MONITORING REPORT FORM (CDM-MR)*
Version 01 - in effect as of: 28/09/2010

CONTENTS

*as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB54 meeting report, annex 34)

MONITORING REPORT
Version 10 03/10/2012

Energas Varadero Conversion from Open Cycle to Combined Cycle Project
CDM 0918
Third monitoring report (01/07/2008-31/12/2010)
VER. 10

SECTION A. General description of the project activity

A.1. Brief description of the project activity:

The project activity converts an open cycle thermal generation facility into a combined cycle facility that adds approximately 75 MW of generating capacity to Cuba's electric power grid with minimal incremental additions to greenhouse gas (GHG) emissions. For the foreseeable future, the project activity will allow an equivalent capacity of existing (relatively high GHG emitting) generating units supplying the grid to be taken out of service for such things as scheduled maintenance and/or to conserve (increasingly costly) imported fuel. Over the long term, the facility will continue to displace energy produced by other (relatively high GHG emitting) facilities supplying the grid and might also delay the need to construct additional generating capacity, depending on the country's growth in electricity demand.

The Varadero Project involves retrofitting each of 3 existing gas turbines (GTs) with a heat recovery steam generator. All equipment used was standard to the electrical industry anywhere in the world, subject to its availability for use in Cuba. The HRSGs use water drawn from the municipal water supply that is first treated to remove excess minerals that could damage the equipment. The water entering the HRSG absorbs heat from the GT exhaust gases through a series of heat exchangers, and is transformed into high pressure steam. The steam is used to power a steam turbine which in turn drives an electric generator, producing about 75 MW of electric power. The generation capacity available from the steam turbine can be enhanced, if needed, by burning surplus gas in the HRSG boiler to provide a supplementary source of heat. .

The project was completed at the existing Energas Varadero gas plant and power generation facility in early 2003. CDM registration was originally planned as a Prompt Start project but this proved to be impossible and registration was awarded as a regular CDM project. The operation of the plant for over four years before registration eliminates much of the performance risk associated with the project. While planned maintenance and unforeseen circumstances may produce variations in performance, the final amount of emission reduction is expected to be close to the projected level. The combined cycle project was fully implemented and started-up in 2003.

Total emission reductions are calculated in accordance with ACM0007 ver. 01. In this monitoring period the emissions reduction is ER= 639,388 tCO_2

Clarification:

Due to a mistake in PLF calculation of the previous monitoring period (01/01/2008-30/06/2008), which did not take the most conservative between Option 1 and 2, PP voluntarily discounts from this monitoring period the over-issued CER's of 5,180 tCO_2

The final ER after this discount is ER = 639,388 -5,180 = 634,208 tCO_2

ER = 634,208 tCO_2

A.2. Project Participants

Name of Party Involved (*) (host) indicates a host Party	Private and/or Public Entity(ies) Project Participants (*)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Cuba (Host)	Energas S.A.	No
Canada	Sherritt International Corporation	No
United Kingdom of Great Britain and Northern Ireland	Sherritt International Corporation	No
* In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public as the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party (ies) involved is required.		

Energas S.A. is a Cuban joint venture company established in 1997 with shares distributed in three equal parts among UNE, CUPET and Sherritt Utilities Inc.

CUPET (Union Cubapetroleo) is Cuba's state oil entity and is owned by the Government of Cuba. CUPET supplies raw natural gas to Energas at no cost.

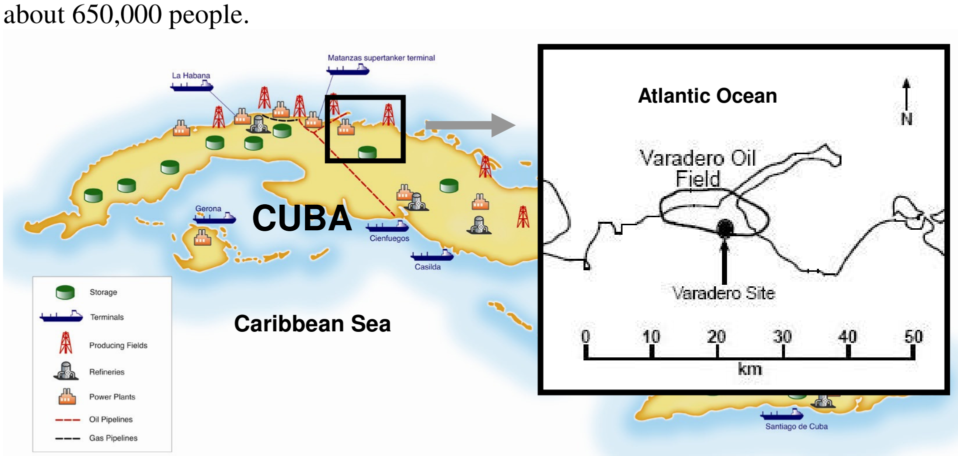
UNE (Union Electrica) is Cuba's national electric utility and is owned by the Government of Cuba. UNE purchase power from Energas at fixed prices under long term contracts.

Sherritt Utilities Inc. is a private company that is a 100% owned subsidiary of Sherritt International Corporation. Sherritt provided 100% of the project financing and technical expertise for the project.

Sherritt International Corporation is a widely held Canadian company which has shares traded on the Toronto Stock Exchange

A.3. Location of the project activity:

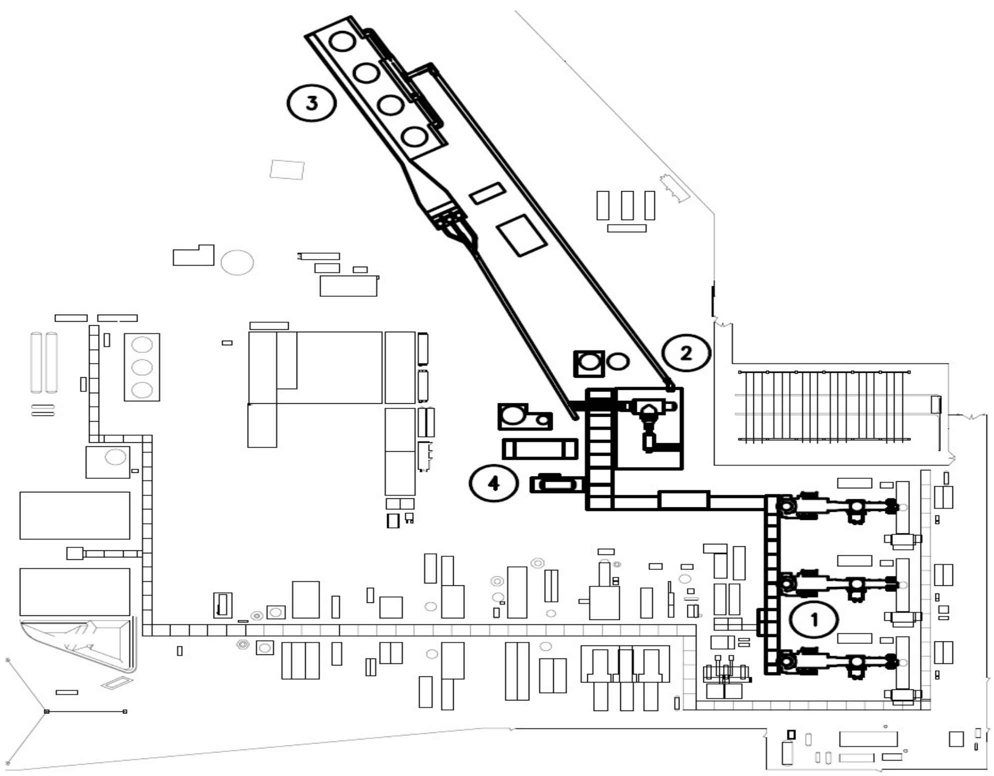
The Varadero Project is south of the town of Varadero, which is 30 km east of the Provincial capital of Matanzas province. Matanzas Province is the second largest province in Cuba, with a population of about 650,000 people.



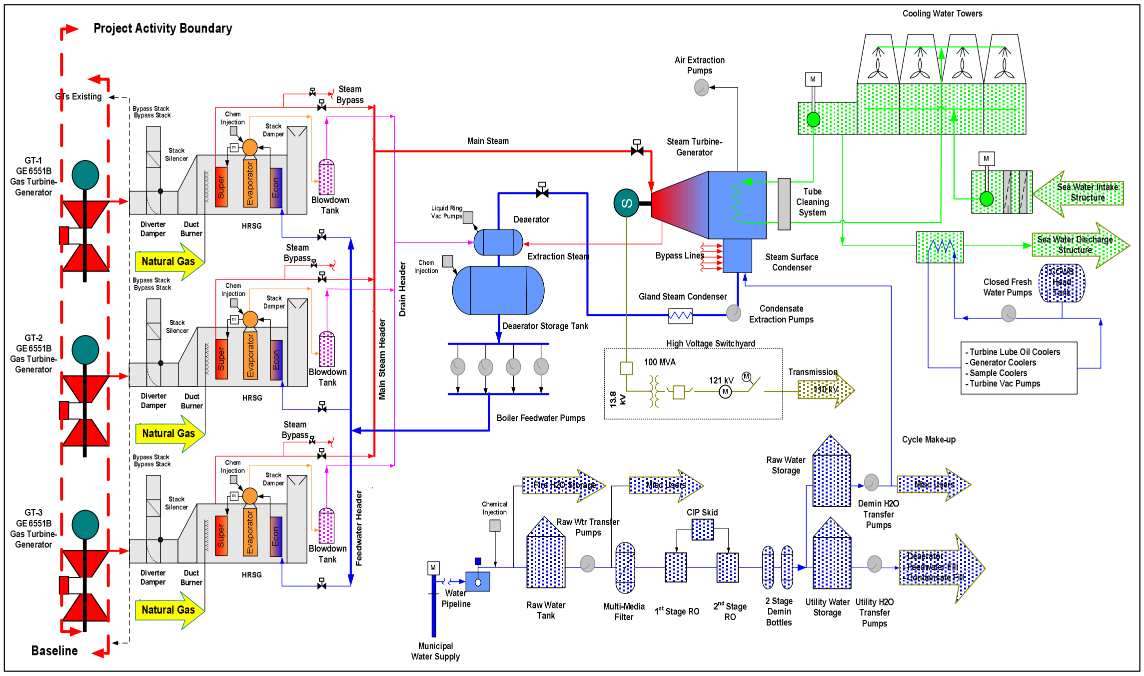
The project activity is located at the existing Varadero power generation facility, indicated on the map above, having the following GPS coordinates: 23°06'51.50" N with 81°17' 23.68" W.

A.4. Technical description of the project

The Varadero Project involves retrofitting each of 3 existing gas turbines (GTs) with a heat recovery steam generator (HRSG marked ❶ on the site diagram below). (See also the boundary diagram below.) All equipment used was standard to the electrical industry anywhere in the world, subject to its availability for use in Cuba. The HRSGs use water drawn from the municipal water supply that is first treated to remove excess minerals that could damage the equipment (water treatment marked ❹ on site diagram). The water entering the HRSG absorbs heat from the GT exhaust gases through a series of heat exchangers, and is transformed into high pressure steam. The steam is used to power a steam turbine (marked ❷ on site diagram) which in turn drives an electric generator, producing about 75 MW of electric power. The generation capacity available from the steam turbine can be enhanced, if needed, by burning surplus gas in the HRSG boiler to provide a supplementary source of heat. .



Varadero Project Site Diagram



Energas Varadero Conversion from Open Cycle to Combined Cycle Project Boundary Diagram

In general, generating electric power using waste heat is environmentally preferable to generation requiring primary combustion of any fuel, including renewable biomass or biogas. Whereas the latter are associated with air emissions and (with the exception of natural gas) solid waste residue, utilizing waste heat has little or no fuel-related emissions.

Steam turbines - like most other thermal generation technologies - require process or "feed" water. In the case of the project activity, this is for the purpose of producing steam. At Varadero the spent steam leaving the steam turbine is condensed and pumped back to the HRSGs to be reused as feed water.

Seawater is used to condense the spent steam and is itself cooled in an evaporative cooling tower (marked ❸ on site diagram). The seawater cooling water forms a partially closed system, with a makeup seawater stream being added to replace evaporative losses and a blowdown stream being returned to the ocean to keep the dissolved solids in the cooling water below the concentration where solids would precipitate out in the cooling tower.

The feed water/steam circuit similarly forms a partially closed system, but there are small but continuous losses (about 4% of the total stream) that must be replaced. The makeup feed water is supplied from the municipal water supply[1] but before it can be used it must be demineralised so that solids are not deposited when the water is evaporated in the HRSGs. The demineralization process concentrates the naturally occurring dissolved solids in the municipal water into a smaller (about 36%) reject water stream, which is then pumped back into the ocean with the seawater cooling water blowdown stream.

Operation of the facility involves a large number of pumps, valves and control equipment to ensure the safe production of electricity, the operation of the demineralised water system and the cooling water system. This equipment at the Varadero plant consumes 5.6 MW of the electrical power produced by

[1] Originally, a well was dug to provide a backup water supply, but groundwater levels were insufficient so the well is not used.

the facility. This figure is based on the average of the first 3 years of operation of the combined cycle project.

Environmental monitoring of the water treatment and effluent discharge processes must be conducted on a continuous basis. Ground water testing is also continuous to ensure no leakage of sea water from the condenser cooling circuit to the water table. Moreover, the equipment and controls must be maintained to a high standard to ensure reliability. Consequently, Energas has undertaken the extensive program of training mentioned earlier, in order to transfer to local staff the skills required to operate and maintain this equipment, record and analyse monitoring data, and respond to operational situations if and when they occur. Cuban staff on-site is progressing towards attaining Canadian trade certification.

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

1. Approved consolidated baseline methodology ACM0007: "Baseline methodology for conversion from single cycle to combined cycle power generation" (Version 01; Sectoral Scope 01; 28 November 2005)

2. Approved consolidated baseline methodology ACM0002: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (Version 06; Sectoral Scope 01; 19 May 2006)

A.6. Registration date of the project activity:

The project has been registered on Jun 22, 2007.

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

The crediting period is 22 Jun 07-21 Jun 14 (renewable)

A.8. Name of responsible person(s)/entity (ies):

Mihai Lincan – OGP Operation Engineer/ Sherritt International
Phone: 403 303 0176
Fax: 403 260 2900
E-mail: mlincan@sherrittpower.com

SECTION B. Implementation of the project activity

B.1. Implementation status of the project activity

The conversion from open cycle to combined cycle project has fully implemented in 2003 and the starting date of the CDM project activity has recorded as Jun 22, 2007.
The entire activity of the project consists in only one site, located in Varadero Plant, and the project has been implemented in one phase.
In the third monitoring period July 2008-December 2010, there were recorded some special events, GT 3 with generator rotor which failed two times in September 2008 and September 2009. The same failure occurred at GT 1 in April 2009 and other than that there were a couple of major inspections on GT 1 and GT 3 as a part of annual maintenance.
The applicability of methodology has not been affected by any situation or occurrence during the monitoring period.

B.2. Revision of the monitoring plan

Monitoring plan has been revised in April 2011 and approved in May 13, 2011.

B.3. Request for deviation applied to this monitoring period

According with the registered PDD the gas consumption for GT's and HRSG's (FGT and FST) has been recorded daily which is not consistent with ACM0007 ver.01, related to recording frequency required for the parameters above mentioned, which requires an hourly recording frequency.. Therefore a deviation request has been raised. The deviation has been incorporated in the request for Revision of the Monitoring Plan which was approved on May 13, 2011, and it has been applied from 01/01/2008 until 31/03/2011.

B.4. Notification or request of approval of changes

Not applicable.

SECTION C. Description of the monitoring system

Monitoring Equipment

The gas input for each turbine and each HRSG is continuously monitored and is recorded hourly. The recording frequency has been changed from April 2011 onwards as a result of deviation from methodology ACM0007 ver.01 because the registered PDD indicated a daily recording frequency. Data are downloaded and consolidated for input to the monitoring data model for periodic verification. Fuel to the GTs is measured with SMAR PDT in conjunction with Rosemount PT. Fuel to the HRSG's is measured with Foxboro Vortex meters as specified in the project design document and recorded in the same manner as the fuel consumption in GT's. These data have been used in this report.

The actual electricity generated by the project net of plant consumption is the basis on which revenues are generated for sales. This is measured by Energas based on ION 7330 meters and delivered to Union Electrica (UNE – Cuba's national electric utility) in order to enable payment for the electricity. All data for deliveries are verified by UNE and the results are countersigned by both parties on invoices. All invoices for the monitoring period have been made available to the DOE for verification.

Parameters Monitored

1) The amount of fuel used to operate the gas turbines in the measurement period;
2) The amount of fuel used for supplementary heat in the HRSGs in the measurement period
3) The net calorific value (NCV) of the natural gas fuel used in the measurement period;
4) The CO_2 emission factor of the natural gas fuel used in the measurement period;
5) The oxidation factor of the natural gas fuel used in the measurement period;
6) The actual net electricity generated by the project in the measurement period
7) The actual electricity (OG) generated by open cycle in a year
8) The actual electricity (CG) generated from waste heat in the steam turbine
9) Net generation capacity (PC) of the project power plant

All of these data are collected from within the plant, and are input to a computer model that does the required calculations.

In addition to these quantifiable parameters for emission calculation, there are a number of monitoring activities that are maintained to ensure that there is no environmental degradation resulting from the project activity and that Cuba continues to receive the planned benefits in areas such as training that were expected from the activity. Most of these activities are on-going, may not be specific to the project activity and often have no quantifiable measures available for them. In such cases, anecdotal evidence will be relied on where available..

Monitoring Procedure

1. Measure power production.
The combined cycle facility is equipped with four Ion 7330 power meters which continuously record the net power shipped. The power sales are totalled daily and recorded. These meters are accurate to within 0.5%.

2. Determine fuel gas consumption associated with the power generation.
The fuel gas feed to the GTs and the combined cycle facility is measured using the equipment described above. During the monitoring period the fuel gas flow was continuously monitored and recorded daily. Since the deviation has been approved, the fuel gas flow consumption would be continuously monitored and recorded hourly as per ACM0007 ver.01 requirements starting with April 01, 2011.

Metering for GTs #1, 2 & 3 allow for precise measurement within the project boundary. Additional AGA 3 compliant meters have been installed to ensure that fuel used outside of the project boundary has been accounted for and excluded. A new meter also allows more accurate measurement of fuel used in the duct burners, resulting in a more precise calculation of gas used by the combined cycle alone.

Gas input to the HRSGs during the monitoring period is continuously monitored and recorded daily using the Foxboro vortex meters described in the registered PDD. The supplementary fuel gas burned in each HRSG increases the total power produced by the combined cycle facility.

3. Determine net calorific value of gas.
The fuel to the combined cycle facility is natural gas produced from Energas's adjacent gas processing facility. The composition of the gas is analyzed at least once a month, using a chromatograph, and then a monthly average is calculated. The net calorific value is calculated monthly and an average net calorific value is used in the calculations which determine the CO_2 emissions for the combined cycle plant.

QUALITY ASSURANCE AND QUALITY CONTROL MEASURES

Monitoring Equipment

The primary purpose of measuring equipment originally installed at the Varadero gas plant was to provide flow indications to assist in the operation of the plant. The same is true of the measuring equipment installed in the combined cycle generating facility. The project developer has endeavored to provide enhanced accuracy in overall measurements where possible to ensure that rigorous flow calculations have been developed.

The power meters and fuel gas meters are replaced when faulty. The ION 7330 meters for measuring power are not required to be calibrated annually. The vendor does not require recertification of these meters unless extraordinary environmental conditions exist. The current transformers in the ION 7330 meters are of metering class accuracy. The transmitters and sensors that measure the flow in the orifice meters for measuring fuel used by the gas turbine generators and the vortex meters that measure fuel used by the HRSGs in the project are all calibrated as specified by the manufacturer.

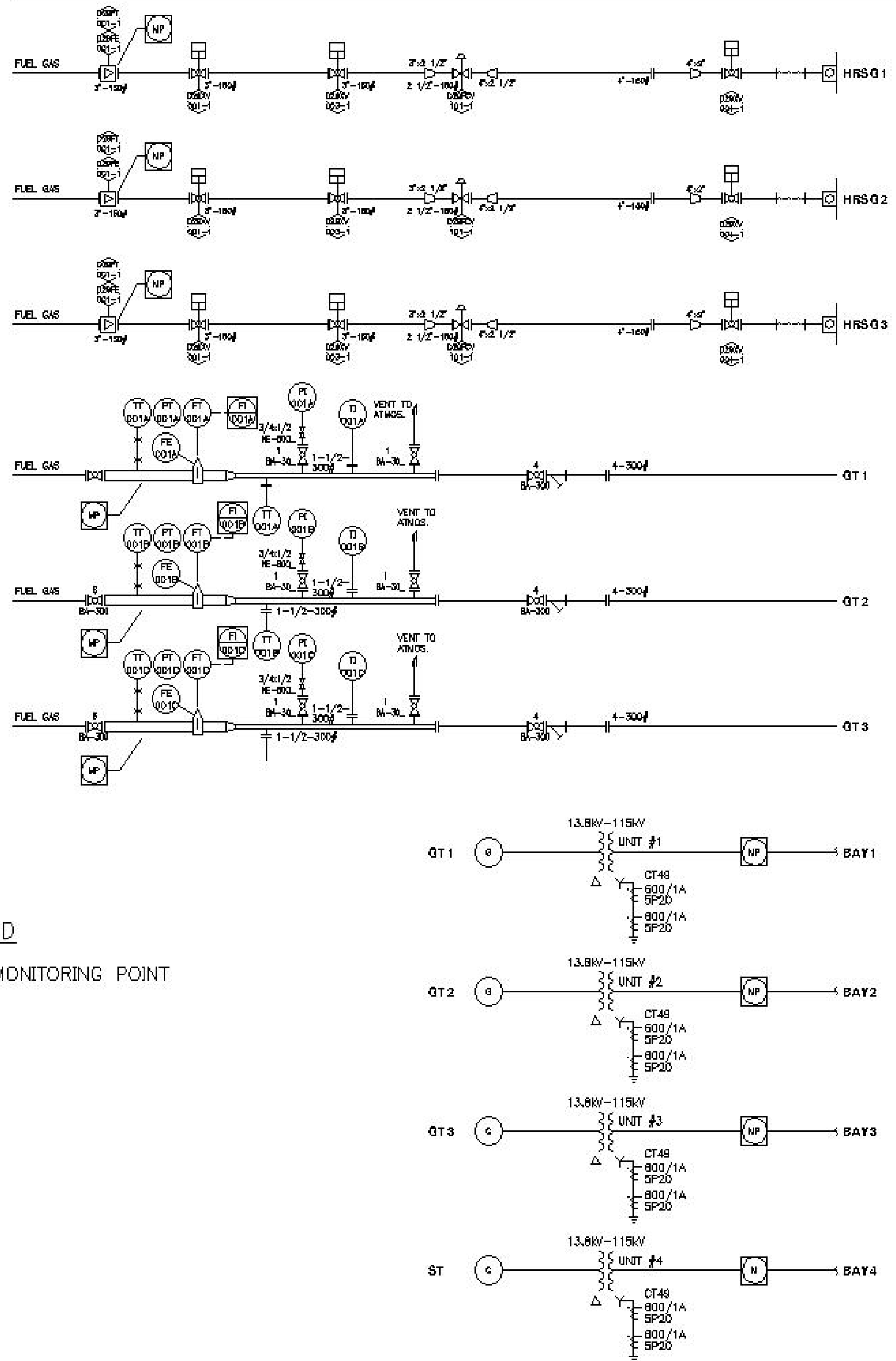
All parameter data are verified during the year or at least once per year. Power deliveries to the grid are measured on-site and verified by UNE for monthly invoicing. The quantity and composition of fuel used by the GTs or the HRSGs are measured continuously and compared with energy balance data throughout the year. Annex 2 is representing the instrumentation used to monitor the parameters, reflecting the calibration and accuracy of the equipment, for the period considered.

Roles and Responsibilities

The operational responsibility for the project activity is under the authority of the Varadero Plant Manager, who reports to Energas senior management. Sherritt International has been authorized by the shareholders of Energas S.A. to make the CDM application in respect of the Varadero project on behalf of Energas and to file CDM Monitoring Reports in relation thereto.

The monitoring points including the flow gas meters are figured in the diagram below.

MONITORING POINT DIAGRAM – VARADERO CC



LEGEND

MP = MONITORING POINT

SECTION D. Data and parameters

D.1. Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors	
Data / Parameter:	w_{OM}
Data unit:	%
Description:	Weighting factor - Operating Margin
Source of data used:	Given by ACM0002
Value(s) :	50
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Additional comment:	

Data / Parameter:	w_{BM}
Data unit:	%
Description:	Weighting factor - Build Margin
Source of data used:	Given by ACM0002
Value(s) :	50
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Additional comment:	

Data / Parameter:	$OXID_{NG,HIS}$
Data unit:	%
Description:	Average Oxidation Factor for natural gas in 3 years before the project activity
Source of data used:	IPCC
Value(s) :	99.5
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Additional comment:	

Data / Parameter:	EF_{grid}
Data unit:	tCO_2/MWh
Description:	Average CO_2 Emission Factor for the grid
Source of data used:	Calculated in PDD
Value(s) :	0.906
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Additional comment:	

Data / Parameter:	$EF_{OC,y}$
Data unit:	tCO_2/MWh

Description:	Average CO_2 Emission Factor for the open cycle plant
Source of data used:	Calculated in PDD
Value(s) :	0.766
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	$HG_{OC,HIST}$
Data unit:	MWh
Description:	Average annual net generation in open cycle in 3 years before project activity
Source of data used:	Metered on-site by Energas
Value(s) :	725,585
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	OC_{HIST}
Data unit:	MW
Description:	Average net capacity of open cycle plant for 3 years before project activity
Source of data used:	Calculated in PDD
Value(s) :	99.23
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	FC_{HIST}
Data unit:	Nm^3
Description:	Average annual fuel used in the GTs for 3 years before the project activity
Source of data used:	Calculated in PDD
Value(s) :	260,872,645
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	OC
Data unit:	MW
Description:	Net capacity of open cycle plant
Source of data used:	Calculated in PDD
Value(s) :	106.2
Indicate what the data are used for (Baseline/ Project/ Leakage emission	Baseline

calculations)	
Additional comment:	

Data / Parameter:	$NCV_{NG,HIST}$
Data unit:	GJ/Nm^3
Description:	Average net calorific value for natural gas in 3 years before project activity
Source of data used:	Calculated in PDD
Value(s) :	0.0346
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	$EF_{CO2,NG,HIST}$
Data unit:	tCO_2/Nm^3
Description:	Average emission factor for natural gas in 3 years before project activity
Source of data used:	Calculated by Energas
Value(s) :	0.0618
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	$F_{i,j}$
Data unit:	l, t, Nm^3
Description:	Amount of fuel used at power sources in the grid in the year
Source of data used:	Union Electrica
Value(s) :	*
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	NCV_i
Data unit:	GJ/t, Nm^3
Description:	Average net calorific value of fuels 'i' used on the grid
Source of data used:	Union Electrica
Value(s) :	**
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	$EF_{CO2,j}$
Data unit:	tCO_2/Gj
Description:	Average CO_2 emission factor for each power source 'j' on the grid
Source of data used:	IPCC

Value(s) :	0.07333
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Average oxidation factor for fuels 'i' used on the grid.
Source of data used:	IPCC
Value(s) :	99
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Additional comment:	

* Extra Heavy Fuel Oil = 381,105 t; Crude 650 = 960,286 t; Fuel Oil – 131,886 t; Crude 1100 = 897,110 t; Crude 1400 = 972,865 t; Natural Gas = 398,432,488 Nm^3
** Extra Heavy Fuel Oil = 40.821 GJ/t; Crude 650 = 40.193 GJ/t; Fuel Oil – 41.868 GJ/t; Crude 1100 = 40.193 GJ/t; Crude 1400 = 40.193 GJ/t; Natural Gas = 0.035 GJ/Nm^3

D.2. Data and parameters monitored	
Data / Parameter:	$\mathbf{FGT_{NG,y}}$
Data unit:	Nm^3
Description:	Consumption of natural gas to operate the gas turbine for Jul 2008-Dec, 2010
Measured /Calculated /Default:	Measured
Source of data:	Metered on site by Energas
Value(s) of monitored parameter:	2008 (Jul-Dec) – 141,179 Nm^3 2009 – 255,083 Nm^3* 2010 – 260,235 Nm^3* *A correction of 2.89% for GT1, 2.16% for GT2 and 1.81% for GT3 has been applied to the measured values, between Dec 09, 2009- Dec 31, 2010.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	Gas input to each turbine is measured continuously and recorded daily. The recording frequency is for the period of 01/01/2008 until 31/03/2011, and has been changed from April 01, 2011onwards for an hourly recording frequency. This deviation has been applied from 01/01/2008 until 31/03/2011. Data are downloaded and consolidated for input to the monitoring data model annually or when periodic

	verification is required. Measure to be used with the GHG Coefficient to calculate project emissions from GTs.
Calculation method (if applicable):	Not Applicable
QA/QC procedures applied:	These data are measured on-site , using SMAR PDT technology, LD301D21IVD 10012A1I3P in modelwith yearly calibration frequency required by manufacturer. The results are compared to energy balance data over the year.

Data / Parameter:	**$FST_{NG,y}$**
Data unit:	Nm^3
Description:	Consumption of natural gas used for supplementary heat in the HRSG for Jul, 2008-Dec, 2010
Measured /Calculated /Default:	Measured
Source of data:	Metered on site by Energas
Value(s) of monitored parameter:	2008 (Jul-Dec) – 21,774 Nm^3 2009 – 29,309Nm^3 * 2010 – 17,869 Nm^3* *A correction of +2%, has been applied to the measured values, between Dec 14, 2009-Dec 31, 2010
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	Gas input to each HRSG is measured continuously, recorded daily. The recording frequency is for the period of 01/01/2008 until 31/03/2011, and has been changed from April 01, 2011 onwards for an hourly recording frequency. This deviation has been applied from 01/01/2008 until 31/03/2011. Data are downloaded and consolidated for input to the monitoring data model annually or when periodic verification is required. Measure to be used with the GHG Coefficient to calculate project emissions from STs.
Calculation method (if applicable):	Not Applicable
QA/QC procedures applied:	These data are measured on-site using Foxboro Model 83W-A03S1SSSTNE-N Vortex meters with pressure and temperature compensation with yearly calibration frequency required by manufacturer. The results are compared to energy balance data over the year.

Data / Parameter:	**$NCV_{NG,y}$**
Data unit:	GJ/Nm^3
Description:	Net Calorific Value of natural gas.
Measured /Calculated /Default:	Measured/Calculated
Source of data:	Measured on site by Energas
Value(s) of monitored	2008 (Jul-Dec) – 0.0363GJ/Nm^3

parameter:	2009 – 0.0365 GJ/Nm³* 2010 – 0.0367 GJ/Nm³ * A correction of + 1% has been applied to the measured values of **NCV** for the month of December 2009
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	Calculation is attached
QA/QC procedures applied:	These data are calculated by Energas based on monthly testing on-site using a chromatographer HP 5890 in model, with no recalibration requirement from manufacturer. The internal re-calibration is performed annually, to confirm the equipment accuracy.

Data / Parameter:	$\mathbf{EF_{CO2,NG,y}}$
Data unit:	tCO_2/GJ
Description:	CO_2 Emission Factor for natural gas
Measured /Calculated /Default:	Measured
Source of data:	Measured
Value(s) of monitored parameter:	2008 (Jul-Dec) – 0.0591 tCO_2/GJ 2009 – 0.0591 tCO_2/GJ* 2010 – 0.0585 tCO2/GJ *A correction of +1% has been applied to the measured values of $\mathbf{EF_{CO2}}$ for the month of December 2009
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	
QA/QC procedures applied:	These data are calculated by Energas based on monthly testing on-site using a chromatographer HP 5890 in model, with no recalibration requirement from manufacturer. The internal re-calibration is performed annually, to confirm the equipment accuracy.

Data / Parameter:	$\mathbf{OXID_{NG,y}}$

Data unit:	%
Description:	Oxidation factor for natural gas
Measured /Calculated /Default:	Default
Source of data:	IPCC
Value(s) of monitored parameter:	100%
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Project
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable since is a default value.
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	
QA/QC procedures applied:	These data are provided by IPCC 2006

Data / Parameter:	**PG_y**
Data unit:	MWh
Description:	Actual electricity generated by project in the year, and represents the sum of power sold trough Bay1 to Bay 4.
Measured /Calculated /Default:	Measured
Source of data:	Metered
Value(s) of monitored parameter:	2008 (Jul-Dec) – 632,812 MWh 2009 – 1,029,253 MWh 2010 – 1,054,192 MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	Measured continuously and recorded daily
Calculation method (if applicable):	
QA/QC procedures applied:	These data are measured on-site by Energas, based on ION 7330 meters having a 10 years calibration frequency as specified by the supplier of equipment. The results are cross-checked with UNE power sale invoices.

Data / Parameter:	**OG_y**

Data unit:	MWh
Description:	Actual electricity generated by open cycle in the year
Measured /Calculated /Default:	Calculated
Source of data:	ACM0007 ver 01 provide calculation formula
Value(s) of monitored parameter:	2008 (Jul-Dec) – 399,017 MWh 2009 – 739,035 MWh 2010 – 725,585 MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	This parameter is measured continuously and recorded daily.
Calculation method (if applicable):	According with methodology the formula used for calculation is $OG_y = PLF_y \times OC_y \times T$ where $PLF_y = \frac{HG_{OC,HIST,y}}{OC_{HIST,y} \times 8760}$ Or $PLF_y = \frac{PG_y}{PC \times 8760}$ The most conservative value of PLF is used in OG calculation formula. OG_y Calculated values are verified against the metered values.
QA/QC procedures applied:	These data are measured on-site by Energas, based on ION 7330 meters having a 10 years calibration frequency as specified by the supplier of equipment. . The most conservative value of OG between the calculated and the metered values is used to calculate BE_y

Data / Parameter:	**CG_y**
Data unit:	MWh
Description:	Actual electricity generated from waste heat use in steam turbine
Measured /Calculated /Default:	Calculated
Source of data:	ACM0007 ver 01 provides calculation formula
Value(s) of monitored parameter:	2008 (Jul-Dec) –233,795 MWh 2009 –290,218 MWh 2010 –328,607 MWh
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline

Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Not applicable since this parameter is calculated by formula.
Measuring/ Reading/ Recording frequency:	Monthly
Calculation method (if applicable):	According with the methodology the formula used for calculation is $CG_y = PG_y - OG_y$
QA/QC procedures applied:	

Data / Parameter:	**PC**
Data unit:	MW
Description:	Net generation capacity of the project power plant
Measured /Calculated /Default:	Measured
Source of data:	Annual records from UNE
Value(s) of monitored parameter:	160 MW
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	Baseline
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Details provided in Annex 2
Measuring/ Reading/ Recording frequency:	Annually
Calculation method (if applicable):	
QA/QC procedures applied:	These data are recorded by UNE

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

The formula to be used for the calculation of baseline emissions is as follows:

$$BE_y = (EF_{OC,y} * OG_y) + (EF_{grid,y} * CG_y)$$

Where $EF_{OC,y}$ is the emission factor for the plant operating in open cycle mode, OG_y is the electricity generated by the plant operating in open cycle for the period y, $EF_{OC,y}$ is the emission factor for the open cycle operation as calculated and fixed ex ante in the PDD, $EF_{grid,y}$ is the emission factor for the electricity grid as calculated and fixed ex ante in the PDD and CG_y is the electricity generated from the use of waste heat in the period. Detailed derivations of these parameters are in the PDD at the following web site: http://cdm.unfccc.int/Projects/DB/DNV-CUK1170423186.13/view.html

For the specific monitoring period 01st Jul 2008 – 31st Dec 2010 detailed calculation is provided in Annex 2 related to each of the above mentioned periods.

<u>July-December 2008</u>

Baseline emissions are BE = (0.766*399,017) + (0.906*233,795) = 517,465 tCO_2 (after rounded down)

<u>January-December 2009</u>

Baseline emissions are BE = (0.766*739,035) + (0.906*290,218) = 829,038 tCO_2 (after rounded down)

<u>January-December 2010</u>

Baseline emissions are BE = (0.766*725,585) + (0.906*328,607) = 853,516 tCO_2 (after rounded down)

E.2. Project emissions calculation

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The emissions associated with the project activity (PE_y) are calculated for each period as outlined in the registered PDD. As per that document and the two approved methodologies used to prepare it, the project emissions are calculated as follows:

$PE_y = (FGT_{NG,y} + FST_{NG,y}) * COEF_{NG,y}$

$COEF_{NG,y} = NCV_{NG} * EF_{CO2,NG} * OXID_{NG}$

Where: $FGT_{NG,y}$ is the amount of natural gas (in Nm^3) used to operate the gas turbines at the project in period *y* and $FST_{NG,y}$ is the amount of natural gas (in Nm^3) used to add supplementary heat in the HRSG for production of steam to operate the steam generator at the project in the period *y*. $COEF_{NG,y}$ is the CO_2 coefficient for natural gas used in the project, in tCO_2/Nm^3 as described in the PDD, based on the heat content (NCV) the emission factor (EF) and oxidation factor (OXID) of the fuel.

Detailed calculation is provided in Annex 2 for all the factors involved. Subsequently Project emissions are as follows:

<u>July -Dec 2008</u>

$COEF_{NG} = NCV_{NG} * EF_{CO2,NG} * OXID_{NG}$

$COEF_{NG}$ = 0. 0362721* 0.0590767*1.000 = 0.002142832

PE = (141,179 + 21,774)*0.002142832*1,000 = 349,181 tCO_2 (after rounded up)

PE = 349,181 tCO_2

<u>Jan-Dec 2009</u>

$COEF_{NG} = NCV_{NG} * EF_{CO2,NG} * OXID_{NG}$

$COEF_{NG}$ = 0.0365234* 0.0590863*1.000 = 0.002158035

PE = (255,083 +29,309)*0.002158035*1,000 = 613,729 tCO_2 (after rounded up)

PE = 613,729 tCO_2

Jan-Dec 2010

$COEF_{NG} = NCV_{NG} * EF_{CO2,NG} * OXID_{NG}$

$COEF_{NG}$ = 0.0367385* 0.0585019*1.000 = 0.002149272

PE = (260,235 + 17,869)*0.002149272*1,000 =597,721 tCO_2 (after rounded up)

PE = 597,721 tCO_2

E.3. Leakage calculation

ACM0007 specifies that leakage (L_y) during construction need not be considered and that CH_4 emissions can be ignored if project proponents demonstrate that these are a negligible fraction of the baseline. A review of possible leakage at the project indicated that this represented less than 0.03% of the total estimated project emissions. The methodology excludes CH_4 emissions from the baseline and the project emission calculations as a simplification since they are assumed to be very small. The approved monitoring methodology specifically states that no data are required as Leakage is assumed negligible. [ACM0007 ver.01 page 15].
L=0 tCO_2

E.4. Emission reductions calculation / table

According with the Annex 2 where the fully calculation is provided for the monitoring period of 01st Jul 2008-31st Dec, 2010 the emissions reductions are as follows:

Total emission reductions

ER = BE-PE- L

July-Dec 2008

ER = 517,465–349,181–0= 168,284 tCO_2

ER = 168,284 tCO_2

Jan-Dec 2009

ER = 829,038–613,729–0= 215,309 tCO_2

ER = 215,309 tCO_2

Jan-Dec 2010

ER = 853,516–597,721–0= 255,795 tCO_2

ER = 255,795 tCO_2

Total emission reductions is ER =168,284 +215,309+255,795 = 639,388 tCO_2

ER = 639,388 tCO_2

Clarifications:

1) Since the calibration certificates for Fluke and Crystal devices could not be provided, the maximum allowable error of +2% has been applied to FST values, since December 14, 2009 until December 31, 2010. That resulted in a conservative value of the ER calculation.

2) For the same reason a correction of 2.89% for GT1, 2.16% for GT2 and 1.81% for GT3 has been applied to FGT values from December 09, 2009 until December 31, 2010.It has been demonstrated that the SMAR PDT plus Rosemount PT& TT maximum resulted error by measurement will conduct to maximum values of the gas flow and conservative values for ER, instead to apply individually the maximum allowable for error for Rosemount TT&PT and SMAR PDT.

3) A correction has been applied to the NCV and $EFCO_2$ values measured in December 2009, according to the maximum permissible error of the gas chromatograph (1%), due to a calibration delay identified from the period 21/11/2009-12/01/2010. The correction has been applied only for December 2009, because all the measured values taken during the period between the scheduled date of calibration (21/11/2009) and the actual date of calibration (12/01/2010) correspond to 03/12/2009, 18/12/2009 and 29/12/2009.

4) Due to a mistake in PLF calculation of the previous monitoring period (01/01/2008-30/06/2008), which did not take the most conservative between Option 1 and 2, PP voluntarily discounts from this monitoring period the over-issued CER's of 5,180 tCO_2

The final ER after this discount is ER = 639,388 - 5,180 = 634,208 tCO_2

ER = 634,208 tCO_2

E.5. Comparison of actual emission reductions with estimates in the CDM-PDD

Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO_2e)	**172,524 (for 184 days in Jul-Dec 2008) 342,235 (for a year) The total amount of estimated ER's equivalent to the corresponding period would be the result of 172,524+342,235x2= 856,994**	**The total is = 639,388 The final ER's after discount is = 634,208 please see the clarification 4) in section above (E4)**

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

The significant decrease in ER for the monitoring period compared with project calculation is due to fuel gas availability and PLF error in the previous MR.

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Annex 1

Monitored Parameters

July 1, 2008 – December 31, 2008

Parameter *Month*	**FGT_{NG} $N10^3m^3$**	**FST_{NG} $N10^3m^3$**	**NCV_{NG} GJ/Nm^3**	**$EF_{CO2.NG}$ tCO_2/GJ**	**$OXID_{NG}$ %**	**CG MWh**	**OG MWh**	**PG MWh**	PC MW
July 2008	23,658	3,721	0.0363	0.0589	1.000	39,489	64,480	103,969	160
August 2008	24,097	3,976	0.0365	0.0588	1.000	41,787	68,232	110,019	160
September 2008	19,843	3,067	0.0364	0.0590	1.000	25,954	59,637	85,591	160
October 2008	24,232	3,794	0.0362	0.0591	1.000	41,452	67,687	109,139	160
November 2008	24,113	3,518	0.0362	0.0592	1.000	41,526	67,806	109,332	160
December 2008	25,236	3,699	0.0360	0.0595	1.000	43,588	71,174	114,762	160
Total / Average	**141,179**	**21,774**	**0.0363**	**0.0591**	**1.000**	**233,795**	**399,017**	**632,812**	160

Monitored Parameters

January 1, 2009 – December 31, 2009

Parameter *Month*	**FGT_{NG} $N10^3m^3$**	**FST_{NG} $N10^3m^3$**	**NCV_{NG} GJ/Nm^3**	**$EF_{CO2.NG}$ tCO_2/GJ**	**$OXID_{NG}$ %**	**CG MWh**	**OG MWh**	**PG MWh**	PC MW
January 2009	23,185	2,903	0.0363	0.0592	1.000	35,077	61,625	96,702	160
February 2009	22,825	676	0.0361	0.0594	1.000	33,048	58,098	91,146	160
March 2009	23,207	2,218	0.0363	0.0594	1.000	36,257	61,625	97,882	160
April 2009	16,247	2,551	0.0363	0.0593	1.000	10,300	59,637	69,937	160
May 2009	22,069	2,524	0.0366	0.0591	1.000	20,799	61,625	82,424	160
June 2009	18,259	2,275	0.0365	0.0590	1.000	14,215	59,637	73,852	160
July 2009	24,552	3,562	0.0365	0.0589	1.000	40,740	66,523	107,263	160
August 2009	23,506	3,847	0.0365	0.0589	1.000	29,700	61,625	91,325	160
September 2009	19,351	3,334	0.0366	0.0591	1.000	25,706	59,637	85,343	160
October 2009	16,716	744	0.0366	0.0591	1.000	-13,550	61,625	48,075	160
November 2009	21,069	1,303	0.0368	0.0585	1.000	16,441	59,637	76,078	160
December 2009	24,095	3,372	0.0371	0.0590	1.000	41,485	67,741	109,226	160
Total / Average	**255,083**	**29,309**	**0.0365**	**0.0591**	**1.000**	**290,218**	**739,035**	**1,029,253**	160

Monitored Parameters

January 1, 2010 – December 31, 2010

Parameter *Month*	**FGT_{NG} $N10^3m^3$**	**FST_{NG} $N10^3m^3$**	**NCV_{NG} GJ/Nm^3**	**$EF_{CO2.NG}$ tCO_2/GJ**	**$OXID_{NG}$ %**	**CG MWh**	**OG MWh**	**PG MWh**	**PC MW**
January 2010	22,298	2,419	0.0367	0.0586	1.000	27,390	61,625	89,015	**160**
February 2010	21,186	878	0.0368	0.0587	1.000	29,441	55,661	85,102	**160**
March 2010	23,830	1,289	0.0368	0.0585	1.000	37,737	61,625	99,362	**160**
April 2010	22,205	1,018	0.0368	0.0583	1.000	32,574	59,637	92,211	**160**
May 2010	22,296	832	0.0369	0.0589	1.000	29,186	61,625	90,811	**160**
June 2010	20,670	1,827	0.0368	0.0584	1.000	21,253	59,637	80,890	**160**
July 2010	22,796	1,604	0.0368	0.0584	1.000	32,706	61,625	94,331	**160**
August 2010	23,707	1,242	0.0368	0.0583	1.000	37,428	61,625	99,053	**160**
September 2010	16,003	2,323	0.0368	0.0583	1.000	7,805	59,637	67,442	**160**
October 2010	19,561	1,298	0.0366	0.0583	1.000	11,245	61,625	72,870	**160**
November 2010	21,612	1,758	0.0366	0.0584	1.000	26,787	59,637	86,424	**160**
December 2010	24,071	1,381	0.0363	0.0587	1.000	35,056	61,625	96,681	**160**
Total / Average	**260,235**	**17,869**	**0.0367**	**0.0585**	**1.000**	**328,607**	**725,585**	**1,054,192**	**160**

Where: FGT_{NG} = Consumption of natural gas to operate the gas turbines in the period in $N10^3m^3$

FST_{NG} = Consumption of natural gas for supplementary heat in the HRSGs in the period in $N10^3m^3$.

NCV_{NG} = Net calorific value of natural gas used in GJ/Nm^3.

$EF_{CO2,NG}$ = Emission factor of natural gas used in tCO_2/GJ.

$OXID_{NG}$ = Oxidation factor of natural gas used as provided by the IPCC, expressed as a %.

CG = Net electricity generated by the combined cycle steam generator in MWh.

OG = Net electricity generated by the gas turbines in open cycle in MWh.

PG = The actual electricity generated by project MWh

PC = Net capacity of the power plant according with UNE records

Annex 2

Parameter	*Source*	*Equipment description*	*Manufacturer*	*Model*	*Serial number*	*Installed date*	*Calibration date*	*Calibration frequency*	*Accuracy*
FGT_{NG}	GT1	Differential Pressure Transmitter	SMAR	LD301D21IVD 10012A1I3P	177898-03	October 1998	Dec 26,2007 Dec 18,2008 Dec 09,2009 Feb 10,2010 Nov 04,2011	yearly	± 0.075%
		Pressure Transmitter	Rosemount	3051PG5	unreadable	December 1998	Dec 26,2007 Dec 18,2008 Dec 09,2009 Nov 02,2010 Nov 04,2011	yearly	± 0.15%
		Temperature Transmitter	Rosemount	00G5A11D080 N0385E1X1X7	1605982	December 1998	Dec 26,2007 Dec 18,2008 Dec 09,2009 Nov 02,2010 Nov 04,2011	yearly	±0.18°F
FGT_{NG}	GT2	Differential Pressure Transmitter	SMAR	LD301D21IVD 10012A1I3P	154040	October 1998	Jan 08,2008 Dec17,2008	yearly	± 0.075%

*as contained within the document entitled "Guidelines for completing the monitoring report form (CDM-MR)" (EB54 meeting report, annex 34)

							Dec 09,2009 Feb 10,2010 Nov 04,2011		
		Pressure Transmitter	Rosemount	3051PG5	Unreadable	1998	Jan 08,2008 Dec 17,2008 Dec 09,2009 Nov 02,2010 Nov 04,2011	yearly	± 0.15%
		Temperature Transmitter	Rosemount	00G5A11D080 N0385E1X1X7	1605980	1998	Jan 08,2008 Dec 17,2008 Dec 09,2009 Nov 02,2010 Nov 04,2011	yearly	±0.18°F
FGT_{NG}	GT3	Differential Pressure Transmitter	SMAR	LD301D21IVD10012A1I3P	200263	1998	Dec 28,2007 Dec 17,2008 Dec 09,2009 Feb 10,2010	yearly	± 0.075%

							Nov 04,2011		
		Pressure Transmitter	Rosemount	3051PG5	unreadable	1998	Dec 28, 2007 Dec 17,2008 Dec 09,2009 Nov 02,2010 Nov 04,2011	yearly	± 0.15%
		Temperature Transmitter	Rosemount	00G5A11D080 N0385E1X1X7	1605981	1998	Dec 28, 2007 Dec 17,2008 Dec 09,2009 Nov 02,2010 Nov 04,2011	yearly	±0.18°F
FST_{NG}	HRSG1	Flow Transmitter	Foxboro	83W-A03S1SSTNE-N	98382301	2002	Dec 18, 2007 Dec 16,2008 Dec 14,2009 Dec 08,2010 Nov 04,2011	yearly	±1% (RD≥ 20000) ± 2% (RD= 5000-20000)

FST_{NG}	HRSG2	Flow Transmitter	Foxboro	83W-A03S1SSTNE-N	98382299	2002	Dec 18, 2007 Dec 16,2008 Dec 14,2009 Dec 08,2010 Nov 04,2011	yearly	±1% (RD≥ 20000) ± 2% (RD= 5000-20000)
FST_{NG}	HRSG3	Flow Transmitter	Foxboro	83W-A03S1SSTNE-N	98382300	2002	Dec 18, 2007 Dec 16,2008 Dec 14,2009 Dec 08,2010 Nov 04,2011	yearly	±1% (RD≥ 20000) ± 2% (RD= 5000-20000)
PG	BAY 1	Energy Meter	Power Logic	ION 7330	PB-0308A151-11	Jun 2005	Aug 13,2003	10 years	±0.5%.
		Energy Meter	Power logic	ION 7330	PB-0804A559-11	Sep 16 2008	Apr 24,2008	10 years	±0.5%.
PG	BAY2	Energy Meter	Power Logic	ION 7330	PB- 0308A 149-11	June 2006	Aug 13,2003	10 years	±0.5%
		Energy Meter	Power Logic	ION 7330	PB-0902A148-11	Aug 03 2009	Feb 10,2009	10 years	±0.5%.
PG	BAY 3	Energy Meter	Power Logic	ION 7330	PB-0604A348-11	Dec 2007	Apr 24,2006	10 years	±0.5%
		Energy Meter	Power Logic	ION 7330	PB-0605A116-11	Oct 2008	May 24,2006	10 years	±0.5%.

		Energy Meter	Power Logic	ION 7330	PB-0604A347-11	Aug 06, 2009	Apr 23,2006	10 years	±0.5%.
PG	BAY 4	Energy Meter	Power Logic	ION 7330	PB - 0308A150-11	Nov 2005	Aug 13,2003	10 years	±0.5%
		Energy Meter	Power Logic	ION 7330	PB-0911A606-11	May 20, 2010	Nov 20,2009	10 years	±0.5%.
$NCV_{NG, y}$	Net calorific value determined by laboratory analysis	Gas Chromatograph	HP	5890	3303A50915	Feb 20, 2007	Jan 23, 2008 Sep 26,2008 Nov 21,2008 Jan 12,2010	yearly	± 1%

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History of the document

Version	Date	Nature of revision
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory **Document Type**: Guideline, Form **Business Function**: Issuance		