CDM: form for proposed new small scale methodologies (version 01.1)

(To be used for proposing a new small scale methodology in accordance with article 15 and 16 of the simplified modalities for small-scale CDM project activity categories. This form is not to be used in case of large scale methodologies).

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Title of the proposed small scale methodology:	Flare Gas Recovery in Gas Treating Facilities
Please suggest type to which the new proposed methodology (category) belongs to:	☐ Type I Renewable energy projects ☐ Type II Energy efficiency improvements ☒ Type III Other project activities

Information for completing the form

For proposing a new small scale methodology all sections below should be completed. Approved small scale methodologies shall be used as a reference for language and structure used. If necessary, attach files or refer to sources of relevant information.

A. Technology/measure: please specify and provide reference to the exact technology/measure the proposed small scale methodology is applicable to and describe in detail the applicability conditions of the proposed methodology.

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Source

This methodology is based on the project activity "**Flare Gas Recovery Project in Sarkhoon and Qeshm Gas Treating Company**", whose baseline and monitoring methodology and project design document is prepared by Research Institute for Petroleum Industry and Mehr Renewable Energies Co.

This baseline and monitoring methodology is based on elements from the following approved methodologies:

AM0037 "**Flare (or vent) reduction and utilization of gas from oil wells as a feedstock**"

AM0009 "**Recovery and utilization of gas from oil wells that would otherwise be flared or vented**"

AMS-III.P. **"Recovery and utilization of waste gas in refinery facilities"**

This methodology also refers to the latest version of the following methodological tools[1]:

"**Tool to calculate baseline, project and/or leakage emissions from electricity consumption**";
"**Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion**",
"**Tool to calculate the emission factor for an electricity system**".

Selected approach from paragraph 48 of the CDM modalities and procedures

"Actual or historical emissions, as applicable"

Definitions

For the purpose of this methodology, the following definitions apply:

Gas plant: Also known as "gas treating refinery" is a plant including the processes to separate the constituents from natural gas for the purpose of treating the residue gas to meet required specifications.

Refinery gas: Also known as still gas, can be defined as: "Any form or mixture of gases produced as product in gas plant". The principal constituents are methane, ethane, propane, normal butane, etc. Refinery gas is the main product of gas treating refineries which is routed to the refinery battery limit.

Off- gas: Off- gas is an undesired low pressure by-product generated in several processing units of the refinery and in normal operational processes is partially used for on-site fuel gas consumption and the extra amount is directed to the flares. The principal constituents of this gas are the same as refinery gas (methane, ethane, propane, normal butane, etc). In the project scenario, this off- gas is recovered in order to alter it to the refinery gas.

Existing facilities: Facilities that are operational before start date of the project activity and have at least three years of historical data.

Process gas: The main gas stream which is fed to the process units and refined to the refinery gas (refinery product).

Fuel gas: The gas which is used as fuel in gas plant to supply the required energy.

[1] Please refer to :< http://cdm.unfccc.int/Reference/tools/index.html.>

Applicability

This methodology comprises off- gas recovery in the existing gas treating facilities (gas plants) to be used as feed stock of the facility. Off- gas is characterized by lower pressure for which there is no useful application in the facility, however it may be used partially as fuel gas, and partially be flared or vented to atmosphere.

The methodology is applicable under the following conditions:

- Under the project activity the recovered off- gas, after the pre-treatment (compression), is fed to existing process unit in associated with the process gas. The refinery gas is transferred directly to the gas pipeline and partly consumed on-site to meet energy demands.

- Off- gas volume and composition are measurable.

- There should not be any addition of fuel gas or refinery gas in the off- gas pipeline between the point of recovery and the point where it is fed to process unit.

Also the methodology is applicable for the project activities which result in emission reduction of less than or equal to 60 kt CO_2 equivalent annually.

B. Boundary: please specify the project boundary of the proposed methodology.

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The physical, geographical site of the refinery where the off- gas is produced and transformed into useful *product* delineates the project boundary.

Table 1: Summary of gases and sources included in the project boundary, and justification / explanation where gases and sources are not included

Source		Gas	Included?	Justification / Explanation
Baseline	Flaring and Fuel Gas combustion for on-site consumption	CO_2	Yes	Main source of emissions in the baseline
		CH_4	No	It is assumed that complete oxidation of carbon is occurred in flaring and fuel gas combustion processes. It is conservative.
		N_2O	No	Excluded for simplification. This is conservative
	Grid electrical power consumption for baseline	CO_2	Yes	IF the captive electrical power is used for baseline electrical demand, this value will be zero
	Fugitives emissions resulting from off- gas transport	CO_2	No	Assumed negligible. This is conservative.
		CH_4	No	Assumed negligible. This is conservative.
Project Activity	Refinery Gas combustion for on-site consumption (including the project activity facilities)	CO_2	Yes	Main source of emissions in the project activity
		CH_4	No	Assumed negligible
		N_2O	No	Assumed negligible
	Grid electrical power consumption for project	CO_2	Yes	IF the captive electrical power is used for project activity electrical demand, this value will be zero
		CH_4	No	Assumed negligible
		N_2O	No	Assumed negligible
	Fugitive emissions resulting from transfer of recovered gas	CO_2	No	Assumed negligible
		CH_4	No	Assumed negligible
		N_2O	No	Assumed negligible

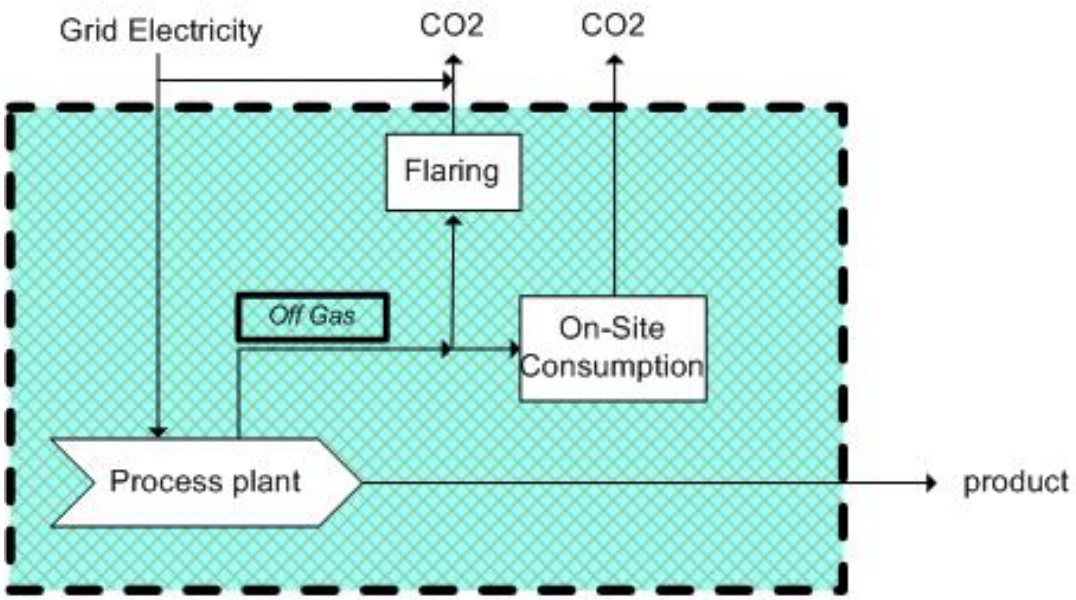

Figure 1: Schematic illustration of the baseline scenario

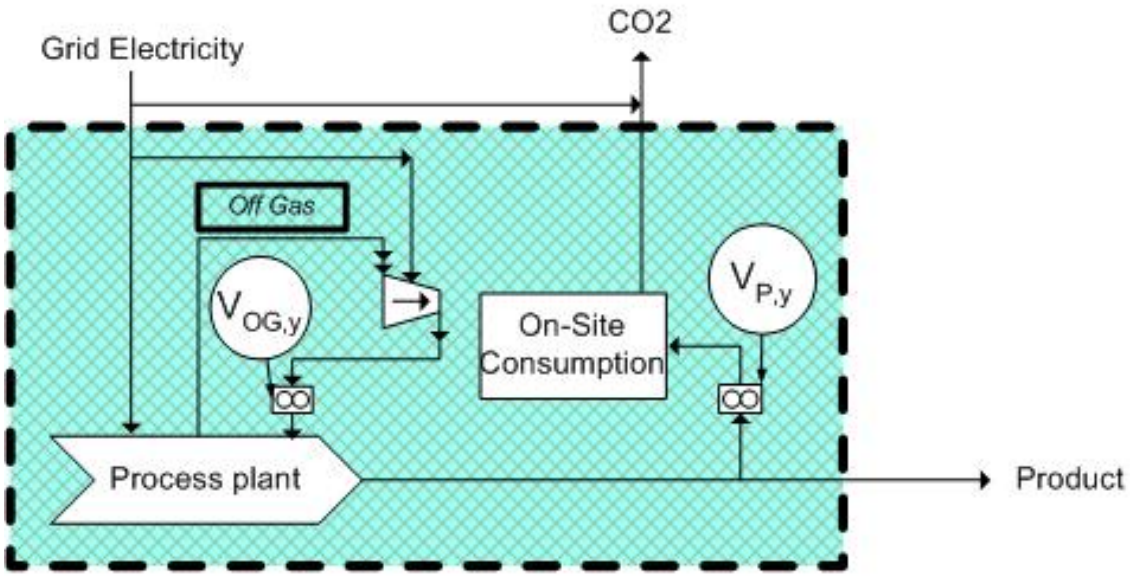

Figure 2: Schematic illustration of the project activity

flow meter

C. Baseline: please specify the baseline scenario and the way baseline emissions are calculated.

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Baseline emissions

In calculating baseline emissions, it is supposed that the off- gas would be flared and/or consumed as fuel gas in the refinery in the absence of the project. It is also assumed that all carbon in the off- gas (i.e. in methane and other gases including other hydrocarbons) is completely oxidized to carbon dioxide. Baseline emissions are calculated as follows in Equation 1:

$$BE_{y} = BE_{FC,y} + BE_{EC,Grid,y} \quad (1)$$

Where:

BE_y	= Baseline emissions during the year y (t CO_2-e/yr)
$BE_{FC,y}$	= Baseline emissions from flaring and fuel combustion in year *y* (t CO_2-e/yr)
$BE_{EC,Grid,y}$	= Baseline emissions from grid electricity consumption in year *y* (t CO_2-e/yr)
y	= Project year

$$BE_{FC,y} = V_{OG,y} \times W_{C,y} \times 44/12 \quad (2)$$

Where:

$V_{OG,y}$	= Net amount of off-gas recovered in year y at the point that enters to the existing process facility (Sm3/year).
$W_{C,y}$	= The carbon content of off- gas recovered in year y (Kg C/Sm3)

Baseline emissions from consumption of grid electricity

Baseline emissions $BE_{EC,grid,y}$ due to the use of grid electricity for gas plant in the absence of project activity are calculated applying the latest approved version of the “Tool to calculate baseline, project and/or leakage emissions from electricity consumption” where the electricity consumption sources *k* in the tool corresponds to all sources of electricity consumption in baseline. All applicable sources of electricity consumption should be documented transparently in the CDM-PDD and in monitoring reports

Capping of baseline emissions

- As an introduction of element of conservativeness, this category requires that baseline emissions should be capped irrespective of planned/ unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuels type and quantity resulting in increase in off- gas generation. The historical three years average of off- gas sent to the flares and/or used as fuel gas shall be the cap for the total annual amount of off- gas during the crediting period. The annual monitored $V_{OG,y}$ [Sm3/year] is compared with this cap and the minimum one is used to calculate the baseline emission in equation (2).

- In case the historical information of the last three years is not available, the cap must be determined using the manufacturers' data for the refinery to estimate the amount of off- gas that the refinery generated per unit of production. In case any modification is carried out by project proponent or in case the manufacturers' data is not available an assessment should be carried out by independent qualified/certified external process experts such as a chartered engineer to determine a conservative quantity of off- gas generated by the plant per unit of production by the process engineering off- gas. The value arrived at should be multiplied by the three years average production by the process generating off- gas, in order to calculate the amount of off- gas to be used as cap. The documentation of such assessment shall be verified by the validating DOE. The basis for determining the capping factor includ ing manufacturers' design document/letter and the expert's analysis) should be provided to DOE during validation.

D. Leakage: please specify if leakage emissions can occur and how they should be calculated.

The GHGs emission for producing/transmitting the same volume of the product in other gas treating facilities is higher than the project activity, therefore, leakage is assumed negligible. It is conservative.

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E. Project activity emissions: please specify possible project activity emissions and how they should be calculated.

The following sources[2] of project emissions are accounted in this methodology:

- CO_2 emissions due to consumption of refinery gas (refinery product) as fossil fuel for the total on-site consumption including the project activity demands (recovery, transportation, and compression of the recovered off- gas).
- CO_2 emissions due to the use of grid electricity for the project activity demands (recovery, transportation, and compression of the recovered off- gas). This parameter is zero if the facilities of the project activity use the captive electrical power which is generated using the refinery fuel gas.

Project emissions are calculated as follows:

$$PE_y = PE_{FC,y} + PE_{EC,grid,y} \quad \textbf{(3)}$$

Where:

PE_y	=	Project emissions in year *y,* (t-CO_2e)
$PE_{FC,y}$	=	CO_2 emissions due to on-site consumption of refinery gas (refinery product) as fuel gas for the total on-site consumption including the captive power plant and the demands of the project activity in year y, (t-CO_2e)
$PE_{EC,grid,y}$	=	Project emissions from electricity consumption in year *y* (t CO_2-e/yr)

Project emissions from the consumption of fuel gas

Project emissions $PE_{FC,y}$ due to the consumption of refinery gas as fuels are calculated applying the latest approved version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion" where process *j* corresponds to all sources of fuel combustion (e.g. a compressor, etc) in the boundary. All applicable emission sources should be documented transparently in the CDM-PDD and in monitoring reports.

Project emissions from consumption of grid electricity

Project emissions $PE_{EC,grid,y}$ due to the use of grid electricity for gas plant including the project activity demands (compression of the recovered off- gas) are calculated applying the latest approved version of the "Tool to calculate baseline, project and/or leakage emissions from electricity consumption" where the electricity consumption sources *j* in the tool corresponds to all sources of electricity consumption which are newly installed as project activity. All applicable sources of electricity consumption should be documented transparently in the CDM-PDD and in monitoring reports.

Capping of project activity emissions

The historical three years average of consumed on-site energy [Kcal/year] (which is produced by fuel gas combustion) shall be the cap for the amount of on-site energy demand during the crediting period. The annual monitored of $V_{p,y}$ [Sm3/year] is multiplied by its heating value [Kcal/Sm3] and the result is compared with this cap. The maximum one is used to calculate the $V_{p,y}$ which is used in equation (3).

- **Note 1:** to simplify the monitoring plan, in case the required on-site energy [Kcal/year] (which is calculated in project activity design stage) is greater equal than the average historical three years of consumed on-site energy, the designed V_p [Sm3/year] can be used as cap for project activity. In this case the annual monitored of $V_{p,y}$ [Sm3/year] is compared with this cap and the maximum one is used in equation (3). This is conservative.

- **Note 2**: this capping is suitable and used if on-site fuel gas consumption descends through an energy efficiency project during the crediting period.

[2] Other sources of project emissions such as emissions from leaks, venting and flaring during the recovery, transportation and processing of recovered gas are assumed to be of similar magnitude in the baseline scenario.

F. Monitoring: Please specify which parameters should be monitored and how they should be monitored.

Monitoring procedures

The monitoring methodology involves monitoring of the following:

- The composition and quantity of off- gas produced by gas processing facility;
- The composition and quantity of refinery gas (product) which is routed to fuel gas unit for on-site consumption
- The quantity of grid electricity which is consumed for baseline and project facilities;

The metering equipments are calibrated either in accordance with the specifications of the company procedures or local/national standards, or as per the manufacturer specification. If local/national standards or the manufacturer specification is not available, international standards may be use (e.g. IEC, ISO). 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. 100% of the data should be monitored if not indicated differently in the comments in the tables below.

Data and parameters monitored

Data / parameter:	$V_{OG,y}$
Data unit:	Sm^3/yr
Description:	The volume of off- gas utilized in year y at the point enters to the existing process facility
Source of data:	Measurements with a flow meter
Measurement procedures (if any):	Data should be measured using accurate and calibrated flow meters. Measurements should be taken at the point the recovered off- gas enters to the existing process facility.
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Meters with capability of online conversion to standard condition. This value is compared with the minimum cap of baseline and the smaller one is selected to calculate the emission of baseline scenario.

Data / parameter:	$W_{C,y}$
Data unit:	KgC/Sm^3
Description:	Average carbon content of off- gas in year *y*
Source of data:	Measurement of the chemical analysis (e.g., gas chromatography)
Measurement procedures (if any):	Analysis can be performed in conjunction with measurement of the methane content of the off- gas
Monitoring frequency:	monthly
QA/QC procedures:	Carbon content of gas should be cross checked with previous months' data as well as with the owners of the gas processing plant
Any comment:	-

Data / parameter:	$V_{P,y}$
Data unit:	$Sm^3/year$
Description:	The volume of refinery gas which is routed to fuel gas unit for on-site consumption
Source of data:	Measurements with a flow meter
Measurement procedures (if any):	Data should be measured using accurate and calibrated flow meters. Measurements should be taken at the point which is close as close to the product pipeline (refinery gas).
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	Meters with capability of online conversion to standard condition. This value is compared with the maximum cap of project activity and the bigger one is selected to calculate the emission of project activity.

Data / parameter:	Grid Electricity Consumption
Data unit:	KWh/yr
Description:	The quantity of grid electricity which is used by baseline and project facilities.
Source of data:	Plant records
Measurement procedures (if any):	None
Monitoring frequency:	Continuous
QA/QC procedures:	
Any comment:	This parameter is zero if the project activity facilities use the captive electrical power which is used the refinery fuel gas for generation.

G. Project activity under a programme of activities: if the proposed methodology is also intended for application to a project activity under a programme of activities (CPA of PoA) guidance on consideration of leakage when applying to the CPA of PoA shall be provided.	
The proposed methodology is not intended for application to a project activity under a programme of activities (CPA of PoA).	
Date you are delivering the contribution:	12/10/12
SECTION TO BE FILLED IN BY THE UNFCCC SECRETARIAT	
F-CDM-SSC-NM doc id number:	
Related to SSC-Submission number :	
Date when the form was received at UNFCCC secretariat:	

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History of the document

Version	Date	Nature of revision(s)
01.1	12 April 2012	Editorial changes to include new logo and other improvements.
01.0	EB 34, Annex 12 15 December 2006	Initial publication.
Decision Class: Regulatory **Document Type**: Form **Business Function**: Methodology		