



Natural Gas:

**A Key Contributor for Advancing
Renewable Energy and Reducing
Emissions**

**Minnesota BLUE FLAME GAS Association
Natural Gas Conservation Conference
September 25, 2018**



Natural Gas Power Generation Enables the Penetration of Renewable Electricity

Harmony Between Renewables & Natural Gas

We all know that increased use of natural gas helps reduce greenhouse gas emissions, but did you also know that natural gas works hand in hand with renewables like wind and solar?



Rhone Resch,
CEO of the SEIA

“Natural gas and renewables complement each other very nicely ... I think it’s important to recognize that these industries, although we do compete, are working together to address some of the most pressing energy needs in the country.”

(Rhone Resch, CEO of the Solar Energy Industries Association, January 2013)



“Power generation based on natural gas offers the flexibility and increased dispatchability that complements renewable energy power generation.”

(National Renewable Energy Laboratory, February 2014)



“Adding controllable gas-fired plants hand-in-hand with wind and solar plants produces benefits for the entire grid...”

(Texas Clean Energy Coalition, June 2013)



“Gas generators, which are inherently flexible technologies that can be easily ramped up and down to meet demand, are natural counterparts for variable resources such as wind and solar.”

(Business Council for Sustainable Energy, January 2013)



Richard Muller, Cal-Berkeley Professor

“Cheap natural gas can also make it easier for solar and wind energy to further penetrate electricity markets by providing the rapid back-up that those intermittent sources require.”

(Richard Muller, Cal-Berkeley Professor, December 2013)



Wall Street Journal

“While natural gas has transformed the electricity sector, gas and renewables are actually complementary, not rivals.”

(September, 2013)

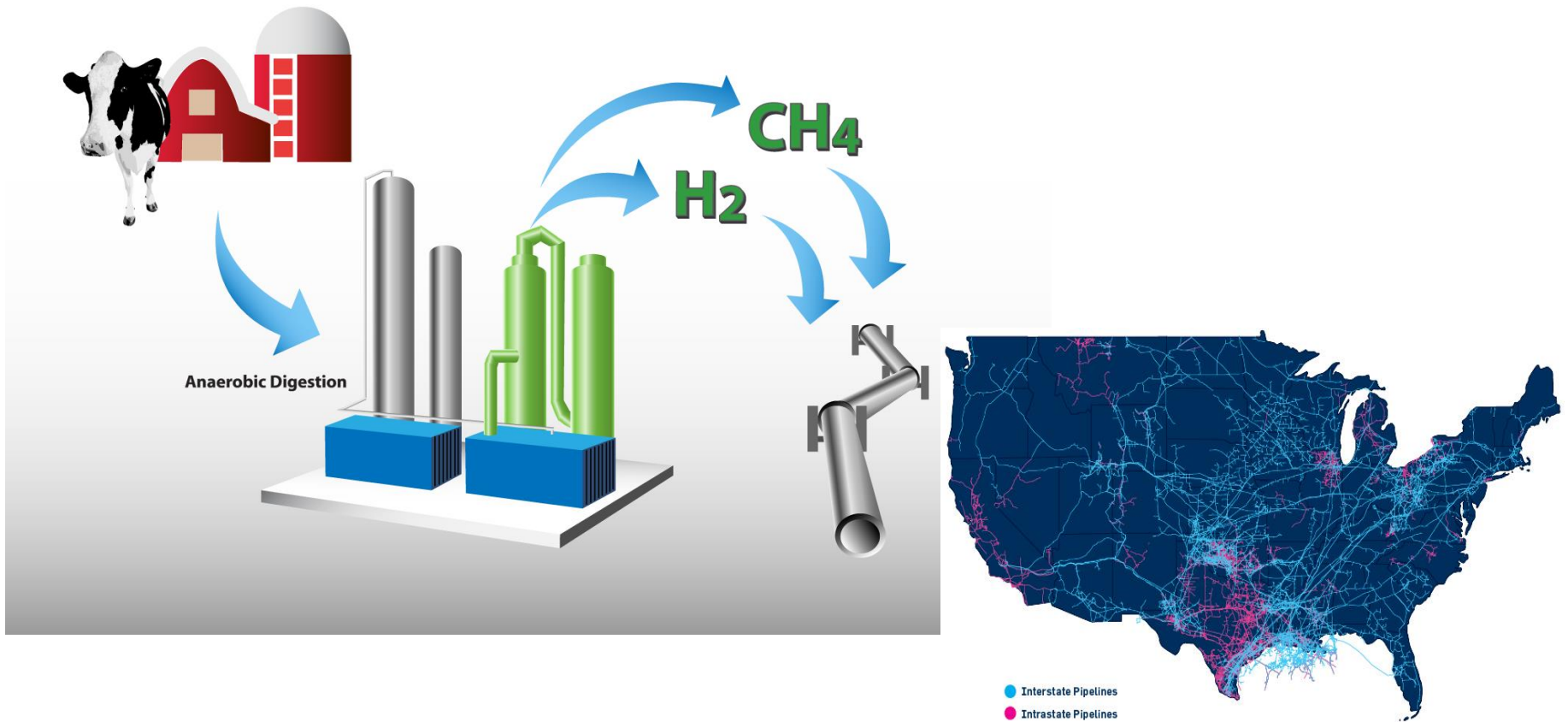


International Energy Agency

“Natural gas has an important role to play in complementing low-carbon energy solutions by providing the flexibility needed to support a growing renewables component in power generation.”

(International Energy Agency, 2011)

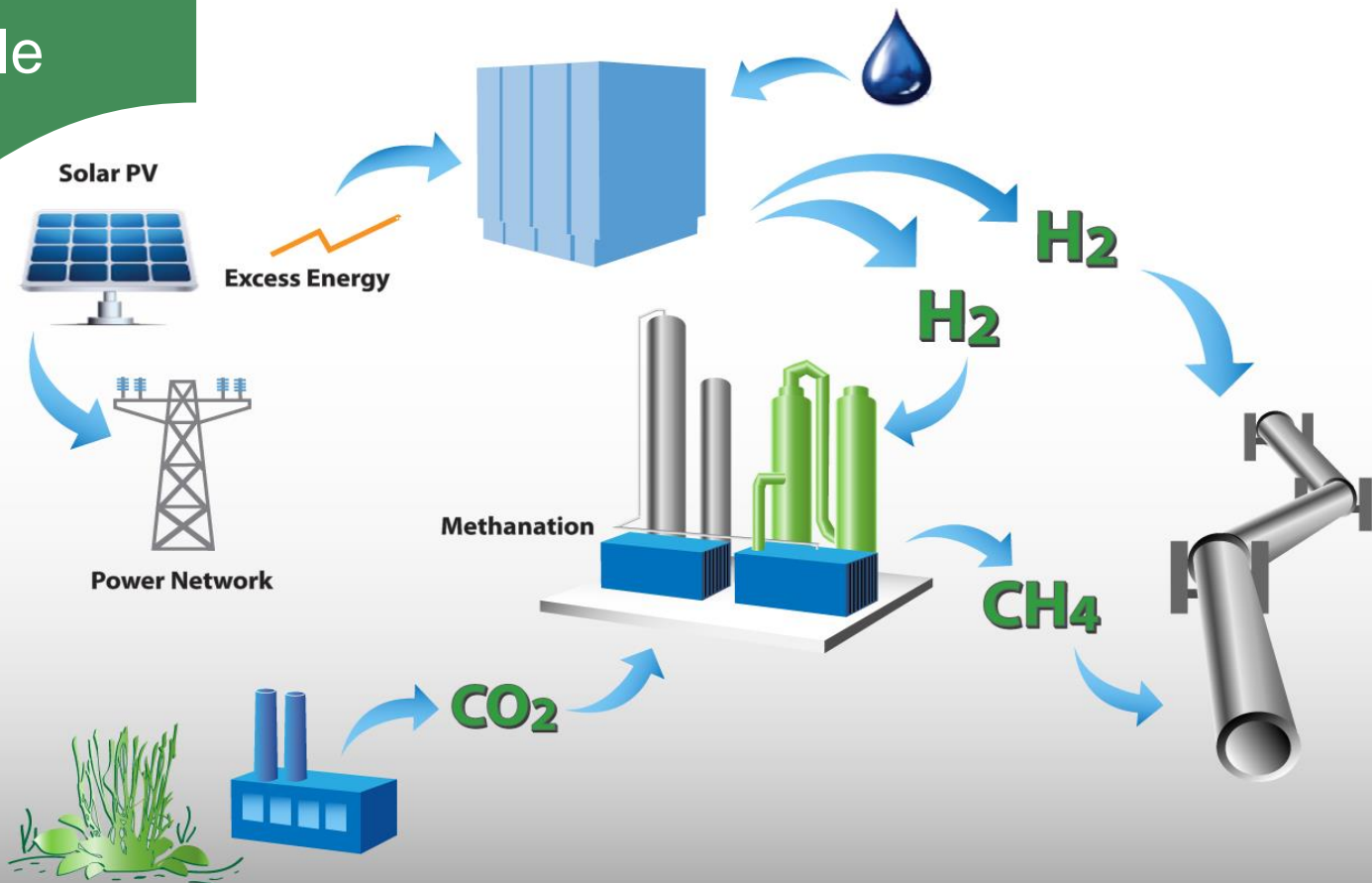
Renewable Natural Gas (RNG)



The Natural Gas Pipeline System Delivers Renewable Sources of Natural Gas Supply Derived from Various Waste Streams

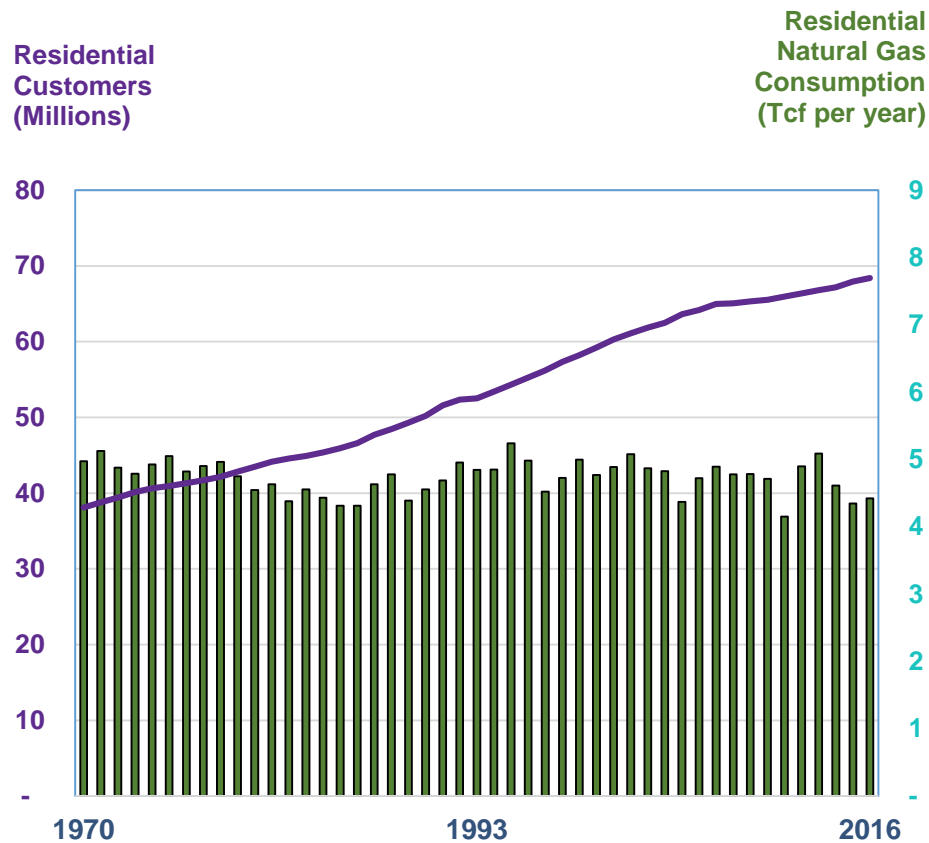
The Existing Natural Gas Network Can Be Utilized as a Storage Solution for Excess Renewable Electricity

Power to Gas (P2G)

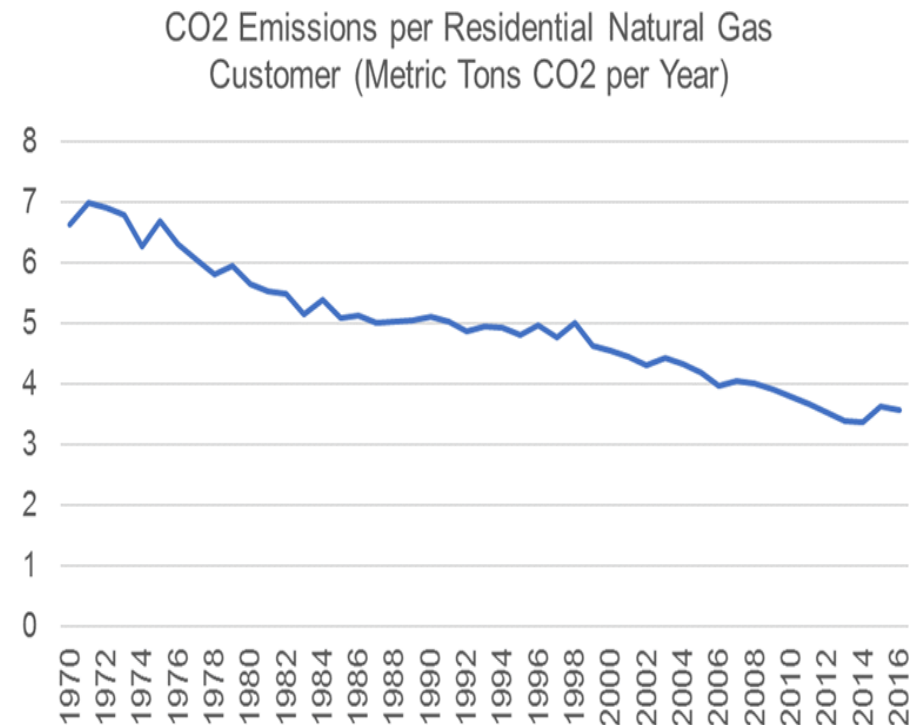


Proven Track Record of Improving Energy Efficiency and Reducing Emissions

Natural Gas Energy Efficiency Programs Have Helped to Reduce Home Energy Consumption and Emissions For Over 40 Years



Source: Energy Information Administration



Based on AGA calculations of weather-normalized residential gas consumption per customer

Advancing and Deploying Energy Efficient Technologies in Homes and Buildings

Space Cooling, up to 45%
Space Heating, up to 40%

- Gas heat pump



Building Efficiency, 10-45%

- IoT based thermostat
- Building Envelope



Water heating, up to 55%

- Absorption heat pump

Cooking, minimal change

- Gas stove
- Gas oven



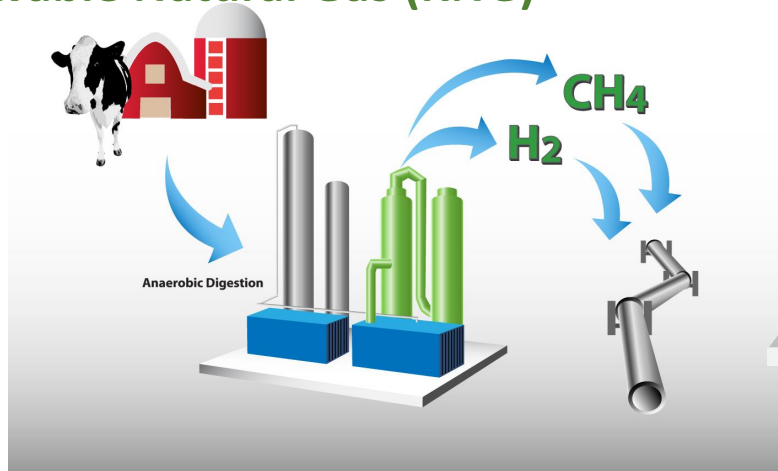
Laundry, 55%

- Gas dryer
- Ozone washing

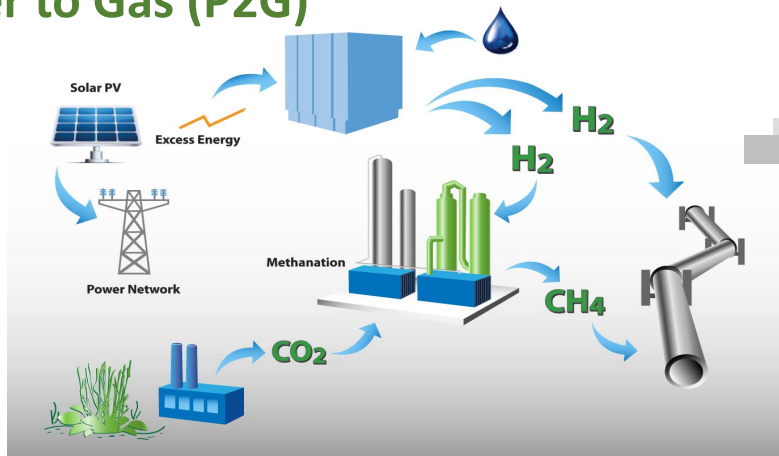
25-40% GHG reduction potential on a customer basis

Providing Decarbonized Natural Gas Solutions for Consumers

Renewable Natural Gas (RNG)

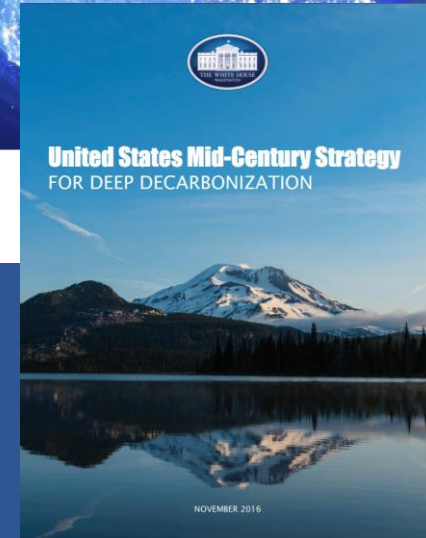
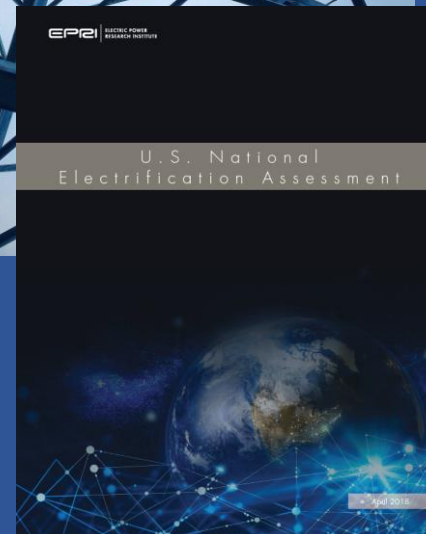
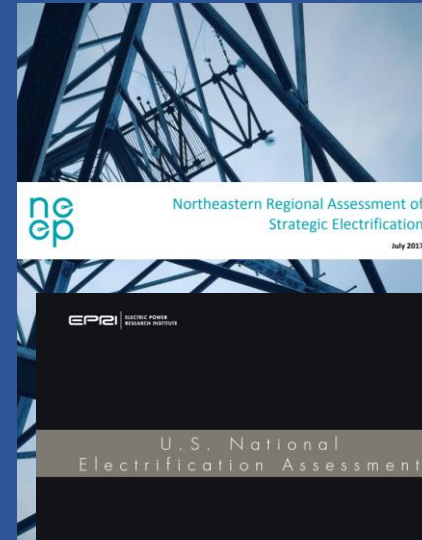


Power to Gas (P2G)



Proposals to reduce greenhouse gas emissions take many forms

Studies referencing electrification of building energy loads to achieve deep decarbonization goals



AGA Study on Implications of Policy-Driven Residential Electrification



Main Questions the Study Addresses

1. Will policy-driven residential electrification actually reduce greenhouse gas emissions?

1% - 1.5% Reduction

2. What are the impacts on the Power Generation and Transmission infrastructure?

\$155 - \$426 Billion in Electric Infrastructure

3. How will policy-driven residential electrification impact natural gas utility customers?

71% Increase in Household Energy Costs

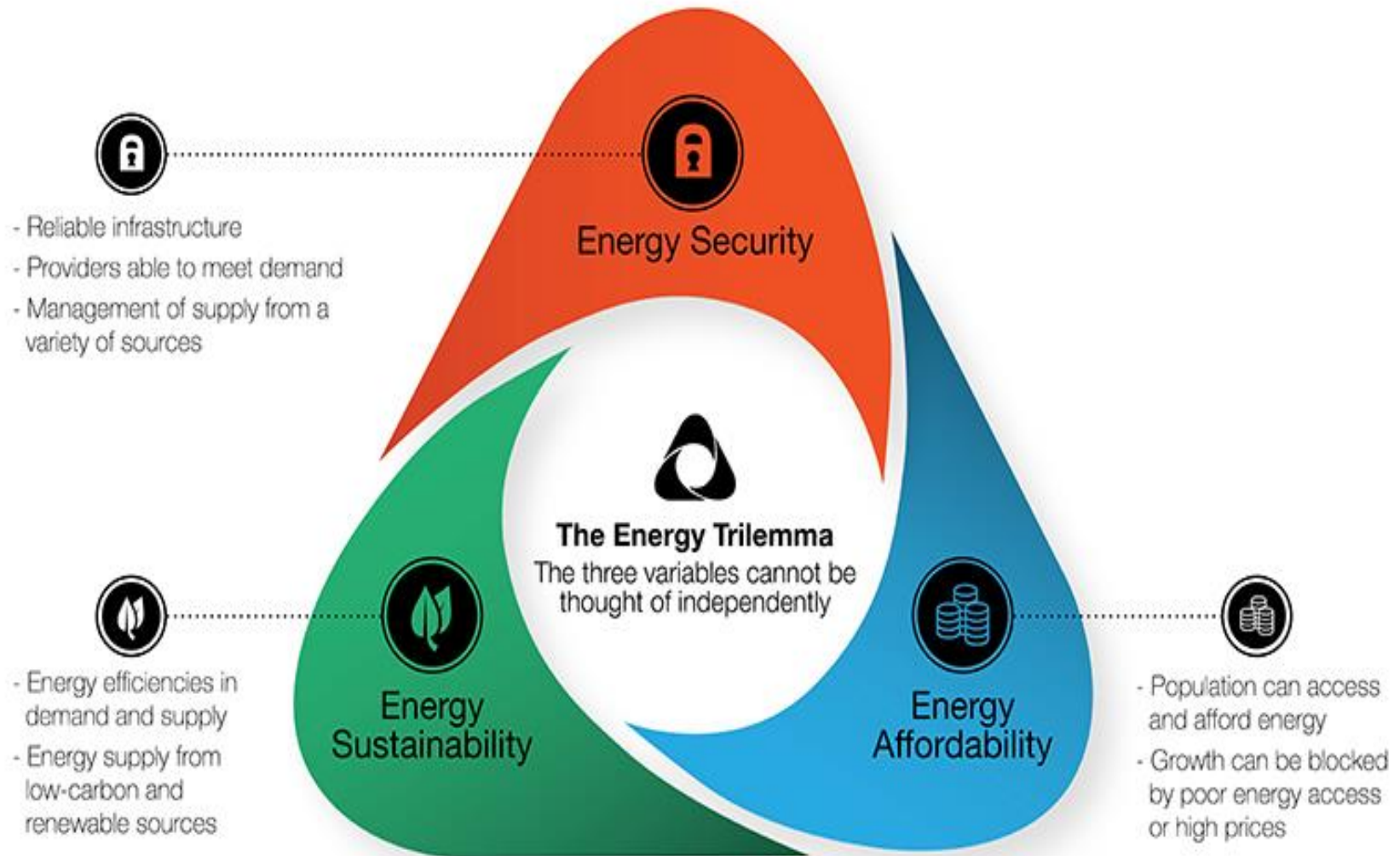
4. What would be the overall cost of policy-driven residential electrification?

\$490 Billion - \$1.2 Trillion

5. How do the costs of policy-driven residential electrification compare to other approaches to reduce greenhouse gas emissions?

2.5 - 3.5 Times the Most Costly Alternative

Natural Gas is a Solution for Solving the “Energy Trilemma”



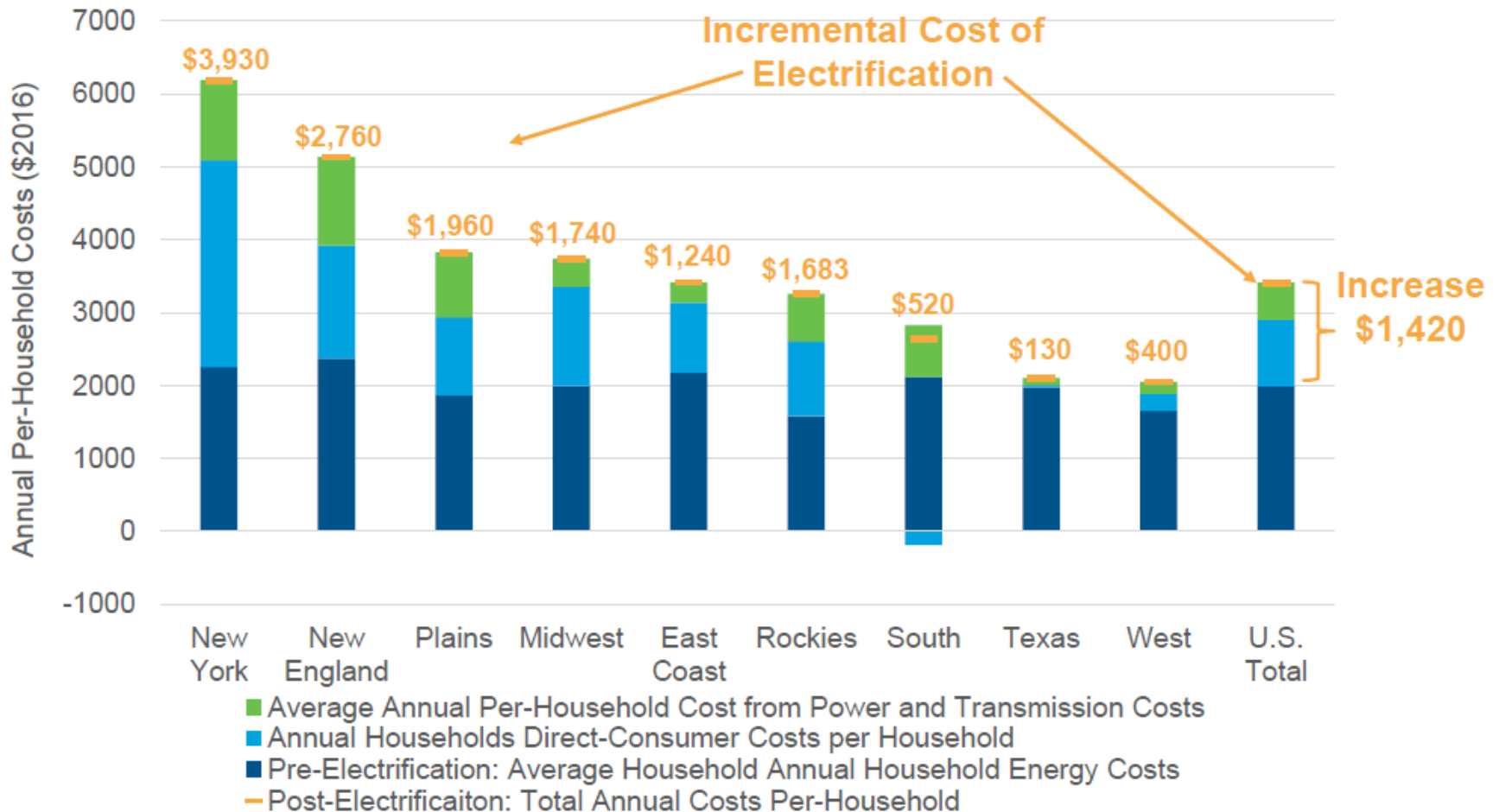


Questions?

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Regional Breakdown of Study Results

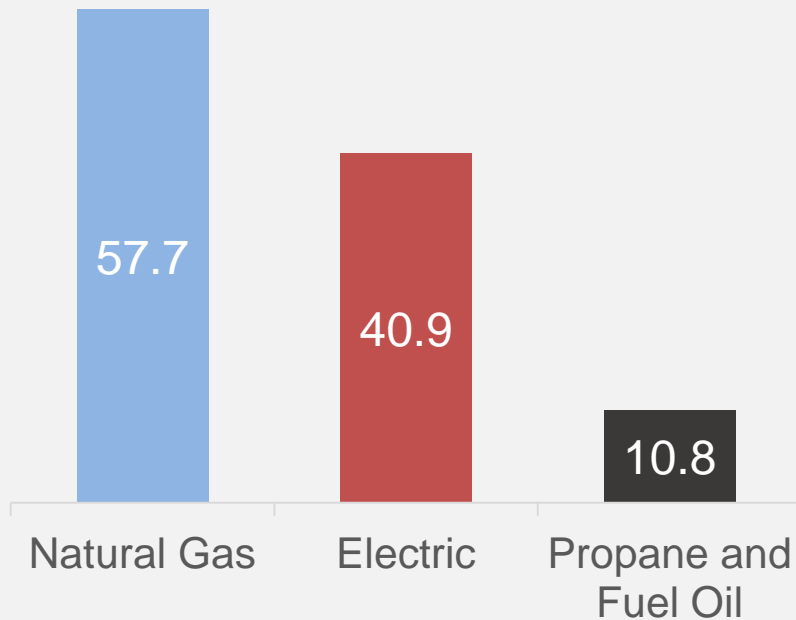
Annual Per-Household Cost of Electrification Policy (Renewables-Only)



A Closer Look at the Residential Market

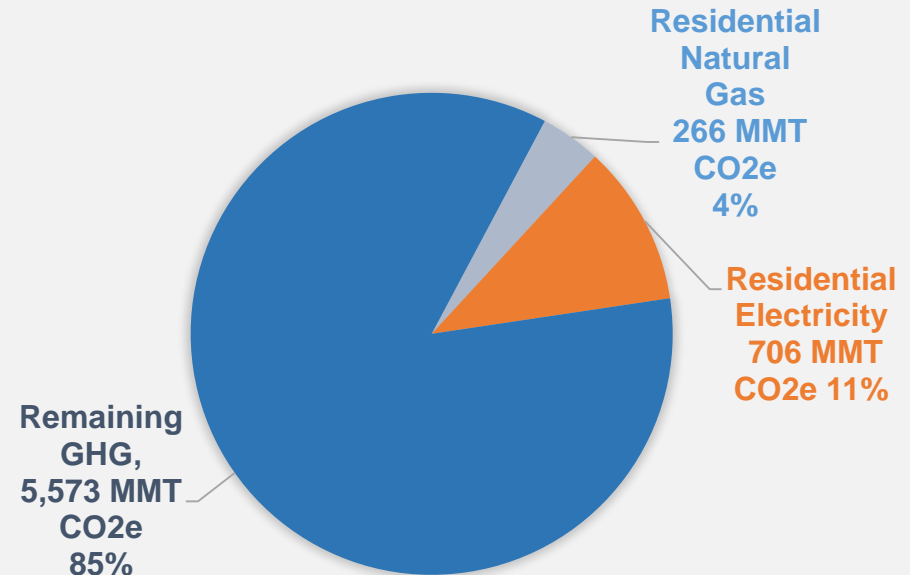
Natural gas is the primary source for heating homes

US Heating Systems
by Fuel
(Millions of Housing Units)



Residential natural gas use accounts for only 4% of U.S. greenhouse gas emissions.

Share of US Greenhouse Gas Emissions

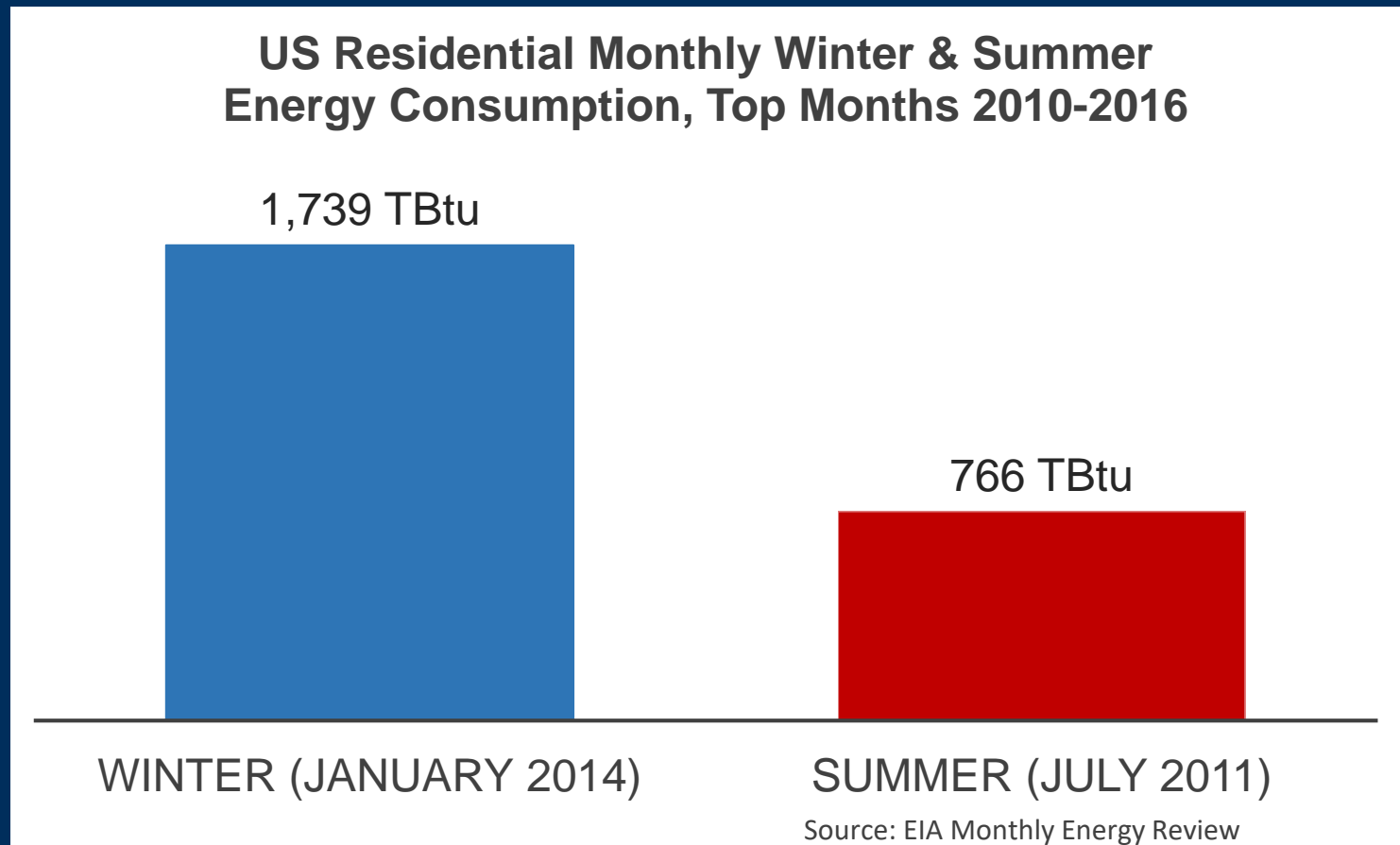


EPA Inventory of Greenhouse Gas Emissions & Sinks 2018 draft, data for 2016
Residential gas methane share based on gas consumption

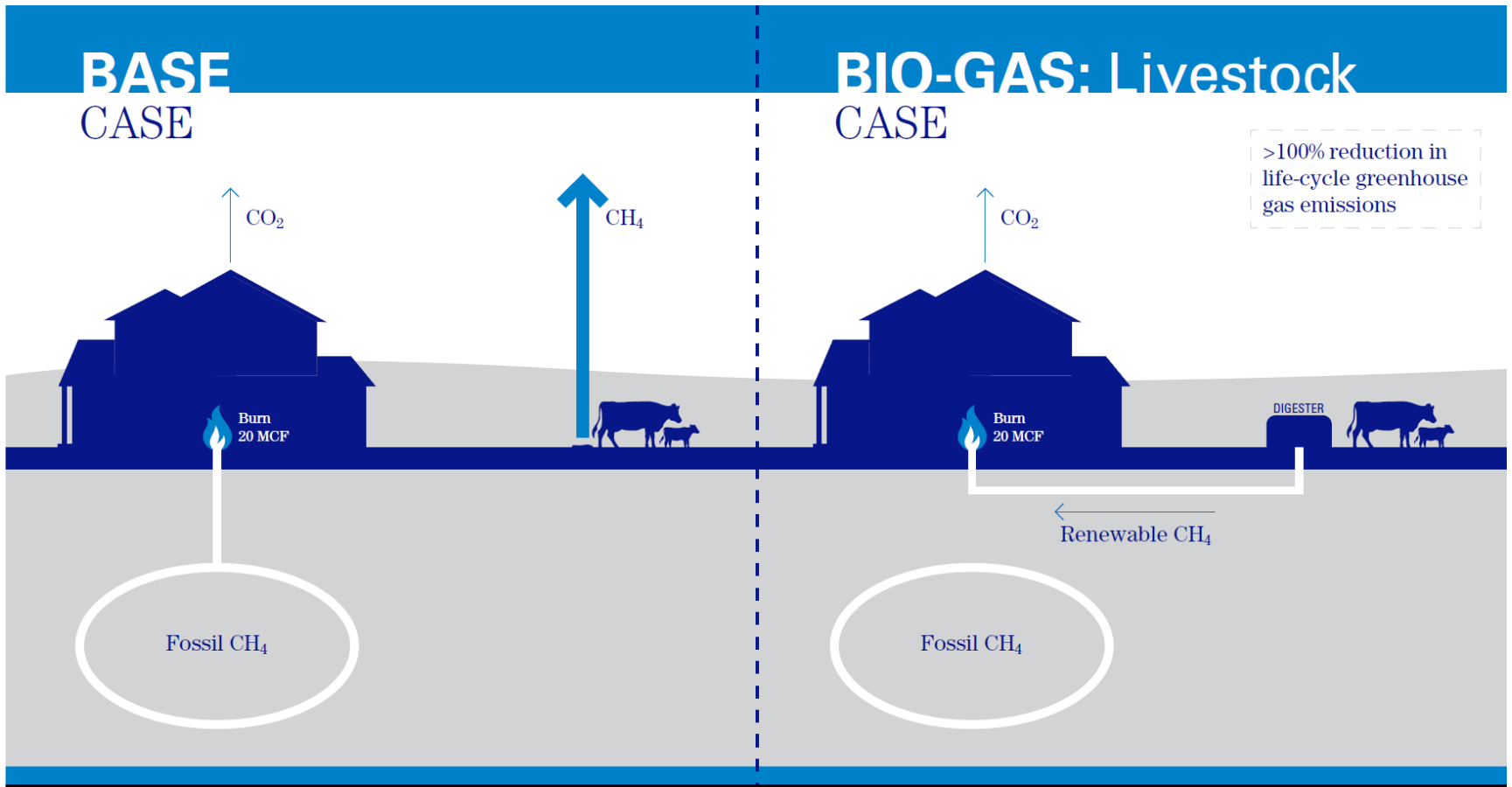
Residential electricity methane share based on gas for electricity consumption & residential electricity
Shares of upstream natural gas system methane emissions allocated based on consumption by end-use

Foundational Energy Facts

- Winter generally requires much more energy than summer
- Peak energy requirements drives infrastructure planning



Capturing Emissions from Waste Streams and Converting it to Pipeline Quality Renewable Natural Gas Reduces Overall Emissions



BASE CASE

BIO-GAS: Livestock CASE

>100% reduction in life-cycle greenhouse gas emissions

CO₂

CH₄

CO₂

Burn 20 MCF

Burn 20 MCF

DIGESTER

Fossil CH₄

Fossil CH₄

Renewable CH₄