UNITED NATIONS
TURKMENISTAN

POLICY BRIEF

# Accelerating Methane Emissions Reduction in Turkmenistan

# Executive Summary

As one of the world's major oil and gas exporters, Turkmenistan has taken important initial steps to reduce methane emissions. These include joining the Global Methane Pledge, adopting a national methane roadmap, and engaging closely with the UN, UNEP's International Methane Emissions Observatory (IMEO), the Asian Development Bank and the World Bank, GIZ and other partners. These foundations have led to and integrating and institutionalizing alerts from IMEO's Methane Alert and Response System (MARS) within national procedures and created a strong basis for accelerated actions and achieve SDG 13 on climate action and reduced global greenhouse gas emissions.

Yet, the latest scientific and satellite-based assessments indicate that global methane emissions continued to rise in 2024, while Turkmenistan's absolute emissions declined modestly, reducing its share of global energy-sector from about 4.1% in 2023 to around 3.8% in 2024.

***Reducing methane emissions in Turkmenistan is one of the fastest and most cost-effective ways for the country to meet its climate commitments.*** UNEP's IMEO estimates that 4.3 million tonnes of methane were emitted from the country's oil and gas sector in 2023, with over 222 satellite-detected methane emission events and point sources identified, all of which qualify as high-emitting sources. A subset of the largest and most persistent sources has been prioritized through the Methane Alert and Response System (MARS), at government request.

Key root causes and factors include old infrastructure, stranded gas and limited access to markets, lack of emission visibility without proper instrumentation, and low international engagement on methane emissions until 2020.

Reducing emissions from methane is an essential part of the Paris Agreement-compatible mitigation strategies, which Turkmenistan can address through the following critical initiatives:

- Establish a Regional Centre for Climate Change Technologies in Central Asia

- Approval and implementation of UN Joint Programme on Methane Reduction

- Leverage carbon markets and climate finance to scale up methane reduction investments

To achieve the SDG 13 while ensuring that climate actions protect jobs, economic stability, and communities that rely heavily on fossil-fuel-based industries, the country needs forward-looking actions in carbon financing to decouple economic growth and GHG emission.

## Methane Emissions Explained

**Methane** is a powerful greenhouse gas with a global warming potential more than 80 times higher than CO2 during the 20 years after it is released into the atmosphere. It is responsible for around 30% of the rise in global temperatures. Methane is the primary component of natural gas, making oil and gas sector a major source of emissions.

The oil and gas sectors is commonly divided into **upstream activities** – covering production, gathering, and processing on all onshore or offshore facilities; **gas transportation** – including pipeline transmission, LNG, and regasification, and **downstream segments** such as refining, oil transport and emissions related to the consumption of oil and gas. The IEA estimates to originates approximately 80% of methane emissions from the oil and gas sector originate from upstream operations.

**Fugitive** methane emissions occur from leakages that are not intended, for example because of a faulty seal or leaking valve, while vented methane emissions are the result of intentional releases.

Methane **flaring** is estimated to result in 4.8%[1] of un-combusted methane being released in the atmosphere - or more when unproperly lit.

**Leak Detection and Repair (LDAR)** is a structured program to detect, quantify, and repair methane leaks in oil and gas infrastructures - such as valves, pumps and connectors - to reduce fugitive emissions and hazardous air pollutants.

[1] https://www.worldbank.org/en/programs/gasflaringreduction/methane-explained

# Context and Situation Overview

Turkmenistan has the 4th largest natural gas reserves in the world, after Russia, Iran and Qatar. The total geological reserves in the country are estimated at 71.0 billion tons of conventional fuel. Natural gas reserves were the basis for the development of a large fuel and energy industry, which is the most important driver for the development of Turkmenistan's economy. In 2024, natural gas generated 66.9% of Turkmenistan's export revenues.

TABLE 1. PRODUCTION AND EXPORT OF NATURAL GAS

| Indicator | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|
| Extraction of natural gas, bln. m³ | 69.8 | 83.8 | 82.3 | 80.6 | 77.6 |
| Export of natural gas, bcm | 34.1 | 45.9 | 43.4 | 42.4 | 37.1 |
| Average price, USD/thousand cm | 130 | 128 | 218 | 210 | 217 |
| Export revenue, mln USD | 4,416 | 5,855 | 9,449 | 8,894 | 8,069 |
| Share of natural gas in exports, % | 57.4 | 56.9 | 64.4 | 67.8 | 66.9 |

SOURCE: 2022-2025 STATISTICAL YEARBOOK OF TURKMENISTAN

Although Turkmenistan's natural gas sector remains the backbone of the economy, gas extraction has been steadily declining from 83.8 bcm in 2021 to 77.6 bcm in 2024. This downward trend in production should, in principle, lead to a corresponding reduction in methane emissions from the sector, provided that operational practices and leak rates do not deteriorate. Turkmenistan ranks 10th in global emissions (1.7%) and sixth in energy-related emissions, with the IEA estimating methane emissions at 6.190 million metric tons in 2025. Around 94% of national methane emissions is generated by the energy sector, accounting for 3.9% of all global energy-related methane emissions (5.811 million metric tons). By comparison, the IEA estimates that globally in 2025, agriculture remained the largest source of methane emissions (41%), followed by the energy sector (40%), and waste (17%), highlighting Turkmenistan's unusually high concentration of methane emissions in the energy sector relative to the global average. This sectoral imbalance underscores why trends in Turkmenistan's oil and gas methane emissions are critical to understanding overall national performance.

A key structural gap underlying Turkmenistan's methane challenge is the near absence of asset level measurement and reporting through the Oil and Gas Methane Partnership 2.0 (OGMP 2.0), the global standard for methane transparency in the oil and gas sector, managed by UNEP's IMEO. OGMP 2.0 requires participating companies to progressively advance through a five tier reporting

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| ESTIMATED METHANE EMISSIONS FROM ENERGY | Globally | Turkmenistan |
|---|---|---|
| | 148 MT | 5.8 MT |
| **ESTIMATED METHANE EMISSIONS FROM ALL SOURCES** | | |
| Energy | 41% | 94% |
| Agriculture | 40% | 5% |
| Waste | 17% | 1% |
| Other | 2% | 0% |

SOURCE: METHANE TRACKER – DATA TOOLS - IEA

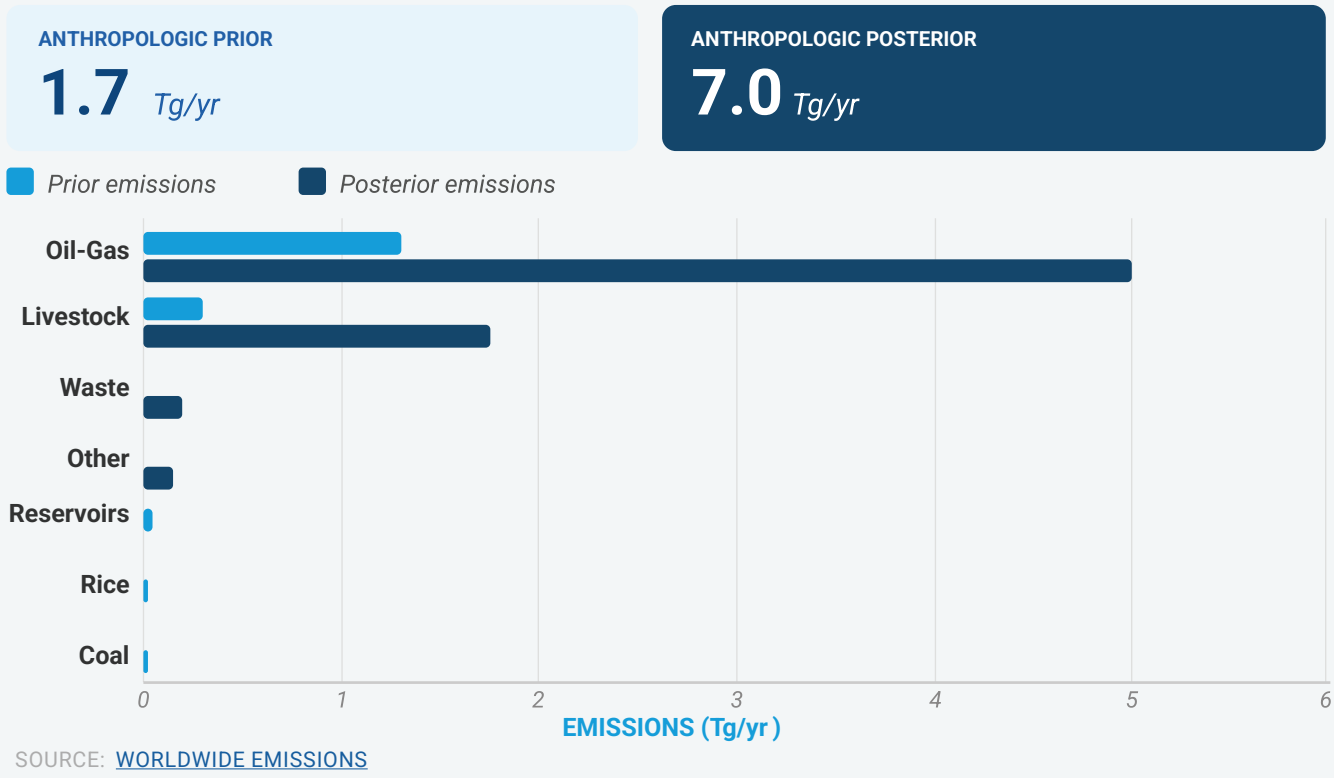
As a signatory of the Global Methane Pledge, Turkmenistan aims to reduce its methane emissions by 30% by 2030.

framework, with Level 5 — the highest tier — based on direct, source level measurement and independent verification.

According to the newly released OGMP 2.0 Level 5 Assessment, only around 9% of Turkmenistan's gas production is currently covered by OGMP 2.0 reporting in 2025, with Level 5 reporting projected to remain at approximately 1% through 2027 and 2030.[2] This places Turkmenistan far behind its Caspian peers, despite its position as one of the world's top five gas exporters and leaves a significant blind spot in global methane accounting. Limited OGMP 2.0 engagement constrains comparability, weakens investor confidence, and reduces access to international methane specific finance and markets.

As a signatory of the Global Methane Pledge, Turkmenistan aims to reduce its methane emissions by 30% by 2030. However, UNEP's IMEO estimates show that total methane emissions have remained persistently high with year-to-year fluctuations rather than a sustained decline. Satellite observations conducted through IMEO's Methane Alert and Response System (MARS) continue to detect large-scale emission events from fossil fuel operations in multiple producing regions.[3] Consistent with these observations, the Global Methane Pledge at Mid-Point Report notes that while natural gas production remained relatively stable, methane emissions showed persistent fluctuation, with renewed increases detected in 2024 following temporary reductions in 2022–2023.

**FIGURE 1. NATIONAL METHANE EMISSIONS IN TURKMENISTAN DERIVED FROM PEER-REVIEWED STAELLITE-BASED ATMOSPHERIC INVERSIONS.[4]**




SOURCE: WORLDWIDE EMISSIONS

[2] Oil & Gas Methane Partnership 2.0. OGMP 2.0 Level 5 Assessment.pdf
[3] UNEP's IMEO: Analysis of Emissions Trend in Turkmenistan
[4] Note: This analysis prioritizes peer reviewed atmospheric inversion studies over proprietary or non reviewed products to ensure methodological transparency and consistency with UN assessment frameworks. The posterior estimate reflects a 317% increase to the prior, driven by the global emissions scaling and sensitivity applied in the worldwide methane emissions inversion framework.

**TABLE 2. OVERALL METHANE EMISSION ESTIMATES IN TURKMENISTAN BY YEAR [5]**

| Year | Mean estimate (Tg $a^{-1}$) | Std. deviation (Tg $a^{-1}$) |
|---|---|---|
| 2020 | 5.1 | ±1.1 |
| 2021 | 6.2 | ±0.8 |
| 2022 | 5.9 | ±1.5 |
| 2023 | 6.0 | ±1.3 |

SOURCE: ANALYSIS CONDUCTED BY UNEP'S IMEO, BASED ON EAST, J.D., JACOB, D.J., JERVIS, D. ET AL. WORLDWIDE INFERENCE OF NATIONAL METHANE EMISSIONS BY INVERSION OF SATELLITE OBSERVATIONS WITH UNFCCC PRIOR ESTIMATES. NAT COMMUN 16, 11004 (2025). HTTPS://DOI.ORG/10.1038/S41467-025-67122-8

Building on these inversion-based assessments, UNEP's International Methane Emissions Observatory (IMEO) provides annual estimates of Turkmenistan's total methane emissions, allowing recent trends to be assessed (Table 2).

When viewed alongside the natural gas production and export figures presented earlier in this brief, these estimates indicate that even as Turkmenistan's gas exports declined between 2022 and 2023, methane emissions did not decrease proportionally. Instead, emissions rebounded by 19%, suggesting that reductions in export volumes or production do not automatically translate into effective methane mitigation. As a result, Turkmenistan's performance adversely affected global average methane abatement outcome in 2024.

The IEA Global Methane Tracker 2025, reports that global methane emissions from the energy sector exceeded 120 million tonnes in 2024.[6] As the window to limit climate warming to 1.5°C continues to close, joint analysis by the International Energy Agency (IEA), UN Environment Programme (UNEP) and the Climate and Clean Air Coalition (CCAC) underscores the critical role of methane reductions in delivering near-term climate benefits while broader decarbonization efforts continue.[7] Global estimates from the IEA indicate that immediate, targeted methane abatement in the fossil fuel sector could, cumulatively to 2050, avoid approximately 1 million premature deaths due to ozone exposure, around 90 million tonnes of crop losses, about 85 billion hours of lost labour due to heat exposure, and deliver approximately USD 260 billion in direct economic benefits, primarily from avoided labour and agricultural losses.

Indicative national benefits for Turkmenistan are derived by scaling the IEA's fossil fuel methane abatement benefits by Turkmenistan's share of global fossil fuel methane emissions (≈3.9%, per the IEA Methane Tracker) and conservatively adjusting for its 30% reduction commitment by 2030, yielding an effective mitigation share of approximately 1.2%.

Applying this scaled share to the IEA global benefit estimates implies that Turkmenistan's methane reduction actions could, cumulatively to 2050, be associated with indicative benefits on the order of:

- **11000** averted premature deaths a year due to ozone exposure
- **1.0 million tonnes** of crop loss avoided
- **0.9-1.0 billion hours** of lost labour due to heat exposure by 2050 reduced
- **2.5-3 USD billion** in direct economic benefits

Evidently, this intervention alone has the potential to deliver results of global significance. The above estimates, while illustrative and order-of-magnitude, highlight the substantial health, productivity and economic co-benefits that Turkmenistan could secure through effective methane abatement, reinforcing the case for early action as part of a broader energy transition strategy.

[5] UNEP's IMEO: Analysis of Emissions Trend in Turkmenistan
[6] Climate & Clean Air Coalition. *Global Methane Tracker 2025.*
[7] IEA (2023). The Imperative of Cutting Methane from Fossil Fuels.

# UN with partners in action and policy options

Turkmenistan, together with the support of UN agencies and multilateral institutions, has accelerated its national climate-action agenda through a series of policy, institutional, and technical measures to align with global climate commitments. Starting from 2022 UN convened all relevant actors through regular UNRCO coordination calls, SDG policy dialogues, bilateral and multilateral meetings (government, private sector, donors, including IFIs, US Embassy, USAID, UK, EU and GIZ) to leverage commitments to allocate needed financing.

**2023**

In 2023, UNEP and UNRCO facilatated a **first** training on methane abatement and leveraged demand and commitment to capacity-building at scale to support public institutions in areas of energy transition and climate action.

**COP28**

On December 1, 2023 at the **COP28 climate summit** in Dubai President Serdar Berdimuhamedov officially announced Turkmenistan's accession to the Global Methane Pledge. Later jointly with UNECE, UNEP, UNFCCC, UNDP and UNOPS UNRCO organized a closed-door Hard Talk on methane reduction and renewable energy uptake which resulted in identified further recommendations for joint actions.

**2024**

The major action was a **UN Joint Programme** "Accelerating Methane Mitigation in Turkmenistan's Oil and Gas Sector" developed in 2024 in consultations with IFIs, which would focus on swift mitigation of major sources of methane emissions and launching carbon markets.

**UNEP MARS**

In 2024, a real time demonstration to **UNEP MARS** system was arranged for the top management of the Oil and Gas sector and the respective Deputy Prime Minister and Adviser to the President, including on establishing of a mechanism for the GoT to receive regular and timely super-emitter alerts from the UNEP MARS system.

**ROADMAP**

A major milestone was the government's adoption of the **2025-2026 Roadmap to strengthen international cooperation** under the Global Methane Pledge in November 2024.

**2025**

In October 2025, a high-level **seminar on the Global Methane Pledge** was held in Ashgabat, gathering policymakers, technical experts, and international partners to translate global best practices into national methane-reduction actions and deepen capacity-building and technical cooperation.

In parallel, the establishment of a Regional Center for Climate Change Technologies for Central Asia (RCCT-CA) in Ashgabat has arrived in the final stages of negotiations, following a series of consultations between environmental agencies and ministries in Central Asia and the UN Climate Technology Centre and Network (CTCN). The Center's Impact Area of Mitigation Technologies is heavily focused on technology transfer, which is critical for curbing methane leakages and energy transition in all Central Asia countries and will serve as a regional platform for fostering implementation of bankable "green energy" projects, reducing evidence gaps, developing capacity for applying best international practices in climate change mitigation technologies.

The Government of Turkmenistan (GoT) has also begun integrating methane-reduction priorities into its next Nationally Determined Contribution (NDC

3.0) with the support of UNDP. During the 2025 Central Asian Climate Change Conference, the Minister of Environmental Protection noted that the analysis of NDC implementation has informed the drafting of NDC 3.0, with strengthened climate, energy-efficiency, and renewable-energy legislation supporting this process.

This work has been reinforced by UNCT's horizon scanning and foresight process (2025-2026), which embeds methane mitigation within anticipatory, SDG linked decision making and frames it as a near term, high impact action under conditions of uncertainty in an energy dependent economy.

Finally, subsequent consultations between parties on the UN Joint Programme "Accelerating Methane Mitigation in Turkmenistan's Oil and Gas Sector" resulted in a joint commitment to leverage $30 million to reduce methane emissions, including via carbon financing. Sighing and starting its implementation would mark the first in the world UN Joint Programme on methane emissions reduction and an important commitment by a government to advance the global methane agenda.

# 3.1 Reducing methane emissions

According to the International Energy Agency, almost 75% of methane emissions can be mitigated, and over half of that at no net cost. This is because methane – the main component of natural gas – is a wasted energy resource that could otherwise be sold or used to generate energy. Turkmenistan's methane emissions represent enough lost energy resources to meet the country's domestic electricity needs five times over. When the value of this lost methane is accounted for, addressing emissions has an economic and climate incentive.

UNEP's IMEO has been using satellites to monitor major sources of methane emissions in Turkmenistan since 2023. To date, 248 individual point sources of methane have been detected by satellites in Turkmenistan.

In 2025, 162-point sources of methane emissions have been detected. Of these sources, 38 show persistent or frequent emissions in the last 6 months.[8]

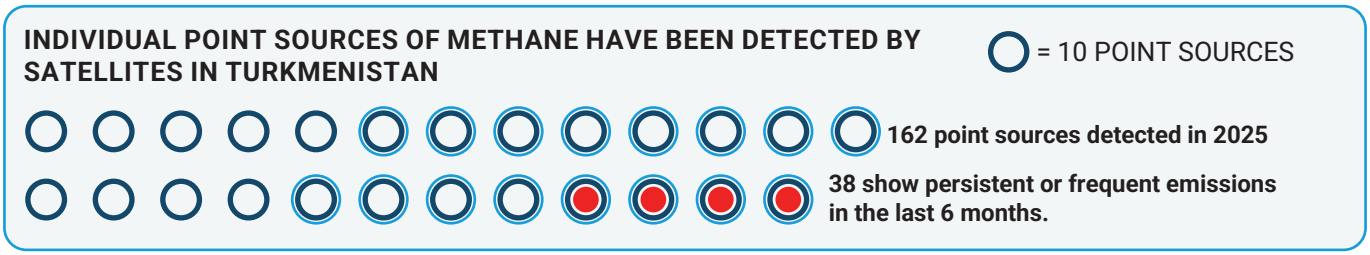



TABLE 3. OVERALL DETECTIONS IN TURKMENISTAN BY YEAR

| Year | Sources with emissions | High-resolution plumes | Avg. flux rate (t/h) |
|---|---|---|---|
| 2023 | 254 | 1,327 | 3.4 |
| 2024 | 138 | 1,012 | 6.4 |
| 2025 (to date) | 162 | 1,145 | 7.0 |

Prioritizing LDAR – Leak Detection and Repair – programs can target super-emitters first, build an MRV system, and use independent verification – including IMEO MARS data – to build credibility for concessional finance and results-based mechanisms.

IMEO's Methane Alert and Response System (MARS) provides key information from satellites to stakeholders in governments and companies that is needed to act on major emissions sources. Turkmenistan is one of the 25 countries that has appointed MARS focal points to facilitate detection

[8] Persistency estimates how often emissions are detected from a specific source over time. It looks at the number of times emissions were actually detected compared to the number of high-quality observations over the past 6 months. Emissions at these sources were detected over 50% of the time.

> Turkmenistan is one of the 25 countries that has appointed MARS focal points to facilitate detection of oil and gas plume, taking an active step towards investigating the cause of emission and addressing it where possible.

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An Eye on Methane reports three emission events were detected in Turkmenistan and linked to gas leaks on pipelines between 2024 and 2025 due to high wear and tear.

***The first source*** was identified several times between July 2024 and June 2025. Following the final alert on 3 June 2025, Turkmengaz determined that the leaks resulted from significant pipeline degradation and subsequently carried out maintenance and repairs in the Northern Balguyy area.[9]

***Two additional sources*** were detected on 22 June 2025, including one that had previously been reported in October 2024. Turkmengaz completed repair and maintenance work at both sites on 24 June 2025 at 10 yyl Abandanchylyk.[10]

Such close monitoring is allowing Turkmenistan to increase mitigation and SDG 13 objectives. As satellites continue to observe emissions in countries like Turkmenistan, collaborating with UNEP and its partners on MARS can empower Turkmenistan to identify near-term climate wins and access the necessary support to take advantage of them.

This suite of data-driven solutions offers a powerful opportunity for Turkmenistan to engage on methane emissions and tap into concrete benefits not only for the climate, but human health and prosperity.

# 3.2 Ensuring a just transition

Turkmenistan's economy is structurally dependent on natural gas production and exports. Methane emissions in the oil and gas sector therefore occur within an economic system where the sector plays a central role in national income, employment, and regional development. Actions to reduce methane emissions must therefore be aligned with these economic realities.

In 2024, nearly 200,000 workers were employed in sectors linked to natural gas production, transport, use, and associated methane emissions, including mining, power generation, manufacturing, transport, and waste management.

Methane emissions can occur not only during upstream oil and gas production, but also through transmission networks, power generation facilities, gas-intensive industries such as cement and fertilizer production, and waste and wastewater management systems.

**TABLE 4. EMPLOYMENT IN METHANE-RELEVANT SECTORS IN TURKMENISTAN (2024)**[11]

Average annual number of employees, thousand persons

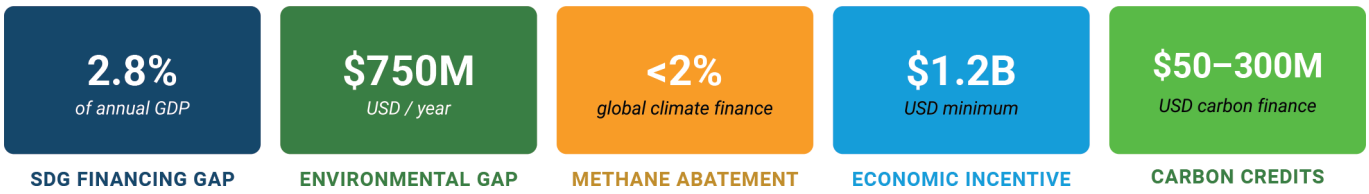
| Sector | Employment (2024) | Methane relevance |
|---|---|---|
| Mining and quarrying | 25,400 | Gas transmission, power generation |
| Manufacturing industry | 83,300 | Cement, fertilizers, petrochemical (gas use) |
| Electricity, gas, steam and air conditioning supply | 26,000 | Gas transmission, power generation |
| Water supply, waste management and remediation | 13,200 | Methane from waste and wastewater |
| Transportation and storage | 49,400 | Pipelines, fuel transport |

[9] UNEP (2025). An Eye on Methane 2025: From measurement to momentum. Data is driving action – now the pace must match the promise. Nairobi. https://wedocs.unep.org/20.500.11822/48664
[10] *Ibid.*
[11] Statistical Yearbook of Turkmenistan 2024 Year.

A just transition in the context of methane mitigation refers to advancing mitigation measures in ways that maintain economic stability in a gas-dependent economy and avoid disruption to workers and communities. In Turkmenistan, methane abatement aligns well with just-transition principles because:

- Methane mitigation targets leaks, venting, inefficient flares, and system losses across production, transport, and gas-using industries, rather than reducing output or employment levels.
- Most mitigation actions involve technical upgrades, routine maintenance, and monitoring improvements, rather than structural changes to the workforce.
- Abating methane emissions reduces losses of saleable gas while protecting long-term export competitiveness.
- Capacity-building measures directly contribute to sector modernization and skills development.

# 3.3 Carbon financing and SDG Transition Financing Gap




The UNRCO estimates the SDG financing gap at 2.8% of the annual GDP of Turkmenistan during 2026-2030 to achieve nation SDG transformation targets, and 5.5% of GDP to achieve globally set targets.[12] As stated in Turkmenistan's National commitments to SDGs transformation, resource mobilization at the national level is required to accelerate SDG progress, yet the financing gaps for key transition of environmental dimension represent 0.5% of the annual GDP, or 17.5% of the total gap, translating into 750 million USD annual gap in 2026-2030.

Worldwide, methane abatement accounts for less than 2% of global climate finance,[13] but Turkmenistan's economic context makes curbing methane strategically relevant. Abating methane emissions equivalent to 7.5% of 2022 total natural gas production has an economic incentive valued at least at US$ 1.2 billion. By reducing methane-specific emissions (CH4), and using it for certified carbon credits, carbon financing can unlock additional investment for Turkmenistan while capturing the economic value of methane that would otherwise be lost. The carbon financing potential is estimated at US$50 - 300 million, spread over 2025 -2029 according to our JP analysis, which makes it a financially viable output for methane emission reduction projects in Turkmenistan.

Overall, reducing methane emissions, combined with an investment in carbon financing to fund technology upgrades, has great potential to strengthen the long-term performance and competitiveness of Turkmenistan's gas economy by targeting gas losses and operational waste and modernizing systems.

[12] UN Country Analysis 2025 | United Nations in Turkmenistan; Turkmenistan-UN Sustainable Development Cooperation Framework for 2026-2030 | United Nations in Turkmenistan

[13] World Bank (2023). Bending the Curve: a triple-win blueprint for Global Methane Reduction. https://www.worldbank.org/en/topic/climatechange/brief/the-critical-path-to-1-5-c-by-bending-the-methane-curve

# Policy recommendations

## A Strengthen monitoring and rapid abatement

- Scale up national LDAR programmes with the support of UN and other development partners across all oil and gas infrastructure, prioritizing super emitters identified through IMEO MARS satellite monitoring.
- Develop a unified national methane MRV system that integrates satellite data, operator measurements and targeted direct measurement campaigns, with technical support from IMEO.

## B Deepen international cooperation

- Support national oil and gas companies in joining OGMP 2.0 and establishing a time-bound pathway toward Level 5 source-level measurement, using IMEO technical assistance and MARS data to enhance data quality, investor confidence, and access to methane-related finance and export markets.
- Promote engagement with UNEP's IMEO, including encouraging national operators to join the Oil and Gas Methane Partnership 2.0 and to take action on major emissions sources notified through the Methane Alert and Response System (MARS).
- Ensure active participation in the UNECE Committee on Sustainable Energy and its Groups of Experts on Gas, Coal Mine Methane and Just Transition, Renewable Energy, Energy Efficiency, Sustainable Resource Management and Cleaner Electricity Systems.

## C Unlock finance and carbon markets

- Leverage methane abatement for carbon finance, including generating certified carbon credits with an estimated value of USD 50–300 million over 2026–2030.
- Integrate potential Methane Abatement Facility (MAF) funding into national mitigation planning to finance leak repairs, flare upgrades and gas recovery.

## D Build institutions for a just transition

- Accelerate the establishment of the Regional Centre for Climate Change Technologies in Central Asia (RCCT CA) in Ashgabat, with a dedicated window for energy transition and methane reduction technologies.
- Support approval and full implementation of the UN Joint Programme on Methane Emission Reductions over five years, including securing Government funding and encouraging national oil and gas companies to contribute.

Implementing these measures would put Turkmenistan on a credible path towards a low carbon future, while supporting workers and communities affected by the gradual phase down of high emitting activities. A just and green energy transition can create new jobs, stimulate growth and deliver social and health benefits, thereby advancing the SDGs and supporting the diversification of Turkmenistan's economy.

All recommended actions are aligned with Turkmenistan's Strategies and Programmes and the National Commitments to SDG Transformation submitted at the SDG summit.

# Methodological Annex

Methane abatement in the fossil fuel sector is addressed by using two complementary approaches: the UNFCCC inventory framework for official national reporting, and the UNEP IMEO satellite-based approach for identifying and reducing real-world large emissions from oil, gas, coal, and waste operations. In addition, the Integrate Methane Inversion (IMI) flux inversion model allows reconciliation of existing inventories—including UNFCCC reporting—with satellite measurements to adjust them based on real, up-to-date measurements at the regional level.

## Comparison of approaches

| Assessment area | UNFCCC inventory framework | UNEP IMEO satellite-based approach | IMI |
|---|---|---|---|
| **Main purpose** | Official reporting, benchmarking and national planning under the Paris Agreement. | Operational intelligence for targeted methane abatement. | Improvement of existing inventories, including UNFCCC reporting, reconciling them with satellite measurements |
| **Data basis** | National activity data, IPCC emission factors and sectoral assumptions. | Observations from more than 30 satellite instruments and sensors, integrated and validated through IMEO's Methane Alert and Response System (MARS) | Satellite measurements, national inventories, sector-specific global inventories, and state-of-the-art atmospheric transport models |
| **Level of detail** | Aggregated national estimates suitable for economy-wide reporting. | Facility- or asset-level evidence that shows where major emissions are occurring. | National estimates, both total aggregated and disaggregated by sector, with a spatial resolution of 12 to 25 km, suitable for economy-wide reporting. |
| **Leaks, venting and flaring** | Often estimated indirectly; intermittent leaks and abnormal events may be under-captured. | Can identify super-emitter events from various sources (e.g., routine venting and flaring, incomplete combustion, and priority leak sources). | All satellite-measurable emissions are equally captured and aggregated into the total, along with their spatial location. The root cause of the emissions is not captured. |
| **Policy use** | Provides the legal and institutional basis for national greenhouse gas reporting. | Supports rapid, low-cost repairs, better MRV and stronger climate diplomacy. | Reconciles and improves national inventories based on real-world measurements. It can be updated annually with year-specific satellite measurements. It provides updated emission estimates closer to reality. |

# Key takeaways

- Both approaches are needed. Turkmenistan has the official UNFCCC framework for sovereign reporting but IMEO MARS helps it to identify high-emitting sources that require practical action.
- Better measurement, better targeting. Satellites, atmospheric measurements and MARS notifications can detect intermittent leakage, super-emitter events, routine venting and flares that are difficult to capture by normal variables alone.
- The IMI helps improve existing inventories by reconciling known ground-based data (bottom-up) with up-to-date, country-wide satellite measurements (top-down). The IMI model is based on state-of-the-art scientific methodology.
- Methane abatement is a win-win opportunity. Existing technology can eliminate many oil and gas methane emissions including leak detection and repair, replacement of high-emitting equipment, enhanced emissions controls, and recovery of otherwise lost gas.
- Better data allows for investment and diplomacy. Transparent MRV can build investor confidence, expand access to climate finance, and assist national authorities to reconcile discrepancies between inventory estimates and observation-based data.

# Data for Central Asia

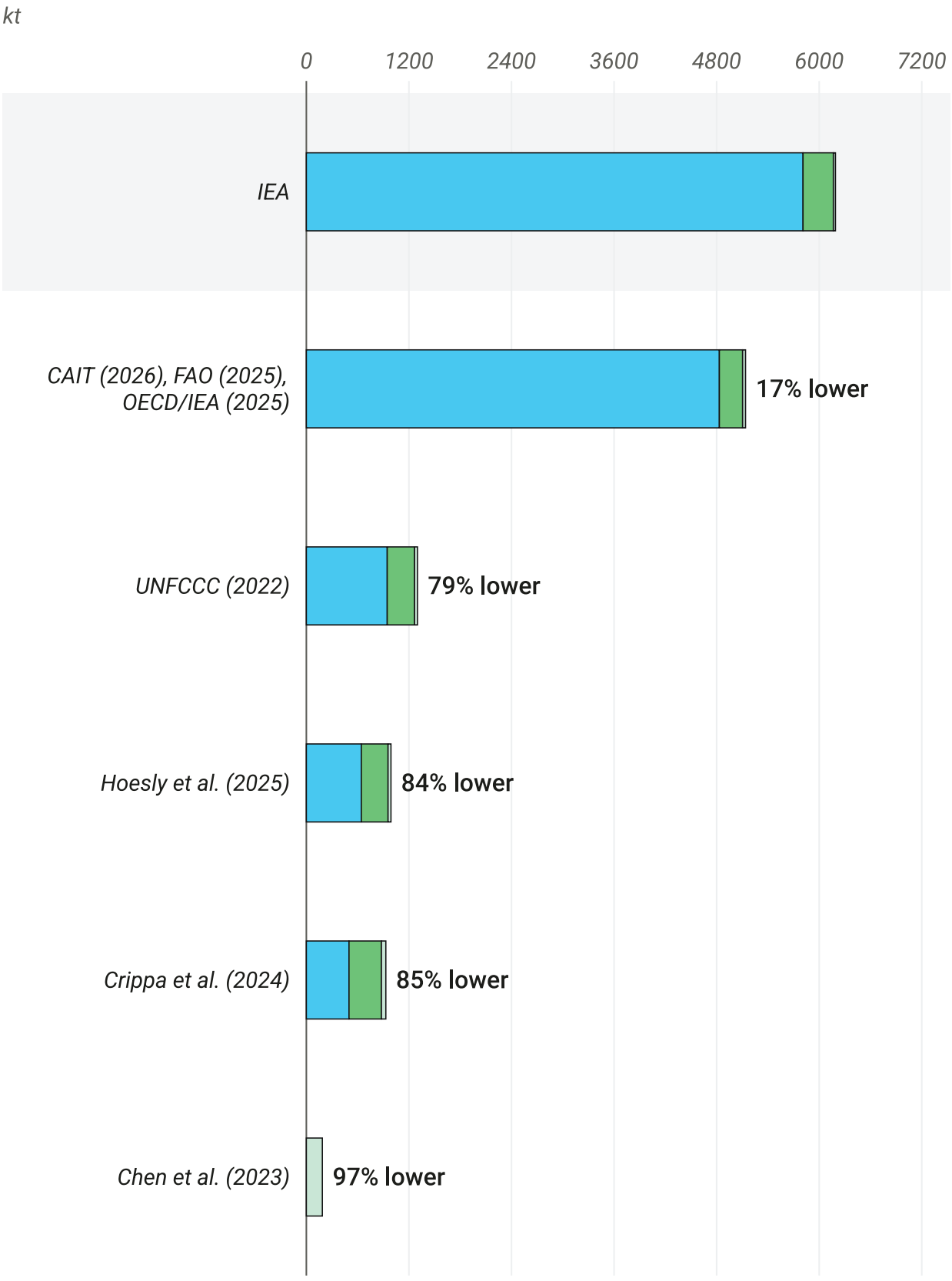
According to the IEA, the energy sector accounts for a highly concentrated share of methane emissions in Central Asia. In 2025, energy-related methane emissions in Turkmenistan were expected to reach 5,811 kt, which is 55.9 per cent of the regional total, compared with 3,079 kt in Kazakhstan and 1,504 kt in Uzbekistan. In 2023, Turkmenistan accounted for 57.7 per cent of the region's energy-related methane emissions.

## IEA estimates of methane emissions in Central Asia in 2025

| *Indicator\Country* | Turkmenistan | Kazakhstan | Uzbekistan | Total CA | World |
|---|---|---|---|---|---|
| *Estimated total emissions, kt* | 6,190 | 7,019 | 2,907 | 16,116 | 363,424 |
| *Rank in global emissions* | 10 | 17 | 25 | *NA* | |
| *UNFCCC (2022) estimate comparison with IEA* | 79% lower | 40% lower | 45% higher | - | 22% lower |
| **Estimated emissions from energy, kt** | 5,811 | 3,079 | 1,504 | 10,394 | 147,733 |
| **Rank in energy-related emissions** | 6 | 9 | 19 | *NA* | |
| *Share of estimated emissions from energy in the world, %* | 3.9% | 2.1% | 1.0% | 7.0% | |
| **Share of estimated emissions from energy in Central Asia, %** | 55.9% | 29.6% | 14.5% | 100.0% | |

SOURCE: METHANE TRACKER (IEA)

## Turkmenistan methane emissions from all sources, comparison with other estimates




IEA. Licence: CC BY 4.0

SOURCE: METHANE TRACKER (IEA)