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Response to request for review

"Flare gas recovery project at Hazira Gas Processing Complex (HGPC), Hazira plant, Oil and Natural Gas Corporation (ONGC) Limited" (Project activity 1354)

Dear Members of the CDM Executive Board,

We refer to the requests for review raised by three Board members concerning DNV's request for registration of the **Flare gas recovery project at Hazira Gas Processing Complex (HGPC), Hazira plant, Oil and Natural Gas Corporation (ONGC) Limited (Project activity 1354)** and would like to provide the following initial response to the issues raised by the requests for review.

Comment 1:

The DOE is requested to clearly state on what basis it has considered that the barriers listed in the PDD would prevent the implementation of this project activity, and the PP is requested to explain why the project activity was commenced prior to being submitted for validation if the barriers are to be considered prohibitive.

DNV Response:

We reiterate that during the validation, DNV has assessed all relevant documentation with respect to the additionality of the project. As presented in the final validation report, version 02 dated 17 September 2007, DNV confirms that the project faces significant technological barrier with respect to the design of the flare gas recovery unit. The circumstances and concerns are summarized here below (all details have been elaborated in DNV's validation report)

- The process of designing the flare gas recovery unit started in 2001 and the Institute of oil and gas production technology, the design cell of ONGC, submitted their initial report in October 2002. Report number IOGPT/GR-II/HZR/17(UN)/01-02 (Annexure 1) from IOGPT to Hazira plant indicates that uncertainty existed in the determination of purge gas quantity and it was thought to be appropriate to re-consult the detail engineering concerning M/s EIL prior to regulating the purge quantity at different unit ends (Refer Annexure 1). In the absence of the project activity the tail gas would be continued to be flared and the gas by itself would serve as the purge gas for the flare header. This would not call for reassessment of the purge gas quantity and there are thus no associated technological risks.
- While the proposal was to put up a screw compressor, the report indicated that the project was not economically viable at the gas price of INR 2074 per 1000 SCM at that time. Only

if the gas price appreciates to around INR 2800 the project would be viable in nature. The detailed financial analysis by IOGPT indicates that the IRR for the project was only 4% and was not economically viable. Excerpts of the financial analysis are enclosed herewith as Annexure 2.

- During implementation, operating personnel of Hazira works assessed the use of a screw compressor in the flare gas recovery to be not suitable due to chances of failure associated with carry over of lubricating oil, and hence re-designed the whole flare gas recovery package based on reciprocating compressor system. The designing of the package was undertaken in house against the originally recommended system based on screw compressor. In the absence of the project the gas would continue to be flared which is not associated with any technological uncertainties.

Thus, as stated in the validation report *Technological uncertainties existed with respect to developing the basic engineering package for the system in-house and the choice of a reciprocating compressor in place of the originally recommended screw compressor by IOGPT. IOGPT reports have been verified by DNV wherein it was confirmed that the recovery of flare gas was recommended using a screw compressor. However, due risk of compressor failure due to lube oil carryover, screw compressor was assessed to be not suitable for the specific purpose and ONGC went ahead with a reciprocating compressor instead.*

Screw compressor system was originally recommended by the IOGPT in light of the variability of flow, variation of suction pressure and variability in the molecular weight of the gas handled. Re-designing of the compressor system and change to a reciprocating system results in technical uncertainties with respect to the ability of the system to handle a gas of varying molecular weight and suction pressure. Although reciprocating compressors can handle gas of any molecular weight, they are vulnerable to wide variation of such inlet conditions of the gas handled which in turn poses technological risks with respect to equipment selection. Reciprocating compressors are not as reliable as centrifugal systems. This is due to the fact that they have more moving parts and more rubbing seals and these wear out and need replacement at a much faster rate as compared to centrifugal systems[*].

The project also faced several design challenges during the basic engineering stage of the project with respect to the capacity of the recovery unit, molecular weight of the gas to be handled and the discharge location of the compressor unit. Elaborating further, the following concerns were envisaged and further experienced by ONGC (as presented in the validation report):

- IOGPT/GR-2/Hazira/78/03-04 dated January 2004 from M/s IOGPT, indicates that initially IOGPT was asked to carry out the feasibility study and cost estimation for installation of recovery system for 40000 SCMD of process gas at 0.15 kg/cm^2 from the flare header. A letter HZR/OPS/2003 dated 3 December 2003 from the GM-Head operations revised the quantity of gas flared from 25000 to 20000 SCMD. Following this the letter HZR/OPS/IOGPT/2003 dated 29 December 2003 confirms the quantity reduction to 25000 SCMD. The series of communications between the detail engineering concern and PP clearly demonstrates the uncertainty related to capacity of the compressor to be installed. Under-designing would result in loss of flare gas where as over-designing would result in pulling vaccum in the flare header whose consequence would be catastrophic in nature.

- There was uncertainty related to wide variation of H_2S quantity in the recovery gas. Samples taken over a 2 year period showed a range of 4 to 300 ppm, hence needing assessment as to whether the gas can be classified as sweet gas or sour gas. It was concluded, as per a report prepared by the plant in 2004, that the gas can be classified as

[*] http://turbolab.tamu.edu/pubs/Turbo35/T35pg113.pdf

sweet gas as per NACE standard rev. 1985. However, severe corrosion in the discharge piping of the compressor system post implementation proved otherwise. The PP is in the process of changing the MOC of the pipeline due to this corrosive nature of the gas.

- Variation in suction pressure and discharge pressure of the compressor unit and variation in molecular weight of the gas handled is also evident from a special note on possible variation in process conditions as provided in the bidder package under "information to Bidder" for the project (Annexure 3)

Post implementation the compressor unit witnessed severe failures of exchanger tubes and the suction and discharge valves resulting in downtime and lower gas compression. The compressor skid consisted of copper tube exchangers during original equipment design. Severe tube failures occurred which were assessed to be related to the sulphide corrosion and thus needing replacement by SS tubes. Repeated failures of the 2nd and 3rd stage valves of the compressors resulted in downtime of the unit. Inter-stage knock out drums had to be provided to remove the condensate which was assessed to be the cause of these failures.

It is thus demonstrated that there were technological risks related to the project implementation with respect to designing of the unit and that some of these technological risks proved to be real as there were failures in the actual technology performance of the unit.

CDM benefits were envisaged to help overcome these barriers by providing additional revenue which would alleviate the economic risk of technology failures or the need for re-designing the system. An assessment of the barriers and their implication is detailed here below.

Barrier	Implication	CDM Impact
Re-designing of compressor system for reciprocating system instead of the original screw compressor based system.	Error in basic assumptions on compressor system would lead to failure of compressor and re-designing of the system. Re-designing of system and procurement of new compressor system would double the cost of the project making it unviable in itself	CDM revenue would help overcoming barrier related to re-financing a new compressor system.
MOC selection based on wide variability in H_2S content in gas.	Wrong selection would result in corrosion of piping network thus requiring change in MOC. Change in MOC is associated with huge cost implications which would be preventive in nature.	CDM benefits would help in overcoming the financial barrier related to risk due to change in MOC of piping system.
Over-designing or under designing of compressor system.	Over designing of compressor system would result in vacuum creation in flare header which may be catastrophic in nature. Under designing would result in loss of flare gas and thus associated loss	CDM benefits would help in retrofitting of compressor system to suit the actual compression capacity.
Failure of elements within the compressor package, like inter-stage valves.	Failure of elements would result in change in components which would attract additional cost. During the design stage the project was assessed to be unviable on the then cost of the unit. Additional cost would render the project to be unviable to the extent that it would have to be closed down.	CDM benefits would help in providing additional revenue to make the project viable in light of the cost associated with the change in components.

From the above it is in our opinion demonstrated that knowledge of flare gas recovery system handling sour gas with large range of variation in flow, pressure, temperature and corrosiveness have been indeed a challenge for ONGC and the barriers to the project activity are prohibitive in nature.

Comment 2:

The common practice analysis has not been conducted in accordance with the Tool for the demonstration and assessment of additionality. The DOE is requested to clarify how this section of the PDD has been validated and considered to be appropriate

DNV Response:
We acknowledge that the common practice analysis has not been conducted fully in accordance with the *Tool for the demonstration and assessment of additionality* and demonstrate thus below the common practice analysis in line with the tool.

Sub-step 4a. Analyze other activities similar to the proposed project activity:
In India there are only two sour gas processing facilities:

1. The ONGC Uran plant with installed capacity of 20 MMSCMD. This is also a registered CDM project activity
2. The proposed CDM project activity, reported to be the largest[*] sour gas processing plant with installed capacities 46 MMSCMD

Sub-step 4b. Discuss any similar options that are occurring
As presented in the validation report *Installation of a flare gas recovery unit is not a common practice in oil refining sector of India. The project was initiated in 2001 and is the first of its kind in the region and there are no precedence for the project, which caused the long design phase prior to its implementation.*

Comment 3:

The DOE shall clarify why the PDD submitted for registration does not contain information regarding the prior consideration of the CDM as required by the guidelines for completing the PDD.

DNV Response:
The PP had initially presented the PDD based on version 2 of the *Tool for the demonstration and assessment of additionality*, which had addressed the information regarding the prior consideration of the CDM under step 0. At the time of requesting for registration, the PDD was suitably modified in line with version 3 of the Tool for the demonstration and assessment of additionality, which no longer included step 0. By mistake, the information earlier provided under step 0 was removed from the PDD.

Nevertheless, DNV had been presented with relevant documentation as proof of CDM consideration during project inception (see also response to comment 4 below).

Comment 4:
The DOE shall provide further details regarding how it is satisfied that the CDM was seriously considered in the implementation of this specific project activity

[*] Reference: http://www.ongcindia.com/press_release1_new.asp?fold=press&file=press220.txt, Viewed on January, 2008

DNV Response:
The development of CDM projects in ONGC (a large public sector organization in India) is the responsibility of a team set up at their Corporate Office in New Delhi. This CDM team facilitates the implementation of CDM activities together with the project implementation teams across the various locations of ONGC in India.
As presented in the validation report, clear evidences have been provided and verified for the consideration of CDM at the start of the project activity.
ONGC in their response to this comment have addressed in detail, the chronology of events leading to the culmination of CDM project activity, together will all the annexures (Annexures 1 to 17), between the CDM team at New Delhi and the Hazira Gas Processing Complex (HGPC-project site).

Comment 5:
The DOE is requested to provide further information regarding how it has validated that the gas has been flared for the previous three years and not vented.

DNV Response:
It is hereby confirmed that prior to installation of the compressor skid the tail gas was flared at the gas processing complex. As per regulatory requirements in the country, venting is not permitted in India[*] . This is corroborated by the fact that:

- Hazira Gas Processing Complex (HGPC-project site) is adhering to all these guidelines. Monthly statutory reports, to be submitted to the authorities (State Pollution Control Board), have been verified by DNV. Ambient air quality measurement reports indicate the hydrocarbon measured to be below the detectable limits (BDL). This would not be the case if the gas was being vented otherwise. A sample report submitted to the authorities has been submitted as annexure 15 in the response to the RFR by ONGC.
- As sour gas otherwise contains H_2S, this cannot be vented out due to safety reasons.

Comment 6:
Further information is required regarding what steps will be taken if the monthly analyses of carbon content indicate significant variations.

DNV Response:
As per the methodology AM0037, the carbon content has been monitored weekly so that any significant variation in carbon content can be taken care of. This has also been indicated in page 35 of the PDD submitted for registration. Thus the frequency of assessment of carbon content of the flare gas is found to be in line with the requirement of the methodology and justified for the project activity.

[*] Reference: CPCB standards for Oil Drilling and Gas Extraction Industry:
http://www.cpcb.nic.in/Environmental%20Standards/Effluent/standard46.html

We sincerely hope that the Board accepts our aforementioned explanations.

Yours faithfully
for DET NORSKE VERITAS CERTIFICATION AS

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