Joint Crediting Mechanism Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Indonesia
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 Centrifugal Chiller
List of documents to be attached to this form (please check):	☐ The attached draft JCM-PDD: ☒ Additional information
Date of completion	29/04/2014

History of the proposed methodology

Version	Date	Contents revised
1.0	30/04/2014	First edition

A. Title of the methodology

Energy Saving by Introduction of High Efficiency Centrifugal Chiller

B. Terms and definitions

Terms	Definitions
Centrifugal chiller	A centrifugal chiller is a chiller applying a centrifugal compressor. It is commonly used for air-conditioning with huge cooling load, e.g., buildings, shopping malls or factories etc.
Cooling capacity	Cooling capacity is the ability of individual chiller to remove heat. In this methodology, "cooling capacity" is used to represent a cooling capacity per one chiller unit and not for a system with multiple chiller units.
Periodical check	Periodical check is a periodical investigation of chiller done by manufacturer or agent who is authorized by the manufacturer, in order to maintain chiller performance.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	This methodology applies to the project that aims for saving energy by introducing high efficiency centrifugal chiller for the target factory, commerce facilities etc. in Indonesia.
Calculation of reference emissions	Reference emissions are GHG emissions from using reference chiller, calculated with power consumption of project chiller, ratio of COPs (Coefficient Of Performance) of reference/project chillers and grid emission factor.
Calculation of project emissions	Project emissions are GHG emissions from using project chiller, calculated with power consumption of project chiller and grid emission factor.
Monitoring parameter	Power consumption of project chiller

D. Eligibility criteria

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

Criterion 1	Project chiller is a centrifugal chiller with a capacity of less than 1,250 USRt. * 1 USRt = 3.52 kW
Criterion 2	COP for project chiller is more than 6.0 in specifications of project chiller prepared for the quotation or factory acceptance test data at the time of shipment by manufacturer. In this methodology, the following temperature conditions are applied in order to calculate COP: *Note : Temperature conditions to calculate COP.* *Chilled water: output 7 degree Celsius* *input 12 degree Celsius* *Cooling water: output 37 degree Celsius* *input 32 degree Celsius*
Criterion 3	Periodical check is planned more than four (4) times annually.
Criterion 4	Ozone Depletion Potential (ODP) of the refrigerant used for project chiller is zero.
Criterion 5	Plan for not releasing refrigerant used for project chiller is prepared. In the case of replacing the existing chiller with the project chiller, refrigerant used for the existing chiller is not released to the air.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Power consumption by reference chiller	CO_2
Project emissions	
Emission sources	GHG types
Power consumption by project chiller	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated by multiplying power consumption of project chiller, ratio of COPs for reference/project chillers, and grid emission factor.

The COP of reference chiller is conservatively set as a default value in the following manner to ensure the net emission reductions:

1. The COP value tends to increase as the cooling capacity becomes larger.
2. The reference COP, which has a certain cooling capacity, is set at a maximum value in corresponding cooling capacity range.
3. The maximum values of COP in each cooling capacity ranges are defined as $COP_{RE\_default}$ as described in Section I.

F.2. Calculation of reference emissions

$$\mathbf{RE_p} = \sum_{\mathbf{i}} \left(\mathbf{EC_{PJ,i,p}} \times \mathbf{COP_{PJ,i}} \div \mathbf{COP_{RE,i}} \times \mathbf{EF_{grid}} \right)$$

RE_p : Reference emissions during the period *p* [tCO_2/p]

$EC_{PJ,i,p}$: Power consumption of project chiller i during the period *p* [MWh/p]

$COP_{PJ,i}$: COP of project chiller i [-]

$COP_{RE,i}$: COP of reference chiller i [-]

EF_{grid} : CO_2 emission factor for an Indonesian regional grid system, from which electricity is displaced due to the project during a given time period [tCO_2/MWh]

G. Calculation of project emissions

$$\mathbf{PE_p} = \sum_{\mathbf{i}} \left(\mathbf{EC_{PJ,i,p}} \times \mathbf{EF_{grid}} \right)$$

PE_p : Project emissions during the period *p* [tCO_2/p]

$EC_{PJ,i,p}$: Power consumption of project chiller i during the period *p* [MWh/p]

EF_{grid} : CO_2 emission factor for an Indonesian regional grid system, from which electricity is displaced due to the project during a given time period [tCO_2/MWh]

H. Calculation of emissions reductions

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

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
EF_{grid}	CO_2 emission factor for an Indonesian regional grid system, from which electricity is displaced due to the project during a given time period	The most recent value available at the time of validation is applied and fixed for the monitoring period thereafter. The data is sourced from "Emission Factors of Electricity Interconnection Systems", National Committee on Clean Development

<table>
<tr><th>Parameter</th><th>Description of data</th><th>Source</th></tr>
<tr><td></td><td></td><td>Mechanism Indonesian DNA for CDM unless otherwise instructed by the Joint Committee.</td></tr>
<tr><td>$COP_{RE,i}$</td><td>The COP value of the reference chiller i is calculated from the following equation, applying the default COP value ($COP_{RE\_default}$) selected from the following table in accordance with cooling capacity of the project chiller i and the temperatures of cooling and chilled water of the project condition:

$COP_{RE,i} = COP_{RE\_default} \times 33.0 \div (T_{cooling-out} - T_{chilled-out} + 3.0)$
$COP_{RE\_default}$: COP of reference chiller under the following standard temperature conditions
$T_{cooling-out}$: Cooling water temperature, output
$T_{chilled-out}$: Chilled water temperature, output
Chilled water: output 7 degree Celsius
input 12 degree Celsius
Cooling water: output 37 degree Celsius
input 32 degree Celsius

$COP_{RE\_default}$<table><tr><th>Cooling capacity /unit (USRt)</th><th>x<300</th><th>300≦ x<450</th><th>450≦ x<500</th><th>500≦ x<700</th><th>700≦ x<1,250</th></tr><tr><td>$COP_{RE\_default}$</td><td>4.92</td><td>5.33</td><td>5.59</td><td>5.85</td><td>5.94</td></tr></table></td><td>Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer in line with the project conditions</td></tr>
<tr><td>$COP_{PJ,i}$</td><td>The COP value of project chiller i is calculated and set under the project temperature condition.</td><td>Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer in line with the project conditions</td></tr>
</table>