AAC BLOCK PROJECT BY AEROCON BUILDWELL PVT. LTD.

(EKIESL- JUNE 2016-02)

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CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The company Aerocon Build well 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 share in the region. The current project of Aerocon is an initiative to manufacture 150,000 cubic meters of AAC 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 Aluminum powder stone dust and plaster of Paris, which enable the blocks 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 313,324 tCO_2e/year and 31,332 tCO_2e respectively.

The manufacturing processes of AAC blocks and fly ash bricks 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[1] produced locally from agricultural residues, which is renewable energy source and displaces the

[1] Biomass briquettes are a biofuel substitute made of biodegradable green waste like agricultural residues with lower emissions of greenhouses gases and carbon dioxide then traditional fuel sources.

carbon intensive coal/fuel oils. Further AAC block and fly ash brick 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/brick 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 and bricks 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 Fly ash bricks and source of raw materials.

During this monitoring period, there is one project deviation to account the no production of fly ash bricks. The production of the fly ash brick was discontinued from June 2016 because of insufficient demand in market.

The monitoring period is from 01-January-2021 to 30-April-2023. The total GHG emission reductions or removals generated in this monitoring period are 52,866 tCO_2e.

Audit Type	Period	Program	VVB Name	Number of years
Validation/ Verification	15-July-2014 to 30-June-2016	VCS	EPIC Sustainability Services Pvt. Ltd.	1 year 11 month 16 days
Verification	01-July-2016 to 31-December-2020	VCS	Earthhood Services Pvt. Ltd.	4 years 6 months

Verification	01-Jan-2021 to 30-April-2023	VCS	VKU Certification Pvt. Ltd.	2 year 4 months
Total	15-July-2014 to 30-April-2023	VCS		8 years 9 months 16 days

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: 4 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 is not AFOLU project and is not a grouped project activity.

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 Environmental Solutions LLP
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-July-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.

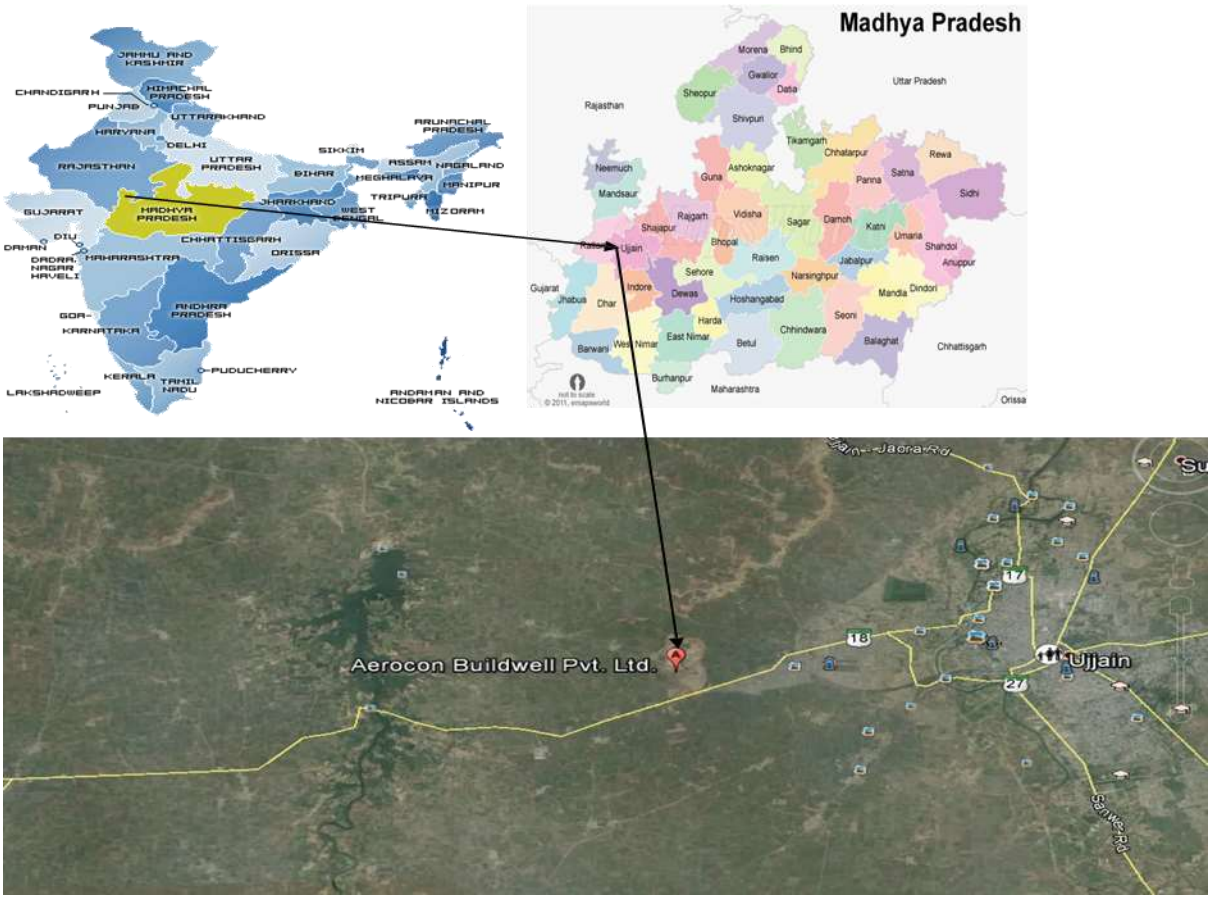
The start date of first crediting period is 15-July-2014 and end date as 14-July-2024.

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	Tehsil	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: 6.0, EB 85 Annex 18

Reference: The approved baseline methodology has been referred from the "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories."

https://cdm.unfccc.int/methodologies/DB/VLZZ1DVT1QI3KHZKSM6QECOAKNSCXZ

Sectoral Scope: 04

The tools referenced in this methodology include:

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

Tool 03 "Tool to calculate project or leakage CO2 emissions from fossil fuel combustion" Version 02, Annex 11, EB41. https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v3.pdf

Tool 05 "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

Tool 12 "Tool to calculate project and leakage emissions from transportation of freight" Version 1.1.0, Annex 23 of EB70

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

There no methodology deviation in current monitoring period.

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 and Supply Chain (Scope 3) Emissions

Include the following information, as applicable:

Emission 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**:**

The Project Proponent 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.

Supply Chain (Scope 3) Emissions:

The emission involved in the procurement of raw materials are consider as the leakage emission in calculating the emission reduction of the project. Whereas sales of manufactured finished products and emission involved is not considered in the project boundary therefore it has not been considered.

1.11 Sustainable Development Contributions

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

- Environmental well-being
- Social well-being

- Economic well-being
- 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 79 skilled-unskilled people in the entire project area.

- **Economic well-being**

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.

- **Technological well-being**

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 fewer deep foundations.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	13.0	Tonnes of greenhouse gas emissions avoided or removed	Implemented activities to increase	In this monitoring period, 52,866 tonne of CO_2e is reduced by the production of AAC block	Prevented the release of total 212,676 tonnes of carbon i.e., (40,695+119,115+52,866) into the atmosphere.

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- September - 2006 and thus an EIA is not required.

Environmental impact:

- **Air quality:** Through the project implementation the need for dumping of waste in landfills, or incineration is avoided. Hence the project activity has a positive impact on air quality in and around the project boundary.
- **Soil quality:** By using the fly ash, soil quality is improved in and around the project boundary. fly ash which creates environmental pollution by increasing dust levels of atmosphere.
- **Biodiversity and ecosystem health:** Local wildlife and organisms are positively impacted by the reduction of fly ash in natural ecosystems.
- **Mining activities:** The project is not obtaining any raw materials from direct from mining; hence, it is not in the scope of PP.

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.

Socioeconomic impact:

Socioeconomic refers to the absolute or relative levels of economic resources, power, and prestige closely associated with wealth of an individual or community. Here are the key socio-economic risks and its mitigations are as follows:

- **Economic Growth:** The salary given to all the workers is better than the Minimum Wages Act [2] requirements. PP is also ensured that the wage is living wage is sufficient to meet basic needs if the employee wishes to work overtime, the pay is done based on over time working hours. The employees and the workers are made aware of proper worker's employment rights, working hours, health, and safety protocols during the project activity.
- **Poverty and Inequality:** Better wages help lift workers and their families out of poverty, reducing income inequality and enhancing overall societal well-being.
- **Health and Safety:** Project proponent ensures that stakeholders face the minimal health risk by providing safe working conditions There are SOPs in place for proper handling of machineries to prevent any potential accidents related to health and safety. wherein the staff is instructed on safety procedures Proper sanitation practices and hygienic conditions are maintained.

  In every 6 months PPE kits[3] are distributed because it is also part of safety and health of employees
- **Education:** The trainings are provided to all the employees for improve their skills. Training is crucial for individual and organizational development, economic growth, and social progress, ensuring a skilled workforce ready to meet future challenges.
- **Child Labour prohibition:** No child is forced to or allowed to work in the project activity and PP is following Child Labour (Prohibition and Regulation) Act, 1986[4]: This act includes key features like Prohibition of Child Labour, Regulation of Adolescent Labour, Working Hours and Conditions and Penalties for Violation.
- **Anti-Discrimination:** PP operates with firm anti-discrimination practices and PP prepared Anti-discrimination Policy before implementation of the project activity. Facility employees are hired and contracted without discrimination based on gender, race, caste, national origin, religion, age, disability, marital status, sexual orientation, cooperative membership, or political affiliation.

  Further, the implementation of the project has improved local-socio economic development through creating career opportunities hence there will be no net harm for socio-economic impacts.

2.2 Local Stakeholder Consultation

The local stakeholder consultation meeting for the proposed project activity has been conducted at project site on 16th May 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.

[2] https://clc.gov.in/clc/node/684

[3] Helmets, safety goggles, masks, gloves, safety footwear and protective clothing are distributed.

[4] https://labour.gov.in/sites/default/files/act_2.pdf

- 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. The Grievance Register is placed at the Security Gate under the custody of the head of security.

A grievance redress procedure is a formalized process through which individuals or employees can address complaints, concerns, or grievances they may have within an organization. Here's a typical grievance redress procedure:

Submission of Grievance: The first step involves the individual formally submitting their grievance in the grievance register which is placed at entrance gate of the project. Security In charge is responsible for record the grievance.

Acknowledgment and Analysis: Upon receiving the grievance, the organization acknowledges receipt of the complaint and do the analyze that the grievance is genuine or not. Site In charge is responsible for acknowledge and analyze the grievance, after that he will forward the grievance to respective department keeping a copy to HR department.

Resolution of Grievance: Based on the findings of the investigation, the organization works towards resolving the grievance. This could involve taking corrective actions, implementing changes in policies or procedures, providing compensation or restitution. The respective department head is resolving the grievance and share the information to the HR.

Documentation: Throughout the entire process, detailed documentation is maintained. This includes records of the grievance, investigation findings, actions taken.HR is responsible for maintaining the documents.

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 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. During this monitoring period, there was one project deviation, i.e., there was no production of fly ash bricks. The production was discontinued since June 2016 due to the lack of demand for fly ash bricks

The key raw material ingredients of the AAC building blocks are fly ash, lime, and plaster of Paris, cement, and Aluminum 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 Aluminum 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)	Source
Fly ash	370	Plant Records-purchase book (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	

3.1.1 Description of major equipment used in AAC block manufacturing:

Name of the	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)	8,000 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	Steam pressure	12 bars	6	
DG set	Capacity	250kVA	2	

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 MoEFCC - 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 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.

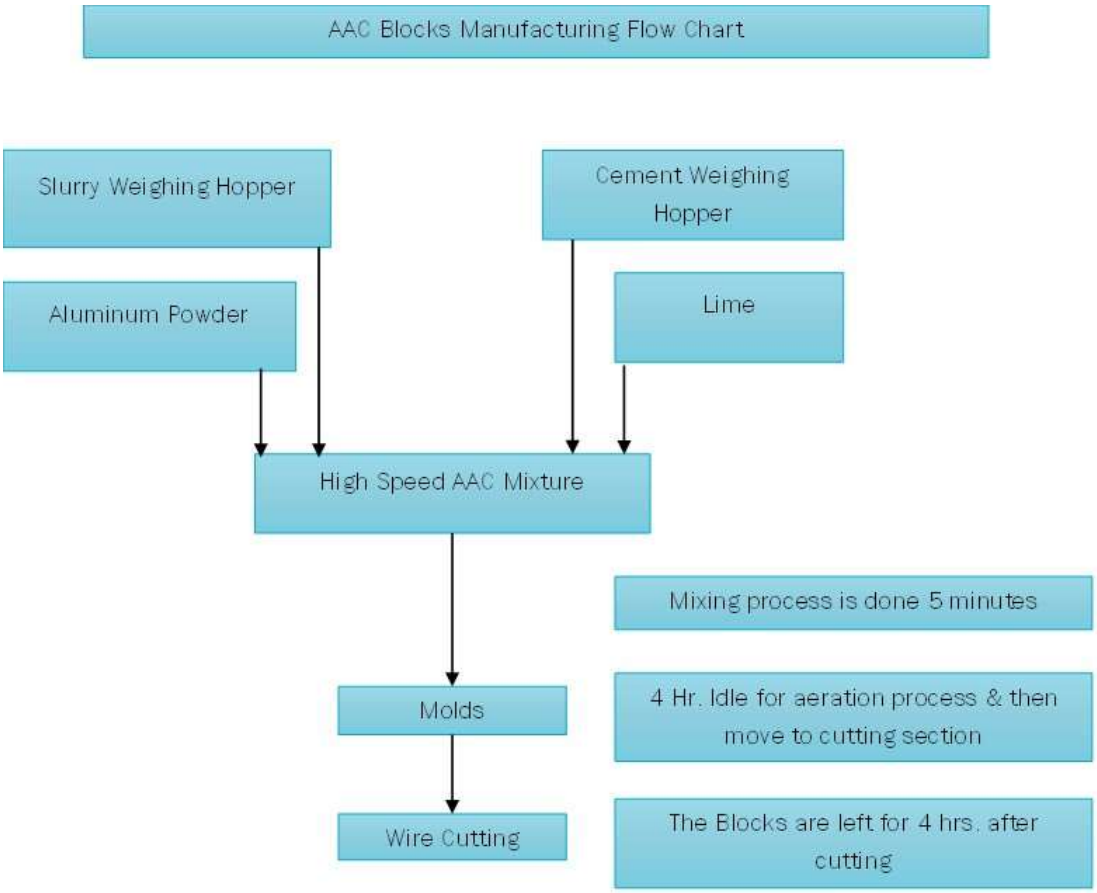


Figure: Flow Chart of Production Process of AAC Blocks

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

3.2.1 Methodology Deviations

There are no methodological deviations applied during this monitoring period. only to the criteria and procedures for monitoring or measurement, and do not relate to any other part of the methodology.

3.2.2 Project Description Deviations

During this monitoring period, it is important to note two project deviations the details are as follows:

1) Deviation 1:

Fly ash brick production was discontinued in June 2016 due to insufficient demand in the market. The discontinuation of fly ash brick production has no impact on the baseline scenario because the demand for AAC Blocks has increased, providing a good alternative to traditional bricks. Furthermore, the decision to resume production will depend on the market demand for fly ash bricks.

2) Deviation 2:

In the registered PDD two fixed parameters $EF_{Biomass\ briquettes}$ and EF_{gypsum} are missed from section 4.1 Data and Parameters Available at Validation and Five monitored parameters Q_{coal} , Q_{Gypsum} , $D_{f,m,\ gypsum}$, $D_{f,m,\ Briquettes}$ and $D_{f,m,\ Coal}$ are missed from section 4.2 Data and Parameters Monitored so, the missed parameters are incorporated in the respective sections the reason to add the parameters is as follows:

S.No.	Parameter	Justification / reason to add the parameter
1	Q_{coal}	Quantity of coal is used in boiler for steam generation in emergency cases whenever Bio mass Briquettes are not available hence, it is used to calculate project emission. The parameter is monitored parameter so it is considered under section 4.2 Data and Parameters Monitored.
2	Q_{Gypsum}	Gypsum is a raw material used in the production of AAC blocks and it is mentioned in the PDD but the monitoring parameter Quantity of Gypsum is missed and it is used in the calculation of project emission. The parameter is monitored parameter so it is considered under section 4.2 Data and Parameters Monitored.

3	$D_{f,m,\ gypsum}$	Return trip road distance between the origin and destination of gypsum transportation is more than 200 KM. Hence, it is used to calculate leakage emission. The parameter is monitored parameter so it is considered under section 4.2 Data and Parameters Monitored.
4	$D_{f,m,\ Briquettes}$	Return trip road distance between the origin and destination of Biomass Briquettes transportation is more than 200 KM. Hence, it is used to calculate leakage emission. The parameter is monitored parameter so considered under section 4.2 Data and Parameters Monitored.
5	$D_{f,m,\ Coal}$	Return trip road distance between the origin and destination of Coal transportation is more than 200 KM. Hence, it is used to calculate leakage emission The parameter is monitored parameter so considered under section 4.2 Data and Parameters Monitored.
6	$EF_{Biomass\ briquettes}$	Biomass briquettes are used in boiler for steam generation hence emission factor of biomass briquettes production is used to calculate leakage emission. It is a fixed parameter so considered under section 4.1 Data and Parameters Available at Validation.
7	EF_{gypsum}	Gypsum is used as a raw material the same is mentioned in s.no 2 of above hence emission factor of gypsum production is used to calculate leakage emission. It is a fixed parameter so considered under section 4.1 Data and Parameters Available at Validation.

However, the applied deviations do not impact the existing applicability conditions of the methodology, additionality or the appropriateness of the baseline scenario.

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 Database "Baseline Carbon Dioxide Emission" 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= $\sum i=1$ ton (Net generation in operating margin in year i * Simple operating margin in year i)/$\sum i=1$ ton (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	Density of furnace oil
Data unit	Litre/kg
Description	Density of Furnace oil
Source of data	As per IOCL Website
Value applied	0.98 Liter/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 id 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	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
Purpose of Data	Calculation of project emissions
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: https://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 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	$EF_{Biomass\ briquettes}$
Data unit	tCO_2e/t biomass briquettes
Description	Carbon emission factor of biomass briquettes production
Source of data	DEFRA,2021[5] Bioenergy (Biomass)[6]
Value applied	0.04923
Justification of choice of data or description of measurement methods and procedures applied	Default values used for biomass briquettes production in which converting biomass and agriculture residue in to briquette. The default value is considered from DEFRA,2021[7]
Purpose of Data	Calculation of leakage emissions
Comments	The value is fixed ex-ante. Host country, India, has no standards for such emission factors, and so PP has checked the value for international sources like IPCC, but international sources have no value for the carbon emission factor of biomass briquette production; hence, the DEFRA value has been used for calculation, which is an authentication source.

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

[5] https://www.gov.uk/government/publications/greenhouse-gas-reporting-conversion-factors-2021

[6] https://assets.publishing.service.gov.uk/media/61ee7495e90e07037c8d6176/conversion-factors-2021-condensed-set-most-users.xls

[7] The Indian source and IPPC data is not available so DEFRA is used as a source.

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	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 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: https://docs.wbcsd.org/2009/06/CementIndustryEnergyAndCO2Performance.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_{gypsum}
Data unit	tCO_2e/tonne gypsum
Description	Carbon emission factor of gypsum production
Source of data	Sector report for the gypsum industry is used for the value[8]
Value applied	0.01
Justification of choice of data or description of measurement methods and procedures applied	Default value is considered. Based on best performing plants in the UK in the middle of the decade the benchmark value is proposed. The benchmark value is used because it is a conservative.
Purpose of Data	Calculation of leakage emissions
Comments	The value is fixed ex-ante. Host country, India, has no standards for such emission factors, and so PP has checked with other Indian sources but got some study[9] which has the value 0.0037. As a conservation approach, a 0.01 value is used. Also, PP has checked international sources like IPCC, but international sources have no value for the carbon emission factor of gypsum production; hence, the Sector report for the gypsum industry has been used, which is an authentication source.

Data / Parameter	$EF_{Aluminium}$
Data unit	tCO_2e/Tonne of Aluminum
Description	Carbon emission factor of Aluminum 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 CO2 emissions and CF4 and C2F6 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

[8] 091102 Gypsum (europa.eu)

[9] https://edgebuildings.com/wp-content/uploads/2022/04/IFC-India-Construction-Materials-Database-Methodology-Report.pdf (Page no 77).

Data / Parameter	EF_{Lime}
Data unit	tCO_2e/Tonne of Lime
Description	Carbon emission factor of calcium Lime ($CaCO_3$) production
Source of data	Chapter 2 of "Mineral Industry Emissions" of 2006 IPCC Guidelines for National Greenhouse Gas Inventories.[10]
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_2/ 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 heavy vehicles[11].
Justification of choice of data or description of measurement methods and procedures applied	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.

Vehicle Class	Emission factor (g CO2/ Tonne KM)
Light vehicle	245
Heavy vehicle	129

4.2 Data and Parameters Monitored

Data / Parameter	$P_{PJ,y}$
Data unit	m^3 (cubic meter)

[10] https://www.ipcc-nggip.iges.or.jp/EFDB/find_ef.php?ipcc_code=2.A.2&ipcc_level=2

[11] All the raw material are transported by multi-Axle heavy vehicles having GVM higher than 28 tones.

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 – 246,013 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)
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	18,271 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 and procedures to be applied	Weigh Bridge
Frequency of monitoring/recording	Monitoring frequency: Every purchase of raw material Recording frequency: Monthly
Value monitored	11,304 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	83 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	122,197 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	1,536 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	$Q_{biomass\ briquettes}$
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	5,091 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	Q_{coal}
Data unit	Tonnes
Description	Tonnes of Coal used in boiler for steam generation
Source of data	Plant records
Description of measurement methods and procedures to be applied	Quantity is measured using weighbridge regularly and records are kept on paper and electronically.
Frequency of monitoring/recording	Monitored continuously and consolidated monthly in the plant records
Value monitored	151 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	Q_{Gypsum}
Data unit	Tonnes
Description	Tonnes of Gypsum used during project activity production
Source of data	Plant records
Description of measurement methods and procedures to be applied	Quantity is measured using weighbridge regularly and records are kept on paper and electronically.
Frequency of monitoring/recording	Monitored continuously and consolidated monthly in the plant records
Value monitored	2,756 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	540 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	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	$D_{f,m,cement}$
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	492 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	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	$D_{f, m, Lime}$
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	1,198 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	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	$D_{f,m,\ Aluminium}$
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	1,084 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	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	$D_{f,m,\ gypsum}$
Data unit	Km
Description	Return trip road distance between the origin and destination of gypsum transportation activity f in monitoring period m
Source of data	Records of vehicle operator or records by project participants
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	1,268 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	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	$D_{f,m,\ Briquettes}$
Data unit	Km
Description	Return trip road distance between the origin and destination of Biomass Briquettes 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	566 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	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	$D_{f,m,\ Coal}$
Data unit	Km

Description	Return trip road distance between the origin and destination of Coal 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	312 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	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.

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 the product is better than that of the baseline product, PP will continuously monitor the mean value of the dry compressive strength of the project activity output at regular intervals throughout the current period. Any product that fails to meet the required compressive strength standards will be excluded from 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.

Simple random sampling is suited to populations that are homogeneous. Since the AAC Blocks and fly ash bricks 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, logbooks, 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:

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

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

The samples are collected randomly from every batch by the operators and submitted to Supervisor manager for further testing. A minimum 4 samples are randomly selected from every match.

The project activity has in-house testing facility and also doing testing using external laboratories the details of the external laboratories testing are mentioned in Appendix-1 of this report. During the current monitoring period more than 7,588 samples are tested in On-site testing facility to check performance requirements and specifications of AAC blocks and all the samples found good. The details of the sampling are as follows:

Period	Total Production Unit (N)	Sample size (n)
01/01/2021 to 31/01/2021	375,981	271
01/02/2021 to 28/02/2021	490,887	271
01/03/2021 to 31/03/2022	555,875	271
01/04/2021 to 30/04/2021	484,462	271
01/05/2021 to 31/05/2021	294,508	271
01/06/2021 to 30/06/2021	318,590	271
01/07/2021 to 31/07/2021	438,924	271
01/08/2021 to 31/08/2021	396,116	271
01/09/2021 to 30/09/2021	452,113	271
01/10/2021 to 31/10/2021	592,148	271
01/11/2021 to 30/11/2021	551,764	271

01/12/2021 to 31/12/2021	507,640	271
01/01/2022 to 31/01/2022	365,135	271
01/02/2022 to 28/02/2022	527,210	271
01/03/2022 to 31/03/2022	466,809	271
01/04/2022 to 30/04/2022	463,409	271
01/05/2022 to 31/05/2022	402,942	271
01/06/2022 to 30/06/2022	597,511	271
01/07/2022 to 31/07/2022	308,702	271
01/08/2022 to 31/08/2022	403,685	271
01/09/2022 to 30/09/2022	386,382	271
01/10/2022 to 31/10/2022	260,833	271
01/11/2022 to 30/11/2022	347,257	271
01/12/2022 to 31/12/2022	558,427	271
01/01/2023 to 31/01/2023	729,695	271
01/02/2023 to 28/02/2023	390,937	271
01/03/2023 to 31/03/2023	773,251	271
01/04/2023 to 30/04/2023	612,585	271
Total		7,588

There is above 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.	Q_{coal}	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
9.	Q_{Gypsum}	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
10.	$FR_{flyash,m}$	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
11.	$FR_{cement,m}$	Tonne	
12.	$FR_{Lime,m}$	Tonne	
13.	$FR_{Aluminium,m}$	Tonne	
14.	$D_{f,m,\ flyash}$	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
15.	$D_{f,m,\ cement}$	Km	
16.	$D_{f,m,\ Lime}$	Km	
17.	$D_{f,m,\ Aluminium}$	Km	
18.	$D_{f,m,\ Coal}$	KM	
19.	$D_{f,m,\ gypsum}$	KM	
20.	$D_{f,m,\ Briquettes}$	KM	
21.	FC_{diesel}	L	The project proponent uses volume meters on each fill basis for recording. Monitored on each fill and aggregated monthly

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

The operation and maintenance team trains the staff on operation and maintenance aspects of the plant. The training ensures preventive maintenance and better operational control for the plant.

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:

$$BE_y = EF_{BL} * P_{PJ, Y}$$

Where,

BE_y = Baseline emissions in year y, tCO2e

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

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

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AAC BLOCK - 500 CUM/day			
Period	Total Production	Emission Factor	Baseline Emissions
	m^3	tCO_2e/m^3	tCO_2e
01/01/2021 to 31/01/2021	7,503	0.3592435	2,695
01/02/2021 to 28/02/2021	9,009	0.3592435	3,236
01/03/2021 to 31/03/2022	10,407	0.3592435	3,739
01/04/2021 to 30/04/2021	9,332	0.3592435	3,352
01/05/2021 to 31/05/2021	5,450	0.3592435	1,958
01/06/2021 to 30/06/2021	5,943	0.3592435	2,135
01/07/2021 to 31/07/2021	7,733	0.3592435	2,778
01/08/2021 to 31/08/2021	7,108	0.3592435	2,553
01/09/2021 to 30/09/2021	8,678	0.3592435	3,117
01/10/2021 to 31/10/2021	10,269	0.3592435	3,689
01/11/2021 to 30/11/2021	9,903	0.3592435	3,558
01/12/2021 to 31/12/2021	9,913	0.3592435	3,561
Vintage 2021	101,246		36,371 (Round down value)
01/01/2022 to 31/01/2022	7,133	0.3592435	2,563
01/02/2022 to 28/02/2022	9,892	0.3592435	3,554
01/03/2022 to 31/03/2022	11,833	0.3592435	4,251
01/04/2022 to 30/04/2022	8,311	0.3592435	2,986
01/05/2022 to 31/05/2022	7,124	0.3592435	2,559
01/06/2022 to 30/06/2022	11,092	0.3592435	3,985

01/07/2022 to 31/07/2022	5,442	0.3592435	1,955
01/08/2022 to 31/08/2022	7,784	0.3592435	2,797
01/09/2022 to 30/09/2022	7,010	0.3592435	2,518
01/10/2022 to 31/10/2022	4,634	0.3592435	1,665
01/11/2022 to 30/11/2022	6,195	0.3592435	2,225
01/12/2022 to 31/12/2022	10,109	0.3592435	3,632
Vintage 2022	**96,560**		**34,688 (Round down value)**
01/01/2023 to 31/01/2023	13,712	0.3592435	4,926
01/02/2023 to 28/02/2023	8,432	0.3592435	3,029
01/03/2023 to 31/03/2023	14,198	0.3592435	5,101
01/04/2023 to 30/04/2023	11,865	0.3592435	4,262
Vintage 2023	**48,208**		**17,318 (Round down value)**
Total			**88,377**

5.2 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:

1. Emissions from electricity consumption and
2. 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, %

= 1,536 MWh * (1+10%) * 0.9613 tCO_2e /MWh

$PE_{EC,y}$ = 1,829 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 coal consumption

NCV_{FO}-Net Calorific value of coal

EF_{FO} –CO_2 emission factor of coal

$PE_{fuel,y}$ = 363 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 are zero.

Total Project Emissions= 2,192 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} : CO2 emission factor of the cement production

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

EF_{lime} : CO2 emission factor of the lime production

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

$EF_{Aluminium}$: CO2 emission factor of the Aluminium production

Leakage Emissions from raw materials production								
Monitoring period	Cement	Lime	Aluminum powder	Fly Ash	Gypsum	Briquettes	Coal	Total of vintage
2021(01-January - 2021 to 31-December-2021)	4,777.34	3,365.63	62.03	0	11.70	134.54	0	8,351.23
2022(01-January - 2022 to 31 December-2022)	4,532.35	3,396.00	49.00	0	10.81	43.50	0	8,031.67
2023(01-January - 2023 to 30-April-2023)	2,347.27	1,716.75	29.88	0	5.05	72.57	0	4,171.52
Total	**11,657.96**	**8,478.38**	**140.91**	**0**	**27.56**	**250.62**	**0**	**20,554.42**

Leakage Emissions from Raw Material Production = 20,554.44 tCO_2e

Calculation of leakage associated with transportation of raw material

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

Where:

$LE_{TR,m}$: Leakage emission from road transportation of freight monitoring period m (tCO2)

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

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

$EF_{CO2,f}$: Default CO_2 emission factor for freight transportation activity f (t CO_2e/km)

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

Transported Raw material	Distance (KM)	Total Freight Transportation activity in t		
	(Round trip)	2021(01-January -2021 to 31-December-2021)	2022(01-January -2022 to 31 December-2022)	2023(01-January -2023 to 30-April-2023)
Fly ash	540	50,185	51,176	21,985
Cement	492	7,532	8,589	5,162
Lime	1,198	4,530	5,577	2,810
Gypsum	1,268	1,228	939	478
Aluminium Powder	1,084	35	32	15
Briquettes	566	2,739	914	1,443
Coal	312	149	-	-

Leakage Emissions due to Transportation of Raw Material are tabulated below

Raw Transport Material/Monitoring period	2021(01-January -2021 to 31-December-2021)	2022(01-January -2022 to 31 December-2022)	2023(01-January -2023 to 30-April-2023)
Fly Ash	3,495.90	3,564.89	1,531.44
Cement	478.01	545.11	327.62
Lime	700.13	861.93	434.29
Aluminium Powder	4.85	4.40	2.05
Gypsum	200.87	153.53	78.11
Coal	6.01	0	0
Briquettes	199.98	66.73	105.34
Total	**5,085.73**	**5,196.58**	**2,478.84**

Leakage Emissions due to transportations = 12,761.16 tCO_2e

Monitoring Period Vintages	Total Leakage from Raw Material used (tCO_2e) production	Total leakage from transportation of raw material (tCO_2e)
01-January-2021 to 31-December-2021	8,351.23	5,085.73
01-January-2022 to 31-December-2022	8,031.67	5,196.58
01-January-2023 to 31-April-2023	4,171.52	2,478.84
Total Leakage during current monitoring period (round off)	20,554.42	12,761.16

Total Leakage Emissions during Monitoring period: -

Period	Total Leakage Emissions (Vintage wise round up values)
	tCO2e
01-January-2021 to 31-December-2021	13,437
01-January-2022 to 31-December-2022	13,229
01-January-2023 to 31-April-2023	6,651
Total	**33,317**

The rounded-up value is used so, 33,317 tCO_2e as total leakage due to project activity.

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)
2021(01-January - 2021 to 31-December-2021)	36,371	1,207	13,437	21,727

2022(01-January - 2022 to 31 December-2022)	34,688	651	13,229	20,808
2023(01-January - 2023 to 30-April-2023)	17,318	336	6,651	10,331
Total	**88,379**	**2,192**	**33,317**	**52,866**

It is to be noted here that as per the estimated emission reduction estimated from the project activity for the current monitoring period is 72,964 tCO_2e, whereas actual emission reductions achieved are 52,866 tCO_2e, which is approximately 27.55% lesser than the estimated emission reductions.

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference
72,964	52,866	-27.55%	The actual emission reduction achieved is approximately 27.55 % lower due to the comparatively low production of AAC Blocks, which is dependent on market demand

APPENDIX 1: TEST RECORD DATA

Sr. No.	Date	AAC Blocks Compressive Strength (Kg/cm^2)	AAC Blocks Compressive Strength (N/mm^2)
1	18-December-2022	38.03	3.72947
2	10-June-2022	37.86	3.71280
3	16- December-2021	39.12	3.83636
4	20-June-2022	38.42	3.76771