

### Joint Crediting Mechanism Proposed Methodology Form

#### Cover sheet of the Proposed Methodology Form

Form for submitting the proposed methodology

Host Country	Kingdom of Cambodia
Name of the methodology proponents submitting this form	Metawater Co., Ltd.
Sectoral scope(s) to which the Proposed Methodology applies	3. Energy demand
Title of the proposed methodology, and version number	Energy Saving by Introducing High Efficiency Electric Transformers_ver01.0
List of documents to be attached to this form (please check):	<input checked="" type="checkbox"/> The attached draft JCM-PDD: <input checked="" type="checkbox"/> Additional information
Date of completion	February 17, 2015

History of the proposed methodology

Version	Date	Contents revised
1.0	February 17, 2015	First version

## A. Title of the methodology

Energy Saving by Introducing High Efficiency Electric Transformers

## B. Terms and definitions

Terms	Definitions
Electric transformer	A piece of equipment which converts AC voltage by using electromagnetic induction.
Project transformer	An electric transformer which is introduced in a JCM project.
Reference transformer	A transformer, which will be selected in a way that the GHG emissions will be calculated more conservatively when compared to the calculation when the transformer is continuously used or newly installed if a JCM project is NOT implemented.
Primary side of transformer	An input side of AC power to transformer.
Secondary side of transformer	An output side of AC power from transformer.

## C. Summary of the methodology

Items	Summary
<i>GHG emission reduction measures</i>	Electricity transformation loss occurs when electric transformers operate. By introducing high efficiency electric transformers, GHG emissions will be decreased through reduction of electricity loss during transformation.
<i>Calculation of reference emissions</i>	Reference emissions are GHG emissions from electricity transformation loss caused by reference electric transformers. Reference emissions are calculated using transformed electricity at the secondary side to project transformers, electricity transformation efficiency of reference transformers and the emission factor of a grid.
<i>Calculation of project emissions</i>	Project emissions are GHG emissions from electricity transformation loss caused by project electric transformers.

	Project emissions are calculated using electricity loss from project transformers, which represents different amounts of electricity between the primary and secondary sides of project electric transformers, and the emission factor of a grid.
<i>Monitoring parameters</i>	<ul style="list-style-type: none"> <li>- Amount of transformed electricity at the primary side of electric transformers. (Measured at the nearest circuit breaker to the primary side.)</li> <li>- Amount of transformed electricity at the secondary side of electric transformers. (Measured at the nearest circuit breaker to the secondary side.)</li> </ul>

#### D. Eligibility criteria

This methodology is applicable to projects that meet all of the following criteria:

Criterion 1	Capacity of project transformers is between 500kVA and 1,000kVA.
Criterion 2	The rated efficiency of project transformers is at least 98.5%.

#### E. Emission Sources and GHG types

Reference emissions	
Emission sources	GHG types
Electricity transformation loss from reference transformers	CO <sub>2</sub>
Project emissions	
Emission sources	GHG types
Electricity transformation loss from project transformers	CO <sub>2</sub>

#### F. Establishment and calculation of reference emissions

##### F.1. Establishment of reference emissions

Reference emissions are the amount of GHG emissions derived from electricity transformation loss from reference transformers during a given period.

Amount of electricity transformation loss from reference transformers is calculated using the amount of transformed electricity at the secondary side of project transformers, electricity transformation efficiency of reference transformers and the emission factor from a grid.

In order to calculate the GHG emissions reduction in a conservative way, the reference transformer is determined in the following manner,

- The transformer whose electricity transformation efficiency is comparatively high will be selected for the reference transformer.
- The electricity transformation efficiency depends on the capacity and operation load factor of transformers.

## F.2. Calculation of reference emissions

$$RE_p = \{ET_{PJ,2,p} * (1/\eta_{REF} - 1)\} * EF_{grid}$$

$RE_p$  Reference emissions during a given period  $p$  [tCO<sub>2</sub>/p]

$ET_{PJ,2,p}$  Amount of transformed electricity at the secondary side of project transformers during a given period  $p$  [MWh/p]

$\eta_{REF}$  Electricity transformation efficiency of reference transformers [-]

$EF_{grid}$  CO<sub>2</sub> emission factor of a grid [tCO<sub>2</sub>/MWh]

## G. Calculation of project emissions

$$PE_p = (ET_{PJ,1,p} - ET_{PJ,2,p}) * EF_{grid}$$

$PE_p$  Project emissions during a given period  $p$  [tCO<sub>2</sub>/p]

$ET_{PJ,1,p}$  Amount of transformed electricity at the primary side of project transformers during a given period  $p$  [MWh/p]

$ET_{PJ,2,p}$  Amount of transformed electricity at the secondary side of project transformers during a given period  $p$  [MWh/p]

## H. Calculation of emissions reduction

Emissions reduction is the difference between the reference emissions and the project emissions and calculated as follows:

$$ER_p = RE_p - PE_p$$

## I. Data and parameters fixed *ex ante*

The sources of each data and parameter fixed *ex ante* are listed as below.

Parameter	Description of data	Sources
$\eta_{REF}$	<p>Default value: 0.9799</p> <p>The transformer's efficiency is the highest among the transformers', and those transformers have similar similar capacity to project transformers'.</p>	<p>Manufacturers' test data of transformers installed at Phnom Penh Water Supply Authority's water treatment plant, or nominal value indicated in manufacturers' catalog of transformers which will be designated and approved when installed by Electricité du Cambodge.</p>
$EF_{grid}$	<p>Fixed ex-ante: 0.6257 tCO<sub>2</sub>/MWh</p> <p>CO<sub>2</sub> emission factor of a grid to which a target plant is connected.</p>	<p>Data is obtained from Climate Change Department, Ministry of Environment, Cambodia.</p> <p>This value will be updated each year, if necessary.</p>