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/PAmethodologies/approved.html.

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[1] 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

*The additionality of the project activity shall be demonstrated and assessed using the latest version of the **"Tool for the demonstration and assessment of additionality"** agreed by the CDM Executive Board, which is available on the UNFCCC CDM web site[2].*

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

[1] One municipal water utility may have several schemes designed to bring water to consumers.
[2] Please refer to: < http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>

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 were 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_2 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.

$$\text{Baseline emissions}_y = M^3{}_y * PPER * EF_y$$

In which:

Baseline emissions$_y$	= CO_2 emissions in the baseline scenario in year y (kg CO_2)
$M^3{}_y$	= Total post-project water volume delivered in year y (m^3)
PPER	= Pre-project efficiency ratio (kWh/m^3)
EF_y	= Carbon emission factor for the electricity grid in year y (kg CO_2/kWh)

Where:
M^3_y = $\sum M^3_{i,y}$ ($M^3_{i,y}$ - Total post-project water volume delivered in year y from the scheme i)
$PPER = kWh_b / M^3_b$

In which:
kWh_b = Total amount of electricity required to move water (kWh) to its destination in the baseline period[3]
M^3_b = Total volume of water (m^3) moved to its destination in the baseline period[3]

The emission factor EF_y is calculated using the approach outlined in the "*Tool to calculate the emission factor for an electricity system*" [4] as a combined margin (CM).

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

$EFy \rightarrow EFy + (ELiny)/(TGENy) * EFiny - (ELouty)/(TGENy) * Efouty$

is needed unless such correction is demonstrated to be conservative or negligible, where *El*in*y* (*EF*in) and *EL*out*y* (*EF*out) are electricity coming in and going out of the grid (and their associate emission factors); and *TGENy* is the electricity generated in the grid. The arrow means replacement of the *EFy* by the right-hand-side of the above formula.

Project

Project $emissions_y = kWh_y * EF_y$

Where 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 "*Tool to calculate the emission factor for an electricity system*"**.**

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 = Baseline $emissions_y$ – Project $emissions_y$ = $(M^3_y * PPER * EF_y) - (kWh_y * EF_y)$

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

[3] 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).
[4] The latest version of the "*Tool to calculate the emission factor for an electricity system*" is available on the UNFCCC CDM web site: <http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html >.

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 "*Tool to calculate the emission factor for an electricity system*"

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/PAmethodologies/approved.html.

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[5] 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 the "*Tool to calculate the emission factor for an electricity system*" .

Emission reductions are established as follows:

ER_y = emissions$_y$ – Project emissions$_y$ = $(M^3_y * PPER * EF_y) - (kWh_y * EF_y)$

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

[5] One municipal water utility may have several schemes designed to bring water to consumers.

Where:
M^3_y = $\sum M^3_{i,y}$ ($M^3_{i,y}$ - Total post-project water volume delivered in year y from the scheme i)
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 "*Tool to calculate the emission factor for an electricity system*" [6] .

[6] The latest version of the "*Tool to calculate the emission factor for an electricity system*" 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^3_y	Amount	Total water delivered	m^3	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_y	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. $M^3_{i,y}$	Amount	Total water entering from each water intake	m^3	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	tCO2eq/ MWh and kg CO_2/kWh	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-2. EF_OMy	Emission factor	Carbon Emissions factor from Operating Margin	tCO2eq/ MWh	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-3. EF_BMy	Emission factor	Carbon Emissions Factor from build margin	tCO2eq/ MWh	C	Yearly	100%	Electronic	2 years after CERs are issued	
5-4. TEMy	Amount	Total GHG emissions from grid	tCO2eq/ 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_2/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	TCO2/ MWH	C	Yearly	100%	Electronic		

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

Data *(Indicate table and ID number e.g. 3.-1; 3.-2.)*	**Uncertainty level of data (High/Medium/Low)**	**Are QA/QC procedures planned for these data?**	**Outline explanation why QA/QC procedures are or are not being planned.**
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.

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History of the document

Version	Date	Nature of revision(s)
02	EB 35, Para 24, 19 October 2007	Revision to incorporate the use of the “Tool to calculate emission factor for an electricity system”
01	EB 18, Annex 1, 25 February 2005	Initial adoption