

VERIFICATION & CERTIFICATION REPORT

OIL AND NATURAL GAS CORPORATION LIMITED
(ONGC)

AMINE CIRCULATION PUMPS ENERGY EFFICIENCY AT HAZIRA WORKS OF ONGC

(UNFCCC Ref. No. 2648)

Monitoring Period
(23/09/2009 to 31/07/2011)

REPORT No.
CDM.11.VER.0177MP01

Date of this issue: 09/09/2013		KBS Ref. No.: CDM.11.VER.0177MP01	
Project Title:		Amine Circulation Pumps Energy Efficiency at Hazira works of ONGC	
Organization:		KBS Certification Services Pvt. Ltd.	
Client:		Oil and Natural Gas Corporation Limited (ONGC)	
Monitoring Period:		23/09/2009 to 31/07/2011 (including both dates)	
Summary:			
<p>KBS Certification Services Pvt. Ltd. has performed the first verification of the CDM project, "Amine Circulation Pumps Energy Efficiency at Hazira" works of ONGC and UNFCCC Ref. Number 2648. The verification includes confirming the implementation of the monitoring plan of the registered PDD and the application of the monitoring methodology as per AMS II D. A site visit was conducted to check the implementation of registered monitoring plan and verify the data submitted in the monitoring report. KBS confirms the following has been reviewed;</p> <ul style="list-style-type: none"> (a) The registered PDD and the monitoring plan, including any approved revised monitoring plan and/or changes from the registered PDD, and the corresponding validation opinion; (b) The validation report; (c) The applied monitoring methodology(ies); (d) The monitoring report to verify that it is as per the standardized format; (e) Any other information and references relevant to the project activity's emission reductions (e.g. IPCC reports, data on electricity generation in the national grid or laboratory analysis and national regulations); (f) CER calculations sheets and all supporting documents; (g) Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board; <p>KBS Certification Services Pvt. Ltd. confirms that the monitoring system is in place and the emission reductions are calculated without material misstatements.</p> <p>Based on the information seen and evaluated we confirm that the implementation of the project has resulted in 3196 tCO₂e emission reductions during period 23/09/2009 up to 31/07/2011.</p>			
Subject Group:		Methodology:	
CDM Verification		AMS II.D Version 11	
Verification Team:		Monitoring report:	
Team Leader	Sanjay Kandari	First version	20/01/2012
Verifier	Shreya Garg	Final version	29/07/2013
Local Expert	Sanjay Kandari		
Technical Expert (4)	Sarang Khati		
Independent Technical Reviewer Team:		Verification status:	
Date	09/09/2013	<input type="checkbox"/> Findings not closed.	
Technical Reviewer	Ashok Kumar Gautam	<input type="checkbox"/> Draft verification opinion	
Technical Expert (4)	Anil Agrawal	<input checked="" type="checkbox"/> Final verification opinion	
Manager T&C	Ashok Kumar Gautam		
Date	09/09/2013		
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Abbreviations

BE	Baseline Emissions
CAR	Corrective Action Request
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CERs	Certified Emission Reductions
CL	Clarification Request
CO ₂ e	Carbon dioxide equivalent
COP	Conference of Parties
DNA	Designated National Authority
DOE	Designated Operational Entity
EF	Emission Factor
ERs	Emission Reductions
FAR	Forward Action Request
GHGs	Greenhouse Gas(es)
GUVNL	Gujarat Urja Vikas Nigam Limited
ISO	International Organization of Standardization
IPCC	Intergovernmental Panel on Climate Change
KP	Kyoto Protocol
kWh	Kilo Watt Hour
LE	Leakage Emissions
MR	Monitoring Report
MP	Monitoring Plan
MWh	Mega Watt Hour
NABL	National Accreditation Board for testing and Calibration of Laboratories
ONGC	Oil and Natural Gas Corporation
PE	Project Emissions
PDD	Project Design Document
PS	Project Standard
PCP	Project Cycle Procedure
SCM	Standard Cubic Meter
QA/QC	Quality Assurance/Quality Control
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation & Verification Standard

Conversion Factors and Definitions

1 Nm³ = 1.055 SCM

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1. INTRODUCTION

1.1 Objective

KBS has been commissioned by, "Oil and Natural Gas Corporation Limited (ONGC)" to perform an independent verification of its registered CDM project Amine Circulation Pumps Energy Efficiency at Hazira works of ONGC, UNFCCC ref. no. 2648 for the reported GHG emission reductions for the given monitoring period 23/09/2009 up to 31/07/2011 (both dates included). The CDM projects must undergo independent third party verification and certification of emission reductions as the basis for issuance of Certified Emission Reductions (CERs).

The objectives of this verification exercise are, by review of objective evidence, to establish that:

- The project activity has been implemented and operated as per the registered PDD and that all physical features (technology, project equipment, and monitoring and metering equipment) of the project are in place;
- Monitoring report and other supporting documents are complete;
- The actual monitoring systems & procedures and monitoring report conforms with the requirements of the approved monitoring plan and the approved monitoring methodology;
- The data is recorded and stored as per the monitoring methodology and approved monitoring plan.

1.2 Scope

The scope of the verification is the independent and objective review and ex post determination of the monitored reductions in GHG emission by the project activity. The verification is based on review of monitoring report, supporting information and

- (a) The registered PDD, including the monitoring plan and the corresponding validation opinion(s);
- (b) Previous verification reports, deviation requests, requests for revision of monitoring plan;
- (c) Monitoring report for the monitoring period under verification including CER calculations sheets and all supporting documents;
- (d) The applied monitoring methodology;
- (e) Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board;
- (f) All information and references relevant to the project activity's resulting in emission reductions

The project is assessed against the requirements of the Kyoto Protocol, the CDM Modalities and Procedures and related rules and guidance.

KBS has, based on the recommendations in the latest version of CDM Validation and Verification Standard, employed a rule-based approach in the verification, focusing on the identification of significant reporting risks and the reliability of project monitoring.

1.3 Description of the Project Activity

Project Parties:	India (Host), Switzerland (Other party)
Title of project activity:	Amine Circulation Pumps Energy Efficiency at Hazira works of ONGC
UNFCCC Registration No:	UNFCCC registration No. 2648
Registration date:	23/09/2009
Applied methodology:	AMS II D Version 11
Start date of crediting period:	23/09/2009
Project Participants:	Oil and Natural Gas Corporation Limited (ONGC)

Location of the project activity:	Hazira in Surat district, Gujarat state of India
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The project activity consists of energy efficiency measures implemented in the amine circulation pumps of the gas sweetening unit (GSU) of "Oil and Natural Gas Corporation (ONGC)" at Hazira in Gujarat (India). The circulation pumps (eight stages horizontal split centrifugal) are of Bharat Pumps and Compressors Ltd (BPCL) make/9/. Project activity comprises of improving the energy efficiency of some of the amine circulation pumps by carrying out stage blanking of the eight stage amine circulation pump. The modification in pump is the stage blanking of eight stage pump to a seven stage pump. Improvement in the energy efficiency of the amine circulation pumps has reduced the power consumption with the same level of performance. The reduction in power consumption leads to reduction in the emissions of GHG.

The verification is done against the claimed total emission reductions of 3196 tCO₂e achieved during the monitoring period 23/09/2009 up to 31/07/2011 (including first and last day)/6.2/

2. METHODOLOGY

KBS follows a rule based verification approach, wherein, as a first step, the contract review is undertaken as per latest version of CDM Accreditation Standard. Subsequently, after the contract is signed, the monitoring report/4.1/ of the project activity is made publicly available at UNFCCC website as per CDM procedures.

A desk review of the project documentation is undertaken, which is followed by an onsite visit by the members of verification team in accordance with the latest version of CDM AS. The verification protocol is filled by the verification team that is based on standard auditing practices and latest version of CDM VVS/25/, to capture the assessment of applicable CDM requirements viz., latest version of CDM Project Standard/26/, registered PDD/1.1/, applied methodology/ies and/or tools and recent decisions. The verification protocol provides transparent means to record the observations and compliances by the verification team members and the nonconformities, if any. The verification protocol is an internal document, and is available on request. Following are the major milestones for the verification under consideration.

Duration of verification

<i>Verification Contract</i>	28/09/2011
<i>Publication of MR</i>	25/01/2012
<i>On site verification</i>	11/03/2012 to 12/03/2012
<i>Draft Verification Report</i>	26/03/2012
<i>Final Verification Report</i>	09/09/2013

2.1 Review of Documentation

A desk review is undertaken, involving but not limited to,

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures;
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

The list of documents reviewed is included in the section 'References'

2.2 Site Visits

A site visit is undertaken by members of verification team, involving but not limited to,

- An assessment of the implementation and operation of the proposed CDM project activity as per the registered PDD;
- A review of information flows for generating, aggregating and reporting the monitoring parameters;
- Interviews with relevant personnel to confirm that the operational and data collection procedures are implemented in accordance with the approved monitoring plan;
- A cross-check between information provided in the monitoring report and data from other sources such as plant log books, inventories, purchase records or similar data sources;
- A check of the monitoring equipment, including calibration performance and observations of monitoring practices against the requirements of the PDD and the selected methodology;
- A review of calculations and assumptions made in determining the GHG data and emission reductions;

An identification of quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

The site visit for this verification assessment was undertaken by Vinay Singh (previous Team Leader) & Sarang Khati (Technical Expert); the details are mentioned below:

Location	Hazira, Gujarat, India	
Dates	12/03/2012 to 13/03/2012	
Key points discussed	Name of person, interviewed	Designation, Organization
Operational data, Calibration Data collection, QA/QC procedures	Satish Chand	DGM, ONGC
	Shantanu Dasgupta	Chief Chemist, ONGC
	A.P. Mohanta	Chief Engineer, ONGC
	N. Bora	Chief Engineer, ONGC
	Harish Bhambhani	Chief Engineer, ONGC
	D.Bora	Chief Engineer, ONGC
	A. Maheshwari	Chief Engineer, ONGC
	Anil K Garg	Chief Engineer, ONGC
Calculation of ERs	Swati Sharma	Assistant Manager, Deloitte, India
CDM requirements	Dinesh Aggarwal	Senior Manager, Deloitte, India

2.3 Reporting of Findings

During the course of verification the findings may be raised as under;

CAR is raised if one of the following occurs:

- Non-compliance with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;
- Modifications to the implementation, operation and monitoring of the registered project activity has not been sufficiently documented by the project participants;
- Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;
- Issues identified in a FAR during validation to be verified during verification(s) have not been resolved by the project participants.

Clarification request (CL) is raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

FAR is raised during verification if the monitoring and reporting require attention and/or adjustment for the next verification period.

The verification report contains (section 7) all CARs, CLs and FARs raised during this verification in transparent manner and provides clear information of the issues raised, response received and its resolutions, including the changes in the documents. Additionally, major changes between the webhosted MR and final MR are presented under Section 6 (below the Reference) for easy reference.

2.4 Verification Assessment

Based on the desk review and site visit the team leader fills in the verification protocol to identify and record the findings in the context of the project activity. The findings are communicated to the client in the findings document (section 7 of report). The project documentation, including responses to the findings is reviewed by the team leader in consultation with team members, wherever appropriate. The team leader prepares the draft verification report subject to closure or non closure of the findings.

2.5 Internal Quality Control

The draft verification report prepared by team leader is reviewed by an independent technical reviewer (having competence of relevant technical area himself/herself or through an independent technical area expert) to confirm the internal procedures established by KBS are duly followed and

the verification report/opinion is reached in an objective manner and complies with the applicable CDM requirements.

The independent technical reviewer may approve or reject the draft verification report. The findings may be identified even at this stage, which needs to be satisfactorily resolved, before the request for issuance is submitted to UNFCCC. The final decision is taken by the Manager Technical and Certification. The technical reviewer and Manager T&C can be same person.

The final decision is authorized by Managing Director, KBS once the report is approved by the Manager T&C.

3. VERIFICATION FINDINGS

3.1 Remaining Issues (FARs from Previous Validation or Verification)

No such issues were identified for this project. The validation report/3/ has been verified by the verification team to confirm the same.

3.2 Compliance of project implementation with registered PDD

Discussion:

The project activity consists of implementation of energy efficiency measures in the ten pumps of ONGC unit located at Hazira in Surat district state of Gujarat in India. As part of the site visit, verification team was able to confirm that the project is not completely implemented as per the registered PDD/1.1/ as the stage blanking (modifications) in 5 pumps out of 10 pumps has not been undertaken by the project proponent, the 5 pumps in which the stage blanking has been implemented as per the registered PDD are:

Pump TAG Number	Completion date of stage blanking /8/	Complete Installation and synchronization of monitoring equipment with DCS/9.3/
31P301B	July 2006	01/01/2010
32P301B	July 2007	
33P301B	April 2008	
34P301A	September 2008	
35P301A	August 2007	

The list of pumps in which the stage blanking and installation of monitoring equipments were not implemented by the PP is as under:

Pump TAG Number	Location	Planned Commissioning date after modifications as per the registered PDD/1.1/	Status of implementation
31P301A	GSU-I	Feb 2010	Not implemented
32P301A	GSU-I	Dec 2010	Not implemented
35P301B	GSU-II	June 2009	Not implemented
33P301A	GSU-I	October 2009	Not implemented
34P301B	GSU-II	August 2010	Not implemented

The delay in project implementation in the remaining pumps is identified as post registration change (Correction) by the project proponent in line to the para 01 of Appendix 01 of CDM project standard and has been processed by the assessment team in accordance with para 257 of VVS. The revised PDD/1.2/ was submitted and the project implementation schedule is now revised as per the latest verified information. The post registration change (Correction) has been assessed by the assessment team in section 3.4 of the report.

The project has been registered as CDM activity on 23/09/2009 having the reference number 2648 (see: <http://cdm.unfccc.int/Projects/DB/DNV-CUK1244454293.38/view>). This is the first monitoring period (23/09/2009 to 31/07/2011) of the project activity.

The crediting period of the project activity starts from 23/09/2009 (as per information available on project web page) but the complete installation of project activity for the five pumps including the installation of energy meters and other key monitoring devices and their synchronization with the DCS system took place on 01/01/2010 and therefore PP couldn't claim the emission reductions from

23/09/2009 to 31/12/2009. However the partial implementation of project activity, which includes the stage blanking in the five pumps out of ten included in the project activity as mentioned in the below table and registered PDD has been carried out by PP between July 2006 to September 2008. The energy meters were installed at the pumps on 15/12/2009 as verified from the letter of Chief Engineer (Electrical)/9.2/ and the complete installation and synchronization of monitoring equipment with the DCS system was started from 01/01/2010 as verified from the declaration letter provided by ONGC/9.3/, apart this the verification team also interviewed the representatives of O&M team during the site visit and reviewed the historical data in the DCS system to conclude that the complete installation and synchronization of the project activity for the five pumps took place on 01/01/2010. Therefore the consideration of ERs from the duration of 01/01/2010 has been assessed conservative by the verification team.

Findings:

CL#07 (a-c), CAR#02, CL#09 (1,2) & CAR#03 (b) were raised and closed successfully. This is discussed in detail in section 7 of this report

Opinion:

- In opinion of the assessment team the implementation and operation of the project activity is in compliance with the description in the revised PDD/1.2/ submitted with the current verification.
- The project activity consists of ten pumps out of five pumps in which the energy efficiency measures has been carried out as verified from the commissioning certificates and physical verification. The energy efficiency measures in the remaining five pumps will be carried out upto 2016; the revised PDD/1.2/ with the updated information has been submitted with the current verification.
- There is no deviation, revision in monitoring plan but a post registration change (Correction) submitted with the current verification.
- In accordance with para. 225 of VVS version 03.0 the verification team reviewed the registered/revised PDD, including the monitoring plan and the corresponding validation report, verification report, the applied monitoring methodology, relevant decisions from the CMP and the CDM EB and found that the MR for this monitoring period is line with all the above mentioned documents
- The actual emission reductions for the current monitoring period are 3196 tCO₂e which are lower than the estimated ERs (7,488 tCO₂e) for the comparable period.

3.3 Compliance of monitoring plan with the monitoring methodology including applicable tool(s)

Discussion:

The monitoring plan mentioned in the monitoring report/4.7/ is in line to the registered PDD/1.1/ and in accordance with the approved methodology applied by the project activity, i.e. AMS-II.D, version 11 /5/. All the ex-post monitoring parameters as per the applied methodology/3/ are included in the monitoring report/4.7/ and ER sheet/6.2/.

Opinion:

The monitoring plan mentioned in the registered PDD is in line with the applied methodology AMS II.D, Version 11. The monitoring mechanism is in line with the methodology and is effective and reliable

3.4 Post registration changes, if any

Type	Permanent changes (Corrections)
Description	During the site visit it was observed that the implementation of project activity is not inline to the description provided in the registered PDD/1.1/. The project activity which indicated stage blanking of 10 pumps in the registered PDD/1.1/; while energy

	<p>efficiency measures have been undertaken in only 5 pumps. The list of pumps in which the implementation was not found are listed below:</p> <table><tr><th>Pump TAG Number</th><th>Location</th><th>Planned Commissioning date after modifications as per the registered PDD/1.1/</th></tr><tr><td>31P301A</td><td>GSU-I</td><td>Feb 2010</td></tr><tr><td>32P301A</td><td>GSU-I</td><td>Dec 2010</td></tr><tr><td>35P301B</td><td>GSU-II</td><td>June 2009</td></tr><tr><td>33P301A</td><td>GSU-I</td><td>October 2009</td></tr><tr><td>34P301B</td><td>GSU-II</td><td>August 2010</td></tr></table>	Pump TAG Number	Location	Planned Commissioning date after modifications as per the registered PDD/1.1/	31P301A	GSU-I	Feb 2010	32P301A	GSU-I	Dec 2010	35P301B	GSU-II	June 2009	33P301A	GSU-I	October 2009	34P301B	GSU-II	August 2010
Pump TAG Number	Location	Planned Commissioning date after modifications as per the registered PDD/1.1/																	
31P301A	GSU-I	Feb 2010																	
32P301A	GSU-I	Dec 2010																	
35P301B	GSU-II	June 2009																	
33P301A	GSU-I	October 2009																	
34P301B	GSU-II	August 2010																	
Assessment	<p>Assessment team raised CL#09(1) in this regard; in response to the query the PP responded that the implementation schedule is postponed up to 2016 and will be carried out during the overhauling of these pumps. The delay implementation schedule has been considered by the PP as PRC under the category of “Corrections” in line to para 01 of CDM PS. The revised PDD/1.2/ was submitted containing the updated information. PP also mentioned that the delayed implementation schedule do not affect the project size as in the CER sheet/2/ submitted with registered PDD/1.1/ consists the ex-ante emission reductions based on the calculation for 5 pumps.</p> <p>Verification team would like to state that the project activity consists of 10 pumps installed at the five trains,each train has 2 pumps, of which one pump is on standby and only one is operational. It was verified during the verification site visit. The computation algorithm used to compute baseline emissions in the registered ER sheet/2/ is based on the historical performance of the unmodified pumps thus the baseline power consumption for the unmodified pumps determined using the algorithm (using monitored flow rate and the equation in the registered ER sheet) would give the same figure as actual power consumption. The technical expert also confirmed the same during the site visit. Therein, delayed implementation of energy efficiency measures in 5 pump does not lead to change in estimated emission reductions and project size and comply with the para 257 of VVS..</p>																		
Opinion	<p>In view of the assessment team the delayed implementation schedule in the remaining five pumps do not impact the project size and therefore emission reduction calculations. The change is categorised as corrections in line to para 1 of Appendix of CDM Project Standard/21/. The correction does not require the prior approval by the CDM EB as it doesn't affect the project design. The revised PDD/1.2/ and MR has been assessed by the assessment team which transparently describes the project activity including the correction.</p> <p>Based on the above assessment and site vist verification team has accepted the revised PDD/1.2/. The verification team confirms that information included in the revised PDD/1.2/ in VVS track is the same as the information in the registered PDD/1.1/ in VVM, the additional information required for the post registration changes is included in track change mode. There is no other change in the revised PDD in VVS track other than listed here.</p>																		

Findings: CL#09 (1) was raised and closed satisfactorily, please refer to section 7 of report where it is discussed in detail.

3.5 Compliance of monitoring activities with registered monitoring plan

Discussion:

During the verification all relevant monitoring parameter have been verified with regard to the appropriateness of the verification method, the correctness of the values applied for ER calculation,

the accuracy, and applied QA/QC measures. It is confirmed that the monitoring parameter has been measured / determined without material misstatements. The monitoring parameters involved in the project activity as per registered PDD/1.1/ are analysed in detail in the subsections below:

3.5.1. Data/Parameter, Unit: Q y, MMSCMD (Million Metric Standard Cubic Meters Per Day)

Average Rate of Gas Processed by the Project Activity during the monitoring period for each pump measured through online flow meter installed at each pump, this parameter is used for the computation of ex-post emission reduction.

	Discussion and verification assessment			
<i>Purpose of data</i>	Baseline emissions			
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	Pump	Tag No. of the flow meters	Make	Accuracy class
	Train-31 P301 (Pump A & B)	31FT1101	Rosemount	+/-0.025% full scale
	Train-32 P301 (Pump A & B)	32FT1101	Rosemount	+/-0.025% full scale
	Train-33 P301 (Pump A & B)	33FT1101	Rosemount	+/-0.025% full scale
	Train-34 P301 (Pump A & B)	34FT1101	Rosemount	+/-0.025% full scale
	Train-35 P301 (Pump A & B)	35FT1101	Rosemount	+/-0.025% full scale
<i>Measuring/Reading/Recording frequency</i>	Continuous measurement and recording at every 2 hours interval.			
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	Separate online meters for each pump are installed as per the registered monitoring plan, the flow meter gives readings in Thousand NM ³ per hour for the gas processed, which are subsequently multiplied by 0.025 to compute the rate of gas processing in MMSCMD. Readings are noted down in every 2 hours of operation as verified from the logbooks/15/. The average flow rate of the gas processed for the monitoring period under consideration is calculated by using weighted average of different readings of gas flow rate through a given train, as compared with the hours of operation.			
<i>Verified value</i>	Pump	Weight average gas flow in MMSCMD (Million Meter Standard Cubic Meter per Day) for the current monitoring period.		
	Train 31P301 (Pump B)	3.66		
	Train 32P301 (Pump B)	3.48		
	Train 33P301 (Pump B)	4.29		
	Train 34P301 (Pump A)	3.14		
	Train 35P301 (Pump A)	4.62		

<i>Cross checks</i>	The values are verified from the logbooks/15/ and during the site visit the instantaneous data/readings were crosschecked in the flow meter and DCS system. The instantaneous readings of flow rate were in line to the specifications of respective flow meter.
<i>QA/QC procedures applied</i>	The calibration of the measuring equipments is conducted on annual basis. The calibration details of the measuring equipment and the master calibrator are included in section 3.6 of the report.

3.5.2. Data/Parameter, Unit: $NCV_{NG,y}$ (Kcal/NM³)

Weighted average net calorific value of the Natural Gas fired, in the period 'Y' in the project activity and used in the calculation of ex-post emission reductions.

	<i>Discussion and verification assessment</i>	
<i>Purpose of data</i>	For project emission and the baseline emission calculations.	
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	<i>Serial numbers</i>	HZR/ISO/EQL071
	<i>Type</i>	Gas Chromatograph
	<i>Make</i>	SHIMADZU
	<i>Model</i>	GC 14A
	<i>Accuracy class</i>	+/- 1%
<i>Measuring/Reading/Recording frequency</i>	It is measured on a monthly basis and the same is recorded.	
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	In-house sampling of the NG used for combustion is conducted on a monthly basis (One sample per month); based on which test reports/11/ are prepared by the lab officials from where the readings are transferred to the emission reduction excel sheet/6.2/. PP has considered the weighted average values of NCV for the calculation of emission reductions. The values are monitored in Kcal/SCM and converted to Kcal/Nm ³ by using a standard ASTM conversion factor of 1.055, and then calculated the weighted average of the same.	
<i>Verified value</i>	7960.27	
<i>Cross checks</i>	Publically available values (report released by the "Central Electricity Authority/24/) for the NCV of NG were checked (8371 Kcal/SCM or 7935 Kcal/NM ³). Therefore the values monitored during the monitoring period were assessed to be appropriate by the verification team.	
<i>QA/QC procedures applied</i>	Annual calibrations of the measuring equipment are conducted annually in accordance with the registered monitoring plan. Details of the calibration are mentioned in section 3.6 of the report.	

3.5.3. Data/Parameter, Unit: $FC_{GT1, NG}$ (NM³/year)

Quantity of fuel used (NG) in GT1

	<i>Discussion and verification assessment</i>	
<i>Purpose of data</i>	Project emissions and baseline	
<i>Monitoring equipment (type, accuracy class, serial number,</i>	<i>Serial numbers</i>	Serial No.: 0610328 Tag No: 23FT541

<i>calibration frequency, date of last calibration, validity)</i>	<i>Type</i>	Gas flow meter
	<i>Make</i>	ABB
	<i>Model</i>	Model: 264DS
	<i>Accuracy class</i>	Accuracy Class: +/-0.075%
<i>Measuring/Reading/Recording frequency</i>	The gas flow meters continuously measures the NG combusted and the readings are displayed in the totalizer which is further recorded in the DCS system and the readings are noted down every 12 hours by the shift incharge in the plant log books/15/. The cumulative values are recorded monthly/15/.	
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The readings from the online DCS system are noted every 12 hours by the shift in-charge in the plant log book/15/ from where the daily readings taken are transferred to an internal excel sheet, based on which the monthly values are evaluated. These monthly values are used in the emission reduction calculation sheet/6.2/.	
<i>Verified value</i>	77698884	
<i>Cross checks</i>	In addition to the checking the reading noted in the internal spreadsheet from the plant log book/15/, real time checks were also conducted during the onsite assessment.	
<i>QA/QC procedures applied</i>	Annual calibrations of the measuring equipments have been conducted. The calibration details of the measuring equipment and the master calibrator are included in section 3.6 of the report.	

3.5.4. Data/Parameter, Unit: FC_{GT2, NG} (NM3/year)

Quantity of fuel used (NG) in GT2

	<i>Discussion and verification assessment</i>	
<i>Purpose of data</i>	Project emissions and baseline	
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	<i>Serial numbers</i>	Serial No.: 0610334 Tag No: 24FT541
	<i>Type</i>	Gas flow meter
	<i>Make</i>	ABB
	<i>Model</i>	Model: 264DS
	<i>Accuracy class</i>	Accuracy Class: +/-0.075%
<i>Measuring/Reading/Recording frequency</i>	The gas flow meters continuously measures the NG combusted and the readings are displayed in the totalizer which is further recorded in the DCS system and the readings are noted down every 12 hours by the shift incharge in the plant log books/15/.	
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The readings from the online DCS system are noted every 12 hours by the shift in-charge in the plant log book/15/ from where the daily readings taken are transferred to an internal excel sheet based on which the monthly values are evaluated.	
<i>Verified value</i>	77811978	

<i>Cross checks</i>	In addition to the checking the reading noted in the internal spreadsheet from the plant log book/15/, real time checks were also conducted during the onsite assessment.
<i>QA/QC procedures applied</i>	Annual calibration of the measuring equipments is conducted. The calibration details of the measuring equipment and the master calibrator are included in section 3.6 of the report.

3.5.5. Data/Parameter, Unit: $FC_{GT3, NG}$ (NM3/year)

Quantity of fuel used (NG) in GT3

	<i>Discussion and verification assessment</i>	
<i>Purpose of data</i>	Project emissions and baseline	
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	<i>Serial numbers</i>	Serial No.: 960032 & 960027 Tag No: 96FT-FF-1 & 96FT-FF-2
	<i>Type</i>	Gas flow meter
	<i>Make</i>	Instrumentation Ltd.
	<i>Model</i>	IIFC-34WB2-500Y
	<i>Accuracy class</i>	Accuracy Class: +/-0.2%
<i>Measuring/Reading/Recording frequency</i>	The gas flow meters continuously measures the NG combusted and the readings are displayed in the totalizer which is further recorded in the DCS system and the readings are noted down every 12 hours by the shift incharge in the plant log books/15/.	
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The readings from the online DCS system are noted every 12 hours by the shift in-charge in the plant log book/9/ from where the daily readings taken are transferred to an internal excel sheet/10/ based on which the monthly values are evaluated. These monthly values are used in the emission reduction calculation sheet/5/.	
<i>Verified value</i>	86155155	
<i>Cross checks</i>	In addition to the checking the reading noted in the internal spreadsheet/10/ from the plant log book/9/, real time checks were also conducted during the onsite assessment.	
<i>QA/QC procedures applied</i>	Annual calibration of the measuring equipments is conducted. The calibration details of the measuring equipment and the master calibrator are included in section 3.6 of the report.	

3.5.6. Data/Parameter, Unit: $EG_{GT1,y}$, MWh

Gross quantity of electricity generated in the GT1 during the current monitoring period

	<i>Discussion and verification assessment</i>	
<i>Purpose of data</i>	Project emissions and baseline	
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	<i>S. No.</i>	GT#1: GJUO4103
	<i>Type</i>	Energy Meters
	<i>Make</i>	Secure
	<i>Model</i>	E3V055
	<i>Accuracy class</i>	0.5S
<i>Measuring/Reading/Recording frequency</i>	Continuous monitoring and monthly recording	

<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The meters installed monitor continuously the energy generated by the project activity (individual meter for each gas turbine). The meters are State utility owned and the metering and calibration lies in their purview. The meters are sealed and the readings daily by plant engineers in the plant log books/15/.
<i>Verified value</i>	205928
<i>Cross checks</i>	Real time checks were performed during the site visit and the reading observed was higher than the mentioned values.
<i>QA/QC procedures applied</i>	The control of these meters is in the hand of state electricity board and the calibration frequency defined by the electricity board for these meters is once in five year details are included in section 3.6 of the report.

3.5.7. Data/Parameter, Unit: $EG_{GT2,y}$, MWh

Gross quantity of electricity generated in the GT#2 during the current monitoring period

	<i>Discussion and verification assessment</i>										
<i>Purpose of data</i>	Project emissions and baseline										
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	<table> <tr> <td>S. No.</td><td>GJB 03340</td></tr> <tr> <td>Type</td><td>Energy Meters</td></tr> <tr> <td>Make</td><td>Secure</td></tr> <tr> <td>Model</td><td>E3V055</td></tr> <tr> <td>Accuracy class</td><td>0.5S</td></tr> </table>	S. No.	GJB 03340	Type	Energy Meters	Make	Secure	Model	E3V055	Accuracy class	0.5S
S. No.	GJB 03340										
Type	Energy Meters										
Make	Secure										
Model	E3V055										
Accuracy class	0.5S										
<i>Measuring/Reading/Recording frequency</i>	Continuous monitoring and monthly recording										
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The meters installed monitor continuously the energy generated by the project activity (individual meter for each gas turbine). The meters are State utility owned and the metering and calibration lies in their purview. The meters are sealed and the readings daily by plant engineers in the plant log books/15/.										
<i>Verified value</i>	206619										
<i>Cross checks</i>	Real time checks were performed during the site visit and the reading observed was higher than the mentioned values.										
<i>QA/QC procedures applied</i>	The control of these meters is in the hand of state electricity board and the calibration frequency defined by the electricity board for these meters is once in five year details are included in section 3.6 of the report.										

3.5.8. Data/Parameter, Unit: $EG_{GT3,y}$, MWh

Gross quantity of electricity generated in the GT#3 during the current monitoring period

	<i>Discussion and verification assessment</i>										
<i>Purpose of data</i>	Project emissions and baseline										
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	<table> <tr> <td>S. No.</td><td>GJU 04151</td></tr> <tr> <td>Type</td><td>Energy Meters</td></tr> <tr> <td>Make</td><td>Secure</td></tr> <tr> <td>Model</td><td>E3V055</td></tr> <tr> <td>Accuracy class</td><td>0.5S</td></tr> </table>	S. No.	GJU 04151	Type	Energy Meters	Make	Secure	Model	E3V055	Accuracy class	0.5S
S. No.	GJU 04151										
Type	Energy Meters										
Make	Secure										
Model	E3V055										
Accuracy class	0.5S										
<i>Measuring/Reading/</i>	Continuous monitoring and monthly recording										

<i>Recording frequency</i>	
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The meters installed monitor continuously the energy generated by the project activity (individual meter for each gas turbine). The meters are State utility owned and the metering and calibration lies in their purview. The meters are sealed and the readings daily by plant engineers in the plant log books/15/.
<i>Verified value</i>	218892
<i>Cross checks</i>	Real time checks were performed during the site visit and the reading observed was higher than the mentioned values.
<i>QA/QC procedures applied</i>	The control of these meters is in the hand of state electricity board and the calibration frequency defined by the electricity board for these meters is once in five year details are included in section 3.6 of the report.

3.5.9. Data/Parameter, Unit: $EC_{PJ,y}$, MWh

Quantity of Energy consumed by the project activity during the monitoring period

	Discussion and verification assessment			
Purpose of data	Project emissions			
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	S. No.	Pump	Meter Sr. No.	
		31P301B	07890523	
		32P301B	08890106	
		33P301B	08890107	
		34P301A	08890081	
		35P301A	08890092	
	Type	Energy Meters		
Make	L&T			
Accuracy class	+/-1.0			
Measuring/Reading/Recording frequency	Continuous monitoring and monthly recording			
Data collection (from data generation, aggregation, to recording, calculation and reporting)	Separate energy meters are installed for each of the Amine circulation pumps, within the Gas Sweetening Units. The readings are noted every 12 hours by the shift in-charge in the plant log book/9/ from where the daily readings taken are transferred to an internal excel sheet based on which the monthly values are evaluated. These monthly values are used in the emission reduction calculation sheet/5/.			
Verified value		Pump	Energy Consumed(MWh)	
		Train 31P301	3884.04	
		Train 32P301	3696.03	
		Train 33P301	4398.91	
		Train 34P301	1910.38	
		Train 35P301	2855.92	
		Total	16745.280	
Cross checks	Real time checks were performed during the site visit and the reading observed was higher than the mentioned values.			
QA/QC procedures applied	Calibration of the meters is conducted on annual basis; details are included in section 3.6 of the report.			

3.5.10. Data/Parameter, Unit: Ty, Thousand Hours

Total operating hours of pumps during the current monitoring period.

	<i>Discussion and verification assessment</i>										
<i>Purpose of data</i>	Project emissions and baseline emissions										
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	NA										
<i>Measuring/Reading/Recording frequency</i>	Recorded in plant log books on shift basis										
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	The working hours of the pumps are monitored daily and recorded in the plant logbooks. Daily compilations of these data have been maintained in the spread sheets, in accordance with the requirement of PDD/1.1/.										
<i>Verified value</i>	<table border="1"> <tr> <td>Train 31P301 (Pump B)</td><td>6.076</td></tr> <tr> <td>Train 32P301 (Pump B)</td><td>6.556</td></tr> <tr> <td>Train 33P301 (Pump B)</td><td>6.756</td></tr> <tr> <td>Train 34P301 (Pump A)</td><td>2.946</td></tr> <tr> <td>Train 35P301 (Pump A)</td><td>6.164</td></tr> </table>	Train 31P301 (Pump B)	6.076	Train 32P301 (Pump B)	6.556	Train 33P301 (Pump B)	6.756	Train 34P301 (Pump A)	2.946	Train 35P301 (Pump A)	6.164
Train 31P301 (Pump B)	6.076										
Train 32P301 (Pump B)	6.556										
Train 33P301 (Pump B)	6.756										
Train 34P301 (Pump A)	2.946										
Train 35P301 (Pump A)	6.164										
<i>Cross checks</i>	The operational days were crosschecked against the shutdown details in the plant logbooks and correlated with the total available working days/hours in the monitoring period.										
<i>QA/QC procedures applied</i>	This is a calculated parameter, therefore required no QA/QC.										

3.5.11. Data/Parameter, Unit: Specifications of the Pumps Modified

Technical specifications of the modified pumps

	<i>Discussion and verification assessment</i>
<i>Purpose of data</i>	-
<i>Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)</i>	NA
<i>Measuring/Reading/Recording frequency</i>	Recorded in the Specification sheet for the modified pump
<i>Data collection (from data generation, aggregation, to recording, calculation and reporting)</i>	NA

<i>Verified value</i>	The specifications of the modified pumps were verified from the specification sheet as: MAKE: POMPES GUINARD, FRANCE TYPE: DVMX 4X6X10 C/E 8 STG NUMBER OF STAGES:7 CAPACITY: 269 M3/HR HEAD: 705 METER RPM: 2980 MOTOR RATING: 840 KW
<i>Cross checks</i>	The name plate details of each pump were physically verified during the site visit.
<i>QA/QC procedures applied</i>	No QA/QC required.

Findings:

CL#09 (3-8), CAR#10, CAR#01, CAR#03, CL#04 CL#05 & CL#06 were raised and closed successfully. This is discussed in detail in section 7 of this report.

Opinion:

The adequacy and compliance of the monitoring plan in the MR was found as per the requirements laid by the monitoring methodology and the registered PDD. The information flow (from data generation, aggregation, to recording, calculation and reporting) is already included under respective parameter above. The verification team has verified all the data and collected evidence as per the required monitoring frequency and found to be correct and appropriate meeting the requirements of the applied methodology.

3.6 Compliance with the calibration frequency requirements for measuring instruments

The applied monitoring methodology/3/ does not specify exact requirements for calibration of the measuring equipment but recommends following the relevant industry standards. There are different monitoring equipments involved including: volumetric flow meters, gas chromatograph and energy meters.

The calibration/12/14/ of the equipments which are in control of PP are conducted once in a year and for the energy meters which are beyond the control of PP are calibrated once in five year as per the frequency defined by the state electricity board as the control of these meters are in the hand of state electricity board. The details of calibrations of various monitoring equipments are presented below:

S. No.	Meter Type	Meter Location	Meter Sr. No./Tag No.	Calibration Frequency	First calibration		Second Calibration		Third Calibration	
					Calibration Date	Calibration validity	Calibration Date	Calibration validity	Calibration Date	Calibration validity
1	Gas Flow meter	GT-1	0610328 (23FT541)	Annual	11/03/2009	10/03/2010	10/03/2010	09/03/2011	08/03/2011	07/03/2012
2	Gas Flow meter	GT-2	0610334 (24FT541)	Annual	22/09/2009	21/09/2010	21/09/2010	20/09/2011	20/09/2011	19/09/2012
3	Gas Flow meter	GT-3	960032 & 960027 (96FT-FF-1 & 96FT-FF-2)	Annual	22/09/2009	21/09/2010	21/09/2010	20/09/2011	20/09/2011	19/09/2012
4	Energy meter	32P30 1B	08890106	Annual	23/11/2009	22/10/2010	30/10/2010	29/10/2011	20.08/2011	19/08.2012
5	Energy meter	31P30 1B	07890523	Annual	23/11/2009	22/11/2010	07/10/2010	06/10/2011	20/08/2011	19/08/2012
6	Energy meter	34P30 1A	08890081	Annual	23/11/2009	22/11/2010	07/10/2010	06/10/2011	20/08/2011	19/08/2012
7	Energy meter	33P30 1B	08890107	Annual	23/11/2009	22/11/2010	30/10/2010	29/10/2011	22/09/2011	21/09/2012
8	Energy meter	35P30 1A	08890092	Annual	23/11/2009	22/11/2010	07/10/2010	06/10/2011	22/09/2011	21/09/2012
9	Gas Flow meter	Train-31 (Row Gas inlet to C-301)	31FT1101	Annual	24/09/2009	23/09/2010	09/09/2010	08/09/2011	01/09/2011	31/08/2012
10	Gas Flow meter	Train-32 (Row Gas inlet to)	32FT1101	Annual	24/09/2009	23/09.2010	09/09/2010	08/09/2011	01/09/2011	31/08.2012

S. No.	Meter Type	Meter Location	Meter Sr. No./Tag No.	Calibration Frequency	First calibration		Second Calibration		Third Calibration	
		C-301)								
11	Gas Flow meter	Train-33 (Row Gas inlet to C-301)	33FT1101	Annual	24/09/2009	23/09/2010	09/09/2010	08/09/2011	01/09/2011	31/08/2012
12	Gas Flow meter	Train-34 (Row Gas inlet to C-301)	34FT1101	Annual	25/09/2009	24/09/2010	10/09/2010	09/09/2011	02/09/2011	01/09/2011
13	Gas Flow meter	Train-35 (Row Gas inlet to C-301)	35FT1101	Annual	25/09/2009	24/09/2010	10/09/2010	09/09/2011	02/09/2011	01/09/2011
14	Energy meter	GT-1	GJU 04103	Once in Five year	06/01/2007	05/01/2012	28/09/2011	27/09/2014	-	-
15	Energy meter [†]	GT-2	GJB 03340	Once in Five year	06/01/2007	05/01/2012	28/09/2011	27/09/2014		

* The control of energy meters is in the hand of electricity board Gujarat Energy Transmission Corporation Ltd (GETCO). The circular issued by GETCO on 25th February 2011 in reference to all IPP/CPP/Wind farm substation/solar/Biomass project, clearly mentions that in line with relevant code, the energy meters needs to be tested once in five years unless there is any problem observed. However, as per the guideline of GUVNL, energy meters will have to be tested once in three years now onwards. Therein, in line with aforesaid guideline, all energy meters installed at GT-1, 2 and 3 were calibrated at least once in a five year till 2011; however, the next calibration is due within the time span of three years.

[†] Refer above footnote.

S. No.	Meter Type	Meter Location	Meter Sr. No./Tag No.	Calibration Frequency	First calibration		Second Calibration		Third Calibration	
16	Energy meter	GT-3	GJU 04151	Once in Five year	06/01/2007	05/01/2012	30/09/2011	29/09/2014		
17	Gas Chromatograph	-	HZR/ISO/EQL071	Annual	19/06/2009	18/06/2010	10/06/2010	09/06/2011	29/04/2011	28/04/2012

It was checked by the assessment team that the master calibrators were calibrated during this period and calibration of the monitoring equipments can be traced to national standards.

It can be concluded by the assesment team that the calibration requirements have been been met and the calculation of emission reductions has been conducted following the latest guidelines on calibration.

* Refer above footnote.

3.7 Data not monitored (ex ante or external parameters)

3.7.1. Data/Parameter, Unit: $EF_{CO_2,NG}$, tCO₂/TJ

The value of emission factor of natural gas is defined ex-ante in the registered PDD and the same was used during the current monitoring period for the calculation of ex-ante emission reductions.

	<i>Discussion and verification assessment</i>
<i>Purpose of data</i>	Baseline & project emissions
<i>Verified value</i>	58.30
<i>Source of value</i>	registered PDD/1.1/
<i>Justification</i>	The value is defined ex-ante in the registered PDD and sourced from the IPCC. The same value used ex-post for the calculation of emission reduction.

Opinion: The assessment team confirms that the parameters fixed ex-ante applied in the calculations in the reported MR/3.5/ are appropriate and justified being consistent with the registered PDD.

3.8 Assessment of Data & calculation of GHG Emission Reductions

Calculation of Energy Savings Using the Metered Energy Consumption Data:

In line to the section B.7.2 of the registered PDD/1.1/, the baseline energy consumption has been calculated by using an expression to determine the energy consumption as specified in the registered PDD (refer page 17). The expression includes parameters viz., operation hours, average gas consumption that are monitored.

The baseline energy consumption comes out by using the expression in the registered PDD/1.1/:

$$EC_{PJB,y} = T_y * L_{Base,y}$$

$$EC_{PJB,y} = 21,030 \text{ MWh}$$

The detailed calculation of baseline energy consumption is shown in the ER sheet /6.2/ based on the monitored parameters. The verification approach of the monitored parameters to derive the baseline energy consumption has been assessed by the assessment team in the section 3.5 above.

The project energy consumption during the monitoring period on the other hand is directly monitored from the energy meter installed and the detail calculation is demonstrated in the emission reduction sheet /6.2/ and verified by the verification team. The metered project energy consumption data has been verified by the verification team and the verification approach of the same is as explained in section 3.5 above.

The verified value of project energy consumption during the monitoring period:

$$EC_{PJ,y} = 16,745 \text{ MWh}$$

Therefore the energy saving for the monitoring period:

$$\begin{aligned} \text{Energy Saving} &= EC_{PJB,y} - EC_{PJ,y} \\ &= (21030 - 16745) \text{ MWh} \\ &= 4,284 \text{ MWh.} \end{aligned}$$

Calculation of Emission Reductions:

The ex-post emission reductions are calculated based on the formula defined in the registered PDD/4/ and the ER sheet/6.2/ consists all the monitoring parameters as per the registered monitoring plan. The units of monitoring parameters are in line to the registered PDD; however the NCV was measured in Kcal/SCM, the measured calorific value of NG in Kcal/SCM is then converted to Kcal/NM3 by using a standard ASTM conversion factor of 1.055, and then calculated the weighted average of the same. The baseline emission calculations are calculated in line to the formula defined in the registered PDD/1.1/ in the ER sheet/2/, assessment team has reviewed all the data and verified with the respective sources and found correct.

$$BE_{EC,y} = EC_{PJ,y} * EF_{CP,y}$$

Total baseline emission achieved during the monitoring period comes out as:

$$BE_{EC,y} = 21030 \text{ MWh} * 0.745984 \text{ tCO}_2\text{e/ MWh}$$

$$BE_{EC,y} = 15688 \text{ ton CO}_2\text{e.}$$

The emission factor $EF_{CP,y}$ (0.745984) has been calculated ex-post based on the actual monitored parameters (power generation and natural gas consumption in the captive power plant) and calculation is presented in the ER sheet/6.2/ assessed appropriate by the verification team based on the formula defined in the section B.6.1 of the registered PDD/1.1/.

The detail calculations and equations to arrive the final figures are presented in the ER sheet/6.2/ and verified by the assessment team with the plant logs and equations provided in the registered PDD/1.1/ and found appropriate.

The project emission calculations are calculated in line to the formula defined in the registered PDD/1.1/.

$$PE_{EC,y} = EC_{PJ,y} * EF_{CP,y}$$

$$= 16745.28 \text{ MWh} * 0.745984 \text{ ton CO}_2\text{e/ MWh}$$

$$= 12492 \text{ tCO}_2\text{e}$$

Since, no energy efficiency technology equipment is transferred from another activity and no existing equipment is transferred to another activity, therein, leakage is considered zero.

$$LE_{EC,y} = 0$$

$$ER = 15688 - 12492 = 0$$

$$= 3196 \text{ tCO}_2\text{e}$$

Findings: CL#09 (3-8) & CAR#11 were raised and closed successfully. This is discussed in detail in section 7 of this report.

Opinion:

The verification team confirms that

- The complete data set for the monitoring parameters was available as mentioned in the monitoring plan in the registered PDD for the duration of 01/01/2010 to 31/07/2011 after the project activity was implemented;
- The cross checks were undertaken for all the parameters indicated in the respective sections and were found complying with the requirements of the monitoring plan of the registered PDD;
- The emission factor is calculated ex-post correctly based on the actual monitored parameters and in line to the procedure defined in the registered PDD.

- d) Appropriate methods and formulae for calculating baseline emission, project emissions and leakage have been followed ;
- e) The claimed emission reductions are free from material errors, omissions or misstatements, with a reasonable level of assurance.

3.9 Quality of Evidence to Determine Emission Reductions

The evidences (Documents/interview/site visit) referred for verification of individual monitoring parameter and fixed parameters are defined section 3.5 and section 3.7 respectively. It can be confirmed by the assessment team that the reported emission reductions have been conservatively calculated. A list of referred documents for verification is also included in section 6 of this report.

3.10 Management System and Quality Assurance

Oil and Natural Gas Corporation Limited (ONGC) has developed GHG emission reduction management system for management of the project. The procedures cover the calibration and quality assurance of the monitoring and metering systems for the project activities. The energy meters, gas chromatograph and flow meters in the project activity were calibrated at annual basis by qualified ONGC staff using master instruments. The calibration records were made available for verification. External calibration of the master calibrators were carried out and are traceable to national standards as per the calibration certificates verified.

3.11 Application of Materiality

Discussion:

The prescribed thresholds for materiality, as per para 10 of EB69 Annex6

Prescribed range of ERs/annum	500,000+	300,000+ to 500,000	300,000	SSC PAs	MSC PAs
Prescribed Threshold	0.5%	1.0%	2.0%	5.0%	10.0%

The identified/selected materiality threshold for the project activity under current monitoring period.

	MR Version (Draft)/4.1/	MR Version (Final)/4.7/
Emission reductions/annum	6036 tCO ₂ e tCO ₂	3196 tCO ₂ e
Identified Threshold	5.0%	5.0%

The risk assessment of parameters (fixed and monitored) with referencing to impact on ERs, type of error expected and development of the audit plan.

Parameter	Impact on ERs?	Significance of Impact (H, M, L)	Justification for significance	Type of errors expected	Remarks
Q _y	Yes	H	The parameter is used in the calculation of baseline emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
NCV _{NG,y}	Yes	H	The parameter is used in the calculation of baseline and	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from

			project emissions.		human errors during the information transfer from the source to emission reduction sheet.
FC _{GT1,NG}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
FC _{GT2,NG}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
FC _{GT3,NG}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
EG _{GT1,y}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
EG _{GT2,y}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
EG _{GT3,y}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the source to emission reduction sheet.
EC _{PJ,y}	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	The measurements are conducted with the aid of calibrated equipments and errors could result from human errors during the information transfer from the

					source to emission reduction sheet
Ty	Yes	H	The parameter is used in the calculation of baseline and project emissions.	Isolated	It is recorded in the plant logs based on the total operating hours of every shift. In the emission reduction sheet and errors could result from human errors during the information transfer from the source to emission reduction sheet
Specifications of the Pumps Modified	No	Low	The parameter does not impact the emission reductions but is meant to ensure that the updated parts have not been replaced.	Not applicable.	Not applicable.

The applied audit/sampling plan, if there is impact on ERs, and confirmation with regard to individual and aggregate level for the claimed emission reductions.

Parameter	Population size	Sample size	Type of error identified	Impact on ERs	
				Extrapolated for population size (Qty and %)	Within Threshold
Q _y	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
NCV _{NG,y}	19	19	Isolated	Not applicable. The whole data was checked.	Yes
FC _{GT1,NG}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
FC _{GT2,NG}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
FC _{GT3,NG}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
EG _{GT1,y}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
EG _{GT2,y}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
EG _{GT3,y}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
EC _{PJ,y}	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes

Ty	577	290	Isolated	50% data on the random basis for each month was verified by the verification team.	Yes
Specifications of the Pumps Modified	5	5	Isolated	Not applicable. The whole data was checked.	Yes

Opinion: The assessment team confirms that the reported emission reductions are free from material errors, omissions or misstatements.

4. RECOMMEDATIONS / FORWARD ACTION REQUEST

There are no recommendations/FAR raised for the project activity.

5. VERIFICATION & CERTIFICATION STATEMENT

KBS Certification Services Pvt. Ltd. has been contracted by Oil and Natural Gas Corporation Limited (ONGC) to undertake independent verification and certification for the greenhouse gas (GHG) emission reductions reported from the Amine Circulation Pumps Energy Efficiency at Hazira works of ONGC, UNFCCC Ref. No. 2648 for the monitoring period 23/09/2009 up to 31/07/2011 in the Monitoring Report Version 01 dated 20/01/2012.

The verification is based on the validated and registered PDD and the monitoring report for this project. Our verification approach was based on the requirements as defined under the Kyoto Protocol, Marrakech accord, as well as those defined by the CDM Executive Board.

The management of the Oil and Natural Gas Corporation Limited (ONGC) is responsible for the preparation of the GHG emissions data and the reported GHG emissions reductions on the basis set out within the project Final Monitoring Report Version 07 dated 29/07/2013. The calculation and determination of GHG emission reductions from the project is the responsibility of the management of the Oil and Natural Gas Corporation Limited (ONGC). The development and maintenance of records and reporting procedures are in accordance with the Monitoring Report Insert Version 07 dated 29/07/2013.

It is our responsibility to express an independent GHG verification opinion on the GHG emissions and on the calculation of GHG emission reductions from the project for the period 23/09/2009 up to 31/07/2011 based on the reported emission reductions in the Final Monitoring Report Version 07 dated 29/07/2013 for the same period.

Based on an understanding of the risks associated with reporting GHG emissions data and the controls in place to mitigate these, KBS planned and performed our work to obtain the information and explanations that we considered necessary to provide sufficient evidence for us to give reasonable assurance that this reported amount of GHG emission reductions for the period is fairly stated.

KBS confirms the following;

Reporting period: From 23/09/2009 up to 31/07/2011

Verified and certified emission in the above reporting period:

	Amount	Unit
Baseline emissions (BE)	15688	tCO ₂ e
Project emissions (PE)	12492	tCO ₂ e
Leakage emissions (LE)	0	tCO ₂ e
Certified emission reductions (CERs)	3196	tCO ₂ e

Location: Faridabad, Haryana, India

Date: 10/09/2013



Kaushal Goyal

Managing Director

KBS Certification Services Pvt. Ltd.

6. REFERENCES

/1/	/1.1/ Registered Project Design Document Version 4.0 dated 21/09/2009 /1.2/ Revised Project Design Document Version 5.0 dated 18/06/2013
/2/	CER sheet submitted to UNFCCC corresponding to the registered PDD and available on project webpage
/3/	Validation Report No 2008 -1083 Project No.:PRJC-146319-2009-IND dated 08-12-2008
/4/	/4.1/ Monitoring report version 01 dated 20/01/2012 /4.2/ Monitoring report version 02 dated 23/03/2012 /4.3/ Monitoring report version 03 dated 23/03/2012 /4.4/ Monitoring report version 04 dated 04/02/2013 /4.5/ Monitoring report version 05 dated 02/04/2013 /4.6/ Monitoring Report version 06 dated 18/06/2013 /4.7/ Monitoring Report version 07 dated 29/07/2013
/5/	Executive Board: Approved Consolidated Methodology, AMS -II.D. Energy efficiency and fuel switching measures for industrial facilities Version 11, EB 35.
/6/	Emission Reduction (ER) Sheet for the current monitoring period: /6.1/ ER Sheet corresponding to webhosted version /6.2/ ER Sheet corresponding to final version
/7/	Specification Sheet of Lean Amine Charge Pumps by Bharat Pumps & Compressors Ltd. Ref.:SPS/752008001-51/1624, dated 07/03/2010
/8/	Commissioning certificates: a) Minutes of meeting between ONGC and BPCL for installation stage blanked rotor assembly of the lean amine charge pump from 27/03/2008 to 05/04/2008 – for Pump 33-P301-B b) Minutes of meeting between ONGC and BPCL for installation stage blanked rotor assembly of the lean amine charge pump from 17/07/2006 to 31/07/2006 – for Pump 31-P301-B c) Minutes of meeting between ONGC and BPCL for installation stage blanked rotor assembly of the lean amine charge pump from 29/06/2007 to 11/06/2007 – for Pump 32-P301-B d) Minutes of meeting between ONGC and BPCL for installation stage blanked rotor assembly of the lean amine charge pump from 07/08/2007 to 16/08/2007 – for Pump 35-P301-A e) Minutes of meeting between ONGC and BPCL for installation stage blanked rotor assembly of the lean amine charge pump from 25/08/2008 to 08/09/2008 for Pump 34-P301-A f) Minutes of meeting between ONGC and BPCL for installation stage blanked rotor assembly of the lean amine charge pump from 07/08/2007 to 16 August 2007 – for Pump 35-P301-A
/9/	/9.1/ Work order issued by ONGC to M/s Bharat Pumps and Compressors Ltd. (BPCL), dated 10/03/2006 /9.2/ Letter issued by the electrical engineer of ONGC regarding the installation of energy meters on the pumps dated 17/12/2009 /9.3/ Declaration provided by the ONGC regarding the complete installation of project activity onwards 01/01/2010.
/10/	Guidelines for completing the monitoring report form (CDM-MR), version 01, EB 54, Annex 34 dated 28/05/2010
/11/	Gas Analysis report –Natural gas calorific value Test Report No 544, dated 01/07/2011 Test report No 454 dated 01/06/2011 Test report no 364 dated 02/05/2011 Test report no 293 dated 08/04/2011 Test report no 220 dated 15/03/2011 Test report no 094 dated 01/02/2011 Test report no 007 dated 03/01/2011 Test report no 1005 dated 01/12/2010 Test report no 838 dated 04/11/2010

	Test report no 834 dated 04/10/2010 Test report no 741 dated 03/09/2010 Test report no 648 dated 04/08/2010 Test report no 567 dated 08/07/2010 Test report no 480 dated 09/06/2010 Test report no 375 dated 05/05/2010 Test report no 287 dated 06/04/2010 Test report no 184 dated 03/03/2010 Test report no 94 dated 01/02/2010 Test report no 11 dated 05/01/2010
/12/	a) Calibration of online energy meters for measurement of electricity generated in the Captive Generators GT-1, GT-2 & GT-3, issued by Gujarat Electricity Board dated 06/01/2007 & 28/09/2011 b) Calibration certificates of Chromatograph in line with ASTM D 4626-95 standard dated 19/06/2009, 10/06/2010 & 29/04/2011 c) Calibration report of flow meters installed at each pump dated 24/09/2009, 09/09/2010 & 01/09/2011
/13/	Energy generation and fuel consumption for the monitoring period from 23/09/2009 to 31/07/2011
/14/	Calibration of energy meters issued by NABL accredited "Accurate Lab" and Electrical Research and Development Agency dated 23/11/2009, 30/10/2010 & 22/09/2011 as listed S.N. 4 to 8 in the table provided in section 3.5 of verification report.
/15/	Plant log books for daily Gas flow monitoring Sheet, energy generation and other monitoring parameters for the monitoring period.
/16/	Monthly Report - Project energy consumption for Lean Amine Pumps of GSU I & II from January 2010 to July 2011.
/17/	Daily project energy consumption for the monitoring period from 01/01/2010 to 31/07/2011
/18/	Major downtime registered and reported for the monitoring period from 2301/01/2010 to 31/07/2011
/19/	Onsite assessment including physical verification of measuring & monitoring procedure, interviews and data/log review
/20/	Technical specification of the gas flow meter, energy meter and other equipments.
/21/	Validation and Verification Manual version 01.2 dated 30/07/2010
/22/	UNFCCC website: http://cdm.unfccc.int/Projects/DB/DNV-CUK1249377814.84/view , web link to confirm date of registration
/23/	Publicly available information available on the CEA website titled "Data of Petroleum Fuels used by Various Gas Turbines & Diesel Engine Power Plants in the Country in 2005" dated December 2005 used for the crosscheck of NCV of Natural gas.
/24/	EB 70, Annex 3: Validation and Verification Standard version 03.0 dated 23/12/2012
/25/	CDM Project Standard, Version 2.1

Key difference between webhosted MR and final MR (indicative not exhaustive)

MR Section	Description of the change
Section A	The numbers of total emission reductions achieved during the monitoring period has been updated as 3196 t CO ₂ e from 6036 tCO ₂ e
Section C	Line diagram of the project activity is included
D	QA/QC procedure for different monitoring parameters is added
D.2	Actual Value and accuracy class of the monitored parameters are added.
Section E	Value of the baseline, project and total emission reduction is updated based on the respective findings.

7. FINDINGS DOCUMENT

Summary of findings	CAR	CL	FAR
	06	05	00

Date	Type & Number	Raised by	Reference
17/03/2012	CAR#01	Assessment Team	CDM-D-30

Non conformities raised

MR is not transparent on the

- a) emergency procedures for the monitoring system
- b) QA/QC system employed by the project activity
- c) line diagrams of all the relevant monitoring points

Project participant response

Date: 23/03/2012

- a) Monitoring Roles and Responsibilities; QA/QC Procedures mentioned in section C of MR describes the precautions that are being taken to ensure trouble free operation of the project activity.
- b) The same has been mentioned in Section C of updated MR- version 02, 23/03/2012.
- c) The same has been mentioned in section C of updated MR- version 02, 23/03/2012.

Documentation Provided as Evidence by Project Participant

Updated MR- version 02, 23/03/2012.

Information Verified by Team Leader

Date of review:

- a) The project activity in the ONGC plant is under continuous monitoring system, the O&M team inspects the site after every 2 hours and check the proper operation of the plant, also the complete project activity is controlled by monitoring station in the plant. The complete process was verified during the site visit and found to be in place.
- b) PP has provided the details on the QA/QC procedures of the project activity and the same was verified during the site visit
- c) Line diagrams of the monitoring points is described in the MR

Reasoning for not acceptance or close out

The information in the revised MR is correct and in line with the registered PDD. Hence this CAR is closed.

Date of acceptance or non-acceptance

Date: 02/03/2012

Status: Closed

Date	Type & Number	Raised by	Reference
17/03/2012	CAR # 02	Assessment Team	CDM-D-30

Non conformities raised

During the site visit it was observed that the data has been monitored from the period 01/01/2010 to 31/07/2011; however the crediting period starts from the period 23/09/2009. PP to justify the project emission and emission reduction during this period and gap between the start date of crediting period and start date of actual monitoring of data.

Project participant response

Date: 23/03/2012

The crediting period as per the registered PDD starts from 23/09/2009 i.e. from the date of the registration of the project activity. However, the project activity could only be completed on a later date i.e. on 01/01/2010. The part of the project activity which could not be implemented in a timely manner pertains to establishment of accredited monitoring system to monitor the parameters in a transparent manner as stated in monitoring plan of the PDD.

Therein, for being more conservative and more accurate while calculating the emission reductions achieved during the monitoring period, we accept to forgo the emission reductions achieved from 23/09/2009 to 31/12/2009 and would claim the CERs for monitored available data during 01/01/2010 to 31/07/2011.

Documentation Provided as Evidence by Project Participant

NIL

Information Verified by Team Leader **Date of review: 17/05/2013**

PP clarified that the monitoring period starts from 23/09/2009, however the PP is claiming the ERs from the period 01/01/2010 because the overall project implementation completed on this date. From the period 23/09/2009 till December 2009, PP is not claiming the ERs. However the dates of reported values for all the monitoring parameters are inconsistent with the ER sheet. CAR is open.

Project participant response **Date: 18/06/2013**

The dates are now revised in the MR for all the monitoring parameters.

Information Verified by Team Leader **Date of review: 18/06/2013**

The dates of reported values for all monitoring parameters have been made consistent as 01/01/2010 to 31/07/2011.

Reasoning for not acceptance or close out

The verification team found the information and revised MR and ER sheet to be satisfactory, hence CAR#02 was closed

Date of acceptance or non-acceptance **Date: 18/06/2013** **Status: Closed**

Date	Type & Number	Raised by	Reference
17/03/2012	CAR # 03	Assessment Team	CDM-D-30

Non conformities raised

- During site visit (verification) it was observed that meter serial number was available on the measuring instrument (integrator type meter) for the quantity of energy consumed by the project activity. However the MR describes this as TAG number, PP to justify the same
- The MR section B.1 is not transparent on the modification (implementation) of all pumps
- MR is not transparent on the accuracy class of the meters used in the project activity.

Project participant response **Date: 23/03/2012**

- As it is mentioned in MR, caption "TAG number" of meter states the same as "Meter serial Number"; both are different in just "choice of expression". However to avoid any misinterpretation, the caption "TAG number" has been replaced with "Meter Sr. No" in updated version of MR- Version 02 dated 23/03/2012.
- The section B.1 has been revised appropriately in updated version of MR- Version 02 dated 23/03/2012.
- The same has been updated in updated version of MR- Version 02 dated 23/03/2012.

Documentation Provided as Evidence by Project Participant

Updated MR version 02, 23/03/2012

Information Verified by Team Leader **Date of review: 02/04/2012**

- PP has revised the MR and the information is correct
- MR is transparent on the modification of the pumps, refer CAR#01
- PP has provided the accuracy class of the meters and the same is found to be correct.

Reasoning for not acceptance or close out

The verification team found the revised MR to be correct and hence this CAR#03 is closed.

Date of acceptance or non-acceptance **Date: 02/04/2012** **Status: Closed**

Date	Type & Number	Raised by	Reference
17/03/2012	CL#04	Assessment Team	CDM-D-30
Non conformities raised			
MR is not transparent on the monitoring equipment/instruments used for determining the calorific value of Natural Gas.			
Project participant response		Date: 23/03/2012	
The calorific value of Natural gas has been measured by using analytical instruments (gas chromatography system) in-line with national fuel standards. Section D.2 of MR has appropriately been revised in updated Version of MR- Version 02, 23/03/2012. Additionally, the supporting document for calorific value measurements has been provided as “Doc 5 CV of NG”.			
Documentation Provided as Evidence by Project Participant			
Updated MR version 02, 23/03/2012			
Information Verified by Team Leader		Date of review:	
PP has mentioned the instrument used for determining the calorific value is Gas Chromatography.			
Reasoning for not acceptance or close out			
The verification team cross verified with the supporting documents for this and found it be correct. Hence this CL#04 is closed out.			
Date of acceptance or non-acceptance		Date: 02/04/2012	Status: Closed

Date	Type & Number	Raised by	Reference
17/03/2012	CL#05	Assessment Team	CDM-D-30
Non conformities raised			
Monitoring report contains information on calibration of monitoring instruments however <ul style="list-style-type: none">a) the date of calibration of the previous/last calibration of the online meter of the TRAIN for the measurement of rate of gas processed by the project activity is not transparent in the MR PP to provide the:b) Calibration details/records of the instrument/equipment used for the NCV of the natural gas fired during the monitoring periodc) Calibration record of the online volumetric flow meters used for measurement of total quantity of Natural gas fired in the Captive Generators, GT-1, GT-2 & GT-3 for the complete monitoring period (23/09/2009 -31/07/2011)d) Calibration record of the energy meters used for measurement of total quantity of Net Electricity Generated in the Captive Generators, GT-1, GT-2 & GT-3 for the complete monitoring period (23/09/2009 -31/07/2011).			
Project participant response		Date: 23/03/2012	
<ul style="list-style-type: none">a) The same has been mentioned in updated version of MR- Version 02, 23/03/2012.b) The same has been provided as "Doc 5 CV of NG".c) The same has been provided as "Doc 6 Calibs for flow and energy meter of GT".d) The same has been provided as "Doc 6 Calibs for flow and energy meter of GT".			
Documentation Provided as Evidence by Project Participant			
Updated version of MR- Version 02, 23/03/2012			
Information Verified by Team Leader		Date of review:	
<ul style="list-style-type: none">a) PP has revised the MR with the first and the last calibration of the meterb) PP has provided the calibration records of the online volumetric flow metersc) PP has provide the calibration record of the energy meters			
Reasoning for not acceptance or close out			
The verification team verified the calibration record of the meters and same is found to be correct. Hence this CL#05 is closed.			
Date of acceptance or non-acceptance		Date: 02/04/2012	Status: Closed

Date	Type & Number	Raised by	Reference
17/03/2012	CL#06	Assessment Team	CDM-D-30
Non conformities raised			
Unit mentioned in the PDD for the following parameters are different than mentioned in the monitoring report/4.7/.			
Parameters	Description	Unit in MR	Unit in PDD
FCGT1,NG	Total quantity of Natural Gas fired in the Captive Generator GT – 1, during the monitoring period from 23/09/2009 to 31/07/2011	NM3	NM3/year
FCGT2,NG	Total quantity of Natural Gas fired in the Captive Generator GT – 2, during the monitoring period from 23/09/2009 to 31/07/2011	NM3	NM3/year
FCGT3,NG	Total quantity of Natural Gas fired in the Captive Generator GT – 3, during the monitoring period from 23/09/2009 to 31/07/2011	NM3	NM3/year
EGGT1,y	Total Quantity of Net Electricity Generated in the Captive Generator GT-1, during the monitoring period from 23/09/2009 to 31/07/2011	MWh	MWh/year
EGGT2,y	Total Quantity of Net Electricity Generated in the Captive Generator GT-2, during the monitoring period from 23/09/2009 to 31/07/2011	MWh	MWh/year
EGGT3,y	Total Quantity of Net Electricity Generated in the Captive Generator GT-3, during the monitoring period from 23/09/2009 to 31/07/2011	MWh	MWh/year
ECPJ,y	Quantity of Energy consumed by the project activity during the monitoring period from 23/09/2009 to 31/07/2011	MWh	MWh/year
Ty	Duration of operations of the pump during the monitoring period from 23/09/2009 to 31/07/2011	Thousand hours	Thousand hours /year
Project participant response		Date: 23/03/2012	
As a standard practice, emissions and the emission reduction has been completed on a yearly basis. This is the reason that the word “per year” has been used for monitoring parameters in PDD. The values for monitored parameter provided in MR are absolute values of the parameter for the monitoring period that is the reason; it does not have any time units.			
Documentation Provided as Evidence by Project Participant			
NIL			
Information Verified by Team Leader		Date of review:	
PP clarified that the word “per year” has been used for monitoring parameters in PDD. The values for			

monitored parameter provided in MR are absolute values of the parameter for the monitoring period.

Reasoning for not acceptance or close out

The verification team accepted the same as the units in per year is for annual estimation and in the MR the period is more than a year. Hence this CL#06 is closed out.

Date of acceptance or non-acceptance	Date: 02/04/2012	Status: Closed
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Date	Type & Number	Raised by	Reference
17/03/2012	CL # 07	Assessment Team	CDM-D-30

Non conformities raised

PP is requested to provide

- the supporting evidences/documents for the project downtime/shut down period in section B.1 of the monitoring report for the current monitoring period
- the work order of the pumps, commissioning certificates of the pumps
- specifications of pumps involved in the project activity

Project participant response	Date: 23/03/2012
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- The same has been mentioned in section B.1 of the update version of MR- version 02, 23/03/2012.
- The same have been provided as “Doc 3 work Order” and “Doc 2 Commissioning cert”
- The same has been provided as “Doc 1 Pump specification sheet”

Documentation Provided as Evidence by Project Participant

Updated MR- version 02, 23/03/2012

Information Verified by Team Leader	Date of review:
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PP provided the scanned copies of the documents,

Reasoning for not acceptance or close out

The documents provided by PP is found to be consistent with the data reported in the MR. Thus the CL is closed.

Date of acceptance or non-acceptance	Date: 02/04/2012	Status: Closed
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Date	Type & Number	Raised by	Reference
17/03/2012	CL # 08	Assessment Team	CDM-D-30

Non conformities raised

PP to provide

- the source of documents/evidences used in the ER calculation spreadsheet
- supporting documents for the accuracy class of all the flow meter and energy meter in the project activity

Project participant response	Date: 23/03/2012
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- The same has been mentioned in updated ER calculation sheet
- The accuracy class of all the flow meters and energy meters are mentioned in calibration certificate itself and calibration certificates has been provided as Doc 4 Calibs for amine gas flow meters, Doc 6 Calibs for flow and energy meters of GT and Doc 8 Calibs for energy meters.

Documentation Provided as Evidence by Project Participant

Updated Monitored Data and ER Calculation sheet 23/03/2012

Information Verified by Team Leader	Date of review:
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a) PP has provided the documents for the data and parameters used in the ER sheet b) PP has provided the calibration record for the accuracy class of all the flow meters and energy meters being used in the project activity		
Reasoning for not acceptance or close out		
The verification team verified the documents and also cross verified during the site inspection and found to be consistent. Thus, CL#08 is closed out.		
Date of acceptance or non-acceptance	Date: 02/04/2012	Status: Closed

Date	Type & Number	Raised by	Reference
17/03/2012	CL# 09	Technical Reviewer	CDM-D-30

Non conformities raised	
<ol style="list-style-type: none"> 1. It is mentioned in the MR that energy efficiency measures were not implemented in the rest 5 amine pumps as described in the registered PDD. PP shall justify that how the implementation of project activity (implementation of energy efficiency measures in 10 pumps) is in compliance with the registered PDD. 2. As per the MR, the monitoring period start date is 23/09/2009. However the data monitoring and ER calculations are performed from 1st Jan 2010. It is discussed in the findings document but no information is available in the monitoring report in section B.1. 3. The ER calculations are performed using the monitoring data of both the pumps for each train. However, it is also mentioned in the MR that the blanking (energy efficiency measure) is only performed for 1 pump in each train. Therefore, please clarify how ERs calculated for operations of stand-by pump are justified. PP needs to provide supporting for the same. 4. Referring to point 3 above, the monitoring of gas flow should also correspond to the operations of the main amine pump. The data of stand-by pump shall be reported in the spreadsheet but excluded from the ER calculation. 5. Emission Reductions for each sub-unit (Pump) shall be provided separately in the ER sheet and MR, in particular, project emissions in the worksheet "Emission Reduction". 6. PP needs to provide justification that in the high running hours of stand-by unit there was no simultaneous operation of both the pumps in each train. 7. PP needs to mention in the MR the conditions under which the equation used to estimate baseline load, $L_{base,y}$, will give accurate results and the factors which may affect the accuracy or validity of the equation. In context of the ER calculations, the project activity is yielding high ERs when it is operating at low load condition which seems contradictory to the normal scenario. 8. The calibration of flow meter for NG consumption does not cover the whole monitoring period. 	
Project participant response	Date: 19/04/2012

<ol style="list-style-type: none"> 1. We acknowledge that the modification in the remaining pumps is yet to be carried out. As a standard practice modifications in the remaining pumps would be carried out at the time of overhauling of the same. Thus the implementation of a part of the project activity would be delayed. As such the monitoring plan given in the registered PDD mentions modification of the pumps as one of the monitored parameters. As modification of the pump is a monitored parameter it is a variable for the purpose of computation of emissions. In accordance with the monitoring plan the parameter regarding the actual modification of the pump has been monitored and reported in the Monitoring Report. 2. Additional information about the monitoring period of project activity has been mentioned in section B.1 of updated version of MR- version 03, 19/04/2012. 3. All the pumps (both modified and unmodified) are within the project boundary. Thus it is required to monitor both sets of the pumps. The computation algorithm used to compute baseline emissions is based on the historical performance of the unmodified pumps thus the baseline power consumption for the unmodified pumps determined using the algorithm (using monitored flow rate and the equation) would be same as actual power consumption. Thus there will be no emission reduction due to unmodified pumps. 4. The gas flow rate does not depend upon which of the pumps is being used at any given point 	
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of time. As explained above in case unmodified pump is being used at any given point of time the corresponding emission reductions computed does not get added up.		
5. The data for the gas flow rate and the power consumption has been done for all the pumps and thereof for each of the absorption tower. As can be seen from the excel sheets for the monitored data and the emission reduction computations.		
6. The operating pump and the standby pump are connected to the inlet of the absorption tower in parallel, using the same input nozzle. Thus it is not possible that both the pump operate at the same time.		
7. The relationship between the load in the baseline ($L_{base,y}$) and the gas flow rate has been determined using the actual historical data. This was done using a large set of historical data to ensure the coverage of the range of data and the possible variations in the operating conditions. Thus the equation used to determine $L_{base,y}$ would give accurate results under the operating conditions and the range of flow rates for the gas.		
8. The same has been mentioned in updated version of MR, Version 03, 19/04/2012.		
Documentation Provided as Evidence by Project Participant		
<ul style="list-style-type: none">Updated MR, version 03,19/04/2012Doc 12- Calibs for GT		
Information Verified by Team Leader	Date of review: 24/04/2012	
Revised MR, version 03 dated 19/04/2012		
Reasoning for not acceptance or close out		
1. As stated above modifications in the remaining pumps would be carried out at the time of overhauling of the same. Thus the implementation of a part of the project activity would be delayed. PP needs to provide the tentative date of the overhauling of the pump and PP to justify how the implementation of project activity (implementation of energy efficiency measures in 10 pumps) is in compliance with the VVM para 198 (a). Open		
2. Justification given by PP is acceptable to the validation team as additional information about the monitoring period of project activity has been mentioned in section B.1 of updated version of MR- version 03, 19/04/2012. Closed.		
3. The ER calculations are performed using the monitoring data of both the pumps for each train. PP needs to provide the revised ER sheet incorporating the changes only due to retrofitted pump. Open		
4. PP to provide the revised ER sheet and MR incorporating the changes only due to retrofitted pump. Open.		
5. PP to refer point no 3 & 4 above.		
6. Justification given by PP is acceptable to the assessment team. Closed.		
7. Justification given by PP is acceptable to the assessment team.		
8. The same has been mentioned in updated version of MR, Version 03, 19/04/2012.		
Date of acceptance or non acceptance	Date: 19/05/2012	Status: Open
Project Participant Response	Date: 01/02/2013	
1. The details of implementation of project activity and tentative schedule for overhauling of the pump is given below: Lean Amine Charge Pumps are multistage centrifugal pumps used for circulation of clean media - MDEA (Methyl Di Ethanol Amine). The Material of Construction of the pump and its components is Stainless Steel which does not react with the circulating fluid. Due to its clean, non-corrosive operating environment, internal wear & tear under standard operating conditions is minimal. These pumps are maintained as per stringent inspection/ overhauling schedules at 4000/ 12000 hrs intervals which are monitored through SAP system. The physical parameters of pump like clearances, alignment with prime mover etc are monitored to see the trends if any. There are no prevalent standard repair norms for these pumps in the Industry as the same will vary remarkably from applications to applications. The OEMs recommend monitoring of the operating parameters of the pumps like Discharge Pressure, Flow Rate, and Head etc for any gradual drop in the values below the operational requirement, in the event of which the pump may be sent for Overhaul. The OEM of GSU I & II Lean Amine Charge Pumps- M/s BPCL, India, in 2008, had estimated the residual life of these pumps as 12 years. During the period of July 06 to Sep 08 05 nos. pumps failed due to various reasons. While repairing of these pumps through OEM, Stage Blanking was also carried out. A departmental in-depth analysis		

of the incidents leading to the failures was carried out which led to redefining of the standard operating & maintenance procedure with fixed responsibilities of various sections. The major areas of concerns where changes in prevalent practice were emphasized are as under:

S.N.	Activity	Earlier Practice	Changed Practice
1	Priming	Was carried out by Process Field personnel. Priming carried out based on the personal judgment only as the priming line was connected to the closed sump w/o any opening for witnessing the continuous flow of liquid.	To be carried out by Process Field personnel and witnessed by the Mech. Maintenance representative. Priming line modified with an opening to the open sump for witnessing continuous flow of liquid.
2	Pump Change Over	Parallel operation time of both pumps undefined	Parallel operation time of both pumps not more than one minute
3	Condition Monitoring	Vibration Monitoring as per the predefined routine.	In addition to the predefined routine, mandatory Vibration Analysis to be done during trial run after any Preventive Maintenance. During daily monitoring of the parameters, for slightest doubt, vibration monitoring is to be carried out.
4	Routine Monitoring	Was carried out by Process & Mechanical Maintenance Field personnel on daily basis.	Now carried out by Process & Mechanical Maintenance Field personnel in a more stringent manner once in every shift of 8 hours

The changes were effected immediately and since then there has been no failure of pumps till date. Based on a broad statistical guesstimate taking into consideration the changed scenario of modified maintenance practices and its effect on the health of the pumps, operational requirement trends and other contributing factors, we may have to send another pump for major repair and stage blanking by 2016. However, conscious efforts shall be made to prevent occurrence of such events. Since the implementation schedule has changed after registration of the project, we would like to process the revised PDD for incorporating corrections as per para 209 of CDM Project Standard. Please find attached the revised PDD dated 30/05/2012.

3. As mentioned on page no 12 of registered PDD, all the pumps (both modified and unmodified) are within the project boundary. Additionally, in line with monitoring plan of project activity as mentioned on page No 25 of registered PDD, it is required to monitor both sets of the pumps. The computation algorithm used to compute baseline emissions is based on the historical performance of the unmodified pumps thus the baseline power consumption for the unmodified pumps determined using the algorithm (using monitored flow rate and the equation) would give the same figure as actual power consumption.

4. Considering the fact that the gas flow rate does not depend upon which of the pumps is being used at any given point of time and monitoring plan of project activity as mentioned on page No 25 of registered PDD, the gas flow rate has been monitored irrespective to type of pump (modified or unmodified) for the monitoring period under consideration. However, in case unmodified pump is being used at any given point of time the corresponding emission reductions computed would turn out to be zero.

5. As justified earlier, the data for the gas flow rate and the power consumption has been done for all the pumps and for each of the absorption tower. As can be seen from the excel sheets for the monitored data and the emission reduction computations. The results would be same irrespective of

the fact that the computations are done at an aggregate level of separate absorption tower wise.		
Documentation Provided as Evidence by Project Participant		
Updated MR Version 05, 02/04/2013		
Information Verified by Team Leader	Date of review: 01/02/2013	
Revised MR		
Reasoning for not acceptance or close out		
<p>1. The schedule for implementation of the energy efficiency in the remaining 5 pumps has been delayed due to technical issues. It is confirmed by means of interviews with the management that the implementation of the energy efficiency measures in remaining 5 pumps will be done tentatively in 2016. The delay in project implementation in the remaining pumps is identified as post registration change (Correction) and will be processed in accordance with para 257 of VVS. The revised PDD is submitted and the project implementation schedule is now revised as per the latest verified information. Closed</p> <p>2. Closed.</p> <p>3. The monitored data for each retrofitted pump is provided in the ER calculation sheet. closed</p> <p>4. The explanation is accepted. Closed.</p> <p>5. The explanation is accepted. Closed.</p> <p>6. Closed.</p> <p>7. Closed.</p> <p>8. Closed</p>		
Date of acceptance or non acceptance	Date: 10/04/2013	Status: Closed

Date	Type & Number	Raised by	Reference
17/03/2012	CAR# 10	Assessment Team	CDM-D-30
Non conformities raised			
Parameters Q_y and $EC_{PJ,y}$, have not been monitored separately for each pump as mentioned in the registered PDD. This causes deviation (temporary or permanent) from the monitoring provisions in the registered PDD. Please justify how it is in compliance with the registered PDD.			
Project participant response		Date: 02/07/2012	
In line with monitoring plan for the project activity as mentioned in registered PDD, the $EC_{PJ,y}$ and Q_y have been monitored separately for each pump. Kindly refer the attached ER calculation sheet for the same.			
Documentation Provided as Evidence by Project Participant			
Revised ER sheet			
Information Verified by Team Leader		Date of review: 17/07/2012	
Revised ER sheet			
Reasoning for not acceptance or close out			
The ER sheet with separate monitoring data is submitted and found with the information required.			
Date of acceptance or non acceptance		Date: 01/02/2013	Status: Closed

Date	Type & Number	Raised by	Reference
28/07/2013	CAR# 11	Assessment Team	CDM-D-30
Non conformities raised			
The calculation of energy saving for the monitoring period is not explicitly depicted in the MR and ER sheet as required in the section B.7.2 of the registered PDD.			
Project participant response		Date: 29/07/2013	
The energy saving calculations are included in the revised ER sheet now and the same has been summarized in the revised MR dated 29/07/2013.			

Documentation Provided as Evidence by Project Participant		
Revised ER sheet, MR		
Information Verified by Team Leader	Date of review: 30/07/2013	
Revised ER sheet & MR		
Reasoning for not acceptance or close out		
The energy saving calculations in detail for the baseline and project scenario have been included in the revised MR and ER sheet. The same have been checked by the assessment team and found appropriate based on the expressions in the registered PDD and monitored data. CAR is closed.		
Date of acceptance or non-acceptance	Date: 09/09/2013	Status: Closed

8. CERTIFICATE OF COMPETENCE

Personnel Name:		Sanjay Kandari	
Qualified to work as:			
Team Leader	<input checked="" type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy industries (renewable/non-renewable sources)		TA 1.2: Energy generation from renewable energy sources	
Approved by (Manager C & T)		Mayank Kumar Jain	
Approval date:		09/02/2012	

Personnel Name:		Shreya Garg	
Qualified to work as:			
Team Leader	<input type="checkbox"/>	Technical Expert	<input type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
Area(s) of Technical Expertise			

Personnel Name:		Vinay Singh	
Qualified to work as:			
Team Leader	<input checked="" type="checkbox"/>	Technical Expert	<input type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
N/A		N/A	
Approved by (Manager C & T)		Mayank Kumar Jain	
Approval date:		12/12/2011	

Personnel Name:		Shilpy Gupta	
Qualified to work as:			
Team Leader	<input type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy industries (renewable/non-renewable sources)		TA 1.2: Energy generation from renewable energy sources	
Approved by (Manager C & T)		Mayank Kumar Jain	
Approval date:		12/12/2011	

Personnel Name:		Sarang Khati	
Qualified to work as:			
Team Leader	<input type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input type="checkbox"/>	Local Expert	<input type="checkbox"/>
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Manufacturing Industries		TA 4.4 Refinery	
Approved by (Manager C & T)		Mayank Kumar Jain	
Approval date:		09/01/2012	

Personnel Name:		Anil Agarwal	
Qualified to work as:			
Team Leader	<input type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input type="checkbox"/>	Local Expert	<input type="checkbox"/>
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
4. Manufacturing Industries		TA 4.7: Oil & Gas Industry	
Approved by (Manager C & T)		Mayank Kumar Jain	
Approval date:		11/01/2013	

Personnel Name:		Ashok Kumar Gautam	
Qualified to work as:			
Team Leader	<input checked="" type="checkbox"/>	Technical Expert	<input checked="" type="checkbox"/>
Validator/Verifier	<input checked="" type="checkbox"/>	Financial Expert	<input type="checkbox"/>
Technical Reviewer	<input checked="" type="checkbox"/>	Local Expert (India)	<input checked="" type="checkbox"/>
Area(s) of Technical Expertise			
Sectoral Scope		Technical Area	
Energy industries (renewable/non-renewable sources)		TA 1.1: Thermal energy generation from fossil fuels and biomass including thermal electricity from solar	
Waste handling and disposal		TA 13.1: Waste handling and disposal	
Approved by (Manager C & T)		Mayank Kumar Jain	
Approval date:		12/12/2011	

History of the document

Version	Date	Nature of revision	Reviewed by	Approved by
3.1	29/10/2012	Updated for EB69 Annex6	Manager CDM Quality 29/10/2012	Managing Director 29/10/2012
3.0	31/08/2012	Revised for VVS Track	Manager CDM Quality 08/09/2012	Managing Director 10/09/2012
2.0	21/12/2011	Comprehensively revised	Manager CDM Quality 21/12/2011	Managing Director 21/12/2011