CDM: Proposed new methodology expert form (version 03)

(To be used by methodology experts providing desk review for a proposed new methodology)

Name of expert responsible for completing and submitting this form	Steven Schiller
Related F-CDM-NM document ID number	NM0084:Natural Gas-Fired Cogeneration Plant Replacing Oil-Fired Boilers

Note to those completing this form, as applicable: Please provide recommendations on the proposed new baseline and monitoring methodologies based on an assessment of annexes 3 and 4 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. Evaluation of the proposed new methodologies by desk reviewers:

I. Evaluation of the porposed new baseline methodology:

Title of new baseline methodology:>>Natural Gas-Fired Cogeneration Plant Replacing Oil-Fired Boilers

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

>>If this methodology incorporates certain improvements and is approved it would be applicable for projects that:

1. Replace grid-purchased electricity and on-site produced thermal energy with fossil fuel based, combined-cycle gas turbine, non-condensing steam turbine cogeneration system
2. Are justified as additional using EB 16 Annex 1 “tool for the demonstration and assessment of additionality”
3. Are installed at an industrial facility where baseline emission rates can be determined using a calibrated model which includes industrial productions volumes as the sole independent variable
4. Involve sales of electrical power to the "grid"
5. Displace grid electricity that can be defined with a grid "build margin" model as defined in related approved methodology AM0015
6. Involve calculation of only project and baseline CO2 emissions

ii. Strengths and weaknesses of the methodology:

>>Strengths: Addresses an excellent project concept for reducing GHG emissions with what may be a simple and conservative methodology for estimating emission reductions as a function of industrial production rates. Relies on what should be readily available and verifiable data.

Weaknesses: The methodology is not general enough to be applied to other projects and requires a number of changes to allow it to provide an accurate and transparent estimate of emission reductions. See item iii (below).

iii. Any changes needed to improve the methodology:

a. Minor changes:>>

Major changes: >>

- The use of the metric of emissions per quantity of corn must be validated before it can be considered appropriate for adjusting baseline emission values.
- The use of natural gas as fuel source for baseline, displaced grid electricity is consistent with the methodology in AM0005 which specifies that hydro power plants are

excluded form the calculation of Operating Margin. However, it would be preferable if the format for calculation of emission factors was consistent with the format established in AM0015.

- Consideration of electricity purchased from the grid in the event of shutdown, maintenance, etc. of the cogeneration system is not considered in the analyses.
- Consideration of possible use of fuel oil and/or natural gas in the backup boilers are not considered in this methodology.
- Consideration of emissions other than CO2 are not considered, and although probably resulting in conservative estimates for this project, do not result in this being a generic methodology.
- The description of the project is not sufficient (particularly in terms of operating modes and cogeneration equipment utilized) to determine whether the methodology for emissions monitoring and baselines is appropriate.
- Separation of fuel use for steam and electrical production is not possible with the cogeneration configuration and is potentially irrelevant.
- The economic analysis of the plant is inadequately documented and may actually indicate the opposite of the additionality argument made. More thorough documentation and sensitivity analyses may provide a more robust financial argument. Application of the EB 16 Annex 1 "tool for the demonstration and assessment of additionality" may indicate that the project is additional based on other, non-financial viability, criteria.
- The baseline and project emission factors and electricity production efficiencies were inadequately documented. Of particular concern was the use of generic gas turbine system efficiencies for the grid baseline.

II. Evaluation of the proposed new monitoring methodology:

Title of new monitoring methodology: >>Natural Gas-Fired Cogeneration Plant Replacing Oil-Fired Boilers

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

>>If this methodology incorporates certain improvements and is approved it would be applicable for projects that meet the criteria described above (A1i) and for which data can be collected on historical and post-installation project (a) industrial production quantities, (b) on-site electricity, natural gas and fuel oil use, and (c) grid electricity characteristics in terms of emission rates per unit of electricity production. In addition, data are required on fuel characteristics and post-project installation electricity sales to grid.

ii. Strengths and weaknesses of the methodology:

>>Strengths: relatively simple metering and data collection/recording requirements

Weaknesses: the proposed methodology does not address:

- That natural gas consumption for electricity production and thermal energy produced by a gas turbine cogeneration system cannot be differentiated
- Fuel oil and natural gas that could be utilized by the auxiliary boilers or for supplemental firing of the HRSGs (not indicated if this capability exists)
- Complete documentation of fuel oil emission factors
- The monitoring methodology would benefit from a more thorough description of the project and at least a rudimentary heat balance indicating all fuel inputs and thermal and electricity outputs.

iii. Any changes needed to improve the methodology:

a. Minor changes:>>a project heat balance and better description of installed systems and how they are operated

b. Major changes: >>The monitoring methodology requires collection of additional project data, clarification and documentation on certain assumptions for emission and other factors, clarification on certain analyses, and a description of the QA/QC procedures that are being enforced.

B. Details of the evaluation of the proposed new methodology by the desk reviewer:

I. Proposed new baseline methodology *(specify title here):* >>

(1) Short description of the methodology, including an assessment of which approach from paragraph 48 of the CDM modalities and procedures was used:

a) Describe the methodology:

>>The methodology consists of five steps:

- Additionality testing based on an economic analysis of the baseline and project options with some limited assessment of barriers.
- Calculation of baseline carbon emissions values for displaced grid power based on a simple build margin model and historic (two years) facility electricity usage, IPCC Guidelines emission factors, and assumptions on grid thermal power generation efficiency.
- Calculation of baseline on-site emission values for displaced oil usage based on facility provided and IPCC Guidelines emission factors and historic (two year) usage.
- Calculation of project natural gas emission values using IPCC Guidelines emission factors and estimated on-site usage data for 2004
- Calculation of emission reductions using the difference between project CO2 emission values and baseline CO2 emission values which are reduced or increased using a ratio of actual to baseline, annual, corn production levels.

b) State the approach selected:

>>48(a) of the CDM M&P – Existing or historical emissions, as applicable

c) Indicate (in summary form) why the approach selected is the most appropriate. Please provide your expert judgement on the appropriateness of the selected approach to the project category:

>>The baseline actually consists of five elements and each needs to be addressed in terms of their appropriateness:

- Additionality calculation using financial model - this approach is not convincing and other approaches such as the Barrier Analysis or Common Practice Analysis indicated in EB16 Annex 1 might be more convincing.
- Calculation of baseline electricity use – the build margin approach is probably appropriate however the generic assumptions of grid electric production efficiency are not well documented
- Calculation of baseline thermal energy and emissions – historic usage data is appropriate, some of the fuel oil emission factors are not documented
- Calculation of "adjusted" baseline emissions using the ratio of current year and baseline annual corn production is not validated and may or may not be appropriate – it is not validated for this project
- Un-addressed baseline emissions of displaced fuel oil transportation emissions, fugitive emissions, and non CO2 GHG probably provide a conservative estimate of reductions – but this is not documented

(2) Basis for determining the baseline scenario:

a) State whether the documentation explains how the baseline scenario is to be chosen and identified:

>>a) The documentation explains how the baseline emissions factors are chosen and calculated.

b) State the basic underlying rationale for algorithms/formulae used (e.g. marginal vs. average basis) (see also section 4 below):

>>The basic underlying rationales consist of:

- the project will not displace hydro electric power, but instead will displace thermal generation units that are and will continue to be built in Brazil
- the project will displace historic fuel oil consumption at the facility
- baseline electricity and thermal usage are directly proportional to corn production rates

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?

>>

- The documentation provided and tools used (a financial analysis tool that is not provided or documented) and the results of the analysis do not provide clear evidence that the project would have not have been implemented in the absence of the CDM.

- The documentation on heating values and thus emission factors could be better presented providing references for baseline "Heavy Fuel Oil 7A and 4A" and clearer reference to which Table(s) within "Revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories" was utilized for the emission factors would be helpful. See http://www.ipcc-nggip.iges.or.jp/public/gl/invs5a.htm

- The grid efficiency assumption of 8,612 Btu/kWh is not documented at all.

d) State whether the basis for determining the baseline scenario and for assessing additionality is appropriate and adequate:

>>The additionality argument is based primarily on the financial viability argument with what appears to be a summary of a spreadsheet analysis of a single project. The additionality argument is not convincing for the following reasons:

- the project began operation in April 2003 – which in itself is not a indication of free-ridership, but it does raise some concern since the CDM application appears to have been submitted one year later
- there is no documentation of the analyses and assumptions
- the results, as described, indicate only about a 2% difference between the baseline and project cases – which is purported to show that the project is not economical
- The analyses is (probably) for a first year of operation and if the project cost is removed from the first year analyses the results indicate that the project has about a one year simple payback – that means that the project is very economical compared to the baseline
- No life-cycle or sensitivity analysis is provided and project economics for this type of project are highly sensitive to fuel and electricity costs fluctuations
- The economic value associated with non-energy saving benefits (e.g. increased reliability) are not monetized

However, there are indications that the project would be considered additional if the Barrier test approach

were used.

Baseline build margin approach to determining source of displaced grid electricity appears appropriate. As noted above in c) assumptions related to emission factors and grid fuel to electricity efficiency (kJ/kWh) are not documented.

A critical element of the baseline scenario is adjusting baseline emissions using a ratio of "actual post-installation corn production" divided by baseline (2000/2001) annual corn production. This approach is not validated in the documentation and therefore may or may not be adequate.

The ignoring of other baseline emission sources such as fugitive emissions from natural gas pipelines and emissions from fuel oil transportation trucks appears to be conservative.

(3) Assessment of the description of the proposed methodology and its applicability

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

>>The methodology is described adequately with respect to displaced electricity from the grid, although as noted elsewhere in this expert form there are concerns about the validity of certain key assumptions.

There is particularly concern about the use of the corn production volumes for calibration of baseline emission values. This may be a very good metric for defining predicted and actual emissions reductions. However, the period of analyses, 2 year average of pre-installation data, was too short to determine if there needs to be a fixed emissions value and a variable value (for example, emissions = m * tons of corn + b). The variation of production volumes (almost 2:1) for the pre- and post-installation period indicates that this metric needs a proof of validity. Also, any variation in plant production processes (for example that effect energy consumption per ton of corn processed) and product changes are not addressed by this methodology. In addition, the emissions associated with power sales to the grid, seasonally variations versus annual variations in corn production, auxiliary loads, and the fuel consumption characteristics of variable electrical output combined-cycle technology are not explicitly covered through this "ratio" approach and may result in significant over or underestimating of emission reduction.

It should also be noted that there is a great deal of repetition within the project design and methodologies forms. In some places a reference to prior descriptions would be helpful and in other places more detail on the material provided in summaries would be useful.

Application of the EB 16 Annex 1 "tool for the demonstration and assessment of additionality" would improve the methodology.

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 Annex 3):

>>Additional documentation is required to determine whether this methodology is appropriate. See prior items in this Expert From.

c) State 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.

>>Additional documentation is required to determine whether this methodology is appropriate. See prior items in this Expert From.

Please explain:

>>see Sections 2 (c) and 3(a) regarding additionality and baseline calculations.

(4) Assessment of algorithms/formulae and type of data needed:

a) State whether the description of the methodology includes algorithms and generic formulae that can be applied to other potential project activities (if not, the proposed new methodology will be considered as a project-specific methodology):

>>In terms of using the methodology as a general methodology for other projects a number of improvements would need to be made in order to move from project-specific to generic information and approaches. The most important change would be concerning the use of industrial production volumes to calibrate baseline emission values.

b) Explain the spatial scope of data used to determine the baseline and whether the scope is appropriate:

>>The information related to on-site oil and electricity consumption is "local" and the displaced emissions form grid electricity is "national". The methodology provides no generic guidance on how to determine spatial boundaries – of particular importance for the displaced grid electricity.

c) Explain the vintage of data used (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:

>>From the proposed methodology: "Baseline data are taken from the baseline period of 2000-2001. The project activity data are taken from estimated performance data for the year 2004. The monitoring and verification plan specifies that the actual emission reductions will be based on actual performance data for each year for which emission credits are to be claimed."

The baseline data from an average of only two years of operation is not adequate. (Note that the data for the two years is averaged and not shown for each year). Essentially, this is a statistical "analysis" of one baseline data point. Significant fluctuation in corn production rates (approximately 1.6 million tons for the average of years 2000 and 2001 versus approximately 800,000 for 2004) indicate that additional baseline data should be used for estimating emission reductions and calibrating the emission reduction algorithms that utilize corn production rates.

(5) 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

>>CO2 from electricity production (using natural gas) and fuel oil combustion

ii) Physical delineation

>>Brazil national electric grid and existing fuel oil boilers for baseline, cogeneration system for project

b) Indicate whether this project boundary is appropriate:

>>The boundary is appropriate except that the boilers that were not removed (as part of the project) can still be used and thus must be included within the project boundary and analyses

(6) Key assumptions/parameters (including emission factors and activity levels) and data sources:

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

>>Key assumptions for the baseline emissions are associated with emission factors for natural gas and fuel oil, characteristics of Brazilian power market, and information on operations at the facility where the project is to be installed. Key assumptions related to additionality relate to information on Brazilian cogeneration market and economic factors associated with financial analysis of project. The most

important implicit assumption is the validity of the factoring of baseline emissions, up or down, based on corn production rates. This later assumption, as discussed elsewhere, is the most problematic. In addition, the format presented is not generic enough for generalized methodology.

b) State whether the key assumptions are arrived at in a transparent manner:

>>The key assumptions concerning the baseline data and electric grid markets are transparent with the exception of (i) efficiency of Brazilian natural gas fueled power generation and (ii) proving individual year data versus aggregated data. The financial analysis is only provided in summary form with no documentation.

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

>>See above, in many cases insufficient documentation is provided to verify the validity of calculations and assumptions.

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

>>Information on the Brazilian market appears to be publicly available and reliable. Some assumptions, such as efficiency of power production, are missing. On site data, such as corn production rates and baseline fuel usage, rely on company provided documentation. The QA/QC process is not transparently described.

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

>>Use of official data are adequate. Use of facility data requires an audit documentation procedure.

f) State possible data gaps:

>>The data gaps may consist of efficiency of power production, historical on site energy usage and production data, and post-installation project gas usage for steam and electricity production.

(7) Assessment of uncertainties:

a) State whether the methodology includes an assessment of uncertainties regarding:

i) The basis for determining the baseline scenario:

>>not assessed other than the relationship between corn production and emissions and, as discussed in other parts of this form, this is a questionable adjustment mechanism

ii) Algorithms/formulae:

>>not assessed

iii) Key assumptions:

>>not assessed

iv) Data:

>>not assessed

b) State whether the uncertainties presented are reasonable:

>>Uncertainties require discussion and possible analyses – such as on financial analyses and validity of baseline adjustments though ratio of project to baseline corn production.

(8) Leakage:

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

>>(a) Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity. The only explicit leakage discussion relates to physical "leakage" of natural gas from pipelines.

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

>>The limited discussion of leakage is probably adequate and conservative for this project with the

condition that the following items be included within the project boundary (i) auxiliary boilers (and Heat Recovery Steam Generator - HRSG) fuel consumption which may be utilized when the cogeneration system is not operating and (ii) power purchase from the grid when the cogeneration system is not operating or providing sufficient quantities of steam and/or not providing sufficient quantities of electricity.

(9) Transparency and "conservativeness":

a) Indicate whether the baseline methodology was developed in a transparent way:

>>With respect to the build margin approach for displaced grid power the methodology is developed in a transparent way. However, as noted elsewhere a number of assumptions are either not documented (e.g. efficiency of grid electrical generation from natural gas) or not validated with respect to other aspects of the baseline methodology.

b) State whether the baseline methodology is conservative:

>>b) For a grid with predominately hydro based generation, it is possible, as described in the methodology, for the grid electricity displaced by a new cogeneration system to be from the "build margin" of natural gas only fueled central power plants. Without further documentation and validation it is not possible to tell whether are other aspects of the methodology are conservative or not.

(10) Potential strengths and weaknesses of the proposed baseline methodology *(please explain)***:**

>>Strengths: Addresses an excellent project concept for reducing GHG emissions with what may be a simple and conservative methodology for estimating emission reductions as a function of industrial production rates. With additional work this could be an important generalized methodology for cogeneration projects.

Weaknesses: see A.I.iii

(11) Other considerations, such as a description of how national and/or sectoral policies and circumstances have been taken into account *(please explain)***:**

>>1. Information is provided on build margin for Brazilian power markets. Information cited was not independently verified.

(12) Applicability of the proposed methodology across project types and regions *(please indicate)***:**

>>If this methodology incorporates certain improvements and is approved it would be applicable for industrial cogeneration projects for which emission rates can be correlated to an industrial plant's product production levels and for which data can be collected on historical and post-installation project (a) industrial production quantities, (b) on-site electricity, natural gas and fuel oil use, and (c) grid electricity characteristics in terms of emission rates per unit of electricity production.

(13) 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:

>>Public Comment From submitted by Ralph Harthan

EB 16 Annex 1

AM0005, AM0014, and AM 0015

b) Indicate any further comments:

>>none

II. Proposed new monitoring methodology *(specify title here):* >>Natural Gas-Fired Cogeneration Plant Replacing Oil-Fired Boilers

In respect of the proposed new monitoring methodology, evaluate each section of annex 4 to the draft CDM PDD. Please provide your comments section by section:

(1) Brief description of new methodology:

Describe new methodology:

>>The proposed methodology involves collection of the following data, as recorded for other purposes at the project site: natural gas consumed by the cogeneration system; amount of electricity and heat supplied to the industrial plant by the cogeneration system; amount of electricity sold to the grid (if any); and production in terms of tons of corn processed at the Mogi Plant.

(2) Key assumptions/parameters:

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

>>According to the methodology project emissions derive from just two sources: consumption of energy (natural gas) for production of steam and consumption of energy (natural gas) for production of electricity. The implied assumption is that the only project emissions will be associated with fuel consumption by cogeneration system. This is problematic since this specifically excludes emissions associated with:

- fuel consumption (oil or natural gas) in backup boilers for steam production when the cogeneration system is not operating or providing inadequate quantities of steam, and
- fuel consumption associated with purchases of electricity from the grid when the cogeneration system is not operating or providing inadequate quantities of electricity
- fuel consumption that may or not be used to supplementary fire the Heat Recovery Steam Generator (HRSG) - it is not known if this feature is available with this specific project, but is common in many cogeneration projects)

The cogeneration will always have some "down-time" during the year to, at a minimum, address maintenance.

As discussed in the review of the baseline methodology, the monitoring methodology (and analyses) relies on the validity of using the corn production values to calibrate baseline emission estimates.

The baseline assumes that documented information is available concerning appropriate emission factors for on-site fuel oil use and grid electricity production. The documentation of these emission factors appears to be problematic as no documentation is provided for certain fuel types used on-site nor the grid efficiency factors.

An assumption is made concerning the efficiency of the cogeneration system (kJ/kWh) but is not clear what this is used for or if it used why a generic versus actual project efficiency was indicated.

b) State whether the key assumptions are arrived at in a transparent manner:

>> Documentation and further explanation required concerning: monitoring methodology, collection methods for all required data, explanation of how project fuel use for electricity production versus fuel use for steam production will be measured, emission factors, and QA/QC procedures.

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

>>At this time for the reasons stated above the methodology is not adequate

(3) Data sources and data quality:

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

>>The data sources are primarily on site data collection.

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

>>(b) As QA/QC procedures are not defined in any way, it is not possible to determine the adequacy, accuracy, etc. of the data sources and quality. Also, as noted above, some required data collection is not included.

c) *State possible data gaps:*

>> Information on fuel use on-site not directly associated with fuel input to the cogeneration gas turbines (e.g. boilers and HRSG) and power sales FROM grid after project installation

(4) Assessment of the description of the proposed methodology and its applicability:

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

>>The proposed methodology has not been described adequately as it mostly involves repetition of material in the baseline methodology and does not cover key aspects of data collection, analyses and QA/QC.

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 annex 4):

>>(c) The methodology is not appropriate without modification.

c) State whether this proposed monitoring methodology is compatible with the proposed baseline methodology described in annex 3 of the draft CDM-PDD:

>>The methodology is compatible with the baseline methodology, but as discussed may have flaws.

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

>>Leakage is minimally addressed and dismissed. This is probably acceptable and leads to overall a conservative estimate, as consideration of indicated leakage elements would most likely result in calculation of greater emission reductions.

(6) Quality assurance and control procedures *(please explain)***:**

>>QA/QC is mentioned but no description is provided of what the QA/QC procedures will actually be and how they ensure data integrity, accuracy, etc.

(7) Potential strengths and weaknesses of the proposed monitoring methodology *(please explain)***:**

>>The strength of the proposed methodology is that it relies on what should be readily available on-site data available at almost all cogeneration project facilities. The weaknesses are the lack of explained QA/QC procedures, inadequate documentation of analyses and assumptions, and missing data that should be collected.

(8) Applicability of the proposed methodology across project types and regions *(please indicate)***:**

>>If the issues are resolved with this methodology it could be applicable to a wide variety of industrial cogeneration projects.

(9) 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:

>>none

b) Indicate any further comments:

>>none

Signature of desk reviewer Steven Schiller ……..

Date: 20 / 12 /2004

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