Joint Crediting Mechanism Approved Methodology LA_AM001

"Installation and operation of energy-efficient data center (DC) in the Lao PDR"

A. Title of the methodology

Installation and operation of energy-efficient data center (DC) in the Lao PDR, Version 01.0

B. Terms and definitions

Terms	Definitions
Project Data Center (Project DC)	Freight container which is transportable by container truck/trailer and is outfitted with components including server racks, power supplies, communication wirings, cooling facilities, fire-extinguishing facilities, and the following features: - Outside-air cooling method - Remote management system - Automatic switching
Outside-air cooling method	A method of cooling which utilizes outside air efficiently. This involves direct intake of the outside air to inside of the DC in order to cool the room temperature to maintain the DC-recommended temperature condition.
Remote management system	A system which remotely monitors and controls the temperature and electricity consumption of the project DC to control a variety of equipment including cooling and IT equipment and to achieve stable operation automatically without using human on-site monitoring or operation, in order to avoid energy loss caused by manual operation, such as door opening and closing to operate manually and adopt the method to automatically reduce energy consumption losses for maintenance.
Automatic switching	A system to automatically switch on the refrigerated air conditioning system when the cooling capacity of the outside air is not sufficient to meet the recommended temperature condition.
DC-recommended temperature condition	The recommended temperature condition for IT equipment operation which is established by the manufacturers.
Power Usage	PUE is the metric to show the efficiency of DC power use. PUE is

Effectiveness (PUE)	defined by the following formula; $PUE = \frac{\text{Overall electricity consumption of DC}}{\text{Electricity consumption of IT equipment of DC}}$ PUE is calculated in accordance with ISO/IEC30134-2:2016.

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Energy reduction which leads to reductions of GHG is achieved by introducing energy-efficient project DC in place of the reference DC.
Calculation of reference emissions	Reference emissions are calculated by multiplying the monitored electricity consumption of the project DC, ratio of reference DC's PUE to project DC's PUE, and the CO_2 emission factor of electricity.
Calculation of project emissions	GHG emissions associated with electricity consumption of project DC are calculated by multiplying the monitored electricity consumption of the project DC by the emission factor of electricity.
Monitoring parameters	Electricity consumption of entire project DC and IT equipment.

D. Eligibility criteria

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

Criterion 1	The project DC is newly introduced, highly efficient with designed PUE value under 1.3.
Criterion 2	The container is highly air-tight with IEC60529 value of IP-54 or higher based on manufacturer's inspection results.
Criterion 3	The project DC installs IT equipment that has operating temperature recommended by manufacturer with upper limit of 40 degrees C or higher.
Criterion 4	Ozone Depletion Potential (ODP) of the refrigerant used for the project DC is zero.
Criterion 5	A plan for not releasing refrigerant used for project DC is prepared.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Electricity consumption by reference DC	CO_2
Project emissions	
Emission sources	GHG types
Electricity consumption by project DC	CO_2

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

Reference emissions are calculated by multiplying the monitored electricity consumption of the project DC, ratio of reference DC's PUE to project DC's PUE, and the CO_2 emission factor of electricity.

In this methodology, PUE values are adopted as the efficiency indicator of DC. Net emission reductions are achieved in this methodology by conservatively setting the PUE value for the reference DC.

In this methodology, the default value of the PUE of the reference DC is conservatively set at 2.0.

The PUE of project DC is calculated with monitored electricity consumption of project DC as a whole and IT equipment of project DC.

F.2. Calculation of reference emissions

Reference emissions are calculated as follows:

$$RE_p = EC_{PJ,p} \times \left(\frac{\eta_{REF}}{\eta_{PJ,p}} \right) \times EF_{elec} \qquad (1)$$

With:

$$\eta_{PJ,p} = \frac{EC_{PJ,p}}{\sum_{i=1}^{n} EC_{IT,i,p}} \qquad (2)$$

Where:

RE_p	=	Reference emissions during the period p [tCO_2/p]
$EC_{PJ,p}$	=	Total electricity consumption of project DC during the period p [MWh/p]
$\eta_{PJ,p}$	=	Energy efficiency (PUE) of project DC during the period p [dimensionless]
η_{REF}	=	Energy efficiency (PUE) of reference DC [dimensionless]
EF_{elec}	=	CO_2 emission factor of electricity consumed [tCO_2/MWh]
$EC_{IT,i,p}$	=	Electricity consumption of IT equipment measured by electricity meter i during the period p [MWh/p]
n	=	Number of electricity meters measuring electricity consumption of IT equipment [dimensionless]
i	=	An index variable for electricity meters, measuring electricity consumption of IT equipment

G. Calculation of project emissions

Project emissions are calculated as follows:

$$PE_p = EC_{PJ,p} \times EF_{elec} \qquad (3)$$

Where:

PE_p	=	Project emissions during the period p [tCO_2/p]
$EC_{PJ,p}$	=	Total electricity consumption of project DC during the period p [MWh/p]

EF_{elec}	=	CO_2 emission factor of electricity consumed [tCO_2/MWh]	

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p \quad (4)$$

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
η_{REF}	Energy efficiency (PUE) of reference DC. Default value: 2.0	A default value provided based on a survey conducted by methodology proponent
EF_{elec}	CO_2 emission factor of electricity consumed. When captive power generation is not available at the project site, the most recent Laotian national grid emission factor is applied; When captive power generation is available at the project site, select the smaller value between the latest Laotian national grid emission factor and the emission factor of captive power generation (0.8tCO_2/MWh).	[Laotian national grid emission factor] The most recent value announced by the Ministry of Natural Resources and Environment (MONRE), DNA for CDM unless otherwise instructed by the Joint Committee. [Emission factor of captive power generation] The most recent figure of CDM approved small scale methodology: AMS-I.A.

History of the document

Version	Date	Contents revised
01.0	14 October 2016	JC2, Annex 8 Initial approval.