Methane intensity and the climate impact of ethane exports

Key takeaways

Ethane for Ineos's Project One ethane cracker in Antwerp, Belgium will be sourced from U.S. shale gas, especially from the Appalachian Basin and Gulf Coast, transported as a cryogenic liquid.

In its climate risk report, Ineos reported expectations of superior greenhouse gas performance for its ethane cracker based on self-reported methane intensities from producers in the Appalachian Basin that are currently its main suppliers of exported ethane.

Methane emissions during production vary greatly from well to well, and at the same well vary greatly from time to time.

Studies using satellite and airborne measurements (e.g., MethaneSAT, Sherwin et al., 2024) consistently find methane emissions that are far higher than industry self-reported values. For example, measurement-based emissions in the Appalachian Basin were found to be 9.5 times higher than self-reported GHGRP emission estimates in 2023.

The MiQ certification process that acknowledges producers for low self-reported methane intensities lacks transparency because no information is shared with the public. For example, the methodologies used to calculate methane intensity for certified producers are not divulged, monitoring strategies and how their results inform methane intensities are not described, and certification grades are disclosed only if producers choose to share them.

In addition, there is no mechanism by which independent verification of methane intensity claims by certified facilities could be conducted.

There is a risk of rewarding certified facilities for shifting assets that have high methane intensities due to age or other factors to other producers, which might result in a higher certification classification but does not reduce overall methane emissions from production.

Certified producers who flare methane instead of venting it reduce their methane intensity without any penalty for the increased CO_2 emissions.

Ineos's reliance on producer-reported methane intensity misrepresents the full climate burden of exported ethane. After adjusting LNG supply chain inventories so that they mimic ethane supply chains, methane emissions during the production stage of exported ethane account for only about 20% of total supply chain emissions.

Contents

Introduction and background

Ineos Olefins Belgium's Project One is an ethylene plant under construction in the Port of Antwerp. It will crack ethane to produce ethylene, a basic building block of the plastics industry. In its climate change risk assessment report (Ineos, 2022), Ineos says that the ethane for Project One will be sourced from shale gas extracted from the American Northeast (the Appalachian Basin) and Gulf Coast regions.

The Appalachian Basin includes the Eastern Overthrust Area, the Marcellus Play, and the Utica-Point Pleasant Play and covers parts of Kentucky, Maryland, New York, Ohio, Pennsylvania, Virginia and West Virginia (USGS, 2019). Not all of the gas produced in the Appalachian Basin is sourced from shale formations. It includes coal seam methane and high permeability gas as well as shale and other tight reservoir rock. It also includes some associated gas that is produced at wells that are primarily producing oil.

The gas that is extracted by wells (produced gas) in oil- and gas-producing basins is a mixture of hydrocarbons, along with carbon dioxide, nitrogen, helium, hydrogen, oxygen, argon, and hydrogen sulfide. At 85,732 wells reported in 2023 in the Appalachian Basin, methane is present at higher concentrations than any other compound on a mole fraction basis, ranging from a low of 65.7% to 99.1%, with a well-count weighted average of 89.5% (US GHGRP, 2024). Ethane is present at the second highest concentration among the hydrocarbons present. The ethane mole fraction in 1,272 well samples in the Appalachian Basin ranged from 0% to 36.2%, with an average of 6.5% (8 samples were discarded for missing or insensible data) (Colón-Román and Ruppert, 2014).

Even though ethane, along with propane and butane, are gases at room temperature, they are referred to as "natural gas liquids (NGLs)." Ethane bound for the Project One cracker will be shipped to Antwerp as a liquid under cryogenic conditions. Cryogenic conditions will be maintained by letting some of the ethane "boil off." The ethane boil off will be used as fuel for propulsion and electricity generation (Ineos, 2022).

Methane intensity and producer/importer claims

In 2022, Ineos released an Environmental and Social Impact Assessment (ESIA): Climate Change Risk Assessment to the Financial Stability Board's (FSB's) Task Force on Climate-Related Financial Disclosures (TCFD) (Ineos, 2022). In this report, Ineos states that "Over the years, since the start of shale gas extraction the large producers have considerably improved their operations in terms of higher extraction efficiency, lower use of chemicals, fully circular water use and reduction of GHG emissions." No data or literature is cited to bolster this claim. Ineos mentions four of its current

suppliers (EQT, CNX, Antero, and Range Resources) as participants in voluntary programs to reduce methane emissions, and Ineos exhibits reliance on the low methane intensity performance reported by these suppliers in its reassurances about climate impacts. Ineos cites

- Range Resources as reducing its methane intensity by 4.5X between 2017 and 2021, going from an already low methane intensity of 0.09% in 2017 to a fabulously low methane intensity of 0.02% in 2021
- Antero as having a methane intensity of 0.044% in 2020, with a goal of 0.025% in 2025
- EQT as having a methane intensity of <0.04% in 2021, with a goal of 0.02% in 2025
- CNX as having a consolidated methane intensity of 0.04%

In this section, the gas production standard for one of the certification programs is described, and some of the ways in which certified methane intensities lack verification and transparency is discussed.

This report focuses on the methane intensity of gas produced in the Appalachian Basin, with extra attention paid to the four producers whose methane intensities are discussed in Ineos' Climate Risk Assessment (2022).

Challenges in estimating methane emissions for exported ethane

During production, methane emissions vary greatly from well to well, and at the same well vary greatly from time to time. Gathering and boosting lines are constantly evolving as new wells are added and retired wells are removed, and their emissions also vary from line to line and from time to time. Emissions during gas processing, transport, and liquefaction are less of a moving target but are hard to quantify because of all the pieces of equipment that are involved, what their technology is, and variations in maintenance practices.

Emissions during shipping have either embedded or direct methane emissions as well, depending on the fuel used. Even if ethane shipping is nearly entirely fueled by ethane boil-off and there is no methane slip, when methane emissions have been allocated to natural gas liquids, the ethane that is burned decreases the ethane delivered, which increases the methane allocated per unit of cargo delivered.

MiQ certification overview

In spite of the inherent complexities and uncertainties in estimating methane emissions along the supply chain for liquefied ethane that is exported to Ineos, there are industry-

led certification programs that allow certified entities to claim extremely low emissions of methane. One of these certification programs is Rocky Mountain Institute's (RMI's) MiQ. The MiQ standards that apply to methane emissions from exports of ethane to Ineos are the standards for onshore gas production (i.e., emissions from well pads), gathering and boosting and gas processing, and gas transport and storage. (MiQ, 2022a-c), There is no standard for liquefying ethane, but there is a standard for liquefaction plants (MiQ, 2024), and liquefied ethane is produced at liquefaction plants.

The only entities that have become MiQ-certified in the Appalachian Basin are producers (the oil and gas production part of the supply chain, which occurs at well pads). In the MiQ standard for onshore gas production, there are 6 certification grades. Grade A is the lowest emission level of certification and for onshore gas production is assigned methane emissions of <0.05% kg methane/kg methane in natural gas, after allocating methane emissions to gas, natural gas liquids, oil, and condensate on an energy basis. Some of the producers in the Appalachian Basin are Grade A certified. Others are certified but their grade is not provided. Table A1 in the appendix lists the producers in the Appalachian Basin that have obtained MiQ certification as of July 2025.

MiQ certification for onshore oil and gas production has three pillars: methane intensity, company practices, and monitoring technology deployment, with different standards applying to the different grades of certification. Methane intensities are self-reported, and companies seeking MiQ certification can base their methane intensity on any of the following:

- direct or indirect measurements
- engineering calculation/process simulation
- measurement-based emission factors
- equipment-specific emission factors
- generic emission factors

Producers are encouraged to utilize quantification methods specific to their facility, and measurement-informed inventories are highly encouraged.

Other certification programs exist or have existed in the past, including the ONE Future Coalition, the EPA Natural Gas STAR Program, Project Canary, and the Responsible Gas Initiative. How methane intensity is defined differs greatly between practitioners. Sometimes all of the methane emissions are assigned to natural gas, sometimes the methane intensity is methane emissions per natural gas sold, and in the case of MiQ for production operations it is mass of methane emissions per mass of methane in gas sold, after allocating.

The monitoring technology deployment pillar for Grade A certification requires an annual inspection of the entire facility (which in the case of oil and gas producers could include tens of thousands of wells, each with a complement of methane-emitting sources), and quarterly leak detection and repair at 50% of sites.

For company practices, there are a number of requirements that must be met in order to be certified and in order to be Grade A, 12 of 15 optional practices must also be implemented. Company practices are divided into managing unintended methane emissions (such as emissions from tanks) and managing intended methane emissions (for example, venting during liquids unloading). The reader is referred to the MiQ standard for gas production for more details (MiQ, 2022a).

In order to be certified, producers have to engage approved auditors to verify annually that they are performing emission calculations properly, that the wells are inspected annually, that the company practices are being conducted as claimed, and that stated monitoring is occurring (MiQ, 2022d). A more complete description of the audit process is given in Appendix 2. Approved auditors as of July 2025 are

- AECOM
- Responsible Energy Solutions
- Environmental Resources Management Certification and Verification Services (ERM CVS)
- Geosyntec
- GHD
- Schlumberger Land Rigs (SLR)
- SGS
- Impact Resolutions
- Intertek
- Montrose Environmental

Limitations of MiQ certification

MIQ certification is not transparent

MiQ certification is not transparent except to the auditors and the producers they are working for. For example, the buyers and the public do not know how the methane intensity is derived, how monitoring is conducted, what company practices exist or how they are assessed. Much is left to the discretion of the producers and auditors. For example, the subsidiary documents for gas production do not specify how to choose

wells for monitoring that are representative of all of the producer's wells, how monitoring is conducted, what the response is to equipment that is "leaking," or how acquaintance with producer practices is assessed for contractors who are probably sporadically onsite and who are not necessarily going to visit the same producer's wells year after year.

The audit process requires the auditor to "verify historical and forecasted data regarding a Facility's methane emissions inventory, including bottom-up and top-down data, for accuracy and completeness to meet the criteria of the Methane Intensity subsidiary document," but it is not clear that anything is mandated regarding the use of top-down data when preparing the inventory. Methane intensity is tied to measurement; the methane intensity subsidiary document states that "Methane Intensity is to be projected annually, using the best available data, including but not limited to historical emission calculations, measurements, as well as detected leaks or abnormal process conditions from Facility Scale and Source Level methane monitoring surveys." The hierarchy of what constitutes as "best available data" is not provided, at least not to the public.

It would be unreasonable to expect the producers to reveal the details of their monitoring activities, but they do not reveal their basic strategy.

Certification grade is not transparent, either. It is only revealed if a producer wishes to reveal it. Certification history, for example the earliest certified date, is not shared in the list of certified operators (MiQ, not dated). The number of wells that are certified and if it is a subset of wells operated by the facility in the given location is not clear. In GHGRP, there is a "Chesapeake Appalachia LLC, 160A - Appalachian Basin (Eastern Overthrust Area)," in the list of MiQ-certified facilities, the certified facility that has Chesapeake in its name is Chesapeake Marcellus. Sometimes the name given in the facility field on the MiQ website suggests further restrictions than the location given in the detail pane.

MIQ certification is not independently verifiable

For independent verification, methane intensity must be measurable by any entity conducting an airborne methane survey in the relevant location. This would not be possible unless the certified wells and only the certified wells occupy a contiguous space whose boundaries are provided, along with production of methane within that contiguous space.

MiQ certification risks emissions shifting and manipulation

Producers can lower their methane intensity by procuring wells after they are completed and divesting from wells once their production starts to fall off. While this can make individual producers look "clean," it does not result in decreased methane emissions from the basin, it just changes who is assigned responsibility for the emissions. The same would be true of wells that require frequent liquids unloading relative to other wells. It would be possible to determine if certified facilities in the Appalachian Basin

have fewer liquid unloading and completion/workover events than average wells in the basin, but that is outside the scope of this project.

Similarly, if producers flare instead of vent methane, it results in increased carbon dioxide emissions, which are also a greenhouse gas. The methane intensity of producers is not penalized when their carbon dioxide emissions rise.

Self-reported emissions are lower than observed emissions

Some publicly available sources of information on methane emissions, for example the US EPA's Greenhouse Gas Reporting Program (GHGRP), are self-reported. Self-reported emissions may be based on emission factors or measurement. In some cases, emissions during certain activities or during process upsets or planned maintenance activities are exempt from reporting. Other sources of information on methane emissions are based on observed methane concentrations in the atmosphere, either airborne or ground-based, that are converted to emissions and apportioned to methane-emitting sources.

In the US, oil and gas industry operators (not just producers) that emit more than 25,000 kg/yr of CO2eq (using IPCC AR4 GWPs) report to the US GHGRP. Invariably, these self-reported methane emissions from oil and gas operations in basins are lower than observed emissions from the basins. There are several reasons for this:

- GHGRP emission factors for some types of equipment do not take into account high episodic emissions
- some operators have emissions that are below the GHGRP reporting threshold and are not required to report (17% of the onshore natural gas produced in 2021 was produced by operators who did not report emissions to the GHGRP (Hellgren et al., 2024))
- emission reporting is not required for some types of production equipment and processes
- emissions from abandoned wells are not reported
- equipment is undercounted
- emission factors are too low even for equipment that is not experiencing an episode of high emissions

The Appalachian Basin had the lowest methane intensity of any of the basins studied during the MethaneSat campaign in 2023, but the observed emissions of 167,000 kg methane/hr were 9.5X higher than GHGRP-reported emissions from production, gathering and boosting, and gas processing in the basin in 2023 (US GHGRP, 2024;

MethaneSAT, 2024). This is aligned with findings of the discrepancy between measured and reported emissions for oil and gas basins in general (Shen et al., 2022; Sherwin et al., 2023, Omara et al., 2024).

Some airborne measurement campaigns provide estimates of methane emissions for the Marcellus Play. As shown in Figure 1, GHGRP-reported emissions for the Appalachian Basin and Eastern Overthrust include regions that are not within the Marcellus Play (GHGRP treats the Eastern Overthrust as if it is a separate basin from the Appalachian Basin). While it would be possible to identify the number of wells lying in counties within GHGRP's Appalachian Basin and Eastern Overthrust but not within the Marcellus Play in order to obtain a sense of the GHGRP-reported emissions that are occurring outside of the Marcellus Play and make comparisons to additional airborne measurement campaigns, it was outside the scope of this project.

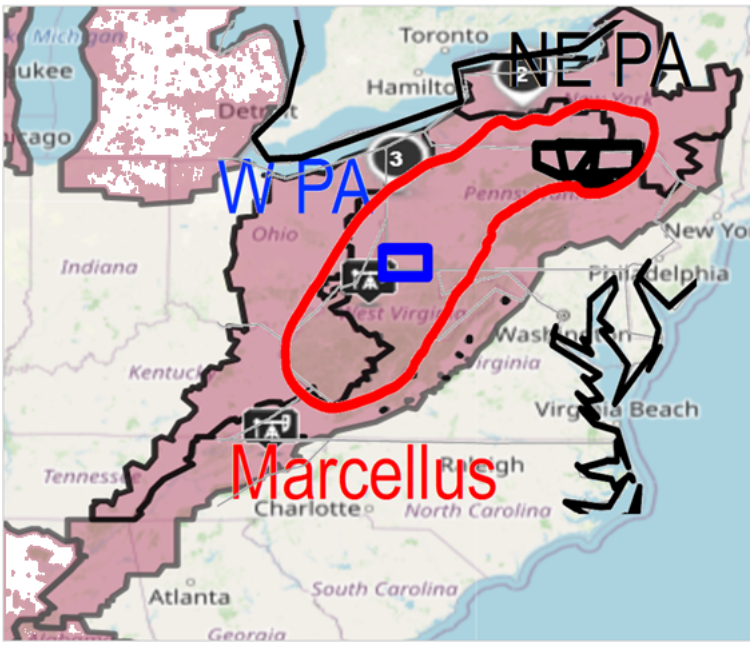

Figure 1. An overlay of figures showing the location of the Marcellus Play (outlined in red) relative to the GHGRP boundaries for the Appalachia and Eastern Overthrust Basins (in solid mauve). Marcellus Play boundary from Supplement to Shen et al., 2022, citing EIA at https://www.eia.gov/maps/maps.htm; GHGRP boundary for the Appalachian Basin and Eastern Overthrust from US EPA FLIGHT at https://ghgdata.epa.gov/ghgp/main.do.

In addition, it should be noted that much of the Utica Play is underneath the Marcellus Play, and airborne methods for estimating emissions based on a column that begins at the surface, without distinguishing which play they originated from, cannot distinguish between Marcellus and Utica sources.

Publicly available methane intensity of Ineos' suppliers

While the Appalachian Basin performs well relative to other US oil and gas basins in terms of methane intensity, a claim of <0.05% kg methane/kg methane in natural gas sales across all operations during production is extraordinary and requires extraordinary substantiation. It is at least 15X less than observed emissions of 0.75% during a measurement campaign that disproportionately focused on a high production area of Pennsylvania in 2021 (Sherwin et al., 2024). There is an inverse relationship between well productivity and methane intensity, and site-level field measurements of low-producing wells suggest that the 0.75% figure obtained for the high production area in Pennsylvania, which covered less than 80% of production in the region and less than 50% of the wells in the region, was not representative of the region in general and underestimated emissions (Sherwin et al., 2024).

Using the MiQ definition but not allocating any methane emissions to natural gas liquids, the methane intensity of the 2023 self-reported GHGRP producer emissions from the Appalachian Basin for the four Ineos suppliers (Antero, CNX, EQT, and Range Resources) are lower than the basin as a whole and range from 0.007% for EQT to 0.032% for CNX, with an average of 0.012% across these four producers even without allocating any emissions to natural gas liquids due to lack of data on production rates (US GHGRP, 2024). These suppliers produced 36% of the basin-wide gas produced for sale and 26% of the basin-wide oil and condensate. The basin-wide average methane intensity for all producers in terms of methane emissions per methane sold in natural gas was 0.038%. Again, observed emissions in the Appalachian Basin were 9.5X higher than emissions reported for production, gathering and boosting, and gas processing in GHGRP in 2023.

Climate impact of ethane exports don't stop at methane emissions during production

Methane emissions during production make up a small portion of the climate impact of ethane exported to Project One. It is disingenuous for Ineos to focus solely on methane emissions during production of gas when making claims about the improved climate impact of using imported ethane from Cove Point in its Project One crackers. Methane emissions are responsible for only a fraction of climate impacts, production emissions are only a fraction of basin emissions, and basin emissions are only a fraction of the total supply chain emissions for delivering ethane to Project One and cracking it.

Obtaining an accurate estimate of greenhouse gas emissions along the supply chain for ethane that is exported from the Appalachian Basin to the Port of Antwerp in Belgium

would not be a trivial endeavor. The supply chain includes gas production (i.e., gas produced at the wells), gathering and boosting, gas processing, transport, liquefaction, shipping, and regasification. If greenhouse gas emissions are to be allocated to various products involved in each part of the supply chain, the crude oil, lease condensate, natural gas, natural gas liquids (which include ethane), and processing plant condensate volumes and energy content have to be understood, along with the emission rates.

The supply chain for ethane exported to Project One has the same stages as the supply chain for LNG: production, gathering and boosting, gas processing, transmission, shipping, regasification, and use. The products of ethane cracking go on to have diverse impacts during final disposal.

During cracking, ethane has several possible fates. The single-pass conversion rate of ethane to ethylene is low (Zimmerman and Walzl, 2012). The ethane that is not converted to ethylene can be separated out and recycled to the cracker or it can be mixed in with the fossil fuel that is fed to the process heaters that are used to produce the high temperatures needed for ethane cracking. Some of the ethane lays down coke on the inner side of the reaction tubes in the cracker, which must be periodically burned off, creating CO_2 emissions. A small amount of the cracker output is used as a fuel and a small amount of CO_2 is generated in the reaction (by far, most of the CO2 associated with ethane crackers is the CO2 from combusting fuel to provide the heat required for the cracking reaction to occur).

Some of the products of ethane cracking are converted into products that are made into plastics. Some of these plastics are long-lived and serve to sequester the carbon in the ethane, but most are single-use and are either recycled, disposed of in a landfill, combusted in municipal incinerators, or disposed of to the environment.

Insights from greenhouse gas emissions for LNG supply chains

While the supply chain for exported ethane and the supply chain for LNG are not interchangeable, there are some shared elements and there is peer-reviewed literature on LNG supply chains that can shed some light on the exported ethane supply chain.

A major difference between the supply chain for ethane and the supply chain for LNG is that all of the LNG that makes it to final use is combusted, creating CO_2 emissions, while only a portion of the ethane delivered to Ineos is combusted. Another difference in the supply chain emissions of LNG vs exported ethane is that there would be no methane slip during shipping of ethane because the fuel for propulsion and electricity generation would be boiloff from ethane instead of boiloff from LNG, which is mostly methane. Some of the methane slip prior to shipping, during transmission and liquefaction, for example, would be allocated to exported ethane.

To obtain a sense of the importance of methane emitted during production to the overall climate footprint of exported ethane, it helps to examine the portion of the greenhouse gas emissions across the supply chain emissions for LNG that occur from methane released during production, the portion that occurs at final use, the portion due to methane emitted during shipping and to CO_2eq emitted during final transmission and distribution, and the portion of CO_2eq that is due to all the remaining stages.

According to a recent study, methane emissions during production only account for 12% of the total supply chain emissions of CO_2eq for LNG exported from the United States (Howarth, 2024; Table 4 and Supplemental Table A, which are based on Sherwin et al., 2024, who clarify in the Supplementary Information that "we designate all emissions from sources other than well sites as midstream;" GWP for methane is 82.5). As shown in Figure 2, carbon dioxide emissions during final use account for another 34%, while methane emitted during shipping and CO_2eq emitted during final transmission and distribution accounts for another 6%. Emissions of methane during production are only about a fifth of total supply chain emissions for exported ethane even after all of the use stage, the methane emissions during shipping, and CO_2eq final transmission and distribution emissions are removed.

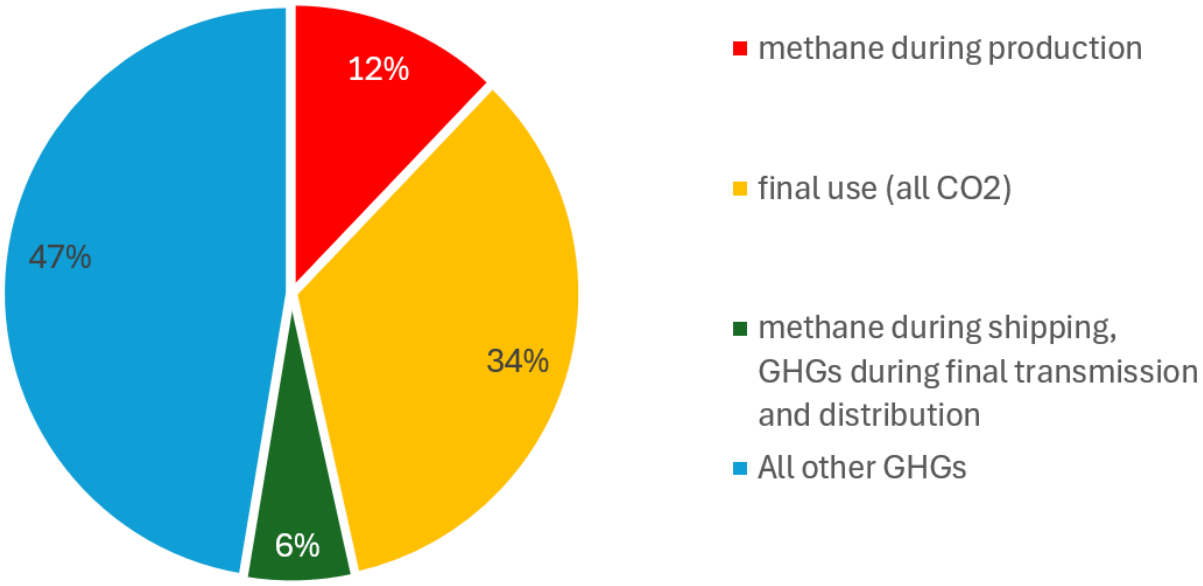

Figure 2. Share of total supply chain of 20-yr CO_2eq due to methane emissions during production for LNG exported from the United States (derived from Howarth, 2024) (emissions allocated to co-products on an energy basis).

The value for the fraction of total LNG supply chain emissions due to methane emissions during production from Howarth (2024) is in alignment with a study that estimated supply chain emissions for LNG exported from two basins in Texas to two provinces in China (7% and 10% of the total supply chain for the LNG exports were due

to methane emissions during production on a CO_2eq basis, using a GWP of 82.5) (Rosselot et al., 2021).

Conclusions and implications

Ineos's reliance on the climate benefits of ethane sourced from its suppliers in the Appalachian Basin introduces a complex array of questions. Ineos highlights reductions in methane intensity by its suppliers and leans on third-party certifications such as MiQ to support its climate claims, but these assurances are undermined by chronic underreporting of self-reported methane emissions and critical gaps in transparency and verification in the certification programs.

Methane emissions reported by oil and gas producers are consistently lower than emissions observed through independent airborne and satellite-based measurements. In the case of the Appalachian Basin, measured emissions from the basin are nearly an order of magnitude higher than self-reported emissions in the GHGRP. Certification schemes like MiQ do little to resolve these discrepancies, as they allow producers to use flexible methodologies, disclose minimal information publicly, and achieve certification grades without independent third-party reproducibility of methane intensities.

Furthermore, focusing narrowly on methane emissions during gas production misrepresents the true climate impact of the ethane supply chain. Production emissions represent only a small portion of total greenhouse gas emissions associated with delivering ethane to Project One and converting it into ethylene. Emissions from gathering and boosting, gas processing, transmission, liquefaction, shipping, and cracking are all significant.

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Appendix 1. MiQ-certified operators in the Appalachian Basin (all producers) as of July 2025 (MiQ, not dated, unless otherwise stated).

Facility	Operator	Location	Grade If Known	First Certified	Source for Date First Certified and Grade	Other Info	Source for Other Info
Ascent Resources - Utica	Ascent Resources - Utica, LLC	Ohio	A	9/29/2022	https://www.expandenergy.com/wp-content/uploads/2023/02/CHK_ESGNews_RSGCertification_Feb_2_2023-1.pdf		
Chesapeake Marcellus	Expand Energy Corporation	Pennsylvania		2/2/2023	https://www.expandenergy.com/wp-content/uploads/2023/02/CHK_ESGNews_RSGCertification_Feb_2_2023-1.pdf https://miq.org/chesapeake-energy-corporation-achieves-grade-a-miq-and-grade-a-eo100-recertification-for-marcellus-operations/		
EQT Corporation - Greene and Washington Counties PA Wells	EQT Production Company	Pennsylvania		1/14/2022 or Dec 2021	https://miq.org/eqt-obtains-equitable-origin-and-miq-certifications-of-a-majority-of-its-natural-gas/	MiQ's findings 9/18/24 estimate that the transaction for EQT-produced gas reduces at least 24,123 metric tons of carbon dioxide equivalent (24,123 MT CO2e-20yr GWP) compared to the current Appalachian basin industry average	https://miq.org/miq-collaborates-with-eqt-and-uniper-on-groundbreaking-pilot-transaction-for-independently-certified-gas/

Facility	Operator	Location	Grade If Known	First Certified	Source for Date First Certified and Grade	Other Info	Source for Other Info
Gulfport Appalachia Basin	Gulfport Energy Operating Corporation	Ohio	A	10/31/2023	https://www.gulfportenergy.com/news/press-releases/detail/1397/gulfport-energy-achieves-grade-a-miq-certification		
Northeast Natural Energy LLC	Northeast Natural Energy LLC	West Virginia	A	1/20/2022	https://miq.org/northeast-natural-energy-announces-it-has-achieved-certification-through-miq/	Northeast and Seneca providing a billion cf/d of certified gas via CG Hub	https://miq.org/seneca-resources-and-northeast-natural-energy-join-cg-hubs
PennEnergy Resources, LLC	PennEnergy Resources, LLC	Pennsylvania	A	11/29/2023	https://www.pennenergyresources.com/news-presentations/pennenergy-resources-achieves-miq-grade-a-methane-emissions-certification-across-entirety-of-operating-asset		
Range Resources - Appalachia, LLC (Southwest PA)	Range Resources - Appalachia, LLC	Pennsylvania	A	7/19/2023	https://ir.rangeresources.com/news-releases/news-release-details/range-resources-releases-updated-corporate-sustainability-report		
Repsol Oil & Gas USA LLC	Repsol Oil & Gas USA, LLC	Pennsylvania		12/1/2022	https://naturalgasintel.com/news/repsol-supplying-400-mmcfd-of-certified-marcellus-natural-gas/		

Facility	Operator	Location	Grade If Known	First Certified	Source for Date First Certified and Grade	Other Info	Source for Other Info
Seneca East Appalachian Production	Seneca Resources Company, LLC		A	8/16/2022	https://miq.org/seneca-resources-achieves-top-emissions-performance-certification-of-its-natural-gas-production-under-the-miq-standard/	Northeast and Seneca providing a billion cf/d of certified gas via CG Hub	https://miq.org/seneca-resources-and-northeast-natural-energy-join-cg-hubs

Appendix 2. MiQ Audit Process (MiQ, 2022d)

An auditor will conduct a desktop review, interviews, and an onsite field verification and interviews with key staff to observe and evaluate a company's adherence to the Standards' performance criteria. Using a combination of the methods below, the Auditor will complete an annual audit report and recommend a grade based for the Facility's overall performance.

As part of the annual audit the auditor will complete the following:

- Verify historical and forecasted data regarding a Facility's methane emissions inventory, including bottom-up and top-down data, for accuracy and completeness to meet the criteria of the Methane Intensity subsidiary document.
- Verify documentation that demonstrates the Facility's compliance with the Company Practices subsidiary document. This documentation may include design standards, operating procedures, equipment inventories, operations training records, maintenance records, and LDAR records,
- Verify documentation related to the Facility's LDAR program and deployment of advanced monitoring technology utilized in reference to the scoring levels of the Monitoring Technology Deployment subsidiary document.
- Interview relevant personnel including operations and environmental management, engineering and environmental staff, lease/site operations, and relevant contractors to confirm documentation, verify data sources, and confirm understanding of operating procedures.
- Conduct onsite field inspections of a representative sample of the Facility's operations to evaluate the implementation and effectiveness of company practices, deployment of monitoring technology, and confirm significant inputs of the emissions inventory.