



**Inside This Issue...**

**Page 2A**

- ◆ Consumption & Production, continued from page 1.

**Page 3A**

- ◆ Consumption & Production, continued from page 2.
- ◆ 2018-2019 Winter Outlook, continued from page 4.
- ◆ Snapshots
  - Natural Gas Storage Graph
  - Rig Count Graph
  - Seasonal Temperature Map
  - Price Per MMBtu Graph

**Page 4A**

- ◆ 2018-2019 Winter Outlook, continued from page 1.

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## U.S. Energy Facts Explained Consumption & Production

### The United States uses a mix of energy sources

The United States uses and produces many different types and sources of energy, which can be grouped into general categories such as primary and secondary, renewable and nonrenewable, and fossil fuels.

Primary energy sources include fossil fuels (petroleum, natural gas, and coal), nuclear energy, and renewable sources of energy. Electricity is a secondary energy source that is generated (produced) from primary energy sources.

Energy sources are measured in different physical units: liquid fuels in barrels or gallons, natural gas in cubic feet, coal in short tons, and electricity in kilowatts and kilowatt-hours. In the United States, British thermal units (Btu), a measure of heat energy, is commonly used for comparing

different types of energy to each other. In 2017, total U.S. primary energy consumption was equal to about 97.7 quadrillion (97,728,000,000,000,000) Btu.

There are five major primary energy consuming sectors. Their share of total primary energy consumption in 2017 were:

- ◆ Electric power - 38.1%
- ◆ Transportation - 28.8%
- ◆ Industrial - 22.4%
- ◆ Residential - 6.2%
- ◆ Commercial - 4.5%

The electric power sector generates most of the electricity in the United States, and the other four sectors consume most of that electricity.

The pattern of fuel use varies widely by sector. For example, petroleum

Continued on page 2.

## 2018-2019 Winter Outlook for Natural Gas

### Executive Summary

The Natural Gas Supply Association's (NGSA) 2018-2019 Winter Outlook for Natural Gas summarizes the association's view of natural gas market conditions and fundamentals. The analysis covers the key points that can affect supply and demand dynamics, which ultimately impact all consumers of natural gas.

Based on publicly available information, NGSA forecasts whether natural gas prices will be subject to upward, downward or level pressure for the upcoming winter of 2018-2019 compared to the winter of 2017-2018, but the association does not forecast actual prices.

Based on an analysis of the weather, economy, consumer demand, production and storage, **NGSA expects neutral price pressure on the natural gas market in winter 2018-2019 compared to last winter, when the average wholesale price for natural gas at the Henry Hub was \$2.99 per MMBtu.**

An expectation for growth in electric sector demand and increased exports are the most significant factors impacting this winter's forecast for record natural gas demand, while slightly warmer temperatures and soaring production set the stage for supply to ably meet demand.

Record production is expected to provide flexibility and optionality to compensate for below-average storage inventories at the beginning of the winter heating season.

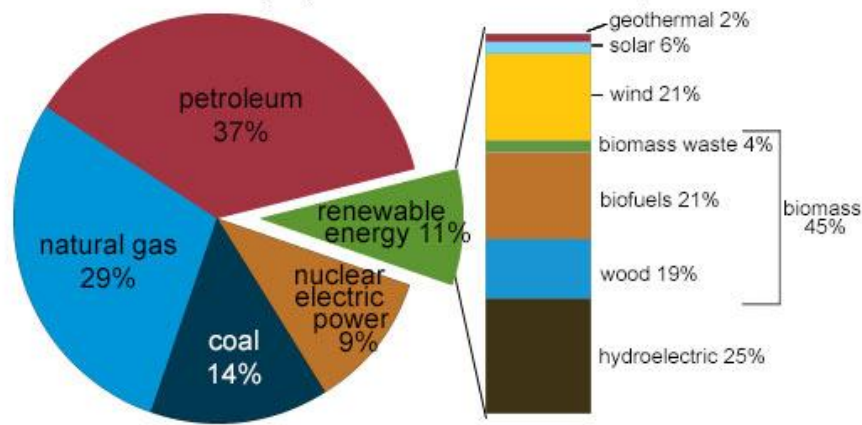
Winter-over-winter increases in demand are forecasted in the electric and industrial sectors, as well as in exports. The biggest increase in demand is expected to come from the export sector in the form of LNG exports and pipeline exports to Mexico. Industrial demand will also contribute to the increase, the result of new natural gas-intensive industrial projects and expansions, as well as stronger industrial activity all around, with plants running at greater capacity than in recent years.

**A glance at the natural gas market's major pressure points for winter 2018-2019 reveals:**

Continued on page 4.

### U.S. energy consumption by energy source, 2017

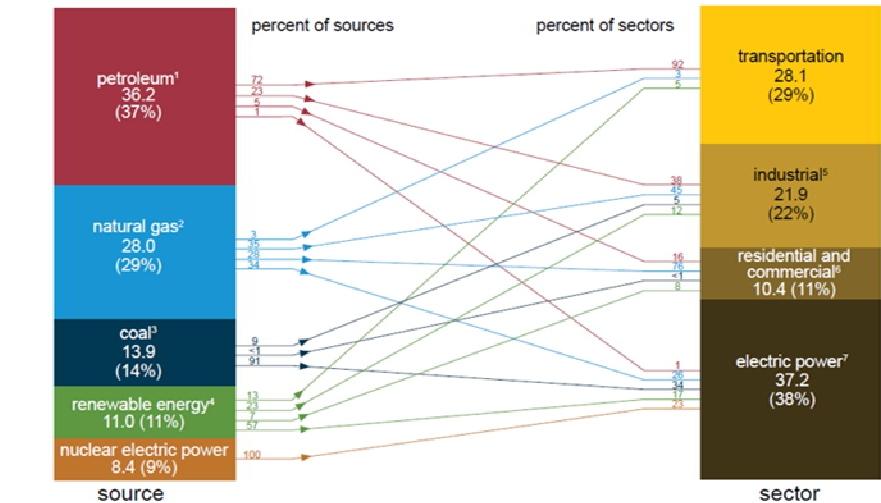
Total = 97.7 quadrillion British thermal units (Btu)



Note: Sum of components may not equal 100% because of independent rounding. Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3 and 10.1, April 2018, preliminary data

### U.S. primary energy consumption by source and sector, 2017

Total = 97.7 quadrillion British thermal units (Btu)



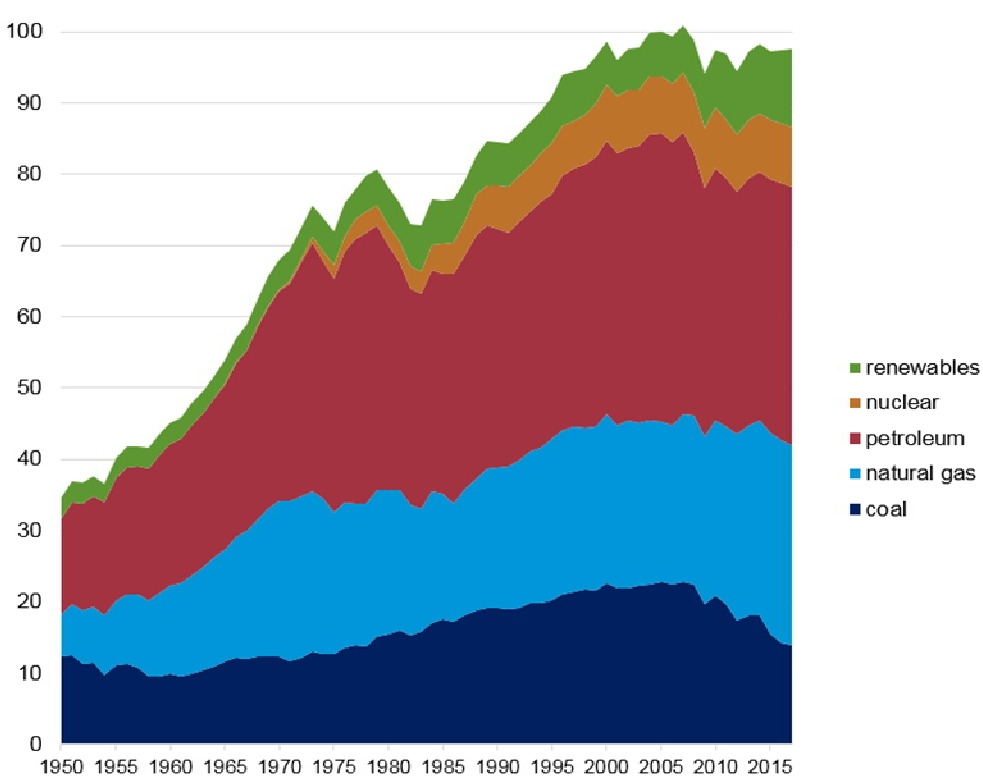
<sup>1</sup> Does not include biofuels that have been blended with petroleum—biofuels are included in "Renewable Energy."  
<sup>2</sup> Excludes supplemental gaseous fuels.  
<sup>3</sup> Includes -0.03 quadrillion Btu of coal coke net imports.  
<sup>4</sup> Conventional hydroelectric power, geothermal, solar, wind, and biomass.  
<sup>5</sup> Includes industrial combined-heat-and-power (CHP) and industrial electricity-only plants.  
<sup>6</sup> Includes commercial combined-heat-and-power (CHP) and commercial electricity-only plants.  
<sup>7</sup> Electricity-only and combined-heat-and-power (CHP) plants whose primary business is to sell electricity, or electricity and heat, to the public. Includes 0.17 quadrillion Btu of electricity net imports not shown under "source."

Notes: • Primary energy is energy in the form that it is accounted for in a statistical energy balance, before any transformation to secondary or tertiary forms of energy occurs (for example, coal is used to generate electricity). • The source total may not equal the sector total because of differences in the heat contents of total, end-use, and electric power sector consumption of natural gas. • Data are preliminary. • Values are derived from source data prior to rounding. • Sum of components may not equal total due to independent rounding. Sources: U.S. Energy Information Administration, *Monthly Energy Review* (April 2018), Tables 1.3, 1.4a, 1.4b, and 2.1-2.6.

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U.S. primary energy consumption by major sources, 1950–2017  
quadrillion British thermal units



Note: Petroleum is petroleum products excluding biofuels, biofuels are included in renewables.  
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.3, April 2018

Consumption & Production  
Continued from page 1.

provides about 92% of the energy used for transportation, but only 1% of the energy used to generate electricity.

Domestic energy production is equal to about 90% of U.S. energy consumption in 2017

In 2017, the amount of energy produced in the United States was equal to about 87.5 quadrillion Btu, and this was equal to about 89.6% of U.S. energy consumption. The difference between the amount of total primary energy consumption and total primary energy production was mainly the energy content of net imports of crude oil.

The three major fossil fuels - petroleum, natural gas, and coal -

combined accounted for about 77.6% of the U.S. primary energy production in 2017:

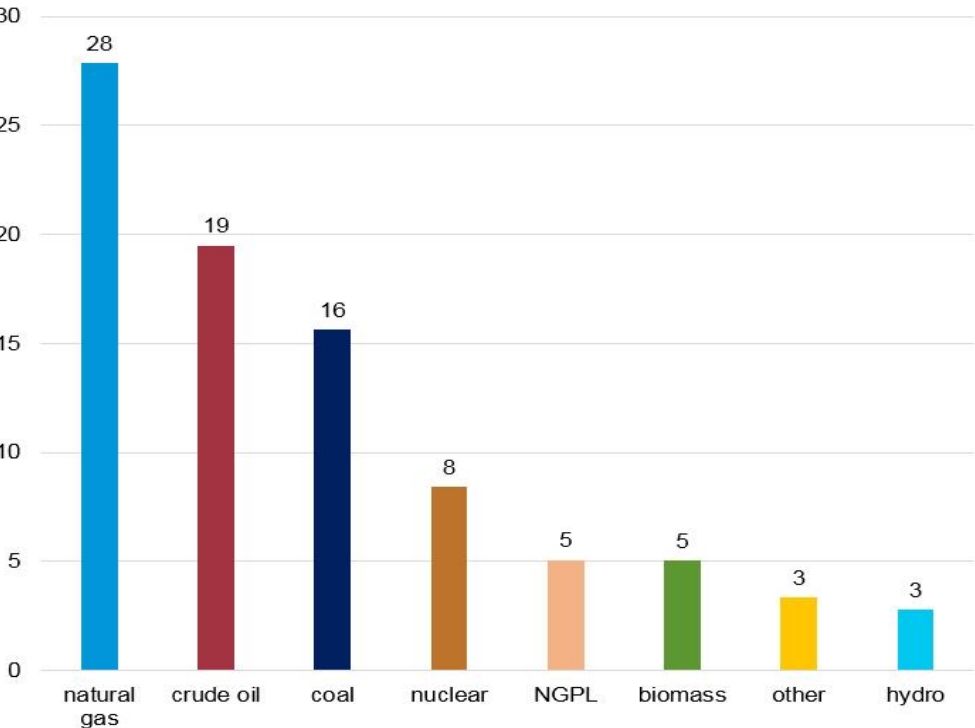
- ◆ Natural gas - 31.8%
- ◆ Petroleum (crude oil and natural gas plant liquids) - 28.0%
- ◆ Coal - 17.8%
- ◆ Renewable energy - 12.7%
- ◆ Nuclear electric power - 9.6%

The mix of U.S. energy consumption and production has changed over time

Fossil fuels have dominated the U.S. energy mix for more than 100 years, but the mix has changed over time.

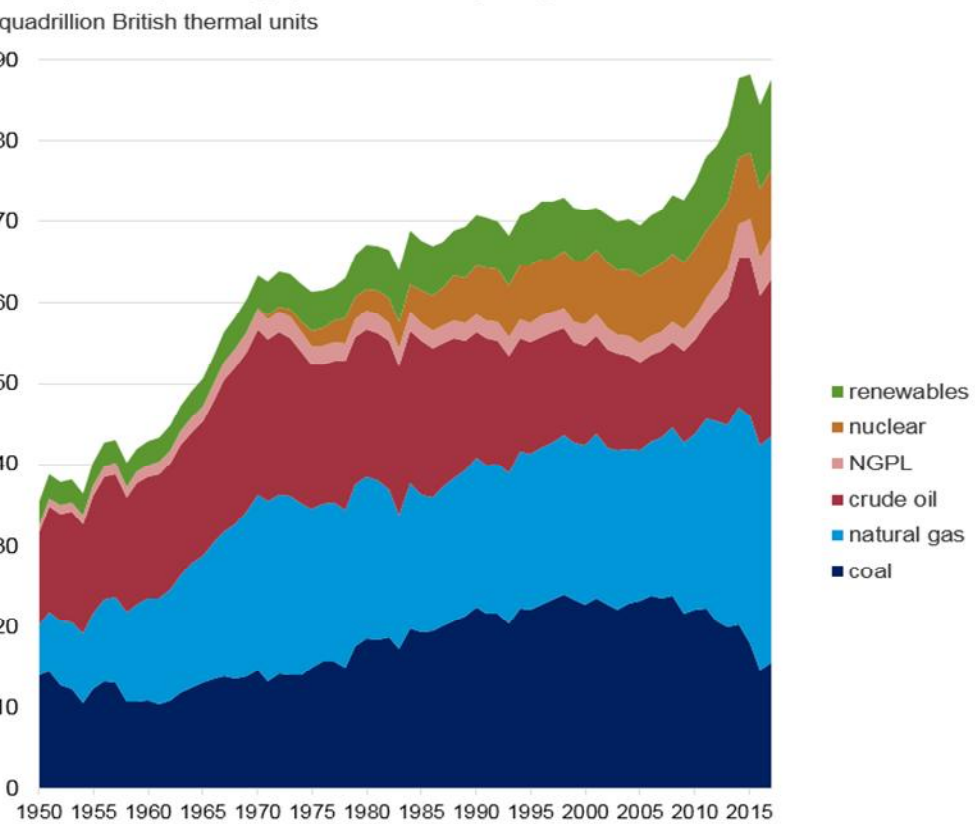
Coal production peaked in 2008, trended down through 2016, and increased about 6% in 2017. Coal production in 2017 was about equal to production in 1979. The main reason for the general decline in U.S. coal

U.S. primary energy production by major sources, 2017  
quadrillion British thermal units



Note: NGPL is natural gas plant liquids; other is geothermal, solar, and wind; hydro is conventional hydroelectric.  
Source: U.S. Energy Information Administration, *Monthly Energy Review*, April 2018, preliminary data

U.S. primary energy production by major sources, 1950–2017



Note: NGPL is natural gas plant liquids.  
Source: U.S. Energy Information Administration, *Monthly Energy Review*, Table 1.2, April 2018

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production in recent years is the decrease in U.S. coal consumption for electricity generation.

Natural gas production in 2017 was the second-largest amount after the record high-production in 2015. More efficient and cost-effective drilling and production techniques have resulted in increased production of natural gas from shale and tight geologic formations. The increase in production contributed to a decline in natural gas prices, which in turn had contributed to increases in natural gas use by the electric power and industrial sectors.

Crude oil production generally decreased each year between 1970 and 2008. In 2009, the trend reversed and production began to rise. Production in 2015 and in 2017 was the second and third highest on record, respectively. More cost-effective drilling and production technologies helped to boost production, especially in Texas and North Dakota.

Continued on page 3.

Consumption & Production  
Continued from page 2.

Natural gas plant liquids (NGPL) are hydrocarbon gas liquids (HGL) that are extracted from natural gas before the natural gas is put into pipelines for transmission to consumers. NGPL production has increased alongside increases in natural gas production and reached a record high in 2017. U.S. consumption and exports of HGL have both increased in recent years.

Total renewable energy production and consumption both reached record highs of about 11 quadrillion BTU in 2017. Hydroelectric power production in 2017 was about 2% lower than the 50-year average. Increases in energy production from wind and solar helped to increase the overall energy production from renewable sources. Energy production from wind and solar were at record highs in 2017.

2018-2019 Winter Outlook  
Continued from page 4.

When customer demand from **ex-ports**, the **electric**, **industrial**, and **residential/commercial** sectors are combined, overall demand averages 102.7 Bcf/day - about 3 percent more than last winter. **Overall customer demand is expected to place neu-tral pressure on prices this winter.**

Winter Sources/Production  
and Imports

Turning to natural gas winter supply, EIA expects domestic production to increase tremendously compared to last winter, reflecting increased drilling activity and takeaway capacity. As a result, average domestic natural gas supply this winter is forecasted to reach 84.9 Bcf/day, a 10 percent increase over last winter’s 77.4 Bcf/day. Vast supply growth across the United States is reflective of continuous improvement in technology and drilling efficiencies.

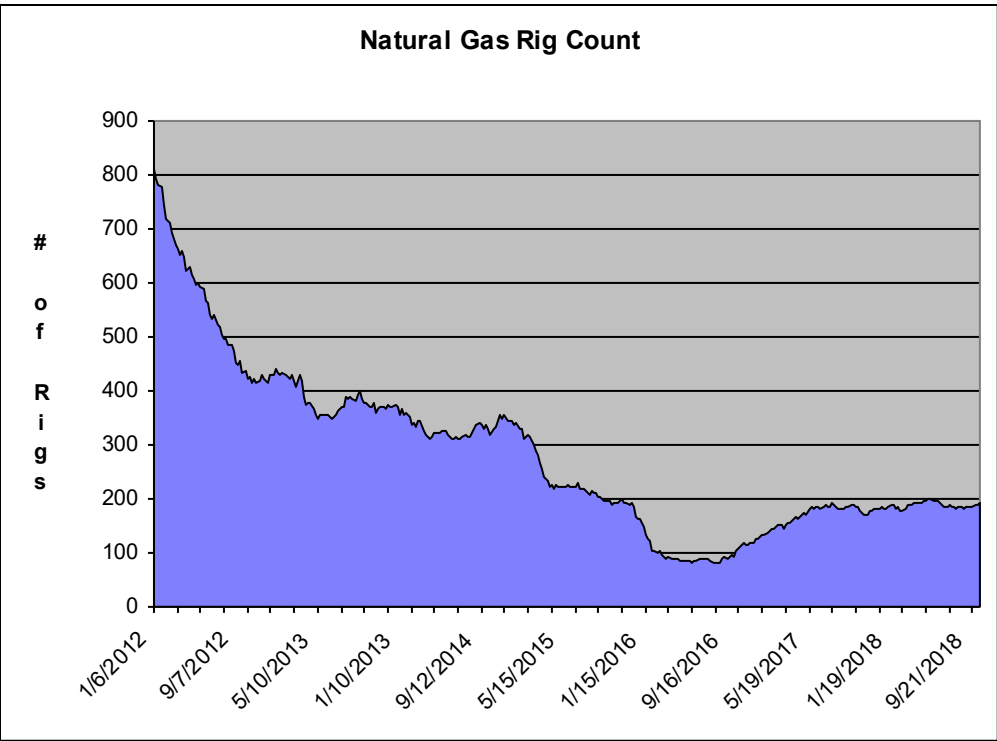
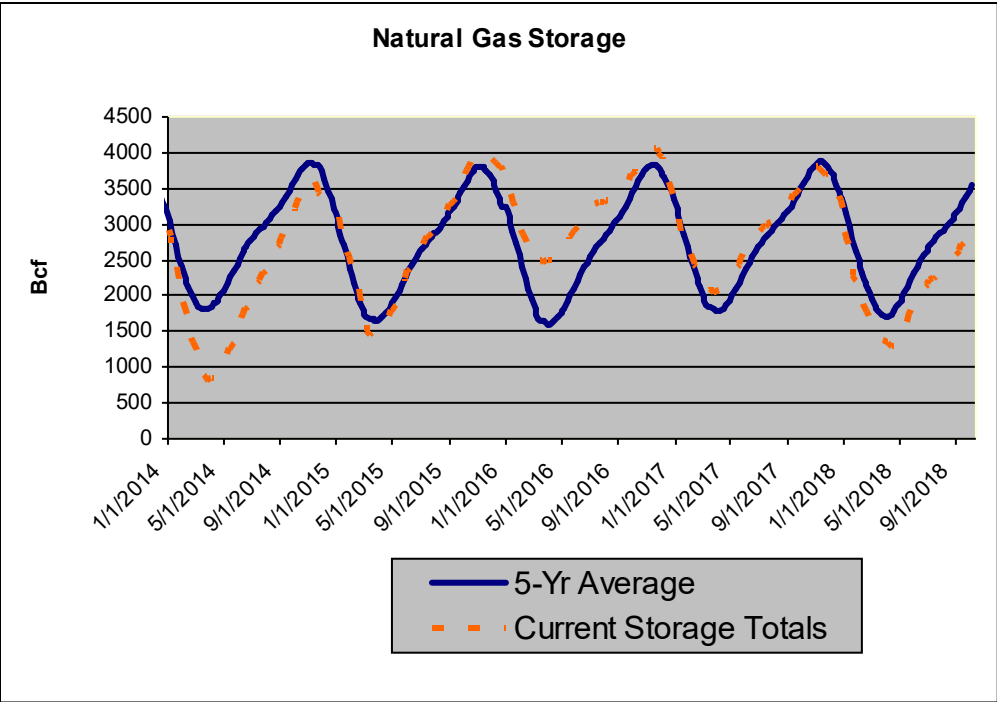
The 2018-2019 Winter Outlook also predicts a moderately-sized, but important, contribution from Canadian imports of 5.2 Bcf/day.

In summary, **record-setting winter production and imports will place downward pressure on natural gas prices** compared to the winter of 2017-2018.

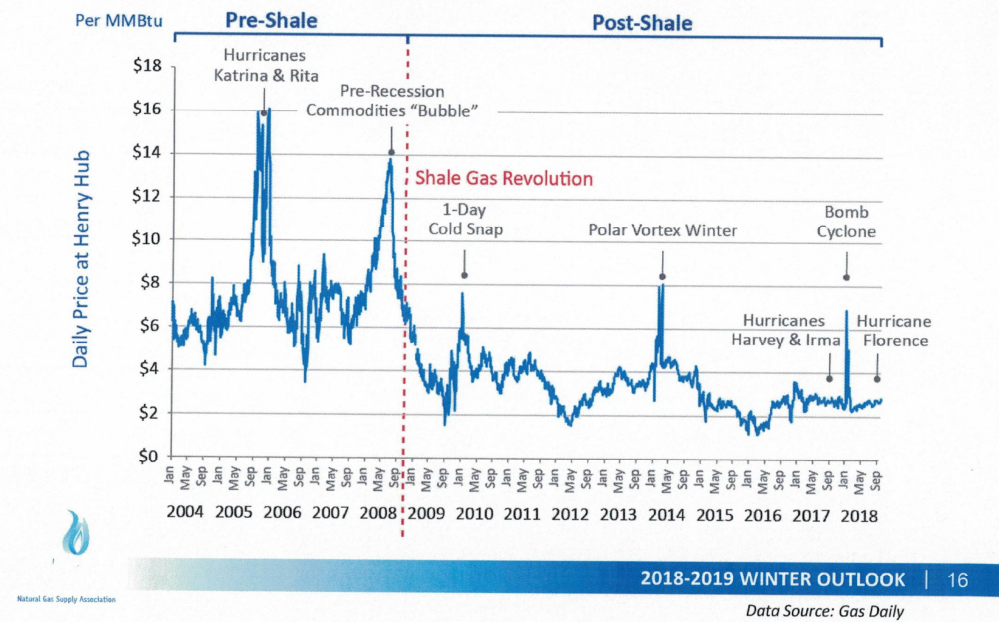
Natural Gas Weather Resilience

NGSA’s forecast also examined the impact of recent hurricanes and deep freezes on natural gas prices, finding that market impacts were generally limited to the demand side, instead of the supply side, which quickly re-bounded. The chart below contrasts

Snapshots



Comparison of Impact of Severe Weather on Daily Prices  
What a Difference a Decade Makes



Storage/Supply

Storage serves as an important hedging and reliability tool. Going into the winter heating season, it is projected that 3,302 Bcf of natural gas will be in storage. This level is 13 percent lower than last year’s inventories and the lowest level of natural gas in storage at the beginning of the winter heating season since 2005, prior to the shale revolution. **Although the lower level of natural gas in storage is likely to place upward pressure on natural gas prices**, the robust production and flexibility offered by the natural gas delivery system provides optionality and alternatives to storage this winter.

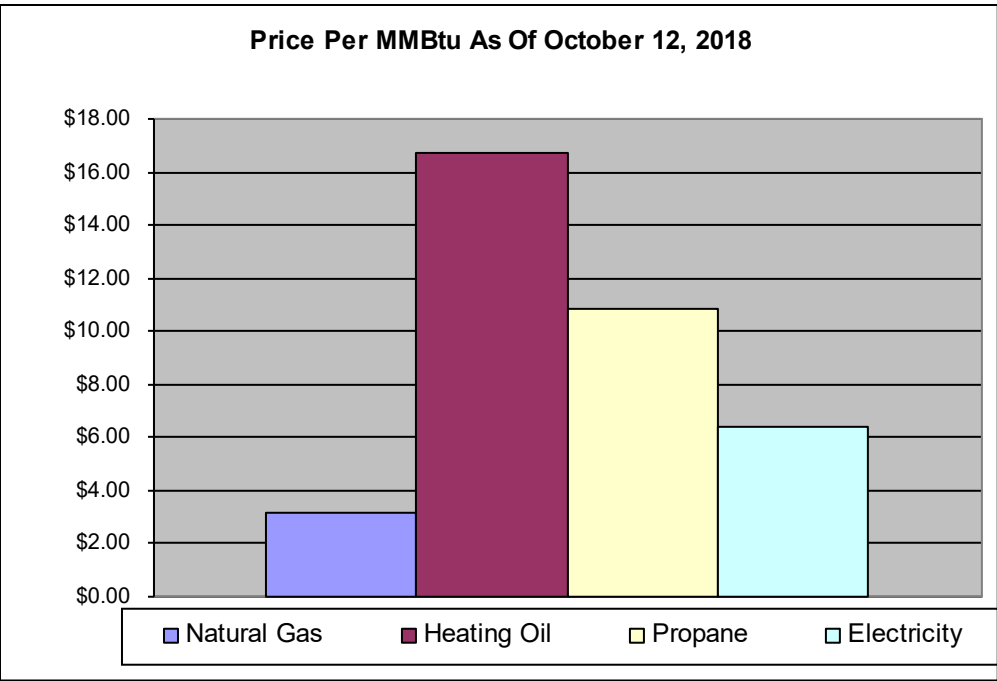
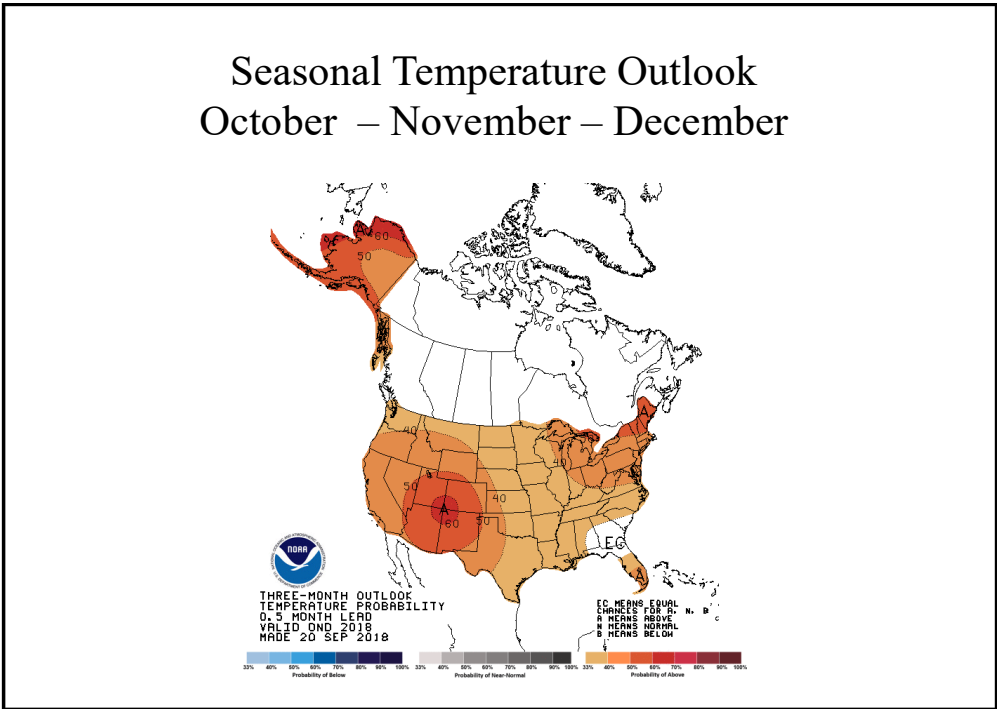
the remarkable difference in the impact of hurricanes on the natural gas market since the shale revolution.

“Wild Card” Market Factors

There are always a few “wild card” factors that can influence the market, in addition to the fundamentals addressed in this Outlook. This winter’s wild cards include:

- ◆ Unexpected early winter cold snaps;
- ◆ Geopolitical events that affect the economy.

NGSA emphasized that winter supply remains ample to meet customer demand, with natural gas storage providing further responsiveness and flexibility in the market.



2018-2019 Winter Outlook

Continued from page 1.

- ◆ **WEATHER:** Based on the National Oceanic and Atmospheric Administration (NOAA), Energy Ventures Analysis (EVA) predicts that the continental United States will on average experience a winter heating season that will be 1 percent warmer than last winter and 2 percent warmer than the 30-year average. Comparing winter-over-winter, total heating degree days (HDDs) are estimated to be very similar, leading to a projection that weather will place **neutral pressure** on prices.
- ◆ **ECONOMY:** Public data anticipates the economy will continue to strengthen, with forecasted GDP growth rate of 3.2 percent but not quite strong enough to exert significant pressure on natural gas prices compared to last winter's 2.5 percent. The economy is expected to put **neutral pressure** on prices compared to last winter.
- ◆ **DEMAND:** When all sectors are combined, **overall natural gas demand** is projected to be more than 102 Bcf/day. Although that is a record amount of winter demand, it is only 3 percent more than the winter of 2017-2018, thus, customer demand is expected to place **neutral pressure** on natural gas prices, individual customer sector forecasts show:
  - ◆ New natural gas combined cycle power plants-representing 19 Gigawatts (GW)-to increase demand from the electric sector by less than 1 Bcf/day, with new demand somewhat offset by the forecast for warmer temperatures.
  - ◆ Pipeline exports to Mexico to increase by 18 percent and net LNG exports to increase by 57 percent, compared to last winter.
  - ◆ Slight industrial demand growth of 0.4 Bcf/day, due to the construction of major gas-intensive facilities and capacity expansions in the petrochemical and fertilizer industries.
  - ◆ **STORAGE:** The natural gas industry is anticipated to finish out the injection season with 3.3 trillion cubic feet (Tcf) of natural gas in storage, the lowest level at this time of year since 2005 and the shale era. Storage is forecasted to place **upward pressure** on prices.
  - ◆ **SUPPLY:** EVA projects an

enormous increase in total supply of more than 7 Bcf/day due to surging production. The forecasted 10 percent increase in winter-over-winter production is expected to result in **downward pressure** on natural gas prices. NGSA emphasized that winter supply, combined with natural gas imports from Canada, are ample to meet record winter demand.

All of these projected pressure points are interrelated and a deviation in one affects the other assumptions in this equation.

Weather/Demand

Based on NOAA's current projections for warmer winter temperatures, Energy Ventures Analysis (EVA) forecasts that on a national average, the winter months will be 1 percent



warmer than the winter of 2017-2018. On a regional basis, NOAA's weather forecast shows warmer-than-average temperatures stretching over two thirds of the country, with only some mid-Atlantic and southern states experiencing more typical, cool winter weather. As a nation, over the full five-month winter heating season (November 2018-March 2019), EVA is forecasting 3,455 heating degree days (HDDs) this winter, compared 3,497 HDDs last winter. Based on the similarity in winter-over-winter heating degrees, **the forecast is for weather to put neutral pressure on natural gas prices.**

Economy/Demand

This winter, public forecasts anticipate a solidly strengthening economy. A key component of economic health is the Gross Domestic Product (GDP). According to HIS Markit, a nationally recognized economic fore-

casting firm, U.S. GDP is expected to increase 3.2 percent compared to the winter of 2017-2018, when GDP expanded by 2.5 percent.

HIS Markit also predicts that manufacturing, an important influence on the GDP, will grow 2.5 percent compared to the winter of 2017-2018. And finally, NGSA for the first time is including global GDP as a factor influencing the natural gas market. Global GDP is expected to be 3.3 percent, quite similar to last winter's 3.2 percent.

In addition, the latest Consumer Sentiment Index (CSI) shows that consumers feel strikingly positive about the economy, with the CSI tracking at 98 percent, reflecting consumer optimism that is likely the result of a strong labor market (3.5 percent un-

**ELECTRIC DEMAND:** EVA projects a small increase in winter **electric** demand of 0.7 Bcf/day, primarily due to the addition of approximately 19 Gigawatts of new natural gas-fired electric capacity going in service in 2018. The forecast for a slightly warmer winter will mean that power plants may not run as much as last winter, slightly dampening demand.

**INDUSTRIAL DEMAND:** EVA expects to see a small but meaningful increase in **industrial** demand of 0.4 Bcf/day this winter. While a small winter-over-winter increase, nevertheless overall industrial demand for natural gas is record-setting. This winter's growth in industrial demand is linked to the completion of major natural gas-intensive facilities and capacity expansions in the petrochemical and fertilizer industries, as

Demand: Customer Demand

Winter Season Period-to-period change	Last Winter 2017-2018 ACTUAL	This Winter 2018-2019 FORECAST
<b>Customer Gas Demand*</b>	<b>99.3 Bcf/d</b>	<b>102.7 Bcf/d</b>
Residential/Commercial	37.8 Bcf/d	36.9 Bcf/d
Electric	24.1 Bcf/d	24.8 Bcf/d
Industrial	24.1 Bcf/d	24.5 Bcf/d
Pipeline exports- Mexico	4.4 Bcf/d	5.2 Bcf/d
LNG exports (net)	3.0 Bcf/d	4.7 Bcf/d
<b>Growth sector</b>	Res/Comm+12% Electric + 13%	LNG Exports +57%
<b>Winter-to-winter pressure on natural gas prices</b>		
*Includes "Lease, Plant and Pipeline Fuel"		

employment), low inflation and a stronger GDP.

While these economic indicators generally reflect good news for consumers, the changes are not quite large enough to pressure natural gas prices, although an unexpected upshift in GDP could change the direction of the arrow from flat to upward. NGSA anticipates the **economy will place level winter-over-winter pressure** on natural gas prices.

Overall Customer Demand

An independent demand analysis performed by EVA notes that total demand for natural gas will reach a record that exceeds even the Polar Vortex winter of 2013-2014. EVA forecasts overall winter 2018-2019 demand for natural gas at 102.7 billion cubic feet per day (Bcf/d) compared to 99.3 Bcf/d last winter. A sector-by-sector breakdown follows.

industries continue to take advantage of affordable natural gas in the United States.

**EXPORTS:** The largest increase in demand is anticipated to come from the export sector. In addition to exporting an expected 5.2 Bcf/day by pipeline to Mexico this winter, the U.S. is also forecasted to be a net exporter of 4.7 Bcf/day of liquefied natural gas (LNG). Although a historic amount, the amount of LNG to be exported is projected to remain merely a small (5 percent) slice of overall demand.

**RESIDENTIAL/COMMERCIAL DEMAND:** Finally, EVA expects that demand from the **residential and commercial** sectors will slightly decrease compared to last winter due to warmer weather.

Continued on page 3.

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