Monitoring Report

India-FaL-G- Brick and Blocks Project No.1

(Project No. 0707)

Monitoring Period: **1 April 2004 to 31 March 2007**

Year I	April 01,2004 to March 31, 2005
Year II	April 01,2005 to March 31, 2006
Year III	April 01,2006 to March 31, 2007

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Project Background

The project ' India-FaL-G-Brick and Blocks Project No.1' promotes an eco-friendly and a patented technology known as 'FaL-G Technology', for production of alternative building materials using fly ash as one of the main inputs. By avoiding use of fossil fuel in the production of bricks the project contributes for conservation of energy and fossil fuel (coal), and, in turn, associated emissions. Fly ash bricks replace clay bricks as walling material and the production of the latter imminently uses fossil fuel for sintering, resulting in generation of CO_2. This is how emission reductions occur in FaL-G project.

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

- Environmental protection by minimising eco-hostile activities such as topsoil denudation and resultant land degradation, and air pollution caused by emission of unprocessed flues.

- Mitigation of the environmental impacts associated with improper disposal of industrial wastes and byproducts through utilisation of the latter towards alternative 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 have the advantage of continuous year-wide operation, and hence provide yearlong employment opportunity for the skilled artisans and create self-help livelihood opportunities for the illiterate poor.

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 further enhance the benefits.

This CDM project has been submitted as a bundle of 14 plants located in different districts in the state of Andhra Pradesh, India, as shown below, and operated by individual entrepreneurs called Sub-Project Entities (SPEs). This bundle got registered with CDM-EB/ UNFCCC under Reference No. 0707 on February 16, 2007.

The project has been submitted under the methodology AMS II- IID (Version 07: 28 November, 2005).

States	District	No. of Plants	Aggregate Capacity - m^3/year
Andhra Pradesh	Krishna	6	27000
	West Godavari	3	12600
	East Godavari	1	3600
	Visakhapatnam	2	9000
	Vizianagaram	2	9000
Total		**14**	**61200**

The Technology

The technology works with the strength of fly ash, lime and gypsum chemistry. The slow chemistry of fly ash and lime is maneuvered by tapping ettringite phase to its threshold limits through sufficient input of gypsum. Therefore, FaL-G does not require energy intensive equipments such as heavy duty-press or autoclave, which are otherwise required in case of only fly ash and lime. The FaL-G process completely eliminates the 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. Byproduct lime is available at competitive cost over the mineral lime. Otherwise, it is economical to use OPC than mineral lime and, hence, OPC is preferred in areas where byproduct lime is scarce or not available 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 PDD and associated documents can be accessed from UNFCCC web site http://cdm.unfccc.int/Projects/DB/DNV-CUK1161790286.9/history

Current Status of the Project:

One of the plants with ID No. AP/VSP/I/12 has been merged with another plant in the bundle with ID No. AP/VSP/I/14. Except this change all remaining 13 plants are in good operation within their project boundaries.

Reporting Period

This is one of the prompt start projects. The reporting period for the project is April 01, 2004 to March 31, 2007 inclusive of both the days. Thus this is the first monitoring report for the project.

Monitoring Plan as per PDD:

Table-1 elucidates 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 for each SPEs plant. Hence Project Entity developed benchmark figures for different parameters for each plant depending upon the production capacity of individual plants, and raw materials used.

Project Entity (PE) developed templates on various data for monitoring and provided to SPEs. SPEs have to fill the templates with the production data on daily basis, and other data on monthly basis, and submit as monthly reports to PE. Upon receipt of monthly data, the same would be reviewed by the monitoring personnel of SPE and electronically archived for consolidation.

The monitoring personnel of PE make random visits to SPEs, during which they verify the records, stock registers and purchase bills to check the diligence of the submitted data. The emissions reductions would then be computed based on production, fuel consumption and raw material consumption and the one representing the lowest would be taken as the final value.

Emission Reductions Achieved:

Emission reductions were computed as the difference between baseline emissions and project emissions.

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 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 @ 0.9 t CO_2/ MWhe for electricity, and @ 0.0032 tCO_2/litre for diesel is therefore used to estimate the project emissions.

Formulae used:

For Baseline emissions:

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

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

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)

$Q_{x, FALG}$ = Quantity of clay bricks (m^3/year) equal in quantity to that of FaL-G bricks and blocks produced in plant x (m^3 clay bricks/year)

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

$$E_b = \sum_x E_{b,x} \qquad \textbf{Eq. 1}$$

For Project Emissions:

a). Estimating emissions from electricity consumption

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

$E_{p,x} = E_{x,elec} = (Q_{x, FALG} \times SEC_{x, FALG}) \times EF_{elec}$. **Eq. 2**

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

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

Where,

$E_{p,x}$ = 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)

b). 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

$E_{p,x} = E_{x,diesel} = Q_{x,FaLG} \times SEC_{FALG} \times EF_{diesel}$ **Eq. 3**

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

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

$$E_p = \sum_x E_{p,x}$$ **Eq.4**

c). Estimating emissions due to 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.

Total project emissions:

Since no leakage is considered for the project, the total project emissions within the project boundary E_p, as per **Eq. 4** represents the total project activity emissions.

Emission Reductions:

Emission reduction generated by the project consisting of 13 plants (x=13) as computed by Eq. 5 as below is the difference between the baseline emissions, as represented by Eq.1, and the project emissions vide Eq.4.

$ER = \sum(E_{b,,x} - E_{p,,x})$ **Eq. 5**

Summary of Energy Savings and Emission Reductions achieved

Table –2 gives the summary of energy savings and emission reductions for three years. Detailed calculations are attached separately vide spreadsheet.

Table 1: Monitoring Plan & Approach

ID No.	Data type	Data Variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long is archived data to be kept?	Comment
1	Production rate	$N_{FaL-G-i}$	Bricks/blocks/ day.	M	Daily	100%	Manual	Till 2 years after the end of the crediting period	
2	Product dimension	$V_{FaL-G-i}$	M^3/brick	M	Daily	sample	Manual	Till 2 years after the end of the crediting period	
3	Monthly Production	Q_{FaL-G}	M^3/Month	C	Monthly	100%	Electronic	Till 2 years after the end of the crediting period	Calculated monthly out of the daily production data.
4	Electricity consumption	$Q_{Electricity}$	KWh_e	M	Monthly	100%	Electronic	Till 2 years after the end of the crediting period	
5	Diesel consumption	Q_{diesel}	Litre	M	Monthly	100%	Electronic	Till 2 years after the end of the crediting period	

Table - 2: Summary of Energy Savings and Emission Reductions

SPE ID No.	2004-05		2005-06		2006-07	
	Thermal Energy savings, GWhth	Emission reduction, t CO_2	Thermal Energy savings, GWhth	Emission reduction, t CO_2	Thermal Energy savings, GWhth	Emission reduction, t CO_2
AP/KRIS/I/1	3.26	1,057.77	3.24	1,048.94	3.06	991.04
AP/KRIS/I/2	3.23	1,046.16	1.94	629.73	2.19	710.13
AP/KRIS/I/3	2.31	749.18	5.77	1,868.90	6.51	2,110.36
AP/KRIS/I/4	3.46	1,122.07	1.56	505.46	2.98	964.04
AP/KRIS/I/5	2.84	939.47	3.40	1,100.65	2.05	663.04
AP/KRIS/I/6	1.23	396.93	2.43	786.23	3.20	1,036.68
AP/WG/I/7	2.57	961.40	1.95	632.78	2.31	749.21
AP/WG/I/8	--	--	--	--	0.97	314.41
AP/WG/I/9	1.40	454.38	1.47	475.68	1.50	487.34
AP/EG/I/10	1.25	404.06	1.79	581.20	1.68	546.05
AP/VSP/I/11	2.42	785.59	2.31	747.04	1.45	469.07
AP/VZM/I/13	1.10	355.23	0.76	248.02	1.17	378.45
AP/VZM/I/14	1.01	327.29	0.84	271.82	1.60	517.90
TOTAL	**26.08**	**8,599.53**	**27.45**	**8,896.44**	**30.67**	**9,937.72**