Reply on Review Requested on HITECH CDM CPP (1693)

1. Further clarification is required on how the DOE has validated the economic comparison, in particular, a 10 MW coal based power plant (with 95% PLF) with the 4.5 MW project activity (with 66% PLF) given the different levels of production from these two options.	The identified options are outcome of "step-1" as per the tools for demonstration of additionality, which requires to make comparison between only the identified plausible options. The difference in PLF does not disqualify the identified plausible option for being compared with the project activity. The reasons for the lower PLF in project activity are well explained in the answer of question no.2, as well as has been narrated in detail under "step-3" in barrier analysis of PDD. For the sake of greater clarity we submitted our response in details as given below: It may be noted that the Investment Analysis Step-2 (tools for the demonstration and assessment of additionality) requires to determine whether the proposed activity is not financially attractive or economically feasible without the revenue from Sales of certified emission reduction. Further to this in substep-2, while determining the appropriate analysis method. It is stated that … " if the CDM Project activity and the alternatives identified in Step-1, generate no financial or economic benefits other than CDM related income, then apply the simple cost analysis (option-I). Otherwise, use the investment comparison analysis (option-II), or the benchmark analysis (option-III)" We understand through the above that we have to apply option-II, as the alternatives identified in step-1 and the Project Activity do generate financial benefits; other than CDM related income also. Also we understand that the option-II requires to make the comparison between the identified alternatives as per step-1. Thus while applying the sub-step-2b- Option-II, we are required to make the comparison between the identified plausible alternatives as per step-1. In which it has been identified that in absence of the project activity the required power would have been generated by increasing the capacity of AFBC to the equal level of WHRB (in terms of MW capacity). Hence the correct level of comparison becomes the added portion of coal based AFBC in absence of the project activity that with the portion of WHRB (without CDM support). It has been allowed to choose any one of the financial indicators. Since we have selected to use the unit cost of services. Thus we have calculated the average (levelized) unit cost of power for the entire 15 years project life, for both the scenarios. Even as per Para 8 of sub-step 2c required to "*calculate the suitable financial indicator for the proposed CDM project activity and, in case of option-II above, for the other alternatives. Including all relevant costs*". Even at para 10 there is mention about "other alternatives". Even in para 11 "a *clear comparison of financial indicators for the proposed CDM activity and the alternatives, if option-II (investment comparison analysis) is used"* has been mentioned. This definitely shows that the comparison has to be made between the identified alternative scenarios in "step-1"; that with the Project Activity. Therefore, the identified alternative cannot be excluded from the comparison only because of a lower PLF than one of the identified baseline scenario, which has a higher PLF. Alternatively vis-à-vis for making the comparison the identified baseline scenario cannot be excluded only because of higher PLF than the project activity.

	Thus we are right in making comparison with one of the alternative selected in "Step-1" i.e. in absence of the project activity the power would have been generated from coal based captive power plant only by increasing the capacity of the same. On going through the methodology and the tool for the demonstration and assessment of additionality we have calculated 'the levelized unit cost of power" as normally done and as also adopted in some of the project activities whicha re also registered. Hence, we had adopted the general and common prevailing approach for calculating the "unit cost of power" from "different scenarios", which are normally considered in any decision making context. In any decision making context the ultimate cost of power per unit is worked out between the two comparable scenarios as worked out by us. On going through the same it will be realized that we have adopted the most conservative approach in making the comparison in unit cost of power between different scenarios. **We are herewith justify our approach in different steps:** **(a) Justification for comparison with coal based power plant, and why it is appropriate:** The size of the project activity is 4.5 MW, whereas the size of the total captive power plant is 10 MW , which comprises of a 5.5 MW Coal based AFBC. Hence in absence of the project activity, the AFBC capacity would have been increased by adding 4.5 MW to the 5.5 MW coal based AFBC, and accordingly the entire power requirement would have been generated by the 10 MW coal based AFBC captive power plant only. Thus we wish to submit that the proposed Project Activity is being implemented as a partial replacement of coal based captive power plant, as in absence of the project activity only the coal based captive power plant would have been established with 10 MW capacity. The prevailing practice and common practice in the region reveal that the coal based captive power plant is the first and foremost choice, and financially most attractive. **Thus the comparison only with coal based power plant is appropriate.** **(b) Justification for comparison with 10 MW capacity of coal based captive power plant, and how it is appropriate:** The comparison for unit cost of power could have been made between the following options of different capacities of the projects: 1) Since the actual baseline scenario is addition of 4.5 MW coal based AFBC over and above 5.5 MW coal based AFBC, therefore in absence of the project activity the cost of power generation from the 4.5 MW added portion (in to the 5.5 MW AFBC) becomes the first choice for comparing the unit cost of power with the 4.5 MW WHRB, which is also added to the 5.5 MW AFBC. 2) Unit cost of power from a single unit having total 10 MW coal based captive power plant. (which would have been implemented in absence of the project activity)

3) Unit cost of power from a standalone 4.5 MW coal based captive power plant only, with 4.5 MW WHRB stand alone facility, which is equivalent to the capacity of project activity. However this scenario is not being implemented as the 4.5 MW WHRB is implemented along with 5.5 MW AFBC. In absence of Project activity 10 MW AFBC would have been implemented. Hence is not a choice for correct comparison
4) Unit cost of power from an independent coal based power plant, connected to the Grid. (these are normally of much higher size in hundreds of mega watt).

Thus the correct comparison was to compare the unit cost of power between the added portion of 4.5 MW AFBC that with the added portion of 4.5 MW WHRB. Since the unit cost of power from 4.5 MW added portion will naturally be less than the average unit cost of power from 10 MW coal based AFBC which is evident with the calculations provided to DOE.

But for making a fair comparison between the baseline scenario and project scenario, we have considered the situation, where in the power requirement would have been met by the 10 MW coal based captive power plant (In which the added 4.5 MW coal based AFBC capacity is a part of it). Because in absence of the Project activity, the total 10 MW CPP would have been based on Coal by increasing the 5.5 MW AFBC with addition of 4.5 MW in AFBC.

The comparison with grid power generation cost as per tariff order of Chhattisgarh State Electricity Regulatory Commission is found to be less than Rs. 1.04 per unit (**Annex- 1**)

S.No.	Scenario	Unit cost of power
1	15 year average unit cost of power for 4.5 MW Coal based AFBC added portion of CPP (into the 5.5 MW Coal based AFBC)	1198.37 Rs./MWh
2	15 year average unit nit cost of power for 10 MW coal based AFBC boiler CPP (which would have been implemented in absence of the project activity as a single unit)	1372.86 Rs./MWh
3	15 year average unit cost of power from 10 MW CPP having combination of 5.5 MW AFBC and 4.5 MW WHRB	1513.58 Rs./MWh
4	15 year average unit cost of power for 4.5 MW WHRB added portion of CPP (into the 5.5 MW Coal based AFBC)	1458.46 Rs./MWh
5	Unit cost of power from an independent coal based power plant connected to grid	1040.00 Rs./MWh

Therefore making a comparison of unit cost of power from project scenario (i.e. 4.5 MW WHRB without CDM support) with the 10 MW capacity coal based power plant is more conservative than making comparison with

	added 4.5 MW coal based portion of power plant of equal capacity. Hence the most appropriate and most conservative investment comparison analysis for unit cost of power is with 10 MW coal based power plant. **(c) Justification for the considering the 66% PLF for WHRB based power plant:** - The lower capacity utilization of a Sponge Iron Plant is the first and major reason for the lower capacity utilization for WHRB power plant. Because the power generation in WHRB power plant is directly linked to the Sponge Iron Plant operation and capacity utilization. Whereas the AFBC power plant has the total freedom to operate as per the requirement. The WHRB power plant also faces a number of barriers which influence the generation of power in WHRB (Refer to the PDD – Page No.21) whereas the coal based AFBC has no such barriers. Hence the best capacity utilization with WHRB, without CDM support would be around 50 to 60%. Whereas, 66% PLF (which is a better PLF) has been considered for the sake of financial comparison for WHRB based unit cost of power. Even on going through the number of registered projects activities which have sought CER issuance during the past years also reveal that normal capacity utilization of sponge iron based WHRB is between 50 to 60%. (refer to **Annex-2**). Even the official website of the State Government of Chhattisgarh reveals that the average capacity utilization of sponge iron plants based on the 300 days is only 50 to 55%. **(d) Justification for consideration of 95% PLF for coal based power plant:** The coal based captive power plant of this size have no Technological and other barriers, hence they can be operated easily up to 95% & above PLF. Hence, the considered PLF is most appropriate for the sake of making economic comparison between the two scenarios. On going through a number of publicly available disclosure also it will be revealed that it is comfortably possible to achieve more than 95% PLF in thermal power plant. This may be appreciated that in a coal based captive power plant where the boiler has higher steam generation capacity than the full load required steam capacity and also where the turbine and generators design allow to generate upto 10% excess power than the design level thus at several moments plant is able to operate even at 105% to 110% level. Also in the coal based power plant there is no crisis of raw material as well as there is no crisis of consumption of generated power or evacuation of generated power. Also the AFBC does not face any of those barriers which are faced by WHRB Therefore the capacity utilization is also not hampered due to these. The 95% PLF has been calculated based on 350 working days only whereas the captive power plant can also operate for 355 day. Therefore, it is easily possible to generate power with 95% PLF in coal based AFBC. A power plant supplier had also confirmed that it is possible to easily achieve up to 95% PLF on annualized basis for coal based AFBC, whereas, it is not possible to have more than 60 to 65% PLF with WHRB Power Plant (refer to **Annex 3** –, the other publicly available information such as **Annex-4**-, **Annex-5**) also reveal that it is possible to have more than 95% PLF in coal based thermal power plant.

	(e) Justification for selecting 10 MW capacity for Coal based captive power plant: The decision to set up a captive power plant is in accordance to the assessed load requirement by us, in this case it is assessed to be 10 MW. To meet the assessed demand a reliable & consistent source of Power is required which could have been easily met by Coal based AFBC as it can easily provide 95% & above PLF, at the same time economically most attractive. **(f) Justification for selecting 4.5 MW capacity for WHRB captive power plant:** The available waste heat from the sponge iron plant flue gases can generate about 4.5 MW power at the optimum operating conditions. Therefore in order to utilize the available waste heat it is designed at 4.5 MW. At the optimum operating conditions the WHRB will generate the same level of energy which would have been otherwise generated by the same capacity of AFBC. But due to a number of technology barriers such optimum conditions do not prevail for long in WHRB and heavy fluctuations are always there. (g) **Conservative approach adopted while making comparison in unit cost of power:** 1. While validating the unit cost of power from the 4.5 MW project activity a number of Manpower cost has been attributed on the 5.5 MW AFBC portion, thus the unit cost of power from WHRB became lower than what would have otherwise been there if calculated for stand alone WHRB. 2. WHRB are known for their power fluctuation & unpredictable system shut downs etc, thus at their best they can give about 66% PLF on annualized basis, therefore to operate the captive load, a grid system back up is essential to provide this 29% gap in generation. Therefore, only the cost of seeking assurance to draw power was considered as the backup power cost. Thus while comparing the average unit cost of power for the equal quantum of power per annum (by considering the cost of imported energy from the grid); the unit cost of power further goes high; as the grid power unit charges are costlier than the WHRB or AFBC power. Thus as a conservative approach the unit cost of power was calculated only on the 66% PLF of WHRB without taking in to account the energy import cost from the grid, but by only including the cost of assurance to draw power i.e. the demand charges only. 3. This may be argued that in absence of the project activity what is the need of increasing the AFBC capacity by 4.5 MW when the equal quantum of energy can be generated only by adding (4.5X.66/.95) =3.12 MW. This argument is practically not valid for the simple reasons that the assessed annual demand of 10 MW captive loads cannot be met from any system of lower capacity (i.e.=5.5MW+ 3.12MW= 8.62MW). More over having invested on every other components of 10 MW power generating system, except boiler; why we would not increase the AFBC boiler capacity to 10 MW which can be done at much less cost than putting up a WHRB. Thus such scenario is not practical. Even if for the sake of an academic exercise it is done; then also the unit cost of power from the added portion of 3.12 MW capacity will be much less than the entire 10 MW AFBC unit cost of power.

	Hence the 10 MW level for considering the Unit cost of power is appropriate. 4. Another argument can be made why not a lower capacity of WHRB equal to 4.5 X 0.66= 3.12 MW is set up & operated at 95% level? This option is not exercisable because at the optimum level of sponge iron production the available waste heat would be capable to generate up-to 4.5 MW. A lower capacity WHRB will require emitting into atmosphere the useable waste heat; which will be against the purpose of the project activity. More over even by doing so, the annualized PLF would not improve from 66% to any better level. Because even by doing so the plant availability of sponge iron plants will neither improve from estimated 300 days; nor any other technical barrier will ease out by doing so. Hence this option also is not exercisable. Hence, the comparison between Project Activity 4.5 MW WHRB power generation with 10 MW Coal based power generation is justified. This is to be noted that 4.5 MW WHRB based power generation (Project Activity) and 10 MW Coal based power generation (Baseline Scenario) cannot give the levelized energy production in terms of MWh/annum, whereas the WHRB will also generate the equal level of energy at the optimum times of operation as that of the same capacity of AFBC; hence we had chosen the cost of per MWh power to compare the scenario, which is also justified. Thus, if the energy level is required to be leveled for Calculations then deficit in power generation to extent of 29% in WHRB based power generation has to be imported from Grid which result higher unit cost of power **(h) Justification for considering the different levels of production as appropriate between AFBC(95%PLF) & WHRB(66%PLF):** The technology employed in proposed project activity is to utilize the waste heat from Sponge Kiln to generate power which at optimum level of operation will generate 4.5 MW power. Regarding difference in level of production, it will be noted that WHRB power plant faces enormous technology barriers. These technology barriers also impact capacity utilization of power plant resulting into poor annual average capacity utilization due to enormous fluctuations & frequent shutdowns. Sponge Iron manufacturing process also faces lot of barrier, which results in poor PLF i.e. 50 to 60%, and which is also evident with SIPB's (a Govt. of Chhattisgarh undertaking- **Annex-6 & Annex-7**) official data, in which average PLF (based on 300 days) of Sponge Iron Plant of the company was 52.13% average PLF for the period of 2006-07 and 57% average PLF for 2007-08. This PLF will further get reduced to 44.68% for 2006-07 and 48.86% for 2007-08 if calculated based on 350 days working as considered in levelized cost comparison. Against which coal based AFBC boiler can be operated for 350 days in a year at 95% PLF and above. Please refer

	to **Annex- 4**, where the coal based power generation PLF is achieved even 104%, and also please refer to **Annex-5** where the coal based power generation PLF is achieved 95%. The Coal based AFBC power plant for captive use is the common practice in the region because of abundant availability of Coal. It will also be evident with list of captive power plant being installed in regions from Ministry of Environment and Forest **(Annex-8)** web site sanctioning environment clearance. The PLF of WHRB power plant is mainly based on Sponge Iron Kiln's performance and then due to the WHRB performance, whereas coal based AFBC faces no barriers. Since at optimum level of operation the WHRB will also give the same output as that of AFBC, hence even with the different level of annual production in terms of MWh per year; the considered level is appropriate. • Even in one of the registered project activity with 49 MW power :- 0285 Tarucani I ("the project") under the same methodology (http://cdm.unfccc.int/Projects/DB/TUEV-SUED1140721859.5/view) the levelized unit cost of power was compared with unit cost of power from the grid, which has several hundred times higher generation capacity • Similarly in case of another registered project activity reference 1169 GIPPL Waste Heat based 11.5 MW Captive Power Project (http://cdm.unfccc.int/Projects/DB/SGS-UKL1181746343.23/view) have also calculated the levelized unit cost of power from a same installed capacity power plant with different percentage of capacity utilization (i.e. 60% for WHRB and 90% for coal based FBC), and has also compared the unit cost of power with the actual power purchase bills of the grid.) • *In another registered project activity NO. 1462, the project having 350 TPD Sponge Iron Kiln had calculated 80% PLF based on 300 days which on calculating for 350 days work out to 68.57% only.* In view of the above the comparison made is most conservative & appropriate. The different level of production does not make any impact on the additionality of the Project activity.

2. Further clarification is required how the DOE has validated that the assumed PLF and the range of variation of PLF in the sensitivity analysis are reasonable.	**Sensitivity analysis** is required to be done at "sub step 2d". Which requires, to include, a sensitivity analysis that shows whether the conclusion regarding financial attractiveness is robust to reasonable variation in the critical assumption. As per the above the reasonable variation in the critical assumption is required to be analyzed for the sensitivity. Since, in case of the project activity the critical assumption made i.e. the PLF considered is already higher than possible to vary reasonably in the realistic conditions. As evidenced that the realistic annualized PLF in case of sponge iron based WHRB power plant in state of Chhattisgarh (India) is only around 50 to 55% against which 66% has already been considered; which is not likely to increase substantially. However for the sake of further confirmation of the same 5% increase in PLF was considered for sensitivity analysis.

	Since any decrease in PLF is ultimately going to increase the cost of WHRB power hence, the 5% PLF level variation selected is found appropriate. The other critical assumptions considered for the project activity are not likely to decrease due to the increasing inflation, due to increasing cost of project, increasing manpower cost, increasing operation and maintenance cost and even increasing backup power cost. Therefore, it will not be reasonable to calculate the unit cost of power (any financial indicator) from WHRB by reducing the cost of these inputs. The increase in cost of these inputs would have made the WHRB power unit cost yet more costlier. Therefore, the most reasonable variation which can take place is increase or decrease in PLF. Thus this was considered for the sensitivity analysis. The production of sponge iron plant in Chhattisgarh State through the official website of Government of Chhattisgarh reveals that based on 300 operating days the average capacity utilization has been only 50.57% for 2006-07 and to 54% PLF for 2007-08, which would work out to be around 43.35% for 2006-07 and 46.29% for 2007-08 based on 350 days. (web-link : http://www.chhattisgarh.nic.in/departments/sipb/Allocation%20of%20Iron%20Ore%202007-08.pdf to demonstrate Sponge Iron Units PLF for the period 2006-07 http://www.chhattisgarh.nic.in/departments/sipb/Iron%20Ore%20Recommended%20for%202008-09.pdf). Thus the assumed 5% PLF level to calculate the sensitivity analysis is appropriate and in accordance to the tool for demonstration of additionality. While calculating the sensitivity analysis the baseline unit cost of power has been kept at the same PLF. During the assessment unit cost of power from coal based AFBC already the higher cost of man power and other operation and maintenance expenses were considered. Even the fuel requirement was assessed at the designed boiler and turbine efficiency as per which it was working out to 3750.49 K Cal/kWh, whereas the executive board has accepted the heat rate prescribed by CEA @2750 K Cal/kWh for determination of the additionality in one of the registered project activity. Therefore, having already adopted the most conservative approach for determination of coal based AFBC unit cost of power there was no reasonability in further increasing the cost of inputs for sensitivity analysis. • Even in one of the registered project activity with 49 MW power :- 0285 Tarucani I (“the project”) under the same methodology (http://cdm.unfccc.int/Projects/DB/TUEV-SUED1140721859.5/view) the sensitivity analysis for unit cost of power was compared with the project PLF of less than 50% and with unit cost of power from the grid, which has several hundred times higher generation capacity • *In another registered project activity NO. 1462, the project having 350 TPD Sponge Iron Kiln had calculated 80% PLF based on 300 days which on calculating for 350 days work out to 68.57% only and has used only 5%.variation in PLF for sensitivity analysis.* • In one of the registered project activity Ref: 1462 of 16 MW based on 2 Nos. 350 TPD Kilns also the sensitivity analysis was

	done by making only 5% variation in PLF. It was found appropriate by the Executive Board and hence was registered. The whole process of financial analysis prescribed in the "tool" is in relevance to the decision making context, as per which the above comparisons made by us and submitted to DOE are most relevant, appropriate and realistic to the decision making context. Therefore the financial calculation for the project activity would have been ideally done at about 50% PLF based on 350 days working. Since most of the other project activities of similar nature were calculated at 66% PLF as a conservative approach to determine the best possible financial impact from WHRB, therefore, we had we had also considered to calculated the financial feasibility based on 66% PLF based on 350 days. Since, we had already considered the 66% PLF which is already much higher than 10% from the average PLF, which can be normally achieved in Sponge Iron Kiln based waste heat recovery power plant of this size. Hence the PLF level used for sensitivity analysis can be treated as more than 10% higher as compared to the normally achievable PLF, as already considered. The 5% variation in PLF is considered only in case of project activity by keeping the Baseline PLF for AFBC as constant at 95%. Therefore we feel that the sensitivity analysis done by increasing 5% percentage level over the already considered higher PLF for WHRB while comparing it with the same baseline PLF of 95% is quite conservative & appropriate. Hence the sensitivity analysis done by us is appropriate and justifiable, hence validated by DOE.

In addition to the above we wish to submit that the project activity faces enormous technology barriers which are narrated in PDD along with the evidences for the resultant lower capacity utilization in the Sponge Iron plant, which will naturally restrict the capacity utilization in WHRB.

It is therefore requested to consider the additionality of the project activity under step 3 barrier analysis also and register the project activity.