

Pathways to a Lower Carbon Economy: Natural Gas Utilities & Industrial Energy

CIBO Annual Meeting - October 20, 2021

Richard Murphy
Managing Director – Energy Markets



Notice

In issuing and making this publication available, AGA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is AGA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances. The statements in this publication are for general information and represent an unaudited compilation of statistical information that could contain coding or processing errors. AGA makes no warranties, express or implied, nor representations about the accuracy of the information in the publication or its appropriateness for any given purpose or situation. This publication shall not be construed as including, advice, guidance, or recommendations to take, or not to take, any actions or decisions regarding any matter, including without limitation relating to investments or the purchase or sale of any securities, shares or other assets of any kind. Should you take any such action or decision; you do so at your own risk. Information on the topics covered by this publication may be available from other sources, which the user may wish to consult for additional views or information not covered by this publication.



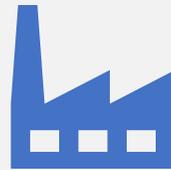
The American Gas Association (AGA) represents companies delivering natural gas safely, reliably, and in an environmentally responsible way to help improve the quality of life for their customers every day. AGA's mission is to provide clear value to its membership and serve as the indispensable, leading voice and facilitator on its behalf in promoting the safe, reliable, and efficient delivery of natural gas to homes and businesses across the nation.

Committed to utilizing America's abundant, domestic, affordable and clean natural gas to help meet the nation's energy and environmental needs.

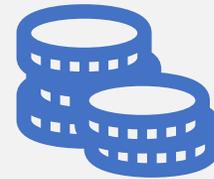
Areas of Focus



NATURAL GAS MARKET
CONDITIONS



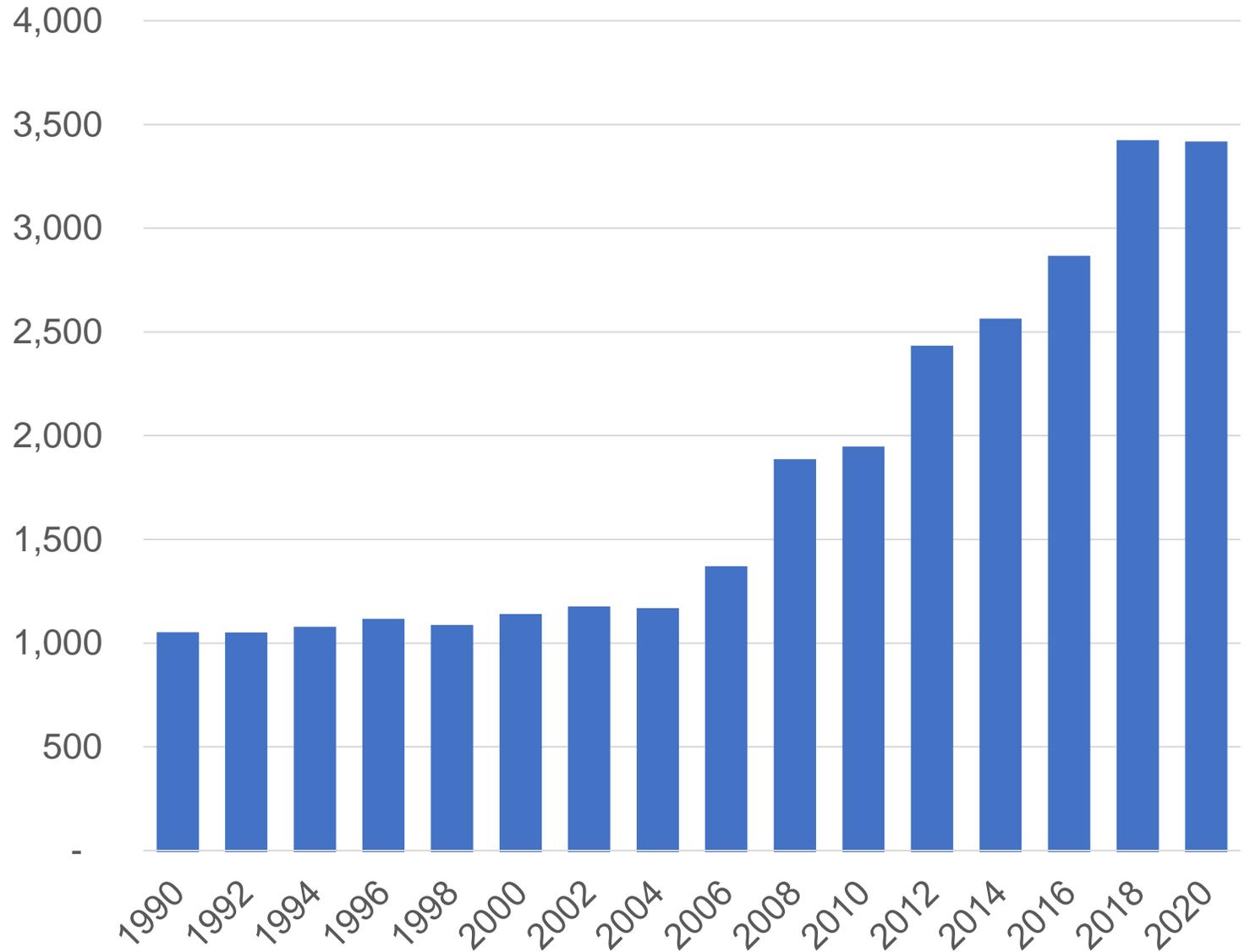
POLICIES IMPACTING
NATURAL GAS UTILITIES
AND THE INDUSTRIAL
SECTOR



THE ROLE OF GAS
UTILITIES IN A LOW-
CARBON FUTURE

Natural Gas Market Conditions

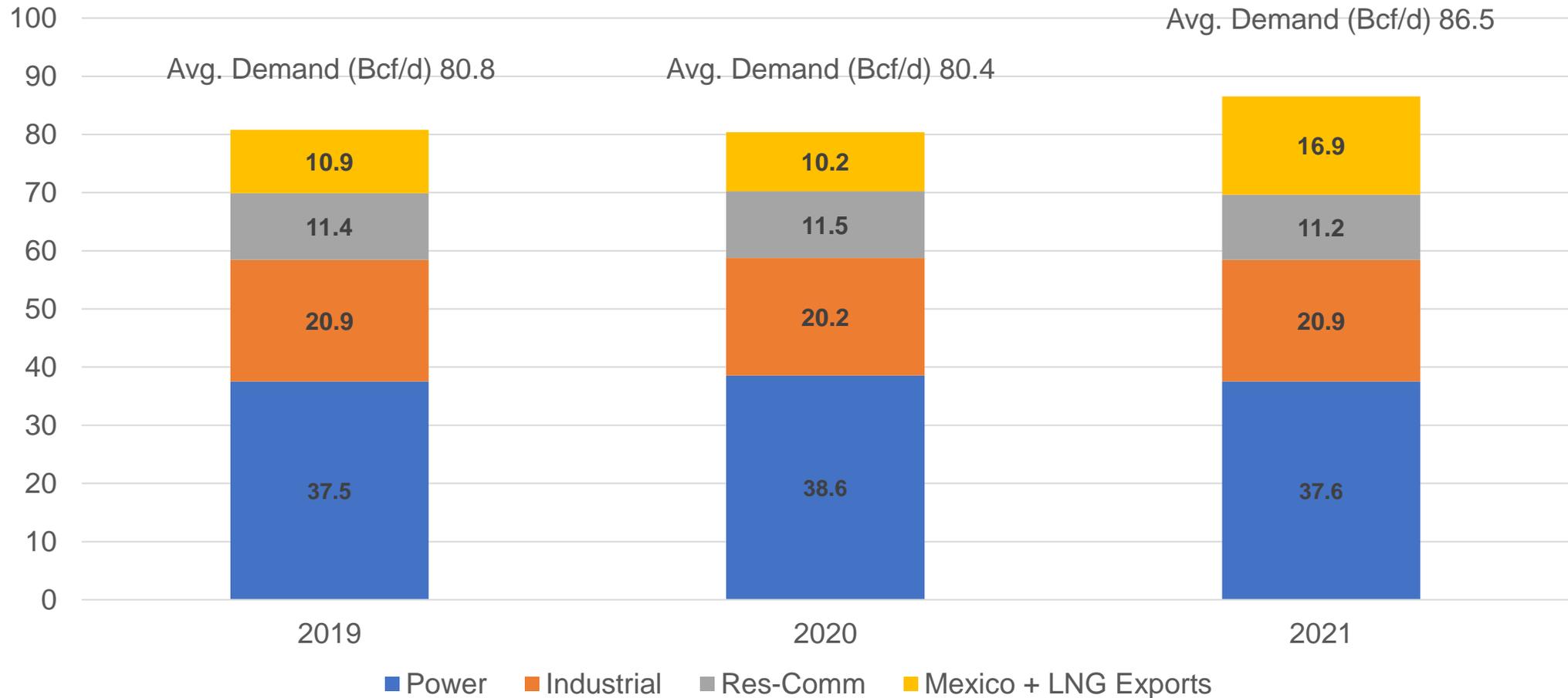
U.S. Natural Gas Technically Recoverable Resources (Tcf)



Potential future supply of natural gas is at a record high.

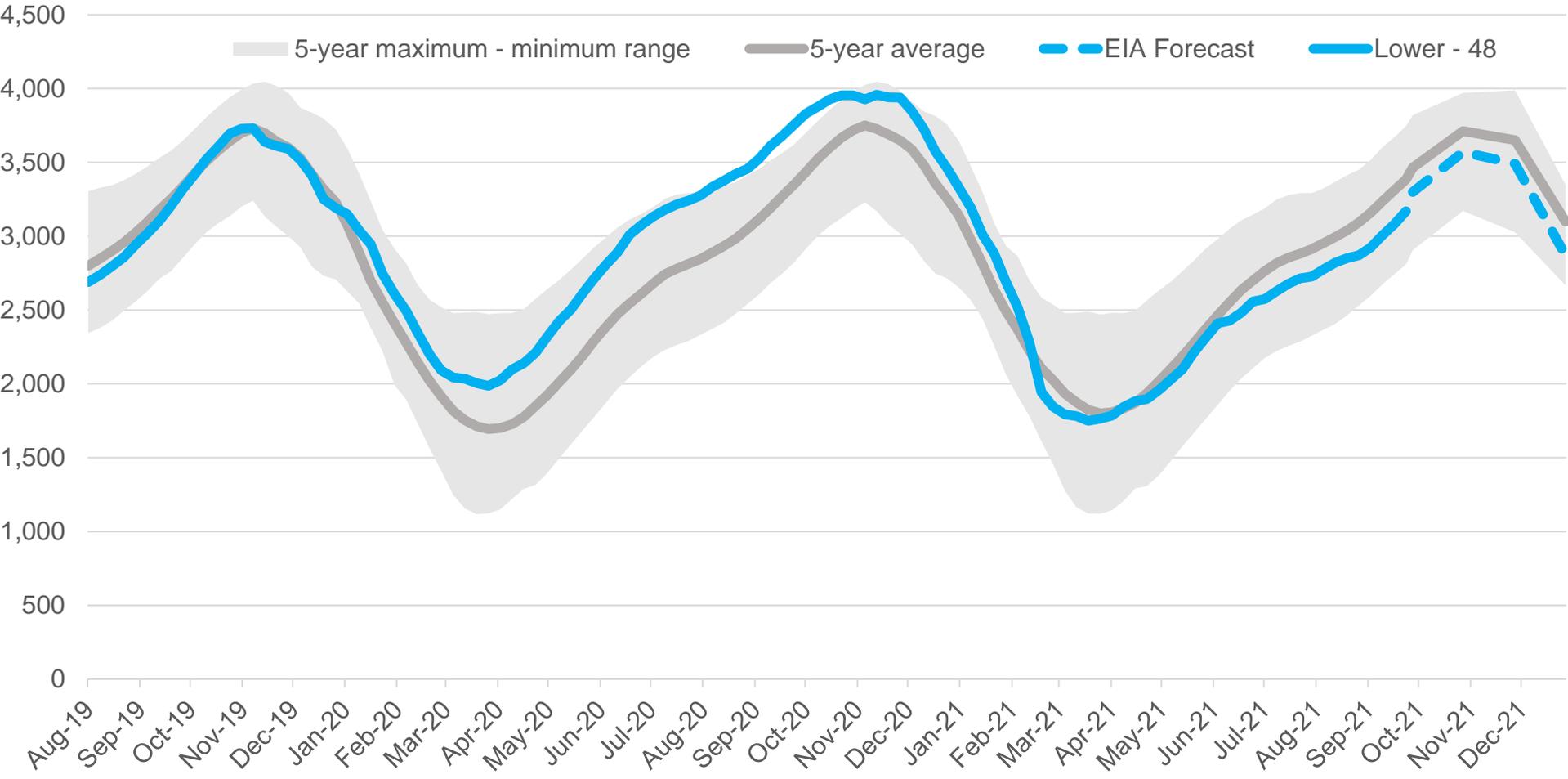
Average Daily Demand for Natural Gas June through September 2019 -2021

June - September US Demand Stack
Bcf per day



Storage inventories are below average this injection season

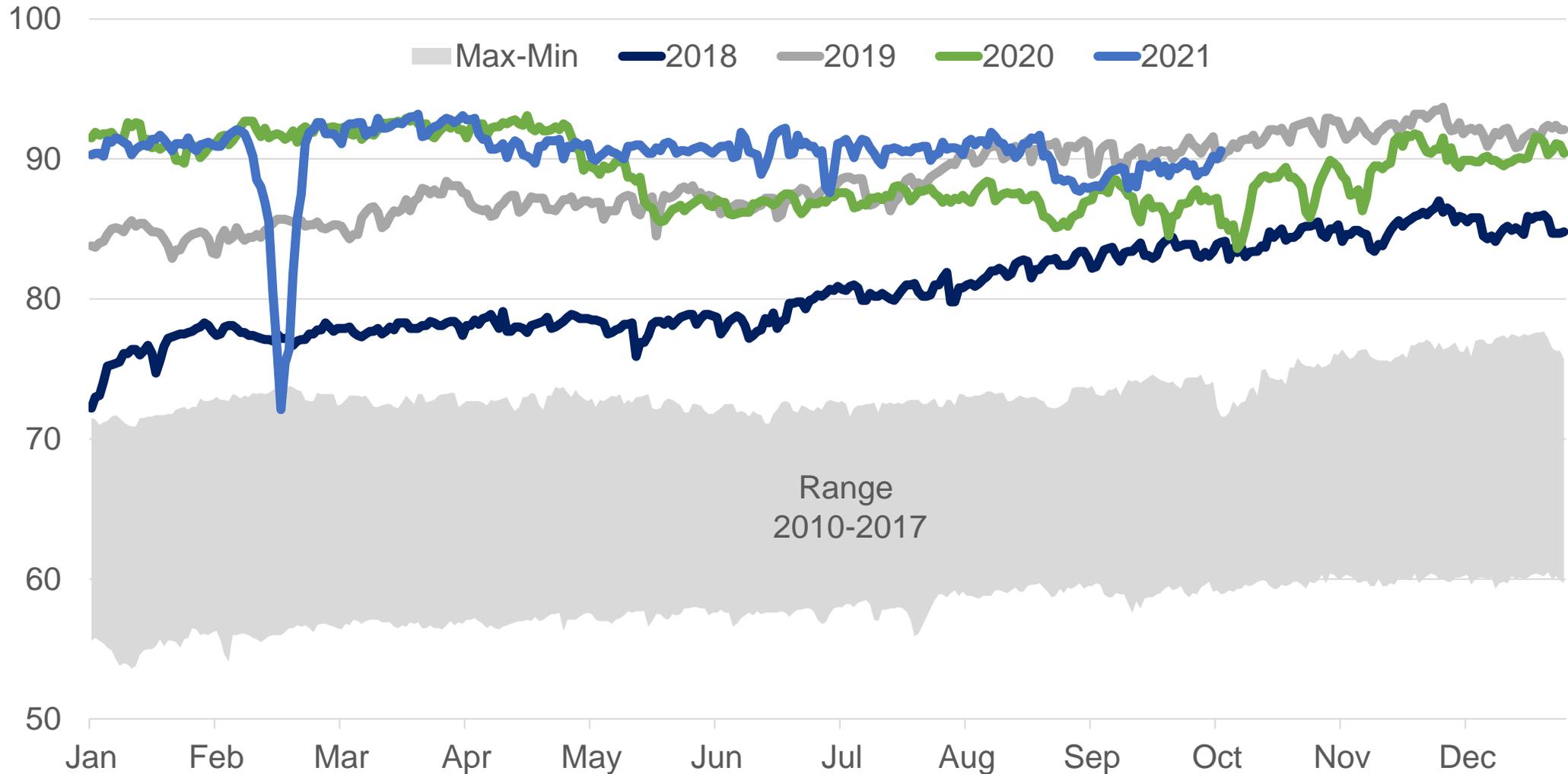
Working Gas in Underground Storage Lower-48 States (billion cubic feet)



Source: EIA

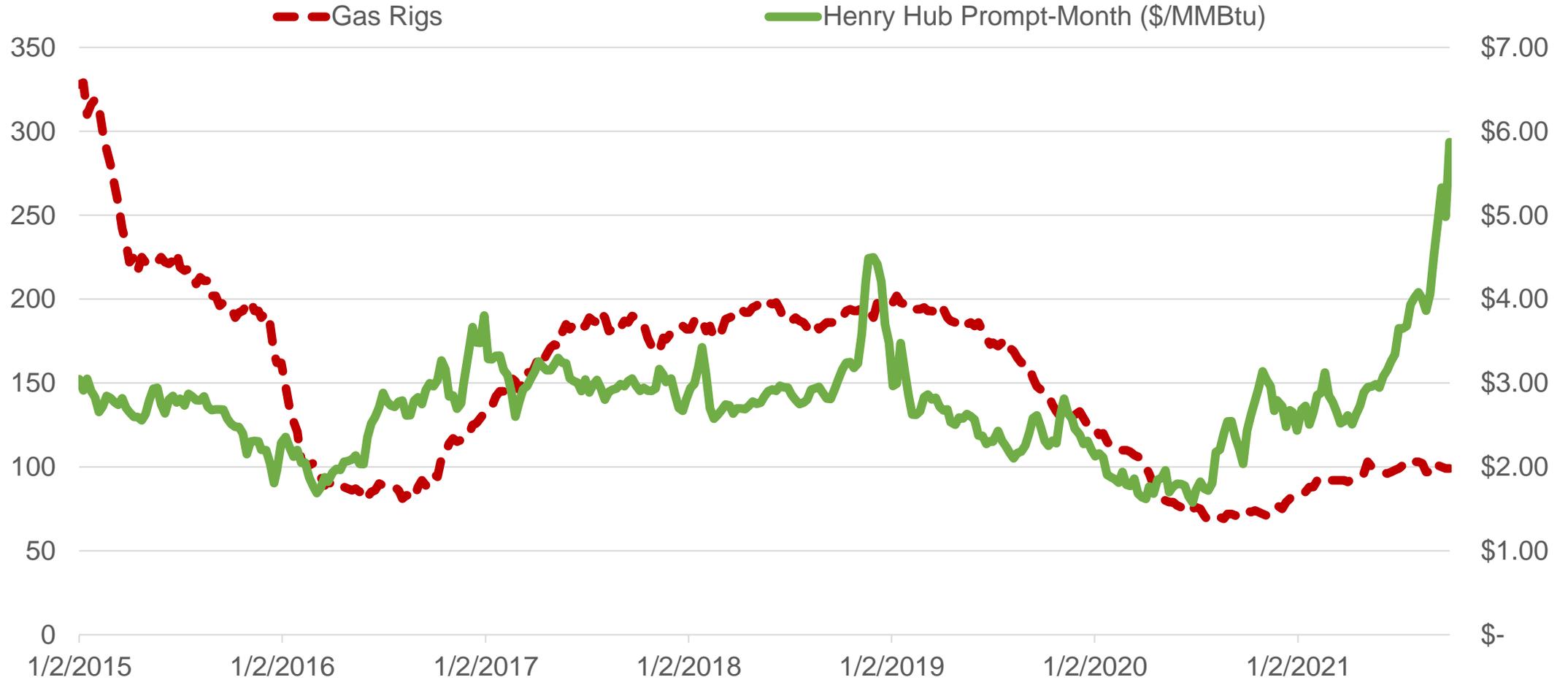
Natural gas production remains flat

US Lower-48 Daily Dry Natural Gas Production, Bcf per day



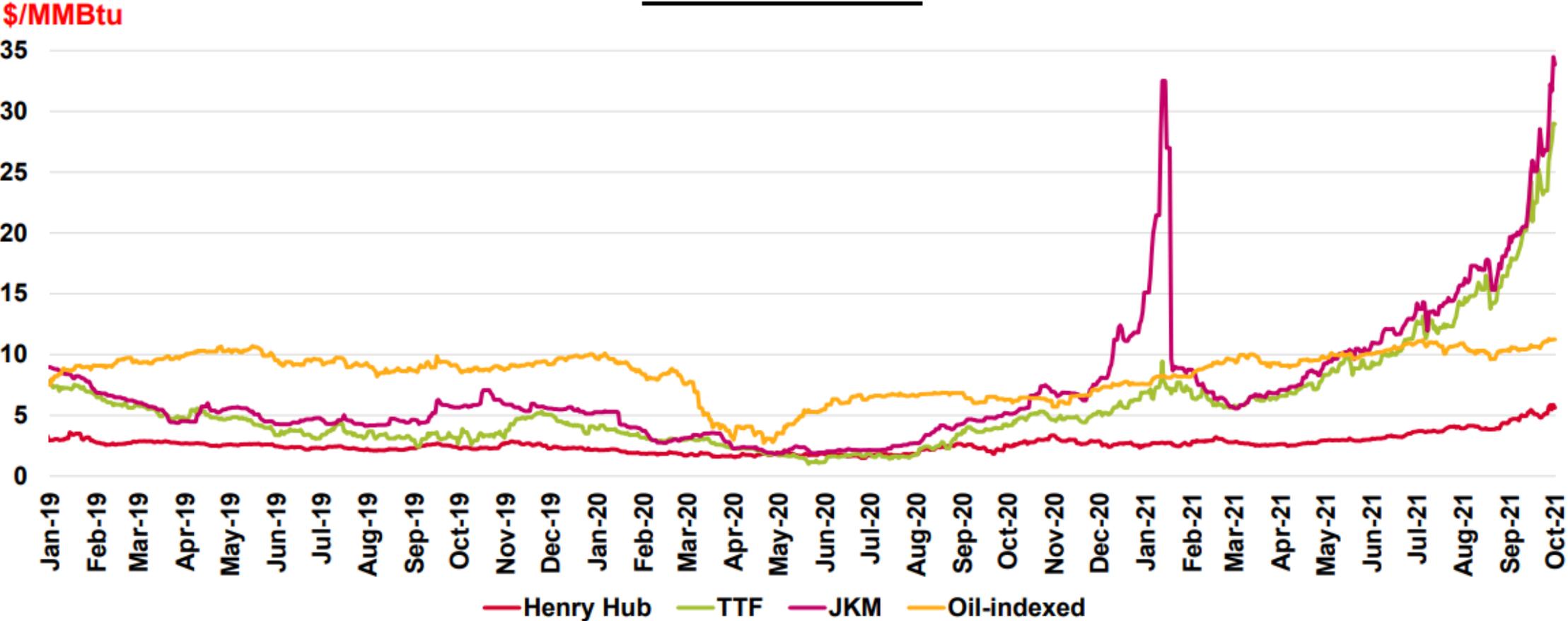
Correlation of Gas Rigs and Natural Gas Commodity Prices

US Gas Rigs in Operation (Red) and
Henry Hub Prompt-Month Futures Prices (Green)



European and Asian Natural Gas Prices

Global Gas Prices



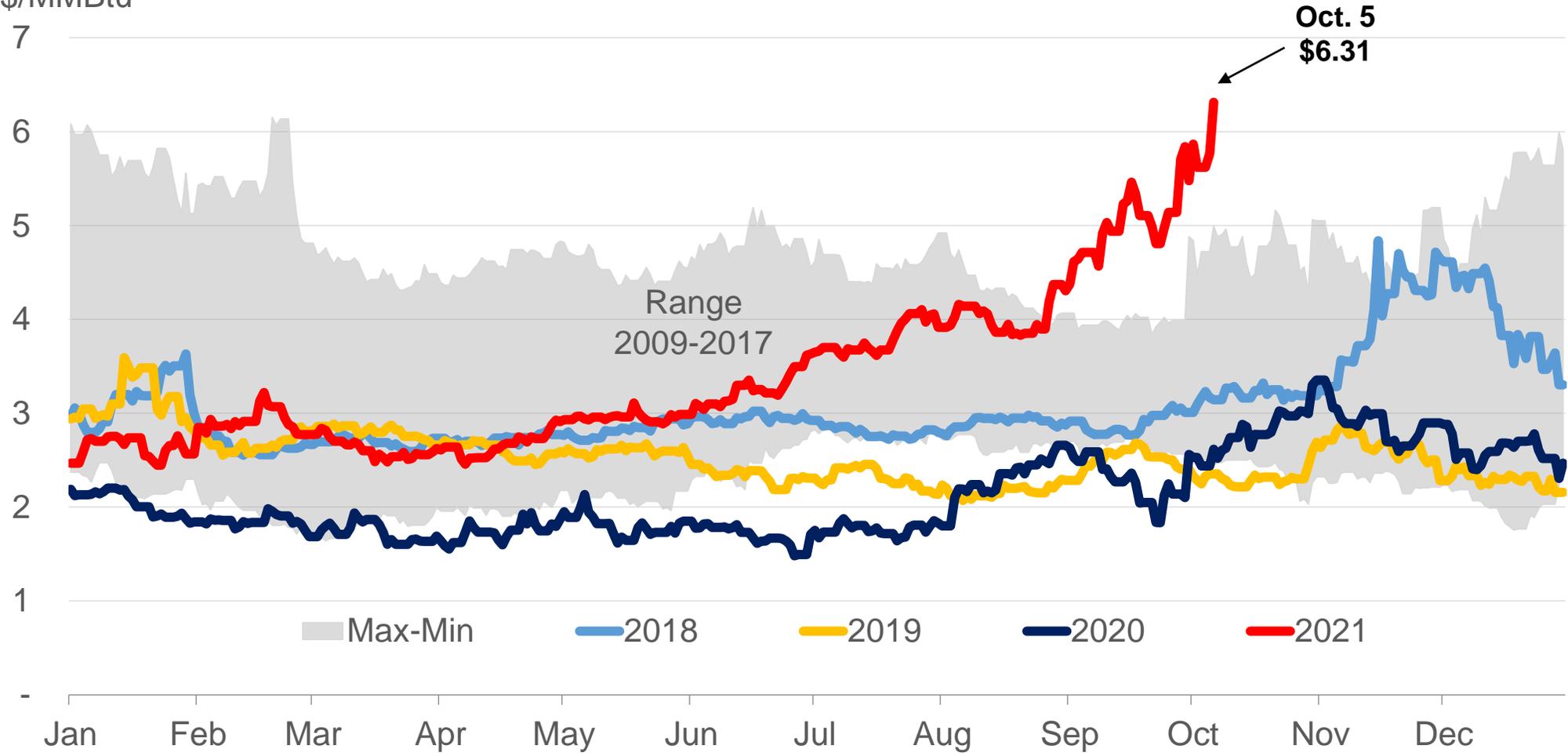
Note: Oil-indexed = 13% Brent + \$1

Factors Contributing to Rising Natural Gas Prices in Europe and Asia

- **Cold winter followed by a hot summer.**
- **Declining domestic production**
- **Consistent but not strong flows from Russia**
- **Low European gas storage levels (less than 80% full)**
- **Intense competition for LNG supply**
- **South American drought/declines in production, boosting LNG demand**
- **LNG production disruptions**

Henry Hub futures prices facing pressure headed into the winter.

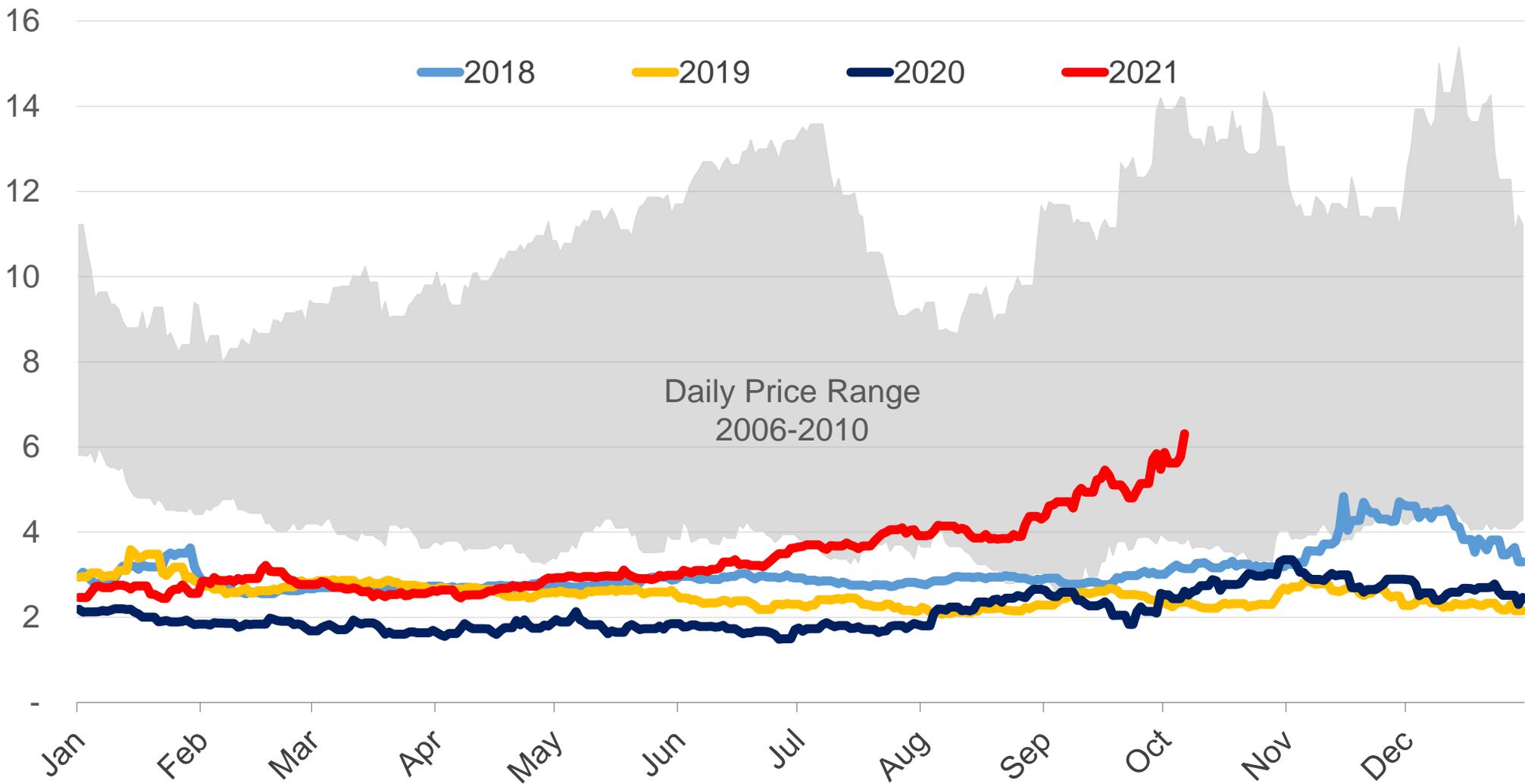
Natural Gas Prices Prompt-Month Futures at Henry Hub
\$/MMBtu



Data: Energy Information Administration

Still, within a larger span of history, prices remain low and stable

Daily Natural Gas Prices Prompt-Month Futures at Henry Hub (\$/MMBtu)



Data: Energy Information Administration

Market Conditions Conclusion

Near-Term Observations

- US market is tighter than prior years, but well supplied.
- Weather will be a key driver for demand.
- LNG demand likely to remain strong given high overseas prices.
- Gas-to-coal switching may be more limited, but potential remains.
- Will producer behavior change if domestic prices remain high?

Key long-term issues to watch

- Environmental concerns – ESG pressure
- Challenges to infrastructure development
- International market influence

POLICIES IMPACTING NATURAL GAS UTILITIES AND THE INDUSTRIAL SECTOR



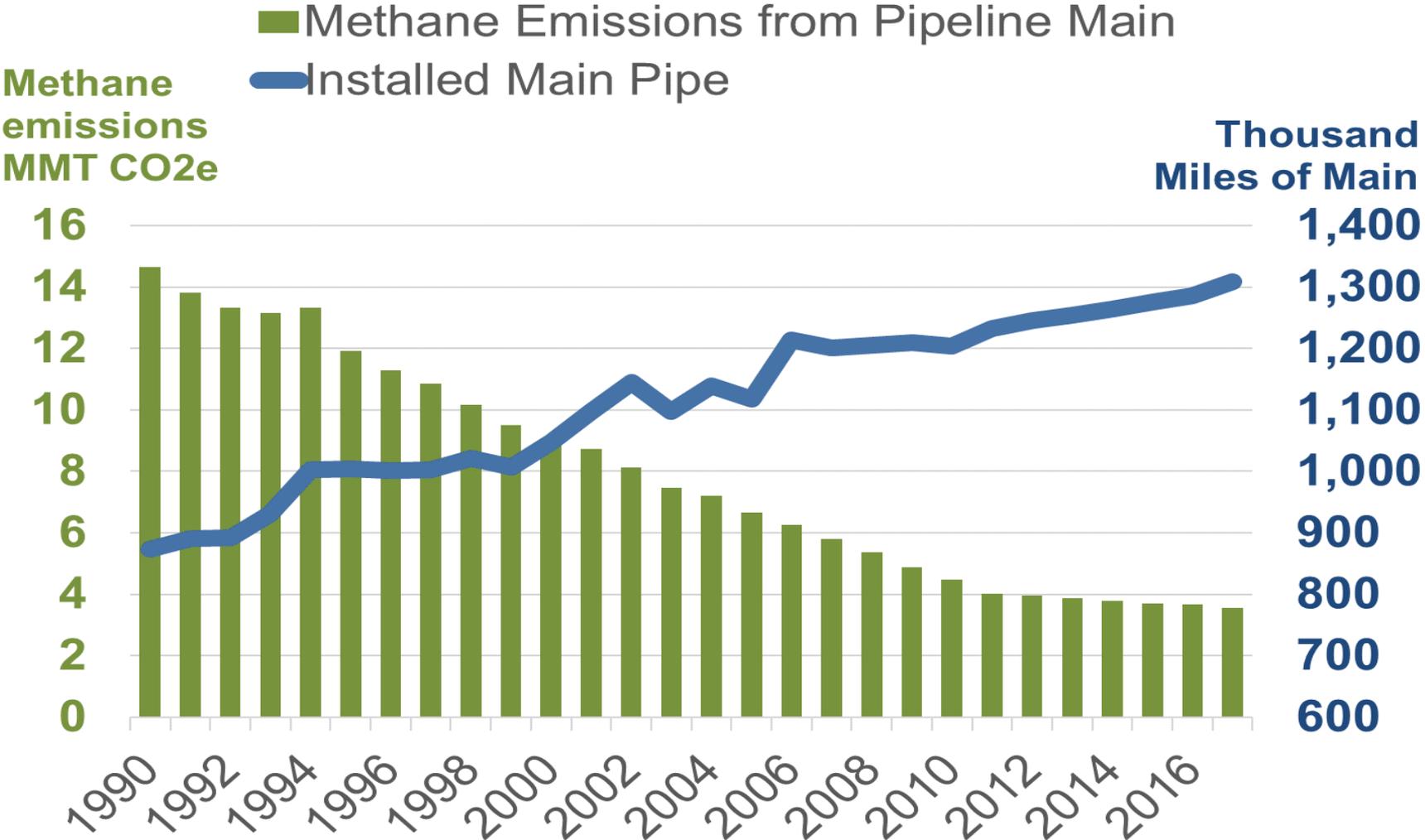
Increased use of natural gas is the single largest factor in power sector emissions reductions

Natural gas accounts for more than 38.4 percent of electricity generation. Natural gas emits fewer greenhouse gases than coal for the same amount of electricity.



Switching from coal to natural gas for electricity generation reduces greenhouse gas emissions by an average of 53%.

Natural Gas Utilities Progress in Reducing Methane Emissions



A CLOSER LOOK



AVERAGE HOME SIZE



CARBON EMISSIONS



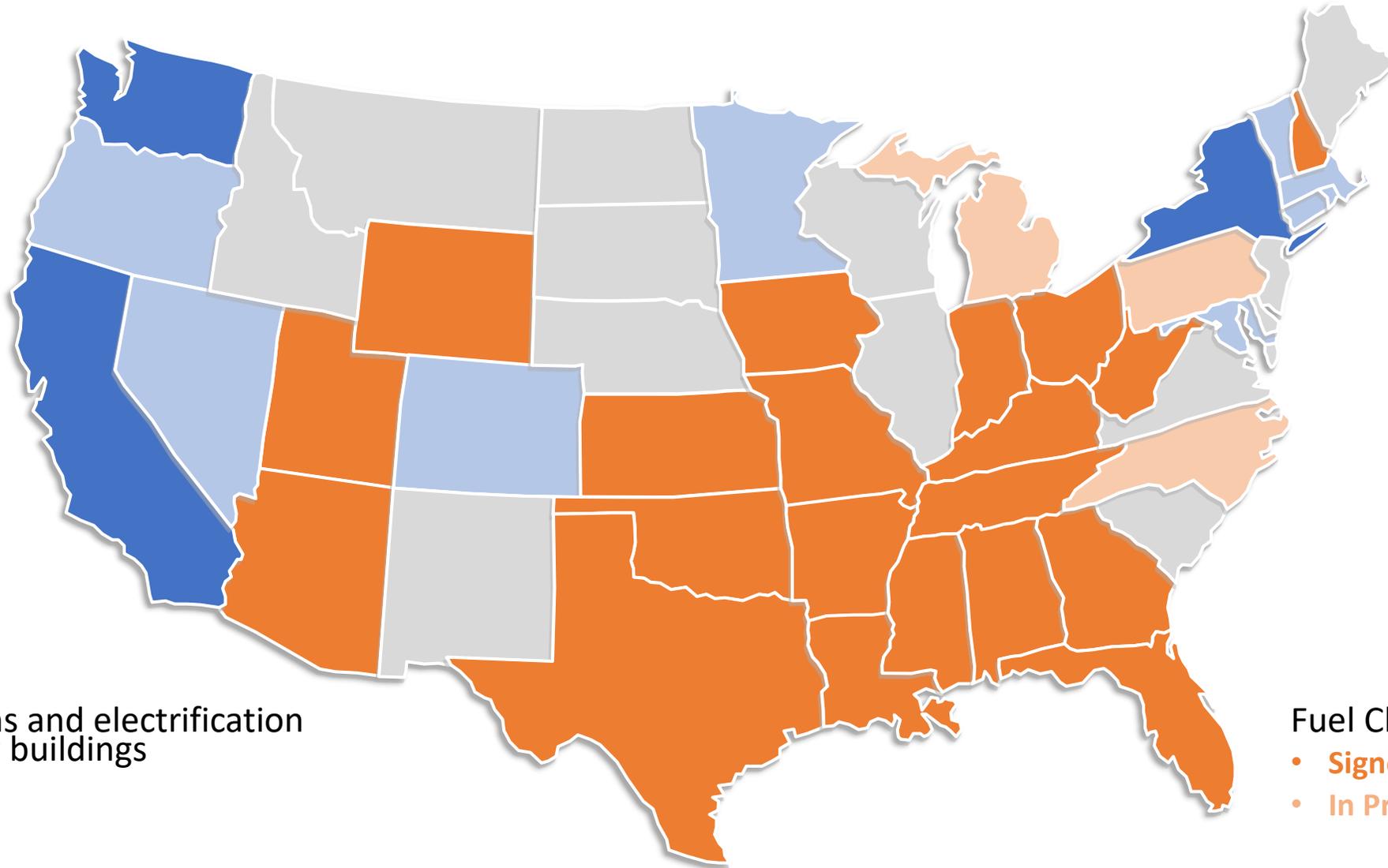
HELPING CUSTOMERS

Reduce Their Carbon Footprints

Carbon emissions from the average natural gas home decline 1.2 percent per year

The total number of residential natural gas customers in the U.S. has grown by 86 percent in the past 40 years, but overall residential natural gas demand has remained steady. Residential customers today use half of the volume of natural gas that they used in 1970 despite consistent growth in the average size of homes.

State and Local Policies Impacting Natural Gas



State gas bans and electrification codes in new buildings

- **Adopted**
- **Proposed**

Fuel Choice States

- **Signed into law**
- **In Progress**

Top 10 Priorities of the Biden Administration to Address Climate Change



1. Cut total emissions 45-50% by 2030 (from 2005 levels)



2. Pass climate-smart stimulus package



3. Require all new passenger vehicles produce zero emissions by 2035



4. Ramp up clean electricity standards



5. Tackle super pollutants like methane and HFCs



6. Set appliance and equipment standards



7. Set emission performance standards for cement, steel and plastics



8. Scale up carbon removal



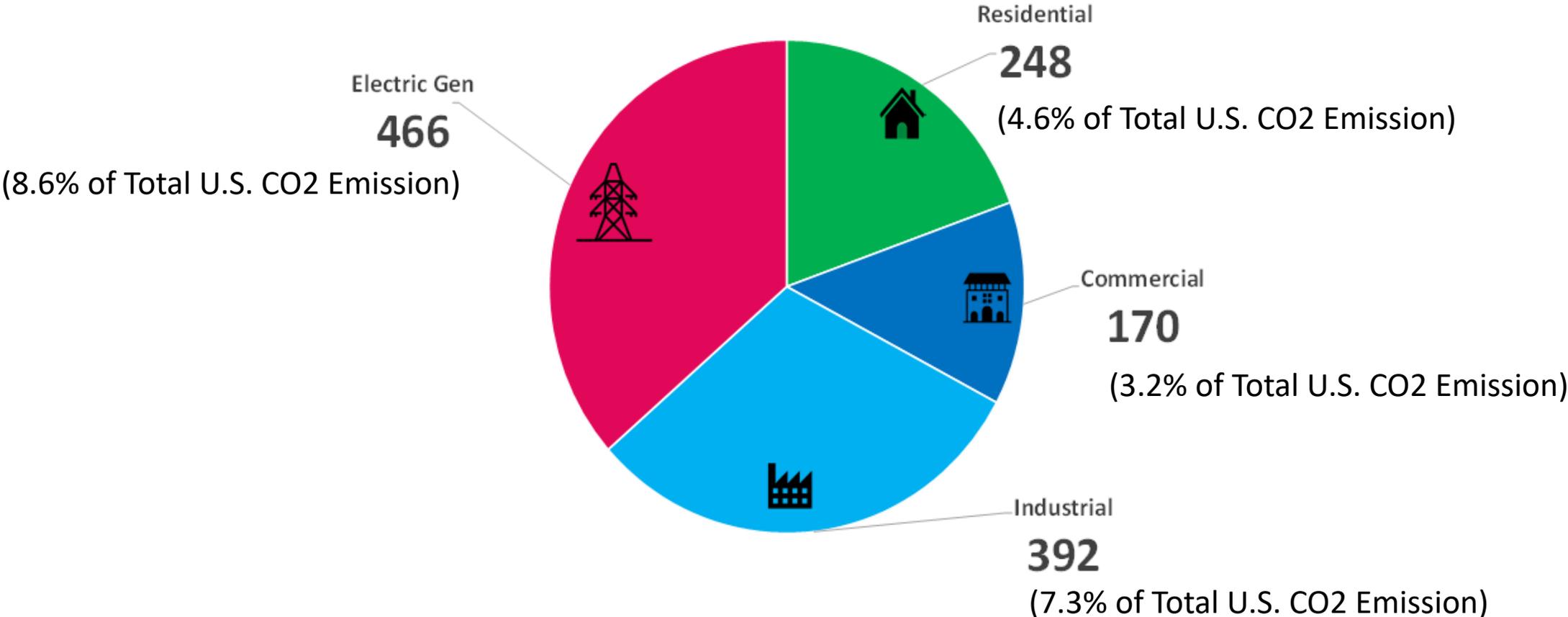
9. Reestablish global climate leadership



10. Tax carbon pollution

Natural Gas Consumption and CO2 Emissions

Average Annual Carbon Dioxide Emissions (MMT)
from Natural Gas Consumption in the U.S.
(2009-2018)





Implications of **Policy-Driven Residential Electrification**

An American Gas Association Study
prepared by ICF

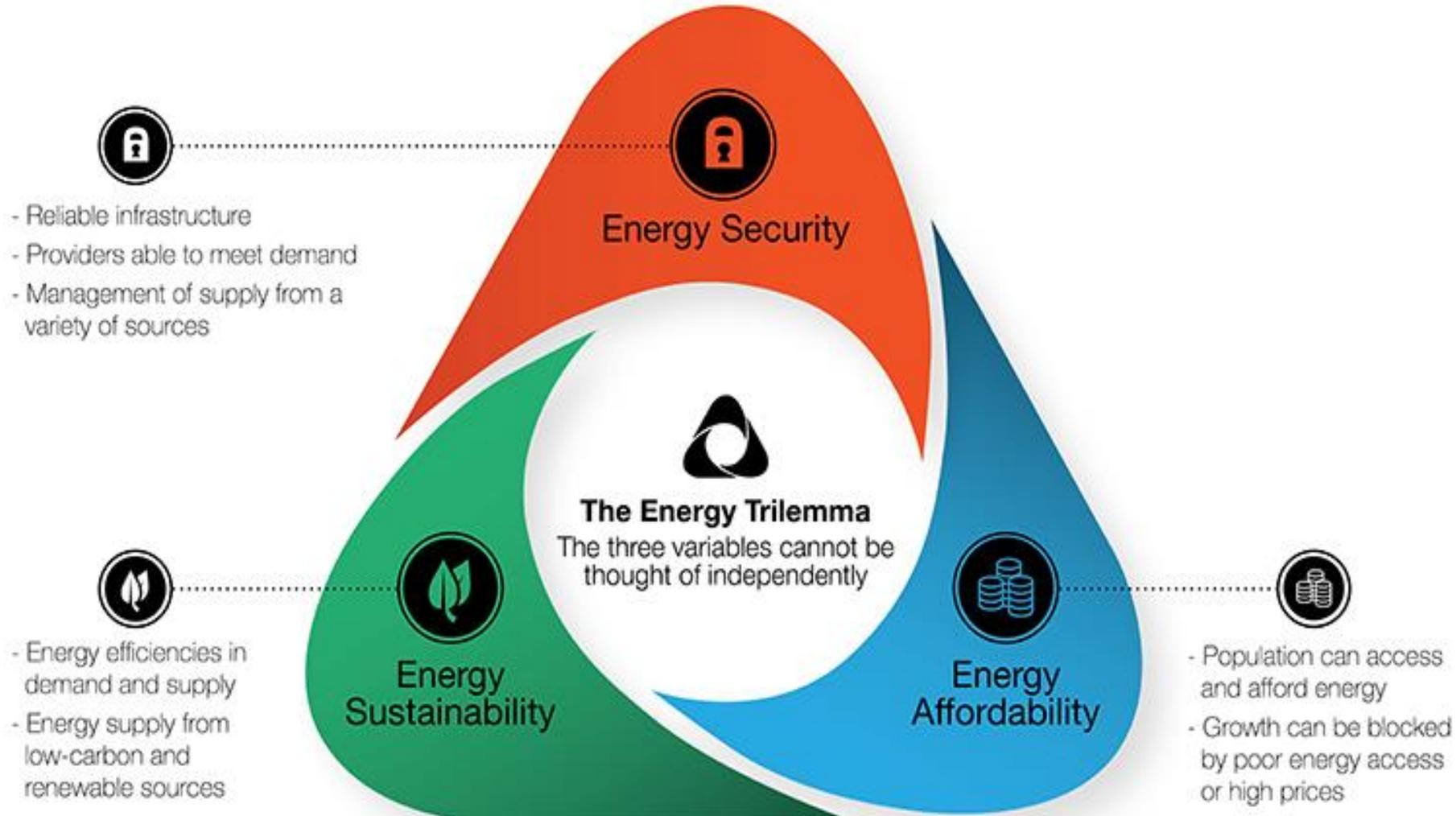
July 2018

ENERGY

Key Findings from Study

- **\$155 to \$426 billion**
in incremental generation capacity
requirements and transmission
system upgrade costs
- Overall emissions could be reduced
by just
1 to 1.5%
- Consumer energy costs could
increase by:
\$750 to \$910 per year.
- Cost of reducing carbon dioxide
through Residential Electrification:
\$572 to \$806 per ton

Energy Policy Must Focus on Solving the “Energy Trilemma”



THE ROLE OF GAS UTILITIES IN A LOW CARBON FUTURE

AGA's Climate Change POSITION STATEMENT

The American Gas Association is committed to reducing greenhouse gas emissions through smart innovation, new and modernized infrastructure, and advanced technologies that maintain reliable, resilient and affordable energy service choices for consumers.



10 commitments
for reducing emissions.

Eight principles
for an effective national
policy approach to
addressing climate change.

aga.org/climate

Advancing Research, Development and Deployment of Next-Generation Natural Gas Technologies



<p>Highly Efficient Appliances (Over 100% efficiency)</p>	<ul style="list-style-type: none"> • Gas Heat Pumps (Space Conditioning, Water Heating) • Combination Space/Water Heating Systems • Ventilation, Indoor Air Quality • Commercial Foodservice 		
<p>Efficient, Clean Industrial Processes</p>	<ul style="list-style-type: none"> • Efficient, low NOx Boilers • Advanced Process Heating • Heat Recovery Systems 		
<p>Combined Heat & Power</p>	<ul style="list-style-type: none"> • Integrated Commercial/Industrial CHP Systems • Micro CHP Systems 		
<p>NGVs and Alternative Vehicles</p>	<ul style="list-style-type: none"> • Ultra-Clean, Efficient HD NGVs • NGV Storage • Advanced NGV Fuel Stations • Home Fueling 		
<p>Renewable Energy</p>	<ul style="list-style-type: none"> • Solar Thermal/Natural Gas Hybrid Systems • Bio-Methane Production, Clean-Up, and Use 		

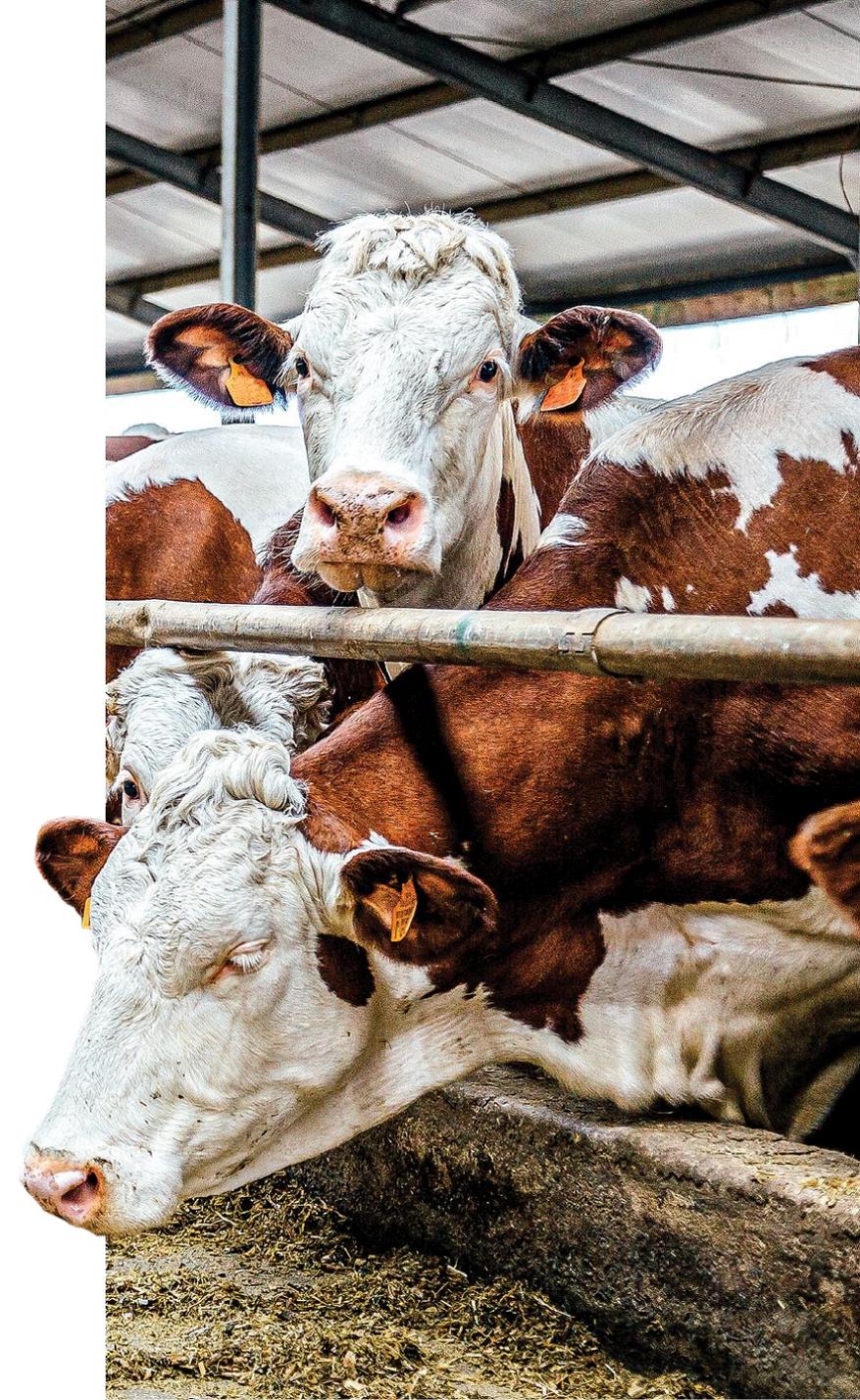
RENEWABLE NATURAL GAS

Renewable Natural Gas (RNG) is pipeline compatible gaseous fuel derived from biogenic or other renewable sources that has lower lifecycle carbon dioxide equivalent emissions than geological natural gas.

RNG can be produced from farms, landfills and water resource recovery facilities or from renewable electricity. It is carbon neutral, versatile and fully compatible with the U.S. pipeline system, so it can lower emissions in homes, businesses and heavy industries such as manufacturing.



Utilities throughout the country are starting to offer RNG to their customers as another option to lower household emissions



THREE TYPES OF WAYS FOR PRODUCING RNG



The most common way to produce RNG today, organic material such as animal or plant waste is broken down by microorganisms creating methane.



Low moisture biomass such as forestry waste or crop residue is converted into RNG through a high-pressure chemical process.



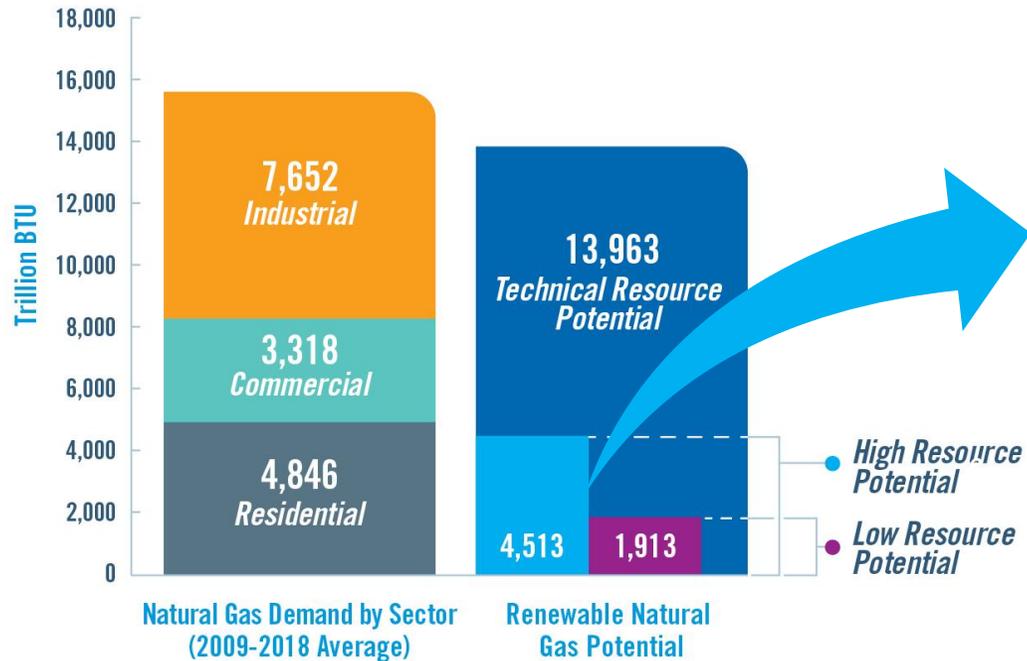
Renewable electricity is used to split water into hydrogen and oxygen through a process called electrolysis. This renewable hydrogen can be blended into the pipeline or combined with CO₂ to create RNG.

RNG Resource Potential Study

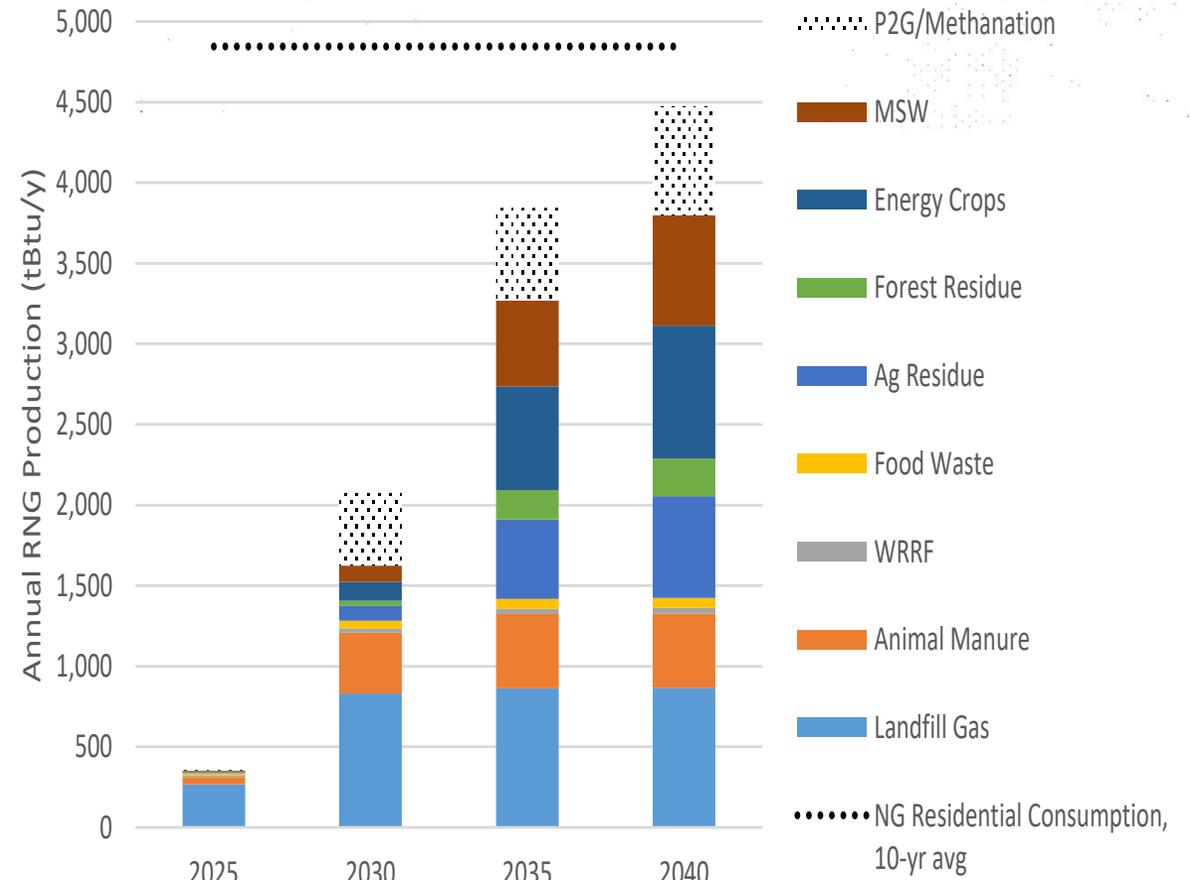
Key Findings

- Meaningful Potential to Offset Natural Gas Demand with RNG
- Moderate Scenario Represents up to 60 percent reduction in Industrial GHG emissions from natural gas
- RNG Costs are Competitive with Other Emission Reduction Strategies, \$55-300/ton of GHG Emission Reductions

RNG Resource Potential



Estimated Annual Production



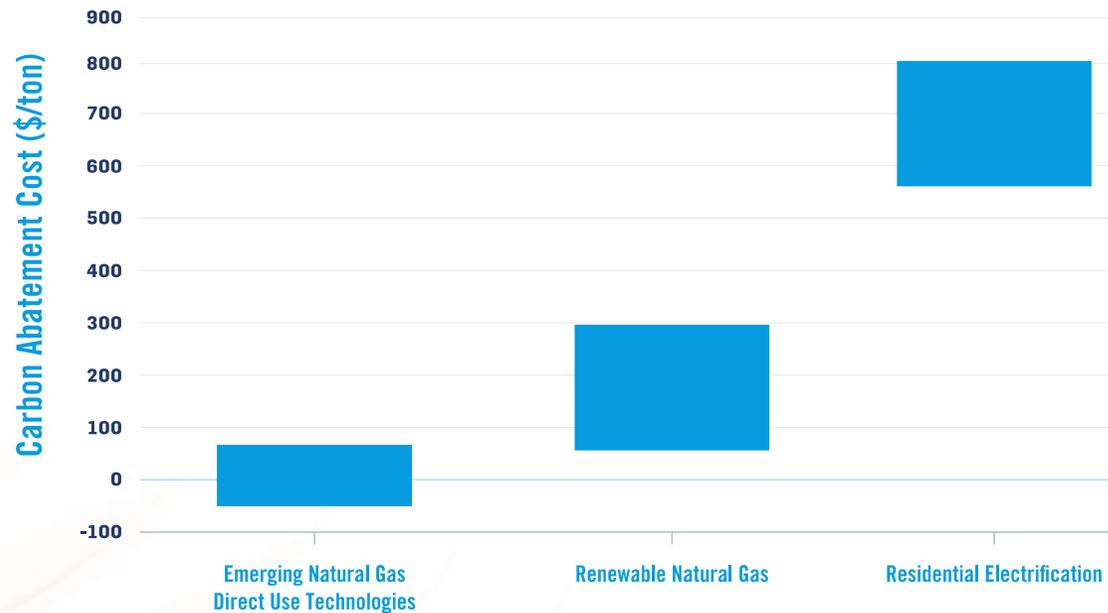
RNG IS A COST-EFFECTIVE WAY TO Reduce Emissions

RNG is a sustainable emission reduction strategy that is cost competitive with other emission reducing technologies.

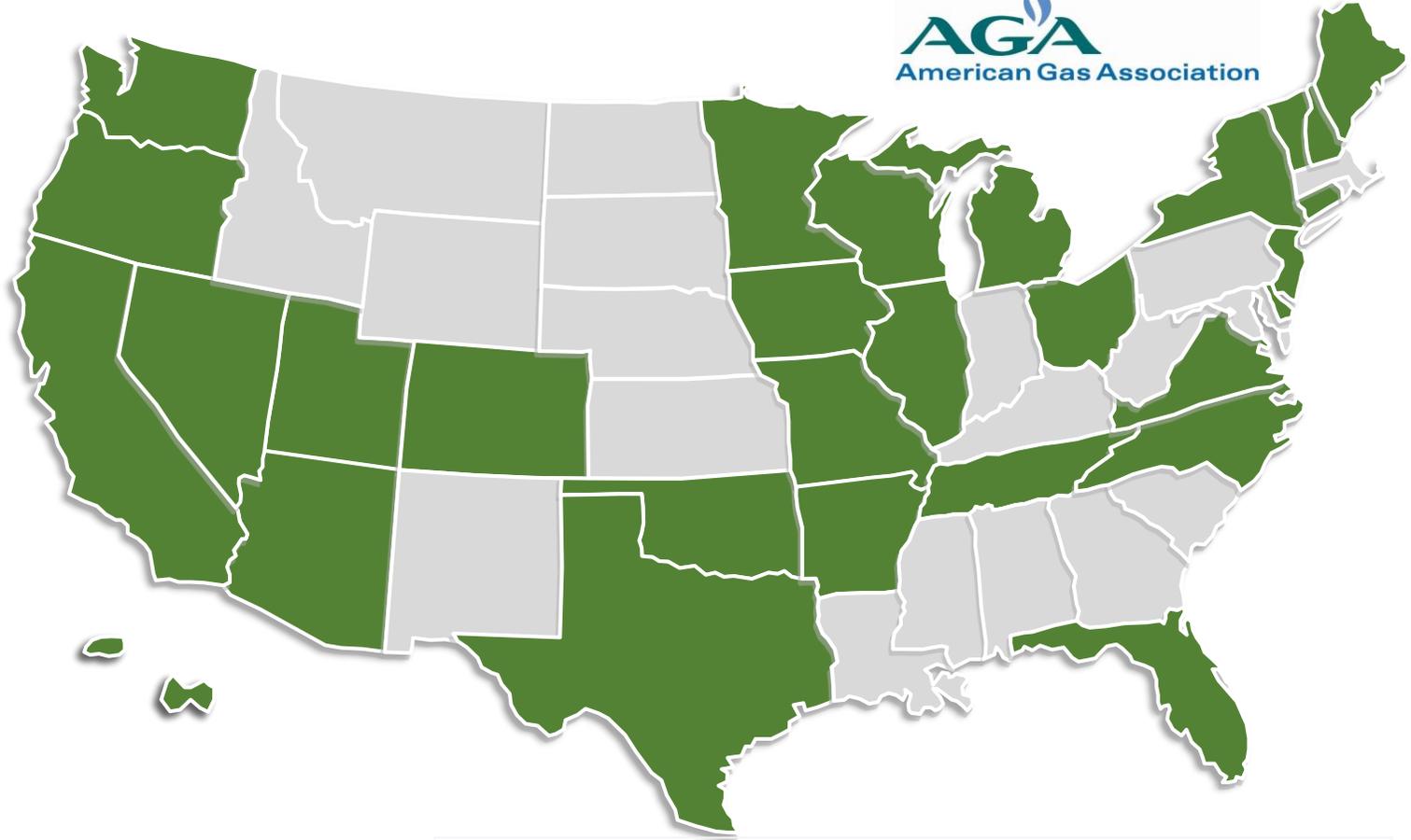


4,513 TRILLION
BTU of RNG by 2040

Cost Comparison of GHG Reduction Pathways



Renewable Natural Gas State Activity



Activity in 29 states to promote the use of RNG in the residential or commercial sector through either legislative, regulatory, or utility led action.

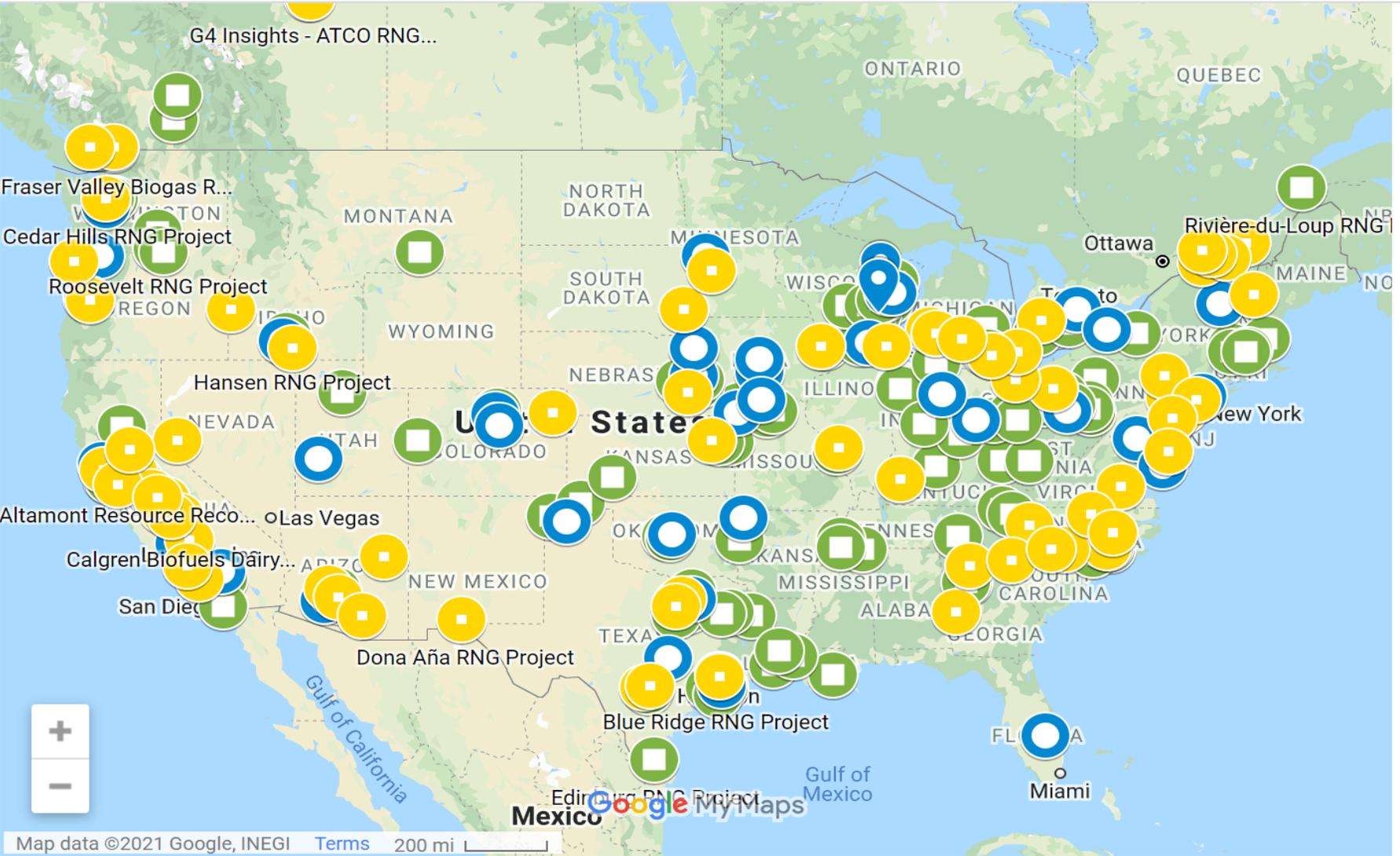
47 Bills have been introduced
20 Bills have become law
State Legislative Proposals

15 Natural Gas Utilities have begun developing or have implemented Voluntary Green Tariffs
Voluntary Programs

18 Natural Gas Utilities are engaged in RNG production projects
Utility Led RNG Projects

*this data does not include RNG interconnection activity

RNG Production Facilities in North America



- 157 Operational
- 76 Under Construction
- 79 Planned



Hydrogen is the most abundant element in the universe

AND A ZERO-CARBON ENERGY SOURCE



The gas system's ability to integrate carbon-neutral sources of energy like renewable natural gas and hydrogen is a critical component of our nation's ability to reach ambitious greenhouse gas reductions goals.

Pure hydrogen does not occur naturally so it must be produced from other sources. Hydrogen produced from water using renewable electricity, also known as green hydrogen, is a promising source of zero-carbon energy.

SELECT EARLY-STAGE

Hydrogen Initiatives at U.S. Gas Utilities

Natural gas pipelines can serve as the necessary and widespread delivery infrastructure for hydrogen



NW Natural
Oregon

Developing a project to produce green hydrogen and pair the locally produced supplies with carbon dioxide to create synthetic natural gas.



CenterPoint Energy Inc.
Minnesota

Preparing to launch a pilot project to produce green hydrogen and flow a less than 1 percent blend to customers through its gas distribution system.



New Jersey Resources Corp.
New Jersey

Developing a renewable hydrogen demonstration project to study natural gas blending and raise awareness among policy-makers and regulators.



Sempra Energy
California

Announced plans to introduce a 1 percent blend of green hydrogen into its natural gas stream, with aspirations to reach a 20 percent blend at its two California utilities.



Dominion Energy Inc.
Utah

Conducting a demonstration project to test hydrogen blends in pipeline systems, with plans to distribute synthetic natural gas made from green hydrogen.



Southern California Gas Co., One Gas Inc.
Texas

Participating in the U.S. Energy Department H2@Scale project to demonstrate commercial hydrogen production, distribution, storage and consumption.



National Grid PLC
New York

Participating in a hydrogen blending study with Stony Brook University and the New York State Energy Research and Development Authority.

Addressing Challenges Relating to Advancing Low Carbon Gas Resources

Policy Parity for
RNG in Buildings

R,D,&D
Support

Facts and Data
to Educate
Policymakers
and
Stakeholders

Scaling
Technology
Deployment to
Reduce Costs

Enabling
Regulatory
Frameworks

Transforming
the Pipeline and
End-Use
Equipment

Attracting and
Retaining Talent



Resilience

noun

[re•sil•ience | \ ri-'zil-yen(t)s]

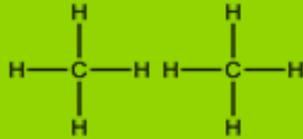
A system's ability to prevent, withstand, adapt to, and quickly recover from system damage or operational disruption.

A resilient energy system is essential to the operation of nearly every critical function and sector of the U.S. economy—and the need is only increasing as emergency services, communications, transportation, banking, healthcare, water supply and other critical systems become more interconnected than ever.

Fundamental Resilience

Characteristics of the Gas System

Inherent Resilience of Gas



A molecular form of energy storage; the natural gas molecule is an abundant energy form with long-duration and seasonal storage capabilities.

- Compressibility
 - Storage
 - Linepack
- Abundance and Diversity of Supply

Physical Resilience of System Assets



Most gas system assets are underground and shielded from major disruptions. In most cases, the system is self-reliant, reducing its exposure to disruption.

- Underground infrastructure
- Looped and Parallel T&D Network
- Self-Reliant Gas-Fired Equipment
- Distributed Customer Generation
- System Storage Capacity

Operational Resilience of the Gas System



Operational flexibility is designed into the gas system within a set of system standards that ensure the system's safety and security.

- Robust Management Practices
- Flexible Delivery
- Demand Side Management
- Large Customer Contract Design



BUSINESSES SAVE with natural gas

Nearly 21,000 businesses sign up to use natural gas each year.



*5.5 million businesses
in the U.S. use natural gas.*



*The affordability of natural gas has
led to **\$121 billion in savings** for
American businesses since 2009.*

COMMERCIAL AND INDUSTRIAL CUSTOMERS SAVE with natural gas

Larger volume customers such as factories, stores, hospitals and restaurants save a lot of money by using natural gas.



In 2018, commercial customers
spent 36% less
on natural gas than in 2008,
while industrial customers
spent 57% less.



PICTURE THE POTENTIAL

To reimagine our industry for the future, we will win tomorrow by innovating today, cultivating our workforce and exceeding customer expectations.



Our industry delivers America's abundant and affordable natural gas every day to help meet the nation's energy needs and environmental goals. The American Gas Association and the companies we represent are committed to enhancing safety, ensuring reliability and reducing emissions to improve the quality of life of our communities and our customers.

Questions?

Rick Murphy
Managing Director – Energy Markets
rmurphy@aga.org

