PROJECT DESIGN DOCUMENT FORM
FOR SMALL-SCALE CDM PROJECT ACTIVITIES (F-CDM-SSC-PDD)
Version 04.0

PROJECT DESIGN DOCUMENT (PDD)

Title of the project activity	Autoclaved Aerated Concrete blocks/panel manufacturing unit based on an energy efficient brick manufacturing technology
Version number of the PDD	04
Completion date of the PDD	20/12/2012
Project participant(s)	M/s UAL INDUSTRIES LTD
Host Party(ies)	India
Sectoral scope(s) and selected methodology(ies)	**Sectoral Scope**: 04 -Manufacturing Industries **Methodology**: AMS III.Z. - "Fuel switch, process improvement and energy efficiency in brick manufacture" Version 4.0
Estimated amount of annual average GHG emission reductions	40619 tCO_2e per annum (approximate)

SECTION A. Description of project activity
A.1. Purpose and general description of project activity

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M/s UAL INDUSTRIES LTD [1] proposes to undertake the project activity at its new unit UAL-KON_CRETE, which entails manufacturing of the Autoclaved Aerated Concrete (hereafter referred to as AAC) blocks and panels with an energy efficient brick manufacturing technology supplied by HESS, Netherland.

The prime objective of the project activity is to produce a high-quality, load-bearing and well insulating building material by adopting an efficient low energy intensive brick production process instead of a high energy intensive brick production process like Clay Brick Bull's trench kilns (BTKs) and positively impact the energy consumption pattern both at the brick production level and at the building operation level.

While attaining the prime objective the project activity will also

(1) Reduce GHG emissions associated to energy consumption (both fossil fuel and electricity) in the high energy intensive BTKs by an energy efficient brick making technology.

(2) Reduce air pollution by introducing robust air treatment facilities in the project activity; the clay brick kiln technology is adopted by an unorganized sector with very poor air treatment facilities; and

(3) Enhance the use of fly ash, an industrial -waste, as an ingredient of building material.

The project activity entails production of AAC blocks, which is a steam-cured mix of sand or pulverized fuel ash (PFA), cement, lime, anhydrite (gypsum) and an aeration agent. The high-pressure steam-curing in autoclaves achieves a physically and chemically stable and light weight product, comprising myriads of tiny non-connecting air bubbles which give AAC its diverse qualities and makes it such an excellent insulating material.

Production process of AAC blocks does not involve sintering or kiln heating for blocks consolidation and thus completely eliminates the burning of fossil fuels as required in the clay brick production by adopting the green waste mixing technology in PFA slurry process, ultimately contributing to the reduction of greenhouse gas emissions. The core of this technology is the AAC blocks composition and its chemistry, with fly ash from thermal plants mixed with lime and gypsum, which enable the blocks to acquire the mechanical properties required during the hydration and curing process without being sintered.

The production process consists of the following steps:

1. Dosing and mixing of fly ash with lime, Ordinary Portland Cement (OPC), stabilisers and gypsum at a high dosing speed at very high accuracy.
2. Casting and rising/pre curing of the mixture to enable the fresh mix to rise and harden to a firm green cake with the volume of the mould.
3. Tilting mould cakes with the tilt manipulator on to a cutter machine and oiling to prevent the sticking of the green cakes for reuse.
4. Horizontal and cross cutting the cakes by cutter which are equipped with broken-wire-detection system.
5. Milling and back tilting onto a cooking frame.
6. Green separation of cut cakes by passing through the green separator to avoid sticking of cut layers during autoclaving and eliminating further mechanical separation in white state.
7. Curing with a steam at pressure of approximately 12 Bar in autoclave system for 12 hrs period.
8. A post autoclaving, after buffering and de-stacking of hardened cakes from the cooking frames to the packaging line for final packaging.

[1] www.ualindia.com

[2] Due to its high insulating properties it would reduce the building's heat load thereby affecting the air conditioning related energy consumption patterns

The machines will be supplied by HESS, Netherland. These types of machines require electricity and/or fuel oil as fuels for their steam generation and operation.[2] The consumption of such forms of energy (electricity and/or Fuel oil in high efficiency boilers) however is much lower compared to the thermal energy consumed for production of burnt clay bricks. AAC block technology needs cement and lime as process inputs, which are sources of emissions during their production. However, such emissions are negligible when compared to the emissions from baseline activity, thereby leading to emission reductions. The project activity description provided above is a summary of the details provided to UAL Industries Ltd by the technology provider HESS AAC Systems BV in their proposal and contract.

The scenario existing prior to the implementation of the project activity and the baseline scenario:
This is a green field project. Presently there is no AAC block/brick manufacturing facility in the project location. The fly ash is dumped in the open and disposed of without using them at Kolaghat Thermal Power Station. The following reference Indian Journal for spatial science - Link: http://www.etravers.net/Art_010.pdf provides further information on flyash disposal practices at KTPS.
Clay brick manufacturing, an alternative brick manufacturing technology and the baseline scenario as identified in section B.4 below involves two key processes: (a) producing green bricks and (b) sintering/firing the green bricks in a kiln. The sintering process requires huge amount of thermal energy inputs which is sourced majorly from the fossil fuel-coal combustion with a small quantum from combustion of biomass in the form of fuel wood. Production of AAC blocks and panels does not require any sintering process as the project activity eliminates the burning of fossil fuel as required in the clay brick production.So the amount of such energy, which is required in the project activity scenario, is much lower than the thermal energy required in clay brick manufacturing process. Therefore, the project activity enables total energy reduction and its associated GHG reduction due to change in brick production process. It may be worthwhile to note that there will be some emissions associated to production of raw materials (cement and lime) used in the project activity, which will be accounted for as leakages to project activity.
Annual emission reductions over the chosen crediting period for the 1st year of operation would be 20367 tCO_2 and thereafter emission reductions for 2nd year and 3rd year onwards would be 41864 tCO_2 and 42996 tCO_2 .Annual average emission reductions over 10 years crediting period would be 40619 tCO_2.

Contribution to sustainable development
The project activity contributes to sustainable development and mitigation of climate change through the following:
Environmental Benefits:
Reduction of energy resources consumption: Since there is no sintering or cooking in the project activity, this technology is more efficient in terms of energy consumption and results in lower energy consumption than the clay brick manufacturing.
Reduction of fossil fuels consumption: Clay brick manufacturing process are fossil fuel based technologies, especially coal, in India. With the implementation of the proposed project activity, consumption of fossil fuels for building material manufacturing will be avoided, thus contributing to reduce GHG emissions.
Utilisation of a waste materials from other industries as raw materials: The raw materials used in the project activity are mostly (to the extent of 67%) waste materials or by products from other industries. Pulverized fuel ash (PFA), is a waste that creates both problems regarding its disposal and environmental degradation due to its potential to pollute both air and water. Indian coals have very high ash content to the tune of 25 and 45%. However, coal with an ash content of around 40% is predominantly used in India for thermal power generation. As a consequence, a huge amount of fly ash is generated in thermal power plants, causing several disposal-related problems.
According to the Annual Report 2010-11 from the Ministry of Environmental and Forests of India, the annual generation of fly ash is expected to be around One hundred seventy five million tonnes by the end

[2] Annex II of HESS contract signed between UAL Industries limited and HESS AAC system.

of the XIth five year plan period, two hundred twenty five million tonnes by end of XIIth five year plan period around five hundred million tonnes[3].With this alternative use of fly ash, the problem of the management of this waste will be slightly reduced.
Reduction of resources consumption: fly ash utilisation in the proposed project activity will contribute to savings in natural resources, mainly the land (and top soil), water, coal and limestone. The utilisation of fly ash in the manufacture of building blocks, as in the proposed project activity, will release considerable amounts of land. Also, water will be saved due to reduced fly ash disposal from thermal power plants.
Reduction of waste generation in the manufacturing process: No waste material is generated in the manufacturing process of AAC blocks and panels. On the contrary, waste materials from other industries are used but no wastes are generated.

Social benefits:
Improvement of air quality in the nearby region: With the avoidance of fossil fuel combustion in the proposed project activity, the exhaust gas emissions and direct air pollution will be substantially reduced in the neighbouring region.
Better quality employment creation: The proposed project activity will be situated in the Bagnan, Howrah in state of West Bengal. Since the proposed project activity is a green field project it will create a huge amount of employment benefits in the entire project area.

Economical Benefits:
Reduction of dependence from fossil fuels: The project activity will reduce to the maximum the dependence of the brick manufacturing process from fossil fuels. This will reduce the overall dependence of the whole region from the imports and availability of fossil fuels and will allow other industries to use energy resources which will allow their development.

Technical Benefits:
Enhancement of the use of green building material:
The following are the eco logical green building quality and characteristics of AAC blocks:
• Energy efficient
• Lower energy consumption per cum in production process
• Best thermal insulation, 6 to 10 times better than regular concrete
• Non-toxic, environmentally friendly
• Un-suppressed fire resistance
• Excellent sound absorption
• No waste of raw materials

AAC blocks/panels are a high quality product with high insulating capabilities – their use would lead to lower energy consumption at the air conditioning end of the construction building and would partly help the building in achieving the green building status. Its low density properties would enable the building structure to be light weight and thus would require less deep foundations.

A.2. Location of project activity
A.2.1. Host Party(ies)
>> India
A.2.2. Region/State/Province etc.
>> West Bengal
A.2.3. City/Town/Community etc.
>> Bagnan, Howrah

[3] http://envfor.nic.in/downloads/public-information/Draft-Report-to-the-People-on-Environment-and-Forests-2010-11.pdf

A.2.4. Physical/ Geographical location

>> The proposed project activity will be set-up in eastern India, preferably near the major raw material source (*i.e.*, fly-ash from the Kolaghat thermal power plant located at 12 km distance from the plant) at Bagnan, Howrah which is located at 50 km away from Kolkata, the capital of West Bengal.

The co-ordinates of the project site as below:

Latitude: 22˚28'11"N

Longitude: 88˚15'00"E

http://policewb.gov.in/wbp/district/Howrah/hwhstat.html

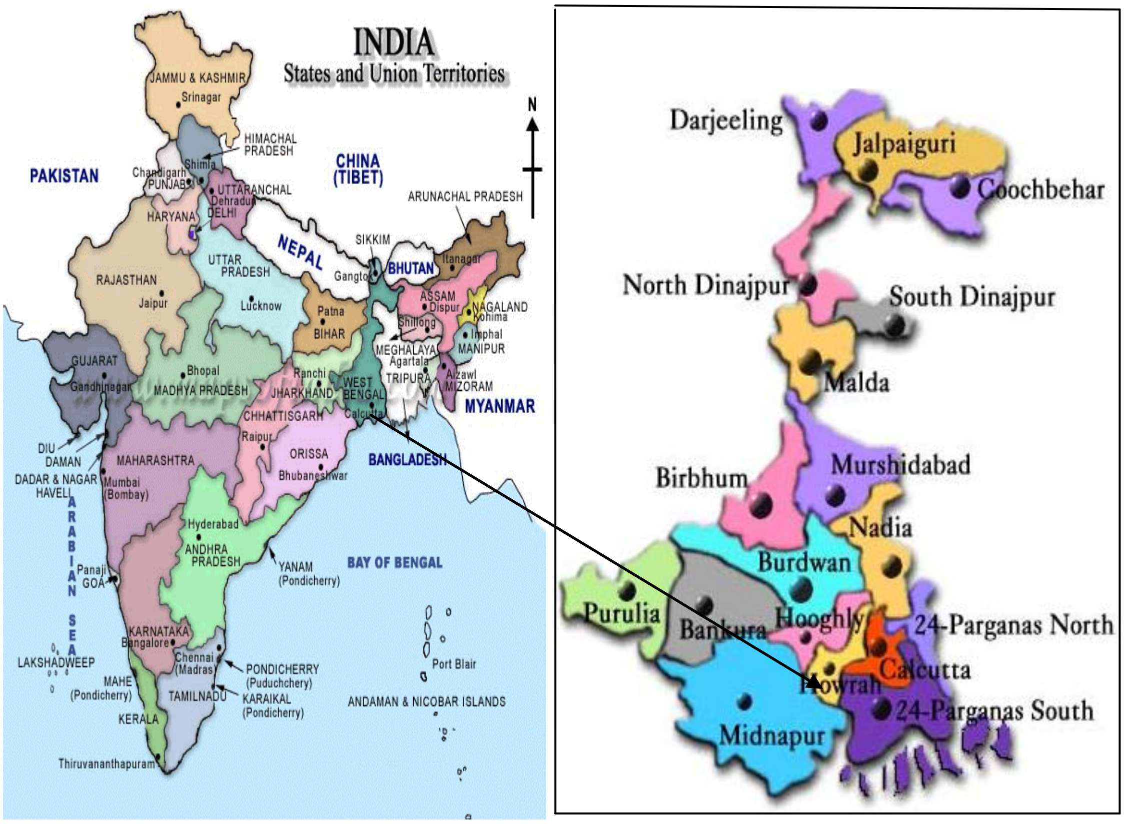

Figure 1: Location Map

The project site is very close to the main source of fly ash a pollutant waste of thermal power station, used as one of the major ingredients of AAC blocks, available at Kolaghat Thermal Power Station (KTPS) which around 12 km from the plant at Bagnan.

A.3. Technologies and/or measures

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The project proponent has adopted the new energy efficient technology which will be supplied by HESS, Netherland for the AAC block/panel manufacturing process. The project activity will have a plant capacity of 450 CuM/day in the 1st year enhanced to 900 CuM/day, 2nd year onwards.

The key raw material ingredients of the AAC building blocks are fly ash, lime, and gypsum, cement, and aluminium, which are well-known mineral substitutes. Raw material flyash is available in the form of wastes from industrial activities and are available in adequate quantities, whereas raw materials lime, gypsum, cement and aluminium are industrial products which will be procured. The following table gives the raw material inputs per cubic meter for typical recipe of AAC blocks and panels:

Table A.3.1: Raw material Consumption for AAC block/panel manufacturing process

Ingredients	Raw Material Consumption per Cum of AAC blocks/panels	Source
Fly ash(PFA)	272 Kg	Proposal from HESS AAC SYSTEM B.V -Along with the Annex II of Standard raw material specification and material specification and consumption values
Lime	71 Kg	
Cement	95 Kg	
Anhydride	12 Kg	
Aluminium (metal powder)	0.46 Kg	
Total solid	450 Kg	
Water in the mix(total,excl. steam)	370 Kg	
Condensate which can be reused in the mix (water consumption above will be reduced correspondingly)	90 Kg	

Besides the HESS machinery there is more additional services machinery & equipments required in the process operations are described as below:

Table A.3.2: Description of the machinery used in AAC block/panel manufacturing process:

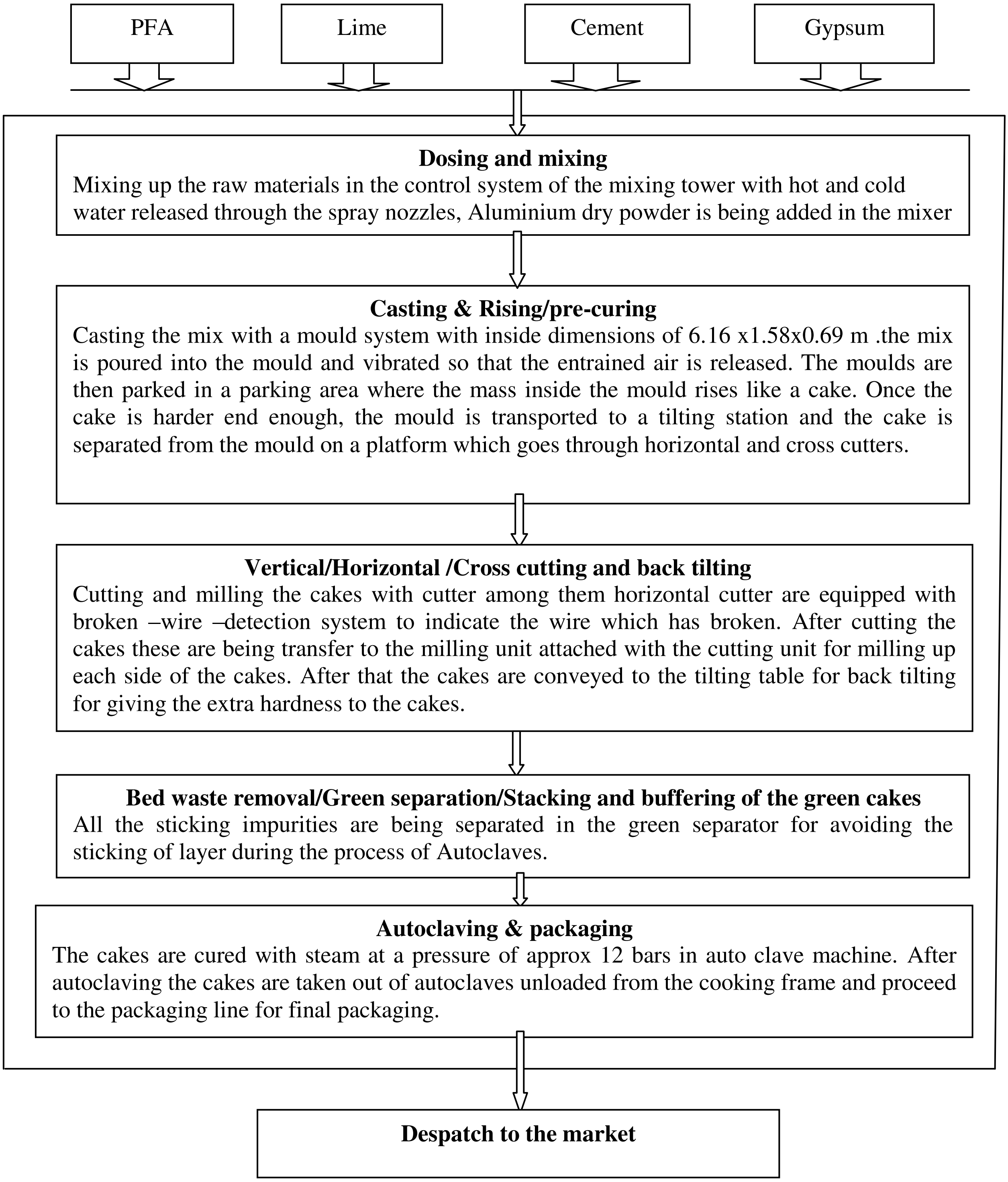
Name of the Machines	Specification of the Machines		Numbers of machines used	Source
Boiler(s)	TPH	8	2 Nos.	Technical Specification provided by the Forbes Marshall for Boiler.[4]
	Boiler pressure 17.5 kg/cm^2	17.5		
	Bolier Capacity, (F& A 100° C)	8000 kg/Hr		
	Type	Oil fired,3 pass, smoke tube type		
Air Compressor	Air Receiver capacity 1.0 (1000 I)	1.0 m^3	2	Design Specification offered by the Atlas Copco for air Compressor
	Free Air delivery	462 cfm		
	Motor Input (Power)	75 KW (100 Hp)		
Vacuum Pump (for Autoclave machine)	Capacity Final pressure	2000 m^3/hr 0.3 Bar Atm (absolute)	1	Proposal and design specification offered by DELVAC pumps Pvt. Ltd.

[4] Technical specification of Boiler (8 TPH)

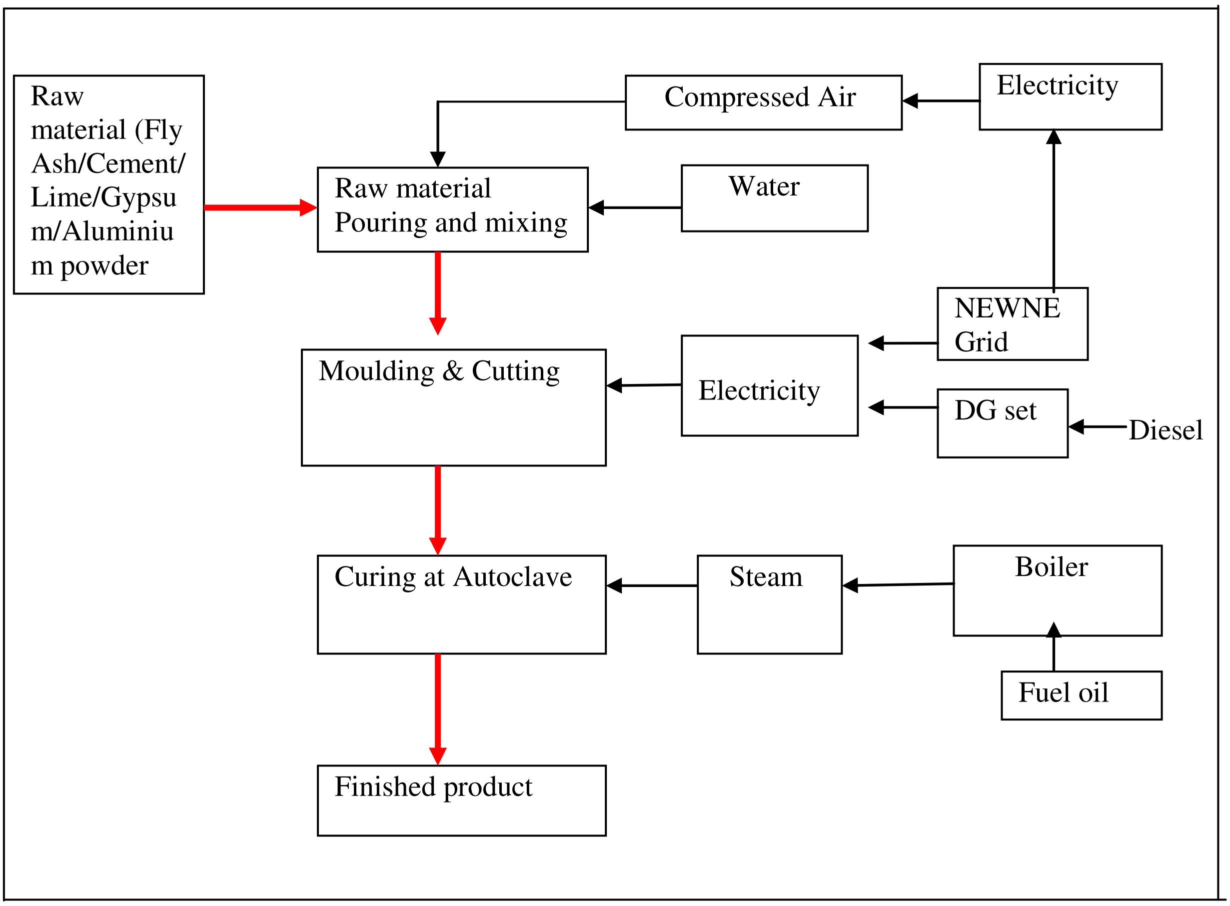
Auto clave	Dimension (Dia x Lengh)		2.9mx43.7m	1	Design specification from Rooftech Engineering and Consultancy
	Steam Pressure		12 bar		
Main Transformer	Specification		1250 kVA, 11kV/440V, Indore type	1	Design specification from Consultant Consortium
DG Set	Capacity		750 kVA	1	Proposal and design specification offered by RAI POWER

All the equipments of the plant are purchased as new so the average life time of all the equipments is 20 years.
The project technology is environmentally safe and sound as compared to the baseline technology of producing red clay bricks. The project would help the reduction of fly ash dumping problem faced by thermal power plants (classified under hazardous materials category by MOEF - GOI) by making useful application of fly ash for producing building construction material. Also, the technology would be less energy and carbon intensive as compared to conventional bricks manufacturing technology in India.

The **Figure 2:** provides **'Detailed Schematic Diagram of the project activity production process:**



The Figure 3: provides 'Energy and mass flow and balance diagram of the project activity production process:



The above figure represents the energy and mass flow and the balance of the systems and equipments included in the project activity. In the project activity Electricity, Steam & Compressed air are the main types of energy used and the main sources of these energies are as follows:
Electricity – from Northern-Eastern-Western & North Eastern (NEWNE) grid & DG set:
Steam- from Boiler(s): from Fuel Oil combustion
Compressed Air – from Air Compressor: from Electricity imported from NEWNE

A.4. Parties and project participants

Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
India	M/s UAL INDUSTRIES LTD	No

A.5. Public funding of project activity
>> No public funding from Annex – I countries is being received by this project as confirmed vide Annex 2.

A.6. Debundling for project activity
>> Reference to Appendix C to the simplified modalities and procedures for the small scale CDM project activities; further reference "Guidelines on assessment of de-bundling for SSC project activities", Version 03[5] (EB 54, Annex 13):

As per paragraph 2: A proposed small-scale project activity shall be deemed to be a de-bundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small scale.
CDM project activity:
(a) With the same project participants
(b) In the same project category and technology/measure
(c) Registered within the previous 2 years
(d) Whose project boundary is within 1 km of the project boundary of the proposed small scale activity at the closest point?
There is no registered project activity or application to register another CDM project activity with the same project participants. Thus it can be concluded that the project activity is not a de-bundled component of a large scale project activity.

[5] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid17.pdf

SECTION B. Application of selected approved baseline and monitoring methodology

B.1. Reference of methodology

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Type III: Other project types

Methodology Applied: AMSIIIZ. "*Fuel Switch, process improvement and energy efficiency in brick manufacture*"

Sectoral Scope: 04

EB 67,

http://cdm.unfccc.int/filestorage/R/H/E/RHEASNU01VILTFY6ZG7W3XDKOCBM59/EB67_repan21_Revisionof%20AMS-III.Z_ver04.0.pdf?t=Snp8bWV4NHNlfDAkmUBMd0ZaBlU9IrotCghV

Version 4.0

Valid from 25th May 2012 onwards.

Applied Methodological Tool:

1."Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" Version 02, Annex 11, EB 41.

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

2. "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", Version 01, Annex 7, EB 39.

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

3. "Project and leakage emissions from road transportation of freight" Version 01.0.0, Annex 10 of EB63

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.pdf

4. "Tool for the demonstration and assessment of additionality", Version (06.1.0), (EB 69)

http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.1.0.pdf

B.2. Project activity eligibility

>> As per the "GLOSSARY OF THE CDM TERMS" Version 06.0.0, Annex 63, EB 66[6] *"A measure, operation or action that aims to reduce GHG emissions, whether as a whole project or as a component of a project, in one of the following categories:*

(a)Type I project activities: Renewable energy project activities which have an output capacity up to 15 megawatts (or an appropriate equivalent), in accordance with the CDM rules and requirements;

(b)Type II project activities: Energy efficiency improvement project activities which reduce energy consumption, on the supply and/or demand side, to a maximum output of 60 GWh per year (or an appropriate equivalent) in accordance with the CDM rules and requirements;

(c) Type III project activities: SSC CDM project activities other than Type I and Type II project activities that result in emission reductions of less than or equal to 60 kt carbon dioxide equivalent annually, in accordance with the CDM rules and requirements".

The project activity does not fall under Type I and Type II project activities category and aims to reduce GHG emissions of less than 60kt carbon dioxide equivalent annually in accordance with the CDM rules and requirements. Please refer to B.6.4 Summary of ex-ante estimates of emission reductions for data values. Therefore the project activity falls under the SSC Category Type III project activities

The selected category for the proposed project activity is as follows:

Type	III - Other Project Types
Methodology	AMS IIIZ "*Fuel Switch, process improvement and energy efficiency in brick manufacture*"
Version:	4.0
EB	67

[6] http://cdm.unfccc.int/Reference/Guidclarif/glos_CDM.pdf

Criteria	Justification
1.The methodology comprises one or more technology/measures listed below in brick production facilities: • *Shift to an alternative brick production technology/process; or* • *Complete/Partial substitution of fossil fuels with renewable biomass (including solid biomass residues such as sawdust and food industry organic liquid residues); or* • *Complete/partial substitution of high carbon fossil fuels with low carbon fossil fuels*	The project activity is a New facility (Greenfield project activity) which entails shift from baseline scenario brick production technology Fixed chimney BTK (a high energy intensive process) to project scenario - an alternative brick production technology AAC Technology (low energy intensive process) – therefore the project activity meets the applicability criterion.
2. Complete or partial fuel substitution and associated activities may also result in improved energy efficiency of existing facility; however project activities primarily aimed at emission reductions from energy efficiency measures shall apply AMS-II.D "Energy efficiency and fuel switching measures for industrial facilities". Thus, the methodology is applicable for the production of: (a) *Bricks that are the same in the project and baseline cases; or* (b) *Bricks that are different in the project case versus the baseline case due to a change(s) in raw materials, use of different additives, and/or production process changes resulting in reduced use or avoidance of fossil fuels for forming, sintering (firing) or drying or other applications in the facility as long as it can be demonstrated that the service level of the project brick is comparable to that of the baseline brick (as per paragraph 11) Examples include pressed mud blocks (soil blocks) with cement or lime stabilization and other 'unburned' bricks that attain strength due to fly ash, lime/cement and gypsum chemistry.*	It may be noted that bricks are different in the project case versus the baseline cases due to changes in the raw materials, use of different additives and production process changes resulting in avoidance of fossil fuels for forming, sintering or drying. However it can be demonstrated that the service level of the project bricks is better than the baseline brick. Please refer to Para 11, Table: B.2.2 for details on Comparison on Service level of the project bricks with baseline bricks: Therefore the project activity meets the applicability criterion.
3. The measures may replace, modify, retrofit or add capacity to systems in existing facilities or be installed in a new facility.	The project activity measure itself is a whole new facility. Thus, the project activity meets the applicability criterion.

4. *New facilities (Greenfield projects) and project activities involving capacity additions are only eligible if they comply with the requirements for Greenfield projects and capacity increase projects specified in the "General Guidelines for SSC CDM methodologies".*	The project falls under the Type III Greenfield projects (new facilities) and the most plausible baseline scenario for this project activity is "the burnt clay brick manufacturing using conventional technologies". This project activity baseline is in line with the baseline requirements of the Type III small-scale methodology. Thus, the project activity meets the applicability criterion.
5. *The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the General Guidance for SSC methodologies. If the remaining life time of the affected systems increases due to the project activity, the crediting period shall be limited to the estimated remaining lifetime, i.e, the time when the affected systems would have replaced in the absence of the project activity.*	The project activity is not a replacement or retrofit to an existing facility. The project activity is being implemented as a New facility (Greenfield project). Thus the criterion under discussion is not applicable.
6. *For existing facilities, it shall be demonstrated, with historical data, that for at least three years immediately prior to the start date of the project implementation, only fossil fuels (no renewable biomass) were used in the brick production systems that are being modified or retrofitted. In cases where small quantities of biomass were used for experimental purposes this can be excluded.*	The project activity is not a replacement or retrofit to an existing facility. The project activity is being implemented as a New facility (Greenfield project). Thus the criterion under discussion is not applicable.
7. *The renewable biomass utilized by the project activity shall not be chemically processed (e.g. esterification to produce biodiesel, degumming and/or neutralization by chemical reagents) prior to the combustion but it may be processed mechanically (e.g. pressing, filtering)/thermally (e.g. gasification to produce syngas)*	In the proposed project activity there is no use of renewable biomass. So there is no scope of any mechanical or chemical treatment of the renewable biomass through the project activity. Thus the criterion under discussion is not applicable.

8. *In cases where the project activity uses crops from renewable biomass origin as fuel, the crops should be cultivated at dedicated plantations and the following conditions shall be met:* *(a) The project activity does not lead to a shift of pre-project activities outside the project boundary, i.e. the land under the proposed project activity can continue to provide at least the same amount of goods and services as it would in the absence of the project;* *(b) The plantations are established on land that:* (i) *Was classified as degraded or degrading at the start of the project implementation, as per the "Tool for the identification of degraded or degrading lands for consideration in implementing CDM A/R project activities"; or* (ii) *Is included in the project boundary of one or several registered A/R CDM project activities;* *c) Plantations established on peat lands are not eligible even if qualifying under condition (i) or (ii) above.*	In the proposed project activity there is no use of renewable biomass as fuel. Thus the criterion under discussion is not applicable.
9. *In cases where the project activity utilizes charcoal produced from renewable biomass as fuel, the methodology is applicable provided that:* *a) Charcoal is produced in kilns equipped with a methane recovery and destruction facility; or* *b) If charcoal is produced in kilns not equipped with a methane recovery and destruction facility, methane emissions from the production of charcoal shall be considered.*	In the proposed project activity there is no use of charcoal produced from renewable biomass as fuel Thus the criterion under discussion is not applicable.
10. *In the case of project activities involving changes in raw materials (including additives), it shall be demonstrated that additive materials are abundant in the country/region according to the following procedures:*	The project activity involves changes in raw materials viz-a-viz baseline scenario of burnt clay brick manufacturing using conventional technologies. The project activity is a small scale project with 450 CuM per day capacity in the 1st year and 900 CuM per day capacity 2nd year

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Step 1: Using relevant literature and/or interviews with experts, a list of raw materials to be utilized is prepared based on the historic and/or present consumption of such raw materials.

Step 2: The current supply situation for each type of raw material to be utilized is assessed and their surplus availability is demonstrated using one of the approaches below:

·Approach 1: Demonstrate that the raw materials to be utilized, in the region of the project activity, are not fully utilized. For this purpose, demonstrate that the quantity of material is at least 25% greater than the demand for such materials or the availability of alternative materials for at least one year prior to the project implementation.

.Approach 2: Demonstrate that suppliers of raw materials to be utilized, in the region of the project activity, are not able to sell all of their supply of these materials. For this purpose, project participants shall demonstrate that a representative sample of suppliers of the raw materials to be utilized, in the region, had a surplus of material (e.g., at the end of the period during which the raw material is sold),which they could not sell and which is not utilized.

As per SSC_518 'The underlying rationale regarding the requirement on demonstration of the availability abundance of the raw materials is that the alternative raw materials used in the manufacturing of alternative bricks are "waste products". The assessment as per paragraph 6 (in version 03 and paragraph 10 in version 04) is not intended for industrial products with commercial value used as raw materials or additives.'

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onwards.

The assessment as per this applicability criterion is intended for raw materials, which are waste products and not industrial products with commercial value.

The project activity's raw material requirements include Fly-ash, Lime, Gypsum, Cement and Aluminium. Fly-ash is a waste product, gypsum is a by-product but used in very small quantity, whereas Lime, cement and aluminium are industrial products.

Therefore the assessment has been conducted only for fly-ash.

Step 1: As per the manufacturer, the project activity's annual requirement of Fly-ash, is as follows –

Table B.2.1: Quantity of raw material consumption for AAC block manufacturing process7

Parameter-Comment	Quantity Required (MT)
Fly ash – Maximum quantity	33048 MT – 1st year 67932 MT – 2nd year

Step 2: The current supply situation of Flyash to be utilized is assessed below and their abundance is demonstrated -

Fly ash - The annual nationwide generation of fly ash is over 130 million tons. (http://www.dst.gov.in/whats_new/what_new08/fly-ash.pdf). Being a by product of coal based thermal power plants with annual generation in millions of tons, fly ash is abundantly available within a feasible distance from the plant.

Fly ash source for the project activity is Kolaghat Thermal Power Station (KTPS) which is 20 km away from the plant. KTPS is generating 7500-8000 MT of fly ash per day (i.e. to the tune of 2625000-2800000MT per annum) by using 18000 tonnes of coal per day[8]. The fly ash is disposed on land and causes soil as well as water pollution and affects the environmental ecosystem. Further to dispose the generated fly ash the plant authority would require 1250 acre land in its whole life span[9] i.e, the growth of generation of fly ash is much higher compared to recycling procedure.

Thus, it may be concluded that flyash is available in abundance and the project activity meets the applicability criterion.

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</table>

[7] UAL_Financials_Version03
[8] Indian Journal for spatial science.Link: http://www.etravers.net/Art_010.pdf
[9] http://www.etravers.net/Art_010.pdf

<table>
<tr><td>11. This methodology is applicable under the following conditions:
a) The service level of project brick shall be comparable to or better than the baseline brick, i.e., the bricks produced in the brick production facility during the crediting period shall meet or exceed the performance level of the baseline bricks (in terms of for example dry compressive strength, wet compressive strength, density). An appropriate national standard shall be used to identify the strength class of the bricks, bricks that have compressive strengths lower than the lowest class bricks in the standard are not eligible under this methodology. Project bricks are tested in nationally approved laboratories at 6 months interval (at a minimum) and test certificates on compressive strength are made available for verification;</td><td>The applied methodology satisfies the following applicable conditions to the project case:
(a) The service level of the project brick is higher than the baseline bricks. The comparative data of the project bricks & baseline bricks are provided below:
Table B.2.2: Comparison of Service level of the project bricks with baseline bricks:
<table><tr><td>Parameters</td><td>Baseline Bricks</td><td>Project bricks</td></tr><tr><td>Minimum Compressive Strength(N/mm^2)</td><td>2.5-3</td><td>3.5-4</td></tr><tr><td>Dry density (kg/m^3)</td><td>1800</td><td>550-700</td></tr></table>Source:
http://aac-india.com/aac-blocks-vs-clay-bricks/

An appropriate national standard shall be used to identify the strength class of the bricks, Further the service level of the project brick will be tested in nationally approved laboratories at 6 months interval and test certificates on compressive strength will be made available for verification through the crediting period in line with the methodology requirements to evidence that service level of the project brick is higher than the service level of the baseline brick.</td></tr>
<tr><td>11b) The existing facilities involving modification and/or replacement shall not influence the production capacity beyond ±10% of the baseline capacity unless it is demonstrated that the baseline for the added capacity is the same as that for the existing capacity in accordance with paragraph 4 of the methodology</td><td>The project activity is not a replacement or retrofit to an existing facility. The project activity is being implemented as a New facility (Greenfield project). Thus the criterion under discussion is not applicable.</td></tr>
<tr><td>11c) Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.</td><td>c) Emission reductions from the project activity are estimated to be around 20.36 ktCO_2 for the 1st year, 41.86 ktCO_2 for the 2nd year and 42.99 ktCO_2 3rd onwards, which is less than the methodology limit of 60 ktCO_2e annually. Thus the criterion under discussion is applicable.</td></tr>
<tr><td>12. This methodology is not applicable if local regulations require the use of proposed technologies or raw materials for the manufacturing of bricks unless widespread non compliance (less than 50% of brick production activities in the country comply) of the local regulation evidenced.</td><td>The project activity adopts a new technology. The local regulation does not require the brick manufacturers to install any specific technology of brick manufacturing.
With regards to use of raw material in brick production - there is a local regulation on use of fly ash (one of the proposed raw material for project blocks) for the manufacturing of bricks. As per MoE&F Notification dated 14th September 1999 and its amendments dated 27th August 2003 and</td></tr>
</table>

	3rd November 2009, use of 50% fly ash in brick manufacturing units set up within 100 km of a coal or lignite based thermal power plant is mandatory. Therefore local regulation requires the use of raw material fly-ash for manufacturing of bricks but the widespread non-compliance rate is very high. As per data taken from "Graph I: Model of Fly-ash Utilization for year 2009-10" on page 93 of the Central Electricity Authority Annual Report 2010 – 11 (Reference: http://www.cea.nic.in/reports/yearly/annual_rep/2010-11/ar_10_11.pdf), of the 62.6% utilization of fly ash generated (77.34 Million tons per annum), annually, that consumed in bricks manufacturing is a meagre 7%.that commensurate to 5.11MT per annum. The absence of compliance of the aforesaid notification has been mentioned in the report. Reasons behind the noncompliance vary from inappropriate quality of the fly ash available, to high transportation costs and lack of adequate technological and financial support from the regulatory or funding institutions, as have been reported in the experimental study by B.V.M Engineering College, Gujarat, and presented in the "National Conference on Recent Trends in Engineering and Technology" (Reference: Section on limitations regarding utilization of fly ash as provided in the report available at: http://www.bvmengineering.ac.in/docs/published%20papers/civilstruct/Civil/101004.pdf). The increase in cost of fly ash based bricks production, compared to the BAU practice of manufacturing clay bricks, resulting from the above factors deter the brick manufacturers from utilizing fly ash, thus leading to low compliance of the aforesaid notification, as has been mentioned in "Utilization of Fly-ash by Brick Manufacturers - Environmental Costs vs. Benefits", a report sponsored by the MoEF (GoI) (reference: Paragraph 4 of the study available at: http://www.mse.ac.in/completed/proj-flyash.htm). These facts have been further corroborated through studies published in the Indian Concrete Journal[11] and independent publications[12] by INSWAREB (Institute for Solid Waste Research& Ecological Balance – an NGO that has made significant contribution to the utilization fly ash in India) in response to the above notification. Hence, it can be concluded from the above discussion that: i. There is no regulation that mandates the use of any specific technology for brick manufacturing ii. There is widespread non-compliance of the

	regulation to use 50% of fly-ash for brick manufacturing within 100 km of a thermal power plant. Hence the applicability condition is applicable to the proposed project activity.

Thus, the project activity fulfils the applicability criteria of AMS-III.Z, version 4.0, and accordingly the application of the methodology is justified.

B.3. Project boundary

>> As per paragraph 13 of the methodology, *"The project boundary is the physical, geographical site where the brick production takes place during both the baseline and crediting periods. It also includes all installations, processes or equipment affected by the switching. In cases where the renewable biomass is sourced from dedicated plantations it also includes the area of the plantations. In cases involving thermo-mechanical processing of the biomass (e.g. charcoal; briquettes; syngas) the sites where these processes are carried out shall be within the project boundary*."

In both Baseline & Project Scenario, boundary is depicted diagrammatically as below:

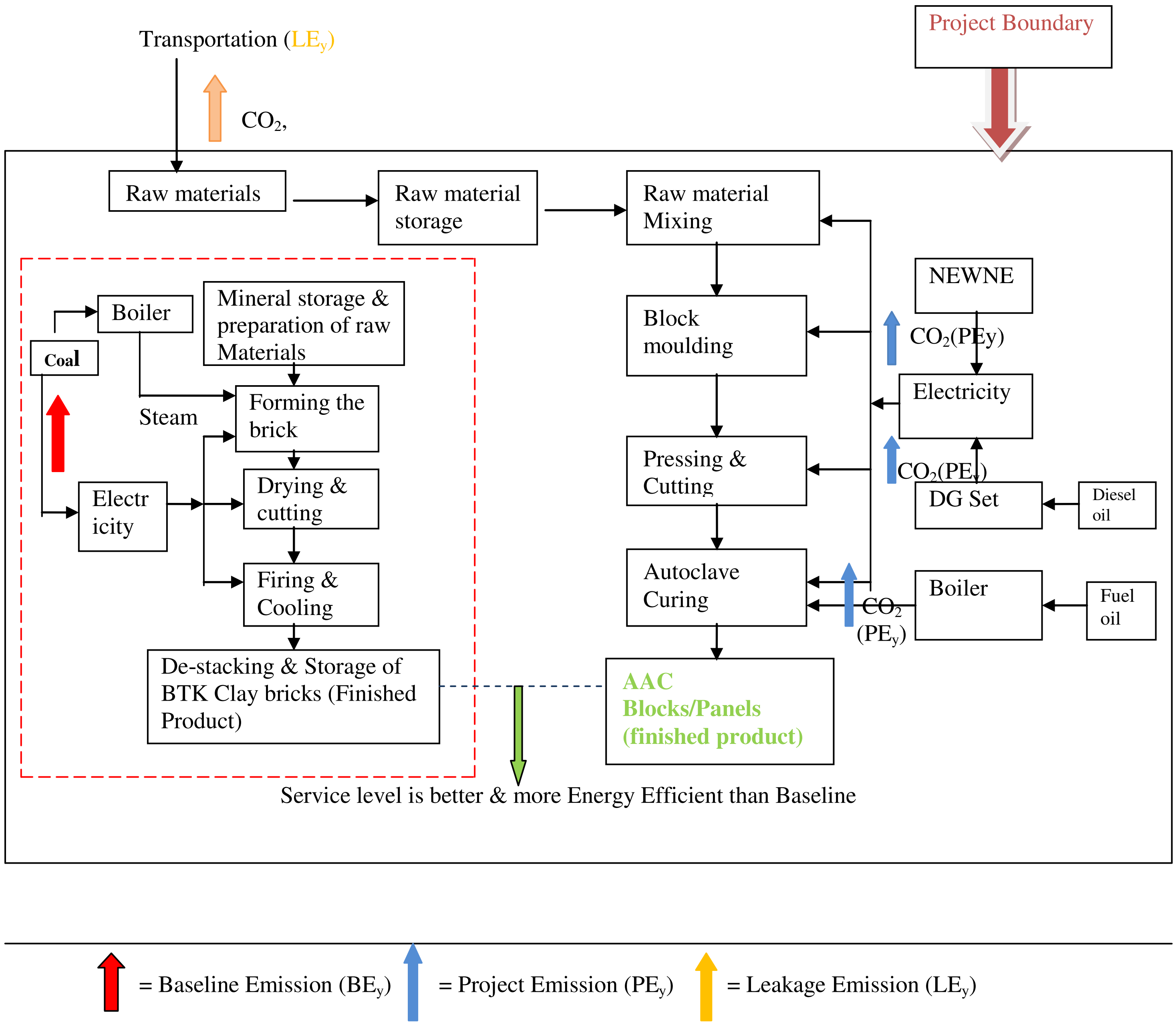

Figure 3: Schematic diagram of boundary at the crediting period

B.4. Establishment and description of baseline scenario
>>
As per paragraph 14 of the methodology AMS-III.Z Version 4.0,
"The baseline emissions are the fossil fuel consumption related emissions (fossil fuel consumed multiplied by an emissions factor) associated with the system(s), which were or would have otherwise been used, in the brick production facility(ies) in the absence of the project activity.''

(a) *For projects that involve replacing, modifying or retrofitting systems in existing facilities, the average of the immediately prior three-year historical fossil fuel consumption data, for the existing facility, shall be used to determine an average annual baseline fossil fuel consumption value. Similarly, prior three-year historical baseline brick production rate in units of weight or volume. For calculating the emission factor, reliable local or national data shall be used. IPCC default values shall be used only when country or project specific data are not available or demonstrably difficult to obtain;*

(b) *For projects involving the installation of systems in a new facility or a capacity addition in an existing system, the average annual baseline fossil fuel consumption value and the baseline brick production rate shall be determined as that which would have been consumed and produced, respectively, under an appropriate baseline scenario. If the baseline scenario identification as per paragraph 4 above (of the methodology) results in more than one alternative technologies with different levels of energy consumption, the alternative with the least emissions intensity should be chosen for determining the baseline emissions of the facility.*

Since the project activity involves setting up new facility for production of bricks by adopting an alternative energy efficient technology and entails GHG emission reductions with reference to the system(s) which would have otherwise been used in the brick production facility in the absence of the project activity, para 14 of the methodology AMS-III.Z Version 4.0 point (b) would apply.

Therefore baseline emissions are the fossil fuel consumption related emissions (fossil fuel consumed multiplied by an emissions factor) associated with the system(s), which would have otherwise been used, in absence of project activity.
For the project activity case the average annual baseline fossil fuel consumption value and the baseline brick production rate shall be determined as that which would have been consumed and produced, under an appropriate baseline scenario.

Building materials in India may include Burnt Clay Bricks, Cement Concrete Blocks, Fly ash bricks and Autoclaved Aerated Concrete Blocks (manufactured in the project activity).
However it is worthwhile to note that Burnt clay bricks continue to be the most popular form of walling material in the country. India is the second largest producer of clay fired bricks, accounting for more than 10 percent of global production. They are cheap and have traditionally been believed to be the most suitable walling material for building construction. Although alternative building materials such as cement concrete block and fly ash bricks, have been introduced in the recent past, burnt clay bricks account for more than 95% of the total market for walling material in larger parts of the country[10]. This can be seen from the data presented below (Source: A study on "Cost Effective Building Materials & Technologies" undertaken by Holtec Consulting Private Limited in the year 2004 on behalf of Building Materials Technology Promotion Council, Ministry of Housing and Urban Poverty Alleviation, Government of India).

[10] http://www.unep.org/ccac/Portals/24183/docs/Brick_Kilns_Performance_Assessment.pdf

Table B.4.1: Market share of different walling materials

Type of walling material	Market Size (Rs. Crores)	% of Total market
Burnt Clay Brick	32825	95.3
Fly Ash Bricks	1135	3.3
Cement Concrete Blocks	485	1.4
Total	34445	100

(Source: A study on "Cost Effective Building Materials & Technologies" undertaken by Holtec Consulting Private Limited in the year 2004 on behalf of Building Materials Technology Promotion Council, Ministry of Housing and Urban Poverty Alleviation, Government of India).

The project activity product output AAC Blocks's awareness levels were very low and are yet to penetrate in the markets.

As stated above the prime reason why clay brick accounts for 95% of the share is that they are cheap and have traditionally been believed to be the most suitable walling material for building construction. This can be demonstrated from the table 4.2 given below:

Table B.4.2: Cost of 100 sq ft area and 4 inch wall with different walling materials

	Dimension (inch/inch/inch)	Number of Brick	Rate (INR/brick)	Cost (INR)
Volume of 100 sq ft area and 4 inch thick wall	57600 inch^3			
Clay Brick (250*125*75) mm^3	139	414	6*	2486
FA Bricks (230*110*75) mm^3	112.6	512	5.5**	2815
AAC Blocks (600*200*250)mm^3	1779.57	32	112.12***	3629

References:

*Construction Trader
**http://promarket.in/p19286-fly-ash-bricks-star-flyash-bricks.html
***http://2.imimg.com/data2/GP/GN/MY-3495884/ultratech-xtralite-autoclaved-aerated-concrete-aac-block.pdf

From the above table 4.1 and table 4.2, we may conclude that use of Burnt Clay Bricks is the cheapest alternative and has been the prevailing practice. In the absence of the project activity, *i.e.* in the baseline scenario, it is expected that the burnt clay brick manufacturing using conventional technologies will continue to meet the walling material demand in the country resulting substantial CO_2 emissions.

As per the paragraph 14 point (b) 1st paragraph of the methodology, "For projects involving the installation of systems in a new facility or a capacity addition in an existing system, the average annual baseline fossil fuel consumption value and the baseline brick production rate shall be determined as that which would have been consumed and produced, respectively, under an appropriate baseline scenario."
As per the paragraph 14 point (b) 2nd paragraph of the methodology "If the baseline scenario identification as per paragraph 4 above (of the methodology) results in more than one alternative different technologies with different levels of energy consumption, the alternative with the least emissions intensity should be chosen for determining the baseline emissions of the facility."

Production of burnt clay bricks employs different technologies with different levels of coal consumption. However some technologies are not comparable and some are legally not acceptable. The brick manufacturing technologies were analyzed to determine the appropriate baseline selection for burnt clay brick manufacturing in line with General Guidelines for SSC CDM Methodologies, Version 19.0, Annex 27, EB 69 and 'Guidelines on the demonstration of additionality of small-scale project activities' Version 09.

The Guidelines for SSC CDM Methodologies requires PP to follow four Steps

Step 1: Identify the various alternatives available to the project proponent that deliver comparable levels of service, including the proposed project activity or PoA undertaken without being registered as a CDM project activity or PoA.

Bull's trench kilns (BTKs) and clamps are two prominent firing technologies used for brick making in India.

Table B.4.3: Identification of Various alternatives

Kiln type		Comments
*Typical production capacity range for Kiln Type: Clamps		0.05 – 1 (Million bricks per year)
Clamps are used for smaller production levels. A variety of fuels such as coal, firewood, various types of agricultural residues and dung cakes are used in clamps. Large variations are observed in the shape, size, stacking of bricks and firing techniques in clamps. Generally, energy efficiencies of clamps are lower.		
*Typical production capacity range for Kiln Type: BTK–Fixed chimney§		3 – 10 (Million bricks per year)
The BTK is a continuous type kiln and has higher production capacities. Coal is the main fuel used in BTKs, however a very small quantum of fuel wood.is also used in FC-BTK.. It also has better energy efficiency compared to clamps. FC BTK Accounts for more than 70% of total brick production in India. (Reference: Therefore, FC-BTK can be considered as a realistic baseline option. "Although there are many brick production technologies existent but almost all the brick kilns in entire Varanasi cluster are of the traditional coal fired fixed chimney Bull's Trench Kilns (BTK) type, with fixed natural draft chimneys except a few kilns which are operating using induced draft fans for better airflow in the firing/ cooling zone." - BEE, 2010, Detailed Project Report on Induced Draft Fan in Brick Industry, Brick SME Cluster, Varanasi, Uttar Pradesh (India), New Delhi: Bureau of Energy Efficiency; Detail Project Report No.: VRN/BRK/IDF/04.		
*Typical production capacity range for Kiln Type: BTK–Moving chimney		2– 8 (Million bricks per year)
Regulatory interventions in the form of stricter emission standards and non-approval of new MCBTKs have been made since 1990's in order to control the increasing pollution from the brick industry (http://www.cpcb.nic.in/standard8.htm). The regulatory intervention has been further strengthened with a Supreme Court ruling, which has banned the use of MCBTK nationwide.		
*Typical production capacity range for Kiln Type: High draft/zig-zag firing		3 – 5 (Million bricks per year)
HDKs are very limited in number (only 200) as they have not been widely accepted by brick entrepreneurs. One of the major considerations in operation of HDKs is the use of forced draught which is created using electrically operated fans. In view of the highly unreliable electricity supply situation in rural areas, the issue of reliable operation remained a high concern for brick entrepreneurs. Backup supply of electricity with captive sources is not financially viable. The entrepreneurs who earlier opted for this technology have already closed down their HDK plants.		
*Typical production capacity range for Kiln Type: Vertical shaft brick kiln (VSBK)		0.5 – 4 (Million bricks per year)
Regulatory authorities have been promoting VSBK technology since it is considered to be one of the efficient technologies amongst those available. VSBKs are very limited in number (only 100) as they have not been widely accepted by brick entrepreneurs due to several barriers. The commonly used clamp technology only requires a limited amount of working capital and capital investment. For instance, a brick unit using the clamp technology with an annual production capacity of 1.8 million bricks requires a capital		

investment of US$ 5,000. In contrast, the capital investment associated with a VSBK unit with an equivalent production capacity is about US$ 20,000, i.e. a cost increase of around 400%. Profitability in the brick business largely depends on the sales volume as the profit margin per brick is low. Given limited capital resources, the manufacturers generally prefer to increase production capacity by setting up a new plant in a new location over investing in cleaner and efficient technologies. The appreciation of energy saving and related savings in the operational cost continues to be low among the brick manufacturers. Given this reality, the brick manufacturers are unlikely to investing in the more costly VSBK technology..In March 2005, as a part of the Community Development C Fund, Technology and Action for Rural Advancement (TARA) was to facilitate installation of 100 VSBKs across 4 states. TARA was to provide the technology package and existing kiln owners the finance. Reference: CDCF Project: Vertical Shaft Brick Kiln Cluster Project.	
AAC Technology	450 CuM
This technology has been considered by the Project participant as the project activity. The project activity is an efficient brick manufacturing technology which entails lower CO_2 emissions, but has been found to be a low returns investment. Please refer to the Section B.5 Demonstration of additionality for further details.	

*Comprehensive industry document with emission standards, guidelines and stack height regulation for vertical shaft brick kilns (VSBK) viz-a-viz pollution control measures, COINDS/71/2007, CPCB, MoEF, May 2007.

Outcome: List of various alternatives available to PP

- Clamps Technology
- Fixed Chimney BTK Technology
- Moving Chimney BTK Technology
- Zig-Zag Firing /High Draft Kiln technology
- Vertical Shaft Brick Kiln technology
- AAC Technology undertaken without being registered as a CDM project activity

Step 2: List the alternatives identified in Step 1 that are in compliance with local regulations. If any of the identified baselines is not in compliance with local regulations, then exclude that alternative from further consideration).

As stated above the Moving Chimney BTK Technology is the only technology which has been banned by the regulatory bodies from operation. Therefore the following technologies are in compliance with local regulations and may not face regulatory hindrances for operation.

- Clamps Technology
- Fixed Chimney BTK Technology
- Zig-Zag Firing /High Draft Kiln technology
- Vertical Shaft Brick Kiln technology
- AAC Technology undertaken without being registered as a CDM project activity

Step 3: Eliminate and rank the alternatives identified in Step 2 taking into account barrier tests specified in the "Guidelines on the demonstration of additionality of small-scale 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.

Table B.4.4: Barrier Analysis

Technology	Barrier
AAC Technology undertaken without being registered as a CDM project activity	Yes; Investment Barrier: As per the Investment Analysis conducted in Section B.5 Demonstration of Additionality '**The project activity has lower returns than the benchmark returns calculated at the time of investment decision.** Even the 10% increase in the important parameters that affects the returns on the project does not make project financially viable in the absence of the CDM revenue. Thus, the CDM revenue is critical for the financial viability of the project activity'. **Therefore ACC technology cannot be considered as the baseline scenario.**
Zig-Zag Firing /High Draft Kiln technology	Yes; Technological Barrier: One of the major considerations in operation of HDKs is the use of forced draught which is created using electrically operated fans. In view of the highly unreliable electricity supply situation in rural areas, the issue of reliable operation remained a high concern for brick entrepreneurs. Backup supply of electricity with captive sources is not financially viable. The entrepreneurs who earlier opted for this technology have already closed down their HDK plants, which have lead to low production. As stated in Table B.4.5 below HDK has very low production contribution in the Indian Brick Sector – it is a meager 0.2% of the total production. **Therefore HDK technology cannot be considered as the baseline scenario**
Vertical Shaft Brick Kiln technology	Yes; Barrier due to prevailing practice; as stated in Table B.4.5 below **VSBK has very low production contribution in the Indian Brick Sector – it is a meager 0.1% of the total production** and the technology faces barriers since it is not a prevailing practice; Further technology diffusion is a very slow process taking several decades in the brick industry sector. The generally observed slow rate of diffusion of technology in the brick industry is mainly attributed to the following factors: • conservative nature of the industry; • absence of scientific innovation and a general lack of requisite technical and managerial capability to handle new technology; • lack of in-house R&D; • poor information dissemination in the industry; • lack of government support for technology development and dissemination, and • poor access to institutional finance. .In fact VSBK technology in India has been conceptualized as CDM project activity due to the these barriers it faces. Please refer to Project 0582 : India - Vertical Shaft Brick Kiln

	Cluster Project - http://cdm.unfccc.int/Projects/DB/DNV-CUK1157015776.99/view for further details **Therefore VSBK technology cannot be considered as the baseline scenario**
Clamps Technology	No; As stated in Table B.4.5 below **Clamps Technology has a nominal production contribution in the Indian Brick Sector – it is around 8.8% of the total production. Therefore Clamp technology may be considered as the baseline scenario**
Fixed Chimney BTK Technology	No; As stated in Table B.4.3 below **FC-BTK has a major production contribution in the Indian Brick Sector – it comprises of 90.9% of the total production. Therefore FC-BTK technology may be considered as the baseline scenario**

Production Contributions and technology penetration were analyzed to further substantiate the barriers faced by some technology and identify the baseline scenarios.
Typical lower and higher range of production capacity for the 4 technologies (Clamps, FC-BTK, Zig-zag firing and VSBK) were extracted from "Comprehensive industry document with emission standards, guidelines and stack height regulation for vertical shaft brick kilns (VSBK) viz-a-viz pollution control measures, COINDS/71/2007, CPCB, MoEF, May 2007." Average production capacity of that of the lower and upper range was calculated for the 4 technologies. The latest data on the number of existing kilns for each technology type was collated from a letter written by Indian brick association to finance minister (www.brick-india.com/images/finace-minister.jpg) and CDCF Project: Vertical Shaft Brick Kiln Cluster Project. Total Annual Production Rate for each technology type was determined as the product of average production range, number of kilns for each technology type and the standard volume of brick as presented in the table B.4.5 below.

Table B.4.5 –provides the Annual Production Rate of brick production.

Kiln type	Typical production capacity range (Million bricks per year)*			Kilns	Total Production	Volume of brick****	Total production	Production %
	Lower Range (l)	Higher Range (h)	Average (l+h)/2	Number (n)	Million bricks (l+h)/2*n	m^3 (v)	m^{3}/year (l+h)/2*n*v	
Clamps	0.05	1	0.525	60000**	31500	0.0015	4847850	8.8%
FC BTK	3	10	6.5	50000**	325000	0.0015	50017500	90.9%
Zig-zag firing	3	5	4.5	200	900	0.0015	13851	0.2%
VSBK	0.5	4	2,25	100***	225	0.0015	34627.5	0.1%
AAC	Data	Not	Available					

* Reference: Table 1.1 of the survey report of "Comprehensive Industry Document with Emission Standards, Guidelines and Stack Height regulation for Vertical Shaft Brick Kilns(VSBK) vis-à-vis Pollution Control Measures" by Central Pollution Control Board minister of Environment & Forest at May 2007
** Reference: Letter written by Indian brick association to finance minister (www.brick-india.com/images/finace-minister.jpg)
*** Reference: CDCF Project: Vertical Shaft Brick Kiln Cluster Project
**** Reference: Indian Standard for Specification for Heavy duty Burnt clay Building Bricks (Third Version)

Therefore as per the above analysis Clamps Technology and FC-BTK face no barriers and the Clamp technology production contribution is 8.8% and FC-BTK technology's production contribution is 90.9%. However both these technologies have been considered as probable baseline scenarios

However, as per the paragraph 14 point (b) of the methodology "If the baseline scenario identification as per paragraph 4 (of the methodology) above results in more than one alternative different technologies with different levels of energy consumption, the alternative with the least emissions intensity should be chosen for determining the baseline emissions of the facility."

The two energy consumption performance of both Clamps Technology and FC-BTK Technology were collated in Table B.4.6

Kiln Type	Energy consumption (MJ/kg of brick)			Specific Coal Consumption (kg Coal/kg brick)	Specific Coal Consumption (kg Coal/m3 brick)
	Lower Range	Upper Range	Average		
Clamps**	2	4.5	3.25	0.125968992	314.9224806
FC BTK*	1.1	2	1.55	0.060077519	150.1937984

It may be noted that the Specific Coal Consumption for Clamps Technology is higher than the Specific coal consumption for FC-BTK Technology. Therefore in line with the guidance provided in the methodology 14(b), the FC-BTK Technology has been chosen as the baseline scenario for determining the baseline emissions of the facility ***since this alternative has the least emission intensity***.

Further as per the paragraph 14 point (b) of the methodology, "For projects involving the installation of systems in a new facility or a capacity addition in an existing system, the **average annual baseline fossil fuel consumption value** and the baseline brick production rate shall be determined as that which would have been consumed and produced, respectively, under an appropriate baseline scenario."

The average annual baseline specific coal consumption for BTK-FC was determined by considering

- The average specific energy consumption (calculated as average of the lower and upper range of energy consumption for FC-BTK technology type), as presented in the table B.4.7 below.
- Net Calorific Value of Coal of 25.8 MJ/t (Reference: Table 1.2 of Chapter 1 "2006 IPCC Guidelines for National Greenhouse Gas Inventories" and
- Standard volume of brick of .0015m3 (190mm*90mm*90mm; Reference: Indian Standard for Specification for Heavy duty Burnt clay Building Bricks (Third Version)) as presented in the table B.4.4 below.
-

Table B.4.7: Baseline Specific Coal consumption and annual production specific emission factor Basis:

Kiln Type	Energy consumption (MJ/kg of brick)			Specific Coal Consumption (kgCoal/kg brick)	Specific Coal Consumption (kgCoal/m3 brick)
	Lower Range	Upper Range	Avg		
FC BTK*	1.1	2	1.55	0.060077519	150.1937984
* Energy Consumption for FC BTK: Reference: Development of Standards and Guidelines, Parivesh, CPCB					

Weighted average Specific coal consumption, kg/m^3 = 150.1937984
Specific heat consumption, MJ/m^3 = 25.8 x 150.1937984= 3875 MJ/ m^3
Emission Factor of Coal, tCO_2/MJ - 25.8 x 44/12 /10^6 = 0.0000946
Annual production specific emission factor, tCO_2/m^3 = 3875 x 0.0000946
Therefore Annual production specific emission factor = 0.366575 tCO_2/m^3

Emission Factor per CuM	TCO_2/m^3	0.366575
Biomass adjustment factor	%	2%
Emission Factor per CuM post adjustment of Biomass use	TCO_2/m^3	0.3592435

Coal is the main source of energy used for manufacturing burnt clay bricks in India. The second choice of fuel is biomass, including fuel wood. In one of the studies undertaken by the FAO[11] the annual use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tons, while the use of coal is reported to be about 14,000,000 tons. Thus use of fuel wood represents less than 2% in terms of energy inputs of the total energy requirement of the brick industry in all of India. Since the values reported in the FAO report do not distinguish between the renewable biomass and non-renewable biomass, the actual fraction of renewable biomass (with zero emissions) is likely to be lower. Further the situation with biomass, which was earlier available as a cheaper fuel, is changing rapidly nationwide. The ongoing initiatives for biomass-based power plants have introduced competition in the market, increasing the cost of biomass. In the absence of any precise information on the use of biomass in brick industry, it is proposed to fix the biomass usage in brick production conservatively at 2% of the total energy input. In order to account for the zero emissions from the use of biomass, the emissions in burnt clay brick production is adjusted appropriately by multiplying it with a "biomass adjustment factor" (0.98 = 1 - 0.02). The baseline emission thus derived would be conservative..

[11] Source: FAO Field Document No. 35, "Regional Wood Energy Development Programme in Asia", GCP/RAS/154/NET.

B.5. Demonstration of additionality:
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The Project's additionality should be demonstrated and assessed using the latest version of "Tool for the demonstration and assessment of additionality".

The following steps from the additionality tool have been presented below:

STEP 1 – Identification of alternatives to the project activity consistent with current laws and regulations
STEP 2 – Investment analysis
STEP 3 – Barriers analysis
STEP 4 – Common practice analysis

Step1. Identification of alternatives to the project activity consistent with current laws and regulations
As per the approved methodology, the project proponent have identified the above mentioned realistic and credible alternative(s) that were available to them and that would provide output and services comparable to the project activity (refer section B.4).These alternatives are in compliance with all applicable legal and regulatory requirements.
Step2. Investment analysis

The tool requires project proponent to
-Determine whether the proposed project activity is not:
(a) The most economically or financially attractive; or
(b) Economically or financially feasible, without the revenue from the sale of certified emission reductions (CERs).
To conduct the investment analysis, used the following sub-steps:

Sub-step 2a. Determine appropriate analysis method
In the "Tool for the demonstration and assessment of additionality" (Version 06.1.0), three options are available for investment analysis: the simple cost analysis (Option I), the investment comparison analysis (Option II) and the benchmark analysis (Option III).

Option I - Simple Cost Analysis - Since the Project will receive additional revenues from the sale of AAC blocks &panels obtained as output, the simple cost analysis is not applicable.

a) **Option II - Investment Comparison Analysis** –The Analysis is based on the comparison of returns of the project investment with the investment required for an alternative to the project. In this case, none of the credible alternatives to the CDM project activity involve investments and returns that could be compared to the project. The project activity service output - AAC Blocks will be replacing the burnt clay bricks and entail reduction in coal consumption and its associated CO_2 emissions. However the investments involved in project activity are much higher than that of the burnt clay bricks. Therefore the two investments are not comparable. Further it may also be noted that burnt clay brick manufacturing projects are small capacity projects (75-1500 m3/annum) but the project activity is a large capacity project (1,20,285-2,53,935 m3/annum). The project capacity difference establishes the fact that they are non-comparable. Therefore investment comparison analysis approach was not found appropriate; benchmark analysis was adopted to assess the project's financial capability. Therefore, Option-II is also not applicable to this project.

According to the Additionality Tool, if the alternative to the CDM project activity does not include investments of comparable scale to the project, then Option III must be used.

Given that the project developer does not have alternative and comparable investment choices, benchmark analysis (**Option III**) is more appropriate than investment comparison analysis (Option II) for assessing the financial attractiveness of the project activity.
References: http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

Sub-step 2b: Option III: Apply benchmark analysis
The project IRR is chosen as the relevant indicator for the project activity. As stipulated in the "*Tool for the demonstration and assessment of additionality*" version 06.1.0.
According to para 12, of EB 62, Annex 5, "*In cases where a benchmark approach is used the applied benchmark shall be appropriate to the type of IRR calculated. Local commercial lending rates or weighted average costs of capital (WACC) are appropriate benchmarks for a project IRR.*"
The likelihood of development of this project, as opposed to continuation of its baseline has been assessed by calculating its IRR and viewing it in the light of the benchmark set at local commercial lending rate. Hence, the project investment would be considered financially attractive if the Project IRR is above the benchmark interest rate at which the funding may be expected *i.e.* 13%, so that the project is capable of servicing the Project Debt.

Table B.5.1: Calculation and comparison of financial indicators

Description	Benchmark	Project IRR Without CDM
M/s UAL INDUSTRIES LTD.	13%	7.86%

As evident the IRR of project is lower than the benchmark rate. However, with the additional revenue from sale of carbon credits from CDM, the IRR increases. This clearly indicates that an investment barrier exists in the project implementation and the project is unattractive compared to the interest rates, which is overcome through the Clean Development Mechanism.

Sub-step 2c: Calculation and comparison of financial indicators
The project participant provides herein the list of assumptions that were considered to conduct the investment analysis in at the time of investment decision in the Board Meeting held on 15th June 2011.

Table B.5.2: Assumptions for Financial Analysis

Assumptions supporting Financial Projections	Unit	Amount	Escalation per year[12]	Sources
Installed Plant capacity	Cum/Day	1st Year= 450 Cum & 2nd Year onwards= 900 Cum.	100% in the 2nd year	Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE dated 10th June 2011. This document was submitted to the Bank for consideration for funding Reference: Bank Acknowledgement receipt for the same dated at 15th July 2011.
Operating days per annum	Days/annu	300		Project Concept Report of

[12] Data derived from Wholesale Price Index for the FY 1994-95 to 2009-10
Link:http://eaindustry.nic.in/Download_Data_0405.html

	m			AAC Block/Panel manufacturing Project by UAL Kon- CRETE
Capacity utilization	%	90	5% upto a maximum of 95%[13]	Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE
Rejection %	%	1		Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE
Fly ash Consumption	MT	33048		Proposal from HESS AAC SYSTEM B.V., Annex-II for Standard raw material specification & Consumption values.
Cement Consumption	MT	11543		
Lime Consumption	MT	8627		
Aluminium powder Consumption	MT	56		
Gypsum Consumption	MT	1458		
Consumption of Electricity for production process.	kWh/Cum	11	-	CESU & DG Power Units Required (KWH) (unit) per CuM ; Proposal from HESS AAC SYSTEM B.V., Annex-II for Standard raw material specification & Consumption values.
Consumption of fuel(Fuel Oil) for production process	Litre/Cum	8	-	Fuel oil consumption; Technical proposal from HESS Group for Furnace Oil Consumption in AAC Block manufacturing process (Secondary Evidence) ,Proposal from HESS AAC SYSTEM B.V., Annex-II for Standard raw material specification & Consumption values (Primary Evidence)
Selling Price of the finished goods in 2013-14 - It may be noted that at the time of decision making, IMRB International conducted a survey and their report dated 16th	INR Rs./Cum	3800	5.26%	Sale Price of Finished Goods: Board Resolution-Minutes of meeting of board of Directors of UAL

[13] The PP has considered a 5% annual increase in capacity utilization with a maximum capacity utilization cap of 95%..In the 1st year of operation it is expected that the Capacity Utilization or Plant Load Factor will be 90%. 2nd year onwards the capacity utilization or plant load factor is expected to be 95%. due to streamlined operations. Phase I:450CuM will be implemented in Year 1 with 90% PLF; In the 2nd year another Phase II:450CuM capacity will be implemented – therefore in 2nd Phase I will operate at 95% capacity utilization whereas Phase II will operate at 90% capacity utilization since it will be its 1st year of operation. From 3rd year onwards both Phase I & II would operate at 95%. These computations were a part of the Project Concept Report which was submitted to the bank.

Feb 2011, stated the optimum price of the AAC block was Rs.2250 per CuM. 42% of the total builders showed interest in using AAC Blocks for their future projects – of these 42%, 68% mentioned to use it at Rs 2250, thus if we look at the overall builder segment around 28% would be willing to use this product at the price of Rs. 2250/per cubic meter. Similarly 10% of the total builders would be willing to use it at Rs 3500/per cubic meter. However with such low prices as Rs 2250-3500 per CuM, the project feasibility was found to be very poor. Therefore the UAL board set a target sale price of Rs3800 per CuM so that the project may be considered for investment. It is worthwhile to note that the sale price set is 9% higher than the highest price attainable and 69% higher than the optimum price of Rs 2250 per CuM.				Industries Limited held on 15.06.2011. IMRB International report dated 16th Feb 2011.
Cost of fly ash in 2010-11	INRRs/ton	212	0%	Fly ash cost ;Proposal from A.I. Enterprise dated at 05.06.2011 ;
Cost of Cement in 2010-11	INR Rs./ton	4115	4.69%	Cement cost; Proposal from Ultratech Cement Ltd dated 29.05.2011
Cost of Lime in 2010-11	INR-Million/ton	4080	-4.17%	Lime cost; Proposal from Niki Chemical Industries dated at 28 .04.2011
Cost of Aluminium powder in 2010-11	INR-Rs./ton	218985	4.64%	Aluminium Cost; Proposal from THE ARASAN ALUMINUM INDUSTRIES PVT. LTD. Dated at 14.03.2011
Cost of Gypsum in 2010-11	INR-Rs./ton	3369	4.63%	Gypsum cost; Proposal from Tanfac Industries Limited dated at 29.03.2011
Furnace oil price in 2010-11	INR-Rs./litre	29	11.30%	Fuel Oil Price; Source from MCX for the statistical analysis for the estimation of the fuel oil price.
DG fuel Price in 2010-11	INR-	9.467	10.37%	CESU & DG Power

	Rs/litre			Units Required (KWH) (unit) per CuM ; Proposal from HESS AAC SYSTEM B.V., Annex-II for Standard raw material specification & Consumption values
Transportation cost of finished goods in 2010-11	INR-Rs./Ton	739.66	10.37%	Transportation cost of Finished goods ;Freight Details provided by Pragati Carrier for the month May 2011 dated at 01.06.2011
Fly ash Transportation in 2010-11	INR-Rs./Ton	192.6	10.37%	Fly ash cost ;Proposal from A.I. Enterprise dated at 05.06.2011 ;
Cement Transportation in 2010-11	INR-Rs./Ton	129	10.37%	Cement cost; Proposal from Ultratech Cement Ltd dated 29.05.2011
Lime Transportation in 2010-11	INR-Rs./Ton	3488	10.37%	Lime cost; Proposal from Niki Chemical Industries dated at 28 .04.2011
Gypsum Transportation in 2010-11	INR-Rs./Ton	3488	10.37%	Gypsum cost; Proposal from Tanfac Industries Limited dated at 29.03.2011
Aluminium Powder Transportation in 2010-11	INR-Rs./Ton	5129	10.37%	Aluminium Cost; Proposal from THE ARASAN ALUMINUM INDUSTRIES PVT. LTD. Dated at 14.03.2011
Salary and wages in 2010-11	INR-Rs./Cum	132	5.26%	Salary and wages ; Sheet for salary & wages detail provided by the project proponent
Tariff of Electricity in 2010-11	INR-Rs./kWh	5.8	5.55%	Electricity & DG Fuel Cost; Statement for cost of the power consumption from Grid & D.G for the period of 2010-11 dated between June-May 2011.
Tariff rate of electricity purchased from grid in 2013-14	INR Rs./kWh	6.8	-	Calculated; 5.55% escalation per year of Average unit charge (Rs./ Kwh) of June-May 2011
CESU power contribution		0.844	-	Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE along with the Bank Acknowledgement receipt for the same dated

				at 15th July 2011.
CESU cost per Cum	INR -Rs	63.31	-	Calculated
DG power contribution		0.156		Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE along with the Bank Acknowledgement receipt for the same dated at 15th July 2011.
Total DG cost per Cum	INR- Rs.	21.84		Calculated; DG Units Required (KWH) (unit) per CuM*Cost/KWH (Rs.) of DG* DG power assumed to be used
Total fuel cost per Cum in 2013-14	INR- Rs.	405.03	-	Calculated; Total CESU Cost per CuM+Total DG Cost per CuM+ Total fuel Cost per CuM
Cost of stores and consumable in 2013-14	INR-Rs./Cum	120.37	-	Hess Proposal for commissioning spare parts dated at 24th May 2011.
Advertising expenses in 2013-14	% of sale value	2%		Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE along with the Bank Acknowledgement receipt for the same dated at 15th July 2011.
General administrative expenses in 2013-14	INR-Rs./Cum	88.89		Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE along with the Bank Acknowledgement receipt for the same dated at 15th July 2011.
Repair & maintenance Cost in 2013-14	INR – Rs./Cum	88.56		UAL financial sheet
Interest Rate in 2013-14	%	13		Previous Bank agreement for loan sanction
Moratorium Period	Years	2		Previous Bank agreement for loan sanction
Total No. of Instalment	Nos.	24		Previous Bank agreement for loan sanction
Depreciation on Civil work	%	3.34%		Depreciation ; Rate of Depreciation as per Company Act 1956
Depreciation on plant & machinery	%	10.34%		Depreciation ; Rate of Depreciation as per

				Company Act 1956
Depreciation on Building & Civil –IT Act	%	10%		Depreciation; Rate of Depreciation as per income Tax Act effective from assessment year 2006-07
Depreciation on plant & machinery –IT Act	%	15%		Depreciation; Rate of Depreciation as per income Tax Act effective from assessment year 2006-07
Income Tax	%	33		http://www.simpletaxindia.net/2011/11/income-tax-rate-chart-slab-fy-11-12-ay.html
MAT Rate	%	18		http://catuts.com/minimum-alternate-tax-mat/
Salvage Value	INR-Million	106		Calculated.
Project Cost:				
Plant & Machinery	INR-Million	499		HESS Machinery; Hess Proposal for AAC Plant project KBT with ref No: A30.04496 ref 5. dated at 16.03.2011 & Plant & Machinery Break Up; Budget Quotation from Masa for UAL Industries Limited dated at 21.02.2011
Erection–Mechanical & Electrical	INR-Million	39.16		Erection - Mechanical & Electrical ;Proposal of Consultant Consortium dated at 11.05.2011
Factory Building	INR-Million	103		Factory Building Break up ; Proposal of Atlas Construction Co. dated at 09.05.2011
Land & land Development cost	INR-Million	65.13		Land Cost; Project Concept Report; Cost estimation from Atlas Construction Co. (As Secondary evidence).
Total project cost	INR-Million	834.187		Project Concept Report of AAC Block/Panel manufacturing Project by UAL Kon- CRETE along with the Bank Acknowledgement receipt for the same dated at 15th July 2011.
Debt amount	INR-Million	494.019		
Equity amount	INR-Million	340.167		
IRR without CDM revenue	%	**7.86%**		**Calculated**

Low return on Investment

An investment analysis of the project activity was conducted based on the above mentioned assumptions considering the Project IRR (post-tax) as the most suitable financial indicator. IRR is the most common financial indicator used by bankers as well as investors to check the financial viability of the project. The Project IRR (post-tax) has been computed over a period of 20 years by taking into account the cash outflows (capital investment in the project) and cash inflows comprising profit after tax, depreciation, interest on term loan and salvage value (in the terminal year).
The IRR for the project was determined at 7.86% and the same is lower than the benchmark of 13%.

Sub-step 2d: Sensitivity analysis:
The purpose of sensitivity analysis is to examine whether the conclusion regarding the financial viability of the proposed project is sound and tenable with those reasonable variations in the critical assumptions. The Investment analysis provides a valid argument in favour of additionality only if it consistently supports (for realistic range of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive (as per Step 2c, para11b of the methodological tool "Tool for the demonstration and assessment of additionality") or is unlikely to be financially attractive(as per Step 2c,para11b of the methodological tool "Tool for the demonstration and assessment of additionality").

Thus, a sensitivity analysis was also applied to the IRR calculations to measure the impact, positive or negative, of changes in the indicated parameters. The project proponent has chosen the following factors as critical to the operations of the project and would impact the project IRR. These above factors were subjected to 10% variation on either side, based on "Guidelines on the Assessment of Investment Analysis, Version 05",Annex- 05 of EB- 62, to ascertain the impact on the profitability and hence the IRR of the project. The results of the sensitivity analysis are as given below:

Parameter	**Resulting IRR**		
	Base case	**Increase by 10%**	**Decrease by 10%**
Capacity utilization	7.86%	10.95%	Negative
Comments		The project IRR<Benchmark	The project IRR<Benchmark
Project cost	7.86 %	Negative	12.49%
		The project IRR<Benchmark	The project IRR<Benchmark
Sale Price of Finished Goods	7.86%	22.90%	Negative
		The project IRR>Benchmark however this scenario is not probable.	The project IRR<Benchmark
Cost of Repair & Maintenance	7.86%	Negative	8.97%
		The project IRR< Benchmark	The project IRR<Benchmark

It may be noted that a 10% increase or decrease in capacity utilization or project costs result in Project IRR which are below the stipulated benchmark.
With a 10% increase in sale price of finished goods the project IRR falls above the stipulated benchmark. However increase in Sale price of finished goods by 10% is a non-probable scenario. It may be noted that at the time of decision making, IMRB International conducted a survey and their report dated 16th Feb 2011, stated the optimum price of the AAC block was Rs.2250 per CuM. 42% of the total builders showed interest in using AAC Blocks for their future projects – of these 42%, 68% mentioned to use it at Rs 2250, thus if we look at the overall builder segment around 28% (68%*42%) would be willing to use

this product at the price of Rs. 2250/per cubic meter. Similarly 10% of the total builders (42%*25%) would be willing to use it at Rs 3500/per cubic meter.
However with such low prices as Rs 2250-3500 per CuM, the project feasibility was found to be very poor. Therefore the UAL board set a target sale price of Rs 3800 per CuM so that the project may be considered for investment. It is worthwhile to note that the sale price set is 9% higher than the highest price attainable and 69% higher than the optimum price of Rs 2250 per CuM. With a 10% increase in the highest sale price attainable as per the IMRB Report i.e. 3500, the Project IRR is 12.68% which is lower than the benchmark of 13%. Further it may be noted that the sale price has been escalated in line with the inflation rates. Therefore further sensitivity on the sale price of finished goods was not found to be appropriate.

Parameter	Base Case: 7.86%; Benchmark: 13%		
	Variation at which IRR will be equal/breach the benchmark	**IRR**	**Comments**
Capacity utilization	10%	10.95%	Since capacity utilization factor range can be 90-95% no further change in Project IRR with any further increase in variation.
Project cost	-12%	13.24%	Reduction in Project Cost by 12% is a non-probable scenario. Latest project cost estimates re-affirm that the project costs have increased from the date of decision making.
Sale Price of finished Goods	2%	14.04%	Increase of 2% of the sale price of finished goods is a non-probable scenario because as stated above, the sale price value assumed herein is 69% above the optimum sale price and 9% above the highest sale price expected.
Cost of Repair & Maintenance	-89%	13.02%	Reduction in Cost of Repair & maintenance by 89% is a non-probable scenario.

Further the following parameters were considered but found to constitute less than 20% of the project costs and project revenue. Therefore these parameters were not subject to variations.

Parameter	Value	% Variation with Project Cost	% Variation with Project Revenue
Project Cost	8342	x	
Sales Value	9890	x	
Total Flyash Cost (Lakh INR)	338	4%	3%
Total Lime Cost	1528	18%	15%
Total Cement Cost	1218	15%	12%
Total Gypsum Cost	276	3%	3%
Total Aluminium Cost	310	4%	3%
Total Cost of Power and Fuel	1114	13%	11%
Total Salary & Administration Cost (INR)	637	8%	6%
Total Transportation Cost	1357	16%	14%
Total Packaging Cost	275	3%	3%
Total Advertising Cost	198	2%	2%

Thus, the sensitivity analysis reveals that even with significant changes in various parameters, the project IRR does not cross benchmark rate. Therefore, the project is additional and is not a business – as – usual Scenario. The project can become financially attractive only with the CDM benefit.

The project activity has lower returns than the benchmark returns calculated at the time of investment decision. Even the 10% increase in the important parameters that affects the returns on the project does not make project financially viable in the absence of the CDM revenue. Thus, the CDM revenue is critical for the financial viability of the project activity.
In view of the above it is concluded that CDM project activity is unlikely to be the most financially attractive proposition.

CDM Consideration
As per the requirement of EB 48, Annex 61; for project activities with a starting date on or after 02 August 2008, the project participant must inform a Host Party DNA and the UNFCCC secretariat in writing of the commencement of the project activity and of their intention to seek CDM status. Such notification must be made within six months of the project activity start date and shall contain the precise geographical location and a brief description of the proposed project activity, using the standardized form F-CDM Prior Consideration.
A duly filled Prior Consideration Form has thus been sent to UNFCCC and host country DNA (Ministry of Environment and Forests, MoEF)[14]. The start date of the project activity is 28th July 2011 [15], date on which first work order was issued for the project while prior consideration form was submitted to UNFCCC and MoEF (Host Country DNA) on 17 the January 2012, i.e., within a period of six months from start date.

B.6. Emission reductions
B.6.1. Explanation of methodological choices
>>Methodology Applied: AMSIIIZ. "*Fuel Switch, process improvement and energy efficiency in brick manufacture*"
Link;
http://cdm.unfccc.int/filestorage/R/H/E/RHEASNU01VILTFY6ZG7W3XDKOCBM59/EB67_repan21_Revisionof%20AMS-III.Z_ver04.0.pdf?t=Snp8bWV4NHNlfDAkmUBMd0ZaBlU9IrotCghV
Version 4.0
Valid from 25th May 2012 onwards
Applied Methodological Tool:
1."Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" Version 02, Annex 11, EB 41.
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf
2."Tool to calculate baseline, project and/or leakage emissions from electricity consumption", Version 01,Annex 7,EB 39.
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf
3. "Tool for the demonstration and assessment of additionality"", Version (06.1.0), (EB 69)
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.1.0.pdf
4. "Guidelines on the Assessment of Investment Analysis, Version 05"
http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

Emission reduction:
Emission reduction as the result of the project activity is calculated using the following equation:

[14] Prior consideration sent to UNFCCC & NCDMA
[15] Work Order dated 28th July 2011 issued by UAL –Kon_CRETE to HESS AAC System B.V for the supply of Plant and machinery and technical documentation for the autoclaved aerated concrete plant project.

$ER_y = BE_y - PE_y - LE_y$ (1)

Where,

ER_y	Emission reduction in year y (tCO_2e/yr)
BE_y	Baseline emission in year y (tCO_2e/yr)
PE_y	Project emissions in year y (tCO_2/yr)
LE_y	Leakage emissions in year y (tCO_2/yr)

As per the approved methodology the emission associated with baseline, project and the leakage are calculated as below in series:

Baseline Emission:

"*The baseline emissions are the fossil fuel consumption related emissions (fossil fuel consumed multiplied by an emissions factor) associated with the system(s), which were or would have otherwise been used, in the brick production facility (ies) in the absence of the project activity.*"

As per Section B.4 of the PDD, the baseline to the project activity is – Production of equivalent baked clay bricks with the FC-BTK technology. For clay brick production process the baseline emissions can be calculated as below:

$BE_y = EF_{BL} \times P_{PJ,y}$ (2)

Where,

BE_y	The annual baseline emission from fossil fuels displaced by the project activity in tCO_2e in year y (of the crediting period).
EF_{BL}	The annual production specific emission factor for year y, in tCO_2/Kg or m^3.
$P_{PJ,y}$	The annual net production of the facility in year y, in kg or m^3.

As per the methodology, paragraph 17, "*Annual production specific emission factor (EF_{BL}) for installation of systems in a new facility or for capacity addition in an existing system shall be determined using one of the options below:*
(a) Using manufacturers' specifications such as for brick production rate, energy consumption in the process;
(b) Using specifications of comparable units having similar techno-economic parameters;
(c) Using reference plant approach"

In the project activity scenario annual production specific emission factor for installation of systems in a new facility is determined using option (b) as stated above.
Indian Brick Industry falls under the unorganized small and medium enterprise category, wherein the economic considerations are comparable.
It may further be noted that annual production specific emission factor for the baseline has been estimated for FC-BTK technology based units operational in India with comparable production capacity in the range of 15,000-50,000 bricks per day, same technology, similar regulatory environment throughout the country and comparable economic parameters. However, the specific energy consumption in BTKs depends on the operation practices, clay characteristics, quality of the product, fuel used, local climatic conditions etc. The specific energy consumption varies between 1.1 MJ per kg to 2.0 MJ per kg of fired bricks. Therefore as per 14(b) average annual baseline fossil fuel consumption value is determined for computation of annual production specific emission factor based on average specific energy consumption in BTK operational in India, net calorific value of coal and biomass adjustment factor.
Coal is the fossil fuel, which are generally used in the traditional brick manufacturing. j is the fuel type considered in the baseline scenario is with 98% Coal with 2% Biomass used as the adjustment factor as detailed out in the section B.4

Leakage Emissions:

As per the paragraph. 18 & 19 of the methodology,,

"*Leakage emissions on account of the diversion of biomass from other uses (competing uses) shall be calculated as per "General guidance on leakage in biomass project activities".*

"*In the case of project activities involving change in production process or a change in type and quantity or raw and /or additive materials as compared with the baseline, the incremental emissions associated with the production/ consumption and transport of those raw materials consumed as compared to baseline, shall be calculated as leakage."*

As per the methodology, the project activity entails two types of leakage due to change in production process which leads to change in type and quantity of raw and/or additive materials as compared to baseline

- Emissions associated with consumption of raw and/or additive materials
- Emissions associated with transportation of raw and/or additive materials

The applicable equation is as below for calculating the leakage emission:

$LE_y = LE_{rm,prod,y} + LE_{TR,m}$ (4)

Where,

LE_y	Leakage emissions associated with consumption and transport of raw and/or additive materials in the year y.
$LE_{rm,prod,y}$	Leakage emissions associated with consumption of raw and/or additive materials in the year y
$LE_{TR,m}$	Leakage emission associated with transportation of raw and/or additive materials in the year y

<u>Leakage emission associated with consumption of raw and/or additive materials:</u>

Aluminium Powder & Gypsum are used for the production of AAC block at very lower amount. In this project cement and lime are two major inputs with significant emissions during their production; the fraction of the contribution of Aluminium Powder & Gypsum in per Cum AAC Block production is very lower. However the Leakage due to the Allumium Powder production has been considered as a conservative approach.

On the other hand, the Gypsum is a by product from hydrofluoric acid and fertiliser industries which is available commercially in the market..Thus it needs not to be considered in the leakage computation.

$LE_{rm,prod,y} = Q_{cement,y} \times EF_{cement} + Q_{lime,y} \times EF_{lime} + Q_{Aluminium,,y} \times EF_{Aluminium}$ (5)

where,

$LE_{rm,prod,y}$	Leakage emissions associated with consumption of raw and/or additive materials in the year y
$Q_{cement,y}$	Quantity of cement consumed for the production of AAC blocks/panels in the year y.
EF_{cement}	CO_2 emission factor of the cement production.
$Q_{lime,y}$	Quantity of lime consumed for the production of AAC blocks/panels in the year y.
EF_{lime}	CO_2 emission factor of the lime production.
$Q_{Aluminium,y}$	Quantity of Aluminium Powder consumed for the production of AAC blocks/panels in the year y.
$EF_{Aluminium}$	CO_2 emission factor of the Aluminium production.

Leakage emission due to raw material transportation:

As per the methodological tool "Project and leakage emissions from road transportation of freight" Version 01 the emissions due to the raw material transportation can be calculated as below:
$LE_{TR,m} = \sum D_{fm} x F_{Rf,m} x EF_{CO2,f}\, x 10^{-6}$ (6)

Where,

$LE_{TR,m}$	Leakage emission from road transportation of freight monitoring period m ($tC0_2$).
D_{fm}	Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m (km).
$F_{Rf,m}$	Total mass of freight transported in freight transportation activity f in monitoring period m (t).
$EF_{CO2,f}$	Default CO_2 emission factor for freight transportation activity f (g CO_2 / t km).
f	Freight transportation activities conducted in the project activity in monitoring period m

Project emission:
As per approved methodology project activity emissions (PE_y) consist of those emissions associated with the use of electricity from grid and fossil fuel (nd Fuel oil).The emission during the project activity can be calculated in accordance with the "Tool to calculate baseline, project and /or leakage emissions from electricity consumption", "Tool to calculate the emission factor for an electricity system"[16], version 2.2.1 and "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" (tCO_2e).

The project activity will consume

- **Fossil fuel (Fuel Oil) for its high-pressure steam-curing operations** and the associated project emissions will be computed in line with the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion".
- **Electricity for its operations**, which will primarily be sourced from grid with a standby option from Diesel Generator Set; and the associated project emissions, will be computed in line with the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" and

Therefore as per eq.20 of applied methodology;

The project emissions should be calculated as follows:

$$PE_y = PE_{elec,y} + PE_{fossilfuel,y} + PE_{transport y} + PE_{cultivation,y} + PE_{CH4,y} \quad \textbf{(7)}$$

Where:

PE_y	Project emissions in year y (tCO_2)
$PE_{elec,y}$	Project emissions due to electricity consumption in year y (tCO_2)
$PE_{fossilfuel,y}$	Project emissions due to fossil fuel consumption in year y (tCO_2)

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

$PE_{transport y}$	Project emissions from transportation of the renewable biomass from the places of their origin to the manufacturing facility site in year *y* (tCO_2)
$PE_{cultivation,y}$	Project emissions from renewable biomass cultivation in year *y* (tCO_2e)
$PE_{CH4,y}$	Project emissions due to the production of charcoal in kilns not equipped with a methane recovery and destruction facility in year *y* (tCO_2e)

Calculation of $PE_{elec,y}$

"The emissions include electricity consumption (including auxiliary use) $PE_{elec,y}$ *associated with the operation of the manufacturing process and the biomass treatment and processing, calculated as per the tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption*".

The project emission from the consumption of electricity can be calculated from the methodological tool "Tool to calculate baseline, project and/or leakage emission from electricity consumption", Version 01, EB 39, Annex 7[17] are as follows:

Electricity is used for the operation of the manufacturing process. However there is no electricity associated with the biomass treatment and processing since no biomass is used in the project activity.

In the generic approach, project emissions from consumption of electricity is calculated based on the quantity of electricity consumed, an emission factor for electricity generation and a factor to account for transmission losses, as follows:

$$PE_{EC,y} = \sum EC_{PJ,j,y} \text{ X } EF_{EL,j,y} \text{ X } (1+ TDL_{j,y}) \quad (8)$$

$PE_{EC,y}$	=	Project emissions from electricity consumption in year *y* (tCO_2/yr)
$EC_{BL,k,y}$	=	Quantity of electricity that would be consumed by the baseline electricity consumption source *k* in year *y* (MWh/yr)
$EF_{EL,j,y}$	=	Emission factor for electricity generation for source *j* in year *y* (tCO_2/MWh)
$TDL_{j,y}$	=	Average technical transmission and distribution losses for providing electricity to source *j* in year *y*
j	=	Sources of electricity consumption in the project

As per the tool, the following three scenarios apply to the sources of electricity consumption:
Scenario A: Electricity consumption from grid.
Scenario B: Electricity consumption from (an) off-grid fossil fuel fired captive power plants(s).
Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plants.

Scenario C: Electricity consumption from the grid and (a) fossil fuel fired captive power plant(s)

Under this scenario, the consumption of electricity in the project, the baseline or as a source of leakage may result in different emission levels, depending on the situation of the project activity. The following three cases can be differentiated:

Case C.I: Grid electricity. The implementation of the project activity only affects the quantity of electricity that is supplied from the grid and not the operation of the captive power plant. This applies, for example,

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

- If at all times during the monitored period the total electricity demand at the site of the captive power plant(s) is, both with the project activity and in the absence of the project activity, larger than the electricity generation capacity of the captive power plant(s); or
- If the captive power plant is operated continuously (apart from maintenance) and feeds any excess electricity into the grid, because the revenues for feeding electricity into the grid are above the plant operation costs; or
- If the captive power plant is centrally dispatched and the dispatch of the captive power plant is thus outside the control of the project participants.

Case C.II: Electricity from captive power plant(s). The implementation of the project activity is clearly demonstrated to only affect the quantity of electricity that is generated in the captive power plant(s) and does not affect the quantity of electricity supplied from the grid. This applies, for example, in the following situation: A fixed quantity of electricity is purchased from the grid due to physical transmission constraints, such as a limited capacity of the transformer that provides electricity to the relevant source. In this situation, case C.II would apply if the total electricity demand at the site of the captive power plant(s) is at all times during the monitored period, both with the project activity and in the absence of the project activity, larger than the quantity of the electricity that can physically be supplied by the grid.

Case C.III: Electricity from both the grid and captive power plant(s). The implementation of the project activity may affect both the quantity of electricity that is generated in the captive power plant(s) and the quantity of electricity supplied from the grid. This applies, for example:

If the captive power plant(s) is/are not operating continuously; or If grid electricity is purchased during a part of the monitored period; or

- If electricity from the captive power plant is fed into the grid during a part of the monitored period.

The project plant would consume the electricity from grid and Diesel Generator Set in absence of grid connectivity *i.e.* “the captive power plant(s) is/are not operating continuously”, thus the applicable criteria is Scenario C.

Where case C.III has been identified, as a conservative simple approach, the emission factor for electricity generation should be the more conservative value between the emission factor determined as per guidance for scenario A and B respectively.

Scenario A: Electricity consumption from the grid:

In this case, project participants may choose among the following options:

Option A1: Calculate the combined margin emission factor of the applied electricity system, using the procedures in the latest approval version of the “Tool to calculate the emission factor for an electricity system” ($EF_{EL,j/k/l,y} = EF_{grid,CM,y}$).

Option A2: Use the following conservative default values:

• A value of 1.3 tCO_2 /MWh if

(a) *Scenario A applied only to project and/or leakage electricity consumption sources but not to baseline electricity consumption sources ;or*

(b) *Scenario A applied to: both baseline and project (and /or leakage) electricity consumption sources; and the electricity consumption of the project and leakage sources is greater than the electricity consumption of the baseline sources.*

• A value of 0.4 tCO_2/MWh for electricity grids where hydro power plants constitute less than 50% of total grid generation in 1) average of the five most recent years ,or 2) based on long-term averages for hydroelectricity production, and a value of 0.25 tCO_2/MWh for other electricity grids. These values can be used if

(a) Scenario A applied only to baseline electricity consumption sources but not to project or leakage electricity consumption sources; or
(b) Scenario A applied to: both baseline and project (and/or leakage) electricity consumption sources; and the electricity consumption of the baseline sources is greater than the electricity consumption of the project and leakage sources.

The project emissions from electricity consumption can be calculated based on the quantity of electricity consumed from grid by the use of Option A1 of the Scenario A.

To calculate the combined margin emission factor of the applicability system the PP have used the procedures in the latest approved version of the "Tool to calculate the emission factor for an electricity system" Ver. 02.2.1, EB 19, Annex 19.
The following steps are applied for calculating the combined margin emission factor:
STEP 1: Identify the relevant electricity systems;
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional);
STEP 3: Select a method to determine the operating margin (OM);
STEP 4: Calculate the operating margin emission factor according to the selected method;
STEP 5: Calculate the build margin (BM) emission factor;
STEP 6: Calculate the combined margin (CM) emission factor.

Step 1: Identify the relevant electricity systems

For determining the electricity emission factors, identify the relevant project electricity system
*Similarly, identify any **connected electricity systems**. If a connected electricity system is located partially or totally in Annex-I countries, then the emission factor of that connected electricity system should be considered zero.*
If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If this information is not available, project participants should define the project electricity system and any connected electricity system, and justify and document their assumptions in the CDM-PDD.

Since the Project Participant (PP) has proposed to establish their project activity of the manufacturing facility of the AAC block/panel manufacturing unit at Howrah, West Bengal, the PP is will draw the electricity from the eastern regional grid system which is a part of the NEWNE grid.
Therefore NEWNE grid is the regional grid system for the relevant electricity system.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Only grid power plants are included in the calculation.

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

As per the tool, the calculation of the operating margin emission factor ($EF_{grid, OM,y}$) can be calculated by any of the following:
(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM

Simple OM method (Option a) has been adopted.

Step 4. Calculate the operating margin (OM) emission factor according to the selected method.

The Central Electricity Authority (CEA) of Government of India (GOI) has calculated based on the weighted average of the CO_2 Operating Margin emission factor of NEWNE Grid. The following table gives the average of the CO_2 Operating Margin emission for the last three financial year of 2008-09, 2009-10 & 2010-11:

Grid	Operating Margin (OM)			
	Year	Values	Net Generation in Operating Margin	Product
	2008-09	1.020625307	421802.6329	430502.44
	2009-10	0.989137344	458043.0846	453067.52
NEWNE	2010-11	0.98207948	476986.7213	468438.87
Weighted Average		0.996444951	1356832.439	1352008.833

Step 5. Calculate the build margin (BM) emission factor

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Build Margin emission factor of NEWNE Grid for the year 2010-11. The following table gives the CO_2Build Margin emission factor of NEWNE Grid as provided by CEA in "CO_2 Baseline Database for the Indian Power Sector / Version 7.0 dated January 2012".

Grid	Year	BM
NEWNE	2010-11	0.858781329

Step 6. Calculate the combined margin (CM) emission factor

As per the "Tool to calculate the emission factor for an electricity system" Ver. 02.2.1, Annex 19 EB 63: The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad (9)$$

Where:

$EF_{grid,BM,y}$ Build margin CO_2 emission factor for the year y (tCO_2/MWh)

$EF_{grid,OM,y}$ Operating margin CO_2 emission factor for the year y (tCO_2/MWh)

w_{OM} Weighting of operating margin emission factors (%)

w_{BM} Weighting of build margin emission factors (%)

The following default values should be used for W_{OM} and W_{BM}

• Wind and solar power generation project activities: W_{OM} = 0.75 and W_{BM} = 0.25 (owing to their intermittent and non-dispatch able nature) for the first crediting period and for subsequent Crediting periods;

• All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM}= 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool. Alternative weights can be proposed, as long as W_{OM} + W_{BM} = 1, for consideration by the Executive Board, taking into account the guidance as described below. The values for W_{OM}+ W_{BM} applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

As stated above, the tool specifies that for other project activities: w_{OM} = 0.5 and w_{BM} =0.5 for the first crediting period.

The Central Electricity Authority (CEA), under the Ministry of Power, Government of India, has estimated the operating margin of the NEWNE grid to be 0.99 (the average of last three years) and the build margin to be 0.86. These values are taken from version 7.0, the most recently available data published by the Central Electricity Authority in January 2012.

Therefore the combined margin emission factor of the NEWNE Grid (Excluding Import) has been be calculated as,

Description	tCO_2/MWh
Operating Margin	0.9964
Build Margin	0. 8587
Combined Margin	(0.9964 *0.5)+(0. 8587 *0.5) = 0.9276

Hence, the combined margin emission factor for the NEWNE Grid is 0.9276 tCO_2e/ MWh.

<u>Scenario B: Electricity consumption from an off-grid captive power plant</u>
In this case, project participants may choose among the following options:

Option B1: The emission factor for electricity generation is determined based on the CO_2 emissions from fuel combustion and the electricity generation in the captive power plant (s) installed at the site of the electricity consumption source.

The emission factor of the captive power plant(s) is calculated as follows:

$$EF_{EL,j/k/l,y} = (\sum\sum FC_{n,i,t} \text{ X } NCV_{i,t} \text{ X } EF_{CO2,i,t})/\sum EG_{n,t} \quad (10)$$

$EF_{EL,j/k/l,y}$	=	Emission factor for electricity generation for source *j*, *k* or *l* in year *y* (tCO_2/MWh)
$FC_{n,i,t}$	=	Quantity of fossil fuel type *i* fired in the captive power plant *n* in the time period *t* (mass or volume unit)
$NCV_{i,t}$	=	Average net calorific value of fossil fuel type *i* used in the period *t* (GJ / mass or volume unit)
$EF_{CO2,i,t}$	=	Average CO_2 emission factor of fossil fuel type *i* used in the period *t* (tCO_2 / GJ)
$EG_{n,t}$	=	Quantity of electricity generated in captive power plant *n* in the time period *t* (MWh)
i	=	are the fossil fuel types fired in captive power plant *n* in the time period *t*
j	=	Sources of electricity consumption in the project
k	=	Sources of electricity consumption in the baseline
l	=	Leakage sources of electricity consumption
n	=	Fossil fuel fired captive power plants installed at the site of the electricity consumption source *j*, *k* or *l*
t	=	Time period for which the emission factor for electricity generation is determined (see further guidance below)

Option B2: Use the following conservative default values:

• A value of 1.3 tCO_2/MWh if

(a) The electricity consumption source is a project or leakage electricity consumption source; or
(b) The electricity consumption source is a baseline electricity consumption source; <u>and</u> the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is <u>less</u> than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).
• A value of 0.4 tCO_2/MWh if

(a) The electricity consumption source is a baseline electricity consumption source; or
(b) The electricity consumption source is a project electricity consumption source and the electricity consumption of all baseline electricity consumptions sources at the site of the captive power plant(s) is **greater** than the electricity consumption of all project electricity consumption sources at the site of the captive power plant(s).

Option B1 was adopted to determine the Emission Factor of electricity under Scenario B;

The emission factor for NEWNE Grid is 0.9276 tCO_2/MWh where as the calculated value of emission factor for the DG set (750 kVA) is 0.5984 tCO_2/MWh, which has been computed & derived as below;

DG Set Emission Factor		
NCV of Diesel (TJ/ton)	0.04	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Table 1.2-Default Net Calorific Values (NCVs) and Upper limit of the 95% confidence intervals.
CO_2 emission factor (TCO_2/TJ)	74.8	2006 IPCC Guidelines for National Greenhouse Gas Inventories Table 1.4 – Default CO_2 emission factors for combustion, Upper value of 95% confidence interval
Specific fuel consumption(kg/kWh)	0.2	Manufacturer's data input
Emission factor of DG Set	0.5984	tCO_2/MWh

So emission factor for electricity generation determined as per guidance for scenario A: Electricity consumption from the grid was found to higher and therefore more conservative than emission factor for electricity generation determined as per guidance for scenario B: Electricity consumption from an off-grid captive power plant.

Calculation of $PE_{fossilfuel,y}$

"The emissions include fossil fuel consumption (including auxiliary use) $PE_{fossilfuel,y}$ *associated with the operation of the manufacturing process and the biomass treatment and processing, calculated as per the "Tool to calculate project or leakage* CO_2 *emissions from fossil fuel combustion".*

As per Baseline Methodology Procedure of the "Tool to calculated project or leakage CO_2 emissions from fossil fuel combustion" Version 02, the *CO_2 emission from fossil fuel combustion in process j are calculated based on the quantity of fuels combusted and the CO_2 emission coefficient of those fuels ,as follows*:

$$PE_{FC,j,y} = \sum FC_{i,j,y} \times COEF_{i,y} \qquad (11)$$

Where,

$PE_{FC,j,y}$	*Are the CO_2 emissions from fossil fuel combustion in process j during the year y (tCO_2/yr).*
$FC_{i,j,y}$	*Is the quantity of fuel type i combusted in process j during the year y (mass or volume unit/yr).*
$COEF_{i,y}$	*Is the CO_2 emission co-efficient of fuel type i in year y (tCO_2/mass or volume unit).*
i	*Are the fuel types combusted in process j during the year y.*

Fuel oil is used as the fuel type i for the production activity of the AAC blocks/panels. There is no fossil fuel consumption associated with the biomass treatment and processing since no biomass is used in the project activity.

The CO_2 emission co efficient COEFi,y can be calculated using one of the following two options ,depending on the availability of data on the fossil fuel type i, as follows:

Option A: *The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on the chemical composition of the fossil fuel type i, using the following approach:*

If $FC_{i,j,y}$ is measured in a mass unit: $COEF_{i,y} = W_{c,i,y} \times 44/12$ *(i)*

If $FC_{i,j,y}$ is measured in a volume unit: $COEF_{i,y} = W_{c,i,y} \times Ᵽ_{i,y} \times 44/12$ *(ii)*

Where,

$COEF_{i,y}$	*Is the CO_2 emission coefficient of fuel type i (tCO_2/mass or volume unit);*
$W_{c,i,y}$	*Is the weighted average mass fraction of carbon in fuel type i in year y (tC/mass unit of the fuel);*
$Ᵽ_{i,y}$	*Is the weighted average density of fuel type i in year y (mass unit/volume unit of the fuel)*
i	*Are the fuel types combusted in process j during the year y.*

Option B:

The CO_2 emission coefficient $COEF_{i,y}$ is calculated based on net calorific value and CO_2 emission factor of fuel type i ,as follows:

$$COEF_{i,y} = NCV\ i,y \times EF_{CO2,i,y} \qquad (12)$$

Where:

$COEF_{i,y}$	*Is the CO_2 emission of fuel type i in year y (tCO_2/mass or volume unit).*
NCVi,y	*Is the weighting average net calorific value of the fuel type i in year y (GJ/mass or volume unit).*
$EF_{CO2,i,y}$	*Is the weighted average CO_2 emission factor of type i in year y (tCO_2/GJ).*
i	*Are the fuel types combusted in process j during the year y.*

The Option B has been adopted in the project case to calculate the project emissions.

Calculation of $PE_{transporty}$

"Project emissions from the transportation of the renewable biomass from its source to the manufacturing production site shall be accounted for following the procedures in AMS-III.AK "Biodiesel production and use for transport applications" if the transportation distance is more than 200 km, otherwise they can be neglected."

PP does not opt for any use of renewable biomass for their AAC Block/Panel manufacturing process. Electricity & Coal are the only sources of the energy for their production process. So there is no scope of transportation of the renewable biomass from its source to the manufacturing plant and the parameter $PE_{transporty}$ is zero for the project activity.

Calculation of $PE_{cultivation,y}$

"In cases where the project activity utilizes biomass sourced from dedicated plantations, the project emissions from renewable biomass cultivation shall be calculated as per the relevant provisions of AMS-III.AK "Biodiesel production and use for transport applications".

The proposed project does not involve utilizing any biomass sourced from dedicated plantation. So the emission from renewable biomass cultivation is considered as zero.

Calculation of $PE_{CH4,y}$

"The project methane emissions from the charcoal produced in kilns not equipped with a methane recovery and destruction facility and methane emissions from the production of charcoal shall be accounted for as per the relevant procedures of AMS-III.K "Avoidance of methane release from charcoal production by shifting from traditional open-ended methods to mechanized charcoaling process". Alternatively, conservative emission factor values from peer reviewed literature or from a registered CDM project activity can be used, provided that it can be demonstrated that the parameters from these are comparable, e.g. the source of biomass, characteristics of biomass such as moisture, carbon content, type of kiln and operating conditions such as ambient temperature."

PP does not involve any use of charcoal in the project activity. Basically it is an Autoclaved curing process. The AAC blocks are to be processed through Autoclaved curing method. So there is no scope of generation of methane emission from the project activity.

B.6.2. Data and parameters fixed ex ante

Data / Parameter	**$EF_{Grid,CM,y}$**
Unit	tCO_2/MWh
Description	Combined margin emission factor for the grid in year y
Source of data	**'The CO_2 Baseline Database for the Indian Power Sector'** Ministry of Power: Central Electricity Authority (CEA) Version 7.0. This database is prepared as per **"Tool to calculate the emission factor for an electricity system" Version 02.2.1** http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf. The value is calculated as the weighted average of the Simple Operating Margin emission factor ($EF_{M, y}$) and the Build Margin emission factor ($EF_{BM, y}$) and giving 50% weight age to each by default
Value(s) applied	0.9276
Choice of data or Measurement methods and procedures	As per the "Tool to calculate the emission factor for an electricity system" Ver. 02.2.1.
Purpose of data	For calculating the project emission.
Additional comment	The emission factor for electricity is fixed ex-ante.

Data / Parameter	**$NCV_{i,y}$**
Unit	GJ /Tonne
Description	Average net calorific value of fossil fuel type (fuel Oil) used in the period t
Source of data	IPCC default value as provided in Table 1.2 of Chapter 1 of Vol.2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories. Link:http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value(s) applied	40.4
Choice of data or Measurement methods and procedures	Default value of IPCC Guidelines has been considered.
Purpose of data	For calculating the project emission
Additional comment	Any future revision of the IPCC Guidelines should be taken into account.

Data / Parameter	**Ƥ$_{i,y}$**
Unit	Kg/Litre
Description	Weighted average density of fuel type (fuel oil) in year y
Source of data	Table 1.1 of IPCC 2006 Guideline of National GHG Inventories. http://www.ipcc.ch/meetings/session25/doc4a4b/vol2.pdf
Value(s) applied	0.91
Choice of data or Measurement methods and procedures	The density of the fuel should be obtained for each fuel delivery, from which weighted average annual values should be calculated.
Purpose of data	For calculating the project emission
Additional comment	

Data / Parameter	**EF_{CO2}**
Unit	tCO_2/GJ
Description	Weighted average CO2 emission factor of fuel type (fuel oil) in year y
Source of data	IPCC default values at the upper limit of the uncertainty at 95%confidence interval as provided in table 1.4 of the Chapter 1 of Vol.2 (energy) of 2006 IPCC Guidelines on National GHG Inventories. http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
Value(s) applied	0.0774
Choice of data or Measurement methods and procedures	Default value of IPCC Guidelines has been considered.
Purpose of data	For calculating the project emission
Additional comment	Any future revision of the IPCC Guideline should be taken into account.

Data / Parameter	**EF_{BL}**
Unit	tCO_2/m^3
Description	The parameter is Annual production specific emission factor for manufacturing the product derived in the baseline scenario to project activity product.
Source of data	- The average specific energy consumption (calculated as average of the lower and upper range of energy consumption for FC-BTK technology type), Reference: Development of Standard and Guidelines, Parivesh, CPCB as presented in the table B.4.4 above. - Net Calorific Value of Coal of 25.8 MJ/t (Reference: Table 1.2 of Chapter 1 "2006 IPCC Guidelines for National Greenhouse Gas Inventories" and - Standard volume of brick of .0015m3 (190mm*90mm*90mm; Reference: Indian Standard for Specification for Heavy duty Burnt clay Building Bricks (Third Version)) - Biomass Adjustment factor – 2%; Reference: FAO Field Document No. 35, “Regional Wood Energy Development Programme in Asia”, GCP/RAS/154/NET.
Value(s) applied	0.3592435
Choice of data or Measurement methods and procedures	The baseline annual production specific emission factor considers only the energy component associated to coal consumption.
Purpose of data	For calculating the baseline emission
Additional comment	This value is fixed ex-ante.

Data / Parameter	**EF_{cement}**
Unit	tCO_2/ton of cement
Description	Carbon emission factor of Cement production
Source of data	CSI Protocol default emission factor of cement production for India and China(Figure5.8:Regional average net CO_2 emissions per tonne cement in page 23/43 of the report) Link: http://wbcsdcement.org/pdf/csi-gnr-report-with%20label.pdf
Value(s) applied	0.638
Choice of data or Measurement methods and procedures	CSI Protocol is an authentic source of data.
Purpose of data	For calculating the leakage emission
Additional comment	Fixed *ex-ante*

Data / Parameter	**$EF_{Aluminium}$**
Unit	tCO_2/ton of Aluminium
Description	Carbon emission factor of Aluminium Powder production
Source of data	**Table 17: Industrial processes-emission factors and activity data**
Value(s) applied	1.89
Choice of data or Measurement methods and procedures	IPCC 2006 refers to emission factor of 1.7 tCO_2/t of Aluminium; However National Greenhouse Accounts (NGA) Factors, Table 17: Industrial processes-emission factors and activity data takes into consideration CO_2 emissions and CF_4 and C_2F_6 emissions due to production of aluminium. The NGA factors have been taken to be on a conservative side.
Purpose of data	For calculating the leakage emission
Additional comment	Fixed *ex-ante*

Data / Parameter	**EF_{Lime}**
Unit	tCO_2/ ton of $CaCO_3$.
Description	Carbon emission factor of Lime
Source of data	Chapter 2 of "Mineral Industry Emissions" of 2006 IPCC Guidelines for National Greenhouse Gas Inventories. Link:http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf
Value(s) applied	0.439 tCO_2/ ton of CaO.
Choice of data or Measurement methods and procedures	In the general practice lime from mineral source is available with a purity of 30-45% in terms of CaO that results in lesser emissions. However the project activity requires 85% purity in terms of CaO. The emission factor is computed using the stoichio-metric ratio of 0.43 tones CO_2/ ton of lime.
Purpose of data	For calculating the leakage emission
Additional comment	The emission factor for lime is fixed ex-ante. However should there be any revision in IPCC values in future the same would be taken for Verification.

Data / Parameter	$EF_{CO2,f}$
Unit	gCO_2/t km
Description	Default carbon di-oxide emission factor for freight transport activity f.
Source of data	Based on the methodological tool “Project and leakage emissions from road transportation of freight.”(Version 01.0.0)
Value(s) applied	<table><tr><th>Vehicle Class</th><th>Emission factor (gCO_2/t Km)</th></tr><tr><td>Light vehicles</td><td>245</td></tr><tr><td>Heavy vehicles</td><td>**129**</td></tr></table> For raw material (Fly ash, Gypsum, Cement, Lime, Aluminium Powder) transportation generally heavy vehicles are being used. So PP has considered the values for emission factor of Heavy vehicles.
Choice of data or Measurement methods and procedures	Based on the default values specified and calculated as per the methodological tool “Project and leakage emissions from road transportation of freight.”(Version 01.0.0).
Purpose of data	For calculating the leakage emission.
Additional comment	For heavy vehicles, the emission factor has been derived based on custom design transient speed-time-gradient drive cycle (adapted from the international FIGE cycle), vehicle dimensional data, mathematical analysis of loading scenarios, and dynamic modelling based on engine power profiles, which, in turn, are a function of gross vehicle mass (GVM), load factor, speed/acceleration profiles and road gradient.

B.6.3. Ex-ante calculation of emission reductions
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Baseline Emission:
As per methodology, the baseline emission due to fossil fuel consumption for the production process (in the absence of the project activity) can be estimated as below:
The following parameters are to be applied for the calculation of the baseline emission of the project activity:

Kiln Type	Energy consumption (MJ/kg of brick)			Specific Coal Consumption (kgCoal/kg brick)	Specific Coal Consumption (kgCoal/m3 brick)	Reference
	Lower Range	Upper Range	Avg			
FC BTK*	1.1	2	1.55	0.06	150.19	Energy Consumption in FCBTK process; Development of Standard and Guidelines
Coal NCV (IPCC)	(MJ/kg)	25.8				NCV of Coal;

						Table 1.2of chapter 1 of "2006 IPCC Guidelines for National Greenhouse Gas Inventories"
Bulk Density of brick	(kg/m3)	2500				Bulk Density of Brick ; Indian Standard for Specification for Heavy duty Burnt clay Building Bricks (Third Version)
Coal Consumption per CuM	kgcoal/m3	150.19380				
Energy Consumption per CuM	MJ/m3	3875				
Emission Factor per MJ	TCO_2/MJ	0.0000946				
Emission Factor per CuM	TCO_2/m^3	0.366575				
Emission Factor per CuM post adjustment of Biomass use	TCO_2/m^3	0.3592435				

The total Estimated Baseline carbon emission (BEy) from the total coal consumption in the baseline scenario during total crediting period as follow:

Description	**Unit**	**Value**									
		2014	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Net brick production	Cum/ yr	120285	247253	253935	253935	253935	253935	253935	253935	253935	253935
The annual production specific emission factor for year y	$tCO_2e/$ m^3	0.3592	0.3592	0.3592	0.3592	0.3592	0.3592	0.3592	0.3592	0.3592	0.3592
Annual baseline emission from fossil fuels	$tCO_2e/$ Year	43211	88823	91224	91224	91224	91224	91224	91224	91224	91224

Leakage emission:

Formula applied:

$LE_y = LE_{rm,prod,y} + LE_{rm,trans,y}$

Where,

LE_y	Leakage emission from raw material production and transportation in the year y.
$LE_{rm,prod,y}$	Leakage emission from raw material production in the year y.
$LE_{rm,trans,y}$	Leakage emission from the raw material transportation in the year y.

The following parameters are to be applied for the calculation of the baseline emission of the project activity:

For parameters of Leakage Emission estimation and references				
Description	**Unit**	**Value**	**References**	**Source with Link**
Carbon emission factor(EF) of cement production	tCO_2/ ton	0.638	CSI Protocol default emission factor of cement production for India and China(Figure 5.8: "Regional average net CO2 emissions per ton cement" in page 23/43 of the report)g	http://wbcsdcement.org/pdf/csi-gnr-report-with%20label.pdf
Carbon emission factor(EF) of Lime production	tCO_2/ ton	0.4397	Chapter 2 of "Mineral Industry Emissions" of 2006 IPCC Guidelines for National Greenhouse Gas Inventories	http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf
Carbon emission factor (EF) of Aluminum Powder Production	tCO_2/ ton	1.89	IPCC Guidelines 2006 for NGGI (Vol 3 Ch 4 Table 4.10)	http://www.ipcc.ch/meetings/session25/doc4a4b/vol3.pdf
Return trip road distance between the origin and destination of freight transportation of Fly ash	Km	39.8	Distance between Kanyanpur , Bagnan,Howrah to Mecheda Purba Medinipur (W.B)	https://maps.google.co.in/
Return trip road distance between the origin and destination of freight transportation of Cement	Km	1564	Distance between Kanyanpur , Bagnan, Howrah to Hirmi, Simga, Raipur(C.G)	https://maps.google.co.in/

Return trip road distance between the origin and destination of freight transportation of Lime	Km	3924	Distance between Kanyanpur , Bagnan, Howrah to Basni Jodhpur	https://maps.google.co.in/
Return trip road distance between the origin and destination of freight transportation of Gypsum	Km	3620	Distance between Kanyanpur , Bagnan, Howrah to 14 SIPCOT Industries Estate, Cuddalore, India	https://maps.google.co.in/
Return trip road distance between the origin and destination of freight transportation of Aluminium Powder	Km	4296	Distance between Kanyanpur , Bagnan, Howrah to 1/C-4 THIRUTHANGAL Rd., Sivakasi	https://maps.google.co.in/
Default CO_2 emission factor for freight transportation activity	gCO_2 /tKm	129	The methodological Tool "Project and leakage emissions from road transportation of freight" version 01	http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.pdf

Description	Unit	Values										References
		2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	
Quantity of cement consumed for production of AAC blocks	tonne/yr	11543	23726	24368	24368	24368	24368	24368	24368	24368	24368	Section 2 of Annex II of the HESS AAC systems B.V Titled as "Standard raw material specification and consumption values"; Linked to UAL Financials Version02
Leakage emission due to Cement consumption ($LE_{rm,prod,y}$)	**tCO_2e/Yr**	**7364**	**15137**	**15546**	**15546**	**15546**	**15546**	**15546**	**15546**	**15546**	**15546**	Calculated based on the cement consumption & the emission factor of the cement
Quantity of lime consumed for production of AAC blocks	ton	8627	17732	18212	18212	18212	18212	18212	18212	18212	18212	Section 2 of Annex II of the HESS AAC systems B.V Titled as "Standard raw material specification and consumption values"; Linked to UAL Financials Version02

Leakage emission due to Lime consumption ($LE_{rm,prod,y}$)	**tCO_2e/Yr**	**3793**	**7797**	**8008**	**8008**	**8008**	**8008**	**8008**	**8008**	**8008**	**8008**	Calculated based on the lime consumption & the emission factor of the lime
Quantity of Aluminium Powder consumed for production of AAC blocks	tonne/yr	56	115	118	118	118	118	118	118	118	118	Section 2 of Annex II of the HESS AAC systems B.V Titled as "Standard raw material specification and consumption values"; Linked to UAL Financials Version02
Leakage emission due to Aluminium Powder consumption ($LE_{rm,prod,y}$)	**tCO_2e/Yr**	**106**	**217**	**223**	**223**	**223**	**223**	**223**	**223**	**223**	**223**	Calculated based on the cement consumption & the emission factor of the cement
Leakage emission due to raw material consumption ($LE_{rm,prod,y}$)	**tCO_2e/Yr**	**11252**	**23130**	**23755**	**23755**	**23755**	**23755**	**23755**	**23755**	**23755**	**23755**	Sum Total Calculated
Total mass of fly ash transported in freight transportation activity f in monitoring	tonne	33048	67932	69768	69768	69768	69768	69768	69768	69768	69768	Section 2 of Annex II of the HESS AAC systems B.V Titled as "Standard raw material specification and
Total mass of Cement transported in freight transportation activity	tonne	11543	23726	24368	24368	24368	24368	24368	24368	24368	24368	

f in monitoring											consumption values"; Linked to UAL Financials Version02
Total mass of Lime transported in freight transportation activity f in monitoring	tonne	8627	17732	18212	18212	18212	18212	18212	18212	18212	18212	
Total mass of Gypsum transported in freight transportation activity f in monitoring	tonne	1458	2997	3078	3078	3078	3078	3078	3078	3078	3078	
Total mass of Aluminium Powder transported in freight transportation activity f in monitoring	tonne	56	115	118	118	118	118	118	118	118	118	
Leakage emission due to Fly ash transportation	tCO_2e/Yr	170	349	358	358	358	358	358	358	358	358	Calculated
Leakage emission due to Cement transportation	tCO_2e/Yr	2329	4787	4916	4916	4916	4916	4916	4916	4916	4916	Calculated
Leakage emission due to Lime transportation	tCO_2e/Yr	4367	8976	9219	9219	9219	9219	9219	9219	9219	9219	Calculated
Leakage emission due to Gypsum transportation	tCO_2e/Yr	681	1400	1437	1437	1437	1437	1437	1437	1437	1437	Calculated
Leakage emission due to Aluminium Powder	tCO_2e/Yr	31	64	65	65	65	65	65	65	65	65	Calculated

transportation												
Leakage due to all the raw materials transportation($LE_{TR,m}$)	**tCO_2e/Yr**	**7577**	**15575**	**15996**	**15996**	**15996**	**15996**	**15996**	**15996**	**15996**	**15996**	**Calculated**
Total Leakage emission	**tCO_2e/Yr**	**18839**	**38726**	**39772**	**39772**	**39772**	**39772**	**39772**	**39772**	**39772**	**39772**	**Calculated**

Project Emission:

The following parameters are to be applied for the calculation of the baseline emission of the project activity:

For parameters of Project Emission estimation and References				
Description	**Unit**	**Value**	**References**	**Sources-link**
Emission factor for electricity generation	tCO_2/ MWh	0.9276	Tool to calculate the emission factor for an electricity system" version 01 & CEA CO_2 database version 7 dated at January 2012	http://cea.nic.in/reports/planning/cdm_co2/user_guide_ver7.pdf
Quantity of electricity consumed	kWh/Cum	11	Quantity of electricity consumption ; Proposal from HESS AAC SYSTEM B.V - Along with the Annex II of Standard raw material specification and material specification	
Quantity of fuel(Fuel Oil) consumed	Liter/Cum	8		
Density of fuel oil	kg/litre	0.91	Table 1.1 of IPCC 2006 Guidelines of National Greenhouse Gas Inventotires	http://www.ipcc.ch/meetings/session25/doc4a4b/vol2.pdf
Quantity of fuel(Fuel Oil) consumed	T/Cum	0.00728	Calculated	
Calorific value of the fuel oil(NCV)	TJ/Gg	40.4	Table 1.2 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories,vol 2;"Default Net Calorific Values (NCVs) And Lower And Upper Limit of the 95% Confidence Intervals"	http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf
NCV of fuel(fuel oil)	TJ/T	0.0404	Calculated;1 Gg= 10^3 T	
CO_2 emission factor of fuel(fuel oil)	TCO_2/ TJ	77.4	Carbon Emission factor of fuel oil ;Table 1.4 of 2006 IPCC Guidelines for National Greenhouse Gas Inventories,vol 2;"Default Net Calorific Values (NCVs) And Lower And Upper	http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

Description	Unit	Value										References
		2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	2022-23	
Gross AAC Blocks		121500	249750	256500	256500	256500	256500	256500	256500	256500	256500	
Quantity of electricity consumed	MWh/yr	1336.5	2747.25	2821.5	2821.5	2821.5	2821.5	2821.5	2821.5	2821.5	2821.5	Section 2 of Annex II document of HESS AAC System B.V "Standard raw material specification and consumpton values "
Project emission from electricity consumption	**tCO_2/yr**	**1239.75**	**2548.385**	**2617.2605**	**2617.26**	**2617.26**	**2617.26**	**2617.26**	**2617.26**	**2617.26**	**2617.26**	**Calculated**
Quantity of fuel consumed	Tonnes/yr	884.52	1818.18	1867.32	1867.32	1867.32	1867.32	1867.32	1867.32	1867.32	1867.32	Section 2 of Annex II document of HESS AAC System B.V "Standard raw material specification

												and consumption values "
Project emission from fuel consumption	**tCO_2/yr**	**2766**	**5685**	**5839**	**5839**	**5839**	**5839**	**5839**	**5839**	**5839**	**5839**	**Calculated**
Total Project Emission	**tCO_2/yr**	**4005**	**8233**	**8456**	**8456**	**8456**	**8456**	**8456**	**8456**	**8456**	**8456**	**Calculated**

B.6.4. Summary of ex-ante estimates of emission reductions

Year	Baseline emissions (tCO_2e)	Project emissions (tCO_2e)	Leakage (tCO_2e)	Emission reductions (tCO_2e)
2013-2014	43211	4005	18839	20367
2014-2015	88823	8233	38726	41864
2015-2016	91224	8456	39772	42996
2016-2017	91224	8456	39772	42996
2017-2018	91224	8456	39772	42996
2018-2019	91224	8456	39772	42996
2019-2020	91224	8456	39772	42996
2020-2021	91224	8456	39772	42996
2021-2022	91224	8456	39772	42996
2022-2023	91224	8456	39772	42996
Total	**861826**	**79886**	**375741**	406199
Total number of crediting years	10			
Annual average over the crediting period	**86182**	**7988**	**37574**	**40619**

B.7. Monitoring plan
B.7.1. Data and parameters to be monitored

Data / Parameter	**Production-**$P_{PJ,y}$
Unit	Cum bricks or blocks per day
Description	Gross production of AAC blocks/panels per day
Source of data	Hess Contract Agreement Dated at 28th July 2011between UAL-KON_CRETE (a subsidiary unit of M/s UAL INDUSTRIES LTD.) and M/S HESS AAC SYSTEMS.
Value(s) applied	1st year =450 2nd year onwards = 900
Measurement methods and procedures	Project proponent record the production of bricks/ blocks as follows: (i) Number of pouring at mixing tower per cycle which are recorded digitally. (ii) Number of pouring rejected per cycle which is recorded manually. Calibration Frequency: Annually Accuracy Class: 1st Class
Monitoring frequency	Continuously
QA/QC procedures	The personnel of PP will make periodical visits to the plant to check the digital & manual record keeping and cross verified through opening & closing stock & sales on monthly basis.
Purpose of data	For calculating the baseline & project emissions
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	Q_{Cement}
Unit	Tonnes per month
Description	Tons of cement used over one month of project activity production
Source of data	Purchase bill of cement
Value(s) applied	1st year = 962 2nd year = 1977 3rd Year onwards = 2031
Measurement methods and procedures	Primary recording by raw material /pour which is recorded digitally through load cell located at mixer tower. Calibration Frequency: Annually Accuracy Class : 1st Class
Monitoring frequency	Continuously
QA/QC procedures	Upon receipt of the monthly data of opening-closing stocks & purchase invoice bills, the personnel of PP will make periodical visits to the plants to cross check the diligence of record keeping.
Purpose of data	For calculating the leakage emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	Q_{Lime}
Unit	Tonnes/Month
Description	Tonnes of lime used over one month of project activity production
Source of data	Purchase bill of lime
Value(s) applied	1st year= 719 2nd year = 1478 3rd Year onwards = 1518
Measurement methods and procedures	Primary recording by raw material /pour which is recorded digitally through load cell located at mixer tower. Calibration Frequency: Annually Accuracy Class : 1st Class
Monitoring frequency	Continuously
QA/QC procedures	Upon receipt of the monthly data of opening-closing stocks & purchase invoice bills, the personnel of PE will make periodical visits to the plants to cross check the diligence of record keeping.
Purpose of data	For calculating the leakage emission
Additional comment	The leakage is taken into account only when lime from mineral source is procured. In the case of by product lime, the data is recorded, but no leakages are accounted for as the same would not have any impact. Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	Q_{Gypsum}
Unit	Tonnes /month
Description	Tons of gypsum used over one month of project activity production.
Source of data	Purchase bill of Gypsum
Value(s) applied	1st year = 121.5 2nd year = 249.75 3rd Year onwards = 256.5
Measurement methods and procedures	Primary recording by raw material/pour which is recorded digitally through load cell located at mixer tower. Calibration Frequency: Annually Accuracy Class: 1st Class
Monitoring frequency	Continuous
QA/QC procedures	Upon receipt of the monthly data of opening-closing stocks & purchase invoice bills, the personnel of PE will make periodical visits to the plants to cross check the diligence of record keeping.
Purpose of data	For calculating the leakage emissions.
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$Q_{Aluminium}$
Unit	Tonnes /Month
Description	Tons of Aluminium used over one month of project activity production
Source of data	Purchase Bill of Aluminium
Value(s) applied	1st year = 4.6 2nd year = 9.5 3rd onwards = 9.8
Measurement methods and procedures	Primary recording by raw material /pour which is recorded digitally through load cell located at mixer tower. Calibration Frequency: Annually Accuracy Class: 1st Class
Monitoring frequency	Continuous
QA/QC procedures	Upon receipt of the monthly data of opening-closing stocks & purchase invoice bills, the personnel of PE will make periodical visits to the plants to cross check the diligence of record keeping.
Purpose of data	For calculating the leakage emissions
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$Q_{Fly\ Ash}$
Unit	Tonnes /Month
Description	Tons of fly ash used over one month of project activity production
Source of data	Purchase Bill of Fly ash
Value(s) applied	1st year = 2754 2nd year = 5661 3rd Year onwards = 5814
Measurement methods and procedures	Primary recording by raw material /pour which is recorded digitally through load cell located at mixer tower. Calibration Frequency: Annually Accuracy Class: 1st Class
Monitoring frequency	Continuous
QA/QC procedures	Upon receipt of the monthly data of opening-closing stocks & purchase invoice bills, the personnel of PE will make periodical visits to the plants to cross check the diligence of record keeping.
Purpose of data	For calculating the leakage emissions.
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	**Performance of AAC blocks/panels in terms of compressive strength once in six months.**
Unit	MPa
Description	The project activity output - AAC blocks/panels are tested in a compressive strength testing machines (CTM) in any of the laboratories of polytechnics, engineering colleges, building centres, national laboratories etc, and the test certificate are provided during verification.
Source of data	The test certificates are being provided by the testing laboratories.
Value(s) applied	3.5 MPa
Measurement methods and procedures	Sampling Approach will be adopted. Please refer to section B.7.2. The test results are recorded bi-annually with the standard. Calibration Frequency: Annually Accuracy Class: 1^{st} Class
Monitoring frequency	Bi-annual
QA/QC procedures	QA ensured by third party reports
Purpose of data	Methodology Justification
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	**$EC_{PJ,j,y}$**
Unit	kWh/day
Description	The electricity consumption per day
Source of data	Internal electricity meter reading
Value(s) applied	1^{st} year = 4455 2^{nd} year = 9157 3^{rd} year onwards = 9405
Measurement methods and procedures	Internal daily meter reading (from 6am to 6am) which is located at substation which is calibrated annually. **Meter Specification**:- Type: Digital (3 ph) Accuracy: 1^{st} Class
Monitoring frequency	Continuous
QA/QC procedures	The Internal meter reading (daily basis) are cross checked through meter reading at S.E.B meter room (sealed by S.E.B) on monthly recording basis.
Purpose of data	For calculating the project emission
Additional comment	The electricity consumption is monitored monthly basis by the Electricity Meter and cross-checked by the meter provided by the Service Provider (State Electricity Department) monthly based on which the Electricity bills are provided. Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	**$FC_{Fuel\ oil}$**
Unit	Litre per day
Description	Quantity of fuel type (Fuel oil) combusted in production process during the year y
Source of data	Onsite measurements
Value(s) applied	1st year = 3240 2nd year = 6660 3rd Year onwards = 6840
Measurement methods and procedures	Use weight or volume meters. Calibration frequency: Annually **Meter Specification**: Type: Magnetic flow meter Accuracy: 0.3-0.5% Accuracy Class – 1st Class
Monitoring frequency	Continuously
QA/QC procedures	The consistency of metered fuel consumption quantities should be cross-checked by an annual energy balance that is based on purchase invoices.
Purpose of data	For calculating the project emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	**$FR_{fly\ ash,m}$**
Unit	Tonnes
Description	Total mass of fly ash transported in freight transportation activity in monitoring period *m*
Source of data	Records by project participants or records by truck operators
Value(s) applied	1st year = 33048 2nd year = 67932 3rd Year onwards= 69768
Measurement methods and procedures	Daily recording by the project proponent through the challans provided by the truck operators.
Monitoring frequency	Continuously
QA/QC procedures	Cross checked through the purchase invoices and opening –closing stocks annually.
Purpose of data	For calculating the leakage emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$FR_{cement,m}$
Unit	Tonne
Description	Total mass of Cement transported in freight transportation activity cement in monitoring period m
Source of data	Records by project participants or records by truck operators
Value(s) applied	1st Year= 11543 2nd year= 23726 3rd Year onwards = 24368
Measurement methods and procedures	Daily recording by the project proponent through the challans provided by the truck operators.
Monitoring frequency	Continuously
QA/QC procedures	Cross checked through the purchase invoices and opening – closing stocks annually.
Purpose of data	For calculating the leakage emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$\mathbf{FR_{Lime,m}}$
Unit	Tonnes
Description	Total mass of Lime transported in freight transportation activity in monitoring period *m*
Source of data	Records by project participants or records by truck operators
Value(s) applied	1st year = 8627 2nd year= 17732 3rd year onwards= 18212
Measurement methods and procedures	Daily recording by the project proponent through the challans provided by the truck operators.
Monitoring frequency	Continuously
QA/QC procedures	Cross checked through the purchase invoices and opening –closing stocks annually.
Purpose of data	For calculating the leakage emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$FR_{Gypsum, m}$
Unit	Tonnes
Description	Total mass of Gypsum transported in freight transportation activity in monitoring period *m*
Source of data	Records by project participants or records by truck operators
Value(s) applied	1st Year= 1458 2nd Year = 2997 3rd Year onwards = 3078
Measurement methods and procedures	Daily recording by the project proponent through the challans provided by the truck operators.
Monitoring frequency	Continuously
QA/QC procedures	Cross checked through the purchase invoices and opening –closing stocks annually.
Purpose of data	For calculating the leakage emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$FR_{Alumium,m}$
Unit	Tonnes
Description	Total mass of Aluminium transported in freight transportation activity in monitoring period *m*
Source of data	Records by project participants or records by truck operators
Value(s) applied	1st year = 56 2nd year= 115 3rd year onwards = 118
Measurement methods and procedures	Daily recording by the project proponent through the challans provided by the truck operators.
Monitoring frequency	Continuously
QA/QC procedures	Cross checked through the purchase invoices and opening –closing stocks annually.
Purpose of data	For calculating the leakage emission
Additional comment	Data will be archived on paper and electronically. Archived data will be kept during the crediting period plus 2 years or the last issuance of CERs for this project activity, whichever occurs later.

Data / Parameter	$D_{f,m,flyash}$
Unit	Km
Description	Return trip road distance between the origin and destination of fly ash transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
Value(s) applied	39.8
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources). Calibration Frequency: Once in a year Accuracy Class: 1st Class
Monitoring frequency	Continuously
QA/QC procedures	The data should be recorded in Log book (Per trip of incoming of raw material) & it would be cross-checked through the invoiced/Challan provided by the supplier or Vendors.
Purpose of data	For calculating the leakage emission
Additional comment	This value is fixed and ex ante for the specified production procedure.

Data / Parameter	$D_{f,m,cement}$
Unit	Km
Description	Return trip road distance between the origin and destination of cement transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
Value(s) applied	160
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources). Calibration Frequency: Annually Accuracy Class: 1st Class
Monitoring frequency	Continuously
QA/QC procedures	The data should be recorded in Log book (Per trip of incoming of raw material) & it would be cross-checked through the invoiced/Challan provided by the supplier or Vendors
Purpose of data	For calculating the leakage emission
Additional comment	This value is fixed and ex ante for the specified production procedure.

Data / Parameter	$D_{f,m,lime}$
Unit	Km
Description	Return trip road distance between the origin and destination of lime transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
Value(s) applied	3924
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources) Calibration Frequency: Annually Accuracy Class: 1^{st} Class
Monitoring frequency	Continuously
QA/QC procedures	The data should be recorded in Log book (Per trip of incoming of raw material) & it would be cross-checked through the invoiced/Challan provided by the supplier or Vendors
Purpose of data	For calculating the leakage emission
Additional comment	This value is fixed and ex ante for the specified production procedure.

Data / Parameter	$D_{f,m,gypsum}$
Unit	Km
Description	Return trip road distance between the origin and destination of Gypsum transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
Value(s) applied	3620
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources) Calibration Frequency: Annually Accuracy Class: 1^{st} Class
Monitoring frequency	Continuously
QA/QC procedures	The data should be recorded in Log book (Per trip of incoming of raw material) & it would be cross-checked through the invoiced/Challan provided by the supplier or Vendors
Purpose of data	For calculating the leakage emission
Additional comment	This value is fixed and ex-ante for the specified production procedure.

Data / Parameter	$D_{f,m,aluminium}$
Unit	Km
Description	Return trip road distance between the origin and destination of Aluminium Powder transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
Value(s) applied	4296
Measurement methods and procedures	Determined once for each freight transportation activity f for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on-line sources). Calibration Frequency: Annually Accuracy Class: 1st Class
Monitoring frequency	Continuously
QA/QC procedures	The data should be recorded in Log book (Per trip of incoming of raw material) & it would be cross-checked through the invoiced/Challan provided by the supplier or Vendors
Purpose of data	For calculating the leakage emission
Additional comment	This value is fixed and ex ante for the specified production procedure.

B.7.2. Sampling plan
>>
Quality of the Product
Tests will be conducted to validate that the project bricks meet the performance requirements and specifications in line with the following sampling plan which includes the following information -

To validate that the service level of product is better than that of the baseline product, PP will monitor the mean value of the dry compressive strength of the project activity output at six-month intervals during the crediting period and with a 90/10 confidence. The product that does not match necessary compressive strength requirements will be excluded from the production.
Target population will be the production of AAC Blocks starting from the 1st output obtained on the date of commercial operation and thereafter every six months.
The simple random sampling method will be used.
Simple random sampling is suited to populations that are homogeneous. Since the AAC Blocks are manufactured through a fixed composition the output is homogenous in nature.

Sample size the estimated target number of "units" – pieces of equipment, solar cookers, buildings, motors, log-books, etc. – which are to be studied (i.e. the sample size).
The sample size calculations are based on a proportion (or percentage) of interest being the objective of the project, under Simple random sampling method. The following are pre-determined in order to estimate the sample size:
(a) The value that the proportion is expected to take;
(b) The level of precision, and confidence in that precision (90/10 for all small-scale projects)
The equation to give us the required sample size is:

$$n \geq \frac{1.645^2 \otimes N \otimes p(1-p)}{(N-1) \otimes 0.1^2 \otimes p^2 \oplus 1.645^2 \otimes p(1-p)}$$

Where:
n - Sample size
N - Total Production (57,000)
p - Our expected proportion (0.50)
1.645- Represents the 90% confidence required
0.1 -Represents the 10% relative precision
Substituting in our values gives:

$$n \geq \frac{1.645^2 \otimes 57000 \otimes 0.5(1-0.5)}{(57000-1) \otimes 0.1^2 \otimes 0.5^2 \oplus 1.645^2 \otimes 0.5(1-0.5)}$$

Where
n ≥ 269.32;
n=270;

Sampling frame would include the AAC Block production on the date of commercial operation and thereafter production every six months.

Data will be collected randomly by the operators and submitted to Supervisor manager for further testing.

B.7.3. Other elements of monitoring plan

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The data monitoring will involve all the parameters mentioned in the section B.7.1. Due care will be taken for the measurement of all these parameters and maintenance of records. Proper training would be imparted to concerned personnel for accurate measurement and collection of data for each parameter.

The CDM monitoring team will composed the following staff:

Position	**Report to:**
Operator	Project owner
Supervisor managers (technical/maintenance)	
Plant manager	
CDM monitoring project manager	Project owner/External CDM consultant

The allocation of responsibility to ensure compliance with the monitoring requirement of the methodology is given here below:

Sl. No.	**Task description**	**Operator(s)**	**Supervisor**	**Plant Manager**	**CDM monitoring project manager**
Monitoring activity					
1.	Recording of monitored data	√	√		
Quality assurance and quality control					
2	Verification of data monitored (consistency and completeness)		√	√	
3	Ensuring adequate training of staff			√	√
4	Ensuring adequate maintenance		√	√	√
5	Ensuring calibration of monitoring instruments		√	√	√
6	Data archiving: ensuring adequate storage of data monitored (integrity and backup)			√	√
7	Identification of non-conformance and corrective/preventive actions and monitoring plan improvement			√	√
8	Emergency procedures		√	√	
Calculation of GHG emission reductions and reporting					
9	Processing of data and calculation of emission reductions				√
10	Monitoring report: management review of monitoring report (internal audit)			√	√

All data would be collected in paper log books and would be converted to spreadsheet form on a 6 months basis.

Various templates are made to record the data to be monitored. The monitoring personnel of PE would be provided with such templates. As the steps involved in monitoring are simple, in-house training is imparted in recording the data and to translate the same into the computation of ERs.

SECTION C. Duration and crediting period
C.1. Duration of project activity
C.1.1. Start date of project activity
>>
The start date of the project activity is the day at which first advance payment placed to the HESS AAC system B.V dated at 28th July 2011.
C.1.2. Expected operational lifetime of project activity
>>
20 years 0 months[18]
C.2. Crediting period of project activity
C.2.1. Type of crediting period
>>
Fixed

C.2.2. Start date of crediting period
>>
01/07/2013 or the actual registration date of the project – whichever is later.

C.2.3. Length of crediting period
>>
10 years 0 months g

[18] Supportive for operational lifetime of the project activity dated at 29th August 2012 provided by HESS AAC system.

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>

As per the prevailing regulations of the Host Party i.e. India represented by the Ministry of Environment and Forests (MoEF), Govt. of India, Environment Impact Assessment Notification 2006, the project activity does not require Environment Impact Assessment to be conducted.

The facility does not produce any pollution in manufacturing process but proposes to use the waste products like fly ash which create environmental pollution by increasing dust levels of atmosphere. The fossil fuel consumption by the project activity is much lower, as demonstrated earlier, compared to fired clay brick manufacturing units of equivalent capacity. Hence there is positive impact on the environment due to this small scale project activity of reducing the pollution caused by fly ash and fossil fuels.

The following conditions are applicable to establish that the project activity is environment friendly:

i. There shall be no nuisance due to industrial activity to surroundings.

ii. The handling of fly ash *i.e.* transport, loading and storage shall be done in a scientific manner so as to avoid fugitive emissions and nuisance.

iii. Water shall be sprinkled on stored fly ash to avoid fugitive emissions.

The project activity has obtained the No Objection Certificate for Consent to Establish from the West Bengal Pollution Control Board and No Objection Certificate from the Kalyanpur Gram Panchayat, Howrah, for establishing the manufacturing unit of Autoclaves Aerated Concrete (AAC) Blocks by using fly ash as the main raw material which is the by-products of the nearby thermal power station.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

The stakeholder consultation for AAC block manufacturing project was held at on 20th April 2012 from 11 am onwards.

Objective

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

· To list down the concerns of stakeholders

The identified stakeholders were villagers, officers from the Municipal Corporation, farmers around the project area, and representatives of project developers.

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

The presentation was followed by a detailed open discussion with the identified stakeholders, the details of which are provided below in Section E.2.

E.2. Summary of comments received

>>

The stakeholders' consultation started with a brief presentation from representatives of UAL-KON_CRETE about the project activity and its benefits. The stakeholders' consultations were well attended with a number of participants coming from the local residents, farmers around the project area and representatives from UAL-KON_CRETE.

The consultation process started with welcome speech by UAL-KON_CRETE representative, who gave brief description about the company, about the process of AAC block/panel manufacturing technology and its positive environmental benefits. The stakeholders raised their concern on environmental and social impact of the project, its financial viability and marketability of the finished product. These concerns were appropriately addressed by the project proponent, and following table briefs the concerns raised by stakeholders and their corresponding response.

Stake holder's Concerns	Answers from Representatives of UAL-KON_CRETE, (a subsidiary unit of M/s UAL INDUSTRIES LTD.)
1. What are the specific employment opportunities? What are the qualifications required?	The project will open up many job opportunities. Villagers in the neighbourhood would be recruited for both the civil as well as the operational requirements of the plant. Employment generation opportunity will be in the following areas: - the collection, transportation and sizing of the raw materials –unskilled labour - plant operation – skilled labour - Packaging & transportation – skilled & unskilled labours.
2. What are the safety issues?	The proposed project activity will equipped with latest and modern equipments, so there is no chance of accidents.
3. Whether there will be any pollution for the process plant?	Main fuel used for the power project is electricity mainly from grid & fuel oil whose pollution (carbon emission factor) is much lower than the coal use for clay brick manufacturing so there is a chance of lower carbon emission through the project activity. More over the plant equipment and accessories will be latest and as per pollution control board norms. So there is no chance for pollution.

E.3. Report on consideration of comments received

>>

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

The feedbacks from different stakeholders of the project activity are positive and encouraging. A summary of the same is given below:

Serial No.	Name of the stake holders	Mode of Communication	Comments
1.	Arun Roy	Verbal communication	The proposed project is an example of energy efficient technology which will reduce the fossil fuel consumption as well as will minimize the environmental pollution.
2.	Partha Manna	Verbal communication	The project activity proposed to use the industrial by product fly ash as their raw material in the production purpose which is very good for our environment as because this fly ash generally create soil and water pollution and destroy the environmental

			ecosystem.
3.	Tapas Das	Verbal communication	This proposed project activity will generate the employment opportunity to the local peoples.
4.	Sujata Paul	Verbal communication	The project activity is environment friendly and will replace the traditional clay brick manufacturing technology which is much energy incentive and create huge carbon emission through their production process.
5.	Manas maity	Verbal communication	The finished product of the project activity is AAC blocks/panels which has much higher technical characteristics like thermal resistance, load sharing capacity etc. than the traditional clay bricks and can be use as appropriate materials for the construction purposes.
6.	Narayan Maity	Verbal communication	As the plant is equipped with the energy efficient machineries so there is a no chance of accident and as well as no doubt regarding the safety issue of the operators.

SECTION F. Approval and authorization

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The letter(s) of approval from Party for carrying out the project activity is available at the time of submitting the PDD to the validating DoE and same has been provided along with the PDD.

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Appendix 1: Contact information of project participants

Organization	M/s UAL INDUSTRIES LTD
Street/P.O. Box	16,May fair Road
Building	
City	Kolkata
State/Region	West Bengal
Postcode	700019
Country	India
Telephone	9133-40115102
Fax	9133-40115199
E-mail	
Website	
Contact person	
Title	Director
Salutation	Ms.
Last name	Saraf
Middle name	
First name	Noel
Department	
Mobile	919830025655
Direct fax	
Direct tel.	033-40115102
Personal e-mail	noelsaraf@ualind.com

Appendix 2: Affirmation regarding public funding

1. **THE PROJECT ACTIVITY INVOLVES NO FUNDING FROM ANY ANNEX I PARTY.**

Appendix 3: Applicability of selected methodology

Referring to Section B.2 of PDD, the applicability criterion has been applicable with the proposed project activity.

Appendix 4: Further background information on ex ante calculation of emission reductions

EMISSION FACTORS

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

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	0.83	0.82	0.84	0.83	0.81
South	0.72	0.72	0.75	0.75	0.74
India	0.80	0.80	0.82	0.81	0.79

Simple Operating Margin (tCO2/MWh) (excl. Imports) (1)

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	1.02	1.01	1.02	0.99	0.98
South	1.00	0.99	0.97	0.94	0.94
India	1.01	1.01	1.01	0.98	0.97

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

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	0.63	0.60	0.68	0.81	0.86
South	0.70	0.71	0.82	0.76	0.73
India	0.65	0.63	0.71	0.80	0.83

Combined Margin (tCO2/MWh) (excl. Imports) (1)

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	0.82	0.81	0.85	0.90	0.92
South	0.85	0.85	0.89	0.85	0.84
India	0.83	0.82	0.86	0.89	0.90

(1) Operating margin is based on the data for the same year. This corresponds to the *ex post option* **given in "Tool** to Calculate the Emission Factor for an Electricity System", Ver. 2.2.1 (p.6)

GENERATION DATA

Gross Generation Total (GWh)

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	499,380	531,539	548,956	586,311	622,447
South	161,897	167,379	167,587	180,638	185,257
India	661,277	698,918	716,543	766,950	807,704

Net Generation Total (GWh)

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	465,361	496,119	510,693	544,915	579,181
South	152,206	157,247	157,336	169,765	173,925
India	617,567	653,366	668,029	714,680	753,106

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

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	18.5%	19.0%	17.4%	15.9%	17.6%
South	28.3%	27.1%	22.8%	20.6%	21.0%
India	20.9%	21.0%	18.7%	17.1%	18.4%

Net Generation in Operating Margin (GWh)

	2006-07	2007-08	2008-09	2009-10	2010-11
NEWNE	379,471	401,642	421,803	458,043	476,987
South	109,116	114,634	121,471	134,717	137,387
India	488,587	516,275	543,274	592,760	614,374

Source: "BASELINE CARBON DIOXIDE EMISSION FROM POWER SECTOR, Government of India, Ministry of Power, Central Electricity Authority, Sewa Bhavan, R.K.Puram,New Delhi -66
http://cea.nic.in/reports/planning/cdm_co2/user_guide_ver7.pdf

Appendix 5: Further background information on monitoring plan

TEST PROCEDURE FOR BRICKS AND BLOCKS BASED ON HYDRATION CHEMISTRY

AAC blocks/panels shall be tested for their strength class as per the procedures below.
Step 1: Identify the product type; ceramic product or hydraulic product.
This procedure is applicable only to hydraulic product.
Step 2: Identify the national standard for Test of the AAC blocks/panels

(i) Block Density: The block density shall be determined in the manner described in IS: 6441(part I) -1972.
(ii) Compressive Strength: The compressive strength shall be determined in accordance with IS: 6441(Part 5)-1972.
(iii) Thermal Conductivity: The thermal conductivity shall be determined in accordance with IS: 3346-1980.
(iv) Drying Shrinkage: The drying shrinkage shall be determined in the manner described in IS 6441(part 2) -1972.

Step 3: Follow the appropriate national standard for recording the number of test:
As per IS standard 24 blocks shall be taken for testing in a lot. Out of that 24 blocks,12 blocks shall be subjected to the test for compressive strength,3 blocks to the test for density,3 blocks to the thermal conductivity, and 3 blocks shall be reversed for re-test for drying shrinkage if a need arise.
Step 4: Identify the National standard for the specification of the raw materials used in the production process:

(i) Fly ash conforming to satisfy IS 3812-1981 with loss on ignition not more than 6 percent.
(ii) Lime shall satisfy IS 712-1973.
(iii) Sand conforming to satisfy IS: 383-1970.
(iv) Cement complying with the IS 2185(Part 3) -1984.
(v) Water used for production should be free from harmful matters to concrete or reinforcement and it should meet the Indian standard IS:456-1978.
(vi) Additives or admixtures conforming to IS: 9103-1979.

Step 5: Submerge the specimen in water for 24-hours before subjecting for compressive strength test.
Step 6: The specimens are capped with high-grade strength mortar for even surface. Alternately, for quick tests, the specimen surfaces can be dressed with sand evenly.
Step 7: Use testing equipment such as hydraulic compressive strength testing machines.
Step 8: Repeat this procedure every 6 months (e.g., March and September of each year) or at a specified interval for seasonally operating units.
Step 9: Test Certificate should be provided for each production unit, specifying the following:
1. Name and address of production unit
2. Date and location of testing
3. Type of product tested
4. Name and number of testing standard
5. Results of the test.

Appendix 6: Summary of post registration changes

No changes will be incurred yet for the project activity.

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History of the document

Version	Date	Nature of revision
04.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the project design document form for small-scale CDM project activities" (EB 66, Annex 9).
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.
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>.
01	21 January 2003	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		