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Report

on

Second Assessment and Evaluation

of

New Baseline and Monitoring Methodology
”NEW COGENERATION FACITILITES SUPPLYING LESS CARBON INTENSIVE ELECTRICITY TO GRID AND STEAM AND/OR HOT WATER TO ONE OR MORE GRID CUSTOMERS”

under

Voluntary Carbon Standard 2007.1 (VCS 2007.1)

REPORT NR.01 996 2120 9941

REVISION NO. 02

Date of first issue: 2008-08-11	Project No.: 01 996 2120 9941	TÜV Rheinland Immissionsschutz und Energiesysteme GmbH TÜV Rheinland Group Am Grauen Stein D – 51105 Cologne Germany
DOE: TÜV Rheinland (CDM- E-0013 / JI- E-0012)	Organisational unit: TIE	
Client: Camco International, Carbon Asset Qualification	Client ref.: Mr. Dominic Schmitz	Certificate Number: 01 996 2120 9941

Executive Summary:

Applied GHG Standard: Voluntary Carbon Standard 2007.1(VCS 2007.1)

Country: Macedonia

Title of the proposed new baseline methodology:

"New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers" (revised from previous proposed methodology with the title "New waste heat recovery facilities supplying steam and/or hot water to multiple customers and displacing grid /off grid steam and grid hot water generation from natural gas"), to be applied at CDM-project activity "Skopje Cogeneration Project" in Macedonia, which is currently under validation. **Version: 1**

History of submission:

Submitted from Camco International to TÜV Rheinland Immissionsschutz und Energiesysteme GmbH on 5th of August, 2008 and on 2nd of July, 2009 as well 12th of August, 2009.

Size

☒ Large Scale
☐ Small Scale

Validation Phases:

☒ Desk Review
☒ Follow up interviews
☒ Resolution of outstanding issues

Validation Status

☒ Corrective Actions Requested
☒ Clarifications Requested
☒ Full Approval and submission for registration
☐ Rejected

Report No.: 01 996 2120 9941	Subject Group: Environment & Energy	
Report title: New VCS 2007.1 methodology "New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers"		
Desk review carried out by: • Kurt Seidel		
Report submitted to Camco/VCS on: 2009-08-12		
Date of this revision: 2009-08-12	Rev. No.: 02	Number pages 51

Indexing terms

Climate Change
Kyoto Protocol
Large Scale Project Validation
Voluntary Carbon Standard (VCS)

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Abbreviations

Explain any abbreviations that have been used in the report here.

ACM	Consolidated Approved Methodology Large Scale
AM	Approved Methodology Large Scale
AMS	Approved Methodology Small Scale
BAU	Business as Usual
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction
CH_4	Methane
CL	Request for Clarification
CO_2	Carbon Dioxide
CO_{2e}	Carbon Dioxide Equivalent
DNA	Designated National Authority
DOE	Designated Operational Entity
DR	Document Review
EB	Executive Board
ER	Emission Reductions
GHG	Greenhouse Gases
GWP	Global Warming Potential
I	Interview
IETA	International Emissions Trading Association
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
LoA	Letter of Approval
MoV	Means of Verification
MP	Monitoring Plan
N_2O	Nitrous Oxide
NGO	Non-Governmental Organization
NM	New Methodology
ODA	Official Development Assistance
O & M	Operation and Maintenance
PDD	Project Design Document
PE	Project Emissions
QA/ QC	Quality Assurance / Quality Control
SOP	Standard Operating Procedures
t	Tonne
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard

TABLE OF CONTENTS

1. Introduction
2. Objectives
3. Assessment Scope
4. Overview of the Assessment Process
5. Conflict of Interest Review
6. Assessment Team
7. Final Audio Conference and Meeting
8. Corrective Actions, Clarifications, Forward Actions, Recommendations and Supplemental Information
9. Assessment Reporting
10. Assessment Results: Evaluation of the proposed new methodology by the desk reviewer

10.A. Recommendation for approval or non-approval of the new methodology

10.A.1. Outline any changes needed to improve the methodology for approval or reasons for non-approval

10.B. General information on the submitted proposed new methodology

10.B.1. One sentence describing the purpose of the methodology.

10.B.2. Summary description of the methodology.

10.B.3 Relationship with approved or pending methodologies (if applicable).

10.C. Details of the evaluation of the proposed new methodology

10.C.1. Applicability conditions

10.C.2. Definition of the project boundary

10.C.3. Determining the baseline scenario and demonstrating additionality

10.C.4. Methodological basis for calculating baseline emissions and emission reductions

10.C.5. Leakage

10.C.6. Key assumptions

10.C.7. Data and parameters NOT monitored

10.C.8. Key data and parameters monitored

10.C.9. Assessment of uncertainties

10.C.10. Transparency, “conservativeness” and consistency

10.C.11. If relevant, state whether the proposed changes required for the methodology implementation on 2nd and 3rd crediting periods are appropriate.

10.C.12. State the baseline approach selected, indicate whether this is appropriate, and why.

10.C.13. State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context

10.C. 14. Any other comments

11. Final recommendation for the proposed new VCS baseline and monitoring methodology

1. Introduction

This assessment report is provided to Camco International as a deliverable of the Voluntary Carbon standard 2007.1 (VCS 2007.1) Double Approval Process.

Camco International, Carbon Asset Qualification has commissioned TÜV Rheinland Immissionsschutz und Energiesysteme GmbH to perform an assessment of the proposed new baseline and monitoring methodology "New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers" (revised from previous proposed methodology with the title "New waste heat recovery facilities supplying steam and/or hot water to multiple customers and displacing grid /off grid steam and grid hot water generation from natural gas"), designed by Camco International.

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH operated in the capacity as the second reviewer as independent entity for the assessment.

This evaluation is prepared based on the following documents: New baseline and monitoring methodology "New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers", Version: 1, July 2nd, 2009.

2. Objectives

The purpose of this second independent entity assessment report was, through review of appropriate documentation, to assess whether:

- the methodology's applicability criteria are appropriate and adequate;
- the approach for determining the project baseline is appropriate and adequate;
- the approach/tools for determining whether the project is additional are appropriate and adequate;
- an appropriate and adequate approach is provided for the definition of the project's physical boundary and sources and types of gases included;
- an appropriate and adequate approach is provided for calculating baseline emissions, project emissions, and emission reductions;
- the approach for calculating leakage is appropriate and adequate;
- the monitoring approach is appropriate and adequate;
- monitored and not monitored data and parameters used in emissions calculations are appropriate and adequate.
- the methodology complies with the following VCS 2007.1 requirements:
  1) Projects shall apply the principles of relevance, completeness, consistency, accuracy, transparency and conservativeness (VCS 2007.1, Section 5.1).
  2) Methodologies shall be informed by a comparative assessment of the project and its alternatives in order to identify the baseline scenario (VCS 2007.1, Section 6.1).

3) The project proponent shall select the most conservative baseline scenario for the methodology. This shall reflect what most likely would have occurred in the absence of the project (VCS 2007.1, Section 6.3).
4) In developing the baseline scenario, the project proponent shall select the assumptions, values and procedures that help ensure that GHG emission reductions or removal enhancements are not overestimated (VCS 2007.1, Section 6.3).
5) Based on selected or established criteria and procedures, the project proponent shall quantify GHG emissions and/or removals separately for:
   - each relevant GHG for each GHG source, sink and/or reservoir relevant for the project; and
   - each GHG source, sink and/or reservoir relevant for the baseline scenario.
   - When highly uncertain data and information are relied upon, the project proponent shall select assumptions and values that ensure that the quantification does not lead to an overestimation of GHG emission reductions or removal enhancements (VCS 2007.1, Section 6.5.2).

3. Validation Scope

The assessment scope is the independent and objective review of the proposed new methodology as discussed above. The Validation Team was provided with the new methodology ”New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers”, dated 2nd of July 2009 (revised from previous proposed methodology with the title “New waste heat recovery facilities supplying steam and/or hot water to multiple customers and displacing grid /off grid steam and grid hot water generation from natural gas”, dated 05th of August 2008) in July 2009.

Based on this documentation, a document review took place which resulted in Corrective Action Requests (CARs), Clarification Requests (CLs) and Forward Action Requests (FARs) and modifications to the proposed new methodology document. The final methodology document, dated July 2, 2009 and the final underlying project design document serves as the basis of the final conclusions presented herewith.

4. Overview of the Assessment Process

The following validation process was used:

- conflict of interest review;
- selection of assessment team;
- initial interaction with Camco International;
- final audio conference and meeting;
- review and evaluation of the methodology document and underlying project document;
- follow-up interaction with Camco International for supplemental information; and
- final statement and assessment report development.

The assessment process was utilized to evaluate whether the proposed new methodology is acceptable and complies with VCS 2007.1 eligibility criteria and requirements.

5. Conflict of Interest Review

Prior to beginning of the independent assessment work on the methodology and the underlying project, TÜV Rheinland Immissionsschutz und Energiesysteme GmbH has conducted an evaluation to identify any potential conflicts of interest associated with the task. No potential conflicts were found for this project.

6. Assessment Team

TÜV Rheinland Immissionsschutz und Energiesysteme GmbH's assessment team consisted of the following individuals who were selected based on their GHG validation experience, as well as familiarity with the sectoral scopes 1 (Energy industries {renewable - / non-renewable sources}.) 2 (Energy distribution) and 3 (Energy demand): Dipl.-Ing. Kurt Seidel, CDM/JI/VER Auditor and Senior Expert.

7. Final Audio Conference and Meeting

The assessment process was initiated with an exchange of emails and phone calls between TÜV Rheinland Immissionsschutz und Energiesysteme GmbH, Mr. Seidel and Mr. Dominic Schmitz of Camco International, Carbon Asset Qualification. The communication focused on confirming the scope and schedule and the information required for the assessment. The final steps were initiated in an audio conference and meeting on 26th of June 2009 at Camco's office in Sofia with Mr. Francisco Garcia-Koch und Mr. Stratsimir Nedlaykov as well as Mr. Dominic Schmitz.

8. Corrective Actions, Clarifications, Forward Actions, Recommendations and Supplemental Information

The team requested clarification and supplemental information as well as several corrective actions during the validation. The corrective action requests, clarifications, forward actions and recommendations and the responses provided are summarized in section 10 and the attached Annex for transparency reasons.

9. Assessment Reporting

Validation reporting, represented by this second independent entity assessment report for Camco International, documents the assessment process and identifies its findings and results.

10. Assessment Results: Evaluation of the proposed new methodology by the desk reviewer

The validation process focused on assessing the appropriateness and adequacy of the new methodology's applicability criteria, baseline approach, additionality, project boundary, emissions, leakage, monitoring, data and parameters, and compliance in the application of the new methodology and the Voluntary Carbon Standard 2007.1 (VCS 2007.1). The assessment results are summarized in the tables below are, which are further substantiated with details in the following sections and in the attached annex.

Summary of the assessment results

No.	Evaluation criteria	YES	NO
1.	Coverage of the Voluntary Carbon standard 2007.1 NM sections as outlined in the applicable guidelines.	X	
2.	The language is sufficiently transparent, precise and unambiguous to undertake a full assessment.	X	
3.	The proposed methodology reflects methodology-specific information and not project-specific information.	X	
4.4.	The baseline methodology is internally consistent i.e., the applicability conditions, project boundary, baseline emissions estimation procedure, project emission estimation procedure, leakage, and monitoring section are consistent with each other.	X	
4.5.	The baseline scenario identification has a clear and concise presentation of methodological steps to identify baseline scenario and description of baseline scenario to which the methodology is applicable.	X	
4.6.	The additionality section has clear and concise presentation of methodological steps to assess additionality and relationships between them.	X	
4.7.	The emission reductions calculation section has relevant formula provided and all variables used adequately explained.	X	
4.8.	The baseline methodology is internally consistent with the monitoring methodology, which is clearly documented in accordance with applicable guidelines.	X	
4.9.	If it is a resubmitted case, all the issues raised in the previous corrective action requests, clarification requests and / or recommendations are addressed or are sufficiently/ properly explained.	X	
4.10.	No other issue was identified that leads to a further review of the proposed new methodology.	X	

No.	Evaluation criteria	YES	NO
A.	Is a similar methodology already under review / approved ? (If YES, specify methodology ID number below) Approved CDM baseline and monitoring methodology AM0048 "New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels"	X	

10.A. Recommendation for approval or non-approval of the new methodology

Title:

"New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers" (revised from previous proposed methodology with the title "New waste heat recovery facilities supplying steam and/or hot water to multiple customers and displacing grid /off grid steam and grid hot water generation from natural gas"), to be applied at CDM-project activity "Skopje Cogeneration Project" in Macedonia, which is currently under validation.

This methodology applies in general to:

• fossil-fuel-fired cogeneration facilities that supply steam and / or hot water to multiple project customers, including both grid and off-grid steam and grid hot water applications;
• cases in which project customers maintain a self-generation of steam and / or hot water based on fossil fuels or are supplied from the local district heating system which is based on fossil fuels that can be displaced by steam and / or hot water from the project facility.

The following application criteria have been further specified:

- The project activity is the construction and operation of a new gas fired cogeneration plant which is connected to the electrical grid and where all the electricity produced other than that required to operate the cogeneration facility is exported to the grid;

- The geographical/physical boundaries of the baseline power grid can be clearly identified and information is publicly available to establish the grid emissions factor;

- Natural gas is sufficiently available in the region or country, for example future natural gas power capacity additions of similar size to that of the project activity are not constrained by the use of natural gas in the project activity;

- This methodology is only applicable to cases in which the steam and/or hot water that is to be displaced by the project activity is either produced for export to a steam/hot water grid or is drawn from a steam/hot water grid. It shall not be applied to situations in which it would lead to the displacement of steam and/or hot water that is generated at a project customer's installations to meet its heating/process requirements;

- Where the project activity results in the substitution of imported steam and/or hot water, the project proponent shall provide evidence to prove that the thermal energy which is displaced is that which the project customer(s) would have otherwise imported from the grid and not that which is self-generated, assuming that such option exists for the project customer(s);

- The methodology is applicable only to project customers that do not cogenerate electricity, steam and/or hot water in the baseline scenario;

- Only applicable to project customers that ensure that the equipment displaced by the project activity will not be sold for other purposes;

Further amendments as described in the following sections and the attached annex have been carried out prior to a recommendation for approval by the VCS Board.

10.A.1. Outline any changes needed to improve the methodology for approval or reasons for non-approval

a) Minor changes:

Only applicable with minor changes for the concrete project scenario in Skopje, Macedonia, excluding the described extension of project scenarios.

Figure 1 should be more generic, not limited to the project participants and companies involved in Skopje, Macedonia

Response of the project proponent:

The scheme is made more generic. It will be in accordance with the generic names given to all entities that may be related to the project. The names chosen should be more intuitive and facilitating the quick grasp of their exact roles in the project or of their relations to project entities.

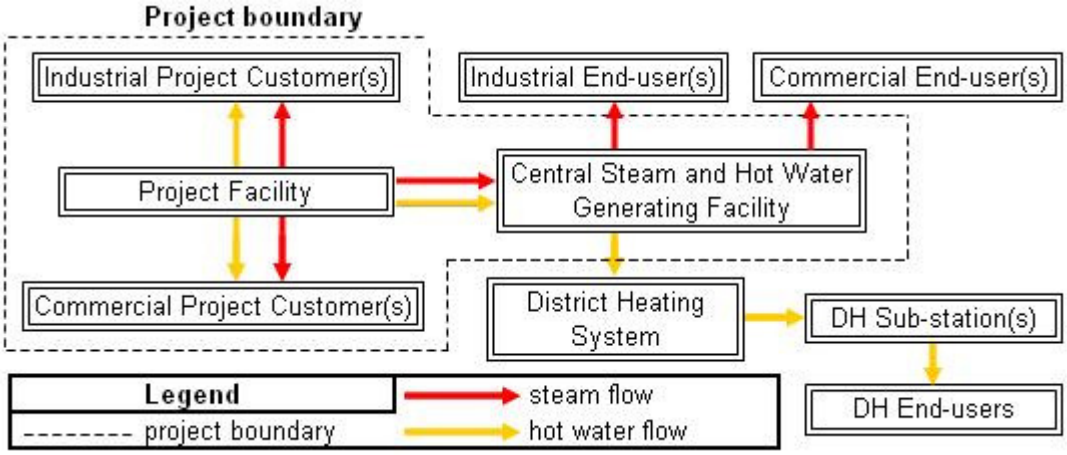

Figure 1: Generic scheme of the project participants and boundary

Referring to the comment below about the multiple project customers scenario, it shall be noted that a distinction is made between the project customers and end-users (as in Figure 1 above). End-users are now defined as those that actually make use of the steam and hot water for heating and other purposes and with which the project owner has no commercial relationship (i.e. does not sell energy to), as opposed to those who receive it and then distribute it to the end-users via a grid, a dedicated pipe or set of pipes, through a plant steam distribution system in an industrial facility. Hence, as the above figure shows and industrial facility may be or not a project customer: in an off grid supply of steam from the project facility to an industrial facility, the industrial facility is the project customer because it is with whom a commercial agreement is struck. If however the industrial facility buys steam from the Central Steam and Hot Water Generating facility, then as far as the project owner is concerned, the same facility is an end-user. This is because the commercial relation is between the project owner and the central heating plant.

The project delivers steam and hot water, which it sells to the project customers. As far as the project customers are concerned the baseline alternatives shall be those that can provide steam and hot water in the same quantities and at the same conditions as those which are offered by the project owner. In all cases, the project owner provides an alternative source of steam and hot water, at a lower cost than that at which it would have been otherwise generated or sourced by the project customers.

Conclusion Assessment Team:

The methodology description and related scheme was amended accordingly.

OK

b) Major changes:

The overall methodology submission remains somewhat problematic, and does not fully reflect the complexity of the likely project situations with multiple project customers with different fuels or a mix of different fuels in the baseline scenario which are supplying

- An industrial customer with steam demand and replacing an industrial boiler for steam generation for industrial use
- A municipal or individual customer with steam or hot water demand and replacing a boiler for steam or hot water generation for space heating
- A municipal or individual customer with steam or hot water demand and replacing a boiler for steam or hot water generation for domestic hot water
- A municipal or individual customer with steam or hot water demand and replacing a boiler for steam or hot water generation for cooling (e.g. throughout absorption chillers in shopping malls, office buildings or administrative buildings)
- The local district heating company with steam or hot water demand and reducing the generation of steam or hot water from own fossil fuels of this local district heating company

besides of the concrete situation in Skopje, Macedonia. For the concrete situation in Skopje, Macedonia an additional PDD has to be prepared to demonstrate the real case in detail and not only in a generic way within the methodology description.

Response of the project proponent:

Question*:Could you please describe or rephrase the above. Are you saying for instance that the meth does not address for example a situation in which the project produces steam, sells it to DH company and therefore displaces (replaces) steam the DH company would otherwise have produced? In any of the above cases what matters is how the end customers would have produced the steam or hot water if they did not buy the steam or hot water we produce. "how" meaning here with what efficiency, or to be inline with our meth, the tonnes CO2/tonne or TJ of steam or hot water they would have otherwise produced*

Conclusion Assessment Team:

The possible application scenarios should be described in general, in order to be covered by the new methodology. It is clear, that for any steam/heat produced using fossil fuels the baseline emissions are calculated in the same way:

$BEy = HG_y * EF_{CO2} / \eta_{th}$

η_{th} represents the efficiency of the plant using fossil fuel that would have been used in the absence of the project activity to supply the net quantity of steam or heat during the year y in TJ.

In case the producers of heat or steam are not directly accessible or not identical with the end users respectively, additional distribution losses (by pipes, storage, heat exchange, circulation, etc.) or the overall efficiency of the heat or steam system including the distribution network have to be taken into account:

η_{th} should be replaced by $\eta_{th\text{-}system}$.

That means, that the energy consumption or energy demand is divided into the following parts:

- Energy requirement depending on the way of energy generation, represented by the efficiency η_{th} of the primary energy generation plant, e.g. a fossil fuel based boiler.
- Energy requirement depending on the way of energy distribution.
- Energy demand depending on the ability of the HVAC system to deliver space heating, domestic hot water, cooling and fresh air as required.
- Energy demand depending on the building physics or industry physics and the utilization of the building or industry / specific demand per ton of product, in relation to outside temperature, etc.

In case that during the crediting period of the new Fuel-Switch VCS methodology additional energy saving measures would be implemented in connection with carbon financing it might be possible to combine the new Fuel-Switch VCS methodology with small-scale energy demand reducing methodologies of the category II (< 60,000 MWh / a).

- An industrial customer with steam demand and replacing an industrial boiler for steam generation for industrial use

Response of the project proponent:

- In this case, the customer's steam demand is fixed, but by installing a new boiler it could generate steam at a higher efficiency than before.

-Issue that the meth needs to deal with: a change in emissions per tonne of steam that the customer would have produced the steam at

-How does the meth deal with it: it needs to either:

- *be able to capture the moment when such change would occur and reflect in the baseline calculation. We would need to add how this is to be done or*
- *use a default efficiency value*

- *plant specific data*
- *based on sectoral data*
- *default of 100% efficiency*

A municipal or individual customer with steam or hot water demand and replacing a boiler for steam or hot water generation for space heating

Response of the project proponent:

same as above

A municipal or individual customer with steam or hot water demand and replacing a boiler for steam or hot water generation for domestic hot water

Response of the project proponent:

In what way is this case and the above different, what matters is the efficiency with which the hotwater is generated.

- A municipal or individual customer with steam or hot water demand and replacing a boiler for steam or hot water generation for cooling (e.g. throughout absorption chillers in shopping malls, office buildings or administrative buildings)

Response of the project proponent:

We cannot bring in these end users, the meth does not apply to this case.

- The local district heating company with steam or hot water demand and reducing the generation of steam or hot water from own fossil fuels of this local district heating company

Response of the project proponent:

Please describe in what sense is this a scenario.

Alternative baseline scenarios

To me, the alternative baseline scenarios are those that enable the steam and hot water that our project would like to sell, to be produced by different means, for example.:

- *steam/hot water from renewable energy sources, no matter which end customer implements them. For instance an industrial end user and potential customer of ours installs a biomass boiler.*
- *steam/hot water from waste heat recovery, say Mittal steel installs heat recovery to produce steam*
- *for an end user which is not a central steam or DH plant, importing steam from a centralized provider like energetica*
- *for an owner of a steam or hot water grid, buying steam produced by another industrial end user or from an independent steam producer*

We note that in all of the above cases the emissions that are displaced are related to the tonnes of CO2/tonne of steam which is produced, in turn associated with the efficiency of the process by which they are produced.

The methodology should not be limited to natural gas as primary fossil, but should be extended to the fossil fuels LPG, LNG, coal, fuel oil and diesel oil as the primary energy sources. It should exclude for simplification as primary energy sources renewables and waste heat from industrial processes other than cogeneration.

Response of the project proponent:

Other methodologies exist which are "fuel specific", so we do not understand why this is necessary. Additionaly, by circumscribing the meth to gas only, the issue of fuel switching is removed, and the baseline fuel is the one with the lowest emission factor. If a project customer uses higher c containing fuels or switches from one to another, keeping track of this can be challenging. Hence we feel that by assuming gas is used, even though it may not be fired in reality it offers simplification on the monitoring front and conservativeness in the emissions reductions estimates. The meth as it stands though, limits its application to cases where gas only is used, but if you agree with above could be amended to state that also is applicable in other cases where the project proponent is willing to assume that the steam and hot water to be displaced has been produced by burning natural gas.

Conclusion Assessment Team:

This would be a conservative simplification and should be applied in case the efforts to re-construct the real scenario would be excessive and disproportionate.

It can be concluded that the overall objective of the new methodology to design a generic conservative methodology to cover the main application cases has been achieved. Project specific deviations have to be further substantiated with relevant evidences within the project documentation.

OK

In case of a parallel feed-in of an increasing amount of primary energy from renewables and waste heat from industrial processes other than cogeneration these amount have to be monitored separately ex-post to reflect the development.

The type of the applied technical cogeneration system and boiler system has to be described in detail in a technical drawing of the primary heating network with the main energy supply facilities and direct industrial users and substations and secondary network users with the related monitoring points of the measuring systems for steam, condensate, feed-water, hot water and heat:

1. Steam turbine CHP plant
    - CHP with back-pressure turbine
    - CHP with extraction / condensing turbine

2. CHP with gas turbine
3. Internal combustion (IC) reciprocating engine generator
4. Combined-cycle CHP plant
5. Heat only boilers

Response of the project proponent:

Please clarify. Detailed technical diagrams in our opinion are project specific, and would thus not be appropriate for the methodology (although clearly so for the pdd). In our opinion the meth should be applicable to all those that find themselves in a similar situation such as ourselves, in terms of the project proponent. We do not understand the need (if this is what is suggested) to develop the meth to cater to project technologies which are different from ours.

Conclusion Assessment Team:

Yes, we agree it would be sufficient in the relevant PDD, because it is very project specific. The new VCS methodology is describing only the capture and utilization of the waste heat streams of scenario 3: Internal combustion (IC) reciprocating engine generator.

It has to be clarified, how an update can be provided annually with indication of technical changes of above technical supply facilities with regard to capacity, efficiency and fuel as well as status of users (existing, new) as one option.

Response of the project proponent:

Yes, unless default values are applied. For instance if a default value is applied then any emissions reductions resulting from a change in boiler efficiency at a customers installation for whatever reason, would result in real emissions reduction compared to what was on the ground previously. The meth takes into account exante by assuming the default value, in other words assuming before hand that such changes will take place. The question that might be raised though is that the default value cannot apply for 21 years, because that would mean that technical developments are ignored. The default values would therefore have to be reviewed and adjusted as improvements in thermal efficiency.

Conclusion Assessment Team:

The default values for efficiency η_{th} should be fixed ex-ante for the first 7 years of a renewable crediting period or for a fixed 10 years crediting period, considering the remaining lifetime of the boiler or system prior to project implementation. In case that during the crediting period of the new Fuel-Switch VCS methodology additional energy saving measures would be implemented in connection with carbon financing it might be possible to combine the new Fuel-Switch VCS methodology with small-scale energy demand reducing methodologies of the category II (< 60,000 MWh / a). The energy users should ensure in such a case not to apply in addition for carbon credits (double-counting). To prevent double counting, users of heat/steam exported have to sign a contract that they do not claim carbon credits.

The assessment of baseline scenarios should also consider the perspective of project customers. This implies some changes in the baseline scenario and additionality sections, as well as in the application of the methodology.

Response of the project proponent:

Yes, we agree.

Possible changes in fuels used by project customers should be monitored and reflected in the emissions calculations.

Response of the project proponent:

Please see our comments above with regards to the benefits of assuming gas as the baseline fuel. Should any other project proponent wish to propose alternative fuels may we suggest they modify the meth as appropriate.

Conclusion Assessment Team:

See comments above.

Local fuel characteristics should be used instead of IPCC defaults where such data are available.

Response of the project proponent:

Ok, we add this to the meth

Conclusion Assessment Team:

See comments above.

Three years of historical data should be used in all cases where available.

Response of the project proponent:

Ok

Conclusion Assessment Team:

See comments above.

The monitoring methodology needs to be made consistent with proposed changes in the baseline methodology.

Response of the project proponent:

Yes, we haven't done this because we haven't done the monitoring part waiting first for the baseline to be approved

Conclusion Assessment Team:

OK, see comments above.

c) Reasons for recommendation of non-approval

10.B. General information on the submitted proposed new methodology

10.B.1. One sentence describing the purpose of the methodology.

The proposed new methodology is designed to estimate CO2 emission reductions that result from the utilization of the heat from waste heat streams of new fossil-fueled electricity cogeneration plants, especially internal combustion generator sets (namely heat contained in engine exhaust gases, heat from gas engine cooling and oil-cooling systems) that displace steam and / or hot water from existing grid and/or off-grid sources based on existing fossil fuel-based boilers or existing district heating systems.

10.B.2. Summary description of the methodology.

This methodology is designed for applications which represent the following scenarios:

- The project activity is the construction and installation of systems for recovery of heat from exhaust gases and other waste heat streams of a natural gas fired power generating facility;
- Waste heat recovery project activity supplies steam and hot water to one or more project customers, who purchase the steam and hot water, and transport it to their customers via grids or use it directly in their installations;
- No supplementary fuel firing takes place in the waste heat recovery boilers;
- The heat utilized replaces heat that would otherwise be generated using fossil fuel boilers.

10.B.3. Relationship with approved or pending 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.

This methodology is based on elements of the following approved methodology under the Clean Development Mechanism:

- AM0048 - New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels --- Version 2;

This methodology also refers to:

- the latest version of the "Tool for the Demonstration and assessment of additionality" agreed by the Executive Board and available at the UNFCCC website

and

- the "Tool to estimate the baseline, project and/or leakage emissions from electricity consumption" (Version 01).

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.

- AM0048 - New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels --- Version 2

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.

There are also elements of the following tools and methodologies from CDM of relevance for the above proposed new methodology in case it would be extended as described under section A.1.:

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

"Tool to calculate project or leakage CO2 emissions from fossil fuel combustion"´;

AMS-II H "Energy efficiency measures through centralization of utility provisions of an industrial facility";

AM0058 : Introduction of a new primary district heating system--- Version 1;

AM0029 : Methodology for Grid Connected Electricity Generation Plants using Natural Gas --- Version 3;

AM0044 : Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors --- Version 1;

Proposed NM 274 " Methodology for "Natural gas based combined cooling, heating, and power (CCHP) systems in Industrial/commercial/institutional facilities", Version 1 of 05/04/2008

The new proposed methodology could be combined and extended as described under section 10.A.1., but the revisions would be major.

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.

They are different enough to not be readily comparable.

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

N.A.

10.C. Details of the evaluation of the proposed new methodology

10.C.1. Applicability conditions

a) State the applicability conditions as provided in the NM (simply copy from the submitted NM)

This methodology is applicable to situations in which:

- The project activity is the construction and installation of systems for recovery of heat from exhaust gases and other waste heat streams from of a natural gas fired power generating facility;
- Waste heat recovery project activity supplies steam and hot water to one or more project customers, who purchase the steam and hot water, and transport it to their customers via grids or use it directly in their installations;
- No supplementary fuel firing takes place in the waste heat recovery boilers;

- The heat utilized replaces heat that would otherwise be generated using fossil fuel boilers.

Definitions:

Waste Heat	by-product thermal energy of machines and technical processes for which no useful application is found in the absence of project activity and which is demonstrated to be unused in other activities
Industrial/ Commercial Facility	the industrial or commercial facility where heat is consumed
Project Customer	industrial, commercial and/or residential entity receiving steam and/or hot water from the project facility. This may include the grid operator and other distribution entities that supply to localized grids. Clusters of smaller residential or commercial customers can be considered as a single project customer.
Project Facility	waste heat recovery facility developed as a project activity to supply steam and/or hot water to grid/off-grid to any industrial, commercial and/or residential entities.

This methodology should only apply to the following scenarios:

- To the existing capacity available at project customers previous to the implementation of the project activity.
- Only to project customers that ensure that the equipment displaced by the project activity will not be sold or used for other purposes, see also under leakage (C.5.).

For new capacities during project life cycle components of AM0058 : Introduction of a new primary district heating system--- Version 1 have to be applied;

b) Explain whether the proposed applicability conditions are appropriate and adequate. If not, explain required changes:

The proposed new VCS methodology is only applicable with minor changes for the concrete project scenario in Skopje, Macedonia, excluding the described extension of project scenarios.

The methodology should not be limited to natural gas as primary fossil, but should be extended to the fossil fuels LPG, LNG, coal, fuel oil and diesel oil as the primary energy sources. It should exclude for simplification as primary energy sources renewables and waste heat from industrial processes other than cogeneration.

10.C.2. Definition of the project boundary

Only to project customers that ensure that the equipment displaced by the project activity will not be sold or used for other purposes.

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

i) Gases and sources

The project boundary includes the site of the project facility (s) and the sites of the project customer (s). Figure 1 illustrates the project activity, which is very project-specific for the first application of the new proposed methodology in Skopje, Macedonia. A very generic flow chart is represented by figure 2 below, that should be overworked taking into account the typical project boundary for such projects, described under AMS-II H "Energy efficiency measures through centralization of utility provisions of an industrial facility" as well as under AM0058 : Introduction of a new primary district heating system--- Version 1, which differentiates between a primary network and a secondary network.

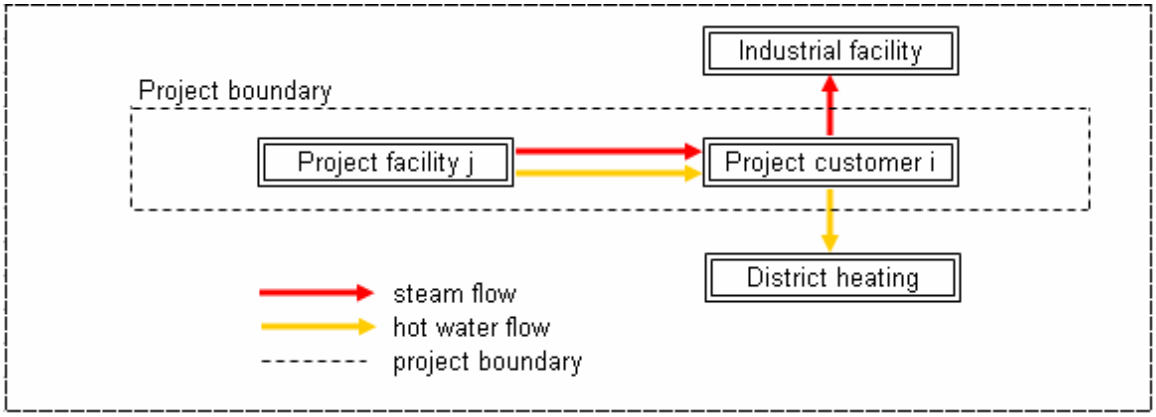

Figure 2: Project activity scheme

The emissions sources are given in table one below, which is plausible, but can be extended as discussed under section A.1:

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included	Explanation/Justification
	Combustion of natural gas to produce steam and hot water at the project customer's sites.	CO_2	Yes	Main emission source. Burning of the fuel emits carbon dioxide.
		CH_4	No	Excluded for simplification.
		N_2O	No	Excluded for simplification.
	Combustion of natural gas to produce hot water in a hot water boiler	CO_2	Yes	Main emissions source.
		CH_4	Yes	Excluded for simplification
		N_2O	No	Excluded for simplification.

Project emissions	Generation of steam from engine exhaust in waste heat recovery boilers	CO_2	No	The project does not generate CO2 emissions from the combustion of fossil fuels. CO2 emissions however are associated with the generation of electrical power from the generator sets.
		CH_4	No	The project activity does not involve the use of gas, hence no CH4 is used.
		N_2O	No	No combustion takes place under the project activity. .
	Generation of hot water from other waste heat streams	CO_2	No	The generation of hot water does not involve the combustion of fossil fuels
		CH_4	No	The project activity does not involve the use of natural gas
		N_2O	No	No combustion takes place under the project activity

Conclusion Assessment Team:

We have obviously overlooked some minor issues, which are in contradiction with chapter C.4. or 3.4. (Project emissions) respectively. It is clear, that project emissions from use of electricity have to be taken into account, which should be shown also within table 1.

This is an extension in comparison to AM 48, which only applies for steam production but not mentions hot water. Hot water is not differentiating between the different applications of hot water like space heating or domestic hot tap water.

Response of the project proponent:

Question. *Correct, hot water needs to be added, but why do we need to differentiate between that used for space heating and tap?*

Table 1: Emissions sources (corrected by project proponent)

	Source	Gas	Included	Explanation/Justification
Baseline	Combustion of fossil fuels to produce electricity, steam and/or hot water at the project customer(s)' site, which provide steam and or hot water to the project customer site, and the power generating facilities connected to the grid.	CO_2	Yes	Main emissions source in the combustion of fossil fuel.
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification.
Project	Combustion of natural gas to produce electricity, steam and/or hot water at the site of the project	CO_2	Yes	Main emissions source in the combustion of natural gas.
		CH_4		Excluded for simplification

	activity.		No	
		N_2O	No	Excluded for simplification.

Conclusion Assessment Team:

The above table has been corrected accordingly.

See comments before. A description and explanation of the possible application scenarios would be sufficient.

OK

ii) Physical delineation

The project boundary includes the site of the project facility(s) and the sites of project customer(s), which excludes the technical installations and facilities of the end-users. In order to avoid any confusion it is recommended to provide a flow chart with a position of the metering points and a specification of the monitoring instruments, see also under section C.8.

Response of the project proponent:

Comment*: Thank you Yes, agree*

Conclusion Assessment Team:

OK

The ongoing monitoring of the physical situation (at a high level) should be included in the tables in the monitoring sections of the new methodology.

Response of the project proponent:

Comment. *Can you clarify what you mean by high level*

Conclusion Assessment Team:

The expression “high level”is self-evident, but can be deleted.

b) Indicate whether this project boundary is appropriate. If not, outline required changes:

The project boundary is appropriate, but should be further specified in terms of physical delineation as per the above suggestions.

10.C.3. 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. If not, outline required changes:

The baseline scenario is determined by identifying all reasonable alternatives based on provision of a similar outcome and using the barriers test in the "Tool for demonstration and assessment of additionality" to assess the likelihood of these alternatives. This basis is appropriate and adequate.

It should be further demonstrated at a selected case study in an attached project design document.

The new proposed methodology could be combined and extended as described under section A.1., which would allow an applicability to more scenarios in practice, but the revisions would be major.

Response of the project proponent:

Comment. *yes, we might do so just as well cause we have to as part of the PDD anyhow*

Conclusion Assessment Team:

OK

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.

Procedure for estimating lifetime of the boiler(s)

The following approaches have been described in the proposed new methodology, taken into account to estimate the remaining lifetime of the boilers that provide steam and hot water in the absence of the project activity:

- The typical average technical lifetime of the type of equipment may be determined taking into account common practices in the sector and country (e.g. based on industry surveys, statistics, technical literature, etc.);

- The practices of the responsible company regarding replacement schedules may be evaluated and documented (e.g. based on historical replacement records for similar equipment).

The time to replacement of the existing equipment in the absence of the project activity should be determined in a conservative manner but on a case-by-case basis thus taking into consideration local conditions, existing practices and possible barriers to implementation of new projects or regulatory acts relating to the continuation of existing practices for each piece of equipment that is being replaced.

New steam and hot water generating equipment may be still considered to be part of the project boundary, because in the absence of the project activity, fossil fuel would still be used, although probably at a higher efficiency. Hence the steam and hot water generated from the heat recovery systems in the project activity still contribute to displace fossil fuel derived steam and hot water.

Should such situations occur, the baseline emissions factor for steam and hot water production will have to be recalculated.

For this purpose, project participants should provide information about the size, typical age, conditions as well remaining lifetime of the baseline heat supply systems.

The remaining lifetime of heat supply systems for each identified category should be documented and justified in a case study within an additional project design document.

It is suggested that the provision of certain technical diagrams would assist in establishing and verifying a clear and consistent project boundary for evaluation of displaced sources.

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 clearly describes the approach to demonstrating additionality and employs the "Tool for demonstration and assessment of additionality" with certain sections explained in more detail in an additional to be submitted case study as project design document to provide guidance specific to the project activity.

d) Explain whether the basis for assessing additionality is appropriate and adequate. If not, outline required changes:

Additionality will be demonstrated using the latest version of the "**Tool for the demonstration and assessment of additionality**", which is deemed to be appropriate and

adequate. This approach should be further demonstrated at a selected case study in an attached project design document.

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10.C.4. 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. If not, outline required changes:

Baseline emissions

This methodology is only applicable for situations in which the baseline scenario is the continuation of the current practice of generating steam from natural gas at the project customer facilities and the pre-project power generating facility venting hot exhaust gases to atmosphere and dissipating heat from the engines cooling systems to atmosphere.

Baseline

The baseline emissions for this particular methodology are the sum of emissions from steam generation for sale to industrial facilities and customers and the emissions associated with steam and hot water production for satisfying the needs of hot water consumers:

$$BE_y = BE_{st,y} + BE_{hw,y} \quad (1)$$

Where:

$BE_{st,y}$ Baseline emissions resulting from the production of steam supplied to project customer i in the year y (in tonnes of CO_2). Calculated below as per equation (2);

$BE_{hw,y}$ Baseline emissions resulting from the production of hot water supplied to project customer i in the year y (in tonnes of CO_2). Calculated below as per equation (9).

I. Baseline emissions from production of steam that is supplied to project customer i in year y (in tonnes of CO_2):

$$BE_{st,y} = \sum_i \sum_j \left(SC_{BL,j,y} \cdot SEF_{BL,i} \right) \quad (2)$$

Correction requested:

The fuel consumption should be basis for the conversion into CO2-equivalent, not the steam or hot water consumption. The result has to be divided by the efficiency of the displaced steam or hot water generation plant.

Response of the project proponent:

Question. *Please explain how, preferably in algebraic terms. We do not understand how this can be done. This is not the case in AM00048 by the way*

Conclusion Assessment Team:

It is clear, that for any steam/heat produced using fossil fuels the baseline emissions are calculated in the same way:

$BEy = HG_y * EF_{CO2} / \eta_{th}$

η_{th} represents the efficiency of the plant using fossil fuel that would have been used in the absence of the project activity to supply the net quantity of steam or heat during the year y in TJ.

Where:

$SC_{BL,j,y}$ The amount of energy consumed in the form of steam supplied by the project facility j to the project customer i in year y (in TJ). It is further analyzed in equation (3).

$SEF_{BL,i}$ The baseline emission factor for the production of steam in project customer i (in t CO_2/TJ), and obtained from equation (4) below.

The amount of energy consumed in the form of steam supplied by the project facility j to the project customer i in year y is given by:

$$SC_{BL,j,y} = SP_{BL,j,y} \cdot SDEN_{BL,j,y} \quad (3)$$

Where:

$SP_{BL,j,y}$ = quantity of steam produced by the project facility j and supplied to the project customer i for the year y, (in tonnes)

$SDEN_{BL,j,y}$ = the specific enthalpy of steam leaving the project facility j (in TJ/tonne of steam supplied). This data shall be obtained from steam tables, using temperatures and pressure of the steam purchased.

The following options are provided to determine the baseline CO_2 emissions factor for the steam produced by the project customer (in tonnes of CO_2/TJ of steam) produced.

Option I.A.

When historical data for the amount of fuel consumed and steam generated by the customers steam generating facilities is available, the baseline emission factor for the steam generated by the project customer i may be calculated as:

$$SEF_{BL,i} = \frac{44}{12} \cdot \frac{\sum_i \left(CEF_{NG,i} \cdot HEC_{BL,NG,st,i} \right)}{\sum_i HSC_{BL,i}} \quad (4)$$

Where:

$CEF_{NG,i}$ = Carbon emission factor corresponding to the natural gas used by project customer i to generate steam (in tonnes of C/TJ), be obtained from the technical literature or from project customer i.

$HEC_{BL,NG,st,i}$ = the energy associated with the natural gas that was consumed by the project customer i to self-generate steam (in TJ). Calculated below in equation (5).

$HSC_{BL,i}$ = the amount of energy contained in the steam which was generated by the customer i by burning natural gas (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity.

The present methodology offers two options upon which to establish $HEC_{BL,NG,st,i}$:

Option I.A.a.

The energy associated with the natural gas that would have been consumed for self-generation of steam is given by:

$$HEC_{BL,NG,st,i} = HFC_{BL,NG,st,i} \cdot NCV_{NG,i} \quad (5)$$

Where:

$HFC_{BL,NG,st,i}$ = the quantity of natural gas consumed for steam generation by project customer i during the three most recent years for which data is available prior to the implementation of the project activity. (Tonnes)

$NCV_{NG,i}$ = net calorific value of the natural gas used in the scenario of self-generation. Specific data may be provided by the project customer or from the technical literature (TJ/Tonne)

Option I.A.b.

Alternatively, $HEC_{BL,NG,st,i}$ may be calculated as follows:

$$HEC_{BL,NG,st,i} = \frac{(HSC_{BL,i} - HSP_{BL,i} \cdot HSEN_{w}) \cdot 100}{\eta_{BL,st,i}} \quad (6)$$

Correction requested:

The energy and mass balance of the steam boiler is simplified and is not taking into account the feed water and the rate of blowdown.

Response of the project proponent:

Comment*. We need to review the equation, and agree on how efficiency is determined. The efficiency used here is one which is used to estimate the amount of fossil fuel energy that would have had to been used to generate an amount of steam equivalent to that which the project customer is buying from the waste heat plant. In any case this number should be on the low side, for the sake of conservativeness in the emissions reductions calculations. Therefore the efficiency should be on the high side. However the most practical definition of efficiency is that which relates the energy contained in the steam which is available for productive use divided by the fuel that was consumed. If the blowdown where higher than that which it needs be, which is often the case in boiler plants, then to be conservative or on the safe side (keep the level of impurities in the boiler water low to avoid problems), then the efficiency would be low, and the fuel consumption to produce a tonne of TJ of steam, high. That is, a test run would show a decrease in the amount of steam produced at the same pressure and temperature for an equal amount of fuel burned. The proposed meth allows the proponent to apply the actual measured efficiency, provided a qualified entity does establishes what the value it. Otherwise he should use the design boiler efficiency, which would constitute, in comparison a higher number. Hence blowdown can be considered, but only in the determination of the efficiency of the conversion of fossil fuel energy to energy in the steam.*

Conclusion Assessment Team:

This was mentioned for completeness reasons. Anyhow, for conservative reasons a higher default efficiency would result in a smaller amount of emission reductions and would therefore be acceptable, compensating other uncertainties, e,g. from measuring equipment.

Where:

$HSC_{BL,i}$ = the amount of energy contained in the steam which was generated by the customer i by burning natural gas (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity.

$HSEN_{w}$ = the specific enthalpy of water entering the hot water boiler during the three most recent years for which data is available

$HSP_{BL,i}$ = the quantity of steam produced by the project customer i during the most recent three years for which data is available prior to the implementation of the project activity (in tonnes of steam produced)

$\eta_{BL,st,i}$ = project customer i's boiler efficiency based on NCV (in %). This parameter shall be one of the following:

i) the highest measured value of boiler efficiency recorded over full range boiler test;

ii) the boiler's peak thermal efficiency as per manufacturer's information;

iii) a default boiler efficiency of 100%;

Energy content (in TJ) of the steam generated by customer i is given by:

$$HSC_{BL,i} = HSP_{BL,i} \cdot HSEN_{BL,i} \quad (7)$$

Where:

$HSP_{BL,i}$ = the quantity of steam produced by the project customer i during the most recent three years for which data is available prior to the implementation of the project activity (in tonnes of steam produced)

$HSEN_{BL,i}$ = the specific enthalpy of the steam produced project customer i and self-generated during the three most recent years for which data is available prior to the implementation of the project activity (in TJ/ tonne of steam produced).

Option I.B.

The baseline CO_2 emissions factor per TJ of steam energy generated by customer i prior to project implementation can be determined from boiler manufacturer's design data for customer i, as follows:

$$SEF_{BL,i} = \frac{44}{12} \cdot \frac{CEF_{NG,i} \cdot 100}{\eta_{BL,st,i}} \quad (8)$$

Where:

$CEF_{NG,i}$ = Carbon emission factor (in tonnes of C/TJ), corresponding to the natural gas consumption by customer i;

$\eta_{BL,st,i}$ project customer i's boiler efficiency based on NCV (in %).In the absence of boiler design performance data, $\eta_{BL,st,i}$ can be determined by one of the following:

i) the highest measured value of boiler efficiency recorded over full range boiler test;

ii) the boiler's peak thermal efficiency as per manufacturer's information;

iii) efficiencies of boilers of similar design;

iv) a default boiler efficiency of 100%.

II. Baseline emissions from production of hot water

The baseline emissions from the production of hot water in project customer installation i are given by:

$$BE_{hw,y} = \sum_i \sum_j \left(HWC_{BL,j,y} \cdot HWEF_{BL,i} \right) \quad (9)$$

Correction requested:

The fuel consumption should be basis for the conversion into CO2-equivalent, not the steam

or hot water consumption. The result has to be divided by the efficiency of the displaced steam or hot water generation plant.

Where:

$HWC_{BL,j,y}$ = the energy content in the hot water produced by the project facility j, which is purchased by project customer i in year y (in TJ);

$HWEF_{BL,i}$ = the CO_2 emissions factor for the hot water produced by the project customer i (in t CO_2/TJ) prior to the implementation of project activity.

The energy content in the hot water produced by the project facility j, which is purchased by project customer i in year y is obtained by the following equation:

$$HWC_{BL,j,y} = HWP_{BL,j,y} \cdot HWEN_{BL,j,y} \quad (10)$$

Where:

$HWP_{BL,j,y}$ = the amount of hot water produced by project facility j and supplied to project customer i in year y (in tonnes)

$HWEN_{BL,j,y}$ = the specific enthalpy of hot water produced by the project facility j in the year y (in TJ/tonne of water).

This part of the methodology considers situations in which customer i would have produced hot water in the absence of the project activity from the following sources of energy:

- natural gas, in hot water boilers, hwb (Option II.A.)
- steam, in heat exchangers, sthx (Option II.B.)

Option II.A. Hot water produced in boilers firing natural gas

The following alternatives are provided to determine the baseline CO2 emissions factor associated to the production hot water in tonnes of CO_2/TJ.

Option II.A.a.

The baseline CO_2 emission factor associated with hot water production in boilers running on natural gas can be calculated as:

$$HWEF_{BL,i} = \frac{44}{12} \cdot \frac{\sum_i \sum_j \left(CEF_{NG,i} \cdot HEC_{BL,NG,hwb,i} \right)}{\sum_i HHWC_{BL,hwb,i}} \quad (11)$$

$CEF_{NG,i}$ = Carbon emission factor corresponding to the natural gas used by the project customer i to generate hot water (in tonnes of C/TJ). Obtained from the project customer i or from the technical literature.

$HEC_{BL,NG,hwb,i}$ = the energy associated with the natural gas consumed by customer i to self-generate hot water in a hot water boiler (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity.

$HHWC_{BL,hwb,i}$ = the energy contained in the hot water, which was generated by the customer i from burning natural gas (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity

The present methodology offers to options upon which to determine $HEC_{BL,NG,hwb,i}$

Option II.A.a.i

The energy associated with the natural gas consumed by customer i to self-generate hot water in a hot water boiler in customer i facilities is

$$HEC_{BL,NG,hwb,i} = HFC_{BL,NG,hwb,i} \cdot NCV_{NG,i} \quad (12)$$

Where:

$HFC_{BL,NG,hwb,i}$ = the quantity of natural gas consumed for hot water generation in hot water boilers by project customer i during the three most recent years for which data is available prior to the implementation of the project activity. This can be reported as mass units of the baseline fuel or in units of volume if data is provided on the mass density of the natural gas used (in tonnes)

$NCV_{NG,i}$ = net calorific value of the natural gas used in the scenario of self-generation, specific data to be provided by the project customer

Option II.A.a.ii

Alternatively, in the absence of suitable historical data or if preferred, $HEC_{BL,NG,hwb,i}$ may be calculated as follows:

$$HEC_{BL,NG,hwb,i} = \frac{(HHWC_{BL,hwb,i} - HHWP_{BL,hwb,i} \cdot HSEN_w) \cdot 100}{\eta_{BL,hwb,i}} \quad (13)$$

Where:

$HHWC_{BL,hwb,i}$ = the energy contained in the hot water, which was generated by the customer i from burning natural gas (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity

$HSEN_w$ = the specific enthalpy of water entering the hot water boiler during the three most recent years for which data is available

$\eta_{BL,hwb,i}$ = customer i's hot water boiler's efficiency based on NCV. This parameters shall be one of the following:

a. the highest measured value of boiler efficiency recorded over full range boiler test

b. the boiler's peak thermal efficiency as per manufacturer's information

c. a default boiler efficiency of 100%

The energy content of the hot water self-generated by project customer i is given by:

$$HHWC_{BL,hwb,i} = HHWP_{BL,hwb,i} \cdot HHWEN_{BL,hwb,i} \quad (14)$$

Where:

$HHWP_{BL,hwb,i}$ = the mass of hot water self-generated in hot water boilers by the project customer i during the three most recent years for which data is available prior to implementation of project activity (in tonnes)

$HHWEN_{BL,hwb,i}$ = the specific enthalpy of the hot water leaving the project customer i's installations during the three most recent years for which data is available prior to project implementation (in TJ/tonne of water)

Option II.A.b.

The baseline specific CO_2 emissions factor for each customer "i" can be determined from the hot water boiler manufacturer's design data as follows:

$$HWEF_{BL,i} = \frac{44}{12} \cdot \frac{CEF_{BL,i} \cdot 100}{\eta_{BL,hwb,i}} \quad (15)$$

Where:

$CEF_{BL,i}$ = CO_2 emissions factor in tonnes CO2/TJ corresponding to the natural gas used by customer i

$\eta_{BL,hwb,i}$ = customer i's hot water boiler's efficiency based on NCV. This parameters shall be one of the following:

a. the highest measured value of boiler efficiency recorded over full range boiler test

b. the boiler's peak thermal efficiency as per manufacturer's information

c. efficiencies of boilers of similar design

d. a default boiler efficiency of 100%

Option II.B. Hot water produced from steam using heat exchangers

The following alternatives are provided to determine the baseline CO2 emissions factor associated to the production hot water in tonnes of CO_2/TJ.

Option II.B.a.

The CO_2 emission factor associated with hot water production in steam heat exchangers can be calculated as:

$$HWEF_{BL,i} = \frac{44}{12} \cdot \frac{\sum_i \sum_j \left(SEF_{BL,i} \cdot HEC_{BL,NG,sthx,i} \right)}{\sum_i HHWC_{BL,sthx,i}} \quad (16)$$

$SEF_{BL,i}$ The baseline emission factor for the production of steam in project customer i (in tonnes CO_2/MWh), and obtained from equation (4).

$HHWC_{BL,sthx,i}$ = the energy contained in hot water self generated by project customer i from steam, in a steam-to-water heat exchanger (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity

$HEC_{BL,st,sthx,i}$ = the energy associated with the steam consumed by customer i to self-generate hot water in a steam-to-water heat exchanger (in TJ) during the three most recent years for which data is available prior to the implementation of the project activity.

The energy contained in hot water that would have been self generated by project customer i from steam, in a steam-to-water heat exchanger can be obtained by:

$$HHWC_{BL,sthx,i} = HHWP_{BL,sthx,i} \cdot HHWEN_{BL,hw,sthx,i} \quad (17)$$

$HHWP_{BL,sthx,i}$ = the mass of hot water self-generated by the project customer i by steam-to-water heat exchanger during the three most recent years for which data is available prior to the implementation of the project activity (in tonnes)

$HHWEN_{BL,hw,sthx,i}$ = specific enthalpy of water leaving the steam-to-water heat exchanger of the project customer i.

The amount of energy consumed in the form of steam to produce hot water prior to the project activity (in TJ) is given by

Option II.B.a.i.

$$HEC_{BL,st,sthx,i} = HFC_{BL,NG,hwb,i} \cdot HHWEN_{BL,st,sthx,i} \quad (17)$$

$HFC_{BL,st,stbx,i}$ = quantity of steam consumed by the project customer for hot water production during the three most recent years for which data is available prior to the implementation of the project activity (in tonnes)

$HHWEN_{BL,st,sthx,i}$ = difference of the specific enthalpy of steam entering and condensate leaving the heat exchanger during the three most recent years for which data is available prior to project implementation (in TJ/tonne of water)

Option II.B.a.ii.

Alternatively, in the absence of suitable historical data or if preferred, $HEC_{BL,st,sthx,i}$ may be calculated as follows:

$$HEC_{BL,st,sthx,i} = \frac{(HHWC_{BL,sthx,i,y} - HHWP_{BL,sthx,i} \cdot HSEN_w) \cdot 100}{\eta_{BL,sthx,i}} \quad (18)$$

Where

$HSEN_w$ = the specific enthalpy of water entering the hot water boiler during the three most recent years for which data is available

$\eta_{BL,sthx,i}$ = customer i's (in %) steam-to-water exchanger efficiency based on one of the following:

a. the highest measured annual value of heat exchanger efficiency

b. the design heat exchanger efficiency

c. a default heat exchanger efficiency of 100%

Option II.B.b.

The baseline CO_2 emissions factor for each customer i can be determined from the steam-to-water heat exchanger manufacturer design data as follows:

$$HWEF_{BL,i} = \frac{44}{12} \cdot \frac{SEF_{BL,i} \cdot 100}{\eta_{BL,sthx,i}} \quad (19)$$

Where:

$SEF_{BL,i}$ = The baseline emission factor for the production of steam in project customer i (in tonnes CO_2/TJ). Obtained from equation 4.

$\eta_{BL,sthx,i}$ = customer i's steam-to-water exchanger efficiency based on one of the following:

a. the highest measured annual value of heat exchanger efficiency;

b. the design heat exchanger efficiency;

c. a default heat exchanger efficiency of 100%.

Correction requested:

There is no option considered for supply of consumers of space heating or cooling throughout steam or hot water.

It is recommended to use homogeneous abbreviations comparable to abbreviations within CDM methodologies.

b) Explain how the methodology calculates project emissions and whether the basis for calculating project emissions is appropriate and adequate. If not, outline required changes:

Project emissions

Project emissions include only emissions from the use of electricity for the operation of the heat recovery systems. The processes of hot water and steam production under the project activity do not involve direct emissions, since there is no supplementary nor auxiliary fuel being used in their generation. Thus,

$$PE_y = PE_{el,y} \quad (20)$$

$PE_{el,y}$ = project emissions from use of electricity

Emissions from electricity consumption at the project site can be calculated the following way:

$$PE_{el,y} = \sum_j E_{el,j,y} \cdot EGEF_y \quad (17)$$

Where:

$E_{el,j,y}$ = net electricity consumed by the project facility j, from the electricity grid. For this parameter the following options can used:

- Metered quantities of electricity consumed
- Invoices, electricity bills for amount of electricity consumed
- Highest electricity consumption rate for the period described in technical data of the equipment

$EGEF_y$ CO_2 electricity grid emission factor of the grid supplying electricity to project facility j in year y using the latest version of the CDM approved "Tool to calculate emissions factor for an electricity system."

Clarification requested: It has to be clarified if optionally the "Tool to estimate the baseline, project and/or leakage emissions from electricity consumption" (Version 01) can be applied.

Emission Reductions

$$ER_y = BE_y - PE_y \quad (18)$$

The emission reduction achieved by the project activity are correctly calculated as the difference between the baseline emissions and the sum of the project emissions and leakage, which is considered as zero, see C.5.

10.C.5. Leakage

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

Leakage emission

No leakage emissions occur in the proposed new methodology.

Corrections requested:

- Leakage is to be considered if the displaced energy generating equipment is transferred

from another activity or the existing equipment is transferred to another activity.

- Leakage resulting from fuel extraction, processing, liquefaction, transportation, regasification
  and distribution of fossil fuels outside of the project boundary shall be considered.
  The guidance provided in the leakage section of ACM0009 as in AM0029 shall be followed
  for this purpose.

b) Indicate whether the treatment for leakage is appropriate and adequate. If not, outline required changes:

This treatment is appropriate and adequate. There may be some potential that through the displacement of off-grid generation, and the subsequent decommissioning of existing off-grid generation plant, that older and more emissions intensive plant could be transported to neighbouring regions and re-commissioned there, resulting in higher emissions intensity elsewhere. The actual likelihood of this scenario unfolding is extremely small (exiting generating plant is more likely to be used as on-site backup or if it is decommissioned, scrapped rather than relocated and re-commissioned) and if it did occur, the impact of the re-commissioned plant on other emissions intensity baselines would be minor.

It can be concluded that the proposed methodology adequately addresses leakage considering the amendments requested.

10.C.6. Key assumptions

a) List the implicit and explicit key assumptions and rationale for the methodology:

Explicit assumptions:

• That reliable and accurate data is available for the establishment of key factors in the baseline year(s). This includes derived/estimated output/consumption where appropriate metering of hot water and/or steam has not taken place.
• That appropriate grid factors and emission factors are made available or other approaches throughout default values will be used.
• That the project boundary can be clearly and consistently defined to include those customers and sources affected by the output of hot water and steam from the new cogeneration facility.
- For more details see under sections C 7 – C 10.

Implicit assumptions:

• That the baseline period is representative of the existing (and recent) situation with respect to emissions factors and duty cycles for off-grid generators and heat only boilers within the project boundary.
• That the fuel consumption data used in the calculations reflects combustion over the period, rather than invoices or sales receipts. Stockpiling or drawing down on purchased stores of replaced fossil fuels can have a significant effect on emissions intensity calculations, especially when only one period is being considered and the installation is small to medium in size.
• That the performance of the off-grid generating plant is not going to naturally improve based on age, use and maintenance activities. This is an appropriate assumption given the natural tendency of generation plant to degrade over time with respect to efficiency and emissions performance.

- For more details see under sections C 7 – C 10.

b) Give your expert judgement on whether the assumptions are adequate. Identify those, if any, which are problematic and outline required changes:

Yes, they are adequate, if the proposed changes and amendments are made.

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

Data is sourced from the IPCC (carbon content of fuels), official electricity generation and transmission company statistics (grid coefficient), operational records for off-grid sources within the project boundary (specific coefficients), and the project participants (combustion emissions and output from new cogeneration facility).

The proposed methodology does specify that the data required for calculating specific coefficients for offgrid sources must be available, accurate and transparent. The proposed methodology then goes on to state:
"the project developer will have to ensure the completeness and accuracy of the data set during the baseline measurement year by installing, repairing, and calibrating meters as appropriate."
This is an appropriate measure to avoid poor data sources impacting on key baseline calculations, but will of course require some forethought and planning by the project participants to be properly satisfied.

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 proposed methodology recommends obtaining three years of data prior to project implementation to determine the baseline emissions factors. A minimum of one complete year of data is stated in the proposed methodology as required for establishing baseline emissions

factors. It is suggested that it be made explicit that the most recent years' data should be used, and that steps be included to ensure that clearly non-representative years are not included in the baseline sample.
Data is collected on an ongoing basis during the project crediting period to determine both the baseline emissions and the project emissions.

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

The proposed methodology lists the appropriate data requirements and states that the data used in the calculations must be available, accurate and transparent. The consistency and reliability of that data will very much depend on the monitoring systems that are implemented prior to and during the project activity. This of course will need to be assessed during the validation process on a project specific basis.

f) State possible data gaps:

The proposed baseline and monitoring methodologies should require data on the physical characteristics of the project situation. This is not necessarily directly used in the calculations, but will be critical in ensuring that the calculations are consistent across the project years and crediting periods.
There is no approach described how to calculate the heat or steam consumption in absence of installed heat or steam demand monitoring devices in substations or at customers.
Obligations to install heat meters or other monitoring equipment for steam / condensate may vary and may need several years for implementation in different countries, where the above new methodology can be applied.
AM0058 describes a default method based on a lump sum allocation throughout the carpet area of buildings connected to a substation.

10.C.7. Data and parameters NOT monitored (i.e. data that is determined only once and remains fixed throughout the crediting period)

a) Indicate for all key data and parameters which data sources or default values are used and how the data or the measurements are obtained (e.g. official statistics, expert judgement):

The following data and parameters not monitored, are listed in the new proposed methodology:

Data/parameter:	$EGEF_y$
Data unit:	t CO_2/MWh
Description:	Electricity grid emission factor
Source of data:	Calculated in the CDM PDD for the electricity component and taken the same for consistency. It has been calculated conservatively. Calculations of the EGEF are all based on official published data.

Measurement procedures (if any):	
Any comment:	

Data/parameter:	$CEF_{NG,i}$
Data unit:	t CO_2/TJ
Description:	Carbon emission factor of natural gas used at project customer i for self-generation
Source of data:	IPCC data for specific fuel type
Measurement procedures (if any):	
Any comment:	95% confidence level

Data/parameter:	$NCV_{NG,i}$
Data unit:	TJ/t
Description:	Net calorific value of project fuel used for electricity generation
Source of data:	IPCC guidelines on Energy
Measurement procedures (if any):	
Any comment:	95% confidence level

Data/parameter:	$\eta_{BL,st,i}$
Data unit:	factor
Description:	Efficiency of steam generation of the baseline steam boilers
Source of data:	
Measurement procedures (if any):	
Any comment:	

Data is sourced from the IPCC (carbon content of fuels), official electricity generation and transmission company statistics (grid coefficient), operational records for off-grid sources within the project boundary (specific coefficients), and the project participants (combustion emissions of the baseline steam boilers and output from new cogeneration facility).

The proposed methodology has to further specify that the data required for calculating specific coefficients for off-grid sources must be available, accurate and transparent. The proposed methodology has to require that the project developer will have to ensure the completeness and accuracy of the data set during the baseline measurement year by installing, repairing, and calibrating meters as appropriate. This is an appropriate requirement to avoid poor data sources impacting on key baseline calculations.

b) 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. If not, outline required changes:

The proposed methodology recommends obtaining three years of data prior to project implementation to determine the baseline emissions factors. Data is collected on an ongoing basis during the project's crediting period to determine both the baseline emissions and the project emissions.

c) Give your expert judgement on whether the data and the measurement procedures (if any) used are adequate, consistent, accurate and reliable. Identify those, if any, which are problematic and outline required changes:

The proposed methodology lists the appropriate data requirements. The consistency and reliability of that data will very much depend on the monitoring systems that are implemented prior to and during the project activity. This of course will need to be assessed during the initial verification process on a project specific basis.

d) State possible data gaps:

The proposed baseline and monitoring methodologies should require data on the physical characteristics of the project situation. This is not necessarily directly used in the calculations, but will be critical in ensuring that the calculations are consistent across the project years and crediting periods.

10.C.8. Key data and parameters monitored (i.e. data that is determined throughout the crediting period)

a) Indicate for all key data and parameters which data sources (e.g. official statistics, expert judgement) or measurement procedures are used:

Corrections requested:
Data and parameters, monitored are not described and missing within the new proposed methodology, see AM0048 and AM0058.

The following requirements for the monitoring have to be fulfilled, missing information has to be submitted including a project design document with a case study of the "Skopje Cogeneration Project" in Macedonia to the assessment team for the new proposed VCS methodology "New waste heat recovery facilities supplying steam and/or hot water to multiple customers and displacing grid /off grid steam and grid hot water generation from natural gas":

- Specification of the metering points, period(s) of metering, meter characteristics, meter reading and witnessing protocol, meter commissioning procedure, routine calibration process and method of dealing with lost data.

- Specification of quality assurance procedures.

- Quantification of the expected accuracy associated with the measurement, data capture and analysis. Also describe qualitatively the expected impact of factors affecting the accuracy of results but which cannot be quantified. Quantified uncertainty should be expressed in a statistically meaningful way, namely declaring both accuracy and confidence levels.

- The required length of the metering or monitoring period depends on the type of heat or steam consumer. If the project's energy use varies both across day and seasons, as with air-conditioning and space heating equipment, a much longer metering or monitoring period may be required to characterize the system. In this case, long-term data are used to determine annual emission reductions.

- If the energy consumption of the metered equipment or systems varies by more than ten percent from month to month, additional measurements must be taken at sufficient detail and over a long enough period of time to identify and document the source of the variances. Any major energy consumption variances due to weather influences, seasonal production increases or periodic fluctuations in occupancy or use must also be tracked and recorded.

  Examples of situations which might require baseline adjustments are:
  - Changes of occupant or user demand for services (e.g. space temperature, plant
  - throughput)
  - Changes in the amount of space being heated
  - Changes in the amount or use of equipment
  - Changes in environmental conditions (e.g. set-point temperatures, etc.)
  - Changes in occupancy level, schedule
  - Equipment deterioration
  - Equipment lifetime

- Specification of how results will be reported and documented.

- Specification of the data that will be available for another party to verify reported emission reductions, if needed.

- Special meters may be used to measure physical quantities or to submeter an energy flow. Example quantities which may have to be measured without the use of energy supplier meters are temperature, humidity, flow, pressure, equipment runtime, electricity and thermal energy.

- The measurement of thermal energy flow requires the measurement of flow and some temperature difference. An energy flow meter performs an internal thermal energy or MWh (Btu) calculation in real time based on input from a flow meter and temperature sensors. These electronic energy flow meters offer a high accuracy. They also provide other useful data on flow rate and temperature (both supply and return).

- Thermal energy measurements for steam can require steam flow measurements (e.g., steam flow or condensate flow), steam pressure, temperature and feedwater temperature where the energy content of the steam is then calculated using steam tables. In instances where steam production is constant, this can be reduced to measurement of steam flow or condensate flow (i.e., assumes a constant steam temperature-pressure and feedwater temperature-pressure) along with either temperature or pressure of steam or condensate flow.

- Complete error analysis through the measurement system is suggested, in recognition of the difficulty of making accurate thermal measurements.

- The monitoring plan should consider two aspects of data collection problems:
    - establish a maximum acceptable rate of data loss and how it will be measured. This level should be part of the overall accuracy consideration.
    - The level of data loss may dramatically affect cost.
    - establish a methodology by which missing or erroneous data will be interpolated for final analysis.

  In such cases, base-year and post-retrofit models may be used to calculate emission reductions.

b) Give your expert judgement on whether the data sources and measurement procedures (if any) used are adequate, consistent, accurate and reliable. If not, outline required changes:

See sections above.

c) Give your expert judgement on whether the monitoring frequency for the data and parameters is appropriate. If not, outline required changes:

See sections above.

d) Give your expert judgement on whether the QA/QC procedures are appropriate. If not, outline required changes:

See sections above.

e) State possible data gaps:

See sections above.

10.C.9. Assessment of uncertainties

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

The proposed methodology recommends that metering of relevant consumers/sources be performed at an accuracy of 95% or higher, and that appropriate quality control procedures are in place. This is a reasonable level of accuracy given the approach calculating emissions reductions.

However, there is limited guidance on the approaches to assessing the uncertainty of key factors and inputs used in the calculations. In particular, the methodology does not address uncertainty related to purchase records (e.g. fuel types and amounts) used to calculate off-grid baseline emission rates, given the possibility of incomplete records or stockpiling and the possibility of non-availability of monitoring equipment for monitoring of heat and steam and relevant meter readings.

The proposed methodology has to ensure that project developers will have in place "protocols to ensure quality control, including maintenance/calibration of meters and other monitoring equipment".

10.C.10. Transparency, "conservativeness" and consistency

a) Explain whether the methodology has been described in an adequate and transparent manner. If not, outline required changes:

The baseline methodology is presented in a generally transparent way, however many improvements are needed in the presentation of equations, project scenarios, monitoring details and other elements as noted in sections above.

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

The level of conservatism in the resulting calculations of emissions reductions will depend heavily on the integrity of the data used to produce baseline emissions factors and the application of an appropriate project boundary.

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

The baseline methodology is internally consistent.

10.C.11. If relevant, state whether the proposed changes required for the methodology implementation on 2nd and 3rd crediting periods are appropriate.

No changes are proposed for the time being. This is appropriate.

10.C.12. State the baseline approach selected, indicate whether this is appropriate, and why.

The baseline approach selected is as per paragraph 48 (a) of the CDM modalities and procedures. "Existing actual or historical emissions, as applicable". This an appropriate selection based on the nature of the project activities and the displacement of existing sources of hot water and steam within a given project boundary.

10.C.13. State whether the proposed methodology is appropriate for the referred proposed project activity and the referred project context *(described in Sections A - C of the PDD and submitted along with NM). If not, explain why:*

The proposed methodology is appropriate for the referred proposed project activity and the referred project context.

The proposed methodology has been explained and described at an adequate level of detail. The language used is explicit, and provides solid guidance to project participants and independent entities. However, improvements may be needed to address issues noted for the baseline methodology and especially the monitoring methodology.

10.C. 14. 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 additional source(s) of information (i.e. other than documentation on this proposed methodology available from the project developer) have been used in evaluating this new VCS methodology:

[1] Approved CDM baseline and monitoring methodology AM0048 "New cogeneration facilities supplying electricity and/or steam to multiple customers and displacing grid/off-grid steam and electricity generation with more carbon-intensive fuels"
[2] Approved CDM baseline methodology AM0029 "Baseline Methodology for Grid Connected Electricity Generation Plants using Natural Gas"
[3] Approved CDM baseline methodology AM0014 "Natural gas-based package cogeneration"
[4] Approved CDM baseline and monitoring methodology AM0058 "Introduction of a new primary district heating system"
[5] Approved CDM baseline and monitoring methodology AM0044 "Energy efficiency improvement projects: boiler rehabilitation or replacement in industrial and district heating sectors"
[6] CDM methodological tool "Tool for the demonstration and assessment of additionality"

[7] CDM methodological tool "Tool to calculate the emissions factor of an electricity system"

[8] CDM methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality"

[9] CDM methodological tool "Tool to calculate baseline, project and/or leakage emissions from electricity consumption"

[10] Methodological tool "Tool to determine the baseline efficiency of thermal or electric energy generation systems"

[11] Proposed but rejected NM0274 "Installation of Natural gas based building combined cooling heating and power (CCHP) systems in commercial buildings of DLF in India".

b) Indicate any further comments:

No further comments.

11. Final recommendation for the proposed new VCS baseline and monitoring methodology

The assessed methodology with the title ”New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid customers”, Version 1 of 2nd of July 2009 (revised from previous proposed methodology with the title “New waste heat recovery facilities supplying steam and/or hot water to multiple customers and displacing grid /off grid steam and grid hot water generation from natural gas”, dated 5th of August 2008), meet the requirements of the Voluntary Carbon Standard 2007.1 (VCS 2007.1) and is consistent with its objectives. We therefore recommend the methodology to be approved under the Voluntary Carbon Standard 2007.1 (VCS 2007.1).

Signature of desk reviewer

Kurt Seidel

Date: 09/08/2009

Annex

Final List of Corrective Action Requests (CARs) – Table 3, Clarification Requests (CLs) – Table 4 and List of Forward Action Requests (FARs) – Table 5 for proposed new VCS Methodology “New cogeneration facilities supplying less carbon intensive electricity to grid and steam and/or hot water to one or more grid/off-grid customers”