Interstate Natural Gas Association of America

2024 CLIMATE REPORT

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INGAA 2024 Climate Report

A Message from
INGAA President and CEO

Natural gas is a foundational fuel source that will continue to play a critical role in our energy landscape for years to come. Members of the Interstate Natural Gas Association of America (INGAA) know that any evolution to a cleaner energy future must include natural gas to provide the consistency and stability needed to complement intermittent renewable energy sources such as wind and solar. Natural gas's ability to ramp up quickly and efficiently helps balance supply and demand, ensuring that energy remains accessible and dependable even when renewable resources cannot produce power. Moreover, advancements in technology and best practices are further maximizing the climate benefits of natural gas, making it a crucial component in our efforts to reduce energy industry emissions.

In our second year reporting INGAA membership-wide emissions metrics, we have great news to share. Methane emissions – both in terms of absolute emissions as well as methane emissions intensity – decreased significantly from 2021 to 2022. We are proud of our members' efforts to enable this year-over-year progress in reducing methane emissions and improving our methane intensity. INGAA remains committed to providing consistent and transparent data, measurement, and reporting of GHG emissions from operations to demonstrate that our members are making actionable progress towards achieving our shared climate goals.

In another positive development, INGAA members in 2022 exceeded two of INGAA's GHG Emissions Commitments: conducting leak survey and repairs on pipelines, and pipeline blowdowns. Natural gas pipeline companies are investing in cutting-edge technologies that allow for better monitoring, detection, and reduction of methane emissions from their operations.

As we embrace the future of energy, let us remember that lowering emissions is not merely an obligation – it is an opportunity for us to lead by example on the world stage, and an opportunity that INGAA members are seizing with determination. Together, we are making progress and transforming challenges into solutions.

Sincerely,

Amy Andryszak
President and CEO of INGAA and the INGAA Foundation

Executive Summary

This report presents a high-level snapshot of the state of emissions reduction and disclosure efforts within the natural gas pipeline industry. As concerns about climate change are juxtaposed by rapidly increasing demand for energy around the globe, the role of natural gas as a foundational fuel has garnered significant attention. This report discloses the aggregate emissions and reduction efforts of natural gas transmission & storage through the collection, aggregation, and dissemination of emissions data related to INGAA member company assets and showcases INGAA members' efforts to address climate change.

Total Methane Emissions & Methane Intensity

Methane, a greenhouse gas with a warming potential 28 times greater than carbon dioxide, significantly contributes to climate change when released into the atmosphere. By transparently sharing methane emissions data, INGAA hopes to empower policymakers and stakeholders with information to make informed decisions. This openness fosters accountability and encourages industry innovations aimed at reducing methane emissions, ultimately guiding us toward progress.

In this year's climate report, INGAA is pleased to announce that methane emissions from members' reported assets decreased significantly from 2021 to 2022, showing progress in lowering the carbon footprint of natural gas transmission & storage facilities. Emissions metrics from 2022 (total methane emissions as well as methane intensity) were calculated by an external consultant and are disclosed below. The process undertaken by the external consultant[1] was then verified for accuracy by a separate consultant.[2] The verification effort involved a review of all quantitative data from the point at which the data was received by the external consultant to the final compilation of data published herein. For the calculations, INGAA collected, reviewed, and aggregated 2022 data from members' interstate pipeline assets and any intrastate assets for which members voluntarily applied INGAA's GHG Emissions Commitments. This year's Climate Report marks the first report in which INGAA has multiple years of data, allowing the organization to draw comparisons on a year-to-year basis. See the 2023 Climate Report for a detailed description of the development of INGAA's methane intensity methodology.[3]

Methane Emissions Intensity (%)[4]

2021 = 0.087% 2022 = 0.075%[5]

Calculated as: Total Methane Emissions / [Throughput Normalized Natural Gas Transported * Methane Content of Transported Natural Gas * Density (0.0192 MT/Mcf)]

[1] INGAA utilized an external consultant, Environmental Resources Management (ERM), to ensure the data collected from INGAA member companies was analyzed, complete, and consistent with INGAA's methane intensity protocol and scorecard methodology.

[2] INGAA utilized an external consultant, Trinity Consultants, Inc. (Trinity), to verify the reported climate metrics. Trinity applied the main elements and basic approach of a "Limited Assurance" verification based upon the ISO 14064-3:2019 verification standard, Greenhouse Gases – Part 3: Specification with Guidance for the Verification and Validation of Greenhouse Gas Statements. Based on Trinity's review of INGAA's emissions metrics for 2022, no discrepancies were identified in the final asserted emissions that would indicate that emissions calculations and equations supporting the emissions statements are not represented fairly in accordance with the relevant criteria.

[3] See 2023 Climate Report, Appendix, pages 25-29.

[4] The 2021 Methane Emissions Intensity is accurate as of May 29, 2024. The 2022 Methane Emissions Intensities are accurate as of August 28, 2024. INGAA utilizes a 5% materiality threshold for any updates to these values.

[5] The 2022 methane emissions intensity includes a one-time emissions event that occurred at the Rager Mountain Storage facility of INGAA member, Equitrans Midstream Corporation, in November 2022. The event was safely managed over the course of 14 days, but it represents an outlier in our data set.

In 2022, INGAA members collectively[6] had a methane intensity of 0.075%. That number tells us that of all INGAA member reported assets, only 0.075% of the methane flowing through those pipes was released into the atmosphere. This means INGAA members are more than 99.9% methane-efficient in the transportation of natural gas that warms homes and runs businesses.

Total Methane Emissions (MT)

2021 = 271,583 2022 = 254,502[7]

1% of all methane emissions in the United States, according to the EPA Inventory of U.S. Greenhouse Gas Emissions & Sinks, 1990-2022

In 2022, the total methane emissions from INGAA members were equivalent to 1% of the total methane emissions in the United States.[8] The largest sources of methane emissions in 2022, according to INGAA member data, were transmission (pipeline and station) blowdowns and venting, reciprocating compressor fugitive emissions, and centrifugal compressor dry seals.

Emissions Reductions = 50%

GHG reduction when producing electricity with natural gas instead of coal, according to the International Energy Agency

The International Energy Agency (IEA) estimates that up to 1.2 gigatonnes of CO_2[9] could be abated in the short term by switching from coal to existing gas-fired plants, an amount that offsets all methane emitted in the United States in the years 2021 or 2022, and almost all methane emitted in both years combined.[10] The most potential can be unlocked in the near term in the United States and Europe, where natural gas could reduce power sector emissions by 10%. Best practices being implemented by INGAA members along the gas supply chain are helping maximize the climate benefits of switching to natural gas.

Based on U.S. Energy Information Administration (EIA) throughput data collected about INGAA members and total national EIA throughput data publicly available, approximately 56% of interstate pipeline throughput in the United States is represented in this data collection. Nineteen of twenty-one eligible INGAA members provided data; all companies which reported last year, reported again this year, as well as two additional pipelines which became INGAA members after our last climate report was published.[11]

[6] See statement at the bottom of this page for an overview of the percentage of national pipeline throughput and INGAA membership represented in these values.

[7] The 2022 total methane emissions includes a one-time emissions event that occurred at the Rager Mountain Storage facility of INGAA member, Equitrans Midstream Corporation, in November 2022. The event was safely managed over the course of 14 days, but it represents an outlier in our data set.

[8] See https://www.epa.gov/system/files/documents/2024-04/us-ghg-inventory-2024-main-text_04-18-2024.pdf for gross total methane emissions in the U.S. in 2022 which INGAA used as the basis of comparison.

[9] https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions.

[10] Total methane emissions in 2021 and 2022 is 1.42 gigatonnes of CO_2e, according to EPA (2024) Inventory of U.S. Greenhouse Gas Emissions & Sinks, 1990-2022.

[11] Kern River and Northern Natural became covered by Berkshire Hathaway Energy's INGAA membership in 2023.

GHG Scorecard

This report also analyzes INGAA members' progress in meeting INGAA's GHG Emissions Commitments.[12] To assess member progress, INGAA developed a rating system based on eleven categories and assigned each Commitment one of the following ratings: Exceeding Commitment, Meeting Commitment, Progressing on Implementation, and Commitment to be Implemented. See INGAA's 2023 Climate Report for a detailed description of the development of the GHG scorecard methodology.[13]

The Scorecard update, below, illustrates further improvement to the categories for:

1) Pipelines - Leak Surveys & Repairs and,

2) Pipelines - Blowdowns.

INGAA members are now going above and beyond the goal of those commitments.

INGAA members are meeting commitments across several significant sources of methane emissions, including station venting, leak surveys and repairs for compressor stations, storage well inspections, and research and development (R&D). Importantly, there was no regression in any categories from 2021 to 2022.

GHG Scorecard	2021	2022
Pipelines - Leak Surveys & Repairs	Meeting Commitment	Exceeding Commitment
Stations - Leak Surveys & Repairs	Meeting Commitment	Meeting Commitment
Storage Wells - Inspections	Meeting Commitment	Meeting Commitment
Pipelines - Blowdowns	Meeting Commitment	Exceeding Commitment
Stations - Venting	Meeting Commitment	Meeting Commitment
Storage Wells - Emissions	Progressing on Implementation	Progressing on Implementation
Pneumatic Controllers	Commitment to be Implemented	Commitment to be Implemented
Stations - Rod Packing Seals	Progressing on Implementation	Progressing on Implementation
CO2 Reductions	Commitment to be Implemented	Commitment to be Implemented
R&D	Meeting Commitment	Meeting Commitment
Information Sharing	Exceeding Commitment	Exceeding Commitment

The GHG Emissions Scorecard provides an average rating in each category for all INGAA members combined, with data weighted by member throughput. 2021 data was reported in 2023, and 2022 data is being reported in 2024.[14]

[12] INGAA, *Greenhouse Gas (GHG) Emissions Commitments* (Nov. 2021), https://ingaa.org/2021-ghg-emissions-commitments/ (INGAA's 2021 voluntary commitments).

[13] See 2023 Climate Report, appendix, pages 29-31.

[14] INGAA's data collection effort has a 2 year latency to ensure the data we are reporting is accurate and verified. EPA similarly, reports GHG data on a 2-year time latency with the U.S. Inventory of Greenhouse Gas Emissions and Sinks.

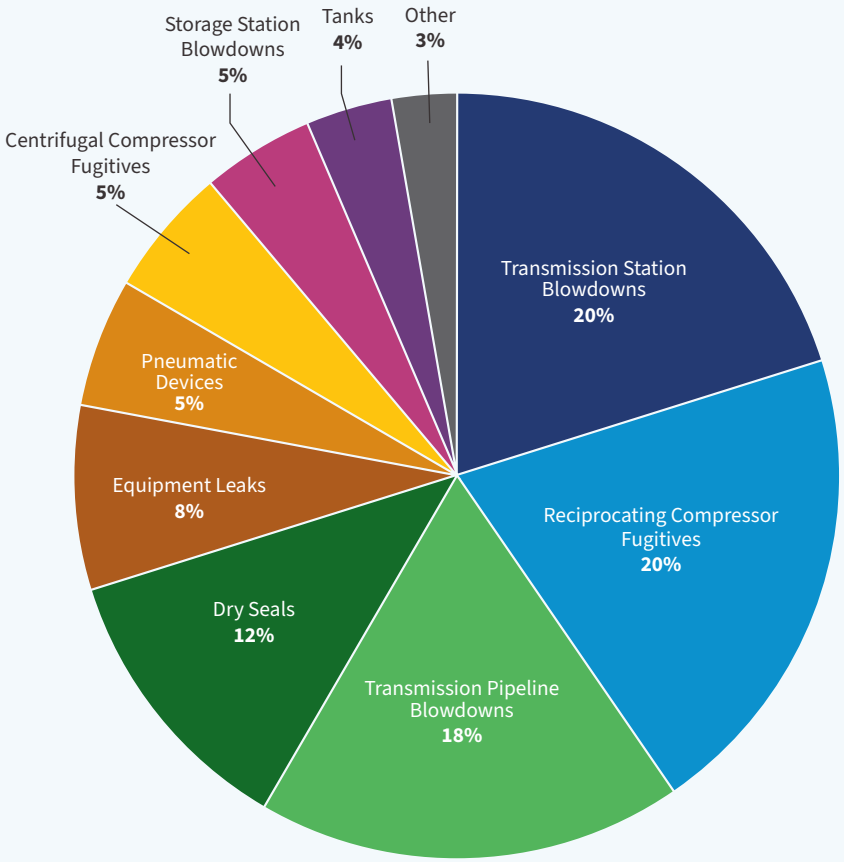
INGAA members are achieving these commitments by lowering line pressure before conducting planned pipeline maintenance; routing compressor blowdown gas into vent gas recovery systems; conducting leak surveys along the pipeline, at compressor stations, natural gas storage wellheads, metering and regulating stations, and taking corrective measures; replacing rod packing at regular intervals on reciprocating compressors; and assessing pipeline and storage well integrity to detect potential defects and leaks that require corrective actions.

While INGAA members continue to make progress, there is still work to do. INGAA members are in the process of replacing older, higher-emitting equipment with current technologies and implementing best management practices that will reduce, or altogether eliminate, methane emissions from pneumatic controllers. Members are also evaluating additional technologies to transport and utilize lower carbon fuels. In the coming years, significant progress in reducing emissions from these sources is expected.

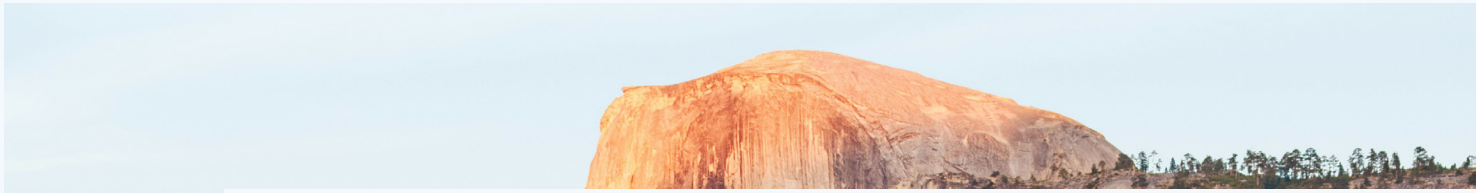
To illustrate how these commitments relate to INGAA members' biggest sources of methane emissions, see the figure below which represents the 2022 collective INGAA membership emissions profile.

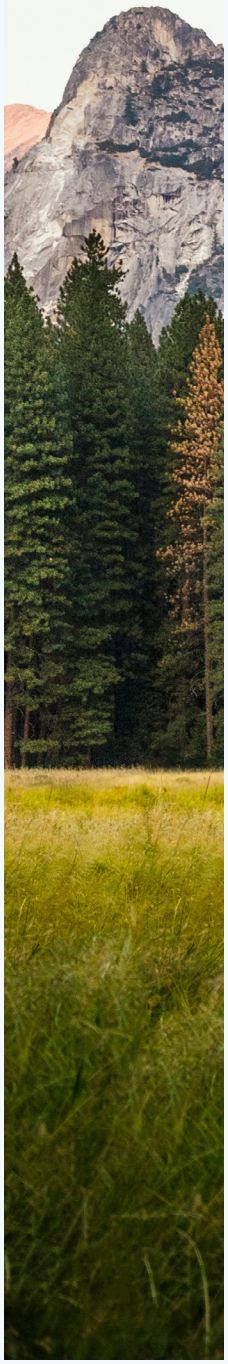
2022 INGAA Members' Methane Emissions Sources

All sources of methane emissions captured in this pie chart are covered by INGAA's GHG Emissions Commitments.



INGAA's 2022 Total Methane Emissions and Methane Intensity numbers, and updated GHG Scorecard, together demonstrate a dedicated effort by INGAA members to achieve climate goals and to maintain transparency and accountability for the industry's emissions throughout the process.





INGAA Climate Commitments

As leaders in America's energy industry, INGAA's members recognize the need to build upon ongoing efforts and continue to address global climate change by reducing GHG emissions, including methane emissions. INGAA members are leading the effort to modernize the nation's interstate natural gas delivery network with a goal of minimizing the impact on the climate. INGAA's commitments address climate change by supporting renewable energy development and deploying new and innovative technologies and process enhancements that are expected to further reduce emissions. INGAA also supports sound federal policies that protect the environment while ensuring a safe, reliable, and resilient energy transmission system that enables the delivery of affordable energy to the homes and businesses that depend upon it. INGAA's leadership has developed forward-thinking policies that are driving continuous improvement in the natural gas industry. Those policies are contained in INGAA's Vision Forward Statement, GHG Emissions Commitments, 2021 Climate Report, and 2023 Climate Report.

Other Methane Reporting, Programs, and Research

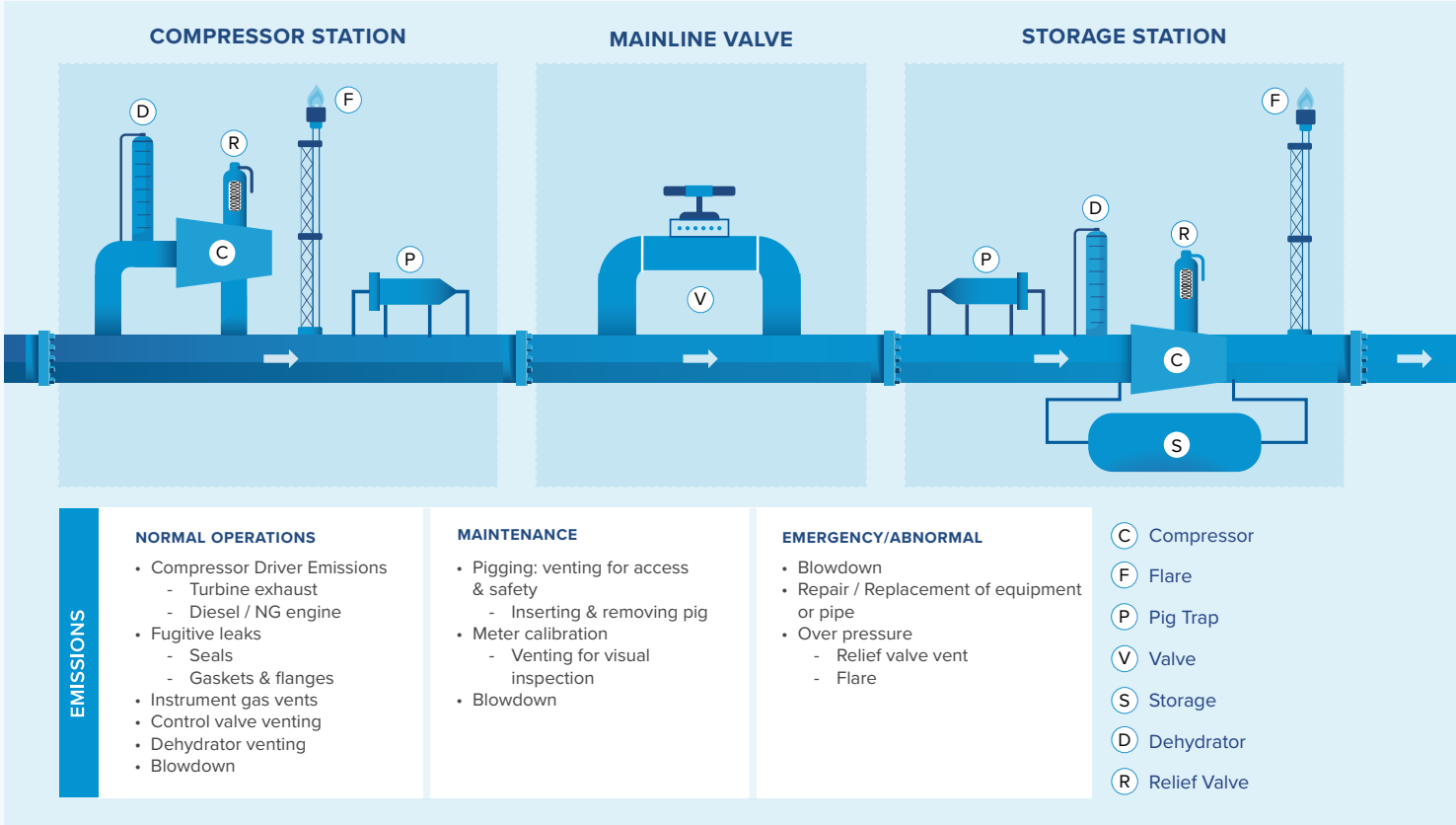
Although state and federal emissions data are publicly available, INGAA's members recognize that these data sources are oftentimes not fully representative of the emissions originating from natural gas transmission & storage operations, and that some stakeholders desire a consistent methodology to compare emissions.

To address this concern, the Natural Gas Sustainability Initiative (NGSI) developed an industry-wide, segment-specific approach to calculate individual company methane emissions intensity. This approach was used to help shape INGAA's efforts to calculate methane intensity. Beyond NGSI, INGAA members support several important programs, initiatives, and research institutions dedicated to better understanding and reducing methane emissions from the natural gas transmission & storage industry. These efforts are highlighted later in this report.

Member Projects and Initiatives

INGAA members are committed to being part of a cleaner energy future by working to reduce GHG emissions from their transmission & storage operations, and a number of members have established specific net-zero targets. Beyond these targets, various members are investing in initiatives to support the transition to a cleaner energy future. These initiatives include, but are not limited to, enabling the growth of renewable natural gas (RNG), supporting research into hydrogen as a zero-carbon fuel, exploring the use of carbon capture, utilization and storage projects, and investing in differentiated gas, to ensure that natural gas continues to be the foundation of the global energy mix.

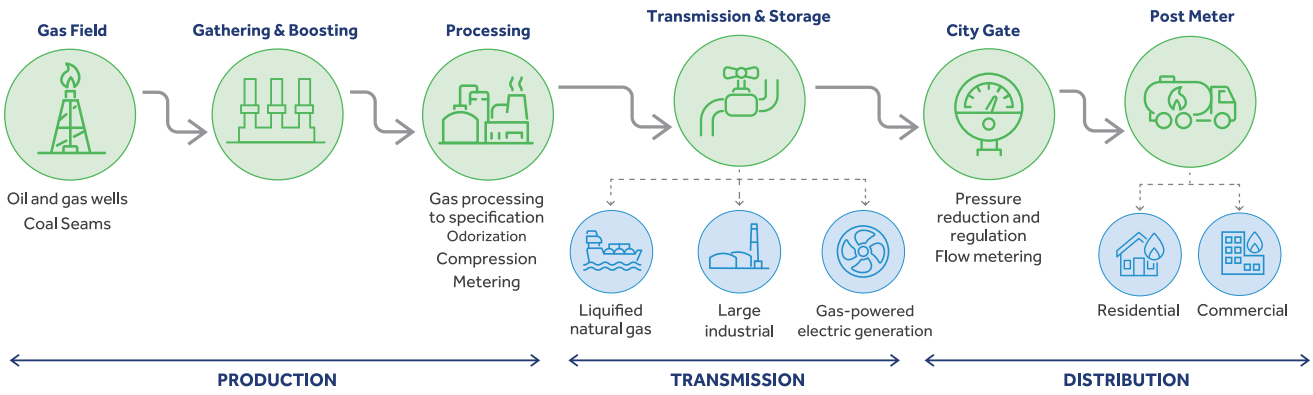
Where Methane Leaks and Venting Occur in the Natural Gas Transmission & Storage System



This infographic displays some of the common components of transmission & storage assets and the variety of ways that methane could be emitted from the system. While many of these occurrences are simply byproducts of normal operations of a natural gas pipeline, others can happen during preventative maintenance, and some are also a result of infrequent emergency procedures. The methodology developed to quantify INGAA members' methane intensity captures the vast majority of these emissions sources. Further, the commitments made by INGAA focus on the larger sources of emissions (station/pipeline blowdowns and venting, reciprocating compressor fugitives, and centrifugal compressor dry seal fugitives) to drive progress towards emissions reductions.

GHG Emissions in the U.S. and the Contribution of Natural Gas Transmission & Storage

Natural Gas Supply Chain



The text (below) is adapted from EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2022.

The U.S. natural gas system encompasses hundreds of thousands of wells, hundreds of processing facilities, and over one million miles of transmission and distribution pipelines.

Exploration & Production: Drilling, testing, and completion enables withdrawal of raw gas from underground gas formations.

Gathering & Boosting: Boosting stations and gathering pipelines are used for this process. They receive natural gas from production and transfer it, through gathering pipelines, to transmission pipelines or processing facilities.

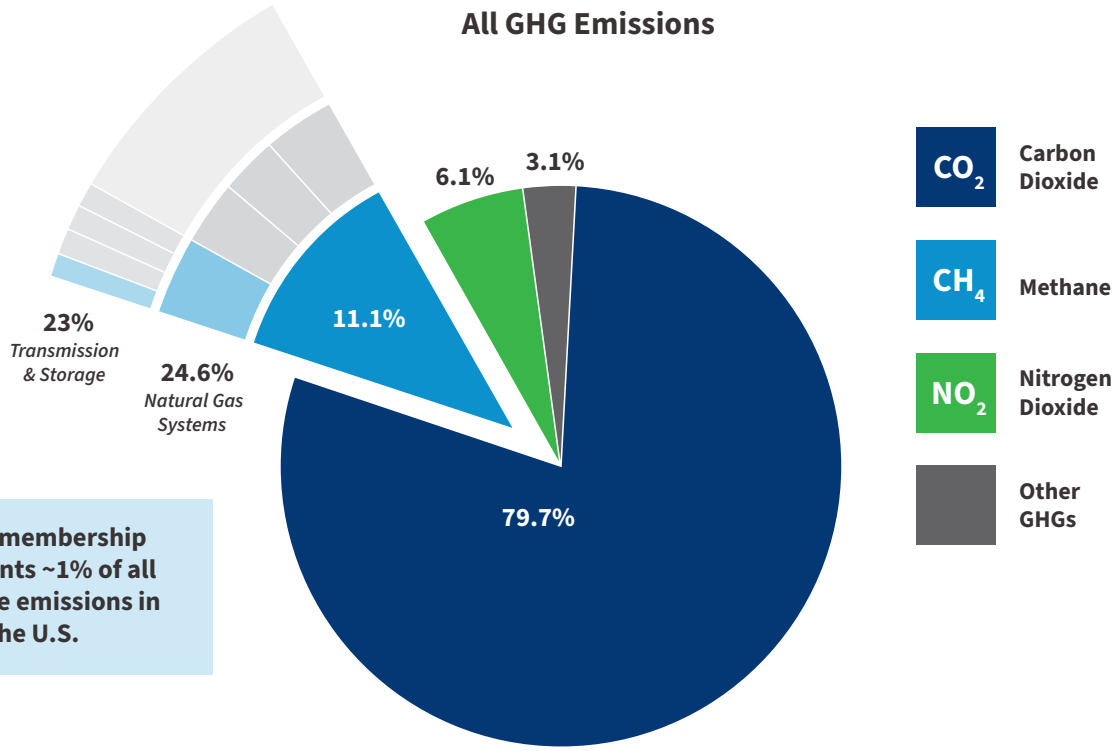
Processing: Natural gas liquids and various other constituents from the raw gas are removed, resulting in "pipeline quality" gas that is injected into the transmission system.

Transmission & Storage: Involves high-pressure, large-diameter pipelines that transport gas long distances from field production and processing areas to distribution systems or large volume customers such as power plants or chemical plants. Compressor station facilities are used to move the gas throughout the U.S. transmission system. Natural gas is also injected and stored in underground formations, or liquefied and stored in above ground tanks, during periods of low demand, and withdrawn, processed, and distributed during periods of high demand.

Distribution: Distribution pipelines receive the high-pressure gas from transmission pipelines at "city gate" stations, which reduce the pressure, and then distribute gas primarily through underground mains and service lines to individual end users.

Post-Meter: Includes residential and commercial appliances, industrial facilities and power plants, and natural gas fueled vehicles.

Methane Emissions from Natural Gas Transmission &Storage Sector



INGAA membership represents ~1% of all methane emissions in the U.S.

Graphic (above) developed from data in EPA Inventory of U.S. Greenhouse Gas Emissions and Sinks, 2022

In the United States, one-quarter of all methane emissions originate from the natural gas supply chain. Within the supply chain, transmission & storage assets represent 23%. Overall, INGAA membership represents approximately 1% of all methane emissions in the United States.

As the lowest carbon-intensive fossil fuel, natural gas represents the greatest opportunity to realize quick reductions of global emissions through the practice of fuel switching. According to the IEA, the largest emissions savings from coal-to-gas switching occurred in the United States due to the rise of shale gas, which lowered natural gas prices and underpinned large-scale switching from coal to gas in the power sector, where emissions have dropped by 20% since 2010.

The IEA estimates that up to 1.2 gigatonnes of CO_2 could be abated in the short term by switching from coal to existing gas-fired plants, if relative prices and regulation are supportive. The vast majority of this potential lies in the United States and in Europe, where doing so would bring down global power sector emissions by 10% and total energy-related CO_2 emissions by 4%. On average, coal-to-gas switching reduces emissions by 50% when producing electricity and by 33% when providing heat.[15]

INGAA's methane calculations and GHG scorecard provide a candid look at the natural gas industry's work to reduce and eliminate methane emissions from the transmission & storage sector. These actions, combined with other industry efforts, are essential to maximizing the climate benefits of switching from coal to natural gas.

[15] https://www.iea.org/reports/the-role-of-gas-in-todays-energy-transitions.

Total Methane Emissions & Methane Intensity

INGAA recognizes that sustainability and protecting the environment is not simply a choice; it is a goal that can be achieved. Building a stronger and more equitable economy aligns with creating a cleaner world. INGAA is committed to supporting its members and their efforts to reduce GHG emissions to achieve the shared goal of addressing climate change.

An important step in this journey is understanding the sources of emissions from transmission & storage assets and quantifying these emissions. Many INGAA members have, for years, publicly disclosed GHG emissions. This report builds on those efforts by reporting INGAA members' emissions data collectively. Driven by a pledge to provide consistent and transparent data collection, measurement, and reporting of GHG emissions from operations, INGAA set forth in this pursuit.

Throughout the past year, INGAA collected, reviewed, and aggregated 2022 data from its members for two methane calculations:

1) Total methane emissions for INGAA membership; and

2) Methane emissions intensity for INGAA membership.

Based on EIA throughput collected and national EIA throughput data publicly available, approximately 56% of interstate pipeline throughput in the United States is represented in this data collection. Nineteen of twenty-one eligible INGAA members provided data. Seven additional INGAA members were excluded from the data altogether due to:

- Assets falling outside the boundaries of the request[16], or
- Data being accounted for by another member[17].

[16] Operation of interstate pipelines is a primary criteria for inclusion in INGAA's data request. INGAA members who do not operate interstate pipelines are not included.

[17] These are assets which are part of a joint venture which are already reported through another INGAA member's data.

Data was collected by INGAA for calendar year 2022 for the following segments, as defined by EPA's GHG Reporting Program:

- Onshore natural gas transmission compression [40 C.F.R. § 98.230(a)(4)];
- Underground natural gas storage [40 C.F.R. § 98.230(a)(5)][18];
- Liquefied natural gas (LNG) storage [40 C.F.R. § 98.230(a)(6)];[19] and
- Onshore natural gas transmission pipeline [40 C.F.R. § 98.230(a)(10)].

Further, the two calculations were applied to assets subject to INGAA's GHG Emissions Commitments, which include all interstate assets and any intrastate assets for which members voluntarily applied the INGAA GHG Emissions Commitments.

For methane intensity, INGAA calculated an average for the membership, weighted by throughput. This was calculated using total reported emissions divided by the total normalized throughput.

Total Methane Emissions of INGAA Members

2022 Total Methane Emissions (MT) = 254,502

Calculated following NGSI Methane Emissions Intensity Protocol, Version 1.0.[20]

In 2022, INGAA members' total methane emissions were approximately 254 thousand metric tons of methane. The largest sources of emissions in 2022 were:

- Station and pipeline blowdowns and venting: Includes depressurization events for sources such as piping, compressors, scrubbers, pigging, and emergency shutdowns.
- Reciprocating compressors fugitives: Leaks associated with blowdown and isolation valves, as well as venting from rod packing.
- Centrifugal compressor dry seal fugitives: Venting associated with dry seals.

Methane Emissions Intensity of INGAA Members

2022 Methane Emissions Intensity (%) = 0.075%

Calculated as: Total Methane Emissions / [Throughput Normalized Natural Gas Transported * Methane Content of Transported Natural Gas * Density (0.0192 MT/Mcf)][20]

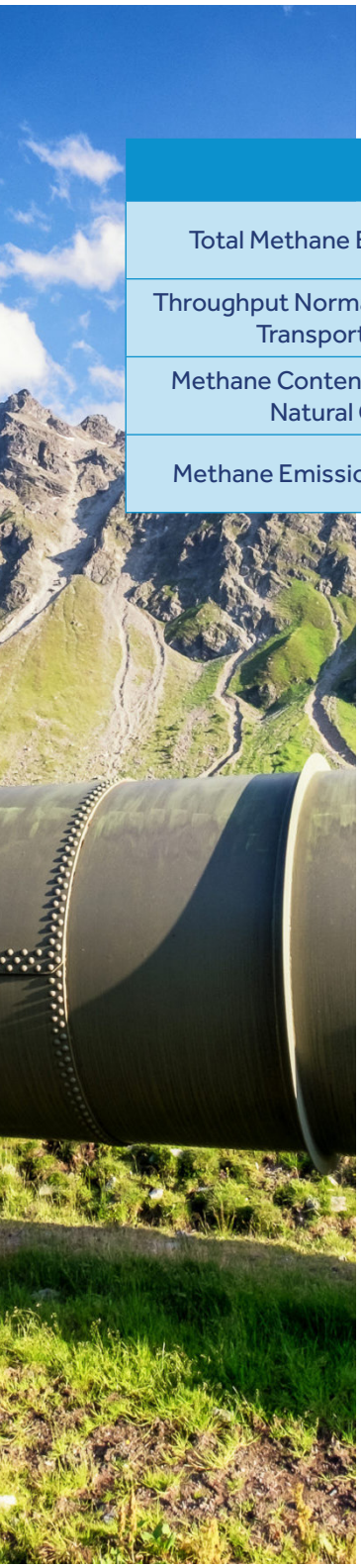
In the natural gas industry, methane emissions intensity is often calculated as emissions divided by throughput to compare emissions performance for different sized companies and different operating segments.

[18] Only included if the Underground Storage facility is before the city gate [i.e., part of transmission & storage system, not part of Distribution system].

[19] Only included if the LNG Storage facility is before the city gate [i.e., part of transmission & storage system, not part of Distribution system].

[20] The 2022 total methane emissions includes a one-time emissions event that occurred at the Rager Mountain Storage facility of INGAA member, Equitrans Midstream Corporation, in November 2022. The event was safely managed over the course of 14 days, but it represents an outlier in our data set.

[21] The 2022 methane emissions intensity includes a one-time emissions event that occurred at the Rager Mountain Storage facility of INGAA member, Equitrans Midstream Corporation, in November 2022. The event was safely managed over the course of 14 days, but it represents an outlier in our data set.



Summary of Data Collected from INGAA Members

Aggregated results are summarized in the table below:

	2021	2022
Total Methane Emissions (MT)	271,583	254,502
Throughput Normalized Natural Gas Transported (Mcf)	17,464,785,503	18,958,182,164
Methane Content of Transported Natural Gas (%)	93.3%	93.6 %
Methane Emissions Intensity (%)	0.087%	0.075%

The resulting total methane emissions can be equated to approximately 7.1 million MT of CO_2 Equivalent (CO_2e), which is less than two coal-fired power plants or 19 natural gas-fired power plants operating for one year.[22,23] CO_2e is calculated as follows:[24]

$$CO_2e = CH_4 \cdot 28$$

There are other voluntary and regulatory programs with methane intensity calculations for transmission & storage assets, however they were ultimately not used by INGAA due to scope and methodology:

- **Inflation Reduction Act (IRA):** Congress mandated that EPA utilize a methane intensity threshold to determine which facilities owe a fee to the government. As of September 2024, EPA has not yet finalized how they will calculate methane intensity for this purpose. As a result, there is no data available through EPA for comparison.
- **Our Nation's Energy Future (ONE Future):** ONE Future's 2023 Methane Emissions Intensity Report cites the following 2022 intensities: [25]
  - Transmission & Storage: 0.088%
  - Other Segments:
    - Production: 0.133%
    - Gathering: 0.077%
    - Processing: 0.028%
    - Distribution: 0.095%

[22] Only includes CH4 emissions; does not include CO_2 or N_2O emissions. Future changes to the GWP of methane could make it appear that methane emissions are increasing (due to CO_2e increase) despite a decrease in methane emissions.

[23] https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator.

[24] EPA updated the Global Warming Potential (GWP) of methane from 25 to 28 as part of updates to Subpart A published 5/14/2024 in the Federal Register: https://www.epa.gov/ghgreporting/rulemaking-notices-ghg-reporting. Changes to the GWP of methane could make it appear that methane emissions are increasing (due to a CO_2 increase) despite a decrease in methane emissions.

[25] https://onefuture.us/2023-annual-report/

When comparing INGAA's methane emissions intensity to that of ONE Future, it is important to clarify that each program follows different methodologies for emissions and throughput. While each program intends to calculate a methane intensity for its respective membership's assets, INGAA's approach differs because it was specifically developed for the interstate transmission & storage industry. ONE Future's program, by comparison, caters to a broader audience of members outside of transmission & storage.

The NGSI Protocol differs from INGAA's in that it is designed to calculate intensity data for individual companies. It would be inaccurate to use the protocol to calculate methane intensity for an industry of transmission & storage companies due to double counting of throughput as it passes from one company to another. INGAA adjusted its approach to address the issue of double counting.

Finally, a U.S. national transmission & storage intensity of 0.241% can be calculated using available national emissions data and the national throughput used to normalize INGAA member throughput in the INGAA intensity calculation.[26] While the emissions protocol used by INGAA (NGSI) and EPA (GHGI) may differ slightly, the significant difference (more than three times lower) suggests that INGAA members operate their assets with a smaller methane footprint than the average transmission & storage company.

Reducing Methane & CO_2 Emissions from Operations

To achieve the emissions targets of various INGAA members, new technology, equipment, and best practices will need to be implemented. Today, there are several ways that companies can reduce methane and CO_2 emissions from their operations and make marked progress on shared climate goals.

INGAA members are working to further reduce and eliminate methane emissions by:

- Reducing blowdown emissions by lowering line pressure before conducting planned pipeline maintenance.
- Routing vented natural gas into vent gas recovery systems at compressor stations.
- Conducting leak surveys along the pipeline, at compressor stations, natural gas storage wellheads, metering and regulating stations and taking corrective measures.
- Replacing rod packing at regular intervals on reciprocating compressors.
- Identifying and replacing high-bleed pneumatic devices with no- bleed devices.
- Assessing pipeline and storage well integrity to detect potential defects and leaks that require corrective actions.

[26] Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 – Main Report (epa.gov)

Member Highlights

In 2022, **Boardwalk Pipelines** implemented an Evacuation and Blowdown Plan to reduce transmission and equipment blowdown emissions. This plan sets a standard for reducing blowdown emissions based on the potential volume of natural gas that can be vented into the atmosphere. Blowdowns occur during some integrity and maintenance work because natural gas needs to be evacuated from the pipeline segment or equipment to complete the activities safely. The plan requires evaluation of a variety of blowdown mitigation activities, including, but not limited to, pressure reduction activities utilizing in-line pump downs, portable compression and customer take-offs. In 2022, **Boardwalk Pipelines** utilized pump-down activities on 74 separate blowdown events, which reduced pipeline blowdown emissions by 72% from 2021. **Boardwalk Pipelines** saved 398 Mscf of natural gas from being vented to the atmosphere, which is the equivalent of removing 40,389 gasoline-powered passenger vehicles from the road for one year.

In 2022, **DTE** used temporary compression to mitigate vented natural gas emissions on 5 transmission projects in Michigan**. DTE** avoided 337,522 Mscf natural gas emissions into the atmosphere. Deploying this technology resulted in reductions equivalent to 18,555 mt of CO_2e.[27]

[27] DTE's projects described in this report calculated CO_2e with a GWP25 for methane.

Member Highlights

Instead of flaring natural gas during well stimulation, **DTE** successfully flowed approximately 12.1 MMscf of natural gas from storage facilities to pipelines. This saving is equivalent to consuming energy in 87 homes' energy use or 665 mt CO_2e.

In 2022, **Enbridge** mitigated or avoided over 65% of pipeline blowdowns by utilizing recompression units to capture vented gas and then inject it back into the pipeline. The emissions savings are equivalent to CO_2 emissions from over 35,000 homes' annual energy use. A specific example is when **Enbridge** needed to replace three large pipelines in Tennessee in 2022. During the construction phase of the pipeline replacement, the work could have led to substantial methane emissions by necessitating extensive blowdown. By using stopple bypass technologies and recompression operations, **Enbridge** was able to replace the three pipelines while keeping its blowdown emissions near zero, saving 9,760 tonnes of CO_2e. **Enbridge** also increased the use of AtlasWrap, an engineered, high-stiffness carbon fiber material that reinforces the operational strength of pipelines. Using mitigation measures like recompression, stopples, and AtlasWrap enabled **Enbridge** to perform maintenance while minimizing or eliminating the amount of natural gas blown down in the pipeline.

INGAA's Greenhouse Gas Scorecard

In 2018, INGAA members voluntarily committed to a variety of initiatives intended to reduce methane emissions. Three years later in 2021, members reaffirmed this commitment and expanded it, pledging to reduce carbon dioxide emissions, support research and development, and share GHG-related information. To evaluate progress on those commitments, INGAA developed and issued a GHG Scorecard in the 2023 Climate Report, which focused on 2021 emissions data. This year's report updated the scorecard with data from 2022 to show year-over-year progress toward achieving the organization's shared climate goals and fulfilling the membership's pledge to provide consistent and transparent data, measurement, and reporting of GHG emissions.

Below is a summary of the categories included in the GHG Scorecard which constitute the largest portions of INGAA members' emissions profile:

- Conducting leak surveys along the pipeline, at compressor stations, natural gas storage wellheads, metering and regulating stations, and taking corrective measures.
- Blowdowns (pipeline, transmission station, and storage station): Represents approximately 43% of INGAA members' methane emissions. This is due to mitigation measures undertaken by member companies during blowdowns. Without such measures, this category would represent an even larger proportion of INGAA members' emissions profile.
- Compressor methane emissions (reciprocating compressor fugitives, centrifugal compressor fugitives, and dry seals) equipment leaks, and tanks collectively make up approximately 47% of INGAA's methane emissions, which can be impacted by station leak surveys and repairs.
- Combustion of natural gas: INGAA estimates that more than half its members' CO_2e emissions are CO_2 emissions, primarily from combustion from compressors. INGAA members look to reduce CO_2 emissions through efficiency and electrification, while maintaining safety and reliability.

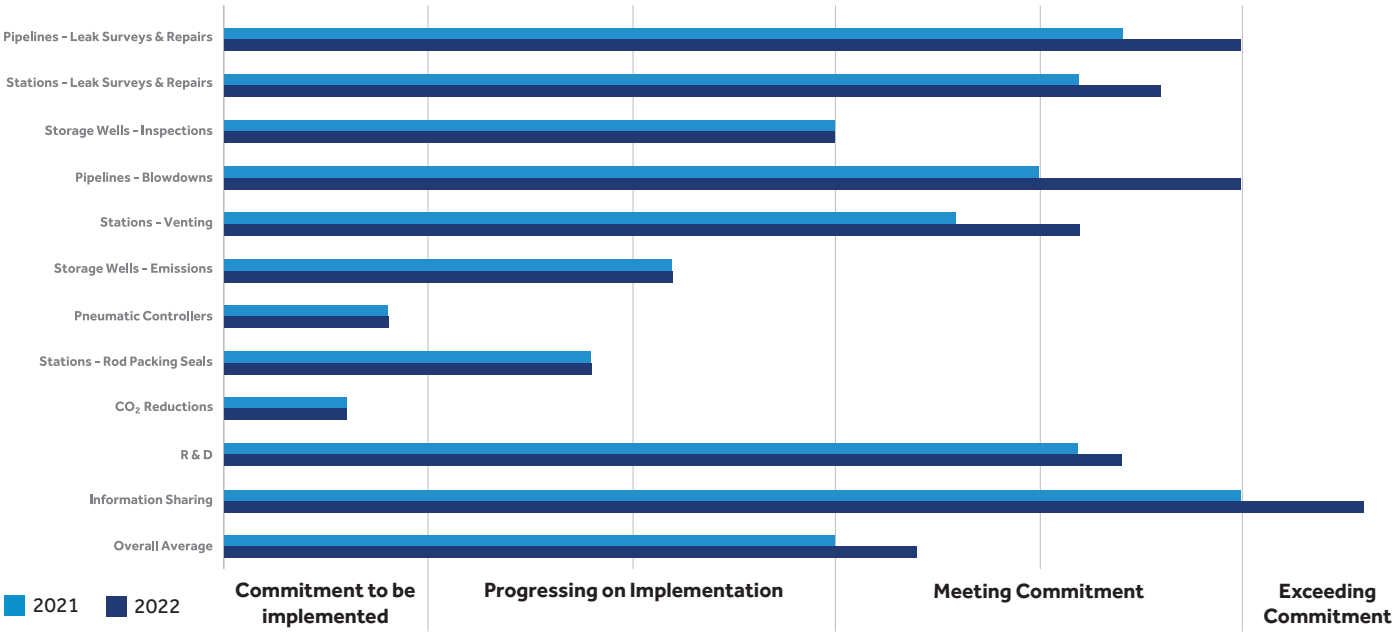
Responses to scorecard questions were assigned point values and used to categorize the following ratings:

Rating	Description
Exceeding Commitment	Based on member responses, commitment has not only been met, but member is taking actions to go above and beyond.
Meeting Commitment	Based on member responses, the commitment has been met.
Progressing on Implementation	Based on member responses, the commitment has not yet been met, but progress is being made toward achieving the commitment.
Commitment to be Implemented	Based on member responses, the commitment has not yet been met and little progress has been made to this point.

Summary of Results

INGAA's GHG Scorecard reflects the aggregated, weighted by throughput, rating for each category and overall average for all categories.

INGAA GHG Emissions Commitments - 2021 vs. 2022



Takeaways from the GHG Scorecard

Based on 2022 data, INGAA members' overall performance continued as "Meeting Commitment," with notable improvements to certain commitments. INGAA members improved from Meeting Commitment to Exceeding Commitment in both pipeline leak surveys & repairs and pipeline blowdowns. This aligns with the understanding of where INGAA members are in their efforts to address emissions, a process that is currently being implemented across multiple priority areas. In addition to pipelines, the industry's collective work to address leaks and blowdowns at stations has been successful, and the data showed marginal improvements in these categories as well.

Other areas for improvement, such as pneumatic controllers, CO_2 reductions, rod-packing, and storage well emissions are continuing to be addressed. However, INGAA did not see any backsliding on these commitments between 2021 and 2022. All of these areas will continue to be enhanced by the industry's information-sharing and R&D, where INGAA members are either meeting (R&D) or exceeding (information sharing) commitments.

INGAA's Climate Commitments

INGAA members address climate change by modernizing the nation's interstate natural gas delivery network infrastructure with a goal of reducing emissions and minimizing the impact on the climate. In January 2021, INGAA members adopted a set of commitments, including working as an industry toward reaching net-zero GHG emissions from the members' transmission & storage operations by 2050. These commitments reflect the consensus of the membership and are memorialized in INGAA's 2021 Vision Forward statement.

In November 2021, INGAA published its inaugural Climate Report which highlighted members' actions in reducing emissions and being part of the climate solution. That same month, the organization updated its Greenhouse Gas Emissions Commitments to build upon efforts to address global climate change by committing to improve information sharing and to reduce CO_2 emissions. As part of INGAA's pledge to building a cleaner energy future, members are committed to the following:

1. Reducing GHG emissions from their natural gas transmission & storage operations, and setting and meeting individual company emission reduction goals.
2. Identifying and continuing to implement long-term strategies to transition the industry and individual INGAA member companies to lower emissions, while working as an industry towards reaching net-zero GHG emissions from natural gas transmission & storage operations by no later than 2050, supported by necessary technology advancements and sound public policy initiatives.
3. Providing consistent and transparent data collection, measurement, and reporting of GHG emissions from operations to demonstrate that INGAA members are making actionable progress to achieve the world's shared climate goals.
4. Reducing both the carbon intensity of natural gas infrastructure operations and supporting the reduction of net global GHG emissions by adopting and investing in more innovative technologies such as renewable natural gas (RNG), carbon capture, and other carbon solutions and transporting low or no-carbon fuels.
5. Working together with customers, governments, non-governmental organizations, and other stakeholders to accelerate efforts to reduce and minimize all GHG emissions across the entire natural gas value chain through the adoption of innovative solutions.
6. Investing in responsible environmental stewardship and practices as part of INGAA's efforts to modernize the nation's natural gas infrastructure, including supporting meaningful and positive engagement with the communities in which member companies operate.

INGAA members support clear and reasonable federal regulation of methane emissions, and INGAA hopes these commitments will assist regulators and lawmakers as they develop energy and climate change policies that encourage innovation, support investment in the country's interstate natural gas transmission & storage network, and benefit the environment.

In the years since INGAA issued its climate commitments (2019-2022), total annual methane emissions for transmission compressor stations reporting to EPA under Subpart W of the GHG Reporting Program

DECREASED BY

1.75 M

METRIC TONS

According to EPA's GHG Equivalencies Calculator, this reduction is equivalent to:

REMOVING 416,029

PASSENGER VEHICLES FROM THE ROAD

OR

344,980 HOMES

ELECTRICITY USE FOR 1 YEAR

Other Methane Programs, Initiatives, and Research

Natural gas companies have reported GHG emissions on an annual basis to the EPA through the Greenhouse Gas Reporting Program (GHGRP) since its inception in 2009. The data provided by natural gas companies, and other reporting sources, is used in a variety of applications including the development of EPA's annual Inventory of Greenhouse Gas Emissions and Sinks. Overall, the GHGRP and the Inventory are foundational resources that help the public, and natural gas companies, understand many of the sources and amounts of GHG emissions coming from reporting facilities.

While these resources are important, INGAA members recognize they are not fully representative of all emissions originating from natural gas transmission & storage operations. INGAA members are engaged in addressing this by participating in a variety of voluntary programs which are aligned with the organization's goals of quantifying GHG emissions and enabling natural gas companies to go above and beyond to reduce and eliminate GHG emissions.

Several of these programs, initiatives, and research institutions are broadly adopted by INGAA membership and are outlined below.

Natural Gas Sustainability Initiative (NGSI)

NGSI is a voluntary, industry-wide approach for companies to calculate methane emissions intensity by segment. In February 2021, NGSI released a protocol for calculating methane emissions intensity for natural gas companies. This voluntary initiative was created through a collaboration between the Edison Electric Institute (EEI) and the American Gas Association (AGA) so that investors, customers, environmental groups, and other stakeholders know that a consistent and transparent methodology was used to calculate a company's methane emissions intensity.

NGSI participants use the protocol to calculate and disclose total methane emissions (in metric tons) associated with the transmission & storage segment, total natural gas transported (thousand standard cubic feet), the methane content (as a percentage) of the transported natural gas, and the methane emissions intensity (as a percentage).

INGAA supports NGSI's work to provide a standardized reporting framework. INGAA's total methane and methane intensity calculations are like NGSI's approach[28] and attempt to transition the company-level reporting in NGSI's protocol to an industry-wide scale. Reducing both intensity and the overall emissions will be critical as economies around the world transition to a clean energy future.

[28] INGAA follow the NGSI protocol for the emissions portion of the intensity calculation. However, as noted elsewhere in this report, a different throughput methodology was chosen to avoid double counting of gas transmitted from one member company to another.

ONE Future Coalition

ONE Future Coalition members agree to segment-specific emissions intensity targets that inform a collective goal of reducing methane emissions associated with the production, processing, transmission, and distribution of the onshore U.S. natural gas value chain to 1 percent or less by 2025. Each industry segment's reduction target is determined by its proportional share of current emissions that can be abated cost-effectively. The 2025 ONE Future target for transmission & storage is 0.301%, and ONE Future members **beat that goal by 70%** with an emissions intensity of 0.089%.

INGAA member participants: BHE GT&S, Boardwalk Pipelines, DT Midstream, DTE Energy, Enbridge, Equitrans, Kinder Morgan, Millenium, National Fuel, National Grid, ONEOK, Southern Company Gas, Southern Star, Spire, TC Energy, Williams, UGI Energy Services, and WBI.

Pipeline Research Council International (PRCI)

PRCI is an association comprised of the world's leading pipeline companies and the vendors, service providers, equipment manufacturers, and other organizations that support the energy pipeline industry. Around the world, PRCI is recognized as a unique forum within the energy pipeline industry for delivering value through the development and deployment of research solutions to improve pipeline safety and performance.
Within its broad research portfolio, PRCI has established two key initiatives to address the issue of pipeline infrastructure GHG emissions.

GHG Emissions Strategic Research Priority

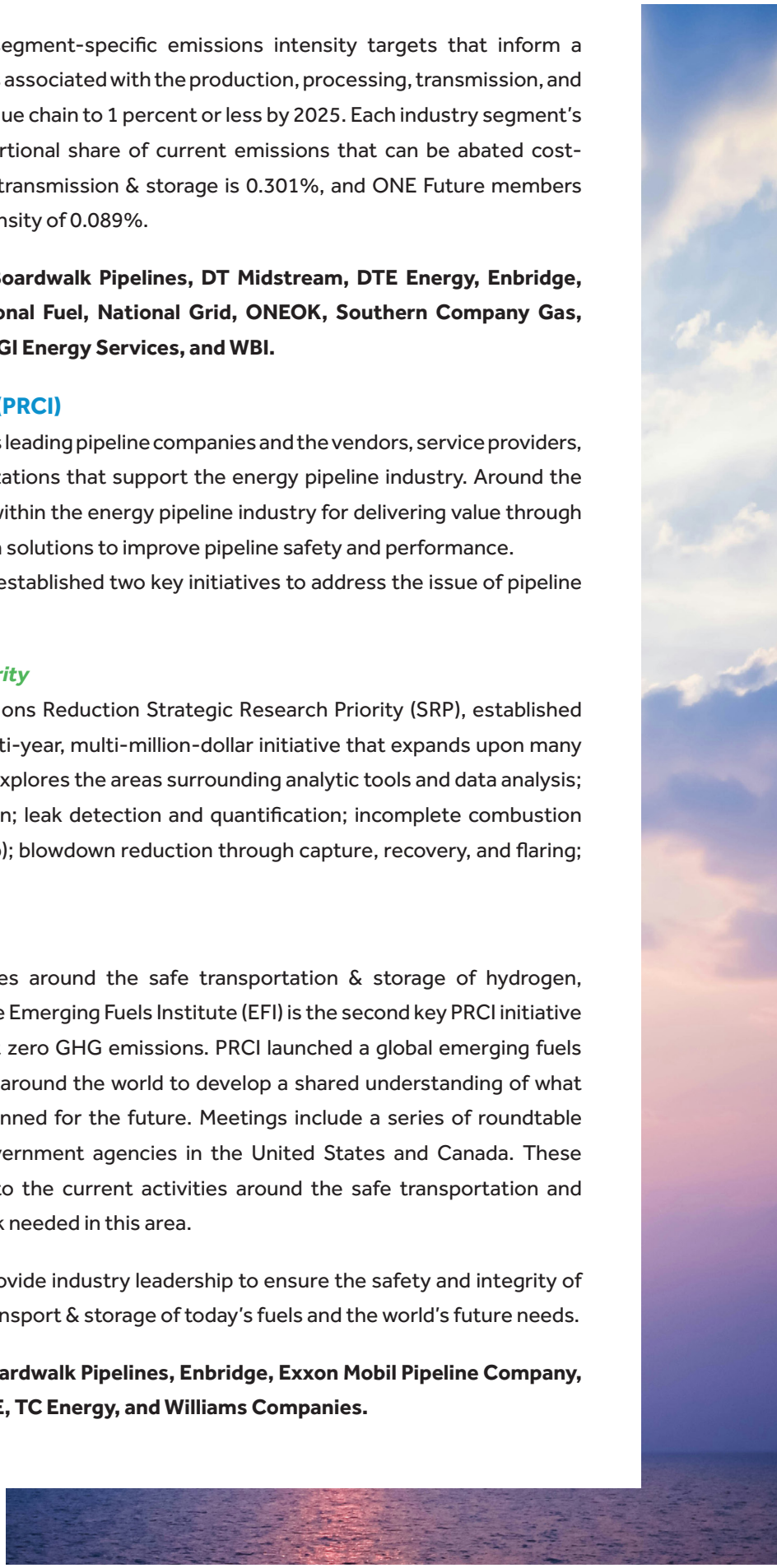
The first key initiative is the GHG Emissions Reduction Strategic Research Priority (SRP), established by PRCI to address these issues as a multi-year, multi-million-dollar initiative that expands upon many years of research in this arena. This SRP explores the areas surrounding analytic tools and data analysis; fugitive emissions surveys and mitigation; leak detection and quantification; incomplete combustion from reciprocating engines (methane slip); blowdown reduction through capture, recovery, and flaring; and efficiency improvements.

Emerging Fuels Institute

Established to solve technical challenges around the safe transportation & storage of hydrogen, renewable natural gas, and other fuels, the Emerging Fuels Institute (EFI) is the second key PRCI initiative that assists the industry in achieving net zero GHG emissions. PRCI launched a global emerging fuels initiative to bring together experts from around the world to develop a shared understanding of what is being done now and what is being planned for the future. Meetings include a series of roundtable discussions with key standards and government agencies in the United States and Canada. These collaborations provide critical insight into the current activities around the safe transportation and storage of emerging fuels and future work needed in this area.

Together, INGAA and PRCI will continue to provide industry leadership to ensure the safety and integrity of current pipeline infrastructure vital for the transport & storage of today's fuels and the world's future needs.

INGAA member participants: BHE GT&S, Boardwalk Pipelines, Enbridge, Exxon Mobil Pipeline Company, Kinder Morgan, National Fuel, ONEOK, PG&E, TC Energy, and Williams Companies.



INGAA Member Projects & Initiatives

Through ongoing partnerships between companies, regulators, and policymakers, the natural gas industry will continue to advance its collective understanding of greenhouse gas emissions and identify additional opportunities to minimize and mitigate these emissions across operations.

INGAA members are committed to advancing the clean energy future and are aggressively pursuing initiatives that will help push the energy transition forward. As detailed throughout this report, INGAA member companies are working to reduce GHG emissions from transmission & storage operations, and many companies have established specific net-zero targets. Beyond emissions reductions from operations, INGAA members are investing in other initiatives to support the energy evolution, including enabling the growth of renewable natural gas (RNG), research into hydrogen as a zero-carbon fuel, building carbon capture, utilization and storage (CCUS) projects, investing in projects for differentiated gas, and other initiatives to ensure that natural gas continues to be a foundation for clean energy.

Below are a few specific examples of efforts INGAA members are pursuing to reduce GHG emissions.

Renewable Natural Gas

RNG provides a beneficial use of waste methane from other sectors, including from livestock and dairy farms, food waste, wastewater treatment digesters, and landfills, resulting in an impactful reduction in GHGs. Increasing the access to and use of RNG will provide carbon-neutral/potentially carbon-negative fuel and accelerate progress toward a clean energy future through infrastructure largely already in place.

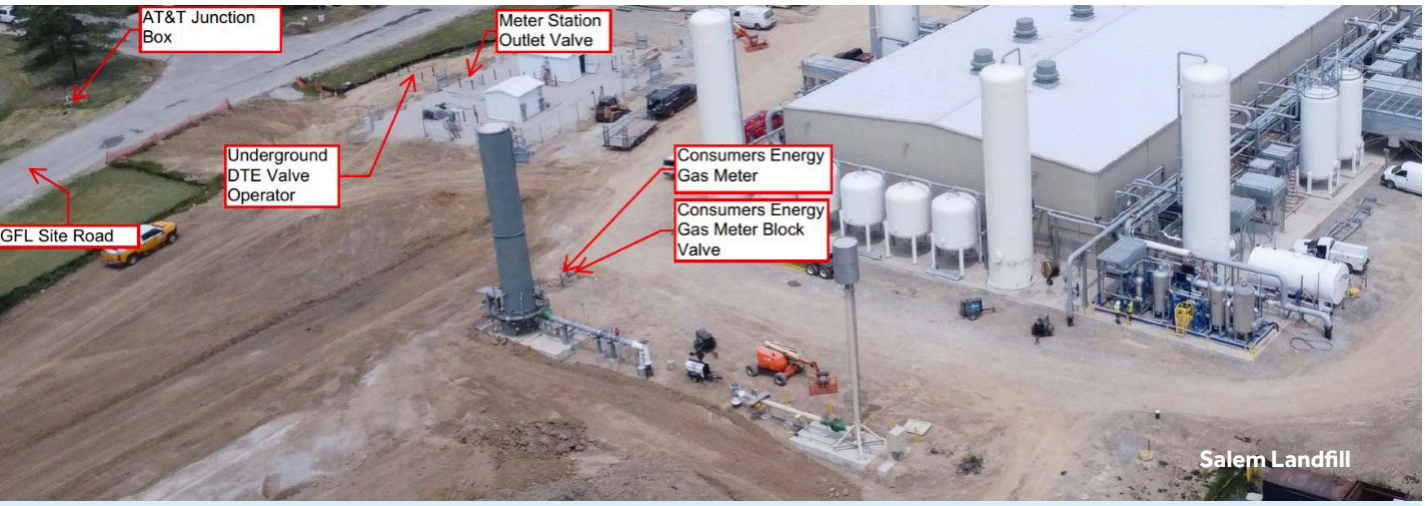
As part of INGAA's IMCI 2.0 program, the organization produced a technical guidance document that provides information regarding the best practices to safely transport and store RNG. Using this IMCI guidance document, INGAA members stand ready to transport RNG as its usage increases.

Non-Traditional Pipe

INGAA members are actively looking at transporting next generation fuels, such as super critical CO_2, hydrogen, and RNG. To meet future demand for these products, operators have been looking into using non-traditional pipe materials, which are different from traditional steel-welded pipelines, to safely transport these energy sources.

With non-traditional pipe technology currently being developed, INGAA completed a study as part of its IMCI 2.0 program looking into these types of pipelines. The study provides operators with more information about what technologies exist and strategies for broader regulatory acceptance of non-traditional pipes.

Member Highlights



DTE transports pipeline-quality gas to residential customers as a commitment to methane reduction goals and renewable energy program. At the Canton 35 and 36 interconnects, approximately 1,682,085 Mscf of converted landfill gas is received from the Sauks Trail Hills Landfill per year into transmission pipeline. This past year, **DTE** built a new meter station to receive approximately 296,486 Mscf of process gas from the Salem Landfill.

Kinder Morgan has renewable natural gas generation capacity of approximately 6.1 Bcf per year with an additional 0.8 Bcf in development. Facilities currently in operation include Indy High BTU, Prairie View RNG, Liberty RNG, and Twin Bridges RNG in Indiana, and Arlington RNG in Texas. Autumn Hills RNG is currently under construction in Michigan, with an expected in-service date in the 4th quarter of 2024. In addition to RNG production, **Kinder Morgan** also owns and operates several landfill gas-to-electricity facilities in Michigan and Kentucky. These facilities convert landfill gas into usable energy.

Hydrogen

Hydrogen can be deployed as a fuel source that does not release CO_2 when combusted. The natural gas industry is currently evaluating the potential of hydrogen blending on the existing natural gas system, providing a lower carbon fuel to consumers while utilizing existing infrastructure. Development of new hydrogen pipeline infrastructure may also be needed as the U.S. hydrogen market grows.

In 2022 **Southern Star** completed a pipeline hydrogen blending feasibility study. The study provided a general framework to assess the company's pipeline fitness of service and readiness for transporting hydrogen by focusing on two-line segments in Kansas and Missouri. Preliminary results of the assessment indicate that the majority of the evaluated segments of pipeline could likely meet the requirements set by ASME B31.12 Hydrogen Piping and Pipelines, though some material testing is required to close some of the data gaps prior to conversion. The study revealed the impact of hydrogen on the gas characteristics, material properties, asset integrity, pipeline transport capacity, and equipment performance of infrastructures designed for natural gas. **Southern Star** continues to digest the contents of the study and evaluate our readiness for alternative fuels in the event our customers call on **Southern Star** to transport alternative fuels in the future.

Member Highlights

Test setup for hydrogen fuel gas blending at an existing Williams transmission compressor station up to 30% blend. Including hydrogen tube trailer, blending skid and associated fuel gas piping.

Williams, in partnership with the Wyoming Energy Authority and their Hydrogen Pilot Program, completed a research study to evaluate the following in the southwest Wyoming area: **1)** the availability of water for hydrogen production, **2)** the effects of hydrogen on the metallurgy of pipeline materials, and **3)** the feasibility of blending hydrogen into the fuel gas streams of turbines and reciprocating engines One specific project, completed in September 2022, involved blending hydrogen into the fuel gas of a legacy reciprocating compressor in Kemmerer, Wyoming. The engine was tested under various conditions, including 70-100% torque, 0-30% hydrogen fuel blend, varied air/fuel ratios, and different ignition timings. The study found that a hydrogen blend improved all tested metrics, including CO_2 emissions, methane slip, and engine stability, with the exception of a slight increase in NOx emissions. These improvements increased with higher hydrogen concentrations and maintained performance even when the engine was throttled below 100% load.

Williams is currently evaluating projects to produce hydrogen for onsite consumption at compressor facilities to reduce their emissions. Additionally, **Williams** is continuing multiple demonstration platforms to validate the efficacy of hydrogen across our asset footprint.

Carbon Capture, Utilization & Storage

CCUS technologies offer the potential to reduce combustion CO_2 emissions from natural gas infrastructure and end use by capturing, transporting, and storing those emissions before they are released into the atmosphere.

According to the IEA, around 45 commercial CCUS facilities are currently in operation for industrial processes, fuel transformation, and power generation. While implementation of CCUS has straggled behind expectations, significant investment in recent years has led to a surge in interest and deployment of this technology, spurred in part by the passage of the Infrastructure Investment and Job Act and the Inflation Reduction Act, which created favorable tax credit changes and investment opportunities.

Member Highlights

Differentiated Gas

Differentiated, or certified gas, is natural gas that has been independently verified to have undergone certain environmental best practices. Depending on the program, differentiated gas verifiers evaluate several attributes of natural gas including whether the gas falls below a certain threshold for methane emissions intensity and whether best practices have been utilized to mitigate methane emissions, reduce community impacts, and limit environmental impacts to water resources.

Differentiated gas allows operators and buyers to distinguish their natural gas in response to market demands, regulatory pressure, or community input, and enables purchasers to select natural gas that meets certain environmental standards.

Williams Companies announced in March 2022 a strategic partnership with Context Labs to measure and verify emissions across its assets in order to capture the progress being made in its GHG reduction efforts and to enhance transparency with respect to the supply and delivery of clean energy to its customers. As part of the collaboration, **Williams** implemented an emissions quantification, monitoring, reporting, and verification program founded upon the use of enhanced measurement practices and multiple advanced technologies, including ground-based sensors, aerial flyovers, and satellites, and designed to meet or exceed OGMP 2.0 standards and protocols. In December 2022, **Williams** executed a first of its kind full supply chain differentiated natural gas transaction, known as NextGen Gas, that consisted of the tracking and tracing of emissions from the production of natural gas by Coterra Energy through the gathering, transmission, and delivery of natural gas by **Williams** to Dominion Energy Virginia, with methane intensity calculated by Context Labs and third-party verified by KPMG. As end-use customers set goals and governments establish targets and implement regulations to reduce emissions, **Williams** anticipates its NextGen Gas product will be an essential component of the clean energy future.

Additional Initiatives

INGAA members invest in additional initiatives aimed at reducing the climate footprint of their operations.

Enbridge and Divert Inc. unveiled plans to join forces and develop more facilities that turn wasted food into renewable natural gas. As wasted food decomposes, it creates methane. Estimates identify wasted food as creating about 10% of greenhouse gas emissions globally. The agreement includes further investment opportunities to develop wasted-food-to-RNG projects across the U.S. providing line of sight to greater than $1 billion of new capital growth, which will be underpinned by long-term take-or-pay contracts. It's a historic collaboration for **Enbridge** that aims to help tackle two important issues—wasted food and GHG emissions.

In 2022, **Southern Star** utilized Earth Day as an opportunity for company-wide tree planting efforts in team members' local communities. The company also purchased a solar charging bench, which was donated to a local park in Owensboro, Kentucky.

About INGAA

Interstate Natural Gas Association of America

INGAA member companies transport more than 95 percent of the nation's natural gas through approximately 200,000 miles of interstate natural gas pipelines. In 46 of the lower 48 contiguous states, INGAA member companies operate more than 5,400 natural gas compressors at more than 1,300 compressor stations and storage facilities along the pipelines that transport natural gas to local gas distribution companies, industrial end-users, gas marketers, and gas-fired electric generators. This network includes over 3,500 stationary natural gas-fired reciprocating engines, 1,500 combustion turbines, and 300 electric motors that drive the compressors.

INGAA Membership:

BHE GT&S A BERKSHIRE HATHAWAY ENERGY COMPANY
BOARDWALK PIPELINES
CHENIERE
DT Midstream
DTE
EASTERN SHORE NATURAL GAS
ENBRIDGE Life Takes Energy
equitrans Midstream
ExxonMobil Pipeline
Iroquois GAS TRANSMISSION SYSTEM IROQUOIS PIPELINE OPERATING COMPANY, OPERATOR
KINDER MORGAN INC.
MILLENNIUM PIPELINE COMPANY, L.L.C.
MountainWest
National Fuel
nationalgrid
NEXTera ENERGY
NiSource
ONEOK
PG&E
SEMPRA INFRASTRUCTURE
Southern Company Gas
SOUTHERN STAR CENTRAL GAS PIPELINE
spire
TC Energy
TELLURIAN
Williams
UGI Energy Services
WBI ENERGY An MDU Resources Group company

Interstate Natural Gas Association of America