# Requirement Of Separate Methane Emission Calculation In GHG Inventory Report/ Disclosure For Better Transparency, Quality, And Accuracy For Pathway To Decarbonization And Net-Zero.

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**Introduction to GHG Emission**

Climate change arising from anthropogenic activity has been identified as one of the greatest challenges facing the world and will continue to affect business and citizens over future decades. Climate change has implications for both human and natural systems and could lead to significant impacts on resource availability, economic activity and human wellbeing. In response, international, regional, national and local initiatives are being developed and implemented by public and private sectors to mitigate greenhouse gas (GHG) concentrations in the Earth's atmosphere, as well as to facilitate adaptation to climate change. There is a need for an effective and progressive response to the urgent threat of climate change on the basis of the best available scientific knowledge.

Due to humans' heavy reliance on fossil fuels, energy usage, and constant deforestation, the amount of greenhouse gas in the atmosphere is increasing, which makes reducing a greenhouse gas footprint harder to achieve.

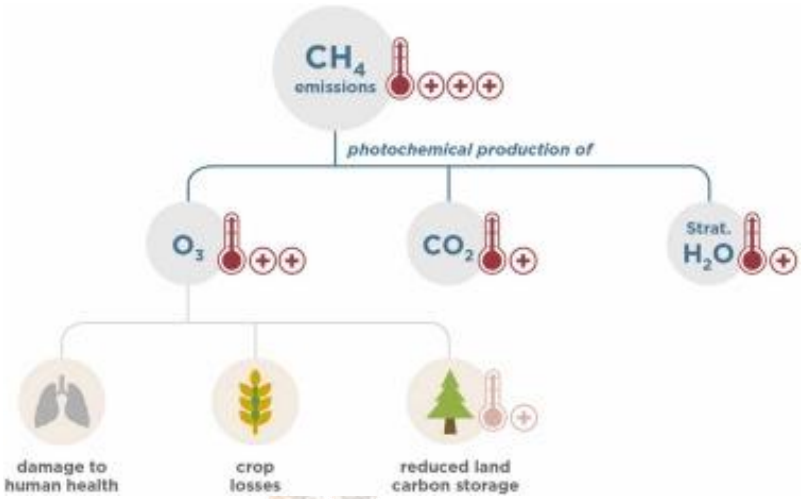
Greenhouse gases (GHGs) are gases that increase the temperature of the Earth due to their absorption of infrared radiation. Although some emissions are natural, the rate of which they are being produced has increased because of humans. These gases are emitted from fossil fuel usage in electricity, in heat and transportation, as well as being emitted as by-products of manufacturing. A greenhouse gas footprint is the numerical quantity of these gases that a single entity emits. The calculations can be computed ranging from a single person to the entire world.

Carbon emissions are generated from a lot of sources, and they have sizeable contributions. Little steps towards minimizing your carbon footprint will go a long way in reversing climate change.

A greenhouse gas (sometimes abbreviated GHG) is a gas that absorbs and emits radiant energy within the thermal infrared range. Greenhouse gases cause the greenhouse effect on planets. GHG are CO2, CH4, N2O, SF6, HFCs, PFCs

It is usually measured as tons of CO2 emitted per year, a number that can be supplemented by tons of CO2-equivalent gases, including methane, nitrous oxide, and other greenhouse gases.

**Impacts of Methane on climate, ecosystems, and health**




Schematic overview of methane's primary impacts on climate, ecosystems, and health. Photochemical reactions of CH4 in the atmosphere lead to the production of tropospheric ozone (O3), CO2, and stratospheric water vapor (Strat. H2O), all of which are also GHGs and contribute directly to global warming. Tropospheric ozone is harmful to human health and also to ecosystems, where it damages plants, leads to crop losses, and reduces the ability of the biosphere to store carbon.

**GHG in Atmosphere**

| Substance | AR1 (1990) | AR2 (1995) | AR3 (2001) | AR4 (2007) | AR5 (2013) |
|---|---|---|---|---|---|
| Carbon dioxide, fossil ($CO_2$) | 1 | 1 | 1 | 1 | 1 |
| Methane, fossil ($CH_4$) | 21 | 21 | 23 | 25 | 28 |
| Methane, biogenic ($CH_4$) | 18.25 | 18.25 | 20.25 | 22.25 | 25.25 |
| Dinitrogen monoxide ($N_2O$) | 290 | 310 | 296 | 298 | 265 |
| HCFC-141b | 440 | - | 700 | 725 | 782 |
| HFC-134a | 1200 | 1300 | 1300 | 1430 | 1300 |
| HCFC-22 | 1500 | - | 1700 | 1810 | 1760 |
| HCFC-142b | 1600 | - | 2400 | 2310 | 1980 |
| CFC-11 | 3500 | - | 4600 | 4750 | 4660 |
| CFC-12 | 7300 | - | 10600 | 10900 | 10200 |
| Sulfur hexafluoride | - | 23900 | 22200 | 22800 | 23500 |

*Note*: The IPCC gives additional factors for fossil methane, but these factors should be ignored. The factor for biogenic methane in the table above was calculated by subtracting 2.75 kg of $CO_2$ per kg of methane from the methane factors. We took the molar mass of $CO_2$ divided by the molar mass of CH4 for the correction factor of 2.75. The changes of the GWP factors for 20-year accumulated impact are similar: fossil methane changed from 72 to 84 kg $CO_2$ equivalents per kg in the latest reports and $N_2O$ changed from 289 to 264 kg $CO_2$ equivalents per kg. The GWP 500 factors for methane and $N_2O$ were not published in the latest report.

**Why Methane need to be reported separately??**

Methane ($CH_4$) is a hydrocarbon that is a primary component of natural gas. Methane is also a greenhouse gas (GHG), so its presence in the atmosphere affects the earth's temperature and climate system. Methane is emitted from a variety of anthropogenic (human-influenced) and natural sources. Anthropogenic emission sources include landfills, oil and natural gas systems, agricultural activities, coal mining, stationary and mobile combustion, wastewater treatment, and certain industrial processes.

Methane is the second most abundant anthropogenic GHG after carbon dioxide ($CO_2$), accounting for about 20 percent of global emissions. Methane released directly into the atmosphere is a highly potent greenhouse gas, with more than 80 times the warming power of carbon dioxide over a 20-year period. Over the last two centuries, methane concentrations in the atmosphere have more than doubled, largely due to human-related activities. Because methane is both a powerful greenhouse gas and short-lived compared to carbon dioxide, achieving significant reductions would have a rapid and significant effect on atmospheric warming potential.

Reducing methane emissions is a crucial effort in the industry's decarbonization pathway. As a factor on which we can have an immediate and concrete positive impact,

According to the International Energy Agency (IEA), roughly three-quarters of methane emissions could be reduced with the technology that exists today, and close to half at zero net cost. Reducing methane emissions from the energy sector by 90% would shave two tenths of a degree Celsius from the forecasted rise in the planet's average temperature by 2050.

Reducing fossil methane emissions by 75 per cent can prevent up to 6 gigatonnes of carbon dioxide equivalent emissions annually – almost ten per cent of the planet's 2019 greenhouse gas emissions, including land-use change.

Many organisation are reporting their GHG emission/Carbon footprint but they are likely concerned about carbon dioxide majorly as carbon neutrality mainly concern about carbon and industries are focusing on that. Once they are talking about net zero that means they are considering every greenhouse gases.

But industries like oil & gas, Dairy & agriculture is having significant impact and contribution of Methane emission. Although there are political as well as economical challenges in agriculture and dairy industries but for oil & gas challenges are not the same.

Oil & gas industries are reporting their GHG emission that too mentioning methane, but the accountability of inventory is not that much of qualitative specially in case of methane data's, majority of the oil & gas industries are partially reporting methane related inventories which comes under scope 1 and very little inventories in scope 3.

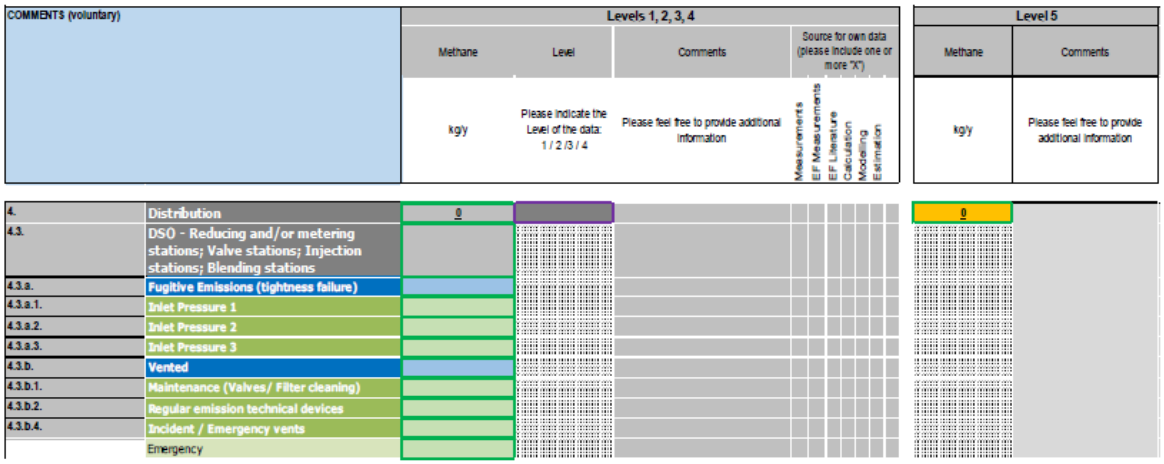
So, as to address this challenge and implementing an strategy to become real transparent and showing actual GHG inventory accounting and pathway to net zero, oil & gas industries has to report it in detailed way and putting it together with carbon footprint inventory and then showing actual total GHG emission of the company.

Company has to report the methane emission staring from exploitation to transmission and distribution to point of use.

Every single source of methane emission in value chain should addressed for transparent reporting and implicating the best practices to mitigate and reduce the emission.

| | | CH4 Emissions - Operated Assets/ Ventures | | CH4 Emissions - Non-Operated Assets/ Ventures | |
|---|---|---|---|---|---|
| | | Prior Year [Year] | Current Year [Year] | Prior Year [Year] | Current Year [Year] |
| Total CH4 Emissions Reported Using L4 - Emissions reported by detailed type and using specific EFs and activity factors | Stationary Combustion | | 0 | | 0 |
| | Flaring (Incomplete Combustion) | | 0 | | 0 |
| | Fugitive Component and Equipment Leaks | | 0 | | 0 |
| | Natural gas driven pneumatic equipment | | 0 | | 0 |
| | Centrifugal compressor shaft seals | | 0 | | 0 |
| | Reciprocating compressor rod packing | | 0 | | 0 |
| | Glycol dehydrators | | 0 | | 0 |
| | Tanks | | 0 | | 0 |
| | Well liquids unloading | | 0 | | 0 |
| | Well casinghead venting | | 0 | | 0 |
| | Hydraulic fracture completions | | 0 | | 0 |
| | Venting - Other | | 0 | | 0 |
| | Others Sources | | 0 | | 0 |
| | TOTAL | 0 | 0 | 0 | 0 |
| TOTAL COMPANY METHANE EMISSIONS INCLUDED IN THIS SUBMISSION | | 0 | 0 | 0 | 0 |
| Total CH4 Emissions Reported Using L5 | Total CH4 using Central Estimate | | | | |

Report example - Upstream Level 4 and 5



| COMMENTS (voluntary) | | Levels 1, 2, 3, 4 | | | | | | | | Level 5 | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Methane | Level | Comments | Source for own data (please include one or more "X") | | | | | Methane | Comments |
| | | kg/y | Please indicate the Level of the data: 1 / 2 /3 / 4 | Please feel free to provide additional information | Measurements | EF Measurements | EF Literature | Calculation Modelling | Estimation | kg/y | Please feel free to provide additional information |
| 4. | Distribution | 0 | | | | | | | | 0 | |
| 4.3. | DSO - Reducing and/or metering stations; Valve stations; Injection stations; Blending stations | | | | | | | | | | |
| 4.3.a. | Fugitive Emissions (tightness failure) | | | | | | | | | | |
| 4.3.a.1. | Inlet Pressure 1 | | | | | | | | | | |
| 4.3.a.2. | Inlet Pressure 2 | | | | | | | | | | |
| 4.3.a.3. | Inlet Pressure 3 | | | | | | | | | | |
| 4.3.b. | Vented | | | | | | | | | | |
| 4.3.b.1. | Maintenance (Valves/ Filter cleaning) | | | | | | | | | | |
| 4.3.b.2. | Regular emission technical devices | | | | | | | | | | |
| 4.3.b.4. | Incident / Emergency vents | | | | | | | | | | |
| | Emergency | | | | | | | | | | |

Report example - Distribution System Operator (DSO) such as reducing and/or metering stations, valve stations, injection stations, blending stations

As a major source of global methane emissions, the oil and gas industry bear a special responsibility for urgent action to bring methane leakage and flaring under control. Ongoing advancements in oil and gas emissions measurement and management technology make abatement a low-hanging fruit for significant climate system impact. Recent analysis from the International Energy Agency (IEA) finds that 40% of global methane emissions from upstream operations can be mitigated at no net cost.

While an estimated 70% to 90% of upstream assets from oil majors are held in joint venture partnerships, most targets set by those same companies only cover those ventures where the company is the operator.

To address this reporting gap, the OGMP2.0 has expanded its reporting scope and includes all member companies operated and non-operated assets.

Methane is a shorter-lived and far more powerful greenhouse gas than carbon dioxide. While cumulative carbon dioxide emissions define global temperature rise in the long term, methane emissions strongly affect the rate of warming, the peak temperature level, and the risk of a temperature overshoot. The IPCC WGIII (2022) found that reductions of methane emissions would lower peak warming and reduce the likelihood of overshooting warming limits. Early methane mitigation is also critical for reducing the risk of catastrophic events such as the near complete loss of summer Arctic Sea ice (Sun et al., 2022). Because of methane's warming power and its short atmospheric lifetime, reducing methane emissions also is the fastest way to slow the rate of global warming in the near term (Ocko et al., 2021; Sun et al., 2021; UNEP and CCAC, 2021). Thus, while methane emission reductions are not a substitute for rapid and deep reductions in carbon dioxide emissions, they are also a critical step toward reaching the temperature goal of the Paris Agreement.

Levels of reporting:

The OGMP 2.0 reporting framework recognizes that companies and individual assets may be at different stages of their methane management and reporting journeys. Companies may have assets with sources in multiple reporting levels. The reporting template allows companies to categorize their asset and sources reporting by five different reporting levels:

✓ Level 1 Emissions reported for a venture at asset or country level (i.e. one methane emissions figure for all operations in an asset or all assets within a region or country). This reporting level will typically be applicable for assets for which a company has not undertaken any methane emission source mapping or survey activities or where information from the operator is highly limited. Emissions will be quantified using generic Emission Factors. In the case of transmission and distribution networks located in a region or country, it is necessary for level 1 reporting to report one methane emissions figure, as well as for underground storage facilities. (kg/y) quantifying total emissions of all facilities along the network (e.g. compressors, valve stations, pipelines, reduction & regulating stations).

✓ Level 2 Emissions reported according to the 3 types of methane emissions:

• Fugitive emissions

• Vents

• Incomplete combustion Emissions reported in each of these categories are typically quantified using generic emission factors, though more advance forms of quantification may also be used.

✓ Level 3 Emissions reported by detailed emission source type and using generic, but source-specific, emission factors. A complete inventory of methane emissions sources is required.

✓ Level 4 Emissions reported by detailed source type and using specific EFs and activity factors (AFs). Source-level measurement and sampling may be used as the basis for establishing these specific EFs and AFs, though other source specific quantification methodologies such as simulation tools and detailed engineering calculations (e.g. as referenced in existing OGMP TGDs) may be used where appropriate. For reference as to what is a valid Level 4 quantification method, please refer to the TGDs. The reporting needs to be done per source of methane emissions.

• Fugitive emissions - Where relevant as per described in the appropriate reporting template, leaks from components due to loss of tightness. Each type of component will be reported separately: connections (flanges, seals, joints), valves and control valves, pressure relief valves, blow-down open-ended lines, open ended lines and others. In the case that there is permeation, and a separate line has not been included, these emissions should be reported in "Others" (e.g. some type of LNG tanks).

- Permeation – In the case of the distribution grids a disaggregation taking into account the (non-metal) materials of the pipelines has been included as well as the pressure range of the pipelines.

• Vents - Operational emissions - Purging & venting Methane emissions associated to maintenance activities, process, commissioning & decommissioning. - Operational emissions - Regular emission technical devices Methane emissions associated to pneumatic devices, gas analysers, seals of the compressor units, reciprocating compressor rod packing…

- Operational emissions - Starts & stops Start/stop of the compressors. - Incidents / emergency situations - Change or removal of gas meters in distribution grids - Others Start/stop of the gas combustion devices (turbines, engines, boilers…) and flares will be reported in "Others" as they are very small.

• Incomplete combustion - Gas combustion devices - A disaggregation of the natural gas combustion devices has been included. - Flaring The category "Others" have been included in all types of methane emissions to give flexibility in the reporting to the OGMP members and to ensure that all the methane emissions are reported. This can be reviewed in the future.

✓ Level 5 Emissions are reported additionally to Level 4 reporting (including the calculation of the uncertainty of the measurement methodologies/technologies used in the construction of the inventory at the Level 4), reconciling the source-level inventory (Level 4) and site-level emission measurements. Level 5 reporting discloses the final estimate at asset-level with its associated uncertainty based on the aforementioned reconciliation. Please refer to the Uncertainty and Reconciliation Guidance for more details.

This quantification of site/facility-wide emissions, which is independent from the source-level quantification, is intended to reconcile source- and site-level emissions estimates, providing improved confidence in reported emissions.

**Reporting requirements: timelines and templates How long do you have to reach the Gold Standard?**

The initiators have set specific timelines to make it feasible for members to work towards the level 4/5 reporting target. This timeline is 3 years for operated ventures and 5 years for non-operated ventures. These timings take the efforts that are necessary to execute these MRV programs into account while bearing in mind the goals of the Paris Climate Agreement. The OGMP 2.0 reporting templates, as visualized in this

article, are based on earlier work from industry organizations: **OGCI** for upstream and **Marcogaz** for midstream and downstream.

methodologies according to level 3 and level 4 reporting:

Data to be tracked/ measured and monitored:

- Leaks
- Pneumatics
- Leaks and Permeation from Underground Pipes
- Gas Well Hydraulic Fracturing
- Oil Well Casinghead
- Purging and Venting
- Incidents, emergency stops and malfunctions
- Liquids Unloading
- Reciprocating Compressors
- Centrifugal Compressors
- Incomplete Combustion
- Flare Efficiency
- Unstabilized liquid storage tanks

Stakeholders now want to see companies' actual methane emissions performances and companies want to highlight their work on reducing methane emissions.
A robust methane reporting framework allows the industry to better understand the current situation, drive further reductions, and create more transparency towards the public and governments in the process.

**So,** there is necessarily needs to implement and to adopt the voluntary OGMP 2.0 protocol or need to amend internal policy of oil & gas institutions for calculating methane emission separately.

Not only it is the need of time but also for being and maintaining actual transparency Oil & gas industries must measure, monitor, and report the methane emission separately and then adding it with Total GHG emission report of the organisation and get it verified with independent 3rd party organisations.
By adopting above methodology of accounting total GHG emission of and organisation (Oil & Gas), it will be more transparent to the stakeholders, moreover it will be easier to mitigate the total GHG emission in a pathway to decarbonisation.

**conclusion**

Transparency encourages accountability, and both are essential for collaboration and developing solutions. ESG and GHG reporting is a voluntary in many countries, helping businesses to communicate their commitment towards Environment, people, and the community. However, the ESG reporting is quickly evolving, and rapidly increasing with increasing demands for global regulations and becoming mandatory reporting in many countries.
Measuring the GHG emission or carbon footprint is a major and a key KPI for businesses for communicating their Environmental impact and commitments towards sustainable development to stakeholders and help in improving ESG ratings. To meet the requirement of the stakeholders, transparent reporting is very critical which helps in tracking progress, set benchmarks, and communicate to the stakeholders, when their ESG goals have been met.

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