JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form	
Form for submitting the proposed methodology	
Host Country	Socialist Republic of Vietnam
Name of the methodology proponents submitting this form	Hitachi Zosen Corporation K.K. Satisfactory International
Sectoral scope(s) to which the Proposed Methodology applies	1.　Energy　industries　(renewable　-　/ non-renewable sources); 13. Waste Handling and Disposal
Title of the proposed methodology, and version number	Waste incineration for electricity generation
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☐Additional information
Date of completion	2 March 2015

History of the proposed methodology

Version	Date	Contents revised
1.0	02/03/2015	First edition

A. Title of the methodology

Waste incineration for electricity generation

B. Terms and definitions

Terms	Definitions
Emissions standards	legal requirements governing air pollutants released into the atmosphere.
Ignition loss	The change in mass as a result of heating waste under specified conditions. The ignition loss is expressed as a weight percentage of the dry mass.
Incineration	The controlled combustion of organic compounds of both biogenic and fossil origin. Ashes are an important by-product.
Municipal solid waste (MSW)	A heterogeneous mix of different solid waste types, usually collected by municipalities or other local authorities. MSW includes household waste, garden/park waste and commercial waste.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	1. Incineration of Solid waste that avoids emissions of methane associated with disposing organic waste in a SWDS. 2. Displacing electricity in a grid.
Calculation of reference emissions	Reference emissions are calculated from the following. 1. Methane emission from anaerobic digestion of organic waste from disposed waste. 2. GHG emissions from the grid electricity.
Calculation of project emissions	Project emissions include emissions from 1. Fossil fuel consumption associated with incineration. 2. Combustion of fossil waste. 3. CH_4 and N_2O emissions from waste combustion

Monitoring parameters	■ The amount of waste combusted.
	■ Fossil fuel consumed.
	■ Electricity supplied to the grid.

D. Eligibility criteria

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

Criterion 1	To install incinerators that combust fresh MSW that would have been treated at landfills.
Criterion 2	The project facility has boilers and turbines to generate electricity from the heat created by waste incineration.
Criterion 3	The incinerators are designed and equipped to achieve the following criteria. Ignition loss: 5% or less Yearly operational period: Longer than 7200 hours
Criterion 4	The treatment capability of an incinerator is designed to be greater than 300t/day.
Criterion 5	The project facility is designed and equipped to satisfy the "National Technical Regulation on Emission of Industrial Waste Incinerators (QCVN30:2010/BTNMT)".

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Methane emissions from SWDSs	CH_4
Grid electricity generation	CO_2
Project emissions	
Emission sources	GHG types
Fossil fuel consumption	CO_2
CO_2 emissions from fossil waste combustion	CO_2
CH_4 and N_2O emissions from waste combustion	CH_4/N_2O

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated on the basis of the amount and composition of the wastes that are fed into the incinerators, and net electricity supplied to the grid by the project.

Reference emissions from SWDSs are calculated based on First Order Decay (FOD) model. Reference emissions from grid electricity generation are calculated by multiplying the amount of electricity supplied to the grid and CO_2 emission factor.

The methodology ensures net emission reductions by including the CH_4 and N_2O emissions from waste combustion both of which are negligible in the project emissions.

F.2. Calculation of reference emissions

$$RE_p = RE_{CH4,SWDS,p} + RE_{elec,p}$$

RE_p	Reference CO_2 emissions during the period p [tCO_2/p]
$RE_{CH4,SWDS,p}$	Reference emissions occurring during period p generated from waste disposal at a SWDS during a time period ending in period p [tCO_2/p]
$RE_{elec,\,p}$	Reference emissions from grid electricity during the period p [tCO2/p]

$$RE_{CH4,SWDS,p} = \phi_p \times (1 - f_p) \times GWP_{CH4} \times (1 - OX) \times \frac{16}{12} \times F \times DOC_{f,p} \times MCF_p$$

$$\times \sum_{x=1}^{p} \sum_{j} W_{j,x} \times DOC_j \times e^{-kj(p-x)} \times (1 - e^{-kj})$$

ϕ_p	Model correction factor account for model uncertainties for the period p
f_p	Fraction of methane captured at the SWDS and flared, combusted or used in another manner that prevents the emissions of methane to the atmosphere during the period p
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)
F	Fraction of methane in the SWDS gas (volume fraction)
$DOC_{f,p}$	Fraction of degradable organic carbon (DOC) that decomposes under specific conditions occurring in the SWDS for the period p (weight fraction)
MCF_p	Methane correction factor for the period p

$W_{j,p}$	Amount of waste type j disposed or prevented from disposal in the SWDS during the period p
DOC_j	Fraction of degradable organic carbon (by weight) in the waste type j (weight fraction)
k_j	Decay rate for the waste type j
j	Type of waste in the MSW
x	Time period in which waste is disposed at the SWDS, extending from the first period in the time period ($x=1$) to period $p(x=p)$
p	Crediting period for which methane emissions are calculated

$$RE_{elec,p} = PEC_p \times EF_{grid}$$

PEC_p	Net electricity amount supplied to the grid by the project during the period p [MWh/p]
EF_{grid}	Emission Factor of the grid [tCO2/MWh]

G. Calculation of project emissions

Project emissions are calculated on the basis of monitored fossil fuel consumption, waste amount and its composition fed into the incinerators.

$$PE_p = PE_{FC,p} + PE_{COM\_CO2,p} + PE_{COM_{CH4N2O},p}$$

$PE_{FC,p}$	CO_2 emissions from fossil fuel consumption during the period p [tCO$_2$/p]
$PE_{COM\_CO2,p}$	CO_2 emissions from fossil waste combustion during the period p [tCO$_2$/p]
$PE_{COM\_CH4N2O,p}$	CH_4 and N_2O emissions from waste combustion during the period p [tCO$_2$/p]

$$PE_{FC,p} = FC_{,p} \times NCV_p \times EF_{CO2}$$

$FC_{,p}$	Amount of fossil fuel consumption during the period p[t]
NCV_p	Net calorific value of the fossil fuel[GJ/t]
EF_{CO2}	CO2 emission factor of the fossil fuel[tCO$_2$/TJ]

$$PE_{COM\_CO2,p} = EFF_{COM} \times \frac{44}{12} \times \sum_{j} Q_{j,p} \times FCC_{j,p} \times FFC_{j,p}$$

EFF_{COM}	Combustion efficiency of combustor
$Q_{j,p}$	Quantity of combusted waste type i [t]
$FCC_{j,p}$	Fraction of total carbon content in waste type j during the period p [tC/t]
$FFC_{j,p}$	Fraction of fossil carbon in total carbon content of waste type j

$$PE_{COM_{CH4N2O},p} = Q_{waste,p} \times (EF_{N2O} \times GWP_{N2O} + EF_{CH4} \times GWP_{CH4})$$

$Q_{waste,p}$	Quantity of waste fed into combustor during the period p [t]
EF_{N2O}	Emission factor of N_2O associated with combustion [tN_2O/t waste]
GWP_{N2O}	Global Warming Potential of N_2O
EF_{CH4}	Emission factor of CH_4 associated with combustion [tCH4/t waste]
GWP_{CH4}	Global Warming Potential of CH_4

H. Calculation of emissions reductions

Emission reductions are calculated as the difference between the reference emissions and project emissions, as follows:

$$ER_p = RE_p - PE_p$$

ER_p	GHG emission reductions 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
NCV_p	Net Calorific Value of fossil fuel [GJ/t]	IPCC 2006 Guidelines for National Greenhouse Gas Inventories

EF_{co2}	CO2 emissions factor for fossil fuel (diesel) [tCO_2/GJ]	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
EF_{grid}	CO2 emissions factor of electricity [tCO2/MWh]	Ministry of Natural Resources and Environment, Vietnam/MONRE
Φ	Model correction factor account for model uncertainties	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
GWP_{CH4}	Global Warming Potential of methane	IPCC Fourth Assessment Report
OX	Oxidation factor (reflecting the amount of methane from SWDS that is oxidized in the soil or other material covering the waste)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
F	Fraction of methane in the SWDS gas (volume fraction)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
DOCf	Fraction of degradable organic carbon (DOC) that decomposes under specific conditions occurring in the SWDS (weight fraction)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
MCF	Methane correction factor	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
DOCj	Fraction of degradable organic carbon (by weight) in the waste type j (weight fraction)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
kj	Decay rate for the waste type j (1/year)	IPCC 2006 Guidelines for National Greenhouse Gas Inventories
$FCC_{j,p}$	Fraction of total carbon content in waste type j	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
FFC_j	Fraction of fossil carbon in total carbon content of waste type j	CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
EF_{N2O}	Emission factor of N_2O associated with	CDM Methodological Tool

		combustion	"Emissions from solid waste disposal site"(version 06.0.1)
GWP_{N2O}	Global Warming Potential of N_2O		CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
EF_{CH4}	Emission factor of CH_4 associated with combustion		CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
GWP_{CH4}	Global Warming Potential of CH_4		CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)
EFF_{COM}	Combustion efficiency of combustor		CDM Methodological Tool "Emissions from solid waste disposal site"(version 06.0.1)