



**Monitoring report form for CDM project activity
(Version 07.0)**

Complete this form in accordance with the instructions attached at the end of this form.

MONITORING REPORT

Title of the project activity	Associated Gas Recovery and Utilization at Block 9	
UNFCCC reference number of the project activity	6817	
Version number of the PDD applicable to this monitoring report	6.0	
Version number of this monitoring report	01	
Completion date of this monitoring report	02/07/2019	
Monitoring period number	1 st monitoring period	
Duration of this monitoring period	31/12/2013-31/12/2018	
Monitoring report number for this monitoring period	01	
Project participants	The Government of the Sultanate of Oman, represented by the Ministry of Oil & Gas Oman Trading International	
Host Party	Oman	
Applied methodologies and standardized baselines	AM0009 "Recovery and utilization of gas from oil wells that would otherwise be flared or vented" (Version 06.0.0)	
Sectoral scopes	Sectoral scope 10: Fugitive emission from fuels (solid, oil, gas).	
Amount of GHG emission reductions or net anthropogenic GHG removals achieved by the project activity in this monitoring period	Amount achieved before 1 January 2013	Amount achieved from 1 January 2013
	0 tCO ₂ e	3,547,792 tCO ₂ e
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the PDD	3,663,133 tCO ₂ e	

SECTION A. Description of project activity

A.1. General description of project activity

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The Associated Gas Recovery and Utilization at Block 9 project (hereafter referred to as the Project) is located at Safah oil field, A'Dhahirah Region, The Sultanate of Oman. The project is operated by Occidental of Oman Inc. under a development and production sharing agreement with the Ministry of Oil and Gas.

The recovery process comprises three main stages including the separation stage where gas is separated from oil and water, the compression stage where gas is compressed for transportation to gas plant, and the processing stage where gas is processed to fit with conditions of gas pipeline for further transportation to end-users. Main equipment necessary for the proposed project activity comprises electric motor-driven reciprocating and screw compressors installed at several locations on site, and a network of pipelines for gas transportation.

The scenario existing prior to the start of the implementation of the proposed project activity is flaring of associated gas at the oil production site, the operation of the existing oil and gas infrastructure without processing of any recovered associated gas, and the use of gas-lift gas from the same source and quantity as under the project activity in the gas-lift system. The baseline scenario is the same as the scenario existing prior to the start of implementation of the proposed project activity. The project reduces greenhouse gases emissions as the utilization of recovered gas displaces the use of non associated gas or other fossil sources at end-users.

The total estimated amount of associated gas to be recovered during crediting period is about 2.1 billion m³ while average methane content is estimated at about 70%. The project activity is expected to reduce emissions by approximately 775,250 tonnes of CO₂ equivalent annually over the crediting period.

A.2. Location of project activity

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The proposed project is located at Block 9, Safah oil field in A'Dhahirah Region of Northern Oman. Approximate coordinates of Safah gas processing plant are east longitude of 55°27'40" and north latitude of 23°11'20". The project includes four other locations: Far West (23°09'11"N, 55°27'03"E), Satellite (23°10'39"N, 55°29'52"E), Jalal (22°55'50"N, 55°48'16"E), and Wadi Latham (22°52'50"N, 55°48'16"E).

A.3. Parties and project participants

Parties involved	Project participants	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Oman (Host)	The Government of the Sultanate of Oman, represented by the Ministry of Oil & Gas	No
United Arab Emirates	Oman Trading International	No

A.4. References to applied methodologies and standardized baselines

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AM0009: Recovery and utilization of gas from oil wells that would otherwise be flared or vented (Version 06.0.0);

Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 1);

Tool for the demonstration and assessment of additionality (Version 06.1.0).

For more information, please refer to:

<http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html>.

A.5. Crediting period type and duration

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The project has been registered on 31 Dec 12.

The fixed crediting period is chosen by the project which is from 31/12/2013 to 30/12/2020.

The first monitoring period is: 31/12/2013 – 31/12/2018.

SECTION B. Implementation of project activity

B.1. Description of implemented project activity

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The project activity mainly comprises the installation of compressor packages at five different locations, including compressor, motor, scrubbers, suction and discharge bottles, coolers, as well as installation of a pipeline network.

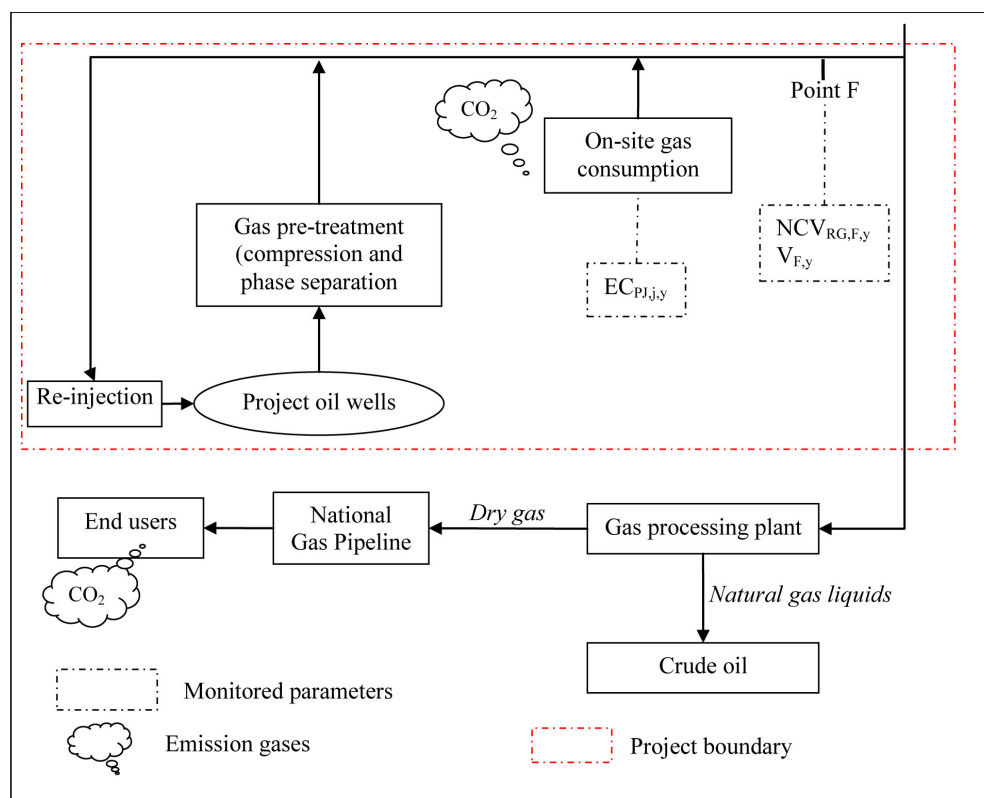


Figure 1 Flow diagram of the project boundary

B.2. Post-registration changes

B.2.1. Temporary deviations from the registered monitoring plan, applied methodologies, standardized baselines or other methodological regulatory documents

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Not applicable.

B.2.2. Corrections

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Not applicable.

B.2.3. Changes to the start date of the crediting period

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The crediting period was changed from 01/01/2013 – 31/12/2019 to 31/12/2013 – 30/12/2020 (Fixed)

B.2.4. Inclusion of monitoring plan

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Not applicable.

B.2.5. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other methodological regulatory documents

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Not applicable.

B.2.6. Changes to project design

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Not applicable.

B.2.7. Changes specific to afforestation or reforestation project activity

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Not applicable.

SECTION C. Description of monitoring system

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The monitoring of the emission reductions will be carried out according to the scheme shown in below Figure 2. The overall responsibility for the monitoring process will be held by the Monitoring Officer which will be selected among senior staff of the operating entity on-site. Some of the monitoring tasks will be delegated as indicated Figure 2. Measurements of the associated gas volumes recovered and project electricity consumption will fall under the responsibility of lead operators at each location who report to the Central Production Facility.

The monitoring officer will be responsible for collecting and performing plausibility check of the measurements. The monitoring reports and calculation of emission reductions will be prepared by experienced CDM consultant. The selection procedure, tasks and responsibilities of the monitoring officer are detailed as below:

Selection procedure:

The monitoring officer will be appointed by the general manager of the entity operating the project. The monitoring officer will be selected from among the senior technical or managerial staff.

Tasks and responsibilities:

The monitoring officer will be responsible for carrying out the following tasks:

- Supervise and verify metering and recording: The monitoring officer will coordinate with the lead operators at each location to ensure and verify adequate metering and recording of volumes of gas recovered at each location. The monitoring officer will also coordinate with the lab at Safah gas plant to ensure proper measurement of net calorific values of recovered gas.

- Collect data: The monitoring officer will collect volumes of recovered associated gas and net calorific values.
- Monitoring report The monitoring officer will coordinate with CDM consultant to prepare periodic monitoring reports including calculation of emission reductions on the basis of measured results. The monitoring officer will be provided with a calculation template in electronic form by the project's CDM advisors

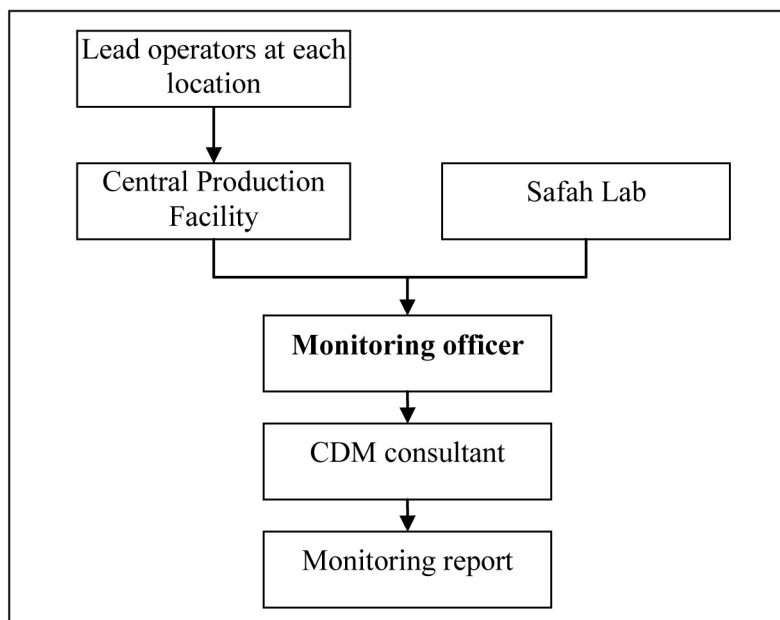


Figure 2 Responsibilities for measurements and reporting emission reductions

Monitoring of volume of recovered gas ($V_{F,y}$)

Gas flow meters at each location will measure volumes of recovered gas after pre-treatment and after part of the recovered gas is used on-site. The total value for parameter $V_{F,y}$ will be equal to the sum of volumes of recovered gas at each location.

Monitoring Net calorific value of recovered gas ($NCV_{RG,F,y}$)

The net calorific value (volume based) of the recovered gas in TJ/standard cubic meter will be calculated according to the following method:

$$NCV_{RG,F,y} = \frac{\sum(X_i \times NCV_i)}{\sum(X_i)}$$

X_i = molar fraction of the individual component i in the recovered gas sample at least monthly.

NCV_i = Net Calorific Value (volume based) of the individual component i as per ISO/DP 6976:1995 standard for a combustion reference temperature of 25°C and the same metering reference condition used for parameter $V_{F,y}$.

Monitoring of electricity consumption $EC_{PJ,j,y}$

Electricity meters will measure electricity consumed by equipment at each project location. The total value for parameter $EC_{PJ,j,y}$ will be equal to the sum of electricity consumption at each location.

Emergencies:

In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the following procedure for declaring the emergency period to be over:

1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.

2. The monitoring officer will sign a statement declaring the emergency situation has ended and normal operations have resumed.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante

(Copy this table for each data or parameter.)

Data/Parameter	EFCO ₂ ,Methane		
Unit	tCO ₂ /TJ		
Description	CO ₂ emission factor for methane		
Source of data	Calculated in line with procedures and data presented in ISO 6976:		
	Unit	Value	Source
	Carbon Content of Methane	12,011 kg/kmol	ISO 6976: Table 1
	CO ₂ Emission Factor for Methane	44.01 kg/kmol	ISO 6976: Table 1
Source of data	NCV of Methane (at 25°C)	802.60 kJ/mol	ISO 6976: Table 3
Value(s) applied	54.834 tCO ₂ /TJ		
Choice of data or measurement methods and procedures	ISO 6976:		
Purpose of data/parameter	Calculation of baseline emissions		
Additional comments	---		

Data/Parameter	TDL _{j,y}		
Unit	-		
Description	Average technical transmission and distribution losses for providing electricity to source j year y		
Source of data	"Tool to calculate baseline, project and/or leakage emissions from electricity consumption";		
Value(s) applied	0		
Choice of data or measurement methods and procedures	Scenario B "Electricity consumption from an off-grid captive power plant" of the "Tool to calculate baseline, project and/or leakage emission from electricity consumption" applies.		
Purpose of data/parameter	Calculation of project emissions		
Additional comments	---		

Data/Parameter	EF _{EL,j,y}		
Unit	tCO ₂ /yr		
Description	Emission factor for electricity generation for source j in year y		
Source of data	"Tool to calculate baseline, project and/or leakage emissions from electricity consumption";		
Value(s) applied	1.3		
Choice of data or measurement methods and procedures	Scenario B, Option B2 is applied as per registered PDD.		
Purpose of data/parameter	Calculation of project emissions		
Additional comments	---		

D.2. Data and parameters monitored*(Copy this table for each data or parameter.)*

Data/Parameter	$V_{F,y}$
Unit	Nm ³
Description	Volume of the total recovered gas measured at point F in methodology Figure 2 in year y.
Measured/calculated/default	Flow meter installed by project entity
Source of data	Flow meter installed by project entity
Value(s) of monitored parameter	1,451,501,073
Monitoring equipment	Flow meter
Measuring/reading/recording frequency	Data will be measured continuously using calibrated flow meters.
Calculation method (if applicable)	Calibration frequency is annual.
QA/QC procedures	Volume of gas will be metered through a differential pressure (or equivalent) flow meter installed at each different location. Calibration frequency is annual. Accuracy is $\pm 2\%$ of reading typical or more accurate. Lead operators at each location are responsible for monitoring and reporting to Central Production Facility.
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	--

Data/Parameter	$NCV_{RG,F,y}$
Unit	TJ/Nm ³
Description	Average net calorific value of recovered gas at point F in methodology Figure 2 in year y
Measured/calculated/default	On site measurement and calculated
Source of data	On site measurement and calculated
Value(s) of monitored parameter	The average NCV during the period y is defined as the arithmetic average of NCVs for the samples taken during the same period.
Monitoring equipment	Gas composition measurements will be undertaken in line with national or international fuel standards under the responsibility of the on-site lab located at Safah gas plant. Samples will be taken at least monthly through chromatography gas analyzer (or equivalent). Calibration frequency is at minimum annual using standard gas.
Measuring/reading/recording frequency	Monthly
Calculation method (if applicable)	NCV will be calculated as the sum of molar fraction of each individual component in the natural gas sample multiplied by net calorific value of each individual component in the natural gas sample as referenced in ISO/DP 6976:1995 standard for a combustion reference temperature of 25°C and the same reference condition used for parameter $V_{F,y}$. The average NCV during the period y is defined as the arithmetic average of NCVs for the samples taken during the same period.
QA/QC procedures	Measurements will be done as per ISO10715 or equivalent standard, in strict accordance with requirements listed in gas purchase agreement.
Purpose of data/parameter	Calculation of baseline emissions.
Additional comments	---

Data/Parameter	EC _{PJ,j,y}
Unit	MWh/yr
Description	Quantity of electricity consumed by the project electricity consumption source j in year y
Measured/calculated/default	Measured
Source of data	Electricity meter
Value(s) of monitored parameter	231,344
Monitoring equipment	Electricity meter
Measuring/reading/recording frequency	Continuous measurement with national standard metering equipment located at each location
Calculation method (if applicable)	--
QA/QC procedures	Accuracy Class 2 or more accurate. Instrument will be calibrated periodically in accordance with local requirements
Purpose of data/parameter	Calculation of project emissions
Additional comments	--

D.3. Implementation of sampling plan

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Not applicable

SECTION E. Calculation of emission reductions or net anthropogenic removals

E.1. Calculation of baseline emissions or baseline net removals

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According to the methodology AM0009 Version 06.0.0, the emissions reduction by the project is calculated as follows:

$$BE_y = V_{F,y} \times NCV_{RG,F,y} \times EF_{CO_2,Methane}$$

Where:

BE_y = Baseline emissions in year y, (tCO₂e)

V_{F,y} = Volume of total recovered gas measured at point F, in year y, (10⁴Nm³)

NCV_{RG,F,y} = Average net calorific value of recovered gas at point F in year y, (TJ/Nm³)

EF_{CO₂,Methane} = CO₂ emission factor for methane (tCO₂/TJ)

E.2. Calculation of project emissions or actual net removals

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Project emissions are calculated as follows:

$$PE_y = PE_{CO_2,fossilfuels,y} + PE_{CO_2,elec,y}$$

Where:

PE_y = Project emissions in year y, (tCO₂e)

PE_{CO₂,fossilfuels,y} = CO₂ emissions due to consumption of fossil fuels for the recovery, pre-treatment, transportation, and if applicable, compression of the recovered gas up to the point F in year y (tCO₂e)

PE_{CO₂,elec,y} = CO₂ emissions due to the use of electricity for recovery, pre-treatment, transportation and if applicable, compression of the recovered gas up to the point F in year y (tCO₂e)

According to PDD section B.6.1, there is no direct consumption of fossil fuels as part of the Project activity therefore above equation can be simplified as:

$$PE_y = PE_{CO_2,y} = PE_{EC,y}$$

$$PE_{EC,y} = \sum_j EC_{PJ,j,y} \times EF_{EL,j,y} \times (1 + TDL_{j,y})$$

Average technical transmission and distribution losses for providing electricity to source j in year y ($TDL_{j,y}$) is set at 0% as the project consumes electricity from an off-grid captive power plant, and $EF_{EL,j,y}$ is set at 1.3tCO₂/MWh as it is a project electricity consumption source, which is the conservative default value set in the tool.

E.3. Calculation of leakage emissions

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According to the registered PDD, there is no leakage emission considered, thus $LE_y = 0$.

E.4. Calculation of emission reductions or net anthropogenic removals

	Baseline GHG emissions or baseline net GHG removals (t CO ₂ e)	Project GHG emissions or actual net GHG removals (t CO ₂ e)	Leakage GHG emissions (t CO ₂ e)	GHG emission reductions or net anthropogenic GHG removals (t CO ₂ e)		
				Before 01/01/2013	From 01/01/2013	Total amount
Total				0	3,547,792	3,547,792

E.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the registered PDD

Amount achieved during this monitoring period (t CO ₂ e)	Amount estimated ex ante for this monitoring period in the PDD (t CO ₂ e)
3,547,792	3,663,133

E.5.1. Explanation of calculation of “amount estimated ex ante for this monitoring period in the PDD”

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This monitoring period (31/12/2013-31/12/2018) including the whole year of 2014, 2015, 2016, 2017 and 2018, plus one day in 2013. According to the registered PDD, the estimated ER during this period is: (1,327,326/365 + 1,082,529 + 816,065 + 713,032 + 567,231 + 480,640) = 3,663,133 tons.

E.6. Remarks on increase in achieved emission reductions

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The actual ERs is less than estimated in the PDD.

E.7. Remarks on scale of small-scale project activity

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Not applicable.

Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
07.0	31 May 2019	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 02.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Add a section on remarks on the observance of the scale limit of small-scale project activity during the crediting period; • Add "changes specific to afforestation or reforestation project activity" as a possible post-registration changes; • Clarify the reporting of net anthropogenic GHG removals for A/R project activities between two commitment periods; • Make editorial improvements.
06.0	7 June 2017	Revision to: <ul style="list-style-type: none"> • Ensure consistency with version 01.0 of the “CDM project standard for project activities” (CDM-EB93-A04-STAN); • Make editorial improvements.
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> • Include provisions related to delayed submission of a monitoring plan; • Provisions related to the Host Party; • Remove reference to programme of activities; • Overall editorial improvement.
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> • Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1; • Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>; • Editorial improvement.
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB 70, 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).
01.0	28 May 2010	EB 54, Annex 34. Initial adoption.

<i>Version</i>	<i>Date</i>	<i>Description</i>
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		