2024

ANNUAL REPORT

ON CALENDAR YEAR 2023 METHANE INTENSITIES

Working together to reduce methane emissions across the natural gas value chain

ONE OUR NATION'S ENERGY FUTURE

KINDER MORGAN


WILLIAMS


SOUTHERN COMPANY GAS


ATMOS ENERGY

Table of Contents

Letter from the Executive Director

ONE Future is pleased to publish its seventh Annual Methane Intensity Report, reflecting another year of progress, leadership and collaboration in reducing methane emissions across the natural gas value chain.

Our report shows a material decrease in emissions intensity year-over-year – a 21.3% decrease, indicating that our members' emissions are dropping even as they work to deliver more natural gas to consumers in America and abroad.

Since inception, ONE Future and its members have focused on continuous improvement and sharing of best practices. The work is not glamorous, and it often takes time to demonstrate results, but it has again proven that our approach is valid, based in science, and driven by a performance-based protocol.

Over the past few years, our members have:

- Accelerated deployment of detection and measurement methodologies;
- Increased the use of measurement-informed data;
- Identified and shared best practices in a dynamic environment; and
- Led the way in reinventing natural gas systems, such as the upgrading of pneumatic devices.

Yet, we are not done and our commitment to continuous improvement is unwavering. We've crushed our 2025 targets routinely and now is the time to look to the future and answer how our collective leadership can best serve the goals of energy and climate security.

This year we engaged ICF International to update ONE Future's landmark 2016 Marginal Abatement Cost Curve analysis. Our work last year to inventory the technologies and practices employed by our members demonstrated a 700% increase since 2016. We are digging into the data to understand where opportunities remain to drive cost-effective emissions reductions. And in 2025, we will set our next targets for emissions intensity across six segments – including the addition of LNG – and the value chain, based upon science and a steadfast commitment to continuous improvement.

Our path ahead also includes leading and collaborating with other organizations.

Since ONE Future's founding, we've partnered with organizations and agencies ranging from the EPA to GTI Energy to make progress on our shared goals. We worked with the EPA to develop the ONE Future protocol when our coalition was originally formed. Since then, we have collaborated with GTI Energy to create a methodology to validate methane intensity on an individual company basis and we're currently working with the DOE, State Department, EPA and global partners in Asia and Europe to advance a global framework for monitoring, measurement, reconciliation and validation (MMRV).

At our annual meeting back in the Spring, we heard from several of these partners, along with our own members, who are leading the industry on a bright path forward. Just this past Fall, I was reminded of the strength of partnership yet again at the Energy Emissions Modeling and Data Lab's annual event, where scientific inquiry and collaboration were key as we envisioned the path forward for natural gas.

In this pivotal year ahead, I look forward to continued partnership and collaboration as we work toward our shared energy future.

Sincerely,

Jim Kibler

Overview

ATMOS ENERGY

Our Nation's Energy Future (ONE Future) is a coalition of approximately 50 natural gas companies taking action to reduce methane (CH_4) emissions across the natural gas value chain. This industry-leading coalition spans five segments of the value chain: oil and natural gas production, natural gas gathering and boosting, natural gas processing, natural gas transmission and storage, and natural gas distribution.

ONE Future is the only platform that has both developed a segment target and a way to aggregate those emissions through the value chain to yield a comprehensive emissions intensity, designed to represent the emissions intensity of the entire industry if every operator were to apply ONE Future's methodologies. The coalition's protocol also allows members to benchmark themselves against their peers, fostering a culture of continuous improvement and accountability.

Through shared best practices and groundbreaking technologies, the coalition's member companies are driving down emissions and advancing the innovation and cutting-edge technologies needed to progress a net zero future, all while delivering the affordable, reliable, and secure energy the U.S. and the world needs.

Mission

> ONE Future's mission is to ensure that natural gas is a long-term sustainable fuel in a net zero future by reducing member companies' ratio of methane emissions to natural gas produced (methane intensity) to 1.0% or less by 2025.

We're reaching that goal by demonstrating that the natural gas industry can minimize methane emissions while increasing production to meet increasing demand for affordable, reliable, and cleaner energy. This progress is critical for ensuring natural gas can play an important, foundational role in the energy transition for decades to come.

That's why the coalition is focused on supporting the nation's energy needs and climate goals by accelerating action to reduce emissions through sharing best practices and advancing new technologies. This includes identifying policy and technical solutions that support continuous improvement in the management of methane emissions associated with the production, processing, transmission, and distribution of natural gas.

ONE Future's approach is science-based and goal oriented, but flexible in that member companies can choose how they cost-effectively and efficiently achieve their methane intensity goal for their assets – whether that is by deploying an innovative technology, modifying a work practice, implementing best practices, or in some cases replacing or retrofitting methane emitting pipe or equipment. What is important is that each company demonstrates progress toward the target, which in turn allows the members, as a collective, to achieve ONE Future's overall emissions intensity target of 1.0% or less by 2025.

More information on the history behind the 1% target can be found on page 15.

SOUTHERN COMPANY GAS

Impact

ANNUAL MEETING

At the 7th Annual Methane & Climate Strategies Workshop, we heard from leaders from the U.S. Environmental Protection Agency (EPA), U.S. Department of Energy (DOE), Williams, American Gas Association, Virginia Natural Gas, Cheniere Energy, Japan Oil, Gas and Metals National Corporation (JOGMEC), and more. Discussions focused on natural gas resilience, technological advancements, data transparency, as well as current and future collaboration across the natural gas value chain. Each year at the annual meeting, the ONE Future Annual Awards are presented, recognizing individuals and organizations who step up to meet the challenges the natural gas industry faces with a focus on positive environmental impact.

ONE FUTURE REPRESENTS OVER 39% OF THE U.S. NATURAL GAS VALUE CHAIN.

LOOKING AHEAD

In 2025, ONE Future will update its industry-leading marginal abatement cost study. Through completion of this study, ONE Future aims to further understand the opportunity for its members (and other operators) to add materially to cost-effective methane emissions reductions through innovative technologies, considering its work to date in achieving a value chain methane emissions intensity well below its 1.0% target for seven consecutive years.

Duke Energy/Piedmont Natural Gas technicians study methane leaks identified by their satellite methane monitoring technology. Satellite technology is one of the many innovative tools our members are deploying to reduce emissions across the value chain.

Member Companies

Calendar Year 2023 Report Highlights

ONE Future member companies achieved

A COLLECTIVE METHANE INTENSITY OF 0.331%.

5 SEGMENTS OF THE VALUE CHAIN

were represented in methane emissions reporting.

49 COMPANIES provided methane emissions reporting.

ONE Future members deploy

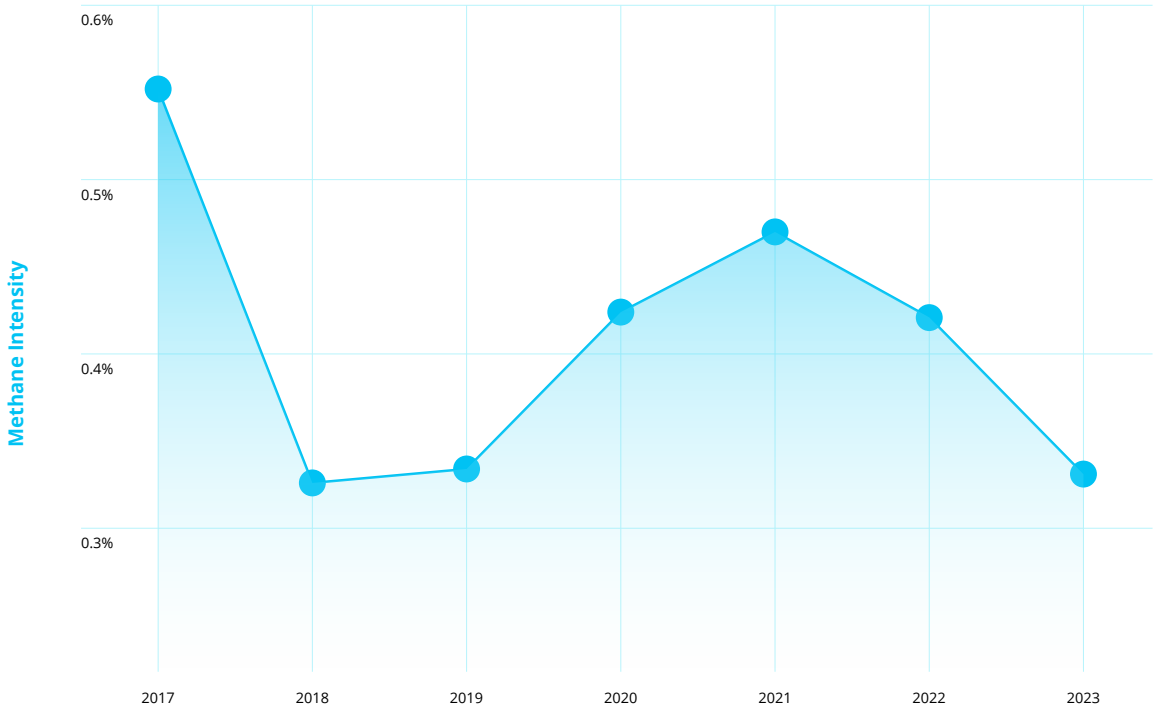
83 UNIQUE METHANE ABATEMENT ACTIVITIES ACROSS SEGMENTS.

ONE FUTURE SURPASSES GOAL FOR THE SEVENTH YEAR IN A ROW.

Reported methane intensity:
2025 Goal: 1% **2023 Report: 0.331%**

Overall methane intensity

DECREASED BY 21.3% YEAR OVER YEAR.



Executive Summary


WILLIAMS

2023 METHANE INTENSITY RESULTS

This marks ONE Future's seventh year of reporting methane intensity, and based on 2023 methane emissions and throughput, ONE Future's methane intensity is 0.331%. The 2023 ONE Future methane intensity decreased year over-year compared to the 2022 methane intensity of 0.421%, largely due to members accelerating deployment of emerging detection and measurement technologies, sharing best practices, and increasing use of measurement-informed data in compiling emissions inventories. The results from 2017 through 2023 demonstrate that ONE Future continues to be significantly below the 2025 target of a 1.0% methane intensity, and that natural gas continues to be a vital and viable resource as we move towards a cleaner energy future while providing customers with a reliable and affordable energy source.

PROGRESS AT A GLANCE

Even as the coalition grows, the methane intensity from ONE Future members continues to remain well below the 1.0% goal set for 2025, reflecting the constant progress of the industry. Despite reaching our goal well ahead of schedule, we are continuously assessing and updating our targets to ensure ongoing progress. We strive for continuous improvement through shared best practices and innovative technologies, including a growing number of abatement technologies, to ensure that natural gas remains a long-term sustainable fuel source. These results further underscore that we do not have to choose between reducing emissions and providing access to the affordable natural gas Americans rely on every day. We can drive toward a low-carbon future through continued progress and technological advancements.

HISTORY

When the ONE Future coalition was formed in 2014, most ONE Future member companies had already been investing and implementing methane emissions reduction technologies and work-practices for several decades. Today, the coalition is comprised of nearly 50 of the largest natural gas production, gathering & boosting, processing, transmission & storage and distribution companies in the U.S. and represents more than 39% of the U.S. natural gas value chain.

Driving Down Emissions

THE ONE FUTURE PROTOCOL

The coalition developed the ONE Future Protocol[1] over 10 years ago to enable companies across different segments of the natural gas value chain to calculate, report, and track methane intensity goal progress and to benchmark their performance against peer member companies consistently, transparently, and verifiably. This protocol defines methane intensity calculation techniques and how annual results will be compared to the coalition's collective goals.

The ONE Future Protocol describes how we track company methane emissions reduction progress by calculating emission intensities at the national, segment, and member levels. ONE Future uses national gas production rates that are published annually by the U.S. Department of Energy's Energy Information Administration (DOE EIA). Additionally, the protocol follows a combination of the EPA's Greenhouse Gas Reporting Program (GHGRP)[2], EPA's annual Greenhouse Gas Inventory (GHGI), and other representative methodologies as outlined in the protocol document.

Segment-specific methane intensity targets are identified in the ONE Future Protocol to allow member companies to benchmark progress and facilitate comparisons toward methane intensity goals within each segment. These segment methane intensity targets have been scaled to the national level to track progress toward ONE Future's overall methane intensity goal.

The ONE Future Protocol serves as a model for the world to follow as it is easily adaptable to the measurement, monitoring, reporting, and verification (MMRV) of greenhouse gas (GHG) emissions global environment. ONE Future reviews its target periodically as the coalition gains a better understanding of the methane intensity data collected each year and the areas that need continued improvement.

WILLIAMS

CROSS COMPRESSION TECHNOLOGY UTILIZED BY NEW JERSEY NATURAL GAS COMPANY

HOW WE ARE GETTING THERE

To reach our emissions reduction goals, ONE Future is committed to continuous improvement through shared best practices and groundbreaking technologies. Through 83 unique methane abatement activities across segments, our member companies are leading the way in driving down emissions across the natural gas value chain. Since 2016, ONE Future's catalogue of abatement strategies and technologies has skyrocketed from 11 to 83 – a sevenfold increase. Select abatement activities implemented by some of the members are highlighted below, with a full list available in the Appendix.

Conducting wellpad pressure testing with onsite Optical Gas Imaging teams to find emissions sources prior to the start of production.

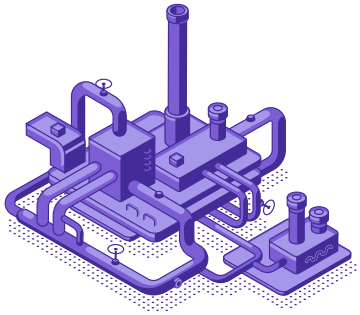
Replacing existing gas-driven pneumatic controllers/actuators with other devices (such as nitrogen- or electric-driven devices) at gathering compressor stations, gas processing plants, transmission & storage facilities, and distribution systems.

Utilizing cross compression technology for transmission/large pipes (major projects); piloting for distribution pipe.

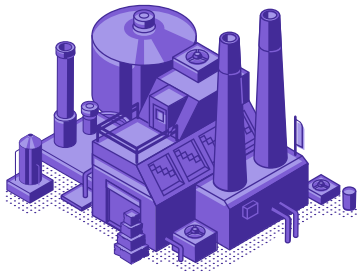
Deploying advanced mobile leak detection units around distribution systems to identify leaks for repair.

Overview of Segments

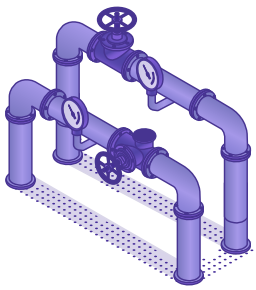
Production



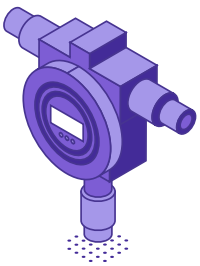
Gathering & Boosting



Processing



Transmission & Storage



Distribution

In 2023, 49 member companies reported their emissions. There were decreases in methane intensities for four segments (Production, Gathering & Boosting, Processing, and Transmission & Storage) and only a slight increase in methane intensity for one segment (Distribution), resulting in an overall decrease in the ONE Future value chain methane intensity. The chart below summarizes this data by segment.

Segment	2022 Methane Intensity	2023 Methane Intensity	Percent Change in Methane Intensity	2025 Methane Intensity Goal	Beating Goal By:
Production	0.133%	0.067%	-49.4%	0.283%	76.3%
Gathering & Boosting	0.077%	0.066%	-14.1%	0.080%	17.5%
Processing	0.028%	0.021%	-26.1%	0.111%	81.1%
Transmission & Storage	0.088%	0.081%	-8.4%	0.301%	73.1%
Distribution	0.095%	0.097%	1.7%	0.225%	56.9%
ONE Future Value Chain	0.421%	0.331%	-21.3%	1.000%	66.9%

METHODOLOGY UPDATES FOR THIS YEAR

All Segments: For the combustion exhaust methane emissions, ONE Future members were given several options to report data for engines/turbines that underwent stack testing in their respective fleet. Members were able to provide both company-averaged combustion exhaust methane emission rates from stack tests and/or discrete stack test emission rates for individual units within their fleets. For member companies that tested only a portion of their engines/turbines, ONE Future used the methane stack test data to calculate methane emissions from engines/turbines that were tested at least once in 2023. For those engines/turbines not tested by the member company in 2023, fuel usage and AP-42[3] emission factors were used to calculate the emissions for the non-tested engines/turbines. This approach prioritizes the use of measurement-based estimation techniques for improved accuracy.

Production

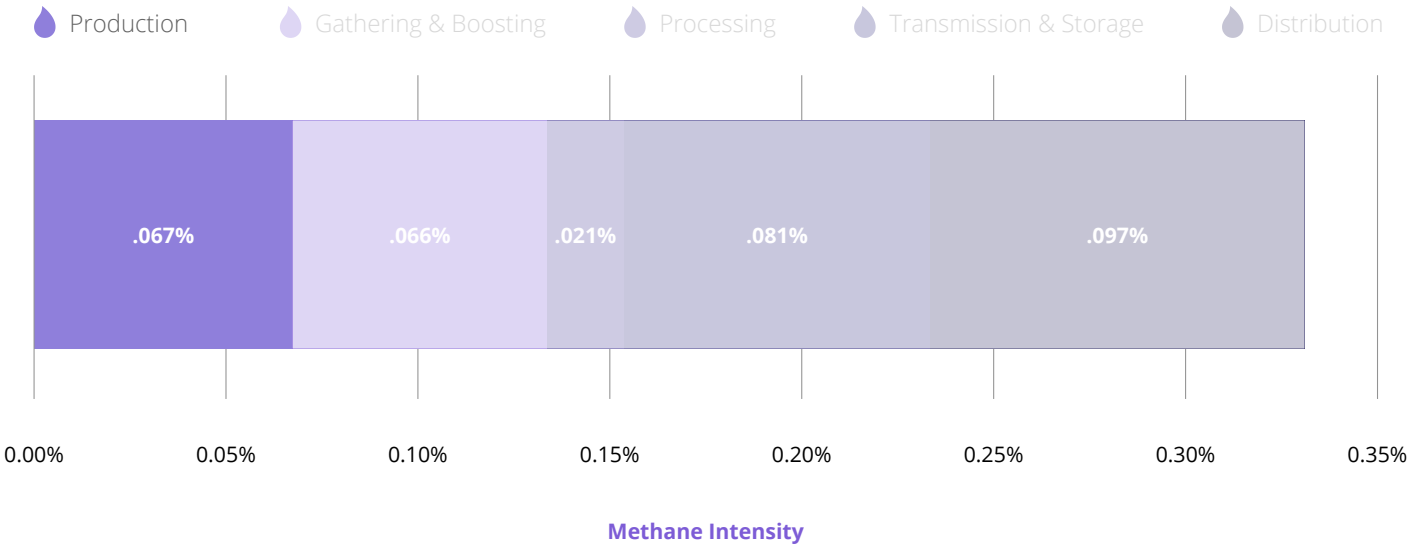
OVERVIEW

The production segment consists of the exploration of natural gas, wells producing natural gas, and production equipment located at the well site. Because wells often co-produce natural gas and crude/ condensate, the ONE Future Protocol provides an approach that allocates the total methane emissions associated with only natural gas.

ONE Future members represent 23% of the natural gas produced in the U.S. in 2023.

2023 SEGMENT RESULTS:

METHANE INTENSITY OF 0.067% VS. GOAL OF 0.283% BEATING GOAL BY 76.3%



Gathering and Boosting

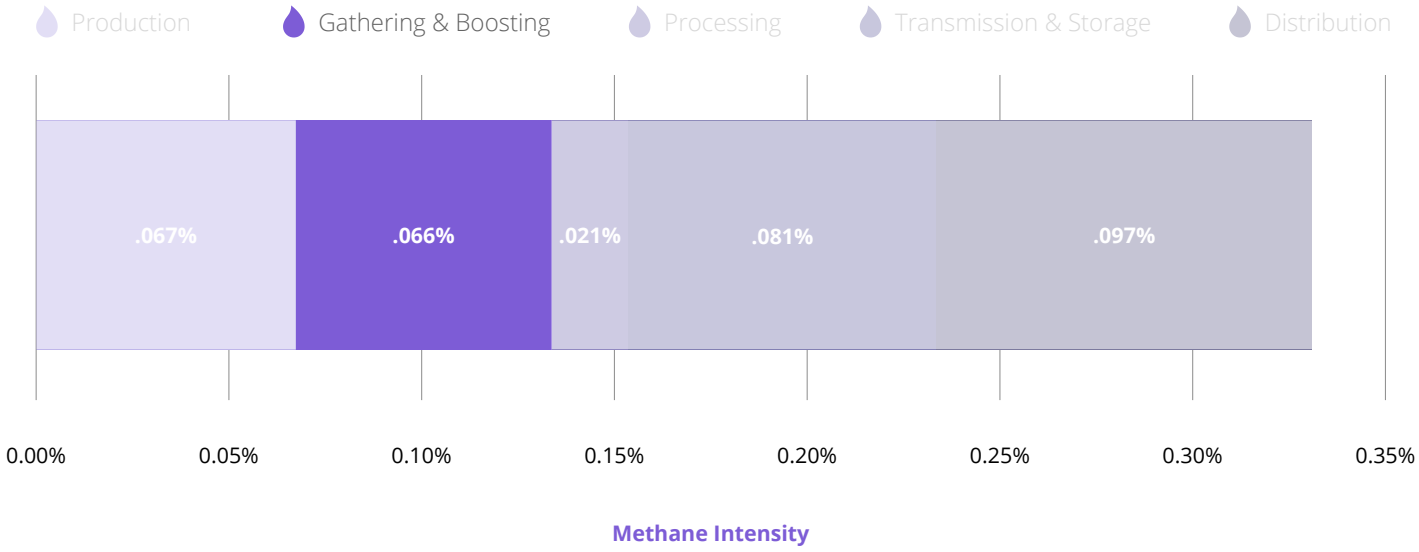
OVERVIEW

The gathering and boosting (G&B) segment includes pipelines and other equipment used to gather natural gas from production facilities, treat the gas as needed through dehydration or acid gas removal, and compress the gas to transport it to a natural gas processing facility, a natural gas transmission pipeline, or to a natural gas distribution pipeline. Methane emissions from combustion, equipment leaks, and natural gas-operated pneumatic controllers are the three largest emissions sources that gathering and boosting companies are working to further reduce.

ONE Future members represent 40% of the natural gas gathered in the U.S. in 2023.

2023 Segment Results:

METHANE INTENSITY OF 0.066% VS. GOAL OF 0.080% BEATING GOAL BY 17.5%



Processing

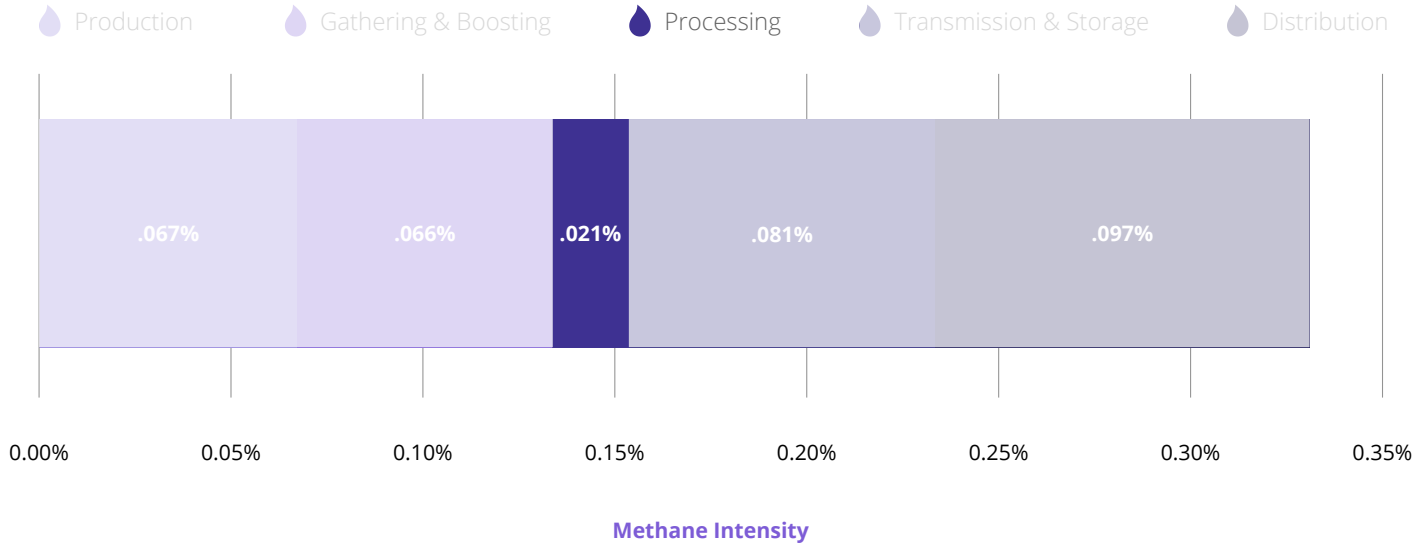
OVERVIEW

The processing segment consists of gas processing plants where hydrocarbons and fluids in produced natural gas are separated to produce natural gas that meets pipeline specifications. Equipment associated with the gas processing segment includes the equipment inside a gas processing plant, such as absorption units or cryogenic expanders, fractionators, dehydrators, acid gas removal units, and compressors. Engine exhaust from uncombusted natural gas is the largest source of methane emissions that the processing segment is tackling.

ONE Future members represent 26% of the natural gas processed in the U.S. in 2023.

2023 SEGMENT RESULTS:

METHANE INTENSITY OF 0.021% VS. GOAL OF 0.111% BEATING GOAL BY 81.1%



KINDER MORGAN

Transmission and Storage

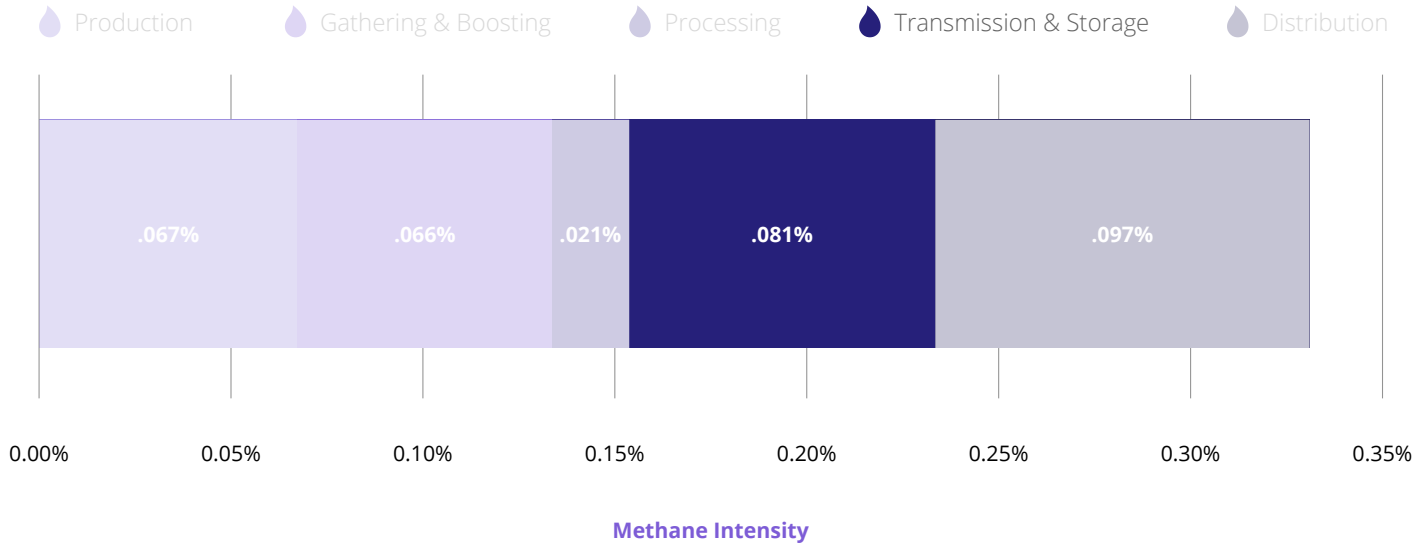
OVERVIEW

The transmission and storage (T&S) segment includes high-pressure, large-diameter pipelines that transport natural gas from G&B and processing to natural gas distribution systems or large-volume consumers such as power plants. EPA combines T&S into one segment since transmission companies own and operate many of the storage facilities. Natural gas compression is a significant operation for the T&S segment – therefore emissions from compressors, components designed to vent gas, and compressor exhaust play a more prominent role in methane emissions.

ONE Future members represent 62% of total transmission pipeline miles in the U.S. in 2023.

2023 SEGMENT RESULTS:

METHANE INTENSITY OF 0.081% VS. GOAL OF 0.301% BEATING GOAL BY 73.1%



Distribution

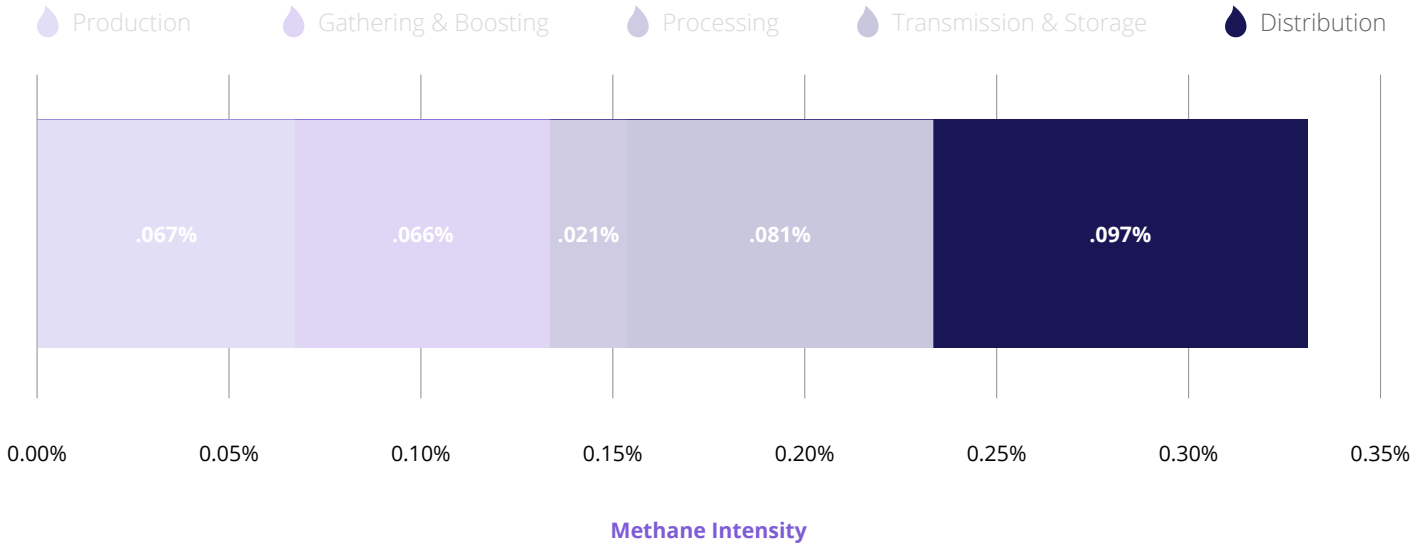
OVERVIEW

The distribution segment covers natural gas pipelines that take high-pressure gas from transmission systems and gathering systems, reduce the pressure, and distribute the gas through primarily underground service lines to users. This segment includes natural gas mains and services, metering and pressure regulating stations, customer meters, as well as associated underground storage and LNG storage assets.

ONE Future members represent 41% of gas delivered to end users in the U.S. in 2023.
ONE Future members represent 42% of miles of mains in the U.S. in 2023.

2023 SEGMENT RESULTS:

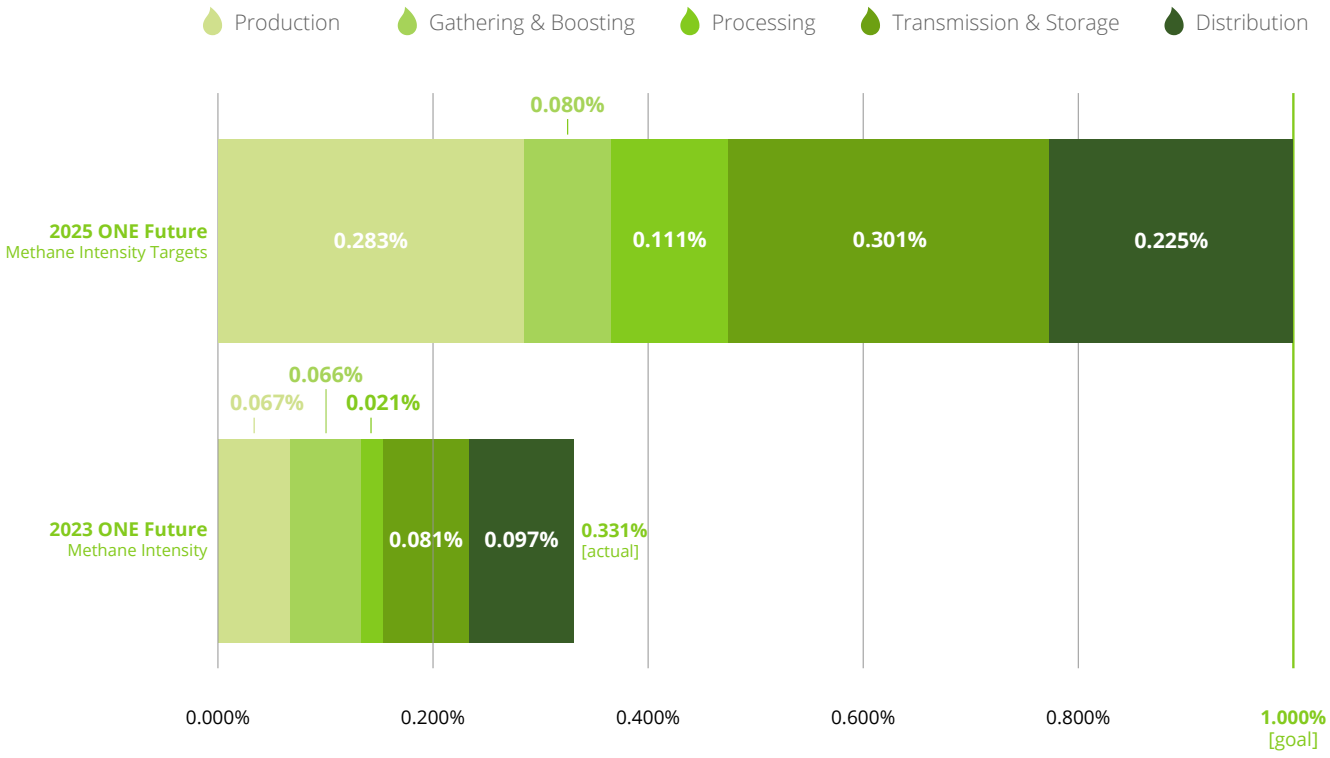
METHANE INTENSITY OF 0.097% VS. GOAL OF 0.225% BEATING GOAL BY 56.9%



Conclusion

ONE Future has surpassed its 2025 target of 1.0% methane intensity for the seventh year in a row, ahead of schedule. In 2023, our members achieved a collective methane intensity of 0.331%, a 21.3% decrease from the prior year, while the number of ONE Future members that reported decreased by 9.3%.

The coalition's goal is not only to continue to drive down methane emissions, but to measure emissions more precisely than ever before by investing in advanced detection, monitoring, and measurement technologies and practices to continue contributing to global emissions reductions goals. We encourage other natural gas companies to join us in our mission to continue reducing the methane intensity of the natural gas value chain.



The above graph illustrates ONE Future's 2023 cumulative methane intensity of 0.331% by segment versus ONE Future's 2025 cumulative target of 1.0%.

Year-to-year segment changes and comparisons for 2023 are described below.

PRODUCTION

The production segment's year-over-year change in emissions is due largely to a decrease in pneumatic device and pump emissions and a decrease in equipment leaks. There was an overall net decrease of one member company reporting in the production segment. Additionally, five of the 18 companies reporting in the production segment provided measured engine stack test data, which had an influence on this segment's intensity. Production from member companies increased by 4.40% from CY2022 to CY2023.

GATHERING & BOOSTING

The gathering & boosting segment's year-over-year change in emissions is due largely to a decrease in combustion emissions and equipment leaks. There was an overall net decrease of five member companies reporting in the gathering & boosting segment. Additionally, nine of the 18 companies reporting in the gathering & boosting segment provided measured engine stack test data, which had an influence on this segment's intensity. Gas gathered by member companies decreased by 12.95% from CY2022 to CY2023.

PROCESSING

The processing segment's year-over-year change in emissions is due largely to decreases in combustion and flaring emissions. There was an overall net decrease of four member companies reporting in the processing segment. One of the eight companies reporting in the processing segment provided measured engine stack test data. Gas processed by member companies decreased by 14.55% from CY2022 to CY2023.

TRANSMISSION & STORAGE

The transmission & storage segment's year-over-year change in emissions is due largely to decreases in equipment leaks and a decrease in tank emissions. There was an overall net increase of two member companies reporting in the transmission & storage segment. Additionally, 10 of the 27 companies reporting in the transmission & storage segment provided measured engine stack test data, which had an influence on this segment's intensity. Gas transported (based on transmission pipeline miles) by member companies increased by 1.12% from CY2022 to CY2023.

DISTRIBUTION

The distribution segment's year-over-year change in emissions is due to an increase in meters, while emissions from distribution services and mains decreased. There was no change in number of member companies reporting in the distribution segment. One of the 18 companies reporting in the distribution segment provided measured engine stack test data. Gas delivered to customers from member companies decreased by 8.47% from CY2022 to CY2023.

> While ONE Future's 2023 data demonstrates strong progress, the coalition is focused on the future and is committed to continuous improvement through further collaboration across the industry, engagement with policymakers, and investment in innovative technologies that allow our members to add materially to cost-effective methane emissions reductions.

Endnotes and References

1. ONE Future Methane Intensity Protocol 2023 is accessible via the following link: onefuture.us/resources/protocols/. ONE Future reserves the right to update the contents of the ONE Future Protocol at any time to maintain alignment with EPA definitions and methodologies and reflect EPA's most current GHG emissions data.
2. EPA's Greenhouse Gas Reporting Program (GHGRP): epa.gov/ghgreporting
3. EPA's AP-42 Emission Factor database for Reciprocating Engines can be found here: AP-42, Vol. I, 3:2 Natural Gas-fired Reciprocating Engines (epa.gov) and EPA's AP-42 Emission Factor database for Stationary Gas Turbines can be found here: AP-42, Vol. I, 3.1: Stationary Gas Turbines (epa.gov)

Appendix

Methane Abatement Activities from ONE Future Member Companies

PRODUCTION

- Company requirement to have adequate takeaway capacity at wellpads to prevent venting or flaring of associated (or stranded) gas. All natural gas produced is sent directly to pipeline.
- Implementation of various Optical Gas Imaging (OGI) leak survey and leak detection and repair (LDAR) programs: Quarterly, biannual, or annual leak surveys across assets. The companies implementing LDAR programs are performing them either under a voluntary or regulatory program or a combination of both programs.
- Quarterly aerial leak surveys and repairs across all unconventional wellpads and annual across all conventional wells. Desktop review of work orders and site data followed by field investigation of each emission event >10 kg/hr (intermittent and persistent).
- Implementing large pilot of continuous monitoring system with multiple technologies for detection.
- Wellpad pressure testing is conducted with an onsite Optical Gas Imaging team member to find emission sources prior to the start of production.
- Wellpads are investigated daily or weekly for leaks using Audio, Visual and Olfactory (AVO) checks.
- New wells are monitored with a density meter. If the density meter notes gas going to the tank the well is shut-in to perform a field investigation and possible maintenance of the dump valves associated with those tanks.
- Install ultrasonic listening devices and Lower Explosive Limit (LEL) detectors within gas units. They are programmed to shut in the well pad if gas is detected.
- Equip all well tenders with CH4 detection monitors that are checked weekly to ensure there are no leaks.
- Best management and operational practices integrated across construction and production sites with the goal of minimizing venting and flaring.
- Best management and operational practices that limit number of compressor and vessel blowdowns to atmosphere only when needed.
- Use of portable compression equipment to capture and recompress the gas blowdown from compressors and other vessels transferring the gas to a pipeline downstream of the isolated equipment or pipeline segment.
- Installation of instrument air to replace gas starters on compressor drivers.
- Automated plunger lifts are installed and monitored by a central control center to minimize liquids unloading emissions.
- Tubing is installed either during initial construction or within 3 years of acquisition to support the installation of plunger lifts and minimize liquids unloading emissions.
- Pneumatic controllers/actuators: replacing existing gas driven pneumatic controllers/actuators with electric, solar, nitrogen or instrument air devices and implemented plans to design all new wellpads without any gas driven pneumatic controllers/actuators.
- Installing solar power for chemical injection pumps.
- Using glycol energy exchange pneumatic pumps resulting in minimal levels of CH4 released.
- Implementation of reduced emission completions during well completions and hydraulic fracturing.
- State regulatory agency regulates/limits venting from well unloading (down to ~400 total unloads/month from ~1200/month in 2021) - mostly all on plunger lifts.

- Routing of vented gas from pneumatic controller/actuator to combustor/separator pilot fuel when it is not feasible to have a portable compressor to capture and recompress the small amount of gas vented from pneumatic controllers/actuators.
- Began utilizing emission control devices (ECDs) to lower completions emissions.
- Changed the facility design to perform bulk test separation vs. having separator units on every well.
- Installed compressors on wells to enhance gas lift and/or boosting to minimize emissions from liquids unloading.
- Glycol Dehydration units: all flash off-gas is captured and sent back to station inlet or controlled via VRU or combustion device (flare or enclosed combustor), all regen off-gas routed to BTEX condenser/sump and routed to combustion device for control.

GATHERING & BOOSTING

- Implementation of various Optical Gas Imaging (OGI) leak survey and leak detection and repair (LDAR) programs: Quarterly, biannual, or annual leak surveys across assets. The companies implementing LDAR programs are performing them either under a voluntary or regulatory program or a combination of both programs.
- Installation of instrument air to replace gas starters on compressor drivers.
- Pig launcher/receiver trap blowdowns: Some facilities utilize VRU/ECD/Flare to capture ~90% pig trap blowdown.
- Pig launcher/receiver trap blowdowns: Auto Launcher and larger barrel to receive multiple pigs before depressuring trap to atmosphere.
- Perform aerial leak surveys performed to identify methane slip due to combustion.
- Perform regular preventative maintenance and burner tip maintenance on combustion units and flares (tuning of the unit).
- Perform rod packing maintenance and replacement for all reciprocating compressor units regardless of whether they are subject to regulatory requirements.
- Implement best management and operational practices by minimizing the frequency of blowdowns to the extent possible thru scheduling and grouping of maintenance activities.
- Utilize vapor recovery units (VRUs), ECDs, or flares to combust or capture 90%+ of compressor or pipeline blowdowns.
- Gas control continuous monitoring of significant changes in gathering pipeline pressures to minimize chances of gathering pipeline unplanned events/mishaps outside of the control of the operator. If event were to occur, the company gas control personnel can take immediate actions to close valves and isolate the pipeline to minimize the gas vented until personnel can make the repair.
- Perform routine gathering pipeline walking leak surveys to minimize gathering pipeline unplanned events/mishaps outside of the control of the operator.
- Best management and operational practices to minimize pipeline segment length and gas volume needing to be blown down during gathering pipeline planned events.
- During gathering and transmission pipeline planned events, reduce the operating pressure on segment(s) of gathering and transmission pipelines as much as possible using portable compression and/or existing compression and route the gas downstream of the isolated segment being blown down.
- Glycol Dehydration units: all flash off-gas is captured and sent back to station inlet or controlled via VRU or combustion device (flare or enclosed combustor), all regen off-gas routed to BTEX condenser/sump and routed to combustion device for control.
- Utilize electric glycol pumps instead of energy exchange glycol pumps which do vent methane emissions.
- Perform periodic maintenance on flare burner and blower (air-assisted) to improve flare efficiency and minimize methane slip due to combustion.
- Pneumatic controllers/actuators: replacing existing gas driven pneumatic controllers/actuators with instrument air devices at

gathering compressor stations, gas processing plants, transmission & storage facilities, and distribution systems.
- Best management or operational practice by minimizing the operating frequency of gas driven pneumatic pumps.
- Facility engineering incorporates pressure cuts prior to routing liquids to tanks to minimize storage tank venting.
- Installation and maintenance of properly designed and weighted thief hatches on storage tanks to minimize frequency of venting from thief hatches.
- Performing annual methane slip stack testing of reciprocating engines and comparing to gas engine rating pro (GERP) curves to improve combustion efficiency and minimize methane slip.
- Increasing the length of pressurized holds on compressor drivers to reduce the frequency of compressor unit blowdowns.
- Implementation of emergency shutdown system procedures to more effectively isolate the station and close station block valves. This helps to manage and reduce the amount of gas blown down from the station if an emergency shutdown of the station occurs. During testing of the system, the blowdown valves/vents are capped to prevent blowdown to atmosphere.
- Installation of solar powered generator at a station instead of a natural gas-fired generator.

PROCESSING

- Implementation of various Optical Gas Imaging (OGI) leak survey and leak detection and repair (LDAR) programs: Quarterly, biannual, or annual leak surveys across assets. The companies implementing LDAR programs are performing them either under a voluntary or regulatory program or a combination of both programs.
- Perform aerial leak surveys performed to identify methane slip due to combustion.
- Perform regular preventative maintenance and burner tip maintenance on combustion units and flares (tuning of the unit).
- Utilize electric glycol pumps instead of energy exchange glycol pumps which do vent methane emissions.
- Pneumatic controllers/actuators: replacing existing gas driven pneumatic controllers/ actuators with instrument air devices at gathering compressor stations, gas processing plants, transmission & storage facilities, and distribution systems.
- Utilizing the acid gas removal (AGR) system to exclusively treat the ethane stream rather than the methane stream.
- Routing AGR system vents to emission control device such as combustor, flare or thermal oxidizer to reduce methane slip from combustion.
- Utilize nitrogen gas purge prior to evacuation of equipment/piping to reduce the gas volume blown down to atmosphere.
- During the repair of equipment leaks, nitrogen gas purges the locked-out equipment or piping before opening the vent to atmosphere.
- Replacement of natural gas-fired compressor drivers with electric motor driven compressor drivers.
- Replacement of wet seal centrifugal compressors with dry seal centrifugal compressors when feasible.
- Route reciprocating compressor unit blowdowns to ECD, VRU, or flare to capture or combust the blowdown gas volumes rather than venting to atmosphere.
- Perform rod packing replacement on reciprocating compressors equal to or more frequently than required by regulation.
- Install mole sieve dehydration units in lieu of glycol dehydration units and implement best management or operational practices to minimize mole sieve bed changeouts to reduce frequency of venting during those changeouts.
- Vapor recovery unit on flare header to recover vent gas from process with the flare only used as backup in the event the VRU goes down.
- Route AGR vented gas to underground injection well.

TRANSMISSION & STORAGE

- Implementation of various Optical Gas Imaging (OGI) leak survey and leak detection and repair (LDAR) programs: Quarterly, biannual, or annual leak surveys across assets. The companies implementing LDAR programs are performing them either under a voluntary or regulatory program or a combination of both programs.
- Installation of instrument air to replace gas starters on compressor drivers.
- Pneumatic controllers/actuators: replacing existing gas driven pneumatic controllers/ actuators with instrument air devices at gathering compressor stations, gas processing plants, transmission & storage facilities, and distribution systems.
- Increasing the length of pressurized holds on compressor drivers to reduce the frequency of compressor unit blowdowns.
- Perform rod packing replacement on reciprocating compressors equal to or more frequently than required by regulation.
- Utilizing hot taps/Stopple® fittings during pipeline maintenance not requiring pipeline blowdowns to atmosphere.
- Recovery of compressor unit blowdowns (Compressor Unit BDR).
- Replace Bi-directional Orifice Meters with Ultrasonic Meters.
- Directed Inspection and Maintenance (DI&M) – Atmospheric Pressure Gas Loss (AGL) Inspections and repairs of leaks.
- Use of YALE Enclosures for Emergency Shut Down (ESD) Testing to prevent full station blowdowns.
- Capture and recompression of dry seal vented gas and compressor process vented gas.
- Installation of cathodically protected pipe.
- Installation of "line break" valves to prevent a significant loss of gas to the atmosphere.
- Reduce excessive compressor purging.
- Install compressor rod packing case purging systems.
- Perform valve maintenance.
- Reduce "methane slip" through combustion efficiency improvements.
- Use of pipeline wrap or steel sleeves during pipeline maintenance to reduce or eliminate pipeline blowdowns to atmosphere.
- Emergency Shut Down (ESD) blowdown to flare.
- Compressor Vent line alarms.
- Replacement of reciprocating engines with newer more efficient reciprocating engines resulting in lower methane slip from combustion.
- Implementation of valve maintenance best management practice under Methane Challenge program that includes unit isolation and blowdown valve maintenance.
- Installation of rod packing vent capture systems.

DISTRIBUTION

- Implementation of various Optical Gas Imaging (OGI) leak survey and leak detection and repair (LDAR) programs: Quarterly, biannual, or annual leak surveys across assets. The companies implementing LDAR programs are performing them either under a voluntary or regulatory program or a combination of both programs.
- Pneumatic controllers/actuators: replacing existing gas driven pneumatic controllers/ actuators with instrument air devices at gathering compressor stations, gas processing plants, transmission & storage facilities, and distribution systems.
- Cross compression for transmission/large pipes (major projects); piloting for distribution pipe.
- Satellite methane leak detection pilot scaled to an entire state in 2023.
- Creation of PAR (Pinpoint, Access & Repair) tool to ingest satellite data and advance leak remediation.
- Gas cloud imaging technology regulator stations, compressor station & LNG plant (Pilot).
- Leak surveys once every 3 years instead of 5 years combined with goal for find it & fix it process (Q4 2023) - zero leak inventory.

- MSRP Replacement program for older metallic services under a 20-year program in one of the states with cost ~13 million a year.
- Advanced Mobile Leak Detection Units deployed around distribution system to identify leaks for repair.
- Capital based allocation largely based on leakage rate and type of pipe in the system.

STACK TEST DATA

Segment	Production	Gathering & Boosting	Processing	Transmission & Storage	Distribution
Number of Engines/ Turbines for which Stack Test Data were Provided	434	791	11	536	7
Number of Engines/ Turbines for which Fuel Usage Data were Provided (Engines/Turbines not stack tested)	269	201	0	1788	70
Segment CH4 Intensity using Stack Test Data (%)	0.067%	0.066%	0.021%	0.081%	0.097%
Segment CH4 Intensity using Fuel Usage and AP-42 EFs (%)	0.068%	0.068%	0.021%	0.081%	0.097%
Percent Difference (Change in Segment CH4 Intensity when using Stack Test Data as compared to using Fuel Use and AP-42)	-1.04%	-3.91%	0.28%	0.16%	0.00%

> From 2022 to 2023, there was a 35% increase in number of member companies providing stack test data, as well as a 35% increase in the number of engines/turbines tested.