Indicative simplified baseline and monitoring methodologies
for selected small-scale CDM project activity categories

TYPE III - OTHER PROJECT ACTIVITIES

Project participants shall take into account the general guidance to the methodologies, information on additionality, abbreviations and general guidance on leakage provided at http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html .

III.P. Recovery and utilization of waste gas in refinery facilities

Technology/measure

1. The category is applicable to project activities at existing refinery facilities that develop an alternative use for the energy content of waste gas that is currently being flared, to generate process heat in elemental process(es)[1], replacing fossil fuel combustion.

2. The waste gas utilized in the project activity was flared into the atmosphere in the absence of the project activity. This shall be proven by one of the following options:

- **By direct measurements** of energy content and amount of the waste gas for at least three years prior to the start of the project activity.
- **Energy balance** of relevant sections of the plant to prove that the waste gas was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance must demonstrate that the waste gas was not used and also provide conservative estimations of the energy content and amount of waste gas released.
- **Process plant** manufacturer's original specification/information, schemes and diagrams from the construction of the facility may be used for an estimate of quantity and energy content of waste gas produced for rated plant capacity per unit of product produced.

3. The following conditions apply to the category:

- Recovered waste gases are used in the same refinery facility.
- The project activity does not lead to an increase in the production capacity of the refinery facility.
- Waste gas flow and composition are measurable.

[1] An "*elemental process*" is defined as fuel combustion or heat utilized in equipment at one point of an industrial facility, for the purpose of providing thermal energy. Examples of an elemental process are steam generation by a boiler and hot air generation by a furnace. Each elemental process should generate a single output (such as steam or hot air) by using mainly a single fuel (not plural energy sources). For each elemental 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 value of the fuel multiplied with the fuel quantity).

- There should not be any addition of fuel gas or refinery gas in the waste gas pipeline between the point of recovery and the point where it is mixed in fuel gas system or used directly in an elemental process.
- The recovery device is placed just before the flare header (with no possibility of diversions of the recovered gas flow) and after all the waste gas generation devices.

4. The recovery of waste gas may be a new initiative or an incremental gain in an existing practice.

5. In case the project activity is an incremental gain, the difference between the technology used before project activity implementation and the project technology should be clearly shown. It should be demonstrated why there are barriers for the project activity that did not prevent the implementation of the technology used before the project activity implementation.

6. Measures are limited to those that result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually. Wherever the measures lead to waste gas recovery which is incremental to an existing practice of waste gas recovery, only the incremental gains in GHG mitigation should be taken into account and such incremental gains shall result in emission reductions of less than or equal to 60 kt CO_2 equivalent annually.

Definitions

7. For the purpose of this category the following definitions apply:

Refinery gas: Also known as ‘still gas’, can be 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. Still gas is used as a refinery fuel and a petrochemical feedstock” and is generally produced from light ends distillation units of refinery facilities, where it has a pressure that allows its immediate use.

Waste gas: Waste gas is a by-product generated in several of the processing units of the refinery and in normal operational processes is directed to the flares. The principal constituents of this gas are the same as in refinery gas (methane, ethane, ethylene, normal butane, butylene, propane, propylene, etc). However, waste gas is characterised by a low pressure for which no useful application is found in the absence of the project, because recovering waste gas for energy use is not feasible in the baseline scenario (e.g. owing to low pressure, heating value or quantity available). In the project scenario, this waste gas is recovered in order to make it useful as a fuel.

Boundary

8. The physical, geographical site of the refinery where the waste gas is produced and transformed into useful energy delineates the project boundary.

Baseline

9. The following formula shall be used to calculate baseline emissions:

$$BE_y = Q_{wg,y} * LHV_{wg} * EF_{ff,y} * F \quad (1)$$

Where:

BE_y	Baseline emissions from process heating in year *y* (tCO_2e per year)
$Q_{wg,y}$	Net amount of recovered waste gas that replaces fossil fuel used for process heating in year *y* (Nm^3)
LHV_{wg}	Lower heating value (LHV) of waste gas recovered (GJ/Nm^3)
$EF_{ff,y}$	Emission factor of the fossil fuel to be replaced by waste gas in year *y* (tCO_2e/GJ)[2]
F	Efficiency correction factor calculated as the efficiency of the process heating device using waste gas divided by the efficiency using fossil fuel (%). Maximum efficiency correction factor is fixed as 100%.

Net amount of recovered waste gas

10. If there is a bypass gas exit (deviation) between the point where the recovered waste gas is mixed with other fuel gases and the elemental process where the mixed gas is used, it can not be assumed that all recovered waste gas is used, resulting in displacement of fossil fuel. The total volume of fuel gas measured at bypasses (deviations) should be deducted from the amount of recovered waste gas. The result of the deduction is the net amount of recovered waste gas.

Process heating efficiency

11. In the following cases the adjustment in emission correction factor is not required because the use of waste gas will not result in a decrease of efficiency in the element process.

- the waste gas has the same or higher LHV as that of the refinery gas.
- the fossil fuel used in the baseline scenario and replaced by waste gas has a lower thermal utilisation efficiency than that of the waste gas.

In such cases the efficiency correction factor F should be taken as 100%.

12. For other cases the emission correction factor F has to be determined for a representative elemental process. As a typical refinery uses different elemental processes such as boilers and furnaces and in many cases it is not feasible to measure the efficiencies (baseline and project) of each elemental process, the

[2] Emission factor (tCO_2/TJ) =Carbon emission factor (tC/TJ)*44/12. Carbon emission factor to be sourced from IPCC Good Practice Guidance, other reliable sources (e.g. American Petroleum Institute) or estimated based on the composition of the replaced fuels.

methodology requires conservative determination of a representative elemental process where the efficiency will be more affected by using the waste gas. The ratio of efficiency of elemental process with waste gas and baseline fuel will be used for the determination of the most affected elemental process. The efficiencies of representative elemental process should be determined for the highest load. The project proponent shall identify the representative elemental process using manufacturer's specifications of best efficiencies or by a technical assessment. The assessment should be carried out by independent qualified/certified external process experts such as a chartered engineer. The assessment should consider the technical information provided by the manufacturers of the elemental process.

13. The following options can be used to determine process heating efficiency:

- Data from manufacturer specification.
- Actual measurement following international standard.

14. For process heating efficiency using fossil fuel, 100% efficiency may be assumed.

Capping of baseline emissions

15. 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 waste gas generation.

16. The historical three years average of waste gas sent to the flares minus the sum of the amount of waste gas released due to emergencies/exigencies or shutdown and the amount of waste gas required to maintain the pilot flame shall be the cap for the net amount of recovered waste gas.

17. In case the historical information of the last three years is not available, the cap must be determined using the manufacturer's data for the refinery to estimate the amount of waste gas that the refinery generates per unit of production. In case any modification is carried out by project proponent or in case the manufacturer's 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 waste gas generated by the plant per unit of production by the process generating waste gas. The value arrived at should be multiplied by the three years average production by the process generating waste gas, in order to calculate the amount of waste 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, (including manufacturer's design document/letter and the expert's analysis) should be provided to DOE during validation.

Project emissions

18. Project Emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and electricity emissions due to consumption of electricity by the project activity.

Emission reductions

19. Emission reductions are calculated as baseline emissions minus project emissions.

Monitoring

20. Monitoring parameters for the purpose of determining baseline emissions shall include:

- Amount of waste gas recovered in the project scenario. The amount of waste gas will be monitored continuously by a flow meter.
- Total volume of fuel gas measured at bypasses (deviations) between the point where the waste gas is added into other fuel gases and the elemental process (monitored continuously by flow meters).
- Lower Heating Value of Waste Gas recovered in the project scenario. LHV of waste gas recovered will be monitored monthly with a representative sample taken from the waste gas streams and an annual average value will be considered.
- Emission factor of the fossil fuel to be replaced by waste gas in year *y*. Local or country specific values or IPCC default values are to be used.
- Process heating efficiency.

21. For project emissions determination, the "Tool to calculate project or leakage CO_2 emissions from fuel combustion" and the "Tool to calculate project emissions from electricity consumption" shall be used.

Project activity under a programme of activities

The following conditions apply for use of this methodology in a project activity under a programme of activities:

22. In case the project activity involves the replacement of equipment, and the leakage effect of the use of the replaced equipment in another activity is neglected, because the replaced equipment is scrapped, an independent monitoring of scrapping of replaced equipment needs to be implemented. The monitoring should include a check if the number of project activity equipment distributed by the project and the number of scrapped equipment correspond with each other. For this purpose scrapped equipment should be stored until such correspondence has been checked. The scrapping of replaced equipment should be documented and independently verified.