
NATIONAL PETROLEUM COUNCIL

**CH₄ARTING
THE CO₂OURSE**

**Reducing GHG Emissions from the
U.S. Natural Gas Supply Chain**

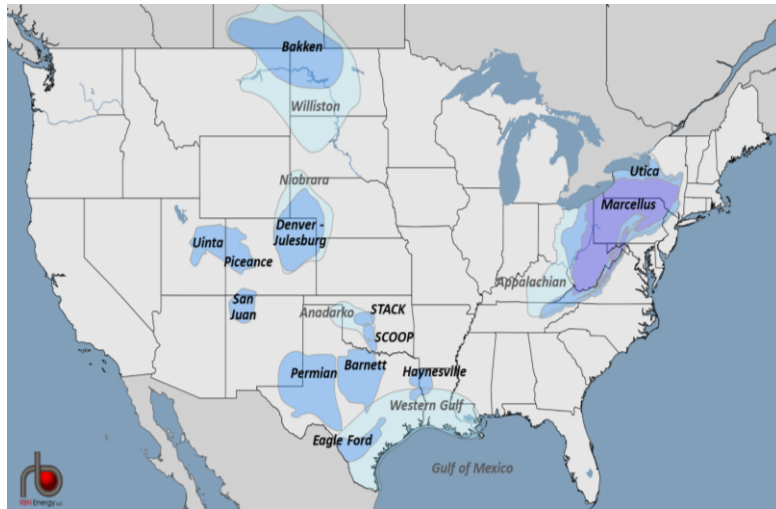
The Energy Council

September 13, 2024

The Challenge: Natural gas supply chain greenhouse gas reduction

A valuable resource...

U.S. MAJOR NATURAL GAS BASINS



Source: RBN

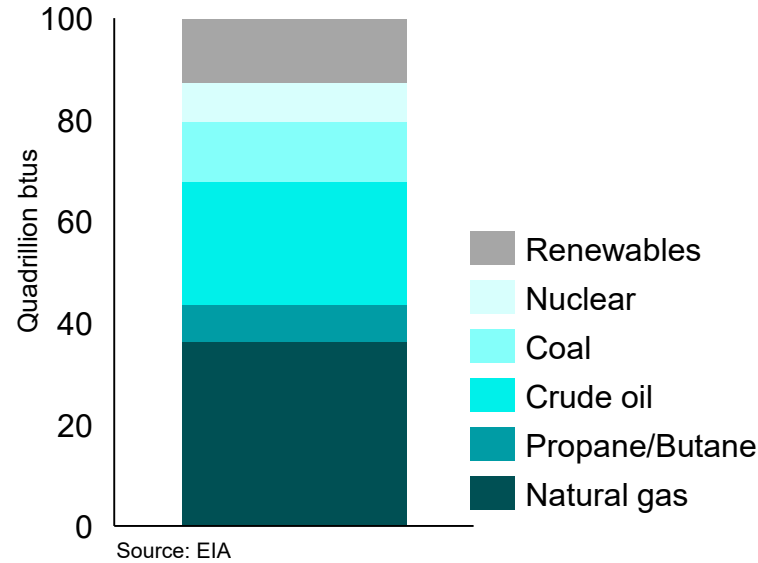
The U.S. has one of the world's largest natural gas resource bases

The U.S. is the leading producer of natural gas. Resources of 3,978 TCF will last over 100 years at current rates.



that the U.S. depends on...

PRIMARY ENERGY PRODUCTION



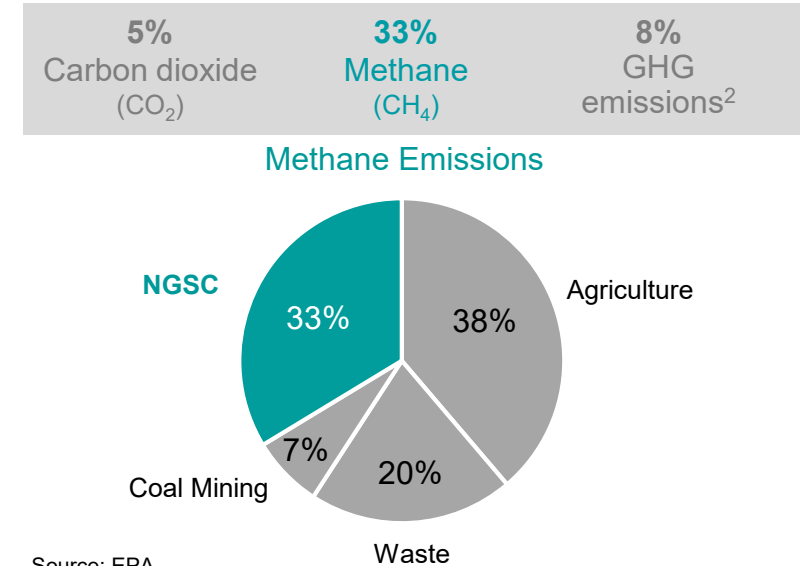
Source: EIA

It is the largest primary energy source

Natural gas and its liquids supplied 43% of U.S. primary energy production in 2022. Natural gas is also the top source of electricity generation.

but it faces challenges

% OF U.S. GREENHOUSE GAS (GHG) EMISSIONS FROM NATURAL GAS SUPPLY CHAIN (NGSC)¹



Source: EPA

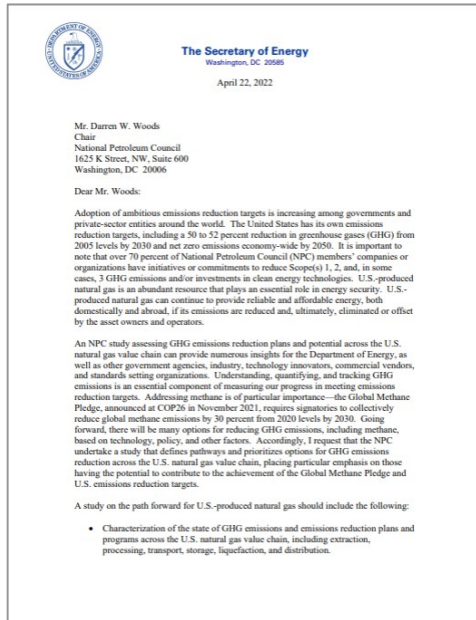
Producing and delivering natural gas generates GHG emissions

¹Direct emissions from production, gathering, processing, transmission, liquefaction, and shipping to end-user

²Net CO₂ Equivalent on a GWP100 basis

The Response: A collaborative study

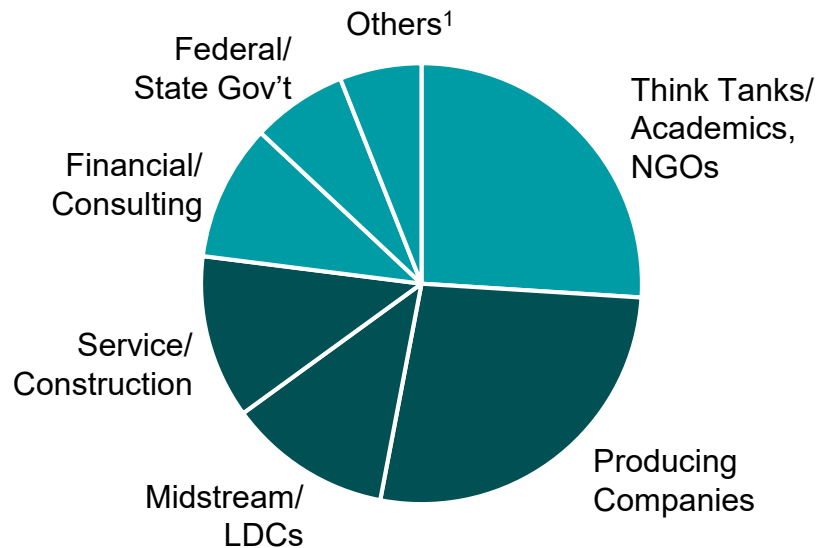
A clear mission...



DOE Sec. Granholm requested NPC Study

Address potential options to reduce GHGs in the U.S. natural gas supply chain.

with over 200 contributors...



NPC mobilized a diverse team

NGSC GHG emissions reduction opportunities evaluated by representatives from governments, tribes, NGOs and industry.

¹Others: Tribes, Electrics, Large Consumers, International

and a focused effort

Over **2** years

38 recommendations in executive summary

5 task groups

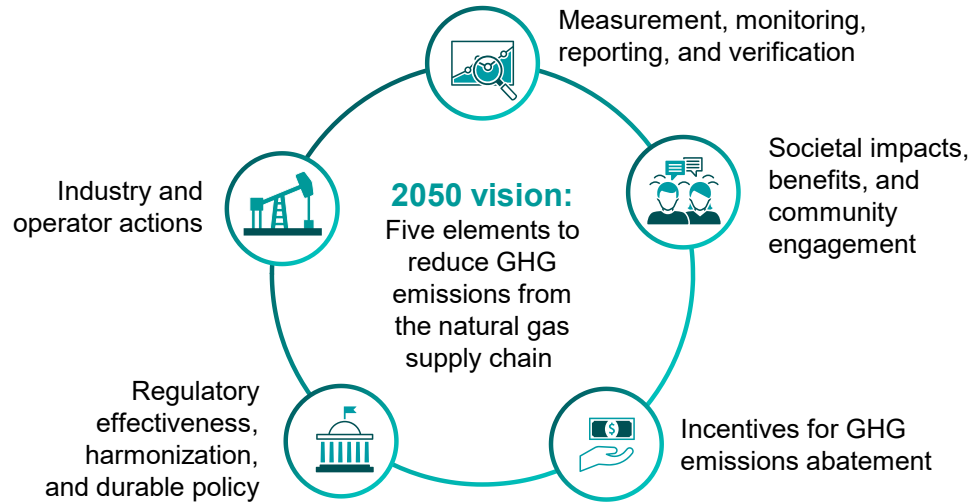
- Baseline and Expected Pathways
- Societal Considerations and Impacts (SCI)
- Detection and Quantification
- Life Cycle Assessment
- Analytics and Tradeoffs

Emphasized societal considerations and impacts

Collaborated with NPC Hydrogen study on SCI and community engagement.

The Integrated Solution: *Charting the Course*

A collaborative vision...



and a crucial role for natural gas

Abundant, affordable natural gas is the largest source of primary energy production and will continue to play a crucial role in energy security and an important role in economic security beyond 2050 under all Energy Information Agency (EIA) scenarios.²

With advances in technology and policy, one study¹ outlines a 2050 reduction potential of:

70%
methane



33%
carbon dioxide



52%
combined GHGs

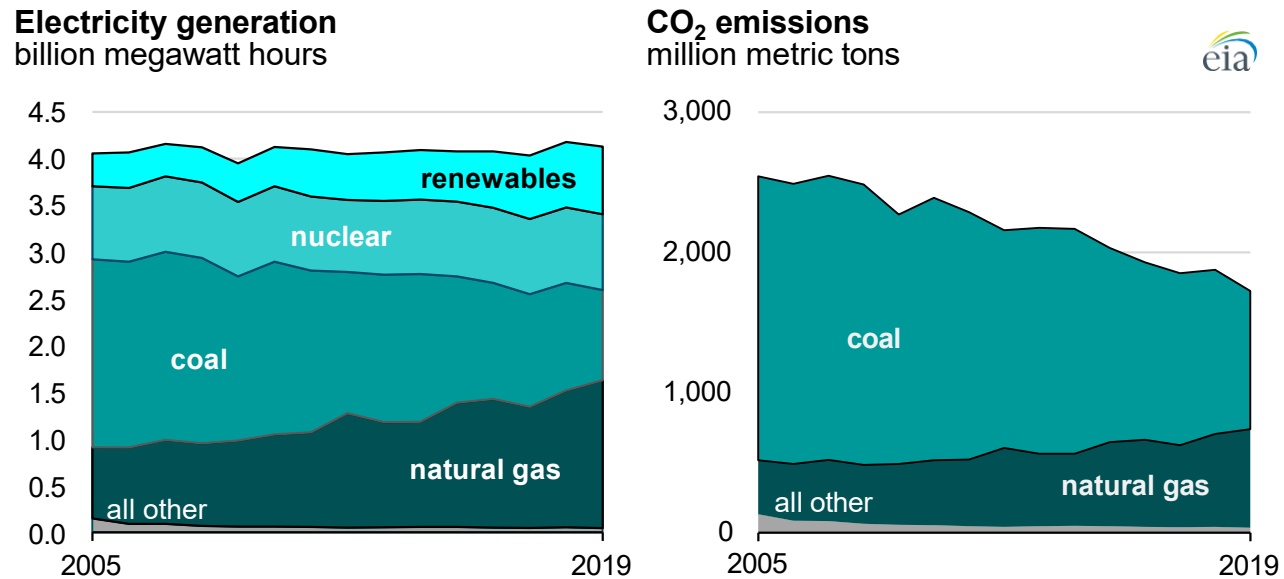


¹Technology, Innovation, and Policies (TIP) pathway, relative to a 2020 baseline

²EIA does not currently provide a scenario that targets net zero by 2050. EIA scenarios all assume existing policies and regulations only.

Natural gas plays a crucial role in U.S. GHG emissions reduction

U.S. electric power sector electricity generation and CO₂ emissions by source (2005-2019)



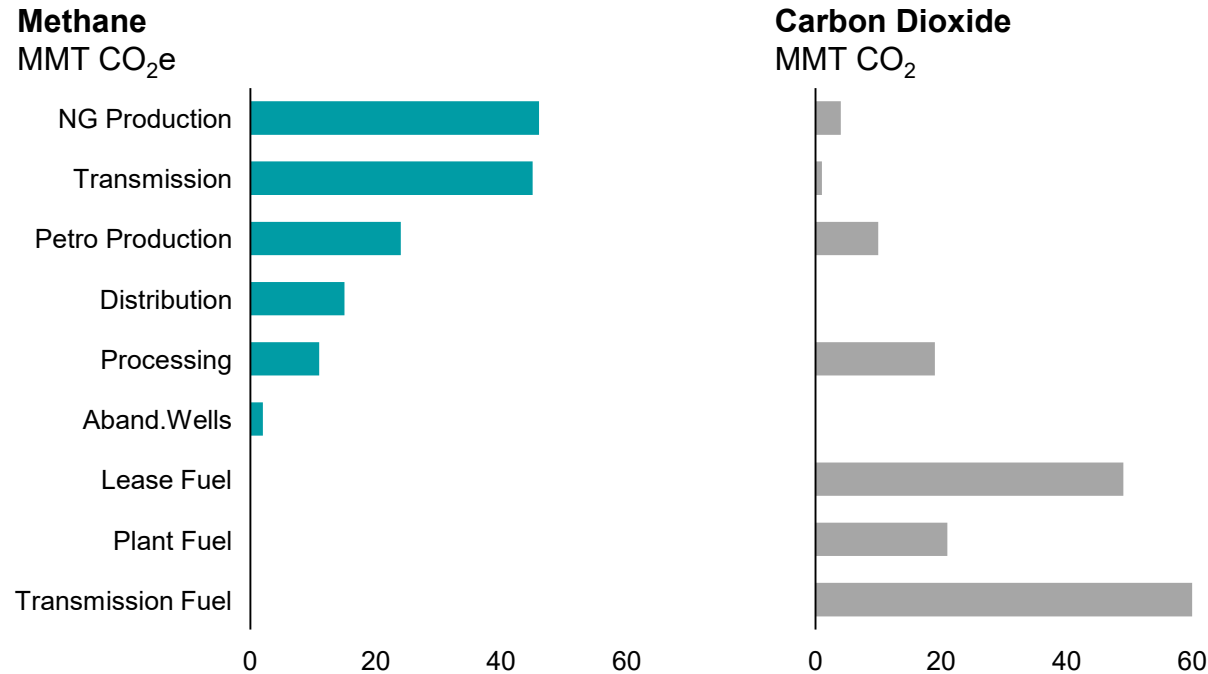
Source: U.S. Energy Information Administration, *Power Plant Operations Report*

On natural gas displacing coal, EIA analysis stated...

“Of the 819 million metric ton decline in CO₂ emissions from 2005 to 2019... almost 532 million metric tons (65%) of the decline in CO₂ emissions is attributable to the shift from coal-fired to natural gas-fired electricity generation.”

Methane and carbon dioxide have different sources

Emissions along the natural gas supply chain¹



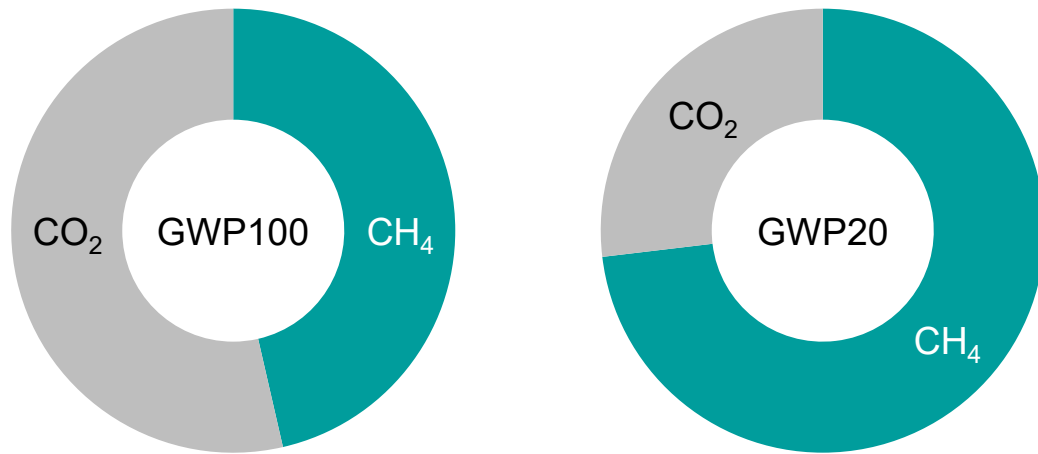
Source: Data from EPA with energy allocation

- Natural gas and petroleum production account for the most methane emissions
- Fuel use for transmission accounts for the most CO₂ emissions

The study recommends reducing GHG emissions at the source-level, which is relevant for a wide range of future energy scenarios.

Methane emissions matter and are on the decline

2021 NGSC GHG emissions, two GWP¹ views



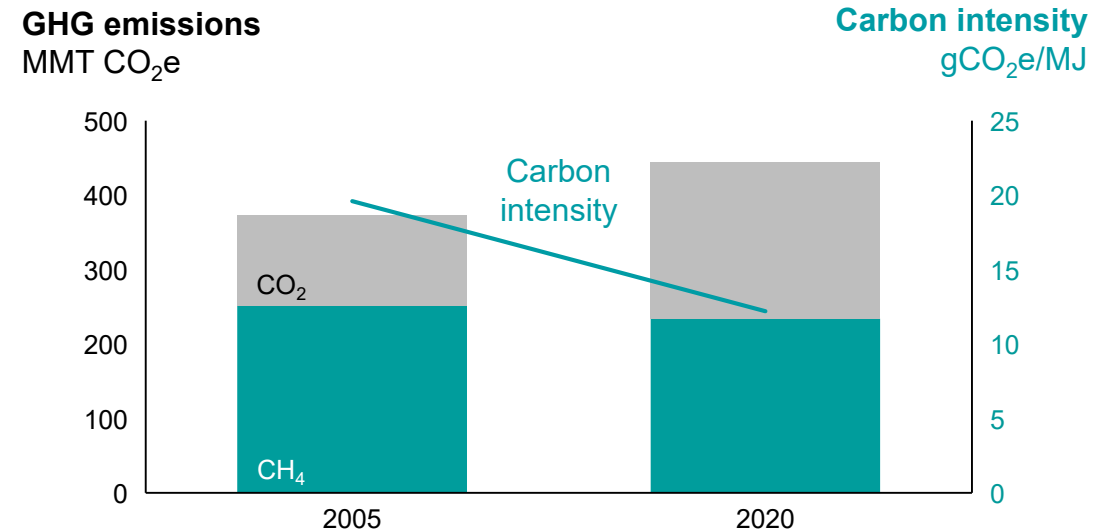
Source: Data from EPA with energy allocation

Emissions are roughly even on a GWP100 basis, but methane dominates on a GWP20 basis

GWP seeks to place GHG emissions on a carbon dioxide equivalent (CO₂e) basis.

¹GWP Global Warming Potential AR5 100-yr and 20-yr basis

NGSC GHG Emissions and Carbon Intensity



Source: Data from EPA with energy allocation

NGSC Methane and Carbon intensity declined

Reduced methane emissions and carbon intensity, but CO₂ and total emissions increased as gas production roughly doubled from 2005 to 2020.

Methane regulations, voluntary efforts and technologies are advancing rapidly

Regulations and policies

- OOOO Regulations (EPA)
- Start of GHG Reporting (Subpart W)
- First state methane regulations (CO)
- OOOOa Regulations (EPA)
- Global Methane Pledge
- Methane rules (OOOOb/c)
- Most recent EPA Subpart W changes proposed
- Super-Emitter Program
- Subpart W reporting methods tied to IRA waste emissions charge with \$1.5B funding
- Some states developing OOOOc plans for existing sources

2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022 2023 2024 2025 2026

Research, technology, and voluntary advances

- First methane measurement studies in U.S. from unconventional oil and gas production
- ARPA-E MONITOR program catalyzes new methane detection technology development
- Expansion of DOE research funding for methane measurement, monitoring, and mitigation
- New Global Satellites Operational
- First METEC site
- Oil and Gas Methane Partnership 2.0
- Regulatory approval of alternative technology expected for use by operators
- International Methane Emissions Observatory
- MMRV program (DOE)

Collaborative opportunities for all stakeholders

Charting the Course:

Three pathways to reduce NGSC GHG emissions

Existing Policies (EP)

- Includes IRA, OOOOb,c, existing state regs, and existing voluntary actions
- Excludes additional technology, breakthrough, or market mechanism deployment

Continued Reductions (CR)

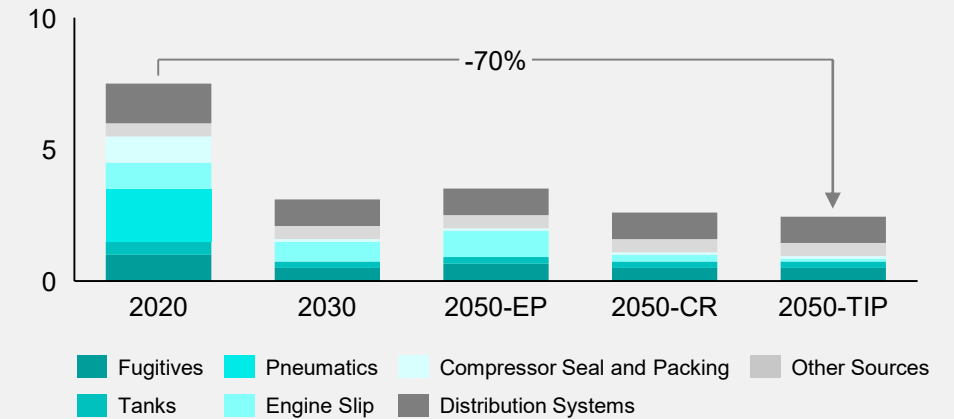
- On trend improvements for voluntary efforts and technology progress
- Does not assume additional market mechanisms

Technology, Innovation, and Policy (TIP)

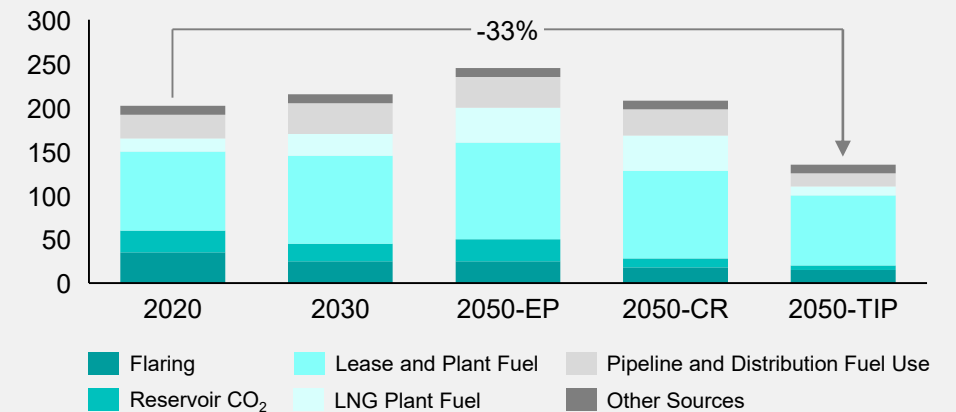
- Policy and voluntary efforts shift to CO₂ emissions reduction
- Assume advancements in technology
- Market mechanisms support wider carbon capture and storage (CCS) deployment and electrification

**CHARTING
THE COURSE**

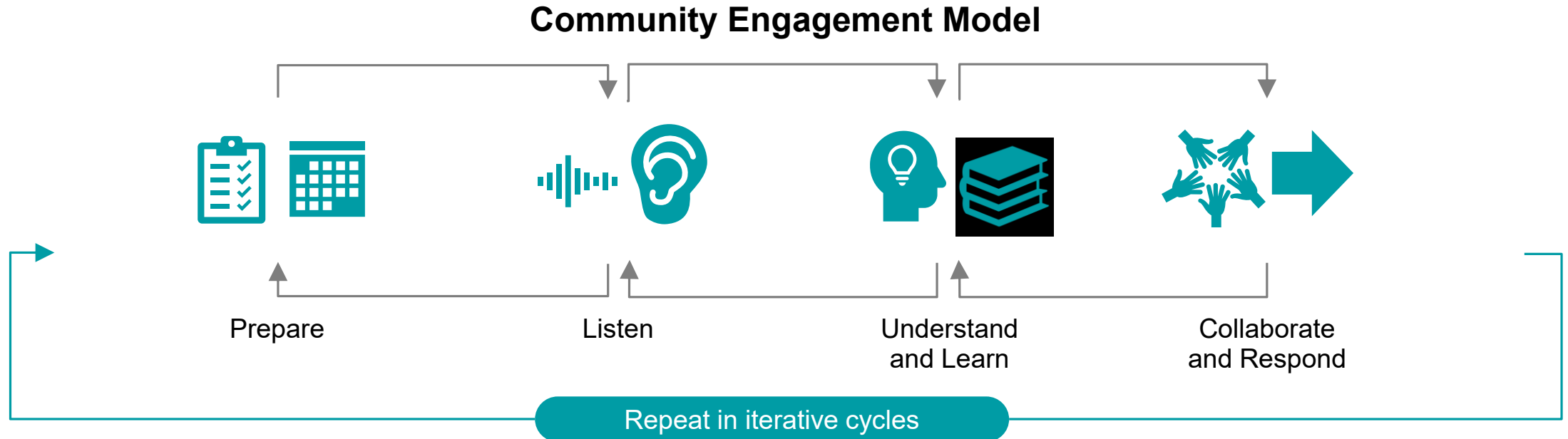
Annual Methane Emissions (MMT CH₄)



Annual CO₂ Emissions (MMT CO₂)



SCI: It's not just what you do, it's how you do it

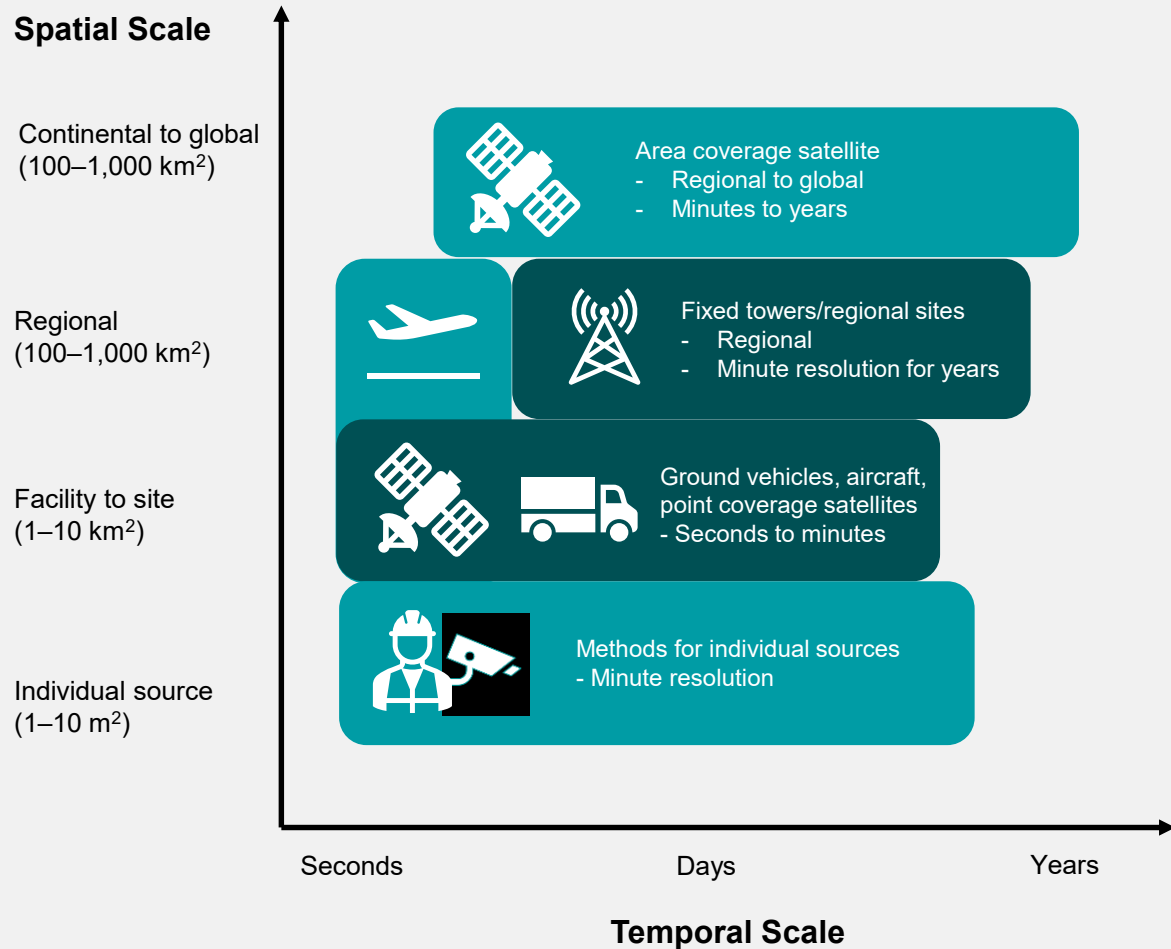


***Charting the Course* conducted six focus groups and a poll to better understand perspectives of impacted communities**

The study also partnered with the NPC hydrogen study to examine SCI and community engagement best practices, including:

- Authenticity and building trust
- Transparency
- Early, open, responsive, and accessible engagement
- Identifying and responding to community input and concerns
- Articulation and delivery of community value and recognition of value

Detection technology varies spatially and over time



Detection technologies have advanced rapidly. However,

- they vary in spatial and temporal scale but quantification remains a challenge
- and Less Capitalized Operators expressed concern that supply chain issues could prevent cost-effective and timely solutions

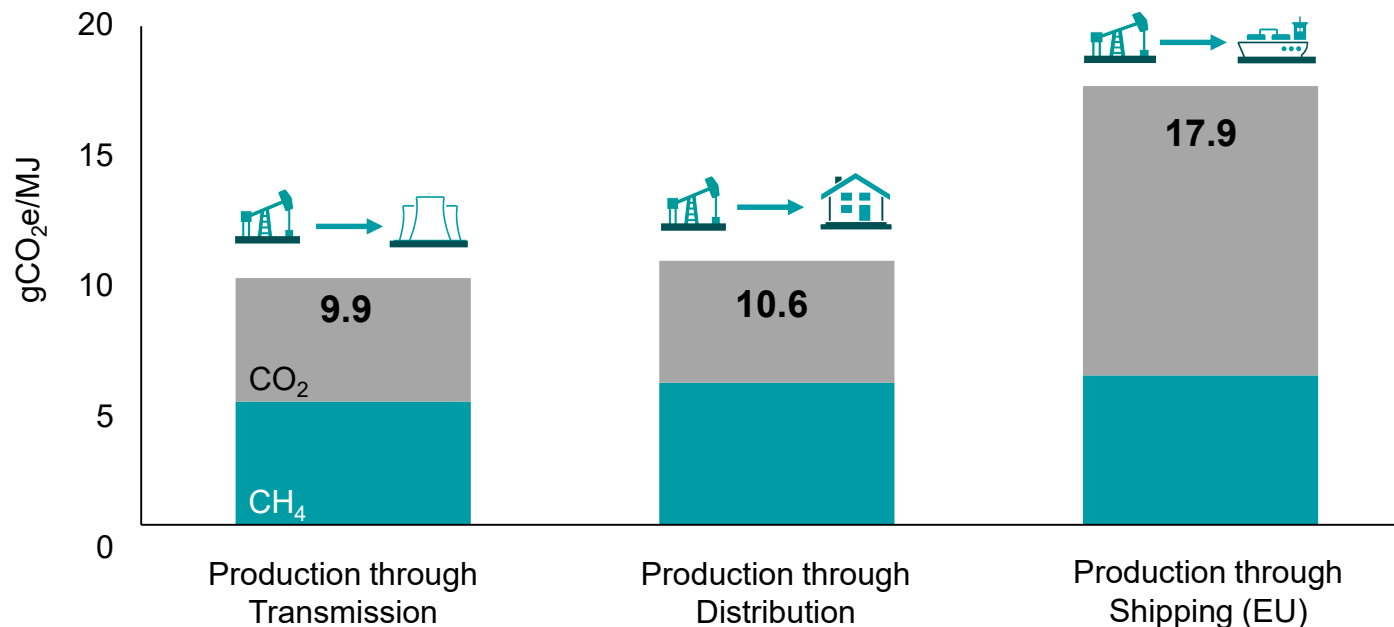
Example Recommendation

The NPC recommends:

- ...scaling up production and deployment of equipment and technology to abate methane emissions.
- ...directly funding and tax credits to support innovation and deployment of equipment and technology.

LCAs are critical tools to identify and quantify GHG emissions

Life cycle GHG emissions intensity delivered¹



Life cycle assessments (LCAs) can be complex and time consuming

The NPC developed a streamlined LCA model that is publicly available – SLiNG-GHG².

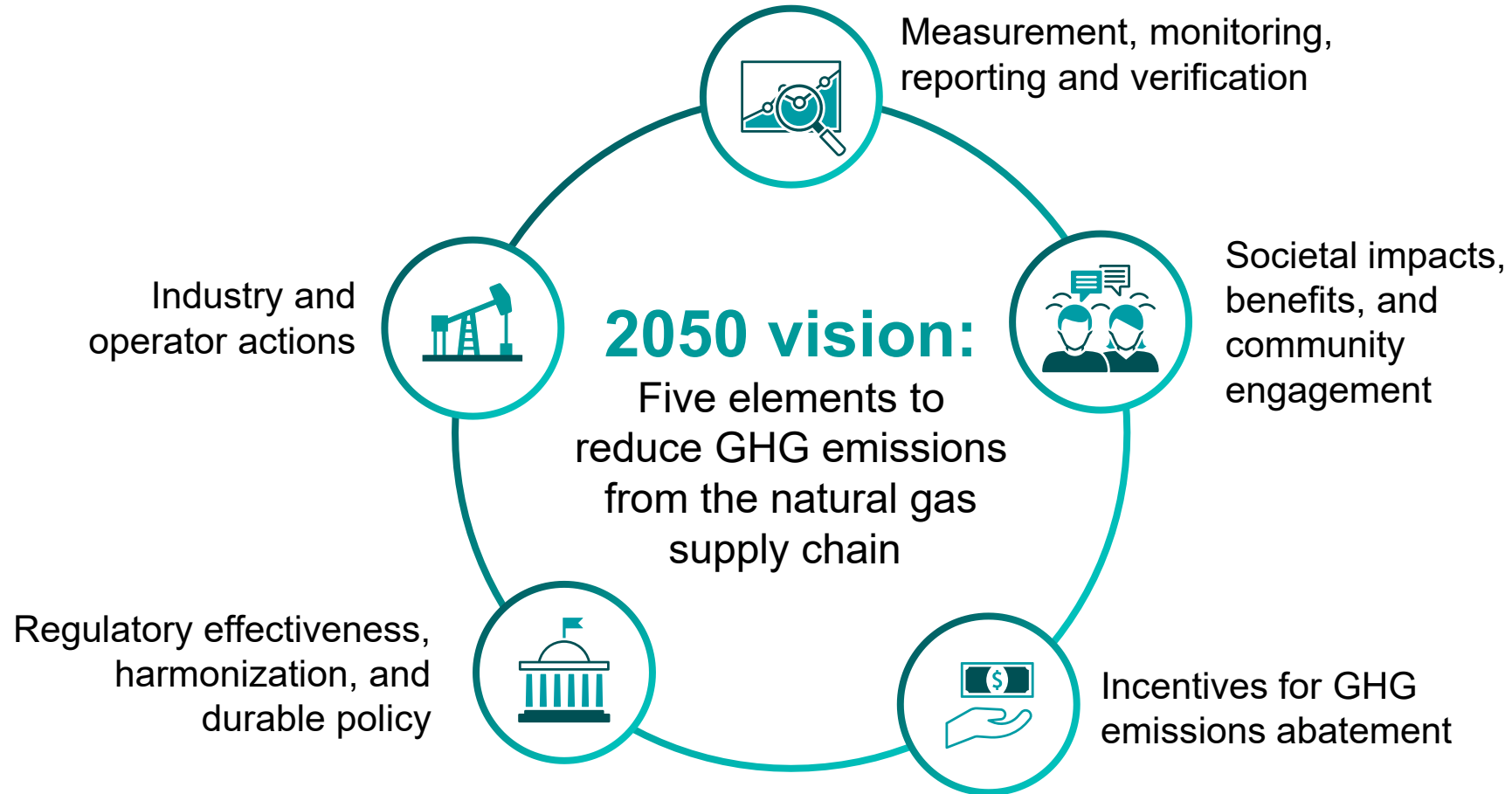
Example LCA Recommendation

- The NPC recommends that DOE support the adoption of open-source, user-defined, simplified and streamlined models such as SLiNG-GHG
- as part of its Measuring, Monitoring, Reporting, and Verifying (MMRV) efforts
- and through the Federal Life Cycle Assessment Commons interagency process






¹ Delivered MJ NG accounts for all NG used along the NGSC (GWP100)

² Streamlined Life Cycle Assessment for Natural Gas GHG

Industry, government, communities and academia working together to support GHG emissions reductions



2050 vision elements and categories

	Taking action	Scaling impact	Building foundations
 Measurement, monitoring, reporting, and verification	<p>Enhance capacity to monitor and report methane emissions</p> <p>Improve use of and confidence in GHG emissions reporting</p>	<p>Scale the use of emissions monitoring and reporting</p> <p>Harmonize GHG emissions data and tools</p>	<p>Deploy standards to differentiate GHG intensity of natural gas</p>
 Societal impacts, benefits, and community engagement	<p>Maximize effectiveness of community benefits; improve understanding of impacts</p>	<p>Build capacity for community engagement best practices; document impacts and benefits</p>	<p>Scale government incentives for and expand use of community benefit planning</p>
 Incentives for GHG emissions abatement	<p>Expand existing market mechanisms and voluntary initiatives</p>	<p>Introduce new market mechanisms, voluntary standards and tech. investment</p>	<p>Develop new economy-wide and/or sectoral market mechanisms</p>
 Regulatory effectiveness and durable policy	<p>Maximize effectiveness and impact of existing and proposed regulations</p>	<p>Demonstrate, deploy, and harmonize technologies to support regulations</p>	<p>Implement durable policy to create a stable investment environment</p>
 Industry and operator actions	<p>Develop additional capabilities of oil and gas operators</p>	<p>Enhance industry and operator cooperation</p>	<p>Develop and deploy new methods for assessing industry progress</p>

Recommendation themes

▶ Energy and economic security

Leveraging consequential analysis and recognizing the low GHG intensity of US-produced natural gas and LNG through climate and energy diplomatic efforts. Harmonizing methane policy across federal and state governments through the White House Methane Task Force adopting policy that utilizes durable market mechanisms to drive economically efficient GHG emissions reductions.

▶ Promote SCI awareness

Committing investments to address social, environmental, and public health impacts and benefits of NGSC projects and activities and pursuing research based on Societal Considerations and Impacts best practices and community engagement.

▶ Incorporate more measurement

Incorporating advanced technology measurements into measurement, monitoring, reporting, and verification (MMRV) programs and leveraging this study for development of a common MMRV global framework.

▶ Technology advancements to further emission reductions

Prioritizing research, development, demonstration, and deployment (RDD&D) of technologies for reducing and monitoring the GHG intensity of the NGSC.

▶ Leverage life cycle assessments

Leveraging LCAs to quantify supply chain carbon intensities and develop measurement-informed geospatial LCA tools.

▶ Employ enablers for change

Revitalizing an organization like the Petroleum Technology Transfer Council for efficiently socializing best practices and technology adoption throughout industry.

How to access the study report

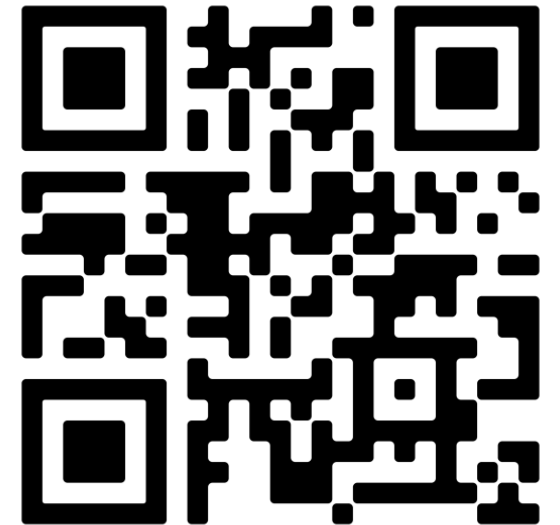
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CHARTING THE COURSE

Reducing GHG Emissions from the
U.S. Natural Gas Supply Chain

Study website:

chartingthecourse.npc.org



Charting the Course: Reducing GHG Emissions from the U.S. Natural Gas Supply Chain

Q&A

Recommendations for Target Audiences

Recommendations¹ for industry and related associations

Reducing emissions from the U.S. NGSC is a priority that requires collaborative solutions. By implementing these recommendations, Government can help accelerate GHG emissions reductions in natural gas production, transportation, distribution, and LNG exports.



Measurement, monitoring, reporting and verification

- Leverage LCAs to conduct contribution analyses.
- Utilize a harmonization process in the evaluation of LCA results.
- Participate in federal agency led stakeholder working groups on MMRV.



Regulatory effectiveness and durable policy

- Engage with federal and state governments to design durable policies.
- Fund policy and regulatory education and share best practices with smaller operators through trade associations.



Incentives for GHG emissions abatement

- Develop recognized frameworks, standards, and metrics for differentiated gas.²



Societal impacts, benefits, and community engagement

- Deploy effective community engagement practices during siting and development of infrastructure.
- Avoid or mitigate adverse impacts on communities and maximize community benefits during GHG emissions reduction projects.
- Develop and share community engagement training programs through trade associations.



Industry and operator actions

- Dedicate additional resources to analyzing emissions reduction opportunities.
- Revitalize an organization in the model of the Petroleum Technology Transfer Council (PTTC) to share emissions reduction technology and best practices.

¹Not indicative of all recommendations, accompanying language, and findings that are provided in study, only provides high-level recommendations for industry and trade associations.

²This recommendation is directed towards standards-setting bodies, not specifically industry or a trade association.

Recommendations¹ for Department of Energy

Reducing emissions from the U.S. NGSC is a priority that requires collaborative solutions. By implementing these recommendations, Government can help accelerate GHG emissions reductions in natural gas production, transportation, distribution, and LNG exports.



Measurement, monitoring, reporting and verification

- Support detection technology improvement and evaluation through the creation of technology evaluation centers.
- Coordinate with EPA to incorporate advanced technology measurements into Subpart W.
- Support the development of public-private partnership to improve methane measurement technology and promote consistent interchange formats for emissions data.
- Integrate measurement data into LCAs through the creation of an advisory group.
- Publish best practice guidelines for conducting natural gas LCAs.



Regulatory effectiveness and durable policy

- Work with EPA to incorporate evolving technology into regulations.
- Support the democratization of LCAs as a screening tool for stakeholders who do not have the capacity to conduct detailed life cycle assessment modeling.



Incentives for GHG emissions abatement

- Undertake RDD&D to reduce the carbon intensity of energy use in the natural gas supply chain for compression, heat, and power activities.
- Fund the improvement of site/facility-scale data systems used in the public attribution of emissions sources through emissions detection and quantification solutions.



Societal impacts, benefits, and community engagement

- Undertake an additional societal considerations and impacts study.
- Commit to investing in efforts that consider the societal impacts of natural gas projects.
- Fund research of effective industry-community engagement best practices.
- Commission additional workforce study on skills needed for GHG emissions reduction projects.

Recommendations¹ for federal, state, Tribal, and local governments

Reducing emissions from the U.S. NGSC is a priority that requires collaborative solutions. By implementing these recommendations, Government can help accelerate GHG emissions reductions in natural gas production, transportation, distribution, and LNG exports.



Measurement, monitoring, reporting and verification

- Work with the White House Methane Task Force to harmonize reporting, control, and technology requirements.



Regulatory effectiveness and durable policy

- Engage with industry to design durable policies.
- Advance permitting reform at every level of government.
- Coordinate policies and initiatives for low-carbon technology RDD&D.
- Support diplomatic efforts to standardize exported products' GHG intensity.



Incentives for GHG emissions abatement

- Adopt market mechanism options to generate incentives for investments in GHG emissions reduction.
- Review options for emissions reduction incentives for marginal wells, including the deduction of GHG emissions reduction investments from state/federal taxes or royalty obligations.



Societal impacts, benefits, and community engagement

- Charter public/private councils of excellence in effective industry-community engagement practices.
- Assess which communities might benefit from or be harmed by GHG emissions reduction infrastructure siting or operational decisions, policies, and technologies.

Study governance and operating model

