MRV Methodology Title: "Introducing Hybrid System to Stabilize PV Power Generation in Indonesia"**(Draft Ver. 3.0)**

Note: This methodology is drafted as the result of the GEC's JCM Demonstration/Feasibility Study in JFY2012. Therefore, this draft methodology is not officially approved by any governments involved in JCM, and is subject to change in the future.

0. Precedent Approved Methodologies

System Component	Framework	Meth Number	Meth Title
Solar Power Generation	CDM	ACM0002	Consolidated baseline methodology for grid-connected electricity generation from renewable sources
	CDM	AMS-I.D.	Grid connected renewable electricity generation
Diesel Engine Power Generation	CDM	ACM0013	Construction and operation of new grid connected fossil fuel fired power plants using a less GHG intensive technology
	CDM	AMS-II.B.	Supply side energy efficiency improvements – generation
-	CDM	-	Tool to calculate the emission factor for an electricity system

1. Title of the Methodology

"Introducing Hybrid System to Stabilize PV Power Generation in Indonesia"

2. Summary of the Methodology

This methodology is applicable to projects designed to install "PV/Diesel Engine Hybrid System" generating electricity in Indonesia, which is consumed in the same country. The hybrid system is the combination of (1) PV system and (2) diesel-engine power generator system.

On the electricity generated by using (1) PV system, it replaces the grid-connected power or off-grid power supplied directly to the customers, generated mainly by fossil fuels in the future under the reference scenario, which leads to the reduction of all CO2 emissions related to the related power generation.

On the electricity generated by using (2) diesel-engine power generator system, it reduces fuel consumption in the grid-connected power stations or off-grid power generators as a result of difference of the efficiencies between reference scenario and project scenario, which leads to the reduction of all CO2 emissions related to the related power generation. (see **Figure 1**.)

Furthermore, the diesel-engine used in the project can accept bio-fuel by 100% (mixed combustion of both fossil fuel and bio-fuel is impossible; the ratio of bio-fuel is 0% or 100%), in that case the project CO2 emissions related to (2) above is regarded as zero. (see Figure 2.)

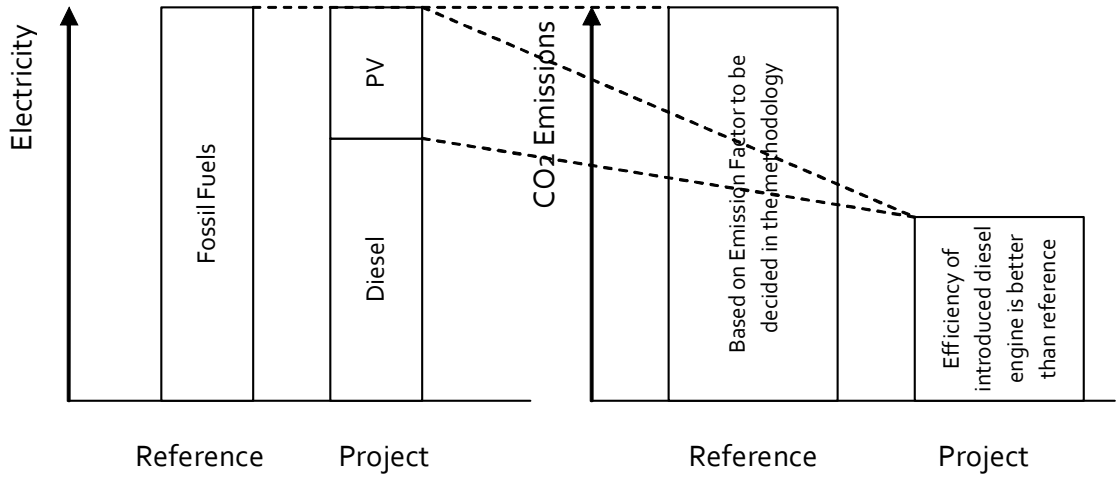


Figure 1 Emission reduction (ratio of bio-fuel is 0%)

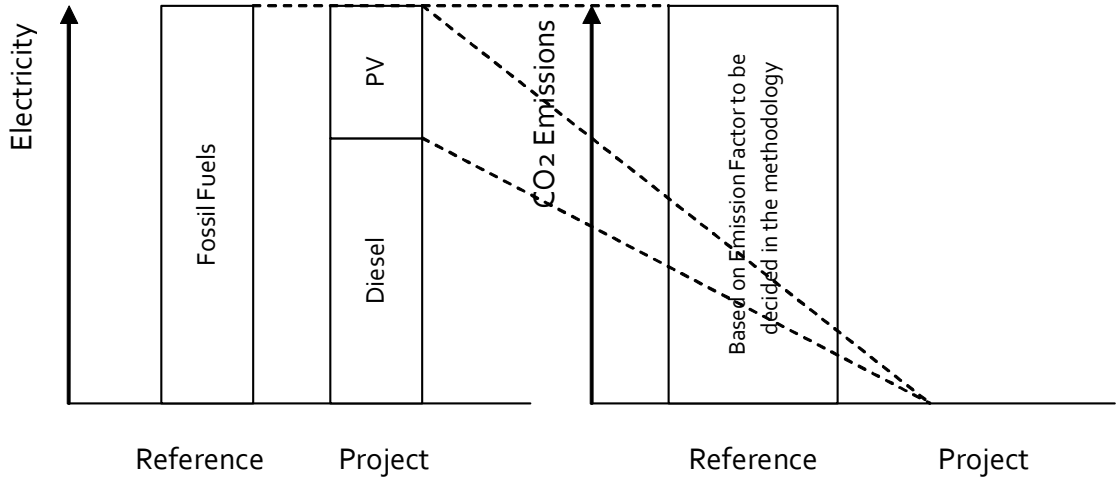


Figure 2 Emission reduction (ratio of bio-fuel is 100%)

3. Eligibility Criteria

Applicability Conditions

This methodology is applicable to projects that satisfy either of the following cases.

		Check
Case 1	install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant)	☐
Case 2	involve a capacity addition	☐
Case 3	involve a replacement of (an) existing plant(s)	☐

Eligibility Criteria: Technology to be applied (Positive List)

In addition, this methodology is applicable to projects that satisfy all of the following technological features and characteristics of the hybrid system.

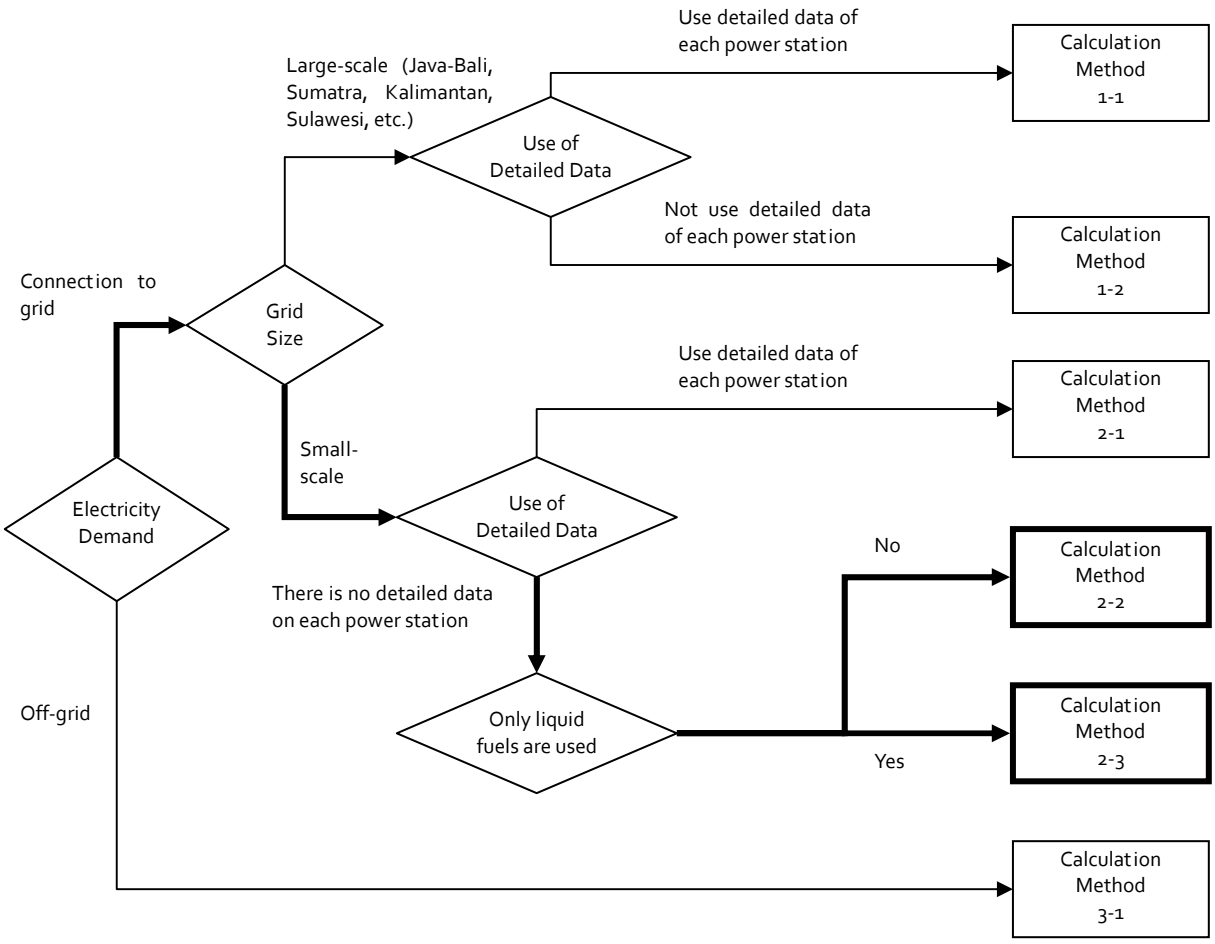
		Check
Case 1	Provide base-load electricity by operating the software to compensate the fluctuation of PV power output and to stabilize the total power output of the hybrid system	☐
Case 2	Apply low-load type diesel power generator and CIS type PV panel	☐
Case 3	Keep the usage of battery for stabilizing the power output supplementary or no usage	☐

4. Selection of Calculation Method

To calculate the reference emission, the project developer must refer to the calculation method best suited for his/her project type, using the emission factor (EF), judged by both (1) grid size and (2) usage of default value, using the flow chart below. (see Figure 3 and Table 1.)
On (1), the grid size is regarded as large if it is owned and managed by PLN.
On (2), in case of using default value, CO2 reduction amount must be calculated in a conservative manner.
As a principle, CO2 emission factor is fixed as ex-ante.

Table 1 CO2 emission factor used in each calculation method

Calculation Method	CO2 Emission Factor (in t CO2/MWh)	Calculation or Default
1-1	CM (Combined Margin) calculated according to "Tool to calculate the emission factor for an electricity system" of CDM	Calculation
1-2	CM (Combined Margin) calculated and published by the Indonesian government	Default value
2-1	CM (Combined Margin) calculated according to "Tool to calculate the emission factor for an electricity system" of CDM	Calculation
2-2	The weighted average emissions of the current generation mix.	Calculation
2-3	Emission factors for a modern diesel generating unit of the relevant capacity operating at optimal load	Default value
3-1	The same with 2-2 or 2-3 above	Calculation or Default



* Bold Line: Main type to apply the MRV methodology

Figure 3 Selecting the calculation method (CO2 emission factor)

5. Necessary Data for Calculation

The data that requires presetting in the planning stage of the project or monitoring after the start of the project is determined below based on the calculation method selected in section 4. If the data shown below is imported, a calculation tool is provided in this methodology that will allow you to measure emission reductions.

5.1 Calculation method 1-1: Large-scale grid / detailed data

(1) Monitoring and input after project starts

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"		tCO2/MWh

(2) In the planning stage, enter the data to determine …. of the reference

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Quantity of net electricity generation using diesel engine that is		MWh/y

produced and fed to the grid as a result of the implementation of the project activity annually		
Combined margin CO2 emission factor for grid connected power generation in the latest year calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"		tCO2/MWh

5.2 Calculation method 1-2: Large-scale grid / default data

(1) Monitoring and input after project starts

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Combined margin CO2 emission factor for grid connected power generation in year y calculated and published by the Indonesian government		tCO2/MWh

(2) In the planning stage, enter the data to determine …. of the reference

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Combined margin CO2 emission factor for grid connected power generation in the latest year calculated and published by the Indonesian government		tCO2/MWh

5.3 Calculation method 2-1: Small-scale grid / detailed data

(1) Monitoring and input after project starts

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Combined margin CO2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"		tCO2/MWh

(2) In the planning stage, enter the data to determine …. of the reference

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Combined margin CO2 emission factor for grid connected power generation in the latest year calculated using the latest version of the "Tool to calculate the emission factor for an electricity system"		tCO2/MWh

5.4 Calculation method 2-2: Small-scale grid / without detailed data

(1) Monitoring and input after project starts

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is		MWh/y

produced and fed to the grid as a result of the implementation of the project activity in year y		
Weighted average emission factor of the generation mix in year y		tCO2/MWh

(2) In the planning stage, enter the data to determine …. of the reference

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Weighted average emission factor of the generation mix in the latest year		tCO2/MWh

5.5 Calculation method 2-3: Small-scale grid / default data

(1) Monitoring and input after project starts

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity in year y		MWh/y
Emission factor for diesel generator systems for three different levels of load factors		tCO2/MWh

(2) In the planning stage, enter the data to determine …. of the reference

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to the grid as a result of the implementation of the project activity annually		MWh/y
Emission factor for diesel generator systems for three different levels of load factors		tCO2/MWh

5.6 Calculation method 3-1: Off-grid

(1) Monitoring and input after project starts

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to direct customer(s) as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to direct customer(s) as a result of the implementation of the project activity in year y		MWh/y
Weighted average emission factor of the generation mix in year y		tCO2/MWh
Emission factor for diesel generator systems for three different levels of load factors		tCO2/MWh

(2) In the planning stage, enter the data to determine …. of the reference

Description of data	Value	Units
Quantity of net electricity generation that is produced and fed to direct customer(s) as a result of the implementation of the project activity in year y		MWh/y
Quantity of net electricity generation using diesel engine that is produced and fed to direct customer(s) as a result of the implementation of the project activity in year y		MWh/y
Weighted average emission factor of the generation mix in the latest year		tCO2/MWh

Emission factor for diesel generator systems for three different levels of load factors		tCO2/MWh

6. Terms and Definitions

Term	Definition
Hybrid system	The system uses a combination of a diesel engine and a solar power generation. By utilizing an inverter and a controller, the total power output can be stabilized.

7. Project Boundaries

The project boundary shall include the following GHG emission sources and GHG emissions.

- CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity
- CO2 emissions from combustion of fossil fuels for electricity generation in the hybrid system

8. Reference Scenario

8.1 Connection to grid

If the project activity is the installation of a new grid-connected renewable power plant/unit or a capacity addition to / the replacement of existing grid-connected renewable power plant/unit, the reference scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the CO2 emission factor (EF) calculations, decided by the following procedure.

8.2 Off-grid

If the project activity is the installation of a new off-grid renewable power plant/unit or a capacity addition directly delivered to the customer(s), the reference scenario is the following:

Electricity delivered to the customer(s) by the project activity would have otherwise been generated by the operation of power plant(s) and by the addition of new generation sources, as reflected in the CO2 emission factor (EF) calculations, decided by the following procedure.

8.3 The proposed project

In the Nias Island, the hybrid system plans to be connected to the small-sized grid. Currently only diesel engines are operating. Although there are plans to introduce coal-fired plant, coal-gassification plant and replacement of diesel engines in the near future, they are not fixed yet.

Hence Calculation Method 2-2 or 2-3 can be applied for the ex-ante calculation, and 2-2 can be applied for the ex-post calculation if fossil fuels except for liquid are used in the future.

9. Reference Emissions and Calculation

The reference emissions are calculated using the equations below, reflecting the CO2 emission factor (EF) for each calculation method.

$REy = EG_{PJ,y} \times EF_y$

Where:

RE_y	Reference CO2 emissions in year y [tCO2/y]
$EG_{PJ,y}$	Quantity of net electricity generation that is produced and fed to the grid or to direct customer(s) as a result of the implementation of the project activity in year y [MWh/y]
EF_y	CO2 emissions factor (EF) in year y [tCO2/MWh]

9.1 Calculation method 1-1: Large-scale grid / detailed data

If there is detailed data on each power station connected to the large-scale grid, the project developer can calculate CO2 emissions factor (EF) in year y for the connected grid as the combined margin (CM) in the same manner with CDM, using the latest version of the "Tool to calculate the emission factor for an electricity system".

9.2 Calculation method 1-2: Large-scale grid / default data

If there is not detailed data on each power station connected to the large-scale grid or hard to collect the data, the project developer can decide CO2 emissions factor (EF) in year y for the connected grid by using the latest data of the combined margin (CM) for each grid [default value], calculated and published by the Indonesian government.

Generally under the framework of CDM ("Tool to calculate the emission factor for an electricity system"), the combined margin emissions factor is calculated as follows:

$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$

Where:

$EF_{grid,BM,y}$	Build margin CO2 emission factor in year y (tCO2/MWh)
$EF_{grid,OM,y}$	Operating margin CO2 emission factor in year y (tCO2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

The following default values should be used for w_{OM} and w_{BM}:

- Wind and solar power generation project activities: $w_{OM} = 0.75$ and $w_{BM} = 0.25$ (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods;
- All other projects: $w_{OM} = 0.5$ and $w_{BM} = 0.5$ for the first crediting period, and $w_{OM} = 0.25$ and $w_{BM} = 0.75$ for the second and third crediting period

The following CMs for large-scale grids are made out and announced by the Indonesian government, based on the condition of $w_{OM} = 0.5$ and $w_{BM} = 0.5$, even if they are applied to the solar power generation project.

If operating margin is higher than build margin, usage of these factors can be regarded as conservative.

Table 2 Combined Margins (CMs) for large-scale grids[1]

Sistem Interkoneksi dan Tahun Perhitungan		Faktor Emisi (ton CO_2eq. / MWh)	
		Ex-ante	Ex-post
1.	Sistem Interkoneksi Jawa-Madura-Bali (JAMALI)		
	2010	0.741	0.730
2.	Sistem Interkoneksi Sumatera		
	2007		0.539
	2008		0.577
	2009	0.708	0.717
	2010	0.748	0.749
3.	Sistem Interkoneksi Khatulistiwa (Sistem Kalimantan Barat)		
	2009	0.759	0.738
	2010	0.748	0.733
4.	Sistem Interkoneksi Barito (Sistem Kalimantan Selatan dan Tengah)		
	2009	1.287	1.345
	2010	1.003	0.960
5.	Sistem Interkoneksi Mahakam (Sistem Kalimantan Timur)		
	2009	1.131	1.200
	2010	0.820	0.861
6.	Sistem Interkoneksi Minahasa-Kotamobagu		
	2009	0.376	0.378
	2010	0.319	0.332
7.	Sistem Interkoneksi Sulawesi Selatan-Sulawesi Barat		
	2009	0.360	0.397
	2010	0.601	0.605
8.	Sistem Interkoneksi Batam		
	2008		0.625
	2009		0.625
	2010	0.568	0.549

9.3 Calculation method 2-1: Small-scale grid / detailed data

If there is detailed data on each power station connected to small-scale grid, the project developer can calculate CO2 emissions factor (EF) in year y for the connected grid as the combined margin (CM) in the same manner with CDM, using the latest version of the "Tool to calculate the emission factor for an electricity system".

9.4 Calculation method 2-2: Small-scale grid / without detailed data

If there is no detailed data on each power station connected to small-scale grid or hard to collect the data, the project developer can calculate CO2 emissions factor (EF) in year y for the connected grid by calculating the weighted average emission factors of the current generation mix[2]. The data of the year in which project generation occurs must be used.

[1] KNMPB/DNPI and DJK-ESDM (published in 2011)
http://pasarkarbon.dnpi.go.id/web/index.php/dnacdm/read/23/updates-on-emission-factors-of-electricity-interconnection-systems-2011.html

[2] This way of calculation is included in the small-scale CDM methodology "AMS-I.D."

$$EF_y = \frac{\sum_i \left(FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}\right)}{EG_y}$$

Where:

EF_y	CO2 emissions factor (EF) in year y [tCO2/MWh]
$FC_{i,y}$	Amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	CO2 emission factor of fossil fuel i in year y (tCO2/GJ)
EG_y	Net electricity generated and delivered to the grid by all power sources serving the systems, not included low-cost/must-run power plants/units, in year y (MWh)

If there is not any data to identify low-cost/must-run power plants/units among grid-connected power plants/units, emission factor for total grid is to be calculated.

The weighted average emission factor of the current generation mix in the Nias Island is 0.83 tCO2/MWh. (Only diesel engines are used.)

9.5 Calculation method 2-3: Small-scale grid / default data

If there is no detailed data on each power station connected to small-scale grid or hard to collect the data and all power plants/units are using liquid fuels (fuel oil or diesel oil), the project developer can calculate CO2 emissions factor (EF) in year y for the connected grid by using constant emission factors for displaced power stations [default value].

Using default value must lead to the conservative way of CO2 reduction as a trade-off between the easiness and the amount of carbon credit. The following default values have been decided for a modern diesel generating unit of the relevant capacity operating at optimal load, therefore it can be said to be conservative to use them.

The value applied to the Nias Island is to be 0.80 tCO2/MWh, which is smaller than the weighted average emission factor of the current generation mix in the Nias Island is 0.83 tCO2/MWh, hence conservative.

Table 3 Emission Factors for diesel generator systems (in kg CO2e/kWh*) for three different levels of load factors** [3]

Cases	Mini-grid with 24 hour service	i) Mini-grid with temporary service (4-6 hr/day) ii) Productive applications iii) Water pumps	Mini-grid with storage
Load factors [%]	25 %	50 %	100 %
< 15kW	2.4	1.4	1.2
> = 15 < 35kW	1.9	1.3	1.1
> = 35 < 135kW	1.3	1.0	1.0
> =135 < 200kW	0.9	0.8	0.8
> 200kW***	0.8	0.8	0.8

* A conversion factor of 3.2 kg CO_2 per kg of diesel has been used (following revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories)

** Values are derived from fuel curves in the online manual of RETScreen International's PV 2000 model, downloadable from http://retscreen.net/

*** Default values

[3] AMS-I.D. up to ver.15 (from Ver.16, the emission factor has altered to be calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".

9.6 Calculation method 3-1: Off-grid

The calculation method is in accordance with either 2-2 or 2-3 shown above.

10. Project Emissions and Calculation

The project emissions are calculated using the equations below.

$PE_y = PE_{FF,y}$
$PE_{FF,y} = EGD_{J,y} \times EFD_y$
$EFD_y = FCD_y \times NCV \times EF / EGD_{J,y}$

Therefore,
$PE_{FF,y} = FCD_y \times NCV \times EF$

Where:

PE_y	Project CO2 emissions in year *y* [tCO2/y]
$PE_{FF,y}$	Project emissions from fossil fuel consumption in year y [tCO2/y]
$EGD_{J,y}$	Quantity of net electricity generation using diesel engine that is produced and fed to the grid or to direct customer(s) as a result of the implementation of the project activity in year y [MWh/y]
EFD_y	CO2 emissions factor (EF) of diesel engine in year *y* [tCO2/MWh]
FCD_y	Quantity of consumed fuel for diesel engine in year y [t/y]
NCV	Net Calorific Value of the fuel used for diesel engine [TJ/kg]
EF	Emission Factor of the fuel used for diesel engine [kgCO2/TJ]

The emission factor of the diesel engine introduced in the project will be 0.64 tCO2/MWh.

11. Leakage emissions and Calculation

Leakage emissions are regarded as zero.

12. Calculation of Emission Reduction

Emission reductions are calculated from specific reference emissions and project emissions.

$ER_y = RE_y - PE_y (- L_y)$

ER_y	Emission reductions in year *y* [tCO2/y]
RE_y	Reference emissions in year *y* [tCO2/y]
PE_y	Project emissions in year *y* [tCO2/y]
L_y	Leakage emissions in year *y* [tCO2/y]

13. Monitoring

The project developers must monitor the parameters described in the table below based on the calculation method of the selected GHG emission reductions.

Table 4 Monitoring parameters

Parameter	Description	Measurement Procedure (e.g.)
$EGP_{J,y}$	Quantity of net electricity generation that is produced and fed to the grid or to direct customer(s) as a result of the implementation of the project activity in year y [MWh/yr]	Electricity meters
$EGD_{J,y}$	Quantity of net electricity generation using diesel engine that is produced and fed to the grid or to direct customer(s) as a result of the implementation of the project activity in year y [MWh/y]	Electricity meters
EF_y	CO2 emissions factor (EF) in year *y* [tCO2/MWh]	• Data on each power station (Calculation method 1-1); • Government announcement (Calculation method 1-2); • Data on grid (Calculation method 2-1); • Literature values (Calculation method 2-2); • Default values (Calculation method 2-3 and 3-1)
EFD_y	CO2 emissions factor (EF) of diesel engine in year *y* [tCO2/MWh]	Electricity meter and amount of fuel consumption
FCD_y	Quantity of consumed fuel for diesel engine in year y [t/y]	Amount of fuel consumption

Annex: Information on the calculation tool

Calculation method 1-1: Large-scale grid / detailed data

1. Monitoring and input after project start

Description of data		Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		35,040	MWh/y
Quantity of consumed fuel for diesel engine as a result of the implementation of the project activity in year y		7,692	kL/y
CO2 emission factor (Combined Margin) of the grid	CM	0.810	tCO2/MWh
CO2 emission factor used in the project power plant in year y	Diesel Oil (Diesel Oil / Bio Fuel)	74,100	kgCO2/TJ

2. CO2 emission reductions

CO2 emission reductions	Units
7,452	tCO_2/y

Emission Factors of the fuels

Diesel Oil	74,100	kgCO2/TJ
Bio Fuel	0	kgCO2/TJ

Calculation method 1-2: Large-scale grid / default data

1. Monitoring and input after project start

Description of data		Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		35,040	MWh/y
Quantity of consumed fuel for diesel engine as a result of the implementation of the project activity in year y		7,692	kL/y
CO2 emission factor of the grid in year y	Sumatera (Jawa-Madura-Bali / Sumatera / Khatulistiwa (Siste / Barito (Sistem Kal / Mahakam (Sistem / Minahasa-Kotamot / Sulawesi Selatan- / Batam)	0.748	tCO2/MWh
CO2 emission factor used in the project power plant in year y		74,100	kgCO2/TJ

2. CO2 emission reductions

CO2 emission reductions	Units
5,279	tCO_2/y

Calculation method 2-1: Small-scale grid / detailed data

1. Monitoring and input after project start

Description of data		Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		35,040	MWh/y
Quantity of consumed fuel for diesel engine as a result of the implementation of the project activity in year y		7,692	kL/y
CO2 emission factor (Combined Margin) of the grid	CM	0.810	tCO2/MWh
CO2 emission factor used in the project power plant in year y	Bio Fuel (Diesel Oil / Bio Fuel)	0	kgCO2/TJ

2. CO2 emission reductions

CO2 emission reductions	Units
28,382	tCO_2/y

Calculation method 2-1: Small-scale grid / without detailed data

1. Monitoring and input after project start

Description of data		Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		35,040	MWh/y
Quantity of consumed fuel for diesel engine as a result of the implementation of the project activity in year y		7,692	kL/y
The weighted average emissions of the current generation mix of the grid	OM	0.830	tCO2/MWh
CO2 emission factor used in the project power plant in year y	Diesel Oil (Diesel Oil / Bio Fuel)	74,100	kgCO2/TJ

2. CO2 emission reductions

CO2 emission reductions	Units
8,152	tCO_2/y

Emission Factors of the fuels

Diesel Oil	74,100	kgCO2/TJ
Bio Fuel	0	kgCO2/TJ

Calculation method 2-3: Small-scale grid / default data

1. Monitoring and input after project start

Description of data		Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		35,040	MWh/y
Quantity of consumed fuel for diesel engine as a result of the implementation of the project activity in year y		7,692	kL/y
Emission factors for a modern diesel generating unit of the relevant capacity operating at optimal load	> 200kW / Mini-grid with 24 hours service	0.8	tCO2/MWh
CO2 emission factor used in the project power plant in year y	>= 35 < 135kW / i) Min / >= 35 < 135kW / Mini-g / >=135 < 200kW / Mini- / >=135 < 200kW / i) Min / >=135 < 200kW / Mini- / > 200kW / Mini-grid wi / > 200kW / i) Mini-grid / > 200kW / Mini-grid wi	74,100	kgCO2/TJ

2. CO2 emission reductions

CO2 emission reductions	Units
7,101	tCO_2/y

Calculation method 3-1: Off-grid

1. Monitoring and input after project start

Description of data		Value	Units
Quantity of net electricity generation that is produced and fed to the grid as a result of the implementation of the project activity in year y		35,040	MWh/y
Quantity of consumed fuel for diesel engine as a result of the implementation of the project activity in year y		7,692	kL/y
Emision factors	> 200kW / Mini-grid with 24 hours service	0.80	tCO2/MWh
CO2 emission factor used in the project power plant in year y	Bio Fuel (Diesel Oil / Bio Fuel)	0	kgCO2/TJ

2. CO2 emission reductions

CO2 emission reductions	Units
28,032	tCO_2/y