Implications of Electrification and Natural Gas Pathways Towards U.S. Emissions Reductions

Northeast Gas Association Sales & Marketing Conference
March 28, 2019
Proposals to reduce greenhouse gas emissions take many forms

Studies referencing electrification of building energy loads to achieve deep decarbonization goals
States and municipalities committing to pursue clean energy goals

381 US #ClimateMayors, representing 67.9 million Americans, have committed to adopt, honor and uphold the climate goals of the Paris Agreement
The Clean Energy Debate is Back in D.C.
A Closer Look at the Residential Market

Natural gas is the primary source for heating homes.

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

US Heating Systems by Fuel (Millions of Housing Units)

Natural Gas: 57.7
Electric: 40.9
Propane and Fuel Oil: 10.8

Share of U.S. GHG Gas Emissions (MMT = Million Metric Tons)

Residential Natural Gas: 266 MMT CO2e 4%
Residential Electricity: 706 MMT CO2e 11%
All Other Sectors: 5,573 MMT CO2e 85%

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

Source: Energy Information Administration
Foundational Energy Facts Impacting Electrification Pathways for Decarbonization

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


- **Winter (January 2014)**: 1,739 TBtu
- **Summer (July 2011)**: 766 TBtu

### U.S. Peak Month TBtu

- **Residential**: 1,070 TBtu (Electricity: 531, Natural Gas: 441)
- **Commercial**: 590 TBtu (Electricity: 272, Natural Gas: 318)
- **Industrial**: 893 TBtu (Electricity: 272, Natural Gas: 621)

Source: Energy Information Administration
Main Questions the Study Addresses

1. What are the impacts on the Power Generation and Transmission infrastructure?
2. Will policy-driven residential electrification actually reduce greenhouse gas emissions?
3. How will policy-driven residential electrification impact natural gas utility customers?
4. What would be the overall cost of policy-driven residential electrification?
5. How do the costs of policy-driven residential electrification compare to other approaches to reduce greenhouse gas emissions?
Electrifying the entire residential sector would nearly double the U.S. electric grid’s peak hourly demand.

Impact of Residential Electrification on Peak Winter Hourly Demand (GW)

- Historical Peak Electric Demand: 671
- Growth in Capacity (2016 to 2035): 81
- Market-Based Generation case: 267
- Renewables-Only case: 219
- Remaining Residential Gas Load: 441
- Potential Peak Electric Demand: 1,679

Source: Implications of Policy-Driven Residential Electrification, 2018
Total GHG reduction potential from policy-driven residential electrification is small.

Changes in 2035 GHG Emissions (MMT)

-159.7  63.4  -96.3

= 1.5% Reduction

Change in Res'l Emissions  Change in Power Gen. Emissions  Net Change in Emissions

Source: Implications of Policy-Driven Residential Electrification, 2018
GHG reduction potential is small and cost to consumers is high.

GHG Emissions Reduction Potential from Residential Electrification

Annual Per Household Cost of Electrification Policy

Incremental Cost of Electrification

Source: Implications of Policy-Driven Residential Electrification, 2018
Regional Breakdown of Consumer Impacts

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

- New York: $3,930
- New England: $2,760
- Plains: $1,960
- Midwest: $1,740
- East Coast: $1,240
- Rockies: $1,683
- South: $520
- Texas: $130
- West: $400
- U.S. Total: Increase $1,420

Legend:
- Green: Average Annual Per-Household Cost from Power and Transmission Costs
- Blue: Annual Households Direct-Consumer Costs per Household
- Black: Pre-Electrification: Average Household Annual Household Energy Costs
- Orange: Post-Electrification: Total Annual Costs Per-Household

Source: Implications of Policy-Driven Residential Electrification, 2018
Natural gas utilities in the U.S. invest $4 million in energy efficiency programs every day.

These investments have helped reduce residential household GHG emissions by 50% since 1970.
Developing and Deploying Energy Efficient Technologies in Homes and Buildings

25-40% GHG reduction potential on a customer basis

**Space Cooling, up to 45%**
- Gas heat pump

**Space Heating, up to 40%**

**Building Efficiency, 10-45%**
- IoT based thermostat
- Building Envelope

**Cooking, minimal change**
- Gas stove
- Gas oven

**Water heating, up to 55%**
- Absorption heat pump

**Laundry, 55%**
- Gas dryer
- Ozone washing
Advancing Renewable Sources of Supply

Renewable Natural Gas (RNG)

Power to Gas (P2G)
Thank you!

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