
INGAA
Interstate Natural Gas Association of America
2023
CLIMATE
REPORT

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*The 2023 INGAA Climate Report was updated in February 2024 due to an error in the data collection process. That error was identified by INGAA staff after the original release; we regret this mistake but are now confident in the data contained in this updated version of the report.*

# A MESSAGE FROM INGAA PRESIDENT AND CEO

Natural gas serves as the foundation to nearly every aspect of daily life, and the members of the Interstate Natural Gas Association of America (INGAA) know that natural gas has a critical role as we evolve to a cleaner energy future.

INGAA members operate nearly 200,000 miles of natural gas pipelines, representing the vast majority of the interstate natural gas transmission in the U.S. and Canada. Our members have worked for years to reduce methane emissions from their operations and are leading the effort to modernize our nation's energy infrastructure to meet the dual goals of lowering emissions and delivering affordable, clean energy safely and reliably to homes and businesses.

Our efforts are succeeding. In the years since INGAA issued its Climate Commitments (2019 – 2021), average methane emissions for transmission compressor stations reporting to EPA under Subpart W of the GHG Reporting Program decreased by 28% and total annual methane emissions decreased by 1.2 million metric tons of $CO_2$ equivalent ($C0_2e$). This reduction is the equivalent of removing 266,079 passenger vehicles from the road. This edition of the INGAA Climate Report provides an overview of our progress and highlights actions our members are taking to reduce emissions from natural gas infrastructure.

This edition marks the first time INGAA is publishing the methane intensity and total methane emissions of our membership. In another first for INGAA, we will show you how our industry is doing in meeting INGAA's GHG Emissions Commitments, including a pledge to reduce methane emissions from pipelines, pneumatic controllers, storage and compressor stations, and natural gas storage wells, as well as a commitment to reduce $CO_2$ emissions and to support the development of new technology and effective practices and information sharing.

We will continue to report this information on a yearly basis in an effort to show year-over-year progress in reducing total emissions and improving our methane intensity. INGAA is committed to providing consistent and transparent data, measurement, and reporting of GHG emissions from operations to demonstrate how our members are making actionable progress towards achieving our shared climate goals.

With this report, in conjunction with other efforts, we hope to foster collaboration and information sharing across our industry that will lead to further improvements and, ultimately, deliver the clean energy future we all support.

Sincerely,

**Amy Andryszak**
President and CEO
of INGAA and The
INGAA Foundation

**"Our members have worked for years to reduce methane emissions from their operations and are leading the effort to modernize our nation's energy infrastructure to meet the dual goals of lowering emissions and delivering affordable, clean energy safely and reliably to homes and businesses."**

# EXECUTIVE SUMMARY

When INGAA developed its Climate Statement in 2021, members pledged transparency related to their emissions. For the first time, this year's Climate Report meets that commitment by reporting methane intensity and total methane emissions for the INGAA membership.[1]

**2021 Methane Emissions Intensity (%)** = **0.087%**

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

We are proud to report that more than 99.9% of methane transported through INGAA members' assets reached its intended destination, warming homes and powering businesses. INGAA's methane intensity calculation tells us that of all the methane flowing through INGAA members' pipelines in 2021, only 0.087% was released into the atmosphere. This is an improvement of 83% since 1992 and 73% since 2012.[2]

**2021 Total Methane Emissions (%)** = **1%**

Of all methane emissions in the United States, according to the EPA (2023) Inventory of U.S. Greenhouse Gas Emissions & Sinks, 1990-2021

The total methane emissions from INGAA members' transmission & storage assets in 2021 were 1% of all methane emitted in the United States, which translates to 271,583 metric tons of methane. Within the 1%, the largest sources of methane emissions were from transmission station blowdowns and venting, and from reciprocating and centrifugal compressors. INGAA members are meeting, or progressing on, commitments to reduce emissions from these sources.

**Emissions Reductions** = **50%**

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

Up to 1.2 gigatonnes of $CO_2$ could be abated in the short term by switching from coal to existing natural gas-fired plants, an amount that offsets all methane emitted in the United States in 2020 or 2021, and almost all methane emitted in both years combined.[3] The best practices INGAA members are implementing along the gas supply chain are helping maximize the climate benefits of switching to natural gas.

[1] INGAA utilized an outside consultant, Environmental Resources Management, to ensure the data collected and analyzed is accurate. Data from 19 of INGAA's 26 member companies is included.
[2] This compares to 0.52% for transmission and storage in 1992 based on the seminal EPA/GRI report, and 0.32% in 2012 based on an industry-EDF study.
[3] Total methane emissions in 2020 and 2021 was 1.47 gigatonnes of $CO_2e$, according to EPA (2023) Inventory of U.S. Greenhouse Gas Emissions & Sinks, 1990-2021.

## GHG Scorecard

This report also includes the first ever scorecard of INGAA members' collective progress on achieving INGAA's GHG Emissions Commitments. The organization developed a rating system and assigned each Commitment one of the following ratings: Exceeding Commitment, Meeting Commitment, Progressing on Implementation, and Commitment to be Implemented.

The results demonstrate INGAA members' progress in achieving several important emissions reduction commitments, including pipeline blowdowns, station venting, and leak repairs for pipeline and compressor stations. INGAA members are achieving these commitments by:

- lowering line pressure before conducting planned pipeline maintenance;
- routing compressor blowdown gas into a vent gas recovery system;
- conducting leak surveys along the pipeline, at compressor stations, natural gas storage wellheads, metering and regulating stations, and taking corrective measures; and,
- assessing pipeline and storage well integrity to detect potential defects and leaks that require corrective actions.

### 2021 Scorecard

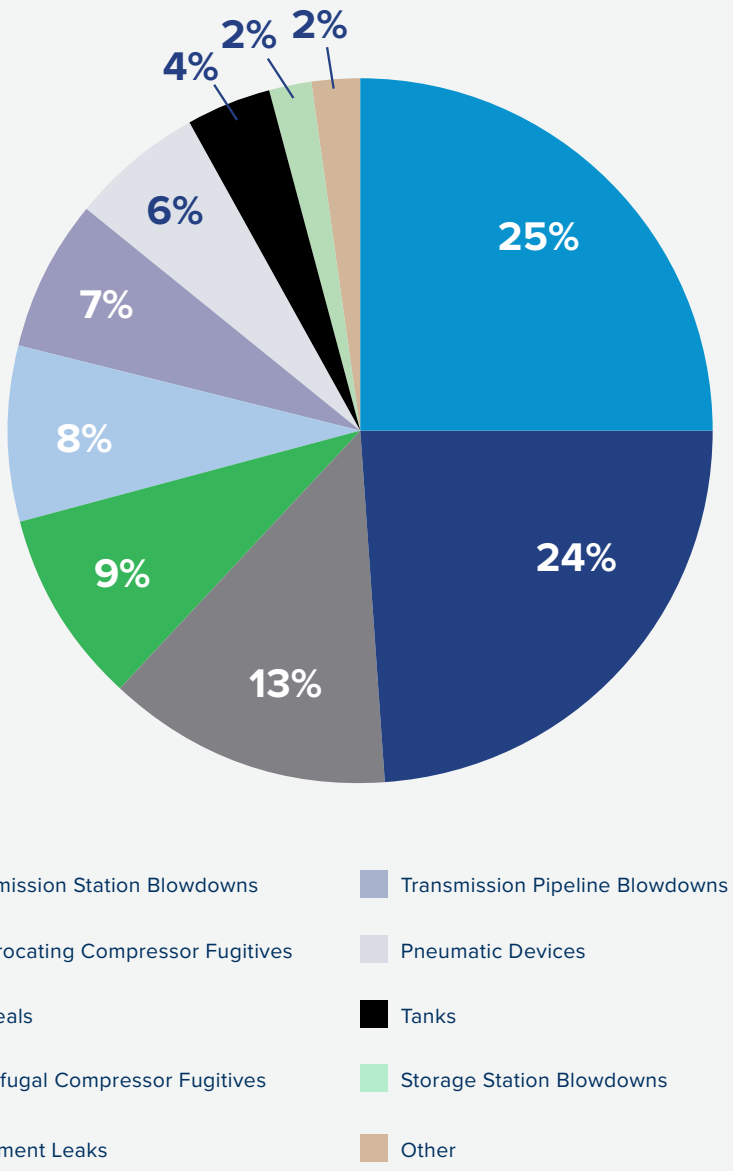
| | | |
|---|---|---|
| Pipelines Leak Surveys & Repairs | ● | Meeting Commitment |
| Stations Leak Surveys & Repairs | ● | Meeting Commitment |
| Storage Wells Inspections | ● | Meeting Commitment |
| Pipelines Blowdowns | ● | Meeting Commitment |
| Stations Venting | ● | Meeting Commitment |
| Storage Wells Emissions | ◒ | Progressing on Implementation |
| Pneumatic Controllers | ○ | Commitment to be Implemented |
| Stations Rod Packing Seals | ◒ | Progressing on Implementation |
| $CO_2$ Reductions | ○ | Commitment to be Implemented |
| R&D | ● | Meeting Commitment |
| Information Sharing | ⊕ | Exceeding Commitment |

The GHG Emissions Scorecard provides an average rating in each category for INGAA membership, with data weighted by member throughput.

While INGAA members have made substantial progress, there is still work to do. INGAA members are in the process of replacing older, higher-emitting equipment with modern technologies and best management practices that are expected to reduce, or altogether eliminate, methane emissions from sources such as pneumatic controllers. Additionally, INGAA is also evaluating the transportation and utilization of lower carbon fuels that will reduce $CO_2$. In the coming years, we expect to see significant emissions reductions from these sources.

The figure on the next page demonstrates how our commitments relate to INGAA members' sources of methane emissions.

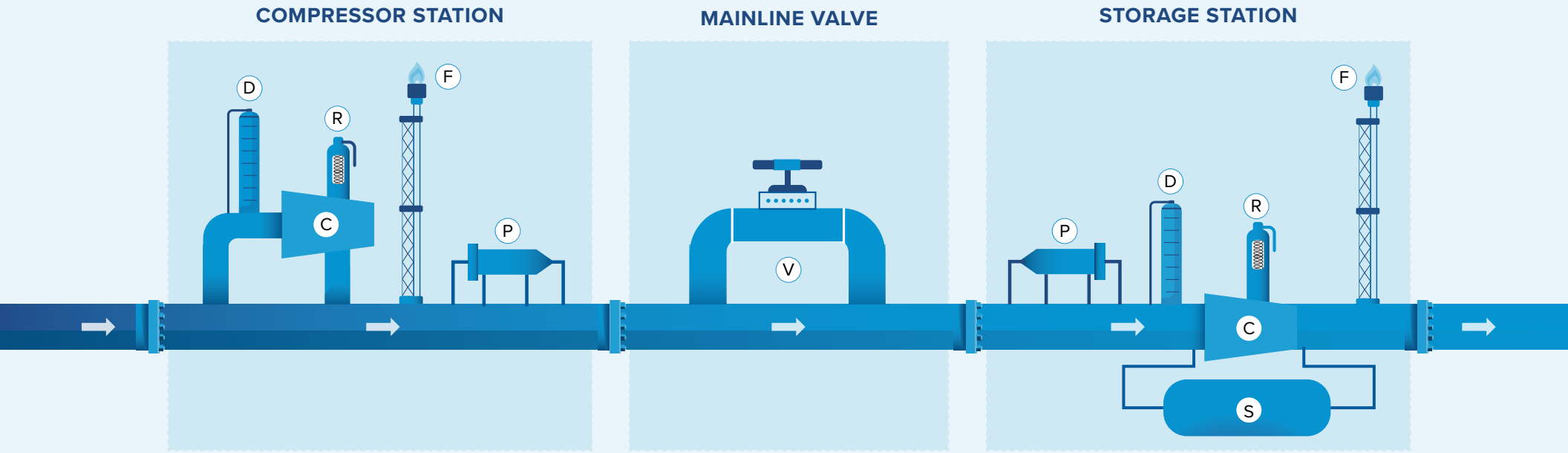
## INGAA Members' Methane Emissions Sources




INGAA's commitments focus on larger sources of emissions, including station blowdowns, reciprocating compressor fugitives, and centrifugal compressor dry seal fugitives, to drive progress towards greater emissions reductions. Members are meeting or progressing on commitments to reduce emissions from these sources.

INGAA plans to update these calculations each year with new member data to show year-over-year progress toward achieving our shared climate goals and fulfilling our pledge to provide consistent and transparent data, measurement, and reporting of GHG emissions.

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




**EMISSIONS**

### NORMAL OPERATIONS

- Compressor Driver Emissions
  - Turbine exhaust
  - Diesel / NG engine
- Fugitive leaks
  - Seals
  - Gaskets & flanges
- Instrument gas vents
- Control valve venting
- Dehydrator venting
- Blowdown

### MAINTENANCE

- Pigging: venting for access & safety
  - Inserting & removing pig
- Meter calibration
  - Venting for visual inspection
- Blowdown

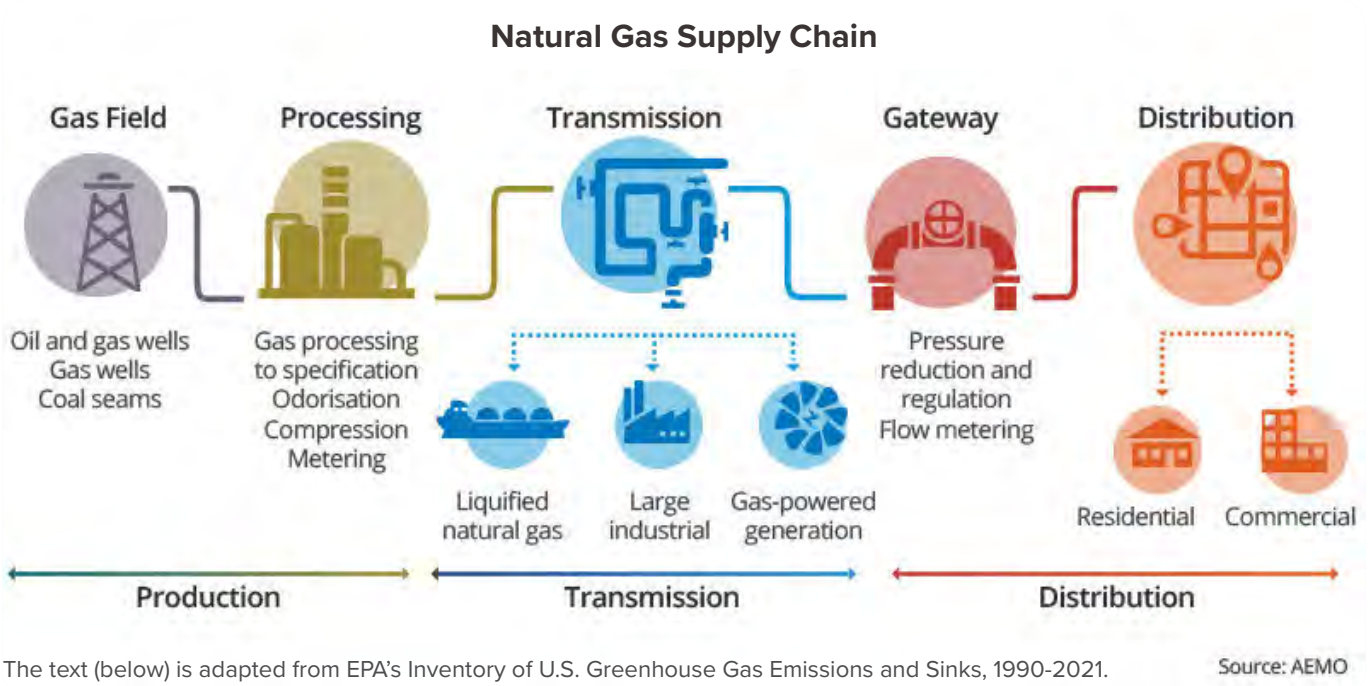
### EMERGENCY/ABNORMAL

- Blowdown
- Repair / Replacement of equipment or pipe
- Over pressure
  - Relief valve vent
  - Flare

- (C) Compressor
- (F) Flare
- (P) Pig Trap
- (V) Valve
- (S) Storage
- (D) Dehydrator
- (R) Relief Valve

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 a result of infrequent emergency procedures. The methodology developed to quantify INGAA members' methane intensity captures the vast majority of these emission sources. Further, the commitments made by INGAA members focus on these larger sources of emissions (station blowdowns & 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




The text (below) is adapted from EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2021. Source: AEMO

The U.S. natural gas supply chain 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 and 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.

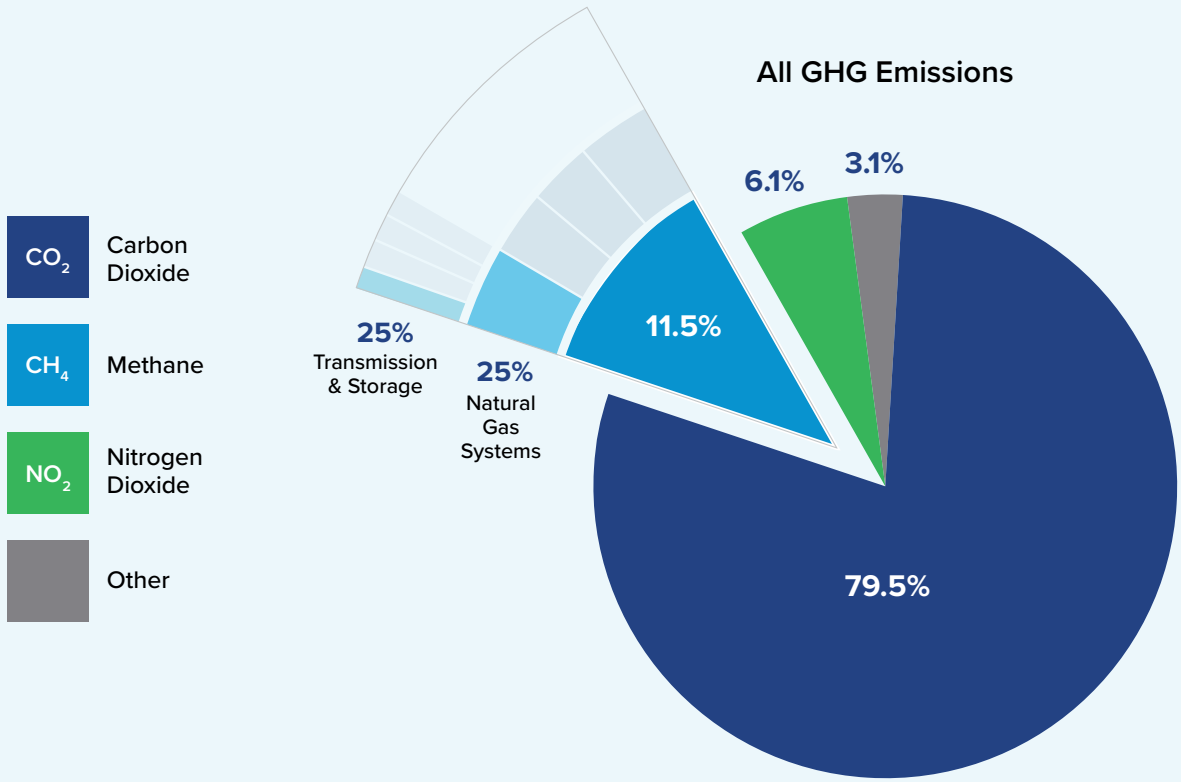
**Processing:** Natural gas liquids and various other constituents from the raw gas are removed, resulting in "pipeline quality" gas that is injected into the transmission system.

**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, including 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, which are then withdrawn, processed, and distributed during periods of high demand.

**Distribution:** Distribution pipelines receive high-pressure gas from transmission pipelines at "city gate" stations, which reduce pressure, and subsequently 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 and Storage Sector




Graphic (above) developed from data in EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2021.

Overall, INGAA membership represents 1% of all methane emissions in the United States.

Additionally, as the lowest carbon intensive fossil fuel, adoption of natural gas represents the greatest opportunity to accelerate global emissions reductions through the practice of fuel switching. According to the International Energy Agency (IEA), switching from coal to gas to produce electricity reduces $CO_2$ emissions, on average, by 50%. The largest emissions reductions from coal-to-gas switching occurred in the United States following the rise of shale gas, which lowered natural gas prices and underpinned large-scale switching from coal to gas in the power sector. This transition has lowered emissions 20% since 2010.

The IEA estimates that up to 1.2 gigatonnes of $CO_2$ could immediately be abated in the short-term by switching from coal to existing natural gas-fired plants, if relative prices and regulation are supportive. The United States and Europe share the greatest potential for emissions reductions through fuel switching, which is projected to lower global power sector emissions by 10%.

Natural gas is also critical to integrating renewable sources of electricity, including wind and solar power, into the energy mix. Both wind and solar energy are weather-dependent, non-dispatchable sources of energy and, therefore, need a foundational fuel to ensure continued electric reliability. Natural gas provides a clean and low-cost source of back-up fuel to accelerate the development of wind and solar energy, without sacrificing energy reliability.

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

# INGAA'S TOTAL METHANE EMISSIONS & METHANE EMISSIONS INTENSITY

INGAA members recognize the need to maintain energy reliability while addressing climate change. An important part of that is understanding current emission sources from transmission & storage assets, and quantifying those emissions so members can continue to work to reduce them.

For years, numerous INGAA members have disclosed GHG emissions to the public, and this report builds on those efforts to report emissions from the membership collectively.

Throughout the past year, INGAA collected, reviewed, and aggregated 2021 data from its members for two methane calculations that will be used in reports going forward:

**1** **Total methane emissions for INGAA membership**

**2** **Methane emissions intensity for INGAA membership**

Five of the INGAA members were excluded from the data altogether due to:

- Their assets falling outside the boundaries of the request,[4] or
- Data being accounted for by another member (assets part of joint ventures).

Nineteen of the remaining twenty-one eligible INGAA members provided data.

Data was collected by INGAA for calendar year 2021 for the following segments, as defined by EPA's GHG Reporting Program:[5]

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

Further, the two calculations were limited 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 overall average for the membership collectively, weighted by throughput. This was calculated using total reported emissions divided by the total normalized throughput (both emissions and throughput further discussed in Methane Emissions Intensity, Overview section).

[4] See Appendix for two exceptions.
[5] These segments represent the boundaries as referred to throughout this document. Please see the Appendix for further details.
[6] Only included if the LNG Storage facility is before the city gate [i.e., part of transmission & storage system, not part of Distribution system].

## Total Methane Emissions of INGAA Members' Transmission & Storage Assets

**2021 Total Methane Emissions (MT) = 271,583**

Calculated following NGSI Methane Emissions Intensity Protocol, Version 1.0.

In 2021, INGAA members' total methane emissions were approximately 272 thousand metric tons (MT) of methane, representing 1% of all methane emitted in the United States during that period. The largest sources of emissions in 2021 were:[7]

- Station 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.

For each INGAA member that provided data for this report, emissions were calculated following the Natural Gas Sustainability Initiative's (NGSI) Methane Emissions Intensity Protocol Version 1.0 (Protocol).[8] The NGSI Protocol was selected based on the following criteria:

- NGSI is an open-sourced protocol with templates which are publicly available;
- It accounts for all EPA reported emissions sources, as well as additional emissions sources not reported to EPA; and
- It accounts for EPA-reporting facilities as well as non-EPA reporting facilities.

## Methane Emissions Intensity of INGAA Members

**2021 Methane Emissions Intensity (%) = 0.087%**

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

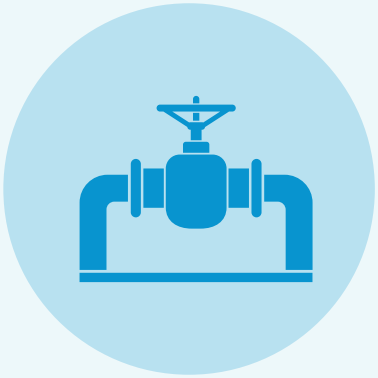
In the natural gas industry, methane emissions intensity is often calculated as emissions divided by throughput to compare emissions performance for different sized companies and different operating segments.

## Methane Emissions Intensity of INGAA Members

Aggregated results for the selected methodology are summarized in the table below:

| | | |
|---|---|---|
| Total Methane Emissions (MT) from INGAA member transmission & storage assets | 271,583 | Calculated following NGSI Methane Emissions Intensity Protocol, Version 1.0. |
| Throughput Normalized Natural Gas Transported (Mcf) | 17,464,785,503 | Total member EIA Throughput, normalized based on National Throughput (see Appendix). |
| Methane Content of Transported Natural Gas (%) | 93.3% | Average of each Member's CH4 content, weighted by Member throughput. |
| Methane Emissions Intensity (%) | 0.087% | Calculated as: Total Methane Emissions / [Throughput Normalized Natural Gas Transported * Methane Content of Transported Natural Gas * Density (0.0192 MT/Mcf)] |

[7] Based on data where members provided a source breakdown and estimates for sources where a breakdown was unavailable. See appendix for further details.
[8] Protocol: https://www.eei.org/-/media/Project/EEI/Documents/Issues-and-Policy/NGSI_MethaneIntensityProtocol.pdf?la=en&hash=8A2A2B5D4F237F65533229871B743988EE37917B



# In the years since INGAA issued its climate commitments, (2019 – 2021), average methane emissions for transmission compressor stations reporting to EPA under Subpart W of the GHG Reporting Program

**DECREASED BY**

# 28%

**TOTAL ANNUAL METHANE EMISSIONS DECREASED BY**

## 1.2 million MT of CO2e

According to EPA's GHG Equivalencies Calculator, this reduction is the equivalent of removing

# 266,079 PASSENGER VEHICLES FROM THE ROAD.

Source: EPA's Subpart W reported data, available at https://www.epa.gov/ghgreporting/subpart-w-reported-data

# INGAA'S GREENHOUSE GAS SCORECARD

Below is a summary of the eleven categories that were included in the GHG Scorecard.[9]

## Methane Commitments

**Pipelines**

- Leak Surveys & Repairs
- Blowdowns*

**Pneumatic Controllers**

**Stations (Storage and Compressor)**

- Venting*
- Rod Packing Seals*
- Leak Surveys & Repairs*

**Storage (Wells)**

- Emissions
- Inspections

## Non-Methane Commitments

**$CO_2$ Reductions**

**Research & Development (R&D)**

**Information Sharing**

In 2018, INGAA members voluntarily committed to a variety of initiatives to reduce methane emissions. Three years later, in 2021, members reaffirmed this commitment and pledged to reduce $CO_2$ emissions, support research and development, and transparently share GHG-related information. To evaluate progress on those commitments, this report includes a GHG scorecard focused on INGAA members' climate commitments across eleven categories.

Commitments designated * are estimated to have a larger emissions reduction benefit for the following reasons:

- **Pipeline Blowdowns:** Represents 6% of INGAA members' methane emissions. Due to mitigation measures undertaken by member companies during blowdowns, the impact of this source has been reduced.
- **Station Venting:** Represents 27% of INGAA members' emissions (25% from Transmission Station Blowdowns and 2% from Storage Station Blowdowns).
- **Rod Packing Seals:** Rod packing seals are a component of Reciprocating Compressor Fugitive emissions which represent 24% of INGAA members' methane emissions.
- **Station Leak Surveys & Repairs:** Several categories (Reciprocating Compressor Fugitives, Dry Seals, Centrifugal Compressor Fugitives, Equipment Leaks, Tanks) collectively make up over half of INGAA's methane emissions, which can be reduced through station leak surveys and repairs.

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

| | | | | |
|---|---|---|---|---|
| Exceeding Commitment | ⊕ | Based on member responses, commitment has not only been met, but member is taking actions to go above and beyond. | Progressing on Implementation | ◒ | Based on member responses, the commitment has not yet been met. Based on the level of partial implementation, one of two levels of scoring is assigned. |
| Meeting Commitment | ● | Based on member responses, the commitment has been met. | Commitment to be Implemented | ○ | |

[9] See the Appendix for further details.

## Reducing Methane & $CO_2$ Emissions from Operations

To achieve various emissions reductions targets being pursued by INGAA members, new technologies will have to be created and deployed. Today, there are several ways companies are working to reduce methane and $CO_2$ emissions from their operations and making marked progress on shared climate goals, including:

- Reducing blowdown emissions by lowering line pressure before conducting planned pipeline maintenance;
- Routing compressor blowdown gas into a vent gas recovery system;
- 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 low- or no- bleed devices; and
- Assessing pipeline and storage well integrity to detect potential defects and leaks that require corrective actions.

### Member highlights

**TC Energy** is committed to avoidance or mitigation of vented natural gas releases and successfully implemented venting mitigation efforts that avoided methane emissions of more than 300,000 MT of $CO_2e$ in 2022. Examples of venting mitigation employed by **TC Energy** include the use of portable compression on pipeline maintenance projects to move gas from isolated to live segments of pipeline to avoid venting gas into the atmosphere, as well as optimization of purge times on stationary compressor units to reduce gas loss during startups. On the digital forefront, **TC Energy** is rolling out a new tool to increase system efficiency and reduce overall GHG emissions resulting from combustion at compressor stations. The Compressor Optimization Tool provides real time recommendations on compressor station level unit configuration to optimize the volume of gas that can be pumped through each station with the lowest amount of resulting $CO_2$ emissions.

**National Fuel** completed the installation of vent gas recovery (VGR) systems at multiple natural gas compressor stations. A VGR is an electrically powered system that is used to capture otherwise-vented gas and directs it back into the station piping. A second VGR system was added for the turbine compressor's dry gas seal (DGS). The DGS system also redirects gas into the station piping that would otherwise be vented. Both systems are reducing emissions at this station by reducing the amount of methane released to the atmosphere.

Mobile compression units at a TC Energy compressor station.

National Fuel's DGS system reduces methane emissions from their compressor station.

## INGAA GHG Emissions Commitments – 2021 Results


## Summary of Results

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

## Takeaways from the GHG Scorecard

As of 2021, INGAA members' overall average performance fell halfway between "Progressing on Implementation" and "Meeting Commitment," which signals the significant ongoing efforts members have taken to reduce their emissions across operations. For example, the industry's collective work to survey and repair leaks across pipelines and stations has been successful and commitments on blowdowns are nearing achievement. The INGAA membership is committed to continuous improvement in areas that have not yet been fulfilled, such as evaluating and replacing pneumatic controllers and rod packing, and $CO_2$ and storage well emissions reductions. These initiatives will continue to be enhanced by the industry's information-sharing and R&D, which are areas where INGAA members have met and exceeded commitments.

# INGAA'S CLIMATE COMMITMENTS

INGAA members address climate change by modernizing the nation's interstate natural gas delivery network infrastructure with the 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 towards achieving 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, utilization & storage, and other carbon solutions as well as 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 industry 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 new energy and climate change policies that encourage innovation, support investment in the country's interstate natural gas transmission & storage network, and benefit the environment.

# OTHER METHANE PROGRAMS, INITIATIVES, AND RESEARCH

Natural gas companies have reported GHG emissions on an annual basis to the U.S. 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 the sources and amount of GHG emissions attributed 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 address 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)

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) to ensure 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 (in 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 similar to NGSI's approach[10] 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.

## 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% or less by 2025. Each industry segment's reduction target is determined by its proportional share of current emissions that can be cost-effectively abated. The 2025 ONE Future target for transmission & storage is 0.301%, and ONE Future members already beat that goal by 70% with an emissions intensity of 0.089%.

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

[10] INGAA follow's 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 between member companies.

## EPA's Methane Challenge

Members of EPA's Methane Challenge Program are committed to transparently reporting systematic and comprehensive actions to reduce methane emissions through one or both of the program's frameworks: Best Management Practice Commitment and the ONE Future Emissions Intensity Commitment. Both options seek to mitigate methane emissions across the natural gas value chain. Methane Challenge Program partners share information, technologies, and best practices among peers.

**INGAA member participants include:** BHE GT&S, DTE Energy, DT Midstream, Duke Energy, Iroquois, Kinder Morgan, National Fuel, National Grid, PG&E, Sempra LNG, Southern Company Gas, Spire, TC Energy, and UGI Energy Services.

## 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 supporting the energy pipeline industry. PRCI's mission is to collaboratively deliver relevant and innovative applied research to continually improve the global energy pipeline systems.

There are many areas in which INGAA and PRCI members work to lower overall GHG emissions and reduce the environmental impact of global pipeline infrastructure. Together, the memberships advance collaborative research of innovative technologies, methodologies, and practices to enhance the safety of pipeline systems and minimize emissions within the industry.

PRCI has established two key initiatives to address these issues. The first is the GHG Emissions Reduction Strategic Research Priority which expands upon many years of research into 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.

The second initiative is the Emerging Fuels Institute (EFI), which was established to solve the technical issues around the safe transportation and storage of hydrogen, renewable natural gas, and other fuels. The EFI also launched a global emerging fuels initiative which brings together leaders from around the world to understand what is being done now and planned for the future, including 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 & 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 which is vital for the transport and storage of today's fuels and the world's future needs.

**INGAA member participants include:** BHE GT&S, Boardwalk Pipelines, Enbridge, Kinder Morgan, National Fuel, ONEOK, PG&E, TC Energy, and Williams.

# INGAA MEMBER PROJECTS AND INITIATIVES

Through ongoing partnerships between companies, regulators, and policymakers, the natural gas industry will continue to advance its collective understanding of GHG 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 and affiliates are working to reduce GHG emissions from transportation & storage operations, with many companies establishing specific net-zero targets. Beyond emissions reductions from operations, INGAA members are investing in other initiatives to support the energy transition, including enabling the growth of renewable natural gas (RNG), research into hydrogen as a zero-carbon fuel, building carbon capture, utilization & storage (CCUS) projects, investing in projects for responsibly sourced gas (RSG), alongside other initiatives to ensure that natural gas continues to be the foundation for clean energy development.

**Examples of INGAA members' efforts toward reducing GHG emissions are as follows.**

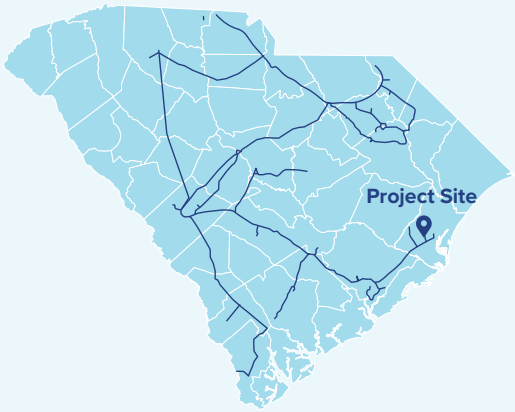
## Renewable Natural Gas

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 Integrity Management – Continuous Improvement (IMCI) program, the organization commissioned 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 production increases.

### Member highlights

**Carolina Gas Transmission (CGT)**, a BHE GT&S company, provides safe, reliable, and affordable natural gas transportation services to markets in South Carolina and southeast Georgia. In 2022, **CGT** completed and placed into service the new Georgetown County Interconnection to receive RNG and compressed natural gas (CNG) in Georgetown County, SC. **CGT** purchases RNG at the new Georgetown interconnect point for its system use, enabling **CGT's** pipeline operations to become carbon neutral. Since the Georgetown Injection point was placed into service on April 1, 2022, approximately 283,000 Dth (134,500 MT CO2e, or the equivalent of 16,952 homes' energy use for one year) of RNG has been received into **CGT's** system. Of those volumes, **CGT** has purchased approximately 198,000 Dth for its own system use which offsets **CGT's** compressor fuel use emissions.




Above: location of the Georgetown County Interconnection RNG project in South Carolina.

**Kinder Morgan** currently has 5.4 Bcf renewable natural gas (RNG) generation capacity annually, with an additional 1.5 Bcf in development. Facilities currently in operation include Indy High BTU, Liberty RNG, and Twin Bridges located in Indiana, and Arlington RNG in Texas. Additional plants are in construction including the Prairie View and Autumn Hills facilities, with expected in-service dates in the fourth quarter of 2023 and second quarter of 2024, respectively.

Above: Kinder Morgan's Indy High BTU facility converts landfill gas from the South Side Landfill into 800,000 MMBtu of pipeline-quality RNG each year, which when used in transport, displaces about 8 million gallons of diesel.

**Southern Star** designed and installed two new RNG receipt points in 2022, which eliminate methane emissions from a landfill in Oklahoma City, OK and a water treatment facility in Topeka, KS. These connections are bringing approximately an additional 2.3 MMcfd of RNG onto **Southern Star's** system.

Above: Southern Star receives RNG from landfill in Oklahoma City, OK.

## 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 impacts of hydrogen blending on the existing natural gas system, which would provide a lower carbon fuel to consumers with existing infrastructure. However, as the hydrogen market grows, development of new hydrogen pipeline infrastructure may be needed.

The INGAA Foundation and INGAA's IMCI 2.0 Hydrogen Subgroup engaged Mott MacDonald to produce a study focused on the feasibility of preparing natural gas transmission infrastructure to transport hydrogen blends. The study draws upon selected public domain work that has been completed or is currently underway. The relevant key findings are limited to transmission pipelines defined as operating above 50% of maximum operating stress. The study found that there is no clear consensus on the level of hydrogen content at which modification of existing natural gas pipeline infrastructure is required. Characterizing the integrity of an existing natural gas pipeline is essential before attempting a hydrogen blend, as it provides baseline information and identifies potential hazards.

### Member highlights

**Southern Star** partnered with Cooper Machinery Services to complete a first-of-its-kind keystone project: co-firing a hydrogen and natural gas fuel blend in a legacy reciprocating compressor engine (2,400 horsepower). The project, completed in August 2022 in Hugoton, KS, aimed to investigate the effects of the fuel blend on a reciprocating compressor engine's performance and emissions. The program led to an emissions reduction of up to 35%. Additionally, hydrogen was found to favorably improve combustion performance due to its high flame speed, small quenching distance, and wide flammability limits. Running at a 30% hydrogen blend achieved the same combustion stability and unburned hydrocarbon emissions as full load operations at 100% natural gas. Southern Star continues to digest the contents of the project and evaluate their readiness for alternative fuels in the event their customers call on **Southern Star** to transport alternative fuels in the future.

**Enbridge Gas**, in partnership with Cummins Inc., and with support from Sustainable Development Technology Canada, the Canadian Gas Association, and NGIF Capital Corporation, launched the first-of-its-kind in North America hydrogen-blending project in Markham, Ontario, in January 2022. The project injects clean hydrogen into the delivered natural gas of the existing Markham Power-to-Gas facility. This project will eliminate up to 117 tons of $CO_2$ emissions annually, moving the City of Markham further toward its objective of net zero emissions by 2050, and is just one of many steps **Enbridge Gas** is taking as part of its overall commitment to help drive Ontario's transition to a clean energy future. Additionally, the pilot project's success places **Enbridge Gas** in a position to validate and pursue larger-scale hydrogen-blending activities in other parts of its distribution system, strengthening the capacity for made-in-Ontario clean energy solutions.


Above: A trailer mounted hydrogen fuel blending system stationed at Southern Star's facility where hydrogen fuel blends were used in GMV engines at a rate up to 30%.


Above: The Markham, ON, Power-to-Gas facility produces clean hydrogen that's injected into the Enbridge Gas distribution network.

## 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, 40 commercial CCUS facilities are currently in operation for industrial processes, fuel transformation, and power generation. While the development of CCUS facilities has been modest to date, 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 (IIJA) and the Inflation Reduction Act (IRA), which created favorable tax credit changes and investment opportunities across the clean energy industry.

Below is an example of an INGAA members' effort to deploy CCUS.

### Member highlights

In January 2023, **Kinder Morgan** announced that it executed a detailed term sheet with the Red Cedar Gathering Company to provide transportation on **Kinder Morgan's** $CO_2$ pipelines and permanently sequester captured $CO_2$ at an existing Class II well in the Permian Basin. The project will capture $CO_2$ from two natural gas treating facilities in Southern Colorado (up to 400,000 metric tons per year of $CO_2$) and deliver the captured $CO_2$ to **Kinder Morgan's** Cortez pipeline. Red Cedar is a joint venture between the Southern Ute Indian Tribe Growth Fund and **Kinder Morgan**, with an ownership interest of 51% and 49%, respectively.

**Enbridge** was awarded the right to pursue development of $CO_2$ sequestration hub west of Edmonton, Alberta, in March 2022. **Enbridge** is developing the Open Access Wabamun Carbon Hub (the Hub) to support near-term carbon capture projects being advanced by project partners Capital Power Corporation and Lehigh Cement, a division of Lehigh Hanson Materials Limited. The Hub and associated carbon capture projects being advanced by Capital Power and Lehigh Cement represent an opportunity to avoid nearly 4 million tons of atmospheric $CO_2$ emissions with phased in-service dates starting as early as 2025. Once built, the Hub will be among the largest integrated CCS projects in the world and can be scaled to meet the needs of other nearby industrial emitters.

## Responsibly Sourced Gas

RSG, also known as differentiated or certified gas, is natural gas that has been independently verified to have undergone certain environmental best practices. Depending on the program, RSG verifiers evaluate several attributes of natural gas including methane emissions intensity, implementation of best practices to mitigate methane emissions, the community impact, and environmental impacts to water resources.

RSG 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.

## Additional Initiatives

INGAA members invest in additional initiatives, including solar power installations and carbon offset purchases, to reduce the climate footprint of the natural gas transmission & storage sector.

### Member highlights

In 2020, Southern Star installed an approximately 660 kW, AC solar field at its Headquarters in Kentucky. In 2022, total renewable energy production was 1.18 GWh, compared to its total energy consumption of 1.13 GWh—resulting in a net 0.05 GWh of renewable energy excess. As of the end of 2022, Southern Star is proud to announce its Headquarters is net-zero for carbon-based electric energy.

The image (above) shows Southern Star's solar field located at their HQ in Owensboro, Kentucky.

Enbridge in 2022 invested $6.6 million in Smartpipe Technologies Inc., a company based on Houston, Texas, that has developed a high-strength composite liner that can be pulled through existing pipelines. Smartpipe's retrofit provides the ability to facilitate transportation of hydrogen and $CO_2$, enabling the use of existing infrastructure in the energy transition. The SmartPipe internal replacement sleeve could also result in less environmental disruptions for communities or environmentally sensitive areas, and could create less emissions from construction – with a 70% reduction in emissions compared to traditional construction methods.

Enbridge workers produce the company's innovative liner product at a Smartpipe mobile factory.

# ABOUT INGAA

INGAA member companies transport more than 95% 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 more than 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 Energy
EASTERN SHORE NATURAL GAS
ENBRIDGE Life Takes Energy
equitrans Midstream
Iroquois GAS TRANSMISSION SYSTEM IROQUOIS PIPELINE OPERATING COMPANY, OPERATOR
KINDER MORGAN INC.
MILLENNIUM PIPELINE COMPANY, L.L.C.
MountainWest
National Fuel
nationalgrid
NEXTera ENERGY
ONEOK
PG&E
SEMPRA LNG
Southern Company Gas
SOUTHERN STAR CENTRAL GAS PIPELINE
spire
TC Energy
TELLURIAN
Williams
UGI Energy Services
WBI ENERGY An MDU Resources Group company

# APPENDIX

## Boundaries

Both the intensity and scorecard include assets from the following segments, as defined by EPA's Greenhouse Gas 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)];
- Liquefied natural gas (LNG) storage [40 C.F.R. § 98.230(a)(6)]; and
- Onshore natural gas transmission pipeline [40 C.F.R. § 98.230(a)(10)].

Further, data is only included for the following assets from INGAA members:

- Interstate assets; and
- Intrastate assets with 2018 INGAA commitments applied voluntarily.

## Intensity

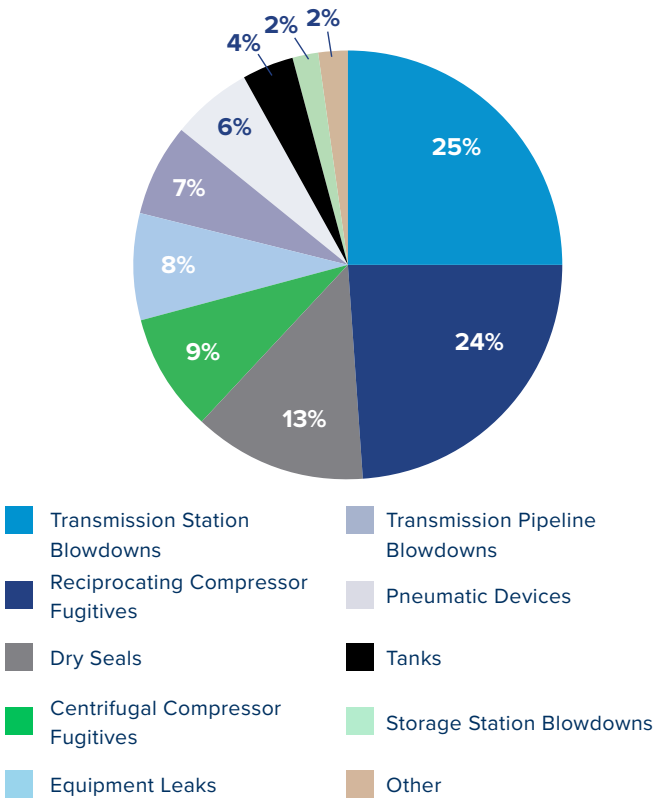
### PROTOCOL - EMISSIONS

Emissions sources were identified in accordance with those laid out in version 1.0 of NGSI and include the following:

- GHG Reporting Protocol (GHGRP) Sources
  - Blowdowns, Transmission Pipeline (Between Compressor Stations)
  - Blowdown Vent Stacks
  - Combustion Units
  - Compressors, Centrifugal
  - Compressors, Reciprocating
  - Equipment Leaks
  - Flare Stacks
  - Pneumatic Device (Controller) Vents, Natural gas
  - Storage Tank Vents, Transmission Compression
- GHG Inventory (GHGI) Sources
  - Compressors, Centrifugal with Dry Seals
  - Dehydrator Vents, Transmission
  - Dehydrator Vents, Storage
  - Equipment Leaks, Transmission Pipeline
  - Station Venting, Natural Gas Storage and LNG Storage

The largest sources of methane emissions are summarized in the figure below. Please note that some INGAA members provided EPA's Greenhouse Gas Reporting Program (GHGRP) source emissions in an aggregated format. For the purposes of estimating the percentages below, aggregated GHGRP Source emissions were assumed to be distributed similarly to those emissions provided by emission source category by other INGAA members.

INGAA MEMBERS' METHANE EMISSIONS SOURCES



The proposed (July 6, 2023) updates to the GHGRP will add reporting requirements for new sources of emissions, revamp existing sources that already report, and standardize reporting with other EPA regulatory programs. For example, the "other large release events" category in the GHGRP updates create parity with the proposed "Super Emitter Response Program" from the EPA's December 2022 NSPS supplemental proposal. INGAA is aware that some proposed changes to the GHGRP include emissions from methane slip, as well as emissions from smaller, auxiliary facilities along a transmission pipeline (e.g., farm taps, interconnects). Likewise, the NGSI Protocol may be updated to include additional GHGI Sources or revised methodologies for existing sources. Since the NGSI Protocol captures GHGRP sources, any changes to the GHGRP would be included in future versions of the NGSI Protocol. For 2021, INGAA selected the NGSI Protocol and intends to follow the NGSI Protocol going forward.

## Protocol – Throughput

To determine a throughput for the intensity calculation, INGAA considered different methodologies, asset sets, and data sources:

- Methodology Considerations:
  - Use of reported throughput for a member company; or
  - Use of normalized throughput using national throughput data and member metric.
- Asset Set Considerations:
  - Interstate assets only; or
  - Committed Assets: Interstate assets plus intrastate assets with 2018 INGAA commitments applied voluntarily.
- Data Source Considerations:
  - PHMSA throughput and mileage from Form F 7100.2-1; or
  - EIA throughput from Form EIA-176.

A list of five different options is shown below. Each option was considered for the two different boundaries noted above (interstate only; interstate plus intrastate with voluntary commitments).

- Option 1A: Reported Throughput (EIA);
- Option 1B: Reported Throughput, PHMSA (NGSI)[11];
- Option 2: Normalized Throughput, PHMSA Mileage (OF)[12];
- Option 3A: Normalized Throughput, EIA Throughput; and
- Option 3B:[13]Normalized Throughput, PHMSA Throughput.

Detailed equations for each throughput option considered by INGAA are outlined below:

- Option 1A: EIA Throughput from Form EIA-176, including:
  - Other receipts of natural gas within the report state (Mcf) (Line 5.0)
  - Supplemental gaseous fuels supplies (Mcf) (Line 6.0)
  - Net Storage Withdrawals (underground and LNG, Mcf) (Line 2.1 + Line 2.2 – Line 13.1 – 13.2)

[11] Consistent with NGSI Protocol.
[12] Consistent with ONE Future (OF) Protocol.
[13] Option 3B was excluded from consideration due to data quality concerns in the national data set for PHMSA throughput that would have been used for the normalization process.

**Option 1A EIA Throughput = EIA (Line 2.1+Line 2.2+Line 5+Line 6-Line 13.1-Line 13.2)**

$$\text{Option 1A Intensity} = \frac{\text{Methane Emissions}}{\text{EIA Throughput} \cdot \text{Methane Content} \cdot \text{Methane Density}}$$

- **OPTION 1B**: Throughput from Form F 7100.2-1 Part C (Volume Transported in Transmission Pipelines (Only) in MMscf).

**Option 1B PHMSA Throughput = Natural Gas Transported in Transmission Pipelines**

$$\text{Option 1B Intensity} = \frac{\text{Methane Emissions}}{\text{PHMSA Throughput} \cdot \text{Methane Content} \cdot \text{Methane Density}}$$

- **OPTION 2**: National Throughput defined by EIA dry gas production, net imports, and net storage withdrawals, and normalized based on PHMSA Mileage from Form F 7100.2-1 Part D (Total Miles, Transmission).

**National EIA Throughout = Dry Gas Production+Net Imports + Net Storage Withdrawals**

$$\text{Option 2 Normalized Throughout} = \frac{\text{National EIA Throughput*Company PHMSA Mile}}{\text{National PHMSA Miles}}$$

$$\text{Option 2 Intensity} = \frac{\text{Methane Emissions}}{\text{Normalized Throughput} \cdot \text{Methane Content} \cdot \text{Methane Density}}$$

- **OPTION 3A**: National Throughput defined by EIA dry gas production, net imports, and net storage withdrawal, and normalized based on EIA Throughput from Form EIA-176, including:
  - Other receipts of natural gas within the report state (Mcf) (Line 5.0)
  - Supplemental gaseous fuels supplies (Mcf) (Line 6.0)
  - Net Storage Withdrawals (underground and LNG, Mcf) (Line 2.1 + Line 2.2 – Line 13.1 – 13.2)

$$\text{Option 3A Normalized Throughput} = \frac{\text{National EIA Throughput*Company Option 1A EIA Throughput}}{\text{Option 1A National EIA Throughput}}$$

$$\text{Option 3A Intensity} = \frac{\text{Methane Emissions}}{\text{Normalized Throughput} \cdot \text{Methane Content} \cdot \text{Methane Density}}$$

- **OPTION 3B**: National Throughput defined by EIA dry gas production, net imports, and net storage withdrawals, and normalized based on PHMSA Throughput from Form F 7100.2-1 Part C (Volume Transported in Transmission Pipelines (Only) in MMscf).

$$\text{Option 3B Normalized Throughput} = \frac{\text{National EIA Throughput*Company Option 1B Throughput}}{\text{Option 1B National PHMSA Throughput}}$$

$$\text{Option 3B Intensity} = \frac{\text{Methane Emissions}}{\text{Normalized Throughput} \cdot \text{Methane Content} \cdot \text{Methane Density}}$$

## Comparison of Results

INGAA determined Option 3A for Committed Assets is the best representation of aggregated member data.

| Throughput Option | Interstate | Committed Assets |
|---|---|---|
| Option 1A – Reported Throughput, EIA | 0.033% | 0.031% |
| Option 1B – Reported Throughput, PHMSA (NGSI) | 0.031% | 0.030% |
| Option 2 – Normalized Throughput, PHMSA Mileage (OF) | 0.097% | 0.101% |
| Option 3A – Normalized Throughput, EIA Throughput | 0.093% | 0.087% |

- INGAA chose Option 3A, Committed Assets, as the preferred throughput methodology for the following reasons:
- The Committed Asset data set is more inclusive and transparent than the Interstate data set.
- It normalizes throughput data to a national throughput. This means that the methodology does not count throughput more than once in a scenario in which gas is transported from one member company to another while traveling through different pipeline systems. Options 1A and 1B do not normalize throughput data.
- Option 3A normalizes throughput data using actual throughput data rather than using mileage (Option 2); this is more representative as pipelines have different diameters, operate at different pressures, and are in locations with varying temperatures.

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

- **Natural Gas Sustainability Initiative (NGSI):** NGSI Follows Option 1B as described above. However, NGSI is an open protocol; there is no national data available through NGSI for comparison.
- **Inflation Reduction Act (IRA):** Congress mandated that EPA utilize a methane intensity threshold to determine which facilities owe a fee to the government, but EPA has not yet specified 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 follows Option 2 as described above. ONE Future's 2022 Methane Emissions Intensity Report cites the following 2021 intensities:
  - Transmission & Storage: 0.089%
  - Other Segments:
    - Production: 0.152%
    - Gathering: 0.080%
    - Processing: 0.027%
    - Distribution: 0.113%

To compare INGAA's intensity to ONE Future's, it is important to clarify each program follows different methodologies for emissions and throughput. While both programs intend to calculate a methane intensity for their 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 membership outside of transmission & storage.

The NGSI Protocol differs from INGAA's in that it is designed to calculate intensity data for individual companies. The NGSI protocol, by comparison, is not appropriate to calculate an intensity for the collective transmission & storage industry because it would double count throughput as it passes from one company to another, while INGAA adjusted its approach to address this.

Finally, the U.S. transmission & storage intensity of 0.288% can be calculated using available national emissions data and the national throughput used to normalize INGAA member throughput in the INGAA intensity calculation.[14] While the emissions protocol used by INGAA (NGSI) and EPA (GHGI) may differ slightly, the significant difference (over three times lower) tells us that INGAA members operate their assets with a smaller methane footprint than the average transmission & storage company.

## Assumptions

There were three member companies that did not have EIA-176 data available, which is the throughput data source for the selected intensity methodology. In order to include those companies in the data set, INGAA used PHMSA throughput as a surrogate for EIA-176 throughput.

## GHG Scorecard

### COMMITMENTS

In 2018, INGAA members committed to reducing methane emissions through a variety of initiatives. These commitments were updated in 2021 to include reducing carbon dioxide emissions, implementing research and development, and sharing of greenhouse gas related information. The GHG Scorecard rates INGAA membership on the level of progress made in achieving these commitments. The specific commitments are detailed below and are available on INGAA's website.

METHANE COMMITMENT DETAILS

#### PIPELINES

- **Surveys (and Repairs)** - Conducting surveys on transmission pipelines at least once per calendar year to detect leaks and make environmentally beneficial repairs or take proactive measures to mitigate emissions associated with the leaks identified. INGAA members commit to using leak detection methods, technologies, or other agency-approved methods during these surveys, including handheld equipment, equipment mounted on mobile platforms, or other technologies as appropriate.
- **Blowdowns** - Maintaining safe and efficient operations while minimizing methane emissions from interstate natural gas pipelines during maintenance, repair or replacement (a practice commonly referred to as a "blowdown") by evaluating and implementing voluntary practices, such as reducing pipeline pressure or utilizing cross compression prior to conducting planned maintenance and other recommendations found in the U.S. Environmental Protection Agency's (EPA's) Natural Gas STAR Program.

#### PNEUMATIC CONTROLLERS

- Selecting air-driven, or no-bleed, low-bleed or intermittent pneumatic or electric controllers when installing new controllers, unless a different device is required for safe or reliable operations. For existing high-bleed pneumatic controllers, INGAA members will evaluate the feasibility of replacing them with air-driven, no bleed, low-bleed, intermittent pneumatic, or electric controllers. INGAA members shall repair or replace malfunctioning pneumatic controllers.

#### STATIONS (STORAGE & COMPRESSOR)

- Venting - Minimizing methane emissions from natural gas transmission & storage compressor stations, where practical, such as:
  - conducting capped PHMSA required emergency shutdown system tests; and
  - installing and utilizing vent gas recovery (VGR) systems.
- **Rod Packing Seals** - Minimizing methane emissions from rod packing seals on all reciprocating compressors at transmission & storage facilities. Member companies agree to replace rod packing on all transmission & storage reciprocating compressors by utilizing one of the following options: (1) a condition-based replacement approach; (2) replacing packing every 26,000 hours of operation; (3) replacing packing 36 months from the date of the most recent rod packing replacement; or (4) installation and utilization of rod packing vent gas recovery (VGR).
- **Leak Surveys (and Repairs)** - Conducting leak surveys at transmission & storage compressor stations. INGAA member companies shall evaluate leaks detected during such surveys and take corrective actions to reduce emissions by repairing or replacing leaking valves and fittings. INGAA member companies will perform leak surveys using optical gas imaging (OGI) cameras or other agency-approved methods at all transmission & storage compressor stations owned and operated by INGAA member companies before January 1, 2023. Subsequent leak surveys shall be conducted at least every two years or more frequently as otherwise required by law.

[14] Data utilized to calculate this intensity is from EPA (2023) Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2021 – Main Report (epa.gov).

### STORAGE (WELLS)

- **Emissions** - Minimizing methane emissions from natural gas storage wells.
- **Inspections** - Inspecting all natural gas storage wells owned and operated by INGAA members for leaks at least annually.

NON-METHANE COMMITMENT DETAILS

### $CO_2$ REDUCTIONS

- Reducing $CO_2$ emissions from natural gas transmission & storage compressor stations while maintaining safe operations and meeting contractual and reliability commitments through actions which may include:
  - purchasing energy or installing equipment with lower $CO_2$ emissions;
  - optimizing compressor operations to preferentially run equipment with lower $CO_2$ emissions;
  - using electric-driven compressors;
  - improving combustion efficiency; and
  - other technologies.

R&D AND INFORMATION SHARING[15]

Supporting the development of new technology and effective practices and sharing information:

- Several research and development programs are exploring the application for hydrogen blending in existing natural gas systems. Members that are participating in these programs are encouraged by early results which indicate the potential for transporting new lower-carbon fuels through natural gas systems. Additional research into safety and reliability considerations associated with hydrogen blending is ongoing.
- Members are also participating in pilot programs to further reduce combustion emissions from compressor stations and working with vendors and manufacturers to capture and minimize venting emissions.
- INGAA member companies will also continue to collaborate within the membership and with other organizations on research and development to identify effective practices to detect and reduce GHG emissions.
- Member companies are reporting their methane and $CO_2$ emissions transparently to EPA, as appropriate, and reporting emissions or emissions reductions through other voluntary emission reduction and sustainability programs.
- INGAA member companies are analyzing the data reported under EPA's Greenhouse Gas Mandatory Reporting Rule, state-level reporting programs, and corporate emissions inventories to improve their understanding of these emissions and identify additional opportunities for reductions.

[15] In INGAA's commitments, R&D and Information Sharing were listed together. For the purposes of the Scorecard, INGAA evaluated R&D and Information Sharing as separate categories.

## Boundary Notes

Scorecard data represents operations for Calendar Year 2021, as of the end of Calendar Year 2021, except for the following items which dated back to the commitment start year (2018):

- Stations (Storage & Compressor) - Leak Surveys (and Repairs): Assessed number of stations surveyed since 2018 (time of commitment), since commitment has a once initial survey requirement before January 1, 2023.
- Pneumatic Controllers: Assessed amount of existing high-bleed pneumatics replaced since 2018 (time of commitment).

Below is some further clarification used when scoring Members against the INGAA commitments:

- **Stations:** Includes compressor stations (see 40 CFR § 98.230 for definitions of Transmission, Storage, and LNG Storage Stations), but not Metering and Regulation stations.
- **Storage Wells:** Refer to Part 98 segment definitions for Underground Storage.
- **Pneumatic Devices**: Only those listed under Part 98 segment definitions for Transmission Stations and Storage Stations, not those at LNG Storage Stations or Transmission Pipeline; approach is consistent with Part 98 emission source applicability.

Additional boundary considerations are listed below:

- Scoring accounts for both regulatory and voluntary actions except the category “Pipelines – Blowdowns,” which only accounts for voluntary activities (as stated in the INGAA commitment).
- “Stations (Storage and Compression) - Venting” accounts for emissions from stations during planned maintenance (i.e., blowdowns) and when conducting the PHMSA required emergency shutdown system tests (i.e., ESD testing).
- In some cases, an entire category may not be applicable to a member (e.g., “Storage Wells – Inspections,” “Storage Wells – Emissions,” “Pneumatic Controllers,” “Stations - Rod Packing Seals”). Overall scoring (member level and/or INGAA level) was conducted such that non-applicable categories do not impact scoring. Further, if an individual question was deemed not applicable to a member, overall scoring was adjusted to ensure results were not impacted by non-applicable questions.


INGAA
Interstate Natural Gas Association of America