

METHANE IN
TURKMENISTAN
& THE CASPIAN
REGION

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Summary

Methane¹ is estimated to be 80 times more effective than carbon dioxide at trapping heat in the atmosphere, making its reduction crucial. Unlike carbon dioxide, which can linger in the atmosphere for centuries, methane only lasts for about a decade.² Herein lies the opportunity implicit within methane's short lifespan in our atmosphere: its significant and fast-acting impact on global warming in the form of ground-level ozone could be negated if rapid methane emissions reduction strategies are implemented. Although future generations will have to suffer the repercussions associated with existing atmospheric carbon dioxide levels, concrete action on methane could help significantly lessen its contribution to the climate crisis in the short term.

Central Asia and the Caspian region, rich in oil and gas, are home to one of the worst methane emitters in the world, Turkmenistan. As of 2021, in the energy sector, Turkmenistan trailed only Russia, the United States, and Iran in total methane emissions; this places Turkmenistan ahead of countries like Saudi Arabia, Iraq, and China. It also leads the world in methane intensity, which measures emissions per unit of production.³ Turkmenistan, a country of just over 6 million people,⁴ emits more methane from its oil and gas operations than China, a country of nearly 1.5 billion people.

Non-emergency, intentional venting and/or flaring of gas, fugitive emissions from pipeline leaks or other gas-related infrastructure, and so-called 'super-emitter' events, which are especially endemic in Turkmenistan, all contributed to the sky-high methane emissions statistics emanating from their energy sector in 2022.

Fortunately, many pathways and technologies already exist to help mitigate methane emissions. Not only have these been proven to work, many are also cost-effective. Whether through willful ignorance or lack of political will, countries like Turkmenistan continue to allow the oil and gas industry to operate as if these solutions do not exist. OSCE policymakers, as well as civil society organizations engaged in climate justice work, must hold regimes like Turkmenistan accountable for their lack of action in addressing rampant anthropogenic methane emissions and the dangers associated with them.

¹ <https://scied.ucar.edu/learning-zone/how-climate-works/methane>

² <https://www.nasa.gov/feature/jpl/methane-super-emitters-mapped-by-nasa-s-new-earth-space-mission>

³ <https://www.iea.org/reports/global-methane-tracker-2022/overview>

⁴ Turkmenistan's population statistics are highly disputed. While organizations such as the World Bank list Turkmenistan's population as just exceeding 6 million people (as of 2021), media outlets such as Radio Azatlyk (RFE/RL's Turkmen Service) estimate that actual population totals may be closer to 3 million, owing to mass migration spurred on by long-standing economic hardship and repression of basic rights in the country. <https://www.rferl.org/a/turkmenistan-students-banned-leaving-population-decline-/32127844.html>

Methane Emissions in Turkmenistan & the Caspian region

By the Numbers

Utilizing the interactive ‘Methane Tracker’ database published as part of the International Energy Agency’s (IEA) most recent Global Methane Tracker report,⁵ Crude Accountability accessed estimates of anthropogenic methane emissions in 2022 from several countries. This data, gathered by the IEA across multiple sectors, represents the cutting edge of methane emissions tracking. Satellite imagery analysis, the latest data from measurement-based, peer-reviewed studies, and a number of additional resources come together to paint a much more accurate picture of global methane emissions than that portrayed by self-reported measurements under the United Nations Framework Convention on Climate Change.

The estimated total methane emissions for Turkmenistan⁶ in 2022 are included below. Methane emissions statistics for Turkmenistan’s neighbors; Kazakhstan,⁷ Uzbekistan,⁸ and Azerbaijan,⁹ are also included for comparison. This paper will focus primarily on methane emissions originating from the energy sector. All methane emissions statistics are presented in kilotons (kt).

Turkmenistan

- Estimated total emissions: 5094 kt; 1.4% of global methane emissions in 2022
- 93% of emissions from the energy sector; 6% from the agricultural sector; 1% from the waste sector

In comparison, estimated total methane emissions in:

- Kazakhstan = 3719 kt; 1.0% of global methane emissions in 2022
 - 74% of emissions from the energy sector; 20% from the agricultural sector; 5% from the waste sector
- Uzbekistan = 1967 kt; 0.6% of global methane emissions in 2022
 - 40% of emissions from the energy sector; 46% from the agricultural sector; 14% from the waste sector
- Azerbaijan = 624 kt; 0.2% of global methane emissions in 2022
 - 52% of emissions from the energy sector; 31% of emissions from agricultural sector; 17% of emissions from waste sector

⁵ <https://www.iea.org/reports/global-methane-tracker-2023/overview>

⁶ <https://www.iea.org/data-and-statistics/data-tools/methane-tracker>

⁷ Ibid.

⁸ Ibid.

⁹ Ibid.

Intentional Venting

No matter the country of focus, intentional venting accounts for a sizable percentage of methane emissions originating from the oil and gas sector. Venting is the direct release of methane gas into the atmosphere. It occurs primarily for safety reasons, and the amount of gas vented varies depending on the operational requirements and design of the equipment/facility in question.¹⁰

Turkmenistan

- 46% of oil and gas-related methane emissions are the result of venting (2,200 kt)

In comparison, intentional venting accounts for:

- 77% of oil and gas-related methane emissions in Kazakhstan (1,490 kt)
- 54% of oil and gas-related methane emissions in Uzbekistan (420 kt)
- 77% of oil and gas-related methane emissions in Azerbaijan (249 kt)

Despite making up far larger percentages of overall estimated methane emissions related to the oil and gas sectors, the total amount of methane emissions released via intentional venting in these three countries is dwarfed by those released via intentional venting in Turkmenistan.

Leaks and Flaring

Aging Soviet-era energy infrastructure litters the Caspian and Central Asian landscape,¹¹ meaning that fugitive methane emissions, or emissions resulting from unintentional leakages of methane gas, are a significant problem in the region. Couple this with the continuing practice of flaring— when natural gas that cannot be used or recovered economically is burned instead of being sold or vented¹²— and we begin to develop a clearer picture of what factors contribute to methane emissions from the energy sector. Concerning flaring, it must be noted that the majority of natural gas is converted to water and carbon dioxide during the combustion process, but small amounts are often not combusted and released as methane into the atmosphere.

Turkmenistan

- 21% of oil and gas-related methane emissions are fugitive emissions (1,002 kt)
- Flaring contributed an additional 151 kt of methane emissions

In comparison, fugitive emissions and flaring account for:

- 13% of oil and gas-related methane emissions in Kazakhstan (247 kt)
 - Flaring contributed an additional 104 kt of methane emissions

¹⁰ https://earthworks.org/issues/flaring_and_venting/

¹¹ <https://www.naruc.org/international/news/central-asian-countries-map-next-steps-in-energy-sector-development-through-participation-in-regional-regulatory-partnership/>

¹² Ibid.

- 37% of oil and gas-related methane emissions in Uzbekistan (283 kt)
 - Flaring contributed an additional 36 kt of methane emissions
- 19% of oil and gas-related methane emissions in Azerbaijan (62 kt)
 - Flaring contributed an additional 8 kt of methane emissions

The estimated amount of fugitive methane emissions released in Turkmenistan in 2022 far outweighs the amounts released in neighboring countries, including Azerbaijan, which has a similar population. Both of these economies rely heavily on the oil and gas industry.

By contrast, the total estimated methane emissions produced by Denmark, Norway, and Sweden in 2022 was 856 kt of methane.¹³ More methane gas is leaked from Turkmen oil and gas infrastructure than is produced by the energy, waste, and agricultural sectors of three nations.

Super-Emitter Events

In differentiating among various energy sources connected to methane emissions (onshore oil, offshore gas, gas pipelines, etc.), the IEA's 2022 estimates provide a valuable lens through which one can determine the prevalence of so-called 'super emitter' events. What qualifies as a methane 'super-emitter' event varies depending on the source, but they can broadly be understood as mass leakages or venting, often from pipelines or gas facilities, which emit a large amount of methane per hour, so much that the plumes can be detected via satellite. Nowhere are such 'super-emitter' events more prevalent than in Turkmenistan.

Information gathered by *The Guardian*, in tandem with leading energy and environmental geanalytics company Kayrros, identified 1,005 methane super-emitter events in 2022; 559 were from oil and gas fields and their supporting infrastructure. Of these super-emitter events, not only did the highest number occur in Turkmenistan, 184, but also the largest of these events: a leak of 427 tons of methane per hour occurred in the vicinity of a major Turkmen pipeline in August 2022. This single leak was equivalent to the rate of emissions from 67 million cars. The nation also dominated the list of the top 100 largest fossil fuel-related super-emitter events of 2022, with 70 such events.¹⁴

¹³ <https://www.iea.org/data-and-statistics/data-tools/methane-tracker>

¹⁴ <https://www.theguardian.com/environment/2023/mar/06/revealed-1000-super-emitting-methane-leaks-risk-triggering-climate-tipping-points>

Turkmenistan

- 29% of oil and gas-related methane emissions were super emitter events in Turkmenistan (1,380 kt)

In comparison, super-emitter events accounted for:

- 4% of oil and gas-related methane emissions in Kazakhstan (77 kt)
- 2% of oil and gas-related methane emissions in Uzbekistan (18 kt)
- 0% of oil and gas-related methane emissions in Azerbaijan (0 kt)

Existing Policies & Solutions

Turkmenistan continues to allow its oil and gas sector to release methane emissions in staggering amounts, instead of choosing to benefit from the well-established and cost-effective pathways to emission reduction, as seen in the examples below.

Take, for instance, the U.S. state of New Mexico's methane strategy, put in place in 2021. The central tenet of the strategy is categorizing vented or flared natural gas as waste, effectively framing regulation of these emissions as a way to reduce losses; the state estimates that vented or flared natural gas in 2018 equated to approximately \$10 million in lost state revenues. The strategy requires oil and gas operators to attain a natural gas capture rate of 98% by the end of 2026 and prohibits venting or flaring except in emergency situations. Oil and gas operators that fail to meet capture requirements are liable to lose their drilling permits in the state, and monthly reporting and routine inspection requirements are also in place to hold the industry accountable.¹⁵

The technology to support these pathways towards emissions reduction exists and has been proven to be effective. In 2016, GRTgaz, the main gas transmission system operator in France, with more than 32,000 km of pipelines as well as subsidiaries operating in Germany and in LNG terminal services, set the ambitious objective of reducing two-thirds of its methane emissions by 2020. To achieve this goal, the company implemented a number of technological measures that allowed it to save more than 90% of the gas that would have otherwise been vented since 2018. These include a mobile gas booster technology (the "Quick Booster Access"), which enables gas pressure reduction within a pipeline, making it feasible to reinject what would have been vented gas back into said pipeline. GRTgaz has also developed flaring systems with high combustion efficiency, thus limiting the amount of methane slip when gas recovery isn't feasible.¹⁶

Turkmenistan's regional neighbors have made significant progress in recent years to address flaring concerns. According to the World Bank, between 2015 and 2021, Kazakhstan achieved remarkable reductions in both flaring intensity (-62%) and volume

¹⁵ https://methaneguidingprinciples.org/wp-content/uploads/2022/07/MGP23_GMT_case-study_New-Mexico-Waste-Rule-GTI-Energy.pdf

¹⁶ https://methaneguidingprinciples.org/wp-content/uploads/2022/07/MGP23_GMT_case-study_GRT-Abating-vented-emissions.pdf

of gas flared (-59%).¹⁷ SOCAR, Azerbaijan's state energy company, has also made significant progress in addressing gas flaring. In 2020, about 1.4 billion cubic meters (approximately 900,000 tons of methane) of gas was collected by SOCAR, helping to reduce production emissions to 2% of the total produced gas. This captured gas was then utilized to generate electricity for some 15 rural villages in Azerbaijan.¹⁸

These established pathways and technological innovations, coupled with the growing prevalence of leak detection and repair (LDAR) regimes worldwide, which not only contribute to more accurate emissions reporting but also allow for prioritization of repairs to address the most hazardous fugitive emissions,¹⁹ suggest that lack of political will (and pressure) is keeping Turkmenistan from mitigating its methane emissions.

Impact of Methane Emissions on Health and Global Efforts to Fight Climate Change

The negative health impacts associated with oil and gas production, especially for local communities, are well documented. Most pernicious about methane emissions are the health-damaging air pollutants (HDAPs) often emitted alongside methane.²⁰ Exposure to these pollutants, among them hydrogen sulfide, xylene, benzene, and formaldehyde, can cause premature birth, asthma, and cancer, as well as a number of additional respiratory or neurological illnesses.²¹ Crude Accountability's work at the Karachaganak Oil and Gas Condensate Field in Kazakhstan highlighted significant health problems among local residents due to exposure to these toxins.²²

The highly secretive and deeply authoritarian nature of Turkmenistan's regime makes comprehensive accounting of the environmental and human harms associated with its energy sector near impossible. Since 2003, when the Turkmenistani government rewrote the country's NGO law, civil society activism has been severely restricted, leaving the Turkmenistani population in country without an avenue to safely voice their human and environmental rights concerns. All NGOs were required to re-register at that time, and virtually none of the registrations of independent groups were approved.²³ The result has

¹⁷ <https://thedocs.worldbank.org/en/doc/fd5b55e045a373821f2e67d81e2c53b1-0400072022/related/Global-Flaring-and-Venting-Regulations-28-Case-Studies-from-Around-the-World.pdf>

¹⁸ <https://www.worldbank.org/en/programs/gasflaringreduction/brief/aiming-to-slash-emissions-to-zero-by-2022>

¹⁹ https://methaneguidingprinciples.org/wp-content/uploads/2022/07/MGP23_GMT_case-study_LDAR-SNAM.pdf

²⁰ <https://www.hsph.harvard.edu/c-change/news/methane-reductions-in-the-oil-and-gas-sector-can-protect-public-health/>

²¹

https://www.edf.org/sites/default/files/content/methane_rule_health_fact_sheet_reboot_final_no_citations.pdf

²² <https://crudeaccountability.org/first-independent-air-monitoring-from-berezovka-the-results-are-in-december-2004/>

²³ <https://crudeaccountability.org/turkmenistan/>

been an absence of public environmental monitoring, which continues to this day. If the statistics above communicate anything, it is that, given the absence of an active and engaged civil society, Turkmenistan cannot be treated as an ancillary piece in addressing the climate crisis; it must be placed front and center by the international community.

Turkmenistan's Galkynysh and Dauletabad gas fields are two of the world's largest. In a study comparing fugitive methane emissions rates from five of the most productive natural gas basins in the United States against Galkynysh and Dauletabad, the Turkmen gas fields led the group with a fugitive emissions rate of $4.1 \pm 1.5\%$.²⁴ Those conducting the study concluded that, at such a rate of fugitive methane emissions, any climate benefit associated with a shift to natural gas, often lauded as a cleaner 'bridge fuel', from coal, was offset entirely. Newly developed oil and gas sites were found to have higher fugitive emissions rates than more mature sites,²⁵ further solidifying that significant political pressure is needed to hold oil and gas operators accountable and ensure that they utilize the pathways and technologies proven to reduce anthropogenic methane emissions.

Conclusion

In the global fight against climate change, Turkmenistan's outsized negative impact, especially its rampant methane emissions, must be more widely recognized. The shocking methane intensity statistics (emissions per unit of production) associated with the Turkmen energy sector make this point clearly. If Turkmenistan had the same oil and gas production capacity as the likes of Russia and the United States, which already lead the world in total methane emissions from oil and gas production by a wide margin (more than double Iran in third place), it would far outpace even those global giants, who, in 2021, emitted 14.30 Mt (metric tons) and 13.82 Mt of methane, respectively.²⁶ Only through increased awareness does accountability become possible, and so long as Turkmenistan is situated on the outskirts of the global debate regarding climate change mitigation efforts, those efforts will continue to be hamstrung by Turkmenistan's inaction.

According to the most recent Intergovernmental Panel on Climate Change report on the climate crisis, concentrations of methane in the atmosphere were higher (as of 2019) than at any time in at least 800,000 years. Given methane's particular capacity for trapping heat in the atmosphere, the need for methane emissions reduction is urgent. Yet, according to IEA estimates, methane emissions from the global energy sector rose in 2022.²⁷ In order to limit warming to 1.5°C, climate scientists estimate that global methane

²⁴ The fugitive emissions rate at the other gas fields covered by this study were as follows: Permian Basin (Texas, USA): 1.3% fugitive emissions rate, Appalachia (Northeastern/Mid-Atlantic, USA): 1.2% fugitive emissions rate, Eagle Ford (Texas, USA): 1.4% fugitive emissions rate, Bakken (North Dakota, USA): 1.3% fugitive emissions rate, and Anadarko (Oklahoma, USA): 3.9% fugitive emissions rate.

²⁵ <https://acp.copernicus.org/articles/20/9169/2020/>

²⁶ <https://www.iea.org/reports/global-methane-tracker-2022/overview>

²⁷ <https://www.iea.org/reports/global-methane-tracker-2023/overview>

emissions must be reduced by 34% by 2030 relative to 2019 levels;²⁸ this will not be achieved so long as countries like Turkmenistan continue to emit methane at their current rates.

Fortunately, there are many proven pathways toward significant methane emissions reduction. It is incumbent upon the international community to make these solutions so apparent, and so unavoidable, that methane super emitters like Turkmenistan are forced to act.

This will necessitate a combination of efforts from any organization interested in climate justice, starting with OSCE policymakers holding Turkmenistan accountable to its international environmental obligations. Civil society actors must increase pressure on the Turkmenistani government to provide transparent and accurate statistics regarding their methane emissions, and efforts to rein them in. The overall feasibility and cost-effectiveness of methane abatement must become widely recognized; if nations realize that methane abatement can be in their own financial self-interest, they will undoubtedly be more likely to act.

Recommendations

Regarding methane mitigation pathways:

- Implement leak detection and repair regimes as part of any existing or future gas or gas pipeline project.
- Utilize other existing technologies, such as mobile gas booster technology, to capture and thus limit vented or flared gas from contributing to methane emissions.
 - Drastically limiting non-emergency venting and flaring while increasing gas capture capabilities can help create a more efficient and cost-effective electrical grid.
- Modernize existing oil and gas-related infrastructure; outdated and aging infrastructure is a primary reason for the prevalence of fugitive emissions in the region²⁹

For OSCE policymakers, participating states, and civil society:

- Hold Turkmenistan to its OSCE commitments, including in the second dimension, which focuses on environmental concerns.
- Per Decision No. 3/21, established at the 28th OSCE Ministerial Council, the OSCE and participating states should continue to encourage Turkmenistan to:
 - “integrate climate considerations into national or domestic strategy, planning, documents and processes, in order to mitigate and build resilience against the impacts of climate change.”³⁰

²⁸ https://report.ipcc.ch/ar6syr/pdf/IPCC_AR6_SYR_SPM.pdf

²⁹ <https://novastan.org/en/turkmenistan/turkmenistan-the-unknown-mega-polluter/>

³⁰ <https://www.osce.org/files/f/documents/8/2/519351.pdf>

- “co-operate, where appropriate, to build greater resilience to climate change and to take relevant mitigation and adaptation measures, including, inter alia, through joint research and investment, climate-related analysis, disaster risk reduction and management, and the increased use of clean and renewable energy sources.”³¹
 - “address the short and long-term impacts of environmental degradation, as well as its restoration.”³²
- Hold Turkmenistan accountable to the commitments outlined in the Aarhus Convention, to which Turkmenistan is a signatory.
 - Demand the government ensure access to information, public participation in decision-making, and access to justice in environmental matters by all citizens and civil society organizations.
 - In 2004, a case was filed on behalf of Turkmenistani civil society with the Aarhus secretariat, which, in 2005, found Turkmenistan out of compliance.³³ However, this did not change the situation in the country, and environmental activists were threatened, imprisoned, forced to leave the country, or to go completely underground with their activities.
 - The Aarhus Center in Ashgabat should receive more economic and political support from OSCE policymakers to carry out its mission of “facilitat[ing] the free access to environmental information, public participation in environmental decision-making and access to justice on environmental matters.”³⁴
- OSCE policymakers, participating states, and civil society actors must advocate for regular reporting and inspection requirements at all oil and gas facilities in Turkmenistan, including along the country’s many pipelines, in keeping with commitments outlined in the Helsinki Final Act to, “...encourage, where possible and appropriate, national and international efforts by their interested organizations, enterprises and firms in the development, production and improvement of equipment designed for monitoring, protecting and enhancing the environment”³⁵
 - To bolster this accountability regime, the Turkmenistani government must be encouraged to work in tandem with community leaders in revoking the licenses of those operators who fail to make progress in reducing methane emissions.
 - Broadly, reporting mechanisms to international environmental organizations must be improved across the greenhouse gas spectrum.
- OSCE executive bodies and participating states should continue to advocate on behalf of voluntary global initiatives, such as the Global Methane Pledge, so that methane emissions reduction targets become more commonplace worldwide, and countries can be held accountable to their commitments.

³¹ Ibid.

³² Ibid.

³³ <https://unece.org/acccc20045-turkmenistan>

³⁴ <https://aarhus.osce.org/centres/turkmenistan/ashgabat>

³⁵ <https://www.osce.org/files/f/documents/5/c/39501.pdf>

- OSCE policymakers, participating states, as well as civil society, must do a better job spreading the word about methane reduction success stories, and the cost-effectiveness of these proven solutions.
 - Again, this is in keeping with principles outlined in the Helsinki Final Act to promote participating states to make, “wider use, in all types of cooperation, of information already available from national and international sources, including internationally agreed criteria, and utilizing the possibilities and capabilities of various competent international organizations.”³⁶