



**CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM
(CDM-SSC-PoA-DD) Version 01**

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NOTE:

- (i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.
- (ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).



SECTION A. General description of small-scale programme of activities (PoA)

A.1 Title of the small-scale programme of activities (PoA):

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First Solar PoA in India by SENES Consultants
Version 04, Date 09/03/2012

A.2. Description of the small-scale programme of activities (PoA):

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India has more than 164,000 MW of installed capacity for power generation, out of which the contribution of solar energy is negligible¹. States like Rajasthan, Gujarat, Punjab, Uttarakhand etc. have a huge solar potential. However, till date it has not been explored due to high cost associated with solar power generation in India. Government of India (GoI) has launched JNNSM² in 2010 and other various country/state level schemes under National Action Plan on Climate Change (NAPCC)³ for incentivising implementation of solar power projects in India.

Though these policies are an E- type of policy incentive⁴ and should not be considered while formulating the baseline scenario, these policies combined with financial incentive available under CDM provides incentive to install grid connected solar power plants in India. However, the high cost associated with CDM cycle along with registration uncertainty proves detrimental to the development of small scale solar power projects.

Through the managing entity SENES Consultants, a group of Indian entrepreneurs joined forces to carry on the development and implementation of small scale solar power projects, with the objective to contribute and promote generation of renewable energy in India.

United in a larger entity under the programme, solar power project developers anticipate the advantage in jointly overcoming hurdles and uncertainties faced by small scale Solar CDM project developers in India.

In order to reduce the cost of CDM cycle and facilitate quick and timely registration of the small scale Solar CDM projects across India, SENES Consultants has launched the first solar PoA for India.⁵

General operating and implementing framework of PoA

SENES Consultants will coordinate the Small-Scale Programme of Activities (SSC-PoA) and will support the project operator(s) in implementing the CDM Programme Activities (CPAs) in India. The scheme after implementation will result in reduction of GHG emissions (CO₂) from power plants connected to the grid.

¹ http://www.cea.nic.in/power_sec_reports/executive_summary/2010_09/8.pdf

² <http://mnre.gov.in/pdf/resolution-jnnsnm.pdf>

³ <http://mnre.gov.in/pdf/mission-document-JNNSM.pdf>

⁴ http://cdm.unfccc.int/EB/022/eb22_repan3.pdf

⁵ <http://cdm.unfccc.int/ProgrammeOfActivities/registered.html>



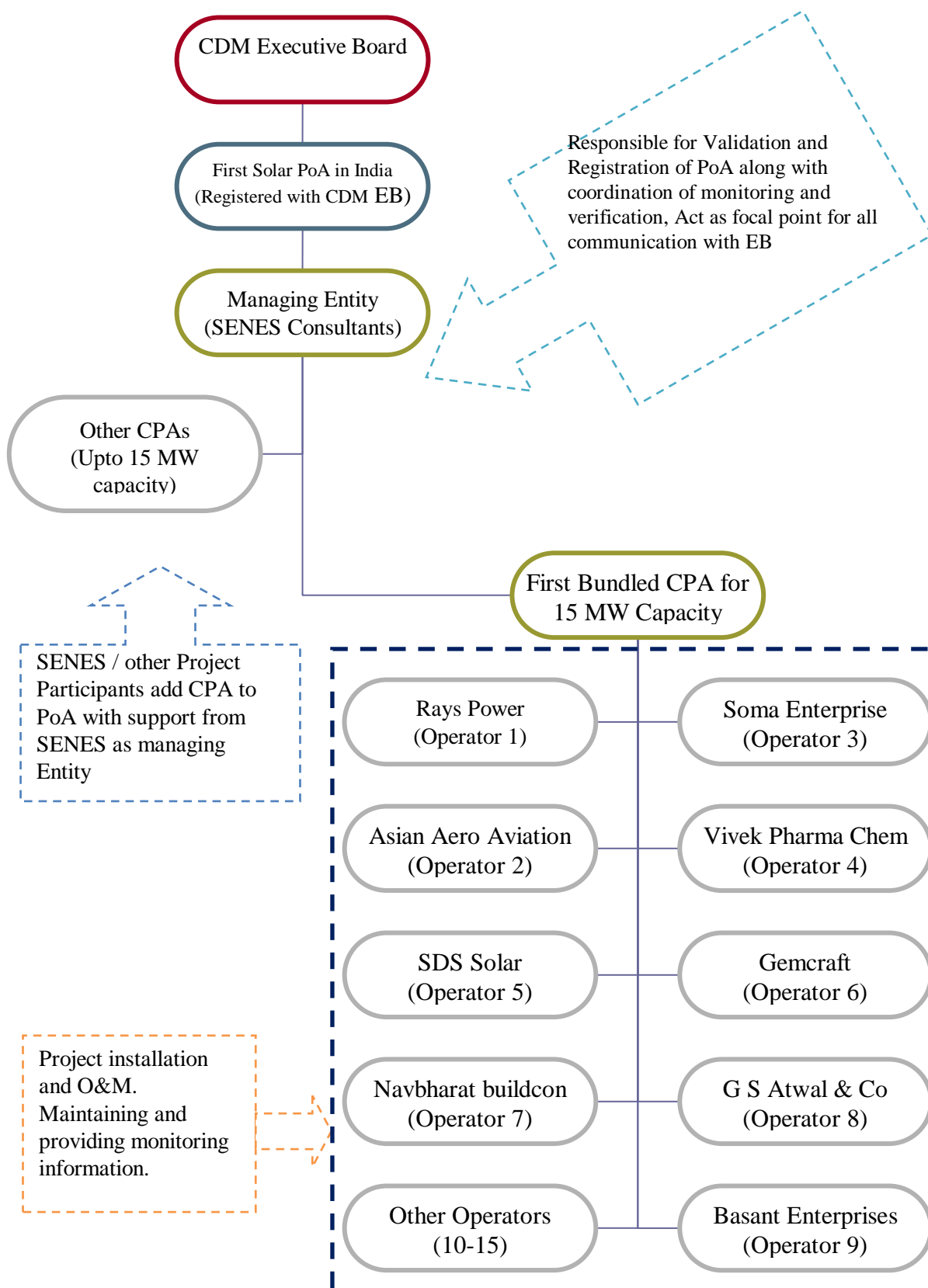
SENES would act as the focal point for all the CDM related activities and communications of the PoA. SENES would also be responsible for contracting the DOE for the PoA and would interact directly with DOE and EB to fulfil all the validation, registration and verification requirements under CDM.

The programme and its managing entity thereby aim to contribute to reduction of India's heavy dependence on fossil fuels to generate electricity⁶

The first CPA would constitute 13 small scale solar power generation units operating at different locations across India with a total capacity of 14.8 MW. Subsequent CPA shall have a total capacity of upto 15 MW.

More CPA would be launched as more and more entrepreneurs become a part of the initiative and SENES Consultants would be the managing entity of all the subsequent CPAs.

⁶ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf





1. Policy/measure or stated goal of the PoA

The objective of Solar PoA in India by SENES Consultants is to develop a platform for overcoming institutional, financial and structural hurdles for the construction of a series of small scale grid connected solar power projects in India.

Since all the small scale solar power projects in India face similar hurdles, the Solar PoA in India by SENES Consultants would provide synergies to overcome hurdles that are common to development of a small scale grid connected solar power project.

Joint development of the small scale solar power project as CDM would be a corner stone in project development and would maximise the CDM benefit through economies of scale.

The key Policies/measures or stated goals of the Solar PoA in India by SENES Consultants are as follows:

1. Reduce dependence on fossil fuel based electricity generation in India.
2. Promote installation of grid connected solar power projects in India through facilitation of accrual of CDM revenue.
3. SENES Consultants would be the entity that acts on behalf of all members to promote the programme and it's connected projects
4. Professional and legal advice would be sought to promote the CDM approval process and the sale of Emission Reductions generated from the project to maximise CDM benefits to participating members.
5. The additional revenues obtained through the sale of "carbon credits" would be used to improve viability of the projects.
6. SENES Consultants would encourage more and more entrepreneurs / project developers to become a member of the programme to promote development of grid connected small scale solar power projects across India.
7. Generate short term employment during construction in general as well as long term job opportunities during operations, thereby contributing to sustainable development of India.

2. Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity.

The proposed PoA is a voluntary action by the private entity SENES consultant.

A.3. Coordinating/managing entity and participants of SSC-POA:

The coordinating or managing entity of the SSC-PoA will be SENES Consultants India Private Limited
The contact details are as listed in Annex 1.

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

A.4. Technical description of the small-scale programme of activities:

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A.4.1. Location of the programme of activities:

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A.4.1.1. Host Party(ies):

>> India

A.4.1.2. Physical/ Geographical boundary:

Geographical area

The political boundary of India is chosen as the country/ geographical boundary of the SSC-PoA. The SSC-CPAs that will be included under the SSC-PoA will be within the defined geographical location of the SSC-CPA area and follow applicable national and / or sectoral policies and regulations.

Lying entirely in the northern hemisphere, the mainland extends between latitudes 8° 4' and 37° 6' north, longitudes 68° 7' and 97° 25' east and measures about 3,214 km from north to south between the extreme latitudes and about 2,933 km from east to west between the extreme longitudes. It has a land frontier of about 15,200 km. The total length of the coastline of the mainland, Lakshadweep Islands and Andaman & Nicobar Islands is 7,516.6 km⁷.

The Indian peninsula is separated from mainland Asia by the Himalayas. The Country is surrounded by the Bay of Bengal in the east, the Arabian Sea in the west, and the Indian Ocean to the south. The border countries of India are Afghanistan and Pakistan to the north-west; China, Bhutan and Nepal to the north; Myanmar to the east; and Bangladesh to the east of West Bengal. Sri Lanka is separated from India by a narrow channel of sea, formed by Palk Strait and the Gulf of Mannar⁸. Presently India has 28 States and 7 Union Territories as listed in Table below⁹, all of which are covered by the PoA. In future if there is any further change in state boundaries, the areas will still be covered in PoA to cover the complete political boundary of India.

S. No	State/ Union Territory	S. No	State/ Union Territory
1	Andhra Pradesh	19	Nagaland

⁷ <http://india.gov.in/nowindia/profile.php>

⁸ http://india.gov.in/nowindia/india_at_a_glance.php

⁹ http://india.gov.in/nowindia/state_uts.php



2	Arunachal Pradesh	20	Orissa
3	Assam	21	Punjab
4	Bihar	22	Rajasthan
5	Chhattisgarh	23	Sikkim
6	Mizoram	24	Tamil Nadu
7	Goa	25	Tripura
8	Gujarat	26	Uttar Pradesh
9	Haryana	27	Uttarakhand
10	Himachal Pradesh	28	West Bengal
11	Jammu and Kashmir	29	Andaman And Nicobar
12	Jharkhand	30	Chandigarh
13	Karnataka	31	Dadra and Nagar Haveli
14	Kerala	32	Daman and Diu
15	Madhya Pradesh	33	Delhi
16	Maharashtra	34	Lakshadweep
17	Manipur	35	Pondicherry
18	Meghalaya		

Any grid connected solar power project of capacity upto 15MW located in any of the state above covered under any state or country level scheme shall be covered under the PoA.

A.4.2. Description of a typical small-scale CDM programme activity (CPA):

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A.4.2.1. Technology or measures to be employed by the SSC-CPA:

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All CPAs¹⁰ under the PoA will be a bundle of small scale solar power generation units located across India with a combined capacity below or equal to 15 MW connecting to the Indian National grid. The project activity utilizes solar energy, one of the most environmentally safe technologies for meeting the needs of the energy sector in India. The Project activities would contribute to reducing the consumption of fossil fuels for generation of the equivalent power outputs and meet the PoA's objectives

The following general technical conditions will apply for all CPAs:

The project activity is either grid connected solar photovoltaic or solar thermal based power generation. The rated capacity of the power plant will be upto 15MW at standard test conditions.

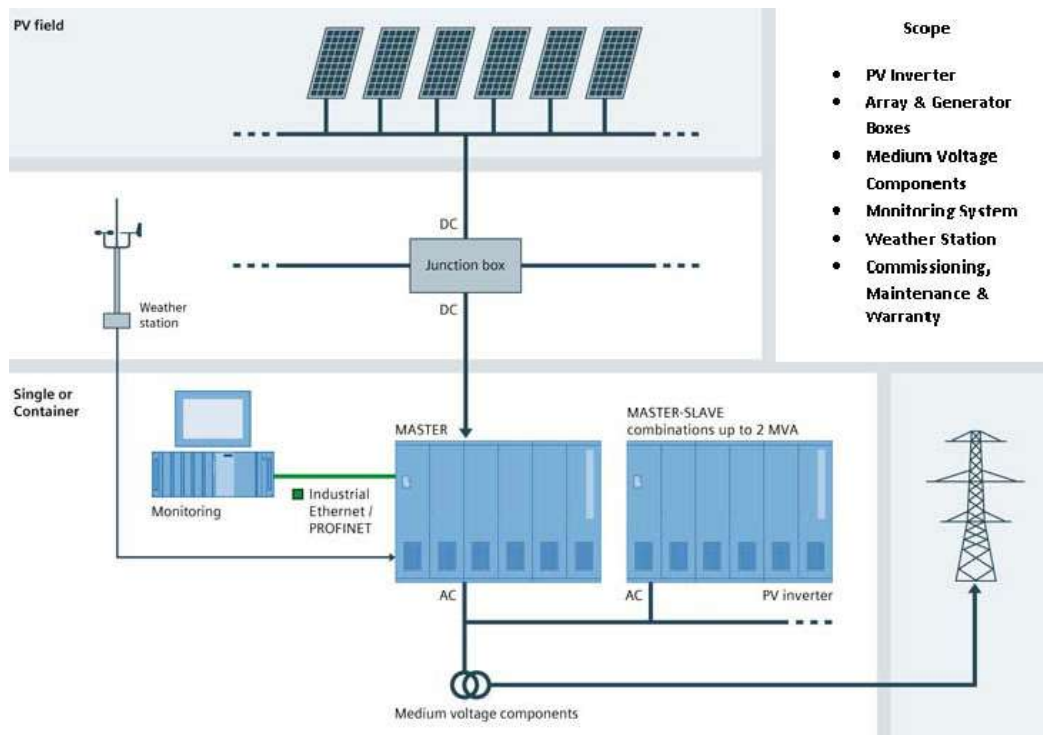
General Description of Solar Photovoltaic technology

Photovoltaic module consists of several photovoltaic cells connected by circuits and sealed in an environmentally protective laminate, which forms the fundamental building blocks of the complete PV generating unit. Several PV panels mounted on a frame are termed as PV Array.

¹⁰ CPA or the plural CPAs is used throughout the document as acronym for SSC- CPA or SSC CPAs respectively



Type of PV Modules will be either Crystalline or thin film type PV modules or a combination of both. Inverter, Switchgear Cubicle for Grid Connection, Circuit Breaker and Transformer of suitable capacity would be installed; details of the same would be provided at CPA level.



Each power production unit will constitute the following equipments:

1. SPV modules of suitable rating.
2. Power conditioning unit
3. Mounting structures.
4. Cables and hardware.
5. Junction box and distribution boxes.
6. Earthing kit.
7. Lightning arrestors.
8. PVC pipes and accessories.
9. Tool kit.
10. Control room equipments.
11. System for control and monitoring.
12. Evacuation system

General Description of Solar Thermal Technology

A solar thermal power plant in principle works no differently than a conventional steam power plant. However, there is one important difference. It is produced solely by the energy that comes from the sun. In order to achieve the high Temperatures required, solar radiation must be concentrated. The troughs are made up of parabolically shaped mirror segments. The troughs track the sun over the course of the day and focus the resulting radiation along the caustic line of the mirrors onto specially coated, evacuated absorber tube receivers and generated heat is used to heat the thermic fluids such as heat transfer oils, air or



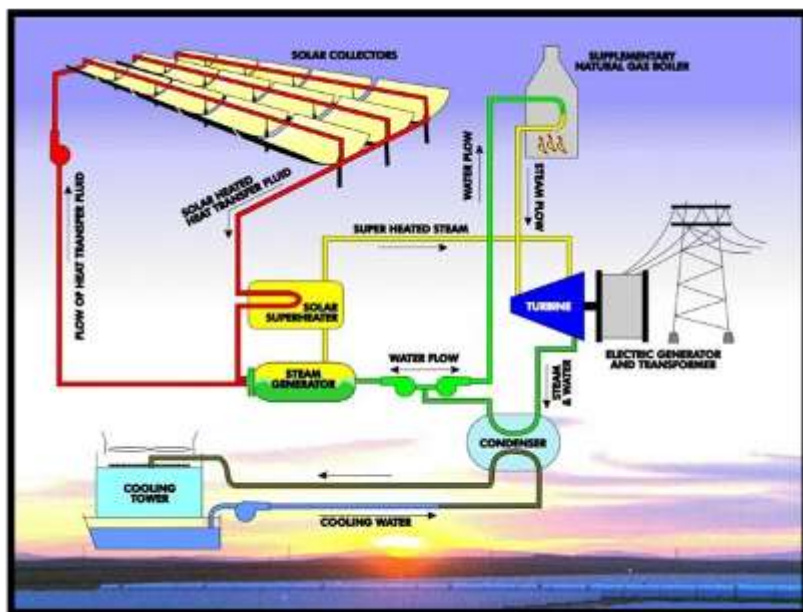
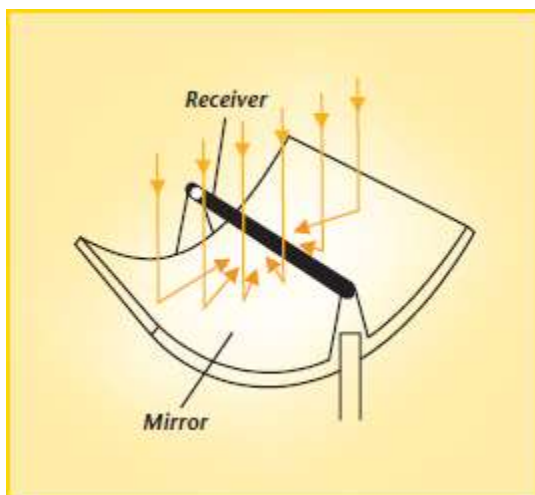
water/steam, depending on the plant design, acts as heat carrier and/or as storage media. The hot thermic fluid is used to generated steam or hot gases, which are then used to operate a heat engine.

High temperature solar energy collectors are basically of three types;

- a. **Parabolic trough system:** at the receiver can reach 400° C and produce steam for generating electricity.
- b. **Power tower system:** The reflected rays of the sun are always aimed at the receiver, where temperatures well above 1000° C can be reached.
- c. **Parabolic dish systems:** Parabolic dish systems can reach 1000° C at the receiver, and achieve the highest efficiencies for converting solar energy to electricity.

Major Components

1. Collectors
2. Mirrors/Reflectors
3. Mirror/Reflector Films
4. Heat Collection Element
5. Steam generator
6. Heat Storage
7. Central Control



8. Pumps

Since, the technology employed under this Program of Activity does not result in GHG emissions; the project does not cause any negative effects on the environment. The technology used does not pose any threat to the environment in comparison to the fossil fuel-fired power plants.

A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:

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The eligibility criteria have been defined in accordance with EB 65, Annex 3, A CPA to be included in the present PoA shall:

1. Be a grid connected solar based renewable energy generation units.
2. Be a newly built solar power plant.
3. Have no energy generation equipment transferred from another activity and no existing equipment is transferred to another activity.
4. Ensure that the geographical boundary of each solar power generation unit under the SSC-CPA is uniquely defined with GPS coordinates and is within the boundary of PoA.
5. Confirm that the power generation unit / units under the CPA is not registered or being registered as a stand-alone CDM project outside of the PoA. This would be achieved through undertaking by project implementer and display of Unique identification number of the power generating unit (as per the CPA) along with PoA name for each power generation units at entrance and near main energy meters and other measures as elaborated in Section 4.4.1
6. Confirm that if the new unit has both renewable and non-renewable components (e.g., a solar/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component.
7. Confirm that the start date of any CPA is not, prior to the commencement of validation of the programme of activities, i.e. the date on which the CDM-PoA-DD is first published for global stakeholder consultation¹¹. The CME shall check the start date of the project activity by means of first purchase order placed by activity implementer / operator for the project (For example purchase order for solar panel / equipment / civil construction / Engineering and procurement contract etc) and confirm that it's after 30th December 2010
8. Confirm and fulfil the additionality criterion set in the PoA as defined in Section E.5.2 of the PoA-DD.
9. Declaration that there is no ODA funding flowing into the individual CPA.
10. In the event the power plant operator has an operating solar power plant within 1 km of boundary of the proposed plant then the combined capacity of all such plants put together by the same operator should not exceed 15 MW. At the time of inclusion of CPA, the managing entity would do a check within a radius of 1 km of power plant as part of the CPA to confirm the condition is met.

A CPA under this PoA can comprise of a number of smaller solar power plants with varying generation capacities dispersed all across India. In case of adoption of bundle approach, the total installed capacity of power generation units under the CPA should not exceed 15 MW.

A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):

>> The following shall be demonstrated here:

- (i) The proposed PoA is a voluntary coordinated action;

There is no mandatory legal requirement in India to generate electricity by installing solar power plants. In India electricity generators are free to choose the type of energy and technology to be deployed in their projects as long as all required environmental, construction and operational permits are in place. In fact a

¹¹ http://cdm.unfccc.int/EB/047/eb47_repan29.pdf



number of fossil fuel based power projects are in pipeline in India¹². The PoA is being coordinated by SENES Consultants, a private entity which has no legal requirement to promote solar power projects in India.

Hence the PoA is a voluntary coordinated action.

- (ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;

As per EB 47, paragraph 73 “Additionality is to be demonstrated either at the PoA level or at CPA level”¹³.

The project participants have chosen to demonstrate Additionality at PoA level.

Additionality

Additionality analysis has been conducted as per Attachment A to Appendix B (EB63, Annex 24)¹⁴ using barrier analysis as detailed below:

11th five year plan of MNRE (2006) states that¹⁵ –

1. That there are no existing feed in tariff mechanism for Solar power in India (page 6)
2. Unit cost of generation of solar power was very high and therefore unviable.(Page 8)
3. There may be a case for support to solar power provided. Incidentally, the present unit cost of SOLAR power is around Rs.20/kWh (without battery back-up) and Rs.30/kWh (with battery back-up). Incentivizing could be done on the basis of feed-in tariff, fiscal concessions and some subsidy. (Page 18).

Upto 2009 the total installed capacity of grid connected Solar project in India was 2.1 MW¹⁶ against a total installed capacity of 147965.41 MW¹⁷

Thus, it is clearly demonstrated that solar projects are not a baseline scenario in India and would not be installed in absence of E- policy level support influenced by the Kyoto protocol.

Barrier analysis

Investment Barrier:

¹² <http://thermalpower.industry-focus.net/index.php/industry-overview/342-list-of-upcoming-thermal-plants-in-india.html>

¹³ <http://cdm.unfccc.int/EB/047/eb47rep.pdf>

¹⁴ http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf

¹⁵ <http://www.mnre.gov.in/pdf/11th-plan-proposal.pdf>

¹⁶ <http://www.ecoworld.com/products/electronics/indias-solar-power.html>

¹⁷ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver5.pdf



Solar power project has the highest investment requirement per MW of capacity. All major other sources of grid connected electricity in India i.e. thermal, hydro, biomass, and wind¹⁸ has substantially lower investment requirement than solar as discussed in following table:

Table 1: Comparison of investment required to other major grid connected sources of electricity

S.no	Source of Grid connected electricity	Installation cost per MW (Indian Rupees)
1	Thermal	50 Million
2	Hydro	35 Million ¹⁹ (Page 19)
3	Biomass	45 Million ²⁰ (Page 20)
4	Wind	65 Million ²¹ (Page 18)
5	Project Activity (Solar)	190 Million ²² (Page 22)

As demonstrated in the table above, solar Power projects in India suffer from investment barrier, as the cost of installation of solar projects is 2 – 3 times higher when compared to other grid connected sources of electricity. As a consequence the share of Solar based power plant in the Indian national grid is negligible.²³

In fact as per MNRE annual report in 2006, the provision for the 140 MW Integrated Solar Combined Cycle plant at Mathania, Rajasthan could also not be utilized on the basis of a review that recommended a more cautious approach towards deployment of grid-interactive solar projects at this juncture, in view of the very high unit cost of generation of solar electricity, apart from technological and commercial reasons²⁴. The same report mentioned that the present unit cost of solar Power is around Rs.20/kWh²⁵ against a prevailing Maximum tariff of Rs 5/ kWh.²⁶

Further an investment analysis has been conducted to calculate the NPV for solar power projects upto 15 MW capacity. An investment analysis of 5 different capacities of solar power projects viz 1MW, 2MW, 5MW, 10MW and 15 MW were undertaken to calculate the NPV. The investment analysis has been carried out in according to the “GUIDELINES ON THE ASSESSMENT OF INVESTMENT ANALYSIS version 05.0, EB 62 Annex 05²⁷”. The assumptions considered in the analysis and their compliance with the guidelines is provided in table 2. Incentives available under National Action Plan on Climate Change

¹⁸ http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf

¹⁹ http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf

²⁰ http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf

²¹ http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf

²² http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf

²³ <http://www.mnre.gov.in/press-releases/press-release-13072009-2.pdf>

²⁴ <http://www.mnre.gov.in/pdf/11th-plan-proposal.pdf>

²⁵ <http://www.mnre.gov.in/pdf/11th-plan-proposal.pdf>

²⁶ http://www.cercind.gov.in/2010/November/Signed_Order_256-2010_RE_Tariff_FY_11-12.pdf

²⁷ http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf



(NAPCC)²⁸ an E- policy to combat climate change by Government of India launched in 2008 has not been considered in the financial analysis. NAPCC led to formulations of several E - policies, such as the Generation Based Incentive (GBI) Mechanism in 2008, state level solar policies such as that of Gujarat in 2009, and the launch of the Jawaharlal Nehru National Solar Mission (JNNSM)²⁹ in 2010. However the financial analysis refers to a hypothetical situation without such E- policies and assumes that the tariff available to the solar power projects would be as per the prevailing tariff in the region. This is as per guideline provided in EB 22 Annex 3³⁰ and EB 53 annex 32³¹ and avoids creation of perverse incentives that may impact host parties contribution to the ultimate objective of the convention.

Guidance³²	Project compliance
General issues in calculation and presentation	
<i>Period of assessment</i>	The project assessment period is considered as 25 years, which is the expected operational life time of the project. This period is also in line with the guideline, suggesting a minimum of 10 years and a maximum of 20 years is considered as appropriate. Hence an analysis for 25 years is conservative.
<i>Salvage value</i>	The salvage value considered for the project components is the 10% of the capital cost
<i>Depreciation and other non-cash items</i>	After deducting in the profit before tax calculations, Depreciation is added back into the net cash inflow, since, it is not considered as actual expense incurred. Depreciation values are considered for tax calculations, as the investment analysis is calculated for post tax NPV.
<i>Time of assessment and input values</i>	The investment analysis was carried out during the decision making period of the PoA ie 2010 -11. The input values for plant and machinery costs considered in the estimation were based on quotations provided by third party manufacturers / EPC contractors or as per CERC order whichever is conservative. Working capital has been considered as 2 months revenue as per CERC order and other capital cost including land cost, preliminary and pre-operative cost have been considered as 5% of plant and machinery cost. The O&M expenses have been taken quotations provided by third party manufacturers / EPC contractors or as per CERC order whichever is

²⁸ http://pmindia.nic.in/climate_change.htm

²⁹ <http://www.mnre.gov.in/solar-conclave2010.htm>

³⁰ http://cdm.unfccc.int/EB/022/eb22_repan3.pdf

³¹ http://cdm.unfccc.int/EB/053/eb53_repan32.pdf

³² Tool for the demonstration and assessment of additionality, Version 5.2. Annex: Guidance on the Assessment of Investment Analysis Version 02. Point no 1 & 2 of the guidance refers to general introduction.



	conservative. Manpower cost has been taken as the minimum requirement of staff for a power plant.
<i>Restart of project implementation</i>	Not applicable to the project
<i>Provision of investment analysis spread sheets</i>	Spread sheets will be provided as per the requirement.
<i>Cost of financing expenditure</i>	Cost of financing expenditure such as interest and loan repayments are not included in the NPV calculation.
<i>Equity IRR</i>	Not applicable to the project
Selection and Validation of Appropriate Benchmarks	
<i>Application & suitability of discount rate</i>	The interest (prime lending) rate for nationalized bank is 12.5%. However to be conservative default value for return on equity for energy industries projects in India has been taken as discount rate (11.75%) ³³ .
<i>Risk premiums</i>	Has not been considered, this is conservative.

Investment comparison analysis and benchmark analysis

The result of Investment analysis is demonstrated in Table 3. As evident in table 3 the NPV of all the projects is negative and thus poses investment barrier.

Table 3 NPV Analysis

S.no	Plant Capacity (MW)	Total Capital cost (Million INR)	O&M and Manpower Cost (Annual for First year) (Million INR)	Revenue (Annual for First year) (Million INR)	NPV
1	1	152.9	1.96	9.15	negative
2	2	303.4	3.56	18.31	negative
3	5	764.7	5.95	45.77	negative
4	10	1453.8	12.69	91.54	negative
5	15	1975.9	17.72	137.31	negative

Hence, it is concluded that solar power plants upto a capacity of 15 MW are additional.

This is also in line with para 2 of Attachment A of Appendix B which states that 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;

³³ Annex 05,EB 62, Guidelines on the assessment of Investment Analysis version 05



(c) Marine technologies (wave, tidal).

Since all the projects to be implemented under the PoA are covered under option (a) Solar technologies (photovoltaic and solar thermal electricity generation), the PoA and the individual projects to be included under the PoA are additional.

Sensitivity analysis

The purpose of sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the assumptions. The investment analysis provides a valid argument in favor of additionality only if it consistently supports (for realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is likely to be financially attractive.

Thus, a sensitivity analysis was also applied to the NPV calculations to measure the impact, positive or negative, of changes in the indicated parameters. Following factors have been selected as critical to the operations of the project namely project cost, tariff and annual operation and maintenance expenses. These 3 factors were subjected to 10% variation on either side, based on “Guidelines on the Assessment of Investment Analysis”, version 05 to ascertain the impact on the profitability and hence the NPV of the project. The results of the sensitivity analysis are as given below:

1MW:

Parameter	Resultant NPV		
	Base Case	Increase by 10%	Decrease by 10%
Project Cost	negative	negative	negative
Tariff	negative	negative	negative
Annual operation and maintenance expenses	negative	negative	negative

2MW:

Parameter	Resultant NPV		
	Base Case	Increase by 10%	Decrease by 10%
Project Cost	negative	negative	negative
Tariff	negative	negative	negative
Annual operation and maintenance expenses	negative	negative	negative

5MW:

Parameter	Resultant NPV		
	Base Case	Increase by 10%	Decrease by 10%
Project Cost	negative	negative	negative
Tariff	negative	negative	negative
Annual operation and	negative	negative	negative



maintenance expenses			
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10MW:

Parameter	Resultant NPV		
	Base Case	Increase by 10%	Decrease by 10%
Project Cost	negative	negative	negative
Tariff	negative	negative	negative
Annual operation and maintenance expenses	negative	negative	negative

15MW:

Parameter	Resultant NPV		
	Base Case	Increase by 10%	Decrease by 10%
Project Cost	negative	negative	negative
Tariff	negative	negative	negative
Annual operation and maintenance expenses	negative	negative	negative

- Project Cost: Decrease in project cost is not expected since the estimates are based on the minimum requirement of capital for the plants. Moreover, the project remains additional upto more than 71% decrease in project cost for 1 and 2MW capacity power plants, 66% decrease for a 5 and 10MW power plant and 62% decrease for 15MW power plant, which is unrealistic to achieve since it would result in almost half or one fourth of the estimated cost.
- According to the analysis, NPV increases on increasing the tariff. The NPV does not become positive even with an increase of 100% in tariff and hence such an increase is not possible.
- Decrease in O&M expenses also lead to increase in NPV; however likelihood of such a scenario is unrealistic because even the elimination of O&M expenses does not result in NPV becoming positive for any of the capacity power plant upto 15MW.

Barrier due to prevailing practice

The growth of Indian Power Sector is quite impressive as the installed capacity has grown to 147965.41 MW on 2009³⁴ but at the same time the growth of grid connected solar PV power is negligible.

In 2008, the E- National Action Plan on Climate Change policy was declared, which identified development of solar energy in the country by setting up a Solar Mission³⁵. Though the Ministry is implementing several schemes to promote solar energy, still the growth of utilization of solar PV power systems is very nominal

³⁴ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf

³⁵ <http://www.mnre.gov.in/press-releases/press-release-15122008-3.pdf>



in the country. This is because of the high initial cost of solar energy systems which is a barrier in large scale utilization of solar energy systems, especially for power generation.³⁶

There was no grid connected solar PV power plant in operation in India till 2007³⁷. In the year 2008, with the financial support from Indian Government, a total of 33 grid interactive solar PV power plants have been installed with aggregate capacity of 2.12 Megawatt with estimated generation of 2.55 million units of electricity in a year³⁸.

A number of ambitious solar projects in India could not off take in past due to various barriers. For example, the provision for the 140 MW Integrated Solar Combined Cycle plant at Mathania, Rajasthan could also not be utilized on the basis of a review in 2006 that recommended a more cautious approach towards deployment of grid-interactive solar projects at this juncture in view of technological and commercial reasons³⁹.

The small scale projects would be resulting in generation of on an average 70 CER per project, made it impossible for these projects to avail CDM benefits, in consideration of high cost involved in CDM cycle. Recognizing the need to reduce transaction cost, the First solar CDM PoA is being launched in India by SENES Consultants.

The following table clearly demonstrates the growth of grid connected power sources in India.

Table 2: Growth of different grid connected power sources in India

Installed capacity (MW) as on	Thermal	Hydro	Nuclear	Renewable including solar energy	Grid connected Solar power
2006⁴⁰	82410.54	32325.77	3360.00	6190.86	00
2007⁴¹	86014.84	34653.77	3900.00	7760.60	00
2008⁴²	91906.84	35908.76	4120.00	12194.57	2.12

It is evident from the table above that around 64% share of installed capacity is from thermal stations, 25% from hydro, 3% from nuclear stations and 8% from renewable sources. Against this, the grid connected solar PV power projects in operation in India is only 2.12MW with a contribution share of 0.00147% of total installed grid power, which is negligible.

³⁶ <http://www.mnre.gov.in/press-releases/press-release-13072009-2.pdf>

³⁷ http://mnre.gov.in/annualreport/2006_2007_English/HTML/ch2_pg4.htm

³⁸ <http://www.mnre.gov.in/press-releases/press-release-31032008.pdf>

³⁹ <http://www.mnre.gov.in/pdf/11th-plan-proposal.pdf>

⁴⁰ <http://www.cea.nic.in/planning/c%20and%20e/user%20guide%20ver1.1.pdf>

⁴¹ http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver2.pdf

⁴² http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf



Post 2008, as a consequence of E- policy incentive provided by Government of India and availability of CDM benefits, a number of Grid connected solar power projects are planned. These projects are already in process of getting registered under CDM with the UNFCCC⁴³. Launch of the first solar PoA by SENES Consultants would streamline the CDM approval process and promote more grid connected solar power projects across the country thereby supporting the ultimate objective of the convection i.e., reducing GHG emission and combating Climate change.

Hence it is adequately proved that installation of solar power project is not a common practice in India and in absence of GHG reduction incentives, Grid connected solar Power projects would not be installed in the host country.

In conclusion, the grid connected Solar Power plants installed in the host country under the project activity are additional and would not have happened under business as usual scenario. The baseline scenario in the absence of the projects is generation of electricity in existing and/or new power plants in the electricity grid.

- (iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;

PoA is not implementing any mandatory policy/regulation

- (iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.

PoA is not implementing any mandatory policy/regulation

The information presented here shall constitute the demonstration of additionality of the PoA as a whole.

Hence, as demonstrated above, the PoA of the solar power projects in India is additional and would not have occurred in the absence of the CDM revenues.

A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

A.4.4.1. Operational and management plan:

The operational and management arrangements established by the coordinating/managing entity for the implementation of the PoA are as per EB 63 Annex 3 Para 9. The operational and management arrangements for the PoA is discussed below.

a) Clear definition of roles and responsibilities of personnel involved in the process of CPA inclusion

The role of the CME (SENES) is to assess and review potential CPAs and work with the implementing entity to perform eligibility assessment, complete the CPA-DD, and submit a CPA inclusion request to

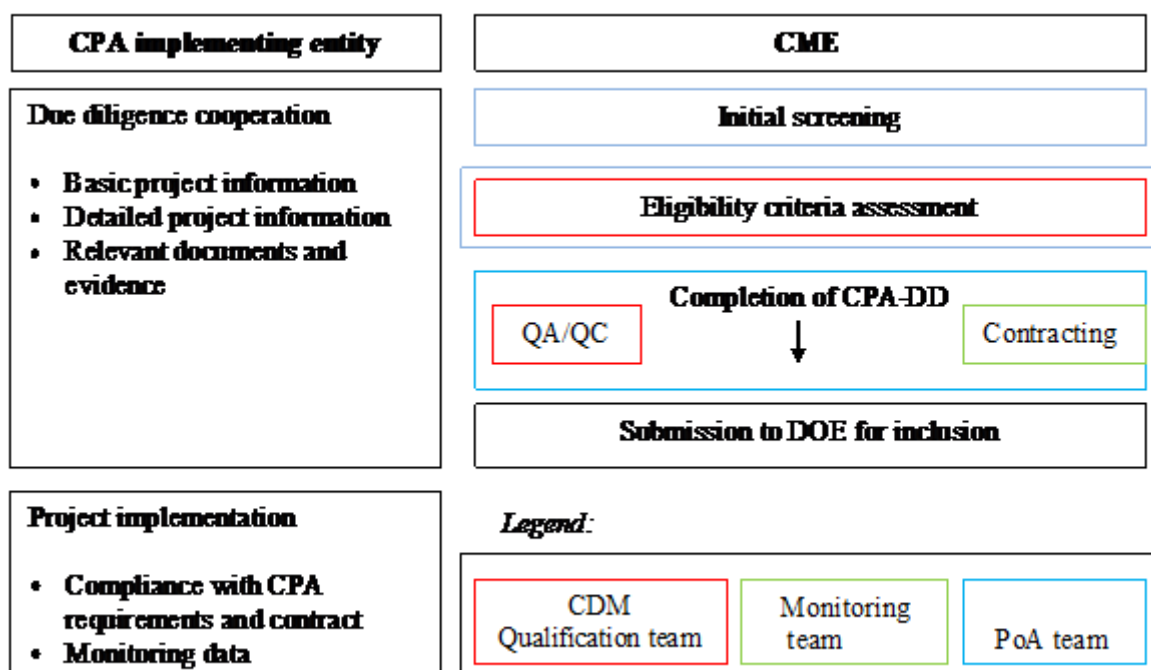
⁴³ <http://cdm.unfccc.int/UserManagement/FileStorage/0PZ2XOU3HGIRED68FB5YWALVJC1KQN>



the DOE. The CME responsibilities are split across three teams within the organization: the PoA, CDM qualification, and Monitoring teams (see Figure 2). All three teams report to the CME Director who has the overall responsibility for the inclusion process. A review of the existing team members and competencies (e.g. short profiles) have been made available to the DOE at the time of PoA validation.

The role of the CPA implementing entity is to provide all necessary project information and documentation to the CME to facilitate the comprehensive assessment of the project's PoA eligibility and the completion of the CPA-DD.

A summary of the roles and responsibility is provided in Figure 1 below



The Competency required from team members from each team are as follows

CDM Qualification team:

- (i) Should have clear understanding of CDM modalities and protocol
- (ii) Should have clear understanding of the eligibility criteria of the PoA
- (iii) Should be able to scrutinise all the project related documents of the CPA like PPA, Land documents, licences etc to ascertain the qualification of the CPA to be included in the PoA
- (iv) Should be competent to check de bundling and all other criteria as listed in section A.4.2.2. of the PoA DD
- (v) Should be fluent in English



- (vi) Should have at least 3 Years of experience in validation / registration / documentation of CDM project activity

Monitoring Team

- (i) Should have clear understanding of CDM modalities and protocol
- (ii) Should have clear understanding of the Monitoring Requirement of the PoA
- (iii) Should be able to scrutinise all the monitoring related documents and equipments like electricity meters, calibration certificate, electricity bills / Invoice etc
- (iv) Should have good communication skill and be able to effectively communicate the requirement of monitoring plan to project activity implementer.
- (v) Should have good knowledge of Microsoft excel to be able to archive and maintain monitoring information
- (vi) Should be fluent in English
- (vii) Should have at least 3 Years of experience in monitoring of CDM project activity

PoA team

- (i) Should have clear understanding of CDM modalities and protocol
- (ii) Should have clear understanding of the Requirement for formulation of CPA DD
- (iii) Should be able to interact with possible CPA implementation and clearly communicate the PoA concept so as to generate new CPAs for the PoA
- (iv) Should be able to preliminary access whether the CPA / activity implementer is eligible to be a part of PoA.
- (v) Should be fluent in English
- (vi) Should have at least 2 year of experience in CDM documentation like PDD/POA DD/ CPA DD/ Monitoring Plan / Validation or verification report

b) Records and arrangements for training and capacity development for personnel

Training will be provided whenever a new member is inducted to any of the above mentioned team and a record will be kept and made available to the DOE. The CDM qualification team, the monitoring team and POA team would be trained in their respective field annually. An important focus of the training shall be latest EB decisions and changing monitoring requirement. Training manuals will be developed and disseminated among the team member. Such training manual and attendance sheet shall be available to DOE on request.

c) Procedures for technical review and inclusion of a CPA in the PoA

In order to be included in the PoA, the CME will assess the eligibility of each CPA to see if its characteristics fit the criteria set in section A.4.2.2. As per Figure 1, the procedures for inclusion of a CPA in the PoA are the following:

- 1) Initial screening (By the PoA team)
- 2) Preparation of the CPA-DD (incl. QA/QC and contracting by PoA Team)
- 3) Eligibility checks (incl. technical review by CDM qualification team)
- 4) Official submission to DOE for inclusion by CDM qualification team



The procedures performed by PoA team are as follows:

- 1) The procedure for Additionality assessment will review the geographical location of the CPA and ensure that it is within the boundary of India
- 2) It will involve checking if the **capacity** of the grid connected Solar power plant is less than 15 MW vide checking the PPA/ Licence or any other relevant document.
- 3) Check the **start date** of the project activity by means of first purchase order placed by activity implementer for the project (For example purchase order for solar panel / equipment / civil construction / Engineering and procurement contract etc) and confirm that it's after 30th December 2010
- 4) Once there is sufficient confidence in the project information and the CPA eligibility, the PoA team will proceed with the inclusion process and sign PoA contract with approval from Director of the PoA.
- 5) After signing the contract and explaining all the modalities and procedure of PoA to activity implementer the PoA team shall prepare the CPA design Document.

The procedures performed by CDM qualification team are as follows:

- 1) The CDM qualification team shall scrutinise the CPA design document against the PoA requirement and latest EB guidelines.
- 2) The procedure for **technical review** will assess the technical specifications of the CPA and their fit into the technical and methodological requirements of the PoA.
- 3) The process will be done in cooperation with the CPA implementing entity / operator in order to ensure that the CME takes an informed view of the validity and accuracy of the available CPA technical information. The CPA implementing entity will have to supply technical documentation which is available at the time, for example feasibility study, engineering design documents, Purchase order, PPA etc report.
- 4) Once there is sufficient confidence in the project information and the CPA eligibility, the CME will proceed with the inclusion process.

d) The procedure to avoid double-counting

In order to avoid double counting and to ensure that the operators of Solar Power plants under this PoA and to ensure that operators are aware of and have agreed that their activity is being included under this PoA, the operators would submit undertaking to SENES Consultants the Managing Entity of the PoA. In fact, the contractual agreement with all the operators covered under a CPA forms qualifying criteria for addition of the CPA. The contractual agreement would cover the following points:

1. The operator is aware and agreed that the Solar power generating unit is included in the present PoA
2. The Operator undertakes that no emission reduction benefit from the project shall be claimed by it through any other instrument either as a standalone project or through bundle or as a CPA to any other PoA.

This will include cross referencing the CPA with the:

- i) Existing CPAs in the electronic database;
- ii) UNFCCC CDM website project cycle and validation pages, available at:

<http://cdm.unfccc.int/Projects/projsearch.html>



<http://cdm.unfccc.int/Projects/Validation/index.html>

iii) CDM PoA project database information provided by UNEP Risø Centre and the Institute for Global Environmental Strategies:

<http://cdmpipeline.org/>

http://www.iges.or.jp/en/cdm/report_cdm.html

To hedge against future double counting and debundling accusations, the CPA would have to enter into contractual agreement with the CME. The agreements provisions will ensure that the CPA is exclusive to SENES Consultants. Namely, the CPA implementing entity would have to agree that it:

- Will not register the CPA as a single CDM activity or as a CPA under another PoA;
- Is aware of and have agreed that their activity is being subscribed to the PoA of the particular CME;
- Shall not undertake a CDM project that employs the same technology, or another CPA within 1 km of the proposed CPA;
- Cedes its rights to claim and own emission reductions under the CDM to the CME of the present PoA.

The CME shall also make it mandatory that all the participating project activity implementer / operator clearly displays the POA name and Unique CPA identification number to which it is subscribed at the following locations

- 1) Every Entrance of plant facility
- 2) Near the main Energy meter that calculates the amount of electricity produced in the plant

To avoid any possible overlapping between two different CPA

- The procedure for **de-bundling check** will have to confirm that the CPA is not a debundled component of another CDM activity. The CME will assess the evidence that proves that there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:
 - With the same implementing entity;
 - In the same project category and technology/measure; Registered within the previous 2 years; and
 - Whose project boundary is within 1 km of the CPA project boundary at the closest point.

e) Records and documentation control process for each CPA

The CME will maintain an electronic database which will include the following information for each CPA:

- Unique identification code;
- CPA title/name;
- Implementing entity – name, address, contact person and details;
- Installed capacity and other relevant technical specifications;
- Location of the CPA (e.g. GPS coordinates of the power plant);
- List of documents provided by the CPA implementer / operator and available to the CME;



- Project status – e.g. start date, timeline.

This information will be used both for internal management purposes and for external control by the DOE. Therefore, the electronic database will be the prime evidence that debundling and double counting are avoided.

The records for all the data would be kept and maintained on-site by each project operator included in the CPA in the specified format as detailed in Section E.7 of PoA-DD. The copy of records (in soft format) will be submitted to SENES (managing entity) half yearly for internal audit and checking the consistency of the data and calculation of baseline emissions. Each CPA would constitute of a number of power generating units located across India totalling to a maximum capacity of 15 MW. The location of each power generating units with their geographical coordinates along with name of operator would be recorded and kept by SENES Consultants (the Managing entity) and a Unique Identification Number will also be assigned to the power plants. A GIS based map would be available with SENES Consultants for ready reference by a DOE/ any other entity.

All the records pertaining to monitoring and inclusion criteria would be achieved and kept with CME for 2 years after the end of crediting period

f) Measures for continual improvement of the PoA management

The PoA management process will be assessed annually with comments invited from all team members and participating CPA implementing entities to help identify any areas of improvement.

The annual assessment will take the form of a questionnaire that will be sent out electronically to all CME team members and on paper and/or electronically to participating CPA implementing entities / Operators.

Further a bi annual audit would be conducted by the director of the CME to ascertain the smooth functioning of the process and any possible deviation from the approach as planned in the PoA DD.

A.4.4.2. Monitoring plan:

>> The following information shall be provided here:

- (i) Description of the proposed statistically sound sampling method/procedure to be used by DOEs for verification of the amount of reductions of anthropogenic emissions by sources or removals by sinks of greenhouse gases achieved by CPAs under the PoA.

Monitoring will be carried out per CPA. For each CPA, all parameters included in Section E.7.1 will be monitored by the implementing entity of the CPA according to the procedures and monitoring framework established in E.7.2 and will be submitted to the managing entity. The managing entity will store the data in an electronic database. Primary data will be stored by the implementing entities/operators.



The PoA proposes 100% monitoring of all grid connected Solar Power Projects under the program. Hence, no sampling is proposed. Details of monitoring procedures followed under each CPA is described in section E.7.1

- (ii) In case the coordinating/managing entity opts for a verification method that does not use sampling but verifies each CPA (whether in groups or not, with different or identical verification periods) a transparent system is to be defined and described that ensures that no double accounting occurs and that the status of verification can be determined anytime for each CPA;

Verification will occur either separately for each CPA or in groups, In any case, data shall be verified per CPA and the verification status of each CPA will be recorded by SENES Consultants (the managing Entity) electronically and would be made available to DOE as required.

A.4.5. Public funding of the programme of activities (PoA):

>>

There is no public funding involved in the PoA.

SECTION B. Duration of the programme of activities (PoA)

B.1. Starting date of the programme of activities (PoA):

>> 1/03/2012 (start date of the crediting period of PoA)

04/02/2011 (Start date of PoA ie the start date of fist CPA included in the PoA)

B.2. Length of the programme of activities (PoA):

>>28 years

SECTION C. Environmental Analysis

>>

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

- 1. Environmental Analysis is done at PoA level ☒
- 2. Environmental Analysis is done at SSC-CPA level ☐

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>

The environmental aspects and impacts for the project activity were analyzed and it was inferred that there are no significant negative environmental impacts on air, water, noise or ecology. The summary of findings is given below:



During construction phase

The construction phase involved erection of panels and other civil structures in their respective location. Although movement of materials for erection produced some dust pollution, the impacts are negligible and do not have any significant impact on the environment.

During operation phase

Impact on Air

There are no negative impacts on air due to the project activity.

Impact on water

No effluent is discharged from the project activity and hence, there is no impact on water due to the project activity.

Impact due to noise

There are no impacts on the environment due to noise.

Impact on ecology

No impact is envisaged.

Following positive environmental impacts have been envisaged:

1. Using solar panels does not pollute the air.
2. Using solar panels doesn't release carbon dioxide, nitrogen oxide, sulfur dioxide, into the atmosphere as many traditional forms of electrical generation do.
3. The solar panels operate silently, have no moving parts, and don't release offensive smells.
4. Does not contribute to acid rain, global warming, or smog and it reduces the emissions into environment.

No significant negative impacts considered due to implementation of project activity by the host party. Hence, no references or procedures specified here.

C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA):

As per the prevailing host party laws, (Notification by Ministry of Environment and Forests, Government of India notification dated September 14, 2006, Schedule 1)⁴⁴, 38 activities are required to undertake environmental impact assessment studies. As clear from the document, Environmental Impact Assessment study is not required for solar project as there is no negative environmental impact due to the project activity and it is one of the cleanest sources of energy.

SECTION D. Stakeholders' comments

>>

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

- | | |
|--|-------------------------------------|
| 1. Local stakeholder consultation is done at PoA level | <input checked="" type="checkbox"/> |
| 2. Local stakeholder consultation is done at SSC-CPA level | <input type="checkbox"/> |

⁴⁴ <http://envfor.nic.in/legis/eia/so1533.pdf>



Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>

The stakeholder's consultation for the Solar Photovoltaic PoA was organized on 24th November 2010.

Objective

- To conduct open discussion where stakeholders are encouraged to raise questions, express their concern and comments about the proposed project through a participatory process.
- To list down the concerns of stakeholders

The identified stakeholders were project developers, officers from the Renewable Energy Corporation, and representatives of project operators.

These identified stakeholders were invited through letters. Stakeholders were given project introduction and informed about its objective through a presentation. The information shared included the project description, objective, environmental impacts and benefits, applicability of technology, implementation strategy, case studies where technology implemented has been successful, global and local benefits, and contribution towards sustainable development.

The presentation was followed by a detailed open discussion with the identified stakeholders, the details of which are provided below in Section D.3.

D.3. Summary of the comments received:

>>

The stakeholder's consultation started with a brief introduction from the representatives of SENES Consultants about Solar projects, CDM and their benefits. The meeting was well attended with a number of participants comprising of project operators, RREC officials and representatives from SENES Consultants.

The stakeholders focused mainly on the environment problems, problems they might face with PoA approach and the potential benefits the community may get out of CDM. These were all addressed by SENES Consultants as summarized below:

Participant's Concerns	Answers
How is the start date of a CDM project defined?	The first financial commitment towards the project is defined as the start date to the project.
What if two Solar projects are within 1 km?	They cannot be treated as two separate projects.
Difference between 21 Years and 10 Years?	Crediting period for a CDM project can be taken as either fixed 10 years or 7 years renewable crediting period which can be renewed twice making the total to 21 years
What if some power plant fails to produce electricity in the bundle?	That specific power plant won't receive any credits for that crediting year, it won't affect the registration of the project in anyway and also rest of the power plants under the same CPA would get credits based on their generation.



What if the different solar plants of same capacity produce different units of electricity?	CERs would be issued to each Power plant according to the amount of electricity produced in the crediting period
What if the solar plants have different commission dates? How will the monitoring take place?	The amount of electricity produced between two monitoring periods would be taken into account
Who will be the co-ordinating agency for the PoA?	Co-ordinating agency would be SENES. SENES would manage the PoA and addition of CPAs.
How the individual monitoring and PoA monitoring would be done?	All the stakeholders were informed about the detailed monitoring framework of the PoA.



D.4. Report on how due account was taken of any comments received:

>>

The project proponent will take up suggestion and inform the stakeholders regularly on the progress of project. The project proponents were commended for their action towards environment protection. Apart from the above comments and questions, no major issues were raised that could be related to the environmental or CDM aspect of the project. All comments and questions were duly taken into account by the project developer. The main concern of the community was related to the monitoring framework and monetary impacts. All concerns were addressed by the project developer.



SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:

>>

The project activity applies to approved SSC baseline and monitoring methodology; AMS-I.D, version 16.

E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:

>>

The project activity applies to approved SSC baseline and monitoring methodology; AMS-I.D. The project is eligible under this methodology since:

S.no	Applicability conditions under AMS-I.D,	Project activity is applicable to use the methodology since
1	This category comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to a national or a regional grid.	<u>Applicable and Fulfilled</u> The project activities comprise of renewable energy generation using Solar photovoltaic or Solar Thermal technology and will supply electricity to Indian grid.
2	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) existing plant(s).	<u>Applicable and Fulfilled</u> The project activities falls under option (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) since each CPA envisages setting up a number of Solar based power generation units across India with a combined capacity of power generation units under each CPA not exceeding 15



		MW.
3	<p>Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:</p> <ul style="list-style-type: none"> • 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. 	<p><u>Not Applicable</u></p> <p>CPAs would involve setting up of new Solar project and does not involve hydropower plant. Thus this applicability condition is not applicable.</p>
4	In the case of biomass power plants, no other biomass types than renewable biomass is to be used in the project plant.	<p><u>Not Applicable</u></p> <p>CPAs would involve setting up of new Solar project and does not involve biomass power plants. Thus this applicability condition is not applicable.</p>
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 component.	<p><u>Applicable and Fulfilled</u></p> <p>If the new unit has both renewable and non-renewable components, the eligibility limit of 15 MW for a small-scale CDM project activity will only to the renewable component.</p>
6	Combined heat and power (co-generation) systems are not eligible under this category.	<p><u>Not Applicable</u></p> <p>Grid connected Solar projects does not involve Combined heat and power (co-generation) systems. The only output from such system is power that would be exported to the Grid.</p>
7	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 ⁶ from the existing units.	<p><u>Not Applicable</u></p> <p>Project involves setting up of Greenfield Solar power project. Thus this applicability condition is not applicable.</p>
8	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.	<p><u>Not Applicable</u></p> <p>No retrofit or replacement to an existing system is involved. Thus this applicability condition is not applicable.</p>



Hence according to AMS-I.D, the proposed project is eligible to use this methodology.

E.3. Description of the sources and gases included in the SSC-CPA boundary

>>

	Source	Gas	Included?	Justification/Explanation
Baseline	Grid-connected electricity generation	CO ₂	Yes	In the baseline scenario the electricity would have been sourced from Indian grid which in turn would be connected to fossil fuel fired power plants which emit CO ₂ .
		CH ₄	No	As per AMS-I.D Methane Emission is not to be accounted for, this is conservative.
		N ₂ O	No	As per AMS-I.D nitrous oxide Emission is not to be accounted for, this is conservative.
Project Activity	Greenfield Solar energy conversion system	CO ₂	Yes	No Project emission are expected.
		CH ₄	No	No methane generation is expected to be emitted.
		N ₂ O	No	No nitrous oxide generation is expected to be emitted.

In accordance with para 9 of AMS-I.D, the physical, geographical site of the renewable generation sources included in the PoA delineates the project boundary.

E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

>>

The Baseline scenario has been defined in AMS 1 D. The baseline scenario is: Power would be generated in existing power plants in the electricity grid.

E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>

E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:

As per EB 47, paragraph 73 “Additionality is to be demonstrated either at the PoA level or at CPA level”⁴⁵. As per EB 60, Annex 26; the confirmation of additionality for CPAs should be conducted by means of eligibility criteria⁴⁶.

⁴⁵ <http://cdm.unfccc.int/EB/047/eb47rep.pdf>

⁴⁶ http://cdm.unfccc.int/filestorage/1/Q/R/1QRAJGC0P2MWD48Z369INYOK7F5SET/eb60_repan26.pdf?t=TFN8MTMwNDY2MDE1My42OA==_HX16umnhcP56cdsEi7Gxnby4g=



The project participants have chosen to demonstrate Additionality at PoA level.

Additionality analysis has been conducted as per Attachment A to Appendix B of 4/CMP.1 Annex II⁴⁷. While conducting Additionality analysis Non – binding practice examples to demonstrate Additionality for SSC project activity (EB 35 Annex 34) has been followed. The same is provided in section A.4.3. of the PoA

E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

Based on above analysis and EB 63 guidelines as provided in section A.4.3. of the PoA each power generation unit has to satisfy the following criteria to be considered additional.

S.no	Criteria	Benchmark	Rationale
1	Scale	The installed capacity of the power generating unit should be less than or equal to 15 MW.	<p>The eligibility criterion has been selected in accordance with analysis done in Section A.4.3 above.</p> <p>The source of installed capacity to be checked while adding a CPA would be based on allotment letter or signed Power Purchase Agreement (PPA) by the respective state electricity board or any other similar agency.</p>

E.6. Estimation of Emission reductions of a CPA:

E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

The CPA would constitute a bundle of new grid connected SOLAR based power generation units.

Baseline:

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the Solar Power generating unit multiplied by the grid emission factor. Details about calculation of grid emission factor are provided in section E.6.2 of this PoA.

Project emissions:

For SPV based electricity generation unit under this POA, there is not project emission

⁴⁷ http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf



$PE_y = 0$.

Leakage

Since the PoA would involve in establishment of new Solar based power plant, leakage is considered as zero.

Provisions regarding the revisions of the CPAs in case the methodology is put on hold or withdrawn.

- If the approved methodology is put on hold or withdrawn, for any reason other than for the purpose of inclusion in a consolidated methodology, no new CPAs shall be included to the PoA.
- If the methodology is subsequently revised or replaced by inclusion in a consolidated methodology, the PoA shall be revised accordingly and the changes shall be validated by a DOE and approved by the Board if new CPAs are to be included. The Board's approval defines a new version of the PoA and the PoA specific CDM-CPA-DD.
- Once changes have been approved by the Board, each new CPA shall use the latest version of the PoA specific CDM-CPA-DD.
- CPAs that were included before the methodology were put on hold, shall apply the latest version of the PoA specific CDM-CPA-DD at the time of the renewal of the crediting period.

E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:

Baseline Emissions

According the AMS-I.D, version 16, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the electricity delivered to the grid by the project activity that otherwise would have been generated by the operation of grid-connected power plants and by the addition of new generation sources.

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.

$$BE_y = EG_{BL,y} * EF_{CO2,grid,y} \quad (1)$$

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) |
| $EF_{CO2,grid,y}$ | = | CO ₂ emission factor of the grid in year y (tCO ₂ /MWh) |

Calculation of Baseline Emission Factor

As per paragraph 12 of AMS-I.D, version 16, the baseline emission factor for a grid system can be calculated as either any one of the following options in a transparent and conservative manner:



a) Combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the approved methodology “Tool to calculate the emission factor for an electricity system”, version 02.

OR

b) The weighted average emissions (in t CO₂/MWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations shall be based on data from an official source (where available) and made publicly available.

The project proponent has selected approach ‘a’ i.e. combined margin approach to calculate the emission factor for the grid with *ex-ante* approach.

According to the tool the baseline emission, project proponent shall apply the following seven steps;

- Step 1 Identify the relevant electric power system
- Step 2 Choose whether to include off-grid power plants in the project electricity system (optional)
- Step 3 Select a method to determine the operating margin (OM)
- Step 4 Calculating the operating margin emission factor according to the selected method.
- Step 5 Identify the group of power units to be included in the build margin (BM)
- Step 6 Calculate the build margin emission factor.
- Step 7 Calculate the combined margin (CM) emission factor.

Central Electricity Authority (CEA) (which is an official source of Ministry of Power, Government of India) have worked out baseline emission factor for various grids in India and made them publicly available i.e. “CO₂ Baseline Database version 5.0” at

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

The emission factor of the grid for the ex-ante approach is calculated in the following manner:

Step 1 Identify the relevant electric power system

The Indian electricity system is divided into two power grids, viz; North- East- West- North-East (NEWNE) and Southern grid. Since PoA is pan India and individual project can be located anywhere across India, emission factor has been calculated for both the grids. The baseline Emission factor (including Imports) of both the regions published by CEA is considered for calculation of Emission reductions due to displacement of electricity in accordance with the Baseline of “Tool to calculate the emission factor for an electricity system”, version 02.

Geographical scope of the two electricity grids⁴⁸

NEWNE Grid	Southern Grid
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⁴⁸ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm



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

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.

Option I has been selected for the programme of activity.

Step 3 Select a method to determine the operating margin (OM)

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

- Simple OM, or
- Simple adjusted OM, or
- Dispatch data analysis OM, or
- Average OM.

As per 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.

As observed in the CEA database, Version 5, less than 30% of grid energy is provided by the low cost/must-run power sources (hydro/ nuclear power)⁴⁹, hence project proponent has chosen to calculate Simple OM. 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: If the *ex-ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is

⁴⁹ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm



required. For grid power plants, use 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.

- Ex post option: If the *ex-post* option is chosen, the emission factor is determined for 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 preceding 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 using the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission. The OM is calculated using 3 year data calculated by Central Electricity Authority (CEA) in their CO₂ baseline database Version 5.0, November 2009.

Step 4: Calculation of the Operating Margin emission factor ($EF_{OM,y}$)

Simple OM method

The simple OM emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of all generating power plants serving the system, not including low-cost/must-run power plants/units.

The simple OM may be calculated:

- Option A: Based on the net electricity generation and a CO₂ 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.

Option B can only be used if:

- a) The necessary data for Option A is not available; and
- b) Only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known; and
- c) Off-grid power plants are not included in the calculation (i.e., if Option I has been chosen in Step 2).

For programme of activity, Option B has been used.

In the Simple OM method, the emission factor is calculated as generation weighted average emissions per electricity unit (tCO₂/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants. The data vintage option selected is the *ex-ante* approach, where a 3 year average OM is calculated. The CEA baseline is derived using the following formulae to calculate simple OM.



$$EF_{\text{grid,OMsimple},y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{\text{CO}_2,i,y})}{EG_y} \quad (2)$$

Where:

$EF_{\text{grid,OM simple}, y}$	Simple operating margin CO ₂ emission factor in year (tCO ₂ /MWh)
$FC_{i,y}$	Amount of fossil fuel type i consumed by power plant/unit m year y (mass or unit volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{\text{CO}_2,i,y}$	CO ₂ emission factor of fossil fuel type i in the year y (tCO ₂ /GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
i	All fossil fuel types combusted in power plant/ unit m in year y
y	The relevant year as per the data vintage chosen in Step 3

The operating margin emission factor has been calculated using a 3 year data vintage from CEA database⁵⁰:

Simple Operating Margin (tCO ₂ /MWh) (incl. Imports)				Average (tCO ₂ /MWh)
	2006-07	2007-08	2008-09	
NEWNE	1.008	1.000	1.007	1.005
Southern	0.999	0.991	0.973	0.988
India	1.006	0.998	1.009	1.004

Step 5 Identify the group of power units to be included in the build margin (BM)

As per the tool, the sample group of power units *m* used to calculate the build margin consists of either:

- The set of five power units that have been built most recently, or
- The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently

Project participants should use the set of power units that comprises the larger annual generation. Accordingly, the CEA database calculates the build margin consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently as this sample group comprises larger annual generation than the generation of the sample group *m* consisting of the five power plants that have been built most recently.

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

⁵⁰ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm



- 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.

Option 1 is chosen to calculate the build margin emission factor for the programme of activity. 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.

Step 6: Calculation of the Build Margin Emission Factor $EF_{BM,y}$

The Build margin emission factor has been calculated *ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently as this sample group comprises larger annual generation than the generation of the sample group *m* consisting of the five power plants that have been built most recently.

The value for BM is taken from Central Electricity Authority (CEA) CO₂ baseline database Version 5.0, November 2009⁵¹

Build Margin (tCO₂/MWh)	
	2008-09
NEWNE	0.675
Southern	0.818
India	0.709

Step 7: Calculation of the combined margin emission factor

The baseline emission factor EF_y is calculated as a combined margin (CM) consisting of combination of Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y} \times W_{BM} \quad (3)$$

⁵¹ http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm



Where the weights w_{OM} and w_{BM} are 75% and 25% respectively, and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated and are expressed in tCO₂/MWh.

As per the “Tool to calculate emission factor for an electricity system, version 02”, for wind and solar projects, the default weights are as follows: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature).

Combined Margin/ Grid Emission Factor

Grid	Simple Operating Margin (tCO₂/MWh)	Build Margin (tCO₂/MWh)	Combined Margin (tCO₂/MWh)
NEWNE	1.005	0.675	0.9225
Southern	0.988	0.818	0.9451
India	1.004	0.709	0.9303

Project emissions:

For SPV based electricity generation unit under this POA, there is not project emission

$$PE_y = 0.$$

Leakage

If the energy generating equipment is transferred from another activity, leakage is to be considered. Since the PoA would involve in establishment of new Solar based power plant, leakage is zero.

$$LE_y = 0$$

Emission reductions

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y Emission reductions in year y (t CO₂/y)

BE_y Baseline Emissions in year y (t CO₂/y)

PE_y Project emissions in year y (t CO₂/y)

LE_y Leakage emissions in year y (t CO₂/y)

Since $PE_y = 0$ & $LE_y = 0$

$$ER_y = BE_y$$

The Grid Emission factor is fixed ex ante

E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:



Data / Parameter:	EF _y
Data unit:	t CO ₂ /MWh
Description:	CO ₂ emission factor for the regional grid system (Fixed Ex ante)
Source of data used:	CEA published grid emission factors
Value applied:	0.9225 (For NEWNE Grid) and 0.9451 (For Southern Grid)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Central Electricity Authority (CEA) database, version 5 dated November 2009 values have been used for authenticity of the data, available publicly by Govt of India with a view to obtain uniformity of approach in the country towards a common objective.
Any comment:	

E.7. Application of the monitoring methodology and description of the monitoring plan:

E.7.1. Data and parameters to be monitored by each SSC-CPA:

Data / Parameter:	EG _y
Data unit:	MWh
Description:	Net Electricity supplied to the grid by the project
Source of data to be used:	Plant log books
“Value of data applied for the purpose of calculating expected emission reductions in section B.5”	To be specified in each CPA
Description of measurement methods and procedures to be applied:	The energy exported to the grid will measured continuously and will be recorded every month for each Solar Power plant using calibrated meter in log books. All meters shall be jointly inspected, and sealed by authorised representatives of the company and the state utility.
QA/QC procedures to be applied:	The electricity meters record both export and import of electricity from the Solar Power plant and the readings with regard to net electricity generated will be used for calculation of Emission reductions. The two meters (main and check) would be checked for accuracy (minimum 1% or 1s) and calibrated as per the procedures of State Electricity Board (minimum once a year). Data recorded will be cross verified from statement of generation/ invoices issued monthly by State Electricity Authorities
Any comment:	The data archived will be maintained for crediting period +2 years or last issuance for this project activity whichever is later. The data archiving will be done on both paper and electronically.



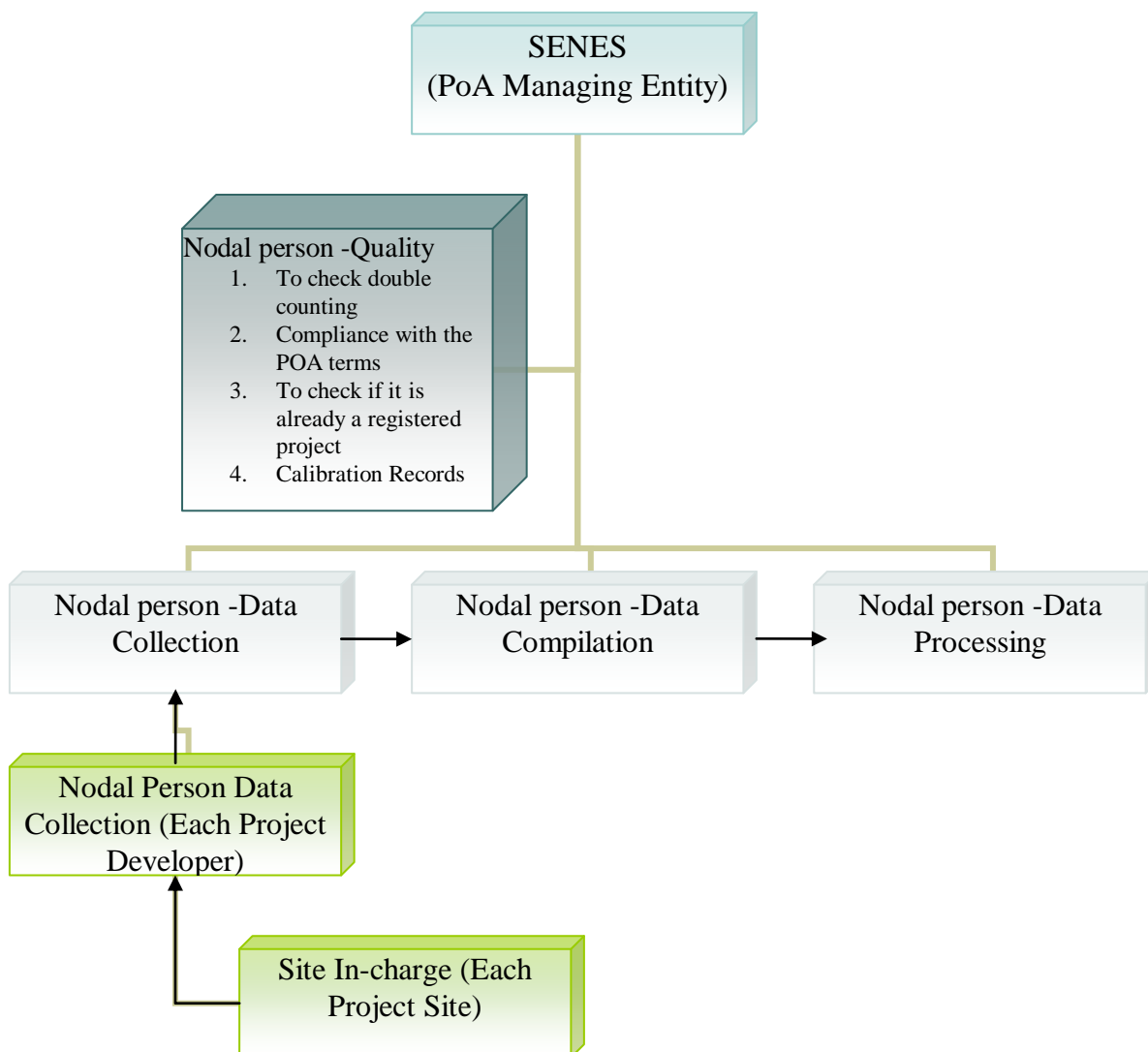
E.7.2. Description of the monitoring plan for a SSC-CPA:

SENES will be the managing entity and would set the procedures verifying the CERs generated by the solar power projects annually and would coordinate with individual Operators for monitoring and verification of CERs achieved by each solar power plant. The operators will record and submit the data to SENES, as per the monitoring requirements and in the provided formats for the periodic audit and verification process that will be undertaken to confirm the achievement of the corresponding CERs.

1. Monitoring Plan Objective and Organization

The managing entity (SENES) and the project operator, as defined in each CPA, will monitor the electricity delivered to the electricity grid by the respective power production unit. The data will be archived electronically and be stored for 2 years after the end of the crediting period of each CPA.

To ensure that the data is reliable and transparent, the project entity will also establish Quality Assurance and Quality Control (QA&QC) measures to effectively control and manage data reading, recording, auditing as well as archiving data and all relevant documents. The data will be monitored on a monthly basis and will be submitted to SENES on a monthly basis. The record keeping system will be following the hierarchy given below:



2. Responsibility

The main roles and responsibilities of the parties involved is as described below:

SENES- PoA Managing Entity

- Acts as the entire PoA managing entity
- Development of small-scale Programme of Activities Design Document (SSC-PoA-DD)
- Registration of the SSC-PoA with UNFCCC CDM Executive Board
- Inclusion of SSC-CPAs to the SSC-PoA upon satisfaction of the eligibility criteria stipulated in the SSC-PoA-DD
- Managing and archiving the database of all the CPAs.
- Authorized entity for any official communication with the CDM-EB, DOE and Indian DNA for the PoA



- Allocation of CERs to the SSC-CPA project developers according to their share in electricity generation and export during the monitoring period.

Operators

- Periodic monitoring and reporting of data and information as per the monitoring plan.
- Maintaining records on-site as per the monitoring plan.
- Construction and implementation of projects
- Operation and maintenance of the projects
- Calibration of electricity meters on a regular basis as per State Electricity Board's mandatory requirement.

3. Monitoring Data and Reporting

Data to be monitored is the electricity delivered to the electricity grid by the project. The electricity delivered will be monitored using a electricity meter at the point of connection with the grid, as further detailed in each CPA. The entity responsible for monitoring as detailed in the CPA will provide SENES with meter readings for electricity delivered and calibration certificates of the electricity meter as per grid operator's instructions. SENES will subsequently provide the verifying DOE with the data from all CPAs.

4. Quality Assurance and Quality Control

QA&QC procedures for recording, maintaining and archiving data shall be implemented as part of this CDM project activity.

A database of all the CPAs will be maintained by SENES in computer format. It would be regularly updated to avoid any double counting.

The installation location of the meters is detailed in each of the CPAs. The project entity will implement QA&QC measures to calibrate and ensure the accuracy of metering and safety aspects of the project operation. The meters installed will be of minimum accuracy level of 1% (1s). The metering devices will be calibrated and inspected properly and periodically, according to state electricity board's specifications (atleast once per annum) and requirements to ensure accuracy in the readings.

- 5. Training and maintenance procedures:** EPC Contractors for each of the power plants would train the on-site staff of the power plant on operation and maintenance of the power plant. SENES (managing entity) would ensure training to on-site staff with respect to adherence to the Monitoring Plan of the project activity. Records of the training would be kept.

Internal audit of all the records of the plants will be carried out twice a year. During these audits all the data and parameters that need to be monitored as per the monitoring plan would be checked and shortcomings if any will be reported and addresses.

6. Data Storage and Archiving



In order to facilitate auditors' reference and for any future requirement, relevant literature relating to the project such as the project material and monitoring results will be indexed. All the data items monitored under the monitoring plan will be kept for 2 years after the end of crediting period or till the last issuance of CERs for this project activity, whichever occurs later. The data will be maintained in both electronic and paper formats. The data will be stored in following manner:

- A copy of data will be maintained in electronic and paper format on-site for anytime reference and validation
- A copy of data will be stored in paper format by respective project operators in their head office in safe storage.
- A copy of data will be submitted to SENES in electronic and paper format and will be maintained by SENES.

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

Date : 21/11/2010

The baseline and Monitoring sections have been prepared by SENES Consultants, the Managing Entity of the PoA.

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Annex 1

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The CPA under this project would not receive any public funding



Annex 3

BASELINE INFORMATION

Detailed in Section E. 6 of PoA



Annex 4

MONITORING INFORMATION

Detailed in Section E. 7 of PoA
