Response to request for review for Project 0264: Waste heat based 7 MW Captive Power Project

Comment No.1:
The following data variables included in the Monitoring Plan have not been monitored:
-Enthalpy of WHR steam h_1 (Should be calculated)
-Enthalpy of FBC steam h_2 (Should be calculated)
-Enthalpy of effective WHR steam H_1 (Should be calculated)
-Enthalpy of FBC steam H_2 (Should be calculated).

Response by project proponent:
-Enthalpy of WHR steam h1: calculated from steam table using the temp and pressure of WHR steam and the same has been incorporated in the revised Monitoring Report.
-Enthalpy of FBC steam h2: calculated from steam table using the temp and pressure of FBC steam and the same has been incorporated in the revised Monitoring Report.
-Enthalpy of effective WHR steam H1: calculated as(h1 x Mass Flow rate of effective WHR steam) and the same has been incorporated in the revised Monitoring Report.
-Enthalpy of FBC steam H2: calculated as(h2 x Mass Flow rate of FBC steam) and the same has been incorporated in the revised Monitoring Report.

Response by TÜV SÜD:
Parameters h1 and H1 mentioned above can be calculated based on temperature, pressure and quantity of steam from WHRB #1 and h2 and H2 can be calculated based on temperature, pressure and quantity of steam from FBC. Temperature, pressure and quantity of steam from WHRB #1 and FBC have been monitored during the monitoring period under consideration, as required by registered PDD. Corrective Action Request 2 (CAR 2) was raised during the verification process to include the data of steam temperature and pressure generated from WHRB #1 and FBC. Since the temperature and pressure of steam from both these sources was found to be almost same, the enthalpies were not calculated and calculations were based on steam flow only.
However, the revised monitoring report contains data on enthalpies of steam from all sources.

Comment No.2:
What is the origin/source of the parameter 15: TG#3 Auxiliary Steam Flow? PDD of the project 0772 “Waste Heat based 10 MW captive power project “GPIL- WHRB 2” does not provide any information on this.

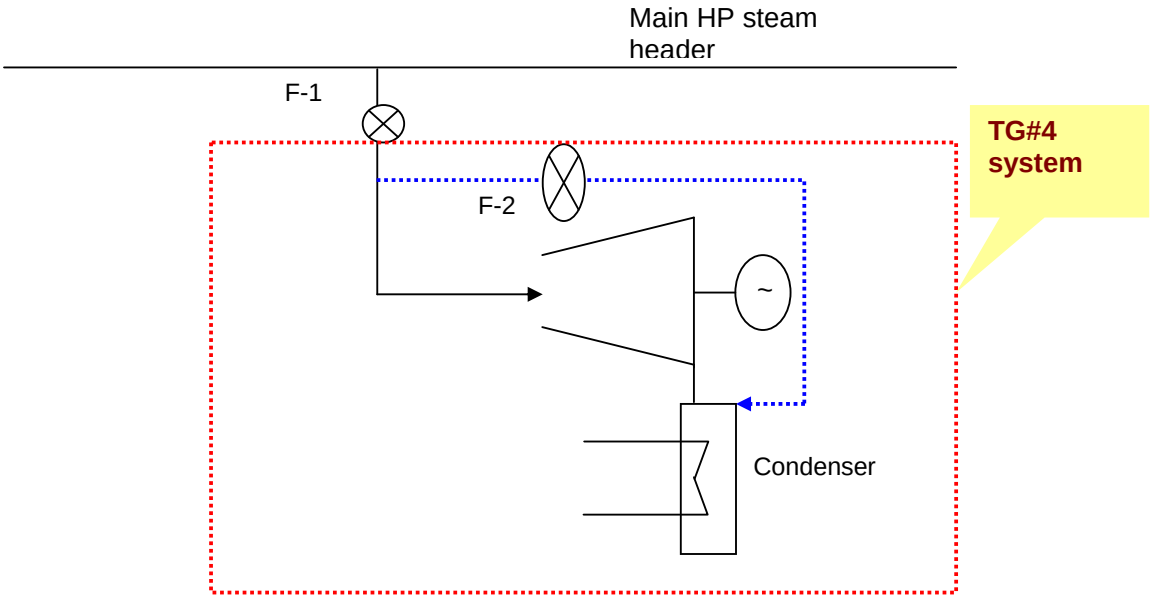
Response by project proponent:
‘Auxiliary steam flow’ in TG represents the steam consumption in the steam-jet ejector used for creating vacuum in the condenser located at the TG outlet. However, ‘TG#3 Auxiliary Steam Flow’ has no importance for the calculation of emission reductions for the project activity and hence, the same parameter (parameter 15 mentioned in the Monitoring Report) is deleted from the revised Monitoring Report.

Response by TÜV SÜD:
Clarification request no. 1 (CR 1) was raised during the verification process to clarify the parameter ‘TG#3 Auxiliary Steam Flow’ and explain its impact on emission reduction

calculations. It was clarified that auxiliary steam is the steam required in ejector system to create vacuum in condenser of TG #3. It was also clarified that steam flow to TG #3 is measured before the auxiliary steam is extracted from the turbine. Based on these arguments the audit team concluded that parameter 'TG#3 Auxiliary Steam Flow' does not have any impact on the emission reduction calculations for the 0264 project activity. However, following the request for review for the project 0264, further clarifications were requested from the project proponent and it was clarified that auxiliary steam for TG #3 is tapped before steam flow to TG #3 is measured. This will not have any impact on the emission reduction calculations for the 0264 project activity.

Comment No.3:
The same with the parameter 16: TG#4 Auxiliary Steam Flow.

Response by project proponent:
In case of TG#4 the 'Auxiliary Steam Flow' is measured due to the following positioning of the flow meter:



In case of TG#4 there is a bifurcation of the steam-line which is going to TG#4 system. From this bifurcation an Auxiliary Steam Line is going to the condenser; auxiliary steam is utilized in the ejector used to maintain vacuum in the condenser. One flow transmitter viz. F-1 (Tag No.: FT-001, Make: Tata Honeywell) is installed before steam-line bifurcation takes place and the other flow transmitter F-2 (Tag No.: FT-406, Make: Tata Honeywell) is installed in the Auxiliary Steam Line to monitor the auxiliary steam flow to the condenser.
The auxiliary steam-flow data recorded by F-2 is deducted from the steam-flow data recorded by F-1 to arrive at the inlet steam flow to TG#4. Both the steam-flow data recorded by F-1 and F-2 are monitored on-line through DCS.
During validation of the project 0772 "Waste Heat based 10 MW captive power project "GPIL- WHRB 2" TG#4 was under installation and therefore the location of the steam-flow transmitter to measure the TG inlet steam flow was taken same as TG#1, TG#2, TG#3.

Note: In case of TG#1, TG#2, TG#3 the flow transmitter (say, F-3) is located after the steam-line bifurcation takes place and the steam-flow data as recorded by F-3 is monitored online through DCS. Hence, for TG#1, TG#2 and TG#3 the direct monitored data is available for TG inlet steam flow.

Response by TÜV SÜD:
Clarification request no. 1 (CR 1) was raised during the verification process to clarify the parameter 'TG#4 Auxiliary Steam Flow' and explain its impact on emission reduction calculations. It was clarified that auxiliary steam is the steam required in ejector system to create vacuum in condenser of TG #4. It was also clarified that steam flow to TG #4 is measured before the auxiliary steam is extracted from the turbine with lower pressure. Based on these arguments the audit team concluded that parameter 'TG#4 Auxiliary Steam Flow' does not have any impact on the emission reduction calculations for the 0264 project activity. However, following the request for review for the project 0264, further clarifications were requested from the project proponent and it was clarified that auxiliary steam for TG #4 is tapped after steam flow to TG #3 is measured. Based on this information, the audit team has asked the client to provide monitored data for 'TG#4 Auxiliary Steam Flow' (Annex 1) and deduct it from monitored steam flow to TG #4 to arrive at the net steam flow to TG #4. The TG #4 started operation in November 2006 and the correction has been made to the data for TG #4 steam flow for November 2006 and December 2006 in the revised monitoring report. This correction has led to reduction in emission reductions in a conservative manner.

Comment No.4:
How TG#3 Steam consumption is obtained, through online measurement or calculated as a sum of TG#3 Inlet Steam Flow and TG#3 Auxiliary Steam Flow.

Response by project proponent:
TG#3 in-let steam consumption data is obtained through online measurement; the flow transmitter is located at the in-let steam line after the line bifurcation takes place for auxiliary steam flow. Please refer to the reply provided against Item No 2 for further clarification

Response by TÜV SÜD:
It is measure directly, for more information, please see response to Comment No.2 above.

Comment No.5:
The same with TG#4 Steam consumption.

Response by project proponent:
Contrary to TG#1, TG#2, TG#3 in-let steam consumption, TG#4 inlet steam consumption is a calculated parameter which is obtained by the difference between steam-flow from main HP steam-header to TG#4 system and the TG#4 auxiliary steam flow. Please refer to the diagram mentioned in the reply provided against Item No 2 for further clarification.
It is hereby clarified that in the Monitoring Report submitted for issuance there was a mistake in the TG#4 inlet steam consumption data. This mistake has been rectified and in the revised Monitoring Report the TG#4 net inlet steam consumption is calculated as the difference between steam flow from header and the auxiliary steam consumption in TG#4.

Response by TÜV SÜD:
This values is calculated, please see response to Comment No.3 above.

Comment No.6:
Why the accuracy of power generation monthly data (p.27) are different for TG#1 and TG#2 (accuracy – 10 kWh) and TG#3 (accuracy – 1 kWh) if the same types of meters are installed (compare monitoring equipment for parameters 11 and 13 with that one for parameter 16)?

Response by project proponent:
Initially, the energy meters from TG#1, TG#2 and TG#3 were of electro-mechanical type; for TG#1 and TG#2 the meter reading multiplication factor was 1600 whereas for TG#3 the meter reading multiplication factor was 160[1]. Difference in meter reading multiplication factor was attributing to the difference level of data accuracy (for TG#1, TG#2 and TG#3) as mentioned in the comment.
During November 2006 all the three above-mentioned energy meters were changed to digital meters and the meter reading multiplication factor for each of these energy meters was changed to 1000. This change over of the meter reading multiplication factor started sometimes around October 2006 and finally in December 2006 all the three energy meters (meant for TG#1, TG#2 and TG#3) attained the same meter reading multiplication factor.

Response by TÜV SÜD:
During the period from January 2006 to September 2006 the energy meters for monitoring the energy generation by TG #1 and TG #2 were similar having a multiplication factor of 1600 whereas the meter for monitoring the energy generation by TG #3 was having a multiplication factor of 160 as stated in the monthly report of energy generated from all sources at project site (Annex 2). This difference in multiplication factor is the reason for difference in least count of TG #1, TG #2 meter compared to TG #3 meter. During the period between October 2006 and November 2006 the energy meters for TG #1, TG #2 and TG #3 were replaced with new meters all having a multiplication factor of 1000.

Comment No.7:
Accuracy of the monthly steam generation and consumption data is 1 t/day except TG1 Steam consumption in June 2006 (recorded as 30,068.6).

Response by project proponent:
The Steam Consumption data in the TG#1 for the June 2006, as mentioned in the Monitoring Report was 30068.6. However, we confirm that this is a typographical error in transferring the data from log-book to daily report. The correct data is 30068 and the revised Monitoring Report incorporates this corrected figure of TG#1 steam consumption in the month of June 2006.

Response by TÜV SÜD:
The monitoring report contained the data as available in the daily records of steam parameter that were available at project site. Please refer the data for 16 June 2006 in Annex 3. The project proponent has clarified that it was a typographical error, which has been corrected in the revised monitoring report and results in small reduction in the emission reductions.

Comment No.8:
Vent steam, calculated as the difference between the Total steam generated and Total steam consumed. The calculated values presented in the Monitoring Report are underestimated for January, April, June, September and October (by 10,297; 12,068; 2,960; 11,413 and 9,113 t correspondingly). Due to this reason effective WHR steam, is overestimated by the same values.

[1] The accuracy class of TG#1 and TG#2 was 2 and that of TG#3 was 1 when these meters were of electro-mechanical type. The accuracy class of all the three meters is now 0.5s after these meters were changed to digital type.

Response by project proponent:

Vent steam data is obtained from the daily reports maintained in the plant. In case the WHR # 1 is not operating on a particular day, the vent steam generation for that day was conseidered zero. In the month of January, April, June, September and October WHR#1 was under shut-down for few days and for those days the vent steam from WHR#1 was considered zero. That is why for January, April, June, September and October the vent steam data was at lower side and not exactly matching with that calculated as Total steam generation minus Total steam consumption.

However, in order to conform to the conservativeness, the calculation for vent steam has been revised and computed as the difference between Total Steam Generated and Total Steam Consumed and hence the error due to over-estimation as commented by EB, UNFCCC is taken care of for the month of January, April, June, September and October. The revised value of vent steam is presented in the revised Monitoring Report and subsequently the emission reduction computation has also been revised as per the corrected value of vent steam

Response by TÜV SÜD:

Corrective Action Request 3 (CAR 3) was raised during the verification process because the vent steam data in monitoring report for months of Jan, April, June, Sept and Oct 2006 was not matching with the plant records. Subsequently the monitoring report was updated inline with plant records. The difference was due to the fact that during the periods when the WHR1 was not operating the vent steam was not attributed to the project activity. As a result, the vent steam (used for emission reduction calculations due to project activity) for these months was not exactly equal to difference of total steam generated by WHRB 1, WHRB 2 & FBC and steam consumed by TG 1, TG 2, TG 3 & TG 4 (see Annex 4). This approach was deemed logical by audit team. Nevertheless the project proponent has decided to include this steam vented in the emission reduction calculation, in order to be more conservative. The revised monitoring report includes this conservative approach.

Comment No.9:

WHR based power should be calculated by the formula:

EG = (EG GEN CPP – EG AUX CPP) x (h1 x s1) / (h1 x s1 + h2 x s2 + h3 x s3 + h4 x s4), where h1, h2, h3 and h4 are enthalpies, which depend on steam temperature and pressure; s1 is the effective WHR steam.

PP use the formula EG = (EGGEN CPP – EGAUX CPP) x (s1) / (s1 + s2 + s3 + s4), i.e. the ratio of enthalpy from WHRB is assumed to be the same as the ratio of stem from WHRB. This should be justified.

Due to the incorrect values of s1 WHR based power is also overestimated for January, April, June, September and October by 37,552; 17,273; 83,442; 24,700 and 4,053 kWh correspondingly, which makes in total 167,020 kWh overestimation. Therefore, Emission reduction for the period 1 January – 31 December 2006 should be 18,667.0 t CO2 instead of 18,793.7 t CO2, i.e. less by 126.7 t CO2.

Response by project proponent:

The enthalpy of WHR #1 steam (h1), WHR#2 steam (h2) and FBC steam (h3) are calculated from the steam table based on the average temperature and pressure of the steam from the respective above-mentioned boilers and the same are also presented in the revised Monitoring Report. It is observed that the month-wise enthalpy data of the steam generated from WHR#1, WHR#2 and FBC boilers are more or less the same. As a result, there is a difference of only 28 ton CO_2e when using steam enthalpy and steam flow for emission reduction calculations rather than using only steam flow. Hence as a conservative approach, the emission reductions in the revised monitoring report have been calculated using enthalpy of steam.

Response by TÜV SÜD:

The necessary correction has been made in the revised monitoring report, using as required the enthalpy and not only the steam data for the emission reduction calculation, showing a rather small difference in the result.