## **Detailed feasibility study survey form – Solar grid-connected system**

Version 3, 14 February 2023

**Note to surveyor:** Please take as many photographs as possible, GPS location tagging, and videos of the project location specific to the sections in the form below (for example, solar array location, powerhouse, power evacuation location, etc.)



 = take photos = record the GPS point(s) = use measuring tape

|  |  |
| --- | --- |
| Tools required during the survey | Checklist |
| GPS device |  |
| Measuring Tape (>50 meters) |  |
| Power analyser |  |
| Mobile phones with camera, calculator, angle meter |  |
| Pen and notebook |  |
| A3 printout of Google map/field papers with positions of the facility etc., (for easy layout of site details) |  |
| Civil and architectural drawings of the facility |  |
| Suitable mobile application to find and record sun path diagrams for 12 months |  |

|  |  |
| --- | --- |
| Documents to be collected from the site | Checklist |
| NEA electricity bills for the last 3 years |  |
| Diesel generator set log sheet for at least 1 year (3 years preferred) |  |
| Distributor side statutory requirements, limitation, capacity |  |
| Single line diagram/Electrical as-built diagram of the whole facility |  |
| Site load list (list of all the electrical equipment with ratings) |  |

The following section gathers data about the selected site and related information which will be helpful in planning and designing the system and operational modality.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Location information | | | | | | | | |
| Name of the Organisation/ Customer |  | | | | | | | |
| Key contact person | Name: | | | Contact no.: | | Email: | | |
| Tole name |  | | | | | Ward no.: | | |
| Village/Town |  | | | | | | | |
| Rural municipality/municipality |  | | | | | | | |
| District |  | | | | | | | |
| Province |  | | | | | | | |
| Nature of business |  | | | | | | | |
| Facility expansion plans | Yes | | | | No | | | |
| If yes, mention details: | | | | | | | |
| Which mobile network works best? | NTC  Ncell  Others: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | | | | | | |
| Geographical coordinates of the site | Latitude |  | | Longitude |  | Elevation | |  |
| Temperature range | Minimum (°C) | |  | | Maximum (°C) | |  | |
| Preferred model | CAPEX | | | | OPEX/ESCO | | | |
| Others (mention): | | | | | | | |



|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| General information | | | | |
| Study team | | | | |
| SN | **Name** | **Designation** | **Phone no.** | Signature |
| 1 |  |  |  |  |
| 2 |  |  |  |  |
| 3 |  |  |  |  |

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| --- | --- | --- |
| Ownership  *(Information from the Commercial/Industrial facility)* | | |
| Probable ownership of the solar grid-connected system *(tick all that apply)* | Self-owned   Installer   Third party, mention: | |
| Probable management of the solar grid-connected system *(tick all that apply)* | Self-managed   Installer   Third party, mention: | |
| Source of project funds (*estimated*) | **Contribution (NPR)** | **Remarks**  *(if % share is applicable, indicate here)* |
| Subsidy (mention the donor agency) e.g. AEPC |  |  |
| Contribution from the beneficiary |  |  |
| PG/LG contribution |  |  |
| Third-party contribution |  |  |
| For OPEX/ESCO, contribution from developer |  | |
| Financial institutions - FIs *(loan/equity)* |  |  |
| In the case of loans from financial institutions (FI) | | |
| Name of FI | **Interest rate per annum** | **Term period *(years)*** |
|  |  |  |
|  |  |  |
|  | | |
| Loan/credit experience | | |
| Does the organisation have prior loan/credit experience? For purchase of diesel generator, online UPS, solar PV system, etc. | Yes  No | |
| If yes, for what purposes was the loan taken? | 1. | |
| 2. | |
| 3. | |
| 4. | |

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Site accessibility | | | | |
| Name of the road up to the facility |  | | | |
| Is the road motorable (from the roadhead to the project site)? | Yes  No If yes, road type:  Asphalt coated  Gravel  Earthen | | | |
| If no, mention the means of access (E.g., Walking, two-wheeler only, etc.): | | | |
| If access to the site is NOT motorable | Name of the nearest motorable road from the site: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Type of vehicle access:   22ft truck  Tractor  Pickup trucks  Hand-held tractorsDistance from the site to the nearest accessible road: \_\_\_\_\_\_\_\_\_\_\_ kmTime taken to reach the nearest motorable road (From the site): \_\_\_\_\_\_\_\_ hoursoad type:  Asphalt coated  Gravel  Earthen | | | |
| Indicate the months when the site is accessible/not accessible | January | Accessible Not accessible | July | Accessible Not accessible |
| February | Accessible Not accessible | August | Accessible Not accessible |
| March | Accessible Not accessible | September | Accessible Not accessible |
| April | Accessible Not accessible | October | Accessible Not accessible |
| May | Accessible Not accessible | November | Accessible Not accessible |
| June | Accessible Not accessible | December | Accessible Not accessible |
| What is the nearest airport? | Name of the airport: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Walking distance from the airport to the site: \_\_\_\_\_\_\_\_\_\_\_km | | | |
| Describe directions to the facility (for example, landmarks, key directions) | *(The purpose of the collection of this data is to provide guidance to anyone who wants to reach the site by enquiring with the dwellers)* | | | |

The following section gathers information on the electricity demand of the facility, existing energy sources scenario etc., vital information for designing the type and size of the system.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Electricity demand, plant operation, and current energy source information | | | | | | | | | | |
| Current source of electricity  *(Please use extra sheets, if required)* | | | | | | | | | | |
| SN | **Type of energy source** | | | | | | | | | |
| 1. | **Primary source (e.g., national grid)** | |  | | | | | | | |
| Transformer (kVA) | |  | | 1- phase | | 3-phase | |
| Load (Ampere) | |  | |  | |  | |
| 2. | **Secondary source (e.g., diesel generator)** | |  | | | | | | | |
| Capacity (kVA) | |  | | 1-phase | | 3-phase | |
| 3. | **Non-utility generation (If any, e.g., biomass gasifier)** | |  | | | | | | | |
| Capacity (kVA) | |  | | 1-phase | | 3-phase | |
| **If solar PV system** | | System size(kW) | |  | | PV inverter size(kW/Phase) | |  | |
| Battery size (kWh) | |  | | Battery inverter size (kW/Phase) | |  | |
| 4. | **Other sources (e.g., UPS battery backup)** | |  | | | | | | | |
| Capacity (kVA/kWh) | |  | | 1-phase | | 3-phase | |
| 5. | **Do power cuts exist?** | | No | | Yes | | If yes, mention the schedule: | | | |
| Average outage time in a week (Hrs.): | | | |
| 6. | **Diesel generator (DG)** | | Capacity(kVA) | | Fuel consumption/hour | | Usage (hours) | | | |
| Per day | Per week | | Per month |
| **DG 1** | |  | |  | |  |  | |  |
| **DG 2** | |  | |  | |  |  | |  |
| **DG 3** | |  | |  | |  |  | |  |
| 7. | **Changeover type** | | Automatic  Manual | | | | | | | |
| Operation hours/days | | | | | | | | | | |
| Is the plant operational for 365 days? | | | Yes | | No (provide details): | | | | | |
| Days | | Sunday | 24 hours | 12 hours | | Others (mention): | | | | |
| Monday | 24 hours | 12 hours | | Others (mention): | | | | |
| Tuesday | 24 hours | 12 hours | | Others (mention): | | | | |
| Wednesday | 24 hours | 12 hours | | Others (mention): | | | | |
| Thursday | 24 hours | 12 hours | | Others (mention): | | | | |
| Friday | 24 hours | 12 hours | | Others (mention): | | | | |
| Saturday | 24 hours | 12 hours | | Others (mention): | | | | |

The following section gathers information to assess solar PV potential and the location used for designing and installing a solar grid-connected system at the given location.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Assessment for solar grid-connected design | | | | | | |
| **Solar photovoltaic energy assessment** | | | | | | |
| **Winter (shortest day)** | | | | **Summer (longest day)** | | |
| **Sunrise***(above horizon)* | **Sunset***(above horizon)* | | | **Sunrise***(above horizon)* | | **Sunset***(above horizon)* |
|  |  | | |  | |  |
| Are there any obstacles on the horizon during sunshine hours throughout the year or on seasons? (use PV application for sun path diagrams) | | Yes | No | | If no, describe the time and hours of shading: | |

## 

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Solar array and powerhouse location | | | | | | | | | |
| *Identify the location for solar panel considering the following criteria:*   * *South-facing roof/land with maximum sunlight.* * *Free from tall trees, buildings, and obstacles. (no shading)* * *Safe from exposure to chemicals, and industrial waste, not falling on the right of way.* * *Permanent structures with the capacity to lodge distributed static loads.* * *Near the powerhouse.* * *The powerhouse must be chosen in such a way that it lies close to the solar PV array location. (Advocate the beneficiary on benefits and risk of having powerhouse at the farther end)* * *Structure analysis of the roof designated for installation of solar PV modules. (Visual inspection as well as analysis report)* | | | | | | | | | |
| SN | **Parameters** | | | **Value** | | | | **Remarks** | |
| Solar PV array location | | | | | | | | | |
| For ground mount type installation | | | | | | | | | |
| 1. | **Is the feasible land area available?** | | | Yes | | No | |  | |
| 2. | **Type of land** | | | Own | | Lease | |  | |
| 3. | **Total land area available (m2)** | | |  | | | |  | |
| . | **Land facing direction** *(if applicable)* | | | E | W | N | S |  | |
| **Azimuth angle** | | | \_\_\_\_\_\_\_\_\_\_\_\_0 | | | |  | |
| 5. | **In the case of lease, land lease agreement tenure?** | | | Yes | | No | |  | |
| **If yes, the agreement timeline**  *(in years)* | | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ years | | | |  | |
| **Land lease amount/year** | | | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ NPR/year | | | |  | |
| 6. | **Exact PV array location** | | | Pictures | | | |  | |
| Taken | | Not taken | |  | |
| 7. | **GPS coordinates of the exact array location** | | | \_\_\_\_\_N | | \_\_\_\_ E | |  | |
| 8. | **Free from shading from all directions** | | | Yes | | No | |  | |
| 9. | **Type of land available** | | | Flat  Inclined land  Damp area  Rocky area  Others (Mention): | | | | | |
| 10. | **Is any noticeable wind blowing observed? Describe, if any mishaps occurred due to extreme wind in the past.** | | | Yes | | No | | Mention (if any): | |
| For roof mount type installation (use extra sheets if required) | | | | | | | | | |
|  | | | | Roof 1 | | Roof 2 | | Roof 3 | Roof 4 |
| Height of the roof from the ground (metres) | | | |  | |  | |  |  |
| Ownership of the roof (self/rental) | | | |  | |  | |  |  |
| In case of lease, lease agreement tenure (years) | | | |  | |  | |  |  |
| Land lease amount/year (NPR/year) | | | |  | |  | |  |  |
| Age of the roof and relevant structure (years) | | | |  | |  | |  |  |
| ~Slope (degrees) | | | |  | |  | |  |  |
| Accessibility to the roof | | | | Yes  No | | Yes  No | | Yes  No | Yes  No |
| Free from shading from all directions? | | | | Yes  No | | Yes  No | | Yes  No | Yes  No |
| Planned future expansion of the roof | | | | Yes  No | | Yes  No | | Yes  No | Yes  No |
| This roof is considered for installation purposes? | | | | Yes  No | | Yes  No | | Yes  No | Yes  No |
| Will roof penetration be allowed (with proper sealants for waterproofing) | | | | Yes  No | | Yes  No | | Yes  No | Yes  No |
| In case of more than 1 roof | | | | | | | | | |
| Roof 1 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |
| Roof 2 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |
| Roof 3 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |
| Roof 4 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |
| Roof 5 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |
| Roof 6 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |
| Roof 7 | | Type: | Orientation: | Total Area (m2): | | | | *\*Use extra sheet to draw the perimeter and shape* | |

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Description automatically generated with medium confidenceA black background with a black square

Description automatically generated with medium confidence

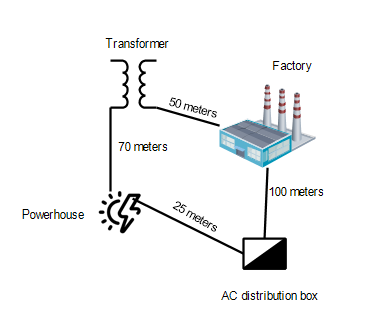
|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Powerhouse location | | | | | | | | |
| 1. | **Should the powerhouse be constructed?** | Yes  (Space for construction will be availed)  No | | | | | | |
| 2. | **Distance of powerhouse from the solar array location** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_meters | | | |  | | |
| 3. | **Total area allocated for powerhouse** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ m2 | | | |  | | |
| 4. | **Allocated powerhouse area** | Open ground | | | | Inside the facility | | |
| Allocated area (e.g., basement/warehouse): | | |
| 5. | **In the case of a lease, land lease agreement done?** | Yes  No | | | |  | | |
| **If yes, for how many years? (mention)** | \_\_\_\_\_\_\_\_\_\_\_\_\_ years | | | |  | | |
| **Land lease amount/year** | \_\_\_\_\_\_\_\_\_\_\_\_\_\_ NPR/year | | | |  | | |
| 6. | **Exact powerhouse location** | Pictures | | | |  | | |
| Taken  Not taken | | | |  | | |
| 7. | **GPS coordinates of the proposed powerhouse location** | \_\_\_\_\_\_ N | \_\_\_\_\_\_\_ E | | |  | | |
| 8. | **Cable route plan (from PV array to PH)** | Underground via | | a. existing cable trench  b. new cable trench | | | | |
| Overhead via existing poles  using new cable trays in the buildings | | | | | | |
| Overhead using existing cable trays on the exterior part of the building | | | | | | |
| Overhead using existing cable trays on the interior part of the building | | | | | | |
| Both underground and overhead OR others (explain): | | | | | | |
| Power evacuation plan and others | | | | | | | | |
| 1. | **Existing transformer size** | \_\_\_\_\_\_\_\_\_\_\_\_kVA | | | I/P voltage (kV): | | O/P voltage (kV): | |
| 2. | **Metering** | Type of meter used: | | | | | Rating: | |
| 3. | **Existing Earthing** | Nos. of earthing pits: | | Termination point 1: | | | Value:\_\_\_\_ohm | |
| Termination point 2: | | | Value:\_\_\_\_ohm | |
| Termination point 3: | | | Value:\_\_\_\_ohm | |
| Termination point 4: | | | Value:\_\_\_\_ohm | |
| Termination point 5 | | | Value:\_\_\_\_ohm | |
| Termination point 6: | | | Value:\_\_\_\_ohm | |
| Termination point 7: | | | Value:\_\_\_\_ohm | |
| 4. | **Lightning arrestors** | Nos. of lightning Arrestors: | | | | | Type: | |
| 5. | **Existing AC distribution boards** | Distance from the powerhouse(m): | | | | Rated Voltage(V): | | |
| Capacity: kVA | | | | Type of circuit breaker used: | | |
| Presence of SPDs | | | | Yes | | No |
| Presence of an extra slot for connection | | | | Yes | | No |

## A black background with a black square Description automatically generated with medium confidence

Sketch the overall project layout including solar array location, powerhouse, power evacuation points, existing relevant civil and electrical infrastructures, etc.

North

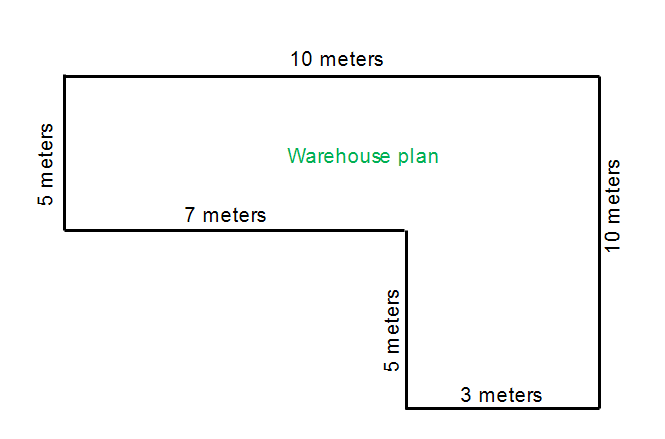
*For example*



Sketch the roof layout plan, size, perimeter, and shape.

North

*For example*



# Annex I

The following section gathers information about loads, energy demand, and consumption scenarios within the facility which will be used for designing the system.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Use of Power Analyzers(Use a 3-phase power analyzer to record the following, download the data from the logger in the format obtained from the logger to process for further use) | | | | | | |
| 72-hour load profile(weekdays), 48 hours (weekends or scheduled office/factory closure) | | | | Done | | Not done |
| 72-hour power and energy profiles-real, apparent, and reactive power consumption, power factor, etc. (weekdays), 48 hours (weekends or scheduled office/factory closure) | | | | Done | | Not done |
| Major load list(Use extra sheets, if required) | | | | | | |
| SN | **Loads** | **Quantity (A)** | **Estimated power demand (kW) (B)** | | **Total power (kW)**  **(C=A x B)** | **Usage hours**  **(Over a 24-hour period)** |
| 1. | E.g., Motor (3-phase) | 2 | 20 | | 40 | 9 AM-1 PM |
| 2. |  |  |  | |  |  |
| 3. |  |  |  | |  |  |
| 4. |  |  |  | |  |  |
| 5. |  |  |  | |  |  |
| 6. |  |  |  | |  |  |
| 7. |  |  |  | |  |  |
| 8. |  |  |  | |  |  |
| 9. |  |  |  | |  |  |
| 10. |  |  |  | |  |  |
| 11. |  |  |  | |  |  |
| 12. |  |  |  | |  |  |
| Total power demand (kW) | | | | |  |  |

# Annex II

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Labor cost | | | | |
| SN | **Type of labour** | **Available at site**  **(Yes/No)** | **Rate (NPR/day)** | **Remarks** |
| 1. | Unskilled |  |  |  |
| 2. | Skilled (Mason) |  |  |  |
| 3. | Solar technician/Electrician |  |  |  |
| 4. | Electrical engineer |  |  |  |
| 5. | Porter |  |  |  |

# Annex III

|  |  |  |  |
| --- | --- | --- | --- |
| Checklist of photos required | | | |
| SN | **Description** | **Remarks** | |
| 1. | Pictures of the area allocated for solar PV installation (all the designated roof/total land area) | Taken | Not taken |
| 2. | Pictures of the area allocated for the powerhouse | Taken | Not taken |
| 3. | Picture of the existing main AC distribution board | Taken | Not taken |
| 4. | Picture of the land/roof lease agreement  (if applicable) | Taken | Not taken |
| 5. | Picture of the road condition to reach the site | Taken | Not taken |
| 6. | Picture of the transformer & existing meter | Taken | Not taken |
| 7. | Other relevant pictures to be used for design and installation | Taken | Not taken |

# Annex IV

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Construction materials cost | | | | |
| SN | **Materials** | **Place of availability and distance from site (km)** | **Rate/unit** | **Comments** |
| 1. | Stone |  |  |  |
| 2. | Brick |  |  |  |
| 3. | Sand |  |  |  |
| 4. | Aggregate |  |  |  |
| 5. | Bamboo |  |  |  |
| 6. | Wood |  |  |  |
| 7. | Cement (53  grade, OPC/PPC) |  |  |  |
| 8. | Steel bar/TMT rod |  |  |  |
| 9. | Binding wire |  |  |  |
| 10. | Diesel cost |  |  |  |
| 11. | Others |  |  |  |

|  |  |  |
| --- | --- | --- |
| Additional information | | |
| Remarks (any other relevant information) |  | |
|  | | |
| Name of the consultant:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Phone Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ | | Name of the beneficiary representative:  \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Signature: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_  Phone Number: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ |