Towards and Effective Methane Emissions management: Monitoring, Reporting and Verification

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Overview

Methane has been brought to the spotlight the past few years, as a GHG which has a great impact on climate change and man. It is a gas which needs immediate attention due to its inherent characteristics: it is produced via both natural sources and human-related activities, it is the second most abundant greenhouse gas after carbon dioxide, but most importantly, it has a high global warming potential being responsible for around 30% of the increase in global temperatures (IEA, 2022). The latter, combined with methane's short atmospheric lifespan (10 – 12 years to break down), makes it a perfect 'target' for climate change mitigation.

In the EU, the agricultural sector has the highest share in the total anthropogenic methane emissions (54%), followed by Waste (26%) and Energy supply (12%) (EEA, 2020), while globally these shares (including naturally emitted methane) are 36%, 18% and 34% respectively (IEA, 2022) (Figures 1 and 2). While it is evident that Agriculture is the predominant source, methane emissions mitigation has been associated mainly with the oil and gas sector as it offers the largest share of low-cost reduction opportunities (UNEP, 2021; IEA, 2022).

Although currently methane is very high on the political agenda, before 2020 efforts for methane emissions mitigation were mostly voluntary-driven and business-led. From the first EU Methane Strategy 1996, the first-time tackling emissions was addressed in the EU, various regulatory initiatives were adopted by the EU, up until the European Green Deal (2020) and the launch of Methane Strategy (2020). The EU Methane Strategy was the springboard for the Global Methane Pledge, launched at COP26 (20210 summit in November 2021. The Global Methane Pledge is the first-ever Heads-of-State global commitment to cut methane emissions at a level consistent with a 1.5°C pathway (CCAC, 2021).

One month after the launch of the Global Methane Pledge, and under, at that time, the geopolitical situation and the emerging energy insecurity it entailed, the Commission presented a proposal (COM/2021/804) to decarbonize gas markets, promote hydrogen and regulate methane emissions reductions in the energy sector as part of the second batch of proposals in the 'fit for 55' package. In parallel, in a first-ever EU legislative proposal on methane emissions reduction in the energy sector (COM/2021/805), way was given towards the adoption of a robust Monitoring, Reporting and Verification system (MRV), the establishment of Leak Detection and Repair (LDAR) program and the limitation of venting and flaring. Global monitoring tools (OGMP) where also put forward to ensure transparency of methane emissions from imports of oil, gas and coal into the EU.

Currently, the Monitoring, Reporting and Verification process on methane emissions is as follows: data of methane emissions are obtained from direct measurements from emission sources e.g. using equipment, and estimations based on statistical modeling, using mainly bottom-up and top-down methods. The data are then compiled (along with data of other GHGs) to GHG inventories. Internationally the reporting of GHG emissions is mainly done under the UNFCCC). The GHG inventories allow their monitoring and are used as primary tools by scientists, academics and policy-makers, to support the development of low-emission policies, strategies and action plans to tackle climate change and also to assess the progress of these measures. For the provision of reliable and consistent GHG information, the conference of Parties (COP) has established a set of requirements which must be fulfilled in accordance with Intergovernmental Panel on Climate Change (IPCC) guidelines (1996, 2006, 2019). The scope of this study is to provide a description of the current framework and practices in the Monitoring, Reporting and Verification processes, identify their associated gaps and provide insights for their further improvement.

Methods

We examine legislative and non-legislative acts by the European Commission, supreme decision-making and intergovernmental bodies (UNFCCC, COP, IPCC), to map the framework and actions currently taken on tackling anthropogenic methane emissions from the agricultural, waste, and energy sector with a targeted impact both on the EU and globally. We examine those to describe and assess the processes of Monitoring, Reporting and Verification of GHGs (methane included) for Annex I and non-Annex countries and the Parties to the UNFCCC and/or the Kyoto Protocol.

We assess the most commonly used methane emissions metric GWP, as recommended by the IPCC Guidelines, and through the examination of previous studies we identify its limitations and its impact on decision making. The methodologies on methane emissions estimations, currently in effect and internationally agreed, as these are provided by the IPCC in their Guidelines (1994, 1996, 2006, 2019), for each methane emission source and their subdivisions, are also examined. Their limitations through extensive review of existing and most recent literature, combined with the IPCC's own explanatory remarks on each of these methods, are identified. We also assess and compare the most common methods used for methane emissions measurements (top-down and bottom-up methods), evaluate their applicability and identify their advantages and disadvantages.

Results

By examining key components of the current monitoring, reporting and verification processes several gaps and limitations have been identified regarding the metric, methodologies for measuring and estimating methane emissions as well as their reporting. We consider that those with the most dramatic effects on reporting which consequently affect decision making in methane emissions mitigation are the following:

On the use of the GWP metric, we consider that the use of the metric itself as well as the different timeframes (e.g. GWP20 and GWP100) at international reporting, bring forward issues of inconsistencies within and among inventories in terms of time series analysis and compatibility. The main issue however is that the metric does not capture the different dynamics and impacts of Long Lived and Short Lived Climate Pollutants. On the methods used to measure and estimate methane emissions, common denominators are the issues of unavailability of quality data and their associated low level of accuracy as well as their uncertainty depending on which methods are chosen and used each time.

Conclusions

Methane emissions are extremely difficult to measure and quantify and therefore the choice and use of a single metric or specific methods for measuring and estimating methane emissions is not easy. However, there are certain criteria which could be set and certain improvements that could be made which could help minimise the effects of the forementioned limitations. As methane emissions is a global problem which requires immediate attention, efforts for tackling them should be done under a universal approach. We therefore recommend that the metric/s, methods for measuring and estimating methane emissions and their verification should be universal to the largest extent possible. The choice of a universal metric, or a set of metrics should be done considering the different dynamics and impacts of methane but also serve the purposes of the targets set each time. As the direct measuring of methane emissions is obviously the ideal method, but most of the times not feasible in terms of resources (time and cost), then the reconciliation of different methods (top-down and bottom up) should always be considered to achieve quality data. Universality translates to consistency which is key to the methods used for data acquisition but also for the Reporting and Verification processes. Common and standard approaches and guidelines should be followed by all associated entities and professionals, while it should be ensured that knowledge expertise and skills should be continuously cultivated. Finally, we recommend that the obligation to report publicly on emissions on a specific time scale should be extended to 'smaller' emitters (above certain minimum threshold of emissions) or incentives should be given to promote voluntary reporting. Finally, a reporting 'Network' gathering all information, data, guidelines and research, to facilitate effective communication between inventory compilers, regulators and academia is also recommended.

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