DOE's Natural Gas Infrastructure Modernization R&D Program & QER

PHMSA Pipeline Advisory Committee Meetings

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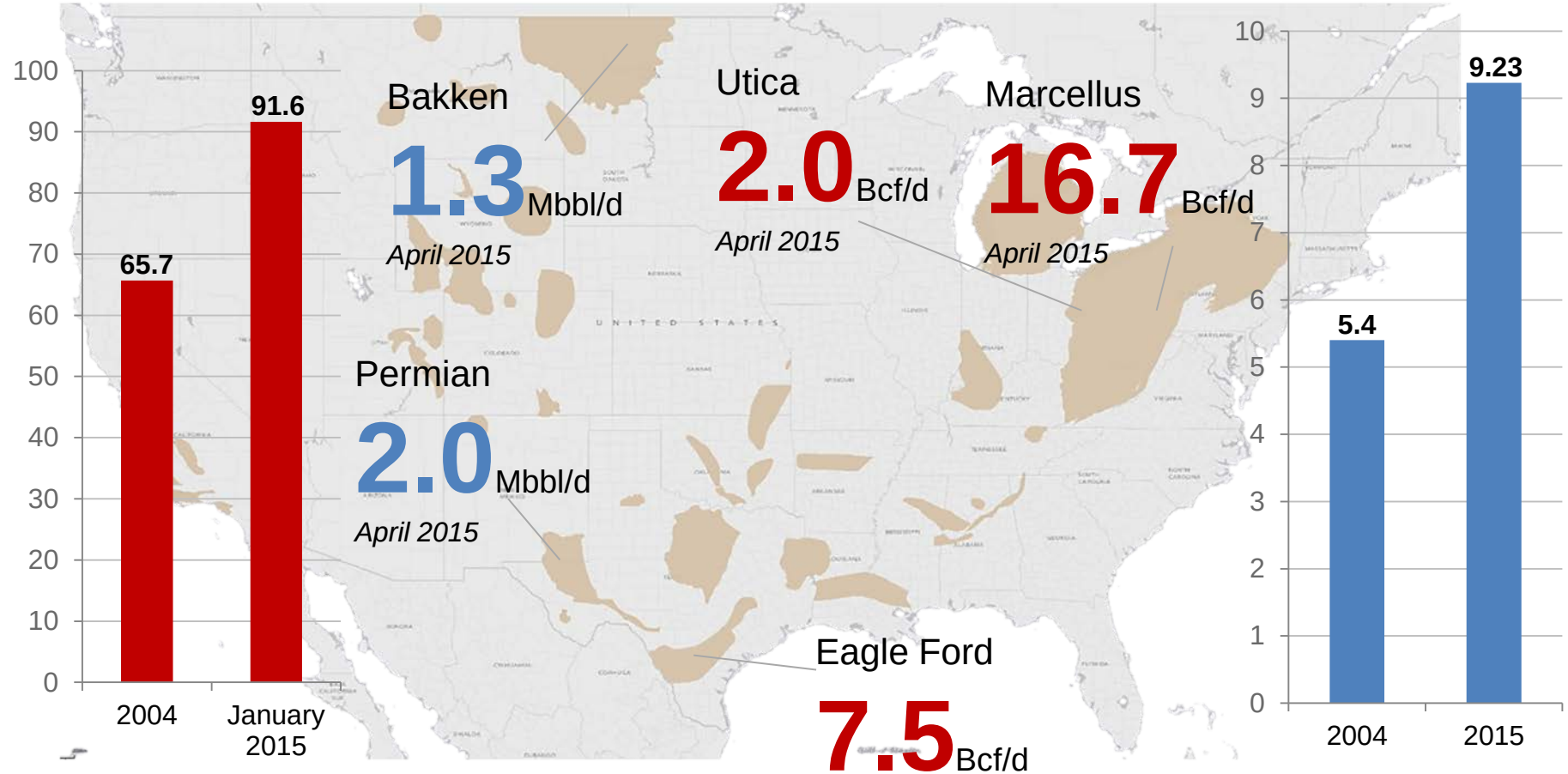
August 26, 2015

U.S. DEPARTMENT OF ENERGY | Fossil Energy

SHALE PLAYS DRIVING NATURAL GAS & CRUDE OIL PRODUCTION GROWTH



Domestic Natural Gas Gross Production
Billions of cubic feet per day

Domestic Crude Oil Production
Millions of barrels per day

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Source: U.S. Energy Information Administration

OVERVIEW

The Administration is engaged in several complementary efforts focused on infrastructure investments that will increase the safety, reliability, and environmental performance of energy infrastructure.

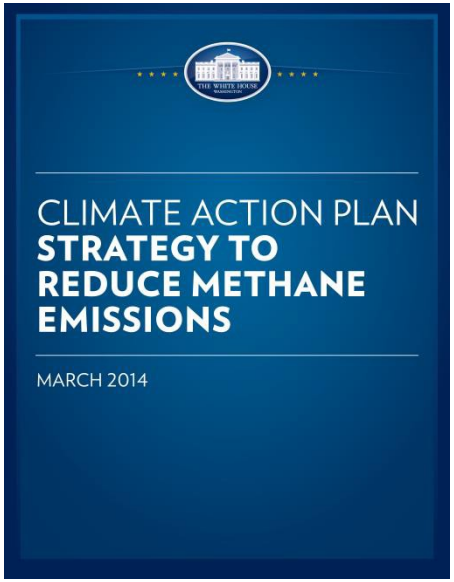
For example:

- Climate Action Plan – Methane Strategy
  - DOE: Natural Gas Modernization Initiative
  - EPA: Developing voluntary and regulatory programs
- PHMSA – Pipeline Safety Programs, R&D, and Regulations
- Quadrennial Energy Review (QER)

Moving forward, Next Steps:

- Collaboration with Congress to invest in infrastructure and related R&D efforts, support re-authorization of the Pipeline Safety Act
- Seek your input and participation in collaborative efforts, raising awareness, working toward solutions

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 (*completed March 2014)*
- Pursue a collaborative approach with state governments and the private sector and cover all methane emitting sectors
- *UPDATE*: Set a 2025 target for the O&G sector to reduce methane emissions by 40 to 45% below 2012 levels, plus additional actions (*January 2015*)

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

SECRETARY'S METHANE STAKEHOLDER ROUNDTABLES

Convened broad range of stakeholders in 2014, discussing opportunities to *modernize natural gas infrastructure & reduce mid- and downstream methane emissions*

Dr. Ernest Moniz
Secretary of Energy

Key lessons learned:

- *There is broad stakeholder support for taking action*
- *The drivers for action vary by stakeholder group*
  - Improve safety
  - Conserve energy and save money
  - Promote efficiency
  - Protect the climate
  - Create jobs

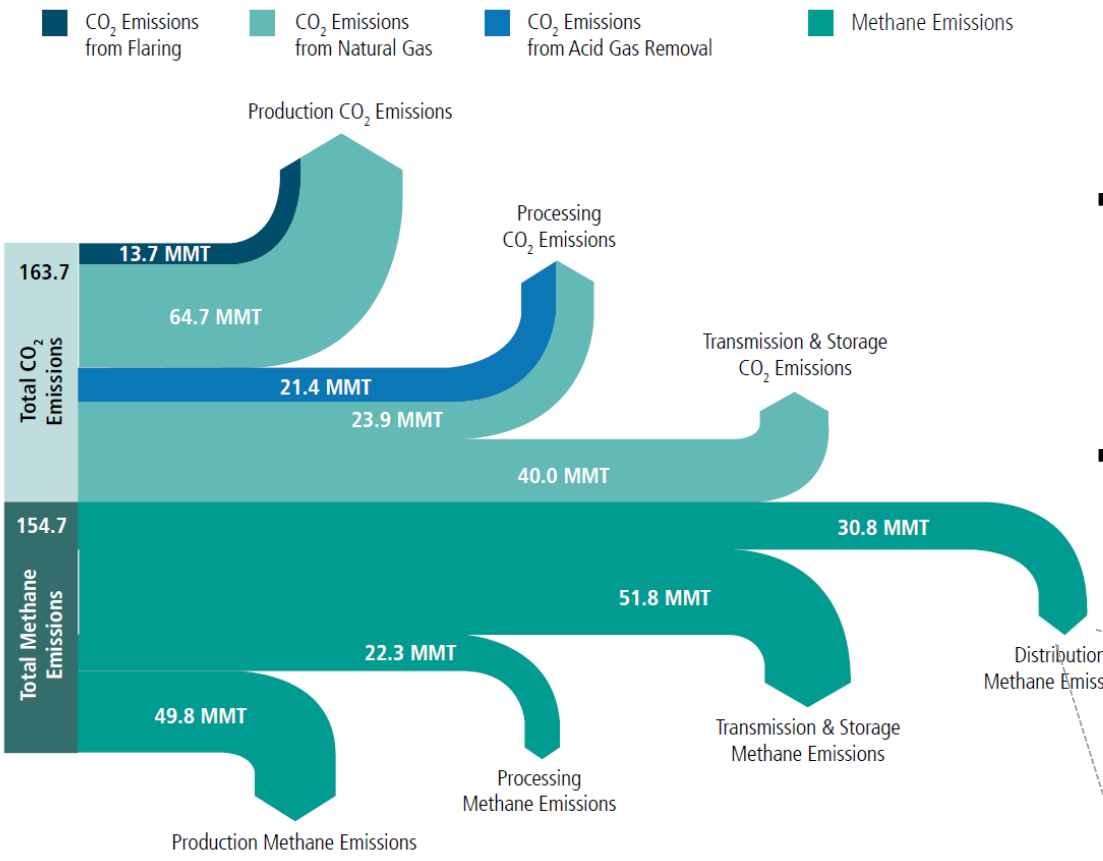
The capstone roundtable took place at the White House on July 29, 2014. Afterward, Secretary of Energy Ernest Moniz announced several new initiatives as DOE's part of the larger Administration Strategy to Reduce Methane Emissions.

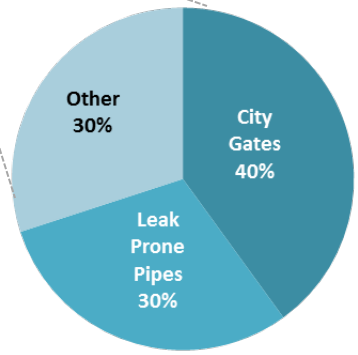
DOE'S NATURAL GAS MODERNIZATION INITIATIVE

- **December, 2014: ARPA-E** announced funding for MONITOR, 11 new projects developing low-cost methane sensing for the oil and gas sector
- **April, 2015: FERC** issued Policy Statement on cost recovery for midstream natural gas infrastructure upgrades
- **DOE hosted the "Natural Gas Infrastructure R&D and Methane Emissions Mitigation Workshop" in Pittsburgh last November,** which will inform a DOE-wide RD&D strategy

- **The DOE-NARUC Natural Gas Infrastructure Modernization Partnership** grant for technical assistance launched on July 13, 2015
- **The DOE Natural Gas Modernization Clearinghouse** is live; provides information on implications of natural gas infrastructure modernization, including: safety benefits; methane measurement; technology R&D; job creation; policies and incentives; etc.
- **Stakeholder action is key:** NARUC, ECOS, and industry partners

GHG EMISSIONS FROM NATURAL GAS SYSTEMS





- The distribution sector accounts for about 20% of methane emissions from the natural gas sector
- Cast iron and uncoated steel pipes account for 30% of emissions from distribution systems
- Leaks at city gate stations (from regulators and meters) account for roughly 40% of emissions from distribution systems

Note: GHG emissions from end-use result in the large majority (80%) of GHG emissions from natural gas systems

Data sources: EPA, 2014, EIA, 2014

QER RECOMMENDATIONS TO HELP REDUCE METHANE EMISSIONS

- **Improve quantification of emissions from natural gas infrastructure.** $10 million requested in FY 2016 budget to update Greenhouse Gas Inventory estimates of methane emissions from natural gas systems. DOE and EPA should undertake a coordinated approach.
- **Expand DOE research and development (R&D) programs** on cost-effective technologies to detect and reduce losses from natural gas TS&D systems. $15 million requested in the FY 2016 budget.
- **Demonstrate and deploy continuous emissions monitoring equipment.** Continuous emissions monitoring valuable component of leak detection and repair programs; DOE should provide additional funding to ensure most successful MONITOR projects are field tested and deployed.
- **Rate relief to increase investments in NG distribution safety and emissions abatement.** $2.5 to 3.5 Billion competitive funding program to help LDC's achieve *dual goals of enhanced safety and lower emissions* through pipeline replacement, DI&M, and other innovative approaches to improving the performance of natural gas distribution systems.

QER RECOMMENDATION: IMPROVE DATA COLLECTION, ANALYSIS AND COORDINATION

- The National Transportation Safety Board found in 2015 that many types of basic data necessary for comprehensive probabilistic risk modeling of natural gas pipelines are not currently available.
- The Board's recommendations included the development of better-quality spatial data on pipelines that can be more easily accessed by regulators and operators.

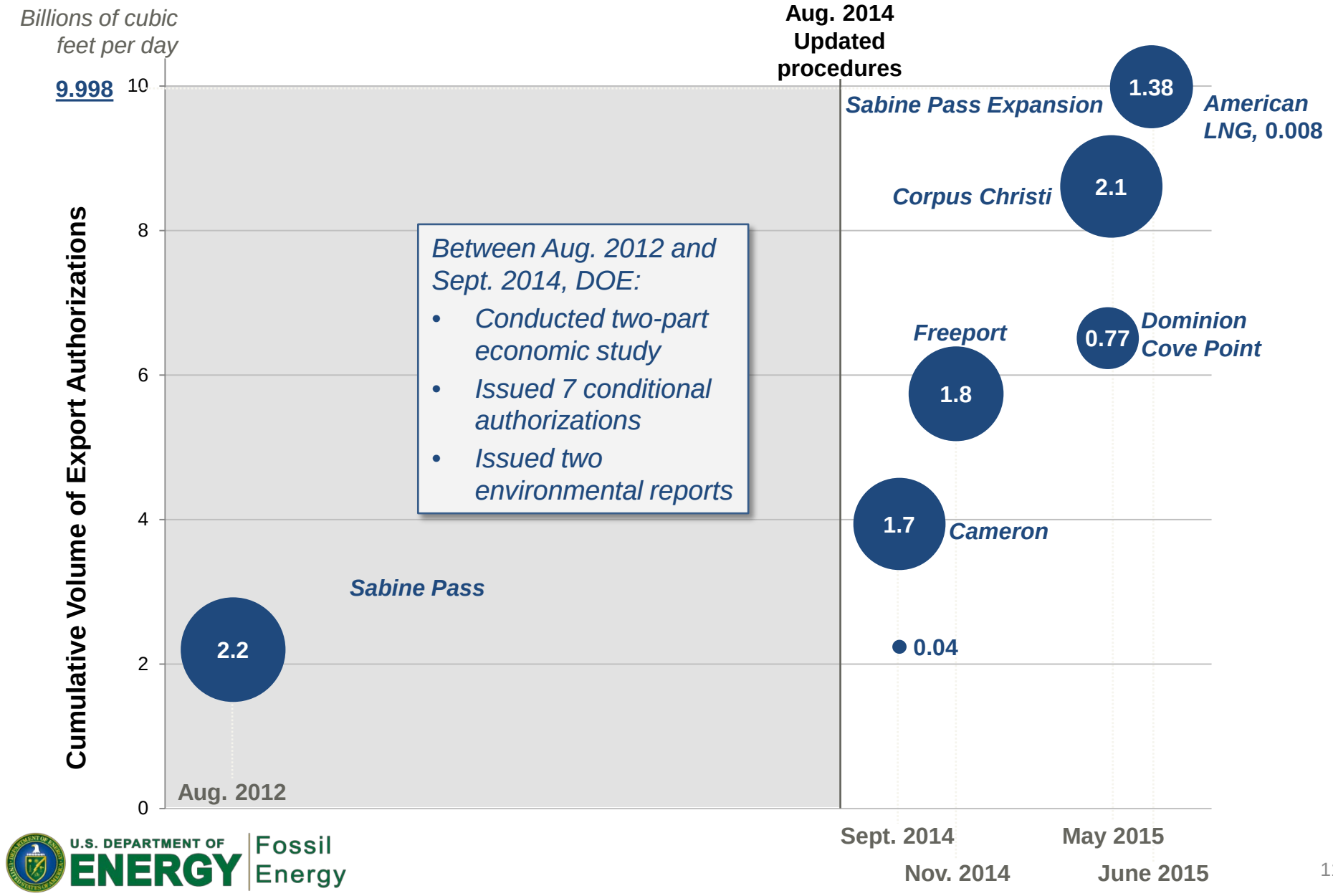
QER Recommendation

- Improve environmental data collection, analysis, and coordination
- DOE should work with other Federal agencies to improve data and analysis on the environmental characteristics and impacts of TS&D infrastructures.
- This work should be designed to fill the host of data gaps on environment, safety, and public health issues with respect to TS&D infrastructure.

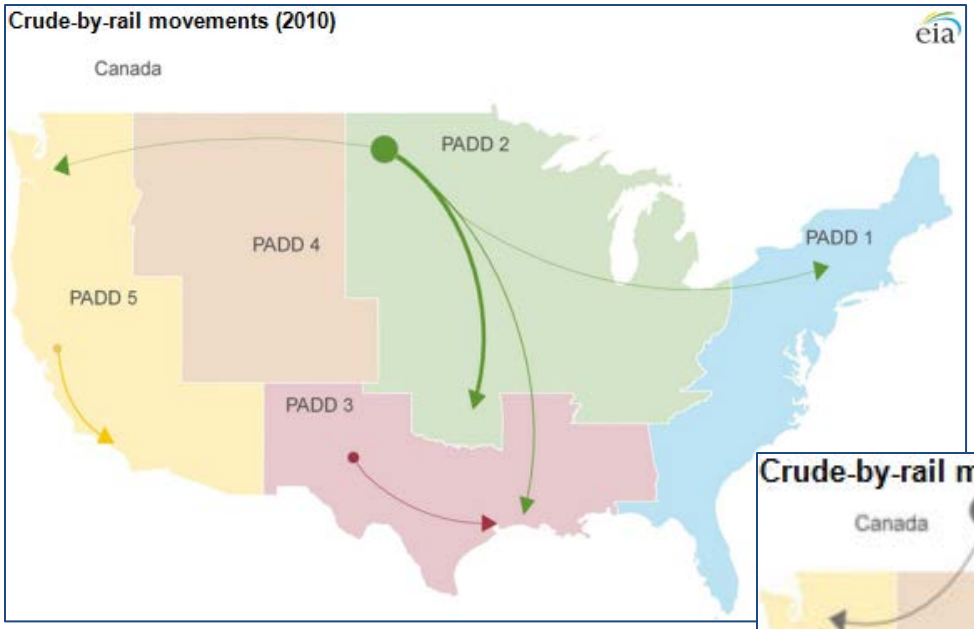
QER RECOMMENDATIONS RELATED TO THE PIPELINES

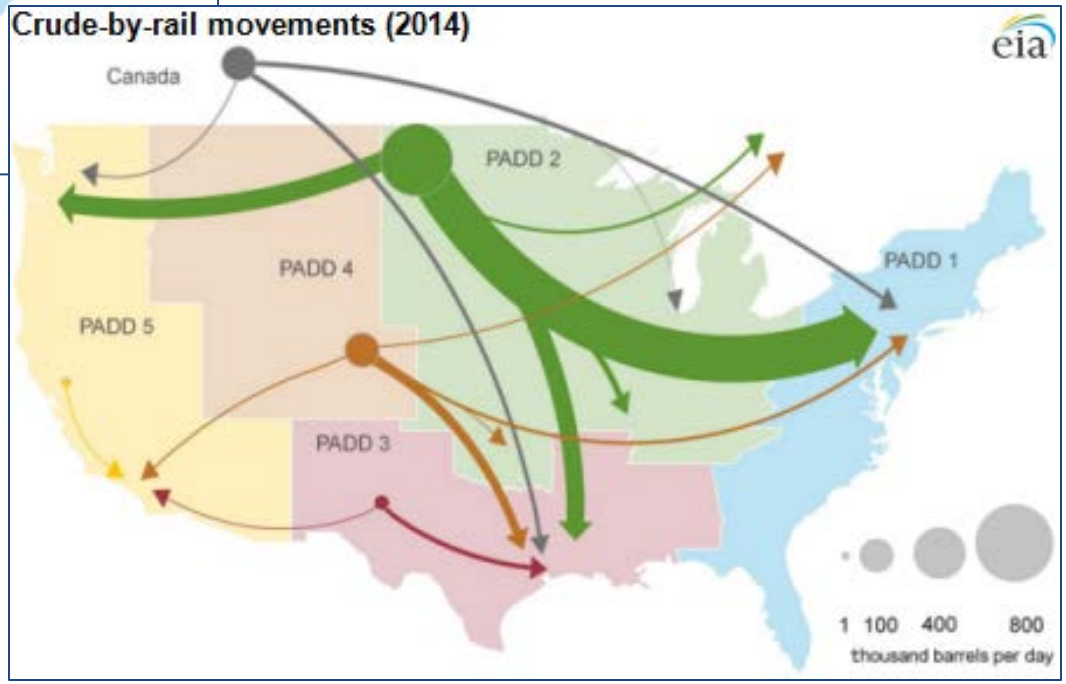
1. **Improve quantification of methane emissions from natural gas infrastructure.** Congress should approve $10 million requested in the FY 2016 Budget to help update Greenhouse Gas Inventory
2. **Expand research and development (R&D) programs at DOE on cost-effective technologies to detect and reduce losses from natural gas TS&D systems.** Congress should approve $10 million requested in the Fiscal Year 2016 Budget
3. **Invest in R&D to lower the cost of continuous emissions monitoring (CEM) equipment,** to further improve safety and reduce emissions from natural gas systems
4. **Funding to reduce diesel emissions.** Protect workers and communities through programs that reduce diesel particulate matter emissions from ports and rail yards
5. **Collaborative R&D on the beneficial use and/or disposal of dredging material.** The Army Corps of Engineers and other Federal agencies should undertake collaborative R&D on dredging
6. **Improve environmental data collection, analysis, and coordination.** DOE should work with other Federal agencies to improve data and analysis on environmental, safety, and other impacts of TS&D infrastructures
7. **Enhance TS&D resilience** to a variety of threats, including climate change and extreme weather
8. **Establish a competitive funding program to provide rate relief for low-income customers** to help enable greater investments in natural gas distribution systems improvements that achieve the dual goals of enhanced safety and lower emissions through pipeline replacement and other measures

Liquefied natural gas export FINAL authorizations



CRUDE OIL GROWTH





CRUDE OIL CHARACTERISTICS RESEARCH - BACKGROUND

- Numerous train derailments resulting in crude oil releases and fires created a high level of public and political concern
- DOT asked DOE for technical assistance:
  - DOE has expertise in petroleum chemistry and industry practices
  - DOT has little knowledge of field conditioning practices
  - Widespread perception that Bakken and other tight oils are fundamentally different and more dangerous to transport
- DOE formed team led by Sandia National Labs with expertise in petroleum chemistry, field production methods, and combustion science
- DOE engaged the Sandia team to perform a literature survey
  - Document current state of knowledge
  - Identify parameters that are relevant to transportation safety
  - Identify gaps in current scientific knowledge
  - Recommend how to close those gaps
- Results of Sandia study are documented in *Literature Survey of Crude Oil Properties Relevant to Handling and Fire Safety in Transport*

Literature Survey Report, March 2015: http://energy.sandia.gov/tight-oil-study/

NEXT STEPS – SAMPLING, ANALYSIS, AND EXPERIMENT (SAE) PLAN

Released in July 2015, the SAE Plan includes six potential tasks:

1. ***Review Emerging Data & Stakeholder Outreach***
2. ***Sampling Method Evaluation***
3. ***Initial Combustion Experiments & Modeling***
4. Crude Oil Characterization – Tight vs. Conventional Oil
5. Large-Scale and Rail Car Combustion Testing and Modeling
6. Comprehensive Sampling and Analysis

The first 3 tasks have been funded and are being started.

SAE Plan: http://energy.gov/fe/articles/crude-oil-characteristics-research

Expected Outcomes:

- Identify which sampling/testing methods are most appropriate for crude oils, including tight oils
- Characterize/compare four selected crude oils based using the most appropriate methods
  - Characterization information can improve usefulness of existing "equations of state"
- Evaluate combustion characteristics for four selected crude oils
- Identify any obvious correlations between selected physical or chemical properties and combustion characteristics

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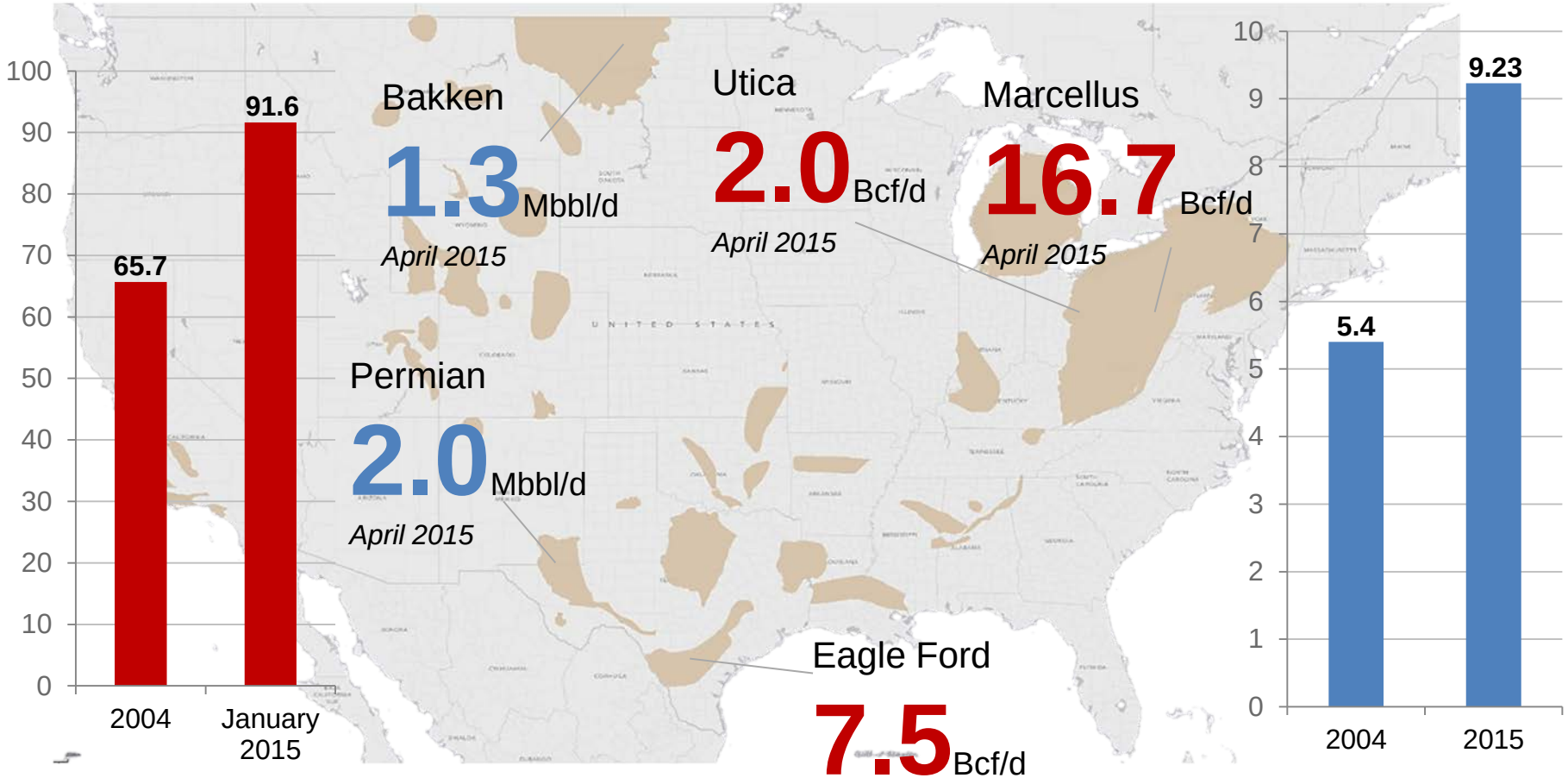

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