



OUR NATION'S ENERGY

FUTURE

ONE Future Framework

A Performance-Based Flexible Model
for Global Application

The background of the slide features a low-angle, close-up view of the Statue of Liberty's head and crown, rendered in a green-tinted color. The statue is set against a bright blue sky with light clouds. The overall design is modern and clean, with green and blue wavy lines at the bottom.

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Committed to achieving cost-effective solutions to environmental challenges across the natural gas supply chain.

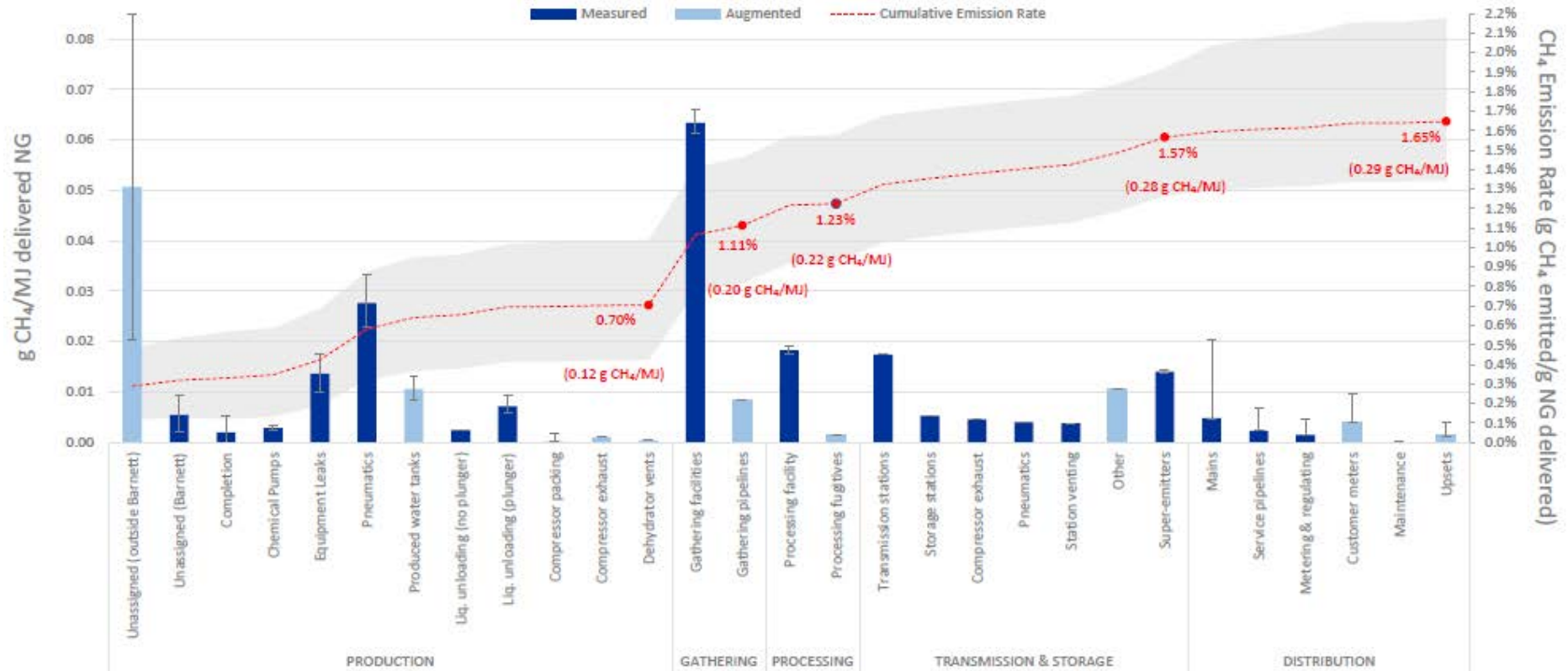
ONE Future Companies



Focus on Methane

- To support the role that natural gas can play in a low-carbon economy
- Methane is our product, so any emissions constitute a loss of saleable product and diminished efficiency
- To be responsive to our shareholders and investment community
- We want to support science, innovate and minimize risks

Current US Lifecycle Methane Emissions Estimates



DOE estimates current US natural gas “methane leakage rates” to be ~1.65%

Key ONE Future Principles

- Natural Gas has a foundational role in a low carbon economy
- Efficiency improvement (methane mitigation) needs a value-chain approach
- Program design should support prudent development and delivery of natural gas
 - Focus on methane intensity
- Performance targets should be ambitious and scientific
 - The 1% goal
- Program should focus on the outcome – i.e. performance-based
 - Baseline development is not required
- Flexibility is key
 - Program should not mandate a specific mitigation technology or practice
 - Account for year-to-year variation by acquisitions and divestitures
- Past performance of companies must be credited
- Reporting must be transparent and consistent with existing reporting programs

Our Experience Supports a Performance-Based Approach

Set an **ambitious target**



Allow **flexibility**

Focus on
cost-effectiveness



Get **results fast**

Foster **innovation**



Insist on **scientific integrity**

ICF 2016 Methane Abatement Cost (MAC) Analysis

Key Takeaways

- ICF builds on its 2014 EDF analysis but updates inputs with current pricing and more recent recoverable gas estimates
- Cost-effective abatement technologies are available
 - Over 88 Bcf of methane reductions across value chain
- Costs are an average 5x higher than the 2014 ICF estimate for EDF
 - While the previous EDF study found that the cost of methane abatement is less than a penny per Mcf of natural gas produced, or \$0.66/Mcf of methane reduced, the new ICF study finds the cost to be \$3.35/Mcf of methane reduced
 - Regional variations exists
- With varied costs and abatement potential, a performance-based framework is best for methane mitigation at existing facilities

ONE Future is Part of EPA Methane Challenge

- Performance-based design
 - Methane intensity goals developed for each segment of value chain
 - Emissions inventory protocol developed and published by the EPA
- Potential to be expanded around the world



Industry Segment	Methane Emissions Intensity	Methane Emission Intensity Goals (percent of Gross Production)	
	2012	2020	2025
Gas Production and Gathering	0.55%	0.46%	0.36%
Gas Processing	0.18%	0.15%	0.11%
Gas Transmission and Storage	0.44%	0.37%	0.30%
Gas Distribution	0.26%	0.24%	0.22%
Total	1.44%	1.22%	1.00%

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Methane Challenge

ONE Future Emissions Intensity Option

ONE Future Reporting Requirements

- One Future's MC reports are an extension of GHGRP reports
 - Emissions reported using EPA Supplementary Technical Information
- Supplementary information includes
 - (1) Facilities that fall below the GHGRP reporting threshold and
 - (2) Emission sources that are included in EPA's national GHG inventory but are not reported through the GHGRP
 - Examples: CH₄ emissions from acid gas removal units, blowdowns at underground gas storage facilities, customer meters from natural gas distribution

ONE Future National Methane Emission Intensity Target

- Progress toward ONE Future goal determined by computing CH₄ emission intensity for each industry segment
 - ONE Future Protocol
- Emissions per gross production (E_s/GP) for each segment is calculated based on the ratio of emissions for each segment and gross natural gas withdrawals
 - Gross withdrawal (from EIA) is the full well stream volume, including all natural gas plant liquids and all nonhydrocarbon gases, excluding lease condensate

ONE Future National Methane Intensity Estimate

2012 Methane Emission Intensity Benchmark

**Production
and Gathering**

Es/GP = 0.55%

Processing

Es/GP = 0.18%

**Transmission
and Storage**

Es/GP = 0.44%

Distribution

Es/GP = 0.26%

National

Es/GP = 1.44%

$$\frac{\text{National Emissions}}{\text{Gross Throughput}} = \sum \frac{\text{Emissions}_{\text{Segment}}}{\text{Gross Throughput}}$$

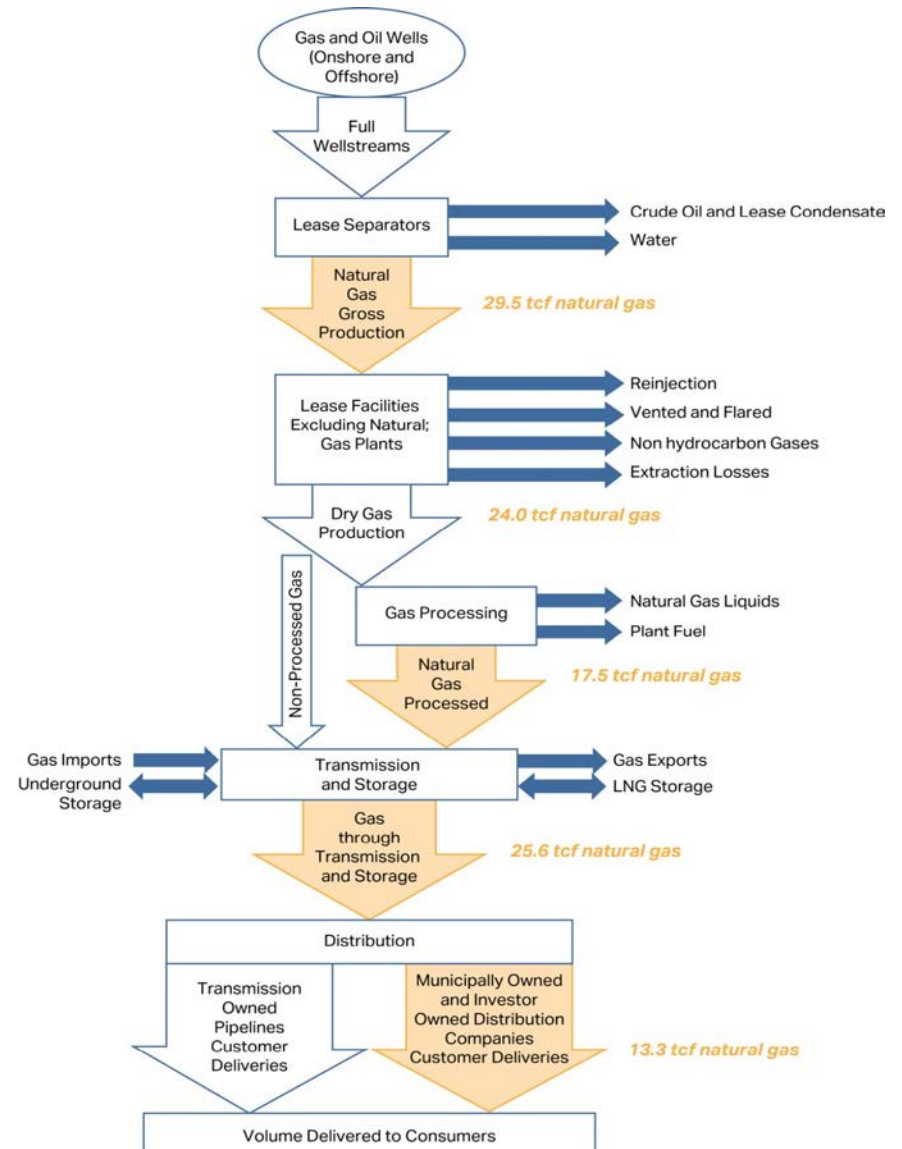
Segment Intensity Targets

- Used to track progress of participant companies and to normalize participant company data to the segment and national level
- Segment Emissions = $\left(\frac{\sum E_c}{\sum TP_c} \right)_{Segment} \times \frac{TP_{Segment}}{GP}$

$$\frac{\sum E_c}{\sum TP_c} = \frac{\text{Sum of the participants emissions}}{\text{Sum of the participants throughputs}}$$

Segment Throughputs

- Production and Gathering/Boosting – Gross gas withdrawals
- Processing – Volume of gas processed
- Transmission and Storage – Dry gas production + net gas imports
- Distribution – Gas delivered to consumers



Net Participant Emissions = $E1 + E2 + E3$

$E1$ Company_i CH₄ emissions for facilities > 25,000 tonnes CO₂e/yr as already reported to the GHGRP

$E2$ Company_i CH₄ emissions for facilities < 25,000 tonnes CO₂e/yr

$E3$ Company_i CH₄ emissions for emission sources not included in the GHGRP

Hypothetical Performance of ONE Future Participant in Production Segment

	2016	2017	2018	2019	2020	Totals
Total Participant Methane Emissions (Gg CH₄)	26	25.5	25	25.2	24.9	126.7
Participant CH₄ Emissions, Bscf (Bcf natural gas – Assuming a CH ₄ concentration of 85 mol% and 1.198 gmol/scf)	1.60	1.57	1.53	1.55	1.53	7.78
Production Throughput (Bcf)	350	370	390	410	390	1,910
Emissions Intensity (%)	0.46%	0.42%	0.39%	0.38%	0.39%	
<u>Weighted</u> Average Intensity (5 year)						0.41%

- 2020 interim segment target = 0.46%
- 2025 segment target = 0.36%

The 5-year weighted average emissions intensity rate for company X is 0.41%. The company's 5-year average emissions are less than the 2020 interim segment target of 0.46%, therefore, company X is on track to meet the ONE Future Program Goal

Conclusions

Methane Challenge ONE Future Option is performance-based

- Participants apply appropriate reductions to meet goals by 2025
- Company performance reported through Methane Challenge
- ONE Future collective performance reported through ONE Future website

Additional Resources

- <https://www.epa.gov/natural-gas-star-program/methane-challenge-program>
 - https://www.epa.gov/sites/production/files/2016-08/documents/methanechallenge_one_future_framework.pdf
 - <https://www.epa.gov/natural-gas-star-program/methane-challenge-program-supplementary-technical-information-one-future-0>
 - https://www.epa.gov/sites/production/files/2016-05/documents/mc_ip_guidelines_final.pdf
- https://www.epa.gov/sites/production/files/2016-08/documents/methanechallenge_one_future_framework.pdf
- <http://www.onefuture.us/wp-content/uploads/2016/06/ONE-Future-MAC-Final-6-1.pdf>