Joint Crediting Mechanism Approved Methodology ID_AM012 "Reduction of Energy Consumption by Introducing an Energy-Efficient Old Corrugated Carton Processing System into a Cardboard Factory"

A. Title of the methodology

Reduction of Energy Consumption by Introducing an Energy-Efficient Old Corrugated Carton Processing System into a Cardboard Factory, Version 1.0

B. Terms and definitions

Terms	Definitions
Old Corrugated Carton Line (OCC line)	A process for adjusting materials to be delivered to the following paper making line (PM line) in the corrugated carton production process. The energy used by the OCC line is electricity. It mainly consists of a pulper which melts old corrugated carton and a screen which refines the corrugated medium, and also motor, pump, agitator, thickener, and cleaner.
Paper Machine Line (PM line)	A process for making paper in a corrugated carton production process.
Paper Yield	Percentage of paper production output in the recycled paper input to the OCC line.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	This methodology targets introduction of energy saving technologies, i.e. energy-efficient old corrugated carton processing system, to OCC lines in a cardboard factory. Mechanical efficiency of each element device is improved and system configuration and control are optimized in the energy-efficient old corrugated carton processing system, e.g. improvement of impeller-shape in an agitator leading to higher

	motor efficiency and optimization of the system configuration of pumps, which leads to a reduction of the electricity consumptions, and consequently GHG emission reductions.
Calculation of reference emissions	Reference emissions are calculated from the energy intensity (specific energy consumption) of the reference OCC line(s), the project paper production and the emission factor for consumed electricity.
Calculation of project emissions	Project emissions are calculated from the electricity consumption by the project OCC line and the emission factor for consumed electricity.
Monitoring parameters	• Paper production measured at the PM line connected to the project OCC line • Electricity consumption of the project OCC line

D. Eligibility criteria

This methodology is applicable to projects that satisfy all of the following criteria.

Criterion 1	The specific energy consumption of the project OCC line guaranteed by the manufacture is, at the minimum, less than the reference specific energy consumption set for the project factory.
Criterion 2	The paper yield of the project OCC line(s) guaranteed by the manufacture is equal to or more than 90% at the range of designed production capacity.
Criterion 3	Production capacity of the project OCC line is no more than the twice as large as the capacity of the existing OCC line.
Criterion 4	Plan for regular adjustment, replacement, and improvements of project OCC line(s) is prepared (at least once every six months).

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Electricity consumption by the reference OCC line(s)	CO_2
Project emissions	
Emission sources	GHG types

Electricity consumption by the project OCC line(s)	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

In this methodology, the reference emissions are calculated conservatively based on the past performance by averaging the values of the specific electricity consumption (SEC) without those which exceed 2 times the standard deviation above the mean within two years from the timing of validation of the existing OCC lines of the same factory where the project OCC line(s) is installed.

Net emission reductions are achieved by fixing the default value of specific electricity consumption (i.e. amount of electricity consumed by the OCC line to produce one unit of paper product measured at the PM line) of the reference OCC line conservatively in the following manner:

- Collect 300 data sets of daily electricity consumption by the OCC line* and daily volume of paper product at the PM line connected to the OCC line and calculate the SEC of the OCC line for each daily data by dividing electricity consumption by volume of paper product.
  *Electricity consumption by the OCC line can be measured with a measuring equipment or can be estimated from measured electricity consumption of the whole corrugated carton production process consisting of the OCC line and the PM line based on the ratio of the rated power consumption in each line.
- Calculate the reference specific energy consumption (SEC_{RE}) by averaging the values of the SEC without those which exceed 2 times the standard deviation above the mean.
- Where multiple OCC lines exist in the factory, select the most recently installed OCC line(s) for data collection.
- Where recently more than one OCC line installed (at the same time), select one with the highest efficiency as the reference OCC line.
- If the existing OCC line has been installed as a JCM project, data of such OCC line is excluded from calculation of the default value.

F.2. Calculation of reference emissions

$$RE_p = \sum_j \left(EC_{RE,j,p} \times EF_{elec} \right)$$

$$EC_{RE,j,p} = SEC_{RE} \times PP_{j,p}$$

Where

RE_p	:	Reference emissions during the period p [tCO_2/p]
$EC_{RE,j,p}$	:	Electricity consumption by the reference OCC line j during the period p [MWh/p]
EF_{elec}	:	CO_2 emission factor for consumed electricity [tCO_2/MWh]
SEC_{RE}	:	Reference specific electricity consumption of the OCC line [MWh/ton]
$PP_{j,p}$	:	Paper production measured at the PM line connected to the project OCC line j during the period p [ton/p]
j	:	Identification number of the OCC line

G. Calculation of project emissions

$$PE_p = \sum_j \left(EC_{PJ,j,p} \times EF_{elec} \right)$$

Where

PE_p	:	Project emissions during the period p [tCO_2/p]
$EC_{PJ,j,p}$	:	Electricity consumption by the project OCC line j during the period p [MWh/p]
EF_{elec}	:	CO_2 emission factor for consumed electricity [tCO_2/MWh]
j	:	Identification number of the OCC line

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$

Where

ER_p	: Emission reductions during the period p [tCO_2/p]
RE_p	: Reference emissions during the period p [tCO_2/p]
PE_p	: Project emissions during the period p [tCO_2/p]

I. Data and parameters fixed *ex ante*

The source of each data and parameter fixed *ex ante* is listed as below.

Parameter	Description of data	Source
SEC_{RE}	Reference specific electricity consumption of the OCC line [MWh/ton] The value for each project is fixed ex ante by the project participant in line with the procedures described in the section F.1 in this methodology.	Data of daily electricity consumption by the OCC line and daily volume of paper product at the PM line connected to the OCC line within two years from the timing of validation of the existing OCC lines of the same factory where the project OCC line(s) is installed.
EF_{elec}	CO_2 emission factor for consumed electricity [tCO_2/MWh]. When the project equipment consumes only grid electricity or captive electricity, the project participant applies the CO_2 emission factor respectively. When the project equipment may consume both grid electricity and captive electricity, the project participant applies the CO_2 emission factors for grid ($EF_{elec,gr}$) and captive ($EF_{elec,ca}$) electricity proportionately. Where multiple fuel types are consumed as captive power sources, the emission factor ($EF_{elec,ca,i}$) and proportion of ($\propto_i$) each fuel type i is identified and applied.	[Grid electricity] The data is sourced from "Emission Factors of Electricity Interconnection Systems", National Committee on Clean Development Mechanism (Indonesian DNA for CDM), based on data obtained by Directorate General of Electricity, Ministry of Energy and Mineral Resources, Indonesia, unless otherwise instructed by the Joint Committee. [Captive electricity] Specification of the captive power generation system including co-generation system provided by

	$EF_{elec} = (EF_{elec,gr} \times \propto_{gr}) + \sum_i (EF_{elec,ca,i} \times \propto_i)$ Where: $\propto_{gr}$: Proportion of grid electricity to the total electricity consumed [fraction] Proportion of captive electricity generated with a specific fuel type *i* is derived from dividing captive electricity generated with a specific fuel type *i* ($EG_{gen,i,p}$)* by total electricity consumed at the project site. The total electricity consumed is a summation of grid electricity imported ($EI_{grid,p}$) and total captive electricity generated at the project site ($EG_{gen,total,p}$) during the monitoring period. $\propto_i = \frac{EG_{gen,i,p}}{EI_{grid,p} + EG_{gen,total,p}}$ * Captive electricity generated is measured with measuring equipment such as electric power meter which is certified in compliance with national/international standards. In case a calibration certificate issued by an entity accredited under national/international standards is not provided, such measuring equipment is required to be calibrated. [CO_2 emission factor] For grid electricity: The most recent value available from the source stated in this table at the time of validation For captive electricity: Calculation from manufacturer's specification (Option a) or	the manufacturer (η_{elec} [%]). Measured data of generated and supplied electricity by the captive power generation system including co-generation system ($EG_{PJ,p}$ [MWh/p]). Data measured or provided by the fuel supplier of fuel amount consumed to generate heat and electricity by the captive power generation system including co-generation system ($FC_{PJ,p}$ [mass or weight/p]). Net calorific value (NCV_{fuel} [GJ/mass or weight]) and CO_2 emission factor (EF_{fuel} [tCO_2/GJ]) of the fuel in order of preference: 1) values provided by the fuel supplier; 2) measurement by the project participants; 3) regional or national default values; 4) IPCC default values provided in table 1.4 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied.

	with measured data (Option b) as follows: Option a) Manufacturer's specification The power generation efficiency (η_{elec}) based on lower heating value (LHV) of the captive power generation system including co-generation system from the manufacturer's specification is applied; $$EF_{elec,ca,i} = 3.6 \times \frac{100}{\eta_{elec}} \times EF_{fuel,i}$$ Option b) Measured data The monitored data of the amount of fuel input for power generation ($FC_{PJ,p}$) and the amount of electricity generated ($EG_{PJ,p}$) during the monitoring period *p* is applied. The measurement is conducted with the monitoring equipment to which calibration certificate is issued by an entity accredited under national/international standards; $$EF_{elec,ca,i} = FC_{PJ,p} \times NCV_{fuel,i} \times EF_{fuel,i} \times \frac{1}{EG_{PJ,p}}$$ Where: $NCV_{fuel,i}$: Net calorific value of consumed fuel *i* [GJ/mass or weight] $EF_{fuel,i}$: CO_2 emission factor of consumed fuel *i* [tCO_2/GJ]	

History of the document

Version	Date	Contents revised
01.0	10 February 2017	JC6, Annex 5 Initial approval.