CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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Title: Solar Power project by Sai Sudhir Energy Limited
Version: 02.3
Date: 27/03/2012

A.2. Description of the small-scale project activity:

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Purpose of the project activity:

Saisudhir Energy Limited (SSEL) a subsidiary company of Saisudhir Infrastructure Limited intends to develop solar photovoltaic power plant (SPV) at T. Veerapuram village of Anantapur (also called as "*Ananthapur*") district, in the State of Andhra Pradesh. The project activity is to install a new grid connected 5 MW solar power project. The project participant will supply power to the grid and hence replaces the equal amount of power which would have otherwise been generated by grid connected carbon intensive power plants.

The proposed 5 MWp solar project is a Greenfield project activity. The project activity uses solar photovoltaic CIS Thin film module for producing the power. The process of generating power through solar energy is a clean technology, as there is no fossil fuel fired or no green house gases are emitted during the process. The generated power from this project activity is supplied to the Southern grid. The project participant has signed Power Purchase Agreement (PPA) for 25 years period, with NTPC Vidyut Vyapar Nigam Limited (NVVN), New Delhi, India. The project activity helps in reducing 8,117 tCO_2e per year, by displacing 8,862 MWh equivalent amount of electricity which would have been generated through the operation power from fossil fuel based electricity generation in the Southern grid. The project has been commissioned on 5th January 2012.

Contribution to Sustainable Development:

The implementation of this project activity would contribute to the sustainable development of the region in the following ways as stipulated by the Ministry of Environment and Forests (MoEF) in the interim approval guidelines for CDM projects. Ministry of Environment and Forests, Govt. of India has stipulated the social well being, economic well being, environmental well being and technological well being as the four indicators for sustainable development in the interim approval guidelines host country approval eligibility criteria for Clean Development Mechanism (CDM) projects[1].

Social well-being:

- The project activity is generating employment opportunities for professional, skilled and unskilled labour for development, engineering, procurement operation and maintenance of the project activity.
- The development of project specific infrastructure will result in employment and income generation activities for local personnel.

[1] http://www.cdmindia.in/approval_process.php

- In addition various kinds of maintenance work would generate employment opportunities for local contractor on regular and permanent basis.

Economic well-being:

- The project activity would promote the application of solar energy based power generation investment which is a significant investment in a green field project in the region.
- The project activity will act as a nucleus for other economic activities such as setting up of cottage industries, shops, hotels etc. around the area, contributing to the economic development around the project area.
- Proposed power plant will use solar radiation as resource for generation of power helps conserve foreign exchange by reducing the need to import fossil fuels to meet the country's growing energy demand.

Environmental well-being:

- Solar energy based power generation system will be a robust clean technology involving latest state of the art renewable energy options to be used for the purpose of electricity generation.
- This project activity would be using the available solar potential for power generation process, which has no associated GHG emissions. This will certainly have a positive impact on the environment both at local and global level.
- The project implementation will lead to reduction of SOx, NOx and particulate matter (PM) emissions. It therefore results in an improvement in air quality and human health.

Technological well-being:

- The project leads to utilization of environmentally safe and sound technologies in similar sector projects. The project proponent has selected to install Copper Indium Selenium (CIS) modules which comply with IEC 61646 for quality and IEC 61730 safety standards. Setting up of this project will also increase the private sector participation in this project category thereby contributing to more green power to the grid system.

A.3. Project participants:

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Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
India (Host Party)	Saisudhir Energy Limited (Private entity)	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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India

A.4.1.2. Region/State/Province etc.:

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State: Andhra Pradesh

A.4.1.3. City/Town/Community etc:

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District: Anantapur
Taluk: Raydurg
Village: T. Veerapuram

A.4.1.4.Details of physical location, including information allowing the unique identification of this small-scale project activity :

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The Proposed project site is in T. Veerapuram village located in Raydurg Taluk of Anantapur district.The coordinates of the site are

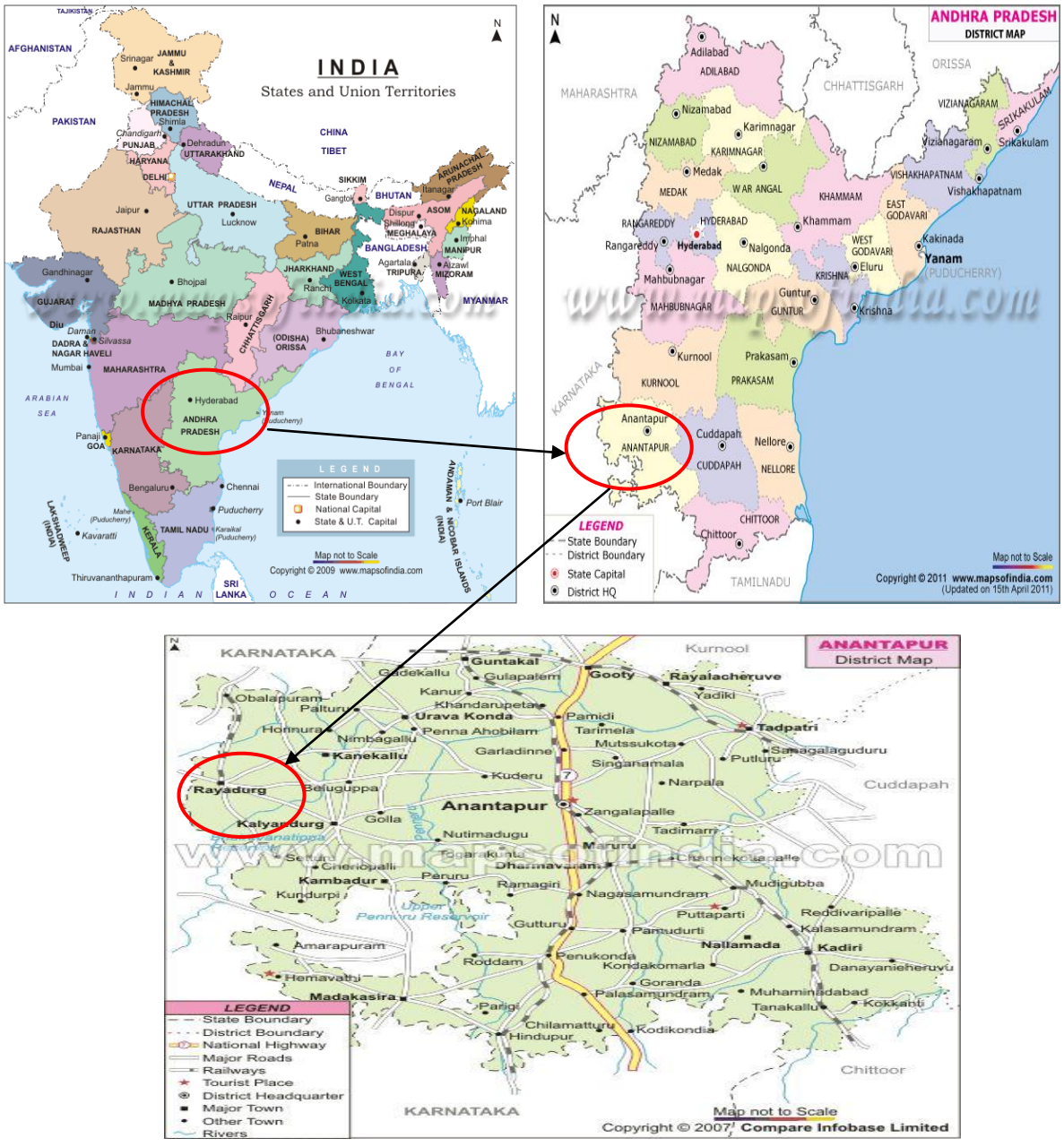
Latitude : 14˚ 45’ 41.97” N
Longitude : 76˚ 57’ 03.86” E

The location map is as given below[2,3,4]

[2] http://www.mapsofindia.com/maps/india/indiastateandunion.htm

[3] http://www.mapsofindia.com/maps/andhrapradesh/andhrapradesh-district.htm

[4] http://www.mapsofindia.com/maps/andhrapradesh/districts/anantpur.htm



A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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The project activity is considered under "Grid-connected electricity generation from renewable sources", with a capacity less than 15 MW. Therefore, as per the scope of the project activity enlisted in the 'list of sectoral scopes and related approved baseline and monitoring methodologies', the project activity may principally be categorized in:

Type I- Renewable Energy Projects

Category: Grid connected renewable electricity generation

Scope Number 1

Sectoral Scope, 01 – Energy Industries (renewable/non-renewable sources).

Technology used:

The solar photovoltaic cells, also known as the solar cells, are used to convert solar energy into electrical energy[5]. The solar cells are the basic elements of a solar module. Essentially, when light strikes the cell, a certain portion of it is absorbed within the semiconductor material. This energy knocks electrons loose, allowing them to flow freely. PV cells have one or more electric fields that act to force electrons freed by light absorption to flow in a certain direction. This flow of electrons constitutes an electric current, which can be drawn from the cell. This current, together with the cell's voltage defines the power that the solar cell can produce.
The proposed project activity is a Greenfield project activity wherein 38,400 numbers of 145 Wp PV modules are installed to generate 5 MWp power. There is no transfer of technology from any Annex I countries.
The project activity uses a safe and sound technology. Also, this is not a commonly used technology in the host country. The solar photovoltaic cells are further connected to inverters. Inverters shall convert the DC energy produced by array to AC voltage using its MPPT (Maximum Power Point Control) control to extract maximum energy from solar array. The output voltage of the inverter is connected to the LT side of the grid through step-up transformer of 0.387/33/132KV or as per the requirement.
Proposed technical specifications of solar photovoltaic CIS Thin film module at standard test conditions (STC) are:

Output power-Pmax (Watts)	145 Wp +/-5%
Warranted minimum Pmax	145 Wp +/- 5%
Voltage at Pmax	78.0V
Current at Pmax	1.86A
Open circuit voltage	110 V
Short circuit current	2.1 A
Maximum system voltage (Volts)	DC 600 V
Fuse rating	15 A
Solar Inverter	500 kW

Even though the PV modules warrantees a maximum power output of 145 Wp, it will be experiencing a deration of 1% every year[6].

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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[5] http://protekan.com/SolarPVTechnology.aspx

[6] As per the Detailed project report for the 5MWpsolar power project of Saisudhir Energy Limited. This can also be confirmed from sales and purchase agreement with supplier, Appendix 2, point no 2a.

Years	Annual estimation of emission reductions in tonnes of CO2 e
Year 1	8,491
Year 2	8,406
Year 3	8,321
Year 4	8,238
Year 5	8,155
Year 6	8,073
Year 7	7,992
Year 8	7,911
Year 9	7,832
Year 10	7,753
Total estimated reductions (tonnes of CO2 e)	**81,172**
Total number of crediting years	10 years (fixed crediting period)
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	**8,117**

A.4.4. Public funding of the small-scale project activity:

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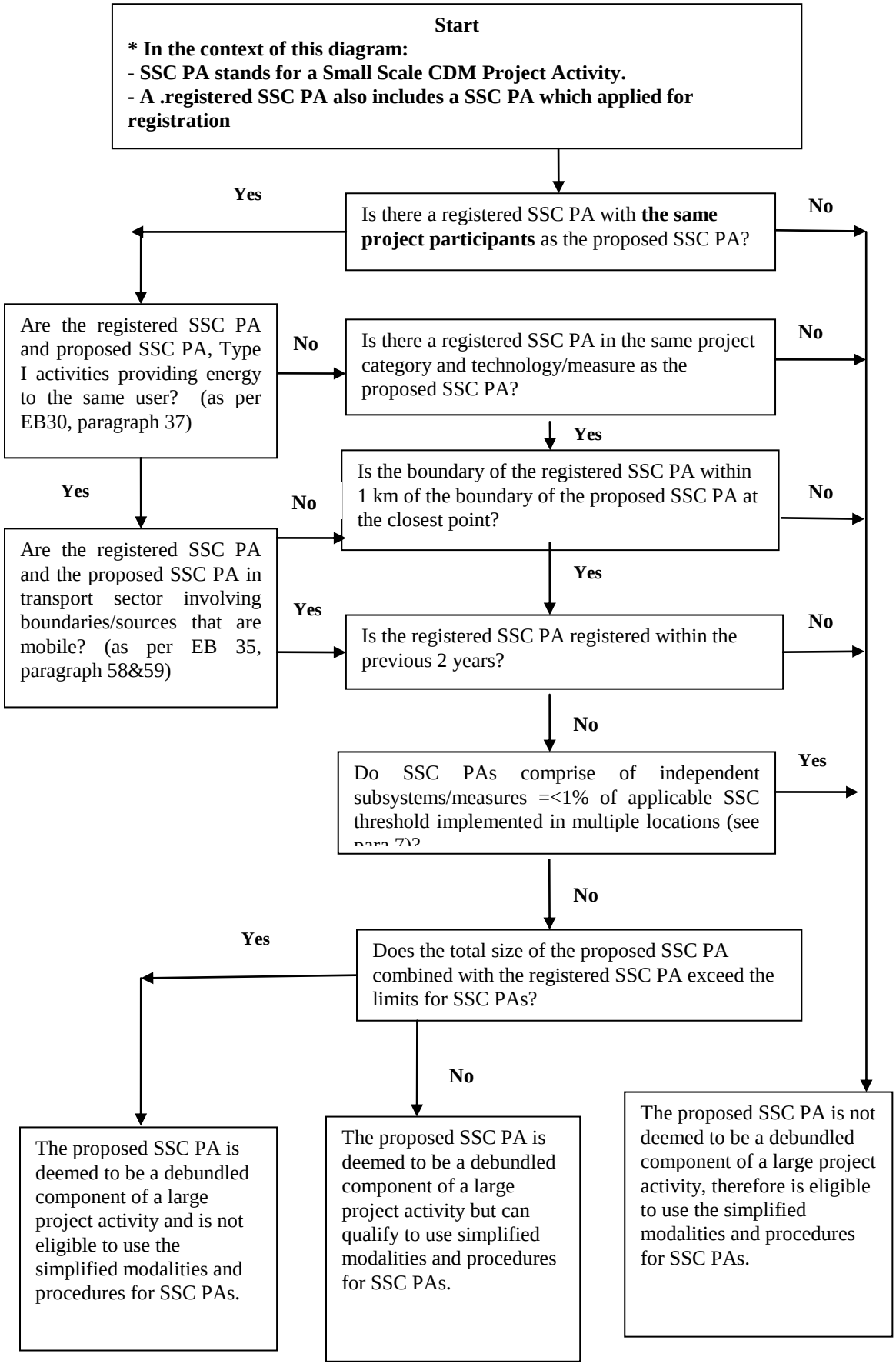
There is no public funding involved in this Project Activity from Annex I countries.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to paragraph 2 of Appendix C to the Simplified Modalities and Procedures for Small-Scale CDM project activities (FCCC/CP/2002/7/Add.3), a small-scale project is considered as a debundled component of a large project activity if there is a registered small-scale activity or an application to register another small-scale activity:

- With the same project participants
- In the same project category and technology
- Registered within the previous two years; and
- Whose project boundary is within 1km of the project boundary of the proposed small scale activity

As per "Guidelines on assessment of debundling for SSC project activities" version 03, EB 54 the procedure for determining occurrence of bundling is as given below: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* In the context of this diagram:
- SSC PA stands for a Small Scale CDM Project Activity.
- A .registered SSC PA also includes a SSC PA which applied for registration
Is there a registered SSC PA with the same project participants as the proposed SSC PA?
Yes
No
Are the registered SSC PA and proposed SSC PA, Type I activities providing energy to the same user? (as per EB30, paragraph 37)
No
Is there a registered SSC PA in the same project category and technology/measure as the proposed SSC PA?
No
Yes
Yes
Is the boundary of the registered SSC PA within 1 km of the boundary of the proposed SSC PA at the closest point?
No
No
Are the registered SSC PA and the proposed SSC PA in transport sector involving boundaries/sources that are mobile? (as per EB 35, paragraph 58&59)
Yes
Yes
Is the registered SSC PA registered within the previous 2 years?
No
No
Do SSC PAs comprise of independent subsystems/measures =<1% of applicable SSC threshold implemented in multiple locations (see para 7)?
Yes
No
Does the total size of the proposed SSC PA combined with the registered SSC PA exceed the limits for SSC PAs?
Yes
No
The proposed SSC PA is deemed to be a debundled component of a large project activity and is not eligible to use the simplified modalities and procedures for SSC PAs.
The proposed SSC PA is deemed to be a debundled component of a large project activity but can qualify to use simplified modalities and procedures for SSC PAs.
The proposed SSC PA is not deemed to be a debundled component of a large project activity, therefore is eligible to use the simplified modalities and procedures for SSC PAs.

The project activity is not a de-bundled component of a large project activity as –

There is no small scale CDM project activity or an application registered by the project proponent, in the same project category in the last two years within 1 km of the project boundary of the proposed small-scale project activity.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

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The project activity is a small scale project activity and conforms to Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Type	:	I - Renewable Energy Industries
Category	:	AMS-I.D. Grid Connected Renewable Electricity Generation[7].
Version	:	17, EB 61
Date	:	03/06/2011
Tools Used	:	Tool to calculate the emission factor for an electricity system[8] Version 02.2.1 / EB – 63 Annex 19
		Tool to calculate baseline, project and/or leakage emissions from electricity consumption[9] Version 1/ EB – 39 Annex 7

B.2 Justification of the choice of the project category:

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AMS-I.D. ver 17 applicability conditions	Project Applicability
This methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal, and renewable biomass supplying electricity to a national or a regional grid. Projects supplying electricity to an identified consumer facility via national/regional grid through a contractual arrangement such as wheeling.	This project generates energy from solar photovoltaic and supply electricity to the regional grid. Hence the condition is applicable.
Illustration of respective situations under which each of the methodology (i.e. AMS-I.D, AMS-I.F and AMS-I.A) applies as included in Table 2 of the methodology.	The project supplies electricity to the regional grid. Hence, this criteria for AMS-I.D. is applicable.
This methodology is applicable to project activities that (a) 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); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of an	This project activity is a newly grid connected solar PV based renewable electricity generation project. Hence, the criterion is applicable for the project activity.

[7] http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X

[8] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf/history_view

[9] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf/history_view

existing plants	
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/m2.	The project is a solar PV based renewable electricity generation project. So, the condition is not applicable.
If the new unit has both renewable and non-renewable components (e.g... a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.	The project activity is a solar PV based renewable electricity generation project. Hence, there is no fossil fuel co fired in this project activity. The total installed capacity of this project activity is 5 MW, which is below than the limit of 15 MW.
Combined heat and power (co-generation) systems are not eligible under this category.	This project activity is not a combined heat and power (cogeneration) systems and hence, the criterion is not applicable.
In the case of project activities that involve the 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.	This project activity is a solar PV based renewable electricity generation project and does not involve addition of capacity in any existing renewable energy generation unit. The total capacity of this project activity is 5 MW which is less than the limit of 15 MW.
In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	Since there is no retrofit or replacement of unit in the project activity, this criterion is not applicable.

B.3. Description of the project boundary:

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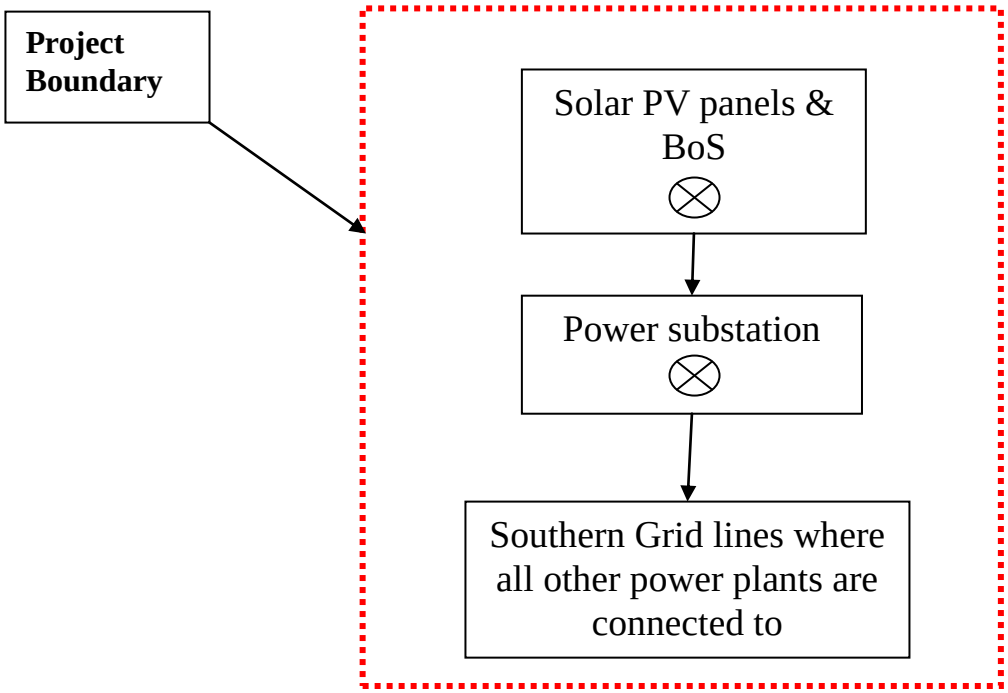
As per the approved methodology, "*The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to"* is termed as boundary. The project boundary is therefore the physical boundary, which includes the Solar PV panels and the metering/substation system connected to Southern Grid.The proposed project and all other power plants are connected physically to the Southern grid.



⊗ Denotes the location of meters at the project site and at the substation.

There is a main meter and check meter located within the premises of the power plant. At the substation end, there is a main meter, check meter and a standby meter to measure the net amount of electricity exported to the grid. The readings from the meter at the substation end will be used for the calculation of emission reductions.

B.4. Description of baseline and its development:

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The project activity installs and operates a new grid connected renewable solar power plant.

The baseline scenario according to AMS-I.D., Version 17 para 10 is-'T*he 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.'*

Hence the baseline scenario for the project activity would be the grid connected electricity being produced from fossil fuel based power plants that would have emitted large quantity of greenhouse gases.

As per AMS-I.D., Version 17, para 11, '*The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.*'

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y}$$

BE_y Baseline emissions in year y (tCO_2)

$EG_{BL, y}$ Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)

$EF_{CO2, grid,y}$ CO_2 emission factor of the grid in year y (tCO_2/MWh)

The emission factor can be calculated as per the procedures described in paragraph 12 (a) and (b) of the methodology.

(a) A 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'

(OR)

(b) The weighted average emissions (in kg CO_2equ/kWh) of current generation mix. The data of the year in which project generation occurs must be used. Calculations must be based on data from an official source (where available) and made publicly available.

Based on the above options project proponent has considered option (a) and the baseline emission factor has been calculated Ex-ante based on baseline methodology AMS-I.D. (Version 17). 'Tool to calculate the emission factor for an electricity system' is used for emission factor calculation

The combined margin of the Southern grid[10] used for the project activity is as follows:

Parameter	**Value (tCO_2/ MWh)**
OM, Operating Margin	0.967
BM, Build Margin	0.763
CM, Combined Margin	**0.916**

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

As per Guidance on Demonstration and Assessment of prior consideration of CDM (Paragraph 2) issued in EB 62, the project participant is required to indicate that continuing and real actions were taken to secure CDM status for the project in parallel with implementation. The exact chronology of the events is explained below; as can be seen the project proponent has made continuous efforts to secure CDM status in parallel with the project's implementation. The chronology of events in the tabulated form is given below:

Chronology of events	**Date**
Detailed project report prepared for 5 MWp solar PV project	21/03/2011
Board resolution note on deciding the project activity to be implemented by the PP	01/04/2011

[10] Based on Baseline Carbon Dioxide Emission Database Version 6.0; dated March 2011 (http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm). The detailed calculation on the combined margin of Southern grid is provided in section B.6.1.

Sale and purchase agreement signed with solar frontier	12/04/2011
Supply and service agreement signed with AEG power solution	15/04/2011
Connection agreement with Transmission corporation of Andhra Pradesh	24/06/2011
Purchase of land	08/07/2011
CDM consideration form e-mailed to UNFCCC and host country DNA (MoEF)	17/08/2011
Engagement of the validator	19/10/2011
Commissioning of the project activity	05/01/2012

According to decision 17/CP.7 paragraph 43, a project will be defined additional if the anthropogenic GHG emissions from the source are reduced below that would have occurred in the absence of the registered project activity.
As per para 2 of the provisions of Attachment A to Appendix B, version 08, of the *simplified modalities and procedures for small-scale CDM project activities, "the positive list of grid-connected renewable electricity generation technologies that are automatically defined as additional, without further documentation of barriers, consists of the following grid-connected renewable electricity generation technologies of installed capacity up to 15 MW:*
(a) Solar technologies (photovoltaic and solar thermal electricity generation);
(b) Off-shore wind technologies;
(c) Marine technologies (wave, tidal)".

The following conditions apply to the proposed project activity:

- The project activity is a grid connected renewable electricity generation unit[11]
- The project activity uses a solar technology using photovoltaic cells[12]
- The project activity has an installed capacity of 5MW[13] (ie, less than 15MW)

Hence, in line with para 2 of the Attachment A to Appendix B, the proposed project activity is automatically additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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The project activity is generation of electricity using solar and exporting the same to the local grid system, which is mainly fed by fossil fuel based power plants. Emission reductions due to the project activity are considered to be equivalent to the emissions avoided in the baseline scenario by displacing the electricity generated to the Grid.

According to the approved methodology AMS-I. D. (version 17) Emission Reductions are calculated as

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

Where:

[11] As per the Power Purchase Agreement with NTPC Vidyut Vyapar Nigam Limited

[12] As per the purchase order placed to Solar Frontier by Saisudhir

[13] As per the purchase order placed to Solar Frontier by Saisudhir

BE_y	Baseline Emissions in year *y* (t CO_2/y)
PE_y	Project Emissions in year *y* (t CO_2/y)
LE_y	Leakage Emissions in year *y* (t CO_2/y)

As this project installs a new grid connected renewable power plant, the baseline emissions according to AMS-I.D., Version 17 para 11 is-
The baseline emissions are the product of electrical energy baseline $EG_{BL,\ y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

$$\mathbf{BE_y = EG_{BL,\ y} * EF_{CO2,\ grid,y}}$$

Where:

BE_y	= Baseline Emissions in year y (t CO_2)
$EG_{BL,\ y}$	= Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)
$EF_{CO2,grid,y}$	= CO_2 emission factor of the grid in year y (t CO_2/MWh)

The emission factor can be calculated as per the procedures described in paragraph 12 (a) and (b) of the methodology.

(a) A 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'
(OR)

(b) The weighted average emissions (in kgCO_2equ/kWh) of current generation mix. The data of the year in which project generation occurs must be used. Calculations must be based on data from an official source (where available) and made publicly available.

Based on the above options project has considered option (a) and the baseline emission factor has been calculated Ex-ante based on baseline methodology AMS-I.D. (Version 17). 'Tool to calculate the emission factor for an electricity system' is used for emission factor calculation. The following steps to be used to calculate the baseline emission factor.

Estimation of Baseline Emissions
Baseline emissions (BE_y in tCO_2) due to displacement of grid-electricity are calculated as the product of the Baseline Emissions Factor (EF_y in tCO_2/MWh) calculated as described below and the electricity supplied by the project activity to the grid, over the crediting period.

$$\mathbf{BE_y = EG_{BL,\ y} * EF_{CO2,\ grid,y}}$$

Where:

BE_y	Baseline emissions in year y (tCO_2)
$EG_{BL,\ y}$	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year *y* (MWh)
$EF_{CO2,\ grid,y}$	Baseline emission coefficient determined in accordance with option (a) specified below

Step 1: **Identify the relevant electric power system**

For the purposes of the CDM, the delineation of the electricity grid is a key step in the calculation of a grid emission factor.
The tool[14] defines the electric power system as the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. Keeping this into consideration, the Central Electricity Authority (CEA)[15], Government of India has divided the Indian Power Sector into two regional grids (see table below).

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

The project activity is located in the state of Andhra Pradesh which comes under Southern Regional grid and the electricity generated by this project displaces the electricity from the southern regional grid. Due to the displacement of electricity, the project activity would have impact on the southern regional grid. Thus all the power generation facilities connected to this grid form the boundary for the purpose of baseline estimation. Since the project supplies electricity to the Southern grid, emissions generated due to the electricity generated by the southern regional grid as per CM calculations will serve as the baseline for this project.

Step 2: Choose whether to include off grid power plants in the project electricity system.

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.

Option I is chosen since the project supplies electricity to the grid alone.

Step 3. Select an operating margin (OM) method

[14] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf/history_view

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

Calculation of operating margin is based on one of the four 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 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 in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

The Share of Low Cost / Must-Run (% of Net Generation) in the generation profile of the different grids in India in the last five years is as follows:

Years	2005-06	2006-07	2007-08	2008-09	2009-10
Southern Regional Grid[16]	27.0%	28.3%	27.1%	22.8%	20.6%

The above table clearly shows that the percentage of total grid generation by low-cost/must-run plants (on the basis of average of five most recent years) for the Southern regional grid is only 25.2% which is much lesser than 50% of the total generation. Thus, Simple OM method can be used for calculating the emission factor.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

• 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 has chosen an ex-ante approach for the calculation of grid emission factor and the value will be considered throughout the crediting period.

Step 4- Calculating Operating Margin (OM) as per the method available for determining Simple OM.
The generation weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.
The Simple OM must be calculated as:

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

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or

Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

The project proponent is using values for calculating OM that are published in the CEA database for calculating CO_2 emissions Version 6, dated March 2011. These calculations are based on "Tool to Calculate the Emission Factor for an Electricity System", Version 2.2.1, EB 63 Annex 19. These correspond with **option A** of the current version of the Tool.

(a) Simple OM

The full generation weighted average for the most recent years has been considered from the Central Electricity Authority data[17].

Operating Margin

Table B.3: Operating Margin

Year	**tCO_2/MWh**	**Net generation in Operating Margin (Gwh)**
2007-08	0.991	114,634
2008-09	0.973	121,471
2009-10	0.942	134,717
Weighted Simple OM (**tCO_2/MWh**) = 0.967		

In this PDD *ex-ante* vintage has been fixed and will not be changed during the crediting period.

Step5: Calculate the build margin emission factor ($EF_{grid, BM,y}$)

In terms of vintage of data, PP has chosen option a) 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.

Calculations were done by the CEA (database version 6) to determine Emission Factor. CEA adopted build margin calculation based on an approach similar to Option b and c) "for sample group of power units m used to calculate the build margin" of the current Tool to calculate emission factor in the electrical system'- Version2.2.1, EB 63, Annex 19..

Build margin is calculated by the formula:

$$EF_{grid, BM,y} = \sum(EG_{m,y} \times EF_{EL,m,y}) / \sum EG_{m,y}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year *y* (tCO2/MWh)

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

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit *m* in year *y* (MWh)
$EF_{EL,m,y}$ = CO2 emission factor of power unit *m* in year *y* (tCO2/MWh)
m = Power units included in the build margin
y = Most recent historical year for which power generation data is available

BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

Table B.4: Build Margin

Build Margin[18]	2009-10
Build Margin (tCO2/MWh)	0.7634

Step 6. Calculate the combined margin emission factor

PP has chosen option a) Weighted Average CM, in calculation of combine Margin emission factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

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 (%)
w_{BM} = Weighting of build margin emissions factor (%)

Where:

The default weights for OM and BM for solar power are as follows: W_{OM} = 75% and W_{BM} = 25%.
$EF_{grid\ OM,\ y}$ and $EF_{grid\ BM,\ y}$ is calculated as described in Steps 1 and 2 above and are expressed in tCO2/MWh.

The weighted average applied by the project participants are fixed for the entire crediting period.

Combined Margin/ Grid Emission Factor

Table B.5: Combined Margin

Year	tCO_2/MWh
2007-08 OM	0.991
2008-09 OM	0.973

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

2009-10 OM	0.942
Average OM	0.967
Build Margin, BM 2009-10	0.763
Combined Margin, CM	**0.916**

OM and BM directly sourced from CEA database

Thus the grid emission factor for the project activity is **0.916 tCO_2/ MWh** and is fixed for the entire crediting period.

Project emissions:

The project activity imports electricity from the grid for to meet its auxiliary power requirements.
Project emission is power imported from grid multiplied by the grid emission factor of Southern grid calculated in transparent and conservative manner.

$$PE_y = EG_{BL,y,\ import} \text{ X } EF_{CO2,grid,y}$$

Where, PE_y is the project emission (tCO2 e)
$EG_{BL,y,\ import}$ is the quantity of electricity imported from the grid during the year
$EF_{CO2,grid,y}$ is the CO2 emission factor of the grid

Leakage:

The project activity is a Greenfield project and there is no transfer of energy generating equipment from another activity. So, there is no leakage within the project boundary as per para 22 of AMS-I.D. ver 17. Hence, leakage, $LE_y = 0$

Emission reductions:

$$ER_y = BE_y - PE_y - LE_y$$
$$= BE_y - PE_y - 0$$
$$= BE_y - PE_y$$

B.6.2. Data and parameters that are available at validation:

(Copy this table for each data and parameter)

Data / Parameter:	**EF_{OM}**
Data unit:	tCO_2/MWh
Description:	Operational Margin of the Southern Grid
Source of data used:	Central Electricity Authority(CEA) of India Database version 6.0 http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
Value applied:	0.967
Justification of the choice of data or description of measurement methods and procedures	Calculated using data provided by CEA for all the regional grids in India. Specifically meant for use in CDM project activities.

actually applied :	
Any comment:	

Data / Parameter:	**EF_{BM}**
Data unit:	tCO_2/MWh
Description:	Build Margin of the Southern Grid
Source of data used:	Central Electricity Authority(CEA) of India Database version 6 http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
Value applied:	0.763
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated using data provided by CEA for all the regional grids in India. Specifically meant for use in CDM project activities.
Any comment:	

Data / Parameter:	**EF_{CM}**
Data unit:	tCO_2/MWh
Description:	Combined Margin of the Southern Grid
Source of data used:	Fixed ex-ante combined margin emission factor as per Central Electricity Authority (CEA) of India's Database version 6 http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm
Value applied:	0.916
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated using data provided by CEA for all the regional grids in India. Specifically meant for use in CDM project activities.
Any comment:	As per the EB guidelines a weightage of 75:25 is assumed in the calculation of emission factor as this is a solar based power generation project. The latest available information on CM emission factor value at the time of submission of project for request for registration would be used and this will be fixed and ex-ante.

B.6.3 Ex-ante calculation of emission reductions:

>>

The below ex-ante calculation of emission reduction is shown for the first year of operation of the solar power project.

Baseline emissions

Baseline for the project activity is power generated from renewable energy source multiplied by the grid emission factor of Southern grid calculated in transparent and conservative manner.

$BE_y = EG_{BL,y,\ export}\ X\ EF_{CO2,grid,y}$

Quantity of net electricity supplied to the grid,
$EG_{BL,y}$ = [5 MW * 24 h/day * 365days/annum *21.28% (Gross PLF[19])]
= 9,321 MWh
The PV modules will be experiencing a deration of 1% per annum[20]from the second year onwards. Hence, the net electricity supplied to grid is reduced by 1% ewvery year.

CO2 emission factor of grid, $EF_{CO2,grid,y}$= 0.916 tCO2e/MWh

BE_y = 8,537 tCO2/ annum

Project emissions
The project activity imports electricity from the grid to meet its auxiliary power requirements.
Project emission is power imported from grid multiplied by the grid emission factor of Southern grid calculated in transparent and conservative manner.

$$PE_y = EG_{BL,y,\ import} \text{ X } EF_{CO2,grid,y}$$

Quantity of electricity imported from the grid during the year , $EG_{BL,y,import}$ = 50 MWh[21]
CO2 emission factor of grid, $EF_{CO2,grid,y}$= 0.916 tCO2e/MWh

PE_y = 46 tCO2/annum

Leakage emissions
The project activity is a Greenfield project and there is no transfer of energy generating equipment from another activity. Hence there is no leakage within the project boundary as per para 22 of AMS-I.D. ver 17.
$LE_y = 0$

Emission reductions
As per the methodology, emission reductions are calculated based on the following formula

$$ER_y = BE_y – PE_y - LE_y$$

or

$$ER_y = 8537 – 46 - 0$$

$$ER_y = 8,491 \text{ tCO2/ annum}$$

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Years	Baseline Emissions	Project Emissions	Leakages	Emission Reductions

[19] Gross PLF is taken from the Detailed project report prepared by a third party consulatant "Green Horsepower Pvt. Ltd".This si in compliance with para 3(b) of EB 48, Annex 11.

[20] As per the Detailed project report for the 5MWpsolar power project of Saisudhir Energy Limited. This can also be confirmed from sales and purchase agreement with supplier, Appendix 2, point no 2a.

[21] Estimated annual auxiliary consumption from DPR for 5 MW solar power plant

Year 1	8,537	46	0	8,491
Year 2	8,452	46	0	8,406
Year 3	8,367	46	0	8,321
Year 4	8,284	46	0	8,238
Year 5	8,201	46	0	8,155
Year 6	8,119	46	0	8,073
Year 7	8,038	46	0	7,992
Year 8	7,957	46	0	7,911
Year 9	7,878	46	0	7,832
Year 10	7,799	46	0	7,753
Total	**81,632**	**460**	**0**	**81,172**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	**$EG_{BL,y,export}$**
Data unit:	MWh
Description:	Quantity of electricity exported to the grid during the year y.
Source of data to be used:	Monthly Statement by APTRANSCO
Value of data	8,912
Description of measurement methods and procedures to be applied:	The electricity exported to the grid by the project activity connected to the sub-station is measured by electronic trivector meters of accuracy class 0.2s. The electricity exported will be measured continuously using above mentioned Main & Check meters at the substation. Export readings of Main & Check meters shall be taken on monthly basis by authorized officer of APTRANSCO (Transmission corporation of Andhra Pradesh Limited) and APCPDCL (Central Power Distribution Company of AP Limited) in the presence of PP or representative of PP.The meter reading will be taken jointly and signed by the representatives of the APTRANSCO, APCPDCL and SSEL. Based on the main meter readings, invoices will be raised by SSEL to NVVN.
QA/QC procedures to be applied:	The monthly recorded readings will be archived in joint meter reading sheets. SSEL will ensure that the metering system is tested for accuracy annually. The calibration of meters will be done by a government accredited agency. The value of electricity exported can be cross checked with the invoice raised by SSEL to NVVN. In case of any failure in the main meter, the invoice will be raised to NVVN based on the check meter readings. Also, the main meter will be replaced immediately with the calibrated back up meter.
Any comment:	The data will be kept for two years after the crediting period or from last issuance.

Data / Parameter:	**$EG_{BL,y,import}$**
Data unit:	MWh
Description:	Quantity of electricity imported from the grid during the year y.

Source of data to be used:	Monthly Statement by APTRANSCO
Value of data	50
Description of measurement methods and procedures to be applied:	The electricity imported from the grid by the project activity connected to the sub-station is measured by electronic trivector meters of accuracy class 0.2s. The electricity imported will be measured continuously using above mentioned Main & Check meters at the substation. Import readings of Main & Check meters shall be taken on monthly basis by authorized officer of APTRANSCO (Transmission corporation of Andhra Pradesh Limited) and APCPDCL (Central Power Distribution Company of AP Limited) in the presence of PP or representative of PP.The meter reading will be taken jointly and signed by the representatives of the APTRANSCO, APCPDCL and SSEL. Based on the main meter readings, invoices will be raised by SSEL to NVVN.
QA/QC procedures to be applied:	The monthly recorded readings will be archived in joint meter reading sheets. SSEL will ensure that the metering system is tested for accuracy annually. The calibration of meters will be done by a government accredited agency. The value of electricity imported can be cross checked with the invoice raised by SSEL to NVVN. In case of any failure in the main meter, the invoice will be raised to NVVN based on the check meter readings. Also, the main meter will be replaced immediately with the calibrated back up meter.
Any comment:	The data will be kept for two years after the crediting period or from last issuance.

Data / Parameter:	**$EG_{BL,y}$**
Data unit:	MWh
Description:	Net quantity of electricity exported to the grid during the year y.
Source of data to be used:	Monthly Statement by APTRANSCO
Value of data	8,862
Description of measurement methods and procedures to be applied:	The net electricity exported to the grid by the project activity connected to the sub-station is measured by electronic trivector meters of accuracy class 0.2s. Net electricity supplied to the grid would be calculated based on export & import data ($\mathbf{EG_{BL,y} = EG_{BL,y,\,export} - EG_{BL,y,\,import}}$). The export and import energy will be measured continuously using above mentioned Main & Check meters. Export & Import readings of Main & Check meters shall be taken on monthly basis by authorized officer of APCPDCL (Central Power Distribution Company of AP Limited) in the presence of PP or representative of PP.The meter reading will be taken jointly and signed by the representatives of the APCPDCL and SSEL. Based on the main meter readings, invoices will be raised by SSEL to NVVN.
QA/QC procedures to be applied:	The monthly recorded readings will be archived in joint meter reading sheets. SSEL will ensure that the metering system is tested for accuracy annually. The calibration of meters will be done by a government accredited agency. The value of net electricity exported can be cross checked with the invoice raised by SSEL to NVVN. In case of any failure in the main meter, the invoice will be raised to NVVN

	based on the check meter readings. Also, the main meter will be replaced immediately with the calibrated back up meter.
Any comment:	The data will be kept for two years after the crediting period or from last issuance.

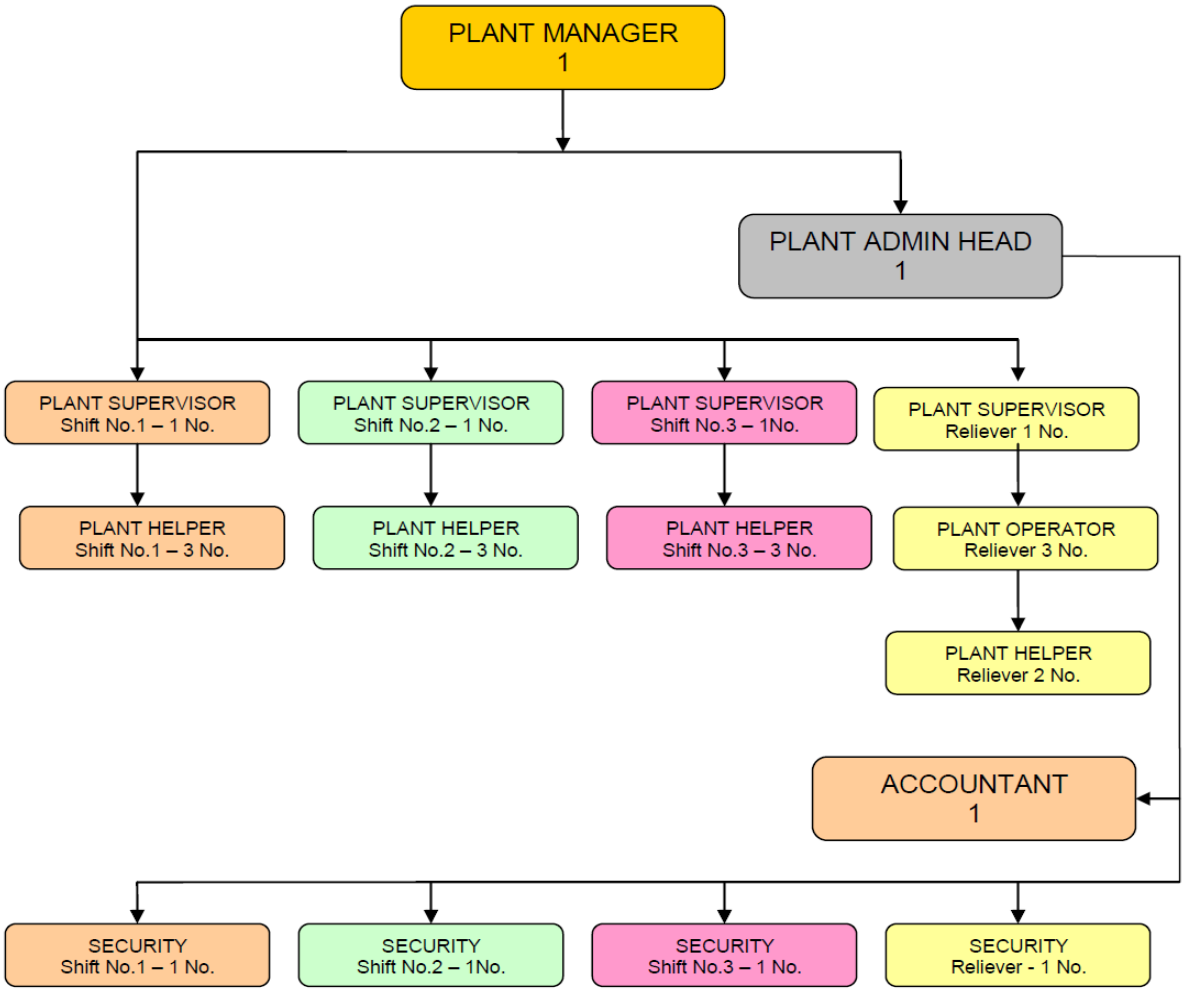
B.7.2 Description of the monitoring plan:

>>

The organization proposed ensures that the proposed power plant will be headed by the plant manager, holding the full charge of the power plant operations, reporting directly to the project promoters. The staffing recommended here takes care of the operation, maintenance and record keeping.

The plant manger will be in charge for both technical and administrative functions. The organization under plant manager shall be divided into operation and maintenance group.

The plant operation team will work in three shifts per day. Each shift will be controlled by a shift supervisor. There will be an additional shift supervisor who will function as reliever.



Data Measurement:
The export and import energy will be measured continuously using above mentioned Main & Check meters. Export & Import readings of Main & Check meters shall be taken on monthly basis by authorized officer of APCPDCL in the presence of PP or representative of PP.The meter reading will be taken jointly and signed by the representatives of the APCPDCL and SSEL. Based on the readings, invoices will be raised by SSEL to NVVN. These invoices can be used for cross checking the meter readings taken for the project activity. Also, there is an online arrangement for the monitoring of the electricity generation data and a report on monthly basis is submitted to MNRE through the NVVN.

Data collection and archiving: Export & Import readings from main & check meter will be collected under the supervision of the plant supervisor. The net electricity supplied to grid would be calculated based on export & import readings. Export and Import data would be recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of CERs for the project activity whichever occurs later.

Emergency preparedness: The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

Personnel training: In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff (CDM team) will be trained. The plant helpers will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
The date of completion of baseline and monitoring methodology is 30th September, 2011.
Details of the entity responsible are furnished in Annex 1.

Mr. P. Udayasankar
Saisudhir Energy Limited
401 GP Elite, 8-2-283/4, Road no 14,
Banjara hills, Hyderabad-500034.
Phone: 040 23554038
Email: udayasankar@saisudhirenergy.net

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
12/04/2011 (The date of placing the Purchase Order for the solar modules is the start date)

C.1.2. Expected operational lifetime of the project activity:

>>

25 years 0 months

C.2 Choice of the crediting period and related information:

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

>>

N/A

C.2.1.2. Length of the first crediting period:

>>

N/A

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

15/04/2012 or date of registration of the project activity with the CDM EB of UNFCCC whichever occurs later.

C.2.2.2. Length:

>>

10 years 00 months

SECTION D. Environmental impacts

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

As per the notification from MoEF dated September 14, 2006[22] and its amendment notification S.O.-3067(E) dated 1/12/2009[23], the list of project activities which require prior environmental clearance is stipulated. This does not include the proposed small scale project activity type as it involves solar power generation. Hence the proposed project activity does not require any Environmental impact assessment. The various factors of the environment which is likely to be affected by the power plant are:

Land and Soil: Since the project activity doesn't have any moving parts to disturb the land or soil at the project activity, there will not be any impact of the project activity on the soil.

[22] http://envfor.nic.in/legis/eia/so1533.pdf

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

Water: There is a very minimal requirement of water for the regular cleaning of the panels. Since only the dust is being washed from the panels, there is no impact of the project activity on the availability of water or quality of water.

Noise: The solar panels operate silently and have no moving parts with it. Thus the project activity doesn't create any noise pollution near the project site.

Air Quality: Solar panel doesn't release carbon dioxide, nitrogen oxide, sulphur dioxide, or mercury into the atmosphere as many traditional forms of electrical generation do. Hence, the impact of the project activity on air quality is minimal.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>> N/A

SECTION E. Stakeholders' comments

>>

E.1. Brief description how comments by local stakeholders have been invited and compiled:

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Saisudhir published notices in Deccan Chronicle (English newspaper) and EENADU (Telugu newspaper) respectively on 17th September 2011, inviting suggestions, views, comments and objections from persons including bonafide residents, environmental groups and others who have a plausible stake in the environment aspects of the project activity. The invitations were sent to the Sarpanchayat Secretary and Tehsildar of the Raydurg Taluk. It was also circulated among the local villagers in Raydurg taluk. A public hearing was conducted by Saisudhir on 29th September 2011 at the project site in Andhra Pradesh. The public hearing involved a detailed discussion session wherein three representatives of Saisudhir Energy Limited and twenty villagers participated in the meeting.

Mr. Maheshwar Reddy started the meeting with a brief introduction and welcomed all the stakeholders. He explained that the meeting has been convened for discussing opinions concerns and benefits from the solar power project established in Raydurg. He further explained to the stakeholders how the project will reduce the power shortage faced by the nation and also reduces the environmental pollution caused by a coal based thermal power plant.

Mr. Rudra Chakrabani explained on the concept of global warming and CDM to the stakeholders. He explained on Kyoto Protocol, CDM by UNFCCC and various other standards in the voluntary markets.

The villagers expressed their views with regard to the project activity that the project has generated employment to the local villagers, increased the standard of living and developed the area near to the project site.

E.2. Summary of the comments received:

>>

The villagers were happy with the fact that the installation of such a project would bring about development in the region. The queries raised by the local stakeholders were:

- Will the project help in improving the electricity supply to the villagers or the neighbourhood areas?
- Does the project activity affect the ground water level?
- Should such kind of projects be promoted?
- Does the project provide employment opportunities or improve economic development of area?
- Does the project affect grazing of animals?

E.3. Report on how due account was taken of any comments received:

>>

The queries of the stakeholders were answered satisfactorily by the project proponent representatives through scientific and logical explanations. The reply of above mentioned queries have been listed below:

- The power generated will be transmitted to the state electricity grid and will be at their disposal.
- The ground water level and drinking water quality of the area will not be affected.
- There are more such projects to come up in the area.
- The employment opportunity for a number of villagers has been increased at the construction stage of the project activity.
- There is no problem of grazing of animals in the area.

There was no negative comment from the stakeholder with regard to the project activity.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Saisudhir Energy Limited
Street/P.O.Box:	Road No 14, Banjara hills
Building:	401 GP Elite
City:	Hyderabad
State/Region:	Andhra Pradesh
Postfix/ZIP:	500034
Country:	India
Telephone:	040 23554038
FAX:	
E-Mail:	udayasankar@saisudhirenergy.net
URL:	
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	
Middle Name:	
First Name:	Udayasankar
Department:	
Mobile:	
Direct FAX:	
Direct tel:	040 23554038
Personal E-Mail:	udayasankar@saisudhirenergy.net

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding involved in the project activity.

Annex 3

BASELINE INFORMATION

The detailed information on baseline is provided in section B.6.1.

Annex 4

MONITORING INFORMATION

The detailed monitoring information is provided in section B7.2.

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