

# Detailed Project Report on Solar PV rooftop system

G Expo sales  
Khurja (Uttar Pradesh)

*Prepared for*

Bureau of Energy Efficiency  
(13/GEF-UNIDO-BEE/LSP/14/4562)



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This DPR has been originally prepared by TERI as a part of 'Capacity Building of LSPs' activity under the GEF-UNIDO-BEE project 'Promoting Energy Efficiency and Renewable Energy in selected MSME clusters in India'.

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GEF-UNIDO-BEE Project, Bureau of Energy Efficiency, 2018  
"Capacity Building of Local Service Providers"

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# Acknowledgement

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The Energy and Resources Institute (TERI) places on record its sincere thanks to Global Environment Facility (GEF), United Nations Industrial Development Organization (UNIDO) and Bureau of Energy Efficiency (BEE) for giving opportunity to partner in this prestigious assignment on Capacity Building of Local Service Providers (LSPs) under the GEF-UNIDO-BEE project 'Promoting energy efficiency and renewable energy in selected MSME clusters in India'.

TERI is particularly grateful to Mr Milind Deore, Director, Bureau of Energy Efficiency, Mr Sanjay Shrestha, Industrial Development Officer, Industrial Energy Efficiency Unit, Energy and Climate Branch, UNIDO, Mr Suresh Kennit, National Project Coordinator, UNIDO, Mr Niranjana Rao Devela, National Technology Coordinator, Mr Ajeet Singh, Cluster Leader, Khurja Foundry Cluster, UNIDO, Mr Karan Gulati, M/s G. Expo Sales and Central Glass and Ceramic Research Institute (CGCRI), Khurja for their support and guidance during the project.

Last but not least, the interactions and deliberations with numerous foundry units, industry associations, technology providers and who were directly or indirectly involved throughout the study were exemplary and the whole exercise was thoroughly a rewarding experience for TERI.

The Energy and Resources Institute (TERI)  
New Delhi



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## List of abbreviations

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|                 |   |  |
|-----------------|---|--|
| BEE             | : | Bureau of Energy Efficiency                        |
| CO <sub>2</sub> | : | Carbon Dioxide                                     |
| D/E             | : | Debt /Equity                                       |
| DPR             | : | Detailed Project Report                            |
| DSCR            | : | Debt Service Coverage Ratio                        |
| EE              | : | Energy Efficient                                   |
| GEF             | : | Global Environmental Facility                      |
| GHG             | : | Greenhouse Gas                                     |
| HSD             | : | High Speed Diesel                                  |
| IDC             | : | Investment without interest defer credit           |
| IGDPR           | : | Investment Grade Detailed Project Report           |
| IRR             | : | Internal Rate of Return                            |
| kW              | : | Kilo Watt  |
| kWh             | : | Kilo Watt Hour                                     |
| LMV             |   | Low and Medium Voltage                             |
| LSPs            | : | Local Service Providers                            |
| MSME            | : | Micro, Small and Medium Enterprises                |
| MT              | : | Metric Tonne                                       |
| NG              | : | Natural Gas  |
| NPV             | : | Net Present Value                                  |
| O&M             | : | Operation and Maintenance                          |
| RE              | : | Renewable Energy                                   |
| ROI             | : | Return On Investment                               |
| SME             | : | Small and Medium Enterprises                       |
| SPP             | : | Simple Payback Period                              |
| TERI            | : | The Energy and Resources Institute                 |
| toe             | : | Tonnes of oil equivalent                           |
| UNIDO           | : | United Nations Industrial Development Organization |
| WACC            | : | Weighted Average Cost of Capital                   |



## Executive summary

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The overall aim of the GEF-UNIDO-BEE project 'Promoting Energy Efficiency (EE) and Renewable Energy (RE) in selected MSME clusters in India' is to develop and promote a market environment for introducing energy efficiency and enhancing the use of renewable energy technologies in process applications in selected energy-intensive MSME clusters in India. This would help in improving the productivity and competitiveness of the MSME units, as well as in reducing the overall carbon emissions and improving the local environment.

Under the GEF-UNIDO-BEE Project, TERI has been entrusted to undertake Capacity building of Local Service Providers (LSPs) to BEE. The Scope of Work under the project

- Organizing 4 one-day training/ capacity building workshops for LSPs in each cluster.
- Development of 10 bankable DPRs for each cluster, based on mapping technology needs with capacities of local technology suppliers/service providers, and also replication potential and applications to banks in each cluster.

### Brief introduction of the MSME unit

|                                     |   |
|-------------------------------------|---|
| Name of the unit                    | M/s G. Expo Sales   |
| Constitution                        | Proprietorship  |
| MSME Classification                 | Small   |
| No. of years in operation           | NA  |
| Address: Registered Office:         | B-8, Industrial Area, Junction Road,<br>Khurja - 203131, Bulandshahr, Uttar Pradesh |
| Industry-sector                     | Ceramic   |
| Products manufactured               | Bone china crockery   |
| Name(s) of the promoters/ directors | Mr Karan Gulati   |

A detailed assessment study was undertaken in the identified area with the use of the sophisticated handheld instruments. Energy consumption pattern and production data were collected to estimate the specific energy consumption of the unit. The unit level baseline of the unit was also estimated using the historical data. The plant is consuming about 173,100 kWh of electricity per year. The annual consumption of the fuel oil is 96 kL and HSD is 2,880 litres. The total energy consumption of the unit during last 12 months is estimated to be 105 toe which is equivalent to 50 lakh rupees. The total CO<sub>2</sub> emission during this period is estimated to be 405 tonnes. Electricity, HSD and fuel oil were considered for CO<sub>2</sub> emission estimation.

The unit manufactures bone china crockery. The average production of the unit during 2017-18 is estimated to be 25,000 pieces per day.

### Accepted/ recommended technology implementation

The recommended technology considered after discussion with the plant personnel for implementation in the unit is given below.

| Energy conservation measure             | Annual electricity saving (kWh/year) | Investment <sup>1</sup> (Rs. Lakh) | Monetary savings (Rs. Lakh/year) | Simple payback period (years) | Emission reduction (tonnes of CO <sub>2</sub> ) |
|---|--------------------------------------|------------------------------------|----------------------------------|-------------------------------|---|
| Installation of solar PV rooftop system | 49,155                               | 15.66                              | 4.31                             | 3.60                          | 40.30   |

## Other benefits

- The proposed project is not expected to bring in any change in process step or operating practices therefore no change expected in the product quality.
- Implementation of the selected technology in the unit may result in reduction in CO<sub>2</sub> emissions.

## Cost of project & means of finance

| S. No. | Particulars     | Unit        | 100% equity | D/E- 70:30 | D/E- 50:50 |
|--------|-----------------|-------------|-------------|------------|------------|
| 1      | Cost of Project | Rs. In Lakh | 15.66       | 16.24      | 16.07      |
| 2      | D/E Ratio       | -           | -           | 7:3        | 1:1        |
| 3      | Project IRR     | %           | 2.53        | -3.64      | -1.88      |
| 4      | NPV             | Rs. In Lakh | -2.31       | -4.68      | -4.01      |
| 5      | DSCR            | -           | -           | 1.40       | 1.93       |

<sup>1</sup> Investment including the solar PV rooftop system including taxes and miscellaneous – Rs. 15.66 lakh

## 1.0 Details of the unit

---

### 1.1 Particulars of unit

**Table 1.1:** Particulars of the unit

|    |   |   |       |
|----|---|---|-------|
| 1  | Name of the unit  | M/s G Expo Sales  |       |
| 2  | Constitution  | Proprietorship  |       |
| 3  | Name of the Contact Person                              | Mr Karan Gulati   |       |
| 4  | Mobile / Ph. No   | +91- 9837087311 / 05738-253528  |       |
| 5  | Email   | karangexpo@gmail.com  |       |
| 6  | Address:<br>Registered Office                           | B-8, Industrial Area, Junction<br>Road, Khurja - 203131,<br>Bulandshahr, UP | Owned |
| 7  | Factory   | B-8, Industrial Area, Junction<br>Road, Khurja - 203131,<br>Bulandshahr, UP | Owned |
| 8  | Industry / Sector                                       | MSME/Ceramic  |       |
| 9  | Products Manufactured                                   | Bone China Crockery   |       |
| 10 | No of hours of operation/ shift                         | 8   |       |
| 11 | No of shifts/ day                                       | 3   |       |
| 12 | No of days/year   | 240   |       |
| 13 | Installed capacity                                      | 30,000 pcs per day  |       |
| 14 | Whether the unit is exporting its products<br>(Yes/ No) | No  |       |
| 15 | Quality Certification, if any                           | NA  |       |



## 2.0 Energy profile

### 2.1 Process flow diagram

Manufacturing of ceramic item uses wide range of raw material combination to produce different shape, size and colour. It requires both electrical and thermal energy at different stages of the process to operate the ball mill, casting/moulding, kilns, cutting & finishing machines and utilities such as motors, pumps air compressor etc. Ceramic manufacturing process primarily consists of mould preparation, body material preparation, shaping, drying and firing. Typical process flow chart is shown with figure 2.1.

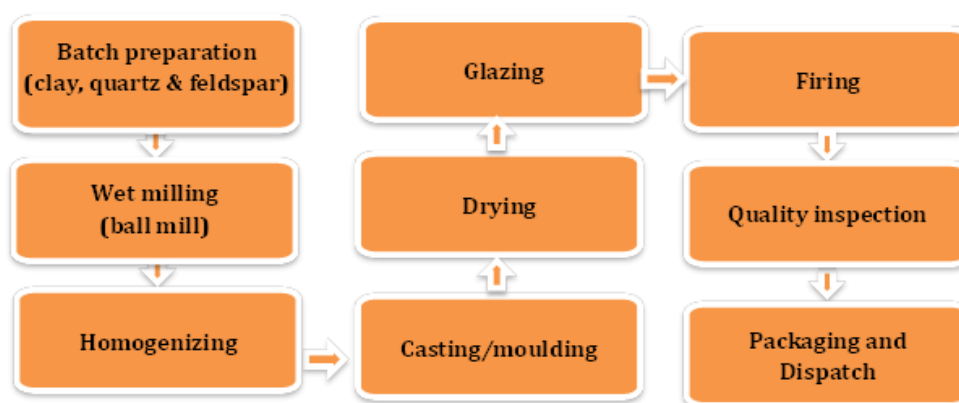


Figure 2.1: Process flow chart

### 2.2 Details of technology identified

The details of the electricity demand, consumption and solar PV rooftop of the unit are given in table 2.2.

Table 2.2: Details of electricity demand and consumption

| Parameters/ Equipment ID         | Value   |
|----------------------------------|---------|
| Connection type                  | LMV6    |
| Supply voltage, volt             | 400     |
| Contract demand, kVA             | 38      |
| Recorded demand, kVA             | 43      |
| Average monthly consumption, kWh | 14,425  |
| Type of solar installation       | Rooftop |
| Installation Capacity, kW        | 35      |

### 2.3 Energy used and brief description of their usage pattern

The unit uses grid power supplied by Paschimanchal Vidyut Vitaran Nigam Limited under the tariff category LMV6. Table 2.3 provides the details of energy uses.

Table 2.3: Energy used and description of use

| S No | Energy source | Description of use  |
|------|---------------|---|
| 1    | Electricity   | Motive power for different drives in different process sections and utilities |
| 2    | Fuel oil      | Kiln  |
| 3    | HSD           | Generator backup power  |

## 2.4 Energy sources, availability & tariff details

Different energy sources, availability of listed energy types and their respective tariffs are given in table 2.4.

**Table 2.4:** Energy sources, availability and tariffs

| Particular     | LMV6   |
|----------------|--|
| Fixed charges  | <ul style="list-style-type: none"> <li>• Up to 4 kW : Rs. 245/kW/month</li> <li>• Above 4 kW to 9 kW : Rs. 255/kW/month</li> <li>• Above 9 kW : Rs. 275/kW/month</li> </ul>  |
| Energy charges | <ul style="list-style-type: none"> <li>• Up to 1,000 kWh/month : Rs. 7.00/kWh</li> <li>• Up to 2,000 kWh/month : Rs. 7.35/kWh</li> <li>• Above 2,000 kWh/ month : Rs. 7.60/kWh</li> </ul>  |
| TOD Charges    | <p><b>Summer Months (April to September)</b></p> <ul style="list-style-type: none"> <li>• 05:00 hrs-11:00 hrs : (-) 15%</li> <li>• 11:00 hrs-17:00 hrs : 0%</li> <li>• 17:00 hrs-23:00 hrs : (+)15%</li> <li>• 23:00 hrs-05:00 hrs : 0%</li> </ul> <p><b>Winter Months (October to March)</b></p> <ul style="list-style-type: none"> <li>• 05:00 hrs-11:00 hrs : 0%</li> <li>• 11:00 hrs-17:00 hrs : 0%</li> <li>• 17:00 hrs-23:00 hrs : (+)15%</li> <li>• 23:00 hrs-05:00 hrs : (-)15%</li> </ul> |

## 2.5 Analysis of electricity consumption

**Table 2.5:** Electricity consumption profile

| Month & Year   | Electricity consumption (kWh) | Electricity consumption (kVAh) | Sanctioned load/ Demand (kVA) | Power factor | Recorded demand (kVA) | Demand Penalty (Rs) | Demand charges (Rs) | Energy charges (Rs) | Mont bill (Rs)   |
|----------------|-------------------------------|--------------------------------|-------------------------------|--------------|-----------------------|---------------------|---------------------|---------------------|------------------|
| Oct-17         | 15,098                        | 15,689                         | 38                            | 0.96         | 42.7                  | 2,346               | 10,578              | 1,07,629            | 1,33,000         |
| Dec-17         | 10,844                        | 11,375                         | 38                            | 0.95         | 36.8                  | -                   | 9,113               | 78,251              | 96,000           |
| Jan-18         | 17,973                        | 18,437                         | 38                            | 0.97         | 42.8                  | 2,356               | 10,583              | 1,26,838            | 1,54,000         |
| Feb-18         | 17,661                        | 18,146                         | 38                            | 0.97         | 46.3                  | 4,118               | 11,464              | 1,25,419            | 1,51,000         |
| Mar-18         | 15,179                        | 15,681                         | 38                            | 0.97         | 44.5                  | 3,208               | 11,009              | 1,07,750            | 1,30,000         |
| May-18         | 12,183                        | 13,387                         | 38                            | 0.91         | 45.9                  | 3,911               | 11,360              | 91,818              | 1,14,000         |
| Jun-18         | 11,164                        | 11,495                         | 38                            | 0.97         | 33.5                  | -                   | 8,301               | 78,734              | 93,000           |
| Jul-18         | 15,298                        | 15,832                         | 38                            | 0.97         | 49.1                  | 5,495               | 12,152              | 1,08,614            | 1,35,000         |
| <b>Average</b> | <b>14,425</b>                 | <b>15,005</b>                  | <b>38</b>                     | <b>0.96</b>  | <b>42.7</b>           | <b>2,679</b>        | <b>10,570</b>       | <b>1,03,132</b>     | <b>1,26,000</b>  |
| <b>Total</b>   | <b>1,73,100</b>               | <b>1,80,063</b>                | <b>-</b>                      | <b>-</b>     | <b>-</b>              | <b>32,150</b>       | <b>1,26,841</b>     | <b>12,37,581</b>    | <b>15,16,000</b> |

Figure 2.5 presents contract demand, recorded maximum demand and the energy consumption of the unit.



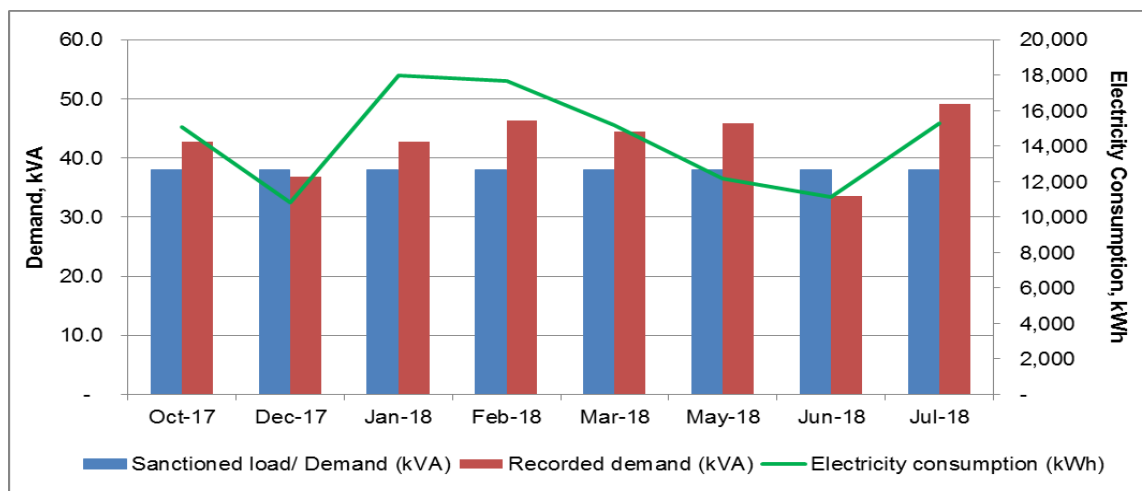


Figure 2.5: Demand pattern and energy consumption profile

## 2.6 Analysis of other energy forms/ fuels

The analysis of the other fuels/forms of energy used in the unit is given in table 2.6.

Table 2.6: Analysis of other energy/ fuel consumption

| Parameters              | Fuel Oil (kL) | HSD (Ltrs) |
|-------------------------|---------------|------------|
| Consumption unit/year   | 96.0          | 2,880      |
| Calorific value per kg  | 9,800         | 10,000     |
| Equivalent toe per year | 87.5          | 2.9        |
| Price (Rs per unit)     | 34.0          | 68.0       |
| Total price per year    | 32,64,000     | 1,95,840   |

The share of various energy forms used in the unit is given in figure 2.6.

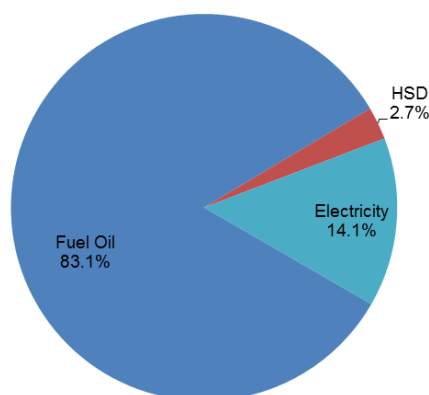


Figure 2.6: Percentage share of various fuel types in the unit

The plant is consuming about 173,100 kWh of electricity per year. The annual consumption of the fuel oil is 96 kL and HSD is 2,880 litres. The total energy consumption of the unit during last 12 months is estimated to be 105 toe which is equivalent to 50 lakh rupees. The

total CO<sub>2</sub> emission during this period is estimated to be 405 tonnes. Electricity, HSD and fuel oil were considered for CO<sub>2</sub> emission estimation.

## 3.0 Proposed technology for energy efficiency

Based on the measurements, observations/ findings during detailed assessment study conducted in the unit, the following technology has been identified for energy efficiency improvement. The detail is given below.

### 3.1 Installation of solar rooftop system

#### 3.1.1 Background

Renewable energy is the resource of clean and zero emission, it has a tremendous potential of energy which can be harnessed using a variety of devices. With the recent technological advancement the availing solar energy are comparatively easily for industrial use with added benefit of minimum maintenance.

#### Irradiation Data

The actual site coordinates for the location is provided as follows:

|                        |   |                              |
|------------------------|---|------------------------------|
| Latitude               | : | 28.25° N                     |
| Longitude              | : | 77.85° E                     |
| Annual solar radiation | : | 5.49 kWh/m <sup>2</sup> /day |

The annual monthly average horizontal solar radiation for the location is provided in the following figure: 3.1.1b.

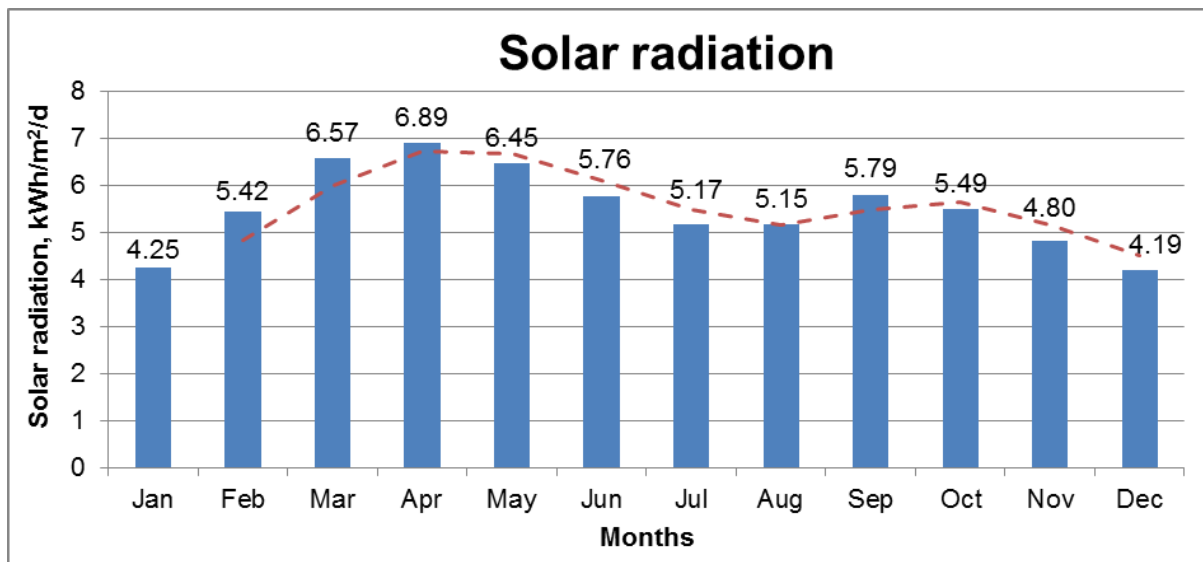


Figure 3.1.1b: Monthly average horizontal solar radiation

The variation of solar radiation for the given location varies in the range of 4.19–6.89 kWh/m<sup>2</sup>/day. The yearly average radiation is about 5.49 kWh/m<sup>2</sup>/year, such radiation levels gives a better feasibility of solar roof top projects in the site.

### 3.1.2 Observations and analysis

The assessment of potential for installation of Solar Rooftop shows that the available area suitable for installation is about 1,672 m<sup>2</sup> which is suitable for up to 100 kWp. In the existing roof topography the shadow varies due to variation solar incident angle in summer and winter, figure 3.1.2a shows the variation of the solar angle in summer and winter. A shadow analysis was carried out in the existing structure for identifying the tentative capacity of the solar PV roof top potential. With the variation of the solar incident angle the length of the shadow also varies in every season, the following formula is used for the shadow analysis of the particular location.

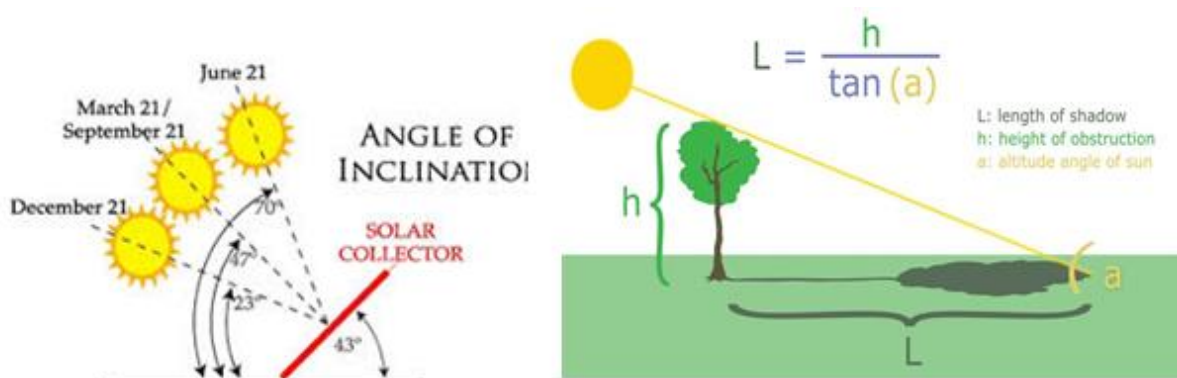


Figure 3.1.2a: Seasonal variation solar incident angle

For the existing location the incident angle was evaluated in both summer and winter, the figure 3.1.2b shows the variation of solar angle in winter and summer.

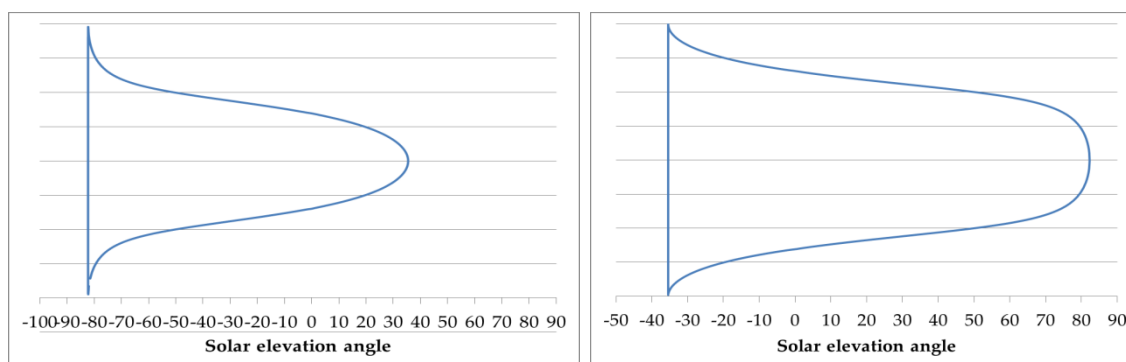


Figure 3.1.2b: Variation of solar angle in winter and summer

It can be observed that the variation of solar angle is from 35 to 82 degree in winter and summer respectively. The length of the shadow for a three meter height object will be having a shadow length of the 4.42m in winter and the same object will be having a shadow length of 2.54m in summer.

### 3.1.3 Recommendation

Based on existing area availability, it is feasible to install solar PV rooftop system of 100 kWp capacity. But based on the existing policy it is feasible to installed 35 kWp capacity. Based on the solar irradiation data as shown in the following figure, annual yield is estimated to be 49,156 kWh per year, which is about 28% of existing annual electricity consumption.

## 3.2 Cost benefit analysis

The estimated annual electricity consumption from the grid by installation of solar rooftop system is 49,156 kWh equivalent to a monetary saving of Rs 4.31 lakh. The investment<sup>2</sup> requirement is Rs 15.66 lakh with a simple payback period of 3.6 years. The detailed calculations of the recommended energy conservation measures for IG DPR are provided in table 3.2.

**Table 3.2:** Cost benefit analysis for recommended measures

| Parameters                       | Units          | Values    |
|----------------------------------|----------------|-----------|
| Total roof top area              | sq. ft.        | 17,991    |
|                                  | m <sup>2</sup> | 1,672     |
| Maximum solar potential          | kWp            | 100       |
| Permissible solar potential      | kWp            | 35        |
| Annual energy generated from SPV | kWh/year       | 49,156    |
| Annual monetary saving           | Rs/years       | 4,30,544  |
| Cost of SPV system               | Rs             | 15,66,000 |
| Simple payback period            | Years          | 3.6       |

## 3.3 Pre-training requirements

Training of operator/supervisor is required on general maintenance practices and periodic cleaning of the panels.

## 3.4 Process down time for implementation

There is no process downtime required for implementation of the recommended measure and the modifications may be planned without affecting its regular operations.

## 3.5 Environmental benefits

### 3.5.1 CO<sub>2</sub> reduction<sup>3</sup>

Implementation of the selected energy conservation measures in the unit may result in reduction in CO<sub>2</sub> emissions due to reduction in overall energy consumption. The estimated reduction in GHG emission by implementation of the recommended energy conservation measures is 40 tonnes of CO<sub>2</sub> per year.

### 3.5.2 Reduction in other pollution parameters (gas, liquid and solid)

There is not significant impact on the reduction in other pollution parameters including gas, liquid and solid.

<sup>2</sup> Quotation – 1 has been considered for estimation of investments

<sup>3</sup> Source for emission factor: 2006 IPCC Guidelines for National Greenhouse Gas Inventories & electricity: CO<sub>2</sub> Baseline Database for the Indian Power Sector, user guide version 12.0, May 2017 (CEA)



## 4.0 Project financials

### 4.1 Cost of project and means of finance

#### 4.1.1 Particulars of machinery proposed for the project

The particulars of machinery proposed for the project is given in table 4.1.1.

**Table 4.1.1:** Particulars of machinery proposed for the project

| S. No. | Name of machinery (Model/ specification)   | Name of manufacturer, contact person  | Advantage | Disadvantage |
|--------|--|---|-----------|--------------|
| 1      | 35 kWp Grids Connected/Interactive Roof top Solar PV Plant   | Green Energy<br>Plot No - G 2016, GIDC Lodhika,<br>Road - L, Almighty Gate,<br>Near Minimatic Machines,<br>Metoda, Dist. Rajkot, Gujarat -<br>360 021                                 | -         | -            |
| 2      | Design, supply, installation, testing and commissioning of a solar power plant<br>Location: Champion Ceramics,<br>Thangadh.<br>Plant capacity: 35 kWp<br>PV Technology/Module: Crystalline-<br>PV<br>Mounting Structure: On the<br>GI/Asbestos roof. | TATA Power Solar Systems<br>Limited<br>Plot No. 78, Electronics City<br>Hosur Road, Bangalore-560100<br>Tel: 080-40702000/40703000<br>Fax: 080-28520116<br>Web:www.tatapowersolar.com | -         | -            |

#### 4.1.2 Means of finance

The means of finance for the project is shown in table 4.1.2.

**Table 4.1.2:** Means of finance

| S. No. | Details                        | 100% equity  | D/E- 70:30   | D/E- 50:50   |
|--------|--------------------------------|--------------|--------------|--------------|
| 1      | Additional (Share) Capital     | 15.66        | 4.70         | 7.83         |
| 2      | Internal Accruals              | -            | -            | -            |
| 3      | Interest free unsecured loans  | -            | -            | -            |
| 4      | Term loan proposed (Banks/FIs) | -            | 10.96        | 7.83         |
| 5      | Others                         | -            | -            | -            |
|        | <b>Total</b>                   | <b>15.66</b> | <b>15.66</b> | <b>15.66</b> |

## 4.2 Financial statement (project)

### 4.2.1 Assumptions

The assumptions made are provided in table 4.2.1.

**Table 4.2.1:** Assumptions made

| Details                   | Unit | 100% equity | D/E- 70:30 | D/E- 50:50 |
|---------------------------|------|-------------|------------|------------|
| <b>General about unit</b> |      |             |            |            |
| No of working days        | Days |             | 240        |            |

| Details  | Unit         | 100% equity | D/E- 70:30 | D/E- 50:50 |
|--|--------------|-------------|------------|------------|
| No of shifts per day                                       | Shifts       |             | 3          |            |
| Annual operating hours                                     | Hrs/year     |             | 6,000      |            |
| Installed production capacity                              | pieces/day   |             | 30,000     |            |
| Production in last financial years                         | pieces/day   |             | 25,000     |            |
| Capacity utilization factor                                | %            |             | 83         |            |
| <b>Proposed investment (Project)</b>                       |              |             |            |            |
| Total cost of the project                                  | Rs. in lakhs | 15.66       | 15.66      | 15.66      |
| Investment without interest defer credit (IDC)             | Rs. in lakhs | 15.66       | 15.66      | 15.66      |
| Implementation time  | Months       | 6.0         | 6.0        | 6.0        |
| Interest during the implementation phase                   | Rs. in lakhs | -           | 0.58       | 0.41       |
| Total investment   | Rs. in lakhs | 15.66       | 16.24      | 16.07      |
| <b>Financing pattern</b>                                   |              |             |            |            |
| Own funds  | Rs. in lakhs | 15.66       | 5.27       | 8.24       |
| Loan funds (term loan)                                     | Rs. in lakhs | -           | 10.96      | 7.83       |
| Loan tenure  | Years        | -           | 5.0        | 5.0        |
| Moratorium period (No EMI (interest and principal amount)) | Months       | -           | 6.0        | 6.0        |
| Total repayment period                                     | Months       | -           | 66.0       | 66.0       |
| Interest rate  | %            | -           | 10.5       | 10.5       |
| <b>Estimation of costs</b>                                 |              |             |            |            |
| Operation & maintenance costs                              | %            |             | 5.0        |            |
| Annual escalation rate of O&M                              | %            |             | 5.0        |            |
| <b>Estimation of revenue</b>                               |              |             |            |            |
| Reduction in energy cost                                   | Rs lakh/year |             | 4.31       |            |
| Total saving   | Rs lakh/year |             | 4.31       |            |
| Straight line depreciation                                 | %            |             | 16.21      |            |
| IT depreciation  | %            |             | 80.0       |            |
| Income tax   | %            |             | 33.99      |            |
| Period of cash flow analysis                               | Years        |             | 5.0        |            |

### 4.2.2 Payback

The simple payback period on the investments made are shown in table 4.2.2.

**Table 4.2.2:** Payback

| Details  | 100% equity | D/E- 70:30 | D/E- 50:50 |
|--|-------------|------------|------------|
| Total project cost (Rs. In lakh)               | 15.66       | 16.24      | 16.07      |
| Cash flow as annual saving (Rs. In lakh/year)  | 4.31        | 4.31       | 4.31       |
| O&M Expenses for first year (Rs. In lakh/year) | 0.78        | 0.81       | 0.80       |
| Net Cash flow (Rs. In lakh/year)               | 3.53        | 3.50       | 3.51       |
| SPP (months)                                   | 53.28       | 55.69      | 55.00      |
| Considered (month)                             | 53.30       | 55.70      | 55.00      |

### 4.2.3 NPV and IRR

The NPV and IRR calculations are shown in table 4.2.3.

**Table 4.2.3a:** NPV and IRR (100% equity)



| Particulars / years                             | 0             | 1    | 2    | 3     | 4     | 5     |
|---|---------------|------|------|-------|-------|-------|
|   | (Rs.in lakhs) |      |      |       |       |       |
| Profit after tax                                | -             | 0.99 | 3.67 | -0.09 | -0.26 | -0.31 |
| Depreciation                                    | -             | 2.54 | 2.54 | 2.54  | 2.54  | 2.54  |
| Cash outflow                                    | 15.66         | -    | -    | -     | -     | -     |
| Net cash flow                                   | -15.66        | 3.53 | 6.21 | 2.45  | 2.28  | 2.22  |
| Discount rate % @ WACC                          | 9.25          | 9.25 | 9.25 | 9.25  | 9.25  | 9.25  |
| Discount factor                                 | 1.00          | 0.92 | 0.84 | 0.77  | 0.70  | 0.64  |
| Present value                                   | -15.66        | 3.23 | 5.21 | 1.88  | 1.60  | 1.43  |
| <b>Net present value</b>                        | <b>-2.32</b>  |      |      |       |       |       |
| <b>Simple IRR considering regular cash flow</b> | <b>2.49%</b>  |      |      |       |       |       |

Table 4.2.3b: NPV and IRR (D/E- 70:30)

| Particulars / years                             | 0             | 1     | 2     | 3     | 4     | 5     |
|---|---------------|-------|-------|-------|-------|-------|
|   | (Rs.in lakhs) |       |       |       |       |       |
| Profit after tax                                | -             | 0.31  | 3.31  | -0.71 | -0.73 | -0.62 |
| Depreciation                                    | -             | 2.63  | 2.63  | 2.63  | 2.63  | 2.63  |
| Cash outflow                                    | 16.24         | -     | -     | -     | -     | -     |
| Net cash flow                                   | -16.24        | 2.94  | 5.94  | 1.92  | 1.90  | 2.01  |
| Discount rate % @ WACC                          | 10.09         | 10.09 | 10.09 | 10.09 | 10.09 | 10.09 |
| Discount factor                                 | 1.00          | 0.91  | 0.83  | 0.75  | 0.68  | 0.62  |
| Present value                                   | -16.24        | 2.67  | 4.90  | 1.44  | 1.29  | 1.24  |
| <b>Net present value</b>                        | <b>-4.69</b>  |       |       |       |       |       |
| <b>Simple IRR considering regular cash flow</b> | <b>-3.67%</b> |       |       |       |       |       |

Table 4.2.3c: NPV and IRR (D/E- 50:50)

| Particulars / years                             | 0             | 1    | 2    | 3     | 4     | 5     |
|---|---------------|------|------|-------|-------|-------|
|   | (Rs.in lakhs) |      |      |       |       |       |
| Profit after tax                                | -             | 0.50 | 3.41 | -0.53 | -0.59 | -0.53 |
| Depreciation                                    | -             | 2.61 | 2.61 | 2.61  | 2.61  | 2.61  |
| Cash outflow                                    | 16.07         | -    | -    | -     | -     | -     |
| Net cash flow                                   | -16.07        | 3.11 | 6.02 | 2.07  | 2.01  | 2.07  |
| Discount rate % @ WACC                          | 9.86          | 9.86 | 9.86 | 9.86  | 9.86  | 9.86  |
| Discount factor                                 | 1.00          | 0.91 | 0.83 | 0.75  | 0.69  | 0.62  |
| Present value                                   | -16.07        | 2.83 | 4.99 | 1.56  | 1.38  | 1.29  |
| <b>Net present value</b>                        | <b>-4.02</b>  |      |      |       |       |       |
| <b>Simple IRR considering regular cash flow</b> | <b>-1.91%</b> |      |      |       |       |       |

### 4.3 Marketing & selling arrangement

The marketing and selling arrangements of the unit are given in table 4.3.

Table 4.3: Marketing &amp; selling arrangements

| Items                                     | Remarks                   |
|---|---------------------------|
| Main Markets (locations)                  | All over India            |
| Locational advantages                     | -                         |
| Indicate competitors                      | Other manufacturing units |
| Any USP or specific market strength       | -                         |
| Whether product has multiple applications | NA                        |

| Items  | Remarks      |
|--|--------------|
| Distribution channels<br>(e.g. direct sales, retail network, distribution network) | Direct sales |
| Marketing team details, if any.  | NA           |

## 4.4 Risk analysis and mitigation

The risk analysis and mitigation for the proposed options are given in table 4.4.

**Table 4.4:** Risk analysis and mitigation

| Type of risk      | Description   | Mitigation  |
|-------------------|---|---|
| Technology        | The equipment/technology provided by the supplier may not be of high quality, which may result in underperformance.   | The equipment/technology should be procured from standard/reputed vendors only.   |
| Market /Product   | Demand of the product manufactured by the unit may change resulting in lower capacity utilization.                    | Regular vigilance/tab on the market scenario by the SME will help in better understanding of new substitute product. The unit may modify the product line based on the emerging market trend.   |
| Policy/Regulatory | Changes in government regulation/policy related to pollution and taxes & duties can affect the viability of the unit. | Local industrial association may play a role in discussing these issues with the relevant governmental bodies on a regular basis, so that any concerns of the unit are brought to their notice. |

## 4.5 Sensitivity analysis

A sensitivity analysis has been carried out to ascertain how the project financials would behave in different situations is given in table 4.5.

**Table 4.5:** Sensitivity analysis

| S. No. | Scenario                           | D/E ratio   | Payback period (months) | NPV (Rs lakh) | IRR (%) | DSCR | ROI (%) |
|--------|------------------------------------|-------------|-------------------------|---------------|---------|------|---------|
| 1      | 10% increase in estimated savings  | 100% equity | 47.50                   | -1.21         | 5.80    | -    | 6.60    |
|        |                                    | 70:30       | 49.60                   | -3.60         | -0.23   | 1.51 | 7.08    |
|        |                                    | 50:50       | 49.00                   | -2.93         | 1.48    | 2.08 | 6.85    |
| 2      | 10% reduction in estimated savings | 100% equity | 60.70                   | -3.43         | -0.97   | -    | 2.57    |
|        |                                    | 70:30       | 63.50                   | -5.78         | -7.33   | 1.29 | -4.25   |
|        |                                    | 50:50       | 62.70                   | -5.11         | -5.51   | 1.77 | -0.62   |
| 3      | 10% rise in interest rates         | 70:30       | 55.90                   | -5.09         | -4.33   | 1.38 | 1.02    |
|        |                                    | 50:50       | 55.20                   | -4.31         | -2.38   | 1.89 | 2.91    |
| 4      | 10% reduction in interest rates    | 70:30       | 55.40                   | -4.28         | -3.02   | 1.43 | 3.12    |
|        |                                    | 50:50       | 54.80                   | -3.72         | -1.45   | 1.96 | 3.91    |

## 5.0 Conclusions & recommendations

The IGDP has been prepared for the installation of solar PV rooftop system based on the performance assessment study conducted at unit and the acceptance of the unit management. The brief of selected energy conservation measure is given below.

### 5.1 List of energy conservation measures

The brief summary of the energy conservation measures are given in table 5.1.

**Table 5.1:** Summary of the energy conservation measures

| Energy conservation measure             | Annual electricity saving (kWh/year) | Investment (Rs. Lakh) | Monetary savings (Rs. Lakh/year) | Simple payback period (years) | Emission reduction (tonnes of CO <sub>2</sub> ) |
|---|--------------------------------------|-----------------------|----------------------------------|-------------------------------|---|
| Installation of solar PV rooftop system | 49,155                               | 15.66                 | 4.31                             | 3.60                          | 40.30   |

The measure has an estimated investment of 15.66 lakh rupees and can yield a savings of 4.31 lakh rupees per year. The total annual reduction in emission by implementation of recommended measure is estimated to be 40.3 tonnes of CO<sub>2</sub>. The financial indicators provided above in the table shows the project is financially viable and technically feasible.

### 5.2 Summary of the project

The summary of the project is given in table 5.2.

**Table 5.2:** Summary of the project

| S. No. | Particulars     | Unit        | 100% equity | D/E- 70:30 | D/E- 50:50 |
|--------|-----------------|-------------|-------------|------------|------------|
| 1      | Cost of Project | Rs. In Lakh | 15.66       | 16.24      | 16.07      |
| 2      | D/E Ratio       | -           | -           | 7:3        | 1:1        |
| 3      | Project IRR     | %           | 2.49        | -3.67      | -1.91      |
| 4      | NPV             | Rs. In Lakh | -2.32       | -4.69      | -4.02      |
| 5      | DSCR            | -           | -           | 1.40       | 1.93       |

### 5.3 Recommendations

The NPV (net present value) of the project will be positive for solar PV projects with longer project life span (20-30 years) and taxation benefits (accelerated depreciation). The solar PV project will also reduce GHG emissions caused due to use of grid electricity. It is recommended that the implementation of the identified the energy conservation measures may be undertaken by the unit.



## 6.0 Financing schemes for EE investments for MSME sector

Government of India has many schemes to provide concessional finance for EE technologies among MSMEs. Some major government schemes are summarised in table 6.1.

**Table 6.1:** Major government schemes

| Name of the scheme  | Brief Description and key benefits   |
|---|--|
| ZED assessment and certification  | <p>Assessment process, fee and subsidy are as follows:</p> <p>Online (e-Platform) self-assessment: Nil fee</p> <p>Desk Top assessment : Rs 10,000 per SME</p> <p>Complete assessment : Rs 80,000 ZED rating per SME; Rs 40,000 for additional ZED defence rating; Rs 40,000 for re-rating</p> <p>The rating costs will include cost of Rs 10,000/- as certification cost by QCI.</p> <p>Subsidy for Micro, Small and Medium Enterprises are 80%, 60% and 50% respectively.</p>   |
| Credit Linked Capital Subsidy Scheme (CLCSS) (2000-ongoing)   | 15% capital subsidy of cost of eligible plant and machinery / equipment for adoption of proven technologies for approved products / sub-sectors for MSE units subject to ceiling of INR 15 lakhs   |
| Credit Guarantee Fund Scheme for Micro and small Enterprises (in partnership with SIDBI) (2000-ongoing) | <p>This scheme was launched by MoMSME and SIDBI to alleviate the problem of collateral security and enable micro and small scale units to easily adopt new technologies. Under the scheme, collateral free loans up to Rs 1 crore can be provided to micro and small scale units. Additionally, in the event of a failure of the SME unit which availed collateral free credit facilities to discharge its liabilities to the lender, the Guarantee Trust would guarantee the loss incurred by the lender up to 75 / 80/ 85 per cent of the credit facility.</p> |
| Technology and Quality Up gradation Support to MSMEs (TEQUP) (2010-ongoing)                             | <p>The benefits available to SMEs under TEQUP include –technical assistance for energy audits, preparation of DPRs and significant capital subsidy on technologies yielding an energy savings of over 15%. The scheme offers a subsidy of 25% of the project cost, subject to a maximum of Rs. 10 lakhs. TEQUP, a scheme under NMCP, focuses on the two important issues in enhancing competitiveness of the SME sector, through EE and Product Quality Certification.</p>   |
| Technology Upgradation Fund Scheme (TUFS) (1999-ongoing)  | <p>Interest subsidy and /or capital subsidy for Textile and Jute Industry only.</p> <ol style="list-style-type: none"> <li>To facilitate Technology Up gradation of Small Scale (SSE) units in the textile and jute industries. Key features being: <ul style="list-style-type: none"> <li>Promoter's margin -15%;</li> <li>Subsidy - 15% available on investment in TUF compatible machinery subject to ceiling of Rs 45 lakh;</li> <li>Loan amount - 70% of the cost of the machinery by way of Term Loan</li> </ul> </li> </ol>                               |

| Name of the scheme | Brief Description and key benefits  |
|--------------------|---|
|                    | <ul style="list-style-type: none"> <li>• Interest rate: Reimbursement of 5% on the interest charged by the lending agency on a project of technology upgradation in conformity with the Scheme</li> <li>• Cover under Credit Guarantee Fund Scheme for Micro and Small Enterprises (CGMSE) available</li> </ul> <p>2. To enable technology upgradation in micro and small power looms to improve their productivity, quality of products and/ or environmental conditions</p> <ul style="list-style-type: none"> <li>• 20% margin subsidy on investment in TUF compatible specified machinery subject to a ceiling of Rs 60 lakhs or Rs 1crore (whichever is applicable) on subsidy amount to each unit – released directly to the machinery manufacturer.</li> </ul> |
| Tax incentives     | <ul style="list-style-type: none"> <li>• Accelerated depreciation is provided to the customers / users of the energy saving or renewable energy devises under the direct tax laws.</li> <li>• Under indirect taxes, specific concessional rates of duty are only available to CFLs and not to all energy efficient products</li> <li>• A further waiver of import tariffs and taxes for EE technology imports are dealt on a case to case basis, meaning higher costs for those imported technologies that are not available in the domestic markets at present.</li> </ul>   |

Two financing schemes have been created by Bureau of Energy Efficiency (BEE) under The National Mission for Enhanced Energy Efficiency (NMEEE) for financing of energy efficiency projects - Venture Capital for Energy Efficiency (VCFEE) and Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE). These funds seek to provide appropriate fiscal instruments to supplement the efforts of the government for creation of energy efficiency market. Highlights of these two schemes are provided in the table 6.2.

**Table 6.2:** BEE’s VCFEE and PRGFEE scheme

|  |  |
|--|--|
| Venture Capital for Energy Efficiency (VCFEE)              | <ul style="list-style-type: none"> <li>• This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase.</li> <li>• A single investment by the fund shall not exceed Rs 2 crore</li> <li>• Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less</li> </ul>  |
| Partial Risk Guarantee Fund for Energy Efficiency (PRGFEE) | <ul style="list-style-type: none"> <li>• A PRGF is a risk sharing mechanism lowering the risk to the lender by substituting part of the risk of the borrower by granting guarantees ensuring repayment of part of the loan upon a default event.</li> <li>• Guarantees a maximum 50% of the loan (only principal). In case of default, the fund will: <ul style="list-style-type: none"> <li>○ Cover the first loss subject to maximum of 10% of the total guaranteed amount</li> <li>○ Cover the remaining default (outstanding principal) amount on</li> </ul> </li> </ul> |

|   |   |
|---|---|
| Venture Capital for Energy Efficiency (VCFEE) | <ul style="list-style-type: none"> <li>This fund is to provide equity capital for energy efficiency projects in Government buildings and Municipalities in the first phase.</li> <li>A single investment by the fund shall not exceed Rs 2 crore</li> <li>Fund shall provide last mile equity support to specific energy efficiency projects, limited to a maximum of 15% of total equity required, through Special Purpose Vehicle (SPV) or Rs 2 crore, whichever is less</li> </ul> |
|   | <p style="text-align: center;">partial basis upto the maximum guaranteed amount</p> <ul style="list-style-type: none"> <li>PFI shall take guarantee from the PRGFEE before disbursement of loan to the borrower.</li> <li>The Guarantee will not exceed Rs 300 lakh per project or 50% of loan amount, whichever is less.</li> <li>Maximum tenure of the guarantee will be 5 years from the date of issue of the guarantee</li> </ul>   |

Indian Renewable Energy Development Agency (IREDA), a non-banking financial institution established by the government also extends financial assistance for setting up projects relating to new and renewable sources of energy and energy efficiency/conservation. The detailed financing guidelines for energy efficiency projects are provided in table 6.3.

**Table 6.3:** IREDA's financing guidelines

|  |   |
|--|---|
| Eligible companies who can apply           | Private Sector Companies/ firms, Central Public Sector Undertaking (CPSU), State Utilities/ Discoms/ Transcos/ Gencos/ Corporations, Joint Sector Companies which are not loss making.  |
| Minimum loan amount                        | <ul style="list-style-type: none"> <li>Rs. 50 lakh</li> </ul>   |
| Type of projects considered for term loans | <ul style="list-style-type: none"> <li>Replacement / retrofit of selected equipment with energy efficient equipment</li> <li>Modification of entire manufacturing processing</li> <li>Recovery of waste heat for power generation</li> </ul>  |
| Incentive available                        | <ul style="list-style-type: none"> <li>Rebate in central excise duty</li> <li>Rebate in interest rate on term loan</li> <li>Rebate in prompt payment of loan instalment</li> </ul>  |
| Interest rate                              | <ul style="list-style-type: none"> <li>10.60% to 11.90% depending upon the grading of the applicant with prompt payment rebate of 15 bps if payment is made on / before due dates</li> <li>Interest rates are floating and would be reset on commissioning of the project or two years from the date of first disbursement. Thereafter, the rates will be reset after every two years.</li> <li>Rebate of 0.5% in interest rates are available for projects set up in North Eastern States, Sikkim, J&amp;K, Islands, Estuaries. Rebates of 0.5% in interest rates are also available for projects being set up by SC/ST, Women, Ex Servicemen and Handicapped categories involving project cost of upto Rs. 75.00 lakh.</li> </ul> |
| Loan                                       | Upto 70% of the total project cost. Promoter's contribution should be Minimum 30% of the total project cost   |
| Maximum debt                               | 3:1   |

|                          |   |
|--------------------------|---|
| equity ratio             | The project cash flow should have a minimum average Debt Service Coverage Ratio of 1.3  |
| Maximum repayment period | 12 years with moratorium of maximum 12 months   |
| Procurement procedures   | The borrower is required to follow the established market practices for procurement and shall demonstrate that the quality goods and services are being purchased at reasonable and competitive prices. Wherever the loan is sanctioned against international lines of credit such as the World Bank, Asian Development Bank, KfW, etc., the relevant procedures will have to be followed and requisite documents will have to be submitted by the borrower |

Small Industries Development Bank of India (SIDBI) has several schemes and focused lines of credit for providing financial assistance for energy efficiency and cleaner production projects for SMEs. Highlights of some of the major financial assistance schemes/projects managed by SIDBI are given in table 6.4.

**Table 6.4:** Major EE financing schemes/initiatives of SIDBI

|  |   |
|--|---|
| End to End Energy Efficiency (4E) Program  | <p>Support for technical /advisory services such as:</p> <ul style="list-style-type: none"> <li>• Detailed Energy Audit</li> <li>• Support for implementation</li> <li>• Measurement &amp; Verification</li> </ul> <p>Financing terms:</p> <ul style="list-style-type: none"> <li>• Terms loans upto 90%</li> <li>• Interest rate upto 3% below normal lending rate.</li> </ul>   |
| TIFAC-SIDBI Revolving Fund for Technology Innovation (Srijan Scheme)                         | <p>To support SMEs for up-scaling and commercialization of innovative technology based project at flexible terms and interest rate.</p> <p>Preference accorded to sustainable technologies / products.<br/>Soft term loan with an interest of not more than 5%.</p>   |
| Partial Risk Sharing Facility for Energy Efficiency (PRSF) Project (supported by World Bank) | <p>Sectors covered:</p> <ul style="list-style-type: none"> <li>• Large industries (excluding thermal power plants)</li> <li>• SMEs</li> <li>• Municipalities (including street lighting)</li> <li>• Buildings</li> </ul> <p>Coverage:</p> <ul style="list-style-type: none"> <li>• The minimum loan amount Rs 10 lakh and maximum loan amount of Rs 15 crore per project.</li> <li>• The extent of guarantee is 75% of the loan amount</li> </ul> |
| JICA-SIDBI Financing Scheme  | <ul style="list-style-type: none"> <li>• The loan is used to provide SMEs with funds necessary to invest in energy-saving equipment (and some medical equipment) in the form of two-step loans through SIDBI or three-step loans through intermediary financial institutions.</li> </ul>  |



|                            |  |
|----------------------------|--|
|                            | <ul style="list-style-type: none"> <li>• Project uses an Energy Saving Equipment List approach</li> <li>• Equipment/machinery with energy saving potential less than 10% is not eligible.</li> <li>• Interest rate: As per credit rating and 1% below the normal lending rate</li> <li>• Separate technical assistance component which is used for wetting of loan applications, holding seminars to raise awareness of energy saving among SMEs and to improve the ability of financial institutions to screen loan applications for energy-saving efforts</li> </ul> |
| KfW-SIDBI Financing Scheme | <p>Coverage</p> <ul style="list-style-type: none"> <li>a) SMEs for energy efficiency projects</li> <li>b) SMEs and clusters for cleaner production and emission reduction measures, waste management and Common Effluent Treatment Plant (CETP) facilities</li> </ul> <p>Interest rate</p> <p>As per credit rating and 1% below the normal lending rate</p> <p>Eligible criteria</p> <p>3 t CO<sub>2</sub> emission reduction per year per lakh invested</p> <p>List of eligible equipment/technology and potential suppliers developed for guidance</p>               |

State Bank of India (SBI) has been provided a green line of credit by Japan Bank for International Cooperation (JBIC) for financing of energy efficiency investments. Highlights of the line of credit are given in table 6.5.

**Table 6.5:** JBIC-SBI Green Line

|  |
|--|
| <p><b><u>Key Features</u></b></p> <ul style="list-style-type: none"> <li>• Amount : USD 90 million</li> <li>• Repayment Schedule: First repayment on May 30, 2017 and final repayment date May 30, 2025 (equal instalment)</li> </ul> <p><b><u>Eligibility Criteria</u></b></p> <ul style="list-style-type: none"> <li>• Projects contributing to preservation of global environment, i.e. significant reduction of GHG emissions</li> <li>• Acceptance of JBIC-MRV (“J-MRV”) by the project proponent in terms of the numerical effect of the environment preservation. To ensure effective GHG reduction emissions in Green financed projects, JBIC reviews such effects through simple and practical Measurement Reporting Verification (MRV) process both in (a) prior estimation and (b) ex-post monitoring.</li> <li>• Procurement in line with the “Guidelines for Procurement under Untied Loans by Japan Bank for International Cooperation”</li> </ul> |
|--|

Canara bank has a dedicated scheme for financing EE investment among SME sector as mentioned in table 6.6.

**Table 6.6:** Canara bank scheme of EE SME loans

|                              |   |
|------------------------------|---|
| <b>Purpose</b>               | <b>For acquiring/adopting energy conservation/savings equipment/ measures by SMEs</b>   |
| <b>Eligibility</b>           | Units under Small and Medium Enterprises<br>Cost of energy for the unit should constitute not less than 20% of the total cost of production<br>Unit should possess energy audit report issued by an approved energy Consultant/Auditor.<br>Borrowal a/cs-ASCC code S1 or S2 during previous review.<br>Current account holders having dealings exclusively with us satisfactorily for a period of last one year |
| <b>Maximum loan</b>          | Maximum Rs 100 lakhs in the form of term loan   |
| <b>Security</b>              | Prime: Assets created out of loan<br>Collateral: Upto Rs.5 lakhs – NIL<br>Above Rs.5 lakhs, as determined by the bank   |
| <b>Repayment</b>             | Maximum 5-7 years including moratorium of 6 months  |
| <b>Guarantee cover</b>       | Cover available under CGMSE of CGTMSE available for eligible loans  |
| <b>Margin</b>                | 10% of the project cost   |
| <b>Rate of interest</b>      | 1% less than the applicable rate  |
| <b>Upfront fee</b>           | 1% of the loan  |
| <b>Insurance cover</b>       | Assets acquired and charged as security to Bank to be insured   |
| <b>Special offer, if any</b> | <b>Grants :</b> Bank provides 25% of the cost of Energy Audit / Consultancy charges with a maximum of Rs 25000/- to the first 100 units on a first come first served basis which is in addition to the grant of Rs 25000/- being provided by IREDA(First 100 units)   |

Among the private sector banks in India, Yes Bank is also active in financing of renewable energy and energy efficiency projects. The bank has an MOU with SIDBI for providing funding for EE through PRSF.

Most commercial banks charge interest rate between from 11% to 13% from MSMEs depending upon general criteria such as credit ratings, references, past lending record, balance sheet for last 3 years and so on. Interest rebate is offered for a few customers whose collateral value is around 125% of the loan amount. Further 0.5% concession in interest rate was offered to women entrepreneurs.

# Annexures



# Annexure 1: Budgetary offers / quotations

## Quotation - 1 : Green Energy



Date: 04-05-2018

### 35 KW Grids Connected/Interactive Roof top Solar PV Plant

#### Technical and Commercial proposal

Submitted to

Pawan Kumar Tiwari

**Contact:**

Mr. Sohil Panjwani  
+91 94264 17146

**MOTIVATION:**

India is not rich in conversional fuels like oil, gas and nuclear. We import these fuels and pay heavy amount offering exchange reserves. There is need to demonstrate and practice alternative energy solutions. Solar Energy is becoming an economically viable alternative for electricity supply. There is now significant reduction in the prices of solar electricity and hence solar electricity is economically viable alternative to grid electricity.

**Address :** Green Energy, Plot No – G 2016, GIDC Lodhika, Road – L, Almighty Gate,  
Near Minimatic Machines, Metoda, Dist. Rajkot, Gujarat –360021(INDIA)  
**Phone No:** 02827- 286296 **E-mail:** marketing@ecogreensolar.co.in



**Executive Summary:**

The proposed Roof Top Solar Photovoltaic (SPV) Power Plant will utilize the vacant area available on the terrace of your building. The SPV power plant with proposed capacity of 35 Kwp. would be a grid connected system without a battery bank. It would meet the partial load of the building during working hours. The 35 KW SPV power plant is estimated to inject 123 to 140 kWh of daily energy in DC side (subjected to the irradiance of the sun and weather condition, before considering the losses of the system). The SPV Power Plant will cost **15,66,000/- INR.** (Extra Charges: PGVCL Quotations + GEDA Fee **11,800/-** + Stamp paper **200/-**)

**SAILENT FEATURES:**

|                                |                                      |
|--------------------------------|--------------------------------------|
| <b>1. Location</b>             |                                      |
| a. State                       | Gujarat                              |
| b. City                        | Thangadh                             |
| c. Locality                    | Thangadh                             |
| d. Name of the building        |                                      |
| e. Latitude                    | 22.5761°                             |
| f. Longitude                   | 71.2010°                             |
| <b>2. Area under SPV</b>       |                                      |
| a. SPV power output            | Polycrystalline                      |
| a. Output                      | 35 Kw                                |
| b. Number of modules           | 110                                  |
| c. Power rating of modules     | 320wp*                               |
| <b>3. Mounting arrangement</b> |                                      |
| a. Mounting type               | Flat Roof mount (Standard Structure) |
| b. Tilt (slop) of PV module    | Shed tilt                            |
| <b>4. Inverter</b>             |                                      |
| a. Number of unit              | 35 kw – 1 Unit                       |
| b. Nominal power               |                                      |
| c. Efficiency                  | 98%                                  |
| <b>5. Cost Estimates</b>       |                                      |
| a. Estimated cost (INR)        | <b>15,66,000/-INR.</b>               |
| 6. System detail               | Grid tied                            |
| 7. Annual generation Unit      | 44713 Kwh from DC Side               |
| 8. Annual Utilization Unit     | NA                                   |
| 9. Turnaround time             |                                      |

\*Number of items may vary according to the module and inverter range availability

\*\*\*Price based on INR.

\*\*\*Validity 30 days.

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**Introduction:**

In the proposal shared below, **ECO GREEN SOLAR** assumes that the roof is suitable for mounting of the array (In case of top installation), with load bearing capacity greater than 25 kg/sq. m. based on the static load of modules and mounting structure. There will be additional dynamic wind loads only at wind speeds over 170 km/hr.

For this project, our recommended infrastructure for the installation of roof top SPV system comprises the following.

**Components and services**

1. **Modules** – A **320 WP** solar array comprising of 110 high efficiency Polycrystalline silicon modules.
2. **Mounting Structures** – Specifically designed mounting structures for shed/ground mounted rooftop installation.
3. **Inverter** – Inverters based on the latest String technology, which offer the highest level of efficiency and operational safety.
4. **Other Equipment** – DC cabling, AC cabling, Junction Boxes and Protection Systems.
5. **Project Management**– We will carry out the detailed design coordination and ideation with different vendors for procurement, installation and commissioning of the project. Throughout the course of the project, **ECO GREEN SOLAR** will be the sole point of contact for the client.
6. **Documentation and Training** – Professional and comprehensive documentation of the project will be done and submitted in the name of the client. Detailed and relevant training sessions will be conducted for each of the staff/concerned person likely to play a role in the operation and management of the system.
7. **Maintenance** – **ECO GREEN SOLAR** will provide free maintenance for the first 5 year, after which the client may opt for an affordable maintenance service. Your project is as important to us, as it is to you. It is our goal to ensure that your satisfaction with our work encourages you to recommend us to your friends, family and acquaintances.

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**Technology Selection:**

**Panels**

The Solar PV system shall be designed using multicrystalline silicon modules. Photovoltaic solar systems use the light available from the sun to generate electricity. PV panels convert the light reaching the system into DC power. The amount of power they produce is roughly proportional to the intensity and the angle of the light reaching them.

**Inverter**

A grid-tied inverter will be used to complement the solar power generated with grid power. Considering the specific requirements of Group, we suggest using inverter based on string technology. The suggested type of inverter will meet the requisite reactive power supply and provide grid support, thus reliably participating in efficient grid management.

**Remote Monitoring System**

A remote monitoring system will be integrated with your PV system enabling monitoring of the entire system from anywhere in the world. It keeps you clearly informed about the faultless operation of the system. A data logger will also be added to maintain historical data logs onsite.

**Others (Junction Boxes, Combiners, Protection Equipment)**

In addition to disconnecting from the grid (islanding protection) on detecting no grid/DG supply or under and over voltage conditions, the PV system shall be provided with adequately rated fuses on the inverter input side (DC) as well as the output side (AC) side for overload and short circuit protection. Disconnect switches to isolate the DC and AC system for maintenance or other relevant functions are also provided.

**Bill of Materials (Subjected to final design):**

| <u>Sr No</u> | <u>Description</u>             | <u>Unit</u> | <u>Quantity</u>    |
|--------------|--------------------------------|-------------|--------------------|
| 1            | 320 Watt Module                | Nos         | 110                |
| 2            | MC4 Connector (Male & female)  | Nos         | As per Requirement |
| 3            | Mounting Structure             | Nos         | As per Requirement |
| 4            | DC junction Box                | Nos         | As per Requirement |
| 5            | DC Cable up to Inverter        | Nos         | As per Requirement |
| 6            | Inverter (String Technology)   | Nos         | 35 kw              |
| 7            | Remote Monitoring              | Nos         | (Inbuilt)          |
| 8            | AC cable from Inverter to ACJB | Nos         | As per Requirement |

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|    |                                |         |                    |
|----|--------------------------------|---------|--------------------|
| 9  | AC Junction Box                | Nos     | As per Requirement |
| 10 | Cable glands, Cables ties etc. | Nos     | As Requirement     |
| 11 | Earthing system                | Nos     | As Requirement     |
| 12 | Installation Works             | Lumpsum |                    |
| 13 | Lighting arrestor              | Nos     | As Requirement     |
| 14 | No Volt Relay                  | Nos     | As Requirement     |

**Quantity of material**

| Sr No | Material Description               | Unit | Qty | Make                                 |
|-------|------------------------------------|------|-----|--------------------------------------|
| 1     | Solar PV Modules - Polycrystalline | kW   | 35  | Raj Ratana Solar or Equivalent       |
| 2     | Solar Module Mounting Structure    | kW   | 35  | GI Pipe                              |
| 3     | Solar String Inverter              | kW   | 35  | Solax or Equivalent                  |
| 4     | <b>Balance of System</b>           |      |     |                                      |
| i     | DC & AC Cables                     | Set  | 1   | KEI DC Cable & Finolex or Equivalent |
| ii    | Earthing & Lightning Protection    | Set  | 2   | Shree Vasudha Gel Earthing Electrode |
| iii   | Switchgear Protection System       | Set  | 1   | ETON, L&T or Equivalent              |
| iv    | Energy Meters                      | Set  | 1   | As per DISCOM standard               |

\*Number of items may vary according to the module and inverter range availability.

**Scope of work and Development Schedule:**

Typical scope of work and Technology

| Sr no | Services   |
|-------|--|
| 1     | Services for final design and drawing                                      |
| 2     | Installation of roof mounted PV support structures                         |
| 3     | Installation of PV panels and electrical connections                       |
| 4     | Testing and Installation of Inverter                                       |
| 5     | Complete Cabling   |
| 6     | Project management (including documentation)                               |
| 7     | Supervision of system installation and commissioning                       |
| 8     | Complete arrangement of labour for installation and installation of system |
| 9     | Training of staff  |

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#### Exclusions

- Any work related to enhancing the roof load bearing capacity.
- Site levelling, removal of obstructions like trees, bushes, transmission lines or any other obstructions below or above the ground.
- Permanent access route to the roof shall be provided by the client or will be charged separately.
- Plant safety and security after handing over the plant.

#### Training

Local staff will be trained after commissioning of the project for effective operation and maintenance of the

Installed system, with specific guidance on:

- Operation of the system
- Safety rules for the operation of the system
- Basic maintenance requirements
- Troubleshooting
- Use of the monitoring features of the system
- Identification of the main protection devices

#### Project Schedule

The precise duration and project schedule will depend on site specific conditions like road access, topography and time of the year (seasonal variations). The procurement process will commence after detailed engineering has been carried out and approved by the client. We expect a staggered delivery over a period of 2 months for the delivery of major components and approximately 1-2 weeks execution time from commencement of the construction.

However, the project schedule may be optimized by mutual agreement between the client and ECO GREEN SOLAR, prior to actual signing of the contract.

- The project team will be led by ECO GREEN SOLAR staff from India. It will also include approved and selected Indian subcontractors.
- The compliance to local regulations (electrical, mechanical and civil) will be ensured by our engineering department.
- The design and project management will be organized in accordance with Indian standards. HSE (Health, Safety and Environment) management on site will be organized by ECO GREEN SOLAR or a local contractor under ECO GREEN SOLAR supervision, with a permanent staff member on site.

The delivery date of the project will be decided on the date of placement of the order by the client. The time schedule given above is for the purpose of reference and shall be reviewed

---

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after understanding the client's ability to achieve the required permits, financing and detailed definition of the site conditions.

#### Client Scope of Work

Client will be responsible for:

- Providing architectural and structural drawings for the building/rooftop.
- Unfettered access to the roof and electrical room during construction and subsequent maintenance of the power plant. This shall include a permanent access route to the roof.
- Facilitating preparedness of the roof top area for installation of the solar power plant.
- Facilitating electrical connection to the existing grid/load point (after energy meter).
- Appropriate storage space for materials during construction of the plant.
- Auxiliary power required during construction.
- Suitable storage space for the inverter & other electrical hardware.
- Water for cleaning along with requisite drainage facilities.
- Provision for lighting on the roof (as required).

#### Warranty Conditions

##### PV Modules by Manufacturer

- 25 years performance warranty (90% up to 10 years, 80% up to 25 years)
- 5 years inverter warranty against manufacturing defects.
- IEC 61215, IEC61730 and CE certified

##### Inverters by Manufacturer

- 5 Years warranty (Expandable as per requirement at extra cost) Full system warranty from **ECO GREEN SOLAR** for 5 year which will include:
  - Terminal boxes, laying the main direct current cable and setup of the grounding device, 5 year from the date of commissioning.
  - Electric installation works in the inverter operation building if used, such as inverter connection to DC and AC as well as installation of ventilation, lights and sub-distribution, 5 year from the date of commissioning.
  - Installation works and provided equipment of the generator terminal box, transformer station and power supply unit, 1 year from the date of commissioning.
  - Guarantee for the structural safety and stability of the mounting system for a period of 5 year.

Until the conclusion of the warranty period plus the operating period of the project, **ECO GREEN SOLAR** shall have access rights to all parts of the plant and to the reports on its work and output.

---

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This warranty shall not apply to defects resulting from:

- Willful damage or negligence, normal wear and tear.
- Replacement of consumables like fuses etc.
- Installation and/or maintenance by customer or a third party.
- Misuse or abuse of equipment.
- Modifications or alterations made by customer or a third party without consent from Eco Green Solar.

Payment Terms

- 1) 10% at time of order confirmation.
- 2) 70 % at times of delivery.
- 3) 20 % after successful installation.

Validity

This commercial proposal is valid for 30 days from the date of submission.

Confidentiality

The information shared in this document should be treated truly confidential. Due respect should be taken to maintain the confidentiality of this document. Producing copies, sharing and circulation must be completely avoided. If required to do so, written permission should be taken while disclosing, sharing, reproducing, copying or circulating

TERMS AND CONDITIONS

**1. Technical design**

Technical design may change as per the site conditions, **ECO GREEN SOLAR** reserve the right to change the technical specifications without the prior notice.

**2. Taxes**

Inclusive.

**3. Delivery**

Material will be delivered as per mutual agreed scheduled.

**4. Warranty**

Our proposal is subjected to the standard warranty of the original manufacturer of the product. Due to continuous R&D the product is subjected to the continuous improvement and change, Hence product is subjected to change with prior notice.

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**5. Force Majeure.**

Our proposal is subjected to force Majeure clause. **ECO GREEN SOLAR** will not responsible for any delay or not supply of material, implementation of projects, management or providing any kind of services or related scope of work due to natural calamities, cyclone, rain, flood, strike, riots, major accident, diseases, war or any other act/ any events beyond control of **ECO GREEN SOLAR**. Thus, our payment should not be stopped or delay.

**6. Jurisdiction**

Our proposal is subjected to RAJKOT.

**7. Other Work**

Any other work which is not covered under our scope of work/ services or include in quote, have to be done by the client with their own cost as directed by our representative in the stipulated time in order to complete the work.


**8. Discom Charge**

Discom connectivity charge, TFR cost, GEDA Application fees is in scope of Customer.

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## Quotation – 2 : Tata Solar



Commercial Proposal  
For 35kWp Solar Rooftop System

**TATA POWER SOLAR**  
ENABLING SOLAR EVERYWHERE

Mangaldeep Ceramics,  
Thangadh INDIA,  
Date: 09<sup>th</sup> May 2018



Type of Business : Solar Rooftop/ Ground mount

Customer Name : **Mangaldeep Ceramics**  
(Hereinafter referred to as the "Customer")

Proposed Capacity : **35 KWp.**

Business Point of Contact :Veer Shukla(Aditya glow)



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### Confidentiality & General Conditions Notice

This commercial proposal for installation of solar rooftop power system (the **"Proposal"**) is submitted with the intent of executing a definitive and legally binding agreement (the **"Agreement"**) following an award of business to TATA POWER SOLAR SYSTEMS LIMITED (**"TATA Power Solar"**). The Proposal itself is a legally binding offer to contract and in the event of an award to TATA Power Solar, it shall execute an Agreement that will be the complete agreement between the parties, however, where the parties do not execute any such Agreement, then the terms and conditions mentioned in this Proposal shall govern any purchase order(s) issued by the Customer in reference to the installation of rooftop solar power system.

This Proposal constitutes confidential and proprietary information of TPS and requires that Customer treat the information contained in this Proposal as confidential. Customer may use the information contained in this Proposal solely for the purposes of evaluating this Proposal and executing the Agreement with TATA Power Solar. This Proposal and all supporting documentation and manuals provided to Customer in connection with this Proposal shall remain the property of TATA Power Solar and must be returned immediately upon request.

This Proposal is based upon the set of requirements provided by Customer to TATA Power Solar, and certain reasonable assumptions taken by TATA Power Solar and that may be set forth by Owner. If Customer alters the requirements or if any assumption stated herein are false or inaccurate, then this Proposal, including pricing, may change. Implementation of any services detailed in this Proposal is subject to applicable legal and regulatory norms and requirements in force as on the date when services are to be implemented and such implementation may vary to cater to the requirements of such applicable legal and regulatory norms and requirements.



## A. Introduction:



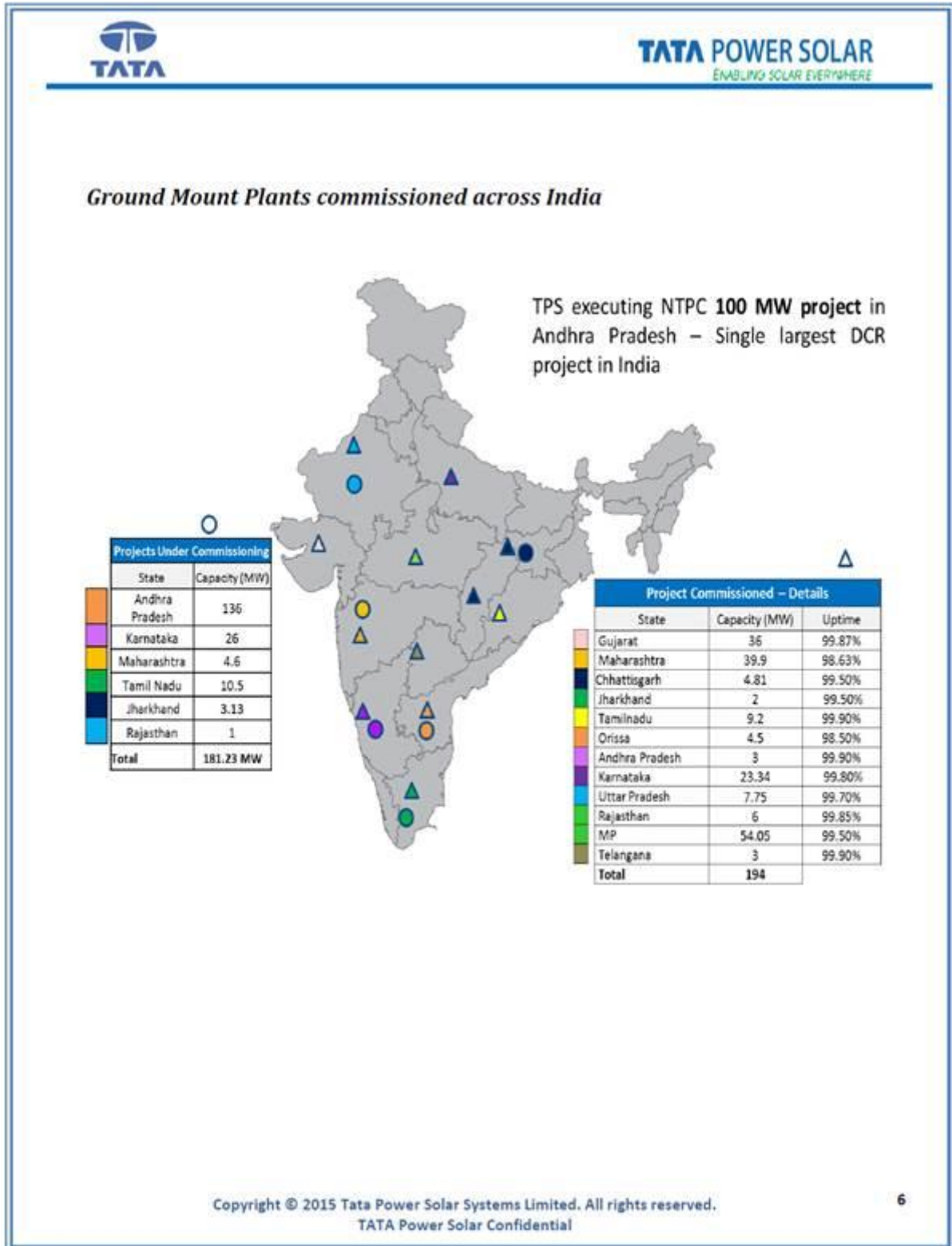
Tata Power Solar, a wholly owned subsidiary of TATA Group, is a fully integrated solar solutions provider in India. Founded in 1989, TATA Power Solar was originally formed as a joint venture between TATA and British Petroleum (BP Solar). Headquartered in Bangalore, TATA Power Solar has a workforce of approximately 700 employees, and has around 25 years of domain expertise.

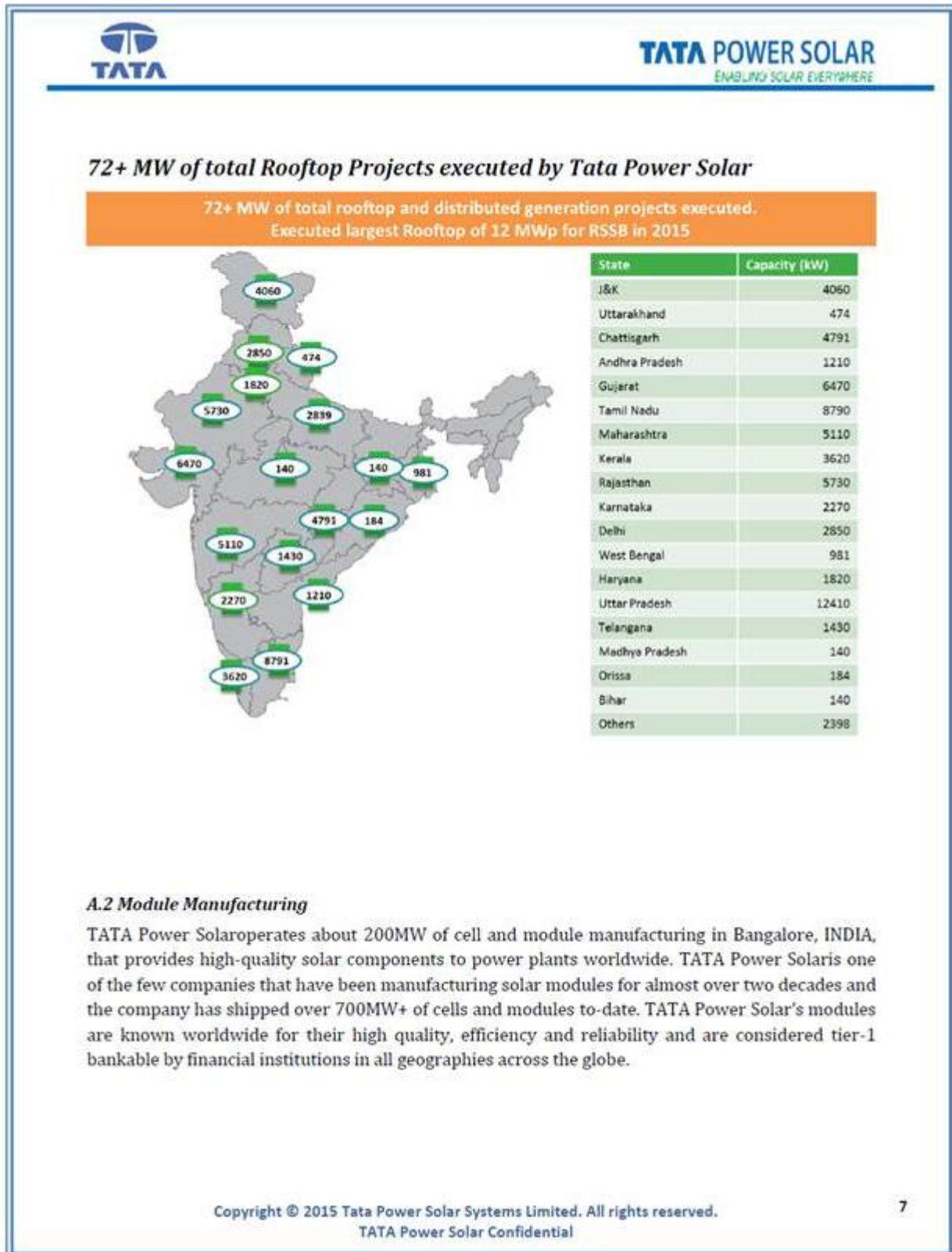
Tata Power Solar focuses on 3 main areas of the solar value chain: manufacturing, EPC and consumer products:

- TPS operates 180 MW of solar cell and 200 MW of solar module manufacturing in Bangalore and is recognized as one of the most bankable tier-1 manufacturers worldwide.
- As one of the pioneers in the solar EPC field, TPS has installed and maintains over 200+ MW of large and small projects across India. In 2013-14, it is building over 90 MW of ground mount projects including 50 MW for NTPC and 29 MW for Tata Power, two of the largest utilities in India.

### **A.1 Project Details**

TATA Power Solar has constructed more than 260+ MW of projects all over India out of which 70+ MW has been commissioned in rooftop segment. It has also been a pioneer in the growing solar industrial solutions space, as many companies move away from captive diesel plants to captive solar power plants to power their factories and businesses.









**TATA POWER SOLAR**  
ENABLING SOLAR EVERYWHERE

Pictures of sample projects enclosed



Titan Industries – 100kWp IIT Roorkee – 1800 kWp Tata Consultancy Services – 60 kWp



RadhaswamiSatsang – 12MWp

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TATA Power Solar Confidential

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Vagdevi Villas - 100KWp

## B. Technical Details:

### *B.1 Key Facts of the Power Plant*

Design, supply, installation, testing and commissioning of a solar power plant

**Location:** Mangaldeep Ceramics, Thangadh.

**Plant capacity:** 35 KWp



**PV Technology/ Module:** Crystalline - PV

**Mounting Structure:** On the GI/Asbestos roof.


**B.2 Tentative Bill of Materials:**

| TYPICAL BILL OF MATERIALS |  |           |                                       |     |
|---------------------------|--|-----------|---------------------------------------|-----|
| Sr. No                    | Description of Major Supply Items                                    | Total Qty | Make                                  | UoM |
| 1                         | Solar PV module: 265 Wp, multicrystalline Silicon                    | 132       | Tata Power Solar, Indian made         | no  |
| 2                         | Module mounting structure  | 1         | TPS Approved Vendors                  | Set |
| 3                         | Array Junction Box (4in-4out, with MOV & Fuses)                      | 1         | Trinity/Hensel/ TPS Reputed vendors   | No  |
| 4                         | Grid Connect Solar Inverter (1 x 30KW, 415V AC, 50Hz, MPPT),         | 1         | TPS Approved Vendors                  | No  |
| 5                         | Monitoring: Data Logger-1No, 5Yr Remote Monitoring on TPS Portal     | 1         | TPS Approved Vendors                  | Set |
| 6                         | ACDB Panel with MCCB Breakers on RCC roof                            | 1         | TPS Approved Vendors / Eligant / Eqv. | Set |
| 7                         | 1C X 4 Sq.mm. EB XLPE Cu.cable (Array Interconnection & to Inverter) | 1         | KEI/Siechem/eqv                       | Set |
| 8                         | 4C X 10 Sq.mm. EB XLPE Cu cable (Inverter to ACDB)                   | 1         | KEI/Siechem/eqv                       | set |
| 9                         | 3.5 C X 50 Sq.mm. EB XLPE Al cable (ACDB to LT panel)                | 1         | KEI/Siechem/eqv                       | set |
| 10                        | Earthing Kit, Earthing Wire & GI Earth Strip (25mm x 5mm)            | 1         | TPS Approved Vendors                  | set |
| 11                        | Lightning Arrestor   | 1         | TPS Approved Vendors                  | set |
| 12                        | MC-4 Cable Couplers (Male & Female Pairs)                            | 1         | Bizlink / Multi-Contact / Eqv.        | set |
| 13                        | Installation kit (Comm. Cable, Inverter Canopy etc)                  | 1         | Tata Power Solar                      | set |

Final BOM may be varied as per engineering layout. capacity and other parameters remains same.

|   |   |
|---|---|
| <b>EXCLUSIONS</b>   | Computer, internet connectivity and related hardware  |
|   | Construction water and power. Water connection <50 meters from solar array for cleaning of modules  |
|   | Rooftop acquisition and titles.   |
|   | Any liasoning with local authorities, state government or central government officials related to the solar power plant. All statutory clearances and approvals are to be sought by Customer and the same are in Customer's scope of duty, including CEIG and State Nodal Agency approval |
|   | Scope of work of TATA Power Solar is electrical connection up to LT panel. LT panel and additional connection points in the LT panel are in Customer scope of duty.   |
|   | Spare feeder in LT panel  |
|   | Access to the roof via staircase for movement of men and material   |
|   | Scaffolding/ safety line/ Walkways and handrails for workmen at site  |
|   | Module Cleaning System and pressurized water during O&M   |
|   | Cables and associated accessories as per the BOM attached. Any variations will be charged extra to the customer   |
|   | Civil works, trenching etc for cable routing to the connection point except as mentioned in the BOM   |
|   | Parking lot structure and civil work is not in our scope  |
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C. Commercial Offer:

**C.1 Price for design, supply, installation, testing and commissioning**

Price offer for design, engineering, supply, transportation, installation, testing & commissioning of the:35 KWp: Total as 35KW solar PV plant as per bill of material enclosed above:

| PRICE SUMMARY  | Total                |
|--|----------------------|
| Design, Supply and Transportation(@ 5% GST)  | Rs. 15,16,000        |
| Erection, Testing and Commissioning ( @ 18% GST)                                     | Rs. 94,000           |
| <b>Total Price of system(GST &amp; Govt Liaising will be charge extra at actual)</b> | <b>Rs. 16,10,000</b> |

**C.2 General Terms & Conditions**

- 1) **PRICE:** The price quoted in this Proposal is inclusive of design, manufacturing, sourcing, testing, supply, installation & commissioning, as per the bill of materials & ratings submitted by TATA Power Solar along with the final offer. Any change in scope of work or addition to the bill of materials and/or ratings or any variation, whatsoever, shall be charged extra to Customer. The price quoted is CIF site and is firm. The price is exclusive of any annual maintenance charges or comprehensive maintenance charges or operation & maintenance charges.

The foreign exchange rate is considered as Current USD rate and any changes in foreign exchange rate shall be passed through and payable by the Customer. Foreign exchange rate shall be considered on the date of order placement and payment of advance.

- 2) **VALIDITY OF OFFER:** The price quoted by TATA Power Solar along with this Proposal is valid for thirty (30) days from such communication to Customer and thereafter the same shall be subject to reconfirmation by TATA Power Solar.



- 3) **PAYMENT TERMS:** The payment terms applicable are as follows:
- a) Advance amount of 10% of the total contract value to be paid by Customer along with the Purchase Order.
  - b) 20% of the total contract value to be paid by Customer on submission of Array layout drawing.
  - c) 60% of the total contract value to be paid by customer on readiness of material before delivery.
  - d) 10% of total contract value to be paid by customer on successful installation and commissioning of plant within seven days.
- 4) **TAXES, DUTIES AND RATES:**
- TPS at its sole discretion shall have the liberty to raise invoices from any location in India. All the applicable taxes on the supply portion of the materials shall be payable by the Customer at actual.
- 5) **INCLUSION OF EXCLUDED ITEMS:** Any items not mentioned in the bill of material shall be charged extra and will be to customer's account.
- 6) **ACCESS AND PERMITS:** The Customer shall ensure the accuracy of all information and/or data to be supplied by the Customer and shall be responsible for acquiring and providing legal and physical possession of the Site and access thereto, for preparation and maintenance of proper access roads to, and provide the right of way for, the site, and for providing possession of and access to all other areas reasonably required for the proper execution of the construction work, including all requisite rights of way. Customer shall ensure handing over valid road permits (multiple numbers depending on number of truck loads) to TATA Power Solar at least five (5) working days prior to dispatch of any supplies.
- 7) **INTERRUPTIONS IN WORK:** The Customer must not interrupt the works, and/or shall abstain from any act or omission of which it can reasonably be expected that it may delay the works or make the works more difficult and or expensive for TATA Power Solar.
- 8) **DELIVERY & HANDOVER:** TATA Power Solar shall complete the project in Fourteen(14) weeks from date of order placement, payment of advance and acceptance of order by TPS, or as mutually agreed between the parties in the Agreement. Project shall be deemed to have been handed over to Customer by TATA Power Solar, on commissioning of the solar power plant.



**9) DEEMED EXPORT OF POWER**

The Project shall be termed as commissioned when TATA Power Solar evacuates the power generated to Customer grid. However, in case where TATA Power Solar has completed its duties as per the scope of duties mentioned in the Purchase Order, and the Project cannot be commissioned due to any act/inaction on the part of Customer, or due to unavailability of Customer grid, then the Project shall be deemed to be commissioned and TATA Power Solar shall be deemed to have completed its part of obligations under the Purchase Order

**10) WARRANTY:** The solar power plant carries a five (5) years' warranty against any manufacturing defects, as per existing warranty policy of TATA Power Solar. Solar photovoltaic modules carry a performance warranty against excess of 20% degradation in twenty five (25) years as per existing warranty policy of TATA Power Solar.

**11) SECURITY & SAFETY:** On delivery of supplies to Customer's site in good condition, Customer shall be responsible for safety & security of the materials till handing over of the same to TATA Power Solar designated personnel for installation. In case there are public disturbances at site which are not exclusively attributable to TATA Power Solar, Customer shall resolve the same at its own risk & cost, for smooth execution of the project by TATA Power Solar. In such case, Customer shall provide safety & security for the TATA Power Solar designated personnel working at site. Any delay in execution or damage of materials due to public disturbances at site shall be attributable to and compensated by Customer.

**12) CIVIL & STRUCTURAL WORK:** TATA Power Solar limits itself to providing civil foundation and structures for its module mounting as per the design submitted along with this Proposal. Any changes in design which are attributable to Customer shall be charged extra. Customer shall allow scrapping of the roof for bonding the civil foundation.

**13) LIMITATION OF LIABILITY:** Notwithstanding anything contained in this Proposal, its appendices, any offer, or order to the contrary, with respect to any and all claims arising out of the performance or non-performance of obligations under this Proposal or resultant Agreement or purchase order(s), whether arising in contract, tort, warranty, strict liability or otherwise, total liability of TATA Power Solar shall not exceed beyond 5% of the total contract value received from Customer.

Notwithstanding anything contained anywhere else in this Proposal, or in the resultant Agreement, or anywhere else, in present or in future, in no event shall TATA Power Solar be liable, whether in contract, tort or otherwise, to the Customer for special, indirect or consequential loss or damage (such as, not exclusively, loss of production, loss of reputation, loss of income, loss of profit, etc.).





- 14) **INDEMNIFICATION:**Customer shall fully Indemnify and hold harmless TATA Power Solar and its affiliates, associates, directors and employees from and against, any and all losses, costs, damages, injuries, liabilities, claims and causes of action, including without limitation arising out of or resulting from claims by third parties, acts, omissions or breach of any of the Customer's affiliates, suppliers, employees, agents or contractors in the performance of Customer's obligations under this Proposal or any resultant Agreement or otherwise arising out of any breakage of asbestos roof, other health hazards arising out of roof condition, the solar power system and its usage.
- 15) **INSURANCE:**For the offered supplies and services, TATA Power Solar shall cover insurance for marine-cum-storage-cum-erection through appropriate erection all risk policy for all offered items till commissioning. On commissioning of the solar power plant, suitable asset insurance will have to be arranged by Customer at its own cost since the asset is in the name the customer
- 16) **FORCE MAJEURE:**Force majeure shall mean any cause, existing or future, which is beyond the reasonable control of TATA Power Solar including, but not limited to, acts of God, storm, fire, floods, explosion, epidemics, quarantine, earthquake, strike, riot, lock out, embargo, interference by civil or military authorities, acts, regulations or orders of any governmental authority in their sovereign capacity, acts of war (declared or undeclared) including any acts of terrorism, and all other such acts of similar or analogous nature (where all such acts to be collectively referred to as "**Force Majeure**"). TATA Power Solar shall not be liable for the failure to perform any obligation in terms of this Proposal if and to such extent such failure is caused by a Force Majeure, provided that none of such acts of Force Majeure will relieve the Customer from meeting its payment obligations.

The periods for performance as agreed upon shall be extended by the periods of delay caused by such Force Majeure, as long as the period of Force Majeure does not last longer than three (3) months.If a Force Majeure continues for more than three (3) months and the parties are not able to reach an agreement on the continuation of work within a further term of one (1) month, the fulfillment of obligations of TATA Power Solar shall automatically be deemed impossible and shall stand suspended.

Upon such suspension, TATA Power Solar shall be entitled to be paid the following amounts: (a) all the amounts payable for the works completed until the date of suspension; (b) the cost of materials which have been delivered to Customer, or of which Contractor is liable to accept delivery; (c) any other cost or liability, including unamortized cost of materials, which in the circumstances was reasonably incurred by TATA Power Solar in the expectation of completion of the works; (d) demobilization costs of Contractor personnel and equipment; and (e) all other costs incurred by TATA Power Solar on account of suspension of order on such other suppliers.



- 17) **PUBLICITY RIGHTS:** The Customer agrees and gives its irrevocable and unconditional consent to TATA Power Solar to issue any press release or announcement relating to this Proposal, or any resultant Agreement, or use the data, photographs, designs, etc. of the solar power plant for its publicity and/or marketing activities or use the same for publication anywhere. TATA Power Solar understands and agrees that no such usage shall be in a manner defamatory to the Customer.
- 18) **ARBITRATION:** Any dispute, including claims seeking redress or asserting rights under applicable law, shall, be resolved and finally settled in accordance with the provisions of the Arbitration and Conciliation Act, 1996, as may be amended from time to time or its re-enactment. The arbitral tribunal shall be composed of two arbitrators to be appointed by each of the parties and the third arbitrator shall be appointed by the arbitrators appointed by the parties and for such arbitration, the seat of arbitration shall be in New Delhi, India. All proceedings of arbitration shall be held in English.
- 19) **GOVERNING LAW AND JURISDICTION:** All questions concerning the construction, validity and interpretation of this Proposal or any resultant Agreement will be governed by the laws of India, and the courts at New Delhi, India shall have exclusive jurisdiction with respect to any dispute that occurs hereof. No remedy described in this Proposal or any resultant Agreement shall in any way limit the parties' remedies available at law, in equity or otherwise in relation to any breach or threatened breach of the terms and condition of the Proposal by any defaulting party, and any party may seek a restrictive injunction from an appropriate court of law to safeguard its interests.

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