

JCM Project Design Document (PDD), JCM proposed methodology and their attached sheets are preliminary drafts and have neither been officially registered/approved under the JCM, nor are guaranteed to be officially registered/ approved under the JCM.

JCM Proposed Methodology Form

Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Republic of Maldives
Name of the methodology proponents submitting this form	Pacific Consultants Co., Ltd.
Sectoral scope(s) to which the Proposed Methodology applies	1. Energy industries (renewable sources)
Title of the proposed methodology, and version number	Electricity distribution by solar PV system, storage battery and energy management system Version number: 01.0
List of documents to be attached to this form (please check):	<input type="checkbox"/> The attached draft JCM-PDD: <input type="checkbox"/> Additional information
Date of completion	XX/XX/2015

History of the proposed methodology

Version	Date	Contents revised
01.0	XX/XX/2015	First Edition

A. Title of the methodology

Electricity distribution by solar PV system, storage battery and energy management system, Ver01.0

B. Terms and definitions

Terms	Definitions
Energy management system (EMS)	A management system which monitors the power fluctuation caused by electric loads and renewable energies, balances the supply and demand within a power grid and economizes energy use by controlling the outputs of generators and storage devices (e.g. storage batteries).
Small-scale grid	A distribution grid system with a peak load of 3 MW or less.

C. Summary of the methodology

Items	Summary
<i>GHG emission reduction measures</i>	Reduction of diesel consumption by installing EMS, solar PV system and storage battery.
<i>Calculation of reference emissions</i>	Reference emissions are CO ₂ emissions from power generation by diesel generators in the absence of project. They are calculated by multiplying the electricity supplied by the default emission factor of diesel generators.
<i>Calculation of project emissions</i>	Project emissions are CO ₂ emissions from diesel fuel consumption by the project diesel generators.
<i>Monitoring parameters</i>	<ul style="list-style-type: none"> - The quantity of electricity supplied by the project (demand side) - The quantity of electricity generated by diesel generation by the project

D. Eligibility criteria

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

Criterion 1	The project involves power generation and distribution, and is the sole power provider in the given area.
Criterion 2	The project involves an installation of a solar PV system in a small-scale grid in which there is no other power source than diesel generators.
Criterion 3	The project involves an installation of a system composed of a storage battery and an EMS.
Criterion 4	The PV modules have obtained a certification of design qualifications (IEC 61215, IEC 61646 or IEC 62108) and safety qualification (IEC 61730-1 and IEC 61730-2).
Criterion 5	The PV modules have an efficiency 19.0% or higher and the temperature coefficient of Pmax of the PV modules is equivalent to or better than - 0.29%/°C.
Criterion 6	The storage battery will retain at least 80% of its rated capacity after 12,000 cycles of 0-100% charge and discharge at the rate of 3C.
Criterion 7	The EMS can forecast the outputs of the solar PV system, develop an operation plan of the storage battery, and control the operation of the diesel generators and storage battery.
Criterion 8	If the project involves an installation of diesel generators, the efficiency of such generators are same or better than all diesel generators in operation before installation.
Criterion 9	All of the consumers supplied electricity by the project are either supplied solely by the project or have a facility to measure the electricity supplied by the project.

E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Electricity generation by diesel generators and electricity distribution in the grid	CO ₂
Project emissions	
Emission sources	GHG types
Electricity generation by diesel generators and electricity distribution in	CO ₂

the grid	
----------	--

F. Establishment and calculation of reference emissions

F.1. Establishment of reference emissions

In the Maldives, diesel generation is the norm for generating electricity. For example, according to the data provided by STELCO, the electricity generated by solar PV was less than 0.3% of the total generation in Male in 2013. The remainder was from diesel. Solar PV system is still not common because of the high initial investment cost. This is particularly true in a small-scale grid because additional investment in grid stabilization system may be required. Based on this situation, the BaU scenario assumes that all electricity is generated by diesel generators in the absence of project. The BaU emissions are CO₂ emissions from the combustion of diesel fuel in the absence of project.

The reference emissions are calculated by multiplying the quantity of electricity supplied by the project measured at the demand side by the default emission factor of diesel generators.

The emission factor of diesel generators is set to 0.533 tCO₂/MWh in a conservative manner. This value corresponds to the power generation efficiency of 49% by diesel engines. Therefore the reference emissions are smaller than the BaU emissions. Thus, this methodology assures conservativeness in calculating emission reductions.

F.2. Calculation of reference emissions

$$RE_p = ES_{\text{project,p}} \times EF_{\text{diesel}}$$

RE_p :Reference emissions during period p [tCO₂/p]

ES_{project,p} :Quantity of electricity supplied by the project during period p (measured at the demand side) [MWh/p]

EF_{diesel} :CO₂ emission factor of diesel generators [tCO₂/ MWh]

G. Calculation of project emissions

$$PE_p = DG_{\text{project,p}} \times EF_{\text{diesel}}$$

PE_p	:Project emissions during period p [tCO ₂ /p]
$DG_{project,p}$:Quantity of electricity generated by the diesel generators of the project during period p [MWh/p]
EF_{diesel}	:CO ₂ emission factor of diesel generators [tCO ₂ / MWh]

H. Calculation of emissions reductions

$ER_p = RE_p - PE_p$	
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_{diesel}	CO ₂ emission factor of diesel generators, calculated based on the power generation efficiency rate of 49% using diesel fuel as the power source. The default value for EF_{diesel} is set to 0.533 tCO ₂ /MWh. *The efficiency of the most efficient diesel engine is close to but below 49%.	Additional information of JCM methodology for Palau: Displacement of Grid and Captive Genset Electricity by a Small-scale Solar PV System