

## **SETTING UP OF SOLAR POWER GENERATION PLANTS IN RAILWAY WORKSHOPS UNDER BUILD-OWN-OPERATE (BOO) MODEL**

### **CONCEPT NOTE**

#### **1. Background:**

Hon'ble Minister of Railways, in his budget speech of 2015-16, has envisaged, as part of the Solar Mission of Railways, setting up of 1000 MW solar plants by the developers on Railway/private land and on rooftop of Railway buildings at their own cost.

Environmental Directorate of Railway Board has emphasized development, production and use of alternate sources of energy In Indian Railways (Letter No: 2015/Environ/6/1 dated 07.01.2015).

Indian Railways Organisation for Alternate Fuel (IROAF) has explored techno-financial feasibilities for setting up of Solar Power Plants in Railway Workshops. Stakeholders consultations and outcome of pilot study of Jagadhari Workshop, Northern Railway, reveal that it will be feasible to install solar power plants of substantial capacity (>250 KW) in Railway Workshops on Public Private Partnership (PPP) –Build Own Operate (BOO) model against a long term (20-25 years) Power Purchase Agreement (PPA) with Railways.

#### **2. Solar Photo Voltaic Cell Technology**

Solar Photo Voltaic (PV) Cell based energy generation has become financially viable due to gradual reduction in cost of these cells, longer life and nearly maintenance free operation. Solar power plant generally consists of arrays of solar photo voltaic cells, inverters, transmission cable and switching equipment. For off grid power system, battery banks are also necessary to store electrical energy.

Government of India has launched 'National Solar Mission' to meet India's energy security need through an ecologically sustainable pathway. The Mission, inter alia, envisages deployment of 20,000 MW of grid connected solar power plant by 2022.

Organisations like Delhi Metro Railway Corporation (250 KW), Raipur Airport (100 KW), BSES, New Delhi (160KW) have already installed solar power systems to supplement their electric power need.

Pioneering work has also been done at Rail Coach Factory, Rai Bareilly where a 2 MW solar power has been commissioned by Railways for meeting in house need.

In Railway Workshops opportunities exist for installation of solar power plants (Solar photo voltaic cells or panels) on the rooftop of shops and administrative building. Depending upon available space for solar cells deployment, installed capacity in a railway workshop can be between 0.5 MW to 1.5 MW. Approximately 10 square meter of area is required for installation of 1 KW generation capacity.

Solar power generated can be directly supplied to workshop on working days and to Railway Colony on holidays.

### **3. Built Own Operate (BOO) Model**

The Solar Power Developer (SPD) or the Private Partner will set up the plant on Build-Own-Operate (BOO) model. The SPD will bear the total project cost including design, supply/manufacturing, erection & commissioning of the plant and undertake operation & maintenance of the plant throughout the concession period.

Railways will purchase solar power generated by the plant in full, on a pre-determined tariff as will be outlined in the Purchase Power Agreement (PPA).

The concession tenure will normally be for a period of 20-25 years, after which the developer and Railways will have options either to continue or decommission the plant.

### **4. Broad Technical Specification of the Plant**

Solar Power Plant consists of equipment/systems for producing solar power and transmitting it to the receiving point. A typical solar plant will comprise of arrays of Solar Photo Voltaic Cells (Solar Panels), mounting accessories, cables, terminals, transmission network, inverters, switchgears etc. Power output shall be compatible to connected load of 415V/3 phase/50 Hz AC.

The components of the plant shall be in accordance with relevant Indian Standards (IS)/International Electrotechnical Commission (IEC) Standards. In addition, all design and commissioning parameters shall also be as per latest IEC/IS standards for meeting functional need and for generating desired output.

Parameters for power generation and transmission shall be as per IS/IEC and appropriate grid code.

## **5. Tariff**

Railways will purchase 100% of solar power produced at a pre-determined tariff, which will necessarily be less than prevailing purchase rate at the location of the project.

The Tariff may be calculated on the basis of following formula:

*Rate per unit (kwh) = (Prevailing Industrial rate at the location of the project- Rs. XX) when the power is consumed for Industrial Purpose, or*

*Rate per unit (Kwh) = (Prevailing domestic rate at the location of the project- Rs. YY) when the power is consumed for domestic purpose.*

The 'discount parameters' XX and YY, which may vary on a year to year basis, can be the determining financial criterion for selection of solar power developer (Also refer to Para-9).

## **6. Power Purchase Agreement (PPA)**

The Solar Power Developer and Railways will enter into a Power Purchase Agreement (PPA) for a period of 20-25 years from the date of commissioning. Broad features of the PPA is at Annexure-A.

## **7. Obligations of the Solar Power Developers (SPD) or PPP partner:**

The SPD will undertake following at its own cost & risk:

- 7.1. Design, engineering, manufacture, supply, civil work, erection, testing & commissioning the project in accordance with the applicable Law, the Grid Code and prudent utility practices;

- 7.2. Obtain all requisite regulatory consents, clearances and permits and maintaining them in full force and effect during the project term;
- 7.3. Undertake necessary site preparation for installation of equipment and maintain the site/premises throughout contract period (20- 25 years). For example, if the solar panels are to be installed on roof top, the SPD shall first repair/do necessary modification to the roof for installation and then undertake regular repair of the related roof section throughout the concession period.
- 7.4. Connecting the Power Project with the Interconnection Facilities at the Delivery Point;
- 7.5. Operation & Maintenance of the plant throughout the concession period for ensuring generation of contacted solar power;
- 7.6. Undertake all necessary and reasonable safety precautions with respect to providing the Installation Work, Solar Power, and System Operations that shall comply with all Applicable Laws pertaining to the health and safety of persons and real and personal property.

## **8. Concessions to be provided by Railways**

Railways shall undertake/provide following:

- 8.1. Granting permission to SPD to use portions of the workshop premises for the installation, operation and maintenance of the solar power system;
- 8.2. Taking reasonable measures for security of the premises;
- 8.3. Provide sufficient auxiliary power/utilities to the SPD, on cost basis, for the maintenance and operation of its System;
- 8.4. Purchase 100% of solar power generated by the plant at the predetermined tariff throughout the concession period.

## **9. Selection of Solar Power Developer (SPD)**

Solar Power Developer (SPD) or PPP partner can be selected through two packet system Open bidding. The technical bid will elaborate suggested capacity, technology parameters, concession period etc while the financial bid may include the tariff 'discount parameters (XX & YY)' as elaborated in para-6 earlier.

The bidder will take into account total cost of the project as well as O&M cost for the project life. It is expected that the bidder will aim at recovering capital cost and cost of operations etc. through a suitable amortizing formula.

Suggested technical eligibility of bidder will include that it should have installed & commissioned at least one "On Grid" or Off grid" Solar PV Power Project having a capacity of not less than 50 KW and total installed & commissioned grid connected Solar PV Project of minimum 3500 KW (Total Capacity) in last 10 years. Financial eligibility could be that annual turnover of the bidder which can be a Company or Bidding consortium should not be less than Rupees 5.0 Crore per MW of the proposed project capacity in any one of the last 3 financial years subjected to the condition that the bidder should at least have completed one financial year of commercial operation.

#### **10. Roadmap for implementation:**

With considerable emphasis by the Government for harnessing renewable sources of energy, opportunity exists to unlock the potential of solar power generation in all Railway Workshops/Production Units. After successful piloting in 4-5 Workshops/Production Units, the model can further be extended to Production Diesel Sheds, Coaching Depot and Railway colonies.

Selection of partners through an open bidding will not only help in saving energy cost but also substantially contribute to Hon'ble MR's vision for environment friendly growth.

Chief Administrative Officer  
IROAF, New Delhi

**Broad Features of Power Purchase Agreement (PPA)<sup>1</sup> for procurement  
Solar Power on Built, Own, Operate Basis (BOOT)  
(Between Railways & Solar Power Developer-SPD)**

**1. Effective Date**

The Purchase Power Agreement (PPA) shall come into effect from the date of its signing by both the Parties and such date shall be referred to as the Effective Date.

**2. Term of Agreement**

The PPA shall commence on the Effective Date and shall continue for *XX years*<sup>2</sup> from the Commercial Operations Date (the “Term”), unless and until terminated earlier pursuant to the provisions of the Agreement.

**3. Supply, Installation & Commissioning**

The Solar Power Developer (SPD) will undertake Design, Engineering, Manufacture, Supply, Storage, Civil work, Erection, Testing & Commissioning of the solar PV project including Operation and Comprehensive Maintenance (O&M) of the project throughout the concession period or terms of agreement.

SPD shall provide and lay the dedicated electrical cables for transmission of Solar Power from the System up to the Delivery Point.

Transmission or distribution of Solar Power beyond this point will be the responsibility of Railways. The Delivery Point shall be where the Main Metering System is located.

Unless otherwise agreed between the Parties, the SPD shall not do any chipping/breaking of rooftop, disturb water proofing and carry out any other modification of the Premises without the written consent of Railways.

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<sup>1</sup> Based on ‘Standard Power Purchase Agreement for procurement of solar power on long term basis’ under JNNSM Phase-II circulated by Ministry of New & Renewable Energy, Govt. of India (08.01.2014)

<sup>2</sup> The Term can be 20-25 years.

Prior to synchronization of the Power Project, the SPD shall be required to get the Project certified for the requisite acceptance/performance test as may be laid down by Central Electricity Authority or an agency identified by the central government to carry out testing and certification for the solar power projects.

#### **4. Grid Compliance:**

The interconnection of the rooftop solar system with the Railways distribution network shall be made as per the technical standards for connectivity, contracted load and/or respective voltage level applicable and as per provisions/regulations as may be notified by the competent authority.

The Power Project shall be required to maintain compliance to the applicable Grid Code requirements and directions, if any, as specified by Government and/or Central Electricity Authority from time to time

#### **5. System Ownership, Operation & Metering:**

The Solar power plant or System will be legally and beneficially owned by the SPD and will be operated, maintained and as necessary, repaired by the SPD at its sole cost and expense.

SPD shall install the Main Metering System at the Delivery Point for the measurement of electrical energy produced by the System. The Main Metering system shall include separate meter(s) to measure flowing of power/electrical energy for industrial and domestic purpose.

The meters will be read jointly by authorised representatives of SPD and Railways. Both the Parties shall sign a joint meter reading report.

SPD shall install necessary equipment for regular monitoring of solar irradiance (including solar radiation in the module plane), ambient air temperature, wind speed and other weather parameters and simultaneously for monitoring of the electric power (both DC and AC) generated from the Project.

SPD shall also submit reports on above parameters on monthly basis to Railways for entire period of PPA

#### **6. Insurance**

The SPD shall maintain, at its own cost and expense, throughout the Term of PPA, Insurances against such risks, with such deductibles and with such endorsements and co-insured(s), which the Prudent Utility Practices would ordinarily merit maintenance of and as required under the Financing Agreements, if any, and applicable laws.

Notwithstanding any liability or obligation that may arise under this Agreement, any loss, damage, liability, payment, obligation or expense which is insured or not or for which the SPD can claim compensation, under any Insurance shall not be charged to or payable by Railways.

### **7. Purchase/sale of Contracted Capacity of solar power and its Consumption**

Subject to the terms and conditions of this Agreement, the SPD undertakes to sell 100% of solar power produced by the System to Railways and Railways undertakes to purchase all the solar energy supplied at the Delivery Point subject to Contracted Capacity and by paying tariff as outlined in the PPA.

The title to the Solar Power supplied by the SPD shall pass to the Railways at the Delivery Point.

Solar power supplied at delivery point will be first consumed for Industrial purpose. In case of inadequate or absence of industrial demand, solar power will be consumed for domestic purpose.

### **8. Tariff:**

Railways shall pay to the SPD a monthly payment (the “Solar Power Payment”) for the Solar Power generated by the System as metered during each calendar month of the Term.

SPD will bill the Purchaser for each kWh metered as above at the Delivery Point, at the predetermined Tariff separately for industrial and domestic feeder. Railways shall pay to the SPD on a monthly basis.

The Tariff will be calculated on the basis of following formula:

- i) Rate per unit (kwh) = (Prevailing Industrial rate at the location of the project- Rs. XX) when the power is consumed for Industrial Purpose, or
- ii) Rate per unit (Kwh) = (Prevailing domestic rate at the location of the project- Rs. YY) when the power is consumed for domestic purpose

The reduction over prevailing tariff can also be in % of the rate also depending upon SPD and Railways.

### **9. Obligations of the Solar Power Developers (SPD) or PPP partner:**

The SPD will undertake following at its own cost & risk:

- i. Design, engineering, manufacture, supply, civil work, erection, testing & commissioning the project in accordance with the applicable Law, the Grid Code and prudent utility practices;
- ii. Obtain all requisite regulatory consents, clearances and permits and maintaining them in full force and effect during the project term;
- iii. Undertake necessary site preparation for installation of equipment and maintain the site/premises throughout contract period (20- 25 years). For example, if the solar panels are to be installed on roof top, the SPD shall first repair/do necessary modification to the roof for installation and then undertake regular repair of the related roof section throughout the concession period.
- iv. Connecting the Power Project with the Interconnection Facilities at the Delivery Point;
- v. Operation & Maintenance of the plant throughout the concession period for ensuring generation of contacted solar power;
- vi. Undertake all necessary and reasonable safety precautions with respect to providing the Installation Work, Solar Power, and System Operations that shall comply with all Applicable Laws pertaining to the health and safety of persons and real and personal property.

## **10. Concessions to be provided by Railways**

Railways shall undertake/provide following:

- i. Granting permission to SPD to use portions of the workshop premises for the installation, operation and maintenance of the solar power system;
- ii. Taking reasonable measures for security of the premises;
- iii. Provide sufficient auxiliary power/utilities to the SPD, on cost basis, for the maintenance and operation of its System;
- iv. Purchase 100% of solar power generated by the plant at the predetermined tariff throughout the concession period.

## **11. Performance Bank Guarantee**

SPD shall submit a Performance Bank Guarantee of Rs 30 Lakh per MW or part thereof, of project capacity for guaranteeing the commencement of the supply of power up to the Contracted Capacity within the time specified in this Agreement.

## **12. Applicability of the General Conditions of Contract (GCC)**

Others terms and conditions not mentioned above will be governed by the Indian Railways General Conditions of Contract.