Gas Industry Update: Emerging Opportunities and Challenges

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A Look at Natural Gas Market Fundamentals
Shale gas has significantly grown and diversified the U.S. natural gas resource base.

**U.S. Natural Gas Resources**

- Total U.S. (mean) 2,817 Tcf
  - Pacific: 56.5 Tcf
  - Rocky Mountain: 469.7 Tcf
  - Mid-Continent: 377.4 Tcf
  - Gulf Coast: 540.9 Tcf
  - Atlantic: 1,064.8 Tcf
  - Alaska: 250.8 Tcf

Shale gas resources significantly increased natural gas supply starting in 2006.
Shale gas accounted for approximately two-thirds of U.S. 2018 production volumes.
We experienced record levels of natural gas production in 2018.

Daily Dry Natural Gas Production
US Lower-48

Data: S&P Global
Shales gas production continues to keep natural gas commodity prices low compared to history.
U.S. consumption of natural gas has steadily increased since the shale gas revolution.

Source: U.S. Energy Information Administration
The increase in natural gas consumption extends across the U.S. and Canada.

Dry Natural Gas Consumption - Canada

Billion Cubic Feet

Source: U.S. Energy Information Administration
The single-largest natural gas consuming day ever: January 1, 2018
January 30, 2019
Peak Day Natural Gas Consumption, 2007–2019 (Bcf)
New records set for power generation & industrial natural gas demand.

US peak-day natural gas demand by sector
January 1, 2018 (Blue) vs January 30, 2019 (Orange)
(Billion cubic feet per day)

- Residential & Commercial: 79 vs 75
- Power generation: 31 vs 34
- Industrial: 27 vs 29
- LNG Feegas: 4 vs 4
- Exports to Mexico: 3 vs 5
- Other Demand: 4 vs 4

Source: American Gas Association
Natural gas exports are growing due to pipeline gas to Mexico and LNG. The US is now a net exporter of natural gas.

Monthly U.S. natural gas imports and exports (Jan 2016-Jun 2018)

- Billion cubic feet per day

- Gross exports as liquefied natural gas by pipeline to Mexico by pipeline to Canada
- Net trade
- Gross imports by pipeline from Canada by pipeline from Mexico as liquefied natural gas
Review Question #1

What month and year did the natural gas industry achieve its largest daily consumption record?
A. December 2013
B. January 2019
C. January 2018
D. January 2011

What was the overall consumption for the record month and year?
A. 147 BCF
B. 139 BCF
C. 150 BCF
D. 186 BCF
How are strong natural gas market fundamentals providing value to the economy?
Impacts of Strong Market Fundamentals

Natural Gas Has Driven Growth in the Manufacturing Sector.

A new comprehensive study from IHS Economics and the National Association of Manufacturers (NAM) Center for Manufacturing Research reveals how natural gas has strengthened manufacturing, encouraged U.S. manufacturing growth and employment and highlights the positive impact to communities around the United States.
Impacts of Strong Market Fundamentals

Natural Gas’ Has Contributed to a Reduction in U.S. CO2 Emissions in the Power Generation Sector.

Annual U.S. Electric Power Net Generation By Sector (Twh)

- Coal
- Natural Gas
- Nuclear
- Hydroelectric
- Wind + Solar

Carbon Intensity of US Electric Power Generation (Metric Tons CO2 per Megawatthour, Rolling 12-Month)

- Carbon dioxide emissions from the U.S. Power sector have declined 28% since 2010.
Impacts of Strong Market Fundamentals

Stable and Moderate Natural Gas Prices Have Enabled the Modernization and Growth of the Delivery Network.

Residential Retail Energy Prices

Types of Natural Gas Main

- Plastic
- Protected Steel
- Unprotected Steel
- Cast Iron

- Natural Gas
- Propane
- Fuel Oil
- Electricity
Even with a very strong value proposition, the natural gas industry is facing policy challenges.
Policies Aimed at Achieving Decarbonization Objectives Through a Single Pathway is Concerning.
States and municipalities are committing to decarbonization goals without a clear understanding of the implications.

406 Mayors, representing 70 million Americans, commit to uphold the Paris Agreement goals.

Source: climatemayors.org
Space heating is the dominant space conditioning load in all regions. Ratio of heating to cooling is high in northern regions (over 10:1).

Source: DOE EIA (RECS, 2015)
## Foundational Energy Facts

### Six Years of Residential Monthly Energy Consumption

<table>
<thead>
<tr>
<th></th>
<th>Residential Electric</th>
<th>Residential Natural Gas</th>
<th>Max Gas/Max Electric Ratio</th>
<th>% Gas Heating</th>
<th>% Electric Heating</th>
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<td>2013 - 2018</td>
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<td>CA</td>
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<td>4.61</td>
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Substantially more natural gas is delivered in a peak month to residential users than electricity. Heating loads

Source: DOE EIA, U.S. Census
Foundational Energy Facts

Share of US Greenhouse Gas Emissions
(MMT = Million Metric Tons)

- Residential Natural Gas: 266MMT CO2e (4%)
- Residential Electricity: 706MMT CO2e (11%)
- Remaining GHG: 5,573MMT CO2e (85%)

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

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 sector sales, Energy Information Administration
Review Question #2

What percentage of 2018 Net Power Generation was from natural gas?
A. 21%
B. 50%
C. 13%
D. 31%

Residential natural gas consumption accounts for what percentage of total U.S. GHG emissions in 2016?
A. 40%
B. 4%
C. .4% BCF
D. None of the above
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 (856 GW)
- Electric Capacity (2016-2035)
- Incremental Peak Demand Growth
- Historical Summer Peak Electric Demand
  - Only Natural Gas
  - Potential Gas Peak

Source: Implications of Policy-Driven Residential Electrification, 2018
Greenhouse Gas Reduction potential is small

Changes in 2035 GHG Emissions (MMT)

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

-159.7
63.4
-96.3

= 1.5% Reduction

Source: Implications of Policy-Driven Residential Electrification, 2018
Cost to consumers would be high.

Annual Per Household Cost of Electrification Policy

- Incremental Power and Transmission Costs
- Incremental Direct Consumer Costs
- Pre-Electrification Average Annual Household Energy Costs

Overall U.S.

$1,420
71% Increase

Source: Implications of Policy-Driven Residential Electrification, 2018
Implications to Natural Gas LDCs

- Reductions in natural gas distribution system throughput
- Reductions in natural gas distribution customers
- Potential increases in natural gas distribution company rates
- Declines in traditional investment opportunities in the regulated natural gas distributions business
- Potential opportunities to earn a regulated rate of return on energy Efficiency investments, and other investments in “green” technologies
- Changes in gas supply planning processes and commitments due to changes in peak heating system load
Natural Gas Pathway Towards U.S. Emissions Reductions
Continued Commitment to Energy Efficiency Programs

Natural gas utilities in the U.S. invest $4 million in energy efficiency programs every day.

These investments have helped customers save 239 trillion Btu of energy and offset 12.5 million metric tons of carbon dioxide emissions in 2016.
Natural Gas Energy Efficiency Programs Have Helped to Reduce Home Energy Consumption and Emissions For Over 40 Years.

Since 1970, gas utilities have added $30 million residential customer with virtually no increases in emissions in the residential sector.

Source: Energy Information Administration

Based on AGA calculations of weather-normalized residential gas consumption per customer.
Developing 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
Advancing Renewable Sources of Supply

Renewable Natural Gas (RNG)

Power to Gas (P2G)
Review Question #3

How much more energy does heating a home require compared to cooling in the northern regions of the country?

A. Its about the same
B. 10% more
C. 10 times more
D. 50% more

How much have emissions increased or decreased from natural gas consumption in residential homes since 1970?

A. None - It about the same
B. 10% less
C. 22% more
D. None of the above
Your Questions?

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