safeguard measures. The Bank will be strengthening SECI’s capacity on these aspects during project preparation phase and also during supervision phase.

C. Environmental and Social Safeguards Specialists on the Team

Gaurav D. Joshi, Parthapriya Ghosh, Pyush Dogra

D. Policies that might apply

Safeguard Policies	Triggered?	Explanation (Optional)
Environmental Assessment OP/BP 4.01	Yes	The project activities will have impacts on the environment that need to be analyzed. Depending on the proposed configuration of installation and operation, as well as site conditions, this would need to be adapted to the conditions of the selected sites since all sites are not currently known.
Natural Habitats OP/BP 4.04	TBD	While the site locations are not known, areas where wind turbines are installed currently include forest areas, which may also be natural habitats. During project preparation, this aspect will be further explored and final determination made. Some water bodies to be used for floating solar may also be natural habitats for aquatic life.
Forests OP/BP 4.36	TBD	Depending on the site, this policy may be triggered.
Pest Management OP 4.09	TBD	Practices for control of weeds and pest may involve pesticide use depending on the site.



Physical Cultural Resources OP/BP 4.11	Yes	The project sites would have some cultural properties which might get impacted. In addition, there is also possibility of chance-finds as project activities would include excavation and earthmoving.
Indigenous Peoples OP/BP 4.10	Yes	Since sub projects will be spread all across the country, some locations may have presence of indigenous population.
Involuntary Resettlement OP/BP 4.12	Yes	While the government plans to prioritize the use of state-owned unproductive land for innovative solar and hybrid technologies, resettlement of communities settled on government land may be required. Additionally, there is a possibility for acquiring private land for substation in case of new construction or augmentation of capacity of the existing ones.
Safety of Dams OP/BP 4.37	TBD	Depending on the activities to be undertaken, applicability of this policy will be reviewed during project preparation and confirmed at appraisal.
Projects on International Waterways OP/BP 7.50	TBD	Since the project sites are not currently known, this will be reviewed during preparation and confirmed at appraisal.
Projects in Disputed Areas OP/BP 7.60	No	No project activities will be undertaken in disputed areas.

E. Safeguard Preparation Plan

Tentative target date for preparing the Appraisal Stage PID/ISDS

Jul 19, 2017

Time frame for launching and completing the safeguard-related studies that may be needed. The specific studies and their timing should be specified in the Appraisal Stage PID/ISDS

Following studies will be undertaken by deploying independent consultants and will be completed by March 31, 2017.

- (i) Social – Social Assessment, leading to a Social Management Framework.
- (ii) Environmental – Environmental Assessment and Environmental Management Framework
- (iii) The sub project specific safeguard documents as required will be prepared before the appraisal is known

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APPROVAL

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