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

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Annexes

Appendices

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 Efficient Design Project – OLYMPIA

Version: 01

Date: 17/09/2007

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

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The project activity involves the design stage incorporation of energy efficient features in a commercial building to reduce its energy consumption. The features include the adoption of high efficiency equipment, high efficiency materials and advanced control systems to bring about an overall reduction in the total energy consumption of the building and an equivalent reduction in import of emission intensive grid electricity.

India has seen an increase in the number of Information Technology (IT) parks[1] in the past few years due to the growth of IT sector in the Indian economy. Given the scale of operations within the building, IT parks are normally sizeable establishments in area and infrastructure requirements. With more and more companies setting up base in Chennai and with the increasing requirement for seating capacity, there has been a steep growth in the need for IT Parks. Building wide space conditioning is an integral part of all such commercial establishments and with round the clock working hours; these are highly energy intensive.

To cater the increasing demand for commercial space in the city, Khivraj Group planned to setup a large commercial building and promoted it under the special purpose vehicle - KTPL.

During the conceptualization of the project, KTPL explored various energy efficiency (EE) measures in the building that would reduce the overall energy consumption and facilitate the environmentally friendly operation of the building. During assessments it was found that the energy efficiency measures had economical and other practical limitations. Eventually, it was decided that the energy efficiency measures would be undertaken under the scheme of Clean Development Mechanism (CDM) of Kyoto Protocol. The energy efficiency measures that form a part of the project activity are:

[1] IT parks are commercial establishments that house one or more IT and related organizations and are furnished with all the infrastructure requirements of an IT organization

- Energy efficient design of the wall construction – Materials with better insulation properties
- Energy efficient design of the roof construction – Over deck insulation and roof garden
- Energy Efficient glass wall area - High performance glazing. Double glazed glass with low U-value, optimum light transmittance and optimum shading co-efficient
- Energy Efficient design of the Heating Ventilation and Air-Conditioning (HVAC) system. This includes:
  - Efficient chillers – Higher Co-efficient of Performance chillers
  - Variable Frequency Drives (VFDs) for Air Handing Unit (AHU) fans and chilled water pumps
  - Heat recovery wheels

Project's Contribution to Sustainable Development

S.No	Project related activity	Effect	Benefits/Contribution to Sustainable Development
1	Reduced Energy Consumption. The energy efficiency measures reduce the peak power demand by around 4 MW.	Reduced import of electricity from the emission intensive grid	▪ Reduces GHG emissions and pollution related with combustion of fossil fuel in grid connected power plants. ▪ Also helps conserve natural resources. ▪ Contributes to mitigation of climate change.
		Improves electricity scenario in the region	▪ Aids in the development of other economic activity resulting in indirect employment to the local people and overall

			economic growth
2	Adoption of the Energy Efficient Design	Serve as a successful model for upcoming and existing commercial buildings	▪ Encourage similar ventures in the region
3	Construction, operation and maintenance of the project activity	Provides employment to both skilled and unskilled personnel	▪ Capacity building of the local population

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)
Government of India	**M/s Khivraj Tech Park Private Limited (KTPL)**	**No**

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

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

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A.4.1.1. Host Party(ies):

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India

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

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Tamil Nadu

A.4.1.3. City/Town/Community etc:

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Chennai

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

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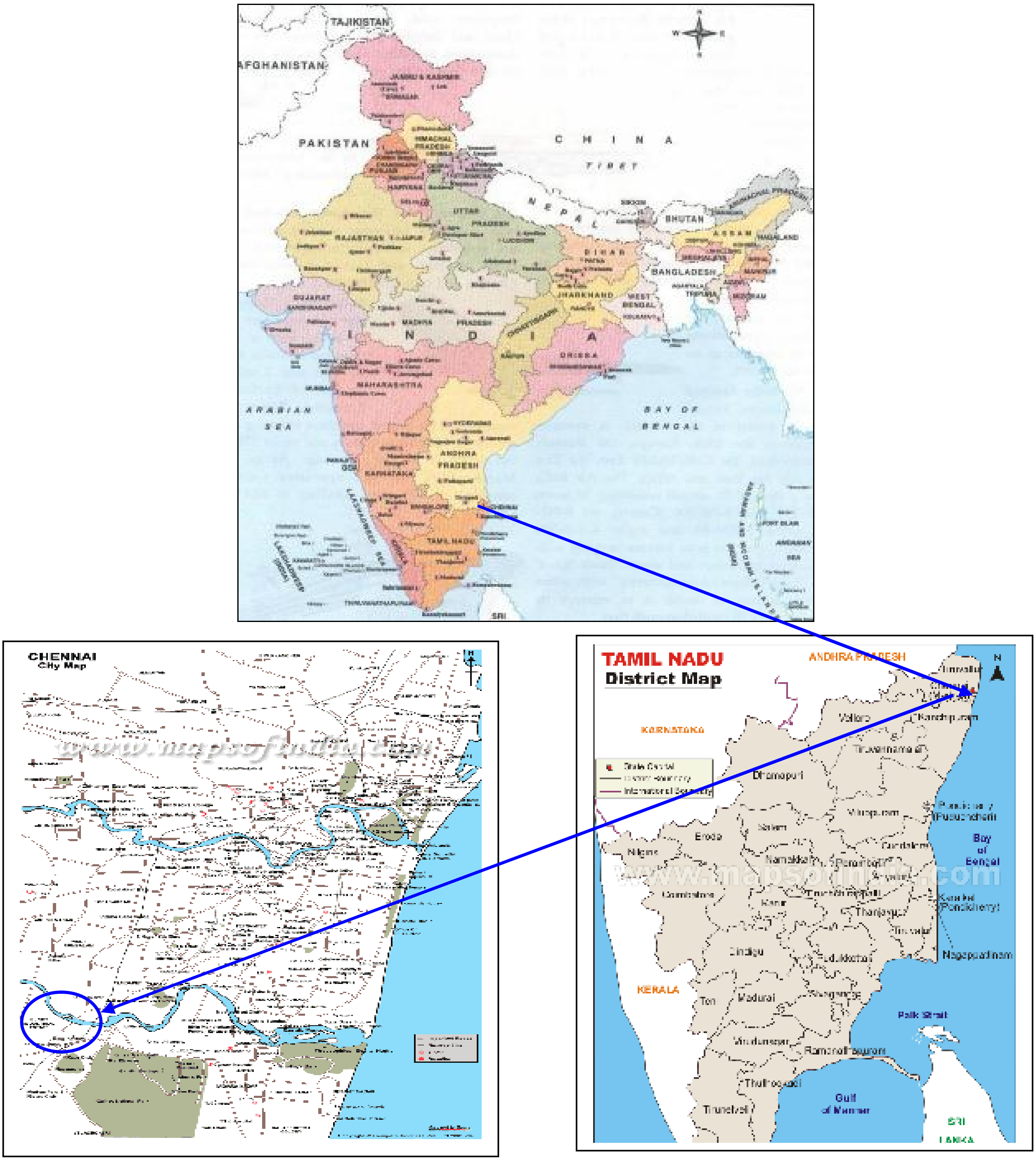
TAJIKISTAN
AFGHANISTAN
PAKISTAN
C H I N A
TIBET
NEPAL
BHUTAN
BANGLADESH
ARABIAN SEA
BAY OF BENGAL
I N D I A
TAMIL NADU
CHENNAI
City Map
TAMIL NADU
District Map
ANDHRA PRADESH
KARNATAKA
KERALA
Bay of Bengal
Palk Strait
Gulf of Mannar
SRI LANKA

The Olympia Technology Park is located at No.1, SIDCO Industrial Estate, Guindy, near the Kathipara junction, the southern gateway to Chennai. The site is a preferred location for its proximity to the Chennai Airport (3.5 kms), Metro rail links (1.2 kms from Guindy rail station) and situation near the city's major arterial roads – the Inner Ring Road and the Mount road. The project activity is located between 12° 9' and 13° 9' of the northern latitude and 80° 12' and 80° 19' of the southern longitude. Olympia's large area and innovative design has created itself as a prominent landmark in the city.

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

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Type and Category:

As defined by Appendix B to the simplified modalities and procedures for small-scale CDM project activities, the project falls under Type-II Category E, Version 09.

Technology/measure of the project activity:

Description of the technology used:

The major energy consumption in any commercial building is towards HVAC (Heating Ventilation and Air-Conditioning). The energy efficiency measures undertaken at Olympia are detailed below in Table A.1:

Table A.1: Energy efficient features incorporated in Olympia:

Feature	**Wall Construction:** Use of low U-Value[2] materials for wall construction
Effect	Better heat insulation of the walls resulting in reduced HVAC load
Description	The project activity building has used autoclaved aerated concrete (AAC) blocks with a U-value of 0.12 Btu/hr-ft^{2o}F for the wall construction against normal brick blocks which have a U-value of 0.58. The AAC blocks provide nearly five times the insulation of a normal building[3] (or baseline building). These 6250x2000x2500 mm blocks have a density of 562.2 kg/m^3 providing high thermal mass to enhance the

[2] U-Value: It is the heat transfer co-efficient of a material. Lower the U-value better is the heat insulation of the material.

[3] Normal building or baseline building refers to the features or equipments that would otherwise have been implemented in the absence of the energy efficiency project activity

	effect of night cooling. Their high fly ash content (40%) further helps the building to address environmental concerns.

Feature	**Roof Construction and Finish:** Use of R-15 over-deck insulation. Extensive garden area on the terrace.
Effect	Better heat insulation of the roof resulting in reduced HVAC load
Description	The project activity building uses over-deck R-15 extruded polystyrene insulation. In addition to the insulation, the terrace area will be covered with extensive roof gardening. This would significantly reduce the heat gain through the roof.

Feature	**High Performance Glazing:**
Effect	Better heat insulation of the window resulting in reduced HVAC load Enhances available sunlight without allowing excess heat gain Optimizes solar heat ingress into the building resulting in reduced HVAC load
Description	The overall Window-Wall-Ratio (WWR) for the building is 27% against 50% of a conventional building. Most of the glazing area is on the north façade of the building – the shading coefficient and light transmittance (23%) for this glass were developed very carefully in order to enhance available daylight in the space and maintain visual comfort for the occupants without comprising on energy-efficiency. The other performance parameters are listed in the following table:

Area	Property	Baseline Building	Project Building
North	U-value	1.22	0.27
	SC	0.51	0.15
Non-north	U-value	1.22	0.27
	SC	0.22	0.15

Feature	**Heat Recovery Wheel:** Cools incoming air stream using the outgoing air stream

Effect	Reduces cooling load on the chillers
Description	In air-conditioned spaces, it is essential to change the circulated air with fresh air over a period to prevent build up of CO_2 levels. This is called "air changes" and is indicated as "air changes per hour". In a baseline building, a preset quantity of fresh air is brought in continuously and an equivalent quantity of cool air is exhausted from the AHUs. In Olympia, heat recovery wheels are installed in each of the AHUs. The HRWs cool the warm incoming fresh air using the cooler exhaust air. This saves over 4% of the baseline case energy use. Fresh air is ducted to each of the AHU rooms, either from the roof or from the lower level. These free ducts are connected with the HRW supply fans with necessary protection. A very efficient HRW, supplied by "Bry Air", is installed in each AHU room. Further, the quantity of "air changes" is controlled by the CO_2 level in the conditioned space rather than the continuous method. The HRW fans would operate based on the CO2 levels and optimise the required quantity of air to be replaced with fresh air.

Feature	**VFDs for AHU Fans:** VFD based flow control for AHU fan motors
Effect	Conserves electricity by optimizing power input to the fans based on flow requirement
Description	In a typical baseline building, the AHU fans are driven by fixed speed electric motors. The load of the system (head or flow requirement) is not always the maximum. However, the fans and pumps operate at constant rated speeds. Therefore, throttle valves and dampers are used to increase friction and reduce the flow as per the requirement. This method of control is inefficient. In Olympia, VFD based control is incorporated in all the AHU fans. The VFD senses the feedback (temperature) from the demand side and correspondingly varies the air flow by electric power control to the motor drive thereby resulting in energy savings.

Feature	**Efficient Chillers:** Installation of high performance chillers
Effect	Consumes lesser quantity of energy than normal chillers for the same cooling load
Description	The chillers selected for this building are air-cooled and water cooled type (8 no., 370 T). The efficiency of chillers are indicated as their coefficient of performance (COP). The project activity building design provides efficient chillers with a COP of 2.9 which is higher than that of chillers in the baseline building (COP 2.6)

Feature	**VFDs in chilled water pumping system:** Variable Frequency Drive (VFD) based flow control for secondary chilled waater pump motors
Effect	Conserves electricity by optimizing power input to the pumps based on flow requirement
Description	In a typical baseline building, the pumps are driven by fixed speed electric motors. The load of the system (head or flow requirement) is not always the maximum. However, the pumps operate at constant rated speeds. Therefore, throttle valves are used to create false heads to reduce the flow as per the requirement. This method of control is inefficient. Olympia has secondary chilled water pumping with variable frequency drives (VFDs) to reduce on pump energy. The VFD senses the feedback (temperature, pressure etc) from the demand side and correspondingly varies the flow by electric power control to the motor drive and thereby resulting in energy savings.

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

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Operating Years	CO_2 Emission Reductions (tonnes of CO_2e)
January 2008 - December 2009	15,073
Jan 2009 - Dec 2010	15,073
Jan 2010 - Dec 2011	15,073
Jan 2011 - Dec 2012	15,073
Jan 2012 - Dec 2013	15,073
Jan 2013 - Dec 2014	15,073
Jan 2014 - Dec 2015	15,073
Jan 2015 - Dec 2016	15,073
Jan 2016 - Dec 2017	15,073
Jan 2017 - Dec 2018	15,073
Total estimated reductions (tonnes of CO_2e)	**150,730**
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	15,073

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

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KTPL has not used public funding from any of the Annex-I parties to the Kyoto Protocol for this project activity.

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

The occurrence of de-bundling of the project activity is determined as described in the Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM project activities. The project activity shall not be deemed to be a de-bundled component of a larger project activity since there is neither a registered small-scale CDM project activity nor an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- 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.

Therefore, the proposed project activity is not a de-bundled component of a larger project activity.

SECTION B. Application of a baseline and monitoring methodology

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

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Title: ***Energy efficiency and fuel switching measures for buildings***

Reference: Type II (*Energy Efficiency Improvement Projects*) E (*Energy efficiency and fuel switching measures for buildings*) - Appendix B of the simplified modalities and procedures for small-scale CDM project activities – Indicative Simplified Baseline and Monitoring Methodologies for selected small-scale CDM project activity categories, (Version 09)

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

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

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The project activity is classified under Type II Category E. The justifications for the applicable type and category and as a small-scale project activity are elaborated below:

The justification of the choice of methodology AMS II.E is provided below:

Applicability criteria	Applicability to project activity
Section 1 of the methodology states "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 involves energy efficiency measures implemented at a single commercial building.
"The technologies may replace existing equipment or be installed in new facilities."	The project involves energy efficiency technologies installed in a new facility.
"The aggregate energy savings of a single project activity may not exceed the equivalent of 60 GWh per year."	The aggregate energy savings from the project activity is 17.5 GWh per year.

All applicability conditions of the methodology (AMS II.E) are met by the project activity.

Eligibility as a small-scale project activity:

The table below demonstrates, following the "Simplified modalities and procedures for small-scale project activities" and its recent revisions, the eligibility of the project activity as a small-scale project activity and confirms that it will remain under the small-scale limits over the crediting period.

Criteria	Eligibility
For Type II: Demonstrate that the annual energy savings on account of efficiency improvements will not exceed 60 GWh (or an appropriate equivalent) in any year of the crediting period.	The reduction in energy consumption resulting from the project activity is estimated in section E. The total baseline energy consumption of the building is expected to be around 37.2 GWh whereas the energy saving from the project activity is around 17.5 GWh per year which is within the small-scale limit.

B.3. Description of the project boundary:

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As per paragraph 2 under the methodology AMS II.E (Energy efficiency and fuel switching measures for buildings), "the project boundary is the physical, geographical site of the building(s)". Therefore for the project activity under consideration, the project boundary will include 'Olympia Technology Park' building where the energy efficiency measures are taken and which will result in consumption of lesser amount of electricity consumption by the building. However, reduced electricity consumption by the commercial building "Olympia Technology Park" will ultimately result in drawing lesser amount electricity from Tamil Nadu State Electricity Board (TNEB) which is a part of the Southern Regional electricity grid. For computation of emission reductions resulting from the project activity, Southern 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.

Leakage:

If the energy efficiency technology is equipment transferred from another activity or if te existing equipment is transferred to another activity, leakage is to be considered. However being a Greenfield project, all new equipment will be procured and therefore no leakage emission is required to be considered.

B.4. Description of baseline and its development:

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B.4.1. Energy Baseline:

The baseline methodology AMS II.E states "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."

As per the recommendation of AMS II.E, the energy baseline is the energy use of the baseline building (i.e. the facility that would otherwise have been built). The energy consumption of the baseline building depends on the features and operational parameters that would have been implemented in the absence of the project activity (Please refer table B.1 below for details). The energy consumption in the baseline is determined/computed following international guidelines[4] for this sector. It is calculated by the energy consumption analysis of the baseline building based on its features and operational parameters.

The typical features of a baseline building and that of the project activity building are summarized below in Table B.1. The features/configurations of the baseline building and project building are used to perform an energy analysis and derive the energy consumption of each configuration. The results of the analysis are provided below in table B.2.

Table B.1: Features / Configuration of the Baseline Building and Project activity Building (Olympia)

Features	**Measure of Performance**	**OLYMPIA**	**Baseline Building**
Wall Construction			
	Material	Autoclaved Aerated Concrete (AAC) blocks	Normal construction materials
	U-Value (Btu/hr-ft^2°F)	0.12	0.58
Roof Construction and Finish		R-15 over-deck insulation. High	Normal roof finish

[4] Details would be submitted to the validating DOE

		reflective coating paint on the terrace.	
	U-Value (Btu/hr-ft^2°F)	0.067	0.12
WWR, High Performance Glazing	U-Value (North)	0.27	1.22
	SC (North)	0.15	0.51
	U-Value (Non-North)	0.27	1.22
	SC (Non-North)	0.15	0.22
Efficient Chillers	COP	2.9	2.6
Energy Recovery Wheel		Installed	Not Present
VFDs in Pumping system		Present in primary and secondary chilled water systems	Not present in both chilled water systems
VFDs for Fans		Installed	Not Present
Overhangs in south-eastern facade		Installed	Not Present
Efficient Lighting	**LPD (W/ft^2)**	0.81	1.2
Daylight Sensors		Installed in common areas	Not Present

Table B.2: Estimated energy consumption of the baseline building and the project building

End use /Application	Olympia ($EG_{Olympia}$)	Baseline Building ($EG_{Baseline}$)
	MWh	**MWh**
Space cooling	17523.55	24201.46
Pumps and miscellaneous	369.89	2198.76
Fans	1815.23	10834.95
Total	19708.68	37235.17

B.4.2. Emission Baseline:

"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."

Tamil Nadu receives power generated by State and Central power plants based on coal, lignite, hydro, gas, nuclear, wind etc. The generated power is fed to the State grid and demand is met. Moreover, significant energy exchanges exist between the southern states that are linked to the southern regional grid. Since the project activity displaces the portion of TNEB grid, it avoids the same quantity of power generation by the southern regional grid generation mix. Considering the above and the latest UNFCCC Executive Board guideline, the baseline for this project activity is the function of the generation mix of the southern regional grid. The power generated from renewable resources emits no green house gases, however, the power sources from coal, lignite, gas and diesel oil emit GHG are in turn responsible for climate change. Central Electricity Authority (CEA) keeps an account of all such generation (a single point source in the country for grid operation and management data) and has access to the data from these generating stations. CEA comes up with an annual publication (CEA Annual report, Performance Reviews of Thermal Power Plants etc) providing details from each generation units and net inter state purchases.

CEA has calculated and published the baseline emission factors of the regional grids in India. The CEA baseline emission factor for the southern regional grid has been adopted here. All the required data of regional grid has been collected for estimation of grid emission factor. The emission factor of the grid as per the methodology has been calculated using the combined margin method. The emission factors calculated using the combined margin method is 0.86 kg of CO_2 per kWh.

B.4.3. Summary:

The business as usual scenario for KTPL would be the implementation of Olympia with the features of a baseline building as described in Table B.1 and without any of the energy efficient features incorporated in the project activity. The results of the energy consumption analysis of the project activity building and the baseline building shows that the energy consumption in the baseline scenario is higher than the project activity scenario by around 17,526 MWh.

The energy requirements of Olympia, both in the baseline scenario and project scenario, would be met by import of electricity from the TNEB grid which is a part of the southern regional grid of India.

Therefore, the baseline for this project activity shall be the implementation of Olympia with a configuration that would have resulted higher energy consumption than the project activity configuration and the import of equivalent incremental electricity from the southern regional grid.

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:

During the conceptualization of Olympia, KTPL explored the incorporation of various energy efficient features in its design. However, KTPL faced the following prohibitive barriers to the implementation of EE measures at Olympia.

Investment Barrier:
KTPL conceptualized Olympia as a commercial building primarily meant for accommodating IT and related organizations. As a real estate project developer, KTPL's primary objective would be to provide all the basic infrastructures necessary for an IT organization at competitive lease/rental rates. At a time when lot of real estate developers are vying to tap the demand[5] for commercial space by setting up IT and Technology Parks, it is imperative for KTPL to offer competitive lease/rental rates to attract tenants. This can only be achieved by optimizing on the capital expenditure of the real estate project. Though, the operating expenditure (like energy cost, operation and maintenance cost) is significant, these are passed on to the tenants and therefore the lease/rental rates are calculated more on the basis of the capital expenditure. Thus, managing and reducing the capital cost is the only way to be competitive and thrive in the real estate market. In this scenario, it is economical for KTPL to have constructed Olympia as a normal building without the energy efficient features. During the conceptualization stage of Olympia, the promoter's project team explored various energy efficient features that could be incorporated in the building design. The energy efficient features involved an additional capital cost compared to standard equipment and features. KTPL was aware that this additional investment would not be recovered since the benefit of energy savings will be passed on to the tenants[6]. Though environmentally friendly operation was the main driver to KTPL in considering the EE features, the additional cost involved served as a barrier. However, consideration of CDM and prospects of carbon revenue to recover the additional cost has encouraged KTPL to implement these energy efficient features at Olympia.
All the energy efficiency features faced higher cost as the barrier and other technical barriers as described below:

[5] The Hindu dated 30.10.2004, http://www.hindu.com/pp/2004/10/30/stories/2004103000090300.htm

[6] The energy bills are passed onto the tenants without any premium for the energy efficiency. Levying any premium on the energy bills could prove detrimental to marketing the commercial space.

Energy Efficiency features and Barriers:

S.No	EE Measure	Barriers
1	**Wall Construction**	**Availability of Technical Expertise:** Skilled masons and supervisors are required to construct with AAC since it requires careful and accurate placement. In addition, AAC due to its light weight is prone to impact damage. Due to its porous nature, an appropriate moisture proof coating is required to prevent the penetration of moisture in to the AAC blocks which may affect its thermal performance. **Higher cost:** The use of better materials involved higher cost than the normal construction materials.
2	**Roof Construction and Finish**	**Higher cost:** The roof construction involves extensive terrace gardening at high capital cost. This also involves recurring expenses towards resources and manpower for its maintenance.
3	**Efficient Glazing**	**Availability of materials:** The kind of glass that has been used for glazing of "Olympia" is not yet locally manufactured by Indian glass industry. So the project proponent had to resort to import of the high performance glass. Their unavailability in the local market makes it difficult to repair/replace failed components during the building's operation over the years. A large stock of spares needs to be maintained by KTPL themselves to overcome this resulting in high inventory cost. **Higher Cost:** KTPL has invested a significant incremental amount for the high performance glazing as against the normal glazing material.
4	**Efficient Chillers**	**Higher Cost:** The chillers used are of higher COP and thus involve higher initial investment.
5	**Heat Recovery**	**Higher Cost:** KTPL has installed efficient HRWs in each of the AHUs in the building.

	Wheels	KTPL has incurred additional cost to install the HRWs in the AHUs.
6	**VFDs in chilled water pumps**	**Higher Cost:** The chilled water pumps are installed with VFDs that involve a significant additional cost. These VFDs need recurring maintenance (to be maintained in cool temperature range) expenditures. Further, extensive monitoring and control elements are required to operate these systems increasing the maintenance expenditure.
7	**VFDs in AHU fans**	**Higher Cost:** The AHU fans are installed with VFDs that involve a significant additional cost. These VFDs need recurring maintenance (to be maintained in cool temperature range) expenditures. Further, extensive monitoring and control elements are required to operate these systems increasing the maintenance expenditure.

As described above, KTPL was apprehensive of implementing the energy efficiency measures mainly due to the lack of economic incentive that was further heightened by other technical barriers. In the business as usual scenario, KTPL would have implemented Olympia with normal features in place of the energy efficiency measures. In such a scenario, Olympia would have consumed a higher quantum of energy (17.5 GWh per year) which would have been imported from the southern regional grid resulting in an equivalent quantity (15,073 tCO_2e per year) of green house gas emissions.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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B.6.1.1: Project Emissions:

The project activity emissions are the GHG emissions resulting from the energy (electricity) use of the equipment/features implemented as part of the project activity. The project activity building (Olympia) imports power from the Tamil Nadu Electricity Board (TNEB) which forms a part of the southern regional grid of India. The project activity emissions can be obtained as the product of electricity consumption of the equipments/systems affected by the project activity and emission factor of the southern regional grid. The electricity use of the project activity is monitored through energy meters and is included in section B.7.

$PE_y = EG_{project,y} \times EF$

Where,

PE_y - Project activity emissions in year y in tCO_2

$EG_{project,y}$ - Electricity consumed by the project activity in year y in MWh

EF - Emission factor of the southern regional grid in tCO_2/MWh. This is equal to the baseline emission factor.

Where,

$EG_{project,y} = EG_{chillers,y} + EG_{AHU,y} + EG_{pumps,y}$

$EG_{chillers,y}$ = Energy consumption of the chillers in the project activity building during year y

$EG_{AHU,y}$ = Energy consumption of the AHUs (AHU fans including that of the HRWs) in the project activity building during year y

$EG_{pumps,y}$ = Energy consumption of the chilled water pumps in the project activity building during year y

These parameters are directly monitored in energy meters during year y in the project activity building.

B.6.1.2: Baseline Emissions:

The baseline methodology AMS II.E states "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."

The baseline emissions are calculated as the product of energy baseline and the emission baseline as defined above.

$BE_y = EG_{baseline,y}$ x BEF

Where,

BE_y - Baseline emissions in year y in tCO_2

$EG_{baseline,y}$ - Electricity consumption of the equipments/systems of the baseline building in MWh that are affected by the project activity

BEF - Baseline emission factor: Emission factor of the southern regional grid in tCO_2/MWh.

Where,

$EG_{baseline,y} = EG_{chillers,baseline,y} + EG_{AHU,baseline,y} + EG_{pumps,baseline,y}$

$EG_{chillers,baseline,y}$ = Estimated Energy consumption of the chillers in the baseline building during year y

$EG_{AHU,baseline,y}$ = Estimated Energy consumption of the AHUs in the baseline building during year y

$EG_{pumps,baseline,y}$ = Estimated Energy consumption of the chilled water pumps in the baseline building during year y

These estimated baseline energy consumption figures are estimated as follows:

Calculation of the energy baseline ($EG_{baseline}$):

For this project activity, the energy baseline consists of the energy use of the facility that would otherwise be built in the case of a new facility. As recommended by international guidelines[7], the energy baseline (energy consumption of the baseline building) should be calculated using the energy analysis of the baseline building (Refer section B.4 for details). As per the energy analysis, the estimated energy baseline (energy consumption of the systems/equipments in the baseline building affected by the project activity) has been determined to be around 37,235 MWh per year.

$EG_{baseline,y}$: 37,235 MWh per year

Calculation of the emission baseline (BEF):

AMS II.E prescribes the calculation of the baseline emission factor in accordance with AMS I.D. Following is the calculation of the baseline emission factor as prescribed by AMS I.D:

$BEF_y = w_{OM}.EF_{OM,\ y} + w_{BM}.EF_{BM\ ,\ y}$

Where,

w_{OM}	Weight of the operating margin emission factor (0.50)
$EF_{OM,\ y}$	Operating margin emission factor
w_{BM}	Weight of the build margin emission factor (0.50)
$EF_{BM,y}$	Build margin emission factor

Approximate operating margin:

$$EF_{OM,y} = \sum_{i,j} F_{i,j,y}\ x\,COEF_{i,j} / \sum_{j} GEN_{j,y}$$

where,

$F_{i\ ,j,\ y}$	Is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*
j	Refers to the power sources delivering electricity to the grid, excluding low-operating cost and must-run power plants, and including imports from the grid
$COEF_{i,j\ y}$	Is the CO_2 emission coefficient of fuel *i* (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$	Is the electricity (MWh) delivered to the grid by source *j*

The CO_2 emission coefficient $COEF_i$ is obtained as:

$$COEF_i = NCV_{i,}\ x\ EF_{CO2} xOXIDi$$

For calculations, local values of NCV_i and $EFCO_{2i}$ have been used and a 3-year average, based on the most recent statistics available at the time of PDD submission has been used for grid power generation data.

Build Margin:

[7] Details would submitted to the DOE during validation

The build margin is calculated as the weighted average emissions of recent capacity additions to the reference grid, based on the most recent information available on plants already built for sample group *m* at the time of PDD submission.

$$EF_{BM,y} = \sum_{i,m} F_{i,m,y}\, x\, COEF_{i,m} / \sum_{j} GEN_{m,y}$$

where,

$F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ - Are analogous to the variables described for the OM method above for plants *m*.

The sample group *m* consists of,

- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group *m* of South India Regional grid mix.

For the Project Activity, the following are the derived baseline values based on the baseline data (As per Annex 3):

1. Operating Margin: 1.00 kgCO_2equ/kWh
2. Build Margin: 0.71 kgCO_2equ/kWh
3. Combined Margin Baseline Emission Factor: 0.86 kgCO_2equ/kWh

B.6.1.3:Leakage:

As per AMS II.E, leakage is to be considered only if the energy efficiency technology is equipment transferred from another activity or if the existing equipment is transferred to another activity. Since the project activity does not result in either of the above, leakage is not applicable.

B.6.1.4: Emission Reductions

The emission reductions can be calculated as the difference between the baseline emissions and project emissions as represented by the below formula:

Emission reduction due to project activity (ERy, power) in tCO_2e	=	Baseline CO_2 emissions (BEy) in tCO_2e	-	Project emissions (PEy) in tCO_2e

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

Data / Parameter:	**$EG_{chillers,baseline}$**
Data unit:	MWh
Description:	Estimated Energy consumption of chillers in the baseline building
Source of data used:	KTPL
Value applied:	24201.46
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been estimated by energy simulation of the baseline building characteristics and expected operational parameters.
Any comment:	

Data / Parameter:	**$EG_{AHU,baseline}$**
Data unit:	MWh
Description:	Estimated Energy consumption of AHU fans in the baseline building
Source of data used:	KTPL
Value applied:	10834.95
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been estimated by energy simulation of the baseline building characteristics and expected operational parameters.
Any comment:	

Data / Parameter:	**$EG_{pumpss,baseline}$**
Data unit:	MWh
Description:	Estimated Energy consumption of chilled water pumps in the baseline building
Source of data used:	KTPL
Value applied:	2198.76
Justification of the choice of data or description of measurement methods and procedures actually applied :	The data has been estimated by energy simulation of the baseline building characteristics and expected operational parameters.
Any comment:	

Data / Parameter:	**EF_{GRID}**
Data unit:	tCO_2/MWh

Description:	Emission factor for electricity imported from the southern regional electricity grid of India
Source of data used:	CEA published CDM – Carbon dioxide baseline database[8]
Value applied:	0.86
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated ex-ante from the following data on simple margin and build margin emission factors for the Southern Regional electricity grid and kept constant for the entire crediting period.
Any comment:	

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2003-04	2004-05	2005-06
South	1.00	1.00	1.01
Build Margin (tCO_2/MWh) (not adjusted for imports)			
	2004-05		
South	0.71		

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

B.6.3 Ex-ante calculation of emission reductions:

>>

Project Emissions:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Comments**
1	$EG_{chillers,y}$	Energy consumption of the chillers in the project activity building during year y	MWh	17523.55	Energy simulation of baseline building
2	$EG_{AHU,y}$	Energy consumption of the AHUs (AHU fans including that of the HRWs) in the project activity building during year y	MWh	1815.23	Energy simulation of baseline building
3	$EG_{pumps,y}$	Energy consumption of the chilled water pumps in the project activity building during year y	MWh	369.89	Energy simulation of baseline building
4	$EG_{project,y}$ (1+2+3)	Total energy consumption of equipments part of the project activity	MWh	19708.68	Refer section B.6.1.1 above
5	EF	Emission factor of project activity energy source	tCO_2/MWh	0.86	Emission factor of southern regional grid from which electricity is imported to the project. Refer Annex 3 for details.
6	PEy	Project emissions	tCO_2	16949.46	Refer section B.6.1.1 above

Baseline Emissions:					
S.No	**Notation**	**Parameter**	**Unit**	**Value**	**Comments**
1	$EG_{chillers,baseline,y}$	Estimated Energy consumption of the chillers in the baseline building during year y	MWh	24201.46	Refer section B.6.2 above
2	$EG_{AHU,baseline,y}$	Estimated Energy consumption of the AHUs (AHU fans) in the baseline building	MWh	10834.95	Refer section B.6.2 above

		during year y			
3	$EG_{pumps,baseline,y}$	Estimated Energy consumption of the chilled water pumps in the baseline building during year y	MWh	2198.76	Refer section B.6.2 above
4	$EG_{baseline,y}$ (1+2+3)	Total energy consumption of equipments part of the baseline affected by the project activity	MWh	37235.17	Refer section B.6.1.2 above
5	BEF	Emission factor of baseline energy source	tCO_2/MWh	0.86	Emission factor of southern regional grid from which electricity would be imported to the baseline building. Refer Annex 3 for details.
6	BEy	Baseline Emissions	tCO_2	32022.25	

Emission Reductions				
S.No	**Notation**	**Parameter**	**Unit**	**Value**
1	BEy	Baseline Emissions	tCO_2	32022.25
2	PEy	Project Emissions	tCO_2	16949.46
3	ERy (1-2)	Emission Reductions	tCO_2	15073

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

>>

Year	Estimation of Project activity emissions (PE_y)	Estimation of Baseline emissions (BE_y)	Estimation of Leakage (L_y)	Estimation of overall emission reductions (ER_y)
	tCO_2	tCO_2	tCO_2	tCO_2
2008-09	16,949	31,649	0	15,073
2009-10	16,949	31,649	0	15,073
2010-11	16,949	31,649	0	15,073
2011-12	16,949	31,649	0	15,073
2012-13	16,949	31,649	0	15,073
2013-14	16,949	31,649	0	15,073
2014-15	16,949	31,649	0	15,073
2015-16	16,949	31,649	0	15,073
2016-17	16,949	31,649	0	15,073
2017-18	16,949	31,649	0	15,073
Total (tCO_2e)	169,490	316,490	0	150,730

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**$EG_{chillers,y}$**
Data unit:	MWh
Description:	Energy consumption of the chillers in the project activity building
Source of data to be used:	KTPL
Value of data	17523.55
Description of measurement methods and procedures to be applied:	Energy meters will measure the energy consumption of the chiller system. Data from all the energy meters will be compiled using the Building Management System (BMS).
QA/QC procedures to be applied:	All the energy meters will be calibrated in periodic intervals as specified by the manufacturer.
Any comment:	This value will include only energy consumption of those building systems affected by the project activity

Data / Parameter:	**$EG_{AHU,y}$**
Data unit:	MWh
Description:	Energy consumption of the AHU fans (includes that of HRW) in the project activity building
Source of data to be used:	KTPL
Value of data	1815.23
Description of measurement methods and procedures to be applied:	Energy meters will measure the energy consumption of the AHU system. Data from all the energy meters will be compiled using the Building Management System (BMS).
QA/QC procedures to be applied:	All the energy meters will be calibrated in periodic intervals as specified by the manufacturer.
Any comment:	This value will include only energy consumption of those building systems affected by the project activity

Data / Parameter:	**$EG_{pumps,y}$**
Data unit:	MWh
Description:	Energy consumption of the chilled water pumps in the project activity building
Source of data to be used:	KTPL
Value of data	369.89
Description of	Energy meters will measure the energy consumption of the chilled water pumping

measurement methods and procedures to be applied:	system. Data from all the energy meters will be compiled using the Building Management System (BMS).
QA/QC procedures to be applied:	All the energy meters will be calibrated in periodic intervals as specified by the manufacturer.
Any comment:	This value will include only energy consumption of those building systems affected by the project activity.

B.7.2 Description of the monitoring plan:

>>

KTPL 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 at “Olympia”. Energy consumption of the building systems affected by the project activity is the main data to be monitored. This will be done through energy meters at various locations that monitor and input the data to the Building Management System (BMS). The BMS compiles and records data from all the energy meters that are part of the project activity.

There is a Head – Facility Management, assisted by a Maintenance Engineer who will conduct monthly review of all the relevant monitored data. They will also be responsible for proper archiving of data required for estimating emission reductions and the periodic calibration of energy meters to ensure accuracy of the monitored data.

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

>>

17/09/2007

Khivraj Tech Park Private Limited

01, SIDCO Industrial Estate, Guindy

Chennai - 600032

Tamilnadu, India

The entity is a project participant listed in Annex I to this document.

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:

>>
February 2004

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

>>
25 years 0 months

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

The project activity will use a fixed crediting period of ten years from the date of Registration with UNFCCC.

C.2.1. Renewable crediting period

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

>>
Not Applicable

C.2.1.2. Length of the first crediting period:

>>
Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/01/2008 or Upon Registration with UNFCCC whichever is 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:

>>

The Tamil Nadu State Pollution Control Board (TNPCB) required a Rapid Environmental Impact Assessment (REIA) of the project activity to be conducted as a prerequisite to receiving its approval for the project activity. KTPL has conducted a REIA and the report has been submitted to TNPCB on the basis of which the project activity has received TNPCB's approvals (under Section 21 of the Air (Prevention and Control of Pollution) Act, 1981 (Central Act 14 of 1981) as amended and under Section 25/26 of the Water (Prevention and Control of Pollution) Act, 1974 (Central Act 6 of 1974) as amended).

Further, the project activity has been designed to operate in an environment friendly way by incorporating the following features:

- Zero discharge of waste water by adopting reuse and recycling of waste water through sewage treatment plant
- No exploitation of ground water (no bore wells) to meet the water requirements
- Minimum plot coverage (The built up area has been kept minimum to provide more open spaces and green landscaping)
- The building orientation has been designed in a manner that most of the trees in the plot have been retained

Thus, there is no significant negative environmental impact due to the project activity.

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:

>>

As required by the host party (TNPCB), KTPL has conducted a Rapid Environmental Impact Assessment (REIA) of the project activity. The REIA report has been submitted to TNPCB, on the basis of which TNPCB has provided approvals to the project activity. A copy of the REIA report will be made available to the Designated Operational Entity (DOE) validating the project activity.

SECTION E. Stakeholders' comments

>>

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

>>

The project promoters had identified and invited all the stakeholders involved in the project activity. They were informed of the date, time and venue of the meeting well in advance. The meeting was conducted at the boardroom of the Olympia Technology Park on 25.11.2006 between 11.00 hrs and 12.00 hrs. Following stakeholders attended the meeting:

- Local residents
- Tenants in the building
- Representatives from local Non Governmental Organisation (NGO)
- Representatives from State Electricity Board (Tamil Nadu Electricity Board – TNEB)
- Operation and Maintenance staff
- Equipment suppliers

Stakeholders were welcomed to the Olympia's administrative office where the boardroom is located. They introduced themselves and also gave a brief description on their association to the project promoters.

The President of Olympia Technology Park gave a presentation on the purpose of the meeting including an intermittent description during the course of the meeting on a number of measures undertaken with relevance to the CDM cycle:

- Background on global warming, UNFCCC and approach on mitigating global warming through CDM.
- State of the art technology installed to substantially decrease power consumption in comparison to other normal buildings.
- Water management system with pertaining to collection and reuse of the condensed water from HVAC chillers.
- Wastewater treatment with particular reference to reduced and reuse of water from toilets in the building and its impact on the groundwater extraction.
- State of the art technology installed to substantially decrease power consumption in comparison to other normal buildings.

- Environmental benefits of the project activity including GHG emission reductions compared to a normal building

The President explained the above topics of discussion and their detailed descriptions in both English and the local Tamil language to enable members of the gathering to have a clear understanding on the project activity. The meeting came to a formal close after collecting written comments and opinions from the stakeholders.

E.2. Summary of the comments received:

>>

Query 1: "*Can you brief us on the source of GHGs from Olympia and how it is reduced by the project activity?"*

Stakeholder: Program Manager – REWS, HPS Global Delivery (Tenant)

KTPL Response: *"The source of GHGs reduced by the project activity is the TNEB grid from which Olympia imports electricity. CO_2 is liberated during power generation in the fossil fuel intensive TNEB and southern regional grid. By implementing energy efficiency measures and reducing the electricity import from the grid, an equivalent CO_2 emission is reduced by the project activity"*

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

>>

All the stakeholders were happy in knowing that a CDM project activity in their locality is contributing to a global cause and they commended the KTPL management for their initiatives in the areas of climate change and sustainable development. The stakeholders appreciated the project promoter for the environment friendly measures. No negative comments were received from the stakeholders.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Khivraj Tech Park Private Limited
Street/P.O.Box:	No.1, Industrial Estate
Building:	OLYMPIA Technology Park
City:	Chennai
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E-Mail:	marketing@olympiatechpark.com, info@olympiatechpark.com
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Represented by:	
Title:	Managing Director
Salutation:	Mr.
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Middle Name:	Kumar
First Name:	Ajit
Department:	
Mobile:	+91 98410 73656
Direct FAX:	
Direct tel:	
Personal E-Mail:	ajitchordia@khivrajtechpark.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The project promoters have not used public funding for the project activity.

Annex 3

BASELINE INFORMATION

The Central Electricity Authority (CEA) has published the baseline emission factors database for the various electricity grids in India. The emission factors have been calculated based on UNFCCC guidelines (based on ACM0002). For further details on the calculation methods and data used, please refer the following web-link:

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

In the CEA database, the simple operating margin, build margin and combined margin emission factors of the regional electricity grids have been provided separately for two cases; Including electricity imports and Excluding electricity imports from other regional grids. Since, emission factors excluding imports are lower, the same has been considered as a conservative approach. The combined margin emission factor for the southern regional grid (0.86 tCO_2/MWh) has been considered for this project activity.

CENTRAL ELECTRICITY AUTHORITY: CO2 BASELINE DATABASE

VERSION	**2.0**
DATE	**21 June 2007**
BASELINE METHODOLOGY	**ACM0002 / Ver 06**

EMISSION FACTORS

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

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.72	0.73	0.74	0.71	0.71	0.71
East	1.09	1.06	1.11	1.10	1.08	1.08
South	0.73	0.75	0.82	0.84	0.78	0.74
West	0.90	0.92	0.90	0.90	0.92	0.87
North-East	0.42	0.41	0.40	0.43	0.32	0.33
India	0.82	0.83	0.85	0.85	0.84	0.82

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

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.98	0.98	1.00	0.99	0.97	0.99
East	1.22	1.22	1.20	1.23	1.20	1.16
South	1.02	1.00	1.01	1.00	1.00	1.01
West	0.98	1.01	0.98	0.99	1.01	0.99
North-East	0.73	0.71	0.74	0.74	0.71	0.70
India	1.02	1.02	1.02	1.03	1.03	1.02

Build Margin (tCO2/MWh) (excl.

Imports)

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North					0.53	0.60
East					0.90	0.97
South					0.71	0.71
West					0.77	0.63
North-East					0.15	0.15
India					0.70	0.68

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

	2000-01	2001-02	2002-03	2003-04	2004-05	2005-06
North	0.76	0.76	0.77	0.76	0.75	0.80
East	1.06	1.06	1.05	1.07	1.05	1.06
South	0.87	0.85	0.86	0.86	0.85	0.86
West	0.87	0.89	0.88	0.88	0.89	0.81
North-East	0.44	0.43	0.44	0.44	0.43	0.42
India	0.86	0.86	0.86	0.86	0.86	0.85

Calculation of combined margin emission factor of southern regional grid based on above CEA data and ACM0002:

Simple operating margin(2003-04)	tCO_2/MWh	1.00
Simple operating margin(2004-05)	tCO_2/MWh	1.00
Simple operating margin(2005-06)	tCO_2/MWh	1.01
Approximate Operating Margin (OM)	tCO_2/MWh	1.00
Build Margin (BM)	tCO_2/MWh	0.71
Weight of OM (w_{OM})		0.50
Weight of BM (w_{BM})		0.50
Combined Margin (BEF)	tCO_2/MWh	**0.86**

Annex 4

MONITORING INFORMATION

Refer Section B.7.1 and B.7.2 for details of the monitoring plan of each parameter.