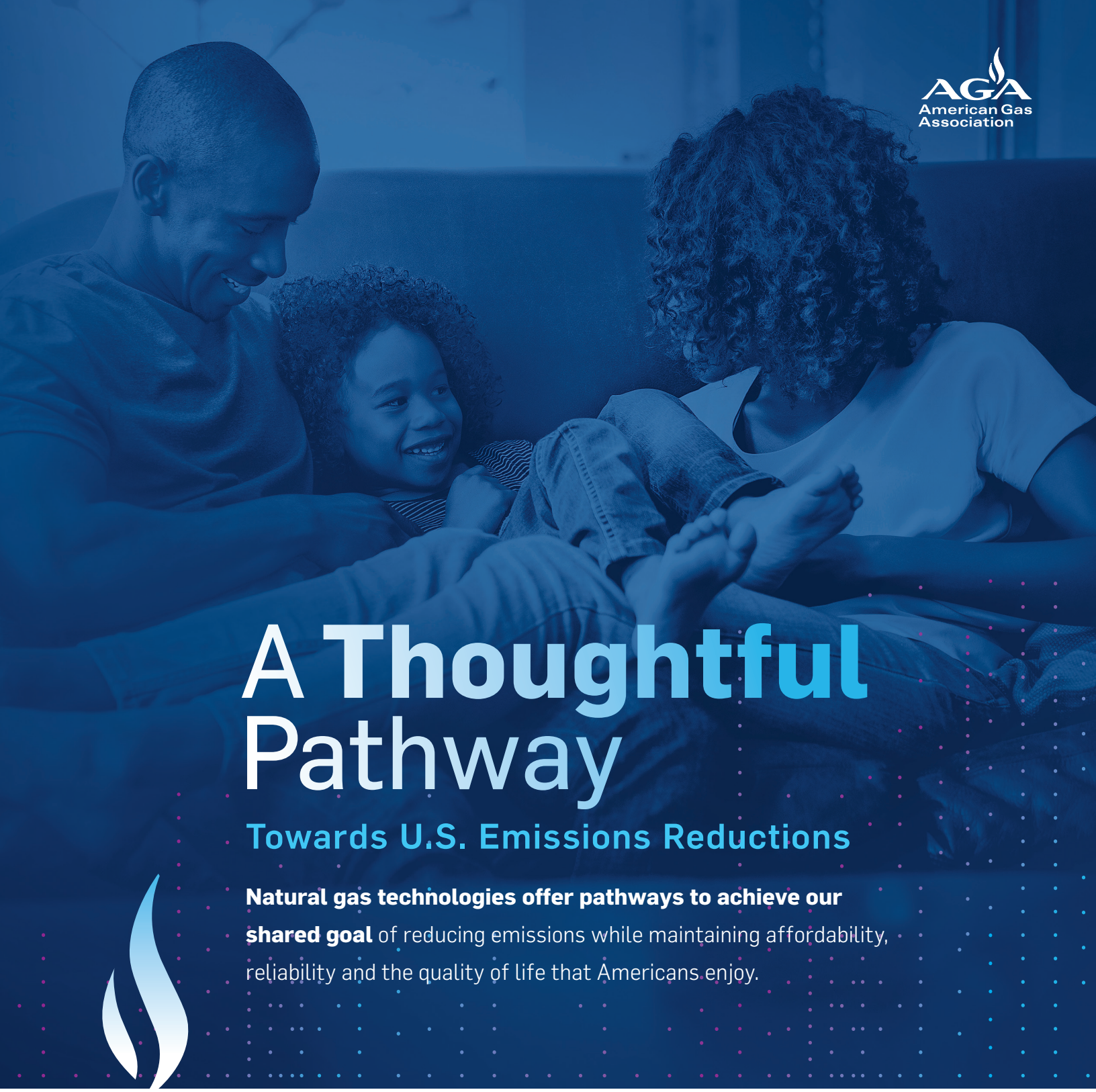


A **Thoughtful** Pathway

Towards U.S. Emissions Reductions

Natural gas technologies offer pathways to achieve our shared goal of reducing emissions while maintaining affordability, reliability and the quality of life that Americans enjoy.

THE FACTS

- **177 million Americans** use natural gas in their homes and businesses
- Households that use natural gas for heating, cooking and clothes drying save an average of **$874 per year** compared to homes using electricity for those applications
- Natural gas is delivered to customers through a **2.5-million-mile underground pipeline system**
- Natural gas utilities spend **$24 billion annually** to help enhance the safety and reliability of natural gas distribution and transmission systems

Americans Want Natural Gas

Natural gas utilities nationwide add an average of one new customer ***every minute.***

More homes and businesses in the United States use natural gas today than ever before and the numbers continue to increase. Americans prefer to cook with natural gas and they enjoy its unmatched reliability and affordability. A domestic abundance of natural gas has led to affordable and stable prices, which are expected to continue for many decades into the future. In addition, the pipelines that deliver natural gas are the safest energy delivery system in the nation.

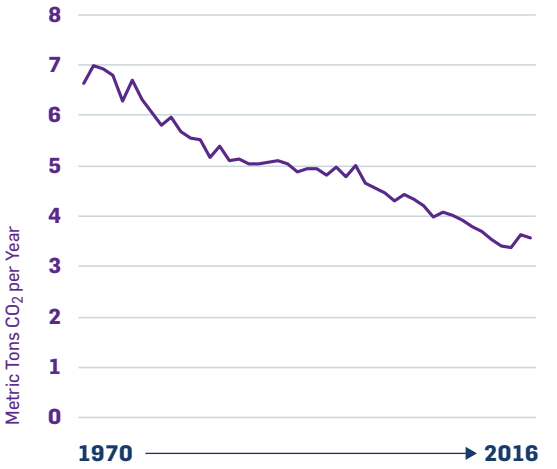
On January 1, 2018, the natural gas system in the United States delivered 147 billion cubic feet—almost double the demand for a typical day

Natural Gas Utilities Deliver Essential Energy When Customers Need It

The amount of natural gas delivered to just residential homes and commercial businesses on January 1, 2018, is equivalent to the energy that nearly the entire fleet of U.S. power plants could generate running at full capacity for 24 hours.

Residential Natural Gas Customers Have Led the Nation in Reducing Emissions for 40 Years

- Since 1970, gas utilities have added 30 million more residential customers with virtually no increases in emissions
- Utilities budgeted $1.5 billion in efficiency programs for 2018
- Utilities helped customers reduce 12.4 million metric tons of carbon dioxide emissions in 2016



Weather- Normalized CO_2 Emissions per Residential Natural Gas Customer

What is Policy-Driven

Residential Electrification?

In recent years, there has been a shift in the types of policies proposed to reduce greenhouse gas emissions. States and municipalities are currently considering policies that include residential electrification in their pursuit of deep decarbonization goals.

Policy-driven residential electrification requires that residential space heating and other loads be served by electric appliances. Driving this assumption is the expectation that conversion of natural gas-based residential heating and other appliances to electricity can reduce emissions over time as the electric grid becomes cleaner.

Proponents also suggest that residential electrification could provide a benefit to the electric grid by taking advantage of under-utilized capacity, and could allow new electric load to be matched with expected renewable generation profiles.

25

year lows

Increased natural gas efficiency and the growth of renewable energy have led to energy-related carbon dioxide emissions hitting 25-year lows

A Thoughtful Analysis

While policy-driven residential electrification has been discussed in multiple venues, there has been little or no analysis of the overall costs, benefits and implications of such policies. To help address these gaps, the American Gas Association (AGA) engaged a cross-discipline team of experts at ICF to assist in the evaluation of AGA's residential electrification policy scenarios focused on space and water heating. The AGA study addresses a series of fundamental questions:

Questions in the Study

1. Will policy-driven electrification actually reduce emissions?
2. How will policy-driven residential electrification impact natural gas utility customers?
3. What will be the impacts on the power sector and on electric transmission requirements?
4. What will be the overall cost of policy-driven residential electrification?
5. How do the costs of policy-driven residential electrification compare to other approaches to reducing greenhouse gas emissions?

Implications of Policy-Driven

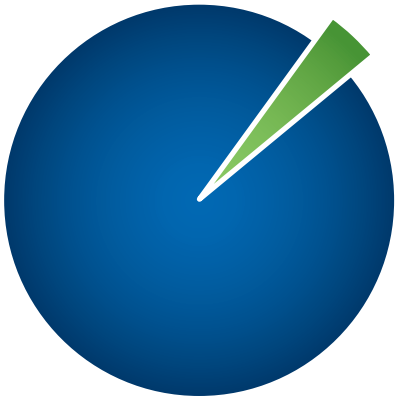
Residential Electrification

Electrification policy measures aimed at residential natural gas could be challenged by:

- **cost-effectiveness**
- **consumer impacts**
- **transmission capacity constraints of the existing electrical system**
- **current and projected electric grid emission levels**
- **requirements for new investments in the power grid to meet growth in peak generation demand over winter periods**

At the same time, the total greenhouse gas emissions reductions available from a policy targeting electrification of residential heating loads represents a small fraction of domestic emissions.

RESIDENTIAL NATURAL GAS ACCOUNTS FOR ONLY 4% OF TOTAL U.S. GREENHOUSE GAS EMISSIONS



Residential natural gas consumption plus a share of natural gas system methane emissions 4%

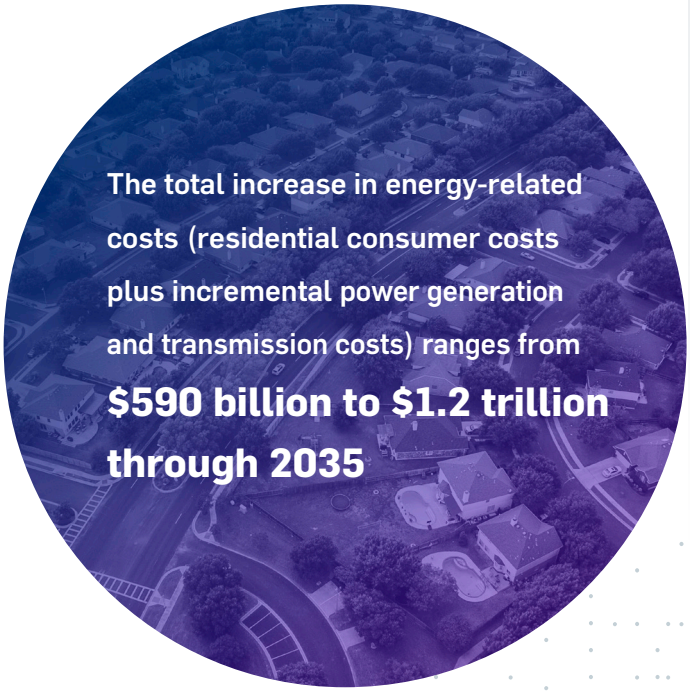
Remaining GHG from all other sectors 96%

Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2016 (April 2018)
Residential gas methane share based on gas consumption
Residential electricity methane share based on gas for electricity consumption & residential electricity sales, EIA

Policy-driven electrification could be financially burdensome to consumers

Average household energy-related costs (appliance and electric system upgrade costs and utility bill payments) could increase by between $750 and $910 per year.

...and to the economy



Policy-driven residential electrification could have profound impacts and costs on the electric sector

Significant increases in peak electric demand could result in the need for major new investments in the electric grid including generation, transmission, and distribution capacity.

$102 to $319 billion
in incremental generation capacity requirements by 2035

$53 to $107 billion
in associated transmission system upgrades

Findings and statistics from Implications of Policy-Driven Residential Electrification, 2018. Appliance and other technology trends based on 2017 EIA Annual Energy Outlook. Baseline generation mix based on 2017 EIA Annual Energy Outlook reference case. Incremental generation and transmission capacity modeled using ICF Integrated Planning Model (IPM©).

Policy-driven residential electrification could be a very costly approach to emissions reductions

The average cost of U.S. greenhouse gas emissions reductions achieved is between $572 and $806 per metric ton of carbon dioxide reduced, which is very high relative to other emissions reduction options.

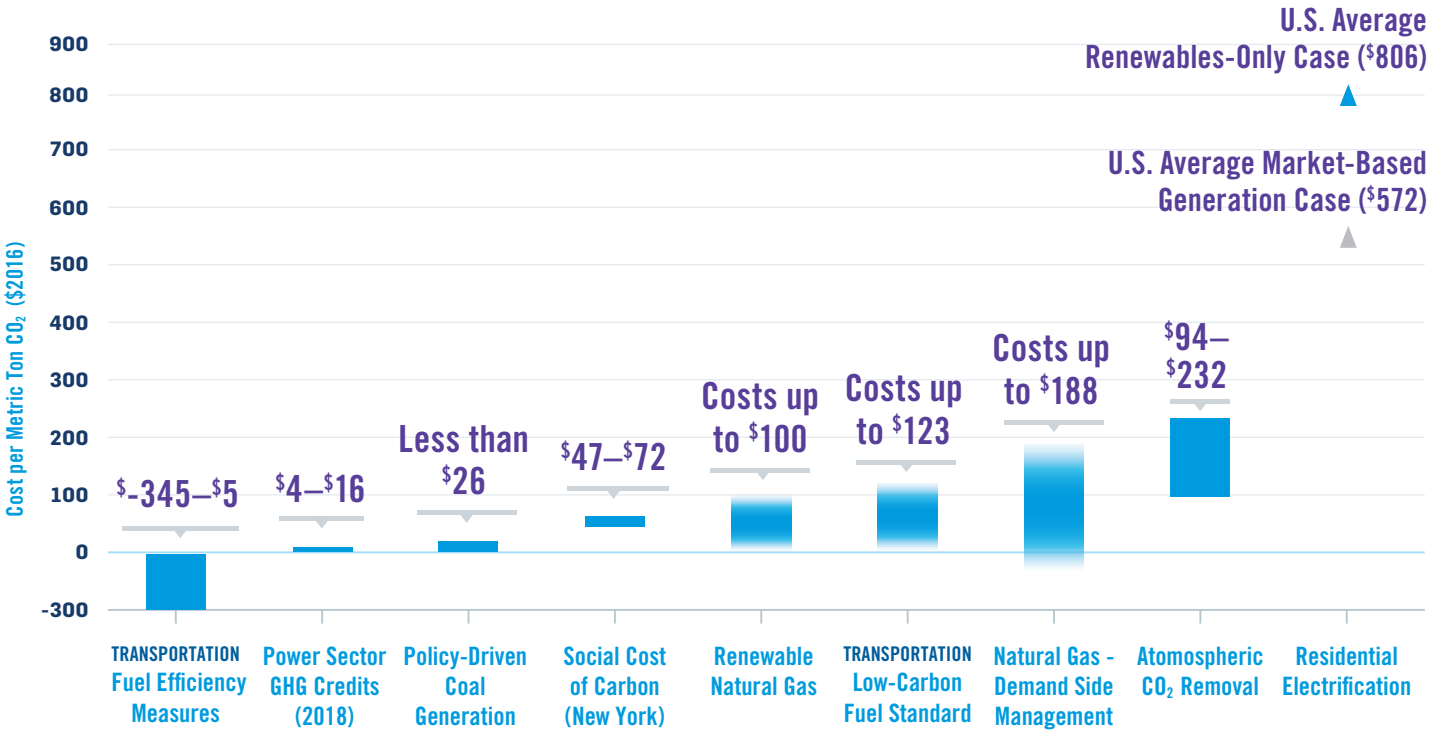
…AND GREENHOUSE GAS REDUCTION POTENTIAL IS SMALL

Reductions from aggressive policy-driven residential electrification could reduce greenhouse gas emissions by

only 1 to 1.5% of

U.S. greenhouse gas emissions by 2035

Comparison of Cost Ranges for Greenhouse Gas Emissions by Reduction Mechanism



Source: Implications of Policy-Driven Residential Electrification, 2018
Policy-driven residential electrification costs vary based on the modeled generation scenario. Details in the report.

Natural gas technologies are

Reducing Emissions

America's natural gas utilities are committed to reducing emissions by using our nation's abundance of natural gas in a sustainable, environmentally sound and safe manner.

Integrating natural gas solutions into long-term resource planning helps achieve emissions reduction goals.

The expanded development of renewable natural gas coupled with natural gas technology innovations can help reduce emissions while:

- Meeting growing energy needs
- Giving customers more choices
- Improving affordability, reliability and comfort

100+	**Innovative natural gas technologies** for the residential/commercial market identified in our global search
25-40%	**GHG reduction potential** on a customer basis by integration of these technologies and other efficiency practices
80%+	**GHG reduction**–sufficient to meet COP 21 goals–with inclusion of future combined heat and power technologies and renewable gas

Source: Enovation Partners

Many innovative natural gas technologies are available today in the residential and commercial sector. These technology pathways offer a significant efficiency improvement potential (some greater than 50 percent), which can contribute to achieving near-term emissions reductions.

Increase Access to High-Efficiency Natural Gas Appliances

Utilities are working with policymakers to enhance energy efficiency programs and to ensure all customers have access to high-efficiency natural gas appliances to reduce emissions and lower costs.

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

More research and development is necessary for continued improvement in next-generation natural gas technologies and making them widely available to consumers for greater efficiency, affordability and emissions reduction.

Develop Renewable Natural Gas

Renewable Natural Gas (RNG) is methane produced from farms, landfills and wastewater treatment plants. It is carbon neutral, versatile and fully compatible with the U.S. pipeline system. It can be used in homes and businesses, in manufacturing and heavy industries, for electricity production and in vehicles.

Using RNG with next generation natural gas technologies further reduces emissions.

AGA
American Gas Association

www.aga.org