



## Approved baseline methodology AM0020

### “Baseline methodology for water pumping efficiency improvements”

#### Source

This methodology is based on the Energy Efficiency Improvements in Municipal Water Utilities project, Karnataka, India, whose baseline study, monitoring and verification plan and project design document were prepared by QualityTonnes. For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0042rev: “Energy Efficiency Improvements in Municipal Water Utilities in Karnataka, India – water pumping efficiency improvement” on <http://cdm.unfccc.int/methodologies/approved>.

#### Selected approach from paragraph 48 of the CDM modalities and procedures

“Existing actual or historical emissions”

#### Applicability

This methodology is applicable to project activities that:

- Seek to reduce GHG emissions by explicitly reducing the amount of energy required to deliver a unit of water to end-users in municipal water utilities;
- Improve energy efficiency in the overall water pumping, including reducing technical losses and leaks as well as the energy efficiency of the pumping scheme, which consume electricity from the electricity grid, where:
  - The efficiency (water and energy) of existing schemes<sup>1</sup> is being improved; or
  - A new scheme is being developed to completely replace the old scheme which will no longer be used. This methodology will apply to the new scheme only up to the measured delivery capacity (annual amount of delivered water) of the old scheme;

This methodology is NOT applicable to project activities cases where entirely new schemes are built to augment existing capacity. This will ensure that only emissions reductions up to the existing capacity of the system will be considered.

This baseline methodology shall be used in conjunction with the approved monitoring methodology AM0020 (“Monitoring methodology for water pumping efficiency improvements”)

#### Project activity

Efficiency improvement in water pumping using electrical pumps using electricity from the grid.

#### Additionality

To demonstrate that the proposed project activity is additional project participants shall use the latest version of the “Tool for the demonstration and assessment of additionality” agreed by the Executive

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<sup>1</sup> One municipal water utility may have several schemes designed to bring water to consumers.



Board<sup>2</sup>. Project participants shall, among others, undertake formal analyses to check that there are no performance related contracts already in place, quality-control or inspection and maintenance procedures or government policies that would mean that the energy efficiency equipment and procedures designed to improve system would have happened without the intervention of the CDM project.

### Project boundary

The project developer will need to clearly define the boundary on the system in question. This could be the boundary of an entire municipal water system, just the water supply system, or a major pumping station. Defining the boundaries of the system in question allows the project implementers to develop an adequate metering and monitoring system to determine water entering the boundaries of the system, water being delivered out of the system and the energy used to move it from start to finish. It also allows the project developer to ensure that the project boundaries do not change significantly over the course of the project. In situations where multiple schemes are being upgraded, the project developer must monitor each scheme separately and calculate the emissions reductions for each separately.

The project boundary will extend from the point of water intake to the system in question, including all pumping stations (major pumping station if the project boundary is the last one) to the delivery point from the system in question. Supplemental pumps, booster stations and other sources of power consumption are included. It is to be noted that pumps not metered or covered by the water utility, as in bulk supplier, will be included in the project boundary only if they are (1) subject to the project implementation and (2) exclusive to the defined water system.

Project boundary in terms of gases and sources is CO<sub>2</sub> from electricity generation.

To determine the project boundaries, the project developers will have to provide the validator with a map of the system covered by the project. This should include all inflows and outflows to the system that must be metered. The map and related materials should also provide the size of all of the major pipelines.

For electricity, the grid is the system boundary.

### Baseline

Once additionality has been established using the “Tool for the demonstration and assessment of additionality”, a typical carbon emissions baseline is established by multiplying the pre-project efficiency ratio with the total post-project water volume delivered and the carbon emission factor.

$$\text{Baseline emissions}_y = M_y^3 * \text{PPER} * \text{EF}_y$$

In which:

Baseline emissions <sub>y</sub>	= CO <sub>2</sub> emissions in the baseline scenario in year y (kg CO <sub>2</sub> )
M <sub>y</sub> <sup>3</sup>	= Total post-project water volume delivered in year y (m <sup>3</sup> )
PPER	= Pre-project efficiency ratio (kWh/m <sup>3</sup> )
EF <sub>y</sub>	= Carbon emission factor for the electricity grid in year y (kg CO <sub>2</sub> /kWh)

<sup>2</sup> The latest version of the “Tool for the demonstration and assessment of additionality” is available on the UNFCCC CDM web site: < <http://cdm.unfccc.int/methodologies/PAMethodologies/approved.html> >.



Where:

$$M_y^3 = \sum M_{i,y}^3 \text{ (} M_{i,y}^3 \text{ - Total post-project water volume delivered in year } y \text{ from the scheme } i \text{)}$$

$$PPER = kWh_b / M_b^3$$

In which:

$kWh_b$  = Total amount of electricity required to move water (kWh) to its destination in the baseline period<sup>3</sup>

$M_b^3$  = Total volume of water (m<sup>3</sup>) moved to its destination in the baseline period<sup>3</sup>

The emission factor  $EF_y$  is calculated using the approach outlined in the consolidated methodology for grid-connected electricity generation from renewable sources (ACM0002)<sup>4</sup> as a combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the following three steps. Calculations for this combined margin must be based on data from an official source (where available) and made publicly available.<sup>5</sup>

**Step 1. Calculate the Operating Margin emission factor(s) ( $EFOM,y$ )** based on one of the four following methods:

- Simple OM, or
- Simple adjusted OM, or
- Dispatch Data Analysis OM, or
- Average OM.

Each method is described below.

Dispatch data analysis should be the first methodological choice. Where this option is not selected project participants shall justify why and may use the simple OM, the simple adjusted OM or the average emission rate method taking into account the provisions outlined hereafter.

<sup>3</sup> The standard baseline period is one year (typically last year available), but in situations where there are wide variations from year to year, (due to weather, etc.) a longer baseline period that would provide a better pre project efficiency average should be used (e.g. a three-year average).

<sup>4</sup> The latest version of the “consolidated methodology for grid-connected electricity generation from renewable sources” (ACM0002) is available on the UNFCCC CDM web site:

<<http://cdm.unfccc.int/methodologies/PAMethodologies/approved.html>>.

<sup>5</sup> Plant emission factors used for the calculation of operating and build margin emission factors should be obtained in the following priority:

(A) *acquired directly* from the dispatch center or power producers, if available; (B) *calculated*, if data on fuel type, fuel emission factor, fuel input and power output can be obtained for each plant; if confidential data available from the relevant host Party authority are used the calculation carried out by the project participants shall be verified by the DOE and the CDM-PDD may only show the resultant carbon emission factor and the corresponding list of plants; and (C) *calculated*, as above, but using estimates such as:

- Default IPCC values from the *IPCC 1996 Revised Guidelines* and the *IPCC Good Practice Guidance* for net calorific values and carbon emission factors for fuels instead of plant-specific values (note that the *IPCC Good Practice Guidance* includes some updates from the *IPCC 1996 Revised Guidelines*);
- Technology provider’s nameplate power plant efficiency or the anticipated energy efficiency documented in official sources (instead of calculating it from fuel consumption and power output). This is likely to be a conservative estimate, because under actual operating conditions plants usually have lower efficiencies and higher emissions than name plate performance would imply;
- Conservative estimates of power plant efficiencies, based on expert judgments on the basis of the plant’s technology, size and commissioning date; or (D) *calculated*, for the simple OM and the average OM, using aggregated generation and fuel consumption data, in cases where more disaggregated data is not available.



The Simple OM method (a) can only be used where low-cost/must run resources<sup>6</sup> constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term normals for hydroelectricity production.

The average emission rate method (d) can only be used

- Where low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply option (b) is not available, and
- Where detailed data to apply option (c) above is unavailable.

(a) *Simple OM*. The Simple OM emission factor ( $EF_{OM, simple, y}$ ) is calculated as the generation-weighted average emissions per electricity unit (tCO<sub>2</sub>/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

$$EF_{OM, simple, y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} \quad (1)$$

Where:

$F_{i,j,y}$  is the amount of fuel  $i$  (in a mass or volume unit) consumed by relevant power sources  $j$  in year(s)  $y$ ;  $j$  refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports<sup>7</sup> to the grid,  $COEF_{i,j,y}$  is the CO<sub>2</sub> emission coefficient of fuel  $i$  (tCO<sub>2</sub> / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources  $j$  and the percent oxidation of the fuel in year(s)  $y$ , and  $GEN_{j,y}$  is the electricity (MWh) delivered to the grid by source  $j$ .

The CO<sub>2</sub> emission coefficient  $COEF_i$  is obtained as

$$COEF_i = NCV_i \cdot EF_{CO_2, i} \cdot OXID_i \quad (2)$$

Where:

$NCV_i$  is the net calorific value (energy content) per mass or volume unit of a fuel  $i$ ,  $OXID_i$  is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),  $EF_{CO_2, i}$  is the CO<sub>2</sub> emission factor per unit of energy of the fuel  $i$ . Where available, local values of  $NCV_i$  and  $EF_{CO_2, i}$  should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC worldwide default values.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s)  $y$ :

- A 3-year average, based on the most recent statistics available at the time of PDD submission, or
- The year in which project generation occurs, if  $EF_{OM, y}$  is updated based on ex post monitoring.

(b) *Simple Adjusted OM*. This emission factor ( $EF_{OM, simple adjusted, y}$ ) is a variation on the previous method, where the power sources (including imports) are separated in low-cost/must-run power sources ( $k$ ) and other power sources ( $j$ ):

<sup>6</sup> Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants.

<sup>7</sup> As described above, an import from a connected electricity system should be considered as one power source  $j$ .



$$EF_{OM, simple\ adjusted, y} = (1 - \lambda_y) \cdot \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_j GEN_{j,y}} + \lambda_y \cdot \frac{\sum_{i,k} F_{i,k,y} \cdot COEF_{i,k}}{\sum_k GEN_{k,y}} \quad (3)$$

Where  $F_{i,k,y}$ ,  $COEF_{i,k}$  and  $GEN_k$  are analogous to the variables described for the simple OM method above for plants  $k$ ; the years(s)  $y$  can reflect either of the two vintages noted for simple OM above, and

$$\lambda_y (\%) = \frac{\text{Number of hours per year for which low - cost/must - run sources are on the margin}}{8760 \text{ hours per year}} \quad (4)$$

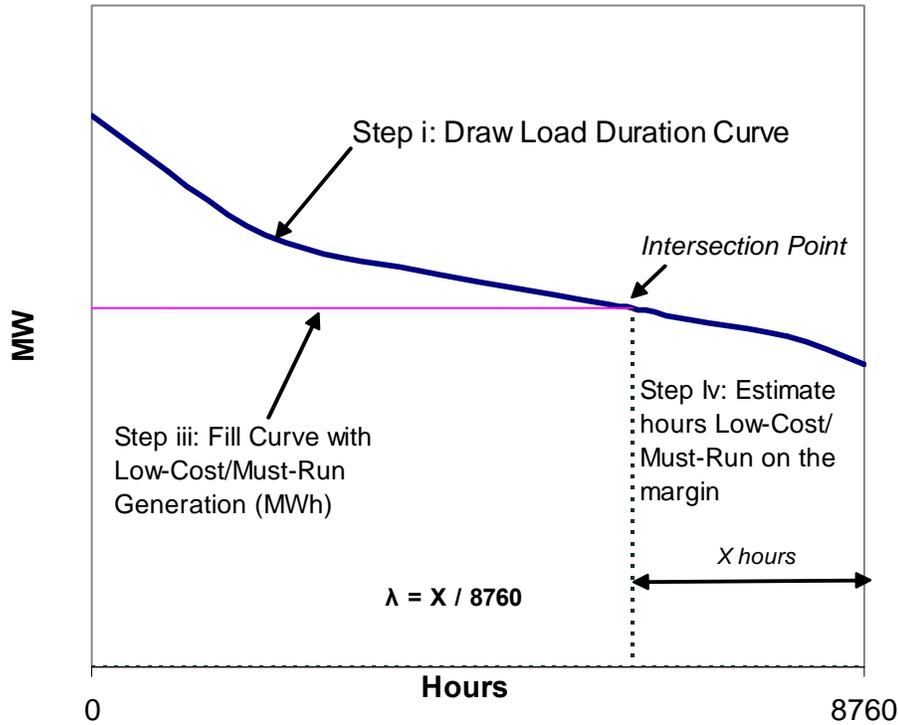
Where lambda should be calculated as follows (see figure below):

*Step i*) Plot a Load Duration Curve. Collect chronological load data (typically in MW) for each hour of a year, and sort load data from highest to lowest MW level. Plot MW against 8760 hours in the year, in descending order.

*Step ii*) Organize Data by Generating Sources. Collect data for, and calculate total annual generation (in MWh) from low-cost/must-run resources (i.e.  $\sum_k GEN_{k,y}$ ).

*Step iii*) Fill Load Duration Curve. Plot a horizontal line across load duration curve such that the area under the curve (MW times hours) equals the total generation (in MWh) from low-cost/must-run resources (i.e.  $\sum_k GEN_{k,y}$ ).

*Step iv*) Determine the number of hours per year for which low-cost/must-run sources are on the margin. First, locate the intersection of the horizontal line plotted in step (iii) and the load duration curve plotted in step (i). The number of hours (out of the total of 8760 hours) to the right of the intersection is the number of hours for which low-cost/must-run sources are on the margin. If the lines do not intersect, then one may conclude that low-cost/must-run sources do not appear on the margin and  $\lambda_y$  is equal to zero. Lambda ( $\lambda_y$ ) is the calculated number of hours divided by 8760.

**Figure1: Illustration of Lambda Calculation for Simple Adjusted OM Method**


(c) *Dispatch Data Analysis OM*. The Dispatch Data OM emission factor ( $EF_{OM, Dispatch Data, y}$ ) is summarized as follows:

$$EF_{OM, Dispatch Data, y} = \frac{E_{OM, y}}{EG_y} \quad (5)$$

Where  $EG_y$  is the generation of the project (in MWh) in year  $y$ , and  $E_{OM, y}$  are the emissions (tCO<sub>2</sub>) associated with the operating margin calculated as

$$E_{OM, y} = \sum_h EG_h \cdot EF_{DD, h} \quad (6)$$

Where  $EG_h$  is the generation of the project (in MWh) in each hour  $h$  and  $EF_{DD, h}$  is the hourly generation-weighted average emissions per electricity unit (tCO<sub>2</sub>/MWh) of the set of power plants ( $n$ ) in the top 10% of grid system dispatch order during hour  $h$ :



$$EF_{DD,h} = \frac{\sum_{i,n} F_{i,n,h} \cdot COEF_{i,n}}{\sum_n GEN_{n,h}} \quad (7)$$

Where  $F$ ,  $COEF$  and  $GEN$  are analogous to the variables described for the simple OM method above, but calculated on an hourly basis for the set of plants ( $n$ ) falling within the top 10% of the system dispatch. To determine the set of plants ( $n$ ), obtain from a national dispatch center: a) the grid system dispatch order of operation for each power plant of the system; and b) the amount of power (MWh) that is dispatched from all plants in the system during each hour that the project activity is operating ( $GENh$ ). At each hour  $h$ , stack each plant's generation ( $GENh$ ) using the merit order. The set of plants ( $n$ ) consists of those plants at the top of the stack (i.e., having the least merit), whose combined generation ( $\sum GENh$ ) comprises 10% of total generation from all plants during that hour (including imports to the extent they are dispatched).

(d) *Average OM*. The average Operating Margin (OM) emission factor ( $EFOM,average,y$ ) is calculated as the average emission rate of all power plants, using equation (1) above, but including low-operating cost and must-run power plants. Either of the two data vintages described for the simple OM (a) may be used.

**Step 2. Calculate the Build Margin emission factor ( $EFBM,y$ )** as the generation-weighted average emission factor (tCO<sub>2</sub>/MWh) of a sample of power plants  $m$ , as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_m GEN_{m,y}} \quad (8)$$

Where  $F_{i,m,y}$ ,  $COEF_{i,m}$  and  $GEN_{m,y}$  are analogous to the variables described for the simple OM method above for plants  $m$ .

Project participants shall choose between one of the following two options:

*Option 1.* Calculate the Build Margin emission factor  $EFBM,y$  *ex ante* based on the most recent information available on plants already built for sample group  $m$  at the time of PDD submission. The sample group  $m$  consists of either

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

*Option 2.* For the first crediting period, the Build Margin emission factor  $EFBM,y$  must be updated annually *ex post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods,  $EFBM,y$  should be calculated *ex-ante*, as described in option 1 above. The sample group  $m$  consists of either

- The five power plants that have been built most recently, or
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.



Power plant capacity additions registered as CDM project activities should be excluded from the sample group *m*.

**Step 3. Calculate the baseline emission factor  $EF_y$**  as the weighted average of the Operating Margin emission factor ( $EF_{OM,y}$ ) and the Build Margin emission factor ( $EF_{BM,y}$ ):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (9)$$

Where the weights  $w_{OM}$  and  $w_{BM}$ , by default, are 50% (i.e.,  $w_{OM} = w_{BM} = 0.5$ ), and  $EF_{OM,y}$  and  $EF_{BM,y}$  are calculated as described in Steps 1 and 2 above and are expressed in tCO<sub>2</sub>/MWh. Alternative weights can be used, as long as  $w_{OM} + w_{BM} = 1$ , and appropriate evidence justifying the alternative weights is presented. These justifying elements are to be assessed by the Executive Board.<sup>8</sup>

The weighted average applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

If the grid imports or exports electricity from/to other grids, the associated correction:

$$EF_y \rightarrow EF_y + (EL_{iny})/(TGEN_y) * EF_{iny} - (EL_{outy})/(TGEN_y) * EF_{outy}$$

is needed unless such correction is demonstrated to be conservative or negligible, where  $EL_{iny}$  ( $EF_{in}$ ) and  $EL_{outy}$  ( $EF_{out}$ ) are electricity coming in and going out of the grid (and their associate emission factors); and  $TGEN_y$  is the electricity generated in the grid. The arrow means replacement of the  $EF_y$  by the right-hand-side of the above formula.

## Project

$$\text{Project emissions}_y = \text{kWh}_y * EF_{y2}$$

Where  $\text{kWh}_y$  = Total post-project amount of electricity required to move water (kWh) to its destination in year *y*

$EF_y$  is the carbon emission factor for grid electricity of year *y*, calculated using the approach outlined in the consolidated methodology - ACM002 (as outlined above).

## Leakage

There are no potential sources of leakages from the project activity. Failure to meet project emission reduction goals would be captured and recorded by the methodology and would account for any emissions attributable to the project.

## Emission Reductions

Annual emission reductions arising from the project activity ( $ER_y$ ) are calculated as:

$$ER_y = \text{Baseline emissions}_y - \text{Project emissions}_y = (M^3_y * PPER * EF_y) - (\text{kWh}_y * EF_y)$$

<sup>8</sup> More analysis on other possible weightings may be necessary and this methodology could be revised based on this analysis. There might be a need to propose different weightings for different situations.



In which:

$M^3_y$  = Total post-project water volume delivered in year y ( $m^3$ )

PPER = Pre-project efficiency ratio ( $kWh/m^3$ )

$kWh_y$  = Total post-project amount of electricity required to move water ( $kWh$ ) to its destination in year y

Where:

PPER =  $kWh_b / M^3_b$

In which:

$kWh_b$  = Total amount of electricity required to move water ( $kWh$ ) to its destination in the baseline period

$M^3_b$  = Total volume of water ( $m^3$ ) moved to its destination in the baseline period

And:

$EF_y$  is the carbon emission factor for grid electricity of year y, calculated using the approach outlined in the consolidated methodology - ACM002 (as outlined above).

**Approved monitoring methodology AM0020****“Monitoring methodology for water pumping efficiency improvements”****Source**

This methodology is based on the Energy Efficiency Improvements in Municipal Water Utilities project, Karnataka, India, whose baseline study, monitoring and verification plan and project design document were prepared by QualityTonnes. For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0042rev: “Energy Efficiency Improvements in Municipal Water Utilities in Karnataka, India – water pumping efficiency improvement” on <http://cdm.unfccc.int/methodologies/approved>.

**Applicability**

This methodology is applicable to project activities that:

- Seek to reduce GHG emissions by explicitly reducing the amount of energy required to deliver a unit of water to end-users in municipal water utilities;
- Improve energy efficiency in the overall water pumping, including reducing technical losses and leaks as well as the energy efficiency of the pumping scheme, which consume electricity from the electricity grid, where:
  - The efficiency (water and energy) of existing schemes<sup>9</sup> is being improved; or
  - A new scheme is being developed to completely replace the old scheme which will no longer be used. This methodology will apply to the new scheme only up to the measured delivery capacity (annual amount of delivered water) of the old scheme;

This methodology is NOT applicable to project activities cases where entirely new schemes are built to augment existing capacity. This will ensure that only emissions reductions up to the existing capacity of the system will be considered.

This monitoring methodology shall be used in conjunction with the approved monitoring methodology AM0020 (“Baseline methodology for water pumping efficiency improvements”)

**Monitoring Methodology**

The monitoring methodology requires monitoring of the following:

- Water from the entire scheme entering in the water system post-project will need to be metered and the total numbers adjusted accordingly to make sure that increases in water supply from new scheme are not counted.
- Energy in the form of kWh required to move the water within the boundaries of the system
- Carbon content of the electricity employed by the water system calculated using the combined margin approach outlined in ACM002.

Emission reductions are established as follows:

$$ER_y = \text{emissions}_y - \text{Project emissions}_y = (M_y^3 * PPER * EF_y) - (kWh_y * EF_y)$$

In which:

$$M_y^3 = \text{Total post-project water volume delivered in year } y \text{ (m}^3\text{)}$$

$$PPER = \text{Pre-project efficiency ratio (kWh/m}^3\text{)}$$

<sup>9</sup> One municipal water utility may have several schemes designed to bring water to consumers.



kWh<sub>y</sub> = Total post-project amount of electricity required to move water (kWh) to its destination in year y

Where:

$M^3_y = \sum M^3_{i,y}$  (M<sup>3</sup><sub>i,y</sub> - Total post-project water volume delivered in year y from the scheme i)

PPER = kWh<sub>b</sub> / M<sup>3</sup><sub>b</sub>

In which:

kWh<sub>b</sub> = Total amount of electricity required to move water (kWh) to its destination in the baseline period

M<sup>3</sup><sub>b</sub> = Total volume of water (m<sup>3</sup>) moved to its destination in the baseline period

And:

EF<sub>y</sub> is the carbon emission factor for grid electricity of year y, calculated using the approach outlined in the consolidated methodology for grid-connected electricity generation from renewable sources – ACM0002<sup>10</sup> (as outlined above).

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<sup>10</sup> The latest version of the “consolidated methodology for grid-connected electricity generation from renewable sources” (ACM0002) is available on the UNFCCC CDM web site:  
<<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>>.

*Parameters to be monitored*

**Data to be collected or used in order to monitor emissions from the project activity and to calculate baseline emissions, and how this data will be archived**

ID number (Please use numbers to ease cross-referencing to table 5)	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	For how long is archived data kept?	Comment
3-1. M <sub>y</sub> <sup>3</sup>	Amount	Total water delivered	m <sup>3</sup>	M	Constant	100%	Electronic	2 years after CERs are issued	Measured at the defined boundaries (both inflow and outflow) to the project. New, post-project sources of water intake must be measured and subtracted from totals as appropriate.
3-2. kWh <sub>y</sub>	Amount	Total Energy required to deliver Total water in 3-1	kWh	M	Constant	100%	Electronic	2 years after CERs are issued	Total Energy required to deliver water from new, post-project sources of water intake must be measured and subtracted from totals as appropriate.
3-3. M <sub>i,y</sub> <sup>3</sup>	Amount	Total water entering from each water intake	m <sup>3</sup>	M	Constant	100%	Electronic	2 years after CERs are issued	Measured at the defined boundaries (both inflow and outflow) to the project. New, post-project sources of water intake must be measured and subtracted from totals as appropriate.



Potential sources of emissions which are significant and reasonably attributable to the project activity, but which are not included in the project boundary, and identification if and how data will be collected and archived on these emission sources

ID number (Please use numbers to ease cross-referencing to table 5)	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	For how long is archived data kept?	Comment
5-1. EFy	Emission factor	Carbon Emissions Factor for the entire grid	tCO <sub>2</sub> eq/MWh and kg CO <sub>2</sub> /kWh	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-2. EF_OMy	Emission factor	Carbon Emissions factor from Operating Margin (	tCO <sub>2</sub> eq/MWh	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-3. EF_BMy	Emission factor	Carbon Emissions Factor from build margin	tCO <sub>2</sub> eq/MWh	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-4. TEMy	Amount	Total GHG emissions from grid	tCO <sub>2</sub> eq/year	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-5. TGENy	Amount	Total electricity to grid, excluding low-cost, zero emission sources	MWh/year	M	Yearly	100%	Electronic	2 years after CERs are issued	



ID number (Please use numbers to ease cross-referencing to table 5)	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	For how long is archived data kept?	Comment
5-6. Fi,y	Amount	Amount of fossil fuel consumed in the grid	Physical unit	M	Yearly	100%	Electronic	2 years after CERs are issued	
5-7. COEFi	Emission factor	GHG co-efficient of each fuel	CO <sub>2</sub> /unit of fuel	M	Yearly	100%	Electronic	2 years after CERs are issued	From IPCC 1996 Guidelines Data set
5-8. jGENj,y	Amount	Electricity generation of the plant	MWH	M	Yearly	100%	Electronic	2 years after CERs are issued	
5-9		Plant identification for OM	Name	M	Yearly	100%	Electronic		
5-10		Plant identification for BM	Name	M	Yearly	100%	Electronic		
5-11	Total electricity generation of imported power	Public Data Sources	MWH	M	Yearly	100%	Electronic		
5-12	Carbon co-efficient of imported electricity	Public Data Sources	TCO <sub>2</sub> /MWH	C	Yearly	100%	Electronic		

*Quality Control (QC) and Quality Assurance (QA) Procedures*

<b>Data</b> <i>(Indicate table and ID number e.g. 3.-1; 3.-2.)</i>	<b>Uncertainty level of data</b> <b>(High/Medium/Low)</b>	<b>Are QA/QC procedures planned for these data?</b>	<b>Outline explanation why QA/QC procedures are or are not being planned.</b>
3-1	Low	Yes	Meters on water lines will be properly calibrated and checked periodically for accuracy.
3-2	Low	Yes	Electricity bills will be validated based on data collection done as part of the project on major energy using devices (pumps)
3-3	Low	Yes	Meters on water lines will be properly calibrated and checked periodically for accuracy.
5-1	Med/Low	Yes	This information should be available from the local electric utility.
5-2	Med/Low	Yes	This information should be available from the local electric utility.
5-3	Med/Low	Yes	This information should be available from the local electric utility.
5-4	Med/Low	Yes	This information should be available from the local electric utility.
5-5	Med/Low	Yes	This information should be available from the local electric utility.
5-6	Med/Low	Yes	This information should be available from the local electric utility.
5-7	Med/Low	Yes	This information should be available from the local electric utility.
5-8	Med/Low	Yes	This information should be available from the local electric utility.
5-9	Med/Low	Yes	This information should be available from the local electric utility.
5-10	Med/Low	Yes	This information should be available from the local electric utility.
5-11	Med/Low	Yes	This information should be available from the other electric utilities providing power imports.
5-12	Med/Low	Yes	This information should be available from the other electric utilities providing power imports.