AAC BLOCK PROJECT BY AEROCON BUILDWELL PVT. LTD. (EKIESL- JUNE 2016-02)

Document Prepared by (Infinite Solutions)

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The company Aerocon Buildwell Pvt. Ltd (ABPL) are involved in manufacturing of Autoclaved Aerated Concrete (AAC) blocks/ fly ash bricks in Ujjain, India and part of the KEMKER and GOYAL 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 Aerocon is an initiative to manufacture 150,000 cubic meters of AAC blocks and 90,000 cubic meters of Fly ash bricks annually at Ujjain, Madhya Pradesh, 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 pairs, 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 and fly ash bricks 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 31,332 tCO2e and 313,324.51 tCO2e respectively.

The amount of such energy, which is required in the project activity scenario, is much lower than the thermal energy required in AAC blocks/ fly ash bricks manufacturing process. Therefore, the project activity enables total energy reduction and its associated GHG reduction due to change in AAC blocks/ fly ash bricks production process. It may be worthwhile to note that there are emissions associated to production of raw materials (cement and lime) used in the project activity, which is accounted for as leakages to project activity.

The monitoring period is from 01/07/2016 to 31/12/2020. The total GHG emission reductions or removals generated in this monitoring period are 119,115 tCO_2e.

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

The project activity is not a grouped project.

1.3 Project Proponent

Organization name	Aerocon Buildwell Pvt. Ltd.
Contact person	Mr. Girish Kemkar
Title	Director
Address	21/1 Snehlatagaj, Street No. 1 Indore (MP)
Telephone	-
Email	aerocinfo@gmail.com

1.4 Other Entities Involved in the Project

Organization name	Infinite Solutions
Role in the Project	Project Consultant
Contact person	Mr. Jimmy Sah
Title	Head – Sustainability
Address	214-215 Milinda Manor, Opp. Next Treasure Island Mall Indore, MP – 452001
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1.5 Project Start Date

The start date of the project activity is 15/07/2014, 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 twice.

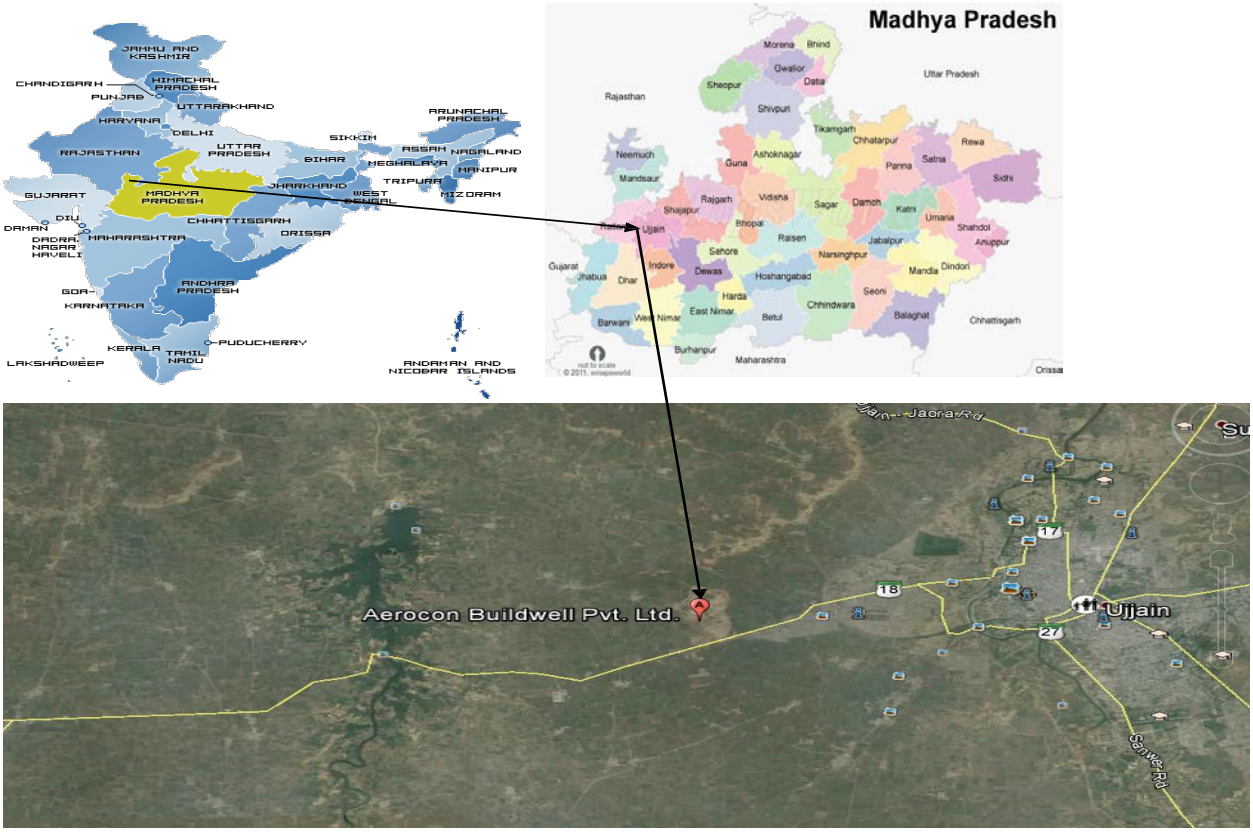
The start date of first crediting period is 15/07/2014 and end date as 14/07/2024.

1.7 Project Location

The nearest airport is in Indore. 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 23.177946	E 75.698998	Jalal Khedi	Ambodia Badnaga	Ujjain	Madhya Pradesh

The map of project site is as indicated in the following figure:



1.8 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 CO2 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.

1.9 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.

1.10 Other Forms of Credit

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

Other forms of Environmental Credit

PP declares that emission reductions generated from the project activity will not be double counted for the particular monitoring 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.

1.11 Sustainable Development

Ministry of Environment, Forests & Climate change, 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.

Utilization of a waste material 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 utilization in the proposed project activity will contribute to savings in natural resources, mainly the land (and top soil), water, coal and limestone. The utilization 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 and

panels. On the contrary, waste materials from other industries are used but no wastes are generated.

Social benefits:

Improvement of air quality in the nearby region: With the avoidance of fossil fuel combustion in the proposed project activity, the exhaust gas emissions and direct air pollution is being substantially reduced in the neighboring region. Better quality employment creation: The proposed project activity is situated in the Ujjain district, Madhya Pradesh 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.

Economic 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/ fly ash bricks 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.

2 SAFEGUARDS

2.1 No Net Harm

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 14/09/2006 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:

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

- ✓ 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.
- ✓ 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 Madhya Pradesh Pollution Control Board and No Objection Certificate from the Gram Panchayat, for establishing the manufacturing unit of Autoclaves Aerated Concrete (AAC).

Blocks and bricks by using fly ash as the main raw material which is the by-products of the nearby thermal power station.

2.2 Local Stakeholder Consultation

The local stakeholder consultation meeting for the proposed project activity has been conducted at project site on 16/05/2014. The PP has identified the relevant stakeholders and send invitation well in advance. The stakeholder meeting process is followed in the following sequence

- Welcome Speech by the organizers.
- Introduction to ‘GHG’ programme
- Interactive Sessions with the stakeholders.

- Vote of Thanks

There were no negative comments raised by stakeholders in the local stakeholder consultation meetings and due to the associated benefits stakeholders have appreciated the proposed project activity.

There were no negative comments received during the meeting and stakeholders appreciated proactive efforts taken by project proponent towards reducing emissions.

For ongoing communication, the PP has also placed a grievance register onsite where in the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately.

However, there is no feedback/grievance has been reported within this monitoring period. Therefore, no action has been undertaken.

2.3 AFOLU-Specific Safeguards

This section is not applicable to the project activity.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project proponent has adopted the new energy efficient technology for the AAC block & fly ash bricks manufacturing process. The project activity has a production capacity of 500 Cum/day for AAC Blocks manufacturing and 300 Cum/day for fly ash bricks 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 and Fly ash bricks.

Ingredients	Raw material consumption per Cum AAC Blocks (Kg/Cum)	Raw material consumption per Cum Fly Ash Bricks (Kg/Cum)	Source
Fly ash	370	166.6	Project Report: Raw Material Consumption
Cement	100.8	40	
Plaster of Paris	10.41		
Lime	68		
Aluminum	0.336		
Stone Dust		38.66	
Total solid	549.546	245.26	
Total water	395.6	234	

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/cm^2	17.5		
	Boiler Capacity, (F& A 100° C)	8000 kg/hr		
	Type	Coal/ Biomass Fired boiler		
Air Compressor	Air Receiver capacity 1.0 (1000 l)	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 (Diameter x Length)		6	
	steam pressure	12 bar		
DG set	Capacity	250kVA	2	

Technical Specifications of Fly Ash Bricks Making Plant by Eco Green Tech Solutions:

1. Type of Pressing:	Heavy Hydraulic Press (Main Cylinder)
2. Pallet Size:	810 X 300 X 18 mm (PVC)
3. Tonnage of Hydraulic Pressure:	80 Ton
4. Total Power:	34.5 HP

PRODUCTION CAPACITY

1. Brick Size	230 X 110 X 75 mm (With Frog) *
2. Production capacity	2520 Bricks/Hour (Rated) **
3. No of Bricks stroke	6 Bricks / Stroke

1. Brick Size	190 X 90 X 90 mm (With Frog) *
2. Production capacity	2940 Bricks / Hour (Rated) **
3. No of Bricks stroke	7 Bricks / Stroke
4 No. of Strokes / Hour	420 Strokes / Hour (7 Strokes / Min)

The average lifetime of the major equipment's under project activity is around 25 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 & CC - 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 m^3, 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 is 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

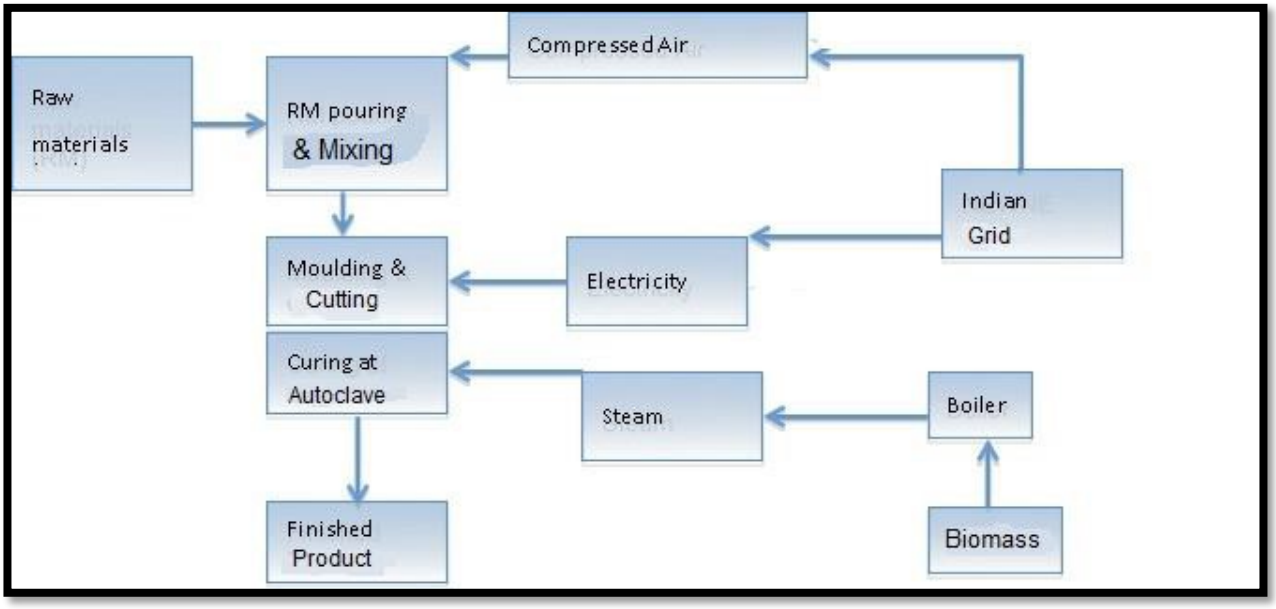
The cakes are cured with steam at a pressure of approx. 12 bars in auto clave machine. After autoclaving the cakes are taken out of autoclaves unloaded from the cooking frame and proceed to the dispatching line for final dispatching.

Summary of production process of Fly Ash Bricks is mentioned below:

Fly ash bricks manufacturing is comparatively simpler process as compared to AAC blocks. In bricks manufacturing, fly ash, cement and stone dust are mixed properly in a grinding unit in appropriate composition and are being transported to the Casting section by means of conveyor belts where sizing and cutting is being done as per the required size. After this, the uncured bricks are being shifted manually to the autoclave section for thermal curing by means of steam. The final product after curing inside the autoclaves are dispatched to the end user by means of trucks.

The below figure represents the energy and mass flow and the balance of the systems and equipment's 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(now a part of unified INDIAN electricity grid.) & DG set: Steam- from Boiler(s): from biomass combustion, Compressed Air – from Air Compressor: from electricity imported from NEWNE now a part of unified INDIAN electricity grid.



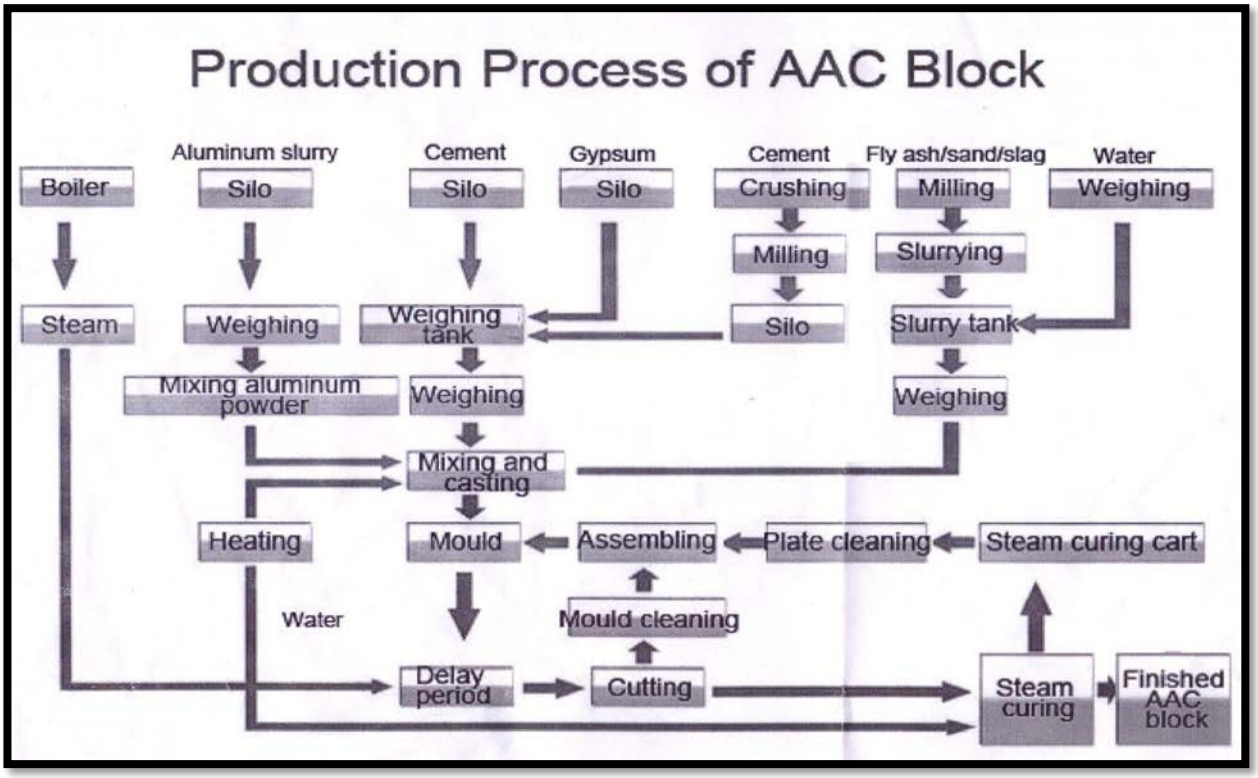


Figure: Flow Chart of Production Process of AAC Blocks

The project activity has been in operation continuously since its commissioning. There have been no emergencies happened to the monitoring system. There are no events or situation that occurred during the monitoring period which may impact the applicability of the methodology.

There is no major shutdown observed during the current monitoring period in the project activity

3.2 Deviations

2.3.1 Methodology Deviations

There are no methodological deviations applied during this monitoring period.

2.3.2 Project Description Deviations

There are no project deviations applied during this monitoring period.

3.3 Grouped Projects

This section is not applicable to the project activity.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid, OM, y}$
Data unit	tCO_2/MWh
Description	Operating Margin CO_2e emission factor for the INDIAN Grid in year y
Source of data	CEA's "Baseline Carbon Dioxide Emission Database Version 11.0
Value applied	0.9941
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_2e 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". 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

Data / Parameter	$EF_{grid, CM, y}$
Data unit	tCO_2/MWh
Description	Combined Margin CO_2e 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 procedures applied	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 procedures applied	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 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 procedures applied	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 methods and procedures applied	IPCC 2006[1]
Purpose of Data	Calculation of project emissions
Comments	The value is fixed ex-ante

Data / Parameter	EF_{coal}
Data unit	tCO_2e/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 methods and procedures applied	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

[1] https://www.ipcc-nggip.iges.or.jp/public/2006gl/

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[2]
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

[2] https://iocl.com/

Justification of choice of data or description of measurement methods and procedures applied	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 procedures applied	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 tCO2/t of Aluminium; However National Greenhouse Accounts (NGA) Factors, Table 17: Industrial processes- emission factors and activity data takes into consideration CO2 emissions and CF4 and C2F6 emissions due to production of aluminum. 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 stoichiometric ratio of 0.43 tones CO2/ 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	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.

Vehicle Class	**Emission factor (gCO_2/t Km)**
Light vehicle	245
Heavy vehicle	129

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 CO2/ ton of lime.
Purpose of Data	Calculation of leakage emissions
Comments	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.

4.2 Data and Parameters Monitored

Data / Parameter	$P_{PJ, y}$
Data unit	m^3 (cubic meter)
Description	Gross annual production of AAC blocks and fly ash bricks
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 bricks and 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 block and bricks.
Frequency of monitoring/recording	Continuous monitoring, monthly recording
Value monitored	AAC BLOCK – 482,231 m^3 FLYASH – 13,697 m^3
Monitoring equipment	Number of Blocks and Bricks produced is manually counted
QA/QC procedures to be applied	Blocks and Bricks selling invoices can be used for verification of figures.
Purpose of the 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 and Bricks
Data unit	N/mm^2 (Newton per mm^2)
Description	Compressive Strength of AAC Blocks and Bricks
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 monitored	Please refer Appendix - 1
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 the 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	Q_{cement}
Data unit	Tonne
Description	Tons of cement used during project activity production (AAC block +fly ash 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 monitored	49,386 Tonnes
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 the 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	Weigh Bridge

and procedures to be applied	
Frequency of monitoring/recording	Monitoring frequency: Every purchase of raw material Recording frequency: Monthly
Value monitored	28,706 Tonnes
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 the 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 monitored	175 Tonnes
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 the 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 fly ash 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 monitored	259,899 Tonnes
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 the 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 monitored	4,852 MWh 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 the 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	$Q_{biomass}$
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 monitored	12,741 Tonnes
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 the 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/recording	Determined once in the first year of crediting period
Value monitored	3,600 Kcal/kg
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 the 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/recording	Number of trips aggregated monthly
Value monitored	945 Km
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 the 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 monitored	1,803 Km
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 the 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 monitored	2,750 Km
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. Premises of the factory gate.
Purpose of the 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 Aluminum 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 monitored	2,535 km
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 the 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.

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

There is no sampling method approached used on the project site during the monitoring period.

Monitoring parameters: -

Sr.No	Monitoring parameter	Data unit	Monitoring/Schedule
1.	$P_{PJ, y}$	CuM/day	Project proponent records the production of blocks as follows: • Number of pouring at mixing tower per cycle which are recorded digitally and manually. • Number of pouring rejected per cycle which is recorded manually. Continuous monitoring and monthly recording
2.	Q_{cement}	Tonne/Month	Project proponent does the primary recording by raw material /pour which is recorded digitally through load cell located at mixer tower. Continuous monitoring and monthly recording
3.	Q_{Lime}	Tonne/Month	
4.	$Q_{Aluminium}$	Tonne/Month	
5.	$Q_{Fly\ ash}$	Tonne/Month	
6.	$EC_{PJ,j,y}$	kWh	Project proponent takes the internal daily meter reading at

			substation. The energy meter is under the control of state energy board; thus, its calibrations are performed by them when required. Continuous monitoring and monthly recording
7.	$Q_{Biomass}$	Tonne	The project proponent determines the data from purchase invoice bills and stock registers on monthly basis based on opening and closing stock. Monthly recording
8.	$FR_{flyash,m}$	Tonne	The project proponent records the challans provided by the truck operators and sums up to get the final weight for each delivery. Monitored on each delivery and aggregated monthly Monitored on each delivery and aggregated monthly
9.	$FR_{cement,m}$	Tonne	
10.	$FR_{Lime,m}$	Tonne	
11.	$FR_{Aluminium,m}$	Tonne	
12.	$D_{f,m,\ flyash}$	Km	The project proponent records the total distance travelled from the origin to the project activity location and return journey. Number of trips aggregated monthly
13.	$D_{f,m,\ cement}$	Km	
14.	$D_{f,m,\ Lime}$	Km	
15.	$D_{f,m,\ Aluminium}$	Km	
16.	$FC_{\ diesel}$	L	The project proponent uses volume meters on each fill basis for recording. Monitored on each fill and aggregated monthly

Quality of the Product

Tests will be conducted to validate that the project 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 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 fly ash Bricks 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.

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 has the following staff:

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

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

Baseline emission has been quantified in accordance with the applied methodology i.e. AMS.III. Z. The formula used for calculation is as follows:

$$BE_y = EF_{BL} * PP_{J,Y}$$

Where,

BE_y = Baseline emissions in year y, tCO2e

EF_{BL} = The annual production specific baseline emission factor = 0.366575 tCO2e/Cum

$PP_{J,Y}$ = The annual net production of the facility in year y

AAC BLOCK - 500 CUM/day			
Period	**Total Production**	**Emission Factor**	**Baseline Emissions**
	m^3	**tCO_2e/m^3**	**tCO_2e**
01/07/2016 to 31/12/2016	53,352	0.36	19,166
01/01/2017 to 31/12/2017	99,669	0.36	35,805
01/01/2018 to 31/12/2018	109,038	0.36	39,171
01/01/2019 to 31/12/2019	113,829	0.36	40,892
01/01/2020 to 31/12/2020	106,343	0.36	38,203
Total	**482,231**		**173,237**

Bricks Fly Ash - 300 CUM/day			
Period	**Total Production**	**Emission Factor**	**Baseline Emissions**
	m^3	**tCO_2e/m^3**	**tCO_2e**
01/07/2016 to 31/12/2016	3,399	0.36	1,221
01/01/2017 to 31/12/2017	3,143	0.36	1,129
01/01/2018 to 31/12/2018	4,756	0.36	1,709
01/01/2019 to 31/12/2019	2,399	0.36	861
01/01/2020 to 31/12/2020	0	0.36	0
Total	**13,697**		**4,920**

Baseline Emissions(tCO_2e) during monitoring period (01/06/2016 to 31/12/2020) = 178,159 tCO_2e

5.2 Project Emissions

Project Emissions

Project emission calculated as $PE_y = PE_{EC, y} + PE_{Fossil\ fuel, y}$

Where, $EF_{grid, CM, y} = 0.9613\ tCO_2e/MWh$

The project activity involves two sources of project emission:

(i) Emissions from electricity consumption and

(ii) Emissions from coal consumption in the boiler for steam generation

1. Project emission from electricity consumption

Emissions resulting from electricity consumption within the project boundary has been calculated in accordance with "Tool to calculate baseline, project and/or leakage emission from electricity consumption". The equation being used is:

$$PE_{EC,y} = \Sigma\ EC_{PJ,j,y} * EF_{grid, CM, y} * (1+TDL_y)$$

Where:

$PE_{EC,y}$ - Project emissions due to electricity consumption in year y, tCO_2/year

$EC_{PJ,j,y}$ - Quantity of electricity consumed by the project emission source j in year y, MWh/year

$EF_{grid, CM, y}$ - Emission factor for electricity generation for source j in year y, tCO_2/MWh

TDL_y - Average technical transmission and distribution losses for providing electricity to source j in year y, %

= 4,411 MWh * (1+10%) * 0.9613 tCO_2e /MWh

$PE_{EC,y}$ = 4,664 tCO_2e

Project emissions due to fossil fuel or NRB consumption in year y ($PE_{fuel,y}$)

As per applied methodology, the emissions include fossil fuel or NRB consumption (including auxiliary use) $PE_{fuel, y}$ associated with the operation of the manufacturing process and the

biomass treatment and processing. In the case of fossil fuels, it is calculated as per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion.

DG set (1 x 250 kVA) is available at the site for standby purpose. But no diesel was consumed in the DG set. As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"

$$PE_{fuel,\,y} = FC_{FO} \times NCV_{FO} \times EF_{FO}$$

Where

FC_{FO} – Yearly Furnace oil consumption

NCV_{FO}-Net Calorific value of furnace oil

EF_{FO} –CO_2 emission factor of furnace oil

$PE_{fuel,y}$ = 0 tCO_2e

Emissions from cultivation of biomass in a dedicated plantation in year y ($PE_{cultivation,\,y}$) =0 tCO_2e

Since briquette is procured and not cultivated in dedicated plantations, this emission is zero.

Project emissions due to the production of charcoal in kilns not equipped with a methane recovery and destruction facility in year y ($PE_{CH4,\,y}$) =0 tCO_2e

Since there is no charcoal produced inside the project activity, these emissions is zero.

Period	Electricity Consumption Emissions($PE_{EC,y}$)	Fossil fuel Emissions ($PE_{Fossil\ fuel,\,y}$)	Project Emissions
	t CO_2e	t CO_2e	t CO_2e
01/07/2016 to 31/12/2016	626	0	626
01/01/2017 to 31/12/2017	1,140	0	1,140
01/01/2018 to 31/08/2018	1,110	0	1,110
01/01/2019 to 31/12/2019	1,159	0	1,159
01/01/2020 to 31/12/2020	629	0	629
Total project Emissions	**4,664**	**0**	**4,664**

for the monitoring period			

PE_y during monitoring period (01/07/2016 to 31/12/2020) = 4,664 tCO_2e

5.3 Leakage

There are two sources of leakage emission in the project:

a. Leakage emission due to raw material production

b. Leakage emission due to raw material transportation

Leakage emission due to raw material production

Formula used for calculation is as follows:

$$LE_{rm,prod,y} = Q_{cement} * EF_{cement} + Q_{lime} * EF_{lime} + Q_{aluminium} * EF_{aluminium}$$

$LE_{rm,prod,y}$: Leakage emissions associated with consumption of raw and/or additive materials in the year y

Q_{cement} : 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} : Quantity of lime consumed for the production of AAC blocks in the year y

EF_{lime} : CO_2 emission factor of the lime production

$Q_{aluminium}$: Quantity of Aluminum Powder consumed for the production of AAC blocks in the year y.

$EF_{Aluminium}$: CO_2 emission factor of the Aluminum production

Leakage Emissions from raw materials				
Monitoring period	**Cement**	**Lime**	**Aluminum powder**	**Fly Ash**
01/07/2016 to 31/12/2016	6,946	3,384	38	0
01/01/2017 to 31/12/2017	6,902	5,023	61	0
01/01/2018 to 31/12/2018	6,639	5,048	67	0
01/01/2019 to 31/12/2019	5,651	4,559	72	0

01/01/2020 to 31/12/2020	5,373	3,519	62	0
Leakage Emissions from Raw Material Production	**31,511**	**21,533**	**300**	0

Leakage Emissions from Raw Material Production = 53,344 tCO_2e

Calculation of leakage associated with transportation of raw material

$$LE_{TR,m} = \Sigma D_{fm} \times FR_{f,m} \times EF_{CO2,f} \times 10^{\wedge -6}$$

Where,

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

D_{fm}: Return trip road distance between the origin and destination of freight transportation activity f in monitoring period m (km)

$FR_{f,m}$: Total mass of freight transported in freight transportation activity f in monitoring period m (t)

$EF_{CO2,f}$: Default CO2 emission factor for freight transportation activity f (t CO_2e/km)

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

Raw Material(Tonne)	Distance (in Km)
Fly Ash	945
Cement	1,803
Lime	2,750
Aluminium Powder	2,535
Total	**8,033**

Raw Material/Monitoring period	**01/07/2016 to 31/12/2016**	**01/01/2017 to 31/12/2017**	**01/01/2018 to 31/12/2018**	**01/01/2019 to 31/12/2019**	**01/01/2020 to 31/12/2020**
Fly Ash	1,233	1,243	1,642	1,101	943
Cement	247	312	306	246	664
Lime	254	439	503	409	257
Aluminium Powder	1	3	3	3	2

Total	**1,735**	**1,997**	**2,454**	**1,759**	**1,866**

Leakage Emissions due to transportations = 9,811 tCO_2e

Total Leakage Emissions during Monitoring period: -

Period	Total Leakage Emissions
	tCO_2e
01/07/2016 to 31/12/2016	12,103
01/01/2017 to 31/12/2017	13,983
01/01/2018 to 31/12/2018	14,208
01/01/2019 to 31/12/2019	12,041
01/01/2020 to 31/12/2020	10,820
Total	**63,155**

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

$= \mathbf{63,155\ tCO_2e}$

5.4 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)
2016(01/07/2016 to 31/12/2016)	22,566	626	12,103	9,837
2017(01/01/2017 to 31/12/2017)	38,948	1,140	13,983	23,825
2018(01/01/2018 to 31/12/2018)	43,927	1,110	14,208	28,609
2019(01/01/2019 to 31/12/2019)	43,291	. 1,159	12,041	30,090
2020(01/01/2020 to 31/12/2020)	38,203	629	10,820	26,754

Total	**186,935**	**4,664**	**63,155**	**119,115**

It is to be noted here that as per the estimated emission reduction estimated from the project activity for the current monitoring period is 141,209 tCO_{2e}, whereas actual emission reductions achieved are 119,115 tCO_2e, which is approximately 16% lesser than the estimated emission reductions.

APPENDIX 1: COMPRESSIVE STRENGTH OF AAC BLOCKS AND BRICKS

Sr.No	AAC Blocks	FLY ASH Bricks
Dated - 02/01/2016		
1	4.13 N/mm^2	5.80 N/mm^2
Dated - 26/06/2016		
2	4.10 N/mm^2	6.20 N/mm^2
Dated - 08/09/2016		
3	4.13 N/mm^2	5.89 N/mm^2
Dated - 01/01/2017		
4	4.28 N/mm^2	6.40 N/mm^2
Dated - 28/06/2017		
5	4.09 N/mm^2	6.01 N/mm^2
Dated - 04/08/2017		
6	4.09 N/mm^2	5.84 N/mm^2
Dated - 01/01/2018		
7	4.03 N/mm^2	5.20 N/mm^2
Dated - 25/06/2018		
8	4.31 N/mm^2	5.00 N/mm^2
Dated - 10/09/2018		
9	4.05 N/mm2	5.45 N/mm2

Dated - 05/01/2019		
10	4.45 N/mm^2	5.60 N/mm^2
Dated - 27/06/2019		
11	4.32 N/mm^2	6.40 N/mm^2
Dated - 11/08/2019		
12	4.31 N/mm^2	6.02 N/mm^2
Dated - 04/01/2020		
13	4.16 N/mm^2	6.60 N/mm^2
Dated - 29/06/2020		
14	4.08 N/mm^2	6.24 N/mm^2
Dated - 16/09/2020		
15	4.16 N/mm^2	5.86 N/mm^2