GREEN HOUSE GAS EMISSION REDUCTION: A REVIEW

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ABSTRACT

Greenhouse gas (GHG) emission reduction aims to support transparent and credible calculation as well as reporting of GHG emission reduction in a comprehensive and consistent manner. Decrease in GHG emission from the atmosphere is relative to the baseline emission. The GHG reduction project consist of more than one activity and overall net reduction is sum of GHG reductions from each individual activity. GHG reduction project is a set of activities that reduce global GHG emissions, increase storage of carbon or enhance GHG removal from the atmosphere.

INTRODUCTION

Gas having ability to absorb infrared radiation in the atmosphere is called greenhouse gas (GHG). Greenhouse gases include water vapour, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), Hydrochloroflourocarbons (HCFCs), Ozone (O_3), hydroflurocarbons (HFCs), perflurocarbons (PFCs) and sulphur hexafluoride (SF_6). The technical concept of GHG emission reduction is the basic principal of completeness, consistency, accuracy, transparency, relevance, and conservation (ISO, 2006).

GHG emission reduction includes the following examples:

- Voluntary actions to reduce GHG emissions;
- Compliance with any applicable regulatory regime;
- Meeting of internal company emission reduction targets;

GHG emission reduction project refers set of activities that result in reduction, removal or storage of GHG emission. GHG emission reduction is quantified as difference between baseline emission and reduction emission, where baseline emission are determined for same quantity of output as the project. Emission reduction will continue to occur for as long as the baseline scenario is applicable and justify. Time frame for the baseline scenario applied should be considered, such that anticipated changes can be factored from start to extent possible. The length of this project depending on technical and policy consideration and baseline emission estimates are static or dynamic (WBCSD, 2005).

Effect GHGs on Global Warming Potential:

Global warming potential allow comparison of the ability of each GHG to trap heat in the atmosphere relative to carbon dioxide over a specific time horizon. A GWP is calculated over a specific time interval, commonly 20,100 or 500 years. GWP is expressed as a factor of carbon dioxide. GWP for CO_2 is standardized to 1 (Elord MJ, 1999).

The GWP depends on following factors:

- The absorption of infrared radiation by a given species
- The spectral location of its absorption wavelengths
- The atmospheric lifetime of the species

Greenhouse Gases:

Gases that trap heat in the atmosphere are called greenhouse gases.

Carbon dioxide (CO_2): The main contributor to enhanced greenhouse effect is carbon dioxide (CO_2). Globally, it accounts for over 60% of the enhanced greenhouse gas effect. In industrialised countries, CO_2 makes up more than 80% of greenhouse gas emissions. CO_2 enters in the atmosphere through burning fossil fuels (coal, natural gas and oil), solid waste, trees

and wood products as well as result of certain chemical reactions (manufacture of cement). CO_2 is removed from the atmosphere when it is absorbed by plants as part of biological carbon cycle (Daniels and Adamowicz, 2000).

Methane (CH_4): It is second most important GHG for enhanced greenhouse effect. Since the beginning of the industrial revolution, atmospheric methane concentrations have doubled and contributed some 20% to enhancement of GHG effect. In industrialised countries, CH_4 accounts typically for 15% of GHG emissions. Methane is emitted during production and transport of coal, natural gas, and oil. Methane emissions also result from livestock and other agricultural practices and the decay of organic waste in municipal solid waste landfills. In the atmosphere, methane traps heat and is 23 times more effective at that than CO_2. Its lifetime is shorter between 10and 15 years (Daniels and Adamowicz, 2000).

Nitrous oxide (N_2O): Nitrous oxide is emitted during agricultural and industrial activities as well as during combustion of fossil fuels and solid waste. In industrialised countries, N_2O accounts for around 6% of GHG emissions. N_2O is 310 times more effective than CO_2 absorbing heat. Since the beginning of industrial revolution, N_2O concentrations in atmosphere have increased by about 16% and contributed 4-6% to the enhanced of the greenhouse effect (Zacny et al., 1995).

Fluorinated gases: Hydrofluorocarbons, perfluorocarbons, and sulphur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for stratospheric ozone depleting substances (e.g. chlorofluorocarbons, hydrochlorofluoro-carbons and halons). These gases are emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as High Global Warming potential gases (High GWP gases). Their share of GHG emission from industrialised countries is around 1.5%. However they are extremely powerful as they can trap heat up to 22,000 times more effectively than CO_2 and they can stay in the atmosphere for thousands of year (Forster et al., 2007).

G1HG Emission Reduction Project

A GHG reduction project is a recognizable and distinct activity or set of activities that reduce global GHG emission, increase storage of carbon or enhance GHG removals from the atmosphere (IPIECA/OGP/API, 2003).

This project defines three fundamental principles for quantification of emission reductions

- ✓ A GHG reduction is difference between the actual emission resulting from implementation of a GHG project and emission baseline emission.
- ✓ GHG project and baseline emission must be evaluated on a comparable basis.
- ✓ Reasonable account or consideration should be taken of emission outside direct control of GHG project.

Quantification of GHG reduction emission

Primarily CO_2 emission resulting from associated combustion. The API compendium recommends estimating this combustion emission based on quantity of fuel consumed and fuel carbon content. GHG reduction project emission should also be based on metered fuel consumption rates and fuel specific carbon contents from onsite measurements or from the fuel supplier (API, 2004). Fuel combustion produces CH_4 and N_2O emissions which may not be materials. API compendium provides CH_4 and N_2O emission factors for stationary combustion sources. Non combustion CH_4 emission may also result from vented and fugitive emission sources associated with the natural gas supply to cogeneration equipment. Emission from these sources is generally small compared to CO_2 emission from combustion. The emission cannot be providing by particular climate change regime or GHG registry. Fugitive emission sources can be applied to natural gas equipment within assessment boundary for cogeneration unit. The emission sources may be excluded from assessment due to their small impact relative to combustion emission (IPIECA/OGP/API, 2003).

Quantification of Baseline Emission

Baseline emission is quantified tonnes of GHG emission for emission sources, sinks, and reservoir corresponding to the baseline scenario. For onsite energy generation displaced by cogeneration project which give information to quantify the baseline scenario emission rate for steam and electricity production. Electricity or steam, the baseline emission should be quantified using fuel consumption rates and carbon content for fuel used to produce imported energy streams. Grid based emission factor methodology is used for quantification of baseline emission. In GHG reduction emission project CO_2, Methane and N_2O emission result from combustion used to generate electricity and steam. Non combustion CH_4 emission also results from vented and fugitive emission sources associated with natural gas use in the baseline scenario (GGFR, 2004).

Monitoring of GHG reduction emission

GHG emission reduction project provides means for quantification, reporting and validation of GHG emission and baseline scenario and includes a combination of measurement, modelling and estimation technique. Monitoring should be cost effective, with emphasis placed on parameters that are highly variable and related to significant emission sources.

Monitoring is based on:

- ✓ Selection of appropriate parameter from which gauge emission is controlled and/or related and affected by project activity, as well as relevant to the baseline scenario.
- ✓ To determine frequency and duration consistent with variability of parameter.
- ✓ To examine change in condition that might impact the baseline scenario.

Reporting of GHG reduction emission

Green house gas emission reduction generally reported on an annual basis. GHG emission reduction report provide a plausible and transparent account project, decisions and assumptions. GHG emission reduction report should be supported by documentation maintained by project proponent (USDE, 2006).

Reported information may include following:

- ✓ Description of GHG emission reduction project
- ✓ Geographic location
- ✓ Start date of project
- ✓ Identification of baseline scenario, justification of baseline scenario
- ✓ Estimation of baseline emission, quantification of project emission, result of reduction
- ✓ Calculation method, monitoring parameter and assumption

Verification of GHG reduction emission

Verification should focus on quality assurance with objective of improving overall reliability of reported emission reduction. Verification should provide the stakeholder or user of the information assurance that the reported emission reduction is credible. Verification requirements may be dictated by the particular climate change regime or GHG registry (WBCSD/WRI, 2006).

CONCLUSION

Industries may evaluate option for reduction of green house gas emission, development of project plans, and implementation of emission reduction project. Various organizations are developing guidance and procedure to quantify, report and register the level of GHG emission reduction which will provide a framework for quantification of GHG emission reduction with sufficient transparency.

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