JCM 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	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	Installation of Solar PV System, Ver. 01.0
List of documents to be attached to this form (please check):	☐The attached draft JCM-PDD: ☒Additional information
Date of completion	15/02/2017

History of the proposed methodology

Version	Date	Contents revised
01.0	15/02/2017	First edition

A. Title of the methodology

Installation of Solar PV System, Ver. 01.0

B. Terms and definitions

Terms	Definitions
Solar photovoltaic (PV) system	An electricity generation system which converts sunlight into electricity by the use of photovoltaic (PV) modules. The system also includes ancillary equipment such as inverters required to change the electrical current from direct current (DC) to alternating current (AC).

C. Summary of the methodology

Items	Summary
GHG emission reduction measures	Displacement of grid electricity and/or captive electricity by installation and operation of solar PV system(s).
Calculation of reference emissions	Reference emissions are calculated on the basis of the AC output of the solar PV system(s) multiplied by either; 1) conservative emission factor of the grid, or 2) conservative emission factor of the captive diesel power generator.
Calculation of project emissions	Project emissions are the emissions from the solar PV system(s), which are assumed to be zero.
Monitoring parameters	The quantity of the electricity generated by the project solar PV system(s).

D. Eligibility criteria

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

Criterion 1	The project newly installs solar PV system(s).
Criterion 2	The PV modules are certified for design qualifications (IEC 61215, IEC 61646 or IEC 62108) and safety qualification (IEC 61730-1 and IEC 61730-2).
Criterion 3	The equipment to monitor output power of the solar PV system(s) and

	irradiance is installed at the project site.

E. Emission Sources and GHG types

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 the solar PV 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 Indonesian regional grids. The emission factor is calculated based on the conservative operating margin that reflects on the latest electricity mix including low cost/must run resources for each regional grid in Indonesia during 2012-2014 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 0.795 t-CO_2/MWh for coal-fired power plant and 0.320 t-CO_2/MWh for gas-fired power plant based on the survey on heat efficiency of power plant in Indonesia. The emission factor for diesel power plant is calculated to be 0.533 t-CO_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 PV system(s) in a proposed project activity is directly connected or connected via an internal grid, not connecting to a captive power generator, to a regional grid (PV Case 1), the value of operating margin including LCMR resources, using the best heat efficiency among currently operational plants in Indonesia in calculating emission factors of fossil fuel power plants, are applied.

In the case the PV system(s) in a proposed project activity is connected to an internal grid connecting to both a regional grid and a captive power generator (PV Case 2), the lower values between emission factors as shown in column "Emission factor for PV Case 1 (t-CO_2/MWh)" of Table 1 of the additional information and the conservative emission factors of diesel-fired

power plant of 0.533 t-CO_2/MWh is applied. The emission factors to be applied are shown in column "Emission factor for PV Case 2 (t-CO_2/MWh)" of Table 1 of the additional information.

In the case that the PV system(s) in a proposed project activity is only connected to an internal grid connecting to a captive power generator (PV Case 3), the emission factor of a diesel generator calculated by applying the most efficient heat efficiency of 49%, an efficiency level which has not been achieved yet by the world's leading diesel generator is applied, which is set to 0.533 tCO_2/MWh.

The result of emission factors for each case is 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 the electricity generated by the project solar PV system *i* during the period *p* [MWh/p]
$EF_{RE,i}$: Reference CO_2 emission factor for the project solar PV system *i* [tCO_2/MWh]

G. Calculation of project emissions

$PE_p = 0$
PE_p : Project emissions during the period *p* [tCO_2/p]

H. Calculation of emissions reductions

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

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
$EF_{RE,\ i}$	Reference CO_2 emission factor for the project solar PV 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 captive diesel power generator ($EF_{RE,cap}$) in the following manner: In case the PV system(s) in a proposed project activity, which is directly connected or connected via an internal grid not connecting to a captive power generator (PV Case 1), to a regional grid, $EF_{RE,grid}$ is set as following: Jamali grid 0.590 tCO_2/MWh Sumatra grid 0.483 tCO_2/MWh Batam grid 0.627 tCO_2/MWh Khatulistiwa, Barito grids 0.600 tCO_2/MWh Mahakam grid 0.522 tCO_2/MWh Sulawesi Island grids 0.353 tCO_2/MWh Lombok, Bima, Sumbawa grids 0.551 tCO_2/MWh Kupang. Ende, Maumere, Waingapu grids 0.515 tCO_2/MWh Ambon, Tual, Masohi grids 0.533 tCO_2/MWh Ternate grid 0.532 tCO_2/MWh In case the PV system(s) in a proposed project activity, which is connected to an internal grid connecting to both a regional grid and a captive power generator (PV Case 2), $EF_{RE,grid}$ is set as following: Jamali grid 0.533 tCO_2/MWh Sumatra grid 0.483 tCO_2/MWh Batam grid 0.533 tCO_2/MWh Khatulistiwa, Barito grids 0.533 tCO_2/MWh Mahakam grid 0.522 tCO_2/MWh Sulawesi Island grids 0.353 tCO_2/MWh Lombok, Bima, Sumbawa grids 0.533 tCO_2/MWh Kupang. Ende, Maumere, Waingapu grids 0.515 tCO_2/MWh Ambon, Tual, Masohi grids 0.533 tCO_2/MWh	Additional information The default emission factor value is obtained from a study of electricity systems in Indonesia and the most efficient diesel power generator (49% heat efficiency). The default value is revised if deemed necessary by the JC.

	Ternate grid 0.532 tCO_2/MWh In case the PV system(s) in a proposed project activity is connected to an internal grid which is not connected to the regional grid (PV Case 3), $EF_{RE,cap}$, 0.533 tCO_2/MWh is applied.	