
CDM – Executive Board

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

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	<ul style="list-style-type: none">• 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	<ul style="list-style-type: none">• 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.

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

Energy Efficiency measures at Desalination Plant in Chennai.

Version: 04

Date: 18/12/2008

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

Chennai Water Desalination Limited (CWDL) is a company created to develop a Desalination Plant that will provide drinking water to the population of Chennai city. The potential production is 100,000 m³/day. The Desalination Plant, whose expected commissioning date is December 2008, will increase the water supply capacity of Chennai City for about 2.5 million people on the basis of 40 litres per day per person. This is a great boon for the water starved city.

The project activity is an energy efficiency measure which is an application of the technology of the variable frequency drive in the Reverse Osmosis process. To improve the operational efficiency of the plant and to develop into a more environmentally friendly operation, five Medium Voltage Variable Frequency Drives (MV-VFD) have been set up for High Pressure Pumps.

The purpose of the project activity is to improve the energy efficiency levels in the High Pressure Pumps. These pumps provide high pressure to the water needed in osmosis membranes. The power consumption in this step amounts more than 65% of the whole energy consumed in the plant. The installation of MV-VFD allows adaptation to sea water conditions in the pressure requested to High Pressure Pumps, and therefore, in energy consumption.

This energy conservation would reduce the demand for an equivalent generation of electrical energy on the grid mix and result in indirect CO₂ emission reductions at the grid power plants. The total expected electricity demand reduction is 19,347 MWh per year.

The main benefits of the project activity may therefore be summarized as:

- **Environmental:**

“This should include a discussion of impact of the project activity on resource sustainability and resource degradation, if any, due to proposed activity; bio-diversity friendliness; impact on human health; reduction of levels of pollution in general”¹

- Reduction in electrical energy losses
- Energy conservation
- Indirect Reduction of GHG / CO₂ emissions at the coal fired power plant
- Conservation of coal, a non-renewable natural resource

¹ Given that it is prerogative of the host Party to confirm whether a CDM assists it in achieving sustainable development, this is taken from INDIA DNA, http://cdmindia.nic.in/host_approval_criteria.htm

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- Abatement of impact on the marine ecosystem produced by delivered brine in the sea. Variable Frequency Drives always guarantee the same salt dilution in the rejected water flow. The brine rejected will be of the order of 137 MLD (5700 m³/hour) with a salinity of 70 PSU (Practical Salinity Units) released into the sea, using HDPE (High-Density Polyethylene) submarine pipelines of 1 x 1400mm diameter and diffuser ports outfall system, which has been designed to have maximum mixing in order to attain ambient salinity within a short distance.
- Reduction in the noise level by adapting the energy needed in High Pressure Pumps. It will contribute to keep final noise levels within limits prescribed by Ministry Of Environment & Forests (in the Enclosure I “Study on Terrestrial Environmental Management Report”, submitted to the Validator for the review).

- **Social**

“The CDM project activity should lead to alleviation of poverty by generating additional employment, removal of social disparities and contribution to provision of basic amenities to people leading to improvement in quality of life of people.”²

- The desalination plant, where is located the project activity, has generated employment opportunities for the local people, both during construction (400 employments approx.) and operation phases (75 employments approx.). Further it will provide direct and indirect employment for about 200 persons on account of contractual job as well as auxiliary services like maintenance of pipes, equipments etc. There will be no adverse impact on surrounding population on factors like culture, religion, etc.
- Also the interaction with international experts enhanced the skill sets of manpower. Indirect employment will be generated for the equipment supplier, contractors & technical consultants.

- **Economic**

“The CDM project activity should bring in additional investment consistent with the needs of the people.”³

- This project will demonstrate the use of new financial mechanism (CDM) in raising finance for energy efficiency measures.
- Contribution towards meeting electricity demand, allowing grid to divert electricity for other activities.
- The project has created a business opportunity for local stakeholders such as suppliers, manufacturers, contractors, bankers, etc.
- The desalination plant leads to an investment of about USD 130 million to a developing region.
- Improvement of access roads with connected civil works, will give indirect benefit to many local people. Overall, the construction phase will bestow a positive impact on the

^{2,3} http://cdmindia.nic.in/host_approval_criteria.htm

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area. During the operational phase, the project will provide permanent employment for about 30 people.

A.3. Project participants:

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	Chennai Water Desalination Ltd. (private entity)	No
Spain	Zero Emissions Technologies, S.A (private entity)	No

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

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

A.4.1.1. Host Party(ies):

India

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

Tamil Nadu State

A.4.1.3. City/Town/Community etc:

Kattupalli Village, Minjur Block, Chennai City.

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

The Desalination plant is proposed to be set up about 4 km north of Ennore Port, which is 22 km north of Chennai. The project site lies in Kattupalli village, Minjur, between Buckingham canal and the Bay of Bengal. The desalination plant will be located approximately at latitude 13°19'01''N and longitude 80°20'25''E.

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

The following indicative simplified baseline and monitoring methodologies for selected small scale CDM project categories are applied to the project activity:

Type: II – Energy efficiency improvement projects

Title: AMS II D –Energy efficiency and fuel switching measures for industrial facilities
version-11

The main Pump design parameters according to the data from the technology provider:

Pump design Parameters	Liquid	Filtered seawater
	Pumping Temperature	25-31 °C
	Specific gravity at P.T.	1.03
	Capacity	892 m ³ /h
	Efficiency	85%
	Nominal Speed (Pump Speed)	Variable rpm
	NPSHr	18-21 m

Specifications of the MV-VFD and High Pressure Pumps are listed in the following tables:

High Pressure Pump Motor Specifications	Power	2,200 kW
	Voltage	3,3 or 4 kV
	Phases	3 ph
	Frequency	50 Hz

MV Variable Frequency Driver Specifications	Motor power	2250 kW
	Rated output current	472 A
	Efficiency (at nominal load)	> 98 %
	Input Power factor (at nominal load)	> 0.96
	Type of driver	Cabinet built
	Frequency range	0-66 Hz

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

Fixed crediting period of ten years has been chosen for the project since the beginning of the plant's commissioning. The estimation of total emission reductions as well as annual estimates for the chosen crediting period of ten years has been depicted as follows:

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Year	Estimation of annual emission reductions in tonnes of CO ₂ e
1 st Year	18,651
2 nd Year	18,045
3 rd Year	17,213
4 th Year	16,521
5 th Year	15,938
6 th Year	16,028
7 th Year	15,753
8 th Year	15,617
9 th Year	15,620
10 th Year	15,448
Total estimated reductions (tonnes of CO₂ e)	164,834
Total number of crediting years	10 years
Annual average of the estimated reductions over the crediting period (tCO₂ e)	16,483

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

No public funding is available for the project activity from countries included in Annex 1.

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

According to appendix C of simplified modalities and procedures for small-scale CDM project activities, ‘debundling’ is defined as the fragmentation of a large project activity into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale CDM project activities. According to paragraph 2 of Appendix C⁴ “A proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure;
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

According to above-mentioned points of de-bundling, proposed project activity is not a part of any of the above, therefore, considered as small scale CDM project activity.

⁴ <http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf>

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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:**

Title: AMS. II.D (Version 11 Sectoral Scope: 04 EB 35)
 TYPE II - Energy Efficiency Improvement Projects
 II.D. Energy efficiency and fuel switching measures for industrial facilities

Reference:

<http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html>.

As per paragraph 7 of AMS II.D “Each energy form in the emission baseline is multiplied by an emission coefficient (in kg CO₂e/kWh). For the electricity displaced, the emission coefficient is calculated in accordance with provisions under category AMS I.D and herewith the “Tool to calculate the emission factor for an electricity system”. For fossil fuels, the IPCC default values for emission coefficients may be used”

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

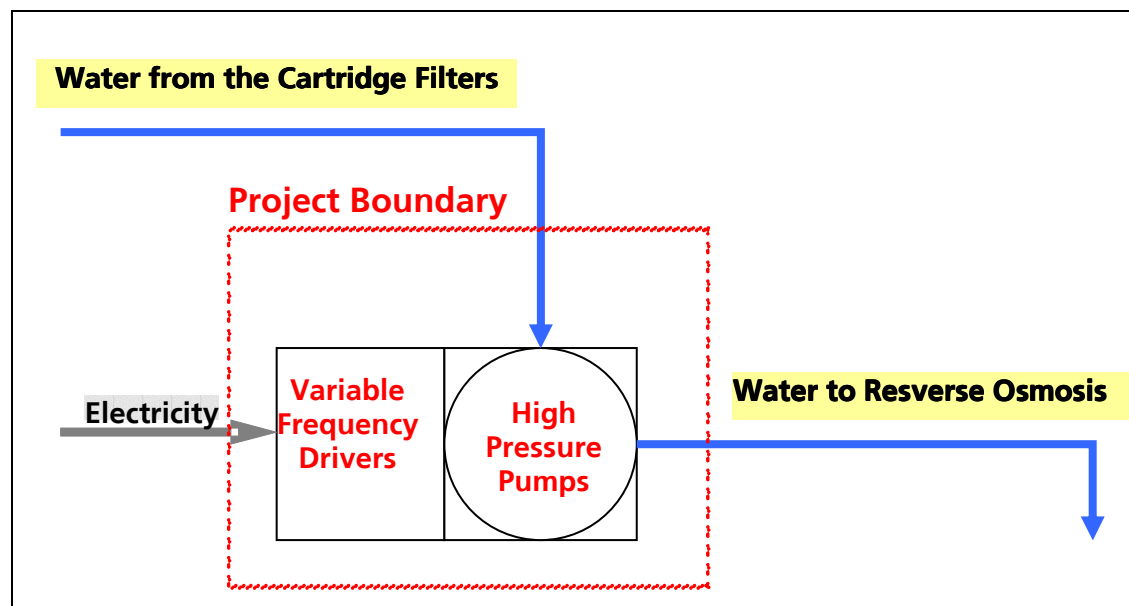
As per Appendix B of the simplified modalities and procedures for small scale CDM project activities, the small scale methodology AMS II.D *i.e.* “Type II – Energy efficiency improvement projects of Category II.D – Energy efficiency and fuel switching measures for industrial facilities” (Version 11, Scope 4, EB 35) has been selected for the project activity as it meets the following requirements:

Methodology Requirement	Applicability of Project Activity
<i>This category comprises any energy efficiency and fuel switching measure implemented at a single industrial or mining and mineral production facility.</i>	The project activity includes measures to improve the energy efficiency of Reverse Osmosis for desalination process that reduces electrical energy consumption on the demand side.
<i>This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B</i>	The project activity improves the efficiency of desalination process and the energy efficiency measures involve installation of Variable Frequency Drives (MV-VFD) for High Pressure Pumps. Project does not involve any activity leading to fuel switch.
<i>The measures may replace, modify or retrofit existing facilities or be installed in a new facility</i>	The Variable Frequency Drives are installed in a new facility, during construction of the plant.
<i>The aggregate energy savings of a single project may not exceed the equivalent of 60 GWhe per year. A total saving of 60 GWhe per year is equivalent to a maximal saving of 180 GWhth per year in fuel input.</i>	The annual energy reduction from the project activity is about 19.5 GWhe per year which is below the limit of 60 GWhe per year as specified in the methodology.

B.3. Description of the project boundary:

As per the approved methodology II.D “Energy efficiency improvements projects”, the project boundary is “the physical, geographical site of the industrial or mining and mineral production facility, processes or equipment that are affected by the project activity”.

In our case, the project activity boundary is composed by the Variable Frequency Drives (5 units operating + 1 in stand-by), high pressure pumps (5 units operating + 1 in stand-by), and the connexion to the grid.

**B.4. Description of baseline and its development:**

The project category applicable to the proposed CDM project is II D. The project activity, based on the installation of Variable Frequency Drives (MV-VFD) for high pressure pumps in a Desalination Plant, will save 19.55 million KWh per annum on an average.

Therefore, a conventional energy equivalent of 193.5 million KWh for a period of 10 years would be conserved by the project activity. Without the project activity, the same energy load would have been taken up by power plants in the grid and emission of CO₂ would have occurred due to coal combustion (proportional share of thermal power in generation mix).

The baseline methodology has followed the one specified under Project category II.D, paragraph 5 “in the case of a new facility the energy baseline consists of the facility that would otherwise be built”.

The annual energy baseline values (annual energy consumption in absence of project activity) for the crediting years are calculated by estimating the “power that would be consumed” and “operating hours” of the High Pressure Pumps that “would have been installed” without MV-VFD.

The “power that would be consumed” by the High Pressure Pumps in absence of the project activity is obtained from calculations on energy consumption by CWDL’s design engineers (See Annex 3 of the PDD). These calculations are based on the fact that without MV-VFD,

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High Pressure Pumps would be operating continuously at the maximum pressure needed to reach contract's commitments.

Emission Factor

The Central Electricity Authority (CEA) of India is a certified government body and a useful resource for grid operation and management data such as performance reviews of power plants, inter-state purchases of power and emission factors of regional grids in India. The CEA has estimated the Emission Factor for the different grids in India, the details of which are available on the following website:

<http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

CEA has compiled the CO₂ Database for the Fiscal Years (FY) 2000-01 to 2007-08 based upon generation, fuel consumption and fuel Gross Calorific Value (GCV) data furnished by each power station. In cases where the station could not provide reliable data for all the relevant parameters, assumptions were made as described below:

Assumptions at Station Level	
Net generation:	For hydro stations, only gross generation was available, but not net generation data. Instead, the CEA standard value for auxiliary power consumption in hydro units (0.5%) was applied to derive the net generation from the gross generation data reported by the stations. Likewise, CEA standard values for auxiliary power consumption had to be applied for some of the gas and diesel-fired thermal stations.
Gross Calorific Value (GCV)	Default values were used for some thermal stations where station-specific GCVs were not available.
Assumptions at Unit Level (for those into the BM)	
Gross generation	For some stations, gross generation data were not available at unit level. Instead, the plant load factor of the respective station was used to derive the gross generation of the units. For units commissioned after the start of the relevant fiscal year, the gross generation was further adjusted pro rata the number of days since commissioning.
Net generation	Net generation data is generally not measured at unit level. Two distinct approaches were applied to estimate net generation. (i) In cases where all units of a station fall into the build margin or where all units of a station have the same installed capacity, the auxiliary consumption (in % of gross generation) of the units was assumed to be equal to that of the respective station. (ii) In all other cases, standard values for auxiliary consumption adopted by CEA were applied.
Fuel consumption and GCV	Fuel consumption and GCV are generally not measured at unit level. Instead, the specific CO ₂ emissions of the relevant units were directly calculated based on heat rates

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In order to ensure conservativeness of calculations, the following approaches and assumptions had been taken by CEA:

- The quality of station-level data was ensured through extensive plausibility testing and interaction with the station operators.
- In cases of data gaps at station level, standard data from CEA was used. For example, standard auxiliary power consumption was assumed for a number of gas-fired stations. Comparison with monitored values shows that these standard values are rather conservative, i.e. they lead to a somewhat lower heat rate and hence lower emissions than observed in many stations.
- Where required, the emission factors of thermal units were also derived from standard CEA values (design heat rate plus 5%). Again, these values are conservative (i.e. relatively low) compared to the heat rates observed in practice. See Section 4.3 for details on the build margin calculation.
- The fuel emission factors and oxidation factors used are generally consistent with IPCC defaults. For coal, the emission factor provided in India's Initial National Communication was used (95.8 t CO₂/TJ on NCV basis), being somewhat lower than the IPCC default for sub-bituminous coal (96.1 t CO₂/TJ)

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 the decision 17/cp.7 paragraph 43, “a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity”

Barriers and Additionality

Referring to attachment A to appendix B document of “indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories”, project participants are required to provide a qualitative explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers.

At least one of the listed elements should be identified in concrete terms to show that the activity is either beyond the regulatory and policy requirement or improves compliance to the requirement by removing barrier(s); the guidance provided herein has been used to establish project additionality. The barriers that were considered are listed below:

- Technological barrier
- Barrier due to prevailing practice
- Regulatory/Legal requirements
- Other barriers

A. Technological Barrier

The project implementation could result in major faults and maintenance problems during the development and operation stages. The inclusion of these huge devices based on the highest technology of their kind, obviously increases the possibilities of failure in the process, with the additional problem that they are coordinated with High Pressure Pumps. This can have a cascading or domino effect of failure in critical production areas directly or indirectly connected. So production could be hampering and could result in lost man-day and lost in water

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quality. Therefore, a key barrier to implement such an activity is preparedness of operational staff on process.

B. Barrier due to prevailing practice

The thermal desalination process for water distillation was the technology employed in the first major desalination plants in the 1950s which were predominantly in the Middle East region.

Membrane technologies were developed in the 1960s and 1970s and by the late 1980s, reverse osmosis desalination technology made up 40% of desalination plants worldwide. This has now increased to levels approaching 60% in 2006.

Desalination in India is in a primitive state. The private sector use disinfection/demineralise mainly and only in last years the Reverse Osmosis desalination has become a feasible alternative.

The IDA Desalination Yearbook 2007-2008 shows that the 100,000 MLD Desalination Plant in Minjur, is in the top of desalinations plant by capacity.⁵ In this way, the Desalination plant in construction by CWDL is the first plant in India by capacity, not only using Reverse Osmosis technology, but also in all types of available technologies.⁶

As it can be seen, there are no comparable plants installed in India with the project developed by CWDL, so it can be counted as “first of its kind” in India. Therefore, the energy efficiency measures can be considered as “unique” not only in Tamil Nadu State, but in India. The installation of Variable Frequency Drives is a pioneer activity in Reverse Osmosis Desalination Plants in India, and obviously in greater extent in developing countries.

C. Regulatory/Legal requirements

There was no legal binding on CWDL to take up the project activity.

Indian government enacted the Energy Conservation Act in the year 2001⁷, with the main objective of institutionalizing and strengthening “delivery mechanism for energy efficiency services in the country and foster the much-needed coordination between the various energy providers and distributors”.

Therefore, the act is more to encourage rather than regulate the adoption of energy efficiency programmes. There is no mandatory law in the country which ensures compulsory adoption of energy efficiency measures. Therefore, all conservation measures adopted by CWDL are over and above any requirement under national law or regulation.

D. Other Barriers

About 80% of the electricity generated in India is produced by power plants run either by state government or central government agencies and supplied at subsidised rates. Thus a high user

⁵ IDA Desalination Yearbook 2007-2008 published by International Desalination Association.

⁶ www.desaldata.com, presented by Global Water Intelligence and Water Desalination Report and Incorporating the IDA Desalination Plants Inventory

⁷ http://powermin.nic.in/acts_notification/energy_conservation_act/

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discount rate and a low electricity tariff do not encourage energy savings from the user's perspective.

Demonstration and Assessment of prior consideration of the CDM

Regarding serious CDM consideration of the project activity, it has been provided to the DOE documentary evidence to prove that the initial project design has been set in the contract "To design, built, own, operate and transfer" of the desalination plant and it was signed in November 2005. The mentioned agreement does not contemplate VFD installation.

As per EB41 Annex 46:

- a) *"The project participant must indicate awareness of the CDM prior to the project activity start date, and that the benefits of the CDM were a decisive factor in the decision to proceed with the project. Evidence to support this would include, inter alia, minutes and/or notes related to the consideration of the decision by the Board of Directors, or equivalent, of the project participant, to undertake the project as a CDM project activity."*

The EB took into consideration the installation of the VFD as a technological and a custom-made alternative for the Chennai desalination but, the decisive factor in the decision was the CDM benefits analysis. A copy of the note related to the consideration of the CDM decision by the Project Owner made in November 2006, has been provided to the DOE.

- b) *"The project participant must indicate, by means of reliable evidence, that continuing and real actions were taken to secure CDM status for the project in parallel with its implementation. Evidence to support this should include, inter alia, contracts with consultants for CDM/PDD/methodology services, Emission Reduction Purchase Agreements or other documentation related to the sale of the potential CERs (including correspondence with multilateral financial institutions or carbon funds), evidence of agreements or negotiations with a DOE for validation services, submission of a new methodology to the CDM Executive Board, publication in newspaper, interviews with DNA, earlier correspondence on the project with the DNA or the UNFCCC secretariat"*

During the previous Technical Due Diligence carried on by Zeroemissions, several DOE have been requested for a proposal. The quotations were sent to Zeroemissions during the months of February and March of 2007. Documentary evidence of agreements or negotiations with DOEs for validation services has been provided to the DOE.

In January of 2008 Zeroemissions completed the drafting of the PDD.

The PDD has been submitted for the period of Public Comments in the web page of UNFCCC on 13th of March of 2008.

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B.6. Emission reductions:

B.6.1. Explanation of methodological choices:
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The baseline calculations are carried out as under:

Emission Factor Calculations

The approved small scale methodology II.D, in paragraph 7, leads to methodology I D:

“Each energy form in the emission baseline is multiplied by an emission coefficient (in kg CO₂e/kWh). For the electricity displaced, the emission coefficient is calculated in accordance with provisions under category I.D.”

The approved small scale methodology I.D, in paragraph 9, mandates:

“The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO₂e/kWh) calculated in a transparent and conservative manner as:

- 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 CO₂e/kWh) of the 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.

The baseline estimation for the project has used the method specified in “Methodological tool to Calculate the Emission Factor for an Electricity System”, version 01, EB 35, for calculation of emission factor due to displacement of grid electricity.

The CEA (Central Electricity Authority) database, official source, has been calculated on the basis of this methodological tool.

The baseline is calculated using the combined margin approach. The baseline emission factor is calculated following the steps according to the “Baseline Methodology Procedure” of the mentioned tool:

- Step 1. Identify the relevant electric power system.
- Step 2. Select an operating margin (OM) method.
- Step 3. Calculate the operating margin emission factor according to the selected method.
- Step 4. Identify the cohort of power units to be included in the build margin (BM).
- Step 5. Calculate the build margin emission factor.
- Step 6. Calculate the combined margin (CM) emissions factor.

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Step1. Identify the relevant electricity power system

The Indian power system is divided into five independent regional grids, namely Northern, Eastern, Western, Southern and North-Eastern. Each grid covers several states, as shown in table below:

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

The project activity is located in Chennai, Tamil Nadu state, so the suitable grid for calculating the Emission Factor is **Southern Grid**.

Step 2. Select an operating margin (OM) method

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

- Simple OM
- Simple adjusted OM
- Dispatch data analysis OM
- Average OM

Method (c) Dispatch data analysis OM

If the dispatch data is available, method (c) should be the first choice. This method requires the dispatch order of each power plant and the dispatched electricity generation of all the power plants in the power grid during every operation hour period. Since the dispatch data are not available in India, this method is not applicable for the proposed project activity.

Method (b) Simple adjusted OM

The application of simple adjusted OM method requires the annual load duration curve of the power grid and the load data of every hour data during the whole year on the basis of the time order. Then again, the dispatch data and detailed load curve data were not available in India. Therefore, method (b) is not applicable for the proposed project as well.

Method (d) Average OM

Method (d) will only be used when (1) low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply method (b) is not available, and (2) where detailed data to apply option (c) above is unavailable. From 2001 to 2006, the low-cost/ must

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run resources constitute less than 50% of total amount grid generation output for the Southern Grid (this method must be used for projects located in North-East grid). Hence method (d) is not applicable for the project activity (See Table below).

Method (a): Simple OM

The simple OM method can only be used where 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 normal for hydroelectricity production. Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)			
	2005-06	2006-07	2007-08
NEWNE	18.0%	18.5%	19.0%
South	27.0%	28.3%	27.1%
India	20.1%	20.9%	21.0%

The above data 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 less than 50 % of the total generation.

In conclusion, method (a) is the only reasonable and feasible method among the four methods for calculating the Operating Margin emission factor ($EF_{OM,y}$) of the Southern Grid in India.

Likewise, for the simple operating margin, the emission factor can be calculated using either 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

For our project activity, ex-ante option has been chosen, using the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission.

Also, following the Tool, the electricity imports have been included in calculations, treated as one power plant.

Step 3. Calculate the operating margin emission factor according to the selected method

As the Tool mandates, the simple operating margin emission factor is calculated as the generation-weighted average CO₂ emissions per unit net electricity generation (tCO₂/MWh) of

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all generating power plants serving the system, not including low-cost/must-run power plants/units. It may be calculated:

- Based on data on fuel consumption and net electricity generation of each power plant/unit (Option A)
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data 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 C)

Option A should be preferred and must be used if fuel consumption data is available for each power plant/unit. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost/must-run power sources and if the quantity of electricity supplied to the grid by these sources is known.

Therefore, the CEA opts for option B, the one that better fits with available data in India. For this option, the simple OM emission factor is calculated based on the electricity generation of each power unit and an emission factor for each power unit, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad (1)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO₂ emission factor in year y (tCO₂/MWh)

$EG_{m,y}$ = 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 = All power units serving the grid in year y except low-cost / must-run power units

y = three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option).

The emission factor of each power unit m should be determined as follows:

Option B1. If for a power unit m data on fuel consumption and electricity generation is available, the emission factor ($EF_{EL,m,y}$) should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot EF_{CO2,i,y} \cdot NCV_{i,y}}{EG_{m,y}} \quad (2)$$

Where:

$EF_{EL,m,y}$ = CO₂ emission factor of power unit m in year y (tCO₂/MWh)

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$FC_{i,m,y}$	= Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO_2,i,y}$	= CO ₂ emission factor of fossil fuel type i in year y (tCO ₂ /GJ)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)
m	= All power units serving the grid in year y except low-cost / must-run power units
i	= All fossil fuel types combusted in power unit m in year y
y	= three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Option B2. If for a power unit m only data on electricity generation and the fuel types used is available, the emission factor should be determined based on the CO₂ emission factor of the fuel type used and the efficiency of the power unit, as follows:

$$EF_{EL,m,y} = \frac{EF_{CO_2,m,y} \cdot 3.6}{\eta_{m,y}} \quad (3)$$

Where:

$EF_{EL,m,y}$	= CO ₂ emission factor of power unit m in year y (tCO ₂ /MWh)
$EF_{CO_2,m,i,y}$	= Average CO ₂ emission factor of fuel type i used in power unit m in year y (tCO ₂ /GJ)
$\eta_{m,y}$	= Average net energy conversion efficiency of power unit m in year y (%)
y	= three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

Option B3. If for a power unit m only data on electricity generation is available, an emission factor of 0 tCO₂/MWh can be assumed as a simple and conservative approach.

Where Option C is used, the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost / must-run power plants / units, and based on the fuel type(s) and total fuel consumption of the project electricity system, as follows:

$$EF_{Grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \cdot EF_{CO_2,i,y} \cdot NCV_{i,y}}{EG_y} \quad (4)$$

Where:

$EF_{grid,OMsimple,y}$	= Simple operating margin CO ₂ emission factor in year y (tCO ₂ /MWh)
$FC_{i,y}$	= Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)

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$NCV_{i,y}$	= Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO_2,i,y}$	= CO ₂ emission factor of fossil fuel type i in 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 sources in the project electricity system in year y
y	= Three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option)

The operating margin emission factor has been calculated following Option B1, with an adaptation to available data: instead of NCV, the CEA used the GCV (Gross calorific value of the fuel), the CO₂ emission factor of the fuel, based on GCV, and the Oxidation Factor of the fuel. So, CO₂ emissions of thermal stations were calculated using the formula below:

$$AbsCO_2(station)_y = \sum_{i=1}^2 FuelCon_{i,y} \times GCV_{i,y} \times EF_i \times Oxid_i \quad (5)$$

Where:

$AbsCO_{2,y}$	= Absolute CO ₂ emission of the station in given fiscal year 'y'
$FuelCon_{i,y}$	= Amount of fuel of type I consumed in the fiscal year 'y'
$GCV_{i,y}$	= Gross calorific value of the fuel i in the fiscal year 'y'
EF_i	= CO ₂ emission factor of the fuel i based on GCV
$Oxid_i$	= Oxidation factor of the fuel i

Thus, using (1), the $EF_{OM,y}$ is **0.99062 tCO₂/MWh**⁸

Step 4. Identify the cohort of power units to be included in the built margin

The build margin has to be calculated by constituting a sample group m from either the 5 most recently built power plants or the power plant capacity additions in the electricity system that comprise 20% of the system generation (that have been built most recently). The sample group that comprises larger annual generation from either of these has to be chosen. It is observed that the generation from the sample group that comprises 20% of the system generation has larger generation than the 5 most recently built plants. So the Build Margin is calculated from the sample group comprising the most recently additions to the grid that comprise 20% of the system generation.

As the Tool mandates, in terms of vintage of data, project participants can choose between one of the following two options:

⁸ As per the Central Electricity Authority (CEA) estimated the EF_{OM} for the Southern grid in India, <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

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- 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

For this project, Option 1 is selected to calculate Emission Factor of Build Margin.

Step 5. Calculate the build margin emission factor

Unit-level CO₂ emissions were only calculated for units falling in the build margin, using the next formula:

$$AbsCO_2(unit)_y = SpecCO_2(unit)_y \times NetGen(unit)_y \quad (6)$$

Where:

$AbsCO_2$ = Absolute CO₂ emissions of thermal units
 $SpecCO_2$ = Specific emissions
 $NetGen$ = Net generation

A unit was assumed to have the same specific emissions as the corresponding station in the following three cases:

- If all units of a station fall into the build margin;
- If all units of a station have the same installed capacity;
- If the default specific emissions for the respective station type is higher than the corresponding station's specific emissions, and the concerned unit is capacity-wise among the largest of the station.

For over 90% of all thermal units in the build margin 2005-06, one of these cases applied. In the remaining cases, the specific emissions of the units were derived from conservative standard heat rate values, defined as the design heat rate plus 5%

The $EF_{BM,y}$ is estimated as **0.71331 tCO₂/MWh**⁹ (with sample group m constituting most recent capacity additions to the grid comprising 20% of the system generation).

^{9,7} As per the Central Electricity Authority (CEA) estimated both EF_{BM} and $EF_{CM,y}$ for the Southern grid in India, <http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>

Step 6. Calculate the combined margin emissions factor

The baseline emission factor i.e. the Combined Margin emission factor will be calculated as the weighted average of Operating Margin and Build Margin. I.D mandates the uses of emission reduction calculation procedures given in “Tool to calculate the emission factor for an electricity system”.

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (7)$$

Hence the following default values should be used for w_{OM} and w_{BM} :

- Wind and solar power generation project activities: $w_{OM}=0.75$ and $w_{BM}=0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.
- All other projects: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

$$\text{Baseline Emission Factor: } 0.5 \times EF_{OM} + 0.5 \times EF_{BM} = 0.5 \times 0.99062 + 0.5 \times 0.71331$$

$$EF_{CM,y} = 0.85197 \text{ tCO}_2/\text{MWh}^7$$

Total amount of emissions per year in the baseline is calculated as the result of multiplying this Emission Factor for the total amount of MWh per year consumed in High Pressure Pumps that “would have been installed” without implementation of Variable Frequency Drives.

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

Data / Parameter:	$EF_{OM,y}$
Data unit:	kgCO ₂ e/kWh
Description:	Southern Grid-Simple Operating Margin
Source of data used:	CEA Emission Factor
Value applied:	0.99062
Justification of the choice of data or description of measurement methods	Southern Grid-Simple Operating Margin obtained from published data Central Electricity Authority (CEA), Government of India (www.cea.nic.in) CO ₂ Baseline Database for the Indian Power Sector Version 4.0.

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and procedures actually applied :	
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$EF_{BM,y}$
Data unit:	kgCO ₂ e/kWh
Description:	Southern Grid-Build Margin
Source of data used:	CEA Emission Factor
Value applied:	0.71331
Justification of the choice of data or description of measurement methods and procedures actually applied :	Southern Grid-Build Margin obtained from published data Central Electricity Authority (CEA), Government of India (www.cea.nic.in) CO ₂ Baseline Database for the Indian Power Sector Version 4.0.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$EF_{CM,y}$
Data unit:	kgCO ₂ e/kWh
Description:	Southern Grid-Combined Margin
Source of data used:	CEA Emission Factor
Value applied:	0.85197
Justification of the choice of data or description of measurement methods and procedures actually applied :	Southern Grid-Combined Margin obtained from published data Central Electricity Authority (CEA), Government of India (www.cea.nic.in) CO ₂ Baseline Database for the Indian Power Sector Version 4.0.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$EC_{HP, baseline}$
Data unit:	kWh
Description:	Energy consumption of High Pressure Pumps that would have been installed in absence of Variable Frequency Drives
Source of data used:	CWDL's design engineers
Value applied:	See Annex 3 of the PDD
Justification of the choice of data or description of measurement methods and procedures actually applied :	See Annex 3 of the PDD
Any comment:	The value will be constant for entire crediting period.

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B.6.3 Ex-ante calculation of emission reductions:

The project activity reduces carbon dioxide through an energy efficiency process. The emission reduction ER_y due to project activity during a given year y is calculated as per the formula given below:

$$ER_y = BE_y - PE_y - L_y$$

Where:

BE_y = Baseline emissions (Please refer Annex 3 of the PDD)

PE_y = Project emissions;

L_y = Emissions due to leakage; $L_y = 0$ for project activity, over crediting period

For the leakage, the methodology mandates that “*if the energy efficiency technology is transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered*”.

In our project activity, the technology installed is 5 new MV VFDs set up in a new facility, so we can consider no leakage for our energy efficiency.

For the Project Activity Emissions, the formula utilized is:

$$PE_y = EC_{HP,y} * EF_{CM,y}$$

Where:

PE_y = Project emissions

$EC_{HP,y}$ = Energy consumption of High Pressure Pumps with Variable Frequency Drives installed.

$EF_{CM,y}$ = Combined Margin emission factor

See Annex 3 of the PDD for detailed information about the ex-ante calculation of emission reductions.

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

Year	Estimation of Baseline Emissions (tCO ₂)	Estimation of Project Activity Emissions (tCO ₂)	Estimation of Leakage (tCO ₂)	Estimation of overall Emission Reduction (tCO ₂)
1	78,901	60,250	0	18,651
2	78,901	60,856	0	18,045
3	78,901	61,688	0	17,213
4	78,901	62,380	0	16,521
5	79,376	63,438	0	15,938
6	79,376	63,348	0	16,028
7	79,376	63,623	0	15,753

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8	79,376	63,759	0	15,617
9	79,376	63,756	0	15,620
10	79,790	64,341	0	15,448
Total (tonnes CO ₂)	792,274	627,440	0	164,834

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

The following two sections (B.7.1 & B.7.2) provides a description of the application of the monitoring methodology and description of the monitoring plan, including identification of the data to be monitored and the procedures that will be applied during monitoring.

Please note that data monitored and required for verification and issuance are to be kept for two years after the end of crediting period or the last issuance of CERs for this project activity, which ever occurs later.

B.7.1 Data and parameters monitored:

Data / Parameter:	EC_{HP}
Data unit:	MWh
Description:	Energy consumption of High Pressure Pump Motors with Variable Frequency Drives installed.
Source of data to be used:	In plant record, based on the energy meter from High Pressure Pump.
Value of data	To be measure from normal operation of High Pressure Pumps
Description of measurement methods and procedures to be applied:	<u>Monitoring:</u> energy meter will be used in monitoring the parameter <u>Data type:</u> measured <u>Archiving procedure:</u> Electronic <u>Responsibility:</u> Head (Utility Services) would be responsible for regular reporting of the parameter and calibration of the energy meter <u>Calibration Frequency:</u> Yearly in accordance with manufacturer indications. Data collected from the operation records (SCADA), and the amount of MWh consumed by the pumps will be use for calculate emission reductions.
QA/QC procedures to be applied:	Quality Management System, following internal procedures. The same procedures would be available at the project site.
Any comment:	Data will be kept for crediting period + 2 years.

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Uncertainty level of data (High/Medium/Low)	<p>Uncertainty is defined by the sensor sensibility.</p> <p>Estimated uncertainty level of monitoring data: Low</p> <p>The data will be directly measured and monitored at the project site. All relevant records will be checked to ensure consistency and will be maintained as per internal procedures of the plant.</p>
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B.7.2 Description of the monitoring plan:

AMS-II-D mandates, in case of a new facility, that monitoring shall consist of:

- A. Metering the energy use of the equipment installed;
- B. Calculating the energy savings due to the equipment installed

The aim of our monitoring plan is to make sure that metering the energy use during the project activities' vintage is completed, consistent, clear and precise. Emission reduction calculations will be done by Zero Emissions' engineers based on the data collected applying an internal quality audit.

Likewise, a Quality Control Plan has been developed by CWDL, and can be verified by the Designated Operational Entity.

1. Monitoring Subject

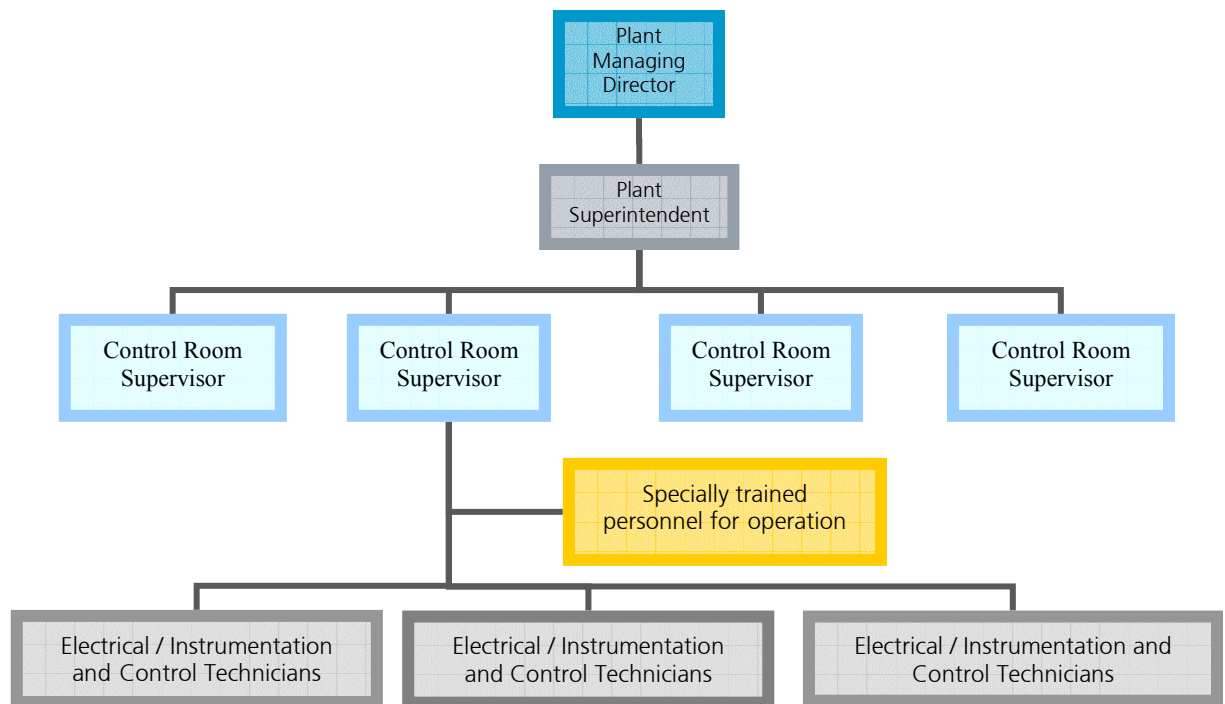
Due to the emission factor is determined by the ex-ante calculation the only data to be monitored is the Energy consumption in High Pressure Pumps with MV-VFD, as only plant devices affecting emission reductions.

This Energy consumption will be collected as part of normal plant operations. The High Pressure Pump consumption is recorded continuously, and these data will be consulted yearly in the large-scale, distributed measurement and control system installed in the plant (SCADA). From these data will be calculated the energy savings annually, comparing them with the energy consumption in the baseline.

2. Managing structure

In order to insure the monitoring has been established the managing structure as shown in Figure, which identified the staffs for data collection and preservation.

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**3. Quality Control**

Quality control will be carrying out as indicates in Quality Control Plan's respective procedure.

4. Training program

It will be implemented an initial training in order to learn all implicated personal working in the project. The initial training will consist to establish a concrete process to assure the correct works as presumed during the project period.

Also it will realize a periodic training plan that provides actualized information to both the operators and the managers responsible for the operation and maintenance of the desalination plant during all the crediting period.

Training program will be carrying out as indicates in Quality Control Plan's respective procedure.

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

Date of completion of the current version of baseline study and monitoring methodology:
07/12/2007

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The name of the responsible person/entity:

Mr. Antonio Marín, Zero Emissions Technologies, SA.
Avda. De la Buhaira, 2 Sevilla.41018, Spain.
Tel: +34 954 937 111 FAX: +34 647 812 610
Email: antonio.marin@zeroemissions.abengoa.com

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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:

10/05/2007, according to the “Purchase Order” for the VFD

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

First 25 years in DBOOT, rest unknown

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

C.2.1. Renewable crediting period

Not applicable

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/04/2009 or the date of registration, whichever is later

C.2.2.2. Length:

10 years

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

To predict the cause-condition-effect-relationship on the environment, an Environmental Impact Assessment (EIA)¹⁰ study was conducted for the Desalination Plant.

The EIA study helps in justifying a project's sustainability plus provides with mitigation and management plan to abate the negative impact and enhance the positive ones. Thus EIA study is obligatory under Indian government policy under the Environmental (Protection) Act 1986 and the notification promulgated under it on 27 January 1994.

The proposed project related activities are mainly concerned with the marine environment; therefore a marine EIA study is essential. Also a "Terrestrial Environmental Management Report"¹¹ has been prepared, which presents the supplementary information on the environmental studies relating to the terrestrial aspects: i) socio-economic aspects, ii) air environment, iii) water environment, iv) noise environment, v) flora & fauna, vi) risk analysis and vii) environmental management plan.

The EIA report can be verified by the Designated Operational Entity.

Also, it may be noted that there are no trans-boundary impacts due to this project activity.

The marine EIA report and "Terrestrial Environmental Management Report" are provided in Enclosure-I, as document submitted to the validators for review.

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:

No environmental impacts have been considered significant. (Enclosure I, submitted as a document for the review for validator)

¹⁰ By Indomer Coastal Hydraulics (P) Ltd. <http://www.chennaidesal.info/EIA.htm>

¹¹ By Indomer Coastal Hydraulics (P) Ltd. <http://www.chennaidesal.info/EIA.htm>

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

Since the project activity implementation involves a set of installations in the Desalination Plant (not requiring major transportation or other energy inputs), and is relatively small scale it has no significant negative environmental impacts to noise, air or water pollution outside the facilities, therefore comments from the local population is not necessary.

The main stakeholders of the project activity are the management representatives who were actively a part of decision-making. The other stakeholders are the employees of the organization who work in the plant.

Although such in-house energy efficiency measures adopted by a plant does not demand an elaborate stakeholder consultation process, the project proponent has involved its employees at all levels in order to ensure proper understanding of the effects of the project activity. The benefits from such activity have also been transparently shared with the supply chain and shareholders. For this purpose, a Questionnaire has been elaborated and distributed between several employees, in a meeting held on 11/03/2008, in order to know their point of view about the energy efficiency measures.

E.2. Summary of the comments received:

The energy efficiency project does not have any negative impact. Instead, the emission from the captive power plant has also been reduced and local environment has been improved. The questionnaire filled and signed by employees will be available for Designed Operational Entity's request.

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

All comments received by the stakeholders were positive. No suggestions concerning the project activity were received.

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Annex 1**CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY**

Organization:	Chennai Water Desalination Limited
Street/P.O.Box:	Door No. 30 A, South Phase, 6th cross Road, Thiru.Vi.Ka Industrial Estate, Guindy
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City:	Chennai
State/Region:	Tamil Nadu
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Country:	India
Telephone:	+91 44 22326612
E-Mail:	info@chennaidesal.info
URL:	http://www.chennaidesal.info
Represented by:	Mr. Venkatasubramaniam
Title:	
Salutation:	Mr.
First Name:	
Department:	
Mobile:	
Direct FAX:	+91 44 22327348
Direct tel:	+91 44 22326612
Personal E-Mail:	info@chennaidesal.info

Organization:	Zero Emissions Technologies, S.A.
Street/P.O.Box:	Avda. de la Buhaira, 2
Building:	
City:	Seville
State/Region:	
Postfix/ZIP:	41018
Country:	Spain
Telephone:	+34 954 937 111
FAX:	+34 647 812 610
E-Mail:	zeroemissions@abengoa.com
URL:	http://www.zeroemissions.com
Represented by:	Emilio Rodriguez-Izquierdo Serrano
Title:	General Director
Salutation:	Mr.
Last Name:	Rodriguez-Izquierdo
Middle Name:	
First Name:	Emilio
Department:	
Mobile:	
Direct FAX:	+34 647 812 610
Direct tel:	+34 954 937 111
Personal E-Mail:	eizquierdo@zeroemissions.abengoa.com

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in project activity.

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Annex 3**Energy consumption of High Pressure Pumps**

Initial Data		
Water Productive capacity	100,000	m ³ /day
Operative days	355	days/year
Emission Factor	0.85197	tCO ₂ /MWh

Energy Consumption - Annual average		
	High Pressure Pumps without VFD	High Pressure Pumps with VFD
year	(kWh/m ³)	(kWh/m ³)
1	2.61	1.99
2	2.61	2.01
3	2.61	2.04
4	2.61	2.06
5	2.62	2.10
6	2.62	2.09
7	2.62	2.10
8	2.62	2.11
9	2.62	2.11
10	2.64	2.13

Savings			
year	(kWh/m ³)	kWh per year	CERs
1	0.617	21,891,638	18,651
2	0.597	21,180,306	18,045
3	0.569	20,204,056	17,213
4	0.546	19,391,106	16,521
5	0.527	18,706,996	15,938
6	0.530	18,812,997	16,028
7	0.521	18,489,947	15,753
8	0.516	18,330,197	15,617
9	0.516	18,333,747	15,620
10	0.511	18,132,598	15,448
Average CERs/year			16,483

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Ex-ante calculations for B.6.3

Year	Energy Consumption (MWh)		Savings
	Baseline	Project Activity	
	High Pressure Pumps without VFD	High Pressure Pumps with VFD	
1	92,609.86	70,718.22	21,891.64
2	92,609.86	71,429.55	21,180.31
3	92,609.86	72,405.80	20,204.06
4	92,609.86	73,218.75	19,391.11
5	93,167.75	74,460.75	18,707.00
6	93,167.75	74,354.75	18,813.00
7	93,167.75	74,677.80	18,489.95
8	93,167.75	74,837.55	18,330.20
9	93,167.75	74,834.00	18,333.75
10	93,653.10	75,520.50	18,132.60

Year	Emissions (tCO2)		Estimation of Leakage (tCO2)	Savings
	Baseline	Project Activity		
	High Pressure Pumps without VFD Estimation of Baseline Emissions	High Pressure Pumps with VFD Estimation of Project Activity Emissions		
1	78,901	60,250	0	18,651
2	78,901	60,856	0	18,045
3	78,901	61,688	0	17,213
4	78,901	62,380	0	16,521
5	79,376	63,438	0	15,938
6	79,376	63,348	0	16,028
7	79,376	63,623	0	15,753
8	79,376	63,759	0	15,617
9	79,376	63,756	0	15,620
10	79,790	64,341	0	15,448
Total (tonnes CO2)	792,274	627,440	0	164,834

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BASELINE INFORMATION**CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE**

VERSION	4.0
DATE	sep-08
BASELINE METHODOLOGY	ACM0002 and "Tool to Calculate the Emission Factor for an Electricity System", Version 1.1

EMISSION FACTORS**Weighted Average Emission Rate (tCO₂/MWh) (excl. Imports)**

	2005-06	2006-07	2007-08
NEWNE	0.84	0.83	0.82
South	0.73	0.72	0.72
India	0.82	0.80	0.80

Simple Operating Margin (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	1.02	1.02	1.01
South	1.01	1.00	0.99
India	1.02	1.01	1.01

Build Margin (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.67	0.63	0.60
South	0.71	0.70	0.71
India	0.68	0.65	0.63

Combined Margin (tCO₂/MWh) (excl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.85	0.82	0.80
South	0.86	0.85	0.85
India	0.85	0.83	0.82

Weighted Average Emission Rate (tCO₂/MWh) (incl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.84	0.82	0.81
South	0.73	0.72	0.72
India	0.81	0.80	0.79

Simple Operating Margin (tCO₂/MWh) (incl. Imports)

	2005-06	2006-07	2007-08
NEWNE	1.02	1.01	1.00
South	1.01	1.00	0.99
India	1.02	1.01	1.00

Build Margin (tCO₂/MWh) (not adjusted for imports)

	2005-06	2006-07	2007-08
NEWNE	0.67	0.63	0.60
South	0.71	0.70	0.71
India	0.68	0.65	0.63

Combined Margin in tCO₂/MWh (incl. Imports)

	2005-06	2006-07	2007-08
NEWNE	0.85	0.82	0.80
South	0.86	0.85	0.85
India	0.85	0.83	0.81

GENERATION DATA**Gross Generation Total (GWh)**

	2005-06	2006-07	2007-08
NEWNE	470,037	499,380	531,539
South	147,355	161,897	167,379
India	617,392	661,277	698,918

Net Generation Total (GWh)

	2005-06	2006-07	2007-08
NEWNE	437,877	465,361	496,119
South	138,329	152,206	157,315
India	576,206	617,567	653,434

EMISSION DATA**Absolute Emissions Total (tCO₂)**

	2005-06	2006-07	2007-08
NEWNE	368,114,047	385,643,080	406,563,416
South	101,551,293	109,020,456	113,626,240
India	469,665,340	494,663,536	520,189,656

Absolute Emissions OM (tCO₂)

	2005-06	2006-07	2007-08
NEWNE	368,114,047	385,643,080	406,563,416
South	101,551,293	109,020,456	113,626,240
India	469,665,340	494,663,536	520,189,656

CDM – Executive Board

Share of Must-Run (Hydro/Nuclear) (% of Net Generation)

	2005-06	2006-07	2007-08
NEWNE	18.0%	18.5%	19.0%
South	27.0%	28.3%	27.1%
India	20.1%	20.9%	21.0%

Net Generation in Operating Margin (GWh)

	2005-06	2006-07	2007-08
NEWNE	359,271	379,471	401,642
South	100,978	109,116	114,702
India	460,249	488,587	516,343

20% of Net Generation (GWh)

	2005-06	2006-07	2007-08
NEWNE	87,575	93,072	99,224
South	27,666	30,441	31,463
India	115,241	123,513	130,687

Net Generation in Build Margin (GWh)

	2005-06	2006-07	2007-08
NEWNE	87,764	93,524	100,707
South	28,228	30,442	31,613
India	115,991	123,965	132,320

Absolute Emissions BM (tCO₂)

	2005-06	2006-07	2007-08
NEWNE	59,023,283	59,042,467	60,193,616
South	19,947,081	21,348,182	22,550,310
India	78,970,364	80,390,649	82,743,926

IMPORT DATA**Net Imports (GWh) - Net exporting grids are set to zero**

	2005-06	2006-07	2007-08
NEWNE	4,853	5,126	8,193
South	0	0	0

Share of Net Imports (% of Net Generation)

	2005-06	2006-07	2007-08
NEWNE	1.1%	1.1%	1.7%
South	0.0%	0.0%	0.0%

CDM – Executive Board

Annex 4

MONITORING INFORMATION

As per Section B.7