NATIONAL PETROLEUM COUNCIL

Reducing Greenhouse Gases (GHG) Emissions from the U.S. Natural Gas Value Chain

Interim Update

December 12, 2023

NPC GHG Study -

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Advising DOE on Reducing Natural Gas GHG Emissions

Natural gas is an important element of U.S. energy, helping solve the energy trilemma:

- Energy Security measures a nation's capacity to meet current and future energy demand reliably.
- **Energy Equity** assesses a country's ability to provide universal access to reliable, affordable, and abundant energy for domestic and commercial use.
- Environmental Sustainability of energy systems represents the transition of a country's energy system toward mitigating and avoiding potential environmental harm and climate change impacts.

The natural gas value chain produces greenhouse gases. This study identifies policy, regulatory, technology, and market mechanisms to reduce those emissions.



Overview

- Study participants, structure, schedule, and scope
- First-of-its-kind aspects of this study
 - Incorporation of small and less-capitalized operators (LCO) input
 - Engagement and investigation of Societal Concerns and Impacts (SCI)
 - Creation of a meta-model for life cycle assessment (LCA)

Emerging themes

- Existing and well-designed proposed federal and state regulations will materially reduce methane emissions
- Converting methane detection into methane quantity has significant uncertainty
- Fuel use (Scope 1 CO₂) emissions are harder to reduce
- Many market mechanisms are available for emissions reductions, each has pros and cons
- Small operators' concerns need to be incorporated in our recommendations
- SCI likely requires a future National Petroleum Council (NPC) study

Maintained important linkages with the NPC Hydrogen Study

Final Report will address U.S. GHG Targets, Key Requests in Secretary's Letter, and Related Issues

Secretary's requests

Report will address three U.S. targets

- 1. 50 to 52% reduction in greenhouse gases from 2005 levels by 2030
- 2. Net zero emissions economy-wide by 2050
- 3. Achievement of the Global Methane Pledge

And six key requests

- 1. Characterization of existing U.S. industry GHG emissions reduction plans
- 2. Identification of most impactful, cost-effective and achievable GHG reduction opportunities
- 3. Exploration of best options for detection of U.S. GHG emissions
- 4. Discussion of modeling frameworks for life cycle emissions analysis
- 5. Discussion of tradeoffs
- 6. Evaluation of the feasibility and effectiveness of different approaches

Diverse GHG study team > 200 members from > 100 organizations



Report structure

GHG study is organized by themes to answer requests

- 1. Role of natural gas and background
- 2. Natural gas as part of the solution but also the challenge
- Natural gas emission reductions' contribution to the three goals outlined by the Secretary
- 4. Societal Considerations & Impact focus
- 5. New emission reduction infrastructure and policy
- 6. Siting and development of new infrastructure to reduce GHG emissions
- 7. Measurement and detection
- 8. Life cycle assessments
- 9. Tradeoffs

Natural Gas GHG Study Milestones



Study Scope & Objectives

How will the oil and gas industry reduce GHG emissions from the natural gas value chain while considering the energy trilemma?

In scope:

- Natural gas value chain GHG emissions, from wellhead, to:
- For LNG, to ships' discharge port
- For domestic use, to end user's delivery meter
- Six representative value chains evaluated, addressing multiple producing basins, destinations, and end-user types
- Both dry gas and associated gas

Out of scope:

- Natural gas GHG emissions from customer's end use
- Natural gas liquids beyond a gas plant's tailgate
- Gas produced outside of Lower 48 states



- 4. Petroleum Refining
- 5. Gathering and Boosting
- "Data collection began in RY 2016 6. Gas Processing Plant
- "May contain NGL Fractionation equipment 7. Natural Gas Liquids (NGL) Supply

Source: EPA's 2011-2020 GHGRP Sector Profile - Petroleum and Natural Gas Systems

Distribution

13. Large End Users

14. Natural Gas Distribution

to Small End Users

"Data collection began in RY 2016

15. Natural Gas & Petroleum Supply



- Subpart NN: CO, associated with supplies of natural gas & natural gas liquids
- Not reported under GHGRP



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First-of-its-Kind NPC Study Elements

- Less Capitalized Operators Workshops (LCO) – engagement with smaller operators to learn of their concerns and discover innovative and cost-effective emissions mitigation practices
- Societal Considerations & Impact (SCI) evaluated impacts and benefits from implementation of emissions reduction actions; conducted community engagement through focus groups and polls
- Meta-model sourced by harmonizing life cycle assessments (LCA) from literature; identified key drivers of carbon intensity of major U.S. natural gas supply chains



Key GHG Study Findings and Themes

- Abundant, affordable natural gas is the largest source of primary energy production and will continue to play a crucial role in economic and energy security beyond 2050 under all Energy Information Agency (EIA) scenarios.
- Accurate, measurement-informed estimates of emissions are critical to tracking and executing U.S. and global emission reporting and reduction goals.
- Methane emissions are a significant GHG contributor in the natural gas and LNG value chains, underscoring the need to mitigate methane emissions. GHG emissions mitigation construction and installation are needed and permitting needs to be prioritized.
- New emission reduction infrastructure and policy should mitigate impacts on disadvantaged communities while supporting positive outcomes, including jobs and other cobenefits. Siting and development of new infrastructure to reduce GHG emissions along the natural gas value chain should **involve community engagement best practices to benefit communities and industry**.
- Remaining GHG emissions will need to be addressed with durable policy formation, including through regulatory harmonization, introduction of market mechanisms, and further technology deployment.

Characterization of the State of U.S. GHG Emissions

Current State

- U.S. natural gas production, reserves, and resources are at all-time high.
- Natural gas displacing coal reduced U.S. emissions by 532 MMT or 65% of the total reduction from 2005 to 2019.

Primary energy production by source

Future State

• The EIA scenario with the least natural gas production in 2050 is constrained by supply, not demand. The EIA does not consider future policy changes.



2023 U.S. natural gas production EIA scenario

Detection & Quantification of U.S. GHG Emissions

Accurate, measurement-informed estimates of emissions are critical to tracking and executing U.S. and global emission reporting and reduction goals. Uncertainty increases from detection through emission rate estimation to annual reporting.



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Highest-Emitting Value Chain Segments & Life Cycle Assessments for Public Policy Consideration

Understanding the life cycle emissions associated with U.S. natural gas production and exports can inform emission reduction opportunities across the natural gas value chain for public policies and corporate strategies.



The meta-model created for this study is a high-level LCA tool with 1/5 of typical inputs that can replicate results of more complicated models. The results of this model identify methane emissions as a significant GHG contributor in the natural gas and LNG value chains, underscoring the need to mitigate methane emissions. GHG emissions mitigation construction and installation are needed, and permitting needs to be prioritized.

Feasibility and Effectiveness of Different Approaches – Policy, Regulatory, and Technology Investments

Remaining GHG emissions will need to be addressed with durable policy formation, including through regulatory harmonization, introduction of market mechanisms, and further technology deployment. This can be enhanced and supported through industry coordination and international diplomatic efforts.



This study's Existing Policy Pathway estimates that methane emissions will reduce by over 60% by 2030, but that carbon dioxide emissions will remain largely unchanged through 2050.

NPC GHG Study

Societal Considerations & Impact

SCI should play pivotal roles in any future energy transition. **New emission reduction infrastructure and policy** should **mitigate impacts on disadvantaged communities** while supporting positive outcomes, including jobs and other cobenefits. Siting and development of new infrastructure to reduce GHG emissions along the natural gas value chain should involve community engagement best practices to benefit communities and industry.



Hydrogen Study Integration

- Purposeful alignments
 - Natural gas carbon intensity for hydrogen production through 2050
 - Societal Considerations & Impacts joint recommendations across studies
 - Life cycle assessment key principles worked in tandem
- Notable differences
 - Carbon price different approaches
 - Societal Considerations & Impacts
 - $\circ~$ Hydrogen focus on safety uncertainty and greenfield/brownfield mix
 - o Natural gas GHG safety is known and projects are largely brownfield
- Studies will continue collaborating as final drafts are worked



Next Steps

– NPC GHG Study ———

Upcoming Milestones

- Currently incorporating NPC member and CSC member feedback into final draft; prepare final report for Steering Committee approval February 29.
- The NPC GHG Study, with the objective to "assess greenhouse gas (GHG) emissions reduction plans and potential across the U.S. natural gas value chain," commenced late October 2022 and is targeting a final report delivery date of ~ April 2024.
- The final report will address the six DOE requests and additional questions by providing policy and technology findings and recommendations for the legislators, regulators, and the O&G industry.

