CDM: Recommendation Form for Small Scale Methodologies (version 01)

(To be used for presenting questions/proposals/amendments to the simplified methodologies for small-scale CDM project activity categories)

Date of SSC WG meeting:	30 January−02 February 2012, SSC WG 35
Title/Subject (give a small title or specify the subject of your submission, maximum 200 characters):	Consideration of monitoring requirement for heat recovery project with an integrated burner
Indicative methodology to which your submission relates (refer the items of Appendix B of the Simplified Modalities and Procedures), if applicable.	AMS-III.Q "Waste Energy Recovery (gas/heat/pressure) project"
Name of the authors of the query:	Cynthia Hendayani Institution: KfW Cynthia.Hendrayani@kfw.de, Helmut.Horn@kfw.de

Summary of the query:

Please use the space below to summarize the query related to SSC methodologies/categories SSC Modalities and Procedures provide recommendation/analysis of the SSC WG.

Original text from PP:

Excerpts: We would like to request clarification for monitoring requirements for AMS-IIIQ project, which (a) can-not monitor waste-heat (WECM) flow-rate and (b) can-not directly measure the steam generated from waste heat and steam generated from supplementary fuel.

Context of Situation Our project recovers waste heat from an existing power plant. The recovery is performed through installation of a Heat Recovery Steam Generator (HRSG) system, which is supplemented with an integrated burner using natural gas as fuel. Essentially the total steam generated by the Project is a combination of steam derived from both waste-heat and natural gas, replacing coal-steam. Whereas the project clearly applicable for AMS-IIIQ, we have two particular challenges in applying the monitoring requirements of the methodology, due to the following aspects:

(a) The HRSG directly recovers heat content from exhaust of the power plant by redirecting the exhaust gas from the stack into the Project unit. The lack of laminar flow during the entire process means that reliability of direct flow meter reading to measure Q_{WECM} is strongly compromised.

(b) Whereas total steam output ST_{total} is measureable, direct measurement of steam generated from waste heat ST_{WH} and steam generated from natural gas ST_{NG} is not possible due to the integrated nature of the equipment.

Illustration of the situation before and after the project is provided overleaf.

Clarification Sought

A. In order to isolate that only steam generated from waste-heat is accounted for in the baseline emission calculation of AMS-IIIQ (Equation 4, AMS-IIIQ), the methodology applies the factor f_{WECM} defined as the ratio of : "the amount of energy generated using waste heat relative to the amount of total energy generated". Since our project generate only steam, we can interprets f_{WECM} as follow:

$$f_{hrsm} = \frac{\text{steam generated from waste heat}}{\text{total steam generated}} = \frac{ST_{whr}}{ST_{whr} + ST_{NG}}$$

Where: ST_{whr} and ST_{NG} is the energy of steam generated from waste-heat and natural gas respectively.

On the above derivation, direct interpretation of f_{hrsm} clearly embodies Equation 9, paragraph 12 of AMS-IIIQ. However, the wordings of paragraph 12 stipulates that the use of Equation 9 is only allowed if two conditions are met (1) the measurement of net calorific value of waste heat is not possible and (2) the steam generated is fed to turbine/s via common steam header.

In our case,

► measurements of waste-heat flowrate Q_{hrsm} is not possible due to reason given above, and measurement of net calorific value of waste heat is not relevant as the flue gas is not combusted, (ie only sensible heat is recovered); and

► the project does not use the generated steam to create additional electricity for the project, instead the steam is sent directly to the end-user as process steam. Thus, no steam is being fed into any turbine.

We would like to request your confirmation, if Equation 9 can be applied in our case, despite the fact that condition 1 is not particularly relevant, and condition 2 is not met, but the fundamental definition of f_{hrsm} is clearly not violated.

B. Considering the difficulties of differentiating steam generated from waste heat and steam generated from the integrated gas burner, we would like to request clarification by SSC WG if the direct *steam* measurement can be replaced with direct *natural gas intake* measurement, with justification as elaborated below.

Whereas the (integrated) natural gas burner efficiency is given by manufacturer as η_{ING}

$$\eta_{ING} = \frac{\text{energy contributed by natural gas to convert incoming water into steam}}{\text{energy value of intake natural gas into the burner}}$$

$$\eta_{ING} = \frac{HG_{NG}}{FC_{NG} \times NCV_{NG}} = \frac{ST_{NG} - \varphi_{NG}}{FC_{NG} \times NCV_{NG}} = \frac{m_{NG} \times (H_s - H_w)}{FC_{NG} \times NCV_{NG}}$$

Where;

► η_{ING} is efficiency of the integrated gas burner as provided in manufacturer specification.

► HG_{NG} is the net heat output of the natural gas burner TJ/yr. Parallel to the definition of HG_y for total steam in AMS-IIIQ, HG_{NG} is equivalent to the enthalpy of steam generated using natural gas ST_{NG} (in TJ/yr) deducted by the enthalpy of incoming water/condensate into the HRSG for the equivalent amount (φ_{NG}) in TJ/yr.

► FC_{NG} is the amount of fuel consumed by the natural gas burner in any given year in kt/yr;

► NCV_{NG} is the net calorific value of natural gas fed into the natural gas burner in TJ/kt;

► m_{NG} is the mass flow-rate of steam generated by the system, associated with the natural gas burner, therefore equivalent to the amount of water being evaporated in the natural gas burner (kt)

► H_s is the specific enthalpy of steam generated by the Project, whereas H_w is the specific enthalpy of input water into the Project.

Consequently the *amount of generated-steam that can be associated with the natural gas burner* can now be calculated using the equation below:

$$m_{NG} = \frac{(FC_{NG} \times NCV_{NG} \times \eta_{Int})}{H_s - H_w}$$

Accordingly, without changing it's meaning, f_{new} in Equation 9 can be modified and calculated as:

$$f_{new} = \frac{ST_{whr}}{ST_{whr} + ST_{NG}} = \frac{ST_{whr}}{ST_{total}} = \frac{ST_{total} - ST_{NG}}{ST_{total}}$$

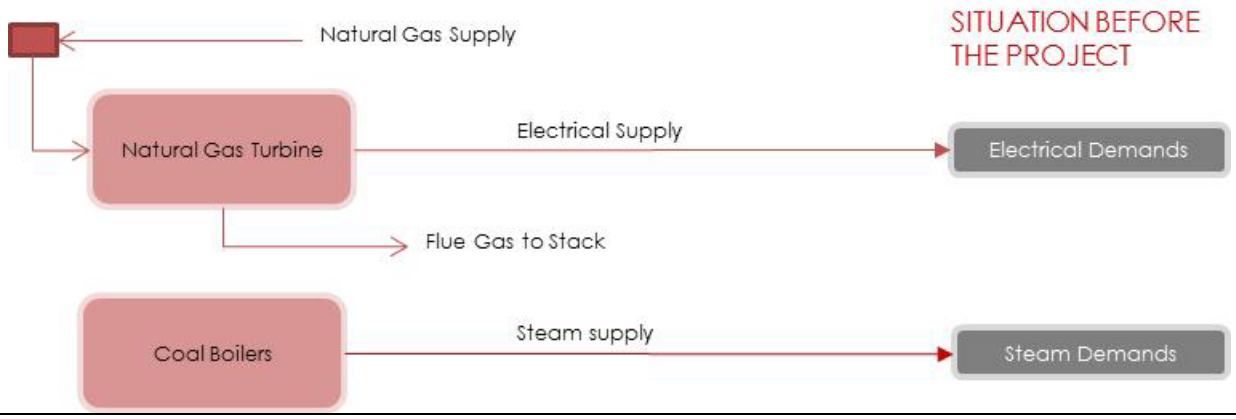
$$f_{new} = \frac{ST_{total} - (m_{NG} \times H_s)}{ST_{total}}$$

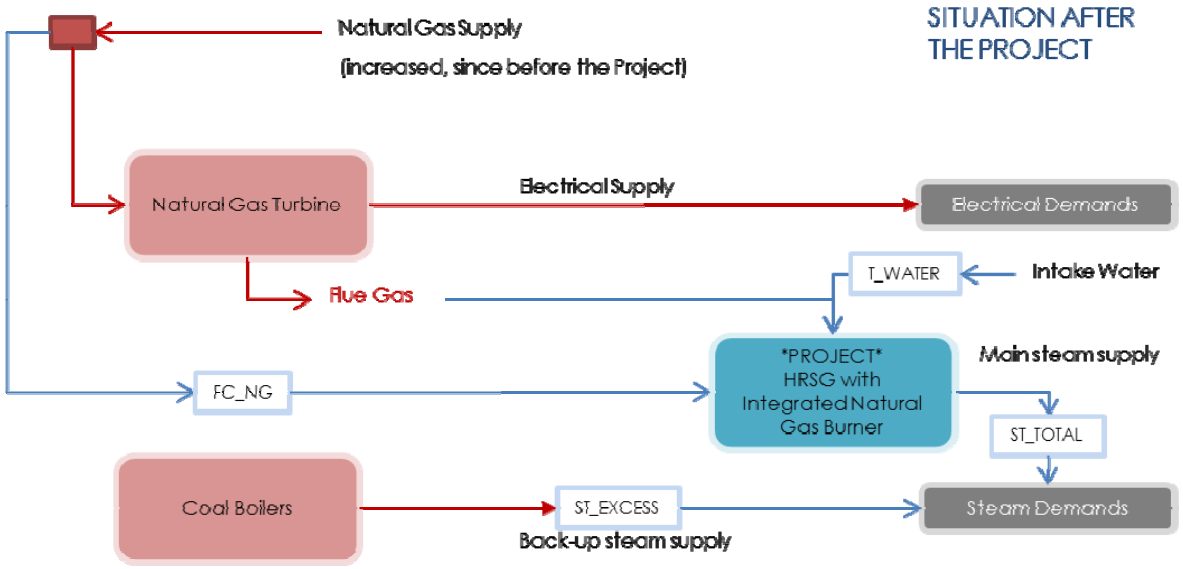
We would like to request clarification by SSC-WG if the above modified equation 9 can be can be applied to our Project, instead of Equation 7 and 8 of the methodologies.

Whereas the propose modification of Equation 9 assumes a fixed integrated gas burner efficiency throughout the duration of credit period, we do not consider that this propose method to be any less accurate choice compared to equation 7, which assumes a constant heat capacity of the flue gas (Cp), a parameter which, inherently assumes a constant pressure or a constant temperature conditions during it's estimation, and it's magnitude depends on the composition of the flue gas, which ultimately also depends on the properties of natural gas being combusted in the power plant.

If this this method can be applied to our project, we will monitor the following parameter: (a) total steam output (in energy term), (b) the natural gas intake & properties (composition and density), instead of monitoring of waste-heat (WECM) quantity and properties (as stipulated in paragraph 17 (b) and (d))

In order to assist the decision making process, we provide you with the illustration of the situation before and after the Project.





Recommendation by the SSC WG:

Please use the space below to provide amendments/change (in your expert view, if necessary).

Please refer to paragraph 35 of the meeting report of the SSC WG 35 <http://cdm.unfccc.int/Panels/ssc_wg>.

Answer to authors of query by the SSC WG:

Please use the space below to provide answer to the authors of the above query.

The small-scale working group of the CDM Executive Board would like to thank the author for the submission.

The proposal made in the submission considers the efficiency value provided by the manufacturer of the burner this procedure would result in an overestimation of emission reduction as the burner efficiency will be of higher order (close to 98%) compared to waste heat generation equipment (85 to 88%).

The project proponent may consider applying AMS-III.Q, adopting a value of 1 for fwcm and consider the emissions resulting from the combustion of natural gas as project emissions.

The above will be further clarified in a future revision of AMS-III.Q. For example when the auxiliary fossil fuel is used to supplement the waste energy directly in the waste heat recovery combustion systems, where the energy output cannot be apportioned between fossil fuels and the waste energy, and when the calculation of fwcm is practically not possible due to technical constraints (e.g. waste gas measurement and its quality), then the above suggested procedure could be applied.

Signed by the Chair, Ms. Fatou Gaye
Date: 02/02/2012

Signed by the Vice-Chair, Mr. Peer Stiansen
Date: 02/02/2012

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