JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Republic of the Union of Myanmar
Name of the methodology proponents submitting this form	Nippon Koei Co., Ltd.
Sectoral scope(s) to which the Proposed Methodology applies	3. Energy demand
Title of the proposed methodology, and version number	Energy Saving by Introduction of High Efficiency Once-through Boiler, ver.01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information
Date of completion	26/02/2019

History of the proposed methodology

Version	Date	Contents revised
01.0	26/02/2019	First Edition

A. Title of the methodology

Energy Saving by Introduction of High Efficiency Once-through Boiler, Version.01.0

B. Terms and definitions

Terms	Definitions
Once-through boiler	A once-through boiler is a boiler without recirculation where water flows through the economizer, furnace wall, and evaporating and superheating tubes, sequentially. Once-through boiler is used to supply heat in factory and commercial facility.
Periodical check	Periodical check is a scheduled examination of the project boiler conducted by manufacturer or agent who is authorized by the manufacturer in order to maintain performance of the boiler.
Boiler efficiency	Boiler efficiency is the percentage of heat quantity used to generate steam against total heat quantity provided by a fuel.
Fuel switching	Fuel switching involves the change of boiler fuel from the one with higher CO_2 emissions factor to lower CO_2 emission factor (i.e. from coal to natural gas).

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	This methodology involves the installation of high efficiency once-through boiler. Compared with the water tube boilers and fire tube boilers which dominate Myanmar market, the efficiency of once-through boiler is higher and fuel consumption is less. Thus the introduction of once-through boiler will contribute to the GHG emission reductions.
Calculation of reference	Reference emissions are calculated based on the efficiency of

emissions	the boiler currently dominant in the Myanmar market. Conservative estimation of reference emissions is made by taking the following points into consideration: (i) lower CO_2 emission factor is selected from IPCC guideline with regard to the fuel used in reference boiler, and (ii) higher efficiency is applied for the reference boiler especially in low load range.
Calculation of project emissions	Project emissions are calculated on the basis of monitored fuel consumption and emission factor of the fuel of the project boiler.
Monitoring parameters	The amount of fuel consumption

D. Eligibility criteria

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

Criterion 1	The project boiler is a once-through boiler with a rated capacity of 7 ton/hour per unit or less (equivalent evaporation)
Criterion 2	Periodical check and maintenance by the manufacturer of boiler or authorized agent is implemented at least once a year.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Fuel consumption by reference boiler	CO_2
Project emissions	
Emission sources	GHG types
Fuel consumption by project boiler	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated based on the efficiency of the water tube and fire tube boilers which dominate the boiler market for industries in Myanmar. The fuel types widely used in Myanmar are oil, followed by coal. Natural gas is mainly used in power sector and not

distributed to private industry sector.
In order to ensure net emission reductions, a higher efficiency of the reference boiler (89%) is adopted to calculate the reference emissions. In addition, 1) compared with reference boiler (oil and gas type), once-through boiler (project boiler, oil and gas type) can maintain high efficiency even at low load range, which improves the operating efficiency of project boiler, and 2) compared with reference boiler (coal), operational efficiency of the project boiler is higher due to better combustion control, which also ensures the net emission reductions. In addition, to calculate the reference emission conservatively, lower emission factor stated in 2006 IPCC guidelines is adopted to secure the net emission reductions.

F.2. Calculation of reference emissions

$$RE_p = \sum_i \sum_j \left(FC_{p,i,j,PJ} \times NCV_{i,j,PJ} \times EF_{RE} \times \frac{\eta_{i,PJ}}{\eta_{RE}} \right)$$

RE_p : Reference emissions during the period *p* [tCO_2/p]
$FC_{p,i,j,PJ}$: The amount of fuel consumption of project boiler *i* for the fuel type *j* during the period *p* [mass or volume unit/p]
$NCV_{i,j,PJ}$: Net calorific value of fuel used by project boiler *i* for the fuel type *j* [GJ/mass or volume unit]
EF_{RE} : CO_2 emission factor of fuel used by reference boiler [tCO_2/GJ]
$\eta_{i,PJ}$: Efficiency of project boiler *i* [-]
η_{RE} : Efficiency of reference boiler [-]

G. Calculation of project emissions

$$PE_p = \sum_i \sum_j \left(FC_{p,i,j,PJ} \times NCV_{i,j,PJ} \times EF_{i,j,PJ} \right)$$

PE_p : Project emissions during the period *p* [tCO_2/p]
$FC_{p,i,j,PJ}$: The amount of fuel consumption of project boiler *i* for the fuel type *j* during the period *p* [mass or volume unit]
$NCV_{i,j,PJ}$: Net calorific value of fuel used by project boiler *i* for the fuel type *j* [GJ/mass or volume unit]
$EF_{i,j,PJ}$: CO_2 emission factor of fuel used by project boiler *i* for the fuel type *j* [tCO_2/GJ]

H. Calculation of emissions reductions

$$\mathbf{ER_p = RE_p - PE_p}$$

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
$NCV_{i,j,PJ}$	Net calorific value of fuel used by project boiler *i* for the fuel type *j* [GJ/mass or volume unit]	In order of preference: (1) Net calorific value (lower heating value) provided by fuel supplier or boiler manufacturer, (2) IPCC default values at the lower limit in Table 1.2 of Chapter 1 of Vol. 2 of the "2006 IPCC Guidelines for National GHG Inventories"
$EF_{i,j,PJ}$	CO_2 emission factor of fuel used by the project boiler *i* for the fuel type *j* [tCO_2/GJ]	IPCC default value from Table 1.4 of Chapter 1 of Vol. 2 of the "2006 IPCC Guidelines for National GHG Inventories"
EF_{RE}	CO_2 emission factor of fuel used by the reference boiler [tCO_2/GJ] In case the project boiler replaces an existing boiler, or a planned boiler of which plan has been officially approved such as through boiler installation permit or initial environmental examination/ environmental impact assessment, the fuel of the existing or planned boiler is applied.	IPCC default value from Table 1.4 of Chapter 1 of Vol. 2 of the "2006 IPCC Guidelines for National GHG Inventories"

	Otherwise, the value is the same as $EF_{i,j,PJ}$.	
$\eta_{i,PJ}$	Efficiency of project boiler *i* [-]	Specifications of the project boiler or factory test data of the project boiler by the manufacturer
η_{RE}	Efficiency of reference boiler [-] The default value of η_{RE} is set as 0.89.	[Additional information] Market survey in Myanmar