**File No.: VIS(2024-25)-PL553-494-701 Dated: 26-11-2024**

**LENDER’S INDEPENDENT ENGINEER’s REPORT**

**OF**

**1.87dc (± 5%) MWp GRID CONNECTED ROOFTOP SOLAR POWER PLANT**

**PROPOSED TO BE SET-UP AT**

**2 NOS. OF PLANTS SITUATED AT SIDCUL INDUSTRIAL AREA, RUDRAPUR, UDHAM SINGH NAGAR, UTTARAKHAND**

**DEVELOPER:**

**M/S TRUERE HAR SPV PRIVATE LIMITED**

**REPORT PREPARED FOR**

**STATE BANK OF INDIA, SME BRANCH, SOUTH EX, DELHI**

***\*\*Important - In case of any query/ issue or escalation you may please contact Incident Manager***

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| **PART A** | **INTRODUCTION** |

|  |  |  |
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|  | **Name of the Project** | 1.87 (±5%) MWp Grid Connected Rooftop Solar Power Plant |
|  | **Project Location** | 1. M/s TVS Srichakra Ltd., Plot No. 17, 18, 19, 52, 53 & 54, Sector-05, SIDCUL Industrial Area, Rudrapur, Uttarakhand 2. M/s Sansera Engineering Ltd., Plot No. 18, Sector-09, SIDCUL Industrial Area, Rudrapur, Uttarakhand |
|  | **Developer Company** | M/s Truere HAR SPV Private Limited |
|  | **Prepared for Organization** | State Bank Of India, SME Branch, South Ex, Delhi |
|  | **LIE Consultant Firm** | M/s. R.K. Associates Valuers & Techno Engineering Consultants (P) Ltd. |
|  | **Work Oder Details** | Via email dated 23-11-2024 (confirmed by the client) |
|  | **Date of Survey** | *NA* |
|  | **Date of Report** | 26-11-2024 |
|  | **Details & documents provided by** | Mr. Monu Prajapati (Manager Finance) |
|  | **Report Type** | Lender’sIndependent Engineering Report |
|  | **Purpose of the Report** | Review of Project cost, CUF and Irradiation Data, current status for lender’s requirement |
|  | **Scope of the Report** | To review Project cost, CUF and Irradiation Data, current status |
|  | **Documents produced for Perusal** | 1. Copy of Power Purchase Agreement (PPA) 2. Copy of Plant Layout 3. Copy of PVSyst report dated 24-10-2024 4. Project Cost 5. Detailed Project Report (DPR) 6. EPC Contract Agreement |
|  | **Annexure with the Report** | * Market Comparables * Global Solar Atlas by World Bank Group * Documents provided by the client |

|  |  |
| --- | --- |
| **PART B** | **PROJECT SNAPSHOT** |

1. **NAME OF THE PROJECT:** 1.87dc (± 5%) MWp Grid Connected Rooftop Solar Power Plant in RESCO Model to be installed at M/s TVS Srichakra Limited & M/s Sansera Engineering Limited, SIDCUL Industrial Area, Rudrapur, Uttarakhand by M/s Truere HAR SPV Private Limited.
2. **PROJECT OVERVIEW:** M/s Truere HAR SPV Private Limited (a SPV of M/s Oriana Power Limited) is a private limited company which is into supplying, installing and distribution of electric power generation using solar energy.

M/s TVS Srichakra Limited (1010 KWDC) & M/s Sansera Engineering Limited (860 KWDC) both have signed Power Purchase Agreement (PPA) with M/s Truere HAR SPV Private Limited under RESCO model for Design, Finance, Build and Operate of ground mounted solar power plant at its location having a cumulative DC capacity of 1.87 (± 5%) MWp for 15 & 25 years respectively of plant operation/ PPA tenure. As per Detailed Project Report shared by the company, the estimated project cost is Rs. 6.34 Cr.

As per Detailed Project Report shared by the company, the estimated project cost is Rs. 6.34 Cr. including duties and taxes for both the locations.

M/s Truere HAR SPV Private Limited has approached State Bank of India, SME Branch, South Ex, Delhi for credit facility to construct these plants who have in turned appointed M/s R.K Associates Valuers & Techno Engineering Consultants Pvt. Ltd. as Lenders Independent Engineer for a specific scope of work.

**As on date of site visit, presently physical work has not started yet. Thus, our scope of work includes only review & comment on total Project cost, CUF and Irradiation Data.**

**RESCO Model: -**

*Under the RESCO model, a renewable energy service company ("****RESCO****"), (i.e., an energy service company that provides energy to consumers from renewable energy sources), develops, installs, finances, operates and owns the Ground Mounted solar power project ("****Project****"), and supplies power generated from the Project to the consumer on whose premises the Project is set up ("****Customer****") or to the grid through net-metering.*

*'Build, Own, Operate and Transfer' (BOOT) is a special kind of RESCO model in which the RESCO constructs, owns, operates, and transfers the ownership of the Project to the Customer after the expiry of a predefined period. The RESCO and the Customer enter into a long-term power purchase agreement ("****PPA****") for an agreed tenure, which sets out, among others, the terms at which the power generated from the Project will be sold to the Customer and the tariff at which the power will be sold. Excess power from the Project (if any) could be sold by the Customer to the distribution utility through net metering system – the net metering regulations differ from state to state.*

*Under the PPA, the RESCO owns the Project and is responsible for its installation as well as its operation and maintenance of the Project throughout the tenure of the Project, and at the end of the PPA term, the ownership of the Project is transferred to the Customer. Thereafter, the Customer may either choose to retain the RESCO for operation and maintenance services or engage a third-party operator.*

*If the entity on whose premises the Project is located does not intend to buy the power generated from the Project and does not entered into a PPA with the RESCO, that entity can either lease the Ground Mounted premises to the RESCO by means of a lease agreement or enter into a license agreement granting the RESCO the right to use the premises for the limited purpose of setting up and operating the Project. The RESCO then operates the Project and exports the energy generated to the local distribution utility at a predetermined feed-intariff (FiT) approved by the State Electricity Regulator under relevant schemes issued by the relevant state.*

1. **SCOPE OF THE REPORT:** To verify and review the Project cost, CUF and Irradiation Data of the Solar Power Plants set-up/ being set-up by M/s Truere HAR SPV Private Limited:-

* *Industry/ sector research and demand & supply trend is out of scope of the report.*
* *Financial feasibility study of the Project is out of scope of the report.*
* *Providing any kind of design report or map is out-of-scope of the report.*
* *Scrutiny of contracts, Agreements and arrangement between the parties from legal perspective is out-of-scope of this report.*
* *Location feasibility is ascertained based on the PVSyst Report provided by the client.*
* *Any kind of technical & economic feasibility of the Project is out-of-scope of this Report.*

*All the assessment carried out for the Project is done based on the documents and information provided to us and various other discussions with the Project proponents and thus forming an opinion out of it.*

*Project assessment is done in totality and not component wise unless otherwise mentioned..*

1. **PURPOSE OF THE REPORT:**  To provide fair detailed analysis report to the Bank based on the “in-scope points” mentioned above.
2. **METHODOLOGY ADOPTED:**
3. To gather relevant data/ information/ documents related to Project planning, execution, current status.
4. Study of relevant data/ information provided by the company.
5. To conduct research if required about the Project/ sector from the sources in the public domain.
6. Correlation of the provided information, site inspection report against Industry/ sector benchmarks/ trend.
7. Information compilation, analysis and reporting.

|  |  |
| --- | --- |
| **PART C** | **PROJECT DETAILS AND KEY TECHNICAL PARAMETERS** |

As per DPR shared by the management of the company, details of the subject plants has been tabulated below:

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Offtaker** | **DC Power (KWp)** | **AC Power**  **(KWp)** |
| 1 | TVS Srichakra Limited (TSL) | ~1,010 | ~800 |
| 2 | Sansera Engineering Limited (SEL) | ~860 | ~600 |
| **Total** | | **1,870** | **1,400** |

**Location Map: -**



**Location:** TVS Srichakra Limited, SIDCUL Rudrapur **GPS:** 29°00'26.5"N 79°24'41.2"E



**Location:** Sansera Engineering Limited, SIDCUL Rudrapur **GPS:** 28°59'49.5"N 79°26'09.3"E

Technical parameters/specifications (Proposed) of solar plant to be installed are as follow:-

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Particulars** | **TVS Srichakra Limited** | **Sansera Engineering Limited** |
| 1 | No. of modules | 1837 | 1284 |
| 2 | Modules capacity | 550 Wp | 670 Wp |
| 3 | PV Module Dimension | 2287x1137x35 mm | 2384x1303x35 mm |
| 4 | Mounting Orientation | Landscape | Portrait- 558  Landscape- 726 |
| 5 | Mounting Structure Angle | 5 Degree | 5/Flush mount |

|  |  |
| --- | --- |
| **PART D** | **ENERGY YIELD ASSESSMENT** |

Company has used PVSyst V7.4.8 to assess energy yield calculation which is the standard Industry practice. The yearly average of main results of irradiation and energy yield from the provided PVSyst is as under:

**Annual production probability (kWh/kWp/Year):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Plant** | **As per PVSyst**  **(In kWh/kWp/Year)** | | **Performance**  **Ratio (%)** | **CUF (%)** |
| **P50** | **P90** |
| 1 | TVS Srichakra Limited | 1513 | 1495 | 83.47% | 17.24 |
| 2 | Sansera Engineering Limited | 1429 | 1419 | 85.56 | 17.24 |

**Estimated Annual production (kWh/Year):**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **S. No.** | **Plant** | **As per PPA**  **(kWh/Year)** | **As per PVSyst**  **(kWh/Year)** | **As per Global Solar Atlas**  **(kWh/Year)** |
| 1 | TVS Srichakra Limited | 15,28,130 | 15,28,087 | 15,53,683 |
| 2 | Sansera Engineering Limited | 12,30,660 | 12,30,846 | 13,22,938 |

**Estimated Specific Production (kWh/kWp/Year):**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Plant** | **As per PPA**  **(In kWh/kWp/Year)** | | **As per PVSyst**  **(In kWh/kWp/Year)** | **As per Global Solar Atlas**  **(In kWh/kWp/Year)** |
| **Estimated** | **Guaranteed** |
| 1 | TVS Srichakra Limited | --- | 1,227 | 1,513 | 1,538.3 |
| 2 | Sansera Engineering Limited | 1,262 | 1,135 | 1,431 |

**Observations and Remarks:**

1. Estimated annual production as found in PVSyst report & Global Solar Atlas is more than or almost equal as specified in PPA.
2. Estimated specific production (Guaranteed) as mentioned in PvSyst report and Global Solar Atlas Report is more than of PPA.

**Analysis of Irridiation & PV Output data:** In respect to Irridiation & PV Output data, company has provided to us PVSyst Report V7.4.8 in which key Irrdidation components and PV Output data is given as enumerated in table below. We have analysed and compared it with other data source points also such as Solar Resource by Global Solar Atlas of World Bank and ISRO Solar Calculator to confirm its legitimacy as mentioned in table below:

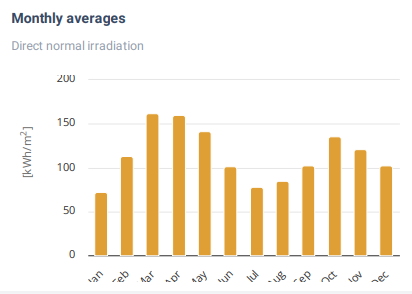
|  |  |  |  |
| --- | --- | --- | --- |
| **Particulars** | **As per Global Solar Atlas\*** | **As per PVSyst** | |
| **TVS Plant** | **Sansera Plant** |
| Global horizontal Irradiation (kWh/m2) | 1783.8 | 1819.3 | 1680.6 |
| Diffuse horizontal Irradiation (kWh/m2) | 866.8 | 889.6 | 888.8 |
| Direct Normal Irradiation (kWh/m2) | 1367.0 | -- | --- |
| Specific Photovoltaic Power Output per year *(kWh/kWp/year)* | 1538.3 | 1513 | 1431 |
| Annual Global Insolation (ISRO Solar Calculator) (kWh/m2/year) | 1420 | | |
| Capacity Utilization Factor (CUF) | TVS- 17.74%  Sansera- 15.10% | 17.44% | 14.05% |

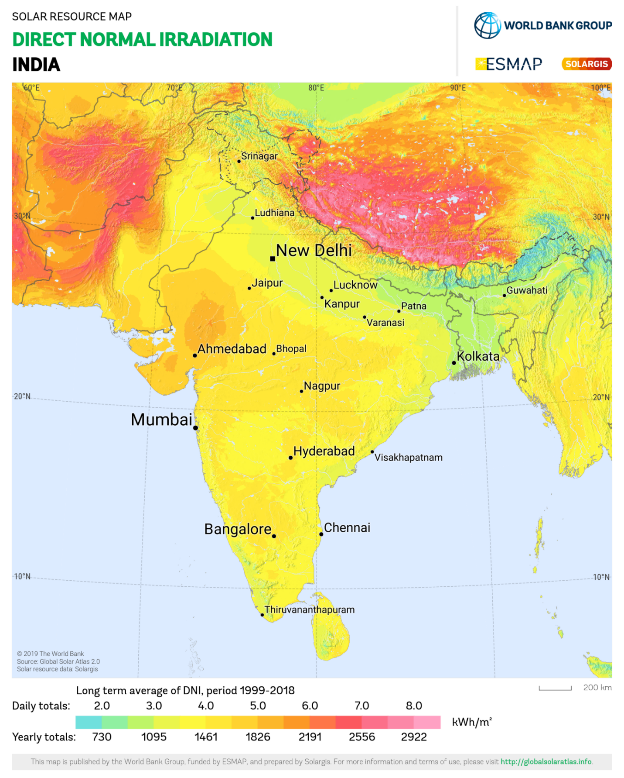
***\*Common for both Plant since geographic location is same.***

**Observations and Remarks:**

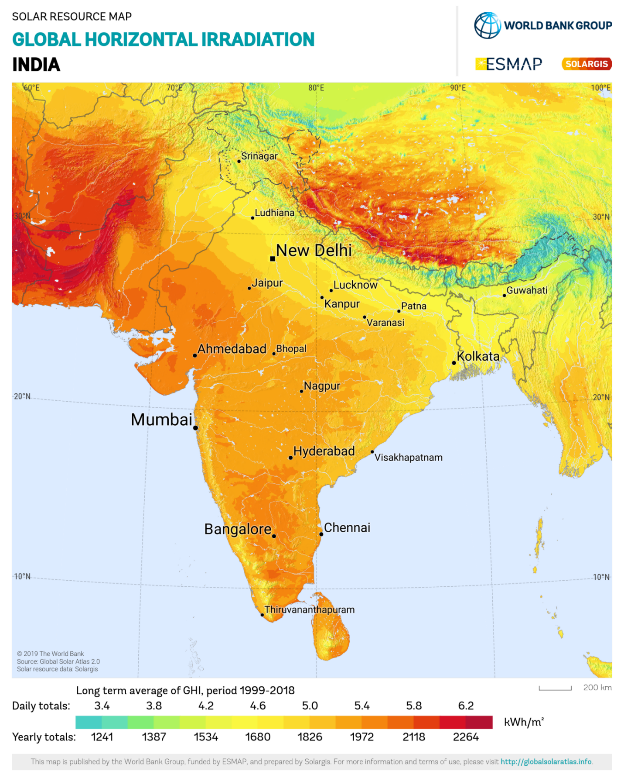
1. As per comparative analysis, PVSyst Irrdiation and PV Output data is slightly below to our analysis from Global Solar Atlas of World Bank and ISRO Solar Calculator.
2. The Specific PV Power Output as per Global Solar Atlas is 1538.3 kWh/kWp/year which is more than that of PVSyst report.
3. However data from Global Solar Atlas may not consider the specific module factors which are covered in PVSyst report as its limitation.

**Monthly averages- Direct Normal Irradiation (kWh/m2)**

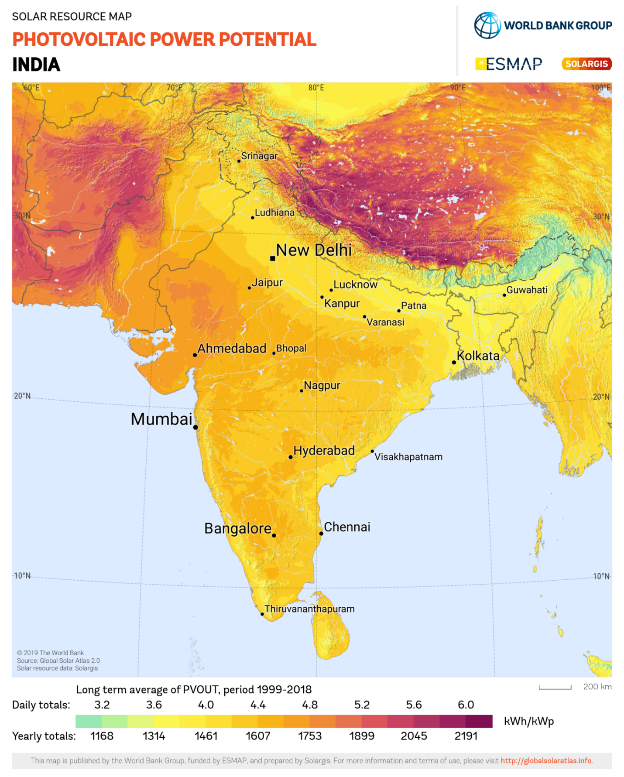
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***Both Plant lies between 3.0 to 4.0.***



***Both Plant lies between 4.2 to 4.6.***



***Both Plant lies between 4.0 to 4.4.***

|  |  |
| --- | --- |
| **PART E** | **POWER PURCHASE AGREEMENT TERMS** |

As per copy of both the PPA, the total proposed capacity of the solar power plant is 1.81 MWp (± 5%). The PPA had been signed between **TVS Srichakra Limited & Sansera Engineering Limited** and **M/s Truere HAR SPV Private Limited.** Details as mentioned in PPA are tabulated below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Offtaker** | **DC Capacity (kWp)** | **Tariff (Rs./kWh)** | **PPA Date** | **PPA Tenure** |
| 1 | TVS Srichakra Limited | 1010.35 | 3.99 | 12-08-2024 | 15 years |
| 2 | Sansera Engineering Limited | 800 | 4.19 | 22-03-2024 | 25 years |
| **Total** | |  |  |  |  |

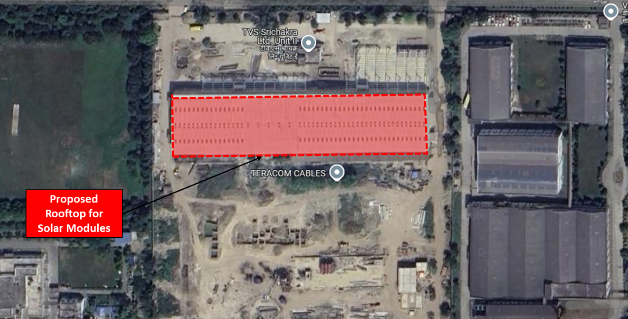
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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  | | --- | --- | --- | | **Sansera Engineering Limited** | | | | **Units as per PPA (Units/Contract Year)** | | | | **Year** | **Estimated Enenrgy** | **Guaranteed Energy** | | 1st | 10,85,024 | 9,76,522 | | 2nd | 10,57,898 | 9,52,108 | | 3rd | 10,50,303 | 9,45,273 | | 4th | 10,42,708 | 9,38,437 | | 5th | 10,35,113 | 9,31,602 | | 6th | 10,27,518 | 9,24,766 | | 7th | 10,19,923 | 9,17,931 | | 8th | 10,12,327 | 9,11,094 | | 9th | 10,04,732 | 9,04,259 | | 10th | 9,97,137 | 8,97,423 | | 11th | 9,89,542 | 8,90,588 | | 12th | 9,81,947 | 8,83,752 | | 13th | 9,74,352 | 8,76,917 | | 14th | 9,66,756 | 8,70,080 | | 15th | 9,59,161 | 8,63,245 | | 16th | 9,51,566 | 8,56,409 | | 17th | 9,43,971 | 8,49,574 | | 18th | 9,36,376 | 8,42,738 | | 19th | 9,28,781 | 8,35,903 | | 20th | 9,21,185 | 8,29,067 | | 21st | 9,13,590 | 8,22,231 | | 22nd | 9,05,995 | 8,15,396 | | 23rd | 8,98,400 | 8,08,560 | | 24th | 8,90,805 | 8,01,725 | | 25th | 8,83,210 | 7,94,889 | | |  | | --- | | **TVS Srichakra Limited** | | **Units as per PPA (Units/Contract Year)** |  |  |  | | --- | --- | | **Year** | **Guaranteed Energy** | | 1st | 12,39,396 | | 2nd | 12,14,608 | | 3rd | 12,04,693 | | 4th | 11,96,017 | | 5th | 11,86,102 | | 6th | 11,77,427 | | 7th | 11,67,511 | | 8th | 11,58,836 | | 9th | 11,48,920 | | 10th | 11,40,245 | | 11th | 11,30,329 | | 12th | 11,21,654 | | 13th | 11,11,739 | | 14th | 11,03,063 | | 15th | 10,93,148 | |

***Note:-*** *Only relevant terms are mentioned above which are important in report in respect to energy gerenration only for illustration purpose.*

|  |  |
| --- | --- |
| **PART F** | **CURRENT STATUS OF WORK** |

As on date, Solar Panel Installation work has not been started yet. As per desktop analysis using Google tool, we did not find any shadow/obstruction on shed where solar panels are proposed to be installed.

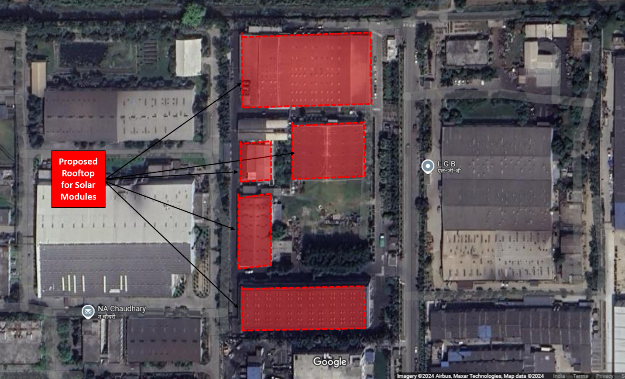
**Please refer to the TVS Srichakra image attached below:-**

**

*Based on analysis using Google’s imagery tool, no significant shadows or obstructions were detected on the roof that could block direct sunlight.*

As per google satellite measurement tools, total roof area is about 6757 sqm. The approximate size of 550 Wp Solar Panel is 2287 x 1137 x 35 (mm) and the total quantity of solar panels to be installed is ~1837 nos. Thus, ~5,000 sqm (after adding 10% additional space in the area of panels) is sufficient to install 1010 kW solar plant.

**Please refer to the Sansera Engineering image attached below:-**

**

*Based on analysis using Google’s imagery tool, no significant shadows or obstructions were detected on the roof that could block direct sunlight.*

As per google satellite measurement tools, total roof area is about 10,000 sqm. The approximate size of 670 Wp Solar Panel is 2384 x 1303 x 35 (mm) and the total quantity of solar panels to be installed is ~1284 nos. Thus, ~4,500 sqm (after adding 10% additional space in the area of panels) is sufficient to install 860 kW solar plant.

|  |  |
| --- | --- |
| **PART G** | **PROJECT COST & EXPENDITURE** |

1. **PROJECT COST:** As per DPR shared by the company, the total project cost for installation of ~1.87 MW solar project is Rs. 6.34 Cr. including GST. Cost break-up shared by the company is as follows:-

|  |  |  |
| --- | --- | --- |
| **S.No.** | **Item** | **Cost/kW**  **(In Rs. Cr.)** |
| 1 | Module | 2,54,53,125 |
| 2 | Inverter | 56,56,250 |
| 3 | BOS | 1,87,90,254 |
| 4 | I&C | 53,68,644 |
| 5 | GST | 80,81,727 |
| **Total Cost of the project (In Rs. Crore)** | | **6,33,50,000** |
| **Total Cost In Rs. per kW** | | **33,871** |

**Observations and Remarks:**

1. Project cost calculated on the basis of the Benchmark Cost provided by the MNRE has been tabulated below:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **S. No.** | **Particulars** | **Benchmark Cost**  **(In Rs./kW)** | **Project Capacity**  **(In MW)** | **Total Project Cost**  **(Excluding GST)**  **(In Rs.)** | **Total Project Cost**  **(Including ~14% GST)**  **(In Rs.)** |
| 1 | As per Ministry of New & Renewable Energy | 35,886\* | 1.87 | 6,71,19,380 | 7,63,81,855 |
|  | | | **1.87 MWp** |  | **~Rs. 7.64 Cr.** |

*\*Benchmark cost for 2021-22 Excludes GST*

1. Project cost calculated on the basis of market comparable:

|  |  |  |  |
| --- | --- | --- | --- |
| **S. No.** | **Particulars** | **Including GST** | **Remark** |
| **Per KW Cost**  **(In Rs.)** |
| 1 | Subject project installation cost | 33,871 | As per Company |
| **Market Research Details** | | | |
| **Market Research** | | | |
| 2 | Reference- 1 | 44,564 | Refer Annexures |
| 3 | Reference- 2 | 46,088 |
| 5 | Reference- 4 | 41,500 |
| 6 | Reference- 5 | 35,800 |

1. The Benchmark is slightly higher than that of cost overall project cost.
2. As per our analysis and market research, the installation cost of Solar Power Plant varies from **Rs. 35,800/- per KW to Rs. 46,000/- per KW**. For the smaller setups the price is higher and for large set-up, price is less.
3. The implementation cost of the said project is Rs. 33,871/- per kW which is within market comparable. Thus, we can say that the cost of the project is satisfactory.
4. The project cost solely depends upon the project location, contractors profit, type of module and its supporting structures, make, etc.

***Note:***

* *Project cost is analyzed based on lump sum cost only and not item wise.*
* *Project cost is assessed for the date of this report only. Due to price fluctuations, it may vary from time to time.*

1. **EXPENDITURE:** Details of expenses incurred till date are not shared with us. Thus, we cannot comment upon expenditure incurred till date on the project.

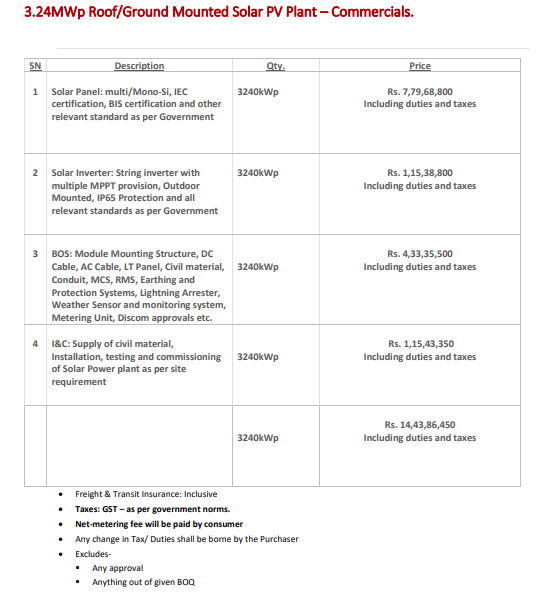
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| **PART H** | **PHOTOGRAPHS** |

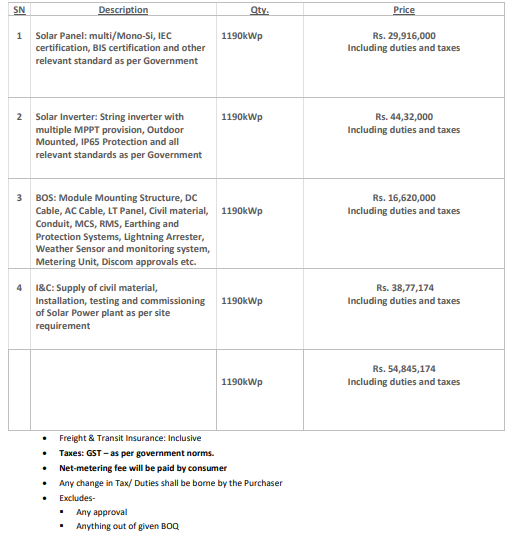
***Since the installation work related to solar panels is yet to start and this is just a Desktop LIE based upon documents provided. Thus, Photographs are not available***

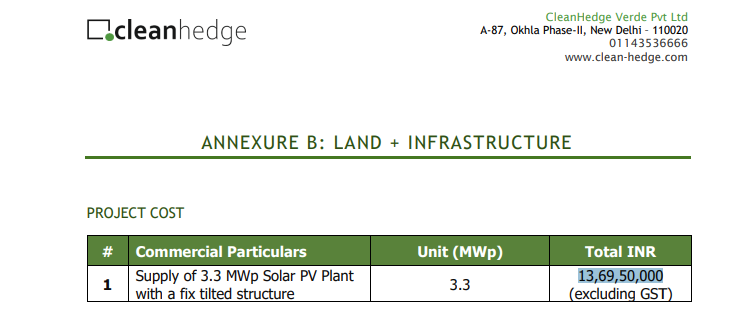
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| **PART I** | **OTHER DOCUMENTS & REFERENCES** |

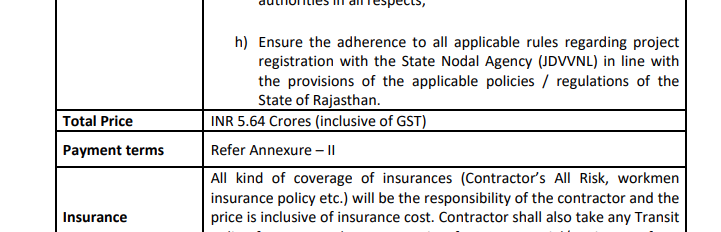
**Market Comparables:**

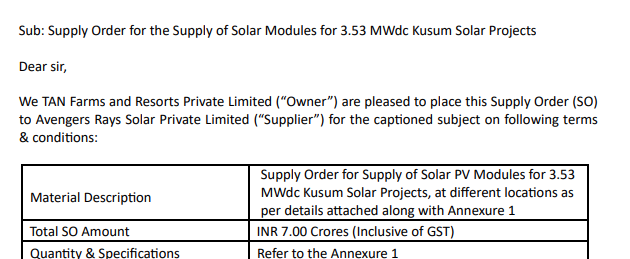
**Annexure-1**

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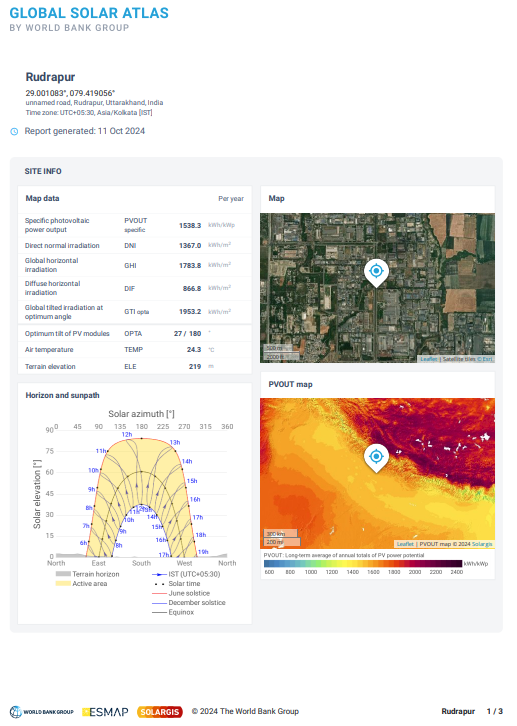
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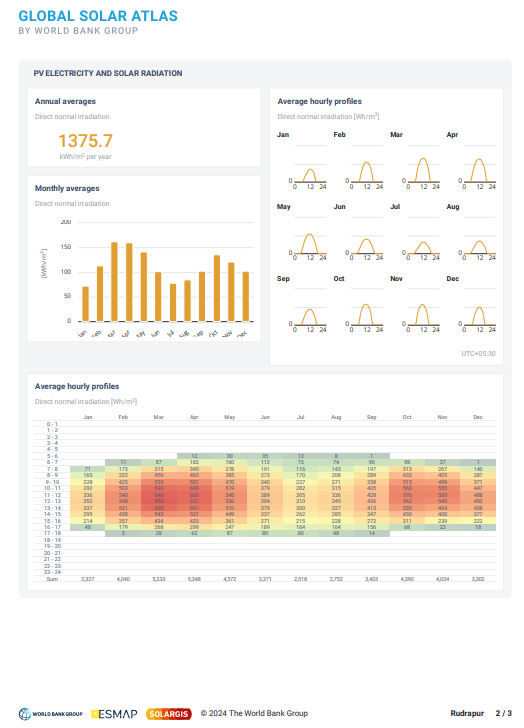
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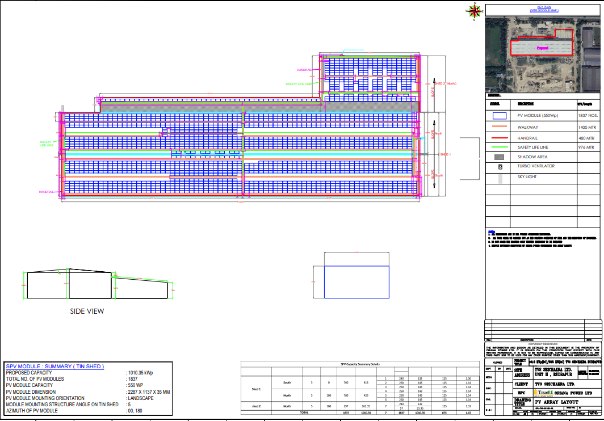
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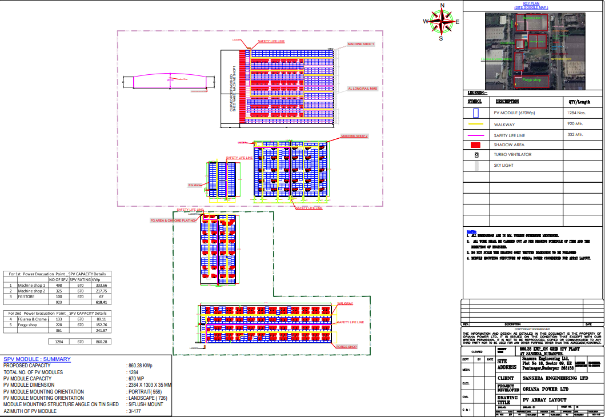
**Data by Global Solar Atlas by World Bank Group**

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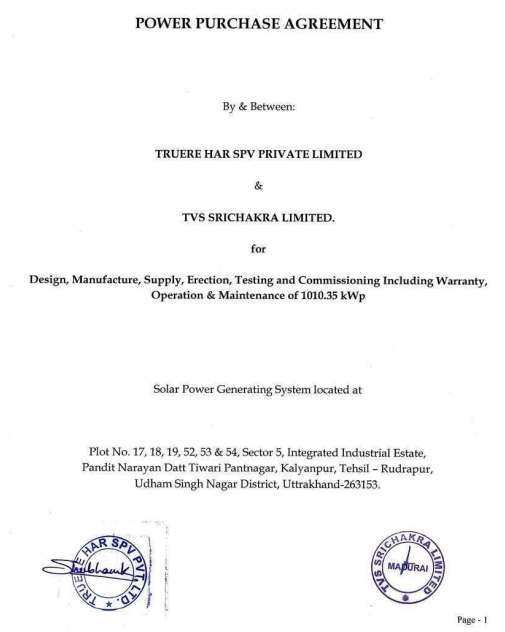
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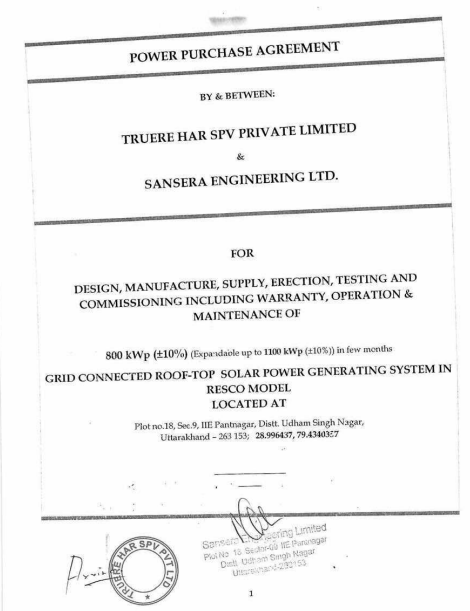
**Layout**

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**Copy of PPA**

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