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Invisible Menace: What Will it Take to Implement the Global Methane Pledge?

Sustainability Industry Report

The Al-Attiyah Foundation

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At the 2021 United Nations Climate Change Conference, more commonly referred to as COP26, over 113 countries signed the Global Methane Pledge to reduce their emissions 30% by 2030. Tackling methane emissions, which is responsible for one-third of current global warming, is one of the most effective short-term measures that can be taken to address climate change. What policies are planned to be employed? What are potential risks? What does this mean for the future of natural gas?

SUSTAINABILITY REPORT

This research paper is part of a 12-month series published by the Al-Attiyah Foundation every year. Each in-depth research paper focuses on a current sustainability topic that is of interest to the Foundation's members and partners. The 12 technical papers are distributed to members, partners, and universities, as well as made available on the Foundation's website.

03 EXECUTIVE SUMMARY

Methane Emissions and the Global Methane Pledge:

- Methane is the Earth's second most important greenhouse gas (GHG) accounting for 20% of the total GHG emissions. It is responsible for 30% of the increase in global temperatures and presents a short-term global warming effect.
- Around 50 – 65% of global methane emissions are from anthropogenic sources, from which 46% of the emissions are from the energy sector.
- China, India, the United States, Russia, and Brazil collectively account for 28% of total anthropogenic methane emissions, with varying sources of emissions in each country.
- In 2021, the United States and the European Union led the Global Methane Pledge, which aims to reduce global methane emissions by 30% from 2020 levels by 2030.

Key Aspects of the Global Methane Pledge:

- All signatories to the Global Methane Pledge are expected to develop, update, and present a national methane reduction action plan at COP27 later this year.
- The Global Methane Pledge must be converted into a binding agreement. In its current form, it is a voluntary pledge that does not specify individual targets for member countries.
- China's reluctance to join the pledge is partially due to differences with the United States and the European Union on the make up of methane emissions, their ease of reduction, and the abatement targets proposed.
- India did not join the pledge because of the impact of the pledge on the country's international trade relations, the growth of its agriculture sector, and the development of its rural economy.
- Russia has also not joined because of the Russian economy's dependence on the oil & gas sector, which contributed 40% of the country's fiscal revenue in 2021.
- An important barrier to the successful implementation of the Global Methane Pledge will be establishing a common global baseline to measure methane abatement

Regulatory Policies on Methane Reduction:

- Regulatory policies that are focused on curbing methane emissions from oil & gas operations, and the hard-to-abate coal mining operations could deliver the sharpest reductions.
- Regulators must leverage advanced measurement technologies and data systems; incorporate established precedents such as leak detection and repair, technology standards, non-emergency flaring and venting; and introduce new market-based mechanisms and fiscal incentives; combined with robust monitoring, reporting, and verification regimes to maximise methane mitigation

- The private sector also has an important role to play in leading methane abatement efforts, by participating global initiatives such as the Methane Guiding Principles, Oil & Gas Climate Initiative, and the China Oil & Gas Methane Alliance.

METHANE EMISSIONS AND THE GLOBAL METHANE PLEDGE

Methane is the Earth's second most important greenhouse gas (GHG), accounting for 20% of total GHG emissions. It is responsible for 30% of the increase in global temperatures since the industrial revolution and presents a potentially cataclysmic short-term global warming effect[ii]. Today[iii], more than half of the global methane emissions originate from anthropogenic (human activity-related) sources, with concentration levels in the atmosphere that are 2½ times greater than the pre-industrial levels.[iv v]

Methane emissions, like other non-CO_2 GHGs, have a higher global warming potential (GWP **1**) than CO_2 emissions. Methane has a much shorter atmospheric lifespan of 12 years compared with > 100 years for CO_2, which makes it a "short-term climate-change forcer". It traps heat in the atmosphere more effectively than CO_2.

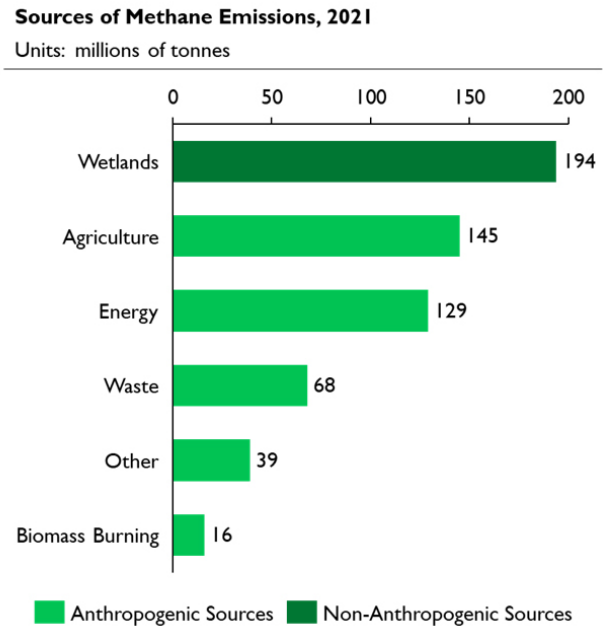
1.Global Warming Potential is used to express a tonne of a GHG emitted in CO_2 equivalent terms (CO_2-equivalent), in order to provide a single measure of total GHG emissions.

2. Tropospheric, or ground level ozone (O_3), is a harmful gas created by chemical reactions between oxides of nitrogen (NOx) and volatile organic compounds (VOC) that is harmful to human and wildlife health and their environment.

The IPCC estimates the GWP from a tonne of methane in the atmosphere to be 84 – 87 (relative to CO_2 = 1) over a 20-year time period (GWP20) and 28 – 36 when measured over a 100-year period (GWP100[vi]).

In addition to climate change, methane also affects air quality and pollution, and is a direct contributor to the formation of tropospheric ozone **2**.

Figure 1: Sources of Methane Emissions[viii]



Globally, 50 – 65% of the methane emissions are emitted from anthropogenic sources, such as landfills, oil & gas production sites, agricultural cultivation (such as rice and beef farming), mining activities, stationary and mobile combustion, wastewater treatment, and various manufacturing and industrial processes[vii].

Currently, global methane emissions stand at 591 million tonnes (MT) / year with 33% emitted from natural wetlands[ix]. These water-logged soils contain microbes that metabolise forest biomass in anaerobic conditions, creating methane.

Methane emissions from agricultural activities are not just limited to livestock and food production, but also land-use and land management activities such as forest disasters and the decomposition of organic matter in forestlands.

The energy sector is responsible for 46% of the total anthropogenic methane emissions causes and contributes to 31% of global methane emissions. Out of the 184 MT of energy-related methane emissions in 2021: 42 MT is from coal mining; 41 MT is from extracting, processing and transporting natural gas; 36 MT is from oil production; 16 MT is from the incomplete combustion of bioenergy, mainly through wood and solid biomass used as cooking fuel; 10 MT is from bioenergy generation; and 39 MT are from other sources, mainly emissions leaked from end-use equipment[x].

Figure 2: Largest Methane Emitters, 2021[xi]

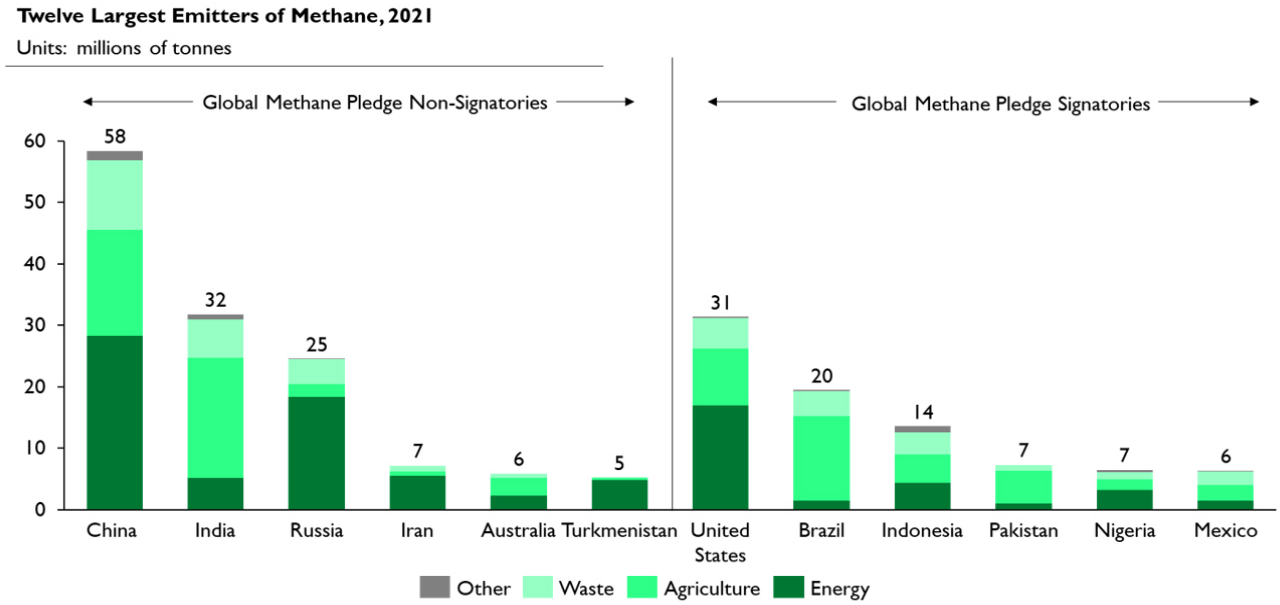
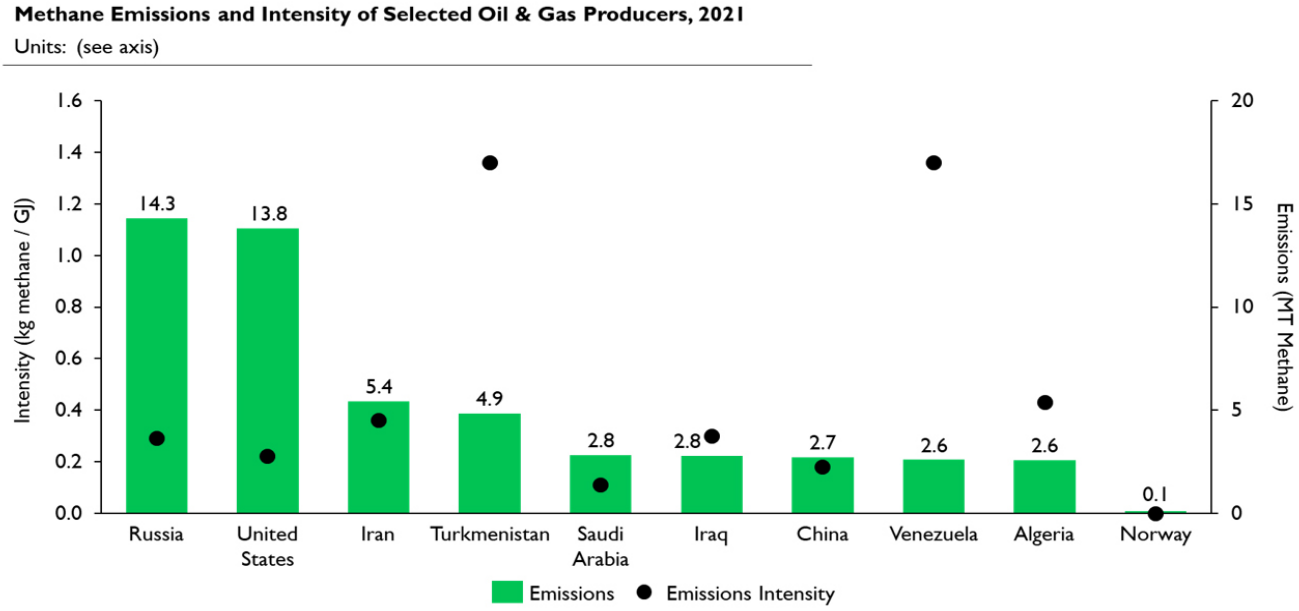


Figure 3: Methane Emissions and Intensity for Selected Oil & Gas Producers, 2021[xiii]

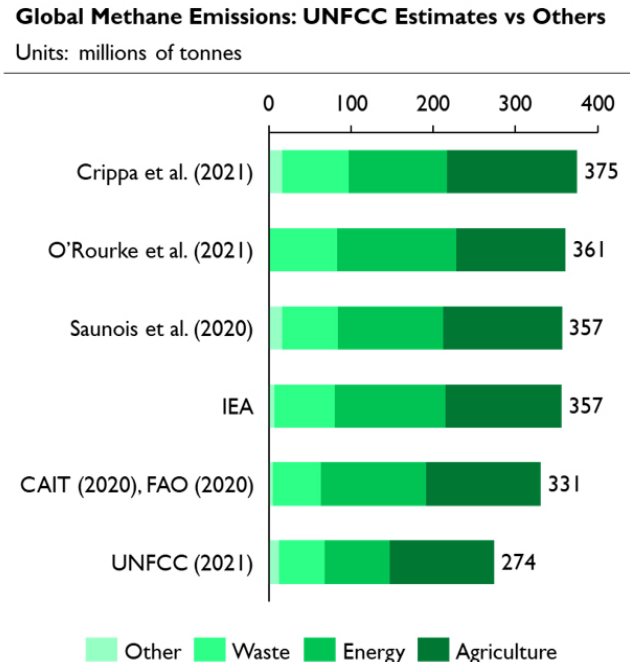


China, India, the United States, Russia, and Brazil account for 28% of the total anthropogenic methane emissions, with varying sources of emissions in each country. For example, coal mining is the main source of methane emissions in China, agricultural production in India, and natural gas production in Russia.

Norway has the least methane-intensive oil & gas sector in the world and if other oil & gas producing countries were to match its intensity levels, global methane emissions from oil & gas operations could decline by more than 90%[xii]. Norway's methane intensity from its oil & gas operations is 100 times less than the most intensive countries – Turkmenistan and Venezuela.

Global estimates of methane emissions are subject to a high degree of uncertainty. A recent assessment by the International Energy Agency (IEA) has concluded that global methane emissions from the energy sector are ~70% higher than estimates submitted by national governments under the UN Framework Convention on Climate Change (UNFCCC)[xiv]. The reason for the mismatch is because official GHG submissions to the UNFCCC have not been updated for several years, with some country statistics based on vague and inconsistent measurement methodologies.

Figure 4: Global Methane Emissions, 2021: IEA vs UNFCC[xv]



Estimates of methane emissions are also subject to uncertainty over emitting sources. For example, some of the largest emitting sources are a result of accidents and unpredictable processes, which contribute to large levels of emissions from oil & gas or other energy sector-related operations, but they are often not included in calculations.

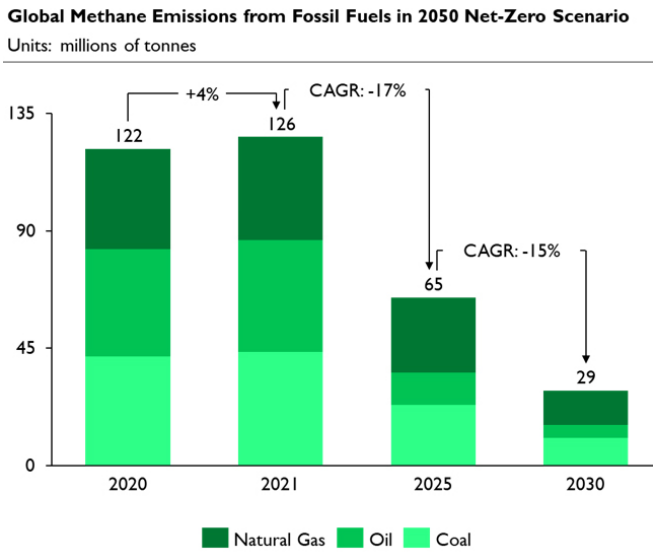
The uncertainty over emissions estimates is part of the problem in tackling methane emissions. Despite multiple efforts, methane recovery projects are not widespread for three reasons:

- Methane is generally a by-product of various extractive operations and industrial processes. Historically, the energy, industrials, and materials sectors have not viewed associated methane as an energy source for internal use.
- Methane emitters are also often not familiar with methane capture technologies and their potential for profitable recovery. This is particularly true across developing countries where awareness, technical training, and availability of capture technologies is limited.
- And at the same time, poorly functioning energy market designs and policy mechanisms by local regulators and utilities fail to incentivise private operators to benefit from methane capture projects.

However, the time is ripe for methane mitigation in the energy sector for two reasons. Firstly, methane recovery projects provide an opportunity for the oil & industry to lower their GHG footprint and simultaneously monetise a valuable commodity and achieve operational cost savings. Secondly, given the current tight global natural gas market, capturing methane provides an opportunity to expand natural gas supplies, which further supports its role in the energy transition by replacing more polluting fuels.

Redoubling efforts on methane abatement is integral to achieving net-zero emissions by 2050, and limiting the rise in global temperatures to 1.5°C. To achieve this, fossil fuel-related methane emissions must fall by 75% by 2030[xvi].

Figure 5: Global Methane Emissions from Fossil Fuels in a 2050 Net Zero Scenario[xvii]



In 2021, the United States and European Union led the Global Methane Pledge, which aims to reduce global methane emissions by 30% from 2020 levels by 2030 by mobilising global action, strengthening support for existing methane emissions mitigation initiatives, and advancing technical and policy mechanisms, which will support individual member country's domestic initiatives[xviii]. The pledge consists of 112 participating countries, and applies to all anthropogenic methane emission, and highlights that the greatest potential for cost-effective mitigation is in the energy sector.

Table 1: Policy Commitments on Methane Emissions across Selected Members of the Global Methane Pledge

Policy commitments and actions on methane emissions from fossil fuel operations in selected countries	
Country	Target / Action on Methane (Year Introduced)
China	▪ Most recent five-year plan commits to increase regulation of methane, and other non-CO_2 gases (2020) ▪ Pledge to reach net-zero by 2060 includes all GHGs (2020)
European Union	▪ Signatory on the Global Methane Pledge (2021) ▪ EU Methane Strategy to reduce methane emissions (2020) ▪ Pledge to reach net-zero by 2050 includes all GHGs (2018)
South Korea	▪ Pledge to reach net-zero by 2050 includes all GHGs (2019)
Japan	▪ Supports the Global Methane Pledge (2021) ▪ Pledge to reach net-zero by 2050 includes all GHGs (2020)
Norway	▪ Pledge to reach net-zero by 2030 includes all GHGs (2016) ▪ Longstanding regulations to limit emissions from oil & gas industry
United Kingdom	▪ Supports the Global Methane Pledge (2021) ▪ Pledge to reach net-zero by 2050 includes all GHGs (2016)
United States	▪ Supports the Global Methane Pledge (2021) ▪ Pledge to reach net-zero by 2050 includes all GHGs (2021) ▪ Executive Order committing to update methane regulations in the oil & gas sector (2021) ▪ 40-45% reduction target for oil & gas methane by 2025 (2016) ▪ Federal regulations on new oil & gas sources (2016)

The Global Methane Pledge covers all sources of methane emissions, which includes emissions from the agriculture, waste, and the energy sector. However, reductions from fossil fuel operations in the energy sector are the most promising areas for signatories to target in the short-term. Not only do these emissions cover a large portion of total emissions, but sharp cuts could be achieved cheaply with existing technologies. Agricultural emissions, by contrast, are widely dispersed, often across small farms with little access to expertise, technology, and finance to limit them.

Signatories of the Global Methane Pledge could reduce their anthropogenic methane emissions by ~20% if they combined all technically available abatement opportunities in the oil & gas and the coal industry, with strong regulatory action[xix]. And an additional 10% of methane emissions could be abated if all technically available abatement opportunities are extended to the agriculture and landfill/ waste management.

The Global Methane Pledge has brought large economies of the United Kingdom, European Union member states, Japan, and South Korea; energy producers such as Qatar, Saudi Arabia, United Arab Emirates, and Iraq; and large emitters like the United States, Brazil, Indonesia, and Pakistan together on a joint global effort to tackle methane emissions.

It has also bolstered the importance of its predecessor, the Global Methane Initiative, which was the most prominent global initiative on methane mitigation. The Global Methane Initiative is an international public-private partnership focused on reducing barriers to methane recovery and the use of methane as a clean energy source. The partnership was launched in 2004 by the United States Environmental Protection Agency (US-EPA) and consists of 70 member countries including China, Russia, India, Brazil, Indonesia, Pakistan, and Saudi Arabia.

Under the Global Methane Pledge, all signatories are expected to develop, update, and present a national methane reduction action plan at COP27 later this year. The national strategies will be developed and supported by various forms of assistance and resource provided by the Climate and Clean Air Coalition (CCAC) and the World Bank's Global Gas Flaring Reductions Programme (GGFR).

The Climate and Clean Air Coalition (CCAC) provides pledged countries with technical tools and systems for measuring methane emissions, expert assistance on mitigating methane emissions from the agriculture and energy sector, and national policy planning to support methane abatement[xx].

Members of the Global Methane Pledge that are members of the World Bank's GGFR will be able to benefit from various technical and regulatory solutions for flaring reduction, country-specific flaring reduction programmes, research and best practice training and awareness, and financial incentives for flaring reduction projects.

GGFR is a multi-donor trust fund consisting of governments, oil companies, and multilateral organisations committed to ending associated natural gas flaring from oil extraction across the world[xxi]. Currently, GGFR consists of 16 member countries including Norway, Kuwait, Iraq, Nigeria, and Mexico[xxii], and 13 member companies such as QatarEnergy, BP, Chevron, ENI, ExxonMobil, Shell, and Total[xxiii].

However, the future success of the Global Methane Pledge will be dependent on three factors: firstly, converting the pledge into a binding agreement; secondly, engaging with large emitters such as China, India, Russia, Turkmenistan, Iran, and Algeria in joining the pledge; and thirdly, establishing a common global baseline to measure the progress of signatories.

The target of 30% reduction in global methane emissions, set in the Global Methane Pledge, falls short of a 45% cut in methane emissions by 2030, which according to IPCC, is necessary for achieving the goal of the Paris Climate Agreement[xxiv].

China's reluctance to join the pledge is partially due to differences with the United States and the European Union on the make-up of methane emissions, their ease of reduction, and the abatement targets proposed[xxv].

Instead, China has entered in a bilateral declaration with the United States through the United States – China Joint Glasgow Declaration on Enhancing Climate Action in the 2020s at COP26, which commits both countries to working jointly on improving monitoring, management, and research of methane emissions over the next ten years[xxvi].

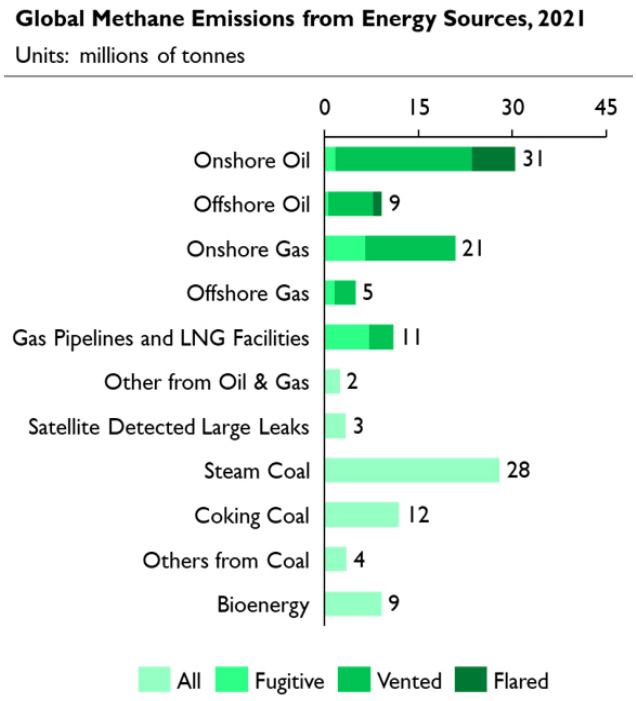
India did not join because of the impact of the pledge on the country's international trade relations, the growth of its agriculture sector, and the development of its rural economy[xxvii]. India's agriculture sector contributes to US$ 350 billion (which is 15% of its national GDP) through domestic consumption and international exports, and employs almost 50% of the country's labour force[xxviii]. Further to this, two-thirds of the Indian population lives in rural areas and country's large livestock population is crucial to its primary sector and its rural economy.

Russia also did not join because of the Russian economy's dependence on oil & gas production, which contributed 40% of the country's fiscal revenue in 2021[xxix]. This is despite Russian President Vladimir Putin's calling for global cuts to methane emissions without a specific policy promise and given the country's 2060 Net-Zero announcement made in October 2021[xxx].

A key challenge to the successful implementation of the Global Methane Pledge will be establishing a common global baseline to measure methane abatement. Not all countries have prepared detailed annual UNFCCC inventory submissions. Some regularly update their inventories based on longstanding reporting frameworks that are inconsistent with reporting inventories, while others do not prepare annual inventory updates and may not have conducted national inventories in many years due to capacity or resource constraints.

Regulatory policies focused on curbing emissions from oil & gas operations and the hard-to-abate coal mining operations could deliver the sharpest reductions. Tackling coal mine methane is challenging because the methane concentration of emissions is generally very low and varies in quality and quantity. The lower the concentration of methane, the more technically and economically difficult it is to abate.

Figure 6: Methane Emissions from Energy Sources[xxxi]



Regulators must leverage advanced measurement technologies and data systems; incorporate established precedents such as leak detection and repair, technology standards, non-emergency flaring and venting; and introduce new market-based mechanisms such as methane emissions pricing, and fiscal incentives; combined with robust monitoring, reporting, and verification regimes to maximise methane mitigation.

Regulators could also utilise advanced data systems operated by international organisations such as the International Methane Emissions Observatory (IMEO), which could help their domestic consumers, companies, and investors identify major sources of emissions, and achieve their emissions reduction targets.

IMEO operates one of the most comprehensive public datasets that details global methane emissions levels and their sources. The dataset was compiled by the United Nations Environment Programme (UNEP) from various sources, including company reporting through the Oil & Gas Methane Partnership 2.0 (OGMP 2.0), direct measurements from peer reviewed studies, satellite observations, and national inventories.

Leak detection and repair policies are designed to address fugitive emissions from leaking components and malfunctioning equipment. These policies require companies to establish systems and protocols for locating and repairing fugitive leaks. They also specify the method and equipment required for leak detection, the frequency of detection campaigns, facilities that are prioritised for inspections, and necessary requirements to fix leaks within a certain timeframe.

Regulators should incorporate new technology standards and protocols, which are specific guidelines designed to reduce emissions associated with the normal operation of certain equipment, with instrument air systems and replace pumps.

An area often overlooked is the combustion efficiency of flaring systems. When properly designed, maintained and operated, a flare should emit the absolute minimal amount of methane; whilst also incorporating malfunctions and changes in weather or production conditions, which can sometimes result in larger volumes of gas to escape.

Regulators could also impose market-based mechanisms such as emissions pricing, which imposes a cost on methane emissions and creates an incentive for companies to mitigate them. The charge or tax could be based on an entity's overall emissions, or the emissions intensity at an individual site. Methane emissions pricing could also be combined with tradable emissions permits that are part of a broader carbon trading scheme.

At the same time, regulators could also help operators to monetise methane recovery through additional natural gas supplies to domestic markets, gas-to-liquids (GTL) or small-scale LNG projects.

Regulators could consider supplementing emissions pricing with fiscal incentives such as subsidies, grants, and loans to incentivise companies to lower their methane emissions. These financial instruments could also be applied through existing fiscal systems or through a targeted programme

In addition to government intervention, the private sector also has an important role to play in leading methane abatement efforts, which they could do by joining global initiatives such as the Methane Guiding Principles, Oil & Gas Climate Initiative, and the China Oil & Gas Methane Alliance.

Each of these initiatives brings together a different group of companies, and they include members from countries across the methane commitment spectrum. The total operated assets of these companies account for ~50% of all global oil & gas production[xxxii].

In addition to voluntary and industry-led efforts to reduce methane emissions, a number of IOCs have announced methane reduction targets over the last few years. For example, Shell has introduced a short-term target of maintaining its overall methane emissions intensity to below 0.2% by 2025[xxxiii].

ExxonMobil has announced an ambition to achieve net-zero scope 1 and 2 GHG emissions for its major operated assets by 2050[xxxiv]. The company has also exceeded its goals announced in 2018 to reduce methane emissions by 15% and flaring by 25% by 2020, compared with 2016 levels.

ENI has introduced a 2025 target for reducing emission intensity by 43% compared to 2014 across is upstream assets, through the elimination of process flaring, the reduction of fugitive methane emissions, and the implementation of energy efficiency projects[xxxvi].

Equinor has set a target to keep its upstream carbon intensity under 8 kg CO_2 / BOE towards 2025 and around 6 kg CO_2 / BOE by 2030[xxxvii]. In 2021, Equinor's corporate methane emissions intensity was 0.02% which is around one tenth the average of Oil and Gas Climate Initiative (OGCI) member companies[xxxviii].

In the GCC, QatarGas has developed a US$1bn Jetty Boil-off Gas Recovery project in order to curb routine flaring from six liquefied natural gas (LNG) berths at Ras Laffan Port[xxxix]. The project helps recover 29 BCF / year of gas, which is used to produce 750 MWh of electricity[xl].

Through its sustainability strategy, QatarEnergy has set a target of eliminating routine flaring by 2030 and limiting methane emissions by setting a methane intensity target of 0.2% across all facilities by 2025[xli].

In the UAE, Dubai Municipality has partnered with Global Energy Solutions in developing the region's largest landfill methane recovery project[xlii]. The captured capture methane will be used in a high-temperature closed combustion system for electricity generation[xliii].

In the Emirate of Sharjah, Masdar in partnership with Bee'ah is developing a waste-to-energy project, which will process more than 300,000 tonnes / year of solid municipal waste[xliv]. The project will convert waste into heat that will be used to produce net electricity of 30 MW, which will be injected in the Sharjah electricity grid. The flue gas and methane from the waste processing will be environmentally treated before being released into the atmosphere.

Similarly, Ras Al Khaimah's Public Works and Services Department along with private utility Utico is developing the world's first integrated hybrid landfill gas-solar-agro project in Ras Al Khaimah, which will generate 16 MW of electricity[xlv].

There are various cost-effective methane mitigation options in the landfills / waste management industry, with the greatest potential relating to separating organic and recycling waste. Regulators could help minimise the cost of mitigating methane gas from waste management by raising landfill taxes to discourage waste and introducing fiscal incentives that help reduce the upfront capital costs.

Occidental Oman and Flare2Value are developing a flare gas recovery project at the Mukhaizna Field in Oman, which will reduce methane emissions and create economic value from captured associated natural gas[xlvi].

Abating all methane emissions would be difficult, however, NOCs could do more in order to achieve the sorts of methane reductions that would be consistent with the QatarEnergy's 2030, Saudi Arabia's 2060, and the UAE's 2050 net-zero target.

NOCs must consider tackling methane emissions across their operational supply chains, especially fugitive emissions resulting from leaking equipment, system upsets, and deliberate flaring and venting.

In addition, regional regulators must support their domestic agriculture, food, waste, and energy industries to contribute their part in tackling methane emissions to achieve their climate goals.

In the municipal waste sector, capturing landfill gas and using it for electricity generation will also reduce methane emissions, help displace high emitting fossil fuels, and help create new revenues for the local economy.

17 CONCLUSIONS

It is too early to assess whether the Global Methane Pledge is on track to achieve its target of a 30% reduction in global methane emissions by 2030. Currently, ~40% of the methane emissions from oil & gas operations originate from countries that have made a strong commitment to reduce emissions under the Global Methane Pledge[xlvii]. And if these countries deploy all the necessary strategies listed to tackle methane emissions, it could lead to a 75% reduction in methane emissions by 2030[xlviii]. It will be important to watch COP27 in Egypt later this year, where current signatories will be presenting their national methane reduction action plans.

Tackling methane emissions is a quick measure to trim a few tenths of a degree of global warming. A 30% cut by 2030 as envisioned by the Global Methane Pledge would reduce the global average temperature by about 0.1°C by 2050[xlix].

Hence, curbing methane emissions will produce results faster than cutting CO_2 emissions and would be beneficial in tackling global warming in the short-term. However, if scarce resources are spent on methane cuts instead of CO_2, then global temperatures will be lower in the short-term but higher in the long-term.

Conversely, if cuts in CO_2 emissions are prioritised over methane emissions, then the long-term nature of CO_2 means we will reach net-zero in 2050 only with rapid action starting from 2025. Fortunately, there are synergies between cutting methane and CO_2, including using fossil fuels more efficiently, cutting flaring and venting in order to save gas to replace coal, and replacing all fossil fuels with low-carbon energies.

APPENDIX

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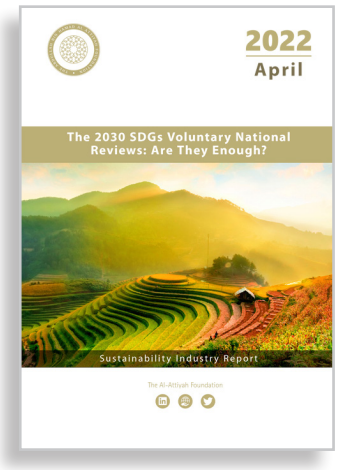

April – 2022

The 2030 SDGs Voluntary National Reviews: Are They Enough?

The 2030 Sustainable Development Goals (SDGs) agenda provides for regular Voluntary National Reviews (VNRs) to assess progress on achieving the SDGs. These have been conducted since 2016, with a growing number of countries participating.

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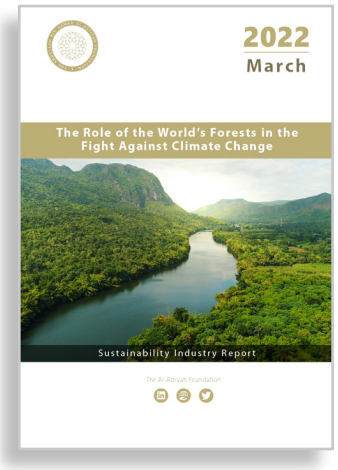

March – 2022

The Role of the World's Forests in the Fight Against Climate Change

Deforestation accounts for 15% - 20% of global greenhouse gas (GHG) emissions, while regrowth is an essential carbon sink. Forests store about 660 gigatonnes (Gt) of carbon, equivalent to almost 80 years of global emissions.They are also an essential store of biodiversity, a home for many peoples and a crucial part of the hydrological cycle.

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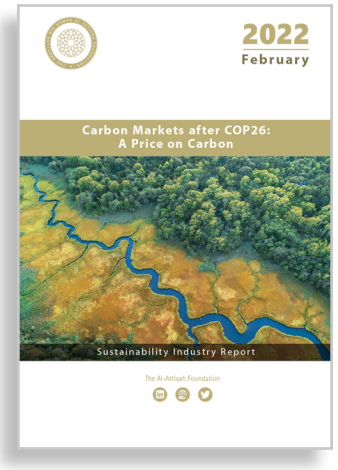

February – 2022

Carbon Markets after COP26:A Price on Carbon

The Paris Agreement's Article 6, on carbon markets, was a crucial part of the COP26 negotiations. A price on carbon is a key tool for reducing global emissions in anefficient and fair way. But there were serious challenges in reaching a workable text, that would allow carbon markets to function effectively while avoiding doublecounting or encouraging unsustainable activities.

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Our partners collaborate with The Al-Attiyah Foundation on various projects and research within the themes of energy and sustainable development.

The Al-Attiyah Foundation

Tel: +(974) 4042 8000,
Fax: +(974) 4042 8099
www.abhafoundation.org

Barzan Tower, 4th Floor,
West Bay.
PO Box 1916 Doha, Qatar

AlAttiyahFndn
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