JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	The Republic of the Philippines
Name of the methodology proponents submitting this form	Institute for Global Environmental Strategies
Sectoral scope(s) to which the Proposed Methodology applies	1. Energy industries (renewable-/non-renewable sources)
Title of the proposed methodology, and version number	Electricity generation by installation of run-of-river hydro power generation system(s) in the Philippines, Version 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information 1) Explanatory note about additional information on calculation the emission factors of the Philippines for the JCM
Date of completion	23/10/2019

History of the proposed methodology

Version	Date	Contents revised
01.0	23/10/2019	First edition

A. Title of the methodology

Electricity generation by installation of run-of-river hydro power generation system(s) in the Philippines, Version 01.0

B. Terms and definitions

Terms	Definitions
Run-of-river hydro power generation system	A system of power generation that uses water running in a river or a waterway directly into power generation unit without storing water in a dam[1].

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Displacement of grid electricity and/or captive electricity by installation and operation of run-of-river hydro power generation system(s).
Calculation of reference emissions	Reference emissions are calculated on the basis of the electricity output of the run-of-river hydro power generation system(s) multiplied by the conservative emission factor.
Calculation of project emissions	Project emissions are the emissions from the run-of-river hydro power generation system(s), which are assumed to be zero.
Monitoring parameters	The quantity of the electricity generated by the project run-of-river hydro power generation system(s).

D. Eligibility criteria

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

Criterion 1	The project installs a run-of-river hydro power generation system(s).

E. Emission Sources and GHG types

[1] A dam is defined as a structure built across a river with a height of 15m or more from its foundation.

Reference emissions	
Emission sources	GHG types
Consumption of grid electricity and/or captive electricity	CO_2
Project emissions	
Emission sources	GHG types
Generation of electricity from run-of-river hydro power generation system(s)	N/A

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

The default emission factor is set in a conservative manner for the Philippines regional grids: Luzon-Visayas and Mindanao systems.

The emission factor is calculated based on the conservative operating margin that reflects on the latest electricity mix including low cost/must run (LCMR) resources for each regional grid in the Philippines during 2015-2017 and refers to the conservative emission factor of each fossil fuel power plant in order to secure net emission reductions.

The conservative emission factor of each plant is calculated to be 0.826 tCO_2/MWh for coal-fired power plant and 0.326 tCO_2/MWh for gas-fired power plant based on the survey on heat efficiency of power plant in the Philippines. The emission factor for diesel power plant is calculated to be 0.533 tCO_2/MWh based on a default heat efficiency of 49%, an efficiency level which is above the value of the world's leading diesel power generators.

In case the run-of-river hydro power generation system(s) in a proposed project activity is directly connected to a regional grid or connected to a regional grid via an internal grid not connecting to a captive power generator (Case 1), the value of operating margin including LCMR resources, using the best heat efficiency among currently operational plants in the Philippines in calculating emission factors of fossil fuel power plants, are applied. The emission factors to be applied are set as "Emission factor for Case 1 (tCO_2/MWh)" in Section I. below.

In case the run-of-river hydro power generation system(s) in a proposed project activity is connected to an internal grid connecting to both a regional grid and a captive power generator (Case 2), the lower value between emission factors of "Emission factor for Case 1

(tCO_2/MWh)" shown in Section I below and the conservative emission factor of diesel-fired power plant of 0.533 tCO_2/MWh is applied. The emission factors to be applied are set as "Emission factor for Case 2 (tCO_2/MWh)" in Section I. below.

In the case that the run-of-river hydro power generation system(s) in a proposed project activity is only connected to an internal grid connecting to a captive power generator (Case 3), the emission factor of a diesel generator calculated by applying the most efficient heat efficiency of 49%, an efficiency level which is above the value of the world's leading diesel generator is applied, which is set as 0.533 tCO_2/MWh.

The emission factors for each case are shown in Section I.

F.2. Calculation of reference emissions

$$RE_p = \sum_i \left(EG_{i,p} \times EF_{RE,i}\right)$$

RE_p : Reference emissions during the period *p* [tCO_2/p]
$EG_{i,p}$: Quantity of electricity generated by the project run-of-river hydro power generation system *i* during period *p* [MWh/p]
$EF_{RE.i}$: Reference CO_2 emission factor for the project run-of-river hydro power generation system *i* [tCO_2/MWh]

G. Calculation of project emissions

$$PE_p = 0$$

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

H. Calculation of emissions reductions

$$ER_p = RE_p - PE_p$$
$$= RE_p$$

ER_p : Emission reductions during period *p* [tCO_2/p]
RE_p : Reference emissions during period *p* [tCO_2/p]
PE_p : Project emissions during 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
$EF_{RE,i}$	The reference CO_2 emission factor for the project run-of-river hydro power generation system *i*. The value for $EF_{RE,i}$ is selected from the emission factor based on the regional grid ($EF_{RE,grid}$) or based on a captive diesel power generator ($EF_{RE,cap}$) in the following manner: In case the run-of-river hydro power generation system(s) in a proposed project activity is connected to a regional grid including through internal grid which is not connected to a captive power generator (Case 1), $EF_{RE,grid}$ is set as follows: Emission factor for Case 1 (tCO_2/MWh) Regional grid name: Emission factor for Case 1: Luzon-Visayas 0.507 tCO_2/MWh Mindanao 0.468 tCO_2/MWh In case the run-of-river hydro power generation system(s) in a proposed project activity is connected to an internal grid connected to both a regional grid and a captive power generator (Case 2), $EF_{RE,grid}$ is set as follows: Emission factor for Case 2 (tCO_2/MWh) Regional grid name: Emission factor for Case 1: Luzon-Visayas 0.507 tCO_2/MWh Mindanao 0.468 tCO_2/MWh In case the run-of-river hydro power generation	Additional information The default emission factor is obtained from a study of electricity systems in the Philippines and the most efficient diesel power generator (a default value of 49% heat efficiency is above the value of the world's leading diesel generator). The default value is revised if deemed necessary by the JC.

	system(s) in a proposed project activity is connected to an internal grid which is not connected to the regional grid, and only connected to a captive power generator (Case 3), $EF_{RE,cap}$, 0.533 tCO_2/MWh is applied.	