Joint Crediting Mechanism Approved Methodology VN_AM009

"Installation of Container Formation Facility at Lead Acid Battery Factory"

A. Title of the methodology

Installation of Container Formation Facility at Lead Acid Battery Factory, Version 01.~~1~~0

B. Terms and definitions

Terms	Definitions
container formation	A formation method of lead acid battery in which the battery is assembled with non-converted plates and then converted in the container.
container formation facility	A facility in which container formation of lead acid battery is done. Two processes of tank formation (formation and charging) are integrated into this facility. Drying facility in tank formation is no longer needed in container formation.
tank formation	A formation method of lead acid battery in which the plates are converted in a formation tank after being manufactured and then assembled into a battery.
tank formation facilities	Facilities including "formation tank" and "washing facility" at tank formation process, "drying facility" at plate drying process, and "charging facility" at charging process.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Installation of container formation facility at lead acid battery production line in place of tank formation facilities leads to reduction of electricity and fossil fuel consumption by the production line.
Calculation of reference emissions	Reference emissions from electricity consumption are calculated by multiplying electricity consumption of reference tank

	formation facilities and CO_2 emission factor for electricity consumed. Electricity consumption of reference tank formation facilities is calculated with production output of lead acid battery and specific electricity consumption by the reference facilities. Reference emissions from fuel consumption are calculated by multiplying net heat quantity required for fuel consumption to produce lead acid battery by reference tank formation facilities and CO_2 emission factor. Net heat quantity required for fuel consumption to produce lead acid battery by reference tank formation facilities is calculated with production output of lead acid battery and specific net heat quantity required for fuel consumption per lead acid battery by the reference facilities.
Calculation of project emissions	Project emissions are calculated by multiplying electricity consumption of project container formation facility including chillier and cooling tower and CO_2 emission factor for electricity consumed.
Monitoring parameters	● Production output of lead acid battery at the container formation facility in the project factory per lead acid battery type ● Capacity of lead acid battery ● Electricity consumption by the container formation facility including chillier and cooling tower in the project factory

D. Eligibility criteria

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

Criterion 1	Container formation facility is newly installed or installed to replace tank formation facilities at lead acid battery production line.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types

Electricity consumption by tank formation facilities	CO_2
Fossil fuel (LPG) consumption by tank formation facilities	CO_2
Project emissions	
Emission sources	GHG types
Electricity consumption by container formation facility	CO_2
Electricity consumption by cooling chiller and cooling tower	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Electricity and fossil fuel are consumed for the process of producing lead acid batteries in tank formation facilities.

Reference emissions from electricity consumption are calculated by multiplying specific electricity consumption per unit of lead acid battery type *i* ($SEC_{RE,i}$) [kWh/unit], production output of lead acid battery type *i* [units/p], and CO_2 emission factor for electricity consumed [tCO_2/MWh].

Reference emissions from fuel consumption are calculated by multiplying specific net heat quantity required for fuel consumption per unit of lead acid battery type *i* ($SNHQ_{RE,i}$) [MJ/unit], production output of lead acid battery type *i* [units/period] and CO_2 emission factor for fuel which is determined as per a factory where a JCM project is implemented [tCO_2/GJ].

In this methodology, SEC_{RE} is calculated with the equation specified, which is formulated in a conservative manner by excluding the electricity consumption by chiller and cooling tower to achieve net emission reductions while typical configuration of the equipment for producing lead acid batteries in tank formation facilities consists of the followings: formation tank, charging facility, chiller and cooling tower and other tank formation facilities such as washing facility and/or drying facility.

F.2. Calculation of reference emissions

$$RE_p = \sum_k \left[\left(EC_{RE,k,p} \times EF_{elec,k} \right) + \left(NHQ_{RE,k,p} \times EF_{fuel,k} \right) \right]$$

$$EC_{RE,k,p} = \sum_i \left(SEC_{RE,i,k} \times N_{i,k,p}\right) \times \frac{1}{1{,}000}$$

$$NHQ_{RE,k,p} = \sum_i \left(SNHQ_{RE,i,k} \times N_{i,k,p}\right) \times \frac{1}{1{,}000}$$

$$SEC_{RE,i,k} = 0.1338 \times AH_i + 0.1531$$

$$SNHQ_{RE,i,k} = 0.3282 \times AH_i + 0.9377$$

Where

RE_p	Reference emissions during the period *p* [tCO_2/p]
$EC_{RE,k,p}$	Electricity consumption by tank formation facilities in the project factory *k* during the period *p* [MWh/p]
$EF_{elec,k}$	CO_2 emission factor for electricity consumed in the project factory *k* [tCO_2/MWh]
$NHQ_{RE,k,p}$	Net heat quantity required for fuel consumption to produce lead acid battery by tank formation facilities in the project factory *k* during the period *p* [GJ/p]
$EF_{fuel,k}$	CO_2 emission factor for fuel applicable to the project factory *k* [tCO_2/GJ]
$SEC_{RE,i,k}$	Specific electricity consumption per lead acid battery type *i* by the reference facilities in the project factory *k* [kWh/unit]
$SNHQ_{RE,i,k}$	Specific net heat quantity required for fuel consumption per lead acid battery type *i* by the reference facilities in the project factory *k* [MJ/unit]
$N_{i,k,p}$	Production output of lead acid battery type *i* in the project factory *k* during the period *p* [units/p]
AH_i	Capacity of lead acid battery type *i* [Ah/unit]
i	Identification number of the project lead acid battery type
k	Identification number of the project factory

G. Calculation of project emissions

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

Where

PE_p	Project emissions during the period *p* [tCO_2/p]
$EC_{PJ,k,p}$	Electricity consumption by the container formation facilities including chillier and cooling tower in the project factory *k* during the period *p* [MWh/p]

$EF_{elec,k}$	CO_2 emission factor for electricity consumed in the project factory k [tCO_2/MWh]
k	Identification number of the project factory

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
$EF_{elec,k}$	CO_2 emission factor for consumed electricity in the project factory k When project container formation facility consumes only grid electricity or captive electricity, the project participant applies the CO_2 emission factor respectively. When project container formation facility may consume both grid electricity and captive electricity, the project participant applies the CO_2 emission factor with lower value. [CO_2 emission factor] For grid electricity: The most recent value	[Grid electricity] Ministry of Natural Resources and Environment (MONRE), Vietnamese DNA for CDM unless otherwise instructed by the Joint Committee. [Captive electricity] For the option a) Specification of the captive power generation system in the project factory k provided by the manufacturer ($\eta_{elec,CG,k}$ [%]). CO_2 emission factor of the fossil fuel type used in the

	available from the source stated in this table at the time of validation For captive electricity, it is determined based on the following options: a) Calculated from its power generation efficiency in the project factory *k* ($\eta_{elec,CG,k}$ [%]) obtained from manufacturer's specification The power generation efficiency based on lower heating value (LHV) of the captive power generation system from the manufacturer's specification is applied; $$EF_{elec,k} = 3.6 \times \frac{100}{\eta_{elec,CG,k}} \times EF_{fuel,CG,k}$$ b) Calculated from measured data The power generation efficiency calculated from monitored data of the amount of fuel input for power generation ($FC_{PJ,CG,k,p}$) and the amount of electricity generated ($EG_{PJ,CG,k,p}$) in the project factory *k* 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; $$EF_{elec,k} = FC_{PJ,CG,k,p} \times NCV_{fuel,CG,k} \times EF_{fuel,CG,k} \times \frac{1}{EG_{PJ,CG,k,p}}$$ Where: $NCV_{fuel,CG,k}$: Net calorific value of fuel consumed by the captive power generation system in the project factory *k* [GJ/mass or volume]	captive power generation system in the project factory *k* ($EF_{fuel,CG,k}$ [tCO_2/GJ]) For the option b) Generated and supplied electricity by the captive power generation system in the project factory *k* ($EG_{PJ,CG,k,p}$ [MWh/p]). Fuel amount consumed by the captive power generation system in the project factory *k* ($FC_{PJ,CG,k,p}$ [mass or volume/p]). Net calorific value ($NCV_{fuel,CG,k}$ [GJ/mass or volume]) and CO_2 emission factor ($EF_{fuel,CG,k}$ [tCO_2/GJ]) of the fuel consumed by the captive power generation system in the project factory *k* 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 tables 1.2 and 1.4 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied. [Captive electricity with diesel fuel] CDM approved small scale methodology: AMS-I.A.

<table>
<tr>
<td></td>
<td>Note:
In case the captive electricity generation system meets all of the following conditions, the value in the following table may be applied to $EF_{elec,k}$ depending on the consumed fuel type.

● The system is non-renewable generation system
● Electricity generation capacity of the system is less than or equal to 15 MW

<table>
<tr><th>fuel type</th><th>Diesel fuel</th><th>Natural gas</th></tr>
<tr><td>$EF_{elec,k}$</td><td>0.8 *1</td><td>0.46 *2</td></tr>
</table>

*1 The most recent value at the time of validation is applied.
*2 The value is calculated with the equation in the option a) above. The lower value of default effective CO_2 emission factor for natural gas (0.0543 tCO_2/GJ), and the most efficient value of default efficiency for off-grid gas turbine systems (42%) are applied.</td>
<td>[Captive electricity with natural gas]
2006 IPCC Guidelines on National GHG Inventories for the source of EF of natural gas.
CDM Methodological tool "Determining the baseline efficiency of thermal or electric energy generation systems version02.0" for the default efficiency for off-grid power plants.</td>
</tr>
<tr>
<td>$EF_{fuel,k}$</td>
<td>CO_2 emission factor for fuel applicable to the project factory k [tCO_2/GJ]

In case tank formation facilities exist in the project factory prior to the project implementation, the lowest CO_2 emission factor of the fuel used by the facilities may be applied.

Otherwise, CO_2 emission factor for Natural Gas is applied.</td>
<td>Country specific data or IPCC default value from “2006 IPCC Guidelines for National Greenhouse Gas Inventory”. Lower limit value of the default net calorific value is applied.</td>
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History of the document

Version	Date	Contents revised
01.1	19 January 2018	- Deleted unnecessary parameters in the tables for calculation of reference emissions and project emissions in MPS (input_separate) sheet of the Monitoring Spreadsheet ; and - Modified the descriptions of the parameters "RE_i,p" and "PE_i,p" in MPS (input_separate) sheet of the Monitoring Spreadsheet.
01.0	10 October 2017	JC6, Annex 4 Initial approval.