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

SECTION A. General description of small-scale project activity

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

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Title: Energy Efficiency measures at Commerzone Industrial Park, Pune

Version: 01

Date: 25/09/2008

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

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The project activity includes undertaking energy efficiency measures in Commerzone Building No 4, 6 and 7 of Commerzone Industrial Park, Pune[1] India. These buildings are for commercial purpose where the entire space would be either rented or leased out.

The energy efficiency measures have been undertaken primarily in the Heating, Venting and Air-Conditioning (HVAC) system and lighting system of the building. The measures adopted in the HVAC system result in reduction in electrical energy consumption, in comparison to that for a conventional building with similar size (in terms of floor area, carpet area and number of storeys), capacity (in terms of occupancy) and architectural perspectives.

The energy efficiency measures undertaken in the HVAC system affect the electricity consumption in two major ways – (i) by reducing the design heat load in the building which in turn reduces the power requirement of the HVAC system and. (ii) by installation of energy efficient equipments and control systems to operate at variable loads through installation of variable frequency drives (VFDs).

The energy efficiency measures taken in the lighting system would reduce the electricity consumption in two major ways: (i) by improving the utilization of natural lighting by optimizing the window openings (ii) by installation of energy efficient lighting systems and fixtures with occupancy sensors.

As a consequence, there will be an equivalent reduction in electricity generation in Western Regional Grid[2] connected power plants, which in turn will result in a reduction of Green House Gases as per the carbon intensity of the grid.

[1] here after referred as Project Proponent

[2] Commerzone Industrial Park is connected to the Maharashtra State Electricity Grid which is a part of the Western Regional Grid of India

The following table provides details of the proposed installations and energy efficiency measures taken at "Commerzone Building No 4, 6 and 7" vis-à-vis the measures that would be taken in a conventional office building (defined as the baseline building in Section B.3).

Commerzone Building No 4, 6 and 7

Parameters affecting the HVAC system	Baseline Building	Energy efficiency measures at Commerzone Building No 4, 6 and 7	Remarks/ Comments
Comparison of various energy efficiency measures adopted in "Commerzone Building No 4, 6 and 7 "which will impact the Design Heat Load and Power Consumption of the HVAC System- Fixed reduction in Heat Load and Power Consumption of HVAC system of Commerzone Building No 4, 6 and 7			
Exterior wall construction	The 9" thick mass wall with plaster inside and outside.	The wall is 8" thick brick made of Autoclaved Aerated Concrete (AAC) blocks with effective U value of 0.67-0.85 $w/m^2 K$	The measure taken in the exterior wall construction of "Commerzone Building No 4, 6 and 7" result in a reduction in the designed heat load of the HVAC system.
Exposure of glass wall area	The glasses used would be 6mm clear glass.	The glazing used in the building is of high performance double glazed panels coated with reflective low "e"-glass panes and having low U-value and solar heat gain co-efficient. For the upper floor glazing high performance glass i.e. Pilkington Eclipse Advantage	The measures taken in the glazing of "Commerzone Building No 4, 6 and 7 " result in a reduction in the designed heat load of the HVAC system

Parameters affecting the HVAC system	Baseline Building	Energy efficiency measures at Commerzone Building No 4, 6 and 7	Remarks/ Comments
		with the following specifications is used; **U-Value**: 0.35 Btu/hr.ft2.ºF **Shading Coefficient**: 0.34 **Light Transmittance**: 44%	
Roof Insulation	Mass Roof with a U-factor of 0.12 Btu/hr.ft2.ºF	Concrete slab over deck R-15 extruded polystyrene insulation with water proofing; The U-value of the roof is 0.12 Btu/hr-ft^2-^{0}F	The measures taken in the roof of "Commerzone Building No 4, 6 and 7" result in a reduction in the designed heat load of the HVAC system.
Chillers	To meet the load demand, water cooled chillers with a full load efficiency of 1.17 kW/ton of refrigeration [kW/TR] (a co-efficient of performance i.e. COP of 3.0 at ARI conditions) would be used.	To meet the load demand, water-cooled screw chillers with full load efficiency of 0.735 kW/TR (COP of >5.20 at ARI conditions) is installed. 1670 ton-hours of thermal storage is considered.	With the installation of efficient chillers, the specific power consumption in kW/TR of the HVAC system is reduced.

Comparison of various energy efficiency measures adopted in 'Commerzone Building No 4, 6 and 7' which will impact the Heat Load and Power Consumption of the HVAC System based on the demand- Variable reduction in Heat Load and Electricity Consumption of HVAC system of

Commerzone Building No 4, 6 and 7.			
Air Handling Unit (AHU) **Heat Recovery Wheel (HRW)**	There would be no CO_2 sensors.	CO_2 sensors would control amount of fresh air taken based on the building occupancy there by reducing the HVAC load when the building is partially occupied. Heat Recovery Wheels having efficiency of 50 % has been installed. The return air from the room/ space is at low temperature than the outside ambient air. Heat recovery wheels can be used to precool the warm fresh air using the cold return air. This results in reducing the Chiller load when compared with the baseline building.	The CO_2 sensors installed in the AHUs of "Commerzone Building No 4,6 and 7 " result in a reduction in the variable heat load and the power consumption taking into account the occupancy variations.
Installation of VFDs in the chilled water pumping system	Chilled water would be pumped with a primary-secondary pumping arrangement. The primary loop pumps would circulate chilled water through the chillers, and the secondary pumps would distribute chilled water to the building. When the secondary pumps, with motors operating at constant speeds are selected, they	Chilled water is pumped with a primary-secondary pumping arrangement. The primary loop pumps circulate chilled water through the chillers, and the secondary pumps distribute chilled water to the building. VFDs are installed in secondary chilled water pumps and used to reduce the speed of the pump while a balancing valve after the	VFD installation in the chilled water pumping system results in reduction in electricity consumption. VFDs installed in the secondary pumping system of chillers, is not a business-as-usual scenario. So the reduction in

	invariably have some extra head in the pump selection as compared to that of the actual demand at site. A balancing valve would be used after the chiller plant in order to introduce this non existing head in the primary loop. The electricity consumption of the pumps in the secondary chilled water loop, therefore, would remain the same. Hence, no VFDs would be installed in the secondary chilled water loop, to accommodate the variations in the building demand. The chilled water system would be designed for 2.67 Gallons/per minute (GPM) flow per TR.	chiller plant, is kept fully open. The electricity consumption of the pumps in the secondary chilled water loop can thus be varied by operating the pump motors at lower frequencies. VFDs in the pumps of secondary chilled water loop accommodate the variations in the chilled water demand depending on the quantity of water being handled by the water pumping system of the building. The chilled water system is designed for 1.9 GPM flow per TR.	electricity consumption from the same has been considered for computation of emission reductions.
Comparison of various energy efficiency measures adopted in 'Commerzone Building No 4, 6 and 7' which will impact the Lighting Load and Power Consumption of the Lighting System based on the equipment selection and demand – Fixed and Variable reduction in Heat Load and Electricity Consumption of HVAC system of Commerzone Building No 4, 6 and 7			
Lighting System	Normal fluorescent lights were used for lighting. No daylight controls resulting in an average lighting power density of the base case building is 1.5 Watts/ ft^2	Energy efficient lighting with flicker free CFL bulbs and T5 fluorescent lights were used. Efficient lighting design is employed to maximize the utilization of natural lighting with day light controls	Energy efficient lighting and maximizing the usage of natural lighting would reduce the annual building energy consumption there by resulting in emission reduction.

		resulting in the following light density: 1.0 W/ft^2 in common areas 1.5W/ft^2 in food court, and 0.9 W/ft^2 in service areas and daylighting Controls in Food Court	

For the Commerzone Industrial Park the main power is sourced from the Western Region Grid. The primary objective of the project activity is to reduce the electricity consumption of the building as compared to the electricity consumption in the baseline building (*which has been arrived at in Section B.3*), through certain energy efficiency measures taken in the HVAC and Lighting system. Therefore, reduced electricity consumption by the building "Commerzone Building No 4, 6 and 7" will ultimately result in drawal of lesser amount electricity from Maharashtra State Electricity grid which is a part of the Western Regional electricity grid. Western Regional grid is a thermal power dominated grid. Thus an equivalent amount of GHG emissions in the form of CO_2 released from generation of fossil fuel based thermal power in the regional grid mix will be reduced by the project activity.

Over a crediting period of 10 years, a total electrical energy consumption of 16.3 GWh will be reduced owing to the project activity.

Project's contribution to sustainable development

The contribution of the project activity to sustainable development can be described as follows:

Socio-economic well being: There was a necessity of skilled and semi-skilled jobs during installation of the different energy efficiency equipment in the HVAC and lighting system required and so thorough training was imparted to relevant personnel on the commissioned system. The training covered design intent of the system, use of operation and maintenance manual, review of control drawings and schematics, optimizing energy performance, start-up, handling seasonal variations, trouble-shooting, health and safety issues and overview on how the system is environmentally responsive. Such an extensive training helped in building the knowledge and skill base of the employees involved in the construction of the building. The building provides its occupants with a comparatively better quality of working environment with a healthier and safer ambience resulting in better productivity at workplace. The energy efficiency measures taken in

the HVAC system have also helped to create business opportunities for technology suppliers, technical consultants not just for "Commerzone Building No 4, 6 and 7 " but also for upcoming energy efficient buildings in the western region of the country.

Technological well-being: "Commerzone Building No 4, 6 and 7 " are energy efficient due to (a) energy efficiency equipments in HVAC system, (b) online monitoring system and control system for optimization of energy performance (c) better roof insulation and (d) glass with glazing of low U factor[3] and solar heat gain co-efficient. These energy efficiency measures have a high replication potential and "Commerzone Building No 4, 6 and 7" will encourage other builders to adopt similar measures.

Environmental well-being: Due to the energy efficiency measures taken in the building, the net electricity consumption in the building is reduced vis-à-vis a similar conventional building which would have been built in absence of the project activity. The project activity would therefore reduce the electricity load on the grid, which will in turn reduce generation of electricity in the grid connected power plants. Reduction in thermal power generation, not only conserves the non-renewable fossil fuels but also reduces the associated emissions of greenhouse gases (GHGs) and other localized pollutants like SPM, SO_X and NO_X.

A.3. Project participants:

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Name of the 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	Commerzone Industrial Park	No

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

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

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Yerwada

A.4.1.1. Host Party(ies):

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India

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

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[3] Source: http://www.nfrc.org/documents/U-Factor.pdf

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Maharashtra

A.4.1.3. City/Town/Community etc:

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Pune

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

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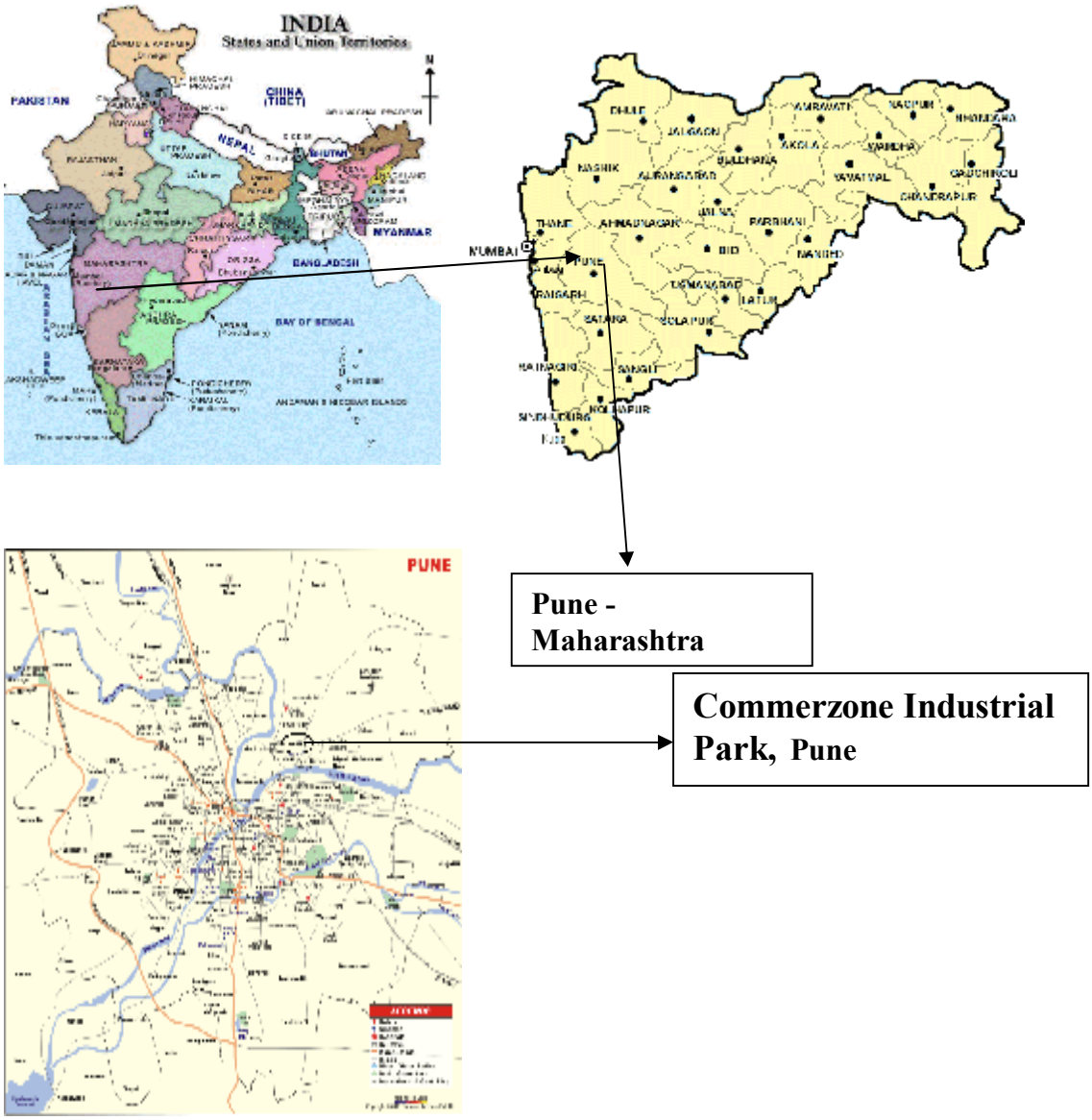
Commerzone Building No 4, 6 and 7 is in Commerzone Industrial Park Yerwada which is an established growth centre in North East Pune in Maharashtra. Yerwada falls under 18^0 32.46' latitude and 73^0 45.96' The project site is strategically located off the Airport. Distance from the airport is around 5- 8 km and is well connected by rail and road.

The detailed map is given below:



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

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As per Appendix B of the simplified modalities and procedures for small scale CDM project activities, the small scale methodology AMS II.E[4] i.e. "Type II – Energy efficiency improvement projects of Category II.E – Energy efficiency and fuel switching measures for buildings" (Version 10, Scope 4 – EB 35) has been selected for the project as it meets requirements specified in the methodology.

The description of how environmentally safe and sound technology and know how is being applied by the project activity is as described below:

Technology in Commerzone Buildings

In "Commerzone Industrial Park", the thermal resistance of the building envelope has been increased, thereby reducing the unwanted heat loss and heat gain from the outside. This in turn reduces the energy required for air conditioning in the building. Insulation also improves thermal comfort in addition to reducing air conditioning equipment sizes. Apart from the building envelope, the central plant also uses efficient chiller type, with proper sizing contributing to optimum energy utilization.

The major parameters which have resulted in the reduced electricity consumption in the HVAC system of "**Commerzone Building No 4, 6 and 7"** are detailed below:

[A] Exposure of glass wall area

(1) The glazing used in the building is of high performance double glazed panels coated with reflective low "e"-glass panes and having low U-value[5] and solar heat gain co-efficient. High quality glass with shading co-efficient of 0.34 and high visible light transmittance 24% has been used in order to reduce solar gains and to enhance available daylight in the space without compromising on energy efficiency. In "Commerzone Building No 4" a simple optimization has been done between the energy reductions with less window area vis-à-vis lighting requirement accordingly an overall Window- Wall –Ratio (WWR) is 24% - 30% for Commerzone Building No 4, 6 and 7

[B] Roof insulation

[4] *Version 10, Scope 3 – EB 35* (http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html)

[5] Glass industry measures the energy efficiency of their products in terms of thermal transmission, or U-factor. U-factor measures the rate of heat transfer through a product. Therefore, the lower the U-factor, the lower the amount of heat loss, and the better a product is at insulating a building. Apart from conductivity, U-factor also is affected by the airflow around the window and the emissivity (e) of the glass. The lower the conductivity and emissivity of the glass, the lower the rate of heat loss and the lower the U-factor.

The material for the roof construction is concrete slab with R-15 extruded polystyrene for over deck insulation. U-value of the roof has been kept low as 0.12 Btu/hr ft^2 F.

[C] Air Handling Unit

Regular office spaces have been divided into zones based on occupancy pattern and ease of air distribution. Each of these zones have been provided with an individual AHU comprising centrifugal supply and return air fans, cooling coil section, steel double sloping drain pan and filter section. Each AHU is provided with a two way valve control, sensing cooling coil leaving air temperature, filter monitoring switch, duct smoke detector unit to trip blower in case of smoke detection. AHUs are provided with CO_2 sensor. The volume of fresh air entering into the building is modulated based on CO_2 sensors, located within return air duct of AHU serving each occupied zone. Both the indoor and outdoor CO_2 levels are continuously logged through integrated building management system (IBMS), Based on the CO_2 differential the quantity of fresh air brought in to the building is varied using the dampers.

[D] Chillers

To meet the load demand, 3 Nos of 299 TR water-cooled screw chillers with COP of more than 5.2 are installed. The specific energy consumption of the chillers 0.735 kW/TR. Water-cooled chillers are more efficient than air cooled ones in air-conditioning of large buildings. Each water cooled chiller has two condenser pumps, one working and the other one as standby.

[E] Chilled Water Pumping system

Chilled water is pumped with a primary-secondary pumping arrangement. Three primary water pumps and three secondary water pumps are installed in the chiller. The primary loop pump circulates chilled water through the chillers, and the secondary pumps distribute chilled water to the building. VFDs are installed only in the secondary chilled water pumps. VFDs in the pumps of secondary chilled water loop accommodate the variations in the chilled water demand depending on the quantity of air being handled by the AHUs of the building.

A VFD is installed to the rotor of the electric drives to operate them at variable speed. Since the rotor can operate at any speed below its maximum capacity, the output of the motor can be made to vary by controlling the rotor speed by a VFD installation. A variable frequency drive can control two main elements of a 3-phase induction motor: speed and torque. This is adjusted by changing the frequency applied to the motor. If the required output of the rotor is lower than the present output capacity, the frequency of the rotor may be regulated below full operational capacity by the variable frequency drive. Therefore under low occupancy scenarios, the VFDs would enable the motor to operate at lower operational capacity, which

would reduce the quantity of chilled water required to be handled by the HVAC system, thereby reducing the power consumption of the chilled water pumps. With reduction in frequency of the rotor, the power input to the motor reduces proportionately.

[G] Heat Recovery Wheel (HRW)

Heat Recovery Wheels having efficiency of 50 % has been installed.

The return air from the room/ space is at low temperature than the outside ambient air. Heat recovery wheels can be used to precool the warm fresh air using the cold return air. This results in reducing the Chiller load when compared with the baseline building.

The major parameters which have resulted in the reduced electricity consumption in the Lighting system of "Commerzone Building No 4,, 6 and 7" are detailed below:

[F] Lighting

Energy efficient lighting like CFL bulbs and T5 fluorescent lights were used in Commerzone Building No 4, 6 and 7 and Efficient lighting design is employed to maximize the utilization of natural lighting with day light controls resulting in the following light density resulting in an light power density of 1.0 W/ft2 in common areas, 1.5W/ft^2 in food court, and 0.9 W/ft2 in service areas. Commerzone Building No 4, 6 and 7 also employs day lighting Controls in Food Court which would optimize the power consumption of lighting system when natural light is available.

With these measures in place, the HVAC and lighting system will operate at high energy efficiency and will have tremendous flexibility to run efficiently under part load conditions. Out of the many functions to be performed by the BMS, one major function will be energy management through optimization of all connected electrical and mechanical plants. BMS comprises the following HVAC automation services – chiller plant automation, AHU monitoring and control, stairwell pressurization and control, common area smoke extraction fan control, smoke extract fans of individual fans, VFDs, CO_2 sensor monitoring and modulating damper control, car park area CO sensor monitoring ,ventilation fan control and lighting control.

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

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The estimated amount of CO2 emission reduction would be about 129440 tons over 10 years crediting period for all the four buildings of Commerzone Industrial Park. Table A.4.3 Estimated amount of Emission Reduction

Years	Annual estimation of emission reductions in tonnes of CO2-e

2008-2009	**12944**
2009-2010	**12944**
2010-2011	**12944**
2011-2012	**12944**
2012-2013	**12944**
2013-2014	**12944**
2014-2015	**12944**
2015-2016	**12944**
2016-2017	**12944**
2017-2018	**12944**
Total estimated reductions (tonnes of CO2 e)	**129440**
Total number of crediting years	**10**
Annual average over the crediting period of Estimated reductions (tonnes of CO2 e)	**12944**

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

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No public funding from parties included in Annex-I is available to the project activity.

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

As mentioned in Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities, a small-scale project activity shall be deemed to be a debundled 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.

The project proponent has not implemented any other project activity, which falls under Category- II.E of "Appendix B of the simplified modalities and procedures for small-scale CDM project activities" and deals with the same technology/measure. No such project activity, proposed by project proponent with the same project category and technology/ measure and whose boundary is within 1 km of the project boundary of the small-scale project activity under consideration at its closest point, is registered or in the advanced stage of registration with UNFCCC in the last two years.

SECTION B. Application of a baseline and monitoring methodology

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

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Title: AMS. II.E (Version 10 Sectoral Scope: 3 EB 35)

TYPE II - Energy Efficiency Improvement Projects

II.E. Energy efficiency and fuel switching measures for buildings

Reference: http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html.

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

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As per Appendix B of the simplified modalities and procedures for small scale CDM project activities, the small scale methodology AMS II.E i.e. "Type II – Energy efficiency improvement projects of Category II.E – Energy efficiency and fuel switching measures for buildings" has been selected for the project activity as it meets the following requirements:

Methodology Requirement	Applicability of Project Activity
This category comprises any energy efficiency and fuel switching measure implemented at a single building, such as a commercial, institutional or residential building, or group of similar buildings, such as a school, district or university.	The Project activity is a set of energy efficiency measures and not fossil fuel switching measure, implemented at a building of project proponent.
This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B. Examples include technical energy efficiency measures (such as efficient appliances, better insulation and	The project activity improves the efficiency of building by adopting energy efficient building design and installation of energy efficient equipments and materials which reduce the building energy consumption when compared with conventional energy inefficient buildings in India.

optimal arrangement of equipment) and fuel switching measures (such as switching from oil to gas).	
The technologies may replace existing equipment or be installed in new facilities. The aggregate energy savings of a single project may not exceed the equivalent of 60 GWh per year.	The maximum total energy reduction in the project activity is 16.3GWh which is below the limit of 60 GWh as specified in the methodology AMS II.E.
This category is applicable to project activities where it is possible to directly measure and record the energy use within the project boundary (e.g. electricity and/or fossil fuel consumption).	The project activity utilizes Building Management System (BMS) which measures and monitors all the energy usage parameters of the building.
This category is applicable to project activities where the impact of the measures implemented (improvements in energy efficiency) by the project activity can be clearly distinguished from changes in energy use due to other variables not influenced by the project activity (signal to noise ratio).	The project activity has specific energy reduction measures like utilization of energy efficient materials and equipments (HVAC & Lighting system) which can be clearly distinguished from changes from other usage like building loads like computers etc.

From the above, it can be concluded that the project meets all the applicability criteria set out under the selected small-scale methodology and hence the project category is applicable to the project activity.

B.3. Description of the project boundary:

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As per paragraph 2 under "Type II.E: Energy efficiency and fuel switching measures for buildings" in Appendix B of the Simplified M&P for small scale CDM project activities (Sectoral Scope: 3, Version 10: EB 35), "the project boundary is the physical, geographical site of the building(s)". Therefore for the project activity under consideration, the project boundary will include 'Commerzone Building No 4, 6 and 7' building where the energy efficiency measures have been taken and which result in consumption of lesser amount of electricity consumption by the building.

However, reduced electricity consumption by "Commerzone Building No 4 ,6 and 7" will ultimately result in drawal of lesser amount electricity from Maharashtra Electricity grid which is a part of the Western Regional electricity grid. For computation of emission reductions resulting from the project activity, Western Regional electricity grid and all the power plants catering to the grid have been considered in order to arrive at the emission factor corresponding to power generation in the grid. However, the emission factor corresponding to power generation in the grid has been taken to be constant for the computation of emission reduction for the entire crediting period.

B.4. Description of baseline and its development:

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The baseline category and methodology applicable for the project activity has already been justified in Section B.2. As per paragraphs 3 and 4 under Category II.E in Appendix B of the Simplified M&P for small scale CDM project activities (Sectoral Scope: 3, Version 10: EB 35), '***the energy baseline consists of the energy use*** *of the existing equipment that is replaced in the case of retrofit measures and* ***of the facility that would otherwise be built in the case of a new facility****. Each energy form in the emission baseline is multiplied by an emission coefficient. For the electricity displaced, the emission coefficient is calculated in accordance with provisions under category I.D. For fossil fuels, the IPCC default values for emission coefficients may be used.'*

The baseline determination is a two-step study conducted to determine the Baseline emissions over the crediting period in absence of project activity.

Step I: Determination of Energy Baseline

The energy baseline for the project activity under consideration is the electrical energy use of the HVAC and lighting system of the baseline building (Please refer to Section B.5 for definition of baseline building). The project activity reduces electricity consumption of the HVAC and Lighting system of "Commerzone Building No 4, 6 and 7" in comparison to the baseline scenario. However, there is an avenue kept for electricity generation by diesel generator (DG) set and consumption of the same electricity in "Commerzone Building No 4, 6 and 7" in case of exigencies like load-shedding by the grid. Emission reduction will be based on the reduced electricity drawal from the grid and also based on the reduced load on the DG set that would be used in case of exigencies, due to the reduced electricity consumption in the HVAC and Lighting system, in the project scenario compared to the baseline scenario.

Step II: Determination of carbon intensity of the chosen baseline

As stated above there are two energy sources

- ✓ Electrical energy drawn from Western Region Grid (major contributor)
- ✓ Electrical energy drawn from Backup Diesel Generator (minor contributor)

The emission coefficient for each of these sources has been determined herein:

[A] Emission Coefficient of the Western Regional Grid[6]

[6] Emission Factor of WR Grid from www.cea.nic.in based on ACM0002 version 06

Present generation mix for western regional grid with sector wise installed capacities, emission co-efficient and generation efficiencies are used to arrive at the net emission coefficient of the chosen grid. As per the provisions of the methodology the emission coefficient for the electricity displaced would be calculated / considered in accordance with Baseline Carbon Dioxide Emission Database Version 3.0 from Central Electricity Authority (CEA), Ministry of Power, and Government of India[7] . The provisions require the emission coefficient (measured in kg CO_2 eq / kWh) to be calculated in a transparent and conservative manner as:

(a) The average of the "approximate operating margin" and the "build margin" (or combined margin)

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix.

The baseline emission factor is calculated based on both approaches above and the combined margin emissions factor of generation mix has been selected to calculate the baseline emission factor.

Combined Margin

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the regional grid mix) and the build margin (i.e. weighted average emissions of recent capacity additions) of the selected western regional grid and the baseline emission coefficient would therefore incorporate an average of both these elements.

Operating Margin

As mentioned above the project activity will have some effect on the Operating Margin (OM) of the western regional grid. The emission coefficient as per the operating Margin takes into consideration the present power generation mix excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation of the selected grid, efficiency of thermal power plants and the default value of emission factors of the fuel used for power generation.

The real mix of power in a particular year is based on actual units generated from various sources of power. The data collected and used is presented in the calculations.

Build Margin

[7] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

The project activity will have some effect on the Build Margin (BM) of the western regional electricity grid. The baseline emission coefficient as per the Build Margin takes into consideration the delay effect on the future projects and assumes that the past trend will continue in the future. As per the baseline methodology, the baseline factor for Build Margin is calculated as the weighted average emissions of recent capacity additions to the system, defined as the greater (in MWh) of most recent 20% of plants built or the 5 most recent plants. In case of western regional electricity grid capacity additions (in MWh) of most recent 20% of the existing plants are greater than that of 5 most recent plants. The data is presented in calculation excel sheets. The thermal efficiencies of coal and gas based plants for calculating build margin has been assumed same as that for calculating operating margin.

Combined Margin Emission Coefficient of Western Regional State Grid is = **0.7937 kg of CO_2 / kWh**[8] generation.

[B] Emission Coefficient for Diesel Generator

Emission reductions corresponding to reduced DG set based electricity consumption by the HVAC and Lighting system, will be obtained by multiplying reduction in DG set based electricity consumption of the HVAC system with the emission factor for electricity generated by the DG set. For the project activity under consideration, the emission factor (EF_{DG}) for the electricity generated by DG set, for both the baseline and project scenarios have been taken to be equal to the 0.8 kg CO_2 e/kWh, a value provided in table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 10, Sectoral Scope: 1, EB 33). In considering the value, it has been assumed that the DG sets of CPP is a mini grid with temporary service (2 hours a day), operating at 50% load factor.

Baseline Emissions

The Baseline emissions associated to grid electrical energy are computed as a product of the Energy Baseline (i.e. electrical energy use of the baseline building) and emission coefficient of western grid.

The Baseline emissions associated to electrical energy from DG are computed as a product of the Energy Baseline (i.e. electrical energy use of the baseline building during power failure from gird) and emission coefficient of Diesel based power generator.

The sum of above two would give the total baseline emissions.

Leakage

[8] Emission Factor of WR Grid from www.cea.nic.in based on ACM0002 version 06

The project activity includes energy efficient measures in Commerzone Building No 4,5 and 6 conserve energy.

As per the Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories, "if the energy efficiency technology is equipment transferred from another activity, leakage is to be considered".

The energy efficiency technologies adopted in the project activity does not involve any equipment transfers from another activity or vice versa. The same may be verified on site. Therefore there would be no net change of anthropogenic emissions by sources of greenhouse gases outside the project boundary. Therefore as per the AMS II – E guidance project proponent does not need to consider these emission sources as leakage in applying this methodology. Therefore project proponent has not taken leakage into consideration.

Key information and data used to determine the baseline scenario are as provided in the following table - Table B.3:

Sl. No.	Variable	Parameters	Data sources
01	$E_{Chiller,b}$	Electricity that would have been consumed by the chiller plant (air cooled chiller of COP 3 without CO_2 sensors in the AHUs) of "Commerzone Building No 4, 6 and 7" in the baseline scenario (in MWh)	Energy simulation based on the design parameters for the baseline building
02	$E_{Pumps,b}$	Electricity that would have been consumed by the chilled water pumping system (without VFDs in the pumps of the primary chilled water loop) of "Commerzone Building No 4, 6 and 7" in the baseline scenario (in MWh)	Energy simulation based on the design parameters for the baseline building
03	$E_{AHUs,b}$	Electricity that would have been consumed by the AHUs (without VFDs on the fans) of "Commerzone Building No 4, 6 and 7" in the	Energy simulation based on the design parameters for the baseline building

		baseline scenario (in MWh)	
04	$E_{Lighting,b}$	Electricity that would have been consumed by the Lighting (without CFLs and occupancy sensors) of "Commerzone Building No 4, 6 and 7" in the baseline scenario (in MWh)	Energy simulation based on the design parameters for the baseline building
05	$T_{op,HVAC,b}$	Operating hours of the HVAC system of "Commerzone Building No 4, 6 and 7" in the baseline scenario.	Expected occupancy pattern report for "Commerzone Building No 4, 6 and 7"
06	$EF_{Grid,}$	Combined margin emission factor (in tCO_2/kWh) of the Western Regional Electricity grid (calculated ex-ante and kept constant for the entire crediting period)	CEA published CDM – Carbon dioxide baseline database[9]
07	EF_{DG}	CO_2 emission factor (in tCO_2/kWh) for electricity generated by the DG set in "Commerzone Building No 4, 6 and 7"	Table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33).

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 green house gases by sources are reduced. Below those that would have occurred in the absence of the registered CDM project activity. . The project activity includes measures to reduce the energy

[9] Source: http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

consumption of the buildings. The measures incorporated in the Commerzone Building No 4, 5 and 7 would reduce the CO_2 emissions when compared with a less energy efficient building.

The project proponent identified all the plausible alternatives for the project activity. There were only two plausible alternatives available with the project proponent.

Alternative 1(Baseline Scenario): Less Energy Efficient Building

Under this alternative, the project proponent would have gone ahead with a less energy efficient building. This alternative is in compliance with all the legal and regulatory requirements. The baseline building does not have any energy efficient features and hence does not involve any additional investment.

Alternative 2 (Project activity) Energy Efficient Building

This alternative is in compliance with all legal and regulatory authority. There are no legal bindings over the project proponent to take up this project activity. The project proponent took up this as a voluntary initiative and had to incur high cost in terms of investment made on the equipments for energy efficiency. A financially more viable alternative would have led to higher emissions.

Barriers and Additionality

According to the Attachment A to Appendix B of the simplified M&P for small-scale CDM project activities

"*Project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:*

(a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

(b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions;

(c) Barrier due to prevailing practice: prevailing practice or existing regulatory or policy requirements would have led to implementation of a technology with higher emissions;

(d) Other barriers: without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources, organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher".

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As per the above paragraph, the barrier identified for the proposed project activity is

Investment barrier

(i) High capital Investment: The project proponent assessed and evaluated the various plausible options for the project activity. The project proponent was well aware of the high expenditure involved in the construction of an energy efficient building. It was decided way back in the project conceptualization stage that the entire project activity building would be either rented or leased out for a third party. The buildings would be either or rented[10] or leased out at the prevailing market prices. No extra rent would be charged for the energy efficient features. As a result the benefits of the energy efficiency measures will not go to the project proponent.

The cost comparison to demonstrate the additional investment has been provided in the table below:

Measures	Energy Efficient building	Typical Building	Differential Cost in Lacs
CFLs in Lighting	Rs 469. 78 lacs	Rs 161.5 lacs	308.28
Glazing	Rs 147.36 lacs	Rs 80.70 lacs	66.66
Building Management System	Rs 89 lacs	-	Rs 89 lacs
HVAC- High side	Rs 129.5 lacs	Rs 176.4000	-46.9
HVAC-Low side	Rs 275.56 lacs	Rs 199.60 lacs	75.96
The costing is exclusive of the Civil construction with AAC blocks and Thermal Insulation.			

The table demonstrates the additional investment to be borne for constructing an energy efficient building when compared with a less energy efficient building.

(ii) Additional capital and recurring expenditures due to BMS

During the project conceptualization phase it was decided the Management of K Raheja Corporate Services that BKC- 30 will have an online Building Management System (BMS). BMS ensures the proper control, accurate monitoring and recording of all relevant parameters affecting the performance of the HVAC system. Such a provision for the monitoring of the electricity consumption of HVAC

[10] Lease agreement

system is not very common. Apart from the installation of the BMS, the regular maintenance of the BMS as well as the building also entails recurring cost. This would continue as long as the building exists.

Apart from the investment barriers, the project proponent faced other barriers like:

(a) Since there is no know-how available at Project proponent to implement the project activity, the project proponent's management could fore-see many operational limitations. The in-house team had no technical experience of implementing the project activity and project proponent had to depend primarily on the technology suppliers for any operational problems.

(b) The technology design is driven by software and control systems installed with PLC and DCS control systems (Building Management System). Any operational failure of these controls will lead to HVAC downtime and its associated problems to the tenants. These control devices rectifications cannot be done by the in-house team. Any problem in the control devices requires addressal by technology supplier and therefore leading to large losses in plant operation.

The project proponent's management chose to undertake the project activity and to invest in the CDM process only after adjusting for the potential carbon financing.

In summary, the corporate decision to invest:

- in overcoming the barriers facing project implementation and operation;
- in the CDM project activity and,
- in additional transaction costs such as preparing documents, supporting CDM initiatives and developing and maintaining M&V protocol to fulfil CDM requirements

was guided by the anthropogenic greenhouse gas emission reductions the project activity would result in and its associated carbon financing the project activity would receive through sale of CERs under the Clean Development Mechanism .

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Calculation of electricity that would be consumed by the HVAC and Lighting system in the baseline scenario

$$E_{Building,b} = E_{Chiller,b} + E_{Pumps,b} + E_{AHUs,b} + E_{Lighting,b}$$

Where,

$E_{Building, b}$: Electricity that would have been consumed by the "Commerzone Building No 4, 6 and 7" in the baseline scenario (in MWh)

$E_{Chiller,b}$: Electricity that would have been consumed by the chiller plant (water cooled chiller of COP 3 without CO_2 sensors in the AHUs) of "Commerzone Building No 4, 6 and 7 " in the baseline scenario (in MWh)

$E_{Pumps,b}$: Electricity that would have been consumed by the chilled water pumping system without VFDs in the pumps of the primary chilled water loop) of "Commerzone Building No 4, 6 and 7 " in the baseline scenario (in MWh)

$E_{AHUs, b}$: Electricity that would have been consumed by the AHUs (without VFDs on fans) of "Commerzone Building No 4, 6 and 7 " in the baseline scenario (in MWh)

$E_{Lighting, b}$: Electricity that would have been consumed by the Lighting system (without occupancy sensors) of "Commerzone Building No 4, 6 and 7 " in the baseline scenario (in MWh)

$$E_{Building,b,y} = \frac{E_{Building,b}}{T_{op,Building,b}} \times T_{op,Building,y}$$

Where,

$E_{Building,b,y}$: Electricity that would have been consumed by the building "Commerzone Building No 4, 6 and 7" in the baseline scenario corresponding to the operating hours of the chiller plant in the year y of the project scenario (in MWh)

$T_{op,Building,b}$: Operating hours of the building "Commerzone Building No 4, 6 and 7"in the baseline scenario

$T_{op,Building,y}$: Operating hours of the building "Commerzone Building No 4, 6 and 7"in a year y in the project activity scenario

Reduction in electricity consumption with respect to the baseline scenario

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$$\mathbf{E_{r,y} = [(E_{HVAC,b,y} + E_{lighting.b.y}) – (E_{HVAC,p,y} + E_{lighting,p,y})]}$$

$\mathbf{E_{r,y}}$ – Reduction in electricity consumption in the year y in the project activity scenario with respect to the baseline scenario due to the energy efficiency measure taken in Commerzone building No 4,5 and 6 (in MWh)

Calculation of electricity consumption in the project activity scenario

$$E_{Building,p,y} = E_{Chiller,y} + E_{Pumps,y} + E_{AHUs,y} + E_{Lighting,y}$$

Where,

$E_{Building,p,y}$: Electricity that will be consumed by the building "Commerzone Building No 4, 6 and 7"in the year y in the project activity scenario(in MWh)

$E_{Chiller,y}$: Electricity that will be consumed by the chiller plant (water cooled screw chillers of COP >4.0) of "Commerzone Building No 4, 6 and 7"in the project activity scenario (in MWh)

$E_{Lighting,,y}$: Electricity that will be consumed by the Lighting system of "Commerzone Building No 4, 6 and 7"in the year y in the project activity scenario (in MWh)

$E_{Pumps,y}$: Electricity that will be consumed by the chilled water pumping system (with VFDs in the pumps of secondary chilled water loops) of "Commerzone Building No 4, 6 and 7" in the year y in the project activity scenario (in MWh)

$E_{AHUs,y}$: Electricity that will be consumed by the AHUs (with VAV and CO_2 Sensors) of "Commerzone Building No 4, 6 and 7" in the year y in the project activity scenario (in MWh)

Calculation of Average Emission Factor with respect to drawal of electricity from the grid and DG

$$EF_{Avg,y} = \left(\frac{E_{Grid,y} \times EF_{Grid,y} + E_{DG,y} \times EF_{DG,y}}{E_{Grid,y} + E_{DG,y}} \right)$$

Where,

$EF_{Avg,y}$: Average Emission Factor with respect to Grid as well as DG power consumption in "Commerzone Building No 4, 6 and 7" (in tCO_2/MWh)

$E_{Grid, y}$: Electricity drawn from the Western Regional Electricity grid by "Commerzone Building No 4, 6 and 7"in the year y in the project activity scenario (in MWh)

$E_{DG, y}$: Electricity generated by Diesel Generator (DG) set of "Commerzone Building No 4, 6 and 7"in the year y (in MWh)

$EF_{Grid,y}$: Western region Grid Emission Factor (in tCO_2/MWh)

$EF_{DG,y}$: DG grid Emission Factor (in tCO_2/MWh)

Calculation of baseline emissions (BE_y)

$$BE_y = E_{Building,b,y} \times EF_{Avg,y}$$

Where,

BE_y : Baseline Emissions for the year y in Commerzone Building No 4, 6 and 7" (in t CO_2/annum)

Calculation of Project emissions (PE_y)

$$PE_y = E_{Building,p,y} \times EF_{Avg,y}$$

Where,

PE_y : Project Emissions for the year y in Commerzone Building No 4, 6 and 7" (in t CO_2/annum)

Leakage

As per paragraph 5 of Appendix B of Category II.E (Version 10, EB 35, Sectoral Scope: 03) small scale methodologies, "*if the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity, leakage is to be considered*". For the project activity under consideration, the energy efficient technology includes installation of electrical equipments, fenestration and insulations in a new building. All the energy efficient technologies are new installations and not diverted from already existing utilization areas. Therefore, there is no leakage that needs to be considered for the project activity under consideration and leakage (L_y) = 0.

Calculation of Emission reductions (ER_y)

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

Where

ER_y: Emission Reduction in year y for Commerzone Building No 4, 6 and 7 in tCO_2/annum.

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

Commerzone Building No 4

Data / Parameter:	$E_{Chiller,b}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the chiller plant (water cooled chiller of COP 3 without CO_2 sensors in the AHUs) of "Commerzone Building No 4" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	1373.02
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the chiller plant of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 4". The specifications of the chiller plant for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$E_{Pumps,b}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the chilled water pumping system (without VFDs in the pumps of the primary chilled water loop) of "Commerzone Building No 4" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	48.85
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the chiller plant of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 4". The details of the measures in the chilled water pumping system for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$E_{AHUs,b}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the AHUs (without VFDs on the fans) of "Commerzone Building No 4" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	288.87
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the AHUs of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 4". The details of the measures in the AHUs for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$E_{Lighting,b}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the Lighting system (without CFLs and occupancy sensors) of "Commerzone Building No 4 " in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	1621.95
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the Lighting System of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 4". The details of the measures in the Lighting sytem for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$T_{op,Building,b}$
Data unit:	hours
Description:	Operating hours of the HVAC system of "Commerzone Building No 4 " in the baseline scenario
Source of data used:	Expected occupancy pattern report for "Commerzone Building No 4"
Value applied:	16
Justification of the choice of data or description of measurement methods and procedures actually applied :	"Commerzone Building No 4" is an commercial office space. It is meant for commercial office spaces which entail average occupancy time of 16 hours/day per head in the offices.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{Grid}
Data unit:	t CO_2/MWh
Description:	Western Grid Emission Factor
Source of data used:	CEA Emission Factor
Value applied:	0.7937
Justification of the choice of data or description of measurement methods and procedures actually applied :	Western Grid Emission factor 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 3.0.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{DG}
Data unit:	tCO2/MWh
Description:	CO_2 emission factor for the DG set of CPP
Source of data used:	Table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33)
Value applied:	0.8

Justification of the choice of data or description of measurement methods and procedures actually applied :	For the project activity under consideration, EF_{DG} is taken to be equal to the 0.8 kg CO_2 e/kWh, a value provided in table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33). In considering the value, it has been assumed that the DG sets of CPP is a mini grid with temporary service (2 hours a day), operating at 50% load factor.
Any comment:	EF_{DG} has been considered as the ex-ante emission factor and will be kept constant for the entire crediting period

Commerzone Building No 6

Data / Parameter:	$\mathbf{E_{Chiller,b}}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the chiller plant (water cooled chiller of COP 3 without CO_2 sensors in the AHUs) of "Commerzone Building No 6" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	1412.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the chiller plant of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 6". The specifications of the chiller plant for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$\mathbf{E_{Pumps,b}}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the chilled water pumping system (without VFDs in the pumps of the primary chilled water loop) of "Commerzone Building No 6" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	50.04
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the chiller plant of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 6". The details of the measures in the chilled water pumping system for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$\mathbf{E_{AHUs,b}}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the AHUs (without VFDs on the fans) of "Commerzone Building No 6" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	273.52
Justification of the choice of data or	An energy simulation has been done for the AHUs of the baseline building which is a conventional building with the same occupancy-type in the same region as

description of measurement methods and procedures actually applied :	"Commerzone Building No 7". The details of the measures in the AHUs for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$E_{Lighting,b}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the Lighting system (without CFLs and occupancy sensors) of "Commerzone Building No 6" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	1620.89
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the Lighting System of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 6". The details of the measures in the Lighting sytem for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$T_{op,Building,b}$
Data unit:	hours
Description:	Operating hours of the HVAC system of "Commerzone Building No 6" in the baseline scenario
Source of data used:	Expected occupancy pattern report for "Commerzone Building No 6"
Value applied:	16
Justification of the choice of data or description of measurement methods and procedures actually applied :	"Commerzone Building No 6" is a commercial office space. It is meant for commercial office spaces which entail average occupancy time of 16 hours/day per head in the offices.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{Grid}
Data unit:	t CO_2/MWh
Description:	Western Grid Emission Factor
Source of data used:	CEA Emission Factor
Value applied:	0.7937
Justification of the choice of data or description of measurement methods and procedures actually applied :	Western Grid Emission factor 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 3.0.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{DG}

Data unit:	tCO2/MWh
Description:	CO_2 emission factor for the DG set of CPP
Source of data used:	Table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	For the project activity under consideration, EF_{DG} is taken to be equal to the 0.8 kg CO_2 e/kWh, a value provided in table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33). In considering the value, it has been assumed that the DG sets of CPP is a mini grid with temporary service (2 hours a day), operating at 50% load factor.
Any comment:	EF_{DG} has been considered as the ex-ante emission factor and will be kept constant for the entire crediting period

Commerzone Building No 7

Data / Parameter:	$\mathbf{E_{Chiller,b}}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the chiller plant (water cooled chiller of COP 3 without CO_2 sensors in the AHUs) of "Commerzone Building No 7" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	1447.13
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the chiller plant of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 7". The specifications of the chiller plant for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$\mathbf{E_{Pumps,b}}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the chilled water pumping system (without VFDs in the pumps of the primary chilled water loop) of "Commerzone Building No 7" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	51.38
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the chiller plant of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 7". The details of the measures in the chilled water pumping system for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$\mathbf{E_{AHUs,b}}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the AHUs (without VFDs on the

	fans) of "Commerzone Building No 7" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	277.855
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the AHUs of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 7". The details of the measures in the AHUs for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$E_{Lighting,b}$
Data unit:	MWh
Description:	Electricity that would have been consumed by the Lighting system (without CFLs and occupancy sensors) of "Commerzone Building No 7" in the baseline scenario
Source of data used:	Energy simulation based on the design parameters for the baseline building
Value applied:	1620.925
Justification of the choice of data or description of measurement methods and procedures actually applied :	An energy simulation has been done for the Lighting System of the baseline building which is a conventional building with the same occupancy-type in the same region as "Commerzone Building No 7". The details of the measures in the Lighting sytem for the baseline building have been provided in Table A.1 in Section A.1
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	$T_{op,Building,b}$
Data unit:	hours
Description:	Operating hours of the HVAC system of "Commerzone Building No 7" in the baseline scenario
Source of data used:	Expected occupancy pattern report for "Commerzone Building No 7
Value applied:	16
Justification of the choice of data or description of measurement methods and procedures actually applied :	"Commerzone Building No 7" is a commercial office space. It is meant for commercial office spaces which entail average occupancy time of 16 hours/day per head in the offices.
Any comment:	Data will be kept for crediting period + 2 years.

Data / Parameter:	EF_{Grid}
Data unit:	t CO_2/MWh
Description:	Western Grid Emission Factor
Source of data used:	CEA Emission Factor
Value applied:	0.7937
Justification of the choice of data or description of measurement methods	Western Grid Emission factor 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 3.0.

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

Data / Parameter:	**EF_{DG}**
Data unit:	tCO2/MWh
Description:	CO_2 emission factor for the DG set of CPP
Source of data used:	Table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33)
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	For the project activity under consideration, EF_{DG} is taken to be equal to the 0.8 kg CO_2 e/kWh, a value provided in table I.D.1 in AMS. I.D in Appendix B of the Simplified M&P for small scale CDM project activities (Version 12, Sectoral Scope: 1, EB 33). In considering the value, it has been assumed that the DG sets of CPP is a mini grid with temporary service (2 hours a day), operating at 50% load factor.
Any comment:	EF_{DG} has been considered as the ex-ante emission factor and will be kept constant for the entire crediting period

B.6.3 Ex-ante calculation of emission reductions:

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The following table elucidates how the project activity reduces the emissions corresponding to the reduced electricity consumption with respect to the baseline scenario:

Commerzone Building No 4

Alternative	**Electrical End-use Totals (MWh/annum)**				
	Chiller $E_{Chiller}$	**AHUs E_{AHUs}**	**Pumps E_{Pumps}**	**Lighting $E_{Lighting}$**	**Total electricity consumption $E_{Building}$**
Baseline Building	3627.17	1572.18	105.06	3437.10	8741.526
Commerzone Building No 4 building as designed	1373.02	288.875	48.853	1621.95	3332.706

Commerzone Building No 6

Alternative	**Electrical End-use Totals (MWh/annum)**				
	Chiller $E_{Chiller}$	**AHUs E_{AHUs}**	**Pumps E_{Pumps}**	**Lighting $E_{Lighting}$**	**Total electricity consumption $E_{Building}$**
Baseline Building	3647.97	1356.80	195.06	3437.10	8546.95
Commerzone	1412.81	273.52	50.049	1620.89	3357.27

Building No 6 building as designed					

Commerzone Building No 7

Alternative	Electrical End-use Totals (MWh/annum)				
	Chiller $E_{Chiller}$	**AHUs E_{AHUs}**	**Pumps E_{Pumps}**	**Lighting $E_{Lighting}$**	**Total electricity consumption $E_{Building}$**
Baseline Building	4025.39	1480.855	164.45	3437.10	9107.81
Commerzone Building No 7 building as designed	1447.13	277.855	51.38	1620.92	3397.305

Considering the operating hours of the Commerzone Building No 4, 6 and 7 both in Baseline Scenario and Project Scenario same and operating hours of DG power generation as zero hours per year we can calculate the following:

Commerzone Building No 4

Emission Factor for electricity drawn from Western Regional Electricity Grid	**0.7937**
Baseline Emissions (tCO_2/annum)	**6938.149**
Project Emissions (tCO_2/annum)	**2645.169**
Emission Reductions due to energy efficiency measures taken in the building "Commerzone Building No 4 " (in t CO_2/annum)	**4292**

Commerzone Building No 6

Emission Factor for electricity drawn from Western Regional Electricity Grid	**0.7937**
Baseline Emissions (tCO_2/annum)	**6783.715**
Project Emissions (tCO_2/annum)	**2664.667**
Emission Reductions due to energy efficiency measures taken in the building "Commerzone Building No 6" (in t CO_2/annum)	**4119.0**

Commerzone Building No 7

Emission Factor for electricity drawn from Western Regional Electricity Grid	**0.7937**
Baseline Emissions (tCO_2/annum)	**7228.869**
Project Emissions (tCO_2/annum)	**2696.441**
Emission Reductions due to energy efficiency measures taken in the building "Commerzone Building No 7" (in t CO_2/annum)	**4532.4**

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

>> The following Tables represent the overall emission reduction of the four Commerzone Buildings

Commerzone Building No 4

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2008	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2009	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2010	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2011	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2012	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2013	**2645. 16**	**6938.14**	**0.0**	**4292.9**
207	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2015	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2016	**2645. 16**	**6938.14**	**0.0**	**4292.9**
2017	**2645. 16**	**6938.14**	**0.0**	**4292.9**
Total Emission	**26451.6**	**69381.4**	**0.0**	**42929.0**
Crediting years	**10**	**10**	**10**	**10**
Average Emission Reductions over the Crediting Years (10 Years)	**2645. 16**	**6938.14**	**0.0**	**4292.9**

Commerzone Building No 6

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2008	**2664.66**	**6783.71**	**0.0**	**4119.0**
2009	**2664.66**	**6783.71**	**0.0**	**4119.0**
2010	**2664.66**	**6783.71**	**0.0**	**4119.0**
2011	**2664.66**	**6783.71**	**0.0**	**4119.0**
2012	**2664.66**	**6783.71**	**0.0**	**4119.0**
2013	**2664.66**	**6783.71**	**0.0**	**4119.0**
207	**2664.66**	**6783.71**	**0.0**	**4119.0**
2015	**2664.66**	**6783.71**	**0.0**	**4119.0**
2016	**2664.66**	**6783.71**	**0.0**	**4119.0**
2017	**2664.66**	**6783.71**	**0.0**	**4119.0**
Total Emission	**26646.6**	**67837.1**	**0.0**	**41190.0**
Crediting years	**10**	**10**	**10**	**10**
Average Emission Reductions over the Crediting Years (10 Years)	**2664.66**	**6783.71**	**0.0**	**4119.0**

Commerzone Building No 7

Year	Estimation of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2008	**2696.44**	**7228.86**	**0.0**	**4532.42**
2009	**2696.44**	**7228.86**	**0.0**	**4532.42**
2010	**2696.44**	**7228.86**	**0.0**	**4532.42**
2011	**2696.44**	**7228.86**	**0.0**	**4532.42**

2012	**2696.44**	**7228.86**	**0.0**	**4532.42**
2013	**2696.44**	**7228.86**	**0.0**	**4532.42**
207	**2696.44**	**7228.86**	**0.0**	**4532.42**
2015	**2696.44**	**7228.86**	**0.0**	**4532.42**
2016	**2696.44**	**7228.86**	**0.0**	**4532.42**
2017	**2696.44**	**7228.86**	**0.0**	**4532.42**
Total Emission	**26964.4**	**72288.6**	**0.0**	**45324.2**
Crediting years	**10**	**10**	**10**	**10**
Average Emission Reductions over the Crediting Years (10 Years)	**2696.44**	**7228.6**	**04532.0**	**4532.42**

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

>>

Title: Monitoring Methodology for – ***Energy efficiency and fuel switching measures for buildings***

Reference: Paragraph 7 of Category II.E as provided in Appendix B of the Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories.

As per the provisions of Simplified Modalities and Procedures for Small Scale CDM Project Activities [FCCC/CP/2002/7/Add.3, English, Page 21] the "Project participants may use the **simplified baseline and monitoring methodologies specified in appendix B** for their project category" if they meet the applicability criteria of Small scale CDM project activity. Since the project activity is a small-scale project of a new energy efficient facility classifiable under II.E category the monitoring methodology and plan has been developed in line with the guidance provided in Paragraph 9 of Category II.E, Appendix B.

Description of Monitoring Methodology:

According to Appendix B of the simplified M&P for small-scale CDM project activities of the UNFCCC CDM website, the project has been identified to belong to Category II.E [***Energy efficiency and fuel switching measures for buildings***]. Paragraph 6 under Category II.E of the same document specifies that for the said category of CDM projects, **'In the case of a new facility, monitoring shall consist of:**

(a) Metering the energy use of the building(s);

(b) Calculating the energy savings of the new building(s).'

Commerzone Building No 4

B.7.1 Data and parameters monitored:

Data / Parameter:	$E_{Chiller,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the chiller plant of "Commerzone Building No 4" in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	For the purpose of arriving at an estimate of the emission reductions, the impacts of the AAC blocks, Glazing on the heat load and on the electricity consumption have been considered in the chiller plant electricity consumption as per the energy simulation done for the HVAC system of "Commerzone Building No 4". The value applied is 1373.02 MWh.
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for each of the two operating chillers of "Commerzone Building No 4". The electricity consumption by a chiller, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by a chiller, for all operating hours of the chiller in a year, will yield its annual value of electricity consumption for the year. Sum of the electricity consumption in each chiller, will provide the measure of total electricity consumption in chiller plant of "Commerzone Building No 4" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Lighting,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the Lighting system of "Commerzone Building No 4" in the year y in the project activity scenario
Source of data to be	BMS maintained log-sheets

used:	
Value of data	1621.95
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meter installed for the Lighting feeder. The electricity consumption by the lighting system will be recorded on an hourly basis in the BMS.
QA/QC procedures to be applied:	Meter will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Pumps,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the chilled water pumping system (with VFDs in the pumps of the primary and secondary chilled water loops) of "Commerzone Building No 4" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	48.85
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for each of the chilled water circulating pumps in the HVAC system. The electricity consumption by a pump, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by the pump, for all operating hours of the chiller plant in a year, will yield the yearly value of electricity consumption of that pump for the year. Sum of the electricity consumption of each pump, will provide the measure of total electricity consumption in the chilled water pumping system of the HVAC system of "Commerzone Building No 4" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{AHU,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the AHUs (with VFDs on fans and HRWs) of "Commerzone Building No 4" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	For the purpose of arriving at an estimate of the emission reductions, the electricity consumption of the all the fans in the AHUs have been considered and the value used is 288.875 MWh.
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for all the AHU rooms of "Commerzone Building No 4". The electricity consumption by an AHU, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by an AHU, for all operating hours of the AHU in a year, will yield the yearly value of electricity consumption of that AHU for the year. Sum of the electricity consumption in each AHU room, will provide the measure of total electricity consumption in AHUs of the HVAC system of "Commerzone Building No 4" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$\mathbf{T_{op,HVAC,y}}$
Data unit:	Hours
Description:	Operating hours of the HVAC system of "Commerzone Building No 4" in the year y in the project activity scenario
Source of data to be used:	BMS generated report for "Commerzone Building No 4
Value of data	16
Description of measurement methods and procedures to be applied:	The hours of operation of the HVAC system of "Commerzone Building No 4" will be monitored continuously by the BMS. The total operating hours at the end of the year will yield $T_{op,HVAC,y}$
QA/QC procedures to	-

be applied:	
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{DG, y}$
Data unit:	MWh
Description:	Amount of electricity generated by Diesel Generator (DG) set that is consumed in "Commerzone Building No 4" in year y
Source of data to be used:	Log-sheets maintained by Project Proponent
Value of data	Not considered in emission reduction estimation since DG set will be operated only in case of exigencies
Description of measurement methods and procedures to be applied:	Continuous measurement through energy meter installed at the DG end
QA/QC procedures to be applied:	The Maintenance Engineer will review the data on a monthly basis
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Grid, y}$
Data unit:	MWh
Description:	Amount of electricity drawn from the Western Regional Electricity grid by "Commerzone Building No 4" in year y
Source of data to be used:	Summation of individual power consumption of building components reflected in BMS reports.
Value of data	3332.70
Description of measurement methods and procedures to be applied:	Continuous measurement through net metering at main feeder connected to BMS.
QA/QC procedures to be applied:	The Maintenance Engineer will review the data on a monthly basis
Any comment:	Data archived: Crediting period + 2 yrs

Commerzone Building No 6

Data / Parameter:	$E_{Chiller,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the chiller plant of "Commerzone Building No 6" in the project activity scenario
Source of data to be used:	BMS maintained log-sheets

Value of data	For the purpose of arriving at an estimate of the emission reductions, the impacts of the AAC blocks, Glazing on the heat load and on the electricity consumption have been considered in the chiller plant electricity consumption as per the energy simulation done for the HVAC system of "Commerzone Building No 6". The value applied is 1412.81MWh.
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for each of the two operating chillers of "Commerzone Building No 6". The electricity consumption by a chiller, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by a chiller, for all operating hours of the chiller in a year, will yield its annual value of electricity consumption for the year. Sum of the electricity consumption in each chiller, will provide the measure of total electricity consumption in chiller plant of "Commerzone Building No 6" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Lighting,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the Lighting system of "Commerzone Building No 6" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	1620.89
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meter installed for the Lighting feeder. The electricity consumption by the lighting system will be recorded on an hourly basis in the BMS.
QA/QC procedures to be applied:	Meter will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Pumps,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the chilled water pumping system (with VFDs in the pumps of the primary and secondary chilled water loops) of "Commerzone Building No 6" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	50.04
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for each of the chilled water circulating pumps in the HVAC system. The electricity consumption by a pump, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by the pump, for all operating hours of the chiller plant in a year, will yield the yearly value of electricity consumption of that pump for the year. Sum of the electricity consumption of each pump, will provide the measure of total electricity consumption in the chilled water pumping system of the HVAC system of "Commerzone Building No 6" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{AHU,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the AHUs (with VFDs on fans and HRWs) of "Commerzone Building No 6" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	For the purpose of arriving at an estimate of the emission reductions, the electricity consumption of the all the fans in the AHUs have been considered and the value used is 273.52 MWh.
Description of	Continuous measurement of electrical energy consumption will be done by energy

measurement methods and procedures to be applied:	meters installed for all the AHU rooms of "Commerzone Building No 6". The electricity consumption by an AHU, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by an AHU, for all operating hours of the AHU in a year, will yield the yearly value of electricity consumption of that AHU for the year. Sum of the electricity consumption in each AHU room, will provide the measure of total electricity consumption in AHUs of the HVAC system of "Commerzone Building No 6" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$T_{op,HVAC,y}$
Data unit:	Hours
Description:	Operating hours of the HVAC system of "Commerzone Building No 6" in the year y in the project activity scenario
Source of data to be used:	BMS generated report for "Commerzone Building No 6"
Value of data	16
Description of measurement methods and procedures to be applied:	The hours of operation of the HVAC system of "Commerzone Building No 6" will be monitored continuously by the BMS. The total operating hours at the end of the year will yield $T_{op,HVAC,y}$
QA/QC procedures to be applied:	-
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{DG, y}$
Data unit:	MWh
Description:	Amount of electricity generated by Diesel Generator (DG) set that is consumed in "Commerzone Building No 6" in year y
Source of data to be used:	Log-sheets maintained by Project Proponent
Value of data	Not considered in emission reduction estimation since DG set will be operated only in case of exigencies
Description of measurement methods	Continuous measurement through energy meter installed at the DG end

and procedures to be applied:	
QA/QC procedures to be applied:	The Maintenance Engineer will review the data on a monthly basis
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Grid, y}$
Data unit:	MWh
Description:	Amount of electricity drawn from the Western Regional Electricity grid by "Commerzone Building No 6" in year y
Source of data to be used:	Summation of individual power consumption of building components reflected in BMS reports.
Value of data	3357.27
Description of measurement methods and procedures to be applied:	Continuous measurement through net metering at main feeder connected to BMS.
QA/QC procedures to be applied:	The Maintenance Engineer will review the data on a monthly basis
Any comment:	Data archived: Crediting period + 2 yrs

Commerzone Building No 7

Data / Parameter:	$E_{Chiller,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the chiller plant of " Commerzone Building No 7" in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	For the purpose of arriving at an estimate of the emission reductions, the impacts of the AAC blocks, Glazing on the heat load and on the electricity consumption have been considered in the chiller plant electricity consumption as per the energy simulation done for the HVAC system of "Commerzone Building No 7". The value applied is 1447.13 MWh.
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for each of the two operating chillers of "Commerzone Building No 7". The electricity consumption by a chiller, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by a chiller, for all operating hours of the chiller in a year, will yield its annual value of electricity consumption for the year. Sum of the electricity consumption in each chiller, will

	provide the measure of total electricity consumption in chiller plant of "Commerzone Building No 7" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Lighting,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the Lighting system of "Commerzone Building No 7" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	1620.92
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meter installed for the Lighting feeder. The electricity consumption by the lighting system will be recorded on an hourly basis in the BMS.
QA/QC procedures to be applied:	Meter will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Pumps,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the chilled water pumping system (with VFDs in the pumps of the primary and secondary chilled water loops) of "Commerzone Building No 7" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	51.38
Description of measurement methods and procedures to be	Continuous measurement of electrical energy consumption will be done by energy meters installed for each of the chilled water circulating pumps in the HVAC system. The electricity consumption by a pump, will be recorded on an hourly

applied:	basis in the BMS. Sum of the hourly electricity consumption by the pump, for all operating hours of the chiller plant in a year, will yield the yearly value of electricity consumption of that pump for the year. Sum of the electricity consumption of each pump, will provide the measure of total electricity consumption in the chilled water pumping system of the HVAC system of "Commerzone Building No 7" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{AHU,y}$
Data unit:	MWh
Description:	Electricity that will be consumed by the AHUs (with VFDs on fans and HRWs) of "Commerzone Building No 7" in the year y in the project activity scenario
Source of data to be used:	BMS maintained log-sheets
Value of data	For the purpose of arriving at an estimate of the emission reductions, the electricity consumption of the all the fans in the AHUs have been considered and the value used is 277.855 MWh.
Description of measurement methods and procedures to be applied:	Continuous measurement of electrical energy consumption will be done by energy meters installed for all the AHU rooms of "Commerzone Building No 7". The electricity consumption by an AHU, will be recorded on an hourly basis in the BMS. Sum of the hourly electricity consumption by an AHU, for all operating hours of the AHU in a year, will yield the yearly value of electricity consumption of that AHU for the year. Sum of the electricity consumption in each AHU room, will provide the measure of total electricity consumption in AHUs of the HVAC system of "Commerzone Building No 7" in the particular year.
QA/QC procedures to be applied:	Meters will be calibrated annually. The Maintenance Engineer will review the data on a monthly basis.
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$T_{op,HVAC,y}$
Data unit:	Hours
Description:	Operating hours of the HVAC system of "Commerzone Building No 7" in the year y in the project activity scenario
Source of data to be used:	BMS generated report for "Commerzone Building No 7"
Value of data	16
Description of measurement methods and procedures to be applied:	The hours of operation of the HVAC system of "Commerzone Building No 7" will be monitored continuously by the BMS. The total operating hours at the end of the year will yield $T_{op,HVAC,y}$
QA/QC procedures to be applied:	-
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{DG, y}$
Data unit:	MWh
Description:	Amount of electricity generated by Diesel Generator (DG) set that is consumed in "Commerzone Building No 7" in year y
Source of data to be used:	Log-sheets maintained by Project Proponent
Value of data	Not considered in emission reduction estimation since DG set will be operated only in case of exigencies
Description of measurement methods and procedures to be applied:	Continuous measurement through energy meter installed at the DG end
QA/QC procedures to be applied:	The Maintenance Engineer will review the data on a monthly basis
Any comment:	Data archived: Crediting period + 2 yrs

Data / Parameter:	$E_{Grid, y}$
Data unit:	MWh
Description:	Amount of electricity drawn from the Western Regional Electricity grid by "Commerzone Building No 7 " in year y
Source of data to be used:	Summation of individual power consumption of building components reflected in BMS reports.
Value of data	3397.30
Description of measurement methods	Continuous measurement through net metering at main feeder connected to BMS.

and procedures to be applied:	
QA/QC procedures to be applied:	The Maintenance Engineer will review the data on a monthly basis
Any comment:	Data archived: Crediting period + 2 yrs

B.7.2 Description of the monitoring plan:

>>

The project proponent has designed a measurement and verification plan in order to ensure the proper, regular measurement and recording of the data pertaining to the energy conservation measures taken in "Commerzone Building No 4, 6 and 7". There is a Head – Facility Management, assisted by a Maintenance Engineer who will conduct monthly review of all the relevant data for the energy efficiency measures. They will also be responsible for proper archiving of data required for estimating emission reductions. There will be annual calibration of all the meters.

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

>>

Name of the responsible person(s)/entity(ies): Experts and consultants of Commerzone Industrial Park.

Date of completion of the application of the baseline and monitoring methodology: 27/08/2008

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:

>>
08/02/2008

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

>>
20 Years

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

C.2.1. Renewable crediting period

NA

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

>>

C.2.1.2. Length of the first crediting period:

>>

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/01/2009 or the date of registration with UNFCCC, whichever occurs later.

C.2.2.2. Length:

>>
10 Years 0 Months

SECTION D. Environmental impacts

>>

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

>>

"Commerzone Building No 4, 6 and 7" is a place where the people have the opportunity to occupy spaces that have the maximum impact on their well-being and a minimal impact on the environment.

The consultants and contract managers for the HVAC system have certified that there are no CFC-based refrigerants in the HVAC and refrigeration systems used in Commerzone Industrial Park. Apart from that, in view of the health hazards posed by tobacco smoke entering office work space, the entire Commerzone Building No 4, 6 and 7 is strictly a no-smoking zone. Air quality in each space is closely monitored through CO_2 sensors installed in return air path from various zones served by the air handling units. A log of indoor and outdoor CO_2 levels is maintained through an advanced IBMS.

Care has been taken to ensure that all fresh air intakes are located at least 25 feet away from possible sources of contamination like building exhaust fans, cooling towers, standing water, parking, sanitary vents and outside smoking vents.

High efficiency pre-filters are provided in supply air stream of all air handling units to remove any contaminants from outside air. In addition to that, continuous building flush out is conducted over a fourteen calendar day period to reduce possible indoor air quality contamination after completion of construction and prior to occupancy. This involves running the mechanical system with 100% outside air for the stipulated period of time.

The purpose of this flushing out is to get rid of particulate matter and VOCs produced by particle emitting construction materials, furnishings, interior finishes and cleaning agents. Care is taken with regard to humidity levels and microbial growth depending on the seasonal weather conditions. All ventilation air filters are changed as a final step of building flush out.

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:

>> Not Applicable.

SECTION E. Stakeholders' comments

>>

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

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Some of the major stakeholders identified for the project activity are employees of Pune Municipality, Building Occupants, the different technology suppliers for the building, the technical consultants, the employees of project proponent and also the contract workers.

Some of the above stakeholders were involved in the project at various stages of obtaining the statutory clearances for the building. The project proponent has not only communicated with the relevant stakeholders under statutory obligations but also has engaged the other stakeholders in a proactive manner in expressing and accounting their opinions on the project.

As a corporate policy of the company, the project proponent is engaged in an on-going initiative to educate all of their own employees and contractual workers. A series of programs were administered at site.

E.2. Summary of the comments received:

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Comments received so far appreciate the energy efficiency measures taken in the HVAC and Lighting system of "Commerzone Building No 4, 6 and 7".

Contractors

The contractors have commended the "Commerzone Building No 4, 6 and 7" project to be an exemplary energy efficient building. They have also commended the efforts of Project proponent towards registration of the project as a CDM project due to its potential of reducing electricity generation related GHG emissions.

Tenants

The tenants of the building commented that through the design and installations of the different energy efficiency measures, project proponent has not only focussed on the comfort of the occupants but as a responsible corporate house, it has also prioritized the sustainable development of the country through optimum utilization of electricity.

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

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Views of some of the relevant stakeholders on the energy efficiency in the HVAC & Lighting system of the building have been collated through notification on the project activity and the invitation of comments. The relevant comments and important clauses mentioned in the project documents / clearances like Detailed

Project Report (DPR), EIA Report, local clearances, and newsletter were considered while preparing the Project Design Document.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	K Raheja Corp
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E-Mail:	skanchwala@kraheja.com
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Represented by:	
Title:	
Salutation:	Mr
Last Name:	Kanchwala
Middle Name:	
First Name:	Shabbir
Department:	Corporate Office
Mobile:	
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Direct tel:	+91-22 -2256 4931
Personal E-Mail:	skanchwala@kraheja.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding from Annex I party.

Annex 3

BASELINE INFORMATION

As per Section B.

Annex 4

MONITORING INFORMATION

The project activity has employed the state-of-the-art monitoring and control equipment that will measure, record, report and monitor various key parameters like electricity consumption in the different areas of the HVAC & Lighting system of "Commerzone Building No 4 , 6 and 7".

The instrumentation system comprises of microprocessor-based instruments of reputed make with the best accuracy available. All instruments will be calibrated and marked at regular intervals so that the accuracy of measurement can be ensured all the time. The calibration frequency too is a part of the monitoring and verification parameters.

Project Parameters affecting Emission Reduction Claims:

Monitoring:

GHG performance parameter and the emission reductions achieved through the project activity will be determined based on the following parameters:

- Electrical energy reduction from the energy efficiency measures taken in the building
- Emission factor for electricity generation in the Western Regional grid (calculated ex-ante for the project activity under consideration and the particular constant value is used for estimation of the emission reductions for the entire crediting period)

Please refer to Section B.7.1 for the details of the parameters that need to be monitored for calculation of the emission reductions arising out of the project activity.

CDM stands on the quantification of emission reduction and keeping the track of the emissions reduced. The project activity would reduce the carbon dioxide whereas an appropriate monitoring system would ensure this reduction is quantified and helps maintaining the required level.

Also a monitoring system brings about the flaws in the system if any are identified and opens up the opportunities for improvement.

The general monitoring principles are based on:

- Frequency
- Reliability
- Registration and Reporting

Frequency of Monitoring

Since the emission reduction units from the project activity would be determined by the reduction in electrical energy consumption in the HVAC & Lighting system, it becomes important for the project activity to monitor the reduced electricity consumption on real time basis. An on-line metering system will be in place to monitor and record the net electricity consumption in the HVAC system.

Reliability

As the reliability of the monitoring system is governed by the accuracy of the measurement system and the quality of the equipment to produce the result:

- All measuring instruments will be calibrated by third party/ government agency once in a year for ensuring reliability of the system.
- The Standard Testing Laboratory (under Central/State Government) will verify the reliability of the meter readings; thereby ensuring the monitored results is highly reliable.

Registration and Reporting:

Registration of data would be on-line in the BMS as well as in log-books. Monthly reports would be prepared stating the electricity consumption and the operating hours of the HVAC & Lighting system of "Commerzone Building No 4, 6 and 7"

The project proponent will also maintain a GHG performance procedure on a regular basis. All the monitored parameters will be recorded for crediting period plus two years.

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