Validation opinion

Notification / Requesting approval of changes from the project activity as described in the registered project design document

Title of project activity:		
Shri Bajrang WHR CDM Project		
CDM reference number:	DNV project No.:	
UNFCCC0528	PRJC-192868-2009-CCS-IND	
Type of request:	☐ Notification of changes from project activity as described in the registered PDD (i.e. changes do not raise any concerns with regard to i) additionality, ii) the scale of CDM project activity and/or iii) the applicability and application of baseline methodology ☒ Request for approval of changes from project activity as described in the registered PDD	
Date	Work carried out by:	Work verified by:
30 July 2010	Indrajit Rana Indrajit Rana.	Ole Andreas Flagstad

1 Description of the changes as compared to the description in the registered PDD

In the project activity additional steam has been introduced to the common steam header of the waste heat recovery boilers. The additional steam has been sourced from another registered CDM project activity (Shri Bajrang RE Project: UNFCCC2128) which comprises of a 60 TPH AFBC boiler that co-fires biomass and fossil fuel and an 8 MW turbine. Excess steam available from 60 TPH AFBC boiler is being diverted to the WHR project to utilise total capacity of WHR project's turbines as projected in the registered PDD of 2128. Electricity generated from this diverted steam is however not claimed as emission reductions in either of the projects.

2 Assessment of the changes

Assessment of when the changes occurred

The changes occurred on 13 August 2008 when the 60 TPH AFBC boiler has been commissioned **(Appendix - I)**

Assessment of the reasons for these changes taking place

In the project activity two turbo Generators (TG) having a combined capacity of 18 MW were linked with two WHRBs attached to each sponge iron kiln. Due to inadequate steam generation in WHRBs the full capacity of the WHR project as envisaged in the registered PDD could not be utilised. After the implementation of the AFBC boiler, the excess steam available from the same is now being diverted to the WHR project to achieve full generation capacity of 18 MW turbine.

Assessment of whether the changes would have been known to the project participants prior to registration of the project activity

The project has been registered on 8 October 2006 and the techno economic feasibility report for installation of 60 TPH AFBC boiler has been prepared on January 2007. More over CER has already been issued for consecutive 4 monitoring period with the existing project activity. Thus project proponent did not know about the changes to the project activity prior to registration of the project activity.

Assessment of how the changes may impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD

The changes in the project activity will not impact the overall operation/ability of the project activity to deliver emission reductions as stated in the PDD as the turbine capacity of the project activity has not been changed and electricity generation from the additional steam will be excluded from the emission reduction calculation.

Nevertheless the electricity generated by the equipment of the project activity will increase and this situation is assessed below with regard to additionality.

3 Assessment of the impact of the changes

Do the changes raise concerns with regard to any of the following aspects?	☐ Additionality ☐ Scale of CDM project activity ☒ Applicability and application of baseline methodology ☐ Not applicable (the changes do not raise any concerns)

Assessment of impacts of the changes on additionality

The changes will not impact on the additionality of the project activity.

The investment analysis was based on benchmark analysis in the registered PDD. The equity IRR was compared with the benchmark cost of equity. As per the registered PDD the equity IRR (12.9%) was less than the benchmark cost of equity of 14.1%. In the analysis electricity generation from 18 MW turbine with PLF of 90% over 300 days annual operation had been considered from third year onwards.

After change of the project activity the turbine capacity will remain same as that of the registered PDD. However, the registered PDD had considered a PLF of 90% over 300 days annual operation. It has been observed from the plant data till Feb 2010 that the highest PLF achieved in any yearly period after the change in the project design is 91.71% **(Appendix-II)** over 300 days of annual operation. For conservative estimate of the impact of the design change on the additionality of the project, during the re-assessment, the highest achieved PLF has been considered in the investment analysis under two different scenarios. The scenarios have been defined depending on whether the data has been verified by a DOE or not.

i) Based on the actual data from September 2005 to August 2009 (most up to date data verified by DNV under the current verification) and there after with the maximum PLF of 91.71% achieved after the design change. This is based on the best PLF calculated over 7 yearly periods (Sep08-Aug09, Oct08-Sep09, Nov08-Oct09, Dec08-Nov09, Jan09-Dec09, Feb09-Jan10 and Mar09-Feb10) after the change. **(Appendix – III)**. This has resulted in an equity IRR of 13.03%

ii) Based on the actual data from September 2005 to February 2010 (most up to date data available from the plant) and there after with the estimated power generation with the maximum PLF 91.71% achieved after the change in project design. This is based on the best PLF over 7 yearly periods (Sep08-Aug09, Oct08-Sep09, Nov08-Oct09, Dec08-Nov09, Jan09-Dec09, Feb09-Jan10 and Mar09-Feb10) after the change. **(Appendix – III)**. This has resulted in an equity IRR of 13.19%

It has been evidenced from the post change IRR analysis with different scenarios that the equity IRR has not crossed the equity bench mark 14.1% in any of the scenarios mentioned above. It has also been evidenced from the actual operation data up to February 2010 if the PLF increased to 95.83% after the design change the equity IRR cross the benchmark which is unlikely as the maximum PLF achieved after design change is 91.71%. Therefore, it is DNV's opinion that the project activity as implemented is still additional and revenue from CERs is more critical to the operation of the project activity.

Assessment of impacts of the changes on the scale of the CDM project activity

The project was registered as a large scale CDM project activity under the approved consolidated methodology ACM0004 version 2 and remains as a large scale project activity after the project activity changes. Therefore, the changes have no impact on the scale of CDM project activity.

Assessment of impacts of the changes on the applicability and application of baseline methodology

The project was registered as a large scale CDM project activity under the approved consolidated methodology ACM0004 version 2. Since ACM0004 has been replaced by another approved consolidated methodology ACM00012, the revised monitoring plan is based on ACM00012 version 3.1. The applied baseline methodology ACM0004 is still applicable. Only some element of ACM0012 version 3.1 is used for steam proportion, which is as per the revision to the methodology ACM0004 version 2(AM_REV_0033).The fraction of total electricity generated by the project activity using waste energy has been calculated from the monitored total electricity generation, the enthalpy of steam generated from the WHRB (as determined from the monitored steam temperature, steam pressure, steam flow and feed water temperature) properties) and the enthalpy of steam generated from the AFBC boiler (as determined from the monitored steam temperature, steam pressure, steam flow and feed water temperature and feed water properties) as per the provisions of the methodology ACM00012 version 3.1. Therefore, the changes have no impact on the applicability and application of baseline methodology.

4 Assessment of the revision of the monitoring plan

The proposed revision of the monitoring plan ensures that the level of accuracy or completeness in the monitoring and verification process is not reduced as a result of the revisions

Due to design change in the project activity monitoring plan of the project has been revised in line with ACM0012 version 3.1 which replaces the applied baseline methodology ACM0004 version 2. After design change extra steam has been added in the project activity from one AFBC based boiler. Thus fraction of total electricity generated by the project activity using waste gas has been multiplied with the total electricity generation by the project activity and that electricity has been considered for baseline emission.

Fraction of total electricity generated by the project activity using waste gas has been calculated as per the following equation:

$$f_{WCM} = \frac{ST_{whr,y}}{ST_{whr,y} + ST_{other,y}}$$

Where

$ST_{whr,y}$ = Energy content of the steam generated in waste heat recovery boiler fed to turbine via common steam header

$ST_{other,y}$ = Energy content of steam generated in other boiler (AFBC) fed to turbine via common steam header

Temperature, pressure and quantity of steam from waste heat boiler and temperature of feed water towards WHRB have been measured to calculate $ST_{whr,y}$ The energy content of the steam from WHRB, $ST_{whr,y}$ is calculated from deducting the energy content of the feed water entering WHRB from the energy content of the steam coming out from WHRB.

Temperature, pressure and quantity of steam from AFBC and temperature of feed water towards AFBC have been measured to calculate $ST_{other,y}$ The energy content of the steam from AFBC, $ST_{other,y}$ is calculated from deducting the energy content of the feed water entering AFBC from the energy content of the steam coming out from AFBC.

Steam tables would be used to calculate these energy quantities using the temperature and pressure of the steam/feed water and the quantity of steam/feed water.

All the measured parameters will be monitored on daily basis. All the flow meters, temperature and pressure gauges will be calibrated annually. The accuracy classes of the temperature gauge and pressure gauge are $\pm 7^{o}$C and ±0.075% respectively. The accuracy classes of the steam flow meters are ±0.075% and ±0.065% for WHRB and AFBC respectively.

Hence it is DNV's opinion the proposed revision of the monitoring plan ensures that the level of accuracy or completeness in the monitoring and verification process is not being reduced as a result of the revisions.

The proposed revision of the monitoring plan is in accordance with the approved monitoring methodology applicable to the project activity whilst ensuring the conservativeness of the emission reductions calculation

Although the applied baseline methodology ACM0004 version 2 is still applicable only some element of ACM0012 version 3.1 is used for steam proportion, which is as per the revision to the methodology ACM0004 version 2(AM_REV_0033).

Hence it is DNV's opinion the proposed revision of the monitoring plan is in accordance with the approved monitoring methodology ACM0004 version 2 applicable to the project activity whilst ensuring the conservativeness of the emission reductions calculation

The findings of previous verification reports, if any, have been taken into account

There are no findings of previous verification report as the design change in the project activity has been implemented after the previous verification period.

5 Validation opinion

In DNV's opinion, the change of the project activity (additional steam input in the common steam header towards turbine will increase the gross electricity generation of the unit but the gross electricity generation will not be increased beyond the capacity of the turbine as the turbine capacity under the project activity remains unchanged. Also as demonstrated above,

the increase in electricity generation is unlikely to increase significantly over that assumed in the registered PDD. It has also been evidenced from the IRR analysis **(Appendix – III)**, that the change doesn't impact the additionality of the proposed project. More over it has been observed from the plant data till Feb 2010 that the highest PLF achieved in any 7 yearly periods (Sep08-Aug09, Oct08-Sep09, Nov08-Oct09, Dec08-Nov09, Jan09-Dec09, Feb09-Jan10 and Mar09-Feb10) after the change in the project design is 91.71% **(Appendix – II)**. If the PLF increased to 95.83% after the design change, the equity IRR cross the benchmark which is unlikely as the maximum PLF achieved after design change is 91.71%. Thus it is DNV's opinion that the design change of the project activity does not help the project to overcome the financial barrier and hence the project is still deemed additional.

DNV recommends the approval of the revised monitoring plan as depicted in the revised PDD version 10 dated 15 April 2010 submitted by the project participants.

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