AAC BLOCK/PANEL MANUFACTURING UNIT AT KRISHNA, ANDHRA PRADESH

Document Prepared By

EPIC Sustainability Services Private Limited

Project Title	AAC Block/Panel Manufacturing unit at Krishna, Andhra Pradesh
Version	01
Report ID	ESSPL/VCS/2016/032

Report Title	AAC Block/Panel Manufacturing unit at Krishna, Andhra Pradesh
Client	Greenway Building Materials India Pvt. Ltd. (Service recipient) and EnvironmentFirst Energy Services (P) Limited (Contractor cum invoice recipient) (both are project proponents)
Pages	19
Date of Issue	12th July 2016
Prepared By	EPIC Sustainability Services Private Limited Scope of DOE: VCS verification (1st verification)
Contact	41, Anugraha, 1st Cross, Sundarnagar, Near BEL Circle, Bangalore-560054, Karnataka, India
Approved By	Mr. K. Sudheendra (Head-Operations)
Work Carried Out By	Verification Team: Mr. R. Vijayaraghavan (Lead Auditor) Mr. G. Subramanyam (Technical expert) Technical Reviewer Team: Mr. A. Prabu Das (Technical reviewer) Mr. R.P. Mohan (Technical expert independent of the verification team)

Summary:

EnvironmentFirst Energy Services (P) Limited has appointed EPIC Sustainability Services Private Limited to perform the first periodic verification of the emission reductions reported for the project titled "AAC Block/Panel Manufacturing unit at Krishna, Andhra Pradesh" (Project ID: 1342) for the period from 1st August 2013 to 31st December 2015. The verification was based on the validated project design document (PD) version 2.0 dated 17th June 2015, corresponding validation report, monitoring report and other supporting documents made available to the verification team by the client.

The project activity involves construction of Autoclaved Aerated Concrete (AAC) block manufacturing unit replacing conventional fired (baked) clay bricks (baseline scenario) as construction material. The installed capacity of the plant at the end of complete implementation is 0.24 Million Cubic metre per year. The initial phase of 0.15 Million Cubic metre per year was commissioned on 1st August 2013 (Project start date) whereas expansion phase is nearing complete implementation soon. The proposed VCS project activity has correctly applied the baseline and monitoring methodology (AMS.III.Z Version 5.0). Coal used in the baseline scenario is replaced by rice husk in the project activity, which is related to the emission reductions. The emission reduction achieved by the project during the monitoring period is 56,233 tCO2e. In summary, it is the opinion of EPIC that the proposed VCS project activity meets the relevant VCS Version 3 requirements and the GHG reductions from the project is real, measurable and permanent.

The verification team identified, through the verification process, 03 CARs. The PP has taken actions and submitted to EPIC the revised monitoring report and supporting evidence. The verification team, through the verification process, confirmed that the emission reductions achieved by the project activity during the monitoring period are correctly calculated in the monitoring report, Version 2.0, dated 6th July 2016 based on the approved monitoring methodology, AMS.III.Z Version 5.0. Therefore, EPIC certifies the emission reductions amounting to 56,233 tCO2e during the monitoring period.

Table of Contents

1 INTRODUCTION

1.1 Objective

EPIC Sustainability Services Private Limited (hereinafter referred to as EPIC) has been contracted by EnvironmentFirst Energy Services (P) Limited (hereinafter referred to as EnvironmentFirst) to undertake the (first periodic) independent verification of the project activity titled "AAC Block/Panel Manufacturing unit at Krishna, Andhra Pradesh" (hereinafter referred to as project activity)

- To verify that the actual monitoring system and procedures are in full compliance with the system and procedures described in the monitoring plan of validated PD, version 2.0 dated 17th June 2015 (hereinafter referred to as validated PD) as well as with the applicable methodology;
- To verify that the data reported were accurate, complete, consistent, transparent and free of material error or omission by checking the monitoring records and the emissions reduction calculation; and
- To verify and certify GHG emission reduction reported for the project for the period from 1st August 2013 to 31st December 2015 (hereinafter referred to as current monitoring period).

1.2 Scope and Criteria

The scope of the verification was the independent and objective review and ex-post determination of the monitored reductions in GHG emissions from the project activity. The verification of this VCS project was based on the validated and registered project design document (PD), validation report and monitoring reports and supporting documents made available to the verification team. These documents were reviewed against the requirements of the VCS program guide version 3.5/1/ VCS Standard/1/ version 3.5, Registration and Issuance Process/1/ version 3.6, Validation and Verification manual/1/ version 3.1, the CDM Modalities and Procedures, related rules and guidance, and the Validation and Verification standard/1/ Version 9.0. The verification is not meant to provide any consulting towards the client. However, stated request for clarifications and/or corrective actions may provide input for improvement of the project design.

1.3 Level of Assurance

In line with VCS requirements and as per ISO 14064-3:2006 para A.2.3.2, a reasonable level of assurance is defined for the verification of the project.

This implies that based on the process and procedures conducted EPIC should state whether the information in the PD is materially correct and is a fair representation of the of the actual project details, and is prepared in accordance with the VCS requirements and the applied CDM methodology for information pertaining to additionality, GHG quantification, monitoring and reporting.

1.4 Summary Description of the Project

The project activity involves construction of Autoclaved Aerated Concrete (AAC) block manufacturing unit replacing conventional fired (baked) clay bricks (baseline scenario) as construction material. The installed capacity of the plant at the end of complete implementation is 0.24 Million Cubic metre per year. The initial phase of 0.15 Million Cubic metre per year was commissioned on 1st August 2013 (Project start date) whereas expansion phase is nearing complete implementation soon. The proposed VCS project activity has correctly applied the baseline and monitoring methodology/2/ (AMS.III.Z Version 5.0). Coal used in the baseline scenario is replaced by rice husk in the project activity, which is related to the emission reductions. The emission reduction achieved by the project during the monitoring period is 56,233 tCO2e. The verification team has also reviewed the commissioning certificate/3/ and accepted the start date of the project activity as correct.

2 VERIFICATION PROCESS

2.1 Method and Criteria

The verification process consists of the following phases:

i) a document review of the project design documents, monitoring reports and preparation of verification protocol;
ii) on-site visit to the project activity and interviews with project developer and project consultant; and
iii) resolution of outstanding issues and the issuance of final verification report and opinion

In order to ensure transparency, a verification protocol was prepared for the project according to the VVS[/1/]version 9.0 verification requirements and VCS Standard[/1/] version 3.5. The verification protocol serves the following purposes:

- it organizes, details and clarifies the requirements that a VCS project is expected to meet;
- it ensures a transparent validation process where the validator will document how a particular requirement has been validated and the result of the validation.

The completed validation protocol is enclosed in Appendix of this report.

During the verification, non-fulfillment of the verification protocol criteria or identified risks to the fulfillment of project objectives were raised as either CAR or CR. Corrective Action Requests (CAR) were issued, where:

i) mistakes had been made that directly impacted on the project results; or
ii) VCS/CDM requirements had not been met; or
iii) there was a risk that the project would not be accepted as a VCS project or that emission reductions will not be certified.

The Clarification Requests (CR) were issued where additional information was needed to clarify issues, and Forward Action Requests (FAR) for issues relating to project implementation that required review during the first verification of the project activity.

The following team members from EPIC are involved in identifying the following:

Name	Role	Responsibility
Mr. R. Vijayaraghavan	Lead Auditor	Completeness check, desk review, onsite inspection, Interview with project representatives, issuance of findings, report preparation
Mr. G. Subramanyam	Technical expert	Onsite inspection and technical input to the lead auditor
Mr. A. Prabu Das	Technical Reviewer	Technical Issues related to project
Mr. R.P. Mohan	Technical expert	Technical input to the technical reviewer

2.2 Document Review

The verification was performed primarily based on the review of the monitoring report and the supporting documentation. This process included:-

1. a review of data and information presented to verify their completeness
2. a review of the Monitoring Plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the QA/QC procedures, and

3. an evaluation of data management and the QA/QC system in the context of their influence on the generation and reporting of ERs.

The monitoring report[/4/], Version 01, dated 2nd April 2016 (hereinafter referred to as initial MR) was initially reviewed and further EPIC requested the PP to present the supporting evidences. Additional background information and documents related to the project performance were also reviewed by EPIC. Through the process of the verification, the revised monitoring report and the supporting documents were evaluated to confirm the actions taken by the PP to the CARs and CLs issued by EPIC. The documents reviewed by EPIC are listed in References section of this report. EPIC reviewed the final version of the monitoring report[/4/] Version 2.0 dated 6th July 2016 (hereinafter referred to as final MR) to confirm that all changes agreed had been incorporated.

2.3 Interviews

After the review of the Project description and documents a site visit was carried out from 15th June 2016. During the site visit physical inspection of the project components followed by interviews with the on-site personnel was carried out to verify the project details. A follow-up meeting was also conducted with the project representatives. The following persons were interviewed.

Name & Designation	Company	Details of Interview
Mr. Param Kumar Senior Manager (Production)	Greenway Building Materials (Nucon Blocks)	Technical Details, Monitoring system, calibration frequency, Overall Project management.
Mr. Sanjeev Kumar – Production Manager	Greenway Building Materials (Nucon Blocks)	Technical Details, Monitoring system, calibration frequency, Overall Project management.
Mr. Ram Prasad	Greenway Building Materials (Nucon Blocks)	Operation and maintenance and monitoring system
Mr. Satyanarayana	Greenway Building Materials (Nucon Blocks)	Operation and maintenance
Mr. Venkatarama Rao	Greenway Building Materials (Nucon Blocks)	Operation and maintenance
Mr. Abhishek Mazumdar	EnvironmentFirst-Director	Emission Reduction calculation

2.4 Site Inspections

After the review of the Project Description and documents, an on- site visit was carried out on 15th June 2016. During the site visit, the actual on-site practices adopted and followed for the operation of the project were compared with the description given in the PD[/5/]. The process layout, energy consumption pattern, baseline, additionality and monitoring plan, calibration and level of accuracy were examined.

An on-site assessment was conducted as a part of verification activity and involved:

1) an assessment of the implementation and operation of the project activity as per the registered PDD

2) a review of information flows for generating, aggregating and reporting of the monitoring parameters

3) interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the Monitoring Plan

4) a cross-check between information provided in the MR and data from other sources

5) a check of the monitoring equipment including calibration performance, and observations of monitoring practices against the requirements of the PDD and the applied methodology

6) A review of calculations and assumptions made in determining the GHG data and ERs, and

7) An identification of QA/QC procedures in place to prevent, or identify and correct, any errors or omissions in the reported monitoring parameters.

2.5 Resolution of Findings

Resolution of Clarification and Corrective Action Requests

The objective of this phase of the verification was to resolve the corrective action requests and clarifications and any other outstanding issues which needed to be clarified prior to EPIC positive conclusion on the monitoring report and the project design. During the validation process three CARs were raised.

All the CARs and CRs were resolved during this phase. In order to ensure the transparency of the validation process, the concerns raised and responses/conclusion that were given are summarized in table attached to this report.

Internal quality control

A Technical Reviewer is appointed to review the final draft verification report and the final verification report. The comments made by the Technical Reviewer are taken into consideration and incorporated in the final report. The final report (after resolutions of all findings) is then submitted to the Head – Operations for review and approval.

2.5.1 Forward Action Requests

There is no FAR raised during this verification process.

2.6 Eligibility for Validation Activities

EPIC has accredited for validation and verification for the scopes 1-11 and 13-15 by CDM UNFCCC and as well as by the VCS board.

3 VALIDATION FINDINGS

3.1 Participation under Other GHG Programs

Not applicable

3.2 Methodology Deviations

There is no methodology deviation involved.

3.3 Project Description Deviations

There are no such deviations observed for this project activity.

3.4 Grouped Project

The project activity is not a grouped project.

4 VERIFICATION FINDINGS

4.1 Project Implementation Status

The verification based on the onsite observation, found that there is no material discrepancies between the project implementation and the project description. The verification team checked the status of monitoring plan the completeness of monitoring system and found no discrepancies between the actual monitoring system and the monitoring plan set in the validated project description. PP has provided an undertaking letter that there will not be any double counting. The verification team was able to conclude the project has been implemented as described in the validated project description.

4.2 Accuracy of GHG Emission Reduction and Removal Calculations

The project activity uses the latest approved monitoring methodology AMS.III.Z Version 05[12], which is applicable to the project. The verification team has reviewed based on the onsite assessment the requirements of monitoring plan including the responsibility, authority, monitoring, measurement, reporting, archiving, the QA / QC procedures such as calibration, meter testing, internal audits, maintenance of monitoring equipment and monitoring plan implementation and able to confirm that all the requirements are complied with the methodology. Further to assessment of the monitoring plan indicated in the PD, the verification team is of the opinion that the project participant has implemented the monitoring plan as per the monitoring plan is in line with the requirements of the methodology and the monitoring arrangements described in the monitoring plan. The verification of all the data ex-ante and data ex-post (monitoring parameters) used for the calculation of baseline emissions, project emissions and leakage emissions are tabulated below.

Parameter	Justification by the validation team
Emission reduction by the project activity (ER_y)	As per para 33 of the applied meth[12], emission reduction achieved by the project activity shall be calculated as below $ER_y = BE_y - PE_y - LE_y$ Where ERy – Emission reductions BEy-Baseline emissions PEy- Proejct emissions LEy-Leakage emissions
Baseline emissions (BE_y)	As per para 20 of the applied meth[12], the baseline emissions are the fossil fuel consumption related emissions (fossil fuel consumed multiplied by an emissions factor) associated with the system, which would have otherwise been used, in the brick production facility in the absence of the project activity. For projects involving the installation of systems in a new facility, the average annual baseline fossil fuel consumption value and the baseline brick production rate shall be determined as that which would have been consumed and produced, respectively, under an appropriate baseline scenario.

<table>
<tr><td></td><td>As per para 21 of the applied meth, Baseline emissions is calculated as below.
BEy = EFBL x PPJ,y
Where EFBL –Annual production specific emission factor (tCO2e/m^3)
PPJ,y –Annual net production of the facility in year y</td></tr>
<tr><td>Annual production specific emission factor (EF_{BL})</td><td>As per para 23 of the applied meth, EF_{BL} for installation of systems in a new facility shall be determined using one of the options below.
a) Using manufacturers' specifications such as for brick production rate, energy consumption in the process;
(b) Using specifications of comparable units having similar techno-economic parameters;
(c) Using reference plant approach</td></tr>
<tr><td>Annual production specific emission factor (EF_{BL}) = 0.78 tCO2e/baseline brick</td><td>As per the report/6/ on "Small and Medium scale Industries in Asia-Energy and Environment", Annual production specific emission factor (EFBL) is 0.78 tCO2e/baseline brick which is accepted by the validation team.</td></tr>
<tr><td>Annual production specific emission factor (EF_{BL}) in tCO2e/M3</td><td>Annual production specific emission factor (EFBL) in tCO2e/M3 = Annual production specific emission factor (EFBL) (in tCO2e/brick)/ volume of baseline brick</td></tr>
<tr><td>Volume of one baseline brick</td><td>Volume of baseline brick = Weight of one brick/ Density of brick</td></tr>
<tr><td>Weight of baseline brick =3.75 kg</td><td>As per report/6/ of "Energy Conservation and Pollution Control in Brick Kilns", weight of baseline brick is 3.75 kg which is accepted by the validation team</td></tr>
<tr><td>Density of baseline brick =1.92 kg/m^3</td><td>As per reade website/6/, density of brick is 1.92 kg/m^3 which is valid and hence accepted.</td></tr>
<tr><td>Volume of one baseline brick</td><td>Volume of baseline brick = Weight of one brick/ Density of brick
= 3.75/1.92 =1.953125 m^3</td></tr>
<tr><td>Annual production specific emission factor (EF_{BL}) = 0.39936 tCO2e/m^3

(ex-ante and fixed for the entire crediting period)</td><td>EF_{BL} in tCO2e/m^3 = EF_{BL} in tCO2e/brick/ volume of baseline brick
=0.78/1.953125
= 0.39936 tCO2e/m^3</td></tr>
<tr><td>Annual net production of the facility in year y ($P_{PJ,y}$)

<table><tr><td>Year</td><td>Net production of the facility during the monitoring period</td></tr><tr><td>2013</td><td>22,694.09 m^3</td></tr><tr><td>2014</td><td>101,060.35 m^3</td></tr><tr><td>2015</td><td>73,377.79 m^3</td></tr></table>
(monitored parameter)</td><td>Ex-post calculation:
It is to be monitored continuously and recorded daily in the plant log sheet/7/. The verification team has reviewed the log sheets and accepted the same as correct.

QA/QC procedure:
It is crosschecked with the sale data/8/ for correctness and the value is exactly matching. The QA/QC procedure is accepted by the verification team.</td></tr>
<tr><td>Baseline emissions

<table><tr><td>Year</td><td>Baseline emissions</td></tr><tr><td>2013</td><td>9063.11 tCO2e</td></tr><tr><td>2014</td><td>40359.46 tCO2e</td></tr></table></td><td>As per para 21 of the applied meth, Baseline emissions is calculated as below.
BEy = EF_{BL} x $P_{PJ,y}$</td></tr>
</table>

2015	29304.16 tCO2e

Project emissions (PE_y)	As per para 24 of the applied meth, project emissions includes 1) emissions include electricity consumption (including auxiliary use) associated with the biomass treatment and processing ($PE_{elec,y}$) 2) emissions include fossil fuel consumption (including auxiliary use) $PE_{fossilfuel,y}$ associated with the operation of the manufacturing process and the biomass treatment and processing ($PE_{fossilfuel,y}$) 3) emissions from the transportation of the renewable biomass from its source to the manufacturing production site ($PE_{transport,y}$) 4) emissions from biomass cultivation In cases where the project activity utilizes biomass sourced from dedicated plantations ($PE_{cultivation,y}$) 5) methane emissions from the charcoal produced in kilns not equipped with a methane recovery and destruction facility and methane emissions from the production of charcoal ($PE_{CH4,y}$)
Emissions include electricity consumption (including auxiliary use) associated with the biomass treatment and processing ($PE_{elec,y}$)	As per para 25 of the applied meth, this emission calculated as per "Tool for calculate baseline, project and or leakage emissions from electricity consumption" /9/ As per the tool referred emission due to consumption of grid electricity = EC_y x EF_{EL} x (1+TDL) Where EC_y –Electricity consumption in the year y FE_{EL}- Emission factor TDL-Technical transmission and distribution losses
Electricity consumption during the monitoring period (EC_y) Year / Electricity consumption 2013 / 212.90 MWh 2014 / 948.09 MWh 2015 / 688.39 MWh (monitored parameter)	Ex-post calculation: It is calculated continuously and recorded every month in the electricity bills/7/. The verification team has reviewed the electricity bills and accepted the same. As per the PD, electricity consumption of the plant is to be calculated as summation of the electricity imports from southern grid and electricity generated by captive diesel generator sets (1 x 750 kVA). However, there is no diesel consumption in the monitoring period as confirmed from the onsite visit. QA/QC procedure: The Internal meter reading is cross checked through meter reading at meter room on monthly recording basis for correctness. As per the onsite observation, the meter is in the control of state electricity board and not with the PP. Hence calibration procedure of the meter is not required which is accepted by the verification team.
Emission factor for electricity generation (FE_{EL}) = 0.9593 tCO2e/MWh (ex-ante parameter and fixed for the crediting period)	As per the "Tool for calculate baseline, project and or leakage emissions from electricity consumption/9/" version 1.0, emission factor for electricity generation is the combined margin emission factor calculated as per latest version of "Tool to calculate the emission factor for an electricity system"/9/ version 4.0 (emission tool). CEA database/9/ version 9.0 is based on emission tool hence accepted by the validation team. As per the emission tool, combined margin = 50% x weighted average simple operating margin + 50% x build margin for the latest year. As per CEA database version 9.0 for southern grid, operating margin = 0.9677 tCO2e/MWh and build margin = 0.9509 tCO2e/MWh for the year 2012-2013
Emission factor for diesel based generation = 0.5984 tCO2e/MWh	As per the PD, a part of electricity is also sourced from captive diesel generator set which is inside the boundary. Emission factor for diesel = Specific Diesel consumption x NCV of

<table>
<tr><td></td><td>diesel x CO2 emission factor for diesel
Emission factor for diesel = 0.2 tonne of diesel/MWh x 0.04 TJ/tonne of diesel x 74.8 tCO2e/TJ =0.5984 tCO2e/MWh
The validation team has reviewed the manufacturer's specification[13] and IPCC 2006[14] data and accepted the above parameters.
But since emission factor for diesel is less than that of imported electricity, the validation team has accepted the emission factor for imported electricity as conservative.</td></tr>
<tr><td>Technical transmission and distribution losses (TDL) =10%

(ex-ante parameter and fixed for the crediting period)</td><td>As per the "Tool for calculate baseline, project and or leakage emissions from electricity consumption"[9], version 1.0, TDL is taken as 10% which is accepted by the validation team</td></tr>
<tr><td>Emissions include electricity consumption (including auxiliary use) associated with the biomass treatment and processing ($PE_{elec,y}$)

<table><tr><td>Year</td><td>$PE_{elec,y}$</td></tr><tr><td>2013</td><td>224.66 tCO2e</td></tr><tr><td>2014</td><td>1000.45 tCO2e</td></tr><tr><td>2015</td><td>726.41 tCO2e</td></tr></table></td><td>As per para 25 of the applied meth, this emission calculated as per "Tool for calculate baseline, project and or leakage emissions from electricity consumption" version 1.0[9]
As per the tool referred emission due to consumption of grid electricity = EC_y x EF_{EL} x (1+TDL)
Where EC_y –Electricity consumption in the year y
FE_{EL}- Emission factor
TDL-Technical transmission and distribution losses</td></tr>
<tr><td>Emissions include fossil fuel consumption (including auxiliary use) associated with the operation of the manufacturing process and the biomass treatment and processing ($PE_{fossilfuel,y}$) = 0 tCO2e/year</td><td>Since there is no emission due to the fossil fuel consumption, this parameter is considered to be zero.</td></tr>
<tr><td>Emissions from the transportation of the renewable biomass from its source to the manufacturing production site ($PE_{transport,y}$) = 0 tCO2e/year</td><td>Rice husk is used in steam boiler for process, but since it is procured not more than 200 km, the leakage emissions due to rice husk usage are neglected. This is as per para 27 of the applied meth.
The transportation distance is monitored for every trip and recorded in the purchase bill[10]. The verification team has reviewed the bills and distance is not more than 50 km each time. Hence the emission is considered to be zero.</td></tr>
<tr><td>Emissions from biomass cultivation in cases where the project activity utilizes biomass sourced from dedicated plantations ($PE_{cultivation,y}$) =0 tCO2e/year</td><td>Since rice husk is procured and not cultivated in dedicated plantations, this emission is zero.</td></tr>
<tr><td>Methane emissions from the charcoal produced in kilns not equipped with a methane recovery and destruction facility and methane emissions from the production of charcoal ($PE_{CH4,y}$) =0 tCO2e/year</td><td>Since there is no charcoal produced inside the project activity, these emissions is zero.</td></tr>
<tr><td>Project emissions (PE_y)

<table><tr><td>Year</td><td>PE_y</td></tr><tr><td>2013</td><td>224.66 tCO2e</td></tr></table></td><td>$PE_y = PE_{elec,y} + PE_{fossilfuel,y} + PE_{transport,y} + PE_{cultivation,y} + PE_{CH4,y}$</td></tr>
</table>

2014	1000.45 tCO2e
2015	726.41 tCO2e

Leakage emissions (LE y)	As per para 30, 31 and 32 of the applied meth, Leakage emission consists of 1) emissions on account of the diversion of biomass residues from other uses (competing uses) shall be calculated as per the "General guidance on leakage in biomass project activities"/9/ 2) incremental emissions associated with the production/consumption and transport of those raw and/or additive materials consumed as compared to baseline in the case of project activities involving a change in the production process or a change in the type or quantity of raw and/or additive materials as compared to the baseline 3) CO2 emissions from the collection, processing and transportation of biomass residues to the project site in cases where the collection, processing and transportation of biomass residues is outside the project boundary and due to the implementation of the project activity biomass residues are transported over a distance of 200 kilometres
Emissions on account of the diversion of biomass residues from other uses (competing uses) =0 tCO2e/year Biomass availability = around 1 Million tonnes in the year 2013 to 2015 Biomass utilisation excluding the project activity = around 10,000 tonnes in the year 2013 to 2015 Rice husk utilisation by the project activity = 5,573.52 tonnes during the monitoring period	As per the "Tool Leakage in biomass small-scale project activities"/9/ version 4.0 if PP is able to demonstrate via Draft project Report/13/ that quantity of available biomass in the region, is 25% larger than the quantity of biomass that is utilised including the project activity, this emission can be considered as zero. Since PP has demonstrated that quantity of available biomass in the region is 25% larger than the quantity of biomass that is utilised including the project activity, this emission is zero. The verification team has reviewed the DPR/11/ and rick husk purchase bills/10/ and concluded the emissions on account of the diversion of biomass residues from other uses is zero.
Incremental emissions associated with the production/consumption and transport of those raw and/or additive materials consumed as compared to baseline in the case of project activities involving a change in the production process or a change in the type or quantity of raw and/or additive materials as compared to the baseline	By reviewing the process at the onsite, the production process involves the use of aerated concrete which is made by introducing air or other gas to a slurry of flyash, lime, cement and gypsum so that when the mixture is set hard after autoclaving, a uniform cellular structure is obtained. AAC blocks are manufactured from fly ash, lime, cement, gypsum and Aluminium powder. As per para 31 of the applied meth, leakage emissions due to 1) production of these raw materials and additives 2) consumption of these raw materials and additives 3) transportation of these raw materials and additives to the project site.
Leakage due to production of fly ash	Leakage due to production of fly ash = Quantity of fly ash consumed x Emission factor for fly ash production
Quantity of fly ash consumed Year / Quantity of fly ash consumed 2013 / 7,650.59 tonne 2014 / 35,583.95 tonne 2015 / 26,301.50 tonne	Ex-post calculation: It is monitored every purchase and recorded the every month using purchase bills/10/. The verification team has reviewed the bills and accepted the same as correct.
Emission factor for fly ash	As per SSC_518/12/ clarification, leakage emission due to waste

<table>
<tr><td>production = 0 tCO2e/tonne of flyash</td><td>material is not required to be considered, hence this emission is zero.</td></tr>
<tr><td>Leakage due to production of fly ash
<table><tr><td>Year</td><td>Leakage due to production of fly ash</td></tr><tr><td>2013</td><td>0 tCO2e</td></tr><tr><td>2014</td><td>0 tCO2e</td></tr><tr><td>2015</td><td>0 tCO2e</td></tr></table></td><td>Leakage due to production of fly ash = Quantity of fly ash consumed x Emission factor for fly ash production</td></tr>
<tr><td>Leakage due to production of lime</td><td>Leakage due to production of lime = Quantity of lime consumed x Emission factor for lime production</td></tr>
<tr><td>Quantity of lime consumed
<table><tr><td>Year</td><td>Quantity of lime consumed</td></tr><tr><td>2013</td><td>919.34 tonne</td></tr><tr><td>2014</td><td>3,694.41 tonne</td></tr><tr><td>2015</td><td>3,148.86 tonne</td></tr></table></td><td>Ex-post calculation:
It is monitored every purchase and recorded the every month using purchase bills[10]. The verification team has reviewed the bills and accepted the same as correct.</td></tr>
<tr><td>Emission factor for lime production =0.4397 tCO2e/tonne of lime

(Ex-ante and fixed for the crediting period)</td><td>The validation team has reviewed the IPCC 2006[13] database and accepted the value as correct.</td></tr>
<tr><td>Leakage due to production of lime
<table><tr><td>Year</td><td>Leakage due to production of lime</td></tr><tr><td>2013</td><td>404.23 tCO2e</td></tr><tr><td>2014</td><td>1624.43 tCO2e</td></tr><tr><td>2015</td><td>1384.55 tCO2e</td></tr></table></td><td>Leakage due to production of lime = Quantity of lime consumed x Emission factor for lime production</td></tr>
<tr><td>Leakage due to production of cement</td><td>Leakage due to production of cement = Quantity of cement consumed x Emission factor for cement production</td></tr>
<tr><td>Quantity of cement consumed
<table><tr><td>Year</td><td>Quantity of cement consumed</td></tr><tr><td>2013</td><td>2,561.03 tonne</td></tr><tr><td>2014</td><td>10,122.25 tonne</td></tr><tr><td>2015</td><td>6,479.30 tonne</td></tr></table>(monitored parameter)</td><td>Ex-post calculation:
It is monitored every purchase and recorded the every month using purchase bills[10]. The verification team has reviewed the bills and accepted the same as correct.</td></tr>
<tr><td>Emission factor for cement production =0.638 tCO2e/tonne of cement

(Ex-ante and fixed for the crediting period)</td><td>The validation team has reviewed the CSI Protocol[13] default emission factor of cement production for India and China and accepted the value as correct.</td></tr>
<tr><td>Leakage due to production of cement
<table><tr><td>Year</td><td>Leakage due to production of cement</td></tr><tr><td>2013</td><td>1633.94 tCO2e</td></tr></table></td><td>Leakage due to production of cement = Quantity of cement consumed x Emission factor for cement production</td></tr>
</table>

2014	6457.99 tCO2e
2015	4133.79 tCO2e

Leakage due to production of gypsum	Leakage due to production of gypsum = Quantity of gypsum consumed x Emission factor for gypsum production
Quantity of gypsum consumed Year / Quantity of gypsum consumed: 2013: 93.30 tonne 2014: 556.97 tonne 2015: 273.23 tonne	Ex-post calculation: It is monitored every purchase and recorded the every month using purchase bills[10]. The verification team has reviewed the bills and accepted the same as correct.
Emission factor for gypsum production =0 tCO2e/tonne of gypsum	Since gypsum is the by-product, it is Leakage due to production of gypsum is zero.
Leakage due to production of gypsum Year / Leakage due to production of gypsum: 2013: 0 tCO2e 2014: 0 tCO2e 2015: 0 tCO2e	Leakage due to production of gypsum = Quantity of gypsum consumed x Emission factor for gypsum production
Leakage due to production of Aluminium	Leakage due to production of Aluminium = Quantity of Aluminium consumed x Emission factor for Aluminium production
Quantity of Aluminium Year / Quantity of Aluminium consumed: 2013: 12.18 tonne 2014: 54.85 tonne 2015: 32.36 tonne (monitored parameter)	Ex-post calculation: It is monitored every purchase and recorded the every month using purchase bills[10]. The verification team has reviewed the bills and accepted the same as correct.
Emission factor for Aluminium production =1.89 tCO2e/tonne of Aluminium (Ex-ante and fixed for the crediting period)	The validation team has reviewed the IPCC 2006[13] database and accepted the value as correct.
Leakage due to production of Aluminium Year / Leakage due to production of Aluminium: 2013: 23.02 tCO2e 2014: 103.67 tCO2e 2015: 61.15 tCO2e	Leakage due to production of Aluminium = Quantity of Aluminium consumed x Emission factor for Aluminium production
Leakage emissions due to production of the raw materials and additives Year / Leakage emissions due to production of the raw materials	Leakage emissions due to production of these raw materials/additives such as lime, cement, gypsum and Aluminium

	and additives
2013	2061.19 tCO2e
2014	8186.10 tCO2e
2015	5579.50 tCO2e

Leakage emissions due to consumption of the raw materials and additives =0 tCO2e/year	It is observed at the onsite that there is no processing of raw materials or additives before using it production of AAC block, hence Leakage emissions due to consumption of the raw materials and additives is zero.
Leakage emissions due to transportation of the raw materials and additives to the project site.	Leakage emissions due to transportation of raw materials = Quantity of each raw material per year x Return trip distance between the origin and destination of freight transportation activity x Default CO2 emission factor for freight transportation activity
Quantity of each raw material per year	The validation of the same is detailed above.
Return trip distance between the origin and destination of freight transportation activity (monitored parameter)	Ex-post calculation: It is recorded for every trip. It is determined once ex-ante for each freight transportation activity for a reference trip (actual purchase invoices) and using online map sources in the trip sheet. The verification team has reviewed actual purchase invoices[/10/] and accepted the same as correct.
Default CO2 emission factor for freight transportation activity =0.000129 tCO2e/tonne-km (ex-ante and fixed for the entire crediting period)	The validation team has reviewed the tool for "Project and leakage emissions from transportation of freight[/9/]" version 1.1.0 and accepted the value.
Leakage emissions due to transportation of the raw materials and additives to the project site during the monitoring period	Leakage emissions due to transportation of raw materials = Quantity of each raw material per year x Return trip distance between the origin and destination of freight transportation activity x Default CO2 emission factor for freight transportation activity
Leakage emissions (LE_y)	As per para 31 of the applied meth, leakage emissions due to 1) production of these raw materials and additives 2) consumption of these raw materials and additives 3) transportation of these raw materials and additives to the project site.
Emission reduction (ER_y)	As per para 33 of the applied meth, emission reduction achieved by the project activity shall be calculated as below $ER_y = BE_y - PE_y - LE_y$

Raw material	Round trip
Flyash	25 km
Lime	3934 km
Cement	176 km
Gypsum	744 km
Aluminium	1988 km

Year	Leakage emissions due to transportation
2013	561.47 tCO2e
2014	2287.03 tCO2e
2015	1864.49 tCO2e

Year	Leakage emissions (LE_y)
2013	2622.66 tCO2e
2014	10473.13 tCO2e
2015	7443.99 tCO2e

Year	Emission reduction

	(ER_y)
2013	6,215 tCO2e
2014	28,885 tCO2e
2015	21,133 tCO2e
Total (rounded down)	56,233 tCO2e

Where
ER_y – Emission reductions
BE_y-Baseline emissions
PE_y- Project emissions
LE_y-Leakage emissions

Compressive strength of AAC blocks (dry)

At the time of commissioning on -2nd August 2013	4 N/mm^2
14th Jan 2014	4.8 N/mm^2
18th June 2014	5.4 N/mm^2
2nd Jan 2015	4.9 N/mm^2
4th June 2015	5.4 N/mm^2
18th Nov 2015	5.4 N/mm^2

(monitored parameter)

As per para 11 of the applied meth, service level of project bricks to be tested in lab at six month intervals. PP has proposed to test the service level at an accredited lab with time interval of 6 months. Hence accepted by the verification team as sufficient number of tests[14] have been conducted by the PP.

4.3 Quality of Evidence to Determine GHG Emission Reductions and Removals

Refer section 4.2 above for details

4.4 Non-Permanence Risk Analysis

Not applicable for a renewable energy project.

5 VERIFICATION CONCLUSION

EPIC Sustainability Services Private Limited has been engaged by EnvironmentFirst Energy Services (P) Limited to perform the first periodic verification of the VCS project "AAC Block/Panel Manufacturing unit at Krishna, Andhra Pradesh" for the period from 1st August 2013 to 31st December 2015.

The verification was based on the validated PD, the baseline and monitoring methodology (AMS.III.Z version 5.0), the Monitoring Report, emission reduction spread sheets and other supporting documents made available to EPIC verification team by the project participant. The management of PP was responsible for the preparation and reporting of GHG emissions data, and the reported GHG emissions reduction on the basis set out within the project monitoring plan.

It is the responsibility of EPIC verification team to express an independent GHG verification opinion on the GHG emissions from the project for the monitoring period and on the calculation of GHG emission reductions from the project based on the verified emissions for the same period.

The verification was carried out in accordance with the requirements of the Validation and Verification standard Version 9.0 and VCS Standard 3.5. As a result of the verification, the verification team confirms that for the reporting period:

- all operations of the project were implemented as described in the registered PD, (project ID 1342) ,
- the monitoring plan is in accordance with the approved monitoring methodology applied by the project activity.

- the monitoring has been carried out in accordance with the validated PD version 2.0 dated 17th June 2015.
- the monitoring aspects (i.e. additional monitoring parameters, monitoring frequency and calibration frequency) were in place and functional, with the installed equipment essential for generating emission reduction operating appropriately and the calibration of all the equipment had been carried out accordingly and appropriate adjustments had been made when there were delays in the calibration, and
- the GHG emission reductions achieved were calculated correctly on the basis of approved monitoring methodology.

We have verified that the information included in the final monitoring report (version 2.0, dated 6th July 2016 was correct and that the emission reductions achieved had been determined correctly. In our opinion, the GHG emission reductions for the monitoring period stated in the latest revised monitoring report for the project are fairly stated

The verifier confirms that the GHG emission reductions were calculated without material misstatements for the whole monitoring period. Our opinion is based on the project's GHG emissions and resulting GHG emission reductions reported, and, to the valid and registered project baseline and monitoring documents. We confirm the following:

Verification period: From [1st August 2013] to [31st December 2015]

Verified GHG emission reductions and removals in the above verification period:

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
Year 2013	9,063.11	224.66	2622.66	6,215
Year 2014	40,359.46	1000.45	10473.13	28,885
Year 2015	29,304.16	726.41	7443.99	21,133
Total	78,726.73	1,951.52	20539.78	56,233 (rounded down)

Prepared by :	R. Vijayaraghavan	Approved by:	
	(R. Vijayaraghavan) Verification Team Leader		(K. Sudheendra) Head-Operations

6 REFERENCES

Ref. No.	Document or Type of Information
1	VCS Version 3 Standard version 3.5 http://database.v-c-s.org/sites/vcs.benfredaconsulting.com/files/VCS_Standard_v3.5.pdf Program guidelines version 3.5 http://database.v-c-s.org/sites/vcs.benfredaconsulting.com/files/VCS_Program%20Guide_v3.5.pdf Registration and Issuance guidance document version 3.6 http://database.v-c-s.org/sites/vcs.benfredaconsulting.com/files/Registration_and_Issuance_Process_v3.6.pdf Validation and verification manual version 3.1 http://database.v-c-s.org/sites/vcs.benfredaconsulting.com/files/VCS_Validation_Verification_Manual_v3.1.pdf CDM Validation and verification Standard version 9.0 https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20150225165159970/reg_stan01.pdf Project Standard version 9.0 https://cdm.unfccc.int/sunsetcms/storage/contents/stored-file-20150225165159970/reg_stan01.pdf
2	CDM approved consolidated baseline methodology AMS.III.Z Version 5.0 https://cdm.unfccc.int/UserManagement/FileStorage/HWF609IQJBMOA38Y47PEL1ZXVSDNCK
3	Commissioning certificate to support start date of the VCS project
4	Monitoring Report version 1.0 dated 2nd April 2016 (Initial MR) Monitoring Report version 2.0 dated 6th July 2016 (Request for Issuance)
5	VCS Project Description (PD) Version 2 and annexures (Base PD for verification process) Corresponding Validation report http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/22202
6	Report on Small and Medium scale Industries in Asia- Energy and Environment (Emission factor for coal) http://www.faculty.ait.ac.th/visu/Prof%20Visu's%20CV/Books%20and%20research%20reports/BRICK%20AND%20CERAMIC.pdf Report on "Energy Conservation and Pollution Control in Brick Kilns" (weight of baseline brick) (http://www.cosmile.org/papers/brick_energyconservationpollutioncontrol.pdf Readme website (Density of brick) http://www.reade.com/Particle_Briefings/spec_gra2.html
7	Plant log sheets for AAC blocks, Electricity bills
8	Sales Data of AAC blocks for crosschecking plant production
9	Tool for calculate baseline, project and or leakage emissions from electricity consumption version 1.0 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-05-v1.pdf Tool to calculate the emission factor for an electricity system version 4.0 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v4.0.pdf CEA database version 9.0 http://www.cea.nic.in/reports/planning/cdm_co2/user_guide_ver9.pdf General guidance on leakage in biomass project activities renamed as Tool Leakage in biomass small-scale project activities version 4.0 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-22-v1.pdf Project and leakage emissions from transportation of freight version 1.1.0 https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-12-v1.1.0.pdf
10	Purchase bills Rice husk, fly ash, lime, Cement, Gypsum, Aluminum
11	DPR for demonstrating rice husk availability in the region
12	SSC_518 clarification (to support leakage emission due to waste material is not required to be considered) https://cdm.unfccc.int/UserManagement/FileStorage/OKLADNE7UWZCSR3Q1GY9H205XV8F4M
13	IPCC 2006 database (emission factor of lime) http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf CSI protocol for cement (emission factor of cement) http://wbcsdcement.org/pdf/csi-gnr-report-with%20label.pdf IPCC 2006 database (emission factor of Al) http://www.ipcc.ch/meetings/session25/doc4a4b/vol3.pdf IPCC 2006 database (emission factor of diesel) http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/3_Volume3/V3_2_Ch2_Mineral_Industry.pdf

TABLE: RESOLUTION OF CORRECTIVE ACTION AND CLARIFICATION REQUESTS

Draft report clarifications and corrective action requests by validation team	Summary of project owner response	Verification team conclusion
CAR 1 Electricity consumed as per ER sheet is not matching as per the electricity invoices sampled at the site. PP is requested for the the corrective action.	Revised ER sheet and hence monitoring report is submitted herewith.	The verification team has reviewed the ER sheet and all the invoices and now it is correct. Conclusion: CAR 1 is closed.
CAR 2 PP is requested to demonstrate rick husk is procured not far away from 100 km from project site. PP to produce purchase bills as well. PP to demonstrate rice husk consumed is not a competing biomass.	PP submitted herewith rice husk purchase bills from 2013 to till date. Rice husk is procured from vendors which are less than 50 km away. PP is also submitted DPR and biomass consumed in the project activity is very less.	As per the "Tool Leakage in biomass small-scale project activities" version 4.0 if PP is able to demonstrate via Draft project Report that quantity of available biomass in the region, is 25% larger than the quantity of biomass that is utilised including the project activity, this emission can be considered as zero. Since PP has demonstrated that quantity of available biomass in the region is 25% larger than the quantity of biomass that is utilised including the project activity, this emission is zero. The verification team has reviewed the DPR and rick husk purchase bills and concluded the emissions on account of the diversion of biomass residues from other uses is zero. Conclusion: CAR 2 is closed.
CAR 3 DG set details is not included in the ER calculation.	DG set was never used in the monitoring period hence no emissions due to DG set. Hence no Corrective action is required from PP side.	The verification team has accepted the argument. Conclusion: CAR 3 is closed.