

NANBA ASSOCIATED GAS PROCESSING PLANT AND THE AUXILIARY ENGINEERING

Document Prepared By Beijing MD Energy Technology Co., Ltd

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

The Nanba Associated Gas Processing Plant and the Auxiliary Engineering (hereafter referred to as the Project) is located in Daqing City, Heilongjiang Province, People's Republic of China. The Project is developed by Daqing Oilfield Co., Ltd. (hereafter referred to as the project developer).

The primary objective of the proposed project is to recover and utilize the associated gas from oil wells in the Second Oil Production Plant of Sanan Oilfield that would otherwise be vented, to process into dry gas and condensate. The oil field development of the Second Oil Production Plant of Sanan Oilfield does not apply and not apply the gas-lift technology, and there is no gas injection infrastructure at the project site. The Project has been registered as a CDM project on December 7th, 2012 (UNFCCC registration reference number: 8598).

The Project constructed the associated gas recovery system and associated gas processing and transport infrastructure, including gas collection facilities, booster station, processing plant and transportation pipelines, etc. After recovery, pre-processing, compression, dehydration, condensate-separation etc., the associated gas is separated into dry gas and condensate. The dry gas is transferred to the end-users via the transportation system. The condensate are transferred to storage tank and then eventually sold to the end users. The daily processing capacity of the processing plant is designed to be $90 \times 10^4 \text{ Nm}^3/\text{d}$. According to the FSR, the recovered associated gas will vary from year to year based on the crude oil output of the Second Oil Production Plant of Sanan Oilfield. In the 10 years from 2012 to 2021, the Project will process $17,344 \times 10^4 \text{ Nm}^3$ associated gas and produce $13,875 \times 10^4 \text{ Nm}^3$ dry gas and $3.64 \times 10^4 \text{ t}$ condensate annually on average.

The date of the project construction started is 20/05/2011, and the project start operation on 29/05/2012.

During the monitoring period (from 29-05-2012 to 06-12-2012, both days included), the monitoring activities were conducted strictly in accordance with the monitoring plan in the registered PDD. The Project has operated without any accidental or emergency events that might impact the accuracy and/or implementation of monitoring activities. The associated gas has been process by the Project during the period is $13,289.6902 \times 10^4 \text{ Nm}^3$. The total GHG emission reductions in this monitoring period are 224,553tCO₂e.

1.2 Sectoral Scope and Project Type

The project was categorized in the sectoral scope 10- Fugitive emission from fuels (solid, oil, gas), which is not a grouped project.

1.3 Project Proponent

Organization name	Daqing Oilfield Co., Ltd.
Contact person	Zhu Lin
Title	Manager

Address	Longnan Ranghulu District Daqing City
Telephone	+86 10-67802748-8008
Email	zhulin_dod@petrochina.com.cn

1.4 Other Entities Involved in the Project

There is no any other project proponent(s).

1.5 Project Start Date

29-05-2012, on that day the project began commissioning.

1.6 Project Crediting Period

The crediting period is from 29-05-2012 to 06-12-2012, and the total number of years is 192days.

1.7 Project Location

The Project is located at the Sanan Oilfield in Daqing City, Heilongjiang Province, People's Republic of China. The associated gas processing plant has a geographical coordinates of the Latitude +46.5501 and the Longitude +125.0152.

1.8 Title and Reference of Methodology

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

Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion (Version 02);

Tool to calculate baseline, project and/or leakage emissions from electricity consumption (Version 01);

Tool to calculate the emission factor for an electricity system (Version 02.2.1);

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>.

1.9 Other Programs

N/A

2 IMPLEMENTATION STATUS

2.1 Implementation Status of the Project Activity

The Project operates normally and has no any special events during this monitoring period. In addition, these are not events or situations that occurred during the monitoring period which may impact the applicability of the methodology.

2.2 Deviations

2.2.1 Methodology Deviations

N/A

2.2.2 Project Description Deviations

N/A

2.3 Grouped Project

N/A

3 DATA AND PARAMETERS

3.1 Data and Parameters Available at Validation

Data Unit / Parameter:	$EF_{CO_2, Methane}$		
Data 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
	NCV of Methane (at 25°C)	802.60 kJ/mol	ISO 6976: Table 3
Value applied:	54.834		
Justification of choice of data or description of measurement methods	--		

and procedures applied	
Purpose of the data:	Calculation of baseline emissions
Any comment:	---

Data Unit / Parameter:	$EF_{grid,CM,y}$
Data unit:	tCO ₂ /MWh
Description:	Combined margin emission factor of the NEPG during the period y
Source of data:	Notification on Determining 2011 Baseline Emission Factors for Regional Power Grids in China issued by China's DNA CDM official, and please see the Website: http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf
Value applied:	0.84195
Justification of choice of data or description of measurement methods and procedures applied	--
Purpose of the data:	Calculation of leakage emissions
Any comment:	---

Data Unit / Parameter:	$TDL_{j,y}$ and $TDL_{l,y}$
Data unit:	--
Description:	Average technical transmission and distribution losses for providing electricity to the project from the grid NEPG (source j or l) in year y.
Source of data:	Electricity consumption by the project activity is from the grid only, which belongs to Scenario A. As the electricity consumption by project and leakage electricity consumption sources, the default value of 20% is applied, as per the "Tool to calculate project or leakage CO ₂ emissions from fossil fuel combustion".
Value applied:	20%
Justification of choice of data or description of measurement methods and procedures applied	It should be estimated for the distribution and transmission networks of the electricity grid of the same voltage as the connection where the proposed CDM project activity is connected to. The technical distribution losses should not contain other types of grid losses (e.g. commercial

	losses/theft). The distribution losses can either be calculated by the project participants or be based on references from utilities, network operators or other official documentation.
Purpose of the data:	Calculation of project emissions ($TDL_{i,y}$) Calculation of leakage emissions ($TDL_{i,y}$)
Any comment:	---

3.2 Data and Parameters Monitored

Data Unit / Parameter:	$V_{F,y}$
Data unit:	10^4Nm^3
Description:	Volume of the total recovered gas measured at point F in figure B3-2 in year y
Source of data:	Measured by gas flow meter FM ₁
Description of measurement methods and procedures to be applied:	Data should be measured using calibrated flow meter. Measurements should be taken at the point(s) where recovered gas exits the pre-treatment plant.
Frequency of monitoring/recording:	Continuously measurement and monthly recording.
Value monitored:	13,289.6902
Monitoring equipment:	Please reference to the information of the meter FM ₁ in Table 3.3-1 for detail.
QA/QC procedures to be applied:	Volume of gas should be completely metered with regular calibration of metering equipment as per relative national standard. The measured volume should be converted to the volume at normal temperature and pressure using the temperature and pressure at the time to measurement. If there is any exceptional situation occurs on the project site, the technician will notify the CDM manager. And for calculating a conservative estimation, the recovered gas flared will not be involved calculating emission reduction.
Purpose of the data	Calculation of baseline emissions
Calculation method:	---
Any comment:	---

Data Unit / Parameter:	NCV _{RG,F,y}
Data unit:	TJ/Nm ³
Description:	Average net calorific value of recovered gas at point F in Figure B3-2 in year y
Source of data:	The project owner authorized a third party to take gas samples on site, and then analyse the composition at the laboratory. Based on the analyse results, the NCV was calculated. The arithmetic NCVs of the samples taken were used for calculation the baseline emissions. (Chemical analysis of gas samples taken at point F in Figure 3.3-2)
Description of measurement methods and procedures to be applied:	Measurements should be undertaken in line with national or international fuel standards Gas samples should regularly be taken at point F in Figure 3.3-2 and the molar composition of each gas sample should be determined through chemical analysis following the procedures for QA/QC. Based on the molar composition, the Net Calorific Value on a volumetric basis should be determined for each sample in line with ISO 6976 or an equivalent standard for a combustion reference temperature of 25°C and the same metering 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.
Frequency of monitoring/recording:	Sampling and compositional analysis and calculation of net calorific value at least monthly.
Value monitored:	0.00003763
Monitoring equipment:	--
QA/QC procedures to be applied:	The recovered gas samples were taken and compositional analyzed and calculated net calorific value by the Petroleum Industry Center for Quality Supervision and Inspection of Crude Oil and Petroleum Products which is the third party laboratory. Sampling in accordance with GB/T 13609-1999. Compositional analysis in accordance with GB/T 13610-2003. Calculation in accordance with GB/T 11062-1998. Deliver monthly the inspection report in accordance with the corresponding analysis and calculation result, and then provided

	to the project owner. The entity has the qualification certificate on metrological authorized by Certification and Accreditation Administration of the People's Republic of China.
Purpose of the data	Calculation of baseline emissions
Calculation method:	---
Any comment:	For the purpose of this methodology, the qualifier "net" is synonymous with "lower" and "inferior", and the term "calorific value" is synonymous with "heating value".

Data Unit / Parameter:	$FC_{NG,D,y}$
Data unit:	$10^4 Nm^3$
Description:	The quantity of dry gas combusted in processes before point F in Figure 3.3-2 during the year y
Source of data:	Measured by gas flow meter FM ₂
Description of measurement methods and procedures to be applied:	Data should be measured using calibrated flow meter. Measurements should be taken at the point(s) where dry gas exits the processing plant
Frequency of monitoring/recording:	Continuously measurement and monthly recording.
Value monitored:	488.9388
Monitoring equipment:	Please reference to the information of the meter FM ₂ in Table 3.3-1 for detail.
QA/QC procedures to be applied:	Volume of gas should be completely metered with regular calibration of metering equipment as per relative national or industry standards. The measured volume should be converted to the volume at normal temperature and pressure using the temperature and pressure at the time to measurement.
Purpose of the data	Calculation of project emissions
Calculation method:	---
Any comment:	---

Data Unit / Parameter:	$NCV_{NG,y}$
Data unit:	TJ/m ³

Description:	Average net calorific value of natural gas combusted in processes before point F in Figure 3.3-2 during the year y
Source of data:	The project owner authorized a third party to take gas samples on site, and then analyse the composition at the laboratory. Based on the analyse results, the NCV was calculated. The arithmetic NCVs of the samples taken were used for calculation the project emissions (Chemical analysis of gas samples taken at point D in Figure 3.3-2)
Description of measurement methods and procedures to be applied:	<p>Measurements should be undertaken in line with national or international fuel standards</p> <p>Gas samples should regularly be taken at point F in Figure B3-2 and the molar composition of each gas sample should be determined through chemical analysis following the procedures for QA/QC. Based on the molar composition, the Net Calorific Value on a volumetric basis should be determined for each sample in line with ISO 6976 or an equivalent standard for a combustion reference temperature of 25°C and the same metering 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.</p>
Frequency of monitoring/recording:	Sampling and compositional analysis and calculation of net calorific value at least monthly.
Value monitored:	0.00003206
Monitoring equipment:	---
QA/QC procedures to be applied:	<p>The natural gas samples were taken and compositional analyzed and calculated net calorific value by the Petroleum Industry Center for Quality Supervision and Inspection of Crude Oil and Petroleum Products which is the third party laboratory.</p> <p>Sampling in accordance with GB/T 13609-1999. Compositional analysis in accordance with GB/T 13610-2003. Calculation in accordance with GB/T 11062-1998. Deliver monthly the inspection report in accordance with the corresponding analysis and calculation result, and then provided to the project owner.</p>

	The entity has the qualification certificate on metrological authorized by Certification and Accreditation Administration of the People's Republic of China.
Purpose of the data	Calculation of project emissions
Calculation method:	---
Any comment:	For the purpose of this methodology, the qualifier "net" is synonymous with "lower" and "inferior", and the term "calorific value" is synonymous with "heating value".

Data Unit / Parameter:	$EF_{CO_2,NG,y}$
Data unit:	tCO ₂ /TJ
Description:	CO ₂ emission factor of natural gas before point F in Figure 3.3-2 during the year y
Source of data:	IPCC default values at the upper limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Volume 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.
Description of measurement methods and procedures to be applied:	---
Frequency of monitoring/recording:	---
Value monitored:	58.3
Monitoring equipment:	---
QA/QC procedures to be applied:	During implementing verification period for the project, the latest IPCC-value is applied.
Purpose of the data	Calculation of project emissions
Calculation method:	---
Any comment:	---

Data Unit / Parameter:	$EC_{PJ,i,y}$
Data unit:	MWh/y
Description:	Quantity of electricity consumed by the project activity source j in year y
Source of data:	Measured by electricity meter M ₁ , M ₂ , M ₃ , M ₄ , M ₅ and M ₆
Description of measurement methods and procedures to be applied:	Data should be measured using calibrated electricity meters.

Frequency of monitoring/recording:	Continuously measured and monthly recorded
Value monitored:	10,059.84
Monitoring equipment:	Please reference to the information of the meter M ₁ , M ₂ , M ₃ , M ₄ , M ₅ and M ₆ in Table 3.3-1 for detail.
QA/QC procedures to be applied:	The electricity meters are calibrated by a qualified third party according to the national standard.
Purpose of the data	Calculation of project emissions
Calculation method:	---
Any comment:	---

Data Unit / Parameter:	$EC_{LE,I,y}$
Data unit:	MWh/y
Description:	Net increase in electricity consumption of source I during the year y
Source of data:	Measured by electricity meter M ₇
Description of measurement methods and procedures to be applied:	Data should be measured using calibrated electricity meter.
Frequency of monitoring/recording:	Continuously measured and monthly recorded
Value monitored:	30,027.24
Monitoring equipment:	Please reference to the information of the meter M ₇ in Table 3.3-1 for detail.
QA/QC procedures to be applied:	The electricity meter will be calibrated by a qualified third party according to the national standard.
Purpose of the data	Calculation of leakage emissions
Calculation method:	---
Any comment:	---

3.3 Monitoring Plan

The operational and management structure that is implemented by the project developer in order to monitor emission reductions and any leakage generated by the project activity is described in the following figure:

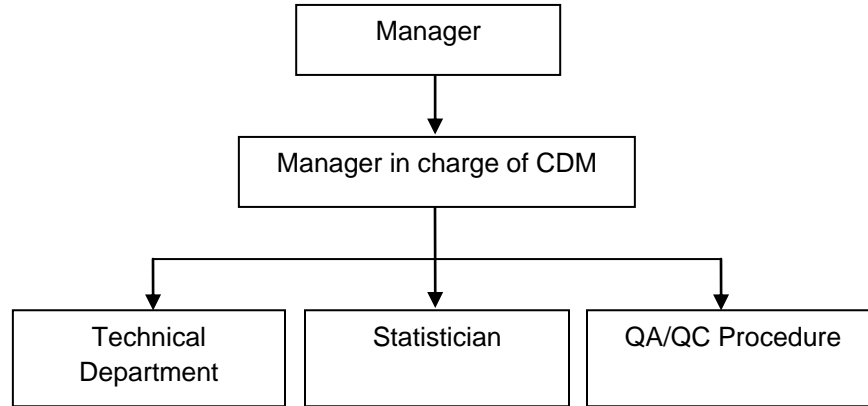


Figure 3.3-1 Monitoring organization chart.

Monitoring system, data collection and archiving

The recovered gas monitoring point sets up in the front of compressor inlet of the processing plant, where one gas flow meter (FM₁) and gas sampling point will be installed.

The dry gas combusted monitoring point sets up at dry gas combusted of total main pipeline, where one gas flow meter (FM₂) will be installed. And the dry gas sampling point will be installed at the dry gas pipeline.

Two electricity meters (M₁ and M₂) are installed at Nanba combined-station, and they only monitor the power imported from the grid.

Four electricity meters (M₃, M₄, M₅, and M₆) are installed at Sanan booster station, and they only monitor the power imported from the grid.

The electricity meter (M₇) is installed at Nanyouqi Substation, and it only monitors the power imported from the grid.

The operating personnel are responsible to measure and to record all data and then report to the CDM project Manager. The CDM project Manager aggregates those data and then reports them to Manager who will check and archive them, as well as manage the regular data back-up. All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the last crediting period.

Calibration of metering units

The accuracy of the gas flow meter FM₁ is 1.0, and the accuracy of the gas flow meter FM₂ is 1.5. The accuracy of the electricity meters (M₁ and M₂) is 2, the accuracy of the electricity meters (M₃, M₄, M₅, M₆ and M₇) is 0.5S.

The calibration for the gas meters was conducted periodically according to the national measurement standard and regulation by the qualified measurement technology verification institution authorized by the Chinese government.

The electricity meters installed have been calibrated by the certified parties quarterly in accordance with manufacturer's recommendations and National Regulations for ensuring

reliability of the system. Calibrations have been evidenced with certificates of calibration for the relevant meters issued by the qualified third party.

In summary, all the meters have been working normally and calibrated according to the registered monitoring plan and relevant national standards.

Table 3.3-1 Main meters calibration.

Meter	Meter Serial number	Accuracy	Calibration date	Validity	Calibration entity
FM ₁	112081	1.0	30-12-2011	29-12-2012	National petroleum and natural gas flow metering station
FM ₂	11057139	1.5	09-05-2012	08-05-2013	
M ₁	2009-03-10172837	2	27-05-2012	26-05-2013	Oilfield Institute of Measurement and Verification of Technical Supervision Center of Daqing Oil Manager Bureau
M ₂	2009-03-10173331	2	27-05-2012	26-05-2013	
M ₃	D040953120028	0.5S	05-04-2012	04-04-2013	
M ₄	D40953120010	0.5S	05-04-2012	04-04-2013	
M ₅	D110953192035	0.5S	05-04-2012	04-04-2013	
M ₆	D110953192011	0.5S	05-04-2012	04-04-2013	
M ₇	D110653192180	0.5S	10-05-2012	09-05-2013	

The monitoring points are distributed in the project site as shown in the figure below:

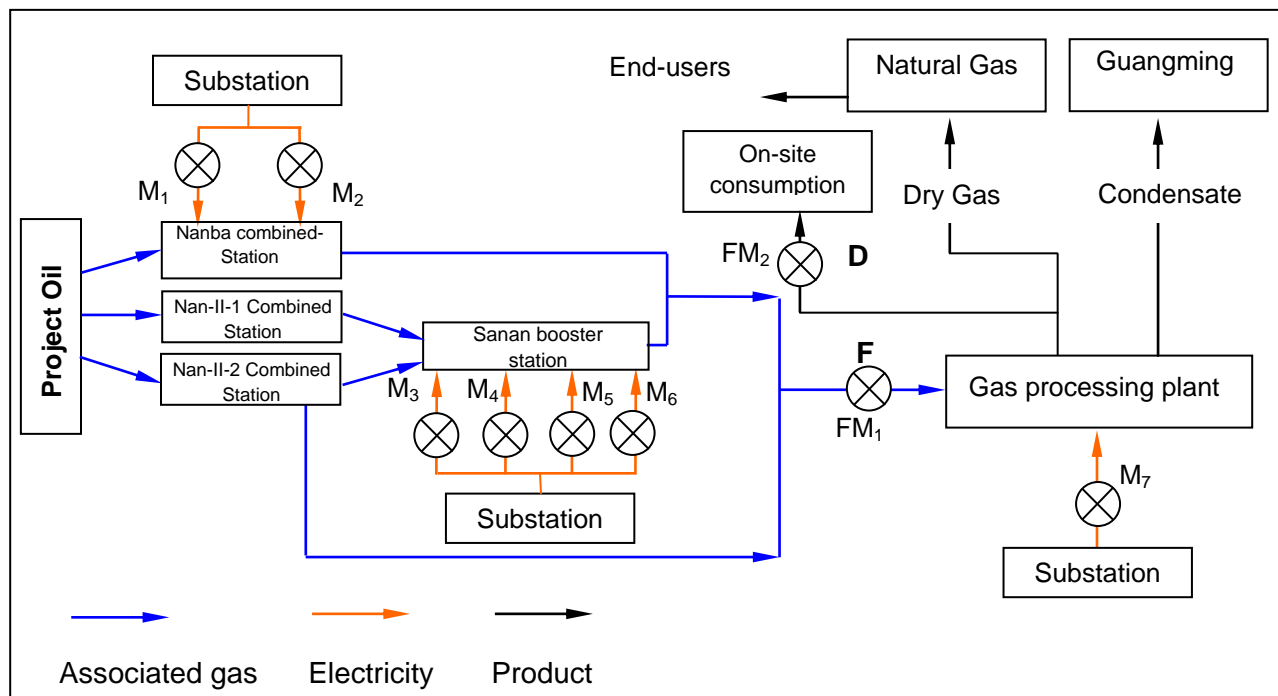


Figure 3.3-2 Monitoring system of the project.

Projection and adjustment of project and baseline emissions on the basis of oil production

Project as well as baseline emissions depend on the quantity of recovered gas, which is linked to the oil production. Oil production is projected with the help of a reservoir engineering studies, reflecting the rock and fluid properties in the oil reservoir. The quantity of recovered gas is a function of the associated gas production which produced in the Second Oil Production Plant of Sanan Oilfield.

The production target of Second Oil Production Plant of Sanan Oilfield is showed on Table 3.3-2.

Table 3.3-2 Production target of Second Oil Production Plant of Sanan Oilfield^{1 2 3}

Period y	Oil Production (10 ⁴ t)	Annual Average Gas-oil Ratio (m ³ /t)	Associated Gas Production (10 ⁸ Nm ³)
01/01/2012-31/12/2012	403	69	2.78
01/01/2013-31/12/2013	445	67	2.98
01/01/2014-31/12/2014	472	68.3	3.22
01/01/2015-31/12/2015	407	68.3	2.78
01/01/2016-31/12/2016	331	67.6	2.24
01/01/2017-31/12/2017	266	67.6	1.80

¹ Source: Oilfield development plan of the Sanan Oilfield and oil and associated gas expectation dated on 23/01/2010

² Feasibility Study Report

01/01/2018-31/12/2018	207	67	1.39
01/01/2019-31/12/2019	157	67	1.05
01/01/2020-31/12/2020	118	66.3	0.78
01/01/2021-31/12/2021	87	66.3	0.58

As projections of the oil production, the methane content⁴ of the gas and other parameters involve a considerable degree of uncertainty, the quantity and composition of the recovered gas are monitored ex-post and baseline and project emissions are adjusted respectively during monitoring. The project developer provides comparative analysis of production data for oil and associated gas and the initial production target as per the information provided in survey used for defining the terms of the underlying oil production project.

If the oil production differs significantly from the initial production target, then the project developer will specify corresponding reasons.

The production statistics of Second Oil Production Plant of Sanan Oilfield is showed on Table 3.3-3.

Table 3.3-3 Production statistics of Second Oil Production Plant of Sanan Oilfield⁵⁶

Period	Oil Production (10 ⁴ t)	Gas-oil Ratio (m ³ /t)	associated gas production (10 ⁸ Nm ³)	Total Volume of Recovered Gas (Point F) (10 ⁴ Nm ³)
01/01/2012-31/12/2012	421.37	69.2	2.9141	15,294 ⁷
29/05/2012-06/12/2012	233.48	69.2 ⁸	1.5888	13,289.6902

The adopting of the alkaline-surfactant-polymer flooding technology by Sanan Oilfield improved the oil production during some period. In the meantime this technology adopted is affected by the variation water cut and geological conditions of oilfield, compared with the estimated value of the initial production target in the FSR, the oil recovery ratio will fluctuate within a band of ±10%.⁹

In addition, the oil wells operated normally and no maintenance took place in the year of 2012, the actual oil production and associated gas production are more than estimated in the initial

⁴ Estimation of average molar content in recovered gas in feasibility study report: 78.41%. The estimated emission reductions are calculated with the quantity of the recovered gas and its contents.

⁵ Source: Production statistics of Section Oil Production Plant of Sanan Oilfield dated on: 18/01/2013.

⁶ Please refer to the calculation spreadsheet for the oil and associated gas, which has been provided to DOE for verification.

⁷ Due to the project start operation on 29/05/2012, the value of 15,294 × 10⁴Nm³ is represents total volume of recovered gas (Point F) from 29/05/2012 to 31/12/2012.

⁸ The value of gas-oil ratio is calculated using the oil production and associated gas production of the whole year.

⁹ Source: The change of oil production dated on: 28/11/2013.

target by 4.56% and 4.82%, respectively. The fluctuation of the actual oil production is within the normal range.

In this monitoring period (29/05/2012-06/12/2012), the actual oil production is more than estimated in the initial production target by 10.44%, the actual associated gas production is more than estimated in the initial target by 8.94%, and the total volume of recovered gas (point F) is more than estimated in the FSR by 2.95%.

Procedures of emergency or abnormal condition

If emergency or abnormal condition occurs at the project site, the technician will notify the CDM manager immediately and try to resolve the problem soon. For conservative purpose, the recovered associated gas during the abnormal period will be transmitted to flare system of the project and not be used for claim emission reductions.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

According to the methodology AM0009 Version 06.0.0, the baseline emissions are calculated as follows:

$$BE_y = V_{F,y} \times NCV_{RG,F,y} \times EF_{CO_2,Methane} \tag{1}$$

Where:

- BE_y = Baseline emissions in year y, (tCO₂e)
- V_{F,y} = Volume of total recovered gas measured at point F in Figure 3.3-2, in year y, (Nm³)
- NCV_{RG,F,y} = Average net calorific value of recovered gas at point F in Figure 3.3-2 in year y, (TJ/Nm³)
- EF_{CO₂,Methane} = CO₂ emission factor for methane (tCO₂/TJ)

During this monitoring period, the V_{F,y} is 13,289.6902×10⁴Nm³, the NCV_{RG,F,y} is 0.00003763 TJ/Nm³, the EF_{CO₂,Methane} is ex-ante determined in the registered CDM-PDD which is 54.834 tCO₂/TJ. Thus, BE_y is calculated as:

$$BE_y = V_{F,y} \times NCV_{RG,F,y} \times EF_{CO_2,Methane} = 13,289.6902 (10^4 Nm^3) \times 0.00003763 (TJ/Nm^3) \times 54.834 (tCO_2/TJ) = 274,193 (tCO_2e)$$

4.2 Project Emissions

Project emissions are calculated as follows:

$$PE_y = PE_{CO_2,fossilfuels,y} + PE_{CO_2,elec,y} \tag{2}$$

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 Figure 3.3-2 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 Figure 3.3-2 in year y (tCO₂e)

Project emissions from the consumption of fossil fuels

$$PE_{CO_2, fossil\ fuels, y} = \sum_j PF_{FC, j, y} = \sum_j \sum_i FC_{i, j, y} \times COEF_{i, y} \quad (3)$$

Where:

- $PE_{CO_2, fossil\ fuels, y}$ = CO₂ emissions due to consumption of fossil fuels for the recovery, pre-treatment, transportation, and compression of the recovered gas up to the point in Figure 3.3-2 in year y (tCO₂e)
- $PE_{FC, i, y}$ = CO₂ emissions of fossil fuels consumption in process j in year y, (tCO₂)
- $FC_{i, j, y}$ = The quantity of fuel type i combusted in process j during the year y (mass or volume unit)
- $COEF_{i, y}$ = The CO₂ emissions coefficient of fuel type i in year y (tCO₂/mass or volume unit)
- i = The fuel types combusted in process j during the year y

$$COEF_{i, y} = NCV_{NG, y} \times EF_{CO_2, NG, y} \quad (4)$$

Where:

- $COEF_{i, y}$ = The CO₂ emissions coefficient of fuel type i in year y (tCO₂/mass or volume unit)
- i = The fuel types combusted in process j during the year y
- $NCV_{NG, y}$ = The weighted average net calorific value of the generated dry gas (natural gas) in year y (TJ/mass or volume unit);
- $EF_{CO_2, NG, y}$ = The weighted average CO₂ emission factor of the generated dry gas (natural gas) in year y (tCO₂/TJ)

The quantity of natural gas combusted in process per year is as follows:

During this monitoring period, the $FC_{NG, D, y}$ is $488.9388 \times 10^4 \text{Nm}^3$, the $NCV_{NG, y}$ is 0.00003206 TJ/Nm³, the $EF_{CO_2, NG, y}$ is ex-ante determined in the registered CDM-PDD which is 58.3 tCO₂/TJ. Thus, $PE_{CO_2, fossil\ fuels, y}$ is calculated as:

$$PE_{CO_2, fossil\ fuels, y} = FC_{NG, D, y} \times NCV_{NG, y} \times EF_{CO_2, NG, y} = 488.9388 (10^4 \text{Nm}^3) \times 0.00003206 (\text{TJ/m}^3) \times 58.3 (\text{tCO}_2/\text{TJ}) = 9,138 (\text{tCO}_2\text{e})$$

Project emissions from consumption of electricity

$$PE_{CO_2, elec, y} = \sum_j EC_{PJ, j, y} \times EF_{grid, CM, y} \times (1 + TDL_{j, y}) \quad (5)$$

Where:

- $PE_{CO_2, elec, y}$ = CO₂ emissions due to the use of electricity for pre-treatment, transportation and if applicable, compression of the recovered gas before point F in Figure 3.3-2 in year y (tCO₂e)
- $EC_{PJ, j, y}$ = The quantity of electricity consumed by the project activity source j in year y (MWh/y);
- $EF_{grid, CM, y}$ = The emission factor for electricity generation for source j in year y

$TDL_{j,y}$ = (tCO₂/MWh).
 = Average technical transmission and distribution losses for providing electricity to source j in year y ;
 j = Sources of electricity consumption in the project.

During this monitoring period, the $EC_{PJ,j,y}$ is 10,059.84MWh, the $EF_{grid,CM,y}$ is ex-ante determined in the registered CDM-PDD which is 0.84195 tCO₂/MWh and the $TDL_{j,y}$ is ex-ante determined in the registered CDM-PDD which is 20%. Thus, $PE_{CO_2,fossilfuels,y}$ is calculated as:

$$PE_{CO_2,elec,y} = \sum_j EC_{PJ,j,y} \times EF_{grid,CM,y} \times (1+TDL_{j,y}) = 10,059.84(MWh) \times 0.84195(tCO_2/MWh) \times (1+20\%) = 10,164(tCO_2e)$$

Based on the calculation above, project emissions during this monitoring period are summarized below:

$$PE_y = PE_{CO_2,fossilfuels,y} + PE_{CO_2,elec,y} = 9,138(tCO_2e) + 10,164(tCO_2e) = 19,302(tCO_2e)$$

4.3 Leakage

$$LE_y = LE_{FC,y} + LE_{EC,y} \tag{6}$$

Where:

LE_y = Leakage emissions in year y (tCO₂e)
 $LE_{FC,y}$ = Leakage emissions due to fossil fuels consumption after point F in figure 3.3-2 in year y (tCO₂e)
 $LE_{EC,y}$ = Leakage emissions due to electricity consumption after point F in figure 3.3-2 in year y (tCO₂e)

Leakage emissions due to electricity consumption

$$LE_{EC,y} = \sum_j EC_{LE,l,y} \times EF_{EL,l,y} \times (1 + TDL_{l,y}) \tag{7}$$

Where:

$LE_{EC,y}$ = Leakage emissions due to electricity consumption after point F in figure 3.3-2 in year y (tCO₂e)
 $EC_{LE,l,y}$ = Net increase in electricity consumed of source l in year y (MWh/y);
 $EF_{EL,l,y}$ = Emission factor for electricity generation for source l in year y (tCO₂/MWh).
 $TDL_{l,y}$ = Average technical transmission and distribution losses for providing electricity to source l in year y ;
 l = Leakage source of electricity consumption.

During this monitoring period, the $EC_{LE,l,y}$ is 30,027.24MWh, the $EF_{grid,CM,y}$ is ex-ante determined in the registered CDM-PDD which is 0.84195 tCO₂/MWh, and the $TDL_{l,y}$ is ex-ante determined in the registered CDM-PDD which is 20%. Thus, $LE_{EC,y}$ is calculated as:

$$LE_{EC,y} = \sum_j EC_{LE,i,y} \times EF_{EL,i,y} \times (1 + TDL_{i,y}) = \sum_j EC_{LE,i,y} \times EF_{grid,CM,y} \times (1 + TDL_{i,y}) = 30,027.24 \text{ (MWh)} \\ \times 0.84195 \text{ (tCO}_2\text{/MWh)} \times (1 + 20\%) = 30,338 \text{ (tCO}_2\text{e)}$$

Leakage emissions due to the consumption of fossil fuels

After point F in Figure 3.3-2, the project does not consume fossil fuel. Therefore, no Leakage emission from the consumption of fossil fuel is considered.

$$LE_{CO_2, fossil fuel, y} = LE_{FC, y} = 0$$

Based on the calculation above, Leakage emissions during this monitoring period are summarized below:

$$LE_y = LE_{FC, y} + LE_{EC, y} = 0 \text{ (tCO}_2\text{e)} + 30,338 \text{ (tCO}_2\text{e)} = 30,338 \text{ (tCO}_2\text{e)}$$

4.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
29/05/2012 - 06/12/2012	274,193	19,302	30,338	224,553
Total	274,193	19,302	30,338	224,553