# Petroleum and Natural Gas Systems
# 2011 Data Summary

United States Environmental Protection Agency

**Greenhouse Gas Reporting Program**

## Introduction

In February 2013, the U.S. Environmental Protection Agency (EPA) released for the first time greenhouse gas (GHG) data for Petroleum and Natural Gas Systems[1] collected under the Greenhouse Gas Reporting Program (GHGRP). The GHGRP, which was required by Congress in the FY2008 Consolidated Appropriations Act, requires facilities to report data from large emission sources across a range of industry sectors, as well as suppliers of certain greenhouse gases, and products that would emit GHGs if released or combusted.

The data show 2011 GHG emissions from over 1,800 facilities conducting petroleum and natural gas system activities, such as production, processing, transmission, and distribution. In total, these facilities accounted for GHG emissions of 225 million metric tons of carbon dioxide equivalent ($CO_2e$).

The data represent a significant step forward in better understanding GHG emissions from Petroleum and Natural Gas Systems. EPA is working to improve the quality of data from this sector and expects that the GHGRP will be an important tool for the Agency and the public to analyze emissions, identify opportunities for improving the data, and understand emissions trends.

When reviewing this data and comparing it to other data sets or published literature, it is important to understand the GHGRP reporting requirements and the impacts of these requirements on the reported data. Facilities used uniform methods prescribed by the EPA to calculate GHG emissions, such as direct measurement, engineering calculations, or emission factors derived from direct measurement. In some cases, facilities had a choice of calculation methods for an emission source. In order to provide facilities with time to adjust to the requirements of the GHGRP, EPA made available the optional use of Best Available Monitoring Methods (BAMM) for unique or unusual circumstances. Where a facility used BAMM, it was required to follow emission calculations specified by the EPA, but was allowed to use alternative methods for determining inputs to calculate emissions.

Petroleum and Natural Gas Systems is one of the more complex source categories within the GHGRP because of the number of emission sources covered, technical complexity, and variability across facilities. It is expected that there can be differences in reported emissions from one facility to another. It is not uncommon for a handful of facilities to contribute the majority of the national reported emissions total for a specific emission source. As described in more detail below, there is a reporting threshold and the data does not cover certain emission sources, and therefore the data does not represent the entire universe of emissions from Petroleum and Natural Gas Systems. There is also variability in the methods used which could impact cross-segment, cross-source, or cross-facility comparisons. It is important to be aware of these limitations and differences when using this data, particularly when attempting to draw broad conclusions about emissions from this sector.

[1] The implementing regulations of the Petroleum and Natural Gas Systems source category of the GHGRP are located at 40 CFR Part 98 Subpart W.

## Petroleum and Natural Gas Systems in the GHG Reporting Program

The Petroleum and Natural Gas Systems source category of the GHGRP includes most of the largest emission sources from the petroleum and natural gas industry. The following eight segments comprise the Petroleum and Natural Gas Systems source category.

- Onshore Production: Emissions from onshore production of petroleum and natural gas associated with production wells and related equipment.
- Offshore Production: Production of petroleum and natural gas from offshore production platforms.
- Natural Gas Processing: Processing of field quality gas to produce pipeline quality natural gas.
- Natural Gas Transmission: Compressor stations used to transfer natural gas through transmission pipelines.
- Underground Natural Gas Storage: Facilities that store natural gas in underground formations.
- Natural Gas Distribution: Distribution systems that deliver natural gas to customers.
- LNG Import/Export: Liquified Natural Gas import and export terminals.
- LNG Storage: Liquified Natural Gas storage equipment.

Other segments of the petroleum and natural gas industry are covered by the GHGRP, but not included in the Petroleum and Natural Gas Systems source category, such as: Petroleum Refineries (Subpart Y), Petrochemical Production (Subpart X), Suppliers of Petroleum Products (Subpart MM), and Suppliers of Natural Gas and Natural Gas Liquids (Subpart NN).

The GHGRP also includes combustion sources that are associated with the petroleum and natural gas industry, but that do not report process emissions from any of the above source categories, such as certain facilities that have a North American Industry Classification System (NAICS) code beginning with 211 (the general NAICS for oil and gas extraction). These facilities are referred to as "Other Oil and Gas Combustion" in this document.

The GHGRP covers a subset of national emissions from Petroleum and Natural Gas Systems. Facilities in the Petroleum and Natural Gas Systems source category are required to submit annual reports if the facility total emissions exceed 25,000 metric tons $CO_2e$. In addition, the Petroleum and Natural Gas Systems source category does not currently include reporting of process emissions from the gathering and boosting segment. It also does not include reporting of vented emissions from hydraulic fracturing of oil wells. In addition, the GHGRP does not cover reporting of emissions from transmission lines between compressor stations. The petroleum and natural gas industry is growing and changing rapidly and that there may be other sources of emissions that are not currently covered. The Agency will continue to review regulatory requirements to ensure the reporting of high quality data.

EPA has a multi-step data verification process, including automatic checks during data-entry, statistical analyses on completed reports, and staff review of the reported data. Based on the results of the verification process, EPA follows up with facilities to resolve mistakes that may have occurred. Because this process is still ongoing, the data currently presented is preliminary. In addition, because of the nature of the petroleum and natural gas industry, there can be variation in emissions from facility to facility.

EPA is currently in the process of reviewing the GHGRP data to determine whether all facilities subject to the requirements submitted annual reports. As part of this process EPA will review applicable information to identify facilities that may have missed the reporting deadline and assist those facilities in submitting reports.

## Reported GHG Emissions from Petroleum and Natural Gas Systems

The following section provides information on reported GHG emissions by industry segment, by greenhouse gas, by combustion and process emissions, and by emission source. It also provides information on BAMM.

### Reported Emissions by Industry Segment

GHG emissions from Petroleum and Natural Gas Systems activities were first required to be collected for the 2011 calendar year and the first annual reports were due to EPA in September 2012. EPA received reports from over 1,800 facilities[2] with Petroleum and Natural Gas Systems activities, with total reported GHG emissions of 225 Million Metric Tons (MMT) $CO_2e$.

The largest industry segment in terms of reported GHG emissions was onshore production, with a total of 94 MMT $CO_2e$, followed by natural gas processing, with reported emissions of 62 MMT $CO_2e$. The next largest segment was natural gas transmission, with reported emissions of 24 MMT $CO_2e$. Other oil and gas combustion accounted for 23 MMT $CO_2e$ and reported emissions from natural gas distribution totaled 14 MMT $CO_2e$. The remaining segments accounted for a total of less than 10 MMT $CO_2e$.

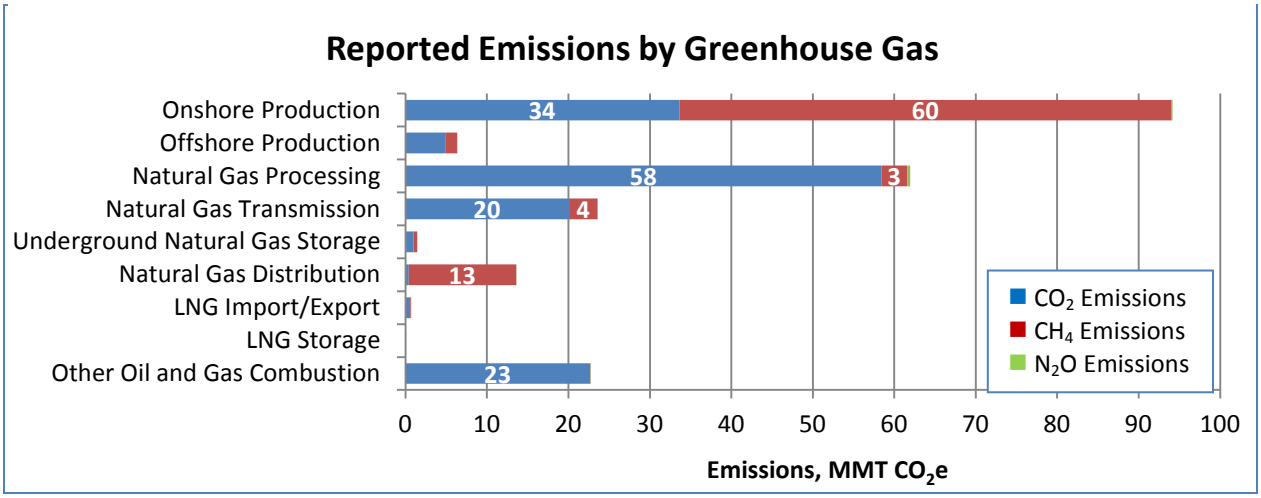
| Segment | Number of Facilities | Reported Emissions (Million Metric Tons $CO_2e$) |
|---|---|---|
| Onshore Production | 448 | 94 |
| Offshore Production | 99 | 6 |
| Natural Gas Processing | 372 | 62 |
| Natural Gas Transmission | 424 | 24 |
| Underground Natural Gas Storage | 44 | 1 |
| Natural Gas Distribution | 168 | 14 |
| LNG Import/Export | 7 | 1 |
| LNG Storage | 5 | < 1 |
| Other Oil and Gas Combustion | 331 | 23 |
| **Total** | **1,880** | **225** |

*Note: Total number of facilities is smaller than the sum of facilities from each segment because some facilities reported under multiple segments.*

### Reported Emissions by Greenhouse Gas

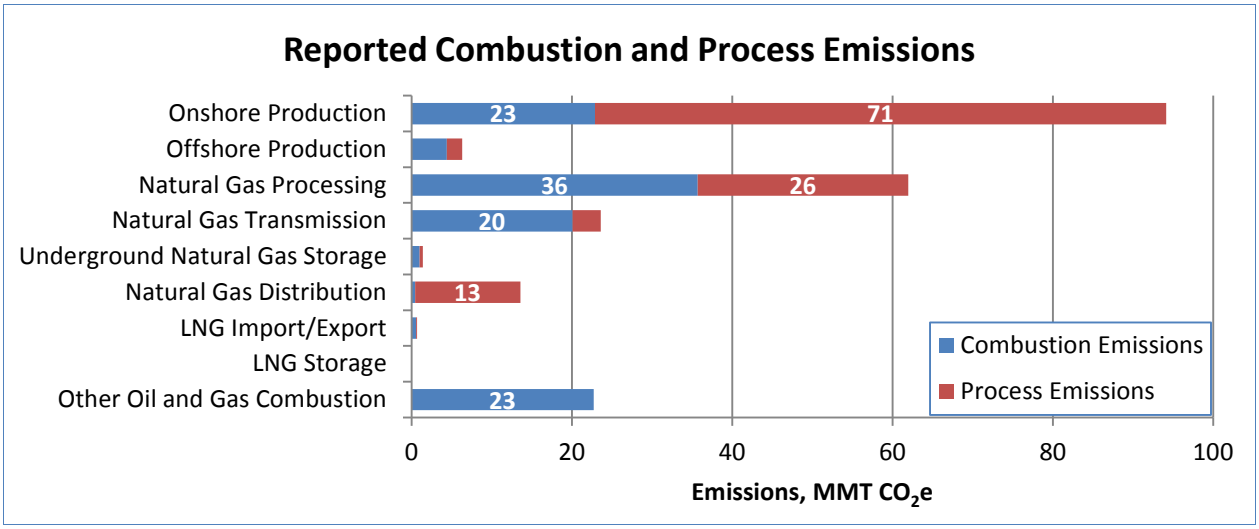
For all segments combined, carbon dioxide ($CO_2$) emissions accounted for 142 MMT $CO_2e$ of reported emissions and methane ($CH_4$) emissions accounted for 82 MMT $CO_2e$ of reported emissions. Emissions from onshore production were primarily methane while emissions from natural gas transmission and natural gas processing were primarily carbon dioxide.

[2] In general, a "facility" for purposes of the GHGRP means all co-located emission sources that are commonly owned or operated. However, the GHGRP has developed specialized facility definitions for natural gas distribution and onshore production. For natural gas distribution, the "facility" is a local distribution company as regulated by a single state public utility commission. For onshore production, the "facility" includes all emissions associated with wells owned or operated by a single company in a specific hydrocarbon producing basin (as defined by the geologic provinces published by the American Association of Petroleum Geologists).

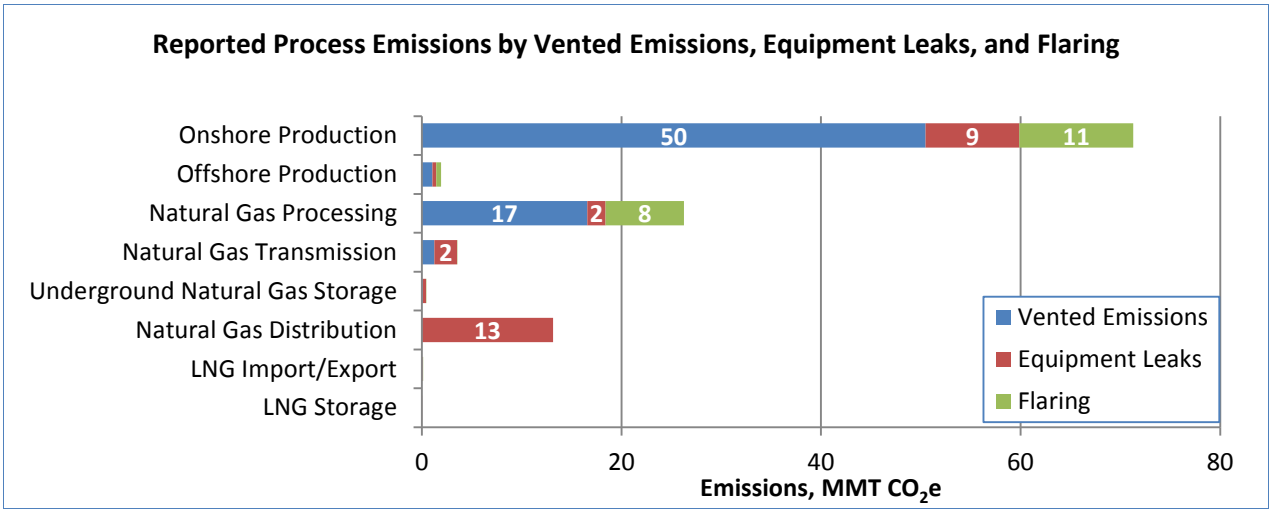



**Reported Combustion and Process Emissions**

Each segment of Petroleum and Natural Gas Systems has unique emission sources. Emissions may result from the combustion of fossil fuels or from process sources that result in the direct emission of GHGs. Reported process emissions in Petroleum and Natural Gas Systems totaled 117 MMT $CO_2e$ and reported combustion emissions totaled 108 MMT $CO_2e$. The majority of combustion emissions were reported by natural gas processing, natural gas transmission, onshore production, and other oil and gas combustion. The majority of process emissions were reported by onshore production, natural gas processing, and natural gas distribution.




Process emissions may be further classified as vented emissions, equipment leaks, and flaring. Vented emissions totaled 69 MMT $CO_2e$, equipment leaks totaled 27 MMT $CO_2e$, and flaring totaled 20 MMT $CO_2e$. Vented emissions in onshore production were primarily methane while vented emissions in natural gas processing were primarily carbon dioxide. Equipment leak emissions were primarily methane and flaring emissions were primarily carbon dioxide.



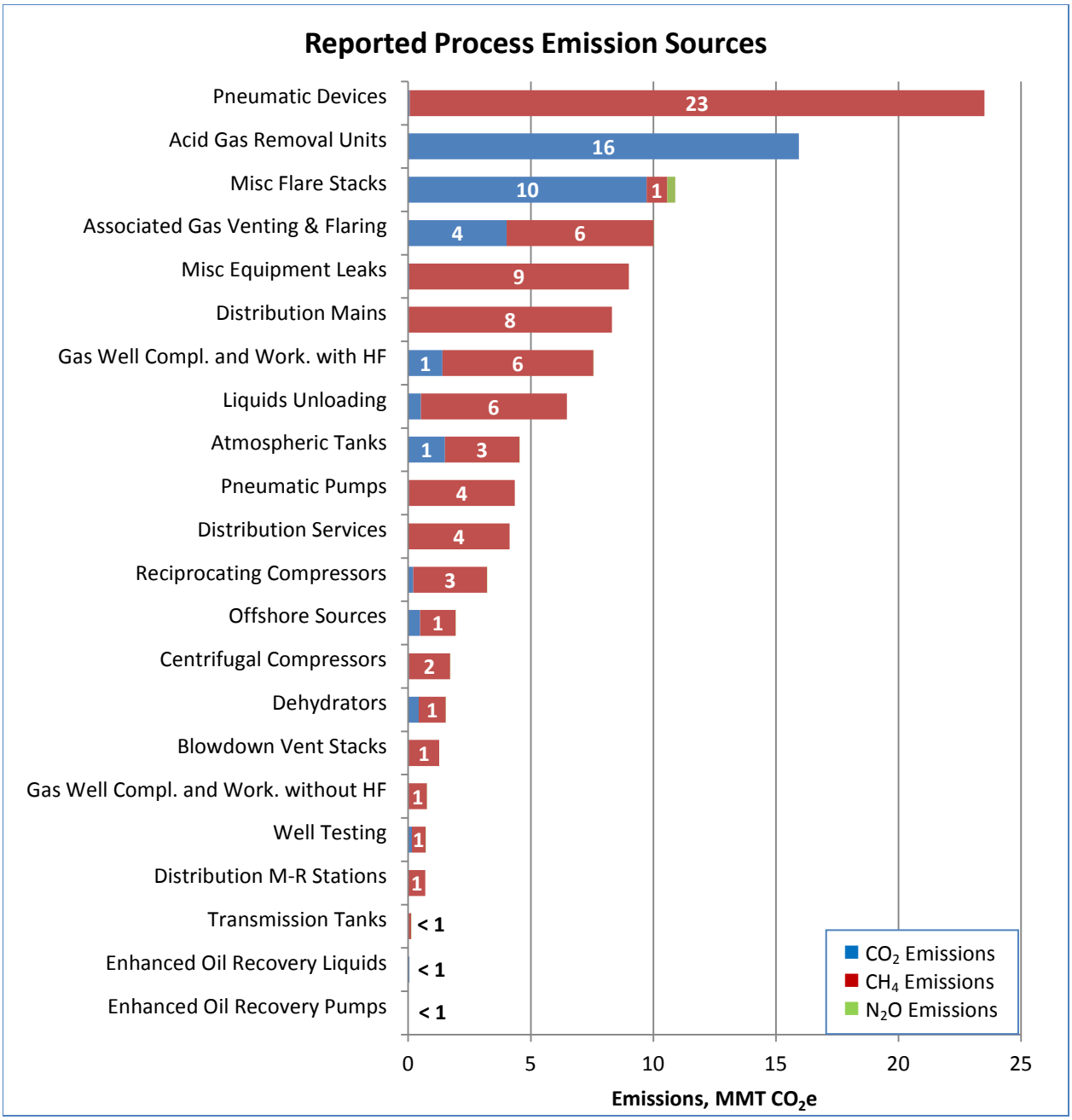

**Reported Process Emission Sources**

The Petroleum and Natural Gas Systems source category (Subpart W) specifies the methods that facilities must use to calculate emissions from applicable sources.

The top reported process emission source in Petroleum and Natural Gas Systems was pneumatic devices with reported emissions of 23 MMT $CO_2e$. Natural gas pneumatic devices are automated, continuous bleed flow control devices powered by pressurized natural gas and used for maintaining a process condition such as liquid level, pressure, delta-pressure and temperature. Emissions from natural gas pneumatic devices are calculated by applying a facility determined population count to a default emission factor.

Acid gas removal units were the top reported contributor to $CO_2$ emissions from non-combustion sources and the top reported source of process emissions in the natural gas processing segment. Acid gas removal units are process units that separate hydrogen sulfide, carbon dioxide or both hydrogen sulfide and carbon dioxide from sour natural gas using absorbents or membrane separators. The $CO_2$ emitted from acid gas removal units is a part of the gas stream that is produced at the wellhead. Natural gas processing creates pipeline quality natural gas and removal of $CO_2$ from the gas streams is a key step in this process.

Associated gas and miscellaneous flare stacks were the top reported sources of process emissions from flaring for Petroleum and Natural Gas Systems. Associated gas is natural gas that is produced out of petroleum wells, but due to proximity and pipeline limitations, may be vented or flared instead of being processed. The miscellaneous flare stacks category is a catch-all category intended to cover all flares not otherwise reported in the onshore production and natural gas processing segments. For example, flaring for gas well completions and workovers with hydraulic fracturing would be reported under the gas well completions and workovers with hydraulic fracturing emission source rather than the miscellaneous flare stacks emission source. The majority of emissions from miscellaneous flare stacks were from natural gas processing and onshore production.



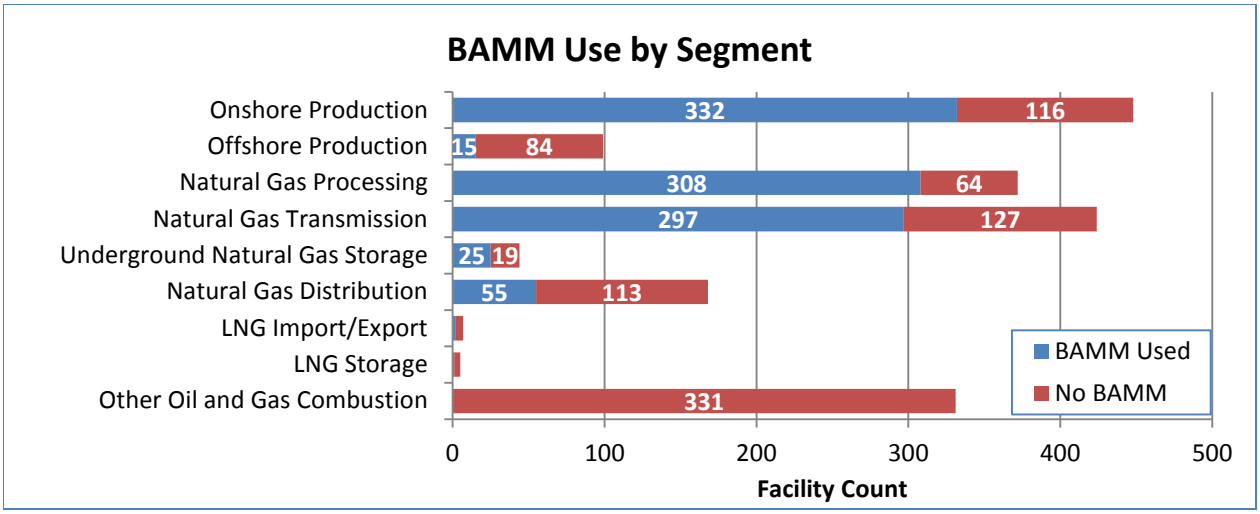

*Note: Gas Well Compl. and Work. with HF is an abbreviation for Gas Well Completions and Workovers with Hydraulic Fracturing, and Distribution M-R Stations is an abbreviation for Distribution Metering-Regulating Stations.*

**Best Available Monitoring Methods (BAMM)**

In order to provide facilities with time to adjust to the requirements of the GHGRP, EPA made available the optional use of BAMM for unique or unusual circumstances. Where a facility used BAMM, it was required to follow emission calculations specified by the EPA, but was allowed to use alternative methods for determining inputs to calculate emissions. Inputs are the values used by reporters to calculate equation outputs. Examples of BAMM include monitoring methods used by the facility that do not meet the specifications of Subpart W, supplier data, engineering calculations, and other company records.

In 2011, facilities were allowed to use BAMM for the Petroleum and Natural Gas Systems source category and these facilities were required to specify in their GHG annual reports when BAMM was used for an emission source. In total 54% of facilities in the petroleum and natural gas source category reported using BAMM in 2011. The largest number of reporters in Petroleum and Natural Gas Systems was in the onshore production, natural gas processing, and natural gas transmission segments, and these three segments also represented the segments with the largest frequency of BAMM use. The onshore production segment had 74% of facilities reporting BAMM use, natural gas processing had 83% of facilities reporting BAMM use, and natural gas transmission had 70% of facilities reporting BAMM use. The remaining segments had a lower number of reporters and proportionally lower BAMM use. Facilities in the other oil and gas combustion category were not permitted to use BAMM for 2011. For purposes of this document, facilities are recorded as using BAMM if they indicated the use of BAMM for any piece of equipment from any emission source.

It is not immediately apparent how the use of BAMM affected emissions. While EPA will continue to analyze BAMM, this analysis is complicated by the fact that facilities may have used BAMM in different ways and for different parameters depending on their unique or unusual circumstances. Over time, EPA anticipates BAMM use will decline and the Agency may have additional information to conduct verification such as certain inputs to emissions equations (which are currently not reported).[3]



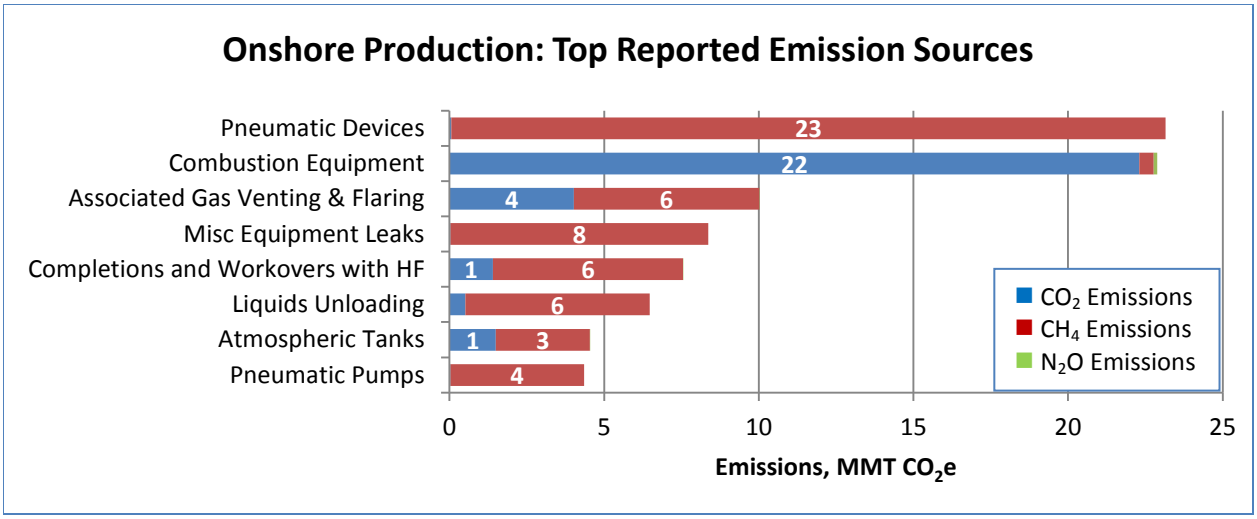

[3] For more information, see: http://www.epa.gov/ghgreporting/reporters/cbi/index.html.

## Reported GHG Emissions by Industry Segment and Source

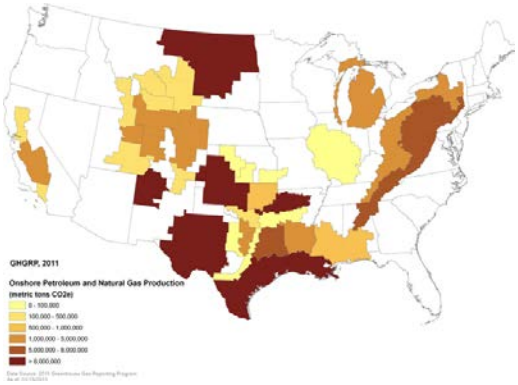
The following section provides information on reported GHG emissions organized by industry segment. For each segment, the top reported emission sources are presented, as well as additional information on emission sources for which stakeholders have expressed interest. Over time, we hope to provide additional information on other emission sources of interest to stakeholders.

### Onshore Production

EPA received annual reports from 448 facilities in the onshore production segment, and 332 of these facilities reported using BAMM. Total reported emissions were 94 MMT $CO_2e$. The top reported emission sources for onshore production were generally consistent with the top reported emission sources for Petroleum and Natural Gas Systems. Pneumatic devices (23 MMT $CO_2e$) and combustion equipment (22.9 MMT $CO_2e$) were the top reported emission sources, followed by associated gas venting and flaring (10.0 MMT $CO_2e$), miscellaneous equipment leaks (8.4 MMT $CO_2e$), gas well completions and workovers with hydraulic fracturing (7.6 MMT $CO_2e$), and liquids unloading (6.5 MMT $CO_2e$).




The emissions data reported by onshore production facilities can be shown by basin. The basins with the top reported emissions were the Anadarko Basin with 10.7 MMT $CO_2e$ and the San Juan Basin with 9.6 MMT $CO_2e$.



***Emission Source in Detail: Gas Well Completions and Workovers with Hydraulic Fracturing***

The data reported to the GHGRP includes gas well completions and workovers with hydraulic fracturing. In the hydraulic fracturing process, a mixture of water, chemicals and a "proppant" (usually sand) is pumped into a well at high pressures to fracture rock and allow natural gas to escape. During a stage of well completion known as "flowback," fracturing fluids, water, and reservoir gas come to the surface at a high velocity and volume. Specialized equipment can be employed that separates natural gas from the backflow, known as a "Reduced Emission Completion" (REC) or "green completion".

The GHGRP provides facilities options for calculating emissions for gas well completions and workovers with hydraulic fracturing. Facilities may measure or estimate the backflow rate in order to report emissions using an engineering calculation. Alternatively, the backflow vent or flare volume may be measured directly.

EPA received information on gas well completions and workovers with hydraulic fracturing from 224 onshore production facilities. Of these facilities 144 reported using BAMM to calculate emissions. The total reported emissions for gas well completions and workovers with hydraulic fracturing were 7.6 MMT $CO_2$e. Reported $CO_2$ emissions were 1.4 MMT $CO_2$e and reported $CH_4$ emissions were 6.2 MMT $CO_2$e.

Emissions were reported by GHG for flaring and venting activities. Facilities were also required to report the total count of completions and workovers. In addition, reporters provided a count of the number of completions or workovers employing purposely designed equipment that separates natural gas from the backflow (RECs).

The table below shows reported activity data and emissions nationally for gas well completions and workovers with hydraulic fracturing. Data collected by the GHGRP also allows for county-level analysis of reported data. As noted earlier, when reviewing the data it is important to be aware of the GHGRP reporting requirements and the impacts of these requirements on the reported data. For example, the GHGRP covers a subset of national emissions and there is variability in the methods used in calculating emissions and use of BAMM.

**Reported Emissions from Gas Well Completions and Workovers with Hydraulic Fracturing**

| Activity | Total Number | Number of RECs | Venting $CO_2$ (MT $CO_2$e) | Venting $CH_4$ (MT $CO_2$e) | Flaring $CO_2$ (MT $CO_2$e) | Flaring $CH_4$ (MT $CO_2$e) | Total Reported Emissions (MT $CO_2$e) |
|---|---|---|---|---|---|---|---|
| Gas Well Completions with Hydraulic Fracturing | 9,811 | 4,296 | 23,854 | 5,186,272 | 1,250,742 | 532,893 | 6,994,497 |
| Gas Well Workovers with Hydraulic Fracturing | 1,868 | 539 | 1,641 | 439,555 | 127,004 | 2,503 | 570,783 |
| **Total** | **11,679** | **4,835** | **25,495** | **5,625,827** | **1,377,746** | **535,396** | **7,565,280** |

### *Emission Source in Detail: Liquids Unloading*

In mature gas wells, the accumulation of fluids in the well can impede and sometimes halt gas production. Liquids unloading is the process by which liquids are removed from the well through venting, the use of plunger lift systems, or other remedial treatments. The liquids unloading source category covers emissions from facilities that have wells that are venting or using plunger lifts.

A total of 246 facilities reported emissions for well venting for liquids unloading in onshore production. Of these facilities 167 reported using BAMM to calculate emissions. Total reported emissions for liquids unloading were 6.5 MMT $CO_2e$. A total of 0.5 MMT $CO_2e$ reported emissions were from carbon dioxide and 5.9 MMT $CO_2e$ were from methane.

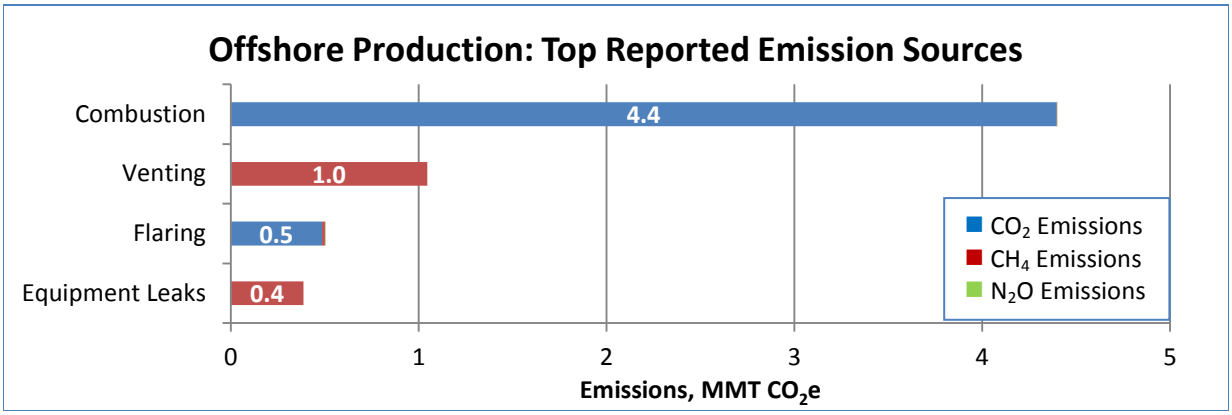
Facilities were given the option between three methods for calculating emissions from liquids unloading. The first calculation method involved using a representative well sample to calculate emissions for both wells with and without plunger lifts. The second and third calculation methods provided engineering equations for wells with plunger lifts and without plunger lifts. The following table shows total activity count and reported emissions for the different calculation methods.

**Reported Emissions from Liquids Unloading**

| Calculation Method | Number of Wells Venting During Liquids Unloading | Number of Wells Equipped With Plunger Lifts | $CO_2$ Emissions (MT $CO_2e$) | $CH_4$ Emissions (MT $CO_2e$) | Total Reported Emissions (MT $CO_2e$) |
|---|---|---|---|---|---|
| Method 1: Direct Measurement of Representative Well Sample | 8,800 | 7,173 | 65,615 | 2,602,058 | 2,667,673 |
| Method 2: Engineering Calculation for Wells without Plunger Lifts | 24,940 | 0 | 393,616 | 1,501,695 | 1,895,311 |
| Method 3: Engineering Calculation for Wells with Plunger Lifts | 35,555 | 35,555 | 57,906 | 1,849,656 | 1,907,562 |
| **Total** | **69,295** | **42,728** | **517,137** | **5,953,409** | **6,470,546** |

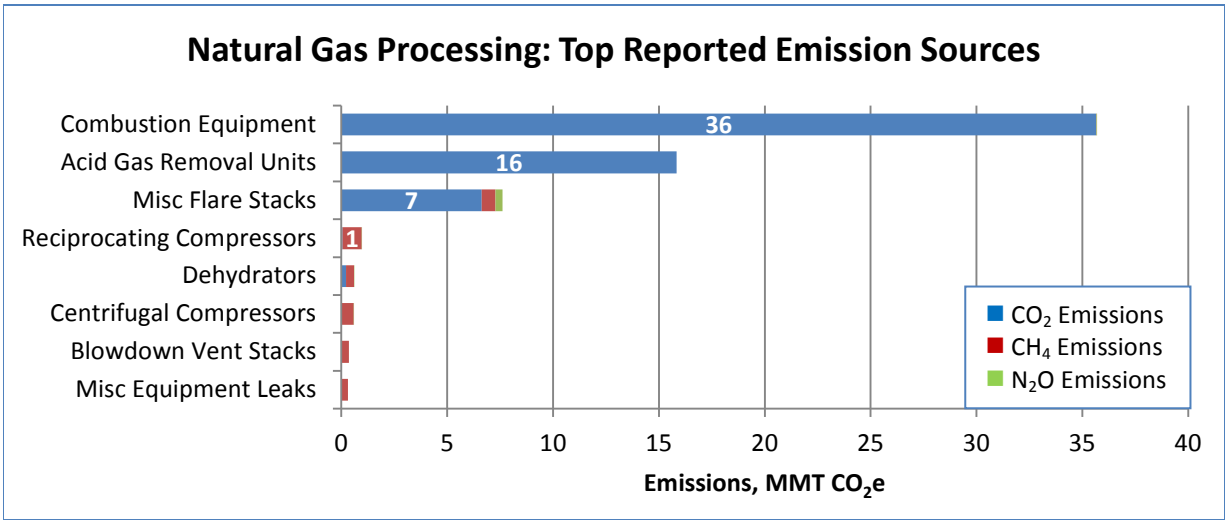
### Offshore Production

EPA received annual reports from 99 facilities in the offshore production segment, and 15 of these facilities reported using BAMM. Total reported emissions were 6 MMT $CO_2e$. For offshore production, facilities calculate process emissions using requirements that were established by the Bureau of Ocean Energy Management (BOEM). In addition, the GHGRP collects data on combustion emissions. The full list of process emission sources is extensive, but can generally be categorized into vented emissions, flaring and equipment leaks. The top reported source of emissions for offshore production was from combustion (4.4 MMT $CO_2e$), followed by venting (1.0 MMT $CO_2e$), flaring (0.5 MMT $CO_2e$), and equipment leaks (0.4 MMT $CO_2e$).



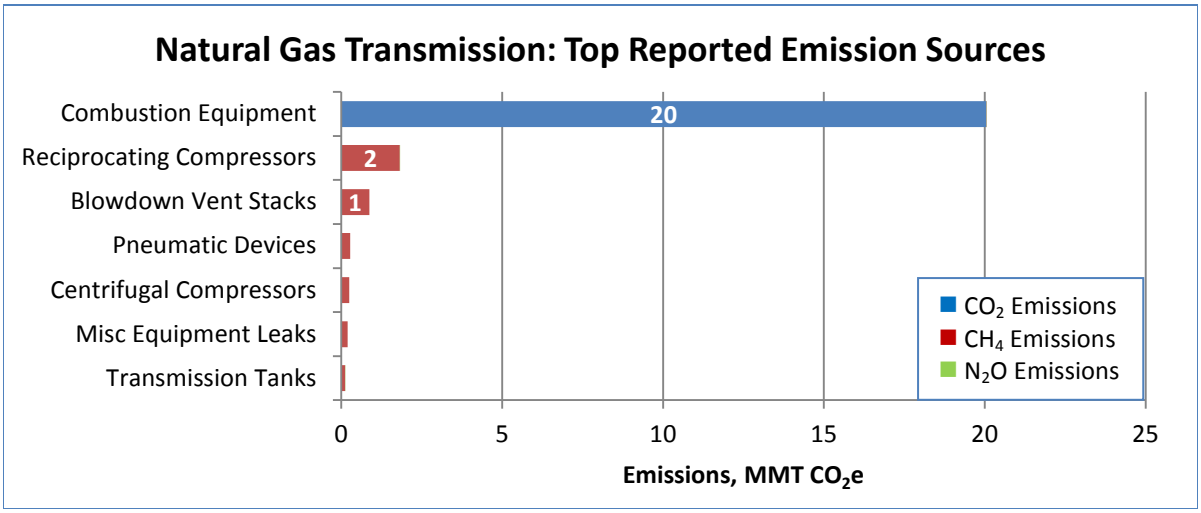

**Natural Gas Processing**

EPA received annual reports from 372 facilities in the natural gas processing segment, and 308 of these facilities reported using BAMM. Total reported emissions were 62 MMT $CO_2e$. The top reported emission sources were combustion equipment (35.7 MMT $CO_2e$), acid gas removal units (15.8 MMT $CO_2e$), and miscellaneous flare stacks (7.6 MMT $CO_2e$). Emissions from the three top reported sources were primarily in the form of $CO_2$. Emissions from compressors were the top reported source of methane emissions, but reported emissions from reciprocating compressors (1.0 MMT $CO_2e$) and centrifugal compressors (0.6 MMT $CO_2e$) were smaller than the three top reported sources from this segment.



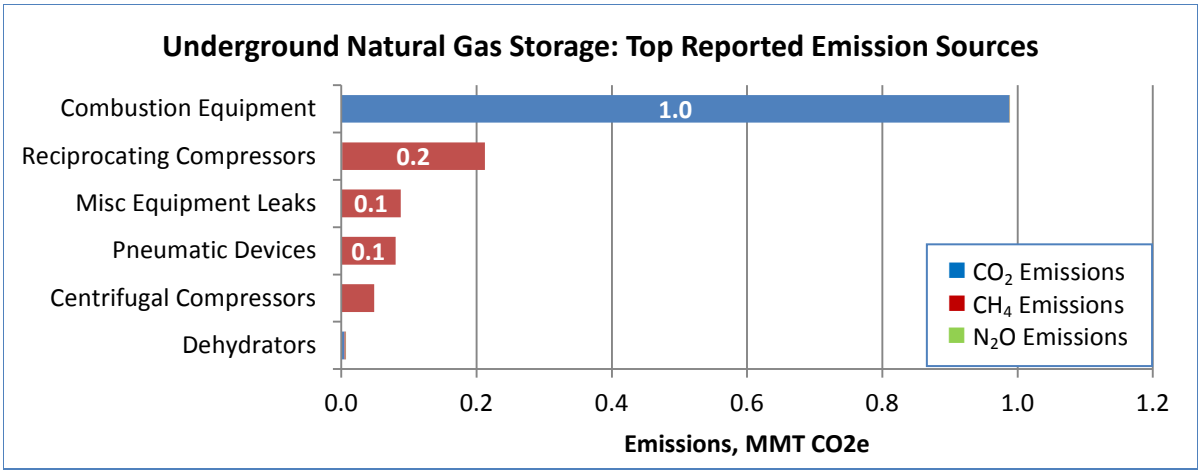

**Natural Gas Transmission**

EPA received annual reports from 424 facilities in the natural gas transmission segment, and 297 of these facilities reported using BAMM. Total reported emissions were 24 MMT $CO_2e$. Combustion emissions (20.0 MMT $CO_2e$) were larger than process emissions. Following combustion equipment, the top reported emission sources were reciprocating compressors (1.8 MMT $CO_2e$) and blowdown vent stacks (0.9 MMT $CO_2e$).




**Underground Natural Gas Storage**

EPA received annual reports from 44 facilities in the underground natural gas storage segment, and 25 of these facilities reported using BAMM. Total reported emissions were 1 MMT $CO_2e$. Combustion equipment (1.0 MMT $CO_2e$) was the top reported source of emissions for underground natural gas storage, followed by reciprocating compressors (0.2 MMT $CO_2e$).




***Emission Source in Detail: Compressors***

Compressors are used in the production, processing, transmission, and storage segments to keep pipelines at a high enough pressure so natural gas will continue flowing through the pipelines. The two primary types of compressors in use in the petroleum and natural gas industry are reciprocating compressors and centrifugal compressors.

Compressors are a large source of combustion emissions in Petroleum and Natural Gas Systems, and combustion emissions for Petroleum and Natural Gas Systems were presented earlier in this document.

Compressors can also be a source of process emissions. The primary source of process emissions from compressors are from leaks in rod packing (reciprocating compressors), emissions from wet or dry seals (centrifugal compressors), emissions from blowdown vents, and emissions from isolation valve leakage. The source of emissions may vary based on the mode of operation that the compressor is in. A compressor in operating mode may have different emissions from a compressor in a shutdown depressurized mode. Because the emissions are from seal leakage, even compressors of the same manufacture can have different emissions based on the quality of the compressor seals. Emissions can be mitigated through rigorous maintenance practices and leak surveys, routing emissions to a flare, or capturing emissions.

Total reported compressor emissions from all industry segments were 5 MMT $CO_2e$. Reported carbon dioxide emissions were 0.2 MMT $CO_2e$ and reported methane emissions were 4.8 MMT $CO_2e$. The calculation method varied by industry segment. Emissions from compressors in onshore production were calculated by using population counts multiplied by an emission factor and accounted for 1 MMT $CO_2e$ of reported emissions. Emissions from compressors in the other industry segment were calculated by the use of direct measurement.

The table below shows activity data and emissions for reciprocating compressors by industry segment (excluding onshore production which used population counts). EPA received data from 4,209 reciprocating compressors, including 1,992 reciprocating compressors in natural gas processing, 1,925 reciprocating compressors in natural gas transmission, and 268 reciprocating compressors in underground natural gas storage. Of these reciprocating compressors, 2,714 reported using BAMM to calculate emissions, including 1,402 in natural gas processing, 1,160 in natural gas transmission, and 143 in underground natural gas storage.

**Reported Process Emissions from Reciprocating Compressors**

| Industry Segment | Total Number of Reciprocating Compressors | Number of Reciprocating Compressors that used BAMM | $CO_2$ Emissions (MT $CO_2e$) | $CH_4$ Emissions (MT $CO_2e$) | Total Reported Process Emissions (MT $CO_2e$) |
|---|---|---|---|---|---|
| Natural Gas Processing | 1,992 | 1,402 | 55,768 | 959,727 | 1,015,740 |
| Natural Gas Transmission | 1,925 | 1,160 | 5,215 | 1,819,143 | 1,824,359 |
| Underground Natural Gas Storage | 268 | 143 | 1,506 | 213,839 | 215,344 |
| LNG Import/Export | 20 | 7 | 426 | 9,630 | 10,530 |
| LNG Storage | 4 | 2 | 1 | 1,164 | 1,164 |
| **Total** | **4,209** | **2,714** | **62,915** | **3,003,502** | **3,067,138** |

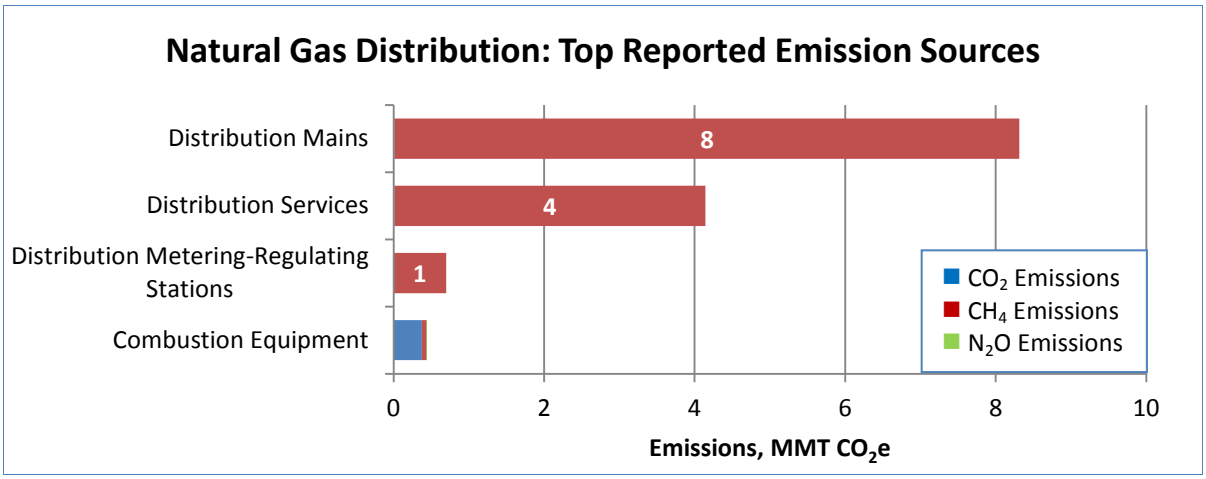
The table below shows activity data and emissions for centrifugal compressors by industry segment. For centrifugal compressors the number of compressors with wet seals is also shown. Overall emissions from centrifugal compressors were lower than those for reciprocating compressors, but the total number of reported compressors was lower as well. EPA received data from 1,088 centrifugal compressors, including 424 centrifugal compressors in natural gas processing, 622 centrifugal compressors in natural gas transmission, and 33 centrifugal compressors in underground natural gas storage. Of these centrifugal compressors, 638 reported using BAMM to calculate emissions, including 309 in natural gas processing, 291 in natural gas transmission, and 30 in underground natural gas storage.

**Reported Process Emissions from Centrifugal Compressors**

| Industry Segment | Total Number of Centrifugal Compressors | Number of Centrifugal Compressors that used BAMM | Number of Centrifugal Compressors with Wet Seals | $CO_2$ Emissions (MT $CO_2e$) | $CH_4$ Emissions (MT $CO_2e$) | Total Reported Process Emissions (MT $CO_2e$) |
|---|---|---|---|---|---|---|
| Natural Gas Processing | 424 | 309 | 319 | 21,213 | 614,524 | 635,850 |
| Natural Gas Transmission | 622 | 291 | 264 | 737 | 244,379 | 245,115 |
| Underground Natural Gas Storage | 33 | 30 | 26 | 64 | 48,486 | 48,550 |
| LNG Import/Export | 9 | 8 | 7 | 47 | 34,381 | 34,429 |
| **Total** | **1,088** | **638** | **529** | **22,061** | **941,771** | **963,944** |

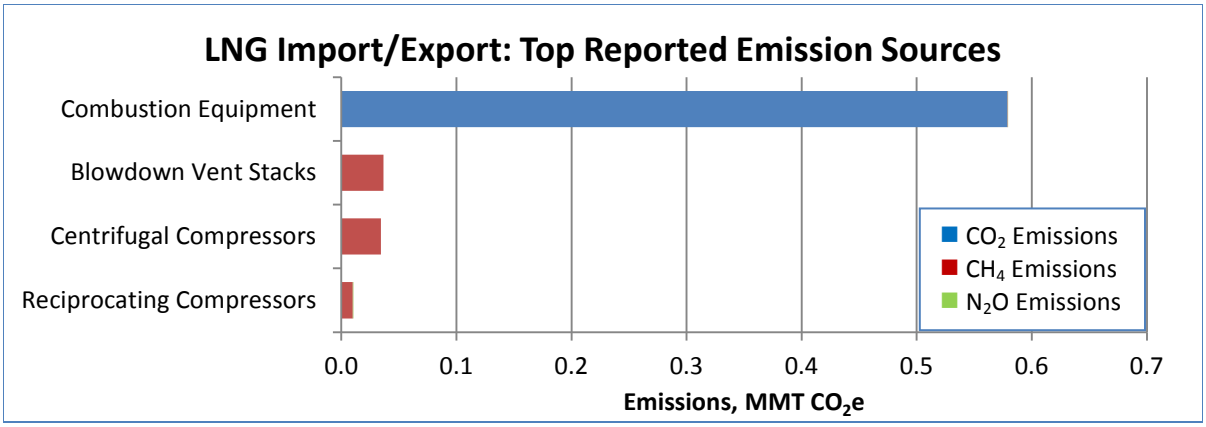
## Natural Gas Distribution

EPA received annual reports from 168 facilities in the natural gas distribution segment, and 55 of these facilities reported using BAMM. Total reported emissions were 14 MMT $CO_2e$. For the natural gas distribution segment, combustion emissions (0.4 MMT $CO_2e$) were relatively lower compared to other industry segments. The primary sources of emission for natural gas distribution were distribution mains (8.3 MMT $CO_2e$) and distribution services (4.1 MMT $CO_2e$), which are caused by natural gas equipment leaks and calculated by multiplying population counts by default emission factors that are specific to pipe material.



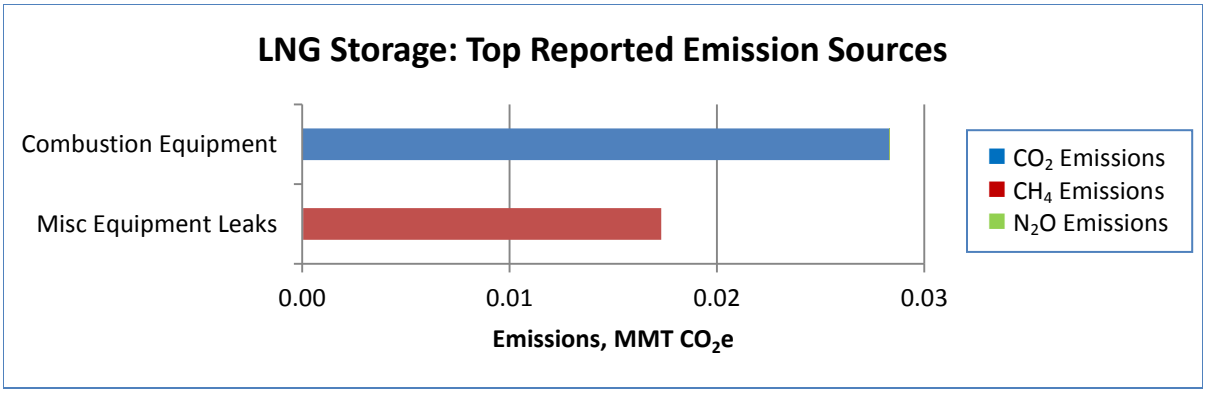

## LNG Import/Export

EPA received emission reports from 7 LNG Import/Export terminals. Total reported emissions were 1 MMT $CO_2e$. The top reported source of emissions was combustion equipment (0.6 MMT $CO_2e$), followed by blowdown vent stacks (0.43 MMT $CO_2e$), centrifugal compressors (0.03 MMT $CO_2e$), and reciprocating compressors (0.01 MMT $CO_2e$).




**LNG Storage**

LNG Storage had the fewest number of reporters of the industry segments that comprise Petroleum and Natural Gas Systems, with 5 facilities reporting. Total reported emissions from LNG Storage were 0.05 MMT $CO_2e$. Combustion equipment (0.03 MMT $CO_2e$) was the top reported source of emissions, followed by equipment leaks (0.02 MMT $CO_2e$).




## Additional Information

View and download GHGRP data: http://epa.gov/ghgreporting/ghgdata/index.html

Additional information about Petroleum and Natural Gas Systems in the GHGRP, including reporting requirements and calculation methods: http://www.epa.gov/ghgreporting/reporters/subpart/w.html.

Data shown in this document reflects the most recent resubmitted reports from facilities as of January 16, 2013.