Monitoring report form
(Version 03.1)

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	May 06, 2013
Registration date of the project activity	February 16, 2007.
Monitoring period number and duration of this monitoring period	Monitoring Report No.3 April 01, 2011 to March 31, 2013, inclusive of both the days.
Project participant(s)	Please Refer Section A.3
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope : 04 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	28,324 ERs for 2011-13
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	27,447 ERs for 2011-13, for the two years covered by this Monitoring Report.

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.

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 enclosed as Figure 1.

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 huze 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 is not uncommon. Similarly the efficiency of man power decides the output rather than the rated capacity of plant.

This project has earned 27,448 ERs for 2011-13, for the two years covered by this Monitoring Report.

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

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.

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)	• Eco-Carbon Private Limited (ECPL)	No
Canada	• Ministry of Foreign Affairs & International Trade	No

	Denmark	• Aalborg Portland A/S • Danish Ministry of Climate and Energy-Danish Energy Agency • Dong Naturgas A/S • Maersk Olie og Gas A/S • Nordjysk Elhandel A/S	No	
	Finland	• Ruukki Metals Oy	No	
	Luxembourg	• Ministry of the Environment	No	
	Italy	• International Bank for Reconstruction and Development as the Trustee of the Community Development Carbon Fund ("CDCF") • Ministry for the Environment, Land and Sea	No	
	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)	No	
	Spain	• Endesa Generación, S.A. • Hidroeléctrica del Cantábrico, S.A. • Ministry of Environment and Rural and Marine Affairs; Ministry of Economy and Finance • Gas Natural SDG, S.A. • EDP-Energias de Portugal, S.A.	No	

Switzerland	• Schweizerische Ruckversicherungsgesellschafts AG (Swiss RE)	No
Belgium	Walloon Region Ministry of the EnvironmentBruxelles Environment - IBGE	No
Germany	• BASF SE • KfW	No
Japan	• Daiwa Securities Capital Markets Co. Ltd. • FUJUFILM 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-IID. 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., April 01, 2004 - March 31, 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 January 01, 2003.

This is one of the prompt-start projects where all the units were set up a few months earlier to April 2004. 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 hence subjected for termination without earning any credits. Two other SPEs with ID Nos. AP/VZM/I/13 & AP/VZM/I/14 earned CERs during 2004-07, but were terminated from earning credits for showing non-compliance since 2008-09 vide Section 1.01 Clause (a) xx of ERPA. 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 are 13 till March 2008 and reduced to 11 there on, and their aggregate capacities district-wise are as follows:

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 01April, 2004 to 31 March, 2007, this project has earned 27,433 CERs.

In the second monitoring period of 01 April 07 to 31st March 2011, the project has earned 44,175 ERs which have to yet to be certified.

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 No. Nil Dated 27.6.2012 with permanent changes from registered monitoring plan has been submitted.

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.

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 -3.

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.

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 line diagram is attached as Figure II showing the monitoring points.

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 CO_2/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 CO_2/mWh
Purpose of data:	To compute project emissions.
Additional comment:	Default values provide for conservative estimates.

Data / Parameter:	$SEC_{clay\ brick}$
Unit:	GWh_{th}/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 GWh_{th}/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 GWh_{th}/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:	CEF_{coal}
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:	QL_{FaL-G}
Unit:	m^3
Description:	SPEs maintain the stocks 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:	117,995 m^3
Monitoring equipment:	N.A
Measuring/ Reading/ Recording frequency:	Daily
Calculation method (if applicable):	Calculations are in number duly converted to volume as per the following formula: Volume in m^3: No. of Bricks x Volume of each element
QA/QC procedures:	The production is recorded in the stock register. As a counter-check mechanism, taking the values of specific fly ash and power and /or diesel consumption, which do vary from unit to unit, two more production quantities are independently derived and, the lowest production value is taken as ‘acceptable production’.
Purpose of data:	For baseline calculations.
Additional comment:	Nil

Data / Parameter:	**Fly ash procurement - Fa_{con}**
Unit:	tons
Description:	The quantity of fly ash as received is recorded by the SPE.
Measured/ Calculated / Default:	Measured.
Source of data:	Stock registers of SPEs.
Value(s) of monitored parameter:	63,440 tons
Monitoring equipment:	NA
Measuring/ Reading/ Recording frequency:	As on the day received by SPE
Calculation method (if applicable):	Procured quantities are checked with the inward challans of power plants or with weighment slips.
QA/QC procedures:	NA
Purpose of data:	For calculating production in order to compute baseline emissions, towards conservative approach
Additional comment:	Nil

Data / Parameter:	Electricity - Q_{elec}
Unit:	kWh otherwise mentioned as units.
Description:	The units are recorded periodically from the Electricity Meter installed by the service provider
Measured/ Calculated / Default:	Measured.
Source of data:	Electricity bills provided by the State Electricity Department/ Service Provider, based on the reading of meters fitted to Main boards at the premises of SPEs.
Value(s) of monitored parameter:	196,988 kWh
Monitoring equipment:	Electricity meters installed by the service provider.
Measuring/ Reading/ Recording frequency:	Periodically such as Monthly/bimonthly as decided by service provider.
Calculation method (if applicable):	Power bills based on readings of power meters.
QA/QC procedures:	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.
Purpose of data:	For calculating project emissions.
Additional comment:	As per norms, though calibration is not applicable to plants below 20 HP, to comply with tool, all SPEs were insisted to get their meters calibrated. Wherever SPE failed to provide calibration certificate, 1% of the consumption is added as per provisions of the tool.

Data / Parameter:	Diesel - Q_{diesel}
Unit:	Litre
Description:	The units are recorded from the purchase bills based on which project emissions are calculated.
Measured/ Calculated / Default:	Measured.
Source of data:	Purchase bills based on diesel drawn through metered pumps duly calibrated from time to time.
Value(s) of monitored parameter:	24,456 litres
Monitoring equipment:	Diesel pumps at which diesel is purchased.

Measuring/ Reading/ Recording frequency:	Whenever diesel is purchased, the same is recorded in stock book.
Calculation method (if applicable):	Based on purchase bills.
QA/QC procedures:	Diesel pumps are calibrated periodically at filling stations.
Purpose of data:	For calculating Project Emissions
Additional comment:	Nil

D.3. Implementation of sampling plan

Sampling plan has been implemented as per available methodology guidelines.

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}. The value 0.000725 GWh_{th} 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 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, as referred in D4, fly ash (as raw material) is taken as one of the basis and electricity as the other basis.

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

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

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.

The applicable factors per each SPE are tabulated as below:

2011-12:

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- $SP.C_{fa}$	17.50	18.00	17.50	15.00	20.00	20.00	19.00	12.30	17.00	12.80	18.00

2012-13:

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- $SP.C_{fa}$	17.60	18.00	15.00	15.00	NA	20.00	19.00	13.90	17.50	13.30	40.00

Based on electricity consumption:

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	1.54	1.2	1.54	1.54	1.54	1.54	2.4
Diesel consumption factor	-	-	-	-	-	-	-	-	-	1.0	-

Based on diesel consumption:

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} : $Diesel_{con}/Sp.C_{diesel}$

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

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

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)
$QL_{x,\ FALG}$ = 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)
2011-12	15,111
2012-13	12,591
Total	**27,702**

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

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

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

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

$E_{p,x}$ = 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)

*Note: In order to arrive to conservative scenario for not having calibration of meters during the monitoring period of 2011-12, 1% is added as correction factor, based on the Class of meters at 1.0. Thus:

$Q_{x,elec}$ is multiplied by 1.01 to arrive to ultimate project emissions due to electricity for 2011-12.

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

$E_{p,x} = E_{x,diesel} = Q_{x, FaLG}$ x SEC_{FALG} x 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})
2011-12	146
2012-13	109
Total	**255**

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)
2011-12	15,111	146	00	14,965
2012-13	12,591	109	00	12,482
Total	**27,702**	**255**	**00**	**27,447**

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)		
2011-12	14,162	14,965
2012-13	14,162	12,482
Total	**28,324**	**27,447**

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

The difference may be attributed to 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)	24,894	2,553

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 a :FaL-G Mix Proportions (kgs) and Factors of Constituents for individual SPEs : 2011-12

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	35	17.5	12	6	2	1	12	1.5	148	74	200	100
AP/KRIS/I/2	45	18.0	12	4.8	0	0	12	1.2	190	76	250	100
AP/KRIS/I/3	35	17.5	11	5.5	2	1	11	0.5	151	75.5	200	100
AP/KRIS/I/4	15	15.0	3	3	1.5	1.5	3	1	79.5	79.5	100	100
AP/KRIS/I/5	40	20.0	12	6	0	0	12	2	144	72	200	100
AP/KRIS/I/6	40	20.0	8	4	0	0	8	1	150	75	200	100
AP/WG/I/7	30	19.0	25	16	0	0	25	2	100	63	158	100
AP/WG/I/8	20	12.3	12	7.4	0	0	12	0.6	129	79.7	162	100
AP/WG/I/9	25	17.0	10	7	0	0	10	1	110	75	146.5	100
AP/EG/I/10	23	12.8	13	7.25	0	0	13	1.62	141	78.33	180	100
AP/VSP/I/11	30	18.0	0	0	8	4.8	0	1.8	126	75.4	167	100

Table 2 b :FaL-G Mix Proportions (kgs) and Factors of Constituents for individual SPEs : 2012-13

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	10.0	5.8	2.0	1.1	1.0	0.5	127	75.0	170	100
AP/KRIS/I/2	36	18.0	12.0	6.0	0.0	0.0	3.0	1.5	149	74.5	200	100
AP/KRIS/I/3	15	15.0	7.0	7.0	3.0	3.0	2.0	2.0	73.0	73.0	100	100
AP/KRIS/I/4	15	15.0	3.0	3.0	1.0	1.0	1.0	1.0	80.0	80.0	100	100
AP/KRIS/I/5	--	--	--	--	--	--	--	--	--	--	--	--
AP/KRIS/I/6	20	20.0	5.0	5.0	0.0	0.0	1.0	1.0	74.0	74.0	100	100
AP/WG/I/7	30	19.0	25.0	16.0	0.0	0.0	3.0	2.0	100	63.0	158	100
AP/WG/I/8	25	13.9	20.0	11.1	0.0	0.0	1.0	0.6	134	74.4	180	100
AP/WG/I/9	35	17.5	0.0	0.0	6.0	3.0	1.0	0.5	158	79.0	200	100
AP/EG/I/10	20	13.3	10.0	6.7	0.0	0.0	2.0	1.3	118	78.7	150	100
AP/VSP/I/11	60	40.0	0.0	0.0	8.0	5.3	2.0	1.3	80.0	53.3	150	100

Table 3: Calibration of power meters of SPEs in Bundle 1

Sl. No.	Name of SPE	ID Number	Connected Load- HP	Date of Calibration	Class of meter
01.	Kodali Fly ash Products	AP/KRIS/I/1	10	27.12.11	1.0
02.	Srinivasa FaL-G Bricks	AP/KRIS/I/2	25	02.01.12	1.0
03.	Sri Sai Fly ash Products	AP/KRIS/I/3	15	29.12.11	1.0
04.	Sri Sai Teja Brick Products	AP/KRIS/I/4	15	30.12.11	1.0
05.	Sree Devi Fly ash Industries	AP/KRIS/I/5	12	04.01.12	1.0
06.	Venkata Lakshmi Industries	AP/KRIS/I/6	27	29.12.11	0.5
07.	Srinivasa Fly ash Bricks	AP/WG/I/7	7.50	10.01.12	1.0
08.	Kodandarama Fly ash Brick Industries	AP/WG/I/8	10.40	30.12.11	1.0
09.	Sri Lakshmi Vasavi Fly ash Brick Industries	AP/WG/I/9	10.48	16.12.11	1.0
10.	Sri Satyasai Sri Anjaneya FaL-G Brick Industry	AP/EG/I/10	10	27.01.12	1.0
11.	Hemanth FaL-G Industry	AP/VSP/I/11	26	28.12.11	1.0

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 VVM. The Calibration was not done during 2011-12 and hence 1% correction factor was added to the electricity consumption in order to arrive to project emission. By 2012-13 all the SPE got their meters calibrated and obtained certificates.

Figure I: The schematic FaL-G process

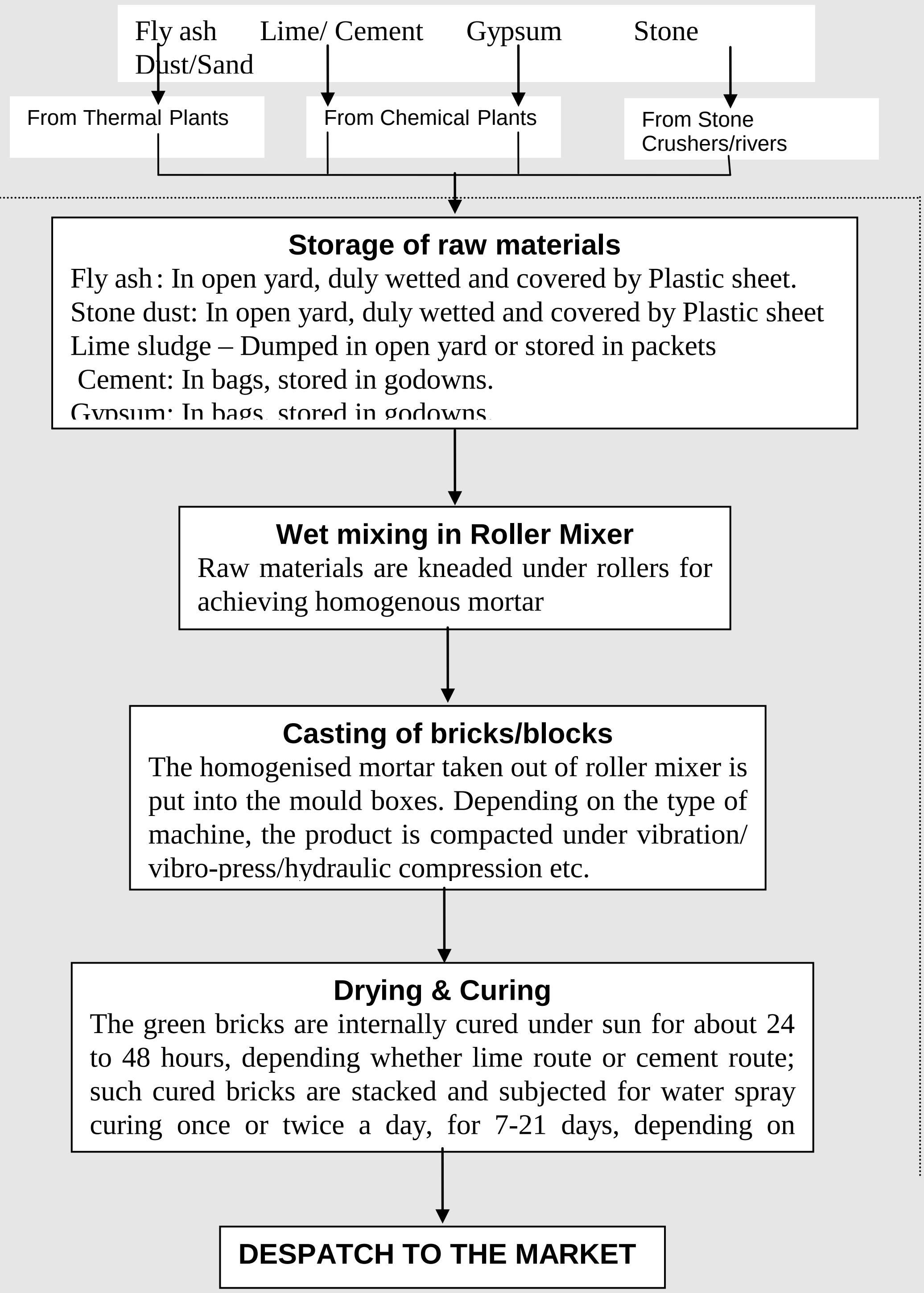
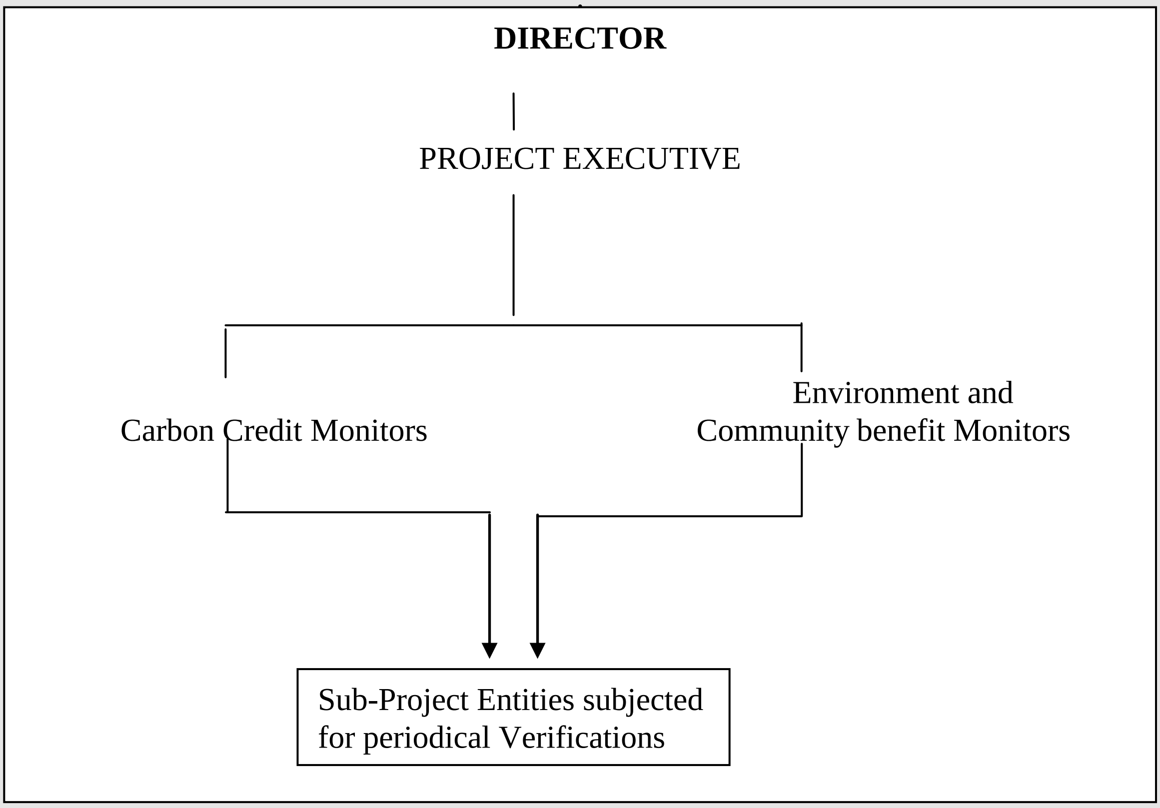


Figure II: Monitoring Information

Organisation Structure for Monitoring Activity



Document information

Version	*Date*	*Description*
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).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
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