Approved baseline and monitoring methodology AM0055

"Recovery and utilization of waste gas in refinery or gas plant"

I. SOURCE, DEFINITIONS AND APPLICABILITY

Source

This baseline and monitoring methodology is based on the following proposed new methodology:

- NM0192-rev: "Baseline and Monitoring Methodology for the recovery and utilization of waste gas in refinery facilities" prepared by YPF S.A., Argentina and by EcoSecurities Netherlands B.V, the Netherlands.

This methodology also refers to the latest version of:

- "Combined tool to identify the baseline scenario and demonstrate additionality";
- "Tool to determine the baseline efficiency of thermal or electric energy generation systems";
- "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

For more information regarding the proposed new methodology and the tools as well as their consideration consideration by the Executive Board (hereinafter referred to as the Board) of the clean development mechanism (CDM) please refer to <http://cdm.unfccc.int/goto/MPappmeth>.

Selected approach from paragraph 48 of the CDM modalities and procedures

Actual or historical emissions, as applicable

Definitions

Under this methodology, the following definitions will apply:

Element process. A process in which fuel is combusted or heat is utilized in a particular piece of equipment at an industrial facility for the purpose of providing thermal energy (the fuel is not combusted in the element process for electricity generation nor is it used as an oxidant in chemical reactions or otherwise used as feedstock).[1]

Refinery. A facility which converts crude oil into high-octane motor fuel (gasoline/petrol), diesel oil, liquefied petroleum gases (LPG), jet aircraft fuel, kerosene, heating fuel oils, lubricating oils, asphalt and petroleum coke.

Gas Plant. A gas processing facility for extracting ethane or natural gas liquids (NGL) from gas, or for the fractionation of NGL to natural gas products, or a combination of both. A gas plant may also include

[1] Examples of an element process could be steam generation by a boiler or hot air generation by a furnace. Each element process should generate a single output (such as steam or hot air) by using mainly a single fuel (not plural energy sources). For each element process, energy efficiency is defined as the ratio between the useful energy (the enthalpy of the steam multiplied with the steam quantity) and the supplied energy to the element process (the net calorific values of the fuel multiplied with the fuel quantity).

gas purification processes for upgrading the quality of the gas to be marketed to meet contract specifications (i.e. for removing contaminants such as H_2O, H_2S and CO_2, and possibly adjusting the heating value by the addition or removal of N_2). The inlet natural gas may or may not have been processed through lease separators and field facilities.

Refinery gas. Also known as still gas, refinery gas is defined as any form or mixture of gases produced in refineries by distillation, cracking, reforming and other processes. The principal constituents are methane, ethane, ethylene, normal butane, butylene, propane, propylene, etc. Refinery gas is used as a refinery fuel and a petrochemical feedstock and is generally produced from the light ends distillation units of refinery facilities, where it has a pressure that allows its immediate use. [2,3,4,5]

Process gas. Any form or mixture of gases produced in a gas plant by sweetening, distillation or other processes. The principal constituents are methane, ethane, ethylene, normal butane, butylene, propane, propylene, etc. Process gas is used as a fuel and a feedstock and it has a pressure that allows its immediate use.

Waste gas. A by-product generated in several processing units of the refinery or gas plant and in normal operational processes flared. The principal constituents of this gas are the same as in refinery gas or process gas. However, waste gas is characterized by a low pressure or a low heating value.

Applicability

The methodology is applicable to project activities at existing refineries or gas plants that use waste gas, that is flared in the absence of the project activity, to generate process heat in element process(es). The methodology is applicable under the following conditions:

(a) Waste gases from the refinery or gas plant, used under the project activity, were flared (not vented) for the last three years prior to the implementation of the project activity;

(b) The recovery device is placed just before the flare header (with no possibility of diversions of the recovered gas flow) and after all of the waste gas generation devices;

(c) Recovered waste gases are used in the same refinery or gas plant;

(d) The project activity does not lead to an increase in the capacity of the refinery or gas plant;

(e) Local regulations neither constrain the refinery or gas plant from using the fossil fuels currently used in the existing processes nor require flaring the recovered gas;

(f) The composition, density and flow of waste gas is measurable;

(g) There should not be any addition of fuel gas or refinery gas or process gas in the waste gas pipeline between the point of recovery and the point where it is added into the fuel gas system or used directly in an element process.

In addition, the applicability conditions included in the tools referred to above apply.

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2 <http://www.energy.ca.gov/oil/refinery_output/definitions.html>. updated 2002.
3 <http://www.ipcc-nggip.iges.or.jp/public/gl/guidelin/glosri.pdf> IPCC.
4 <http://unfccc.int/resource/cd_roms/na1/ghg_inventories/english/8_glossary/Glossary.htm>.
5 <http://stats.oecd.org/glossary/detail.asp?ID=4621> based on Energy Statistics of OECD Countries: 1999-2000, 2002 Edition, International Energy Agency, Paris, Part 2 – Notes on Energy Sources. Created 2002.

Finally, this methodology is only applicable if the baseline scenario, as identified in the "Procedure for the selection of the most plausible baseline scenario and demonstration of additionality" below, is a combination of scenarios W2 for the use of the waste gas and H2 for all element processes.

II. BASELINE METHODOLOGY

Project boundary

The spatial extent of the project boundary includes refinery or gas plant facilities and is schematically presented in Figure 1. The greenhouse gases included in or excluded from the project boundary are shown in Table 1.

Table 1: Emissions sources included in or excluded from the project boundary

	Source	Gas	Included?	Justification/Explanation
Baseline	Emissions from the combustion of fossil fuels for the generation of heat	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Emissions associated with the operation of the flare	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
Project Activity	Emissions from the combustion of recovered waste gas when used for process heating	CO_2	No	Excluded since it is also burned in the baseline scenario
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification
	Emissions associated with electricity generated by a captive power plant or imported from the grid and used under the project activity	CO_2	Yes	Main source of emissions
		CH_4	No	Excluded for simplification
		N_2O	No	Excluded for simplification

Procedure for the selection of the most plausible baseline scenario and demonstration of additionality

The latest approved version of the "Combined tool to identify the baseline scenario and demonstrate additionality" shall be used to identify the baseline scenario and demonstrate the additionality of the proposed project activity. The following guidance is provided for application of the tool.

Realistic and credible alternatives should be determined for:

(a) Waste gas use in the absence of the project activity; and

(b) Steam/heat generation in the absence of the project activity.

For the use of waste gas, the realistic and credible alternative(s) may include, inter alia:

W1: Waste gas is directly vented to the atmosphere without incineration;

W2: Waste gas is flared;

W3: Waste gas is sold as an energy source;

W4: Waste gas is used for meeting energy demand.

For heat generation, realistic and credible alternative(s) may include, inter alia:

H1: The proposed project activity not undertaken as a CDM project activity;

H2: Heat generation in element process(es) using fossil fuels.

In case of undertaking an investment analysis, the project participants shall take into account the revenue resulted from the utilization of the saved waste gas in the project activity.

Baseline emissions

Total baseline emissions are calculated as the sum of baseline emissions from process heating ($BE_{HG,y}$) and baseline emissions associated with the operation of the flare ($BE_{flare,y}$), as follows:

$$BE_y = BE_{HG,y} + BE_{flare,y} \quad (1)$$

Where:

BE_y	=	Baseline emissions in year *y* (tCO_2/yr)
$BE_{HG,y}$	=	Baseline emissions from process heating in year *y* (tCO_2/yr)
$BE_{flare,y}$	=	Baseline emissions associated with the operation of the flare in year *y* (tCO_2/yr)

Step 1: Determination of baseline emissions from process heating ($BE_{HG,y}$)

This methodology estimates baseline emissions from process heating in a simplified and conservative manner. The recovery and use of waste heat instead of fossil fuels may result in a decrease in energy efficiency in some element processes. However, in practice it can be difficult to identify in which exact element processes the waste heat is used and to measure changes in energy efficiency of individual element processes caused by the project activity. For this reason, the methodology offers several simplified options to determine baseline emissions, including options which do not require identifying where exactly the recovered waste gas is used or measuring changes in energy efficiency in the element processes. However, in order to ensure that emission reductions are not overestimated, conservative assumptions must be made in these simplified options. In addition, the amount of waste gas that is eligible for crediting is capped in order to avoid a situation where more waste gas is diverted to the point of recovery as a result of the CDM incentives.

Baseline emissions from process heating are determined as follows:

$$BE_{HG,y} = Q_{wg,y} * NCV_{wg,y} * EF_{BL,HG,y} \quad (2)$$

Where:

$BE_{HG,y}$	=	Baseline emissions from process heating in year *y* (tCO_2/yr)
$Q_{wg,y}$	=	Amount of recovered waste gas that is eligible for crediting in year *y* (Nm^3/yr)

$NCV_{wg,y}$ = Average net calorific value of the waste gas recovered in year *y* (GJ/Nm^3)

$EF_{BL,HG,y}$ = CO_2 emission factor for process heating in the baseline scenario in year *y* (tCO_2e/GJ)

The amount of waste gas that is eligible for claiming emissions reductions is capped by the historic generation of waste gas and the recovery capacity of the system, as follows:

$$Q_{wg,y} = MIN[Q_{CRS}, Q_{wgf}, Q_{PJ,wg,y}] \quad \textbf{(3)}$$

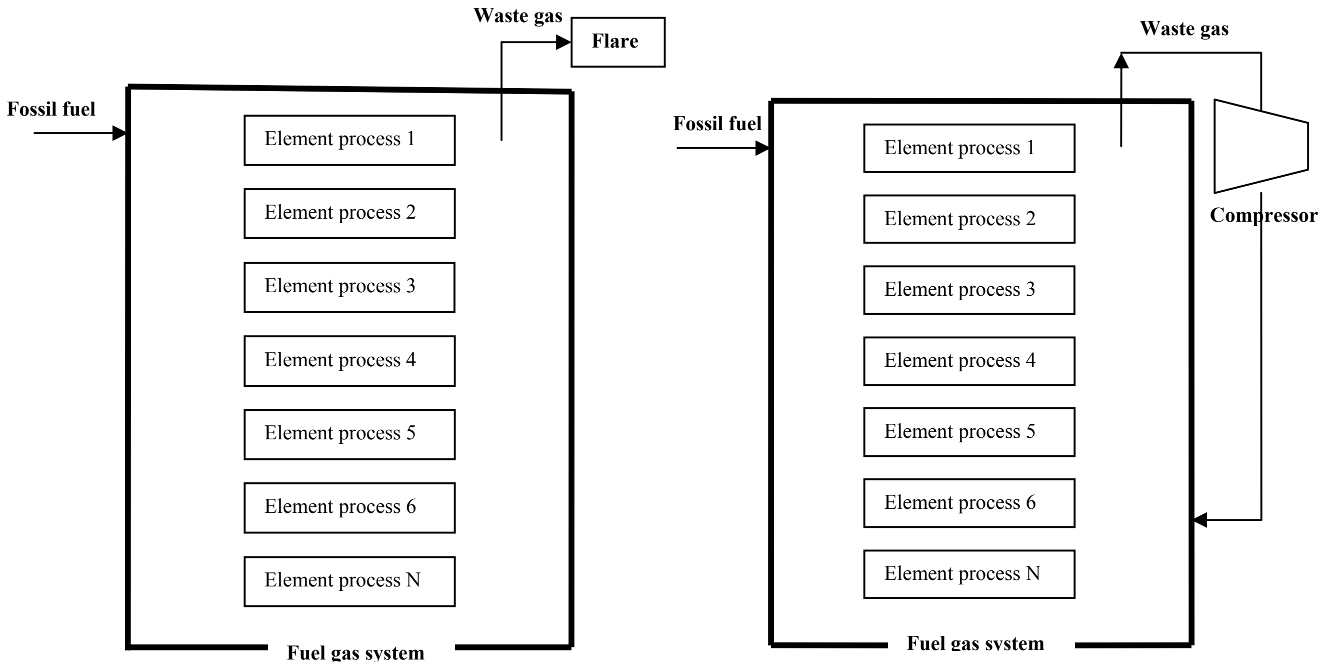
Where:

$Q_{wg,y}$ = Amount of recovered waste gas that is eligible for crediting in year *y* (Nm^3/yr)

$Q_{PJ,wg,y}$ = Amount of waste gas recovered under the project activity in year *y* (Nm^3/yr)

Q_{wgf} = Historic annual average amount of waste gas sent to the flares during the last three years before the project implementation *minus* amount of waste gas released due to emergencies or shutdown and amount of waste gas required to maintain the pilot flame. (Nm^3/yr)

Q_{CRS} = System recovery capacity (Nm^3/hr) *multiplied by* the number of operating hours of the waste gas recovery system in year *y* (Nm^3/yr)



1) Baseline 2) Project activity

Figure 1: Schematic representation of a refinery or gas plant in the baseline (1) and project activity (2)

Determination of the emission factor for process heating in the baseline scenario ($EF_{BL,HG,y}$)

To determine the emission factor for process heating in the baseline, project participants may choose between the following options:

Option A: Use, as a simple and conservative approach, the CO_2 default emission factor of natural gas, as contained in Table 2.2 of the 2006 IPCC Guidelines. This option neglects the impact of using the recovered waste gas on the energy efficiency of the element processes and makes a conservative assumption on the fuel mix that will be replaced by the recovered waste gas.

Option B: Use the minimum of the weighted average emission factors of fossil fuels used to meet fuel demand of the refinery or gas plant between year *y* of the crediting period and the last three historic years prior to the implementation of the project activity, where necessary adjusted for the potential efficiency loss in the element processes due to the use of waste gas, as follows:

$$EF_{BL,HG,y} = MIN\left[\frac{\sum_{x}\sum_{i} FC_{i,x} * NCV_{i,x} * EF_{CO2,i,x}}{\sum_{i} FC_{i,x} * NCV_{i,x}} ; \frac{\sum_{i} FC_{i,y} * NCV_{i,y} * EF_{CO2,i,y}}{\sum_{i} FC_{i,y} * NCV_{i,y}}\right] \times f_{\eta_{PJ}/\eta_{BL}} \quad \textbf{(4)}$$

Where:

$EF_{BL,HG,y}$	=	CO_2 emission factor for process heating in the baseline scenario in year *y* (tCO_2/GJ)
$FC_{i,x}$	=	Quantity of fuel type *i* combusted in historic year *x* (mass or volume unit)
$FC_{i,y}$	=	Quantity of fuel type *i* combusted in year *y* of the crediting period (mass or volume unit)
$NCV_{i,x}$	=	Net calorific value of fuel type *i* combusted in historic year *x* (GJ/mass or volume unit)
$NCV_{i,y}$	=	Net calorific value of fuel type *i* combusted in year *y* of the crediting period (GJ / mass or volume unit)
$EF_{CO2,i,x}$	=	Emission factor of fossil fuel type *i* in the fuel mix used to meet fuel demand of the refinery or gas plant in historic year *x* of the most recent three years prior to the implementation of the project activity (tCO_2/GJ)
$EF_{CO2,i,y}$	=	Emission factor of fossil fuel type *i* in the fuel mix used to meet fuel demand of the refinery or gas plant in year *y* of the crediting period (tCO_2/GJ)
$f_{\eta_{PJ}/\eta_{BL}}$	=	Factor to account for the efficiency loss in element processes due to the utilization of waste gas in the project activity
i	=	Fossil fuel types used to meet refinery or gas plant fuel demand
x	=	Most recent three historical years prior to the implementation of the project activity
y	=	Year of the crediting period

Project participants should document the choice of their option in the CDM-PDD and should not change the option during the crediting period.

Step 2: Determination of baseline emissions associated with the operation of the flare ($BE_{flare,y}$)

This emission source includes emissions from steam that can be used to support the flaring process in the baseline. Project participants can ignore this baseline emission source, given that emissions associated with steam generation can be a minor emission source. The use of fossil fuels to support the flaring process is ignored, since the amount of fossil fuels used to support the flaring process may not decrease if waste gas is partially recovered.

Baseline emissions associated with the operation of the flare ($BE_{flare,y}$) are determined based on the amount of steam that would be used in the baseline, the efficiency for steam generation and the CO_2 emission factor of the fossil fuels used for steam generation, as follows:

$$BE_{flare,y} = \frac{(Q_{wg,y} * d_{wg,y} * f_{st/wg}) * H_{st}}{\eta_{st}} * EF_{st} \tag{5}$$

Where:

$BE_{flare,y}$	=	Baseline emissions associated with the operation of the flare in year *y* (tCO_2/yr)
$Q_{wg,y}$	=	Amount of recovered waste gas that is eligible for crediting in year *y* (Nm^3/yr)
$d_{wg,y}$	=	Weighted average density of waste gas recovered in year *y* (t/Nm^3)
$f_{st/wg}$	=	Weighted average ratio of steam to waste gas combusted in the flares (t of steam/t of waste gas)
H_{st}	=	Weighted average steam energy content (GJ/t steam)
η_{st}	=	Boiler efficiency (%)
EF_{st}	=	Weighted average emission factor of fuel used for steam generation during the last three years prior to the implementation of the project activity (tCO_2/GJ)

To estimate boiler efficiency (η_{st}) the latest version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems" should be used. In applying the tool, a constant efficiency should be determined.

Project emissions

Project emissions include the emissions associated with electricity consumption required for the project activity (e.g. for compression of the recovered waste gas). Electricity may be either generated by captive power plants and/or may be imported from the grid.

To calculate project emissions in year *y (PE_y),* use the latest approved version of "Tool to calculate baseline, project and/or leakage emissions from electricity consumption".

Leakage

No leakage is identified.

Emission reductions

The emission reduction ER_y by the project activity during a given year y is the difference between the baseline emissions (BE_y) and project emissions (PE_y) calculated as follows:

$$ER_y = BE_y - PE_y \quad (6)$$

ER_y	=	Emissions reductions of the project activity during year y (tCO_2/yr)
BE_y	=	Baseline emissions in year y (tCO_2/yr)
PE_y	=	Project emissions in year y (tCO_2/ yr)

Data and parameters not monitored

Data / Parameter:	$f_{st/wg}$
Data unit:	t steam/t waste gas combusted in flare
Description:	Weighted average ratio of steam to waste gas combusted in the flares, based on historical data
Source of data:	On-site measurement
Measurement procedures (if any):	Measured/calculated This parameter has a low level of uncertainty if based upon data measured continuously; raw data should undergo basic descriptive statistical analysis to demonstrate there are no~~t~~ data inconsistencies (e.g. unexplained outliers)
Any comment:	To be calculated based on historical data for the three years prior to the implementation of the project activity

Data / Parameter:	Q_{wgf}
Data unit:	Nm^3/yr
Description:	Historic annual average amount of waste gas sent to the flare during the last three years prior to the implementation of the project activity implementation *minus* amount of waste gas released due to emergencies or shutdown and amount of waste gas required to maintain the pilot flame
Source of data:	On-site measurement
Measurement procedures (if any):	Measured/calculated. This parameter has a low level of uncertainty if based upon data measured continuously; raw data should undergo basic descriptive statistical analysis to demonstrate there are no~~t~~ data inconsistencies. Unless the amount of gas flared in emergency and shut down situations is measured, project proponents must provide the number of hours of duration of each emergency or shut-down and hourly historical refinery gas or process gas consumption during each year of the last three years prior to the implementation of the project activity. Historical hourly gas consumption shall be multiplied by the duration of the emergency or shut-down (hours). If it can be demonstrated that the refinery gas or process gas was diverted to other element processes (e.g. by reducing consumption of other fuels like fuel oil) during these emergencies or shut-downs then the amount of refinery gas or process gas diverted to the flare is zero. The pilot-flame consumption should be determined by means of design

	information provided by the manufacturer of the flare system unless it is directly measured
Any comment:	Historical data for the most recent three years prior to the implementation of the project activity

Data / Parameter:	Q_{CRS}
Data unit:	Nm^3/yr
Description:	System recovery capacity (Nm^3/hr) *multiplied by* the number of operating hours of the waste gas recovery system in year *y*
Source of data:	Manufacturer
Measurement procedures (if any):	The system recovery capacity, is taken from the manufacturer's specification of the recovery capacity (in volume of waste gas) of the recovery equipment. The following information must be supplied: • Name of manufacturer; • Model of recovery equipment; • Capacity of recovery equipment; • Power requirement; • Discharge pressure
Any comment:	Based on technical description provided by the supplier

Data / Parameter:	$FC_{i,x}$
Data unit:	Mass or volume unit
Description:	Quantity of fuel type *i* combusted in historic year *x*
Source of data:	On-site measurement
Measurement procedures (if any):	-
Any comment:	Most recent three historic years prior to the implementation of the project activity

Data / Parameter:	$f_{\eta_{PJ} / \eta_{BL}}$
Data unit:	-
Description:	Factor to account for the efficiency loss in element processes due to the utilization of waste gas in the project activity
Source of data:	In the case that all element processes, in which the recovered waste gas may be used, are designed to use gaseous fuels, use a value of 1.0. In the case that at least one of the element processes, in which the recovered waste gas may be used, is not designed to use gaseous fuels, determine the factor using one of the following two options: • Use a default value of 0.9 as a simple and conservative approach; or • Measure the efficiency of the element process when using a) the waste gas and b) the design fuel. Determine the factor as the ratio between the efficiency when using the waste and the design fuel
Measurement procedures (if any):	In the case that measurements are conducted, apply Option E in the latest version of the "Tool to determine the baseline efficiency of thermal or electric energy generation systems"
Any comment:	-

Data / Parameter:	$EF_{CO2,i,x}$
Data unit:	tCO_2/GJ
Description:	Emission factor of fossil fuel type *i* in the fuel mix used to meet fuel demand of the refinery or gas plant in historic year *x* of the most recent three years prior to the implementation of the project activity
Source of data:	National sources or IPCC default values
Measurement procedures (if any):	Estimated/calculated
Any comment:	Since refineries usually use more that one fuel source, this parameter should use the default IPCC values for each of the fuels in the mix

Data / Parameter:	H_{st}
Data unit:	GJ/t steam
Description:	Weighted average steam energy content
Source of data:	On-site measurement
Measurement procedures (if any):	Measured/estimated This parameter has a low level of uncertainty if based upon data measured continuously; raw data should undergo basic descriptive statistical analysis to demonstrate there are no data inconsistencies
Any comment:	Based on measured temperature and pressure for most recent three years prior to the implementation of the project activity

Data / Parameter:	EF_{st}
Data unit:	tCO_2/GJ
Description:	Weighted average emission factor of fuel used for steam generation during the last three years prior to the implementation of the project activity
Source of data:	National sources or IPCC default values
Measurement procedures (if any):	Estimated/calculated
Any comment:	Since refineries usually use more that one fuel source, this parameter should be based on the default IPCC values for each of the fuels in the mix and then a the weighted average emission factor should be calculated based of the composition of the mix

<table>
<tr><td>Data / Parameter:</td><td>$NCV_{i,x}$</td></tr>
<tr><td>Data unit:</td><td>GJ/mass or volume unit</td></tr>
<tr><td>Description:</td><td>Net calorific value of fuel type i combusted in historic year x</td></tr>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (a) is not available.
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>(d) IPCC default values at the lower limit of the confidence interval with 95% confidence level, as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a) and (b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Any comment:</td><td>Most recent three historic years prior to the implementation of the project activity
QA/QC procedures: Verify that the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values out of this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards</td></tr>
</table>

III. MONITORING METHODOLOGY

Monitoring procedures

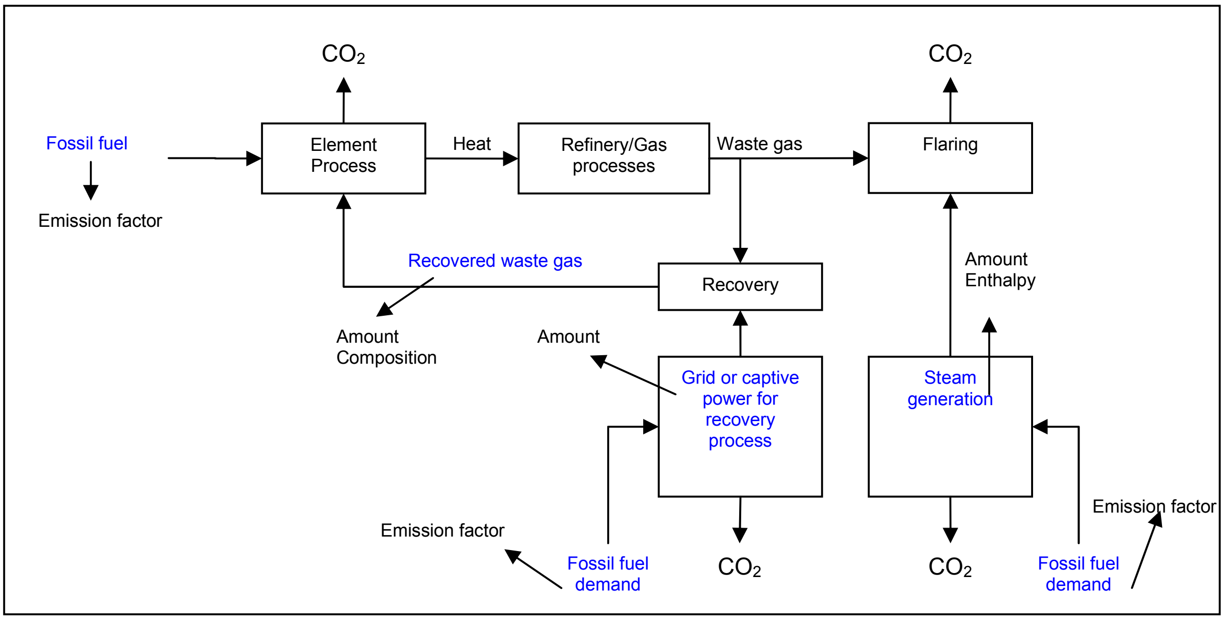


Figure 2: Schematic representation of refinery or gas plant operations

This monitoring methodology is based on baseline emissions being determined by the amount of waste gas recovered. This amount should be monitored ex post and baseline emissions adjusted accordingly. As indicated in the figure the methodology requires the monitoring of:

(a) The amount and composition of recovered waste gas;

(b) The amount of electricity consumed by the project activity either from the grid or captive generation;

(c) Data needed to calculate the emission factors for the electricity used in the project activity, either captive or imported;

(d) Data needed to calculate the emission factors for fossil fuels used for process heating and steam generation within the refinery or gas plant;

(e) Data needed to assure that the recovered waste gas has in fact been used for heating process purposes.

Uncertainty assessment

'Permissible uncertainty' shall be expressed with a 95 % confidence interval around the measured value,[6] for normally distributed measurements. The uncertainty associated with each parameter should be assessed, for example, by calculating the probable uncertainty as the mean deviation divided by the square root of the number of measurements. If this uncertainty is within the 95% confidence interval, then it is considered permissible uncertainty, and no action must be taken.

If not, then the uncertainty should be assessed as:

- Low (<10%);
- Medium (10-60%); or
- High (>60%).

Percent uncertainty may be calculated by dividing the mean of the parameter by the probable uncertainty and multiply by 100% to get percent uncertainty.

A detailed explanation of quality assurance and quality control procedures must be described for parameters with medium or high uncertainty in an attempt to decrease uncertainty, and to ensure that emission reductions calculations are not compromised. In case of a parameter with medium or high uncertainty, a sensitivity analysis should be performed to determine the effect of uncertainty on the emission reductions calculations. The authenticity of the uncertainty levels should be verified by the DOE at the project verification stage.

Data and parameters monitored

Data / Parameter:	$NCV_{wg,y}$
Data unit:	GJ/Nm^3
Description:	Average net calorific value of recovered waste gas in year *y*
Source of data:	Laboratory test
Measurement procedures (if any):	Chromatography performed at an on-site refinery or gas plant laboratory or at an external laboratory to determine the gas composition and subsequent standard calculations to obtain NCV
Monitoring frequency:	At least once per week
QA/QC procedures:	The method of chromatography must follow a recognized standard such as that of ASTM, ISO, CEN, or API. Equipment should be maintained and calibrated regularly according to manufacturer's requirements
Any comment:	To be calculated based on composition

Data / Parameter:	$d_{wg,y}$
Data unit:	t/Nm^3
Description:	Weighted average density of waste gas recovered in year y
Source of data:	Laboratory test

[6] Based on the COMMISSION DECISION of 29 January 2004 establishing guidelines for the monitoring and reporting of greenhouse gas emissions pursuant to Directive 2003/87/EC of the European Parliament and of the Council, (notified under document number C(2004) 130), (Text with EEA relevance), (2004/156/EC).

Measurement procedures (if any):	Chromatography performed at an on-site refinery or gas plant laboratory or at an external laboratory to determine the gas composition and subsequent standard calculations to obtain density. To be measured at the pressure and temperature of waste gas. If measured at NTP, the proper conversion of waste gas volume to be done at NTP before the multiplication of volume and density
Monitoring frequency:	At least once per week
QA/QC procedures:	The method of chromatography must follow a recognized standard such as that of ASTM, ISO, CEN, or API. Equipment should be maintained and calibrated regularly according to manufacturer's requirements
Any comment:	-

Data / Parameter:	η_{st}
Data unit:	%
Description:	Boiler efficiency
Source of data:	Depends on approach selected Option A Use the highest value among the following three values as a conservative approach: 1. Measured efficiency prior to project implementation using international standards referred to above; 2. Measured efficiency during monitoring using international standards referred to above; 3. Manufacturer nameplate data for the efficiency of existing boilers. Option B Assume a boiler efficiency of 100% based on the net calorific values as a conservative approach
Measurement procedures (if any):	Measured or obtained from manufacturer
Monitoring frequency:	Yearly
QA/QC procedures:	In case of being measured, the meter should be calibrated according to manufacturer's requirements
Any comment:	-

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	Emission factor of fossil fuel type *i* in the fuel mix used to meet fuel demand of the refinery or gas plant in year *y* of the crediting period

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<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
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<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
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<tr><td>Monitoring frequency:</td><td>Yearly</td></tr>
<tr><td>QA/QC procedures:</td><td>Verify that the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values out of this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards</td></tr>
<tr><td>Any comment:</td><td>-</td></tr>
</table>

Data / Parameter:	$FC_{i,y}$
Data unit:	Mass or volume unit
Description:	Quantity of fuel type *i* combusted in year *y* of the crediting period
Source of data:	On-site measurement
Measurement procedures (if any):	-
Any comment:	-

Data / Parameter:	$NCV_{i,y}$
Data unit:	GJ/mass or volume unit
Description:	Net calorific value of fuel type *i* combusted in year *y* of the crediting period

<table>
<tr><td>Source of data:</td><td>The following data sources may be used if the relevant conditions apply:
<table>
<tr><th>Data source</th><th>Conditions for using the data source</th></tr>
<tr><td>(a) Values provided by the fuel supplier in invoices</td><td>This is the preferred source</td></tr>
<tr><td>(b) Measurements by the project participants</td><td>If (a) is not available</td></tr>
<tr><td>(c) Regional or national default values</td><td>If (a) is not available.
These sources can only be used for liquid fuels and should be based on well-documented, reliable sources (such as national energy balances)</td></tr>
<tr><td>(d) IPCC default values at the lower limit of the confidence interval with 95% confidence level, as provided in Table 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories</td><td>If (a) is not available</td></tr>
</table></td></tr>
<tr><td>Measurement procedures (if any):</td><td>For (a) and (b): Measurements should be undertaken in line with national or international fuel standards</td></tr>
<tr><td>Monitoring frequency:</td><td>For (a): Monthly, averaged for the year
For (b) and (c): Annually</td></tr>
<tr><td>QA/QC procedures:</td><td>Verify that the values under (a), (b) and (c) are within the uncertainty range of the IPCC default values as provided in Table 1.2, Vol. 2 of the 2006 IPCC Guidelines. If the values out of this range, collect additional information from the testing laboratory to justify the outcome or conduct additional measurements. The laboratories in (a), (b) or (c) should have ISO17025 accreditation or justify that they can comply with similar quality standards</td></tr>
<tr><td>Any comment:</td><td>-</td></tr>
</table>

Data / Parameter:	$Q_{PJ,wg,y}$
Data unit:	Nm^3/yr
Description:	Amount of waste gas recovered under the project activity in year *y*
Source of data:	On-site measurement
Measurement procedures (if any):	On-site flow meters placed at the point where waste gas is added to other fuel gases being sent to the element process(es)
Monitoring frequency:	Continuously
QA/QC procedures:	Flow meters should be maintained and calibrated regularly according to manufacturer's requirements
Any comment:	-

IV. REFERENCES AND ANY OTHER INFORMATION

- American Petroleum Institute (2004). Compendium of Greenhouse Gas Emissions Methodologies for the Oil and Gas Industry;
- Intergovernmental Panel on Climate Change (2006) Guidelines for National Greenhouse Gas Inventories.

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History of the document

Version	Date	Nature of revision(s)
02.1.0	13 September 2012	EB 69, Annex 14 Amendment to: • Expand the applicability to include waste gas recovery from gas plants; • Change the title from "Recovery and utilization of waste gas in refinery" to "Recovery and utilization of waste gas in refinery or gas plant".
02.0.0	EB 61, Annex 7 3 June 2011	Revision to: • Simplify the methodology by removing the requirement to quantify the impact of the project activity on the efficiency of element processes. Instead, emission reductions are determined based on a conservatively chosen baseline emission factor; • Revise the procedure to select the baseline scenario and demonstrate additionality with the view to use the "Combined tool to identify the baseline scenario and demonstrate additionality"; • Remove the reference to the "Tool for the demonstration and assessment of additionality"; • Improve the clarity, readability and consistency of the methodology.
01.2	EB 39, Paragraph 22 16 May 2008	"Tool to calculate baseline, project and/or leakage emissions from electricity consumption" replaces the withdrawn "Tool to calculate project emissions from electricity consumption".
01.1	10 October 2007	In equation (5) variable "EFphf_B" is changed to "EFphf_BL", to make it consistent with the same variable used and defined in equation (3).
01	EB 33, Annex 1 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type**: Standard **Business Function**: Methodology		