The background features a large, faint, circular watermark of the EPA logo. The logo consists of a stylized green flower with three leaves and a central globe, surrounded by the text "UNITED STATES ENVIRONMENTAL PROTECTION AGENCY".

# **EPA Greenhouse Gas Data for Petroleum and Natural Gas Systems**

**October 26, 2017**



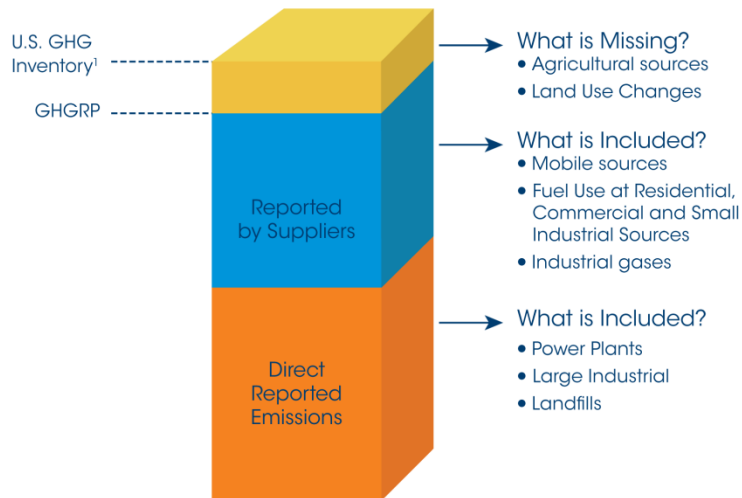
- Greenhouse Gas Reporting Program (GHGRP) and GHG Inventory Overview
- GHGRP
- U.S. GHG Inventory
  - 2017 GHGI Results Overview
  - Oil and Gas CH<sub>4</sub> Trends
  - Updates in the 2017 GHGI
  - Stakeholder Process for 2018 GHGI

# GHG Reporting Program and U.S. GHG Inventory



- Inventory of U.S. Greenhouse Gas Emissions and Sinks (GHG Inventory) tracks total annual U.S. emissions across all sectors of the economy using national-level data
- GHGRP collects detailed emissions data from large greenhouse gas emitting facilities in the United States, as directed by the Clean Air Act
  - GHGRP covers most, but not all, U.S. GHG emissions
  - GHGRP does not include agriculture, land use, and small sources

## GHGRP Covers the Majority of U.S. GHG Emissions



| Task   | Inventory of U.S. GHG Emissions and Sinks | Greenhouse Gas Reporting Program |
|--|---|----------------------------------|
| Find total U.S. emissions                              | ✓   |                                  |
| Review trend data for the past 20 years                | ✓   |                                  |
| Browse a map to find largest emitters in your area     |   | ✓                                |
| Compare facility emissions across an industrial sector |   | ✓                                |
| Find <u>reported</u> emissions by state                |   | ✓                                |



# GHGRP

# Overview of GHGRP



- Launched in response to FY 2008 Consolidated Appropriations Act
- Annual reporting of GHGs by 41 source categories
  - Generally: 25,000 metric ton CO<sub>2</sub>e reporting threshold
- Facilities use 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 have a choice of calculation methods for an emission source
- Direct reporting to EPA electronically
- EPA verification of GHG data

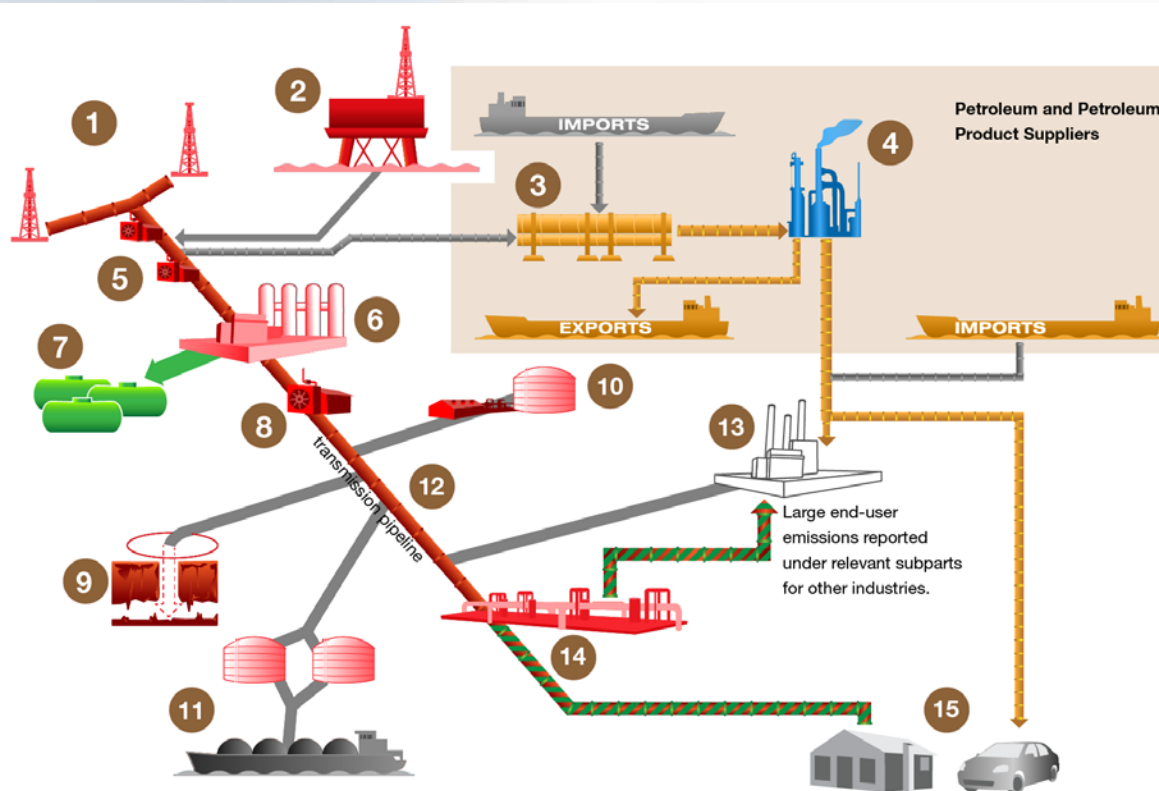
# Source Categories Covered by GHGRP



| Power   | Refining & Petrochem  | Other Chemicals   | Combustion  | Waste  | Metals   | Minerals  | Pulp & Paper   | High GWP Gases  |
|---|---|---|---|--|--|---|--|---|
| <ul style="list-style-type: none"> <li>- Electricity Generation</li> <li>- Electrical Equipment Mfg.</li> <li>- Electrical Equipment Use</li> </ul>   | <ul style="list-style-type: none"> <li>- Petroleum Refineries</li> <li>- Petrochem. Production</li> </ul> | <ul style="list-style-type: none"> <li>- Adipic Acid</li> <li>- Ammonia</li> <li>- Hydrogen Production</li> <li>- Nitric Acid</li> <li>- Phosphoric Acid</li> <li>- Titanium Dioxide</li> </ul> | <ul style="list-style-type: none"> <li>- Stationary Combustion</li> </ul>   | <ul style="list-style-type: none"> <li>- Industrial Waste Landfills</li> <li>- Industrial Wastewater Treatment</li> <li>- MSW Landfills</li> </ul> | <ul style="list-style-type: none"> <li>- Aluminum</li> <li>- Ferroalloy</li> <li>- Iron &amp; Steel</li> <li>- Lead</li> <li>- Magnesium</li> <li>- Silicon Carbide</li> <li>- Zinc</li> </ul> | <ul style="list-style-type: none"> <li>- Cement</li> <li>- Glass</li> <li>- Lime</li> <li>- Misc. Carbonate Use</li> <li>- Soda Ash</li> </ul>                          | <ul style="list-style-type: none"> <li>- Pulp &amp; Paper</li> </ul> | <ul style="list-style-type: none"> <li>- Electronics Mfg.</li> <li>- Fluorinated GHG Production</li> <li>- HCFC-22 Prod./HFC-23 Destruction</li> <li>- Pre-Charged Equipment Import/Export</li> <li>- Industrial Gas Suppliers</li> </ul> |
| <b>Petroleum &amp; Natural Gas Systems</b>  |   |   | <b>Fuel Suppliers</b>   |  |  | <b>Carbon Capture &amp; Sequestration</b>   |  | <b>Mining</b>   |
| <ul style="list-style-type: none"> <li>- Onshore Production</li> <li>- Offshore Production</li> <li>- Gathering and Boosting (as of 2016)</li> <li>- Natural Gas Processing</li> <li>- Natural Gas Transmission Compression</li> <li>- Natural Gas Transmission Pipeline (as of 2016)</li> <li>- Natural Gas Distribution</li> <li>- Underground Natural Gas Storage</li> <li>- Liquefied Natural Gas Storage</li> <li>- Liquefied Natural Gas Import/Export</li> </ul> |   |   | <ul style="list-style-type: none"> <li>- Coal-Based Liquid Fuels Suppliers</li> <li>- Natural Gas and Natural Gas Liquids Suppliers</li> <li>- Petroleum Product Suppliers</li> </ul> |  |  | <ul style="list-style-type: none"> <li>- Geologic Sequestration of CO<sub>2</sub></li> <li>- Injection of CO<sub>2</sub></li> <li>- CO<sub>2</sub> Suppliers</li> </ul> |  | <ul style="list-style-type: none"> <li>- Underground Coal Mines</li> </ul>  |

Direct Emitters  
Suppliers  
CO<sub>2</sub> Injection

# GHGRP and the Oil and Gas Industry



## Production & Processing

1. Onshore Petroleum & Natural Gas Production
2. Offshore Petroleum & Natural Gas Production
3. Total Crude Oil to Refineries
4. Petroleum Refining
5. Gathering and Boosting  
\*Data collection began in RY 2016
6. Gas Processing Plant  
\*May contain NGL Fractionation equipment
7. Natural Gas Liquids (NGL) Supply

## Natural Gas Transmission & Storage

8. Transmission Compressor Stations
9. Underground Storage
10. Liquefied Natural Gas (LNG) Storage
11. LNG Import-Export Equipment
12. Natural Gas Transmission Pipeline  
\*Data collection began in RY 2016

## Distribution

13. Large End Users
14. Natural Gas Distribution
15. Natural Gas & Petroleum Supply to Small End Users

|                                       |   |
|---------------------------------------|---|
| <span style="color: red;">■</span>    | Subpart W: Emissions from petroleum & natural gas systems                                 |
| <span style="color: blue;">■</span>   | Subpart Y: Emissions from petroleum refineries  |
| <span style="color: orange;">■</span> | Subpart MM: CO <sub>2</sub> associated with supplies of petroleum products                |
| <span style="color: green;">■</span>  | Subpart NN: CO <sub>2</sub> associated with supplies of natural gas & natural gas liquids |
| <span style="color: grey;">■</span>   | Not reported under GHGRP  |

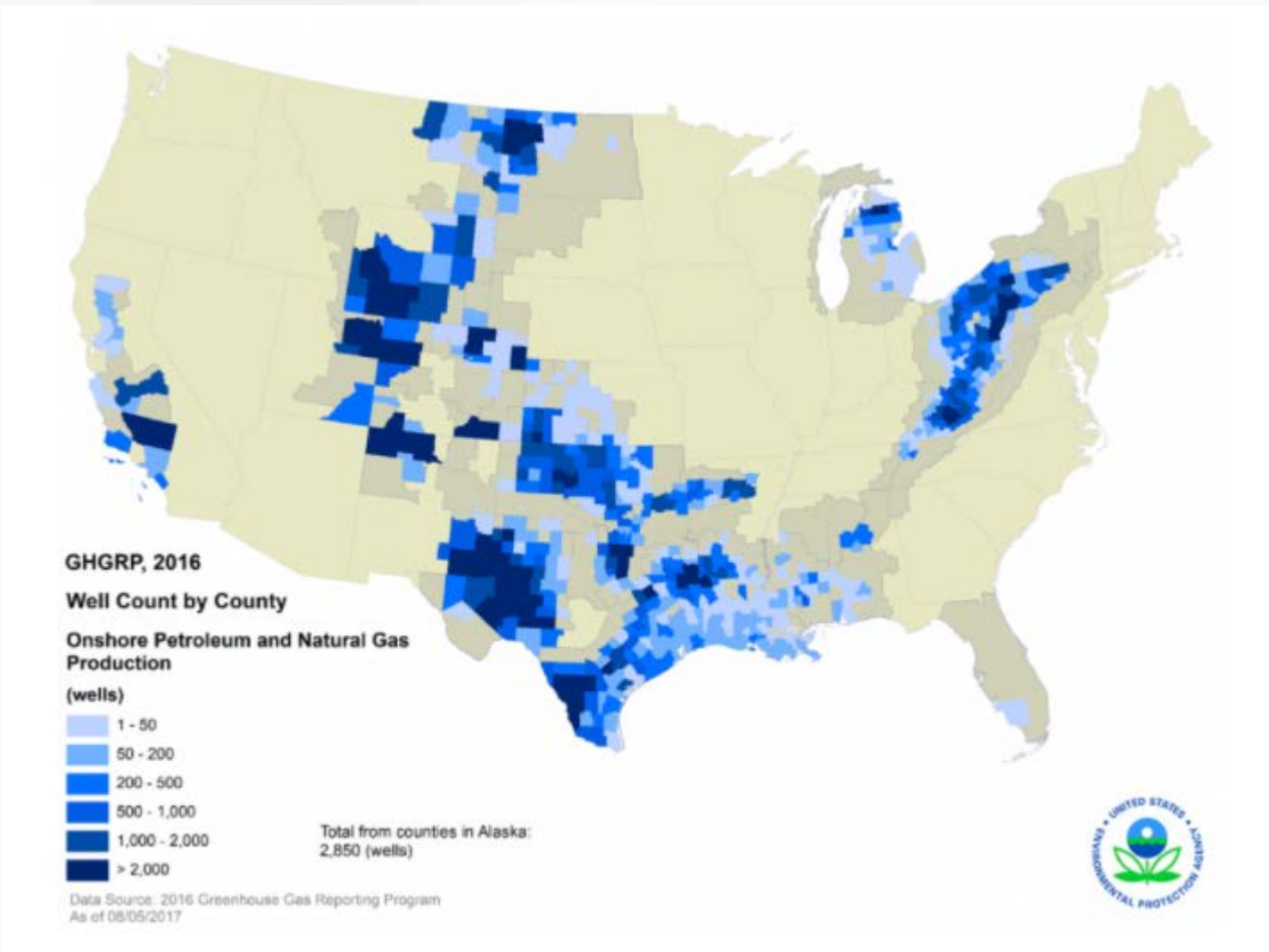
# Petroleum and Natural Gas Systems: What's New for RY 2016?



- Addition of requirements for monitoring, calculation and reporting of emissions for:
  - Oil well completions and workovers with hydraulic fracturing
  - Gathering and boosting systems
  - Blowdowns of natural gas transmission pipelines
- Addition of reporting requirements for well identification numbers
- Where can I find more information?
  - Federal Register: 80 FR 64262 (October 22, 2015, <https://www.gpo.gov/fdsys/pkg/FR-2015-10-22/pdf/2015-25840.pdf>)
  - Docket ID No. EPA-HQ-OAR-2014-0831 ([www.regulations.gov](http://www.regulations.gov))
  - GHGRP Subpart W website: <http://www.epa.gov/ghgreporting/subpart-w-petroleum-and-natural-gas-systems>



# GHGRP RY2016 Well Count By County



# Reported GHG Emissions by Industry Segment

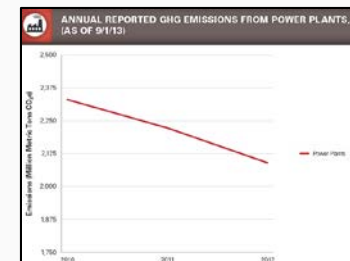
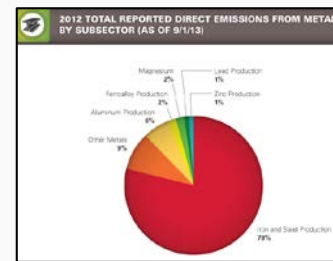


| Segment                              | Number of Facilities | 2016 Reported Emissions (Million Metric Tons CO <sub>2</sub> e) |
|--------------------------------------|----------------------|---|
| Onshore Production                   | 512                  | 85  |
| Offshore Production                  | 134                  | 7   |
| Gathering and Boosting               | 299                  | 83  |
| Natural Gas Processing               | 447                  | 56  |
| Natural Gas Transmission Compression | 525                  | 22  |
| Natural Gas Transmission Pipeline    | 27                   | 4   |
| Underground Natural Gas Storage      | 53                   | 2   |
| LNG Import/Export                    | 6                    | 2   |
| LNG Storage                          | 6                    | <1  |
| Natural Gas Distribution             | 169                  | 14  |
| Other Oil and Gas Combustion         | 92                   | 7   |
| <b>Total</b>                         | <b>2,248</b>         | <b>283</b>  |

# How to Access GHGRP Data



- EPA makes GHGRP data publicly available through several portals
- FLIGHT (<http://ghgdata.epa.gov>)
  - View data in a variety of ways
- Envirofacts (<https://www.epa.gov/enviro/greenhouse-gas-customized-search>)
  - Detailed non-CBI data
- Data Highlights (<https://www.epa.gov/ghgreporting/ghgrp-reported-data>)
  - Summary of data reported in each sector





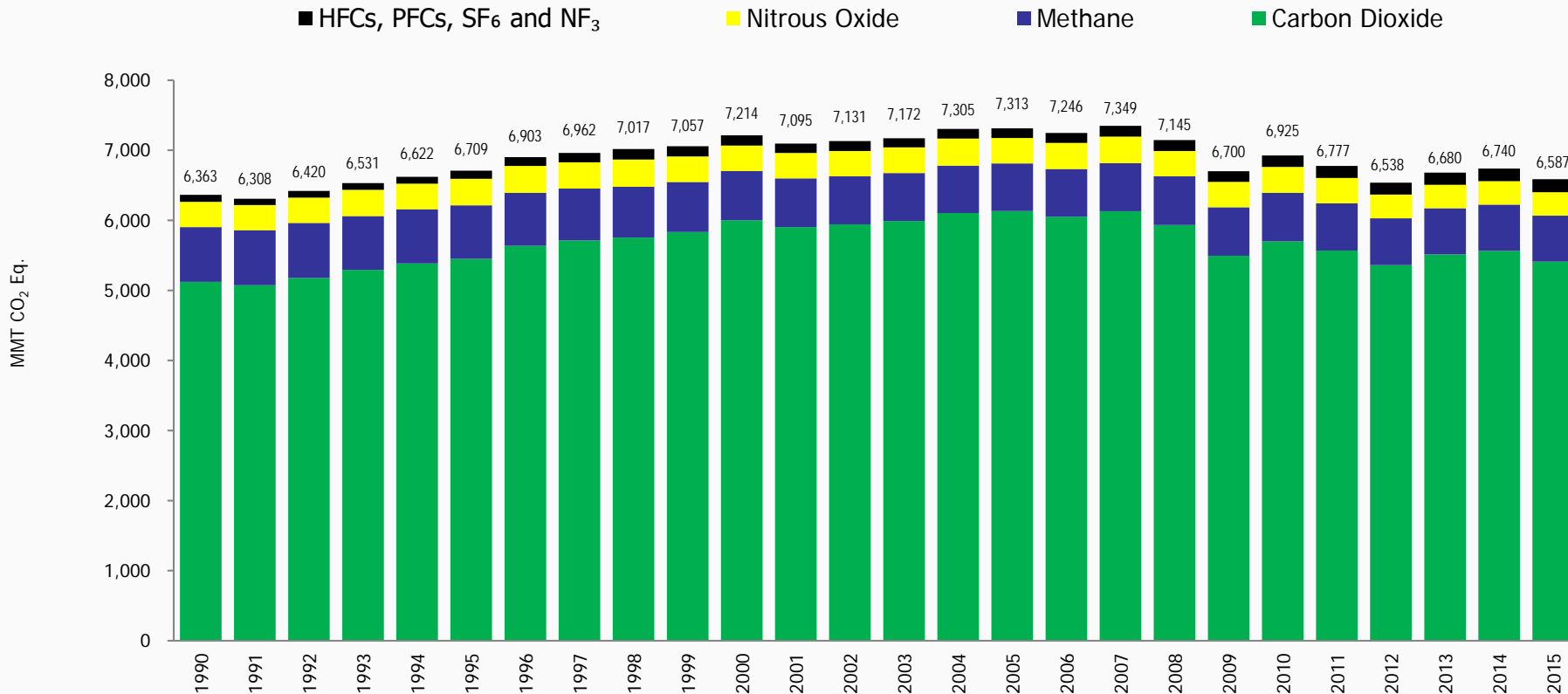
# U.S. GHG Inventory

# U.S. Greenhouse Gas Inventory Background



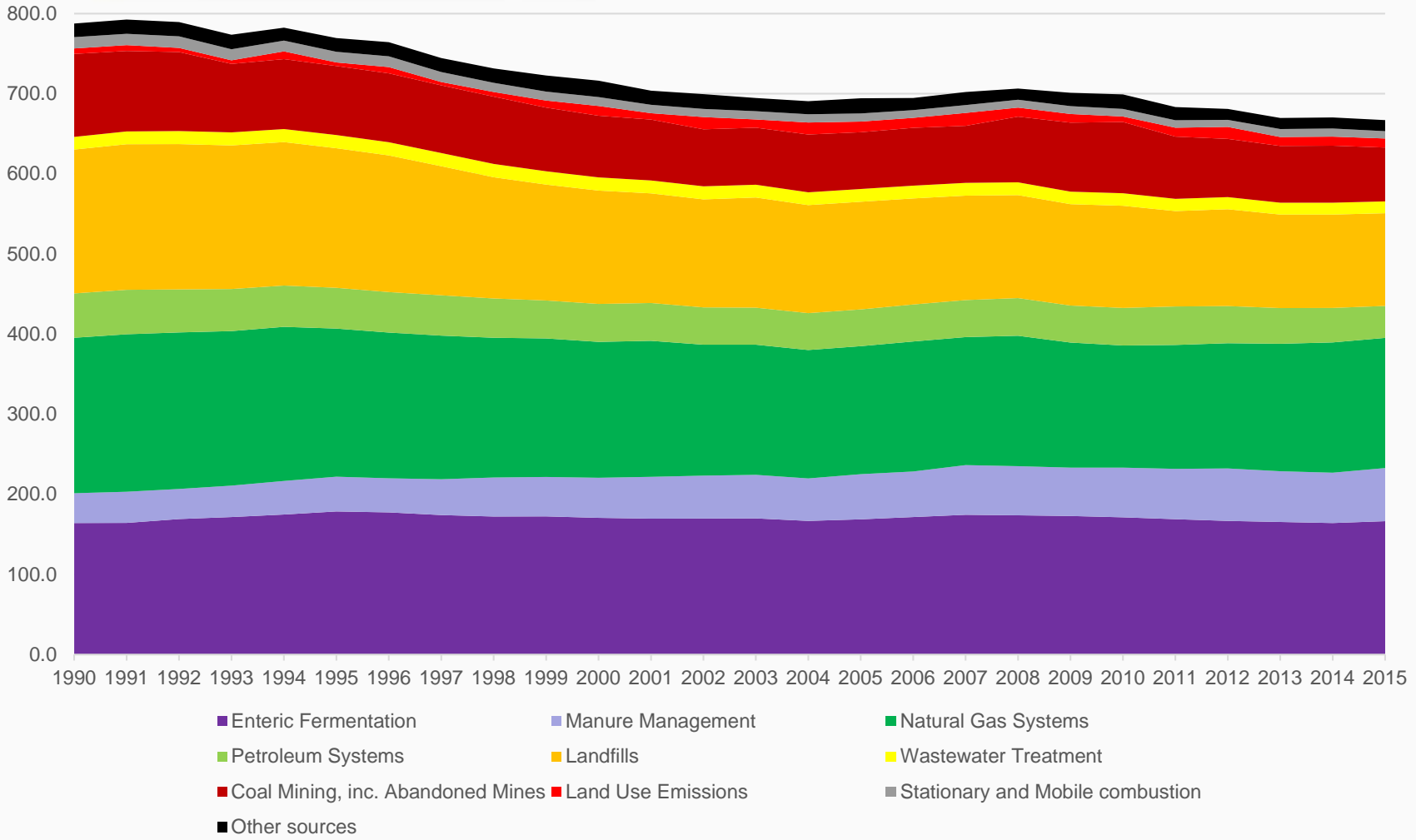
- Official U.S. estimate of greenhouse gas emissions for reporting to United Nations Framework Convention on Climate Change (UNFCCC)
  - Annual national-level inventory submissions to the UNFCCC since 1994
  - Emission estimates begin in 1990; most current inventory covers 1990-2014
- EPA leads Inventory development, working with several other agencies (e.g., agriculture, energy) to prepare estimates and provide activity data
- Sectors Covered
  - Energy, Industrial Processes, Agriculture, Land-Use Change and Forestry, and Waste
- Gases Covered
  - CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, NF<sub>3</sub>, SF<sub>6</sub>
  - Reported in mass of each gas, and as global warming potential (GWP)-weighted CO<sub>2</sub>e emissions
- Record of emissions trends over time
- Each year, Inventory undergoes expert review, public review, and UNFCCC review

# 2017 GHG Inventory Results



GHG emissions for all anthropogenic (human-caused) sources in the U.S.

# Methane in the 2017 GHGI



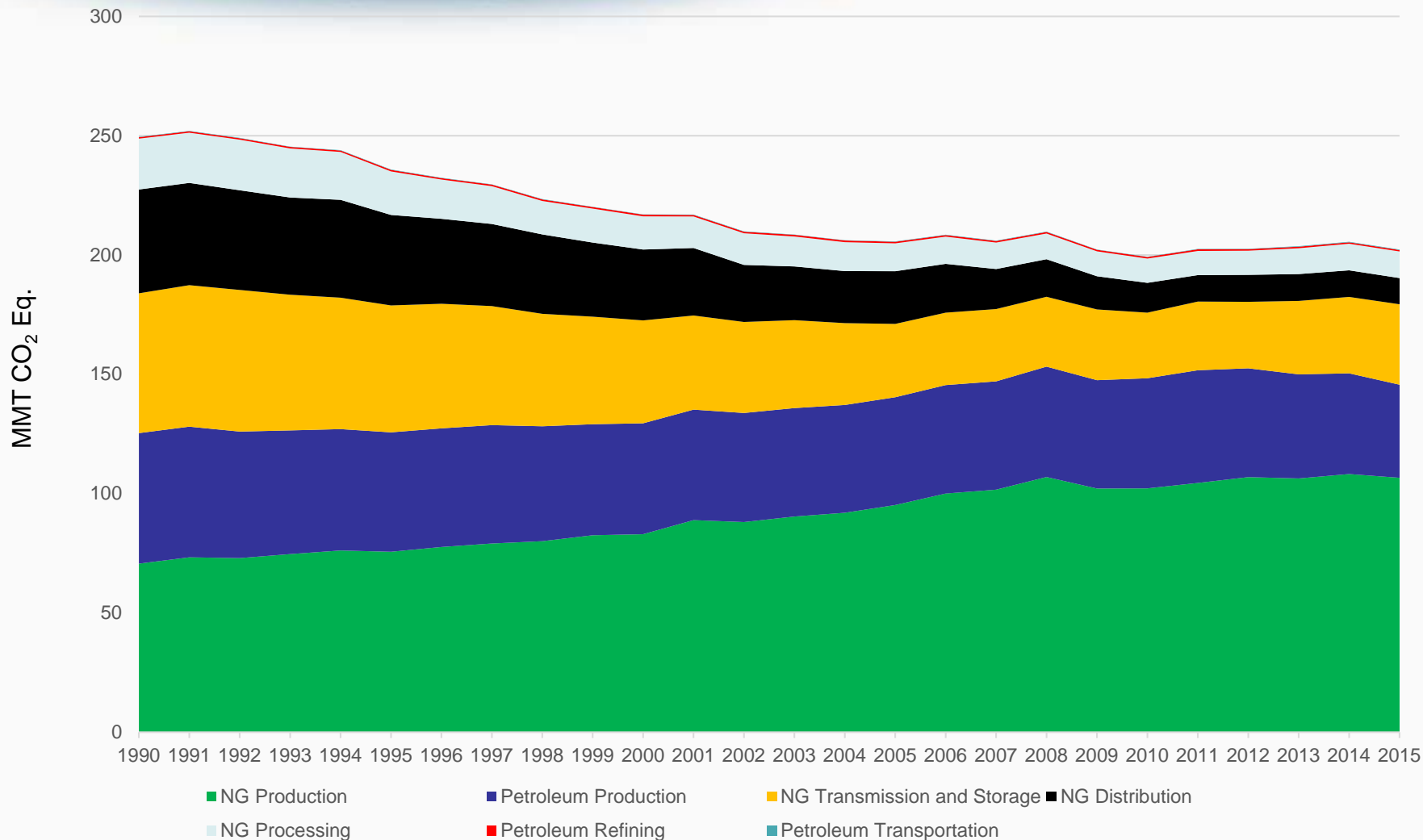
# Calculating U.S. GHG Emissions from Oil and Gas



- Inventory is stratified into natural gas and petroleum pathways of the industry
  - Natural gas - offshore production, onshore production, gas processing, gas transmission, underground gas storage, LNG storage, LNG import and export terminals, and gas distribution
  - Petroleum – offshore production, onshore production, oil transportation, and refineries
- Oil and gas in inventory covers hundreds of types of sources
- Basic approach is to multiply national activity data by emission factors, e.g.:
  - Miles cast iron pipeline x  $\text{CH}_4$  per mile cast iron pipeline
  - # residential meters x  $\text{CH}_4$  per residential meter



# Oil and Gas CH<sub>4</sub> in the 2017 GHGI



# Updating Oil and Gas CH<sub>4</sub> in the GHGI



- Large amount of data and information newly available
- Opportunity to re-evaluate and make updates to GHG Inventory
- Stakeholder process
  - Webinar
  - Memos
- Public review draft and memo comments

# Overview of Revisions in 2017 GHGI



| Segment                  | Last year's 2014 GHGI Estimate | Updates in the 2017 GHGI  | Updated 2014 GHGI Estimate     |
|--------------------------|--------------------------------|---|--------------------------------|
| Production               | 176 MMT CO <sub>2</sub> e      | <ul style="list-style-type: none"> <li>• Updated well counts</li> <li>• Additional scaled up GHGRP data-tanks, liquids unloading, associated gas venting and flaring</li> <li>• Improvements to existing incorporation of GHGRP data</li> <li>• Use of Marchese et al. data (EDF) for episodic events in gathering</li> <li>• Reduced use of Gas STAR data</li> </ul> | 151 MMT CO <sub>2</sub> e      |
| Processing               | 24 MMT CO <sub>2</sub> e       | <ul style="list-style-type: none"> <li>• Use of GHGRP data for most sources</li> <li>• Removal of Gas STAR data</li> </ul>  | 11 MMT CO <sub>2</sub> e       |
| Transmission and Storage | 32 MMT CO <sub>2</sub> e       | No revisions  | 32 MMT CO <sub>2</sub> e       |
| Distribution             | 11 MMT CO <sub>2</sub> e       | No revisions  | 11 MMT CO <sub>2</sub> e       |
| <b>Total</b>             | <b>244 MMT CO<sub>2</sub>e</b> |   | <b>206 MMT CO<sub>2</sub>e</b> |



- Series of webinars and workshops
- EPA and stakeholder presentations with new data or analyses that could be used to update the GHG Inventory
- EPA invites stakeholder feedback on updates under consideration, including
  - CO<sub>2</sub> data update
  - Uncertainty
  - Abandoned wells

# 10/27 Stakeholder Workshop Agenda (1 of 2)



- *Welcome, **EPA***
- *Overview of Petroleum and Natural Gas Systems in GHG Inventory, **EPA***
- *Overview of Petroleum and Natural Gas Systems in the GHGRP, **EPA***
- *Overview of Updates Under Consideration-New Analyses, **ERG***
  - *CO<sub>2</sub>*
  - *Abandoned wells*
  - *Uncertainty*
- *Comments on GHG Inventory, **ONE Future***
- *Comments on GHG Inventory, **Clean Air Task Force***
- *Continuation of API Comments on Updates to the GHG Inventory, **API***

# 10/27 Stakeholder Workshop Agenda (2 of 2)



- *Other GHG Inventory Updates under consideration, **ERG***
- *Discussion of GHG Inventory Updates and Comments*
- *Cost Efficient Approaches for GHGRP compliance, **XTO***
- *Bottom Up Methods and Gas Production Segment Emissions, **Indaco Air Quality Services, Inc.***
- *Paired Measurements and Recent Studies, **Colorado State University***
- *Discussion*



- Stakeholder Process: <https://www.epa.gov/ghgemissions/stakeholder-process-natural-gas-and-petroleum-systems-1990-2016-inventory>
- GHG Inventory: <https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks>
- Additional detail on natural gas and petroleum systems in the GHG Inventory: <https://www.epa.gov/ghgemissions/natural-gas-and-petroleum-systems>
- Relationship of GHGRP and GHG Inventory: <https://www.epa.gov/ghgreporting/greenhouse-gas-reporting-program-and-us-inventory-greenhouse-gas-emissions-and-sinks>