



Monitoring report form (Version 03.0)

Monitoring report

Title of the project activity	Up-gradation of Gas Turbine 1 (GT 1) and Gas Turbine 2 (GT 2) at co-generation plant of Hazira Gas Processing Complex (HGPC) of Oil and Natural Gas Corporation Limited (ONGC).
Reference number of the project activity	0847
Version number of the monitoring report	01
Completion date of the monitoring report	06/12/2012
Registration date of the project activity	01/03/2007
Monitoring period number and duration of this monitoring period	2 nd Monitoring Period (01/07/2011-30/06/2012—First and the last days included)
Project participant(s)	Oil and Natural Gas Corporation Limited (ONGC)
Host Party(ies)	India
Sectoral scope(s) and applied methodology(ies)	Sectoral Scope IV: Manufacturing Industries Applied methodology: Small scale methodology AMS-II.D – Version 08 Type II. Energy efficiency improvement projects. Category D - Energy efficiency and fuel switching measures for industrial facilities.
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	8231(t CO ₂ e)
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	10858 (t CO ₂ e)

SECTION A. Description of project activity**A.1. Purpose and general description of project activity**

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ONGC's Hazira Gas-Processing Complex (HGPC) consists of facilities for receiving natural gas (NG) along with associated condensate from an off-shore field at a rate of 20 Million Metric Newton M³(MMNM³) per day. After separating the condensate, which is processed in condensate fractionation units, the gas is processed through various steps to recover liquefied petroleum gas (LPG) and there is a reduction in its dew point to less than 5 degrees centigrade (C) in order to make it suitable for transportation over long distances. Prior to gas processing, the gas is sent to gas sweetening unit where the acid gas is recovered and further processed to obtain sulphur. The major products manufactured at HGPC are lean sweet gas, LPG, natural gas liquids (NGL) and sulphur.

The HGPC receives economical, quality and uninterrupted supply of electrical power and steam from the cogeneration plant at ONGC, Hazira which was set up in the financial year (FY) 1987 - 1988. The cogeneration plant consists of three nos. of Gas Turbine Generators (GTG) to cater the power demand of Hazira Plant. GT-1 & GT 2, which are of General Electric (GE) make were commissioned in 1988 and fitted with standard technology components. GT-3 is of Bharat Heavy Electricals Limited (BHEL) make was commissioned in 1997 and fitted with up-rated parts.

Gas turbines are high-tech capital equipments and are vital for operations hence Original Equipment Manufacturers (OEM) continuously strive to augment the gas turbine's performance by improving the design/material of its components through research and development (R&D). Such developments are extensively tested and offered to customers in the form of new components commonly called up-rated parts. Aim of these up-rated parts, is to satisfy varied requirement of gas turbine owners, such as improvement in output, efficiency or reduction in maintenance intervals and related. New machines are traditionally supplied with up-rated parts. For older machines, these up-rated parts are available as retrofit and usually suggested for installation at the time of scheduled inspections, so that separate outage of gas turbine is not required for fitment of up-rated parts.

As the existing GT 1 and GT 2 will be completing their expected life time, ONGC is required to replace the entire hot gas path (HGP) components fitted in the gas turbine machines as at present ONGC does not have spare HGP components in stock. Under such circumstances ONGC has the option either to: (a) procure new HGP components of standard technology (Old Design) or (b) opt for up-rated components, which offer higher efficiency and output.

A comparative analysis was made to assess both scenarios (a) and (b) described above by considering one, major inspection cycle (i.e. of 6 years, which is the normal life span of the components). Accordingly maintenance costs (including cost of spares, component repairs and services) have been compared for two scenarios.

ONGC has decided to go for the up-rated components in order to achieve their objective of continuous thrust towards energy conservation and therefore reduction in greenhouse gas (GHG) emissions. The purpose of undertaking the project is to reduce the fossil fuel consumption (NG), and therefore reduce the CO₂ emissions that would otherwise have been released by burning of natural gas (NG) in the GTG. The project would result in reduction of heat rate by 3.3% which would result in saving of 3,926,673 Standard Cubic Meter (SCM) of NG annually. In absence of the project activity, equivalent quantity of NG would have been burnt, thereby resulting in 8231 tonCO₂ emission annually.

The project would contribute to sustainable development of the host country India in the following ways:

The project activity saves NG for better applications and contributes to environmental protection.

The project activity would help in minimizing environmental pollution by reducing emissions of CO₂ and other air

pollutants (SPM, SO₂, NO_x). The project is based on the noble principle that 'energy saved is energy generated'. The project would contribute to enhancement of skills in employees and workers, and would provide benefits to equipment suppliers and technical consultants.

Relevant dates for the project activity (e.g. construction, commissioning, continued operation periods, etc.):

The Project has been completed as given below and as described in the Registered Project Design Document (PDD) Version 06 Dated 20/12/2011

Up-gradation of GT 1 was completed and re commissioning was done on 05/04/2010.

Up-gradation of GT 2 was completed and re commissioning was done on 03/07/2010. Total GHG emissions reduction achieved in this Monitoring Period was 10858 tCO₂e.

A.2. Location of project activity

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Place	Hazira
Post Office	ONGC Nagar
City	Surat
Pin	394 518
State	Gujarat
Country	India



GPS Co-ordinates of ONGC, Hazira, Surat are 21°9'39"N 72°43'31"E

A.3. Parties and project participant(s)

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of India (host) Federal office for the Environment, Swiss Designated National Authority, Switzerland	Oil and Natural Gas Corporation Ltd. (ONGC)- Public entity	No

A.4. Reference of applied methodology

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Small scale methodology AMS-II.D – Version 08

Type II. Energy efficiency improvement projects.

Category D - Energy efficiency and fuel switching measures for industrial facilities.

Reference: Paragraph '3 and 4' as provided in Type II.D of Appendix B of the simplified modalities and procedures for small-scale CDM project activities - Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories.

A.5. Crediting period of project activity

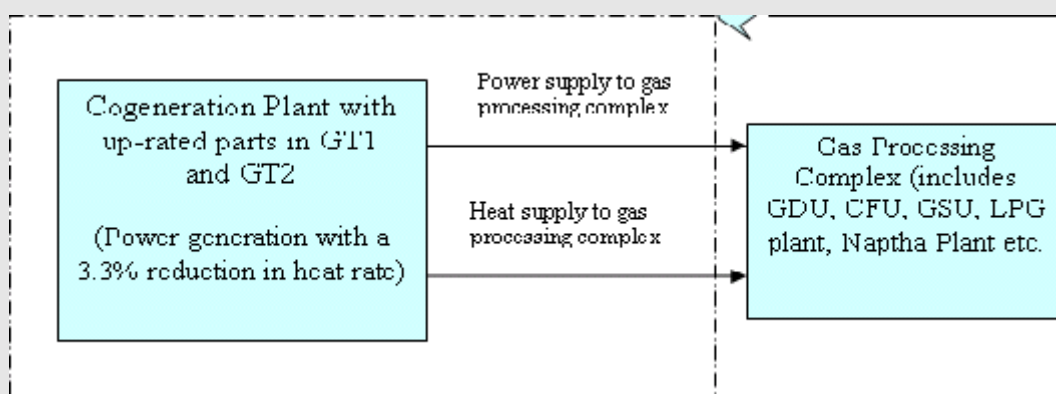
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01/04/2007 – 31/03/2017 (10 Years)

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>> Gas turbines are high-tech capital equipments and are vital for operations hence Original Equipment Manufacturers (OEM) continuously strive to augment the gas turbine's performance by improving the design/ material of its components through research and development (R&D). ONGC has decided to go for the up-rated components in order to achieve their objective of continuous thrust towards energy conservation and therefore reduction in greenhouse gas (GHG) emissions. The purpose of undertaking the project is to reduce the fossil fuel consumption (NG), and therefore reduce the CO₂ emissions that would otherwise have been released by burning of natural gas (NG) in the GTG.



Up-gradation of GT#1 was completed and re commissioning was done on 05/04/2010. Up-gradation of GT#2 was completed and re commissioning was done on 03/07/2010.

The following are the details of the shut down for the monitoring period (01/07/2011 to 30/06/2012).

GT#1			GT#2		
Date	Running hours	Downtime hours	Date	Running hours	Downtime hours
13/07/2011	12.00	12.00	04/09/2011	12.75	11.25
14/07/2011	0.00	24.00	05/09/2011	13.75	10.25
15/07/2011	0.00	24.00	02/11/2011	11.00	13.00
16/07/2011	14.75	9.25	03/11/2011	14.00	10.00
26/11/2011	22.00	2.00	24/11/2011	15.75	8.25
30/11/2011	16.50	7.50	25/11/2011	0	24.00
01/12/2011	10.75	13.25	26/11/2011	18.75	5.25
04/01/2012	16.00	8.00	19/04/2012	18.50	5.50
09/04/2012	12.00	12.00	09/06/2012	23.25	0.75
10/04/2012	0.00	24.00			
11/04/2012	0.00	24.00			
12/04/2012	11.75	12.25			
18/04/2012	4.50	19.50			
19/04/2012	10.50	13.50			
09/06/2012	22.50	1.50			

GT	Downtime hours	Reasons
1	206.75	205.25 Hrs (GT repair and maintenance and other operational requirements); 1.50 Hrs (Tripped)
2	88.25	82.00 Hrs (GT repair and maintenance and other operational requirements); 6.25 Hrs (Tripped)

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

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There has been no deviation in monitoring plan from that of the registered PDD

B.2.2. Corrections

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There has been no correction from that of the registered PDD

B.2.3. Permanent changes from registered monitoring plan or applied methodology

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There has been no permanent change in monitoring plan from that of the registered PDD

B.2.4. Changes to project design of registered project activity

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The notification of change is with respect to revising the baseline heat rate of the GTs (fixed ex-ante) from 3 302 kCal/kWh as stated in the registered PDD to 3 483 kCal/kWh due to the application of a conversion factor for the conversion of baseline Natural Gas (NG) consumption in GT1 and GT2 from Nm3 to Sm3. The fuel consumption

is measured in Nm³ and converted to Sm³, using the conversion factor of 1.055. Notification for Changes in PDD for the CDM Project activity was uploaded and acknowledged by UNFCCC on 12/01/2012. Notification for changes in PDD for the CDM Project activity was approved on 17/02/2012 by UNFCCC.

B.2.5. Changes to start date of crediting period

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There has been no change to start date of crediting period from that of the registered PDD.

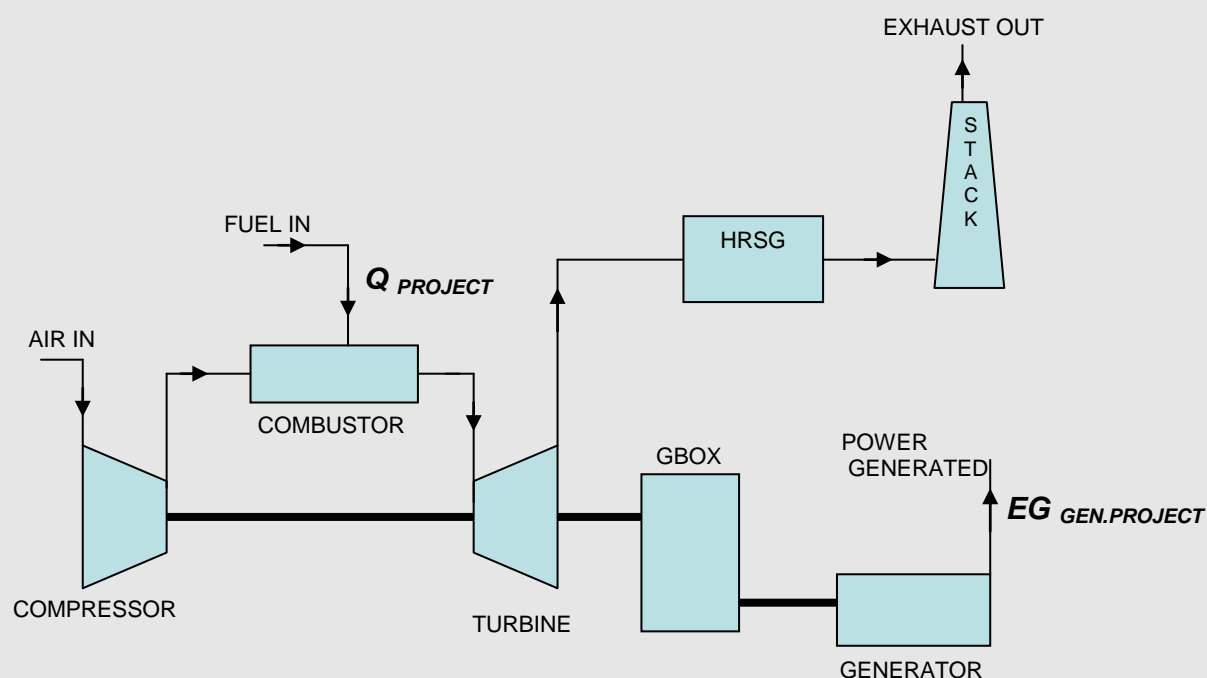
B.2.6. Types of changes specific to afforestation or reforestation project activity

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Not applicable

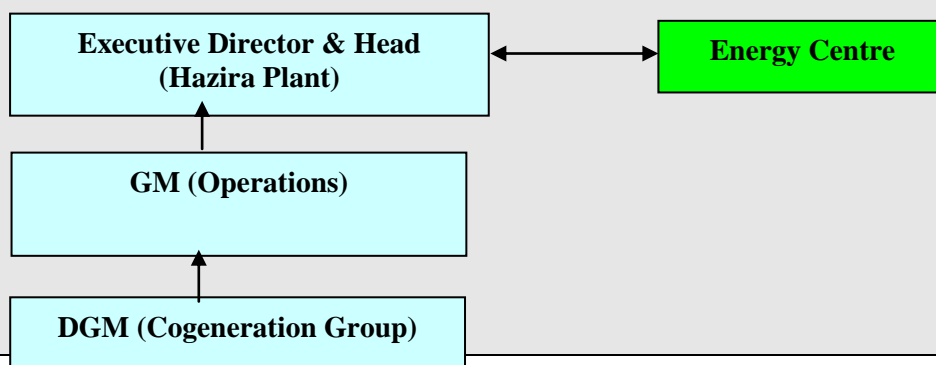
SECTION C. Description of monitoring system

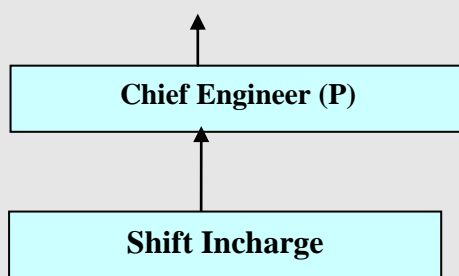
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Roles & Responsibilities:

The operational and management structure that will monitor the project activity is described in Fig D.1 below and the monitoring activities and responsibility is also listed in Table D.1 below:





Organisation structure and responsibility for CDM data gathering and reporting

Monitoring activities and responsibility

Monitoring activities	Procedure and responsibility
Data source and collection	ONGC has state of the art computerised monitoring system installed in the plant. This ensures accurate and continuous monitoring of all the data.
Frequency	Monitoring frequency would be as per section D.3 of PDD
Review	All received data would be reviewed by the engineers in the CDM cell.
Data compilation	All the data would be compiled and stored in the CDM cell.
Emission calculation	Emission reduction calculations will be done annually based on the data collected and recorded. Engineers/Executives of CDM cell will do the calculations

Emergency procedures for the Monitoring system:

The equipment will either be repaired or replaced as the case is and the intervening period is shown as operational shut down. There is no alternative measurement system and emission reduction is shown zero for those periods.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	$Q_{baseline}$
Unit:	SCM/year
Description:	Quantity of fuel used (NG)
Source of data:	Plant Data maintained in the log book.
Value(s) applied):	117755852
Purpose of data:	Three year average data before project is used for Base line calculations.
Additional comment:	Not Applicable

Data / Parameter:	NCV <i>baseline</i>
Unit:	GJ/SCM
Description:	Net Calorific value of fuel
Source of data:	Plant Data maintained in the log book.
Value(s) applied:	0.0376
Purpose of data:	Pre project calorific value is used for Base line calculations.
Additional comment:	Not Applicable

Data / Parameter:	EG <i>gen. baseline</i>
Unit:	kWh/year
Description:	Gross quantity of electricity generated.
Source of data:	Plant Data maintained in the log book.
Value(s) applied:	303874667
Purpose of data:	Three year average data before project is used for Base line calculations.
Additional comment:	Not Applicable

Data / Parameter:	Heat Rate <i>pre project</i>
Unit:	kcal/kWh
Description:	Heat rate
Source of data:	Plant Data maintained in the log book.
Value(s) applied:	3483.75
Purpose of data:	Three year average data before project is used for Base line calculations.
Additional comment:	Not Applicable

D.2. Data and parameters monitored

Data / Parameter:	Q <i>project</i>
Unit:	SCM
Description:	Quantity of fuel used(NG)
Measured/ Calculated / Default:	Measured
Source of data:	Onsite measurements by online volumetric flow meters.
Value(s) of monitored parameter:	Refer Excel sheet
Monitoring equipment:	Gas flow meter. Accuracy class : 0.025% Gas flow meter equipment serial no of GT1 : 23FT541 Gas flow meter equipment serial no of GT2 : 24FT541
Measuring/ Reading/ Recording frequency:	Continuous/Daily/Monthly
Calculation method (if applicable):	Not Applicable

QA/QC procedures:	The parameter would be monitored continuously. The flow meters will be calibrated regularly as per the requirements specified by the Original Equipment Manufacturers (OEM). Validity: Each calibration is for one year interval. Calibration dates of 23 FT541: 08/03/2011,10/02/2012 Calibration dates of 24 FT541: 21/09/2010,20/09/2011
Purpose of data:	The data will be used for project emission calculation
Additional comment:	--

Data / Parameter:	NCV_{project}
Unit:	GJ/SCM
Description:	Net Calorific value of fuel
Measured/ Calculated / Default:	Measured
Source of data:	In-house sampling and calculations.
Value(s) of monitored parameter:	Refer Excel sheet
Monitoring equipment:	Gas Chromatograph Accuracy class : +/- 1% (HZR/ISO/EQL071)
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Calibration of the Chromatograph has been done annually. Calibration is done internally by ASTM D 4626-95 standard. Validity: Each calibration is for one year interval. Calibration dates: 29/04/2011, 26/04/2012
Purpose of data:	This is used for project emission calculation.
Additional comment:	--

Data / Parameter:	EG_{gen. project}
Unit:	kWh
Description:	Gross quantity of electricity generated
Measured/ Calculated / Default:	Measured
Source of data:	Onsite measurements by online energy meters. Plant Data is maintained in the log book.
Value(s) of monitored parameter:	Refer Excel sheet
Monitoring equipment:	Energy Meters Accuracy class : 0.5s Equipment serial no of GT1: GJUO4103 Equipment serial no of GT2 :GJUO4102
Measuring/ Reading/ Recording frequency:	Continuous recording and monthly reporting
Calculation method (if applicable):	Not Applicable

QA/QC procedures:	The parameter would be monitored continuously. The energy meters will be calibrated regularly as per the requirements specified by the OEM and the Statutory Bodies. Calibration frequency for Energy Meter is 5 years but correction factor applied to confirm the calibration frequency of 3 years interval as per guidelines Calibration Dates: GT1: 06/01/2007, 28/09/2011 GT2 : 06/01/2007, GJB 03340 (installed) and calibrated on 28/09/2011 Validity: Each calibration is for Five (5) year interval.
Purpose of data:	This is used for project emission calculation.
Additional comment:	--

Data / Parameter:	<i>Heat Rate_{project}</i>
Unit:	kcal/kWh
Description:	Heat rate
Measured/ Calculated / Default:	Calculated
Source of data:	Plant Data maintained in the log book.
Value(s) of monitored parameter:	Refer Excel sheet
Monitoring equipment:	Plant Data maintained in the log book.
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	$Heat\ Rate_{project} = (Q_{project} * NCV_{project}) / EG_{Gen.\ project}$
QA/QC procedures:	ISO: 9001
Purpose of data:	This is used for project emission calculation.
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Data / Parameter:	<i>Upated components identification number</i>
Unit:	Not Applicable
Description:	Identification number of uprated components
Measured/ Calculated / Default:	Not Applicable
Source of data:	Plant
Value(s) of monitored parameter:	Not Applicable
Monitoring equipment:	Not Applicable
Measuring/ Reading/ Recording frequency:	Yearly
Calculation method (if applicable):	Not Applicable
QA/QC procedures:	Data will not be used directly for Baseline/ Project/ Leakage emission calculations.

Purpose of data:	Data will be used to keep record of uprated components.
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Detailed list is given below:

<u>Specification of Replaced Equipment (GT)</u>				
Equipment is not Replaced But Up-rated				
	Before Up-rate		After Up-rate	
	GT#1	GT#2	GT#1	GT#2
Tag No	23 TG 001	24 TG 001	23 TG 001	24 TG 001
Sr No	295315	295316	295315	295316
Model	PG 5361 P		PG 5371 P N/T	
Rated Capacity	19.52 MW		21.54 MW	

LIST OF UPRATED COMPONENTS GT#1/2

Sr. No.	Description	Part Number	Qty.
1	Blade Kit Turbine Rotor Stage 1	314B7158G015	1
	The above kit consists of following items:		
	Blade, Mach, Turbine Rotor - Stage 1	948E0707P031	119
	Blade, Mach, Turbine Rotor - Stage 1	948E0707P032	1
	Bucket Seal Pin	312A6585P001	120
	Bucket Seal Pin	312A6586P001	120
	Bucket Twist	239B5791P003	120
2	Blade Kit Turbine Rotor Stage 1	314B7158G015	1
	The above kit consists of following items:		
	Blade, Mach, Turbine Rotor - Stage 1	948E0707P031	119
	Blade, Mach, Turbine Rotor - Stage 1	948E0707P032	1
	Bucket Seal Pin	312A6585P001	120
	Bucket Seal Pin	312A6586P001	120
	Bucket Twist	239B5791P003	120
3	Blade Kit, Turbine Rotor - Stage 2	361B6349G001	1
	The above kit consists of following items:		
	Blade Mach Turbine Rotor Stage 2	114E1989P001	90
	Bucket Seal Pin	211A8731P004	90
	Bucket Twist	239B5791P004	90
4	Blade Kit, Turbine Rotor - Stage 2	361B6349G001	1
	The above kit consists of following items:		

	Blade Mach Turbine Rotor Stage 2	114E1989P001	90
	Bucket Seal Pin	211A8731P004	90
	Bucket Twist	239B5791P004	90
5	Nozzle Arrangement, Turbien - Stage 1	230C3524G002	1
6	Nozzle Arrangement, Turbien - Stage 1	230C3524G002	1
7	2nd Stage Nozzle Kit	116E2280G020	1
8	2nd Stage Nozzle Kit	116E2280G020	1
9	Stage 1 Shroud With Abradable Coating:		
	Mod. Turbine Shroud Set	116E3618G003	1
	Seal, Cloth	116E1822P007	36
	Seal, Cloth	116E1822P008	36
	Seal, Cloth	116E1822P009	36
	Seal, Cloth	116E1822P010	36
	Seal, Cloth	116E1822P011	36
	Ext Pressurized E Seal	357A1837P003	1
	Pin Dowel	158A5457P006	36
10	Stage 1 Shroud With Abradable Coating:		
	Mod. Turbine Shroud Set	116E3618G003	1
	Seal, Cloth	116E1822P007	36
	Seal, Cloth	116E1822P008	36
	Seal, Cloth	116E1822P009	36
	Seal, Cloth	116E1822P010	36
	Seal, Cloth	116E1822P011	36
	Ext Pressurized E Seal	357A1837P003	1
	Pin Dowel	158A5457P006	36
11	Stage 2 Honey Comb Shroud:		
	Shroud & Seals Stage 2 (Consists of 30 Shroud Segments & Seals)	236C1641G005	1
	Pin Dowel	158A5457P014	30
	Pipe Plug	286A6290P002	30
12	Stage 2 Honey Comb Shroud:		
	Shroud & Seals Stage 2 (Consists of 30 Shroud Segments & Seals)	236C1641G005	1
	Pin Dowel	158A5457P014	30
	Pipe Plug	286A6290P002	30
13	Combustion Liners:		
	Cap and Liner, Combustion	353B4260G001	2
	Cap and Liner, Combustion	353B4260G002	1
	Cap and Liner, Combustion	353B4260G003	6
	Cap and Liner, Combustion	353B4260G004	1
14	Combustion Liners:		
	Cap and Liner, Combustion	353B4260G001	2
	Cap and Liner, Combustion	353B4260G002	1
	Cap and Liner, Combustion	353B4260G003	6
	Cap and Liner, Combustion	353B4260G004	1

15	Transition Piece Assembly:		
	Transition Piece	943E0237G003	10
	TP Packing	158A3820P002	1
	TP Packing	158A3820P002	1
	Support Combustion Chamber	225A8425P001	20
	TP Bolt	225A8257P002	10
	TP Lock Plate	193B7869P003	10
	TP Bolt / Washer	225A8256P001	10
	TP End Seal	256A1893P001	10
	Lock Plate	294A0150P006	20
	Nut, Hex	N204P00035	20
16	Transition Piece Assembly:		
	Transition Piece	943E0237G003	10
	TP Packing	158A3820P002	1
	TP Packing	158A3820P002	1
	Support Combustion Chamber	225A8425P001	20
	TP Bolt	225A8257P002	10
	TP Lock Plate	193B7869P003	10
	TP Bolt / Washer	225A8256P001	10
	TP End Seal	256A1893P001	10
	Lock Plate	294A0150P006	20
	Nut, Hex	N204P00035	20
17	C450 Reduced Camber High Flow IGVs		
	51 N&P (Kit) IGV's (Rack & Ring)	324A3989G002	1
	The above kit consists of the following items:		
	C450 IGV Blades		64
	C450 IGV Ring & Rack, IGV Gear and associated hardware		1
18	C450 Reduced Camber High Flow IGVs		
	C450 Reduced Flow IGV - 2nd Set	324A3989G002	1
	The above kit consists of the following items:		
	C450 IGV Blades		64
	C450 IGV Ring & Rack, IGV Gear and associated hardware		1
19	Inactive Thrust Bearing - 1st Set	239B9746G001	1
20	Inactive Thrust Bearing - 2nd Set	239B9746G001	1
21	High Pressure Packing Brush Seal:		
	Case, Inner Compressor Discharge	112E6976G001	1
	Segment, Brush Seal HP	362A3468P014	1
	Hex. Head Cap Screw & Bolt	N14TP35040	4
	Pin, Dowel Hard & Grind	N507P04432	2
	Screw Hex. Socket Head	128C7765P001	7
	Wire Locking Insert	N926BP00329	7

	Screw, Set	227C9369P003	2	
22	High Pressure Packing Brush Seal:			
	Case, Inner Compressor Discharge	112E6976G001	1	
	Segment, Brush Seal HP	362A3468P014	1	
	Hex. Head Cap Screw & Bolt	N14TP35040	4	
	Pin, Dowel Hard & Grind	N507P04432	2	
	Screw Hex. Socket Head	128C7765P001	7	
	Wire Locking Insert	N926BP00329	7	
	Screw, Set	227C9369P003	2	
23	Miscellaneous Up-rate items			
	Plug 1St 5/1	248A4777P001	3	
	Plug Bores	192B2915P001	3	
	Case Turbine Hardware	186C1696G003	1	
	Case Turbine consisting of following items:			
a.	Stud Cont	114A8793P073	2	
b.	Stud Cont	114A8793P069	4	
c.	Stud	114A8793P035	8	
	Plug Bores	237B2115P001	3	
	Plug Bores	237B2115P002	1	
	Adapter	193B7194P002	4	
	Pin, Dowel Hard & Grd	N507P01336	4	
	Retainer, Plug	248A4849P001	4	
III	Modification Case Turbine	301C5095G001	1	
a.	Stud Cont	114A8793P075	1	
b.	T/C Arrangement Removable consisting of following Items:			
	Thermocouple, Type K, Type	351A3488P003	2	
	Tc, Type K, Extd	351A3488P022	4	
	Thermocouple	248A4123P092	2	
	Connector, Thermocouple	287A1399P021	4	
c.	Conduit Arrangement Wheelspace TC consisting of following Items:			
	Conduit Air, Wheelspace Tc	813L7880G002	1	
	Conduit Air, Wheelspace Tc	813L7880G003	1	
d.	Chamber Arrangement Combustion Consisting of following Items:			
	Xfire Ret	919B0310P001	20	
	Sealer, Spark Plug	158A5831P001	2	
	Bolt Hx Hd	N14P35028	8	
	Screw, Cap Hex Hd	N14P33032	80	
	Xfire Tube	306A4456G001	10	
	Gasket (Non-Asbestos)	324A9109P107	2	
	Gasket	324A9109P005	10	
	Lock Plate	318A9872P001	80	
e.	Instrument Arrangement Brg1 Consisting of following Items:-			
	Thermocouple	314A5945P002	4	

	B7A17B2 0.75D 0.04T	30120	2
	Tube	348A4081P001	2
	Cable Seal Low Pressure	348A4082P001	2
	Tube	286A6364P001	4
	Tubing Shrinkable	286A6364P007	4
	Epoxy Resin-Hz1	287A7052P001	1
	Junctn Box	302A4582P045	1
	Wire Marker	158A3046P003	1
	Wire Marker	158A3046P004	1
	Tube Clip 0.75 X 1	357A1627P007	4
	Bar	286A6328P010	4
	Tube Connector, Male	156A1075P015	4
	Tube Connector	156A1075P018	2
	Tube Connector	156A1075P014	2
	Tube Connector	156A1075P017	2
	Screw, Cap Hex Hd	N22P21008	4
f	Piping Arrangement Cooling and Sealing Consisting of following items:		
	Orifice	999A0512P084	2
	Gasket, Spiral Wound	N5606P04001G11	4
	Hex Head Cap Screw & Bolt	N14DP33056	16
	Galv. Steel Nut	N260P00035	16
g	Exhaust Thermocouple and Conduit Arrangement consisting of following items:		
	TC, Exhaust Type K,W/Studs	362A1102P022	13
	Cable Thermocouple	361A2327P022	13
	Fitting Tube	287A1399P023	13
	Wrench Torque, Drive End	361A2994P002	1
	Wrench Torque, Drive End	361A2994P003	1
	Wrench Torque	361A2994P007	1
	Shield Radation Assembly, Exhaust Thermocouple	362A1344P013	13
	Washer, Plain	N402P00023	13
	Conduit Arrangement, Exhaust Area	136E6520G002	1
	Haz Mat Conduit Arrangement Exhaust	136E6520G003	2
h	Name Plate, Unit Arrangement consisting of following items:		
	Name Plate, Unit Rating - Unit # 1	249A8115P001	1
	Screw	293A0670P014	4

D.3. Implementation of sampling plan

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Not applicable

SECTION E. Calculation of emission reductions or GHG removals by sinks**E.1. Calculation of baseline emissions or baseline net GHG removals by sinks**

>>

The baseline emissions have been calculated as explained below

The step by step procedure to compute *BE* (baseline emission) is shown below:

$$\text{Heat Rate}_{preproject} = Q_{baseline} * NCV_{baseline} / EG_{Gen,baseline} \quad (1)$$

where:

$\text{Heat Rate}_{preproject}$	Heat rate in kCal / kWh
$Q_{baseline}$	Quantity of fuel consumed in baseline scenario (SCM)
$NCV_{baseline}$	Net Calorific value of the fuel in baseline scenario (kCal/SCM)
$EG_{Gen, baseline}$	Electrical energy generated in baseline (kWh)

$$TEC = \text{Heatrate}_{preproject} * EG_{Gen,average} * 4.186/10^9 \quad (2)$$

Where,

TEC	Total energy content of the fuel in TJ
$\text{Heat Rate}_{preproject}$	Heat rate in pre project scenario kCal/kWh
$EG_{Gen, average}$	Average Gross electricity generated in baseline period in kWh

$$BE = TEC * EF \quad (3)$$

Where,

BE	Baseline emission in tCO ₂ e
TEC	Total energy content of the fuel in TJ
EF	IPCC emission factor of the gas in tCO ₂ e/TJ

E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

The step by step procedure to compute *PE* (project emission) is shown below:

$$\text{Heat Rate}_{project} = (Q_{project} * NCV_{project}) / EG_{Gen,project} \quad (1)$$

where:

$\text{Heat Rate}_{project}$	Reduced heat rate in kCal / kWh
$Q_{project}$	Quantity of fuel consumed in SCM
$NCV_{project}$	Net Calorific value of the fuel in kCal/SCM
$EG_{Gen,project}$	Gross Electrical energy generated in kWh

$$REI = \text{Heat Rate}_{\text{project}} * EG_{\text{Gen average}} * 4.186/10^9 \quad (2)$$

Where,

REI Reduced energy input in TJ

$\text{Heat Rate}_{\text{project}}$ Reduced Heat rate in kCal/kWh

$EG_{\text{Gen average}}$ Average gross Electrical energy generated in base line period in kWh

$$PE = REI * EF \quad (3)$$

Where,

PE Project Emission in tCO₂

REI Reduced energy input in TJ

EF IPCC emission factor of the gas in tCO₂/TJ

E.3. Calculation of leakage

>>

As mentioned in section B.6.1 of registered PDD, the leakage due to the project activity has been considered as zero.

$$LE_y = 0$$

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO ₂ e)	Project emissions or actual net GHG removals by sinks (t CO ₂ e)	Leakage (t CO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO ₂ e)
Total	248641.40	237743.22	0	10858.17

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period	Item	Values estimated in ex-ante calculation of registered PDD
Emission reductions or GHG removals by sinks (t CO ₂ e)	8231 per annum	10858	--	--

E.6. Remarks on difference from estimated value in registered PDD

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The reason for the higher CER during the monitoring period is the best maintenance practices which include

better housekeeping, best operational practices, less human error, all of which have ensured low shutdowns due to tripping of the GTs and higher operational efficiency.

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO ₂ e)	17629 (01/03/2007 to 30/06/2012)	Nil

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Document information

Version	Date	Description
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net anthropogenic GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory		
Document Type: Form		
Business Function: issuance		
Keywords: monitoring report, performance monitoring		