



BOLD  
THINKERS  
DRIVING  
REAL-WORLD  
IMPACT

# NYSERDA Oil and Natural Gas Sector Methane Emissions Inventory

March 26, 2021

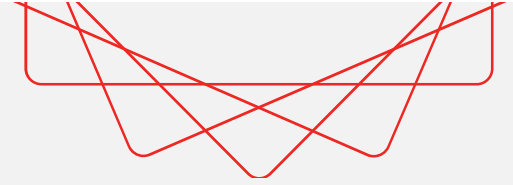
**Public Hearing 2 - Technical Conference:  
Oil and Gas Emissions Accounting**

Jonathan G. Dorn, Ph.D., M.P.P.  
Senior Associate, Abt Associates

**DRAFT**



# Project Goal and Objectives



- Use improved accounting methodologies to develop an activity-driven, site-level, CH<sub>4</sub> emissions inventory for the Oil and Natural Gas sector in New York State that can be used to assess the impacts of methane mitigation strategies

Objective 1: Assess NYS's existing Oil and Natural Gas sector CH<sub>4</sub> emissions inventory

Objective 2: Perform a literature review of CH<sub>4</sub> emissions accounting methodologies and associated analyses and studies

Objective 3: Develop an updated CH<sub>4</sub> emissions accounting methodology for NYS

Objective 4: Implement the methodology to create an updated CH<sub>4</sub> emissions inventory for the Oil and Natural Gas sector in NYS

# The Project Team

- The project team included Abt Associates, EERA and NYSERDA.



- A Project Advisory Committee (PAC) provided oversight and guidance throughout the project. The PAC members included the NYS Department of Environmental Conservation, the NYS Department of Public Service, the Environmental Defense Fund, the US Environmental Protection Agency and Colorado State University.

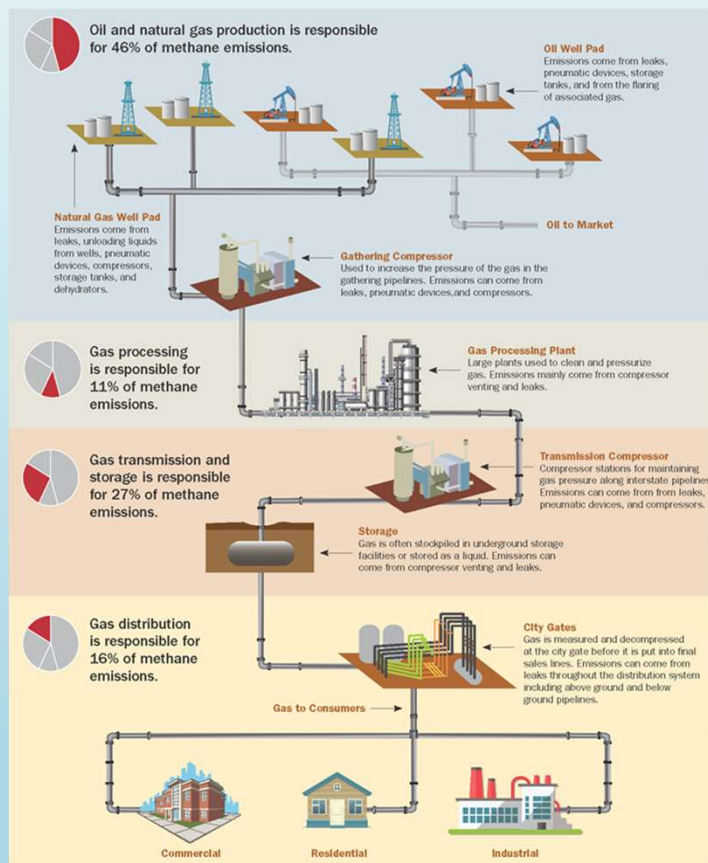


# Characterization of NYS O&G Sector



DRAFT

# Key Terminology: Oil and Natural Gas Supply Chain



Upstream

Exploration  
Production  
Gathering and Boosting

Midstream

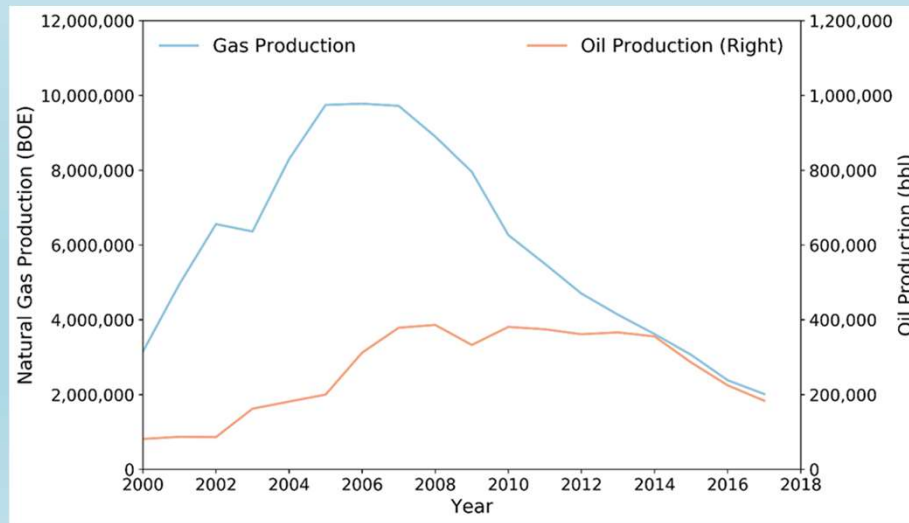
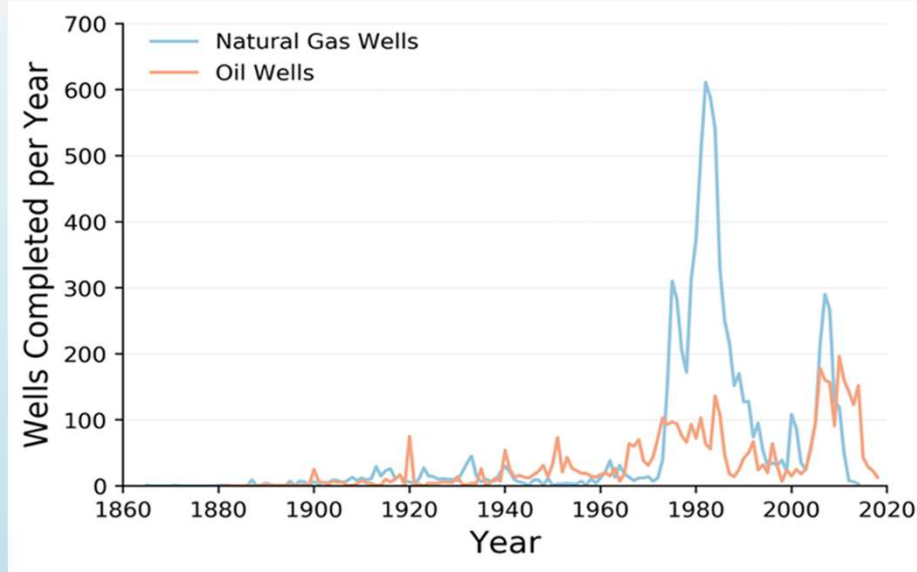
Processing  
Transmission  
Underground Storage  
LNG Import/Export  
LNG Storage

Downstream

Distribution Pipelines  
Meters  
Beyond-the-Meter

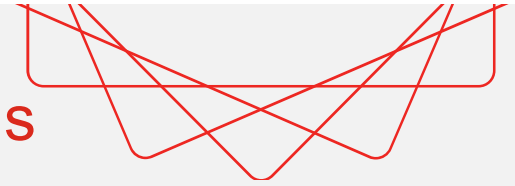


# Historical Production Data

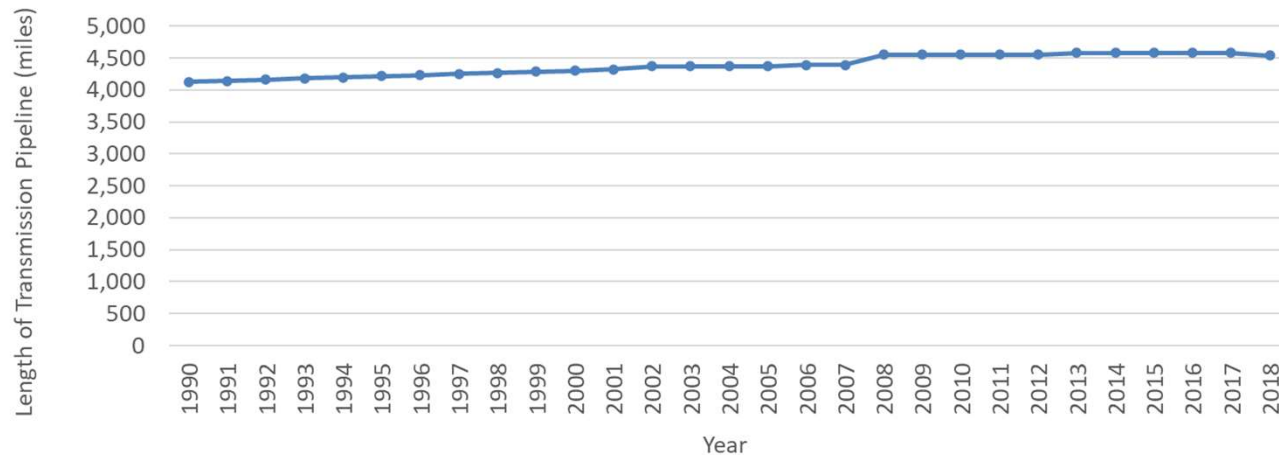


Both oil and natural gas well completions and production in NYS have declined significantly since 2007.

# Transmission Pipeline and Compressor Stations



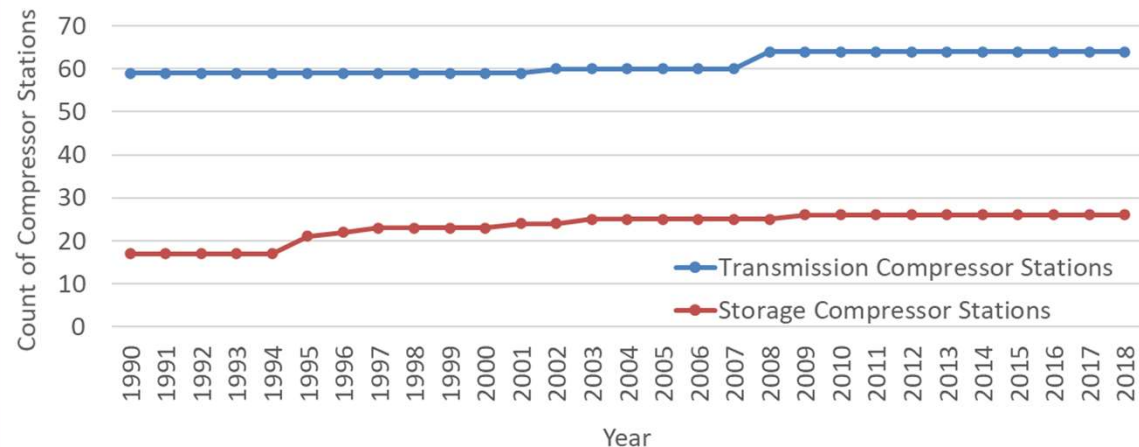
Length of Transmission Pipeline in New York State (miles)



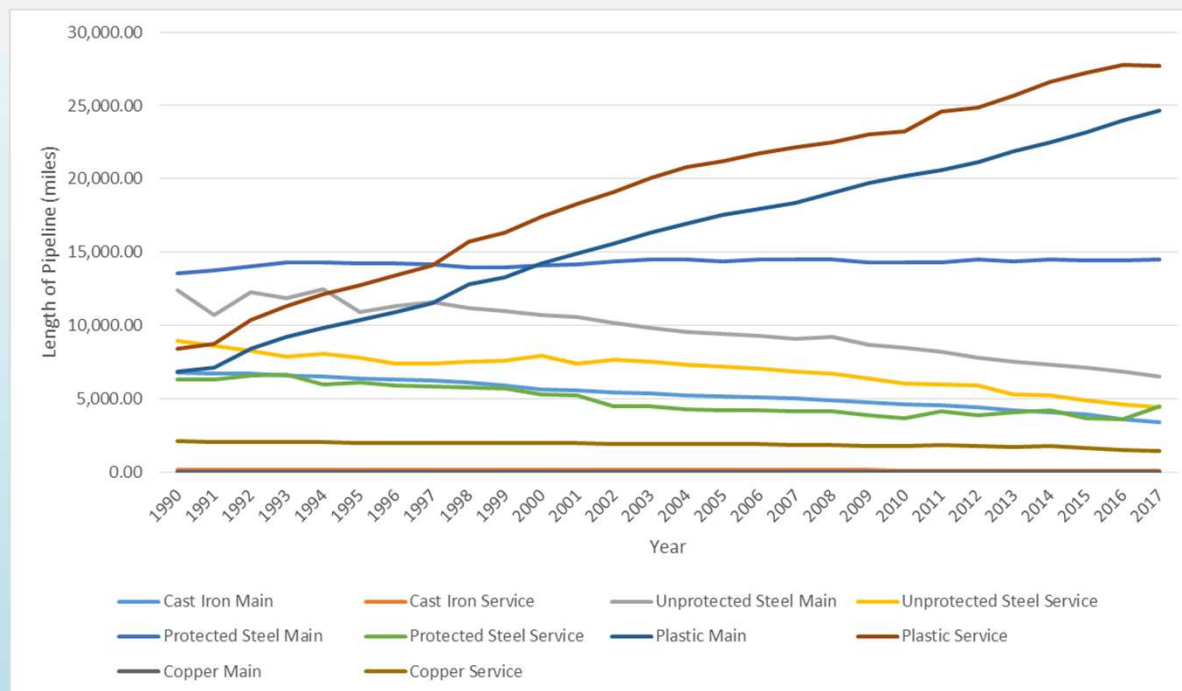
Transmission pipelines increased slightly from 1990-2008 and have remained almost constant since 2008.

Transmission and storage compressor stations have remained constant since 2009, with only a few stations added since 1990.

Count of Natural Gas Compressor Stations in New York State



# Distribution Pipelines and Meters

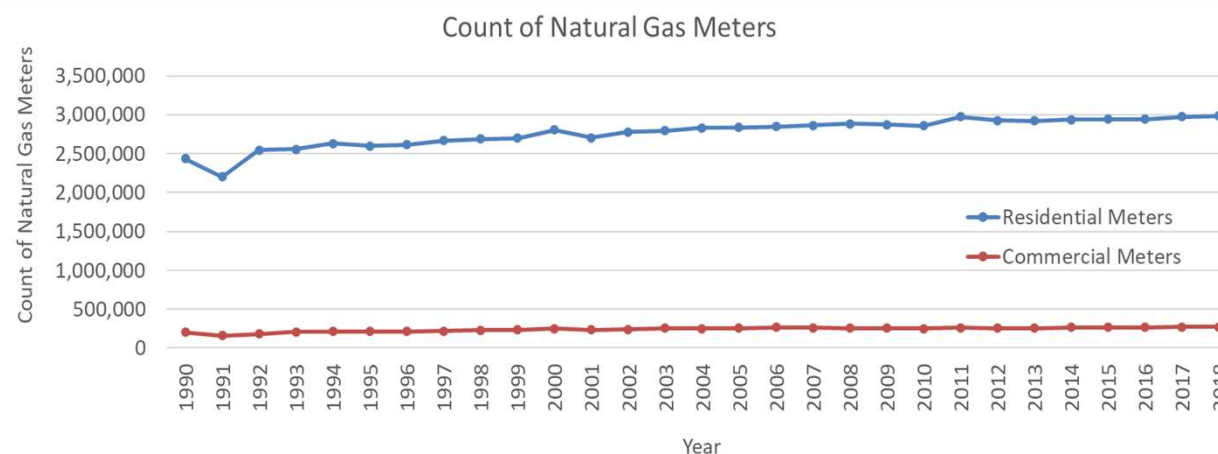


Plastic Service  
Plastic Main

Protected Steel Main

Trend of plastic  
replacing cast iron  
and unprotected  
steel

Natural gas meters have increased since 1990, reflecting the expansion of the natural gas system as well as population growth.



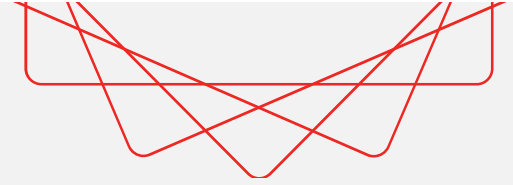


# Objectives 1 and 2: Inventory Development Best Practices and Literature Review

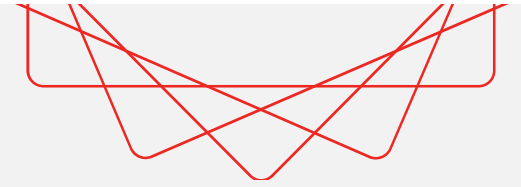


DRAFT

# Best Practices for State Methane Inventory Development



- Developing a bottom-up (BU), activity-driven, component-level CH<sub>4</sub> emissions inventory for NYS that includes:
  - Appropriately scaled activity data;
  - State-of-the-science emissions factors (EFs);
  - Geospatial resolution of activities and emissions;
  - Application and reporting of uncertainty factors, including high-emitting sources;
  - Use of most recent IPCC Assessment Report values (AR5) and long-term (GWP<sub>100</sub>) and short term (GWP<sub>20</sub>) GWP factors in addition to AR4 GWP factors



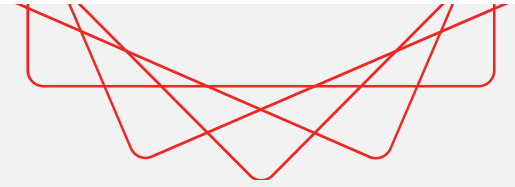
# Key Findings from Literature Review

- Five considerations resulting from the literature review:
  1. The importance of an activity-based component-level analysis
  2. Using region-specific EFs provides the most accurate results
  3. Geospatial allocation of emissions is important for planners and regulators to identify hotspots, and to link emissions inventories with chemical fate and transport and health models
  4. Estimating emissions involves uncertainty, stressing the need to incorporate uncertainty analysis into the emissions inventory methodology
  5. There is a clear and pressing need to consider high-emitting sources, their causes, and the role that they play in overall emissions inventories

# Objective 3: Methodology for the Updated CH<sub>4</sub> Emissions Inventory



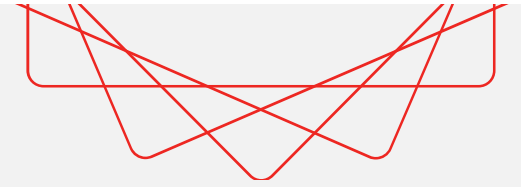
DRAFT



# Overview of Methodology

- Informed by the literature review and guided by identified best practices, an emissions estimation methodology was developed for generating a geospatially resolved, bottom-up CH<sub>4</sub> emissions inventory for the Oil and Natural Gas sector for NYS for 1990 to 2018
- General equation for emissions estimation:  $E = A \times EF$
- Documentation of each source included:
  - Source category description
  - A discussion of EFs
  - A discussion on activity data
  - Geospatial data and allocation methodologies
  - Sample calculations
  - Limitations and uncertainties
  - Potential areas of improvement
- To learn more, please see the New York State Oil and Gas Sector Methane Emissions Inventory report documenting the methodology and results.  
<https://www.nyserda.ny.gov/About/Publications/EA-Reports-and-Studies/Greenhouse-Gas-Inventory>





# Emissions Factor Confidence

- Four metrics should be used to evaluate EFs
  - **Geography** - EFs that most closely reflect local conditions will result in the most robust estimates
  - **Recency** – EFs should represent the current state of the industry
  - **Study methodology** - empirical observations of EFs represent best available practices
  - **Publication status** – peer-reviewed literature represents the best available data
- Each metric should be presented equally and independently

# Objective 4: Updated Oil and Natural Gas CH<sub>4</sub> Emissions Inventory



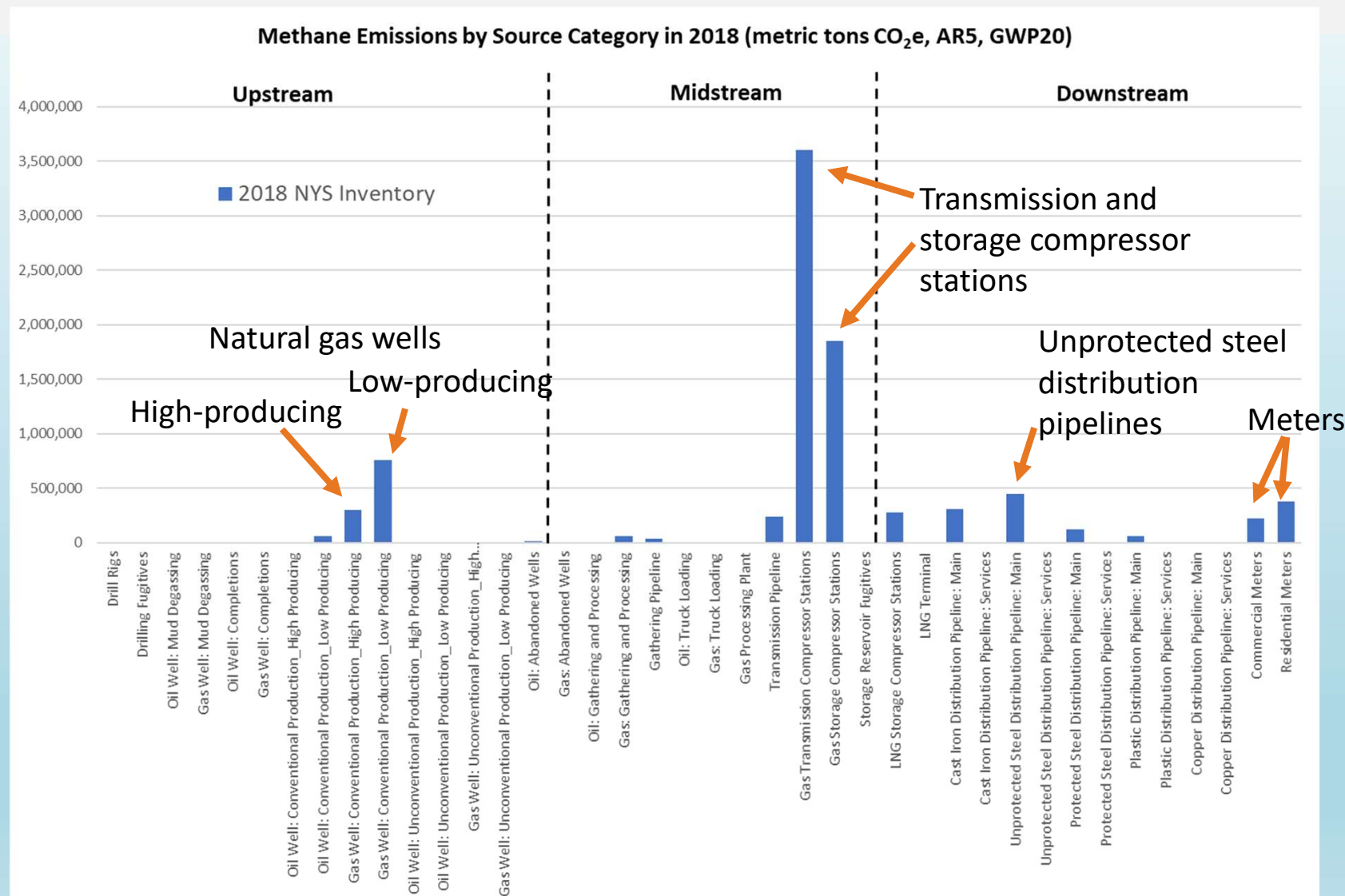
DRAFT

# Overview of 2018 Emissions Inventory

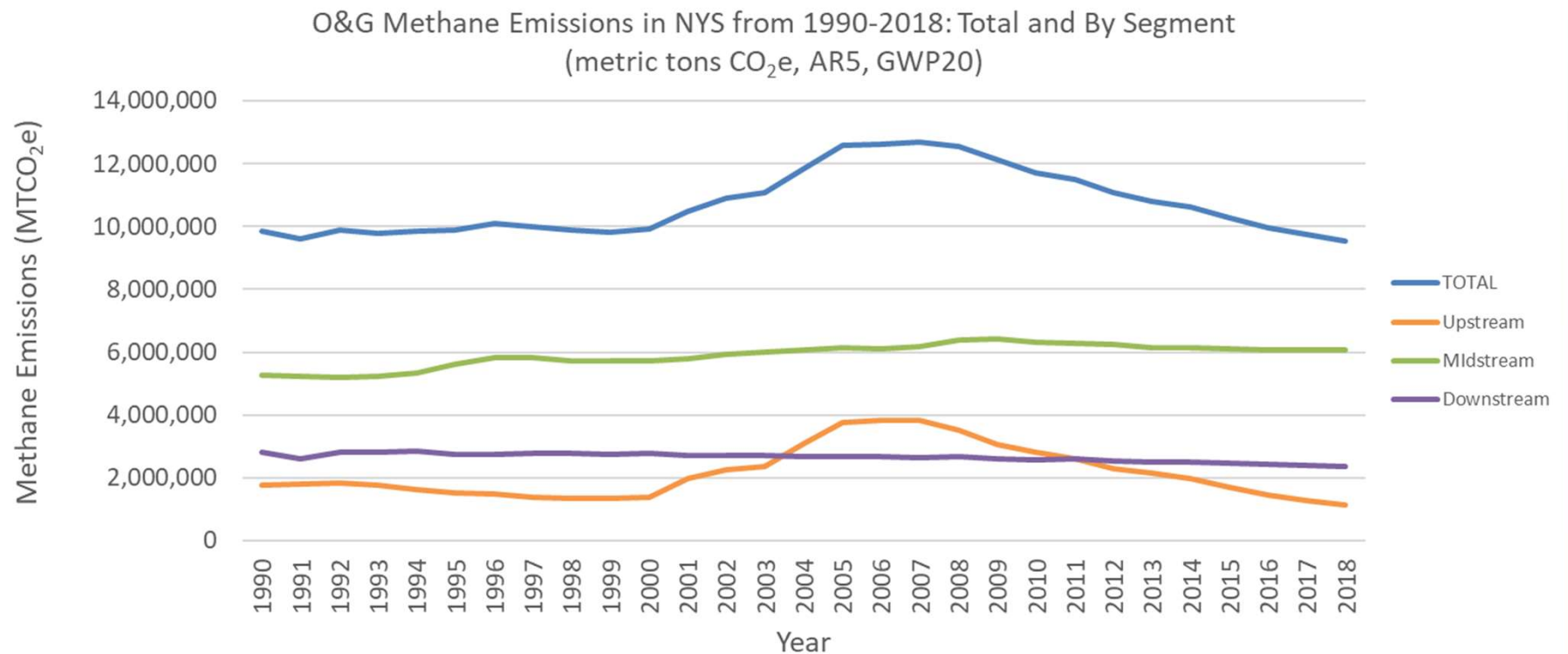


- The methodology developed under Objective 3 was implemented to develop a CH<sub>4</sub> emissions estimation tool in Microsoft Excel for generating a geospatially resolved, bottom-up CH<sub>4</sub> emissions inventory for the Oil and Natural Gas sector for NYS for 1990 to 2018
- CH<sub>4</sub> emissions from oil and natural gas activity in NYS in 2018 totaled 113,635 metric tons (MT) CH<sub>4</sub>, equivalent to 9,545,320 MTCO<sub>2</sub>e (AR5 GWP<sub>20</sub>)

# Methane Emissions in 2018 NYS Inventory

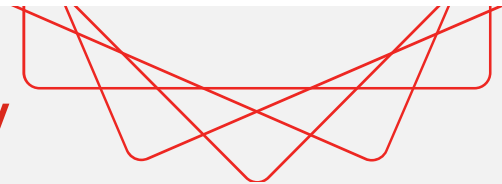


## O&G Methane Emissions in NYS from 1990 to 2018



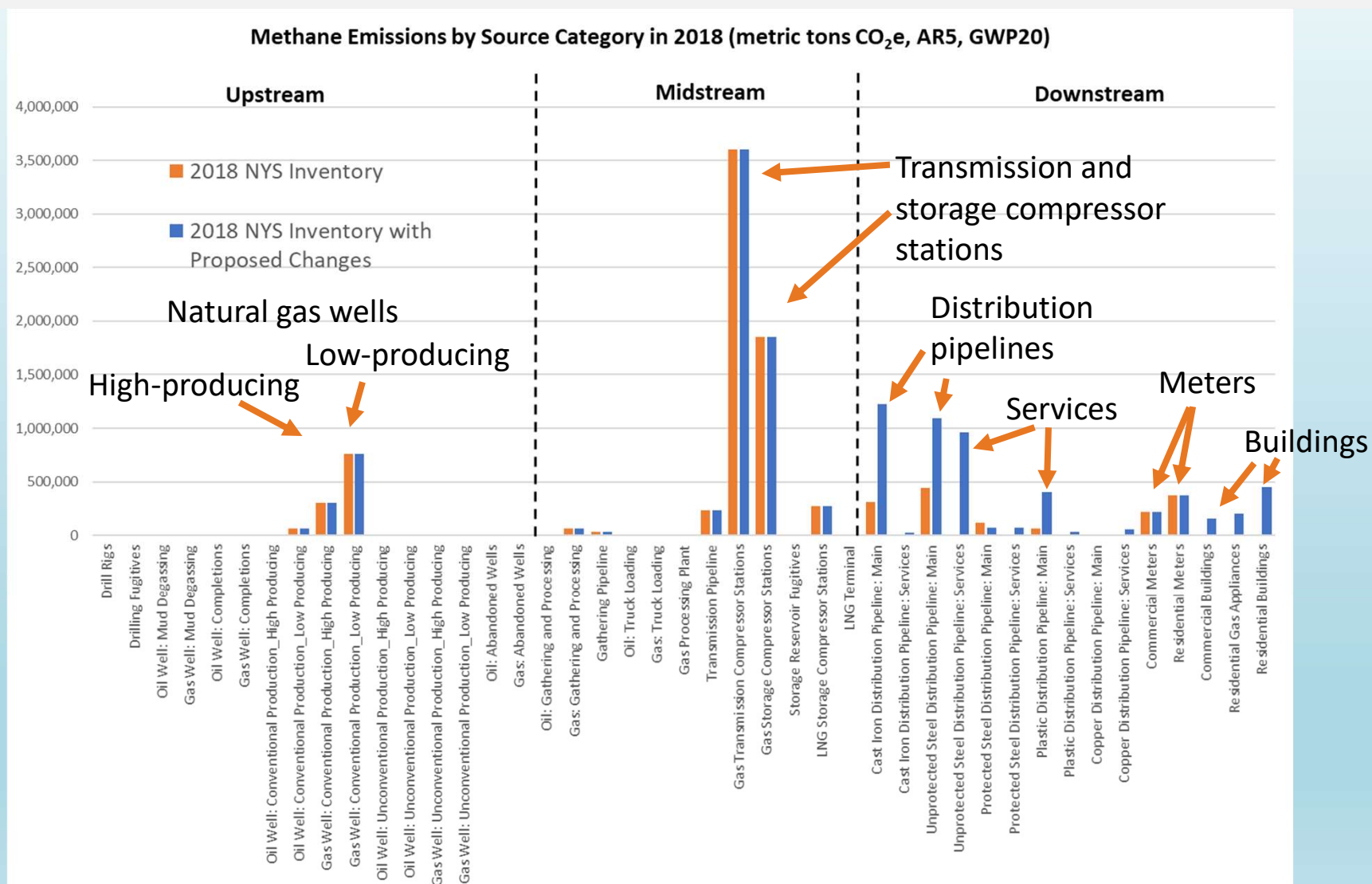


# Proposed Updates to the 2018 Inventory

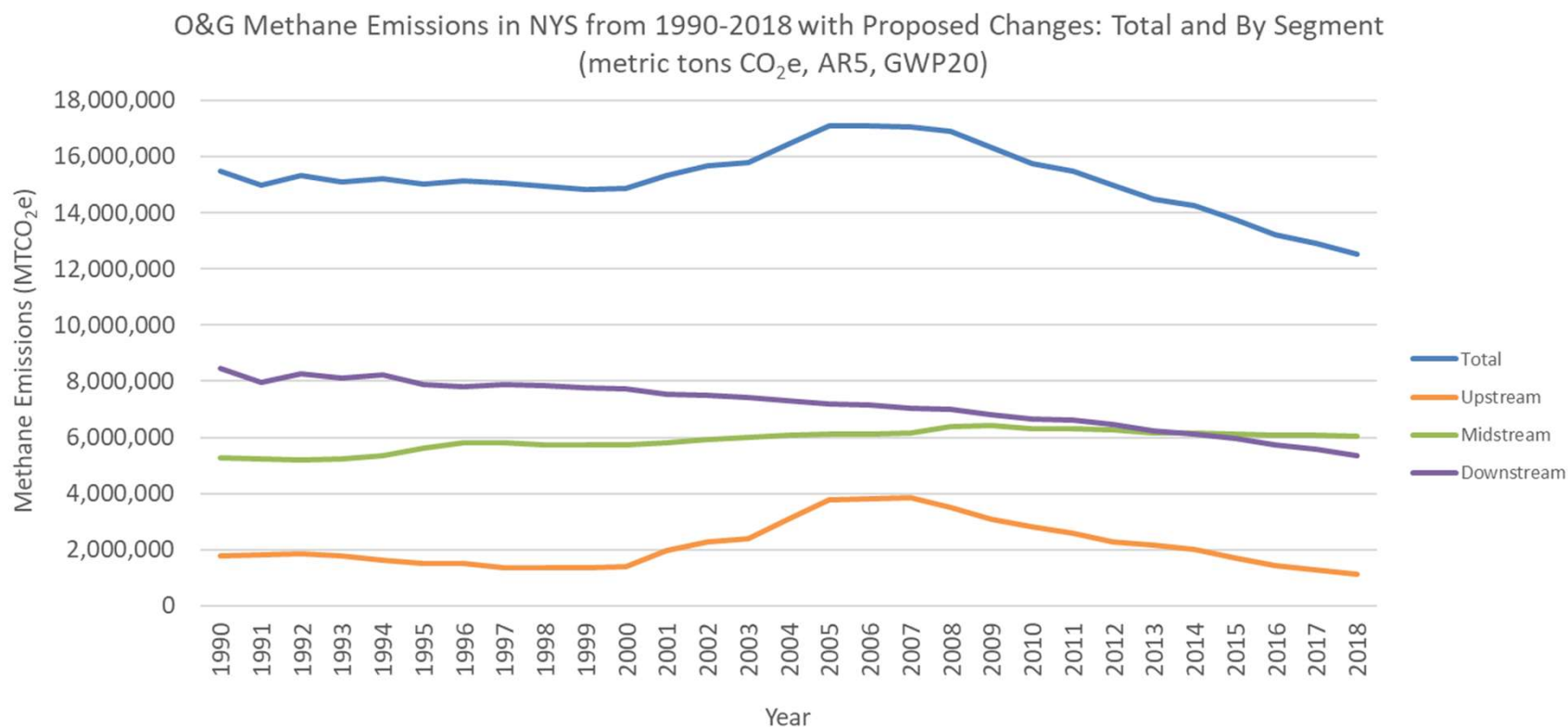


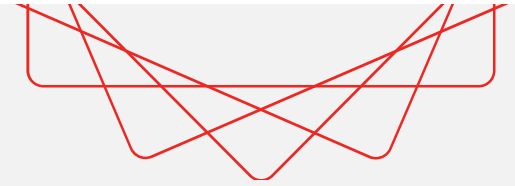
- Updating the emissions factors for distribution pipeline mains and services
  - Comparison of the draft 2018 inventory emissions to methane emissions reported to the GHGRP by utilities revealed that the 2018 emissions factors are inconsistent with those that NYS utilities are using to estimate emissions for the GHGRP (EPA FLIGHT Tool <https://ghgdata.epa.gov/ghgp>)
- Adding beyond-the-meter methane sources
  - New research came out that enabled the addition of beyond-the-meter estimates for residential buildings, commercial buildings and residential natural gas appliances. These estimates should be included to improve the completeness of the inventory.
    - Assessment of Fugitive Emissions from the Natural Gas System – Commercial Buildings, May 2020 <https://ww2.energy.ca.gov/2020publications/CEC-500-2020-035/CEC-500-2020-035.pdf>
    - Natural Gas Methane Emissions from California Homes, August 2018 <https://ww2.energy.ca.gov/2018publications/CEC-500-2018-021/CEC-500-2018-021.pdf>

# 2018 Emissions Inventory with Proposed Changes



# O&G Methane Emissions in NYS from 1990 to 2018 with Proposed Updates





## Key Takeaways

- The 2018 inventory incorporates findings from the most current empirical research and utilizes the most accurate, current and inventory-appropriate available data sources
- Largely driven by decreases in high-producing well activity, and transition away from more leak-prone cast iron and unprotected steel pipelines to plastic, total CH<sub>4</sub> emissions have continued to decline since 2007
- Implementing the proposed updates to the distribution pipeline emissions factors and adding beyond-the-meter sources strengthens the inventory by aligning data with utility reported data and by improving inventory completeness.
- To learn more, please see the New York State Oil and Gas Sector Methane Emissions Inventory report documenting the methodology and results.

# Contact Information

**Macy Testani**

Macy.Testani@nyserda.ny.gov

**James Wilcox**

James.Wilcox@nyserda.ny.gov





# Appendix: Additional Slides



DRAFT

# O&G Methane Emissions in NYS from 1990 to 2018

	1990	1995	2000	2005	2010	2015	2018
<b>Original</b>							
Upstream	1,784,833	1,515,236	1,397,699	3,779,415	2,810,672	1,682,158	1,135,980
Midstream	5,255,043	5,632,734	5,736,595	6,129,112	6,310,548	6,104,889	6,057,125
Downstream	2,816,779	2,737,762	2,771,160	2,670,797	2,583,680	2,475,878	2,352,215
<b>Total</b>	<b>9,856,655</b>	<b>9,885,731</b>	<b>9,905,454</b>	<b>12,579,324</b>	<b>11,704,900</b>	<b>10,262,926</b>	<b>9,545,320</b>
<b>With Proposed Changes</b>							
Upstream	1,784,833	1,515,236	1,397,699	3,779,415	2,810,672	1,682,158	1,135,980
Midstream	5,255,043	5,632,734	5,736,595	6,129,112	6,310,548	6,104,889	6,057,125
Downstream	8,442,137	7,876,237	7,737,901	7,207,555	6,635,045	5,952,143	5,353,178
<b>Total</b>	<b>15,482,014</b>	<b>15,024,206</b>	<b>14,872,194</b>	<b>17,116,081</b>	<b>15,756,265</b>	<b>13,739,190</b>	<b>12,546,283</b>

# Comparison of Updated O&G Methane Emissions in NYS to the Original Inventory (without updates)

