10.9 MW BUNDLED SOLAR POWER PROJECT

Document Prepared By **Infinite Solutions**

Project Title	**10.9 MW Bundled Solar Power Project**
Version	02
Date of Issue	21-Sep-2015
Prepared By	Infinite Solutions
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1 PROJECT DETAILS

1.1 Summary Description of the Project

The proposed project activity involves the installation of Solar Power Projects. The total installed capacity of the project is 10.9 MW; which involves operation of solar projects in different states; Tamil Nadu of Southern Grid while Madhya Pradesh and Maharashtra form part of NEWNE gird in India. The project is promoted by individual sub project investors, the details of which are as follows:

Solar Project Investor	Capacity (MW)	Purpose	Regional Grid	State
JVS Export	5.0	Sale to Grid	Southern	Tamil Nadu
Suma Shilp Ltd.	2.4	Sale to Grid/ Third Party	NEWNE	Maharashtra
Daksha Infrastructure Pvt. Ltd.	2.0	Sale to Grid/ Third Party	NEWNE	Maharashtra
Porwal Auto Components Ltd.	1.5	Captive usage	NEWNE	Madhya Pradesh
Total	**10.9**			

The purpose of the project activity is to generate energy electricity by the utilization of solar power and further selling the generated energy to the respective Grid or for captive purpose. In this process there is no consumption of any fossil fuel and hence it does not lead to any greenhouse gas emissions. Thus, electricity would be generated through sustainable means without causing any negative impact on the environment. The estimated annual average GHG emission reductions from the project activity will be 17,567 tonnes of CO2 and total GHG emission reductions for the chosen 10 year crediting period will be 175,670 tonnes of CO2. The crediting period is renewable for a maximum of 2 times.

In the Pre- project scenario the entire electricity, delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

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1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:

Sectoral Scope : 01 - Energy industries (renewable / non renewable sources)
Project Type : I - Renewable Energy Projects
Methodology : AMS I.D. Grid connected renewable electricity generation --- Version 18.0

https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

PP hereby confirms that the project is not a grouped project and Infinite Solutions is the bundling agency and acting as project participant on behalf of all the individual project investors.

1.3 Project Proponent

Organization name	Infinite Solutions
Contact person	Mr. Sumeet Singhvi
Title	Managing Director
Address	146, Shastri Market, Siyaganj, Indore – 452007, Madhya Pradesh, India
Telephone	+91 731 3917669
Email	sumeet@infisolutions.org

1.4 Other Entities Involved in the Project

Organization name	NA
Role in the project	NA
Contact person	NA
Title	NA
Address	NA
Telephone	NA
Email	NA

1.5 Project Start Date

Project Start Date: 25 – September – 2013;
The project start date is the earliest commissioning date amongst all the individual projects which are part of this Bundled Project.

Solar Project Investor	Capacity (MW)	Village, Distict	Commissioning Date
JVS Export	5.0	Regunathamadai, Virudhunagar	30/09/2013
Suma Shilp Ltd.	2.4	Mandrup, Solapur	25/09/2013
Daksha Infrastructure Pvt. Ltd.	2.0	Mandrup, Solapur	25/09/2013
Porwal Auto Components Ltd.	1.5	Kadodiya, Ujjain	27/12/2013
Total	**10.9 MW**		

1.6 Project Crediting Period

Crediting Period Start date: 25 – Sep – 2013

Estimated life time of the project:

- 25 Years 00 Months - For Solar Projects

The project activity adopts renewable crediting period of 10 years period which can be renewed for maximum 2 times.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	√
Large project	

As the Estimated GHG emission reductions or removals per year is 17,567 (tCO_2e) which less than 300,000 tonnes of CO2e per year, thus the project falls in the category of Project.

Year	Estimated GHG emission reductions or removals (tCO_2e)
2013-14	17,567
2014-15	17,567
2015-16	17,567
2016-17	17,567
2017-18	17,567
2018-19	17,567
2019-20	17,567
2020-21	17,567
2021-22	17,567
2022-23	17,567
Total estimated ERs	175,670
Total number of crediting years	10
Average annual ERs	17,567

1.8 Description of the Project Activity

The proposed project activity involves the installation of Solar Power Projects. The total installed capacity of the project is 10.9 MW; which involves operation of solar projects in different states; Tamil Nadu of Southern Grid while Madhya Pradesh and Maharashtra form part of NEWNE gird in India. The project is promoted by individual sub project investors, the details of which are as follows:

Solar Project Investor	Capacity (MW)	Purpose	Regional Grid	State
JVS Export	5.0	Sale to Grid	Southern	Tamil Nadu
Suma Shilp Ltd.	2.4	Sale to Grid/ Third Party	NEWNE	Maharashtra
Daksha Infrastructure Pvt. Ltd.	2.0	Sale to Grid/ Third Party	NEWNE	Maharashtra
Porwal Auto Components Ltd.	1.5	Captive usage	NEWNE	Madhya Pradesh
Total	**10.9**			

The purpose of the project activity is to generate energy electricity by the utilization of solar power and further selling the generated energy to the respective Grid. In this process there would be no consumption of any fossil fuel, thereby any greenhouse gas emissions. Thus, electricity would be generated through sustainable means without causing any negative impact on the environment. The estimated annual average GHG emission reductions from the project activity will be 17,567 tonnes of CO2 and total GHG emission reductions for the chosen 10 year crediting period will be 175,670 tonnes of CO2.

In the Pre- project scenario the entire electricity, delivered to the grid by the project activity, would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources.

Solar Power Project Technology Details –

The technology being employed, converts solar energy into electrical energy. The technology is an environment friendly technology since there are no GHG emissions associated with the electricity generation.

The proposed PV project will use crystalline silicon based solar PV modules. Since the project activity is a Greenfield installation there was no electricity generation at the project site prior to its implementation. The whole installation will have a 25 years design life. Technical specifications of typical modules will be as follows:

The technical details are as follows:

JVS Export

Technical detail of the equipments	Remark
Type of system	Fixed Structure
Type of PV Modules	Poly Crystalline Silicon
Number of modules	22,128
Capacity of each module	245 Wp/ 250 Wp / 255 Wp
Module make	Vikram Solar
Inverter Capacity	630 KW x 8 Nos.
Inverter Make	AEG

Suma Shilp Ltd.

Technical detail of the equipments	Remark
Type of system	Seasonal Tilt Structure
Type of PV Modules	Poly Crystalline
Number of modules	9412
Capacity of each module	255 Wp
Module make	Jinko
Inverter Capacity	1200 KW x 2 Nos.
Inverter Make	Bonfiglioli

Daksha Infrastructure Pvt. Ltd.

Technical detail of the equipments	Remark
Type of system	Seasonal Tilt Structure
Type of PV Modules	Poly Crystalline
Number of modules	7844
Capacity of each module	255 Wp
Module make	Jinko
Inverter Capacity	1000 KW x 2 Nos.
Inverter Make	Bonfiglioli

Porwal Auto Components Ltd.

Technical detail of the equipments	Remark
Type of system	Fixed structure with seasonal tilt
Type of PV Modules	Polycrystalline PV modules
Number of modules	7,900
Capacity of each module	235/240 Wp
Module make	PV Power - PVQ3
Inverter Capacity	900 kW x 2 Nos.
Inverter Make	Bonfiglioli

1.9 Project Location

The project locations are as follows;

Serial Number	Project owner	Capacity	Lat and Long
1	JVS Export	5.0 MW	9° 30.479’ N & 78° 14.886' E
2	Suma Shilp Ltd.	2.4	17° 29.981’ N & 75° 46.990’ E
3	Daksha Infrastructure Pvt. Ltd.	2.0	17° 30’ N & 75° 46’ E
4	Porwal Auto Components Ltd.	1.5MW	23° 50’’N & 76° 10’ ’E

1.10 Conditions Prior to Project Initiation

The pre project scenario is same as baseline scenario. Please refer section 2.4 for the description of baseline scenario.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project has received necessary approvals for development and commissioning for each Solar Project from the state Nodal agencies and is in compliance to the local laws and regulations.

1.12 Ownership and Other Programs

1.12.1 Right of Use

The Project is owned by individual project proponents and Infinite Solutions is the bundling agency. The individual PPs are the sole owner of project activity, however they have authorised Infinite Solutions to act as the project participant on their behalf. Further the Ownership is demonstrated through the following documents.

- Commissioning certificates for the Solar projects in the name of individual PP

1.12.2 Emissions Trading Programs and Other Binding Limits

The projects are listed as part of CDM project as follows;

Serial Number	Project owner	UNFCCC No:	Current Status
1	JVS Export	10148	Awaiting UN Fee
2	Suma Shilp Ltd.	10148	Awaiting UN Fee
3	Daksha Infrastructure Pvt. Ltd.	10148	Awaiting UN Fee
4	Porwal Auto Components Ltd.	Not available	Under Validation[1]

However, the PP declares that Net GHG emission reductions or removals generated by the Project will not be used for compliance with an emissions trading program or to meet binding limits on GHG emissions in any Emission Trading program or other binding limits any specific monitoring period under two mechanisms.

[1] The project is currently under validation under project title "Bundled Solar Power Project by EKI Energy Services Limited (EKIESL-CDM.July-14-01)"

1.12.3 Other Forms of Environmental Credit

The project investors under the project are listed under REC mechanism. Further the individual project proponents have applied under CDM mechanism and its current status is described above section 1.12.2.

1.12.4 Participation under Other GHG Programs

The individual investors have applied under CDM mechanism as follows;

Serial Number	Project owner	UNFCCC No:	Current Status
1	JVS Export	10148	Awaiting UN Fee
2	Suma Shilp Ltd.	10148	Awaiting UN Fee
3	Daksha Infrastructure Pvt. Ltd.	10148	Awaiting UN Fee
4	Porwal Auto Components Ltd.	Not available	Under Validation[1]

1.12.5 Projects Rejected by Other GHG Programs

The Project is not rejected under any other GHG program.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project activity. The project activity is bundle of 4 project participants.

Leakage Management

Not applicable to the project activity.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description

Further Information

Sustainable development indicators

The National CDM Authority (NCDMA), which is the Designated National Authority (DNA) for the Government of India (GOI) under the Ministry of Environment and Forests (MoEF), has mentioned four indicators for the sustainable development in the interim approval guidelines for

Clean Development Mechanism (CDM) projects from India[2].Thus the project's contribution towards sustainable development has been addressed based on the following sustainable development aspects:

Economic well being:

- The project activity generates employment in the local areas.
- The project activity leads to investment to a developing regions which otherwise would not have happened in the absence of project activity. The generated electricity will be fed into grid, thereby improving the grid frequency and availability of electricity which will provide new opportunities for industries and economic activities for greater local employment and development. The project activity also leads to diversification of the national energy supply, which is dominated by conventional fuel based generating units.
- Use of renewable energy source (solar power) also helps in conservation of natural resources (like coal) in the country & thus less GHG's emissions in the atmosphere
- The project contributes to the economic sustainability around the plant sites, which is promotion of decentralization of economic power

Social well being:

- The plant sites are isolated rural areas which are the victims of unemployment, poverty and other social backwardness. The project would lead to the development of these regions.
- The proposed project would enhance availability of power to the local industries, agriculture and commercial activities in the vicinity of the project area by augmenting power supply to the Southern and NEWNE grid, thereby improving quality of power supplied to various users by stabilizing the grid.
- During civil works, a lot of construction work took place, which generated employment for local people around the plant site.
- Other than these, there are various kinds of mechanical work, which would generate employment opportunity on regular and permanent basis
- Frequency of visits by skilled, technical personnel and industrialists will increase due to installation / site visit / operation and maintenance work related to solar projects. This directly and indirectly positively effects the social behaviour & economy of villages and nearby area.

Environmental well being:

- The Solar power is one of the cleanest renewable energy powers and does not involve any fossil fuel. There are no GHG emissions.

[2] http://www.cdmindia.gov.in/approval_process.php

- There is no impact on land, water, air and soil due to the installation of solar projects. Thus the project activity contributes to environmental well-being without causing any negative impact on the surrounding environment.

Technological well being:

- The project activity is step forward in harnessing the untapped solar potential and further diffusion of the technology in the region.

- The project activity leads to the promotion of Solar projects and demonstrates the success of this technology in the region which further motivate more investors to invest in solar power projects. Similarly the project helps in promoting more and more solar power projects. Hence, the project activity leads to technological well-being.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Title: Grid Connected Renewable Electricity Generation

Reference: AMS I.D. (Version 18)

https://cdm.unfccc.int/methodologies/DB/W3TINZ7KKWCK7L8WTXFQQOFQQH4SBK

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC website. The approved methodology also refers to latest approved versions of "Tool to calculate the emission factor for an electricity system, version 04.0." for determination of baseline scenario of the proposed project activity.

2.2 Applicability of Methodology

The applicability criteria is described as follows;

Applicability Criteria	**Applicability to the project**
1. This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass a) supplying electricity to a national or a regional grid; or b) Supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	The project is renewable energy generation through installation of solar photovoltaic modules. The project will supply electricity to the NEWNE grid and Southern Regional grid for captive consumption, sale to grid as well as third party. Thus, the project activity complies with this criterion.
2. Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and	The 1st and 3rd option of Table 2 of AMS I.D. Version 18 is applicable (please refer

AMS-I.A2) applies is included in Table 2[3]	footnote).
3. This methodology is applicable to project activities that (a) Install a Greenfield plant; b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s).	This methodology is applicable to the project activity as, it's an Greenfield project where Option (a) i.e. install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant) . Hence the project activity fulfils the applicable criterion.
4. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The Project activity is not a Hydro Power Project, therefore this eligibility criterion is not applicable to the proposed project activity.
5. If the new unit has both renewable and non-renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable	The project activity has only renewable component, i.e., solar PV generated power with 10.9 MW capacity, which meets the eligibility of 15 MW for a small scale CDM

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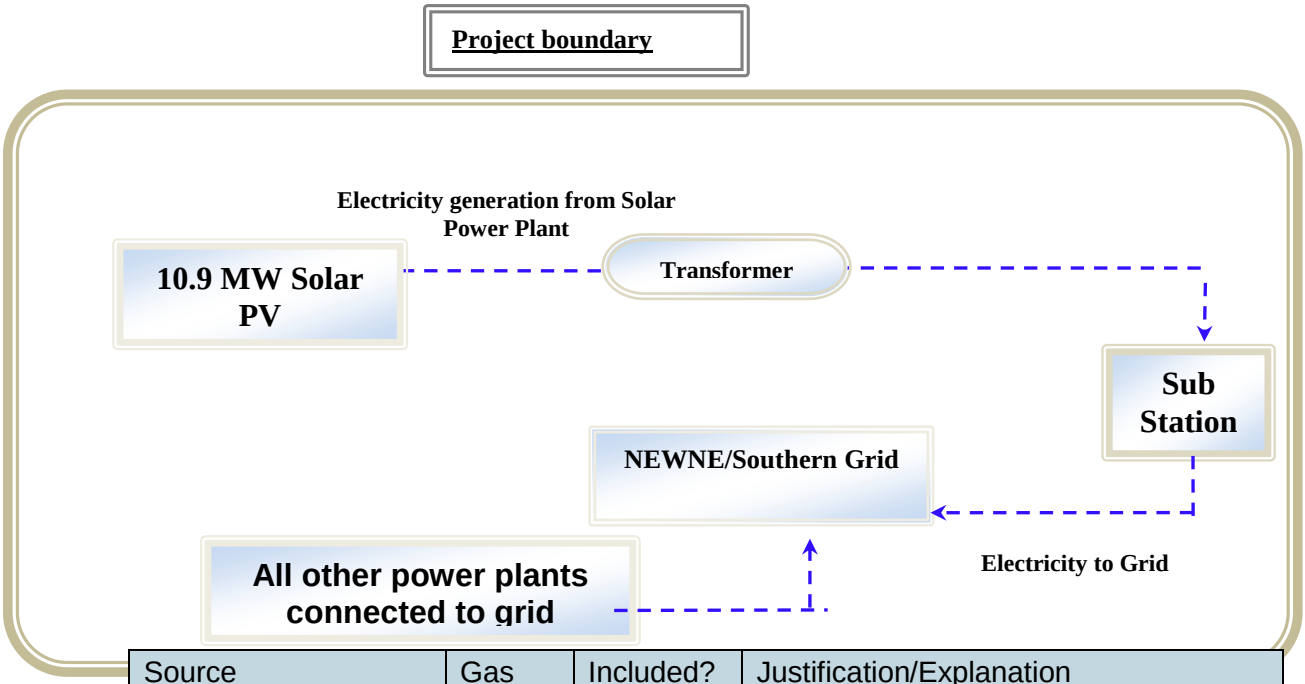
	Project type	AMS-I.A	AMS-I.D	AMS-I.F
1	Project supplies electricity to a national/regional grid		√	
2	Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)			√
3	Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)		√	
4	Project supplies electricity to a mini grid[3] system where in the baseline all generators use exclusively fuel oil and/or diesel fuel			√
5	Project supplies electricity to household users (included in the project boundary) located in off grid areas	√		

component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	project activity. The capacity of the project shall remain the same for the entire crediting period. Further, the project does not involve any use of fossil fuel. Thus, this criterion is not applicable to the project activity.
6. Combined heat and power (co-generation) systems are not eligible under this category.	The project activity generates only power and hence is not a cogeneration system. Thus, this criterion is not applicable to the project activity.
7. In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The project activity is the new installation of small scale solar PV generated power project and doesn't involve the addition of new unit to any of existing renewable power generation facility therefore the given criterion is not applicable to the project activity.
8. In the case of retrofit, rehabilitation or replacement, to qualify as a small-scale project, the total output of the retrofitted, rehabilitated or replacement power plant/unit shall not exceed the limit of 15 MW.	Not applicable, project activity is neither retrofit nor modification of existing facility. The installed capacity of the project will be 10.9 MW, which is not exceeding the limit for small scale projects. The entire project is a Green field project activity and not the enhancement or up gradation project.
9. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	Not applicable as the project activity is neither a landfill gas, waste gas, wastewater treatment and agro-industries projects, nor a recovered methane emissions project.
10. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	Not applicable as the project is not a biomass project.

2.3 Project Boundary

The project boundary is depicted in the diagram below;



Source		Gas	Included?	Justification/Explanation
Baseline	Grid-connected electricity generation	CO_2	Yes	Major emission sources.
		CH_4	No	Excluded for simplification. This is conservative
		N_2O	No	Excluded for simplification. This is conservative
		Other	No	The project activity does not emit any emissions.
Project	Greenfield Solar energy conversion system	CO_2	No	No methane generation is expected to be emitted.
		CH_4	No	No nitrous oxide generation is expected to be emitted.
		N_2O	Yes	Major emission sources.
		Other	No	Excluded for simplification. This is conservative

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2.4 Baseline Scenario

According to the guidelines of the applicable small scale approved methodology AMS.I.D (Version 18),

"The baseline scenario is that the electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid."

Thus, proposed project activity will evacuate power to the NEWNE Grid and Southern Grid, thus complying with the stated guideline.

The emission factor has been calculated by using option (a) as per the paragraph 12 of AMS.I.D (Version18) i.e. as combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' Version 4.0.0.

Key data/ parameters used for baseline calculation:

S. No	Data Variable	Data Unit	Variables	Data source
1	$EG_{PJ,y}$	MWh	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh).	Monthly electricity generation report.
2	$EF_{grid,y}$	tCO_2/MWh	CO_2 emission factor of the grid in year y.	CO_2 Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 10.[4]

Parameter	Baseline Emissions, BE y
Description of Baseline	As per the applied methodology, AMS ID, (Version 18), para 22, baseline emissions include only CO2 emissions from electricity generation in power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.
Rationale	The project is a renewable energy project with maximum output capacity of 10.9 MW which is as per specified limits of 15 MW of maximum output capacity. Also the project activity displaces electricity to Southern and NEWNE grid. Hence Type I Renewable energy projects and Category D – Electricity Generation for a System are applicable to the project as per Appendix B of the simplified modalities and procedures for small-scale project activities. Also applicability of SSC CDM methodology AMS-I.D has been clearly demonstrated in Section 2.2 above. Thus the PP has chosen to determine Baseline scenario and Baseline calculations in accordance with AMS I.D.
Mathematical Relations	$BE_y = EG_{PJ,y} * EF_{grid,y}$ $ER_y = BE_y – PE_y – LE_y$

[4] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

	$ER_y = BE_y – 0 – 0$ (as, $PE_y = LE_y = 0$) $ER_y = BE_y$

2.5 Additionality

In line with VCS Standard version 3.4, the additionality of the Project activity is ascertained in line with the applicable guidance from the UNFCCC.

As per guidance on demonstration of Additionality of small scale Project Activity (ver. 9 EB 68 Annex 27), it goes on to provide a positive list of grid-connected renewable electricity generation technologies that are automatically defined as additional, without further documentation of barriers. The list of technologies and project activity types are defined as automatically additional for project size up to and including small scale CDM thresholds (e.g. installed capacity up to 15 MW). The positive list comprises of the following grid-connected renewable electricity generation technologies of installed capacity up to 15 MW:

1) Solar technologies (photovoltaic and solar thermal electricity generation);

2) Off-shore wind technologies;

3) Marine technologies (wave, tidal).

4) Building-integrated wind turbines or household rooftop wind turbines of a size up to 100 kW;

Since the project activity is a solar photovoltaic electricity generation project of capacity 10.9 MW, it can be concluded from the above list that the project activity is automatically additional and does not require demonstration of barriers.

Thus, it is well established that the proposed project activity is additional.

2.6 Methodology Deviations

There is no methodology deviation

3 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

As per para 22 and Equation No. 1 of the applicable small scale methodology (AMS.I.D, Version 18), the baseline emissions are the product of electrical energy baseline $EG_{PJ,\ y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor. The baseline emissions are to be calculated as follows:

$BE_y = EG_{PJ,y} \times \mathbf{EF_{grid,y}}$

Where,

BE_y = Baseline emission in a year *y* (tCO_2)

$EG_{PJ, y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{grid,y}$ = Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (t CO2/MWh)

Calculation of $EF_{grid,y}$

The emission factor is calculated ex-ante as per the paragraph 23 (a) of the methodology as combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the 'Tool to calculate the emission factor for an electricity system' Version 04.0.0. The stepwise approach for calculation is as follows:

Step 1: Identify the relevant electric power system

For the purpose of determining the electricity emission factors, a project electricity system and connected electricity systems are to be defined.

The Indian power system is divided into two independent regional grids, namely NEWNE and Southern grid. Each grid covers several states. Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional problems relating to the grid.

Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants. Depending on the demand and generation, there are electricity exports and imports between states in the regional grid. There are also electricity transfers between regional grids, and small exchanges in the form of cross-border imports and exports (e.g. from Bhutan). Recently, the Indian regional grids have started to work in synchronous mode, i.e. at same frequency.

Geographical Scope of two regional grids:

NEWNE				**Southern**
Northern	Eastern	Western	North-Eastern	Southern
Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh	Andhra Pradesh
Delhi	Jharkhand	Gujarat	Assam	Karnataka
Haryana	Orissa	Daman & Diu	Manipur	Kerala
Himachal Pradesh	West Bengal	Dadra & Nagar Haveli	Meghalaya	**Tamil Nadu**
Jammu & Kashmir	Sikkim	**Madhya Pradesh**	Mizoram	Pondicherry
Punjab	Andaman – Nicobar	**Maharashtra**	Nagaland	Lakshadweep
Rajasthan		Goa	Tripura	
Uttar Pradesh				
Uttaranchal				

For the purpose of calculating the emission reductions achieved by any CDM project, the *"Tool to calculate the emission factor for an electricity system" (Version 04.0.0)* requires that the *"project electricity system is defined by the spatial extent of the power plants that can be dispatched*

without significant transmission constraints". This implies that the grid emission factors could be most appropriately calculated at the level of the two regional grids. As per the delineation given by CEA, Madhya Pradesh and Maharashtra falls into the NEWNE Regional Grid while Tamil Nadu falls under Southern Regional grid and the same have been as the concerned electricity system for the proposed project activity.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.

Option II: Both grid power plants and off-grid power plants are included in the calculation.

The project participants have chosen Option I for the calculation of the operating and build margin emission factor i.e. off-grid power plants are not being included in the calculation.

Step 3: Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

As per the tool, any of the four methods can be used. For the proposed project activity, simple OM method has been chosen to calculate the operating margin emission factor ($EF_{grid, OM, y}$). However, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation (excluding electricity generated by off-grid power plants) in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. The low cost/must run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

Table: Share of Low Cost / Must-Run (% of Net Generation)

	2008-09	2009-10	2010-11	2011-12	2012-13
NEWNE	17.4%	15.9%	17.6%	19.2%	17.4%
South	22.8%	20.6%	21.0%	21.0%	15.2%
India	18.7%	17.1%	18.4%	19.6%	16.9%

Ref.: CO_2 Baseline Database for the Indian Power Sector prepared by Central Electricity Authority, Version 10.

Percentage of total grid generation by low cost/must run plants (on the basis of average of five most recent years) = 18.1%

The calculation above shows that the generation from low-cost/must-run resources constitutes less than 50% of total grid generation, hence usage of the Simple OM method in the project case is justified.

The Simple OM emission factor can be calculated using either of the two following data vintages for Years(s) y:

– Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period,

or

– Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

The project proponent chooses the Ex ante option for estimating the simple OM emission factor wherein as described above a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period will be undertaken.

Step 4: Calculate the operating margin emission factor ($EF_{grid,OM,y}$) according to the selected method

For NEWNE Grid:

The operating margin emission factor has been calculated using a 3 year data vintage:

Net Generation in Operating Margin (MWh) (incl. Imports)			
	2011-12	2012-13	2013-14
NEWNE	508,004,381	546,941,372	569,215,756

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2011-12	2012-13	2013-14
NEWNE	0.9699	0.9919	0.9953

Weighted Generation Operating Margin	
NEWNE	**0.9862**

For Southern Regional Grid:

The operating margin emission factor has been calculated using a 3 year data vintage:

Net Generation in Operating Margin (MWh) (incl. Imports)			
	2011-12	2012-13	2013-14
Southern	153,155,160	155,891,576	162,396,860

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2011-12	2012-13	2013-14
Southern	0.9524	0.9937	1.0182

Weighted Generation Operating Margin	
Southern	**0.9887**

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project proponent has chosen option 1.

YEAR	**2013-14**
NEWNE Build Margin (tCO_2/MWh)	**0.9495**
Southern Grid Build Margin (tCO_2/MWh)	**0.9609**

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 10.0

BM values have been taken from CO_2 Baseline Database for the Indian Power Sector, Version 10. CO_2 Baseline Database for the Indian Power Sector is published by Central Electricity Authority, Ministry of Power; Govt. of India.

Step 6. Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

(a) Weighted average CM; or

(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option. The combined margin emissions factor is calculated as follows:

$EF_{grid,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$ = Operating margin CO2 emission factor in year y (tCO2/MWh)
W_{OM} = Weighting of operating margin emissions factor (%)
W_{BM} = Weighting of build margin emissions factor (%)

The following default values should be used for W_{OM} and W_{BM}:

- Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatch able nature) for the first crediting period and for subsequent crediting periods.

- All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

For NEWNE Grid

Particulars	Details	Source
Operating Margin (tCO_2/MWh)	0.9862	CEA
Built Margin (tCO_2/MWh)	0.9495	CEA
Combined Margin (tCO_2/MWh)	**= (0.75*0.9862) + (0.25*0.9495) = 0.9770**	

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 10.0

For Southern Region Grid

Particulars	Details	Source
Operating Margin (tCO_2/MWh)	0.9887	CEA
Built Margin (tCO_2/MWh)	0.9609	CEA
Combined Margin (tCO_2/MWh)	**= (0.75*0.9887) + (0.25*0.9609) = 0.9817**	

Source: CO_2 Baseline Database for the Indian Power Sector, CEA, Version 10.0

As mentioned before, the baseline emission factors have been calculated as per CEA sourced data for various regional grids in India according to the formulas specified above. As this is the most authentic information available in the public domain, the baseline emission factor used in the calculation of baseline emissions for the proposed project activity is being referred from the same for transparency and conservativeness.

3.2 Project Emissions

As per Paragraph 39 of the methodology, For most renewable energy project activities, PE_y = 0. Project Emissions are to be considered only in case of geothermal power plants and from water reservoirs of hydro power projects. In the project activity there is no emissions resulting due to the project as the project activity is a solar power project,

Hence PE_y= 0

3.3 Leakage

As per Paragraph 42 of AMS-I.D, "General guidance on leakage in biomass project activities shall be followed to quantify leakages pertaining to the use of biomass residues". As the project activity is a solar power project, hence the leakage is considered as zero.

Hence, LE_y= 0

3.4 Net GHG Emission Reductions and Removals

The project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plant by renewable electricity. The emission reduction ER_y by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission.

$$\mathbf{ER_y = BE_y - PE_y - LE_y}$$

Where,

ER_y = Emission Reduction in tCO_2/year
BE_y = Baseline emission in tCO_2/year
PE_y = Project emissions in tCO_2/year
LE_y = Leakage Emissions in tCO_2/year

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
2013-14	17,567	0	0	17,567
2014-15	17,567	0	0	17,567
2015-16	17,567	0	0	17,567
2016-17	17,567	0	0	17,567

2017-18	17,567	0	0	17,567
2018-19	17,567	0	0	17,567
2019-20	17,567	0	0	17,567
2020-21	17,567	0	0	17,567
2021-22	17,567	0	0	17,567
2022-23	17,567	0	0	17,567
Total	**175,670**	**0**	**0**	**175,670**

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014[5]
Value applied:	0.9862 (NEWNE Grid) 0.9887 (Southern Grid)
Justification of choice of data or description of measurement methods and procedures applied	Calculated as per "Tool to calculate the emission factor for an electricity system, version 04.0.0" as 3-year generation weighted average using data for the years 2011-2012, 2012-2013 & 2013-2014. The data are obtained from "CO_2 Baseline Database for Indian Power Sector" version 10.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014
Value applied:	0.9495 (NEWNE Grid) 0.9609 (Southern Grid)
Justification of choice of data or description of	Calculated as per "Tool to calculate the emission factor for an electricity system, version 04.0.0" for the year 2013-2014. The

[5] http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf

measurement methods and procedures applied	data is obtained from "CO_2 Baseline Database for Indian Power Sector" version 10.0, published by the Central Electricity Authority, Ministry of Power, Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO_2/MWh
Description	Combines Margin CO_2 emission factor in year y
Source of data	Calculated from CEA database, Version 10, December 2014[6]
Value applied:	0.9770 (NEWNE Grid) 0.9817 (Southern Grid)
Justification of choice of data or description of measurement methods and procedures applied	The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,y}$
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project (Solar) plant/unit to the grid in year y
Source of data	Monthly electricity share certificates/note or Credit Note or Joint Meter Reading Report
Description of measurement methods and procedures to be applied	The value of net electricity generation supplied to the grid as per Monthly electricity share certificates/note or Credit Note or Joint Meter Reading Report forms the basis for calculation of the emission reductions; which can be cross checked from the invoice

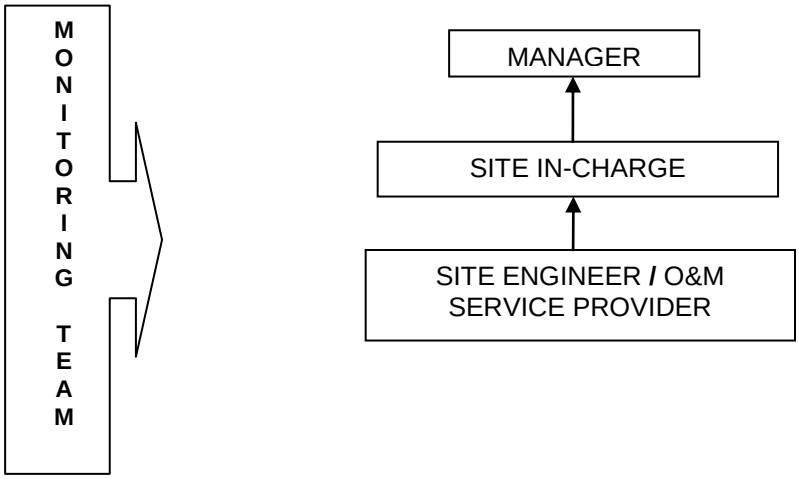
[6] http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver10.pdf

	raised to DISCOM. Net electricity supplied to grid will be calculated as the difference of the measured values of "export" and "import" of electricity through the dedicated SEB energy meter (electronic trivector bidirectional main meter & check meter which measures both export & import concurrently) installed at the delivery point (i.e. the connected yard). Net electricity generated and supplied by the project (Solar) plant/unit to the grid = Electricity Export to the grid - Electricity Import from the grid Monthly meter readings are taken from the main and check meter installed at the yard and certified by the representatives of SEB Officials and the representatives of the project proponent. for apportioning procedure refer section 4.3
Frequency of monitoring/recording	Continuous monitoring, hourly measurement and at least monthly recording
Value applied:	17,943 MWh
Monitoring equipment	Monitoring: Tri vector meter will be used Data type: Measured Type of meter: Static type meter (Main & Check). Both are Bidirectional meters. Class of meter: 0.2s
QA/QC procedures to be applied	• The energy meter reading are taken on monthly basis • Energy meters will be calibrated once in a Five years as per CERC guidelines and faulty meters will be duly replaced immediately. • All the energy meters are under the control of state utility and calibration/testing of energy meters is also under the jurisdiction of state utility. • The Net electricity exported to the grid will be cross checked against the invoice raised by the PP towards the DISCOM
Purpose of data	Calculation of Baseline emissions
Calculation method	-
Comments	The data would be archived electronically and maintained for the entire crediting period plus two years.

4.3 Monitoring Plan

The organizational structure for the proposed power plant envisages site engineers responsible for O&M of the plant. The site engineers will report to the shift in-charge, who will then report to the O&M Head.

The day-to-day operation like planning the routine maintenance, safety and environmental control will be placed under the care of the site engineers. All administrative functions like personnel, industrial relations, labour welfare and financial functions will be looked after by MBSL. The organizational structure and responsibilities on project operation, monitoring and data recording has been mentioned below:



Organizational Structure for monitoring:

Designation	Responsibilities
MANAGER	Holds complete control over monitoring aspects pertaining to the project
SITE INCHARGE	• Recording • Verification • Storage of Data
SITE INCHARGE/ O&M SERVICE PROVIDER	• Operation and Maintenance • Storage of data • Data Recording

Reading and Correction of Meters:

For the purpose of energy accounting, O&M operator will provide ABT compliant meters at the interface points. Interface metering will confirm to the Central Electricity Authority (Installation and Operation Meters) Regulation, 2006. In the event that the main meter is not in service as a result of maintenance, repairs or testing, then the check meter will be used during the period the main meter is not in service.

Calibration of Meters:

Calibration of all the meters will be undertaken once in five years as per CERC guidelines and faulty meters will be duly replaced immediately. Calibration will be done by an authorized agency or reputed laboratory.

Emergency Preparedness and Uncertainty Procedure:

In case Main meter or check meter is found to be outside the acceptable limits of accuracy or faulty or not functioning properly, it will be repaired, recalibrated or replaced as soon as possible. In the event that the Main meter is not in service as a result of maintenance, repairs or testing, the check meter will be used. In case both the main and check meter are found to be outside the acceptable limits of accuracy or faulty or not functioning properly, both the meters shall be calibrated immediately and the error percentage found in the main mater during its calibration shall be applied to its metered energy data for the entire period since its last calibration to obtain the corrected value of net electricity exported to the grid.

Data Recording and Archiving:

O&M operator will keep complete and accurate records of operating log at the Power Plant. The data will be archived electronically as well as in log books at the power plant and will be kept for two years after the end of the crediting period or the last issuance of credits for this project activity, whichever occurs later. The data for each PP is calculated by apportioning procedure described as follows;

Monitoring procedure for projects in State of Maharashtra:

The electricity generated by the project plant along with non-project plant is metered at a common metering point at the substation. This metering point consists of both main & check meters (ABT Meters) having accuracy class of 0.2s. These meters are capable of measuring the electricity parameters on a real time basis.

The Joint Meter Reading (JMR) is taken on a monthly basis. The monthly JMR report records both total export[7] & total import[8] by all the connected solar plants including the project plant in kWh. The total export reading for a given billing month is obtained by subtracting initial reading (taken in previous month) from the final reading (taken in billing month).

The difference is multiplied by the applicable meter constant/factor. Similar procedure is followed to arrive the total import reading.

The PP wise export kWh, import kWh is obtained by apportioning procedure. The sample apportioning procedure is given below:

Sample apportioning procedure: In a given billing month, the individual plant end reading is recorded for each connected plant including the project plant. The % distribution of energy for the project plant is arrived by dividing the project plant end generation with the total generation of all the connected plants including the project plant.

The project plant's export kWh & import kWh is obtained by multiplying the arrived % distribution of energy of the project plant with the total export kWh & total import kWh respectively.
The net electricity supplied to the grid by the project plant in a given month is calculated by subtracting value of import kWh from export kWh.

Thus,
Net electricity supplied to the grid by an individual PP in a given month =
Export kWh – Import kWh

Monitoring procedure for projects in State of Madhya Pradesh and Tamil Nadu:

All the individual Project proponents are allocated a dedicated meter for the individual projects which records both the export and import values on monthly basis. The same shall be considered and the values shall be cross checked with the monthly invoices.

In case the dates of a particular monitoring period do not match with the dates of the billing cycle, the net electricity exported to the grid would be calculated from:

[7] MSEDCL termed this as 'Import' in all relevant documents like PPA, JMR etc.

[8] MSEDCL termed this as 'Export' in all relevant documents like PPA, JMR etc.

- Data collected by O&M operator from the ABT compliant main meter installed at the plant end and recorded in the daily log books
- Apportioning the net electricity exported to grid, as recorded in the consolidated SLDC report, based on the number of days in the monitoring period and the number of days for which SLDC report was prepared.

The conservative value among the two would be used for calculation of emission reductions during that period.

5 ENVIRONMENTAL IMPACT

As per the Schedule 1 of the EIA notification dated 1/12/2009[9] and latest notification dated 24/12/2013[10], given by the Ministry of Environment and Forests under the Environment (Protection) Act 1986, the proposed Project activity does not fall under the list of activities requiring EIA as the environmental impacts for such project are not considered as significant by the host Party or PP.

6 STAKEHOLDER COMMENTS

The Local Stakeholder Meetings were organized for local stakeholder consultation and informed local stakeholder regarding the meeting. The followings are the local stakeholders for the project activity:

- Local community
- Local village administration
- Technology suppliers
- Local vendors

All the stakeholders have been invited through invitation letters (delivered in hand) to attend the stakeholders meeting.

In the introductory speech, the representatives of PP (consultant) welcomed the gathering and given a brief about the project activity. Subsequent to the introductory speech, stakeholders were explained about the electricity generation from solar project is an environmental friendly power generation technology contributing to reduction in GHG emissions. They were also explained about the benefits of the solar power projects like, increasing energy availability and improving quality of power and its assistance to the local population by providing employment opportunities to both skilled & unskilled labors.

[9] http://moef.nic.in/downloads/rules-and-regulations/3067.pdf

[10] http://envfor.nic.in/sites/default/files/ia-24122013.pdf

The Minutes of meeting with commenting sheet from LSH, invitation letter receipt copy are available and shall be submitted to the DOE.

Name of the PP	Invitation Date	Meeting Date	Location of the Local Stakeholder Meeting		
			Village	District	State
Daksha Infrastructure Pvt. Ltd.	18/02/2014	28/02/2014	Mandrup	Solapur	Maharashtra
Suma Shilp Ltd.	18/02/2014	28/02/2014	Mandrup	Solapur	Maharashtra
JVS Export	13/02/2014	03/03/2014	Regunathamadai	Virudhunagar	Tamil Nadu
Porwal Auto Components Ltd.	14/08/2014	28/08/2014	Kadodiya	Ujjain	Madhya Pradesh

APPENDIX X: <TITLE OF APPENDIX>

Use appendices for supporting information. Delete this appendix (title and instructions) where no appendix is required.