Approved baseline methodology AM0005

Baseline methodology (barrier analysis, baseline scenario development and baseline emission rate, using combined margin) for small grid-connected zero-emissions renewable electricity generation

Source

This methodology is based on the El Gallo Hydroelectric Project, Mexico whose Baseline study, Monitoring and Verification Plan and Project Design Document were prepared by Prototype Carbon Fund.
For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0023: "El Gallo Hydroelectric Project" on http://cdm.unfccc.int/methodologies/approved.

Selected approach from paragraph 48 of the CDM modalities and procedures

"Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment."

Applicability

This methodology is applicable to grid-connected zero-emission renewable power generation project activities under the following conditions:

- There is sufficient publicly available information to document in a transparent and conservative manner the nature of the prohibitive barriers to which the proposed project activity is subject, and the nature of the means by which its registration as a CDM activity would enable the project to overcome those barriers (and thus be successfully undertaken);
- There is sufficient publicly available information to document in a transparent and conservative manner that the proposed project is occurring in a sector and investment context that does not feature the type of proposed activity as a common practice;
- The project will provide electricity to the electric grid, displacing power that would otherwise be provided by other generating sources through the operation and expansion of the electric sector. The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available;
- The project is in an electric sector that is not dominated by generating sources with zero- or low-operating costs such as hydro, geothermal, wind, solar, nuclear, and low-cost biomass, and this fuel mix is expected to persist for the duration of the crediting period;
- Electricity exports are included in electricity generation data used for calculating and monitoring the baseline emission rate to avoid potential leakage; and
- Applies only to small electricity capacity additions, i.e. less than or equal to 60 MW and using a 50:50 default weighting of the build and operating margins.

Project Activity

The project activity is a small grid-connected zero-emissions renewable electricity generation plant that would not be implemented otherwise.

Emission Reduction

The project activity mainly reduces carbon dioxide (CO_2) through substitution of the grid electricity generated by fossil fuel power plant by renewable electricity. The methane (CH_4) and nitrous oxide (N_2O) emissions from the grid and/or from the project should be monitored if the project participants do not provide sufficient reasons and information to neglect them such as by demonstrating to be much smaller than the uncertainty level.

The emission reductions ER_y by the project activity during a given year y is[1]

$$ER_y = EG_y * EF_y$$

where EG_y is the electricity supplied to the grid, EF_y is the GHG emission factor of the grid as calculated below (CO_2 emission factor can be used if effects of other GHGs are demonstrated to be negligible).

The emission factor EF_y of the grid is represented as a combination of the Operating Margin and the Build Margin. If we set the emission factor of associated method as EF_OM_y and EF_BM_y, the EF_y is given by

$$EF_y = w_{OM} * EF\_OM_y + w_{BM} * EF\_BM_y$$

with respective weight factors w_{OM} and w_{BM} (where $w_{OM} + w_{BM} = 1$), and by default, are weighted equally ($w_{OM} = w_{BM} = 0.5$).

The Operating Margin emission factor EF_OM_y is defined as the generation-weighted average emissions per electricity unit (tCO_2 / MWh) of all generating sources serving the system, excluding zero- or low-operating cost power plants (hydro, geothermal, wind, low-cost biomass, nuclear and solar generation), based on the latest year statistics data and are derived from the following equation:

$$EF\_OM_y = TEM_y / TGEN_y = [\sum_i F_{i,y} * COEF_i] / [\sum_j GEN_{j,y}]$$

Where TEM_y and $TGEN_y$ is the total GHG emissions and electricity generation supplied to the grid by the power plants connected to the grid excluding zero- or low-operating cost sources. $F_{i,y}$ and $COEF_i$ are the fuel consumption and associated carbon coefficient of the fossil fuel i consumed in the grid. $GEN_{j,y}$ is the electricity generation at the plant j connected to the grid excluding zero- or low-operating cost sources.

[1] Throughout the document, the suffix y denotes that such parameter is a function of the year y, thus to be monitored at least annually.

The Build Margin emission factor EF_BM_y is given as the generation-weighted average emission factor of the selected representative set of recent power plants represented by the 5 most recent plants or the most 20% of the generating units built (summation is over such plants specified by k):[2]

$$EF\_BM_y = [\sum_i F_{i,y} * COEF_i] / [\sum_k GEN_{k,y}]$$

as the default method. The summation over i and k is for the fuels and electricity generation of the plants mentioned above. If the project participant can demonstrate a more accurate sampling method (to the Operational Entity), such a sample can be applied to this part of the methodology.

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

$$EF_y \rightarrow EF_y + (EL^{in}{}_y)/(TGEN_y) * EF^{in}{}_y - (EL^{out}{}_y)/(TGEN_y) * EF^{out}{}_y$$

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 $TGEN_y$ is the electricity generated in the grid. The arrow means replacement of the EF_y by the right-hand-side of the above formula.

Baseline

The baseline scenario is that the electricity grid generates electricity by operation of the connected power plants and adjust power development plan to compensate the generated electricity by the project. No alternative energy conservation programs would be implemented.

The identification of the baseline scenario is given by the stepwise procedures specified in the following additionality section.

The baseline emissions BE_y is

$$BE_y = EG_y * (w_{OM} * EF\_OM_y + w_{BM} * EF\_BM_y)$$

using the notation above, with suitable corrections if the effects of electricity exports/imports from the grid are not demonstrated to be negligible small or neglected conservatively.

As a further step in the methodology to estimate baseline emissions, project participants shall justify the conservatism of baseline methodology in the case of the project. Whether this baseline estimation methodology is a conservative and accurate approximation of the actual

[2] The project participant is to demonstrate which is appropriate for the proposed project to the Operational Entity, otherwise, more conservative one is selected.

electricity displaced will depend on the electric sector in question. Arguments should be presented explaining why this is can be expected to be a conservative baseline methodology, in light of the conditions of the relevant electric sector.

Additionality

The methodology ensures additionality and identifies the baseline scenario by using both of the following steps:

Step 1: Analyze prohibitive barriers to the proposed project

Step 1-a *Identify the relevant barriers to the proposed project activity.*

Establish that there are prohibitive barriers within the relevant sector that would prevent the proposed project from being carried out and coming to completion, assuming the project were not registered as a CDM activity.

Provide transparent information, including documented evidence, and offer conservative interpretations of this documented evidence as to how it demonstrates the existence and significance of the identified barriers. Anecdotal evidence can be included, but alone is not sufficient proof of barriers.

Step 1-b *Explain how only the approval and registration of the proposed project as a CDM activity would enable the project to overcome the identified barriers and thus be undertaken.*

This step helps to prove that the barriers identified in [Step 1-a] are indeed prohibitive barriers. If the proposed project were able to overcome the identified barriers without registration as a CDM project, then the barriers would be surmountable, and they would not be sufficient proof of additionality.

Explain how the approval and registration of the project as a CDM activity, and the attendant benefits and incentives derived therefrom, sufficiently alleviate the identified barriers to enable the project to be undertaken. The benefits and incentives can be of various types, such as:

- the financial benefit of the revenue obtained by selling the CO_2 emissions reductions.
- the institutional benefits of collaborating with partners in the emissions reductions *transaction*
- the technical and capacity building benefits provided by partners in the emissions reductions transaction

Where technological barriers are quantified, e.g. technology penetration rate is less than 5% within the sector, such assessments must be used with other tests.

Step 2 Analyse other activities similar to the proposed project

Provide a sufficiently comprehensive analysis of any other activities implemented previously or currently underway that are similar to the proposed project activity. Projects should be considered similar if they are in the same country and rely on a broadly similar technology, are of a similar scale, and take place in a comparable environment with respect to regulatory

framework, investment climate, access to technology, access to financing, etc. Provide quantitative information where relevant.

If similar activities are widely observed and commonly carried out, it calls into question the claim that the proposed project activity faces prohibitive barriers. Therefore, if similar activities are identified above, then it is necessary to demonstrate why the existence of these activities does not contradict the claim that the proposed project activity is subject to prohibitive barriers. This can be done by comparing the proposed project to the other similar activities, and pointing out and documenting essential distinctions between them that explain why the similar activities did not face the prohibitive barriers to which the proposed project is subject.

Leakage

The main indirect emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing, and transport), and land inundation (for hydroelectric projects). Project activities using this baseline methodology shall not claim any credit for the project on account of reducing these emissions below the level of the baseline scenario. The project developer must justify why the project is not responsible for such indirect emissions to a degree that exceeds corresponding indirect emissions from the baseline scenario.

For project activities using biomass, the methodology requires that the project participants provide justification that fossil fuel usage outside of the boundary is not increased and demonstrate that no purchases of biomass from outside entities are required.

The project boundary is defined as the project site and the electricity grid system connected to it. The emissions associated with the electricity import/export are dealt with in adjusting the calculation of emission reductions as outlined above.

Approved monitoring methodology AM0005

Monitoring methodology for small grid-connected zero-emissions renewable electricity generation

Source

This methodology is based on the El Gallo Hydroelectric Project, Mexico whose Baseline study, Monitoring and Verification Plan and Project Design Document were prepared by Prototype Carbon Fund.
For more information regarding the proposal and its consideration by the Executive Board please refer to case NM0023: "El Gallo Hydroelectric Project" on http://cdm.unfccc.int/methodologies/approved.

Applicability

Used with this baseline methodology.

This methodology is applicable to renewable power generation project activities displacing grid electricity with the conditions as follows:

- The grid, which the project activity is connected, is clearly identifiable;
- The grid is not dominated by zero or low-operating cost generating sources, and this fuel mix is expected to persist for the duration of the crediting period;
- The ex post monitoring of the build margin (in addition to an ex ante estimation) may be used for the calculation of emission reductions for build margin only if the project activity is small compared with the total additions to the grid.

Monitoring Methodology

The methodology involves monitoring of the following:

- Electricity generation from the proposed project activity,
- Annual determination of the emission factor of the grid (weighted average excluding zero- and low cost sources) to recalculate the operating margin with monitored data,
- Annual determination of the emission factor of the grid (weighted average of recently built plants—represented by the 5 most recent plants or the most 20% of the generating units built) to recalculate the build margin with monitored data,
- Annual determination of the combined margin,
- Correction of emission factors due to import/export of electricity (if needed),
- Confirmation to meet applicability especially for additionality at the renewal of the crediting period.

Baseline Emission Parameters

ID number	Data Type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
2. EG_y	electricity	Electricity supplied to the grid by the project	kWh	Directly measured	Hourly measure-ment and Monthly recording	100%	electronic	During the crediting period	Electricity supplied by the project activity to the grid. Double check by receipt of sales.
3. EF_y	emission factor	GHG emission factor of the grid	tCO_2eq/kWh	c	yearly	100%	electronic	During the crediting period	Calculated as a weighted sum of emission factors of Operating Margin and Build Margin
4. EF_OM_y	emission factor	GHG emission factor of the grid (Operating Margin)	tCO_2eq/kWh	c	yearly	100%	electronic	During the crediting period	Calculated as TEM_y divided by $TGEN_y$
5. EF_BM_y	emission factor	GHG emission factor of the grid (Build Margin)	tCO_2eq/kWh	c	yearly	100%	electronic	During the crediting period	Calculated as $[\sum_i F_{i,y}*COEF_i] / [\sum_k GEN_{k,y}]$ over recently built power plants defined in the baseline methodology
6. TEM_y	emissions	Total GHG emissions of the grid	tCO_2eq/yr	c	yearly	100%	electronic	During the crediting period	Calculated as the sum of GHG emissions of each plants
7. $TGEN_y$	electricity	Total	KWh/yr	c	yearly	100%	electronic	During the	Calculated as the sum

ID number	Data Type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
		electricity generation of the grid excluding zero- or low-operating cost sources						crediting period	of electricity generated of the grid excluding zero- or low-operating cost sources
9-i. $F_{i,y}$	fuel	Amount of each fossil fuel consumed in the grid	Physical unit	m	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used.
10-i. $COEF_i$	CO_2 coefficient	GHG emission coefficient of each fuel i	tCO_2eq/ (physical unit of the fuel i)	m	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are applied.
11-j. $GEN_{j,y}$	electricity	Electricity generation of the plant j	KWh/yr	m	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics.
12.	Plant name	Plant identification for OM	-	m	yearly	100%	electronic	During the crediting period	Identification of plants (j) to calculate Operating Margin emission factors
13.	Plant name	Plant identificatio	-	m	yearly	100%	electronic	During the crediting	Identification of plants (k) to calculate Build

ID number	Data Type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
		n for BM						period	Margin emission factors
14. w_{OM} and w_{BM}	Non-dimensional number	Weight factor of OM (BM)	-	m	yearly or fixed	100%	electronic	During the crediting period	Default weight factor is 0.5 each. If the project participant want to use another set values, these values are monitored with reasonable reasons to be demonstrated (w_{OM} + w_{BM}=1)
15	-	Documented evidences	-	-	Once at the renewal time of the crediting period	100%	-	During the crediting period	Documented Evidences of the prohibitive barriers of the proposed project activity
16	-	Documented evidences	-	-	Once at the renewal time of the crediting period	100%	-	During the crediting period	Documented information related to the alternatives to the project, especially diffusion data

Leakage

ID number	Data Type	Data variable	Data unit	Measured (m) calculated (c) estimated (e)	Recording frequency	Proportion of data monitored	How will data be archived? (electronic/ paper)	For how long is archived data kept?	Comment
17. EL^{in}_{y}	electricity	Electricity imported to the grid	kWh	c	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to calculate.
18. EL^{out}_{y}	electricity	Electricity exported from the grid	kWh	c	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics. If local statistics are not available, IEA statistics are used to calculate.
19. EF^{in}_{y}	emission factor	GHG emission factor of the imported electricity	kWh	c	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate.
20. EF^{in}_{y}	emission factor	GHG emission factor of the exported electricity	kWh	c	yearly	100%	electronic	During the crediting period	Obtained from the latest local statistics. If local statistics are not available, IPCC default values are used to calculate.

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

All variables, except one related to off-site transportation, used to calculate project and baseline emissions are directly measured or are publicly available official data. To ensure the quality of the data, in particular those that are measured, the data are double-checked against commercial data. The quality control and quality assurance measures planned for the Project are outlined in the following table.

Data	Uncertainty Level of Data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Outline explanation how QA/QC procedures are planned
2	Low	Yes	These data will be directly used for calculation of emission reductions. Sales record to the grid and other records are used to ensure the consistency.
15, 16	Low	No	These data are used to check whether the applicability conditions are met.
others	Low	Yes	Default data (for emission factors) and IEA statistics (for energy data) are used to check the local data.

Baseline Data

For default emission factors, IPCC 1996 Guidelines on GHG Inventory (The Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories, IPCC) and Good Practice Guidance Report (Good Practice Guidance and Uncertainty Management in National Greenhouse Gas Inventories, IPCC) are to be referred not only for their default values but also for their monitoring methodology as well as uncertainty management to ensure data credibility. These documents are downloadable from http://www.ipcc-nggip.iges.or.jp/. The latter document is a new supplementary document of the former.

1996 Guidelines:
- Vol. 2, Module 1 (Energy) for methodology,
- Vol. 3, Module 1 (Energy) for application (including default values)

2000 Good Practice Guidance on GHG Inventory and Uncertainty Management
- Chapter 2: Energy
- Chapter 6: Uncertainty

IEA (Yearly Statistics)
- CO_2 Emissions from Fuel Combustion
- Energy Statistics of Non-OECD Countries