

DOE's Natural Gas Modernization Initiative

National Conference of State Legislators
Task Force on Energy Supply

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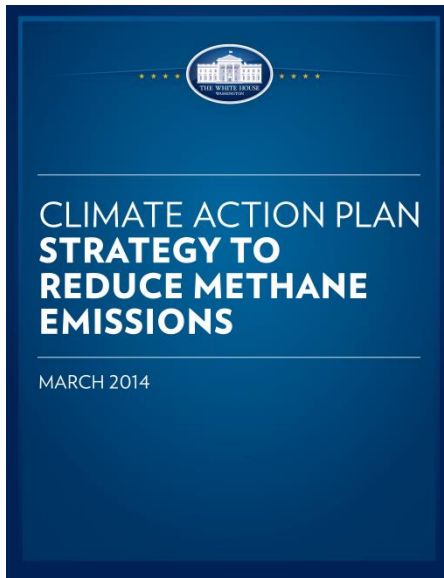
December 9, 2014



AGENDA

- President's Climate Action Plan & the Interagency Methane Strategy
- Secretary Moniz's Capstone & Roundtable Stakeholder Meetings
- DOE Natural Gas Modernization Initiative
- Fossil Energy's Natural Gas Midstream Infrastructure R&D Program
- Technology Prioritization on Reducing Methane Emissions and Enhancing Operational Efficiency
- Fossil Energy's Next Steps

INTERAGENCY METHANE STRATEGY – THREE PILLARS



President's Climate Action Plan

“Curbing emissions of methane is critical to our overall effort to address global climate change. ... To achieve additional progress, the Administration will”:

- Develop a comprehensive Interagency Methane Strategy
- Pursue a collaborative approach with state governments as well as the private sector and cover all methane emitting sectors

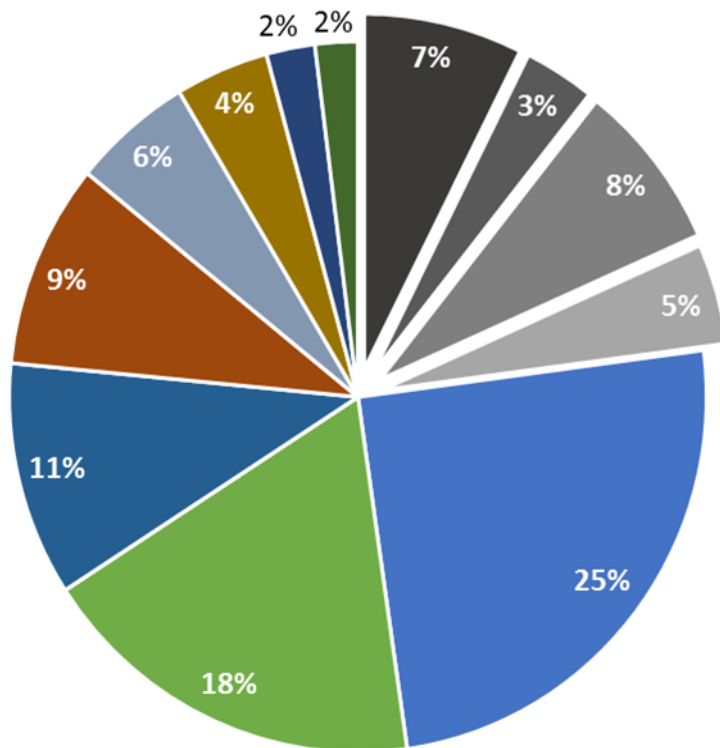
Three Pillars

Assessing current emissions data and addressing data gaps

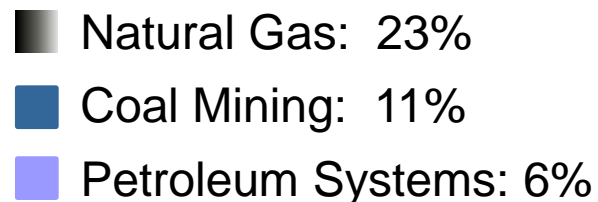
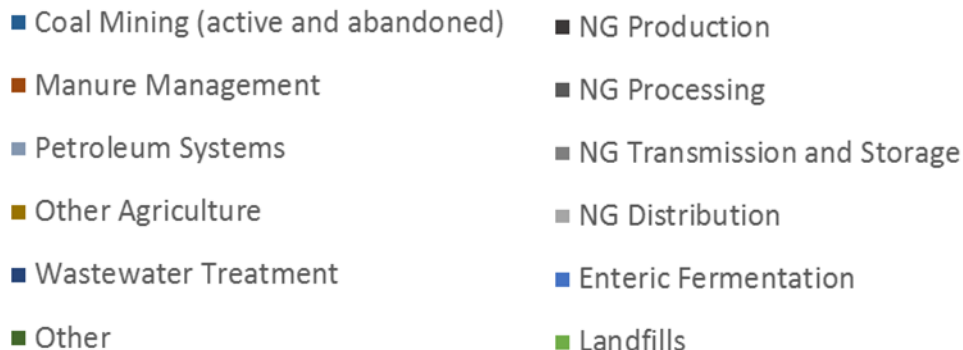
Identifying Technologies and Best Practices for Reducing Emissions

Identifying Existing Authorities and Incentive-based Opportunities for Reducing Emissions

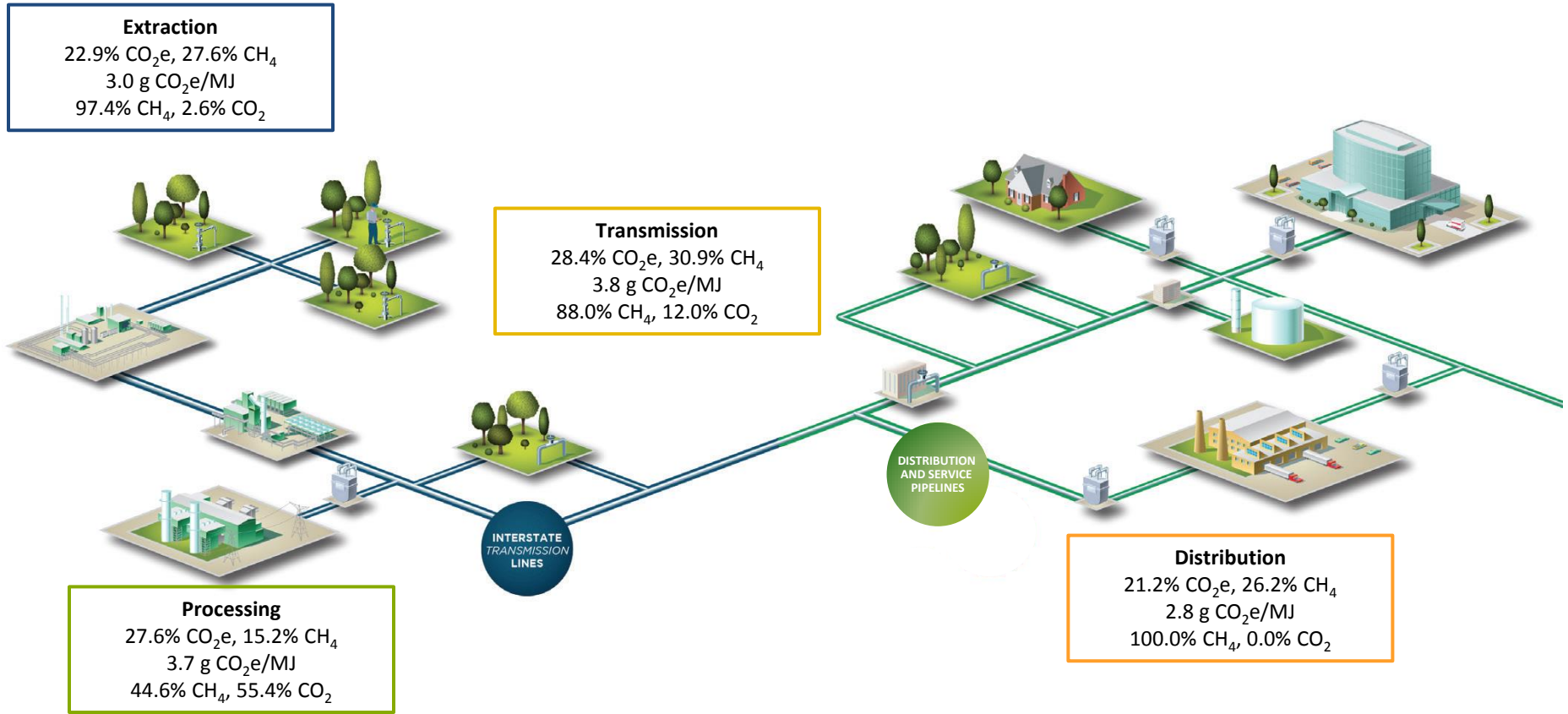
U.S. ANTHROPOGENIC METHANE EMISSIONS, 2012



- Methane emissions are 9% of total 2011 anthropogenic U.S. GHG emissions (in CO₂e)
- Current U.S. fossil fuel related methane emissions are ~ 40% of U.S. anthropogenic methane emissions



NATURAL GAS SECTOR METHANE EMISSIONS: ~57% FROM MIDSTREAM



Global Warming Potential for CH₄ is the IPCC 2013 100-yr value of 36 (fossil, feedbacks included)
 All data is from "Life Cycle Analysis of Natural Gas Extraction and Power Generation", National Energy Technology Laboratory, May 2014

SUMMARY OF WHITE HOUSE AND DOE METHANE STAKEHOLDERS JULY 29TH CAPSTONE ROUNDTABLE

- The fundamental lesson learned from the Roundtables: there is broad stakeholder support for taking action that reduces methane emissions from natural gas transmission and distribution systems.
- The drivers for action vary by stakeholder group

Save money

Promote efficiency

Promote safety

Create jobs



Dr. Ernest Moniz
Secretary of Energy

- DOE is working to address market barriers through our Natural Gas Modernization Initiative to realize these potential cost-effective greenhouse gas reductions.

DOE NATURAL GAS MODERNIZATION INITIATIVE

PATH FORWARD FROM STAKEHOLDER CAPSTONE & ROUNDTABLES 7 KEY ACTIONS

	Action	DOE Office
1	Energy Efficiency Standards for Natural Gas Compressors	EERE
2	Regulatory Incentives for Cost Recovery for Natural Gas Infrastructure Modernization	EPSA
3	Technical Partnership on Infrastructure Modernization	FE
4	Advanced Natural Gas System Manufacturing R&D Initiative	EERE-AMO
5	Pipeline Efficiency Research, Development and Demonstration Program (Midstream)	FE
6	Loan Guarantees for Advanced Fossil Energy Projects that Reduce Methane Emissions	LPO
7	Invest in Technologies for Leak Detection and Measurement	ARPA-E, FE

FOSSIL ENERGY'S NATURAL GAS MIDSTREAM INFRASTRUCTURE R&D PROGRAM

Focusing efforts on reducing methane emissions and enhancing operational efficiency

Research Opportunities & Challenges

- **External Leak Detection & Monitoring**
Identification, measurement of methane leaks
- **Pipeline Inspection & Repair**
Reduce need to evacuate gas from the pipe
- **Improve Reciprocating Compressor Performance**
Increase operating efficiency, pipeline capacity utilization; reduce emissions
- **Smart Sensors for Pipeline Operational Efficiency**
Continuous in-pipe communication of operational parameters
- **Advanced Materials Research**
Develop “Born Qualified” Pipe Materials that are Corrosion Proof, Impermeable, and Strong (Enough), and which are also Self-Monitoring and Self-Healing

TECHNOLOGY PRIORITIZATION WORKSHOP

DOE Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop November 12 & 13, 2014

Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop
November 12-13, 2014

Pipeline Safety Research, Development and Technology

Advanced Materials Manufacturing and Innovative Technologies for Natural Gas Pipeline Systems and Components

Cynthia A. Powell
Director, Office of Research & Development
November 12, 2014

Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop
Nov 2014

U.S. DEPARTMENT OF ENERGY | Fossil Energy

<http://energy.gov/eere/amo/downloads/natural-gas-infrastructure-rd-and-methane-emissions-mitigation-workshop>

LEAK DETECTION/FUGITIVE EMISSIONS MONITORING AND ADVANCED SENSORS, CONTROLS, MODELS AND PLATFORMS

Challenges and Barriers	Goals and Actions	Estimated TRL	Climate Impact	Natural Gas Losses
Pipeline Data Analytics	<ul style="list-style-type: none"> Standards for pipeline data collection/sharing/safeguarding 	5	●●○	●●○
	<ul style="list-style-type: none"> Pipeline safety/efficiency analytics 	3	●●○	●●○
Gas Pipeline Stress Sensors	<ul style="list-style-type: none"> Printed strain and emission sensors 	2-3	●●○	●○○
	<ul style="list-style-type: none"> Pipeline sensor data protocols 	3	●●○	●●○
Methane Detection	<ul style="list-style-type: none"> Lower-cost, ubiquitous methane sensing (stations, components, operations) 	3	●●●	●●○
	<ul style="list-style-type: none"> Lower-cost ubiquitous methane sensing (pipelines) 	3	●●○	●○○
	<ul style="list-style-type: none"> Autonomous detection and interpretation 	3	●●○	●●○
Emission Data Analytics	<ul style="list-style-type: none"> Methane quantification 	5	●●○	●●○
	<ul style="list-style-type: none"> Methane emission analytics 	4	●●○	●●○
	<ul style="list-style-type: none"> Smart systems to mitigate human error and maximize efficiency 	4	●●●	●●○

●○○ - Low

●●○ - Medium

●●● - High

IMPROVING COMPRESSOR SYSTEM OPERATIONAL EFFICIENCY

Challenges and Barriers	Goals and Actions	Estimated TRL	Climate Impact	Natural Gas Losses
Improve Centrifugal Transmission Compressor Operation	• Inexpensive and robust dry seals for centrifugal compressors	8-10	●●●	●●○
	• Broaden efficiency of centrifugal compressors	7	●○○	●●●
	• Improved low-friction bearings	8	●○○	●○○
Improve Reciprocal Transmission Compressor Operation	• Robust rod packing seals/coatings	7	●●●	●○○
	• Modeling of seal wear	3-5	●●○	●○○
	• Vibration control	4-5	●●○	●●○
	• Advanced ignition technology	6	●●○	●●○
	• Exhaust gas treatment or recirculation	6	●●○	●●○
Power Generation and Waste Heat Recovery	• On-site electrical power generation	3-9	●●○	Unknown
	• Turbocharger retrofits	4	●○○	●●●
Increase Compressor Station Hydraulic Efficiency	• Modeling tools for hydraulically efficient components	8	●○○	●○○
	• Hydraulic modeling for compressor systems	5	●○○	●●○
Vented Gas Mitigation	• Vent capture technology	4	●●○	●○○
	• Efficient methane conversion	2-5	●●○	●○○

●○○ - Low

●●○ - Medium

●●● - High

ADVANCED MATERIALS MANUFACTURING AND INNOVATIVE TECHNOLOGIES FOR NATURAL GAS PIPELINE SYSTEMS AND COMPONENTS

Challenges and Barriers	Goals and Actions	Estimated TRL	Climate Impact	Natural Gas Losses
Composite Pipelines	<ul style="list-style-type: none"> Processes/standards for integrity assessment and life prediction 	3-6	●●○	●○○
	<ul style="list-style-type: none"> Low-cost methods/materials for joining and tapping composite pipes 	3	●●○	●○○
Pipeline Liners	<ul style="list-style-type: none"> Conforming, high-strength liner materials 	3-6	●●●	●○○
	<ul style="list-style-type: none"> Low-cost methods/materials for tapping liners 	3-6	●●●	●○○
	<ul style="list-style-type: none"> Processes/standards for liner integrity assessment 	5	●●○	●○○
Pipeline Coatings	<ul style="list-style-type: none"> Self-healing pipeline coatings 	3	●○○	●○○
	<ul style="list-style-type: none"> Field-applicable pipeline coatings 	5	●○○	●○○
Pipeline Components	<ul style="list-style-type: none"> Live pipeline component replacement 	5	●●○	●○○
	<ul style="list-style-type: none"> Protocols for testing live-switched components 	4	●●○	●○○
	<ul style="list-style-type: none"> Advanced-geometry components for direct insertion 	3	●●○	●○○

●○○ - Low

●●○ - Medium

●●● - High

FOSSIL ENERGY NEXT STEPS

- Prioritization of research challenges from workshop and information provided from other stakeholders
- Issue DOE Request for Information (RFI) on R&D for new and innovative technologies and concepts to mitigate methane emissions. The RFI is issued solely to obtain additional information on research topics by DOE in order to develop and issue a Funding Opportunity Announcement (FOA).
- Building on the President's Climate Action Plan, it is the intent of DOE to issue a FOA with Fiscal Year 2015 Appropriations.

energy.gov/fe/science-innovation/oil-gas-research

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