# Monitoring report form for CDM project activity
# (Version 07.0)

*Complete this form in accordance with the instructions attached at the end of this form.*

| MONITORING REPORT | | |
|---|---|---|
| **Title of the project activity** | Improving Kiln Efficiency In The Brick Making Industry In Bangladesh. | |
| **UNFCCC reference number of the project activity** | 6085 | |
| **Version number of the PDD applicable to this monitoring report** | Version 08 | |
| **Version number of this monitoring report** | 01 | |
| **Completion date of this monitoring report** | 05/06/2020 | |
| **Monitoring period number** | Fourth Monitoring Period | |
| **Duration of this monitoring period** | 01/01/2018 to 31/03/2020 (first and last days included) | |
| **Monitoring report number for this monitoring period** | 01 | |
| **Project participants** | Asian Development Bank, as Trustee of the Future Carbon Fund; Swedish Energy Agency | |
| **Host Party** | Bangladesh | |
| **Applied methodologies and standardized baselines** | AMS-II.D – Energy efficiency and fuel switching measures for industrial facilities, version 12, EB 51 | |
| **Sectoral scopes** | 4: Manufacturing Industries | |
| **Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period** | Amount achieved before 1 January 2013 | Amount achieved from 1 January 2013 |
| | 0 t $CO_2e$ | **24,609 t $CO_2e$** |
| **Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD** | 68,879.25 t $CO_2e$[1] | |

[1] As per PDD, 30,613 t $CO_2e$ is estimated annually. Estimated CER for the monitoring period is **{(30,613÷12) × 27} = 68,879.25** t $CO_2e$

## SECTION A. Description of project activity

### A.1. General description of project activity

The construction industry in Bangladesh is still dependent upon clay bricks which are made by very energy intensive and century old technology which uses coal as the primary fuel. As a result, the brick making industry in Bangladesh is also one of the main sources of Green House Gas (GHG) emissions in the country. Aiming at reducing GHG emission by using a more efficient technology in this sector, the Hybrid Hoffman Kiln (HHK) technology was introduced under this project, in Bangladesh. This piloted a modern and sustainable brick making technique in the country and the purpose of the project was to construct six[2] new energy efficient Hybrid Hoffman Kiln (HHK) brick making units for reducing $CO_2$ emissions in Bangladesh.

Clay bricks, one of the most popular construction materials in Bangladesh, are generally produced by Fixed Chimney Kilns (FCKs). They produce these bricks using a very ancient technology where the heat loss is very high combined with inefficient burning of the fuel. This increases coal consumption that results in further $CO_2$ emission. Moreover, these kilns operate only during the dry season, which lasts for only 4-6 months of a year.

The HHK is a hybrid version of the Hoffman Kiln technology, which was developed in Germany in the mid-nineteenth century. Since then, it has been modified to improve heat retention in the kilns and to capture the waste heat from the flue gas for recirculation in the drying chamber. In addition, the coal consumption is reduced by mixing a small amount of pulverised coal with the clay to introduce internal baking.

The production capacity of a HHK varies from a minimum of 50,000 bricks per day to several multiples of 50,000 bricks per day. Though each kiln by itself would qualify as a Clean Development Mechanism (CDM) project, the project bundled the six HHKs, the aggregate maximum daily production capacity of which is 400,000 bricks per day, into one Project Design Document (PDD) for reducing the CDM transaction costs, whilst remaining within the small-scale threshold for this type of project activity.

Industrial and Infrastructure Development Finance Company Ltd. (IIDFC), a Bangladesh based Financial Institution, acts as the bundling agent for the two kiln owners four kilns under one brick company and two kilns under another. The construction of the first kiln (Eeta Kiln 1) under this project started in 20/02/2010. The construction of Bricks 2010 Kiln 1 started on 15/10/2011. More details on implementation and operational timeline of each kiln are given in section B.1.

The project was registered on 31/07/2012[3]. This report presents the emission reductions achieved for the period from 01/01/2018 to 31/03/2020. The total emission reduction reported for this monitoring period is 24,609 t $CO_2e$.

[2] Shiekh Brother's Enterprises Ltd. (Kiln 1 and 2) was part of the bundle during registration of PDD. The kilns will not be constructed anymore and they are dropped out of bundle. Hence, these two kilns are removed from PDD through Post Registration Changes (PRC). https://cdm.unfccc.int/PRCContainer/DB/prcp900477827/view

[2] http://cdm.unfccc.int/Projects/DB/DNV-CUK1334835346.18/view

## A.2. Location of project activity

Locations of the six HHK facilities are furnished in the table 1 below-

**Table 1: Location of kilns**

| HHK Facility | Daily Brick Production | Host Party | Region / State/ Province | City / Town/ Community | Latitude, °N / Longitude, °E |
|---|---|---|---|---|---|
| Eeta and Tiles Ltd. (Eeta Kiln 1) | 50,000 | Bangladesh | Dhaka Division | Gazipur | +24.03935 / +90.36975 |
| Eeta and Tiles Ltd. (Eeta Kiln 2) | 50,000 | Bangladesh | Dhaka Division | Gazipur | +24.03935 / +90.36975 |
| Eeta and Tiles Ltd. (Eeta Kiln 3) | 50,000 | Bangladesh | Dhaka Division | Gazipur | +24.03935 / +90.36975 |
| Eeta and Tiles Ltd. (Eeta Kiln 4) | 50,000 | Bangladesh | Dhaka Division | Gazipur | +24.03935 / +90.36975 |
| Bricks 2010 Ltd. (Bricks 2010 Kiln 1) | 50,000 | Bangladesh | Dhaka Division | Tangail | +24.10278 / +90.1962 |
| Bricks 2010 Ltd. (Bricks 2010 Kiln 2) | 50,000 | Bangladesh | Dhaka Division | Tangail | +24.10278 / +90.1962 |


**Figure 1: Map showing location of project kilns and the distribution of brick making activities**

### A.3. Parties and project participants

| Parties involved | Project participants | Indicate if the Party involved wishes to be considered as project participant (Yes/No) |
|---|---|---|
| Bangladesh (host) | Industrial and Infrastructure Development Finance Company Ltd. (IIDFC) (Private Entity), | No |
| Sweden | Asian Development Bank, as Trustee of the Future Carbon Fund; Swedish Energy Agency | No |

### A.4. References to applied methodologies and standardized baselines

Title : Type II – Energy Efficiency Improvement Projects
Reference : AMS-II.D – Energy Efficiency and Fuel Switching Measures for Industrial Facilities[4]
Version : 12, EB 51, December 2009
Sectoral Scope : 4, Manufacturing Industries

The following CDM Executive Board guidelines and tools are also considered and applied:

- Tool to calculate the emission factor for an electricity system, Version 2, EB 50, Annex 14[5];
- Guidelines for Objective Demonstration and Assessment of Barriers, version 1.0, EB 50[6]
- Guidelines for sampling and surveys for CDM project activities and programme of activities, version 3.0, EB 75[7] (as followed in PRC PDD)

### A.5. Crediting period type and duration

As per PDD version 08, dated 18/04/2014, the crediting period starts from 01/09/2012. However, the kilns did not start commercial operation before 25/11/2013 (EETA Kiln 1). Hence, a Post registration change was requested without prior approval of CDM EB (as per paragraph 275 (b) of CDM Project Standard, version 07, EB 79), to change the crediting period start date as 25/11/2013 in place of 01/09/2012 and got approved on 07/11/2014.

Fixed crediting period of 10 years starting from 25/11/2013 to 24/11/2023 has been chosen.

Monitoring period reported here is from 01/01/2018 to 31/03/2020.

## SECTION B. Implementation of project activity

### B.1. Description of implemented project activity

**Technology description**

Initially at the time of the registration, a total of eight brick kilns based on the HHK technology were planned to be constructed at different locations in Bangladesh.

The brick production involves the following processes:

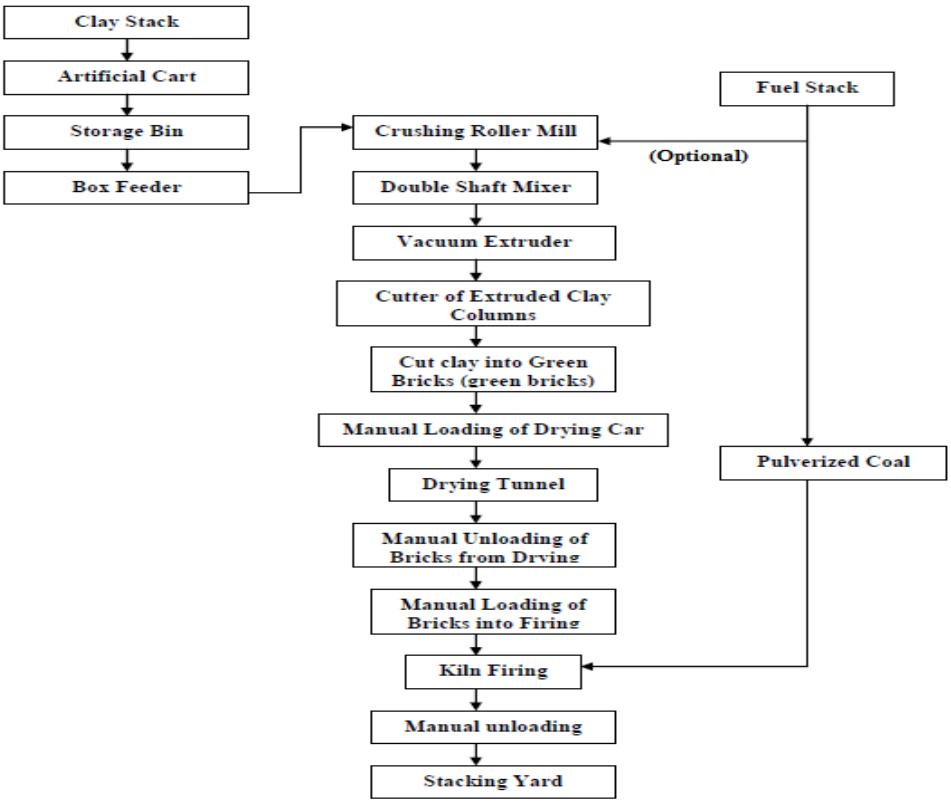
[4] http://cdm.unfccc.int/methodologies/DB/S7EJ89D7U1PNYX1LMI4E3PU1QB1HSQ
[4] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf
[4] https://cdm.unfccc.int/EB/050/eb50_repan13.pdf
[4] http://cdm.unfccc.int/filestorage/e/x/t/extfile-20131010103828384-meth_guid48.pdf/meth_guid48.pdf?t=VzV8bmwwbHYxfDBlou_BWCE16E9nXjr4L72j

*Clay extraction, transportation and preparation*: The clay is excavated by hydraulic excavator from a nearby area or government permitted extraction site and transported to the kiln clay stock yard by trucks. The clay is then crushed by means of roller mill, followed by a double-shaft mixer, where water is added to ensure 15% moisture content.

*Pulverized coal introduction and shaping the brick:* Pulverized coal is mixed with the clay, which is fed into a vacuum extruder. A column of clay is pushed out/extruded. This is then cut into the green (raw) bricks, which are then manually loaded onto a drying car for drying.

*Brick drying:* The drying car is then moved into the drying tunnel. The drying cycle lasts for about *22*-26 hours. The hot air in the drying tunnel is sucked in from the annular kiln.

*Brick firing:* The dried green bricks are removed from the drying tunnel and then loaded manually into the annular HHK kiln. The speed of firing is 1.25 m/h at a sintering temperature of around 950°C - 1050°C. The fired bricks are unloaded and conveyed manually in carts to the stacking yard.




During this monitoring period (01/01/2018 to 31/03/2020), the kilns were operating at 45 - 90% of their rated production capacity. The reason for lesser brick production by some kilns is due to mainly low market demand and maintenance in some kilns, which are undertaken in every 2-3 years.

**Implementation and Operation of the Project Activity**

The idea of the project at the time of registration was to construct eight HHK based brick making units at different locations in Bangladesh.

Shiekh Brother's Enterprises Ltd. (Kiln 1 and 2) was earlier part of the bundle during the registration of PDD. These kilns will not be constructed anymore and they are dropped out of bundle. Hence, these two kilns are removed from the PDD during the Post Registration Changes (PRC).

This HHK technology was imported from China by the brick kiln owners. Kilns were designed and constructed to operate throughout the year in all seasons. However, to undertake corrective and preventive maintenance, the kilns may be closed for 1-2 months a year. Most of the kiln management now carries out regular maintenance without shutting down the operation and opts for a heavy maintenance once in every 3-4 years. The project implementation and operational details of the kilns during this monitoring period (01/01/2018 to 31/03/2020) are given below.

**Table 2: Project implementation details**

| HHK Facility | Construction start date | Commissioning date | Commercial operation date | Is the kiln in continuous operation other than the maintenance period? | Operational days in the monitoring period |
|---|---|---|---|---|---|
| Eeta Kiln 1 | 20-02-2010 | 20-10-2013 | 25-11-2013 | yes | 810 |
| Eeta Kiln 2 | 15-01-2010 | 18-01-2014 | 02-02-2014 | yes | 810 |
| Eeta Kiln 3 | 15-01-2017 | -Not applicable- | -Not applicable- | -Not applicable- | -Not applicable- |
| Eeta Kiln 4 | 15-01-2017 | -Not applicable- | -Not applicable- | -Not applicable- | -Not applicable- |
| Bricks 2010 Kiln 1 | 15-09-2011 | 17-06-2013 | 05-05-2014[8] | No | Not applicable |
| Bricks 2010 Kiln 2 | 01-01-2018 | -Not applicable- | -Not applicable- | -Not applicable- | -Not applicable- |

The sub-project Bricks 2010 Ltd. (Kiln 1) which was earlier operational has not been reported in this monitoring period because the renewal of their brick license and other permits has been postponed by the government. The sub-project owner has taken legal steps on this issue and the matter is under litigation.

## B.2. Post-registration changes

### B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

There are no temporary deviations from the registered monitoring plan or applied methodologies as per the revised PDD version 08, dated 08/04/2014 which was approved by UNFCCC through a Post Registration Change (PRC) request[9] (ref no: PRC-6085-001) on 19/08/2014.

### B.2.2. Corrections

Not applicable

### B.2.3. Changes to the start date of the crediting period

As per PDD version 08, dated 18/04/2014, the crediting period starts from 01/09/2012. However, the kilns did not start commercial operation before 25/11/2013 (EETA Kiln 1). Hence, a Post registration change was requested without prior approval of CDM EB (as per paragraph 275 (b) of CDM Project Standard, version 07, EB 79), to change the crediting period start date as 25/11/2013 in place of 01/09/2012 and got approved on 07/11/2014.

[8] The commercial operation of kiln 1 was delayed due to the presence of leakages in the kiln. Initial operation of the kiln was uneven which lead to incomplete baking and inferior quality of baked bricks. Therefore the kiln was shut down and repair works were carried out until 05/05/2014

[8] https://cdm.unfccc.int/PRCContainer/DB/prcp900477827/view

### B.2.4. Inclusion of monitoring plan

Not applicable

### B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

After the registration of the project, there were few changes in the registered monitoring plan. The changes were carried out in the revised PDD version 08, dated 18/04/2014 and was approved by UNFCCC through a Post Registration Change (PRC) request [10] (ref no: PRC-6085-001) on 19/08/2014. The main changes to the registered project were as follows:

1. Measuring equipment of coal consumption revised from weighbridge to digital weighing scale. The coal consumption will be measured by counting the number of buckets/sacks of coal consumed per day. Each of the bucket/sack of coal is weighed to determine the weight of a bucket of coal using a digital weighing scale.
2. QA/QC procedures for ensuring the accuracy of digital weighing scales are added to as purchasing new weighing scale every year
3. Measuring equipment of diesel consumption revised from flow meter to measuring cans
4. QA/QC procedures for ensuring the accuracy of measuring cans are added to purchase new measuring cans every year
5. Removal of calibration requirement for energy meters. There is no calibration procedure existing for the energy meters in Bangladesh. A letter from Bangladesh DNA is provided as a proof of evidence for the same.
6. Brick sampling procedures is revised to multi-stage cluster sampling as per the latest "Guidelines for sampling and surveys for CDM project activities and programme of activities, version 03.0, EB 75"

### B.2.6. Changes to project design

At the time of the registration, a total of eight brick kilns based on the HHK technology were planned to be constructed at different locations in Bangladesh. Sheikh Brother's Enterprises Ltd. (Kiln 1 and 2) was earlier part of the bundle during registration of PDD. These kilns will not be constructed anymore and they are dropped out of bundle. Hence, these two kilns are removed from the PDD through Post Registration Changes (PRC).

The above corrections reflected in revised PDD version 08, dated 18/04/2014 and was approved by UNFCCC through a Post Registration Change (PRC) request[11] (ref no: PRC-6085-001) on 19/08/2014.

### B.2.7. Changes specific to afforestation or reforestation project activity

Not Applicable.

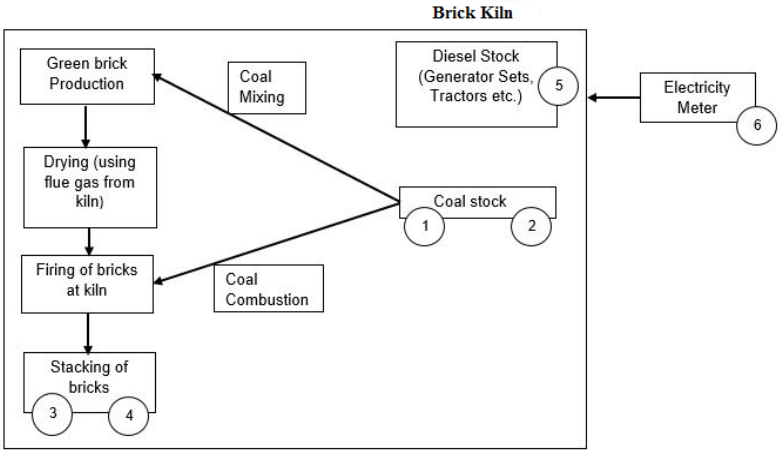
## SECTION C. Description of monitoring system

The details of monitored parameters and their method of collection are described in Section D.2. The monitored data were recorded manually by the kiln operators during the kiln operation on daily basis. Data monitoring points are indicated below in the figure 2.

[10] https://cdm.unfccc.int/PRCContainer/DB/prcp900477827/view

Each kiln owner has employed a competent person in his kiln/office as the CDM monitoring and compliance officer, whose responsibility is to collect the monitored data as described in Section D.2. The CDM monitoring and compliance officer collects the monitored data from different departments/sections of the kiln as given in Figure 2 and compiles the data in the excel format provided by IIDFC, the bundling agent. He is also responsible for monthly delivery of electronic version of the monitored data to IIDFC. Monitoring officer of IIDFC collects the data from each kiln on a monthly basis, creates the monitoring sheets (consolidated details of all the kilns) and submits these reports to IIDFC senior officer.

IIDFC has conducted various training sessions to the kiln CDM monitoring and compliance officers and the kiln operators. Training materials were provided to them. Standard data collection formats were prepared by IIDFC and were provided to the kilns. The brick kilns were also guided through the CDM monitoring mechanisms in terms of record keeping, overall maintenance and procedures for the corrective action to be taken.




**Monitoring points:**

1. Coal consumption
2. NCV of coal
3. Total brick production
4. Mean weight of brick
5. Diesel consumption
6. Electricity consumption

**Figure 3: Location Points of Data Monitoring**

An annual audit was also carried out for 3 consecutive days, at each brick kiln by IIDFC to review the compliance of CDM monitoring practices. The results were presented as a report to the kilns. Improvements in monitoring system such as use of daily CDM log sheet to improve data recording were suggested. The details of the period of audit at each kiln are mentioned in table 3.

**Table 3: Audit days of the kilns**

| No. | Kiln name | Audit days for the Year 2018 | Audit days for the Year 2019 |
|---|---|---|---|
| **1.** | **EETA & Tiles Ltd** | December 20-22, 2018 | November 5-7, 2019 |
| **2.** | **Bricks 2010 Ltd** | - | - |

The monitoring operations were carried out according to the following table:

**Table 4: CDM monitoring and responsibilities**

| Task and area of responsibility | Method used | Frequency | Responsible Person | Responsible Entity |
|---|---|---|---|---|
| Measurement of monitored data | Manual measurement, data recording | Daily | Operator in-charge | Respective kiln |
| Electronic recording | Data transfer to electronic workbook format provided | Daily | CDM compliance and monitoring | Respective kiln |

| | | | | |
|---|---|---|---|---|
| | by IIDFC | | officer | |
| Collection and storage of data (measured, calculated, estimated data) | Collection of monitoring data from each kiln | Monthly | Monitoring Officer | IIDFC |
| Calculation of the emission reductions and any deviations from projections | As per PDD/monitoring plan with excel spreadsheets | Yearly | Monitoring Officer | IIDFC |
| QA/QC | As per the Operation and Monitoring Plan (OMP) | Yearly | Monitoring Officer | IIDFC |
| Kiln staff training (CDM monitoring) | Training program as and when required | As and when required | IIDFC or their Consultants | IIDFC |
| Approval of monitoring reports and achieved ERs | Not applicable | Yearly | Project in-charge | IIDFC |

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante

*(Copy this table for each data or parameter.)*

| **Data/Parameter** | **$CV_{coal, FCK}$** |
|---|---|
| Unit | TJ/kg |
| Description | Net calorific value (energy content) per mass unit of a fuel (*calorific value of the coal used in the baseline)* |
| Source of data | Coal specifications reported by Barapukuria Coal Mining Company Limited (BCMCL) (http://www.bcmcl.org.bd/) |
| Value(s) applied | 6,135 kCal/kg or 6,135× 4.186 × $10^{-9}$ TJ/kg |
| Choice of data or measurement methods and procedures | Fixed ex-ante value |
| Purpose of data/parameter | To calculate baseline emissions |
| Additional comments | Not applicable |

| **Data/Parameter** | **$CEF_{coal}$** |
|---|---|
| Unit | t C/TJ |
| Description | Carbon emission factor per energy unit of coal |
| Source of data | 2006 IPCC Guidelines for National Greenhouse Gas Inventories: Chapter 1: Introduction, Table 1-3; Default values of carbon content, pg.21 |
| Value(s) applied | 25.80 |
| Choice of data or measurement methods and procedures | Fixed ex-ante value |
| Purpose of data/parameter | To calculate baseline emissions |
| Additional comments | Not applicable |

| Data/Parameter | CF |
|---|---|
| Unit | t $CO_2$e/t C |
| Description | Carbon to $CO_2$ conversion factor |
| Source of data | Not applicable |
| Value(s) applied | 3.66 |
| Choice of data or measurement methods and procedures | Fixed ex-ante value |
| Purpose of data/parameter | To calculate baseline emissions |
| Additional comments | Not applicable |

| Data/Parameter | $EF_{CO2, Elec}$ |
|---|---|
| Unit | t $CO_2$e/MWh |
| Description | Grid emissions factor per MWh of power produced |
| Source of data | Bangladesh Designated National Authority, letter dated 09/02/2011 |
| Value(s) applied | 0.62 |
| Choice of data or measurement methods and procedures | Fixed ex-ante value |
| Purpose of data/parameter | To calculate baseline emissions |
| Additional comments | Not applicable |

| Data/Parameter | $SEC_{FCK, Bricks}$ |
|---|---|
| Unit | TJ/kg-brick |
| Description | Specific energy consumption per kg-brick in conventional FCK kilns<br>Key value in determining the current energy consumption of the existing Fixed Chimney Kilns (FCK) in Bangladesh |
| Source of data | Calculation result using equation |
| Value(s) applied | $2.125 \times 10^{-6}$ |
| Choice of data or measurement methods and procedures | It has been fixed ex-ante.<br><br>In the absence of published data, calorific value of Barapukuria coal 6,135 kCal/kg (as measured for this project) and coal use of 24 tons per 100,000 bricks were utilized to calculate the Specific Fuel Consumption per kg-bricks in the baseline (FCK) technology. |
| Purpose of data/parameter | To calculate baseline emissions |
| Additional comments | Not applicable |

| Data/Parameter | $SFC_{FCK, Bricks}$ |
|---|---|
| Unit | kg of coal/brick |
| Description | Specific fuel (coal) consumption (SFC) per unit FCK brick |

| | |
|---|---|
| Source of data | 1. Clean Development Mechanism Project Opportunities in Bangladesh, Pre-Feasibility Report on a Brick Manufacturing Fuel Substitution CDM Project, Bangladesh University of Engineering, December 2002, Table A, pg 3: http://pubs.pembina.org/reports/cdm_bangladesh_brickkilns.pdf<br><br>2. Emissions Baseline Report for the IKEBMI Project (PDF-B Phase BGD/04/014) by The Louis Berger Group, Washington DC, June 2006, Table 2, pg 3 |
| Value(s) applied | 0.24 |
| Choice of data or measurement methods and procedures | Country specific SFC data for FCK is available and therefore used. This value is used only to calculate the specific energy consumption per kg-brick (SECFCK, Bricks) in conventional FCK kilns |
| Purpose of data/parameter | To calculate baseline emissions |
| Additional comments | Not applicable |
| Data/Parameter | $M_{FCK,brick}$ |
| Unit | kg/brick |
| Description | Weight of a single FCK brick |
| Source of data | As per IIDFC study titled “Weight of Bricks in Bangladesh, 2009” |
| Value(s) applied | 2.9 |
| Choice of data or measurement methods and procedures | Average specific weight per unit brick was determined through direct measurement of a substantial number of FCK bricks. This value is used to calculate only the specific energy consumption per kg-brick (SECFCK, Bricks) in conventional FCK kilns. |
| Purpose of data/parameter | To calculate total mass of brick produced per year |
| Additional comments | Not applicable |

| **Data/Parameter** | $NCV_{Diesel,y}$ |
|---|---|
| Unit | TJ/kl |
| Description | Weighted average net calorific value of diesel (fuel type) in year y |
| Source of data | IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied | 0.036509 |
| Choice of data or measurement methods and procedures | In mass unit, the value is 43.3 TJ/Gg or 43.3 MJ/kg. The density used for the conversion is 0.8432 kg/litre. |
| Purpose of data/parameter | To calculate project emissions |
| Additional comments | Not applicable |

| **Data/Parameter** | $Density_{Diesel,y}$ |
|---|---|
| Unit | kg/litre |
| Description | Density value of diesel (fuel type) in year y |
| Source of data | IPCC default values as provided in Table 11 (pg. 81) of Chapter Energy of the 2002 IPCC Background Papers on Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories |
| Value(s) applied | 0.8432 |
| Choice of data or measurement methods and procedures | Density = 1/Specific volume. The specific volume published by IPCC is 1,186 kilolitre/Gg or 1.186 litre/kg. |
| Purpose of data/parameter | To calculate project emissions |
| Additional comments | Not applicable |

| Data/Parameter | $EF_{CO2, Diesel,y}$ |
|---|---|
| Unit | t $CO_2$/TJ |
| Description | Weighted average $CO_2$ emission factor of diesel fuel type) i in year y |
| Source of data | IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories |
| Value(s) applied | 74.8 |
| Choice of data or measurement methods and procedures | Default data from IPCC is used, in the absence of values provided by the fuel supplier in invoices, measurements by the project participants and regional or national default values. |
| Purpose of data/parameter | To calculate project emissions |
| Additional comments | Not applicable |

## D.2. Data and parameters monitored

<table>
<tr><td>Data/Parameter</td><td>$TC_{Coal,i,y}$</td></tr>
<tr><td>Unit</td><td>Tonnes/year</td></tr>
<tr><td>Description</td><td>Total consumption of coal for brick making in brick kiln i in year y</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured using digital weighing scale</td></tr>
<tr><td>Source of data</td><td>Invoices from the coal suppliers and coal consumption registers</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>
<table>
<tr><th>Serial</th><th>Kiln Name</th><th>Tonnes/year</th></tr>
<tr><td>1.</td><td>EETA & Tiles Ltd (Kiln 1 & 2)</td><td>7,377.25</td></tr>
<tr><td>2.</td><td>Bricks 2010 Kiln 1</td><td>NA</td></tr>
</table>
</td></tr>
<tr><td>Monitoring equipment</td><td>Digital weighing scale (used for both coal and brick weight measurement):<br><br>Monitoring Year: 2018
<table>
<tr><th>Serial</th><th>Kiln Name</th><th>Make</th><th>Accuracy (± full scale reading)</th><th>Purchase date</th></tr>
<tr><td>1.</td><td>EETA & Tiles Ltd (Kiln 1 & 2)</td><td>Kamry</td><td>1/3000</td><td>01/11/2018</td></tr>
</table>
Monitoring Year: 2019
<table>
<tr><th>Serial</th><th>Kiln Name</th><th>Make</th><th>Accuracy (± full scale reading)</th><th>Purchase date</th></tr>
<tr><td>1.</td><td>EETA & Tiles Ltd (Kiln 1 & 2)</td><td>Mega</td><td>1/3000</td><td>31/10/2019</td></tr>
</table>
</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Every brick production day</td></tr>
<tr><td>Calculation method (if applicable)</td><td>The coal consumption at the kiln is measured through counting the number of buckets/sacks of coal consumed per day. A bucket/sack of coal is weighed to determine the weight of a bucket of coal using a digital weighing scale. The coal purchased is also cross verified by the supplier invoice provided with each coal consignment. The records are maintained at the kiln office for the amount of coal consumed, which can be cross checked against the invoices taking into account the balance of coal not consumed for the monitoring period concerned.</td></tr>
</table>

| | |
|---|---|
| QA/QC procedures | Coal stock at the end of each monitoring period is estimated and noted down. The coal stock register is used to cross check the consumption.<br><br>The kilns may purchase a new weighing scale every year or calibrate their existing weighing scale in case the calibration services/facilities become more affordable, during that monitoring period. In case of any delay in procuring new weighing scales or calibration of existing equipment after one year, then the maximum permissible error as per the respective manufacturer specifications shall be applied on the measured readings for the period until next calibration or procurement of new equipment. |
| Purpose of data/parameter | To calculate the project emissions |
| Additional comments | The data will be archived for two years after the crediting period |

| **Data/Parameter** | **$NCV_{Coal,i,y}$** |
|---|---|
| Unit | TJ/kg |
| Description | Net calorific value of coal used in $y^{th}$ year in brick kiln i |
| Measured/calculated/default | Measured |
| Source of data | As per the data provided by the supplier and independently verified by a credible Bangladesh laboratory. |
| Value(s) of monitored parameter | **Serial** \| **Kiln Name** \| **x $10^{-5}$ TJ/kg**<br>**1.** \| EETA & Tiles Ltd \| 1.83<br>**3.** \| Bricks 2010 Kiln 1 \| NA |
| Monitoring equipment | Lab analysis |
| Measuring/reading/recording frequency | Quarterly |
| Calculation method (if applicable) | A composite sample of 1 kg is taken from each new consignment of coal at each kiln. At the end of each quarter, all the samples taken in that quarter are crushed and mixed to produce a representative sample for that quarter. The sample is laboratory tested to determine the net calorific value of coal used for that particular quarter. The entire data is monitored and archived on paper and in electronic format. Average of the net calorific values of different quarters are calculated at the end of each monitoring period and is considered<br>as the net calorific value of coal used by related brick kiln for that monitoring period. |
| QA/QC procedures | IIDFC check the coal consumption data by inspecting the coal stock register and reports of calorific value tests at the end of the monitoring period. |
| Purpose of data/parameter | To calculate project emissions |
| Additional comments | The data will be archived for two years after the crediting period |

| **Data/Parameter** | **$DP_{Bricks,i}$** |
|---|---|
| Unit | Bricks |
| Description | Daily production of bricks in brick kiln i |
| Measured/calculated/default | Measured |
| Source of data | Daily brick production registers through manual count of bricks |

<table>
<tr><td>Value(s) of monitored parameter</td><td>Cumulative daily production for the monitoring period in each kiln are given below:
<table>
<tr><th>Serial</th><th>Kiln Name</th><th>No. of bricks</th></tr>
<tr><td>1.</td><td colspan="2">EETA & Tiles Ltd</td></tr>
<tr><td></td><td>EETA Kiln 1</td><td>27,015,600</td></tr>
<tr><td></td><td>EETA Kiln 2</td><td>27,288,200</td></tr>
<tr><td></td><td>EETA Kiln 3</td><td>NA</td></tr>
<tr><td></td><td>EETA Kiln 4</td><td>NA</td></tr>
<tr><td>2.</td><td colspan="2">Bricks 2010 Ltd</td></tr>
<tr><td></td><td>Bricks 2010 Kiln 1</td><td>NA</td></tr>
<tr><td></td><td>Bricks 2010 Kiln 2</td><td>NA</td></tr>
</table>
For the period 01/01/2018 to 31/03/2020, cumulative brick production values were used for CER estimation, as per PRC PDD.</td></tr>
<tr><td>Monitoring equipment</td><td>No equipment is used</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Every brick production day</td></tr>
<tr><td>Calculation method (if applicable)</td><td>The daily brick production is noted down by the technician in a daily log sheet maintained in the kiln. Supervisor verifies the log sheet at the end of each day. The data is provided to the CDM monitoring and compliance officer, who maintains the data gathered at the kiln or kiln head office. Monthly reports are prepared regularly by the CDM monitoring and compliance officer and are stored in electronic and paper modes.</td></tr>
<tr><td>QA/QC procedures</td><td>The amount of bricks manufactured at the end of each monitoring period is cross checked with the invoices for the sale of bricks and the stock in the plant.</td></tr>
<tr><td>Purpose of data/parameter</td><td>To calculate the baseline and project emissions</td></tr>
<tr><td>Additional comments</td><td>The data will be archived for up to two years after the end of the crediting period. In the event that different size or types of bricks, such as holed brick are produced, the number of each type of brick produced will be recorded in the daily register.</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$DMW_{HHK\ Bricks,di}$</td></tr>
<tr><td>Unit</td><td>kg/brick</td></tr>
<tr><td>Description</td><td>Daily mean weight of baked HHK bricks in brick kiln i</td></tr>
<tr><td>Measured/calculated/default</td><td>Measured</td></tr>
<tr><td>Source of data</td><td>On-site measurements by the operator in-charge</td></tr>
<tr><td>Value(s) of monitored parameter</td><td>Annual average of daily mean brick weight values are given below:
<table>
<tr><th>Serial</th><th>Kiln Name</th><th>kg/brick</th></tr>
<tr><td>1.</td><td>EETA & Tiles Ltd</td><td></td></tr>
<tr><td></td><td>EETA Kiln 1</td><td>3.55</td></tr>
<tr><td></td><td>EETA Kiln 2</td><td>3.55</td></tr>
<tr><td></td><td>EETA Kiln 3</td><td>N/A</td></tr>
<tr><td></td><td>EETA Kiln 4</td><td>N/A</td></tr>
<tr><td>2.</td><td>Bricks 2010 Ltd</td><td></td></tr>
<tr><td></td><td>Bricks 2010 Kiln 1</td><td>N/A</td></tr>
<tr><td></td><td>Bricks 2010 Kiln 2</td><td>N/A</td></tr>
</table></td></tr>
</table>

<table>
<tr><td>Monitoring equipment</td><td>Digital weighing scale (used for both coal and brick weight measurement):<br><br>Monitoring Year: 2018<br><table><tr><th>Serial</th><th>Kiln Name</th><th>Make</th><th>Accuracy (± full scale reading)</th><th>Purchase date</th></tr><tr><td>1.</td><td>EETA & Tiles Ltd (Kiln 1 & 2)</td><td>Kamry</td><td>1/3000</td><td>01/11/2018</td></tr><tr><td>2.</td><td>Bricks 2010 Ltd</td><td>NA</td><td>NA</td><td>NA</td></tr></table><br>Monitoring Year: 2019<br><table><tr><th>Serial</th><th>Kiln Name</th><th>Make</th><th>Accuracy (± full scale reading)</th><th>Purchase date</th></tr><tr><td>1.</td><td>EETA & Tiles Ltd (Kiln 1 & 2)</td><td>Mega</td><td>1/3000</td><td>31/10/2019</td></tr><tr><td>2.</td><td>Bricks 2010 Ltd</td><td>NA</td><td>NA</td><td>NA</td></tr></table></td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Daily</td></tr>
<tr><td>Calculation method (if applicable)</td><td>The average weight of bricks is calculated as per the “Guidelines for sampling and surveys for CDM project activities and programme of activities, version 03.0, EB 75” using digital weighing scale and as per the monitoring plan in PRC PDD, version 16 dated 18/04/2014. In accordance to these, 1080 samples were taken from 01/01/2018 to 31/03/2020 and cumulative mean brick weight was estimated</td></tr>
<tr><td>QA/QC procedures</td><td>Since there is no proper institutional/laboratory set up available for easy processing of calibration, new weighing scales are purchased every year by the kilns to ensure the accuracy of measurements. This is also supported by the affordable cost of weighing scales.</td></tr>
<tr><td>Purpose of data/parameter</td><td>To calculate the baseline and project emissions</td></tr>
<tr><td>Additional comments</td><td>The data will be archived for two years after the crediting period</td></tr>
</table>

<table>
<tr><td>Data/Parameter</td><td>$SEC_{i,y}$</td></tr>
<tr><td>Unit</td><td>TJ/kg-brick</td></tr>
<tr><td>Description</td><td>Specific energy consumption in brick kiln i</td></tr>
<tr><td>Measured/calculated/default</td><td>Calculated using the annual mass of brick production and annual energy consumption of coal as fuel</td></tr>
<tr><td>Source of data</td><td>Calculation result using equation (Refer section E.2)</td></tr>
<tr><td>Value(s) of monitored parameter</td><td><table><tr><th>Serial</th><th>Kiln Name</th><th>x $10^{-7}$ TJ/kg-brick</th></tr><tr><td>1.</td><td>EETA & Tiles Ltd (Kiln 1 & 2)</td><td>6.99</td></tr><tr><td>2.</td><td>Bricks 2010 Ltd</td><td>NA</td></tr></table></td></tr>
<tr><td>Monitoring equipment</td><td>No equipment is used</td></tr>
<tr><td>Measuring/reading/recording frequency</td><td>Recording frequency is annual</td></tr>
<tr><td>Calculation method (if applicable)</td><td>The specific energy consumption per kg-brick is calculated once in a year based on the data of coal consumed and the total mass of bricks produced during the corresponding period.</td></tr>
<tr><td>QA/QC procedures</td><td>The data is cross checked by comparing it with the quantity of bricks sold / in stock and coal purchased based on the purchase receipts and coal registers</td></tr>
<tr><td>Purpose of data/parameter</td><td>To calculate the project emissions</td></tr>
<tr><td>Additional comments</td><td>The data will be archived for two years after the crediting period</td></tr>
</table>

| Data/Parameter | N |
|---|---|
| Unit | days |
| Description | Number of operational days of the kiln in a year |
| Measured/calculated/ default | Measured |
| Source of data | Recorded by the operator in-charge |
| Value(s) of monitored parameter | |

| Serial | Kiln Name | Days |
|---|---|---|
| 1. | EETA Kiln 1 | 810 |
| 2. | EETA Kiln 2 | 810 |
| 3. | EETA Kiln 3 | NA |
| 4. | EETA Kiln 4 | NA |
| 5. | Bricks 2010 Kiln 1 | NA |
| 6. | Bricks 2010 Kiln 2 | NA |

| | |
|---|---|
| Monitoring equipment | No equipment is used |
| Measuring/reading/recording frequency | Daily |
| Calculation method (if applicable) | The operator in-charge keeps a record of the number of operational days of the kiln during the year based on the brick production from kilns. |
| QA/QC procedures | The CDM monitoring and compliance officer verifies the recorded data. |
| Purpose of data/parameter | To calculate the baseline and project emissions |
| Additional comments | The data will be archived for two years after the crediting period |

| Data/Parameter | $FC_{Diesel,j,y}$ |
|---|---|
| Unit | kl/yr |
| Description | Quantity of diesel (fuel type) combusted in the process j during the year y |
| Measured/calculated/ default | Measured |
| Source of data | Measured using standard measuring cans |
| Value(s) of monitored parameter | |

| Serial | Kiln Name | kl/year |
|---|---|---|
| 1. | EETA & Tiles Ltd | 197.7 |
| 2. | Bricks 2010 Ltd | NA |

Monitoring equipment: 1/5 litre standard measuring cans

| Serial | Kiln Name | Purchase date | |
|---|---|---|---|
| | | 2018 | 2019 |
| 1. | EETA & Tiles Ltd | 31/10/2018 | 29/10/2019 |
| 2. | Bricks 2010 Ltd | NA | NA |

| | |
|---|---|
| Measuring/reading/recording frequency | Daily |
| Calculation method (if applicable) | The purchased diesel in drums is measured at the supplier end itself and is recorded in the purchase invoice. The diesel consumption at the kiln is measured using 1/2/5 litre standard measuring cans. The records are maintained at kiln office on the diesel purchase and consumption as obtained from the above measurements. Net consumption is calculated at the end of the monitoring period by tallying out the total purchase with the opening and closing stocks of diesel in that period. |

| | |
|---|---|
| QA/QC procedures | The diesel stock at the end of each verification period is estimated and noted down in the annual report and the diesel stock register is used to cross check brick production. Every day consumption and stock records cross checked with purchase invoices show that the diesel consumed for kiln operations is only from the diesel purchased under the project.<br><br>Since there is no proper institutional/laboratory set up available for easy calibration, new measuring cans are purchased every year by the kilns to ensure the accuracy of measurements. This is also supported by the affordable cost of the measuring cans.<br><br>In case of any delay in procuring new measuring cans after one year, the suitable error shall be applied on the measured readings for the period until new equipment is procured. The error value shall be estimated based on actual conditions during the verification in discussion with the verifying DOE. The kilns purchased new weighing scans every year which avoided the necessity of adjusting the values with suitable errors. |
| Purpose of data/parameter | To calculate project emissions |
| Additional comments | The data will be archived for two years after the crediting period |

| | |
|---|---|
| **Data/Parameter** | **$EC_{i,y}$** |
| Unit | MWh |
| Description | Electricity consumption in kiln i per year |
| Measured/calculated/ default | Measured |
| Source of data | Electricity bill from the REB or the electricity supplier |
| Value(s) of monitored parameter | **Serial** \| **Kiln Name** \| **MWh**<br>**1.** \| EETA & Tiles Ltd \| 1,336.1<br>**2.** \| Bricks 2010 Ltd \| NA |
| Monitoring equipment | Energy meter<br>**Serial** \| **Kiln Name** \| **Make** \| **Serial no.** \| **Accuracy Class** \| **Year of make**<br>**1.** \| EETA & Tiles Ltd \| Fitzall \| 13920616 \| 0.5 \| 2013<br>**2.** \| Bricks 2010 Ltd \| NA \| NA \| NA \| NA |
| Measuring/reading/recording frequency | Monthly |
| Calculation method (if applicable) | Monthly electricity bill paid to Rural Electricity Board (REB) is used to calculate the total electricity consumption of the month and is noted down in the monthly report |
| QA/QC procedures | Electricity consumption from the individual monthly electricity bills shall be cross checked with the electricity consumption calculated from the first and the last month of the monitoring period.<br><br>In case of energy meters, there is no practice of regular calibration in Bangladesh. A letter from Bangladesh DNA is provided as proof of evidence for the same. |
| Purpose of data/parameter | To calculate project emissions |
| Additional comments | The data will be archived for two years after the crediting period |

### D.3. Implementation of sampling plan

Multi stage sampling is used for brick weight measurement as stated in the revised monitoring plan in the PDD version 08, dated 18/04/2014 and was approved by UNFCCC through a Post Registration Change (PRC) request[12] (ref no: PRC-6085-001) on 19/08/2014.

As per revised sampling procedure,

- 40 samples (150 samples/4 months) must be selected from a month.
- Taking 20 samples per day, 2 days shall be selected for a month

As per the sampling plan, a kiln operating for a year will be able to achieve 480 sample measurements, which is above the minimum requirement of 150 samples during this monitoring period.

**Table 5: Analysis of weight measurements of baked brick samples**

| No. | Parameter | EETA Kiln 1 | EETA Kiln 2 | Bricks 2010 Kiln 1 |
|---|---|---|---|---|
| 1. | *No. of. months of operation* | 27 | 27 | NA |
| 2. | *No. of. brick samples* | 1,080 | 1,080 | NA |
| 3. | *Mean* | 3.55 | 3.55 | NA |
| 4. | *Standard deviation* | 0.03 | 0.04 | NA |
| 5. | *Sample variance* | 0.0011 | 0.0013 | NA |
| 6. | *Minimum* | 3.48 | 3.34 | NA |
| 7. | *Maximum* | 3.61 | 3.61 | NA |
| 8. | *Standard error* | 0.001 | 0.001 | NA |
| 9. | *Confidence interval (max level / min level)* | 3.552 | 3.555 | NA |
| | | 3.549 | 3.551 | NA |
| 10. | *Precision (%)* | 0.05% | 0.05% | NA |

From the above analysis, the lowest precision level of the brick weight measurement in the brick kilns was found to be 0.05% as against the required level of 10%. Hence, it is clear that the sampling results are in conformity with the CDM requirements. The details of analysis of sample brick weight measurements for each kiln are provided in “ER calculation” excel sheet.

## SECTION E. Calculation of emission reductions or net anthropogenic removals

### E.1. Calculation of baseline emissions or baseline net removals

The baseline emissions $BE_y$ from the baseline activity, if the equivalent amount of bricks that were produced in the $i^{th}$ kiln were to be produced by using FCK technology, are calculated as follows:

$$BE_y = \sum_{i=1}^{6} BEFCK_{i,y}$$

$BE_y$ [t $CO_2$/year] = 38,708.59 t $CO_2$

[12] https://cdm.unfccc.int/PRCContainer/DB/prcp900477827/view

Where,

$BE_{FCK\ i,\ y}$ = Baseline emissions per year for the $i^{th}$ kiln [t $CO_2$/year]

= $TP_{Bricks,\ i\ ,y}$ x $SEC_{FCK,\ Bricks,\ y}$ x $CEF_{coal}$ x CF

[kg-bricks(y)] [TJ/kg-brick] [t C/TJ][t $CO_2$/t C]

Where,

$TP_{Bricks,i\ ,y}$ = Total production of bricks per year in kiln i (kg-bricks/year)
$SEC_{FCK,\ Bricks,y}$ = Specific energy consumption in FCK technology (TJ/kg-brick)
$CEF_{coal}$ = IPCC default carbon emission factor for fuel used (t C/TJ)
CF = Carbon to $CO_2$ Conversion Factor (t $CO_2$/t C)

**Table 5: Estimation of baseline emission**

| Serial | Kiln Name | **$TP_{Bricks,\ i\ ,y}$** kg-bricks | | **$SEC_{FCK,\ Bricks,\ y}$** TJ/kg-brick | | **$CEF_{coal}$** t C/TJ | | **CF** t $CO_2$/t C | | **$BE_{FCK\ i,\ y}$** t $CO_2$/year |
|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | EETA & Tiles Ltd (Kiln 1 & 2) | 192,876,579 | × | $2.125 \times 10^{-6}$ | × | 25.8 | × | 3.66 | = | 38,708.59 |
| **2.** | Bricks 2010 Kiln 1 | NA | | | | | | | | NA |

## E.2. Calculation of project emissions or actual net removals

Total project emissions in $y^{th}$ year, $PE_y$, by operations of N units of HHK kilns (N=6) is given by:

$$PE_y = \sum_{i=1}^{6} PE_{HHK\ i,\ y}$$

[t $CO_2$/year]

= **14,099.26 t $CO_2$/year**

Where,

$PE_{HHK\ i,\ y}$ = Project emissions from operation of $i^{th}$ kiln in year y [t $CO_2$/year]

= $SEC_{i,\ y}$ X $TP_{Bricks,\ i\ ,y}$ x $CEF_{coal}$ x CF +

[TJ/kg-brick(y)] [kg-bricks(y)] [t C/TJ] [t $CO_2$/t C]

$C_{i,\ y}$ x $EF_{CO2,Elec}$ + $PE_{FC,j,y}$

[MWh] [t $CO_2$/MWh] [t $CO_2$/year]

Where,

$SEC_{i,\ y}$ = Specific energy consumption in kiln i (TJ/kg-brick)
$TP_{Bricks,i\ ,y}$ = Total production of bricks per year in kiln i (kg-bricks/year)
$CEF_{coal}$ = IPCC default carbon emission factor for fuel used (t C/TJ)
CF = Carbon to $CO_2$ Conversion Factor (t $CO_2$/t C)
$EC_{i,y}$ = Electricity consumption in kiln i per year (MWh)

$EF_{CO2, Elec}$ = Estimated $CO_2$ emissions factor for grid electricity in Bangladesh (t $CO_2$/MWh)

$PE_{FC,j,y}$ = $CO_2$ emissions from fossil fuel combustion in year y (t $CO_2$/yr)

**Table 6: Estimation of Project Emission**

| No. | Kiln Name | $SEC_{i, y}$ TJ/kg-brick | | $TP_{Bricks,i,y}$ kg-bricks | | $CEF_{coal}$ t C/TJ | | CF tCO2/tC | | $EC_{i,y}$ MWh | | $EF_{CO2,Elec}$ tCO2/MWh | | $PE_{FC,j,y}$ tCO2/year | | $PE_{HHK\ i,\ y}$ tCO2/year |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **1.** | **EETA (**Kiln 1 & 2) | $6.99\times10^{-7}$ | × | 192,876,579 | × | 25.8 | × | 3.66 | + | 1336.1 | × | 0.62 | + | 539.93 | = | **14,099.26** |
| **2.** | **Bricks 2010** (Kiln 1) | NA | | NA | | | | | | NA | | | | NA | | NA |

From the monitored data, the specific energy consumption for the individual kilns are calculated using the following formula:

$SEC_{i, y}$ [TJ/kg-brick] = $TC_{Coal\ i,y}$ [tonnes(y)] x $NCV_{Coal\ i, y}$ [TJ/kg(y)] / $TP_{Bricks, i ,y}$ [kg-bricks(y)]

Where,

$SEC_{i, y}$ = Specific energy consumption in kiln i (TJ/kg-brick)

$TC_{Coal\ i,y}$ = Total consumption of coal per year for kiln i (tonnes)

$NCV_{Coal\ i, y}$ = Weighted average net calorific value of coal used in $y^{th}$ year in kiln i (TJ/kg)

$TP_{Bricks,i ,y}$ = Total production of bricks per year in kiln i (kg-bricks/year)

**Table 7: Estimation of specific energy consumption**

| No. | Kiln name | $TC_{Coal\ i,y}$ tonnes(y) | × | $NCV_{Coal\ i,y}$ TJ/kg(y) x $10^{-5}$ | ÷ | $TP_{Bricks,\ i,y}$ kg- bricks(y) | = | $SEC_{i,y}$ TJ/kg-brick x$10^{-7}$ |
|---|---|---|---|---|---|---|---|---|
| **1.** | **EETA Kiln 1 & 2** | 7,377.25 | | 2.03 | | **192,876,579** | | **7.008** |
| **2.** | **Bricks 2010 Kiln 1** | **NA** | | **NA** | | **NA** | | **NA** |

Total production of bricks per year in a kiln is given by,

$TP_{Bricks,i,y}$ [kg-bricks/year] = $\Sigma_{d=1}^{n} DP_{Bricks,di}$ [nos] x $DMW_{HHK\ brick,di}$ [kg/brick]

Where,

$DP_{Bricks\ di}$ = Daily production of bricks in kiln i (bricks/day)

$DMW_{HHK\ bricks,\ di}$ = Daily Mean weight of HHK bricks in kiln i (kg/bricks)

n = Total no. of production days for kiln i in a year

For the period of 01/01/2018 to 31/03/2020, total production of bricks per year is calculated as a product of sum of brick production on every brick production day and mean brick weight of sample bricks during that period.

For elaborate calculation, refer to the attached the CER estimation file, sheet "6085 CER Estimation sheet 2018 - 20"

$CO_2$ emissions from fossil fuel combustion in year y is given by,

$PE_{FC,j,y}$ [t $CO_2$/yr] = $FC_{Diesel,\ j,\ y}$ [kl/year] x $COEF_{Diesel,\ y}$ [t CO2/ kl]

Where,

$FC_{Diesel, j,y}$ = Quantity of diesel (fuel type) combusted in process *j* during the year *y* (kl/yr)

$COEF_{Diesel, y}$ = $CO_2$ emission coefficient of diesel (fuel type) in year *y* (t $CO_2$/ kl)

**Table 8: Estimation of emissions from fossil fuel combustion**

| No. | Kiln Name | $FC_{Diesel, j, y}$ kl/yr | | $COEF_{Diesel, y}$ t $CO_2$/kl | | $PE_{FC,j,y}$ t $CO_2$/yr |
|---|---|---|---|---|---|---|
| 1. | EETA (Kiln 1 & 2) | 197.72 | x | 2.7 | = | 539.39 |
| 2. | Bricks 2010 (Kiln 1) | NA | | | | NA |

## E.3. Calculation of leakage emissions

According to methodology AMS-II.D (Version 12), leakage is not considered.

## E.4. Calculation of emission reductions or net anthropogenic removals

| | Baseline GHG emissions or baseline net GHG removals (t $CO_2$e) | Project GHG emissions or actual net GHG removals (t $CO_2$e) | Leakage GHG emissions (t $CO_2$e) | GHG emission reductions or net anthropogenic GHG removals (t $CO_2$e) | | |
|---|---|---|---|---|---|---|
| | | | | Before 01/01/2013 | From 01/01/2013 | Total amount |
| **Total** | **38,708.59** | **14,099.26** | **0** | **0** | **24,609** | **24,609** |

## E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

| Amount achieved during this monitoring period (t $CO_2$e) | Amount estimated ex ante for this monitoring period in the PDD (t $CO_2$e) |
|---|---|
| **24,609** | **68,879.25** t $CO_2$e |

### E.5.1. Explanation of calculation of "amount estimated ex ante for this monitoring period in the PDD"

As per the registered PDD, estimated ex ante amount of GHG emission reduction annually i.e. 12 months is 30,613 t $CO_2$e. The monitoring activities reported in this report covers the period from 01/01/2018 to 31/03/2020, which is 27 months. Thus, the amount estimated ex ante as per PDD, for this monitoring period can be calculated as:

Amount Estimated ex ante = {(30,613÷12) × 27} = 68,879.25 t $CO_2$e

## E.6. Remarks on increase in achieved emission reductions

The emission reductions achieved in the reported monitoring period is 64.27% lower than the estimated amount in the registered PDD due to non-operation of the other sub-project and lower demand of bricks in the market for a significant period for which the construction of the other units registered under the ownership of the 2 sub-projects are not completed.

## E.7. Remarks on scale of small-scale project activity

The project introduces energy efficiency measures in 6 HHK kilns. Operating at full capacity, the total energy savings are estimated to be about 99 $GWh_{th}$ per year. This saving is under the 180

$GWh_{th}$ per year threshold applicable to this category of activities as defined in AMS II.D., version 12, EB 51.
Since the boundary limits of the project are set, there is no possibility of exceeding the limits of 180 $GWh_{th}$ per year for small-scale CDM project activities during the crediting period.

Therefore, the project activity meets the 'Small-Scale CDM Project Activities' applicability.

## Document information

| *Version* | *Date* | *Description* |
|---|---|---|
| 07.0 | 31 May 2019 | Revision to:<br>• Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);<br>• Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period;<br>• Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes;<br>• Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods;<br>• Make editorial improvements. |
| 06.0 | 7 June 2017 | Revision to:<br>• Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN);<br>• Make editorial improvements. |
| 05.1 | 4 May 2015 | Editorial revision to correct version numbering. |
| 05.0 | 1 April 2015 | Revisions to:<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to the Host Party;<br>• Remove reference to programme of activities;<br>• Overall editorial improvement. |
| 04.0 | 25 June 2014 | Revisions to:<br>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));<br>• Include provisions related to standardized baselines;<br>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;<br>• Change the reference number from *F-CDM-MR* to *CDM-MR-FORM*;<br>• Editorial improvement. |
| 03.2 | 5 November 2013 | Editorial revision to correct table in page 1. |
| 03.1 | 2 January 2013 | Editorial revision to correct table in section E.5. |
| 03.0 | 3 December 2012 | Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, 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). |
| 01.0 | 28 May 2010 | EB 54, Annex 34. Initial adoption. |

| *Version* | *Date* | *Description* |
|---|---|---|

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