



# **Methane and the Natural Gas Sector: Emissions, Mitigation Opportunities, Programs and Policies**

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# Outline

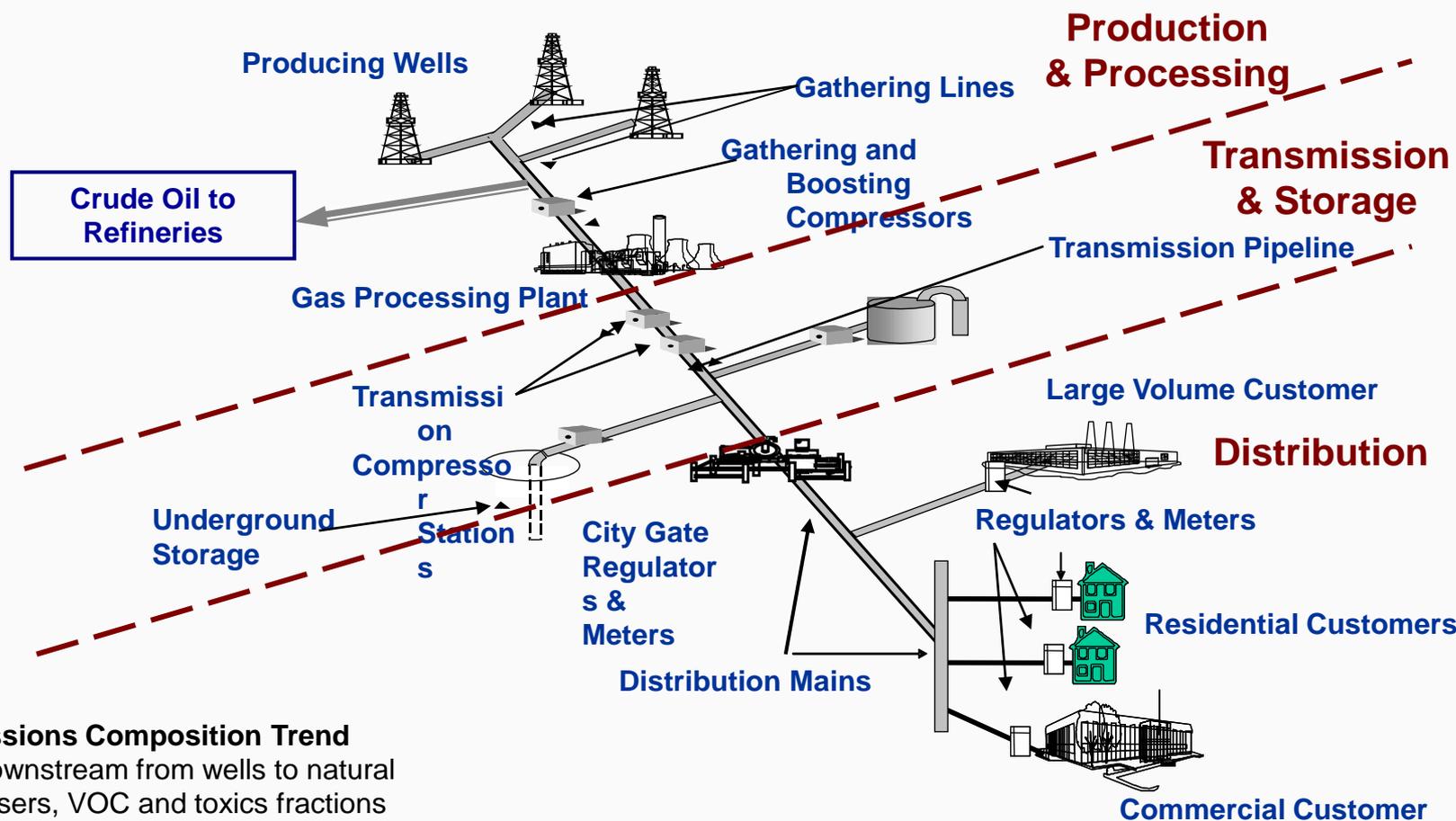
- Emissions
  - National GHG Inventory
  - Greenhouse Gas Reporting Program (GHGRP)
- Mitigation Technologies and Opportunities
- Programs and Policies
  - CAA - New Source Performance Standards
  - Natural Gas STAR Program
  - Global Methane Initiative
  - Climate and Clean Air Coalition



# Framing the Issue

- Methane is important
  - Potent greenhouse gas (GWP = 25) - most important short-lived forcer—based on emissions, accounts for >1/3 of current anthropogenic forcing
  - Ozone precursor - effects background ozone levels
  - Clean energy source - primary component of natural gas
- Natural gas regarded as an important element in climate mitigation scenarios
  - Clean combustion : lower CO<sub>2</sub>-SO<sub>2</sub>-PM emissions compared to coal
- Advancements in drilling and extraction operations provided opportunities to extract natural gas from shale formations
- Projected growth in natural gas demand has also drawn attention to methane losses and possible climate impacts
- Methane leaks and losses can be controlled and minimized and there are a number of existing technologies, programs and policies in place

# Oil and Natural Gas Industry

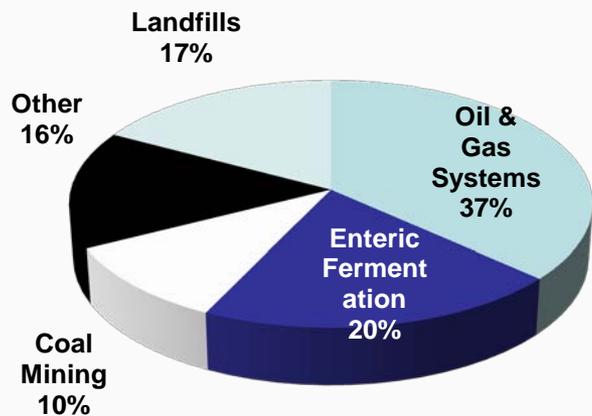


## Emissions Composition Trend

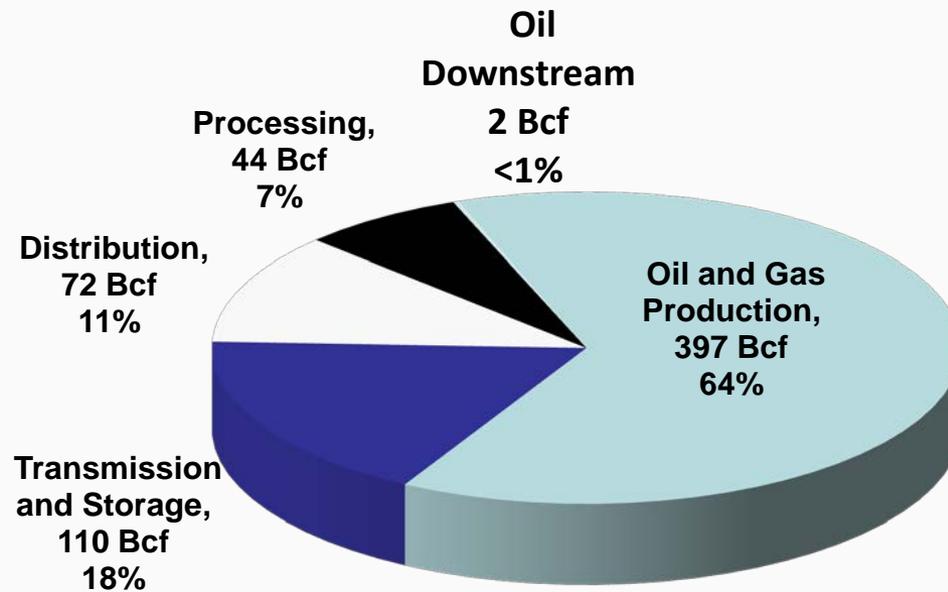
Moving downstream from wells to natural gas end users, VOC and toxics fractions generally decrease, while methane fraction increases to about 95%.



# U.S. Methane Emissions (2009)



**672 MMTCO<sub>2</sub>e – 10% of Total US GHG Emissions**



**252 MMTCO<sub>2</sub>e or 624 Bcf = billion cubic feet**

EPA. *Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990 – 2009*. April, 2011. Available on the web at: [epa.gov/climatechange/emissions/usinventoryreport.html](http://epa.gov/climatechange/emissions/usinventoryreport.html).



# Updates to Natural Gas Estimates (1990-2009)

- Emissions increased 31.4 MMTCO<sub>2</sub>, or 17%, from 1990-2009
  - Key driver of increase is increased production
- EPA did not make changes to the 1990-2010 Inventory
  - Same methodologies, emission factors, sources of activity data as 1990-2009
  - Ongoing review of information and data received
- Several changes made in 1990-2009 Inventory published last year
  - Increased calculated emissions to 120% of the previous Inventory
  - Main contributors to increase were improvements to estimates for gas well clean ups, condensate storage tanks, and centrifugal compressor seals
- Included emissions from gas wells with hydraulic fracturing for the first time
  - Used emission factor first published in the GHG Reporting Program, Subpart W TSD
  - New factor based on four recent data sources containing over 1000 data points
    - Includes direct industry estimates of emissions captured with reduced emission completions.
    - Data are representative, includes both low (e.g., CBM) and higher pressure wells
  - Previous inventories based on assumptions used in the EPA-GRI study (based on data from 1992) when hydraulically fractured gas wells were not as common



# Inventory Improvements Under Consideration

- Evaluate additional data on emissions reductions
  - Gas well cleanups
  - Regulatory reductions from well completions
- Improvements to estimates of emissions from hydraulic fracturing
  - Revisit the estimates for workover frequency
- Evaluation of Data
  - Data collected through EPA's Greenhouse Gas Reporting Program
  - Relevant information provided by industry during NSPS and inventory comment periods
- Improvements to the documentation of the Inventory.
  - More detailed tables on emission factors and activity data
  - More information on calculation methodologies



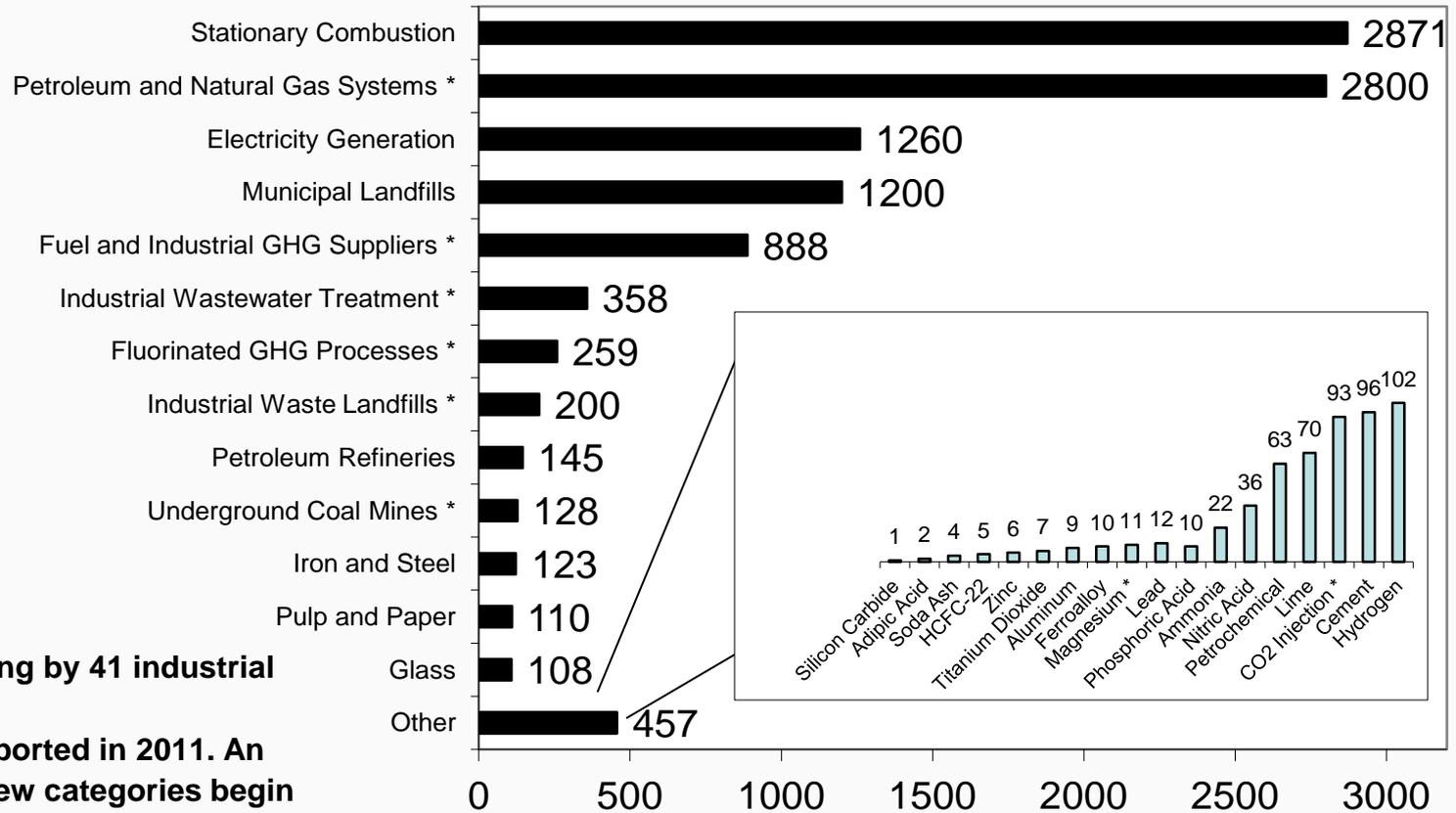
# Greenhouse Gas Reporting Program

## Purpose of 40 CFR Part 98

- Part 98 requires reporting of greenhouse gas (GHG) emissions and other relevant information from certain source categories in the United States
  - Better understand relative emissions of specific industries, and of individual facilities within those industries
  - Better understand factors that influence GHG emission rates and actions facilities could take to reduce emissions
- Does not require control of GHG emissions



# Program Coverage



- Requires reporting by 41 industrial categories.
- 29 categories reported in 2011. An additional - 12 new categories begin reporting in 2012.
- Approximately 10,000 U.S. Facilities Covered

\* Approximate (first reports due Sep 2012)



## Petroleum and Natural Gas - Subpart W

- Reporting is required by facilities that emit GHGs  $\geq 25,000$  metric tons carbon dioxide equivalent (CO<sub>2</sub>e) per year
- First reports due in September 2012
- Industry segments covered:
  - Offshore petroleum and natural gas production
  - Onshore petroleum and natural gas production\*
  - Onshore Natural gas processing facilities
  - Onshore Natural gas transmission compression
  - Underground natural gas storage
  - Liquefied natural gas (LNG) storage
  - LNG import and export equipment
  - Natural gas distribution\*

\* Due to their unique characteristics, the facility definition for onshore petroleum and natural gas production and natural gas distribution differs from the definition of facility in subpart A.



# Non-CO<sub>2</sub> Greenhouse Gas Emissions Projections and Mitigation Estimates

- EPA has developed emissions projections and mitigation estimates for the U.S. and all global regions
- First domestic focused report was published in 1999 and has been updated several times
- Latest iteration is a global report that includes U.S. emissions and mitigation estimates
  - Global Anthropogenic Non-CO<sub>2</sub> Greenhouse Gas Emissions: 1990-2030. (EPA 430-D-11-003)
    - Compiled using UNFCCC National Communications and IPCC Tier 1 Methodologies
  - Global Mitigation of Non-CO<sub>2</sub> Greenhouse Gases Report (June 2006)
  - Global Mitigation of Non-CO<sub>2</sub> Greenhouse Gases Report (DRAFT - March 2012)
    - Mitigation estimates calculated via a bottom-up engineering cost analysis
    - Based on sector specific engineering and cost studies
    - Supplemented with U.S. Greenhouse Gas Voluntary Program partner reported data

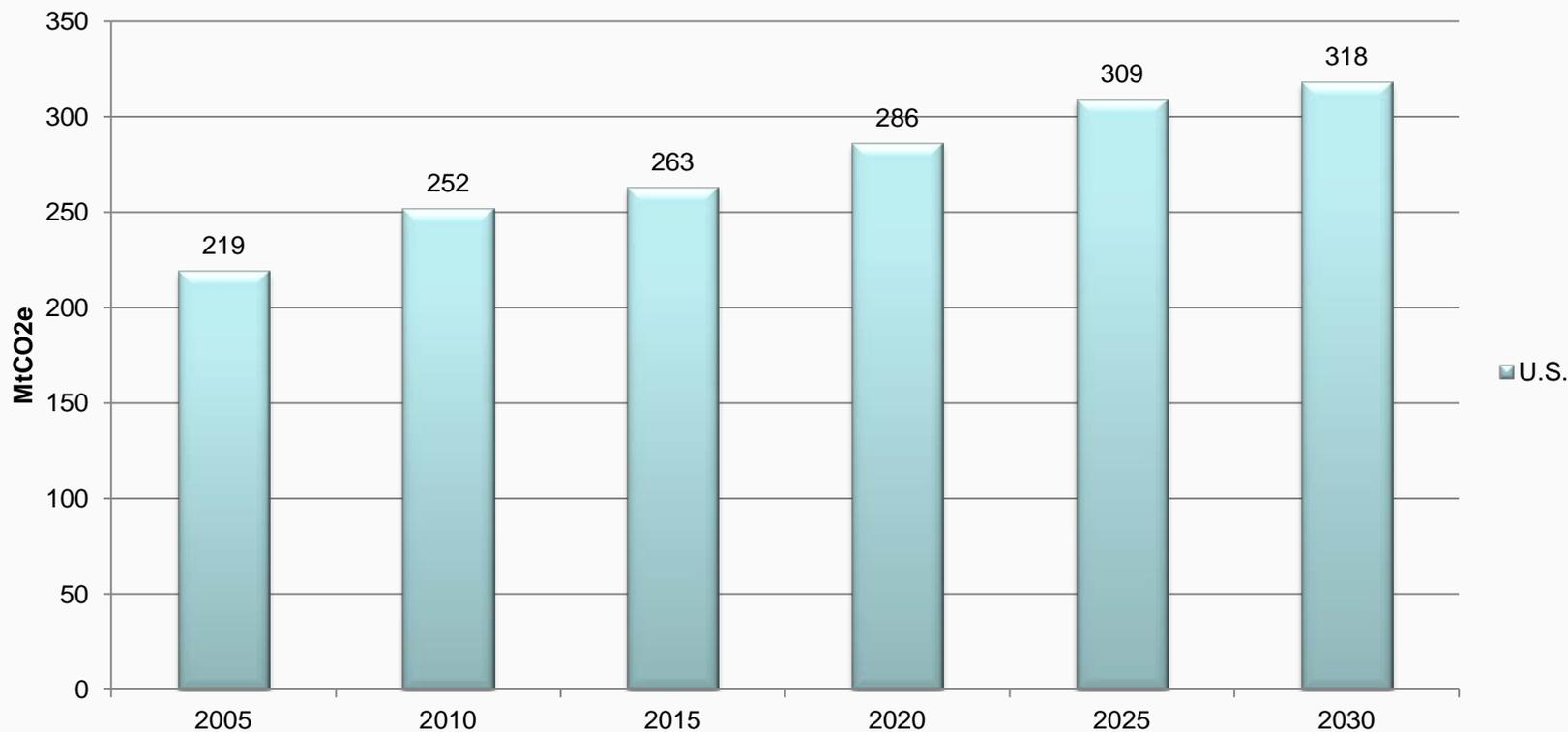


# Non-CO<sub>2</sub> Greenhouse Gas Emissions and Mitigation from Oil and Natural Gas Systems

- Annual U.S. emissions are projected to grow to 318 MtCO<sub>2</sub>e by 2030
- There are numerous abatement measures applicable to the production, processing, transmission, and distribution natural gas and oil, including many that are cost effective now
- 2006 report estimated that the U.S. cost-effective abatement potential in 2020 for CH<sub>4</sub> from the oil and gas sector was approximately 15% of the baseline – updated analysis expected this Fall



# Emissions Projections from Oil and Natural Gas Systems 2005-2030



Source: Global Anthropogenic Non-CO<sub>2</sub> Greenhouse Gas Emissions: 1990-2030. U.S. EPA, 2011.



## EPA's NSPS and NESHAP for Oil and Gas

- Updates standards issued in 1985 and 1999
- Continues growth in clean domestic energy production, while increasing environmental protection
  - Reduce emissions of smog-forming VOCs, air toxics, and methane (co-benefit)
- Relies on available, affordable technology already in use
- Offsets the cost of pollution controls through the capture of emissions
- Provides flexibility and transparency

*“[I]t is vital that we take full advantage of our natural gas resources, while giving American families and communities confidence that natural and cultural resources, air and water quality, and public health and safety will not be compromised.”*

*Executive Order Supporting Safe and Responsible  
Development of Unconventional Domestic Natural Gas Resources  
signed by President Obama on April 13, 2012*



# Reducing Pollution from Well Completions

- Rules **will reduce pollution** from natural gas wells that are hydraulically fractured, **without slowing production**.
- The rules **phase in requirements for capturing natural gas**. This phase-in provides time for equipment to be manufactured and operators to be trained to capture gas through a process known as a “green completion.”
- Industry leaders already are using green completions as a smart business practice.
- Owners/operators of fractured and refractured wells may reduce pollution through flaring until Jan. 1, 2015; after that, gas capture is required.
- Wells that are refractured will not be considered affected facilities if they use green completions and meet recordkeeping/reporting requirements as of the effective date of the rule.
- Exploratory, delineation and low-pressure wells are exempt from green completion requirements; will have to flare.
- EPA streamlined **well completion notification and reporting requirements** to reduce burden to industry and states, while ensuring transparency and accountability.



*Example of Green Completion Equipment  
(Source: Weatherford)*



*A natural gas well site. EPA photo.*



# Additional Requirements to Reduce Pollution

Today's rules also set requirements for several types of equipment that may vent or leak VOCs or air toxics.

## Storage tanks

- EPA is phasing in requirements to reduce VOC emissions from new & modified tanks over one year, to ensure enough combustion devices are available to reduce the emissions.
- Requirement applies to both oil and natural gas production.
- EPA did not change air toxics standards for storage tanks; however emissions storage tanks in natural gas production sector will be counted toward determining a major source under the air toxics standards for oil & natural gas production.

## Centrifugal compressors

- VOC reduction required for compressors with wet seal systems only; requirements do not apply in the natural gas transmission and storage segments

## Reciprocating compressors

- Rule requires replacement of rod packing, which can leak VOCs as it wears.
- Rule provides an alternative schedule for rod packing replacement that does not require monitoring and documentation of operating hours.



*A combustion device and storage tanks. EPA photo*



## Additional Requirements, cont.

### Pneumatic controllers

- Used to regulate conditions such as pressure and temperature.
- Rule affects high-bleed controllers, allows use only for critical applications, such as emergency shutoff valves.
- Requirements apply to controllers used in both oil and gas sectors; (in natural gas sector, applies only to sources upstream of the transmission line).

### Glycol dehydrators

- Covered under two air toxics standards (oil and natural gas production; natural gas processing plants)
- Both standards retain existing standards for large dehydrators at major sources, set new standards for small dehydrators (not “area sources.”)

### Leaks from valves at gas processing plants

- Strengthened requirements for detection and repair for VOCs and air toxics.

### Sweetening units at natural gas processing plants

- Must reduce sulfur dioxide emissions by 99 percent



*Glycol dehydrators at a well production pad.  
EPA photo*



## Cost Savings and Emissions Reductions

- The rules will yield a cost savings of **\$11 to \$19 million** in 2015, because the value of natural gas and condensate that will be recovered and sold will offset costs.
- EPA estimates the following combined annual emission reductions when the rules are fully implemented :
  - **VOCs**: 190,000 to 290,000 tons
  - **Air toxics**: 12,000 to 20,000 tons
  - **Methane**: 1.0 to 1.7 million short tons (about 19 to 33 million tonnes of CO<sub>2</sub> equivalent (CO<sub>2</sub> e))



# Natural Gas STAR Program

- Started in U.S. in 1993, expanded internationally in 2006
- Over 120 domestic and 14 international partners have
  - Identified over 50 cost effective technologies and practices to reduce methane emissions
  - Reported saving over 990 BCF of natural gas, valued at over \$7.2 billion



bp



ExxonMobil

devon



ConocoPhillips



TransCanada  
*In business to deliver*



# Global Methane Initiative (GMI)

- GMI is a voluntary, multilateral partnership that aims to reduce methane emissions and to advance the abatement, recovery and use of methane as a clean energy source.
  - Began in 2004 (as the Methane to Markets Partnership)
  - Targets methane from Ag, Coal mines, Landfills, Oil & Gas, & Wastewater
- Grown from 14 to 40 Partner governments, plus European Commission
- Represent nearly 70% global anthropogenic methane emissions
  - Supporting over **600 projects** and activities that have reduced GHG emissions by over **128 MMTCO<sub>2</sub>E** since 2005
  - US is leveraging significant investment and engagement from the private sector – **leveraged over \$397 million**





# Climate and Clean Air Coalition

- Climate and Clean Air Coalition to Reduce Short Lived Climate Pollutants (SLCPs) - specifically to reduce methane, black carbon and HFCs –launched in February 2012.
  - Founding coalition partners: Bangladesh, Canada, Ghana, Mexico, Sweden, the United States, and the UN Environment Programme
- Working group meeting and High Level Assembly held in Stockholm (April 23, 24).
  - New partners joined: Colombia, Japan, Nigeria, Norway, European Commission and the World Bank.
  - Financial commitments from Sweden and Norway.
- Coalition will build on existing efforts and focus on activities that can be catalytic, to address SLCPs on a global scale.
- Coalition has announced five initial focal areas:
  - Methane and black carbon emissions from the municipal solid waste sector – a collaborative effort led by US, Canada, Mexico, and the World Bank
  - HFC Roundtable to focus on alternatives – led by the US
  - Black carbon emissions from diesel fuel – led by the UNEP and the US
  - **Methane emissions from the oil & gas sector – led by the US and Nigeria**
  - Black carbon emissions from brick kilns – led by Mexico



# Key Takeaways

- Methane is important
  - Climate – Air Quality – Clean Energy
- Emissions quantification is essential and helps inform mitigation strategies/management approaches
  - Quantification infrastructure is in place - GHGRP
- Methane leaks and losses can be controlled and minimized with existing technologies
- Key programs and policies in place – significant reduction opportunities remain – domestic and international