Monitoring report form (Version 03.2)

Monitoring report

Title of the project activity	'India-FaL-G-Brick and Blocks Project No.1'
Reference number of the project activity	0707
Version number of the monitoring report	Version number 01
Completion date of the monitoring report	12/05/2014
Registration date of the project activity	16/02/2007
Monitoring period number and duration of this monitoring period	Monitoring Period No.4 01/04/2013 to 31/03/2014, inclusive of both the days.
Project participant(s)	India: M/s Eco-Carbon Private. Limited (ECPL) Denmark: Aalborg Portland A/S; Danish Ministry of Climate, Energy and Building/Danish Energy Agency; Dong Naturgas A/S; Maersk Olie og Gas A/S; Nordjysk Elhandel A/S. Finland: Ruukki Metals Oy. Luxembourg: Government of Luxembourg – Ministry of the Environment Italy: Government of Italy: Ministry for the Environment, Land and Sea Netherlands: Netherlands' Ministry of Infrastructure and the Environment (IenM) . Spain: Endesa Generacion, S.A.; Hidroelectrica del Cantabrico, S.A.; Kingdom of Spain - Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness; Gas Natural SDG, S.A.; EDP-Energias de Portugal, S.A..

Project participant(s)	Switzerland: Schweizerische Ruckversicherungsgesellschafts AG (Swiss RE) Belgium: Kingdom of Belgium -Walloon Region Ministry of the Environment; Bruxelles Environment – IBGE. Germany: KfW; BASF SE; Japan: Daiwa Securities Co. Ltd, FUJIFILM Corporation; Idemitsu Kosan Co. Ltd. JX Nippon Oil and Energy Corporation; The Okinawa Electric Power Corporation, Incorporated. Sweden: Göteborg Energi AB. Norway: Statkraft Carbon Invest AS. Statoil ASA; Austria Kommunalkredit Public Consulting GmbH.
Bilateral and Multilateral Funds:	**Community Development Carbon Fund (CDCF)** Managing Company: International Bank for Reconstruction and Development (IBRD) as Trustee of the Community Development Carbon Fund (CDCF)
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope: 04: Manufacturing industries Approved Methodology Type II, AMS-IID. Energy efficiency and fuel switching measures for industrial facilities (Version 07: 28 November, 2005).
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	14,162 tCO_2e from 01/04/2013-31/03/2014 inclusive of both days
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	10,752 tCO_2e from 01/04/2013-31/03/2014, both days inclusive

Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012 (if applicable)	N.A
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	10,752 tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

'India-FaL-G-Brick and Blocks Project No.1' is primarily a bundled activity of small and micro-industrial plants those practice an eco-friendly technology known as 'FaL-G Technology', using fly ash as one of the main inputs. FaL-G bricks replace sintered clay bricks, contributing to mineral and energy conservation. By avoiding use of thermal energy in the production of fly ash bricks the project contributes for conservation of fossil fuel (coal), and, in turn, abates associated emissions. Fly ash bricks replace clay bricks as walling material serving all functional and performance criteria with better engineering properties.

This Monitoring Report is applicable to the 11 FaL-G plants that have been set up at various locations in the state of Andhra Pradesh since January 2003. The commissioning period of the project, as mentioned in their applications given to PP, is the earliest period of establishment occurred out of all the SPE units of the bundle, and duly recorded vide Table 4 at the end of the monitoring period.

The Technology

It is a known art since millennia that addition of lime to fly ash initiates pozzolanic chemistry, which can be augmented through hydro-thermal treatment in autoclaves at high temperature (150-180 ^{o}C) and pressure (8-12 bar). The innovative part of FaL-G technology is to accelerate pozzolanic chemistry by adding gypsum by which the development of ettringite phase to threshold limits invigorate the strengths of fly ash-lime mix. Therefore, FaL-G does not require energy intensive equipments such as heavy duty-press and autoclave, which were otherwise, required in case of erstwhile fly ash brick technologies. FaL-G technology completely eliminates thermal treatment, and does not require combustion of any fossil fuel.

The key ingredients of the FaL-G products are fly ash, lime, and gypsum, which are well-known mineral substitutes. All these materials are available in the form of byproducts from industrial activities and are available in adequate quantities in the areas, where the project activities are located. By-product lime is available at competitive cost over the mineral lime. Alternate to FaL-G in lime route, the technology has also been developed in cement (OPC) route, whereby the surplus lime in cement gets into pozzolanic chemistry. It is economical to use OPC than mineral lime and, hence, OPC is preferred in areas where by-product lime is scarce or not available, may be due to profuse FaL-G activity. In view of quality and logistical issues in procuring lime many entrepreneurs adopt FaL-G in OPC route.

The process-flow chart is given as Figure 1 at the end of the report.

The project also contributes to sustainable development in many ways as explained below, thus getting qualified under CDM. By displacing burnt clay bricks the project contributes for:

- Ecology protection by minimising eco-hostile practice of topsoil denudation and resultant land degradation;
- Pollution abatement otherwise caused by emission of unprocessed flues out of brick kilns.
- Environment protection by putting to use industrial wastes as value added building materials.

On social front, the project creates business opportunities for the small and micro enterprises. In contrast to the seasonal production-operations in the clay brick industry, FaL-G plants facilitate

continuous yearlong operation, and hence provide employment all through the year for the skilled artisans and create self-help livelihood for the illiterate poor.

By taking advantage of CDM program, this project targets to catalyse proliferation of huge number of fly ash brick industries in the country, in order to prevent the use of 200 billion clay bricks and resultant emissions of over 48.40 million tons.

Notwithstanding the intrinsic environmental and social benefits of the project, the specific community benefit program, particularly the health and accident insurance schemes being implemented to meet the requirements of the Community Development Carbon Fund (CDCF) of the World Bank, would enhance the benefits further.

FaL-G has its antecedents from the ancient pozzolanic chemistry practiced over 2000 years back. The modern knowledge on material science has helped to pronounce the process with technical rationale. Basically two machines do involve for a plant; roller (pan) mixer for preparation of FaL-G and casting machine to cast the product.

It needs over 2 to 4 weeks for the development infrastructure. Otherwise the plant can be installed in one day and production can be started immediately. The plant is normally operated for single shift. However, depending on the seasonal demand, extra hours of operation are not uncommon. Similarly the efficiency of man power decides the output rather than the rated capacity of plant.

This project has earned 10,752 tCO_2e , in this monitoring period (01/04/2013-31/03/2014).

The PDD and associated documents can be accessed from UNFCCC web site http://cdm.unfccc.int/Projects/DB/DNV-CUK1161790286.9/view

A.2. Location of project activity

Project activity is located in various districts of the State of Andhra Pradesh, India. Please refer Table 1 for details of the units and their geographical coordinates, at the end of the report.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	**Private and/or public entity(ies) project participants (as applicable)**	**Indicate if the Party involved wishes to be considered as project participant (Yes/No)**
India (Host)	• M/s Eco Carbon Private Limited (ECPL)	No

Denmark	• Aalborg Portland A/S • Danish Ministry of Climate, Energy and Building/ Danish Energy Agency. • Dong Naturgas A/S • Maersk Olie og Gas A/S • Nordjysk Elhandel A/S	Yes	
Finland	• Ruukki Metals Oy	No	
Luxembourg	• Government of Luxembourg – Ministry of the Environment	Yes	
Italy	• International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund ("CDCF") • Government of Italy: Ministry for the Environment, Land and Sea	Yes	
Netherlands	• International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund ("CDCF") • Netherlands' Ministry of Infrastructure and the Environment (IenM)	Yes	

Spain	• Endesa Generación, S.A. • Hidroeléctrica del Cantábrico, S.A. • Kingdom of Spain- Ministry of the Agriculture, Food and Environment & Ministry of Economy and Competitiveness. • Gas Natural SDG, S.A. • EDP-Energias de Portugal, S.A. • Community Development Carbon Fund (CDCF) Managing company: International Bank for Reconstruction and Development (IBRD) as Trustee of the Community Development Carbon Fund (CDCF)	Yes
Switzerland	• Schweizerische Ruckversicherungs gesellschafts AG (Swiss RE)	No
Belgium	• Kingdom of Belgium -Walloon Region Ministry of the Environment; • Bruxelles Environment - IBGE	No
Germany	• BASF SE • KfW	No
Japan	• Daiwa Securities Co. Ltd. • FUJIFILM Corporation • Idemitsu Kosan Co. Ltd. • JX Nippon Oil and Energy Corporation • The Okinawa Electric Power Corporation,, Incorporated	No
Sweden	• Göteborg Energi AB	No
Norway	• Statoil ASA • Statkraft Carbon Invest AS	No

Austria	• Kommunalkredit Public Consulting GmbH	No

A.4. Reference of applied methodology

Approved Methodology Type II, AMS II D. Energy efficiency and fuel switching measures for industrial facilities (Version 07: 28 November, 2005).

A.5. Crediting period of project activity

Fixed Ten years ie.,01/04/2004-31/03/2014, inclusive of both days.

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The Start Date of the Project activity is 01/01/2003.

This is one of the prompt-start projects where all the units, except two, were set up a few months earlier to April 2004. Based on Start Date of the project ie.01/01/2003 this is mentioned as prompt-start project. This CDM project has been submitted as a bundle of 14 plants located in different districts in the state of Andhra Pradesh, India, and operated by individual entrepreneurs called Sub-Project Entities (SPEs). However, unit with ID No. AP/VSP/I/12 was closed and has not operated during the monitoring period, and hence no credits have been accounted. Two other SPEs with ID Nos. AP/VZM/I/13 & AP/VZM/I/14 earned CERs during 2004-07, but due to the non-compliance in reporting, no ERs have been accounted for these two units during the monitoring period. Having assigned unconditional and irrevocable agreement for 12 years vide clause 2.02.02 of ERTA, these units are part of the Bundle duly enlisted vide PDD and the bundle is unchanged during the project period. However, the number of operating units qualified for earning credits is 13 till March 2008 and reduced to 11 there on, and their aggregate capacities district-wise are given below. During the monitoring period of 2013-14 one unit with ID No. AP/KRIS/I/5 has become inoperative hence no data are shown and no earning of ERs.

Please refer to Figure I at the end of the MR for the schematic diagram of the project along with the metering point.

Please refer to Table 4 at the end of the monitoring report for the details of the project Establishment period.

States	District	No. of Plants	Aggregate Capacity - m^3/year
Andhra Pradesh	Krishna	6	27,000
	West Godavari	3	12,600
	East Godavari	1	3,600
	Visakhapatnam	1	4,500
	Vizianagaram	-	--
TOTAL		**11**	**47,700**

In the first monitoring period of 01/04/2004- 31/03/2007 this project has earned 27,433 CERs.
In the second monitoring period of 01/04/2007-31/03/2011, the project has earned 44,175 CERs.
In the third monitoring period of 01/04/2011-31/03/2013, the project has earned 26,981 ERs, which are undergoing Verification.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

Nil

B.2.2. Corrections

Nil

B.2.3. Permanent changes from registered monitoring plan or applied methodology

Revised Monitoring Plan, Version 05 Dated 02/09/2013, with permanent changes from registered Monitoring Plan has been approved by CDM-EB and the date of approval is 07/10/2013.

B.2.4. Changes to project design of registered project activity

Nil

B.2.5. Changes to start date of crediting period

Nil

B.2.6. Types of changes specific to afforestation or reforestation project activity

Not applicable.

SECTION C. Description of monitoring system

The monitoring has been conducted in harmony with the revised monitoring plan that has been approved by CDM-EB.

Tables in Section D elucidate the data to be monitored and the frequency of monitoring. Accordingly the data have been collected and archived as per schedule, and emission reductions have been computed at the end of the year.

Monitoring Approach - QC & QA Measures Adopted:

Though all Sub-Project Entities (SPEs) use FaL-G technology, the proportions of the ingredients and type of plant & machinery vary depending on the techno-economic logistics of each SPE's plant. These issues were documented during interaction with SPEs, which had been formed as the basis for developing benchmark values as given vide Table -2.

Project Entity (PE) developed templates on various data for monitoring and provided to SPEs. SPEs submit monthly reports to PE consisting of production and sales data on daily basis and other data on monthly basis. Upon receipt, the monthly reports are reviewed by the monitoring personnel of PE and electronically archived for consolidation. The total data, together with daily reports, are kept ready for submission to DOE for verification. Figure II provides monitoring data inflow.

With regard to internal audit, the monitoring personnel of PE make random visits to SPEs, during which they verify the production records, stock registers and purchase bills to check the diligence of the monthly data. The production output in a small-scale plant does not go by label capacity, and is governed by the manpower number, their efficiency and working hours in a day. Hence instead of taking the production records alone into consideration, it is opined to tally the production output of SPEs through other verifiable factors such as fly ash consumption and electricity consumption, so as to arrive at the conservative datum of production and, in turn, emission reductions. Electricity consumption is recorded from the electricity bills issued by the State Electricity Department.

The approach is described under 'Computation of Emission reductions'. This is small and micro sector activity involving no monitoring/calibration equipment in production front. Whenever SPE notices a fault/malfunction in the meters, the Electricity department is informed for due replacement with good meters.

The responsibility for calibration of power meters lies with the State Electricity Board. The State Electricity Board is required to follow the national standard set by the Central Electricity Authority, Ministry of Power, Government of India, Clause 18 of Gazette Notification No. 502/70/CEA/DP&D dt. 17.3.2006, to undertake calibration of power meters once in 5 years. The consumer does not have any control over the process. Currently, State Electricity Boards do not have established calibration schedules and the government regulation is also not enforced stringently, especially for domestic consumers and small scale industrial consumers, like the FaL-G plants.

Monitoring Methodology as per AMS II.D does not specify calibration requirements for electricity meters. As per the requirement of paragraph 273(a) of VVS (Version 06.0)

"Applying the maximum permissible error of the instrument to the measured values taken during the period between the scheduled date of calibration and the actual date of calibration, if the results of the delayed calibration do not show any errors in the measuring equipment, or if the error is smaller than the maximum permissible error"

In the above background scenario getting calibration done for power meters is not a practice for small scale units, thus no calibration reports are available prior to August 2011.

All the SPEs have been insisted for calibration of power meters only in the concern of compliance with the requirement of VVS. There upon SPEs got the calibration done by Service Provider at the payment of special fee.

Table 3 gives the Status of calibration of power meters duly covering the meter numbers. Though due date is not applicable vide ministry's G.O applicable for category above 20 HP, 5 years is taken as the basis and duly mentioned in table 3.

The line diagram is attached as Figure II showing the monitoring data flow at the end of the report.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	**EF_{diesel}**
Unit:	t CO_2/ litre
Description:	Emission of diesel is derived directly out of diesel purchased, using default values.
Source of data:	IPCC default value
Value(s) applied):	0.0032 ton CO_2/litre
Purpose of data:	To compute project emissions.
Additional comment:	Default values provide for conservative estimates.

Data / Parameter:	EF_{elec}

Unit:	t CO2/MWh_e
Description:	Emissions of electricity are derived directly out of power consumption using default values.
Source of data:	IPCC default value
Value(s) applied):	0.9 t CO2/mWh
Purpose of data:	To compute project emissions.
Additional comment:	Default values provide for conservative estimates.

Data / Parameter:	**SECclay brick**
Unit:	GWhth/m^3 brick
Description:	Specific energy consumption of burnt clay bricks is taken as the base line energy consumption, which is provided in terms of mJ/kg- brick that is duly converted to GWhth/m^3 to tally with cap on energy as per approved methodology.
Source of data:	'Emission standards for brick kilns – an opportunity for technology upgradation' by Tata Energy Research Institute, Delhi, India.
Value(s) applied):	0.000725 GWhth/m^3
Purpose of data:	To compute baseline emissions.
Additional comment:	India being a vast country with different conditions of practices, conservative value is taken for estimating baseline energy consumption which is in turn used to compute baseline emissions.

Data / Parameter:	**CEFcoal**
Unit:	t C/TJ
Description:	Carbon emission factor for coal is used to compute the baseline emissions.
Source of data:	IPCC default value
Value(s) applied):	25.8 t C/TJ
Purpose of data:	To compute baseline emission.
Additional comment:	Default values are taken for conservative estimates.

D.2. Data and parameters monitored

Data / Parameter:	Q_{FaL-G}
Unit:	m^3/ brick and m^3/ block
Description:	SPEs maintain the actual quantities production of different sizes of bricks/blocks in number in the stock registers which are duly converted to cubic meters.

Measured/ Calculated / Default:	Calculated.
Source of data:	Stock registers of the SPEs.
Value(s) of monitored parameter:	55,141.6 m^3
Monitoring equipment:	N.A
Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	SPEs record the production of bricks/blocks on daily basis ($N_{FaL\text{-}G\text{-}i}$) that also includes their dimensions ($V_{FaL\text{-}G\text{-}i}$). These data are made available to PP once in a month in the form of the statement. Based on the above data $Q_{FaL\text{-}G}$ is calculated as below: $Q_{FaL\text{-}G} = N_{FaL\text{-}G\text{-}i} \times V_{FaL\text{-}G\text{-}i}$
QA/QC procedures:	Upon receipt of data on brick/block production and fuel use (electricity or diesel), from the plants on a monthly basis, ECPL has reviewed the data. Depending upon the production capacity of individual plants, and raw materials used, certain benchmark figures are developed by ECPL for different parameters. There are no significant deviations noticed in the data provided by the entrepreneurs. In addition, the Carbon Inspectors (officials of ECPL) of ECPL have also made surprise visits to FaL-G plants to check whether the process and FaL-G recipe used by the plant operators are within the acceptable range to ensure that quality of the products is not affected. Thus they have also tallied the FaL-G recipe to the consumption of raw materials in order to check the diligence of record keeping and accuracy for ultimate diligence of emission computations.
Purpose of data:	For computing baseline emissions
Additional comment:	$Q_{FaL\text{-}G}$ is the production vide stock register for the period 2013-14 as per assessment sheet.

Data / Parameter:	**Fly ash procurement - Facon**
Unit:	tons
Description:	The procurement of fly ash supported by inward challans/weighment slips.

Measured/ Calculated / Default:	Measured.
Source of data:	The raw material inward data as maintained by SPEs.
Value(s) of monitored parameter:	21,858.1 tons
Monitoring equipment:	NA
Measuring/ Reading/ Recording frequency:	As received by SPE
Calculation method (if applicable):	The quantities of fly ash as received at SPE units are duly recorded by them and sent to PP once in a month.
QA/QC procedures:	The data received from SPE are tallied with the inward challans/weighment slips during inspection visits and corrections, if any, are made
Purpose of data:	For computing baseline emissions as a cross check for production records and to arrive to the conservative estimate.
Additional comment:	None.

Data/Parameter	Specific fly ash consumption factor – $Sp.C_{fa}$
Unit	%
Description	Specific consumption factor of fly ash, $Sp.C_{fa,}$ is derived based on the mix proportions declared by SPE at the time of enrolment into the project. For any reason, if the SPE changes the composition, he is advised to report the changed mix proportions to PE for carrying out necessary changes in the data bank.
Measured/Calculated /Default	Calculated.
Source of data	Interaction with SPEs.
Value(s) of monitored parameter	13.3 to 40.0 %
Monitoring equipment	NA
Measuring/Reading/ Recording frequency	Once in six months at any month.

Calculation method (if applicable)	Based on the fly ash input in total FaL-G mix practiced at each SPE, specific consumption factor of fly ash, $Sp.C_{fa,}$ is arrived in terms of %. This factor facilitates to compute 'Production based on fly ash consumption (Q_{fa})' as follows: Q_{fa} is calculated as: $Fa_{con}/Sp.C_{fa}$ where Fa_{con} = total fly ash consumption of unit x for the Corresponding year $Sp.C_{fa}$ = Specific Consumption factor of fly ash of the unit x
QA/QC procedures	During inspection visits to the units, the Carbon Inspectors recheck the mix and record the changes, if any. Without recorded data, if there is conflict of data noticed at site during inspection, the conservative (higher) mix content will be taken that results in lower quantity of production based on fly ash
Purpose of data	For computing baseline emissions as a cross check for production records and to arrive to the conservative estimate.
Additional comment	None

Data / Parameter:	**Electricity – $Q_{Electricity}$**
Unit:	kWh
Description:	The units are recorded periodically from the Electricity Meter installed by the service provider. The consumption of electricity in units for any given period is the difference between Closing Meter Reading (CMR) and Opening Meter Reading (OMR) as shown on the bills. In order to have ready information PP tabulated OMR and CMR for all the SPEs, instead of putting only power consumption as per bill.
Measured/ Calculated / Default:	Measured.
Source of data:	Electricity bills provided by the service provider (State Electricity Boards), based on the reading of meters fitted to Main boards at the premises of SPEs.
Value(s) of monitored parameter:	78,709 kWh
Monitoring equipment:	Electricity meters installed by the service provider. According to norms of Service Provider, calibration is conducted once in 5 years for high capacity meters beyond 20 HP. For details Table 3 may be referred.
Measuring/ Reading/ Recording frequency:	Monthly/bimonthly as provided by service provider.
Calculation method (if applicable):	NA

QA/QC procedures:	As the bills are provided by the State Electricity Boards, no specific QA and QC procedures applied.
Purpose of data:	For computing project emissions.
Additional comment:	None

Data / Parameter:	**Diesel - Qdiesel**
Unit:	Litre
Description:	The quantities are recorded from the purchased bills.
Measured/ Calculated / Default:	Measured.
Source of data:	Purchase bills.
Value(s) of monitored parameter:	3,923.5 litres
Monitoring equipment:	NA
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	The quantity in purchase bills is derived out of pumps those deliver the fuel. These pumps are monitored by statutory authorities and hence their bills are taken as final.
QA/QC procedures:	NA
Purpose of data:	For computing Project Emissions
Additional comment:	None

D.3. Implementation of sampling plan

The units are visited randomly once in six months subject to minimum of 25% operating units of the bundle.
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SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

As per AMS II.D**.** "The energy baseline consists of the energy use of the existing equipment that is replaced in the case of retrofit measures and of the facility that would otherwise be built in the case of a new facility".

The project involves setting up new facilities for production of bricks and blocks by using the FaL-G technology, which is energy efficient. The energy baseline is therefore the energy use of the facilities that would otherwise be built in the absence of the project in order to meet the demand for walling material, comparable in quality and utility to that of bricks and blocks produced through FaL-G technology. The data on market of walling material indicate that burnt clay bricks represent

more than 95% of the total walling material market. Production of burnt clay bricks is therefore considered the baseline scenario.

Energy Baseline

Based on the justifications provided above, energy used in burnt clay brick production is considered as the energy baseline.

Production of burnt clay bricks employs different technologies with different levels of energy consumption. Since it is difficult to determine precisely a particular technology that would be used in the absence of project activity, a weighted average energy use of these technologies is considered to best represent the baseline energy consumption. The technologies, which are banned by regulation, have not been considered in calculating the weighted average energy use.

Energy consumption of different types of brick kilns in India

Burnt clay brick technologies	Specific energy consumption (MJ/kg-brick) SECx		Production capacities (100000 kg -bricks/year) Qx		No. of Plants Nx
	Range	Average	Range	Average	
BTK- fixed chimney	1.0 – 1.5	1.25	83 - 275	179	25000
High draft/ zig zag	0.8 – 1.0	0.9	83 - 138	110	200
Clamps	2.0 – 3.0	2.5	1.4 – 27.5	14	60,000
Vertical Shaft Brick Kiln	0.8 – 1.0	0.9	14 - 110	62	30

The different technologies that are used to produce burnt clay bricks include clamps, Movable Chimney Bull Tranche Kilns (MCBTK), Fixed Chimney Bull Tranche Kiln (FCBTK), High Draft Kilns (HDKs) and the recently introduced Vertical Shaft Brick Kiln (VSBK) technology. Concerned over the increasing pollution from brick industry, the Government of India has already banned the use of MCBTK and it does not issue any clearances/approvals to set up new brick units using MCBTK. Therefore, MCBTKs have not been considered in the energy baseline. The energy baseline (energy use for production of unit volume of bricks/blocks) is determined by considering the remaining technologies and their prevalence in the market using the data presented in the table above.

The weighted average specific energy for burnt clay brick is thus calculated by using the following formulae.

$$SEC_{claybrick} = \frac{\sum_{x} SEC_x \bullet Q_x \bullet N_x}{\sum_{x} Q_x . N_x}$$

Where

$SEC_{clay\ brick}$ = Weighted average specific energy of clay brick (MJ/kg-brick)
SEC_x = Specific energy of brick produced using technology x (MJ/kg)

Q_x = Production capacity of brick plants using technology x (100000 kg-bricks/year)
N_x = No.of plants that use technology x in the country
X = different types of technologies

The weighted average energy consumption figure for clay brick production using the above equation and the data presented above works out to be 1.45 MJ/kg-brick. Considering the popularly practiced dimensions of length, breadth and height of burnt clay brick to be 22 cm, 10 cm, and 7 cm respectively, and weight of the brick to be approximately 2.77 kg/brick (at 1800 kg/m^3), the specific energy consumption translates to be 0.00261 TJ/m^3bricks or 0.000725 GWh_{th} per m^3 . The value 0.000725 GWh_{th} per m^3 was used for calculating thermal energy requirement in baseline and computing baseline emissions.

Emission Baseline

Coal is the main source of energy used for manufacturing burnt clay bricks in India. The second choice of fuel is biomass, including fuel wood. In one of the studies undertaken by the FAO[1] the annual use of fuel wood in the entire brick industry in the country is reported to be only 300,000 tons, while the use of coal is reported to be about 14,000,000 tons. Thus use of fuel wood represents less than 2% in terms of energy inputs of the total energy requirement of the brick industry in all of India. Since the values reported in the FAO report do not distinguish between the renewable biomass and nonrenewable biomass, the actual fraction of renewable biomass (with zero emissions) is likely to be lower. Further the situation with biomass, which was earlier available as a cheaper fuel, is changing rapidly nationwide.

The ongoing initiatives for biomass-based power plants have introduced competition in the market, increasing the cost of biomass. In the absence of any precise information on the use of biomass in brick industry, it is proposed to fix the biomass usage in brick production conservatively at 5% of the total energy input, for all the areas included in the project. This figure is higher than the national average figure of less than 2% reported in the FAO report. In order to account for the zero emissions from the use of biomass, the energy use in burnt clay brick production is adjusted appropriately by multiplying it with a "biomass adjustment factor" (0.95 = 1 - 0.05). The baseline emission thus derived would be conservative.

The amount of CO_2 emissions from burning of coal depends largely on the type of coal and its calorific value. Different types of coal are used in India for brick making. In order to address the variability in coal quality, the IPCC default carbon emission factor for Indian coal as 25.8 tC/TJ (IPCC) has been used to estimate the CO_2 emissions associated with burning of coal in the baseline.

Formulae used:

The approved methodology II.D requires each form of energy, used in the project, to be multiplied with corresponding emission coefficient (kg-CO_2 equ/KWh) to determine the CO_2 emissions.

Different forms of energy used in a FaL-G plant include electricity and/or diesel. In general wherever electricity is available, the same is used in the plant and, in places where electricity is not available, diesel is used to run the plant. However, in certain cases, some of those who run the plants with electricity do keep provision for diesel also in order to overcome intermittent power breakdowns. The emission coefficient of electricity and diesel are therefore used to estimate the

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

project emissions.

Baseline Emissions are computed based on production of bricks and blocks in terms of m^3. In order to make the claim more diligent and conservative, lowest production value ($QL_{x,\ FaL\text{-}G}$) is derived based on three approaches as discussed below. For this purpose, fly ash (as raw material) is taken as one of the basis and electricity as the other basis.

Q_{rec} = Quantity (volume) based on production records
Q_{fa} = Quantity (volume) based on fly ash utilisation
Q_{elec} = Quantity (volume) based on electricity consumption.
In certain units machines are run with diesel, partially or totally, and hence production is monitored based on diesel also, ie.,
Q_{diesel} = Quantity (volume) based on diesel consumption

The data on Q_{elec} and Q_{diesel} have been derived based on normal operational efficiency as studied in the field. Any increase in man power efficiency is bound to decrease the consumption of Electricity/diesel, and thus the given data is proved to be conservative. In case the man power number or efficiency comes down, the labour stop working because they are paid by piece rate and thus their earnings are directly linked to output. For example, during summer, the labour generally do not work during 10:00 to 16:00 hrs for fall of efficiency and, in turn, the output that effects their earnings. Moreover, with decreased efficiency the SPE will not operate the unit on economic considerations.

Whenever the methodology cap exceeds due to higher production, in order to comply with the cap, the production of the units is limited to output of 2-shifts operation that may emerge as fourth approach, which is only incidental and not a regular practice. This does not deviate from the Monitoring Plan.

Based on Fly ash consumption:

Based on the fly ash input in total FaL-G mix practiced at each SPE, specific consumption factor of fly ash is arrived in terms of %. The procurement of fly ash, duly supported by inward challans/ weighment data, is the total consumption of fly ash. Thus 'Production based on fly ash consumption (Q_{fa})' is computed as follows:

$$Q_{fa}: Fa_{con}/Sp.C_{fa}$$

where Fa_{con} = total fly ash consumption of unit x for the corresponding year
$Sp.C_{fa}$ = Specific Consumption factor of fly ash of the unit x.

Specific consumption factor of fly ash is derived based on the mix proportions declared by SPE at the time of enrolment into the project. For any reason, if the SPE changes the composition, he is advised to report the changed mix proportions to PE for carrying out necessary changes in the data bank. During inspection visits to the units, the Carbon Inspectors recheck the mix and record the changes, if any. Without recorded data, if there is conflict of data noticed at site during inspection, the conservative (higher) mix content will be taken that results in lower quantity of production based on fly ash. SPEs are visited once in 6 months, at any month. If there is a change in input ratio, the same is recorded and changed in our data bank.

There is no specific quality management procedure except the strength certificate.

The applicable factors per each SPE are tabulated as below:

SPE ID No.	I/1	I/2	I/3	I/4	I/5	I/6	I/7	I/8	I/9	I/10	I/11
Fa - Spec. Cons. Factor-SP.Cfa	17.6	18.0	15.0	15.0	NA	20.0	19.0	13.9	17.5	13.3	40.0

Based on electricity consumption:

The specific power consumption for each SPE is arrived based on the following approach:

- The label capacities of motors have been recorded from each plant for computation purpose.
- Based on the output in the field, the power factor has been arrived.
  The observation is output Vs power consumption, based on which power utilisation factor was arrived.
- A power factor of 0.40 means a plant with aggregated load of motors at 10HP records to consume 4 HP power/hour based on the loads applied on it for varied durations in a given operational time.
  Output/hour is as studied in the field and arrived on conservative basis.

  This is a one-time study at the beginning, and data is used as ex-ante fixed data.

Thus certain typical types of plants were identified and noted of their specific power consumption on $m^{3.}$ basis, which formulate as the factor for computation of production and, in turn, for ERs. All the plants fall in one of these categories as described below:

Nature of Machinery	Type I	HP	Type II	HP	Type III	HP	Type IV	HP	Type VII	HP
Pan Mixer	Gear box	5.0	Gear Box	5.0	Bevel gear	7.5	Diesel driven bevel gear vibro press combined	10.0	Gear Box	5
Casting Machine	Egg-laying manual	1.5	Egg-laying hydraulic	5.5	Vibro-press manual	2.0			Rotary hydrualic press and conveyo	18

									r	
		6.5		10.5		9.5		10.0		
Specific consumption factor kWh/m^3		1.2		1.2		1.54	Specific consumption factor Diesel ltr/m^3	1.0		2.4

The production based on electricity, Q_{elec}, is calculated as per below formula:

$$Q_{elec} = (Elec_{con} - 2\% \ Elec_{con})/Sp.C_{elec}$$

Where $Elec_{con}$ = total electricity consumed by unit x for the corresponding year
$Sp.C_{elec}$ = Specific consumption factor of electricity of the unit x, vide table above as fixed ex ante.

2% of total electricity consumption is deducted to account for lighting and other miscellaneous needs, while estimating equivalent production output. However, for computing project emissions total electricity consumed is considered.

The applicable factors per cubic meter of production for each SPE are tabulated as below:

SPE ID No.	I/1	I/2	I/3	I/4	I/5	I/6	I/7	I/8	I/9	I/10	I/11
Elec - Spec. Cons. Factor	1.2	1.2	1.2	1.2	NA	1.2	1.54	1.54	1.54	1.54	2.4
Diesel consumption factor	-	-	-	-	-	-	-	-	-	1.0	-

Based on diesel consumption:

The diesel consumption is monitored based on the study undertaken to record diesel consumption vs. output.

Production based on diesel consumption, Q_{diesel}, is computed as follows, wherever diesel is used as an alternate to electricity, totally or partially.

Q_{diesel} is calculated as $Diesel_{con}/Sp.C_{diesel}$

Where $Diesel_{con}$ = total diesel consumed by unit x for the corresponding year
$Sp.C_{diesel}$ = Specific consumption factor of diesel of the unit x, vide table above, as fixed ex ante.

Obviously it is "$Q_{elec} + Q_{diesel}$" when both are used.

For baseline emissions based on lowest production value:

The emissions $E_{b,x}$ from the baseline activity for the plant x is calculated as

$$E_{b,x} = (1 - PER_{biomass}) \bullet SEC_{claybrick} \bullet QLx, \text{ FALG} \bullet CEF \bullet CC$$

where,

$PER_{biomass}$ = biomass correction factor for the baseline = 0.05

$SEC_{clay\ brick}$ = Specific energy consumption of burnt clay bricks (MJ/m^3 clay brick)

$QL_{x,\ FAL\text{-}G}$ = Quantity(Volume) of clay bricks (m^3/year) equal to that of lowest quantity of FaL-G bricks and blocks in plant x (m^3 clay bricks/year) as arrived by three comparative approaches as explained above.

CEF = Carbon Emission Factor for fuel used (bituminous coal) 25.8 tC/TJ (IPCC default value for India)

CC = Carbon to CO_2 conversion factor

The total emissions E_b in the baseline is represented by the formula

$$E_b = \sum_x E_{b,x}$$

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO_2e)
01/04/2013 to 31/03/2014	10,836.35

E.2. Calculation of project emissions or actual net GHG removals by sinks

Estimating emissions from electricity consumption

For those plants, which run on electricity, the project emissions are calculated using the formulae

$*E_{p,x}$ = $E_{x,elec}$ = ($Q_{x,\ FALG}$ x $SEC_{x,\ FALG}$) x EF_{elec}.

$Q_{x,FALG}$ = $Q_{x,\ bricks}$ + $Q_{x,\ blocks}$

$SEC_{x,\ FALG}$ = $Q_{x,\ elec}/Q_{x,FALG}$

$E_{p,x}$ = Project emissions for plant x (tCO_2/year)

$E_{x,\ elec}$ = Annual CO_2 emissions from a plant x associated with annual consumption of electricity (tCO_2/year)

$Q_{x,\ FALG}$ = Annual production of FAL-G bricks/blocks from the plant x (m^3/year)

$Q_{x,brick}$ = Annual production of FaL-G bricks in plant x (m^3/year)

$Q_{x,block}$ = Annual production of FaL-G blocks in plant x (m^3/year)

$SEC_{x,\ FALG}$ = Specific energy consumption of FaL-G product in plant x (KWh_e/m^3)

$Q_{x,\ elec}$ = Annual consumption of electricity in the plant x (KWh_e/year)

EF_{elec} = Emission factor of electricity (tCO_2/KWhe)

Estimating emissions from diesel consumption

Wherever electricity supply is not available, diesel is used to run the equipments and machineries in the plant. Consumption of diesel in the plant is monitored and recorded on a monthly basis, from which the annual consumption is calculated. Emission associated with such consumption of diesel is calculated by multiplying the quantity of diesel consumed with the IPCC emission factor for diesel. The project emission is thus represented by the formulae

$$E_{p,x} = E_{x,diesel} = Q_{x,FaLG} \times SEC_{FALG} \times EF_{diesel}$$

$$SEC_{x,FALG} = Q_{x,diesel}/Q_{x,FALG}$$

Where,

Ex_{diesel} = CO_2 emissions due to direct consumption of diesel in the plant x (tCO_2/year)
$SEC_{x\,prod}$ = Specific energy consumption of FaL-G product in plant x (litre/m^3)
$Q_{x\,diesel}$ = Quantity of diesel used in the plant x per year (litres/year)
EF_{diesel} = CO_2 emission factor for diesel (tCO2/litre), IPCC default value

The total project emissions E_p due to the project activities within the project boundary is represented by the formulae

$$E_p = \sum_x E_{p,x}$$

Time Period	Project emissions or actual net GHG removals by sinks (tCO_{2e})
01/04/2013 to 31/03/2014	83.39

E.3. Calculation of leakage

According to II.D.,leakage consideration is applicable if the energy efficient technology is equipment transferred from another activity or the existing equipment is transferred to another activity. None of these occur in the project. Therefore, leakage calculation is not applicable for this project.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Emission reductions are computed as the difference between baseline emissions and project emissions + emissions due to leakage.

Item	Baseline emissions or baseline net GHG removals by sinks ($t\ CO_2e$)	Project emissions or actual net GHG removals by sinks ($t\ CO_2e$)	Leakage ($t\ CO_2e$)	Emission reductions or net anthropogenic GHG removals by sinks ($t\ CO_2e$)
01/04/2013 to 31/03/2014	10,836.35	83.39	00	10752.96

Rounded down to				10,752

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)		
01/04/2013 to 31/03/2014	14,162	10,752

E.6. Remarks on difference from estimated value in registered PDD

The difference may be attributed to inoperation of one unit, and also to the production that depends on variables such as market demand, Unit performance and workers' availability. As done with large scale unit, this aspect cannot be attributed to specific reason due to heterogeneous locations and logistics.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	N.A	10,752

TABLE 1: LOCATION AND GEOMETRICAL COORDINATES

No.	Name & Address of SPE	SPE ID No.	Geographical Coordinates, Deg	
	Krishna District		North	East
1	Kodali Fly ash Products	AP/KRIS/I/1	16.48	80.68
	7-60. Endowments Colony,			
	Nagarjuna Hospital Road, Kamayyatopu			
	Vijayawada, Krishna Dt. AP			
2	Srinivasa FaL-G Bricks	AP/KRIS/I/2	16.57	80.67
	Nunna, Vijayawada Rural Mandal			
	Krishna Dt. AP			
3	Sri Sai Fly ash Products	AP/KRIS/I/3	16.52	80.70
	D.No. 3-56. Kodalivari Street			
	Enikepadu, Krishna District, AP			
4	Sri Sai Teja Brick Products	AP/KRIS/I/4	16.60	80.47
	Chilkar, Ibrahimpatnam			
	Krishna Dist. AP			
5	Sree Devi Fly ash Industries	AP/KRIS/I/5	16.55	80.75
	Mustabad, Purushothapatnam			
	Gannavaram Mandal, Krishna Dist.			
6	Venkata Lakshmi Industries	AP/KRIS/I/6	16.67	80.28
	Shanthi Ice Factory Compound			
	Amberpet, Nandigama Mandal, Krishna Dist			
	West Godavari District			
7	Srinivasa Fly ash Bricks	AP/WG/I/7	16.92	81.67
	Pangidi Road, Besides FCI Godowns			
	Nidadavole, West Godavari Dist. AP			
8	Kodandarama Fly ash Brick Industries	AP/WG/I/8	16.55	81.55
	Venkayalapalem Road			
	Vissakoderu Post, Palakoderu Mandalam			
	West Godavari Dist. AP			
9	Sri Lakshmi Vasavi FaL-G Brick Industry	AP/WG/I/9	16.65	81.73
	Door No. 16-145 Canal Road			
	Ramachandrarao Peta, Penugonda 534320			
	West Godavari Dist. AP			
	East Godavari District			
10	Sri Satyasai Sri Anjaneya FaL-G Brick Industry	AP/EG/I/10	16.47	81.83
	NH 214 Road, Sompalle Village- 533242			
	Razole Mandal, East Godavari Dist. AP			
	Visakhapatnam District			
11	Hemanth FaL-G Industry	AP/VSP/I/11	17.68	83.07
	Salapuvani Palem, Lankelapalem			
	Visakhapatnam			

Table 2: FaL-G Mix Proportions (kgs) and Factors of Constituents for individual SPEs

ID of SPE	RAW MATERIALS											
	Fly ash		Lime		OPC		Gypsum		Stone dust/ Aggregate		TOTAL	
	kgs	Factor %	kgs	Factor %	kgs	Factor %	kgs	Factor %	kgs	Factor %	kgs	Factor %
AP/KRIS/I/1	30	17.6	10	5.8	2	1.1	1	0.5	127	75.0	170	100
AP/KRIS/I/2	36	18.0	12	6.0	0	0.0	3	1.5	149	74.5	200	100
AP/KRIS/I/3	15	15.0	7	7.0	3	3.0	2	2.0	73	73.0	100	100
AP/KRIS/I/4	15	15.0	3	3.0	1	1.0	1	1.0	80	80.0	100	100
AP/KRIS/I/5	--	--	--	--	--	--	--	--	--	--	--	--
AP/KRIS/I/6	20	20.0	5	5.0	0	0.0	1	1.0	74	74.0	100	100
AP/WG/I/7	30	19.0	25	16.0	0	0.0	3	2.0	100	63.0	158	100
AP/WG/I/8	25	13.9	20	11.1	0	0.0	1	0.6	134	74.4	180	100
AP/WG/I/9	35	17.5	0	0.0	6	3.0	1	0.5	158	79.0	200	100
AP/EG/I/10	20	13.3	10	6.7	0	0.0	2	1.3	118	78.7	150	100
AP/VSP/I/11	60	40.0	0	0.0	8	5.3	2	1.3	80	53.4	150	100

Table 3: Calibration of Power Meters of SPEs in Bundle –I

S. No	Name of the SPE	I.D No	Sanctioned Load (HP)	Accuracy Class, s	Calibration		Meter No	Comments of Service Provider
					Date of Calibration	Due Date of Calibration		
1	Kodali Fly Ash Products**	AP/KRIS/I/1	10	1	27.12.2011	27.12.2016	16705187	% Error of Meter is within the Normal Limits
2	Srinivasa FaL-G Bricks**	AP/KRIS/I/2	25	1	02.01.2012	N.A	16704539	% Error of Meter is found within the Limits
				1	13.06.2013	13.06.2018	16727933	% Error of Meter is found within the permissible Limits
3	Sri Sai Fly Ash Products**	AP/KRIS/I/3	15	1	29.12.2011	29.12.2016	16703667	% Error of Meter is found within the Limits
4	Sri Sai Teja Brick Products**	AP/KRIS/I/4	15	1	30.12.2011	N.A	2146836	% Error of Meter is found within the Limits
				1	19.10.2012	19.10.2017	17990354	% Error of Meter is found within the Limits
5	Sree Devi Fly Ash Industries**	AP/KRIS/I/5	12	1	04.01.2012	04.01.2017	16703910	% Error of Meter is found within the Limits
6	Venkata Lakshmi Industry	AP/KRIS/I/6	27	0.5	29.12.2011	29.12.2016	APE37697	% Error of Meter is found within the Limits
7	Srinivasa Fly Ash Bricks	AP/WG/I/7	7.5	1	10.01.2012	10.01.2017	3058184	Meter results are found satisfactory
8	Kodanda Rama Fly Ash Brick Industries**	AP/WG/I/8	10.4	1	30.12.2011	30.12.2016	15983450	Meter is working satisfactorily
9	Sri Lakshmi Vasavi FaL-G Brick Industry	AP/WG/I/9	10.48	1	16.12.2011	N.A	2494865	Meter is working satisfactorily
			10.48	1	04.01.2012	04.01.2017	17704834	Meter results are found satisfactory
10	Sri Satya Sai Sri Anjaneya FaL-G Brick Industry	AP/EG/I/10	10	1	27.01.2012	27.01.2017	399347	Meter is working satisfactorily
11	Hemanth FaL-G Industry**	AP/VSP/I/11	26	1	28.12.2011	N.A	531733	Pass
			26	1	15.03.2013	15.03.2018	524751	Pass

Note: As a practice by Service Provider (SP), the State Electricity Boards, the connected load of these units being below 20 HP, except I/2, I/6 and I/11, do not qualify for calibration. However, calibration was done by SP, upon being requested by SPEs at payment of special fee, in order to meet the requirement of the VVS.

**Meter Changed

Table 4 :Period of Establishment of SPE units			
S. No	**Name of the SPE**	**SPE ID No.**	**Period of Establishment as mentioned in SPEs'application to PE**
1	Kodali Fly ash Products	AP/KRIS/I/1	Feb-04
2	Srinivasa FaL-G Bricks	AP/KRIS/I/2	Jun-03
3	Sri Sai Fly ash Products	AP/KRIS/I/3	Jan-04
4	Sri Sai Teja Brick Products	AP/KRIS/I/4	Jun-04
5	Sri Devi Fly Ash Industries	AP/KRIS/I/5	Feb-04
6	Venkata lakshmi Industry	AP/KRIS/I/6	Aug-04
7	Srinivasa Fly ash Bricks	AP/WG/I/7	Nov-03
8	Kodanda Rama FlyashBrick industries	AP/WG/I/8	Sep-03
9	Sri Lakshmi Vasavi Fal-G Brick Industry	AP/WG/I/9	Oct-03
10	Sri Satya Sai Sri Anjaneya FaL-G Brick Industry	AP/WG/I/10	Jan-03
11	Hemanth FaL-G Industry	AP/VSP/I/11	Aug-03

Figure I: The schematic FaL-G process

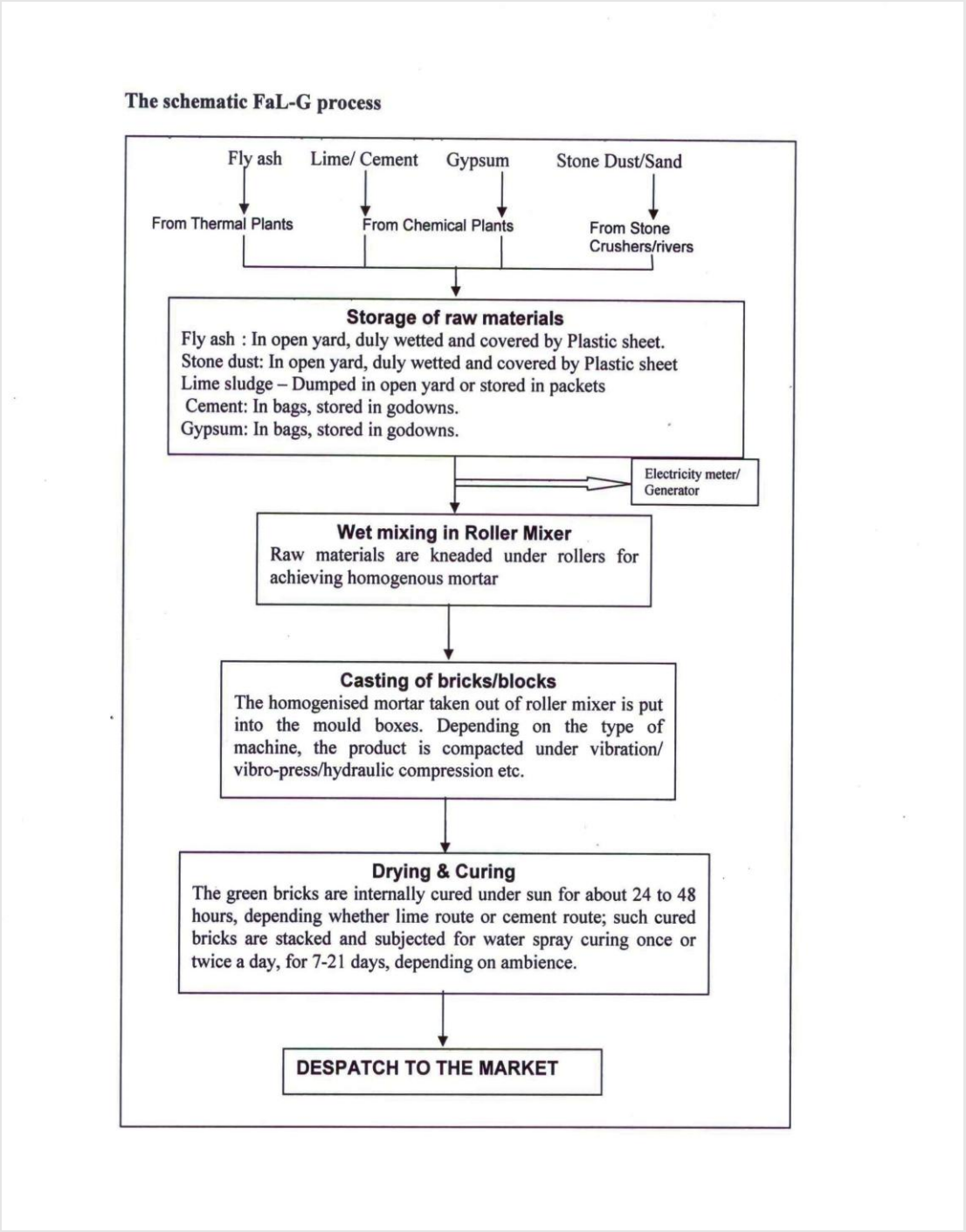


Figure II: Monitoring Data- Flow Chart

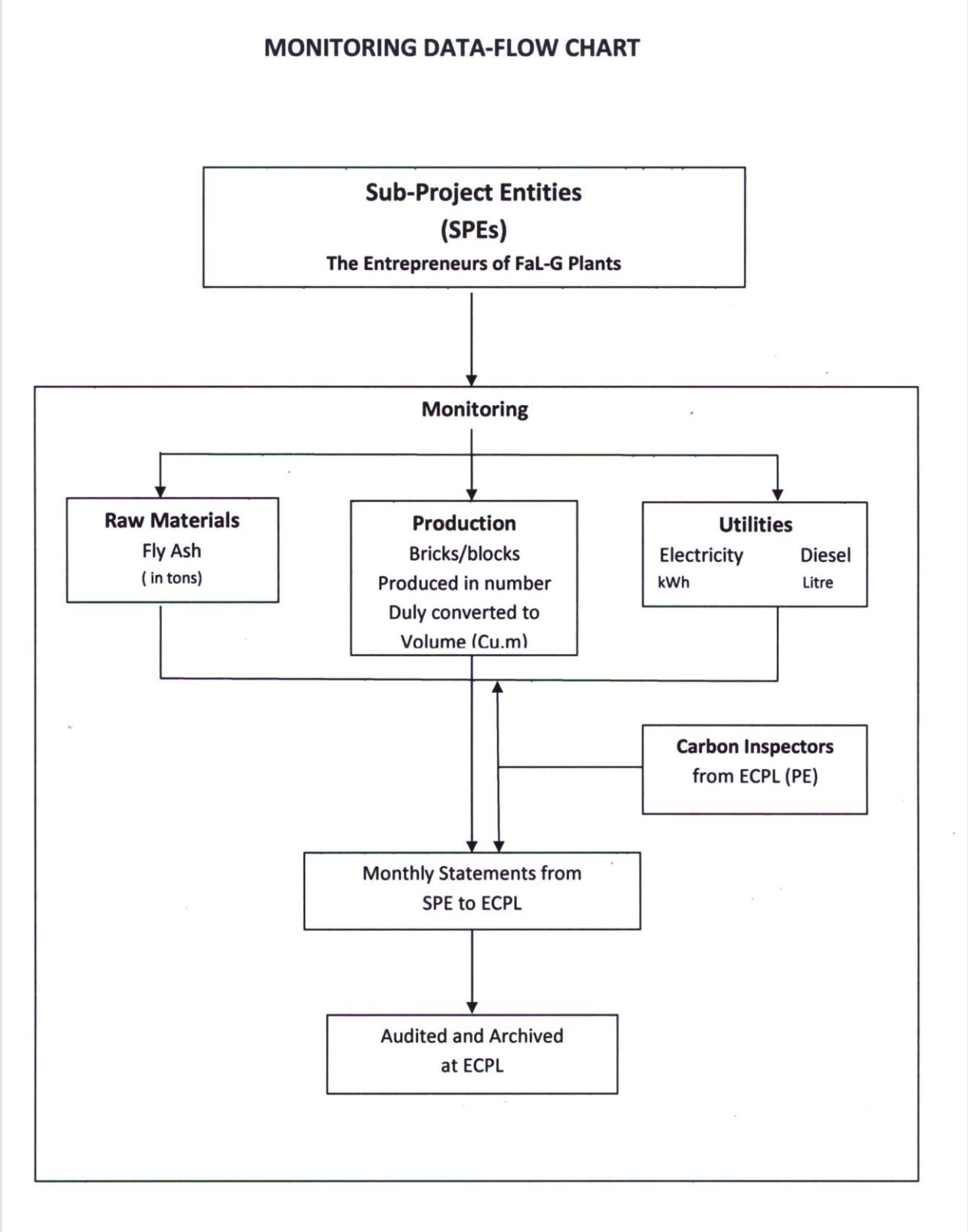
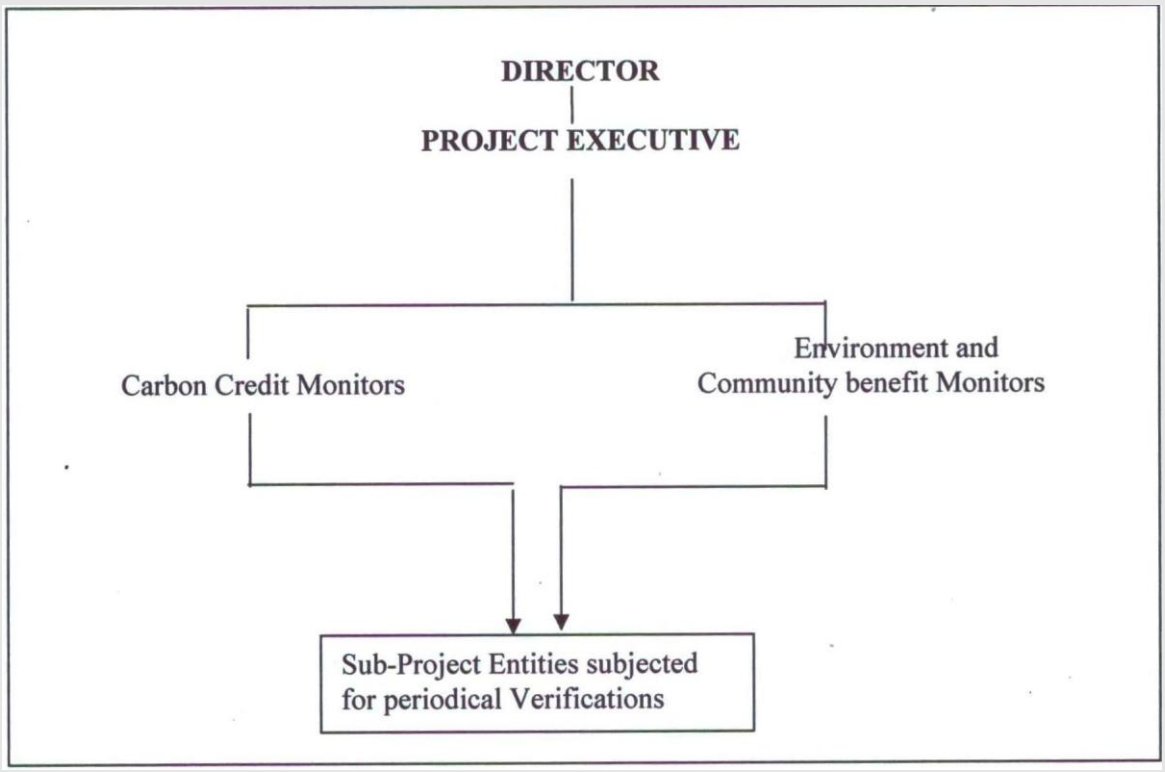


Figure III: Monitoring Information

Organisation Structure for Monitoring Activity



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Document information

Version	*Date*	*Description*
03.2	5 November 2013	Editorial revision to correct table in page 1
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
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