AAC BLOCK PROJECT BY HIL LIMITED

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Table of Contents

1 Project Details 4
1.1 Summary Description of the Project and its Implementation Status 4
1.2 Sectoral Scope and Project Type 5
1.3 Project Proponent 5
1.4 Other Entities Involved in the Project 5
1.5 Project Start Date 6
1.6 Project Crediting Period 6
1.7 Project Scale and Estimated GHG Emission Reductions or Removals 6
1.8 Description of the Project Activity 6
1.9 Project Location 10
1.10 Conditions Prior to Project Initiation 11
1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks 11
1.12 Ownership and Other Programs 11
1.12.1 Project Ownership 11
1.12.2 Emissions Trading Programs and Other Binding Limits 11
1.12.3 Other Forms of Environmental Credit 11
1.12.4 Participation under Other GHG Programs 12
1.12.5 Projects Rejected by Other GHG Programs 12
1.13 Additional Information Relevant to the Project 12
2 Application of Methodology 14
2.1 Title and Reference of Methodology 14
2.2 Applicability of Methodology 15
2.3 Project Boundary 24
2.4 Baseline Scenario 26
2.5 Additionality 36
2.6 Methodology Deviations 41
3 Estimated GHG Emission Reductions and Removals 41
3.1 Baseline Emissions 41
3.2 Project Emissions 43
3.3 Leakage 50
3.4 Estimated Net GHG Emission Reductions and Removals 52
4 Monitoring 53
4.1 Data and Parameters Available at Validation 53
4.2 Data and Parameters Monitored 59
4.3 Monitoring Plan 67
Quality of the Product 67
5 Safeguards 69
5.1 No Net Harm 69
5.2 Environmental Impact 70
5.3 Local Stakeholder Consultation 70
5.4 Public Comments 70
6 Achieved GHG Emission Reductions and Removals 70

6.1 Data and Parameters Monitored 70
6.2 Baseline Emissions 73
6.3 Project Emissions 73
6.4 Leakage 73
6.5 Net GHG Emission Reductions and Removals 73

1 PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

The company Hyderabad Industries Limited are involved in manufacturing of Autoclaved Aerated Concrete (AAC) blocks in Mahabubnagar Dist, Telangana state, India and part of the C.K.Birla Group. With the prime focus on delivering state of the art energy efficient bricks, the group has already delivered a significant market shares in the region. The Current project of Hyderabad Industries Limited is an initiative to manufacture 150,000 cubic meters of AAC blocks annually at Mahabubnagar Dist, Telangana, India. The core of this technology is the composition of raw materials and its chemistry, with fly ash from thermal plants mixed with lime, cement, gypsum and aluminium powder stone dust and plaster of paris, which enable the blocks and bricks to acquire the mechanical properties required during the hydration and curing process without being sintered.

The prime objective of the project activity is to produce a high-quality walling material and wall 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 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.

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 enhance use of fly ash, an industrial -waste, as a major ingredient of building 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 estimated annual average and the total CO_2e emission reduction by the project activity over the crediting period of 10 years are expected to be 34,209 tCO_2e and 342,094 tCO_2e respectively.

The manufacturing processes of AAC blocks require electricity and steam generation for operation. The consumption of such forms of energy (electricity/fuel) to generate steam is much lower compared to the thermal energy consumed for production of burnt clay bricks. Furthermore, the steam required for the process is generated using biomass briquettes produced locally from agricultural residues, which is renewable energy source and displaces the carbon intensive coal/fuel oils. Further AAC block making 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 scenario existing prior to the implementation of the project activity and the baseline scenario:

This is a green field project. Prior to proposed project activity, there was no AAC block manufacturing facility at the project location. The mostly the fly ash generated is dumped in the open and disposed of without using them at Thermal Power Station. Clay brick manufacturing, an alternative brick manufacturing technology and the baseline scenario as identified in section 2.4 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 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.

The spatial extent of project boundary is the Indian grid, manufacturing unit of the AAC Blocks and source of raw materials.

1.2 Sectoral Scope and Project Type

According to Appendix B of the Simplified Modalities and Procedures (M&P) for small-scale CDM project activities, the project activity falls under:

Sectoral scope: Manufacturing Industries
Type: III-Other Project Activity

Category: AMS III. Z. - Fuel Switch, process improvement and energy efficiency in brick manufacture Version 6.0

1.3 Project Proponent

Organization name	Hyderabad Industries Limited
Contact person	Mr. Naresh Miryala
Title	Sr. Manager- Secretarial & Compliance
Address	Office No 1 & 2 , L7 Floor, SLN Terminus, Sy. No.133, Near Botanical Gardens, Gachibowli, Hyderabad – 500032, India.
Telephone	-
Email	naresh.miryala@hil.in

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Contact person	Mr. Manish Dabkara
Title	MD & CEO
Address	Office No. 201, EnKing Embassy, Plot No. 48, Scheme No. 78, Part II, Vijay Nagar INDORE – 452010.
Telephone	+91-731-4289086
Email	manish@enkingint.org

1.5 Project Start Date

The start date of the project activity is 15/11/2015, which is start date of actual operation of the project activity.

1.6 Project Crediting Period

The project crediting period shall be a maximum of ten years which will be renewed at most thrice.

The start date of first crediting period is 15/11/2015 and end date as 14/11/2025.

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Project Scale	
Project	√
Large project	--

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	17863.04
Year 2	23010.49
Year 3	27187.95
Year 4	29862.69
Year 5	30921.55
Year 6	35541.46
Year 7	35541.46
Year 8	35541.46
Year 9	35541.46
Year 10	35541.46
Total estimated ERs	342,094
Total number of crediting years	10
Average annual ERs	34,209 (rounded)

1.8 Description of the Project Activity

The project proponent has adopted the new energy efficient technology for the AAC block manufacturing process. The project activity has a production capacity of 500 CuM/day for AAC Blocks manufacturing.

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

Ingredients	**Raw material consumption per CuM AAC Blocks (Kg/Cum)**	**Source**
Fly ash	370	Project Report: Raw Material Consumption
Cement	100.8	
Plaster of Paris	10.41	
Lime	68	
Aluminum	0.336	
Stone Dust		
Total solid	549.546	
Total water	395.6	

Table: Description of major equipment used in AAC block manufacturing:

Name of the Machines	**Specification of the Machines**		**Numbers of machines used**	**Source**
Boiler(s)	TPH	8	1	Project Report
	Boiler pressure 17.5 kg/cm2	17.5		
	Boiler Capacity, (F& A 100° C)	8000 kg/Hr		
	Type	Coal/ Biomass Fired boiler		
Air Compressor	Air Receiver capacity 1.0 (1000 I)	1.0 m3	2	
	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	
Auto clave	Dimension (Dia x Length)		6	
	steam pressure	12 bar		
DG set	Capacity	250kVA	2	

The average lifetime of the major equipment's under project activity is around 30 years as per the equipment supplier specifications.

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 requires less energy and low carbon intensive as compared to conventional bricks manufacturing technology in India.

Summary of production process of AAC Blocks is mentioned below:

Dosing and mixing

The process begins with cleaning tank where Fly Ash is being mixed with water to form a slurry which is then transferred into the Press Tank after filtration and then finally transferred into the mixing tank through pipeline. Lime and Cement are being simultaneously discharged into the mixing tank from separate silos of Lime and Cement. Mixing up the raw materials in the control system of the mixing tower with hot and cold water released through the spray nozzles, Aluminium dry powder and plaster of paris is being added into the mixing tank and thus final mixing of raw materials is completed.

Casting & Rising/pre-curing

Casting the mix with a mould system with inside dimensions of 5.625 m3, the mix is poured into the mould and vibrated so that the entrained air is released. The moulds are then parked in a parking area where the mass inside the mould rises like a cake. Once the cake is harder end enough, the mould is transported to a tilting station and the cake is separated from the mould on a platform which goes through horizontal and cross cutters.

Vertical/Horizontal /Cross cutting and back tilting

Cutting and milling the cakes with cutter among them horizontal cutter are equipped with broken –wire–detection system to indicate the wire which has broken. After cutting the cakes these are being transfer to the milling unit attached with the cutting unit for milling up each side of the cakes. After that the cakes are conveyed to the tilting table for back tilting for giving the extra hardness to the cakes.

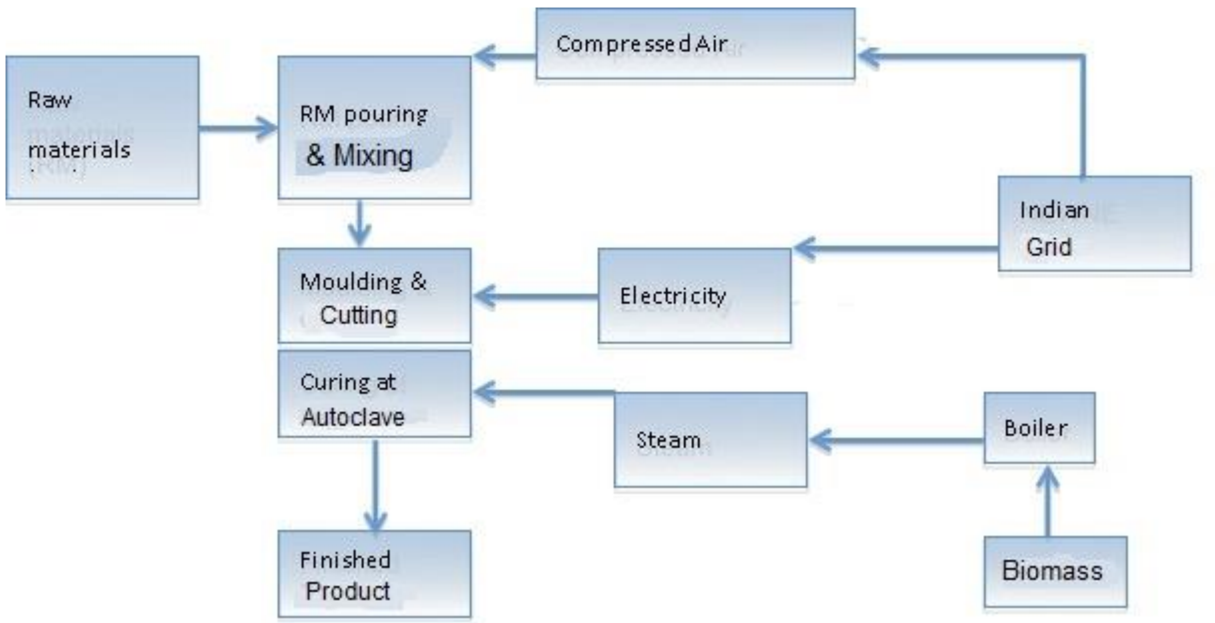
Bed waste removal/Green separation/Stacking and buffering of the green cakes

All the sticking impurities are being separated in the green separator for avoiding the sticking of layer during the process of Autoclaves.

Autoclaving & packaging

The cakes are cured with steam at a pressure of approx 12 bars in auto clave machine. After autoclaving the cakes are taken out of autoclaves unloaded from the cooking frame and proceed to the dispatching line for final dispatching.

The below 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 NEWNE grid & DG set: Steam- from Boiler(s): from biomass combustion, Compressed Air – from Air Compressor: from Electricity imported from INDIAN electricity grid.



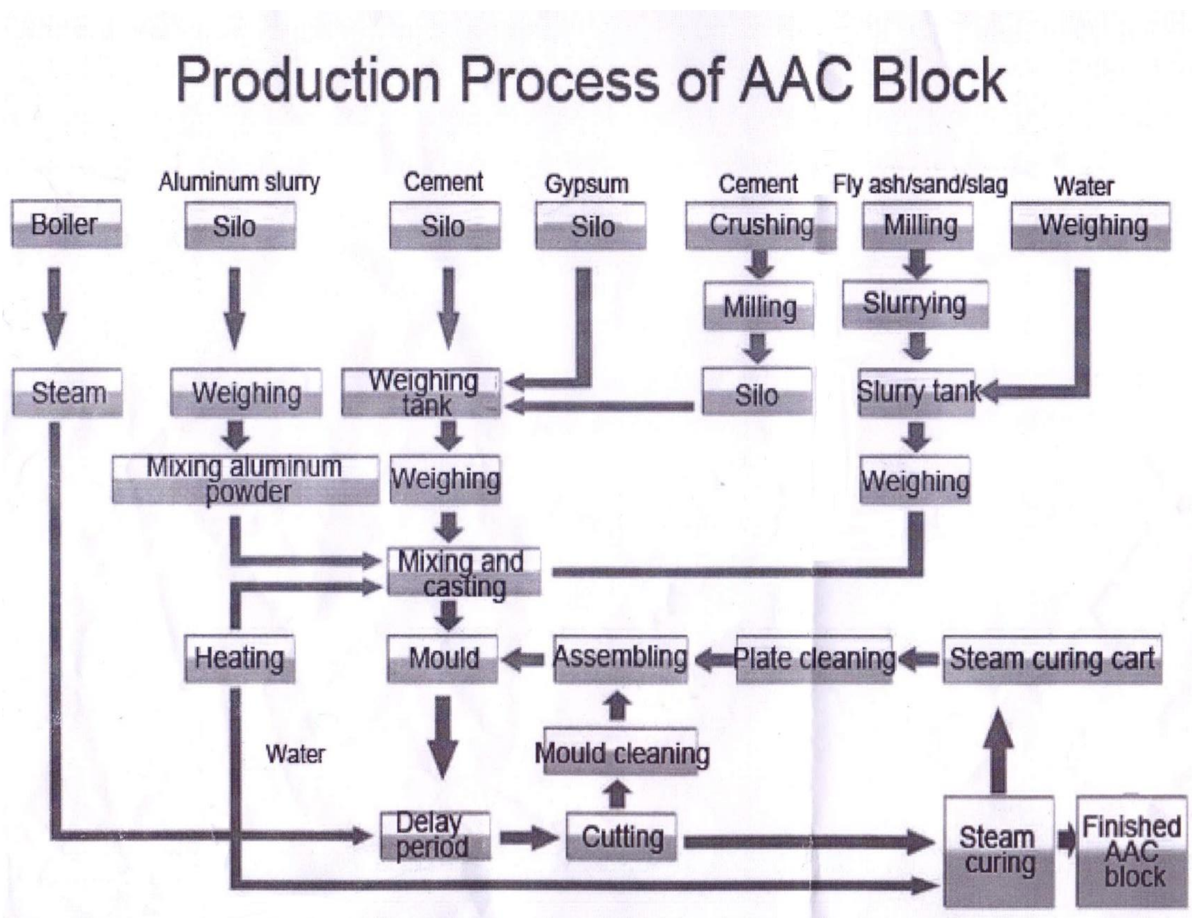
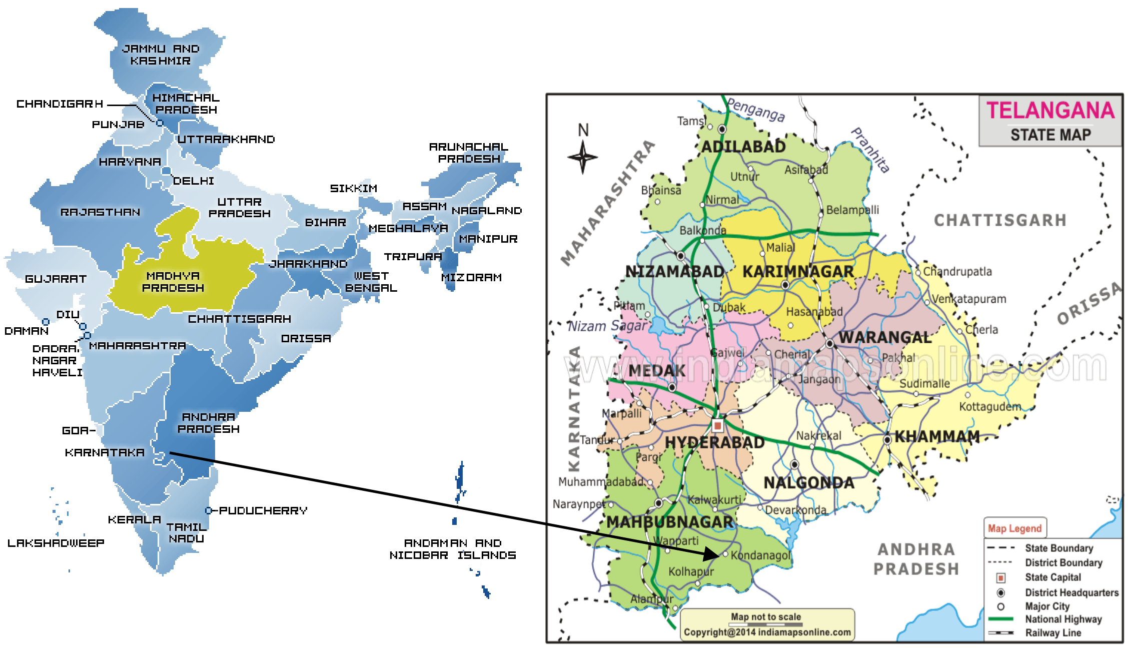


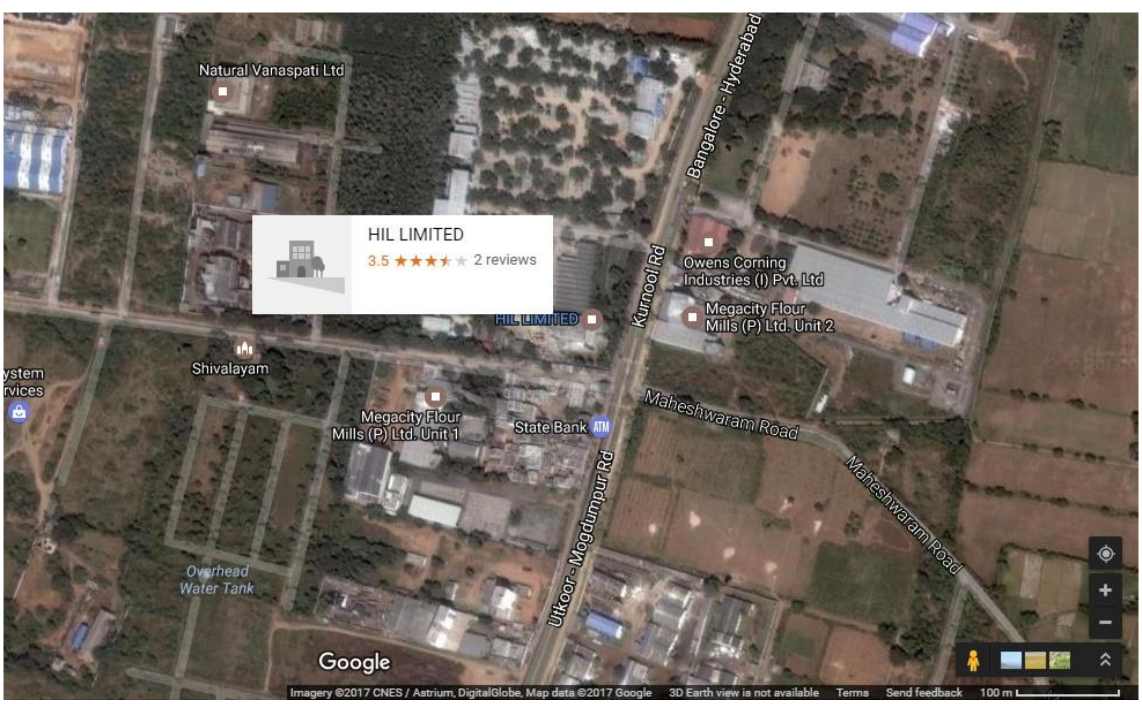
Figure: Flow Chart of Production Process of AAC Blocks

1.9 Project Location

The nearest airport is in Hyderabad. Project site is well connected by district roads to the nearest town. The physical address and geographic co-ordinate of the project activity under the project is provided below:

Latitude	Longitude	Village	Tehshil	District	State
N 17^{0}10'7.1436"	E 78^{0}17'53.09"	Thimmapur	Kothur	Mahabub nagar	Telangana





1.10 Conditions Prior to Project Initiation

This is a Greenfield project (new facility). Prior to proposed project activity, there was no AAC block/brick manufacturing facility at the project location. The fly ash is mostly dumped disposed of without any processing and hence causing a major problem for safe disposal. In absence of the project activity the equivalent amount of bricks would have been produced using conventional technology that is clay bricks.
Fly ash is not available in nearby regions as there are no any thermal power plant within 100 Km of project site. Fly ash is being procured from Third Parties as per requirements.

As per annual report of Central Electricity Authority, Government of India, the utilisation of fly ash was 55.69%[1], resulting in a surplus availability of 44%.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

There is no legal requirement on the choice of a particular technology for brick manufacturing in India. The project activity conforms to all the applicable laws and regulations in India.

1.12 Ownership and Other Programs

1.12.1 Project Ownership

The following evidences can verify the ownership of the Project and its right to use:

1. Commissioning certificates
2. License to Factory operations

1.12.2 Emissions Trading Programs and Other Binding Limits

This project activity is voluntary initiative and it is not to meet any local laws or regulatory compliances. Project has not participated in emission trading program and other binding limits. An undertaking has been submitted that PP shall not claim for GHG emission reduction credits for the given crediting period under any other emission-trading program or GHG binding limits.

1.12.3 Other Forms of Environmental Credit

PP declares that emission reductions generated from the project activity will not be double counted (i.e. issuance of other form of environmental credit like under CDM) for the particular crediting period, which is being claimed under VCS mechanism. PP has submitted an undertaking to the VVB that they shall not claim for GHG emission reduction credits for the given period under any other emission-trading program. Also the project will not claim any other form of environmental credit.

[1] http://cea.nic.in/reports/others/thermal/tcd/flyash_final_1415.pdf

1.12.4 Participation under Other GHG Programs

The project activity has not been registered, or currently seeking registration under any other GHG programs. The project has not participated under any other GHG programme.

For current monitoring period, there is no any claim of GHG emission reductions with other GHG program.

1.12.5 Projects Rejected by Other GHG Programs

PP hereby declares that any other GHG program has not rejected the project activity; an undertaking for the same has been submitted by the PP.

1.13 Additional Information Relevant to the Project

Eligibility Criteria

The project activity is not a grouped project.

Leakage Management

As per the applied methodology, the leakage from the transportation and production of raw material is considered and calculated in a conservative manner. However, the production process does not involve any activity with potential leakage.

Commercially Sensitive Information

No commercially sensitive information has been excluded from the public version of the project description.

Sustainable Development

Ministry of Environment & Forests, Government of India has stipulated following indicators for sustainable development in the interim approval guidelines for GHG projects.

1. Social well-being
2. Economic well-being
3. Environmental well-being
4. Technological well-being

Environmental wellbeing:

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, (sub- bituminous) in India. With the implementation of the proposed project activity, consumption of fossil fuels for building material manufacturing will be avoided, thus contributing to GHG emission reductions.

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.

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, releases considerable amounts of land. Also, water 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. 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 is being substantially reduced in the neighbouring region. Better quality employment creation: The proposed project activity is situated in the Mahabubnagar district, Telangana state, India. Since the proposed project activity is a green field project it has created employment opportunities for more than 300 skilled-unskilled people in the entire project area.

Economical Benefits:

Reduction of dependence from fossil fuels: The project activity reduces to the maximum the dependence of the brick manufacturing process from fossil fuels. This reduces the overall dependence of the whole region from the imports and availability of fossil fuels, thereby allowing other industries to use energy resources.

Technical Benefits:

Enhancement of the use of green building material: The following are the ecological 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 are a high quality product with high insulating capabilities – their use leads 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 feature enables the building structure to be lightweight and thus would require less deep foundations.

In view of the above, the PP has considered that the project activity profoundly contributes to the sustainable development.

Further Information

Till now no legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and/or temporal information that may have a bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

Following approved baseline & monitoring methodology is applied;

Title: Type-III, Other Projects

Methodology: AMS III.Z. Fuel Switch, process improvement and energy efficiency in brick manufacture

Version: 06.0, valid from EB 85 Annex 18. Sectoral Scope: 04,

Reference: The approved baseline methodology has been referred from the "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories."
http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X

The tools referenced in this methodology include:

--- Tool to calculate the emission factor for an electricity system Version 05.0.0, Annex 9 of EB 87 Report (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v5.0.pdf)

--- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" Version 02, Annex 11, EB41.

(http://cdm.unfccc.int/methodologies/pamethodologies/tools/am-tool-03-v2.pdf)

--- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption", Version 02, Annex 8, EB 87. (https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v2.0.pdf)

--- "Project and leakage emissions from road transportation of freight" Version 01.1, Annex 23 of EB70

(https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf)

Guidelines:

--- Guidelines on the Assessment of Investment Analysis Version-05, Annex-5 of EB62 Report http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

--- General guidelines for SSC CDM methodologies, Version 22.1, EB 86, Annex 13.

2.2 Applicability of Methodology

As per the Para 12 of Simplified M & P for small-scale CDM project activities (FCCC/CP/2002/7/Add.3, Page 21) – "to use simplified modalities and procedures for small-scale CDM project activities, a proposed project activity shall meet eligibility criteria for a small scale CDM project activity". AMS III.Z Version-06.0 has been used and justifications for the eligibility conditions are provided below.

Applicability Conditions	Position of the project activity vis-à-vis applicability conditions

1. The methodology comprises one or more technology/measures listed below in brick[2] production facilities: *(a) Shift to an alternative brick production technology/process or installation of a new brick production technology/process;* *(b) Complete/partial substitution of fossil fuels or non-renewable biomass (NRB) with renewable biomass (including biomass from dedicated plantations or solid biomass residues such as sawdust and food industry organic liquid residues);[3]* *(c) Complete/partial substitution of high carbon fossil fuels with low carbon fossil fuels;[4]* *(d) Reduce the consumption of fossil fuels or NRB due to improvement of the production process.*	The proposed project activity adopts an alternative brick production technology i.e. Autoclaved Aerated Concrete (AAC) Technology (low carbon intensive) and displaces the brick production technology BTK (high carbon Intensive) – therefore the project activity meets the applicability criterion.
2. The measures may replace, modify, retrofit[5] or add capacity to systems in existing facilities or be installed in a new facility.	The proposed project activity is a New facility (Greenfield project activity) and there was no existing facility at project site- therefore the project activity meets the applicability criterion.

[2] Brick in the context of this methodology includes solid bricks and blocks as well as hollow blocks used in building construction.

[3] Fatty acids from oil extraction, waste oil and waste fat of biogenic origin (includes waste oil from restaurants, agro and food industry, slaughterhouses or related commercial sectors). The sources/origin of waste oil/fat and respective volumes must be identified and clearly documented in the PDD. No CERs from waste oil/fat can be claimed under this methodology if it is not produced from biogenic origin, biogenic shall mean the oils and/or fats originate from either vegetable or animal biomass, but not from mineral (fossil) sources.

[4] For example from anthracite coal to natural gas.

[5] For example to, replace and/or modify an existing heating and/or firing facility(ies) to enable the use of biomass residues.

<table>
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3. 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 (see paragraph 11). Examples include pressed mud blocks (soil blocks) with cement or lime stabilization[6] and other 'unburned' bricks that attain strength due to fly ash, lime/cement and gypsum chemistry.

</td><td>

It may be noted that blocks 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 Table: details on Comparison on Service level of the project bricks with baseline bricks: For measurement of compressive strength of bricks IS- 6441 (Pt- 5) of 1972 is being used.

<table>
<tr><th>Parameter</th><th>Baseline</th><th>Project</th></tr>
<tr><td>Minimum compressive strength (N/mm^2)</td><td>2.5-3</td><td>3-5</td></tr>
<tr><td>Dry density (kg/m^3)</td><td>1800</td><td>551-650</td></tr>
</table>

Source: http://aac-india.com/aac-blocks-vs-clay-bricks/

Therefore the project activity meets the Applicability criterion.

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<tr><td>

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".

</td><td>

In accordance with para 22 of *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.

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5. The requirements concerning demonstration of the remaining lifetime of the replaced equipment shall be met as described in the "General guidelines for SSC CDM

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The proposed project activity does not involve retrofit or modification of existing facility. As proposed project activity is a new facility (Greenfield Project). Hence the criteria is not applicable.

</td></tr>
</table>

[6] May involve mechanical and hydraulic systems for energy transmission to the soil block via a lever, toggle, cam, pivot, ball and socket joint, piston, etc.

	methodologies". If the remaining lifetime 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 been replaced in the absence of the project activity.	
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 or NRB (non-renewable biomass) were used in the brick production systems that are being modified or retrofitted. In cases where small quantities of renewable biomass were used for experimental purposes this can be excluded.*	The proposed project activity does not involve retrofit or modification of existing facility. As the proposed project activity is a new facility (Greenfield Project). Hence the criteria 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) and/or thermally (e.g. gasification to produce syngas).*[7]	The proposed project activity is using biomass briquettes, a renewable biomass for steam generation, however, the biomass is procured from vendor and directly used in boiler without any chemical or mechanical processing. Hence the criterion is met.

[7] The syngas shall be derived from gasification of renewable biomass only and no methane emissions are to be released to the atmosphere, thus demonstrating the complete use for combustion of the syngas in the project equipment.

8. 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. A default value of 0.030 t CH_4/t charcoal may be used in accordance with "AMS-III.BG.: Emission reduction through sustainable charcoal production and consumption";* (c) *If charcoal is produced from other CDM project activities, it shall be ensured that no double counting of the emission reductions occurs.*	The project activity does not utilizes charcoal. Hence this criteria in not applicable.
9. 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: *(a)* ***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;* *(b)* ***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:*	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 500 CuM (AAC blocks) per day capacity. 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, plaster of paris, Cement and Aluminium and Stone Dust (in very marginal amounts). Fly-ash and stone dust is a waste product, plaster of paris 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 55,666 MT.

(i) 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 per cent greater than the demand for such materials or the availability of alternative materials for at least one year prior to the project implementation; *(ii) Approach 2: demonstrate that suppliers of the 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 materials (e.g. at the end of the period during which the raw material is sold) that they could not sell and that is not utilized.*	Step 2: The current supply situation of Fly ash to be utilized is assessed below and their abundance is demonstrated - Fly ash - The annual generation of fly ash in the year 2013-14 in Telangana is over 3.4276 million tons. (http://cea.nic.in/reports/others/thermal/tcd/flyash_yearly_201314.pdf and utilization is 2.5464. It only shows that utilization is approximately 57% hence showing abundant availability of fly ash in the region. Being a byproduct 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 IBRAHIMPATNAM and Warangal, Andhra Pradesh from Thermal Power plant of MPPGENCO located at a distance of 200 kms from the project site, the proposed project activity is located within permissible limit of thermal power plant, which is generating 0.2333 million MT[8] of fly ash during the first half of year 2014-15. The fly ash is disposed on land and causes soil as well as water pollution and affects the environmental ecosystem. Thus, it may be concluded that fly ash is available in abundance and the project activity meets the applicability criterion.

[8] http://cea.nic.in/reports/others/thermal/tcd/flyash_halfyearly_201415.pdf

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10. 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 six-month intervals (at a minimum) and test certificates on compressive strength are made available for verification;

(b) The existing facilities involving modification and/or replacement shall not influence the production capacity beyond ±10 per cent 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 5 above;

(c) *Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.*

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(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: Comparison of Service level of the project blocks with baseline bricks:

<table>
<tr><th>Parameter</th><th>Baseline</th><th>Project</th></tr>
<tr><td>Minimum compressive strength (N/mm^2)</td><td>2.5-3</td><td>3-5</td></tr>
<tr><td>Dry density (kg/m^3)</td><td>1800</td><td>551-650</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.

b) 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.

c) Emission reductions from the project activity are less than the methodology limit of 60 $ktCO_2e$ annually. Thus the criterion under discussion is applicable.

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11. This methodology is not applicable if local regulations require the use of

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The project activity adopts a new technology. The local regulation does not require the brick manufacturers to install any specific technology

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the proposed technologies or raw materials for the manufacturing of bricks unless widespread non-compliance (i.e. less than 50 per cent of brick production activities in the country comply) of the local regulation evidenced. .	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 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 "Table- XV: Model of Fly-ash Utilization for year 2014-15" on page 21 of the Central Electricity Authority Annual Report 2014–15 (Reference: http://cea.nic.in/reports/others/thermal/tcd/flyash_final_1415.pdf), of the 55.69% utilization of fly ash generated , that consumed in bricks manufacturing is a meagre 11.72%, that commensurate to 12.02 million tonnes. 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 and independent publications 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[9]. Further the brick making plants are finding it difficult to follow the Central Government instructions for using fly ash in brick making[10]. Hence the applicability condition is applicable to the proposed project activity, as Indian brick sector is very informal and penetration of fly ash use in bricks or blocks making is very marginal.
12. In cases where the project activity utilizes biomass sourced from dedicated plantations, applicability conditions prescribed in the tool "Project emissions from cultivation of biomass" shall apply. If the project activity involves reducing the NRB consumption, project participants shall demonstrate that NRB has been used in the project region since 31 December 1989, using survey methods or referring to published literature, official reports or statistics	The proposed project activity uses biomass briquettes in boiler for producing steam, the biomass briquettes are directly procured from local vendors who are located within 60 kms of project boundary. The criterion is not applicable.

9 http://www.business-standard.com/article/economy-policy/brick-makers-seek-exemption-from-green-guidelines-104092401054_1.html

10 http://www.business-standard.com/article/economy-policy/brick-makers-seek-exemption-from-green-guidelines-104092401054_1.html

13. The following cases are exempted from 'determining the occurrence of debundling' as per the "Guidelines on assessment of debundling for SSC project activities": *(a) Project activities that aggregate brick units with holistic production cycles i.e. from raw material procurement to finished product, where each unit is not larger than 5 per cent of the Type III small-scale CDM project activity thresholds i.e. 3,000 t CO_2e; or* *(b) Project activities that aggregate brick units, where each unit qualifies as Type III microscale CDM project activity and the geographic location of the project activity is a least developed countries/small island developing states (LDC)/(SIDS) or special underdeveloped zone (SUZ) of the host country as identified by the government in accordance with the guideline on "Demonstrating additionality of microscale project activities".*	As per the provisions prescribed in "Clean development mechanism project standard" and further referring to "Methodological Tool- "Assessment of debundling for small scale Project Activities" EB 83, Annex 13, Para 5[11], "A small project activity shall be deemed to be a de-bundled component of large scale 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; and* *(c) Registered within the previous 2 years; and* *(d) Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point"* There are no project activities by the same project proponent in same project category, registered or applied under any GHG program whose boundary is within 1 Km of the project boundary. Hence, the project activity is not a de-bundled component of a large-scale project activity.

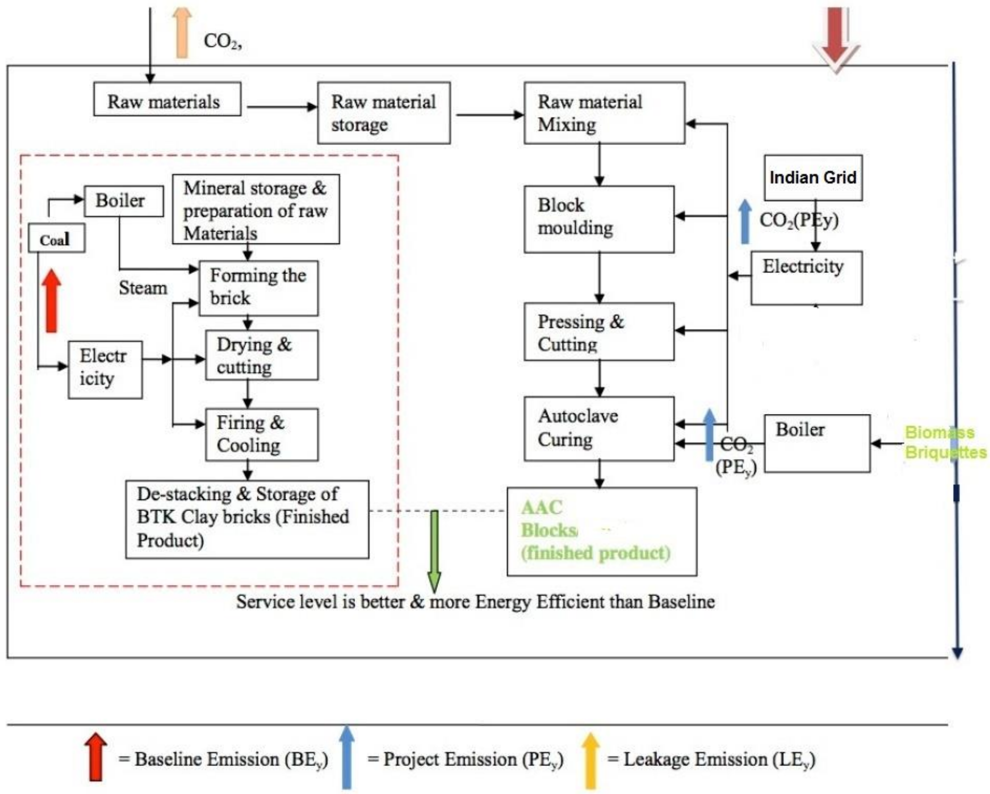
The project activity fulfils the applicability criteria of approved small scale methodology AMS III.Z version-06.0.

2.3 Project Boundary

As per paragraph 19 of the methodology, "The project boundary is the physical, geographical site where the blocks/ bricks 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, however biomass briquettes used in the project activity are being sourced from third parties and are produced from agricultural wastes available locally, hence no any dedicated plantations are used for the production of briquettes. In cases involving thermo-mechanical

[11] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-20-v1.pdf

processing of the biomass (e.g. charcoal; briquettes; syngas) the sites where these processes are carried out shall be within the project boundary." Hence the project boundary includes all the manufacturing facilities of AAC Blocks as well as biomass briquettes production premises also from where it has been sourced.



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

Source		Gas	Included?	Justification/Explanation
Baseline	Fossil fuel combustion in red clay brick kiln	CO_2	Yes	Main emission source
		CH_4	No	Neglected for simplicity
		N_2O	No	Neglected for simplicity
		Other	No	Neglected for simplicity
Project Scenario	Electricity consumption for operating plant machinery	CO_2	Yes	Main emission source
		CH_4	No	Neglected for simplicity
		N_2O	No	Neglected for simplicity
		Other	No	Neglected for simplicity
Leakage	GHG emissions during raw	CO_2	Yes	Main emission source
		CH_4	No	Neglected for simplicity

	material production	N_2O	No	Neglected for simplicity
		Other	No	Neglected for simplicity
	GHG emissions during raw material transportation	CO_2	Yes	Main emission source
		CH_4	No	Neglected for simplicity
		N_2O	No	Neglected for simplicity
		Other	No	Neglected for simplicity

2.4 Baseline Scenario

As per paragraph 20 of the methodology AMS-III.Z Version 6.0, "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 blocks 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 5 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 AAC blocks 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 20 of the methodology AMS-III.Z Version 6.0 point (b) is applicable.

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.

"Type II and III Greenfield projects (new facilities) may use a Type II and Type III small scale methodology provided that they can demonstrate that the most plausible baseline scenario for this project activity is the baseline provided in the respective Type II and Type III small-scale methodology. The demonstration must include an assessment of the alternatives of the project activity using the following steps:

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

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

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

Step 4:
If only one alternative remains that is:

(a) Not the proposed project activity undertaken without being registered as a CDM project activity; and

(b) Corresponds to one of the baseline scenarios provided in the methodology; then the project activity is eligible under the methodology. If more than one alternative remain that correspond to the baseline scenarios provided in the methodology, choose the alternative with the lowest emissions as the baseline."

Step 1 of the Guidelines

The alternative scenarios to the project activity comprises of different walling materials that are available in India. Based on the different walling materials, the alternatives available to GBMIPL which would have comparable levels of output are as follows:

Baseline alternative scenario	**Alternative Walling Materials**	**Alternative description**
A	AAC Blocks	The project activity undertaken without being registered as a VCS project activity, i.e., installation of a 150,000 m^3/annum AAC blocks manufacturing unit. The AAC blocks produced would conform to relevant national standard.
B	Baked Clay Bricks	The prevailing alternative technology in the bricks sector, that deliver outputs or services (e.g. electricity, heat or cement) with comparable quality, properties and application areas, taking into account, where relevant, examples of scenarios identified in the underlying methodology. Prevailing alternative for walling material manufacturing in

		India is baked (fired) clay brick manufacturing through the application of various technologies[12](as VSBK, Fixed Chimney BTK, Moveable Chimney BTK, Tunnel Kiln, Clamp and other Batch Kilns, etc.) and fuels[13]). These bricks have comparable properties with those of the AAC blocks, in terms of quality and application areas (construction purpose). The estimated production of burnt clay bricks is to the tune of 140 billion out of total 151.83 billion brick equivalent[14]. **Hence this is evidently the most prevailing alternative to the project activity.**
C	Fly-ash bricks	Manufacturing of fly-ash bricks having comparable quality and application area as AAC block. There is a local regulation on use of fly ash (one of the raw material for project blocks) for the manufacturing of bricks. As per MOEF Notification dated 14th September 1999 and its amendments dated 27th August 2003 and 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. As per data taken from "International Journal of Waste Resources" Article on Indian fly ash production and consumption scenario[15] on page 2 of the Report 2010 - 11, of the 55.79% utilization of fly ash generated annually, that consumed in bricks manufacturing is a meager 6.30%. The absence of compliance of the aforesaid notification has been mentioned in the report[16] submitted jointly by Akanksha Tiwari and Anubhav Sogani to the regional MoEF office of the Western Region of India. 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[12] by B.V.M Engineering College, Gujarat, and presented in the "National Conference on Recent Trends in Engineering and Technology". In many states of India, incompatibility of the soil in mixing

[12] *Page 27 of the report: Strategies for Cleaner Walling Material in India; http://shaktifoundation.in/wp-content/uploads/2014/02/strategies%20for%20cleaner%20walling%20materials%20in%20india.pdf*

[13] *Page 26 of the report: Strategies for Cleaner Walling Material in India; http://shaktifoundation.in/wp-content/uploads/2014/02/strategies%20for%20cleaner%20walling%20materials%20in%20india.pdf*

[14] *Strategies for Cleaner Walling Material in India, footnote 3 of page 1 in the document; http://shaktifoundation.in/wp-content/uploads/2014/02/strategies%20for%20cleaner%20walling%20materials%20in%20india.pdf*

[15] http://www.omicsonline.com/open-access/indian-flyash-production-and-consumption-scenario-2252-5211.1000118.pdf

[16] Page 82 of the Report: *http://moef.nic.in/downloads/public-information/MoEF-IIFM-thermal-power-plants.pdf*

		with the fly ash was cited as one of the major reasons by the brick manufacturer's contending the notification[17]. The increase in cost of fly ash 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[18] sponsored by the MoEF (GoI). These facts have been further corroborated through studies published in the Indian Concrete Journal[19] and independent publications[20] by INSWAREB (Institute for Solid Waste Research& Ecological Balance – an NGO that has made significant contribution to the utilisation fly ash in India) in response to the above notification. Hence, it can be concluded from the above discussion that there is widespread non-compliance of the regulation to use 50% of fly-ash for brick manufacturing within 100 kms of a thermal power plant. Hence fly-ash bricks cannot be considered as an alternative to the project activity.
D.	Cement stabilized soil blocks	Manufacturing of cement stabilized soil block having comparable quality and application area as AAC block. However the penetration of this technology is to the tune of only 0.1%[21]. Hence this cannot be considered as the prevailing alternative to the project activity.
E.	Concrete Blocks	Manufacturing of concrete blocks having comparable quality and application area as AAC block. The estimated production of concrete blocks is to the tune of 9 billion out of total 151.83 billion brick equivalent which corresponds to 5.9% of total walling materials[22]. Hence the production of concrete blocks as an alternate walling material cannot be construed as the prevailing alternative to the project activity.

[17] Paragraph 4 of the news article available at: http://www.business-standard.com/india/news/brick-makers-seek-exemptiongreen-guidelines/188758/

[18] Paragraph four of the study available at: http://www.mse.ac.in/completed/proj-flyash.htm

[19] Conclusion section in page 21 and point of view section in the report available at: http://www.icjonline.com/forum/point_of_view.pdf

[20] Pages 2, 3, 5 and 7 of the report available at: http://www.fal-g.com/nattach/files/SuggestionstoDNonFAdt._6-11-08.pdf

[21] Strategies for Cleaner Walling Material in India, http://shaktifoundation.in/wp-content/uploads/2014/02/strategies%20for%20cleaner%20walling%20materials%20in%20india.pdf

[22] Strategies for Cleaner Walling Material in India, http://shaktifoundation.in/wp-content/uploads/2014/02/strategies%20for%20cleaner%20walling%20materials%20in%20india.pdf

F.	FAL-G Bricks	Manufacturing of FAL-G bricks having comparable quality and application area as AAC block. The estimated production of FAL-G bricks is to the tune of 2.4 billion out of total 151.83 billion brick equivalent which corresponds to only 1.6% of total walling materials[23]. Hence the production of FAL-G bricks as an alternate walling material cannot be construed as the prevailing alternative to the project activity

Step 2 of the Guidelines
All the baseline alternatives identified under step 1 above, are in compliance with local laws and regulations.

Step 3 of the guidelines: Referring to "Guidelines on the demonstration of additionality of small-scale project activities", version 10:
"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."*

The project proponent has used the "barrier due to prevailing practice" and "other barriers" to determine the most plausible baseline for the project activity.

As demonstrated in Step 1 above, since burnt clay bricks are the prevailing walling material that is widely used in India and since the market share of other bricks/blocks manufacturing technology is negligible as compared to the burnt clay bricks, options C, D, E, & F have not been taken forward for further analysis. Hence only alternative A, B and C have been carried forward for further analysis.

The barrier analysis for identified scenarios is carried out as follows:

Barrier	**Scenario A – Manufacture of fly ash based AAC blocks without VCS benefit in consideration**	**Scenario B – Baked clay brick manufacturing**

[23] Strategies for Cleaner Walling Material in India, http://shaktifoundation.in/wp-content/uploads/2014/02/strategies%20for%20cleaner%20walling%20materials%20in%20india.pdf

Barrier due to prevailing practice	Faces "Barrier due to prevailing practice- Fly ash based AAC block is not the prevailing walling material used or manufactured in India. As per, "Strategies for cleaner walling material in India"[24], AAC blocks have low penetration in India which is to the tune of only 0.2% and fired clay bricks are currently prevalent in Indian walling industry and the scenario is expected to be same in future. AAC block project activity technology, unlike the traditional clay brick making, requires recipe control of several main ingredients namely fly ash, cement, lime and water etc. at the mixing step. In case there are changes to the sources of the raw materials, the chemistry and hence the recipe needs to be reworked. Hence it requires the intervention of advanced technologies leading to much higher investments. AAC blocks being a relatively newer product as compared to baked clay bricks in India, there is high scarcity of skilled operators for successfully running the AAC block manufacturing unit. For operating the unit, special on the job training needs to be provided to operators. On the contrary, clay brick production is a simple commonly used technological practice and is practiced at the cottage industry level. Small fired clay brick producers have no incentives to introduce alternate technologies, which require new investments, training to stabilize the operation, and a different business practice in long-term perspective. Burnt clay bricks are therefore the most prevalent walling material used and manufactured in India and is also expected to remain the most prevalent walling material in the future unless significant regulatory mechanisms are evolved and enforced. -Further, the price of AAC blocks has to	Does not face Barrier due to prevailing practice – Baked clay bricks manufacturing is an age old and widely followed process for construction brick manufacturing in India. The brick manufacturing industry in India is predominantly constituted of conventional clay bricks manufacturing units. There are several small capacity kilns and few large capacity kilns in India. As per Status Report on VSBKs in India[25], there are more than 100,000 fired clay brick kilns in India, manufacturing more than 140 billion bricks per year. This is further corroborated through recent data published in "Strategies for cleaner walling material in India"[26] which estimates that out of 151.83 billion brick equivalent, burnt clay bricks contribute 140 billion brick equivalent. Hence there is an overwhelming prevalence of burnt clay bricks in walling materials used in India. The fuel used is coal[27] (non-coking coal). As a result, there is much easier availability of skilled operators for successfully running a clay bricks manufacturing unit. Raw material is clay which is available to the brick manufacturer from his surroundings. Manufacturing of burnt clay bricks does not require very sophisticated technology and the technique used is proven and widely practiced for many decades. Burnt clay bricks continue to be the most popular form of walling material, accounting for most of the total market in the country. This is supported by studies done by organizations like TERI[28].

[24] http://www.enzenglobal.com/pdf_downloads/strategy_walling.pdf (Page #10)

[25] http://www.cosmile.org/papers/brick_statuspaperVSBKsindia2003.pdf (page #2)

[26] http://www.enzenglobal.com/pdf_downloads/strategy_walling.pdf

[27] http://www.cmaindia.org/upload/file/Quality-of-coal.pdf

[28] http://www.cosmile.org/papers/brick_statuspaperVSBKsindia2003.pdf

	be kept lower than burnt clay bricks due to the reasons of market resistance to fly ash containing AAC blocks, as mentioned below.	
Other Barriers – Market Acceptability barrier	Building construction using AAC blocks is not a common practice in India. According to a studies conducted by market research agency IMRB International, given the wall area addition in India in 2007 - 08, the share of AAC blocks is low at less than 1%. This fact is evidence of the extremely low market acceptance of the product, and poses additional risk to PP, in terms of reduced demand and corresponding underutilization of the plant. It may also be noted that the plant has been operating at a lower capacity due to lower demand of the AAC blocks. The research report alluded earlier to, also presents viewpoints of builders and consultants in construction industry, wherein the choice of AAC block as construction material is found to be negligible compared to clay bricks. The negative perception about the durability and quality of AAC blocks arises from low consumer awareness about the product. In addition to the grey colour of AAC blocks imparted by the colour of fly ash, the mere presence of ash in the product also creates negative perception, affecting the sales of product in the market.	Does not face this barrier The consumer in India is preferentially biased towards clay bricks. A clay bricks manufacturer does not require any additional marketing efforts for selling the complete production output.

Step 4 of the Guidelines

From the above barrier analysis, it can be concluded that alternative B is the only alternative which is not prevented by any barrier. Thus, there is only one alternative remaining, which is not the project activity undertaken without VCS benefits in consideration. Thus, the most plausible alternative (Alternative B) derived from the above analysis is considered as baseline to the VCS project activity.

Thus, the baseline to the project activity is:

Manufacturing of fired-clay bricks through conventional firing production processes using coal as a fuel for thermal energy generation.

The identified baseline scenario, as mentioned earlier, includes different technologies with different levels of energy consumption. Hence, a weighted average energy use of these technologies has been considered for determining the baseline emissions of the facility or facilities.

Building materials in India includes 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. 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).

Table: Market share of different walling materials

Type of walling material	Market share (in INR crore)	Percentage (%) 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 is 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 particularly in India. This can be demonstrated from the table given below:

Table: 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	57600			
Clay Brick*	139.0	414	4	1657
FA Bricks**	112.6	512	5.5	2815
AAC Blocks***	1779.57	32	90.90909091	2942

* http://www.hindu.com/pp/2009/02/14/stories/2009021450090500.htm

** 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 tables, 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.

2.4.1 Table–provides the Annual Production Rate of brick production.

Kiln type	Typical production capacity range			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	m3 (v)	m3/year (l+h)/2*n*v	
Clamps	0.05	1	0.525	60000**	31500	0.0015	4847850	8.80%
FC BTK	3	10	6.5	50000**	325000	0.0015	50017500	90.90%
Zigzag firing	3	5	4.5	200	900	0.0015	13851	0.20%
VSBK	0.5	4	2,25	100***	225	0.0015	34627.5	0.10%
AAC	Data	Not	Available					

Reference:

*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)

The two energy consumption performance of both Clamps Technology and FC-BTK Technology are collated in Table above:

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 20(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 20 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.

It has been observed that the specific coal consumption for "Clamps Technology" is higher than the specific coal consumption for "FC-BTK Technology". Therefore in line to the para 14 (b) of applied methodology, 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. Coal is the main source of energy used for manufacturing burnt clay bricks in India. However the second choice of fuel is biomass, including fuel wood but one of the studies by the FAO[29] the annual use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tonnes, while the use of coal is reported to be about 14,000,000 tonne. 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. The 2% biomass consumption has adjusted by PP to compute the emission factor as mentioned below:

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

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

Kiln Type	Energy consumption (MJ/kg of brick)			Specific Coal Consumption (kg Coal/kg brick)	Specific Coal Consumption (kg Coal/m^3 brick)
	Lower Range	Upper Range	Average		
FC BTK*	1.1	2	1.55	0.060077519	150.1937984

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 (FAO Field Document No. 35, “Regional Wood Energy Development Programme in Asia”, GCP/RAS/154/NET) 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.

2.5 Additionality

As the project activity is energy efficiency, the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale VCS project activity.

In accordance with "Guideline on the demonstration of additionality of small scale project activity" Version-10.0, PP shall provide an explanation to show that the project activity would not have occurred due to at least one of the following barrier

- Investment barrier:
- Technological barrier:
- Barrier due to prevailing practice:
- Other barriers

The project proponent identified "investment barrier" as the most relevant barrier faced by the project activity. The investment barrier faced by the project activity consists of barrier due to high capital cost and consequent impact on return.

The Projects additionality has been 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 0- Demonstration whether project activity is the first-of-its-kind

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

STEP 0- Demonstration whether project activity is the first-of-its-kind

The PP does not claim the proposed project activity as first-of-its-kind.

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 2.4). 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 verified emission reductions (VERs).

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 07.0.0), 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 obtained as output, the simple cost analysis is not applicable.

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, the credible alternatives to the VCS project activity involve investments which is comparatively very less and returns are very high as 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 m^3/annum) but the project activity is a large capacity project (150,000 m^3/annum of AAC Blocks). 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.

Sub-step 2b: Option III: Apply benchmark analysis

The equity IRR is chosen as the relevant indicator for the project activity. As stipulated in the "Tool for the demonstration and assessment of additionality" version 07.0.0. 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 are appropriate benchmarks for a project IRR." The purpose of investment analysis is to determine whether the project activity is economically or financially less attractive than other alternatives without additional funding that may be derived from the VCS project activity. The investment analysis was conducted in accordance with guidelines on investment analysis.

As per paragraph 19 of Annex 5, EB 62, " *If the proposed baseline scenario leaves the project participant no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used. If the alternative to the project activity is the supply of electricity from a grid this is not to be considered an investment and a benchmark approach is considered appropriate."*

Also the guideline says that *"The purpose of an investment analysis in the context of the CDM is to determine whether the project is less financially attractive than at least one alternative in which the project participants could have invested. In cases where the alternative requires investment anyhow and baseline emissions are based on that alternative, the only means of determining that the project activity is less financially attractive than at least one alternative is to conduct an investment comparison analysis. In case of our project activity, the cost involved in case of baseline scenario is not fixed and very marginal when compared to the proposed project activity, as well as not under direct control of PP, and hence the benchmark approach is therefore suited to circumstances where the baseline does not require investment or is outside the direct control of the project developer, i.e. cases where the choice of the developer is to invest or not to invest*".

The project proponent proposes to use benchmark analysis approach to prove additionality. IRR is the most suitable and commonly used financial indicator. Hence, PP has used post tax equity IRR as financial indicator.

Selection of financial indicator:

According to the "Tool for demonstration and assessment of Additionality[30]", the financial indicator can be based either on (1) project IRR or (2) equity IRR. There is no general preference between the approaches (1) or (2). The benchmark chosen for analysis shall be fully consistent with the choice of approach. Therefore in accordance with the guidance, the relevant financial indicator for project activity has been chosen as post tax equity IRR.

The project proponent has adopted to establish the additionality of the project by conducting the investment analysis using equity IRR (post-tax); which is one of the known financial indicators used by the banks, financial institutions and project developer for making investment decision. The project activity is being set up with 70% debt and 30% equity. The chosen indicator, project equity, represents the overall returns from PP investment, and therefore, is duly considered as the financial indicator of the project activity.

As per the UNFCCC "Guidelines on the assessment of Investment Analysis" (EB 62, Annex 5[31], para and guidance 19 which states that *"If the proposed baseline scenario leaves the project no other choice than to make an investment to supply the same (or substitute) products or services, a benchmark analysis is not appropriate and an investment comparison analysis shall be used, ""if the alternative to the project activity is the supply of electricity from the grid, this is not considered an investment and a benchmark analysis is considered appropriate"*. Therefore, the benchmark analysis is applied for the project activity.

Benchmark analysis:

As per the "Guidelines on the Assessment of Investment Analysis" (Annex 5, EB 62) "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". Since the project activity will receive revenue from AAC Blocks/ bricks sales, benchmark analysis is selected for the project's financial analysis.

1. As the proposed project activity has been implemented in manufacturing industries, Group 2 as per para 5 of Appendix of EB 62, Annex 5 has been identified as a suitable category.

2. The investment analysis has been carried out in Nominal terms. Accordingly, Default value as given in Para 17, Annex 5, EB 62 has been adjusted by adding suitable forecasted inflation rate taken from RBI (Central Bank, India).

3. Project investor has calculated Benchmark based on WPI median inflation rate. As per Para 17 of Appendix of EB 62, Annex 5, the inflation forecast should be for the duration of the crediting period. However, since RBI provides forecast inflation only for 5 & 10 years, the project investor has calculated benchmark using both the durations and the most conservative value is considered as Benchmark for the project activity.

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[30] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[31] http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf

The benchmark has been computed in the following manner:

Nominal Benchmark[32] = {(1+Real Benchmark)*(1+Inflation rate)}-1

Where,
Real Benchmark = Default Value, i.e., 12.75% (as per Appendix of Annex 5, EB 62)
Inflation rate = Projected Inflation Rate for India

Benchmark Calculations	Value	Sources Link	Source Page No.	Document Date
Default Value for India as per UNFCCC guidelines	**12.75%**	http://cdm.unfccc.int/Reference/Guidclarif/reg/reg_guid03.pdf	Page 7	15-Jul-11
Inflation forecast (WPI Mean) as per RBI for 5yrs	**6.30%**	https://rbi.org.in/Scripts/PublicationsView.aspx?id=14971	Page 8	2-May-13
Benchmark (with 5yrs Forecast)	**19.63%**			
Inflation forecast (WPI Mean) as per RBI for 10yrs	**5.90%**	https://rbi.org.in/Scripts/PublicationsView.aspx?id=14971	Page 8	29-May-13
Benchmark (with 10yrs Forecast)	**19.06%**			
Minimum Benchmark	**19.06%**			

Post Tax Project IRR Calculation:

The following table illustrates the assumptions used for the calculation of the financial indicator i.e. post tax project IRR for the given project activity. The use of these parameters indicating if they are assumed or based on actual figures is explained in the table. All the relevant costs and revenues for the project activity have been considered for calculation of IRR.

In line with investment analysis guideline of EB, the assumptions used for the determination of post-tax project IRR for the proposed project activity at the time of project decision are given below:

The input values are based on the Detailed Project Report (DPR) and other references supporting the input values for IRR have been furnished to DOE. All the input values were valid at the time of decision-making and in accordance with the "Guidelines on the Assessment of Investment Analysis" (EB 62 Annex 5). The complete references are provided in assumption sheet of financial model.

Post Tax equity IRR for the given project activity comes out to be 8.12% against the benchmark value of 19.40%. Thus, it is evident that the project is not financially attractive.

Sensitivity Analysis

To check the robustness of the project's financial return calculation it has been tested by subjecting critical parameters to reasonable variations as required by Annex 5 EB 62.

[32]As per Pg. 320 of Corporate Finance, Second Edition of AswathDamodaran

The robustness of the conclusion drawn above, namely that the project is not financially attractive, has been tested by subjecting critical assumptions to reasonable variation. As required by Annex 5 of EB 62, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. PP have identified the total revenue from the project activity is dependent on the Production, Project Cost, Raw material Costs and sales price constitute more than 20% of the project costs. These factors have been subjected to a 10% variation on either side and the results of the sensitivity analysis so conducted are given in the following tables.

a) Net production: The installed production capacity considered is based on Third Party detailed project report 90,000 Cum, hence further increase in production is not a possibility.

b) Project Cost: The actual project cost incurred by the PPs is 219.14 million INR thus the variation is well covered under ±10% variation with the investment cost considered at the time of investment analysis. As the project cost has already been incurred by the PP, further reduction in the same is not possible.

c) O&M Costs: The sensitivity analysis reveals that O&M will breach the benchmark at negative values and is hypothetical case. Since the O&M costs is subject to escalation (as evidence by the O&M agreement) and also subject to inflationary pressure, any reduction in the O&M costs is highly unlikely. Hence, the reduction in the O&M cost is highly unlikely.

d) Sales Price: The sales price of finished good used for investment analysis i.e. 2200 INR/Cum is sourced from the DPR available to PP prior to investment decision date. The price ranges from 1900 INR/Cum to 2300 INR/Cum, the PP has considered a conservative value i.e. 2200 INR/Cum. Further, the current market prices in 2014-15 the price are in similar range i.e. 2000-2500 INR/Cum while an annual escalation of 2% is considered in investment analysis, hence an increase in sales price more than 12% to breach the benchmark value is highly unlikely in the near future.

The above analysis proves that varying the parameters does not lead to a Post Tax equity IRR without VCS revenue which will cross the benchmark value. Thus AAC Blocks making project is additional.

The carbon revenue from the project activity would provide significant amount of returns from the sale of the Emission Reductions accrued from the project activity and in turn increase the financial attractiveness of the project activity and hence make the project activity more financially viable.

2.6 Methodology Deviations

None

3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

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

$ER_y = BE_y - PE_y - LE_y$

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_2e/yr)
LE_y Leakage emissions in year y (tCO_2e/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 2.4 of the PD, 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:

$BEy = EF_{BL} \times PP_{J,y}$

Where,

BEy: 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.

$PP_{J,y}$: The annual net production of the facility in year y, in kg or m^3

As per the methodology, paragraph 23, "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;

(a) Using specifications of comparable units having similar techno-economic parameters;

(b) 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 20(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 2.4

3.2 Project Emissions

As per approved methodology project activity emissions (PEy) consist of those emissions associated with the use of electricity from grid and fossil fuel. 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”, version 5.0 and “Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion” (tCO_2e).

The project activity will consume:

- Biomass briquettes (renewable biomass residue) for its high-pressure steam-curing operations, however, the biomass briquettes are locally available within 50Km, hence project emission due to transportation of biomass are not considered. However emissions associated with production of biomass briquettes has been included into project emissions conservatively.

- Electricity for its operations, which will primarily be sourced from grid with a standby option from Diesel Generator Set (1 DG Set of 250 KVA); and the associated project emissions, will be computed in line with the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption”. However in the proposed project activity, as electricity for running plant and machinery is being sourced primarily from fossil fuel based Indian electricity grid and use of diesel for running DG sets is very marginal, hence is being excluded from being accounted in project emissions for simplicity.

- Also as per Para 93 of VVS Version 9, the PD mentioned GHG sources as per methodology requirement and same are justified. Hence project emissions due to DG set are not mentioned in PD being negligible emissions.
- The DG sets are used as back up purpose and PP has considered the monitored diesel consumption data since commissioning of project activity for project emissions calculations.

Therefore as per eq.3 of applied methodology; the project emissions should be calculated as follows:

$$PE_y = PE_{elec,y} + PE_{fossilfuel,y} + PE_{transport,y} + PE_{cultivation,y} + PE_{CH4,y}$$

Where:

PE_y Project emissions in year y (tCO_2e)

$PE_{elec,y}$ Project emissions due to electricity consumption in year y (tCO_2e/yr)
$PE_{fossilfuel,y}$ Project emissions due to fossil fuel consumption in year y (tCO_2e/yr)
$PE_{transport,y}$ Project emissions from transportation of the renewable biomass from the places of their origin to the manufacturing facility site in year y (tCO_2e)

$PE_{cultivation,y}$ 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)

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

Where,

$PE_{EC,y}$: Project emissions from electricity consumption in year y (tCO_2e/yr)

$EC_{BL,k,y}$: Quantity of electricity that would be consumed in the baseline k in year y (MWh/yr)

$EF_{EL,j,y}$: Emission factor for electricity generation for source j in year y (tCO_2e/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

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".

PP does not opt for any use of fossil fuel for their AAC Block/ Fly ash bricks manufacturing process. Electricity & Biomass briquettes is the only source of thermal energy for their production process. So there is no scope of consumption of the fossil fuel to the manufacturing plant and the parameter $PE_{fossilfuel\ y}$, is zero for the project activity.

Calculation of $PE_{transport\ y}$

"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 "Bio diesel production and use for transport applications" if the transportation distance is more than 200 km, otherwise they can be neglected."

PP opt for biomass briquettes for their AAC Block manufacturing process, and the transportation distance is less than 200 Kms, so has been neglected as per the guideline.

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 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.

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 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,

• 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.

The PP has chosen option a i.e. combined margin (CM) consisting of combination OM and BM. Tool to calculate the emission factor for an electricity system (Version 05.0.0), has been used to determine the CO_2 emission factor for displacement of electricity generated by power plants in an electricity system, by calculating the combined margin emission factor (CM) of that electricity system. As per the tool, PP has applied the following six steps:

Option (a) has been considered to calculate the grid emission factor as per the 'Tool to calculate the emission factor for an electricity system' version 5 since data is available from an official source.

CO_2 Baseline Database for the Indian Power Sector, Version 11, April 2016[33], published by Central Electricity Authority (CEA), Government of India has been used for the calculation of emission reduction.

As per the "Tool to calculate the emission factor for an electricity system" Version 05.0, EB 87, Annex 9, the following steps have been followed.

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 power systems

The tool defines that "*for determining the electricity emission factors, identify the relevant electricity system. Similarly, identify any connected electricity systems".* It also states that *"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".* Keeping this into consideration, the Central Electricity Authority (CEA), Government of India has divided the Indian Power Sector into five regional grids viz. Northern, Eastern, Western, North-eastern and Southern.

However since Since August 2006, however, all regional grids except the Southern Grid had been integrated and were operating in synchronous mode, i.e. at same frequency. Consequently, the Northern, Eastern, Western and North-Eastern grids were treated as a single grid named as NEWNE grid from FY 2007-08 onwards for the purpose of this CO_2 Baseline Database. As of 31 December 2013, the Southern grid has also been synchronised with the NEWNE grid, hence forming one unified Indian Grid. Since the project supplies electricity to the Indian grid, emissions generated due to the electricity generated by the Indian grid as per CM calculations will serve as the baseline for this project.

Table: Geographical Scope of Indian Electricity Grid

[33] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf

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

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

Project participants have the option of choosing between the following two options to calculate the operating margin and build margin emission factor:

Option I: Only grid power plants are included in the calculation.
Option II: Both grid power plants and off-grid power plants are included in the calculation.

The Project Participant has chosen only grid power plants in the calculation.

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

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods, which are described under Step 4:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch data analysis OM, or
(d) Average OM.

The data required to calculate simple adjusted OM or Dispatch data analysis is not possible due to lack of availability of this activity data to the project developers. The choice of other two options for calculating the operating margin emission factor depends on the generation of electricity from low cost/must run sources. In the context of the methodology low cost/must run resources typically include hydro, geothermal, wind, low cost biomass, nuclear and solar generation.

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

	2010-11	2011-12	2012-13	2013-14	2014-15
India	18.4%	19.6%	16.9%	18.6%	16.8%

Data Source: Central Electricity Authority (CEA) database Version 11, April'2016

The above data clearly shows that the percentage of total grid generation by low cost/must run plants (on the basis of average of three most recent years) for the Indian grid is less than 50 % of the total generation. Thus the average emission rate method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.
The “Simple operating margin” has been calculated as per the weighted average emissions (in tCO_2/MWh) of all generating sources serving the system, excluding hydro, geo-thermal, wind, low-cost biomass, nuclear and solar generation;

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- **Ex ante option:** If the ex ante option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. **Or**
- **Ex post option:** If the ex post option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring.

PP has chosen ex ante option for the calculation of OM with 3 years generation weighted average of the most recent years available at the time of submission of VCS PD to the DOE for validation.

OM determined at validation stage will be the same throughout the crediting period. There will be no requirement to monitor & recalculate the emission factor during the first crediting period.

STEP 4: Calculate the operating margin emission factor according to the selected method

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

Net Generation in Operating Margin (GWh) (excl. Imports)			
	2012-13	2013-14	2014-15
INDIAN Grid	6,97,187	7,21,632	8,08,417

Simple Operating Margin (tCO_2/MWh) (incl. Imports)			
	2012-13	2013-14	2014-15
INDIAN Grid	0.99	1.00	0.99

Weighted Generation Operating Margin	
INDIAN Grid	**0.9941**

STEP 5: Calculate the build margin emission factor ($EF_{BM,y}$)

Option 1 as described above is chosen to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of PDD and is fixed for the entire crediting period.

Build Margin (tCO_2/MWh) (not adjusted for imports)	
	2014-15

INDIAN Grid	**0.9285**

(With sample group constituting most recent capacity additions to the grid comprising 20% of the system generation)

STEP 6: Calculate the combined margin (CM) emissions factor

Combined Margin – The combined margin is the weighted average of the simple operating Margin and the build margin. In particular, for intermittent and non- dispatchable generation types such as wind and solar photovoltaic, the Tool to calculate the emission factor for an electricity system, Version 05.0.0, EB 87, Annex 9, allows to weigh the operating margin and Build margin at 75% and 25%, respectively for wind and solar projects and 50% and 50%, respectively for hydro and biomass and other projects.

The baseline emission factor is calculated using the combined margin approach as described in the following steps:

Calculation of Baseline Emission Factor EF_y

The baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

$$EF_y = w_{OM} * EF_{OM,y} + w_{BM} * EF_{BM,y}$$

Where,

w_{OM}	50%
w_{BM}	50%
$EF_{OM,y}$	calculated as described in Steps 3&4 above (tCO_2/MWh)
$EF_{BM,y}$	calculated as described in Steps 5 above (tCO_2/MWh)

Baseline Emission factor (INDIAN Grid) = 0.50*0.9941 + 0.50*0.9285
= 0.9613 tCO_2/MWh

Emission reduction (ER_y): The emission reduction ER_y by the project activity during a given year y is the difference between Baseline emission and Project emission & Leakage emission.

$$ER_y = BE_y - PE_y - LE_y$$

Where,

ER_y = Emission Reduction in tCO_2/year
BE_y = Baseline emission in tCO_2/year
PE_y = Project emissions in tCO_2/year
LE_y = Leakage Emissions in tCO_2/year

3.3 Leakage

As per the paragraph. 30, 31 & 32 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 production/ consumption of raw and/or additive materials
- Emissions associated with transportation of raw and/or additive materials

As there will be no emissions due to consumption of raw materials and only emissions associated with manufacturing of raw materials used and emissions associated with transportations has been taken into consideration for calculating leakage emissions.

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

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

Leakage emission associated with consumption of raw and/or additive materials: Aluminium Powder & PoP 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 in per Cum AAC Block production is very less.

However the Leakage due to the Aluminium Powder production has been considered as a conservative approach.

Due to the fact that stone dust is being consumed in very marginal quantities and also being procured from adjacent stone crushing units to the project site, hence leakage emissions due to manufacturing or transportation can be neglected.

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

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 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 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 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:

$$LE_{TR,m} = \sum Dfm \times FRf,m \times EF_{CO_2,f} \times 10^{-6}$$

Where,

$LE_{TR,m}$: Leakage emission from road transportation of freight monitoring period m (tCO_2)

Dfm: 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 (t CO_{2e}/km)

F: Freight transportation activities conducted in the project activity in monitoring period m

3.4 Estimated Net GHG Emission Reductions and Removals

Year	Estimated baseline emissions or removals	Estimated project emissions or removals	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
1	32960.59	1368.928	13728.62	17863.04
2	43648.09	1701.643	17433.94	23010.49
3	47959.01	1835.106	18935.95	27187.95
4	52269.93	1971.856	20435.38	29862.69
5	56580.85	2105.32	21937.39	30921.55
6	59814.04	2105.32	22167.26	35541.46
7	59814.04	2105.32	22167.26	35541.46
8	59814.04	2105.32	22167.26	35541.46
9	59814.04	2105.32	22167.26	35541.46
10	59814.04	2105.32	22167.26	35541.46
Total	532488.67	19509.45	203307	342,094 (rounded down)

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	**EF** $_{grid, OM, y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2 emission factor for the INDIAN Grid in year y
Source of data	CEA's "*Baseline Carbon Dioxide Emission Database Version 11.0*[34]"
Value applied:	0.9941
Justification of choice of data or description of measurement methods and procedures applied	Calculated in line with "*Tool to calculate the emission factor for an electricity system (Version 05.0.0)*" using data from Central Electricity Authority of India's (CEA) "*Baseline Carbon Dioxide Emission Database Version 11.0*". The value used is calculated ex-ante as generation based weighted average of last three years of the operating margin provided in the CEA database. Weighted average = ∑i=1 to n (Net generation in operating margin in year i * Simple operating margin in year i)/∑i= 1 to n (Net generation in operating margin of year i)
Purpose of Data	Calculation of combined margin emission factor
Comments	The value is fixed ex-ante

Data / Parameter	**EF** $_{grid, BM, y}$
Data unit	tCO_2/MWh
Description	Build Margin CO_2 emission factor for the INDIAN Grid in year y
Source of data	CEA's "*Baseline Carbon Dioxide Emission Database Version 11.0* "
Value applied:	0.9285
Justification of choice of data or description of measurement methods and procedures applied	Calculated in line with "*Tool to calculate the emission factor for an electricity system (Version 05.0.0)*" using data from Central Electricity Authority of India's (CEA) "*Baseline Carbon Dioxide Emission Database Version 11.0*[35]". The value is calculated ex-ante as most recent build margin provided by the CEA.
Purpose of Data	Calculation of combined margin emission factor
Comments	The value is fixed ex-ante

[34] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf

[35] http://cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver11.pdf

Data / Parameter	**$EF_{grid, CM, y}$**
Data unit	tCO_2/MWh
Description	Combined Margin CO_2 emission factor for the INDIAN Grid in year y
Source of data	Central Electricity Authority(CEA) of India Database *Version 11.0*
Value applied:	0.9613
Justification of choice of data or description of measurement methods and	This has been calculated based on Operating Margin (OM) and Build Margin (BM) published by Central Electricity Authority (CEA) of India.
Purpose of Data	Calculation of baseline emissions
Comments	The value is fixed ex-ante

Data / Parameter	**EF_{BL}**
Data unit	tCO_2e/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 applied:	0.3592435
Justification of choice of data or description of measurement methods and	The baseline annual production specific emission factor considers only the energy component associated to coal consumption post adjustment of biomass use.
Purpose of Data	Calculation of baseline emissions
Comments	The value is fixed ex-ante

Data / Parameter	**EF_{FO}**
Data unit	tCO_2e/TJ
Description	Carbon emission factor of Furnace Oil
Source of data	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 applied:	78.8
Justification of choice of data or description of measurement methods and	CSI Protocol is an authentic source of data.
Purpose of Data	Calculation of project emissions
Comments	The value is fixed ex-ante

Data / Parameter	NCV_{FO}
Data unit	TJ/kt
Description	Net Calorific value of Furnace Oil
Source of data	IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	41.7 TJ/kt
Justification of choice of data or description of measurement	IPCC 2006
Purpose of Data	Calculation of project emissions
Comments	The value is fixed ex-ante

Data / Parameter	EF_{coal}
Data unit	tCO2e/TJ
Description	Carbon emission factor of Furnace Oil
Source of data	IPCC Guidelines for National Greenhouse Gas Inventories.
Value applied:	94.6
Justification of choice of data or description of measurement	IPCC 2006
Purpose of Data	Calculation of baseline emissions
Comments	The value is fixed ex-ante

Data / Parameter	Specific electricity consumption per MT of briquette

Data unit	kWh/MT
Description	Specific electricity consumption per MT of briquette
Source of data	DPR
Value applied:	38 kWh/MT
Justification of choice of data or description of measurement methods and procedures applied	DPR
Purpose of Data	Calculation of project emissions
Comments	The value is fixed ex-ante

Data / Parameter	TDL
Data unit	%
Description	Transmission and Distribution losses
Source of data	Default value as per Tool for calculate baseline, project and or leakage emissions from electricity consumption
Value applied:	10%
Justification of choice of data or description of measurement methods and procedures applied	Default value
Purpose of Data	Calculation of project emissions
Comments	The value is fixed ex-ante

Data / Parameter	Density of furnace oil
Data unit	Litre/kg
Description	Density of furnace oil
Source of data	As per IOCL website
Value applied:	0.98 litre/kg
Justification of choice of data or description of measurement methods and procedures applied	As per IOCL website
Purpose of Data	Calculation of project emissions

Comments	The value is fixed ex-ante

Data / Parameter	**EF_{flyash}**
Data unit	tCO_2e/Tonne of fly ash
Description	Carbon emission factor of fly ash production
Source of data	UNFCCC source
Value applied:	0 tCO_2e/Tonne of fly ash
Justification of choice of data or description of measurement methods and	UNFCCC source
Purpose of Data	Calculation of leakage emissions
Comments	The value is fixed ex-ante

Data / Parameter	**EF_{cement}**
Data unit	tCO_2e/Tonne 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 applied:	0.638
Justification of choice of data or description of measurement methods and	CSI Protocol is an authentic source of data.
Purpose of Data	Calculation of leakage emissions
Comments	The value is fixed ex-ante

Data / Parameter	**$EF_{Aluminium}$**
Data unit	tCO_2e/Tonne of Aluminium
Description	Carbon emission factor of Aluminium powder production
Source of data	Table 17: Industrial processes-emission factors and activity data
Value applied:	1.7

Justification of choice of data or description of measurement methods and procedures applied	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	Calculation of leakage emissions
Comments	The value is fixed ex-ante

Data / Parameter	EF_{Lime}
Data unit	tCO_2e/Tonne of Lime
Description	Carbon emission factor of Lime ($CaCO_3$) production
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 applied:	0.75
Justification of choice of data or description of measurement methods and procedures applied	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	Calculation of leakage emissions
Comments	The value is fixed ex-ante.

Data / Parameter	$EF_{CO2,t}$
Data unit	g tCO_2e/Tonne 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 applied:	<table><tr><th>Vehicle Class</th><th>Emission factor (gCO_2/t Km)</th></tr><tr><td>Light vehicle</td><td>**245**</td></tr><tr><td>Heavy vehicle</td><td>129</td></tr></table> For raw material (Fly ash, Cement, Lime, Aluminum Powder) transportation generally heavy vehicles are being used. So PP has considered the values for emission factor of light vehicles.

Justification of choice of data or description of measurement methods and	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	Calculation of leakage emissions
Comments	The value is fixed ex-ante.

4.2 Data and Parameters Monitored

Data / Parameter	$P_{PJ, y}$
Data unit	m^3 (cubic meter)
Description	Gross annual production of AAC blocks
Source of data	Plant Records – production log book data and monthly sales Invoices
Description of measurement methods and procedures to be applied	Number of standard sized blocks being manufactured is being monitored manually. Number of blocks or bricks manufactured can be converted to volume units using the standard volume for each blocks and bricks.
Frequency of monitoring/recording	Continuous monitoring, monthly recording
Value applied:	Refer ER sheet
Monitoring equipment	Number of Blocks and Bricks produced is manually counted
QA/QC procedures to be applied	Blocks selling invoices can be used for verification of figures.
Purpose of data	Calculation of baseline emissions and project emission
Calculation method	Production = (Number of Blocks/ Bricks) x Standard Volume
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later. Also it is to be noted that amount of raw material consumption is computed aggregately based upon raw material requirement for both type of products.

Data / Parameter	Compressive Strength of AAC Blocks
Data unit	N/mm^2 (Newton per mm^2)
Description	Compressive Strength of AAC Blocks
Source of data	External Lab Test Reports

Description of measurement methods and procedures to be applied	Dry compressive strength of the project block would be tested in nationally approved laboratory. Compressive strength test would be carried in line with IS code: 6441 Part V.
Frequency of monitoring/recording	Half Yearly monitoring, half yearly recording
Value applied:	5.2
Monitoring equipment	Not Applicable as compressive strength tests are carried out in external laboratories.
QA/QC procedures to be applied	The laboratory would comply with relevant national standards.
Purpose of data	Calculation of baseline emissions and project emission
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$\mathbf{Q_{cement}}$
Data unit	Tonne
Description	Tons of cement used during project activity production (AAC block)
Source of data	Plant Records- purchase book
Description of measurement methods and procedures to be applied	Weigh Bridge
Frequency of monitoring/recordin	Monitoring frequency: Every purchase of raw material Recording frequency: Monthly
Value applied:	Refer ER sheet
Monitoring equipment	Purchase in known quantity
QA/QC procedures to be applied	Purchase data can be cross verified with raw material purchase invoice is a 3rd party data.
Purpose of data	Calculation of leakage emissions
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	Q_{Lime}
Data unit	Tonne
Description	Tons of Lime used during project activity production
Source of data	Plant Records- purchase book
Description of measurement methods and procedures to be applied	Weigh Bridge
Frequency of monitoring/recording	Monitoring frequency: Every purchase of raw material Recording frequency: Monthly
Value applied:	Refer ER sheet
Monitoring equipment	Purchased in known quality
QA/QC procedures to be applied	Purchase data can be cross verified with raw material purchase invoice is a 3rd party data.
Purpose of data	Calculation of leakage emissions
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$Q_{Aluminium}$
Data unit	Tonne
Description	Tons of Aluminium powder used during project activity production
Source of data	Plant Records- purchase book
Description of measurement methods and procedures to be applied	Weigh Bridge
Frequency of monitoring/recording	Monitoring frequency: Every purchase of raw material Recording frequency: Monthly
Value applied:	Refer ER sheet
Monitoring equipment	Purchase in known quantity

QA/QC procedures to be applied	Purchase data can be cross verified with raw material purchase invoice is a 3rd party data.
Purpose of data	Calculation of leakage emissions
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$Q_{Fly\ ash}$
Data unit	Tonne
Description	Tons of Fly Ash used during project activity production (AAC block and flyash brick)
Source of data	Plant Records- purchase book
Description of measurement methods and procedures to be applied	Weigh Bridge
Frequency of monitoring/recording	Monitoring frequency: Every purchase of raw material Recording frequency: Monthly
Value applied:	Refer ER sheet
Monitoring equipment	Every purchase
QA/QC procedures to be applied	Purchase data can be cross verified with raw material purchase invoice is a 3rd party data.
Purpose of data	Calculation of leakage emissions
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$EC_{PJ,j,y}$
Data unit	MWh
Description	The electricity consumption by project activity in year y
Source of data	Electricity meter reading/Monthly invoice by Electricity Board

Description of measurement methods and procedures to be applied	Electricity consumption of the plant would be calculated as summation of the electricity imports from state grid.
Frequency of monitoring/recording	Monitoring frequency: Continuously Recording frequency: Monthly
Value applied:	Refer ER sheet The value has been aggregated from electricity consumption log book available at plant.
Monitoring equipment	Equipment: : Energy Meter or Electricity Consumption Meter(main power supply)
QA/QC procedures to be applied	Since this meter is not under control of PP, the calibration will be done as per state electricity board norms.
Purpose of data	Calculation of project emissions
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$\mathbf{Q_{biomass}}$
Data unit	Tonnes
Description	Tonnes of Biomass briquettes used in boiler for steam generation
Source of data	Purchase bills of Biomass Briquettes
Description of measurement methods and procedures to be applied	Monthly data of opening-closing stocks & purchase invoice bills
Frequency of monitoring/recording	Monthly recording
Value applied:	Refer ER sheet
Monitoring equipment	Weighbridge

QA/QC procedures to be applied	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 by checking the total invoices raised for materials, raw material consumed and opening and closing stocks. The Weighbridge shall be calibrated annually and in case any fault observed at any point of time shall be calibrated or replaced as required.
Purpose of data	Calculation of project emissions
Calculation method	Not Applicable. This is a directly measured parameter
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	**$NCV_{Biomass}$**
Data unit	KCal/Kg
Description	Net Calorific Value of Biomass briquettes
Source of data	Test Reports from external laboratory
Description of measurement methods and procedures to be applied	Measurement in laboratories according to relevant national/international standards. Would be measured yearly, taking at least three samples for each measurement. The average value would be used for the rest of the crediting period. Would be determined once in the first year of the crediting period. The NCV is calculated based on the dry biomass.
Frequency of monitoring/recordin	Determined once in the first year of crediting period
Value applied:	3600
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	External laboratories comply with relevant national standard. The consistency of the measurements will be checked by comparing the measurement results with, relevant data sources (e.g. values in the literature, values used in the national GHG inventory) and default values by the IPCC. If the measurement results differ significantly from previous measurements or other relevant data sources, conduct additional measurements
Purpose of data	Calculation of project emissions
Calculation method	The calorific value of biomass will be tested from external agency using state of the art bomb calorimeter.

Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ flyash}$
Data 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
Description of measurement methods and procedures to be applied	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: Not Applicable Accuracy Class: Not Applicable
Frequency of monitoring/recordin	*Number of trips aggregated monthly*
Value applied:	400
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	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. The PP will note down the starting kilometer reading from the source of raw material and final kilometer reading while entering in the premises of the factory gate.
Purpose of data	Calculation of leakage emissions
Calculation method	Please refer section 3
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ cement}$
Data 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

Description of measurement methods and procedures to be applied	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: Not Applicable Accuracy Class: Not Applicable
Frequency of monitoring/recording	*Number of trips aggregated monthly*
Value applied:	500
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	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. The PP will note down the starting kilometer reading from the source of raw material and final kilometer reading while entering in the premises of the factory gate.
Purpose of data	Calculation of leakage emissions
Calculation method	Please refer section 3
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ Lime}$
Data 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
Description of measurement methods and procedures to be applied	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: Not Applicable Accuracy Class: Not Applicable
Frequency of monitoring/recording	*Number of trips aggregated monthly*
Value applied:	1200
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	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. The PP will note down the starting kilometer reading from the source of

	raw material and final kilometer reading while entering in the premises of the factory gate.
Purpose of data	Calculation of leakage emissions
Calculation method	Please refer section 3
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ Aluminium}$
Data unit	Km
Description	Return trip road distance between the origin and destination of Aluminium transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
Description of measurement methods and procedures to be applied	Determined once for each freight transportation activity for a reference trip using the vehicle odometer or any other appropriate sources (e.g. on- line sources). Calibration Frequency: Not Applicable Accuracy Class: Not Applicable
Frequency of monitoring/recording	*Number of trips aggregated monthly*
Value applied:	3600
Monitoring equipment	Not Applicable
QA/QC procedures to be applied	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. The PP will note down the starting kilometer reading from the source of raw material and final kilometer reading while entering in the premises of the factory gate.
Purpose of data	Calculation of leakage emissions
Calculation method	Please refer section 3
Comments	All the data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

4.3 Monitoring Plan

Quality of the Product

Tests will be conducted to validate that the project AAC Blocks and 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 regular intervals during the crediting period. The product that does not match necessary compressive strength requirements will be excluded from the production.

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.

As per “Best Practice Examples Focusing on Sample Size and Reliability Calculations” (Annex-6, EB 67)**,** 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:

$$n \geq [1.645^2 \otimes N \otimes p(1-p)] / [(N-1) \otimes .1^2 \otimes p^2 \oplus 1.645^2 \otimes p(1-p)]$$

p(1-p)] Where:

n - Sample size

N - Total Production (P)

p - Our expected proportion (0.50)

1.645- Represents the 90% confidence required

0.1 -Represents the 10% relative precision

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.

Sampling Plan for AAC blocks:

Quality of the Product

Tests will be conducted to validate that the project AAC blocks 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, 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:

$n \geq [1.645^2 * N * p(1-p)] \div [(N-1) * 0.1^2 * p^2 + 1.645^2 p(1-p)]$

Where:
n - Sample size
N - Total Production
p - Our expected proportion (0.50)
1.645- Represents the 90% confidence required
0.1 -Represents the 10% relative precision

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

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

QA/QC Procedures

Data Management and Data Archiving

Copies of the break-up sheet, invoices raised and sales receipts will be retained and archived for the entire crediting period plus two years or last issuance whichever is later by the project proponent.

Training

Operation and maintenance team will train the staff on operation and maintenance aspects of the plant. The training will ensure preventive maintenance and better operational control for the plant.

The VCS monitoring team will composed the following staff:

Position	**Report to:**
Operators	Supervisor
Supervisor	Site Incharge
Site Incharge	Unit head
VCS monitoring project manager	Director/ consultant

5 SAFEGUARDS

5.1 No Net Harm

The project does not involve any potential negative environmental and socio economic impacts and hence this criteria is not applicable to this project activity.

5.2 Environmental Impact

The project activity has no significant impact on the environment. Building material manufacturing projects are not included in the Schedule I of the EIA notification S.O.1533 (E) dated 14th September 2006[36] and thus an EIA is not required.

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 proposed project activity will not use fossil fuel except during exigency when DG set may be required to operate for electricity generation. 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 Telangana State Pollution Control Board and No Objection Certificate from the Gram Panchayat, 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.

5.3 Local Stakeholder Consultation

As the Sections 3.17.2-3.17.4 of VCS standard 3.6, the contract for validation is prior to the 19th April 2017, hence the local stake holder consultation is not mandatory.

5.4 Public Comments

Not applicable as for this project DOE contract is already signed on or before 19/04/2017 and project is under validation and verification.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

Data / Parameter	$P_{PJ,y}$
Data unit	CuM
Description	Gross production of AAC blocks during current monitoring period

[36] http://envfor.nic.in/legis/eia/so1533.pdf

Value applied:	Refer ER sheet
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	Q_N
Data unit	N/mm^2 (Newton per mm^2)
Description	Compressive Strength of AAC Blocks
Value applied:	5.2
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$\mathbf{Q_{cement}}$
Data unit	Tonne
Description	Tons of cement used over entire crediting period of project activity production
Value applied:	Refer ER sheet
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$\mathbf{Q_{Lime}}$
Data unit	Tonne
Description	Tons of Lime used over entire crediting period of project activity production
Value applied:	Refer ER sheet
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$\mathbf{FR_{Aluminium,m}}$
Data unit	Tonnes
Description	Total mass of Aluminium transported in freight transportation activity in monitoring period m
Value applied:	68
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$\mathbf{D_{f,m,\ flyash}}$
Data unit	Km
Description	Return trip road distance between the origin and destination of fly ash transportation activity f in monitoring period m
Value applied:	400
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ Lime}$
Data unit	Km
Description	Return trip road distance between the origin and destination of Lime transportation activity f in monitoring period m
Value applied:	1200
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ cement}$
Data unit	Km
Description	Return trip road distance between the origin and destination of fly ash transportation activity f in monitoring period m
Value applied:	500
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$D_{f,m,\ Aluminium}$
Data unit	Km
Description	Return trip road distance between the origin and destination of fly ash transportation activity f in monitoring period m
Value applied:	3600
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$NCV_{Biomass}$
Data unit	KCal/Kg
Description	Net Calorific Value of Biomass briquettes
Value applied:	3600
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

Data / Parameter	$Q_{biomass}$
Data unit	Tonnes
Description	Tonnes of Biomass briquettes used in boiler for steam generation
Value applied:	Refer ER sheet
Comments	Data will be archived till a period of two years from the end of the crediting period or last issuance whichever is later.

6.2 Baseline Emissions

Refer 7.5

6.3 Project Emissions

Refer 7.5

6.4 Leakage

Refer 7.5

6.5 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
15/11/2015 to 31/12/2015	16789.08	888.02	8636.48	7264.58
01/01/2016 to 31/12/2016	41507.841	1856.04	18435.80	21216.00
01/01/2017 to 28/02/2017	18927.27	1042.87	9669.86	8214.54
Total	77,224.19	3786.93	36,742.14	36,695 (rounded down)