CDM: Proposed New Methodology
Meth Panel recommendation to the Executive Board
(version 06)
(To be used by the Meth Panel to make a recommendation to the Board regarding a proposed new methodology)

Date of Meth Panel meeting:	04 - 07 April 2006
Related F-CDM-NM document ID number (electronically available to EB members)	F-CDM-NM0121: "Hydropower Projects that Create New Reservoirs or Expand Existing Ones"
Related F-CDM-NMex document ID number(s) (electronically available to EB members)	F-CDM-Nmex0121: Thomas / Ullrich
Related F-CDM-NMpu document ID number(s) (electronically available to EB members)	F-CDM-NMpu0121: Duchemin / Shigeo / McCully

Note to those completing this form, as applicable: Please provide recommendations on the proposed new baseline and monitoring methodologies based on an assessment of CDM-NMB and CDM-NMM and of their application in sections A to E of the draft CDM-PDD, desk reviews and public input. Please ensure that the form is entirely filled and that arguments and expert judgements are substantiated.

A. Preliminary recommendations by the Meth Panel

(1) History of submission *(to be communicated by UNFCCC Secretariat):*

>> First submission (Round 11; 01 June 2006).

I. Recommendation on the proposed new baseline methodology: *(checkmark the choice made)*

Title of proposed new baseline methodology:>> Hydropower Projects that Create New Reservoirs or Expand Existing Ones

a. To approve this proposed methodology with minor changes

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i. Conditions under which this proposed methodology is applicable to other potential CDM project activities (e.g. project type, region, data availability):

>>

ii. Minor changes:

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b. To reconsider this proposed methodology, subject to required changes

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i. Conditions under which the proposed methodology is applicable to other potential projects (e.g. project type, region, data availability):

>> The conditions cited in A.3 of CDM-NMB are generally applicable. Additional applicability conditions to be considered are:

(i) grid connected hydro power projects where either a new reservoir is created or an existing reservoir is extended;

(ii) if the national electricity grid is too small or underdeveloped to undertake a combined margin analysis (of ACM 0002) default off-grid generation sources with lowest emissions are to be used.

ii. Required changes:

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i) The CDM-NMB proposes a method of measurement and monitoring of methane and CO_2 emissions from the reservoir by using air sampling techniques. It further proposes the use of using a fixed default range of CO_2 and methane emissions values for the reservoir analysis which seems flawed as it is not region-specific. In light of the decision provided by EB 23, the guidance on emission factors for project emissions from the reservoir may be used, if appropriate, based on the power density of the reservoir. However, if based on the EB23 decision, it is determined that ACM0002 could be applied, the proposed methodological approach and applicability conditions may be changed accordingly to reflect appropriately the guidance from EB23.

ii) If the alternative approach of estimating the reservoir emissions by sampling techniques (based on the submitted CDM-NMB) is continued to be proposed in the revision, it should be clarified therein about what the reference for default emission fluxes used (for CO_2 = 190 mg/m²/day and for CH_4 = 200 mg/m²/day) is vis-à-vis the measurements through air sampling. Furthermore, the applicability of the default emission fluxes with respect to the specific characteristics of the reservoir, for instance, what vegetation type flooded the default values refer to (forests, grassland, wetlands, etc.) need to be elaborated further in this case. If the alternative (submitted in CDM-NMB) were to be adopted, it could further consider IPCC guidelines (e.g., Good Practice Guidance [2003] for land, land-use change and forestry, which provides instructions for land conversion to wetlands and associated emission estimation methods for flooded land, remaining flooded land, etc. The Good Practice Guidance provides default emission factors for tropical reservoirs and provides guidance to derive country-specific emission factors). Finally, if the alternative were to be adopted, the methodology should differentiate between bubble, diffusive and degassing emissions.

iii) (Temporal factors and the different application of hydro facilities in a grid at different loads (e.g. base load, mid load and peak load) are not fully accounted for in the methodology. This is important because run of river hydroelectric plants could be used as base load plants. Storage hydroelectric plants (i.e. with dams) are more commonly used as peak load plants or base load following plants. Even in developing countries where reservoir hydroelectric plants contribute to base load energy supply, this contribution is highly dependent on water supply and local climate and varies throughout a year. For example, in a country where there is a distinct wet and dry season, during the wet season (e.g. 8 months) electricity demand is low (e.g. less cooling) and only hydro power plants are operated to respond to demand. During the dry and hot season (4 months) electricity demand is larger and water supply is smaller. Thus fossil fuel fired power plants are used as base load and hydro plants will operate at 25% of their capacity. Thus not all hydroelectric plants will displace off- grid diesel generators and even in countries where this occurs, some consideration of temporal factors should be acknowledged in the methodology. Keeping these issues in mind, the methodology should fully account for such temporal factors and applications as a part of its integral approach.

iv) (Electrical grids do not always provide a consistent uninterrupted supply of electricity. As a result it is common in developing countries for households and companies to have an adaptive response to these scenarios wherein back up diesel generator are provided on site to mitigate shortages in the supply from the grid that result in power cuts and these back up generators may be used regularly, in some instances, even otherwise. The diesel emission factor should only be used when: a). there is evidence that the proposed project will be supplying base load electricity; b) evidence that there are no expansion plans for new alternative electricity generating facilities in the proposed grid; c) Contribution of the proposed hydro plant to the baseload can account for changes within a year due to climate influences on water resources and power cuts. t is not clear which situation applies to the CDM-NMB and the approach should incorporate one or all of the possibilities with appropriate changes in the calculation of baseline and project emissions.

v) As a baseline scenario is possible when a new reservoir is being built, the quantification of pre dam emissions should be elaborated on (e.g. describe the consequences if the pre-dam situation would be a carbon sink or carbon emitter).

vi) The grid emission factor of 0.8 tCO_2/MWH as described in D6 of CDM-NMB should be clarified. It should be clarified why the more conservative emission factor of the two factors (a – default (diesel) factor and b – calculated CM factor) should not be used. The proponent should also provide the underlying assumption for this rule and clarify what fuel type would be displaced if the electricity

produced by the project would be beyond the MWh indicated. Accordingly, section E.4. in the CDM-PDD needs to be changed.

vii) As a general rule, all abbreviations should be described when they appear in the document for the first time and all the equations should be numbered for easy reference.

viii) The new format of CDM-NMB (version 02, July 2005) may be used to resubmit the revised CDM-NMB incorporating the required changes.

(Project participants shall make required changes to the proposed new methodology and send it back to the Meth Panel. The proposed new methodology will be reconsidered by the Meth Panel if changes required are made by the project participants. The Executive Board will only consider this proposed new methodology after the revised proposed methodology has been reconsidered by the Meth Panel.)

c. Not to approve the proposed methodology

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i. Reasons for non-approval:

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(A new proposal should be submitted in accordance with the procedures for submission and consideration of proposed new methodologies of the Executive Board.)

II. Recommendation on the proposed new monitoring methodology: *(checkmark the choice made)*

Title of proposed new monitoring methodology: >> Hydropower Projects that Create New Reservoirs or Expand Existing Ones.

a. To approve this proposed methodology with minor changes

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i. Conditions under which methodology is applicable to other potential projects (e.g. project type, region, data availability):

>>

ii. Minor changes:

>>

b. To reconsider this proposed methodology, subjected to required changes

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i. Conditions under which the proposed methodology is applicable to other potential projects (e.g. project type, region, data availability.):

>> The conditions cited in A.3 of CDM-NMB are generally applicable. Additional applicability conditions to be considered are:

(iii) Grid connected hydro power projects where either a new reservoir is created or an existing reservoir is extended;

(iv) If the national electricity grid is too small or underdeveloped to undertake a combined margin analysis (of ACM 0002) default off-grid generation sources with lowest emissions are to be used;

ii. Required changes:

>> In general, the changes corresponding to those suggested in Section A.1.I.b.ii should be incorporated into the CDM-NMM. In addition the following changes may be considered:

i) If the NMB does not adopt the guidance on reservoir emissions provided by EB23 and adopts the alternative of measuring emissions (as proposed in the submission), the NMM should then provide guidance on how to measure or otherwise quantify pre-dam emissions (natural emissions that occur anyway) to be subtracted from gross emissions measured above the reservoir through the use of air sampling techniques. The QA/QC procedures should incorporate emissions measurements and analysis

of reservoir fluxes to be done by third party bodies with no direct or indirect vested interest in the outcome of project activity using the CDM-NMB. Alternatively, if the CDM-NMB considers the EB23 guidance and approach, then the reference to measurements of reservoir fluxes and measurements of reservoir emissions should be deleted in the context of the recommendations pertaining to reservoir based emissions in EB23.

ii) The methodology should add suggestions on how to account for uncertainties associated with the methodology e.g. cluster definition, quality of measured data etc.

iii) Some information is repeated in the CDM-PDD, CDM-NMB and CDM-NMM. The methodology proponent should delete any repetition and ensure that the information presented is consistent with the section/sub-section headings.

iv) Monitoring data in Section B.4.1 needs to be completed.

(Project participants shall make required changes in the proposed new methodology and send it back to the Meth Panel. The proposed new methodology will be reconsidered by the Meth Panel if changes required are correctly made by the project participants. The Executive Board will only consider this proposed new methodology after required changes proposed have been made and the revised proposed methodology has been reconsidered by the Meth Panel.)

c. Not to approve the proposed methodology

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i. Reasons for non-approval:

>>

(A new proposal should be submitted in accordance with the procedures for submission and consideration of proposed new methodologies of the Executive Board.)

B. General information on submitted proposed new methodology

(1) Title of proposed new baseline methodology:

>> Hydropower Projects that Create New Reservoirs or Expand Existing Ones.

(2) One sentence describing the purpose of the methodology.

>>T his methodology is designed for hydro electric power projects, based on new or expanded reservoirs, and which are connected to small-sized grids that also include alternative, diesel-based off-grid generation resources.

(3) Summary description of baseline methodology.

Short statements on each on how the proposed methodology: chooses the baseline scenario, demonstrates additionality, calculates baseline emissions, calculates project emissions, calculates leakage, calculates emission reductions.

>> The methodology expands the application of ACM0002 to hydro electric plants that create new reservoirs or expand existing ones as and when applicable based on the power density of the hydro reservoir (based on EB 23 recommendations). The "Tool for the demonstration and assessment of additionality" is used for the assessment of baseline scenarios and for additionality. The proposed baseline methodology has two components: a) estimating reservoir emissions as project emissions and b) estimating baseline emissions for grid connected renewable projects, where the project represents a special case (in addition to what has been defined in ACM0002) wherein a diesel emission factor (on the grounds that in developing countries hydro facilities can displace significant amounts of off-grid diesel generation as well as grid connected electricity generation facilities) is used. The diesel-generation default emission factor is defined according to the method described in the small scale diesel category baseline method with a default value as 0.8 tCO2/MWh to be used for both grid and off grid energy supply. In its current form (pre- EB23 decision), the methodology includes an ex-post correction of emission calculations to account for emissions of methane from the hydro electric facility reservoir using fixed default values of emissions fluxes of 190 mg/m²/day for CO_2 and 200 mg/m²/day for CH_4. Ex post measurements are used since it is currently not possible to make accurate predictions of these emissions ex ante.

(4) Title of proposed new monitoring methodology:

>> Hydropower Projects that Create New Reservoirs or Expand Existing Ones.

(5) Summary description of the monitoring methodology.

Short statements on each on how the proposed methodology monitors the baseline and project scenario and calculates leakage and emission reductions.

>> The methodology utilises and extends ACM002: by broadening its application mainly in the following ways: include hydro reservoir expansion projects; allowing the use of a diesel emission factor to calculate emissions reductions (the emission factor is taken from the approved small scale diesel generator baseline methodology); and incorporates monitoring of CH_4 and CO_2 from reservoirs through air sampling at representative points in the reservoir. For the latter, the proposed monitoring methodology suggests measuring CO_2 and CH_4 above the newly created (or extended) reservoir to monitor these emissions over the crediting period. As the preferred method, the proponent suggests to use air sampling at representative points in the reservoir to measure the increase in concentrations of GHGs that are emitted to chambers. Measurement results will be reported in mg/m²/day and will be multiplied by the respective cluster area the sample belongs to. Different samples will be taken over each year since emission fluxes vary according to seasons and weather. The methodology proposes to define clusters across the reservoir. Each cluster should correspond to a certain water depth or vegetation type that will be flooded. For all other data related to the specifics of the project, the monitoring methodology will use monitoring elements provided in ACM0002. The methodology is reflected in the CDM-PDD in so far as the proponent provided tables outlining a cluster and that can be used as a template to record the measurement results. No such generic table has been provided in the CDM-NMM, though. However, if the CDM-NMB is modified in light of new guidance on treatment of reservoir emissions made available by EB23, the monitoring methodology also needs to be changed.

(6) Relationship with approved or pending baseline and monitoring methodologies (if applicable).

a) Does the proposed new methodology include part of an already-approved methodology or a methodology pending approval (see recent EB reports)? If so, please briefly note the relevant methodology reference numbers (AMXXXX or ACMXXXX), titles, and parts included.

>> ACM0002 "Consolidated methodology for grid-connected electricity generation from renewable sources".

b) In particular, is the proposed new methodology largely an amendment or extension of an approved methodology? (i.e. the methodology largely consists of expanding an approved methodology to cover additional project contexts, applicability conditions, etc., and is thus largely comprised of text from an existing methodology) If so, indicate whether the amendments or extensions are appropriate, and explain why.

>> Extension of ACM0002. Based on EB23 guidance on emissions from hydroelectric reservoirs, it could be applied appropriately.

c) Indicate whether , and explain how, any other approved methodology (not noted in response to the previous question) could currently, or with minor modifications, be used to calculate emission reductions from the project activity associated with the proposed new methodology. If so, please indicate the reference number and the parts of the methodology that would need modification.

>> Yes, ACM0002 may be used, if applicable based on EB23 guidance.

d) Please briefly note any significant differences or inconsistencies (baseline emission calculations, leakage methods, and boundary definitions, etc.) between the proposed new methodology and already-approved methodology of similar scope.

>> In this CDM-NMB, the concept of reservoir emissions has been introduced in conjunction with ACM0002. However, measuring reservoir emissions is data, time and resource-intensive. The feasibility of a robust monitoring methodology may not be feasible under the CDM due to impact on increased transaction costs, in particular, if the number of "rejected fluxes" would be high. Recommendations pertaining to emissions from hydroelectricity reservoirs, provided by EB23, in the context of application of

ACM0002 may be followed. Furthermore, in this CDM-NMB, the emissions factor from diesel-based off-grid generation is proposed instead of combined-margin analysis because of the smaller size of the grid.

e) To avoid potential repetition, feel free to provide one comprehensive answer here that covers questions a through d.

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C. Details of the evaluation of the proposed new methodology by the Meth Panel:

I. Proposed new baseline methodology: >> Hydropower Projects that Create New Reservoirs or Expand Existing Ones.

(1) Determining the baseline scenario and demonstrating additionality:

a) Explain the methodological basis for determining the baseline scenario, and whether this basis is appropriate and adequate.

>> The basis for determining the baseline scenario is generally appropriate and adequate given the small size of the grid. However, in the absence of any demand related information, it sees unrealistic that in countries with increasing electricity demand, new large power projects would – even if only in part – displace installed fossil fuel based electricity capacity. Maintaining the status quo (e.g. no capacity extensions) could be a plausible baseline, since no increase in demand is considered but this would be unrealistic. In this context, the basis for determining the baseline scenario the methodology could be strengthened:

Furthermore, if the fuel mix of power plants and efficiency has been improving in the last few years, using data from older constructed plants may not be an accurate reflection of business as usual practice. Therefore the methodology could be improved if an assessment of the improvements in the fuel mix and efficiency of the grid was required. If the fuel mix and efficiency has been improving (i.e. resulting in a decrease in GHG emissions over time) the methodology should refer to emissions from power plants that are under construction or planned. If the fuel mix or efficiency has been declining (i.e. resulting in an increase of GHG emissions) then emissions from existing plants would be valid on the basis of a conservative approach Incorporation of a requirement for project developers to review the changes in the grid under review would improve the conservativeness and accuracy of baselines that utilize this approach.

b) Explain whether the application of the methodology could result in a baseline scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases that would occur in the absence of the proposed project activity.

>> Yes, with limitations described in (a) above

c) State whether the documentation explains how, through the use of the methodology, it can be demonstrated that a project activity is additional and therefore not the baseline scenario. If so, what are the tools provided by the project participants?

>> Yes.

d) Explain whether the basis for assessing additionality is appropriate and adequate:

>> The basis for assessing additionality is generally appropriate and adequate. The methodology uses the "Tool for demonstration and assessment of additionality" It demonstrates that even though large infrastructure projects, such as dams, often would be part of national (government) energy strategies the other barriers, including investment barriers, would prevent the project from being implemented .

(2) Methodological basis for calculating baseline emissions and emission reductions

a) Explain how the methodology calculates baseline emissions and whether the basis for calculating baseline emissions is appropriate and adequate:

>> Algorithms and formulae used refer to ACM0002. The basic underlying rationale for algorithms/formulae is the use of average or default values (e.g. default grid emissions factor, or default reservoir emissions fluxes). By using the default value of 0.8 kgCO2/kWh, the underlying rationale is that the project will displace only off-grid diesel consumption and not be impacted by grid electricity production. Therefore it does not use combined margin analysis (unlike in ACM0002). This approach may not be adequate because electricity demand growth has not been taken into account. There is currently no electricity demand increase considered in the Baseline discussion, which would be very likely in developing countries or least developed countries. In this sense, the methodology does not present a

reasonable Baseline.

b) Explain how the methodology calculates project emissions and whether the basis for calculating project emissions is appropriate and adequate.

>> Yes, generally appropriate and adequate. However, as explained above, the complexity and uncertainty of the approach to estimate reservoir emissions is a matter of concern.

(3) Definition of the project boundary related to the baseline methodology:

a) State how the project boundary is defined in terms of:

i) Gases and sources

>> Gases: CH_4 and CO_2;

Sources: a) national electricity grid including all power plants, the project boundary includes the project site and all the power plants connected physically to the electricity grid that the CDM activity (hydro facility) is connected to. The project electricity system (i.e. regional grid) is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints. b) all off-grid diesel generators in especially poor countries where no developed grid exists, c) the new (or extended) reservoir as result of the dam construction.

ii) Physical delineation

>> Above mentioned GHG emissions directly from reservoirs and degassing immediately downstream of the dam

b) Indicate whether this project boundary is appropriate:

>> Yes, generally appropriate.

***(4)* State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context** *(described in Sections A - E of the draft CDM-PDD and submitted along with CDM-NMB):*

>> The application of the methodology to the CDM project is incomplete and requires changes as described above. In that context, it is not fully appropriate. Further additional changes/clarifications are listed below, where appropriate improvements are required: As far as reference is made to ACM 0002, a generic formulae has been applied. But for the reservoir analysis, there is no generic formula provided in the CDM-NMB for the estimation of reservoir emissions (for CO_2 and CH_4) to get a first proxy. The calculation procedure is only described in text format in the CDM-PDD. There is no mention in CDM-NMB of default emission factors for CO_2 and CH_4 that should be used to estimate project (reservoir) emissions in the Baseline Study. The discussed default values for tropical areas should be cross-checked with default values provided in the IPCC LUCF Best Practice Guidance, where more region-specific data is available. However, if EB23 guidance on reservoir emissions and ACM002 is applied, these should now be adjusted accordingly as per the values (if and as applicable) provided in the guidance.

In addition, the following discrepancies may be noted and corrected/clarified accordingly:

i) E.1. of the CDM-PDD: The formula for estimating GHG emissions by sources (representing a part of project activity emissions) is incorrect. The figure 106 must read 10^6 to match the total estimated annual emissions of 17000t/CO2e. An additional spreadsheet-based calculation may help to better understand how the project emissions were calculated.

ii) E.4. of the CDM-PDD: "Estimated anthropogenic emissions by sources of greenhouse gases of the baseline". The content in this section is not appropriate. The methodology needs to include the Baseline emissions and not the emission reductions. The 27 MW power plant in Sierra Leone is mentioned as the only existing power plant in the country. The proponent should: a) indicate the load factor per year for this plant (in hours/year), get the annual MWh electricity generated from the existing plant and then multiply it with the appropriate emission factor, and b) get figures for the installed capacity (in MW) of off-grid electricity devices in the country (e.g. by using sales statistics), multiply the MW with the annual average load factor and emission factor, c) should sum up a) and b) to get the Baseline emissions, d) should make a provision for demand growth over years and should add these emissions to c). This detailed level of data will provide some indication, whether full displacement of off-grid diesel applications through the hydro power plant

is realistic. If not, then installed capacity is extended. Then the methodology should clearly indicate what fuel type would be avoided in the future and this would be determined.

iii) E.5. of the CDM-PDD: needs to be corrected, see comment above for E.4 of the CDM-PDD. The 0.8 kgCO2/kWh default value has not been applied or discussed in its application in the PDD. It is assumed that hydro power electricity will fully displace off-grid diesel based electricity generation. This assumption must be verified (vis-à-vis CDM-NMB).

(5) Key assumptions/parameters (including emission factors and activity levels), rationale, data sources and uncertainties:

a) List the implicit and explicit key assumptions, and rationale for the methodology. Identify those, if any, which are problematic and explain:

>> As discussed above, the CDM-NMB may consider applying the EB23 recommendations for emissions from hydroelectricity project reservoirs. However, in its current form, the approach has the following assumptions and they need to be clarified further with appropriate elaboration:

i) Average values for CO_2 and CH_4 emission fluxes are assumed for tropical regions. The figures used imply that they can be used regardless of the type of vegetation to be flooded such as forests, grassland etc. No decrease of CO_2 and CH_4 emissions in the reservoir over time are assumed. Gross emissions (including natural emissions) are assumed.

ii) No carbon inflows from the surrounding catchments in the form of dissolved particulate organic carbon are assumed. It is assumed that the reservoir reacts as a carbon source not a sink.

iii) Frequent sampling over different parts of a reservoir is possible and can provide a realistic and accurate measurement of GHGs from the reservoir.

Additional implicit assumptions are:

iv) Hydro plants are operated consistently throughout a year. This is not realistic and needs to be corrected with appropriate capacity (or plant load) factors.

v) The total electricity generated by the project can be accurately measured and recorded. This needs to be elaborated in the CDM-NMM.

b) Give your expert judgement on whether the assumptions/parameters are adequate:

>> See comments in (a) above. Importantly, using the same default emission factor for various types of vegetation and not considering changes in CO_2 and CH_4 fluxes from reservoirs over time are over-simplifying real situations. Moreover, hydro plants are not operated consistently throughout a year, since their capacity is affected by the availability of water resources which in turn is affected by climate.

c) Indicate which data sources are used and how the data are obtained (e.g. official statistics, expert judgement):

>> Official data is used to determine the build/operate margin and the diesel emission factor. However, the default emission factors used have not been clearly referenced and need to be elaborated. There is no discussion of the various categories of land to be flooded and their potential or tendency to release or store CO_2 and CH_4.

d) Explain the vintage of data recommended (in relation to the duration of the project crediting period) and whether the vintage of data is appropriate, indicating the period covered by the data:

>> The vintage of the data is not clear. Further information is required to clarify how old the national level data needs to be included. It is stated that local data will be collected ex post and the data will be current.

With respect to CH_4 and CO_2 emission fluxes, the default fixed values may not be appropriate. .The emission fluxes represent results from 2002/2003 measurements in tropical reservoirs. Long time series (e.g. a 10 or 20 year time series) of emissions fluxes from the same reservoir do not exist yet in many cases. Attention should be given to changes of emissions fluxes of reservoirs over many years. While in the first year/s of flooding new area, CO_2 and CH_4 fluxes increase exponentially, fluxes will decrease as the reservoir gets older, as shown in some reservoir emission measurement campaigns. The methodology makes no differentiation of emission fluxes over time.

e) Give your expert judgement on whether the data used are adequate, consistent, accurate and reliable:

>> Provided a reasonable vintage for the data is defined (e.g. 3 to 5 years old) and the data is adequately referenced/sourced, most of the data used could be considered generally adequate, consistent, accurate and reliable. However, for some parameters data used are not adequate and accuracy is hard to determine based on the information provided. For instance, the emission flux values may be reliable for reservoirs only in those regions that are almost identical to tropical regions where the measured emission fluxes were used for.

f) State possible data gaps:

>> Load factor of existing thermal power plant (27MW), load factor of planned hydro power plant, no differentiation between degassing, diffusion and bubbling emissions, no N_2O emissions covered.

(6) Assessment of uncertainties:

a) *Provide an assessment of uncertainties given (e.g. in determining baseline scenario, data sources, key assumptions)*

>> Not addressed adequately. The methodology does not explicitly address uncertainties related to algorithms and formulae used. Given that the methodology is based on ACM002, it is not expected that uncertainties be repeated, however there are additional algorithms and extensions of ACM0002 concepts and formulae (that are not applied in ACM 002 for hydro reservoirs that displace off grid diesel generators).

The key uncertainties are associated with the variation in reservoir emissions (measured through air sampling techniques) and the amount of off grid diesel generation capacity that is replaced by the proposed project.

In the absence of a full understanding of uncertainties related to reservoir emissions from a scientific point of view, the proponent should refer to the major discussed uncertainty sources in literature and try to relate them to the emission factor discussion. For instance, available data and statistics do not allow defining, with an acceptable uncertainty on a scientific basis, the average rate of decomposition of the flooded organic material, the net GHG emissions for many reservoirs studied. Further uncertainties should be discussed such as decline of annual CO_2, CH_4 emissions over time etc. However, this may not be necessary if the approach in the CDM-NMB applies the appropriate recommendations based on the guidance from EB 23 decision on emissions from hydroelectricity reservoirs.

The methodology suggests the use of the default diesel emission value from the small scale diesel generation category baseline. The figure is taken from the small scale diesel generation approved baseline. Uncertainties regarding the use of this emission factor for a larger scale projects, is not fully addressed.

In addition, the uncertainty regarding the availability of water resources is not addressed. For instance, it is assumed that the hydro facilities will run constantly, however, water resources usually vary over a year.

(7) Leakage:

a) State how the baseline methodology addresses any potential leakage due to the project activity:

>> The discussion on leakage in CDM-NMB cannot be fully understood, other than the ACM0002 part which is available. The proponent should discuss potential leakage emissions as result of the construction of the dam. T his may lead to e.g. colonisation of forest areas, deforestation, and other local and cumulative aspects. The discussion on leakage should be elaborated.

b) Indicate whether the treatment for leakage is appropriate and adequate:

>> Not fully appropriate.

(8) Transparency, "conservativeness" and consistency

a) Indicate whether the baseline methodology is presented in a transparent way, and if not, what changes are suggested:

>> The baseline setting for the electricity grid follows mainly ACM0002. The proponent discusses a special situation where the combined margin analysis is not possible due to small size of the grid. This discussion is made in a transparent way and an example is provided. However, the baseline emissions methodology for reservoir emissions is not discussed adequately.

b) Explain whether the baseline methodology is conservative, and if so, how:

>> As far as pre-dam CO_2 emissions (that could be considered as natural emissions) are concerned, emission factors for CO_2 and CH_4 were used for the Sierra Leone project that refer to measurement results from a climatically comparable region. Without an uncertainty discussion and a discussion of how the expected uncertainties reflect the used data it is difficult to state fully whether the Baseline methodology is conservative. The current baseline methodology may result in non-conservative emission calculations because:

i) Run of river hydroelectric plants are often used as base load plants. Storage hydroelectric plants (i.e. with dams) are more commonly used as peak load plants or base load following plants. However, there are cases In developing countries where reservoir hydroelectric plants may contribute to base load energy supply. In this case, the amount that a hydro reservoir contributes to the base load is highly dependent on water supply and local climate. For example, in a country where there is a wet and dry season, during the wet season (e.g. 8 months) electricity demand is low (e.g. less cooling) and only hydro power plants are operated to respond to demand. During the dry and hot season (4 months) electricity demand is larger and water supply is smaller. Thus at these times fossil fuel fired power plants are used as base load and hydro plants will operate at approximately 25% of their capacity. Thus it is rare that a hydroelectric plant will displace a constant number of off- grid diesel generators for an entire year. This should be acknowledged in the methodology.

ii) In many developing countries the electrical grids can not provide a consistent uninterrupted supply of electricity, due to over-demand. As a result it is common in developing countries for households and companies to have a back up diesel generator to provide on site electricity in the event of power cuts in the supply from the grid. To be on the conservative side, it is suggested that the diesel emission factor is only used when project developers provide evidence that either the proposed project will be supplying base load electricity; or there are no expansion plans for new alternative electricity generating facilities in the proposed grid; or evaluate the contribution of the proposed hydro plant to the baseload accounting for changes within a year due to climate influences on water resources.

iii) If the fuel mix of power plants and efficiency has been improving in the last few years, using data from older constructed plants may not accurately reflect business as usual practice. Therefore the methodology could be improved if an assessment of improvements in the fuel mix and efficiency of the grid was required. If the fuel mix and efficiency has been improving (i.e. resulting in a decrease in GHG emissions over time) a reference to emissions from power plants that are under construction or planned is appropriate. If the fuel mix or efficiency has been declining (i.e. resulting in an increase of GHG emissions) then the reference to emissions from existing plants would be valid. Incorporation of a requirement for project developers to review the changes in the grid under review would improve the conservativeness and accuracy of baselines that utilise this approach.

c) Explain whether the baseline methodology is internally consistent, and if not, highlight which sections are inconsistent:

>> Generally, yes subject to inconsistencies due to the reasons noted in 8(a) and (b) above.

(9) If relevant, state whether the proposed changes required for the methodology implementation on 2nd and 3rd crediting periods are appropriate.

>> Information has not been provided in the submission. Revised submission should include it.

(10) State the baseline approach selected, indicate whether this is appropriate, and why.

>> The approach as per paragraph 48 (a) of the CDM modalities and procedures: "Existing actual or historic emissions, as applicable "has been selected. Further clarification of the baseline approach is required, because in ACM0002, project developers may use either approach as per paragraph 48(a) or paragraph 48 (b) of the CDM modalities and procedures: "Existing actual or historic emissions, as applicable", "Emissions from a technology that represents an economically attractive course of action, taking into account barriers to investment". The proposed new methodology allows only the use of paragraph 48 (a) for hydro reservoir projects. It is not clear why approach as per paragraph 48 (b) could not be used for hydro projects with reservoirs.

The approach selected has been applied out of context. The methodology is based on ACM002 but combined margin emission factor cannot be calculated and most of the grid or off-grid (diesel) electricity will be displaced by the project, the methodology extends ACM0002 to a small-scale paradigm, which is to

use the default emission factor of 0.8 kgCO2/kWh for diesel used for off-grid electricity production.

(11) Any other comments:

a) State which other source(s) of information (i.e. other than documentation on this proposed methodology available on the UNFCCC CDM web site) have been used by you in evaluating this methodology. Please provide specific references:

>> The following documents were referred to and/or used for evaluating this methodology, including by desk reviewers:

- Tremblay et al.: Greenhouse Gas Emissions – Fluxes and Processes. Hydroelectric Reservoirs and Natural Environments. Springer. 2005
- Rosa, L.P.; dos Santos: M.A. Certainty and Uncertainty in the Science of Greenhouse Gas Emissions from Hydroelectric Reservoirs, Thematic Review II.2 prepared as an input to the World Commission on Dams, Cape Town, www.dams.org.)
- Greenhouse Gas Emissions from Reservoirs at www.hydropower.org
- Rosa et al.: Hydroelectric Reservoirs and Global Warming. For RIO 02. World Climate & Energy Event, January 6-11, 2002
- Dam Reservoirs and Greenhouse Gases. Report on the Workshop held on February 24 & 25, 2000, Hydro-Quebec, Montreal. Final Minutes
- Good Practice Guidance for land, land-use change and forestry, IPCC, 2003
- In addition, EB 23 guidance on emissions from hydroelectricity reservoirs has been used.

b) Indicate any further comments:

>> No further comments.

II. Detailed recommendations on the proposed new monitoring methodology

Evaluate each section of CDM-NMM. Please provide your comments section by section:

(1) Indicate if this proposed monitoring methodology is compatible with the proposed baseline methodology described in CDM-NMB of the draft CDM-PDD, and if not, why.

>> Yes, it is generally compatible.

(2) Assessment of key assumptions/parameters:

a) List the implicit and explicit key assumptions. Identify those, if any, which are problematic and explain:

>> Many assumptions have been considered with respect to monitoring approach related to reservoir emissions. If the EB23 guidance is followed and default emission values are used, these will be irrelevant. However, if the proposed approach of measuring reservoir emissions through air sampling is continued to be adopted in this CDM-NMB, the following assumptions need to be noted and, if required, clarified/elaborated:

i) Cluster building is required because the land to be flooded is unlikely to only represent one vegetation type. One must assume a different behaviour of different vegetation types in terms of their emission fluxes over time. Such assumption is plausible.

ii) CO_2 and CH_4 emission levels alter over a year due to changing weather and climate conditions, which requires multiple samples to be taken and analysed over a year. The assumption is plausible.

iii) Gross emissions are measured. The methodology does not make a clear provision how to factor out natural CO_2 (and CH_4) emissions to get net emissions. The assumption to record gross emission may be erroneous because emission that otherwise would occur anyway may be counted.

iv) All reservoir samples should be taken in floating chambers. This assumption is plausible.

v) No monitoring is required for the displacement of off-grid diesel generators. This seems erroneous and needs to be substantiated or changed accordingly.

b) State whether the key assumptions are adequate, and whether they have been arrived at in a transparent manner:

>> Not all assumptions are arrived at in a transparent manner as described above. For instance, the CDM-

PDD mentions the need for considering net emissions only but the methodology consider gross emissions only. The methodology provides no reasons why N_2O should not be considered under the proposed monitoring methodology. Air sample measurement in reservoirs should be backed with a brief advantage/disadvantage discussion of commonly used measurement methods.

(3) Data sources and data quality:

a) Give your expert judgement on whether the data sources and data quality used are adequate, consistent, accurate and reliable. If not, please explain.

>> The following are the specific data sources:

- Data obtained from expert opinion of the dam operator: Square meters of reservoir surface area, and different categories to measure in flux testing;
- Data to be measured: Emissions of CH_4, - Concentration of CH_4 at water in take; Concentration of CH_4 in water downstream of dam; Total volume of water moving through dam; Electricity produced at hydro plant;
- Public sources of information including IPCC data: Carbon emissions factor for the grid; Carbon emission factor for the operating and build margin; Total emissions from the grid; Total electricity to the grid; Amount of fossil fuel used in the grid; GHG co-efficient of each fuel; Electricity generation of the plant; List of plans for operating margin and list of plans in build margin; Total electricity generation of imported power; Carbon co-efficient of imported electricity; Weight factor of operating margin; Evidence of barriers to proposed project; Evidence of alternatives to proposed projects.
- The data to be used for determining project emissions represents measured data. Depending whether a laboratory expert or newly trained staff will collect and analyse the samples, the data quality might vary thereby giving rise to the question of reliability and also uncertainties. Uncertainties with determining emissions from degassing downstream of the dam are mentioned (CDM-NMM, page 8/9), if the same method is used as measuring CH_4 and CO_2. A suggestion is made for a modified measurement procedure, which would look adequate. The data used should be expanded to include monitoring data for off grid diesel generators if displaced by the proposed project.

b) *State possible data gaps:*

>> The QA/QC analysis does refer to the quality of results

(4) Leakage *(please elaborate, if appropriate)***:**

>> The proposed methodology incorporates analysis of leakage from reservoirs but due to uncertainty and lack of data for the sampling of methane from reservoirs it is recommended that ex post measurements of emissions from reservoirs are used. The monitoring methodology should explain how possible leakage will be quantified (measured or calculated, recorded using questionnaires and/or other methods). However, if the project proponent is using the default emissions as per guidance provided by the EB23 (if appropriate) then this approach may not be necessary.

A reference to ACM0002 would be useful in this section of the methodology since ACM00002 monitoring procedures are to be followed for a part of the methodology application.

(5) Quality assurance and control procedures (please explain):

>> Relatively little information is provided on QA/QC. The methodology expands the procedures included in ACM 0002 by requiring frequent samples of emissions from the reservoir and the proposed project site. The data required for this monitoring should be completed in B.4.1.

Field tests and ex-situ analysis (laboratory analysis) have different accuracies. T o be able to get comparable results only one detection method (either in-situ or ex-situ) should be allowed, otherwise allowance should be made for corrections in case a detection method with a lower precision is used. The QA/QC discussion should clearly refer to the issue of "rejected fluxes", meaning those samples that result in a lower correlation coefficient than a defined value. Such standardised value must be provided and agreed to, to keep the quality of detected values under a certain level of control. A large percentage of "rejected fluxes", however, would mean that costs for monitoring increase. However, the project proponent should note that if the NMB is modified in view of the guidance by EB23 on hydroelectric project reservoir emissions (if applicable), the QA/QC procedures in NMM will have to be updated accordingly.

(6) Assessment of the description of the proposed methodology:

a) State whether the proposed methodology has been described in an adequate manner:

>> A significant amount of theoretical underpinnings associated with reservoir emissions are presented but a clear instruction of how to organise the measurement of reservoir and degassing emissions is missing from CDM-NMM. Further elaboration will be useful.

The proponent provides a choice between on-site measurement and laboratory measurement and not a single standardized detection method (either laboratory tests or independently performed on-site tests with mobile detection equipment) because both approaches have a different level of precision and uncertainty. In case both approaches should still be allowed, an explanation should be provided how the different accuracy levels of detection methods can be taken into account. Some level of standardisation will ensure results across countries and different regions are better replicable.

The methodology description is currently also lacking a more practical description of how to build clusters, set up the tests, calibrate the equipment etc. It does also not outline qualification requirements of the personnel undertaking the measurements. Having said this, we however note that the project proponent may also follow the new guidelines provided by the EB23 with respect to hydroelectric reservoir emissions, as appropriate.

b) State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context (described in Sections A - E of the draft CDM-PDD and submitted along with CDM-NMM):

>> The methodology is appropriate for the referred project activity provided the required revisions are made appropriately.

(7) Any other comments:

a) State whether any other source of information (i.e. other than documentation on this proposed methodology available on the UNFCCC CDM web site) has been used by you in evaluating this methodology. If so, please provide specific references:

>> The following documents were referred to and/or used for evaluating this methodology, including by desk reviewers:

- Tremblay et al.: Greenhouse Gas Emissions – Fluxes and Processes. Hydroelectric Reservoirs and Natural Environments. Springer. 2005.
- Rosa, L.P.; dos Santos: M.A. Certainty and Uncertainty in the Science of Greenhouse Gas Emissions from Hydroelectric Reservoirs, Thematic Review II.2 prepared as an input to the World Commission on Dams, Cape Town, www.dams.org.)
- Greenhouse Gas Emissions from Reservoirs at www.hydropower.org
- Rosa et al.: Hydroelectric Reservoirs and Global Warming. For RIO 02. World Climate & Energy Event, January 6-11, 2002
- Dam Reservoirs and Greenhouse Gases. Report on the Workshop held on February 24 & 25, 2000,

Hydro-Quebec, Montreal. Final Minutes.

- Good Practice Guidance for land, land-use change and forestry, IPCC, 2003
- In addition, EB 23 guidance on emissions from hydroelectricity reservoirs has been used.

b) Indicate any further comments:

>> In this NM, the concept of reservoir emissions has been introduced in conjunction with ACM0002. However, measuring reservoir emissions is data, time and resource-intensive. The feasibility of a robust monitoring methodology may not be feasible under the CDM due to impact on increased transaction costs, in particular, if the number of "rejected fluxes" would be high. Recommendations pertaining to emissions from hydroelectricity reservoirs, provided by EB23, in the context of application of ACM0002 may be followed.

Signature of Meth Panel Chair ……..
Date: 13/04/2006 *(Rajesh Kumar Sethi)*

Signature of Meth Panel Vice-Chair ……..
Date: 13/04/2006 *(Jean-Jacques Becker)*

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