



SPRING 2019



For Municipal Gas Systems



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Natural Gas Long Term Projections

Key takeaways

- ◆ The United States becomes a net energy exporter in 2020 and remains so throughout the projection period as a result of large increases in crude oil, natural gas, and natural gas plant liquids (NGPL) production coupled with slow growth in U.S. energy consumption.
- ◆ Of the fossil fuels, natural gas and NGPLs have the highest production growth, and NGPLs account for almost one-third of cumulative U.S. liquids production during the projection period.
- ◆ Natural gas prices remain comparatively low during the projection period compared with historical prices, leading to increased use of this fuel across end-use sectors and increased liquefied natural gas exports.
- ◆ The power sector experiences a notable shift in fuels used to generate electricity, driven in part by

historically low natural gas prices. Increased natural gas-fired electricity generation; larger shares of intermittent renewables; and additional retirements of less economic existing coal and nuclear plants occur during the projection period.

- ◆ Increasing energy efficiency across end-use sectors keeps U.S. energy consumption relatively flat, even as the U.S. economy continues to expand.

Natural Gas

Natural gas experiences the largest production increase of all fossil fuels during the projection period across all cases, driven by continued development of lower-cost shale gas and tight oil resources. The growth in natural gas production supports increasing domestic consumption, particularly in the industrial and electric power sectors, and higher levels of natural gas exports.

Extended range forecast of Atlantic seasonal hurricane activity and landfall strike probability for 2019

By Philip J. Klotzbach, Michael M. Bell, and Jhordanne Jones

We anticipate that the 2019 Atlantic basin hurricane season will have slightly below-normal activity. The current weak El Niño event appears likely to persist and perhaps even strengthen this summer/fall. Sea surface temperatures averaged across the tropical Atlantic are slightly below normal, and the far North Atlantic is anomalously cool. Our Atlantic Multi-decadal Oscillation index is below its long-term average. We anticipate a slightly below-average probability for major hurricanes making landfall along the continental United States coastline and in the Caribbean.

ATLANTIC BASIN SEASONAL HURRICANE FORECAST FOR 2019

Forecast Parameter and 1981-2010 Average (in Parentheses)	Issue Date 4 April 2019
Named Storms (NS) (12.1)	13
Named Storm Days (NSD) (59.4)	50
Hurricanes (H) (6.4)	5
Hurricane Days (HD) (24.2)	16
Major Hurricanes (MH) (2.7)	2
Major Hurricane Days (MHD) (6.2)	4
Accumulated Cyclone Energy (ACE) (106)	80
Net Tropical Cyclone Activity (NTC) (116%)	90

PROBABILITIES FOR AT LEAST ONE MAJOR (CATEGORY 3-4-5) HURRICANE LANDFALL ON EACH OF THE FOLLOWING COASTAL AREAS:

1. Entire continental U.S. coastline—48% (average for last century is 52%)
2. U.S. East coast including Peninsula Florida—28% (average for last century is 31%)
3. Gulf Coast from the Florida Panhandle westward to Brownsville—28% (average for last century is 30%)

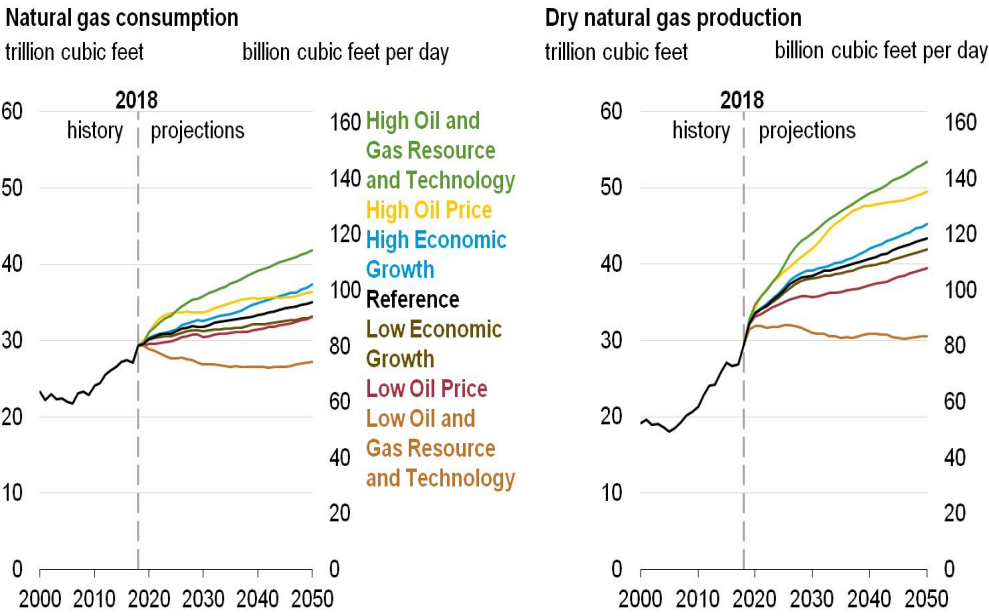
PROBABILITY FOR AT LEAST ONE MAJOR (CATEGORY 3-4-5) HURRICANE TRACKING INTO THE CARIBBEAN (10-20°N, 88-60°W)

1. 39% (Average for last century is 42%)

ABSTRACT

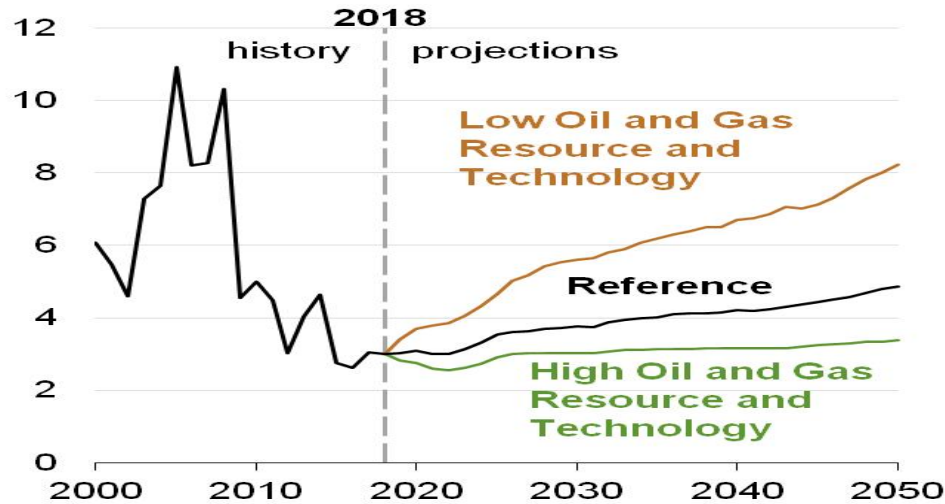
Information obtained through March 2019 indicates that the 2019 Atlantic hurricane season will have activity

U.S. dry natural gas consumption and production increase in most cases with production growth outpacing natural gas consumption in all cases.



Natural gas prices depend on resource and technology assumptions and Henry Hub prices remain lower than \$5 per million Btu throughout the projection period.

Natural gas spot price at Henry Hub 2018 dollars per million British thermal unit



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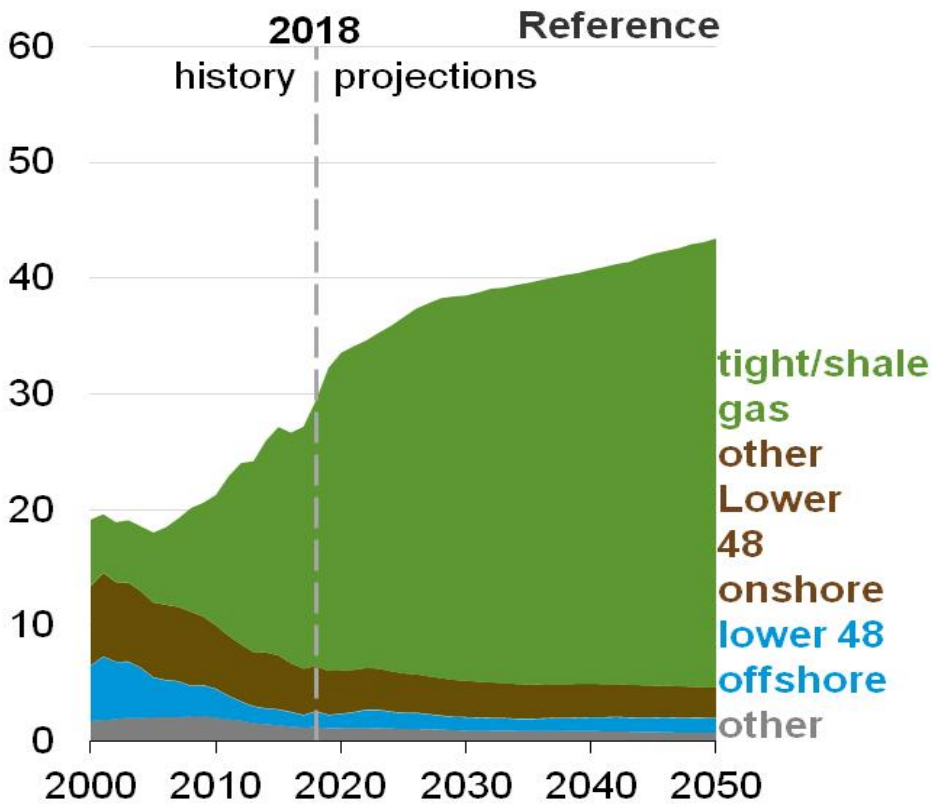
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Natural Gas Long Term Projections

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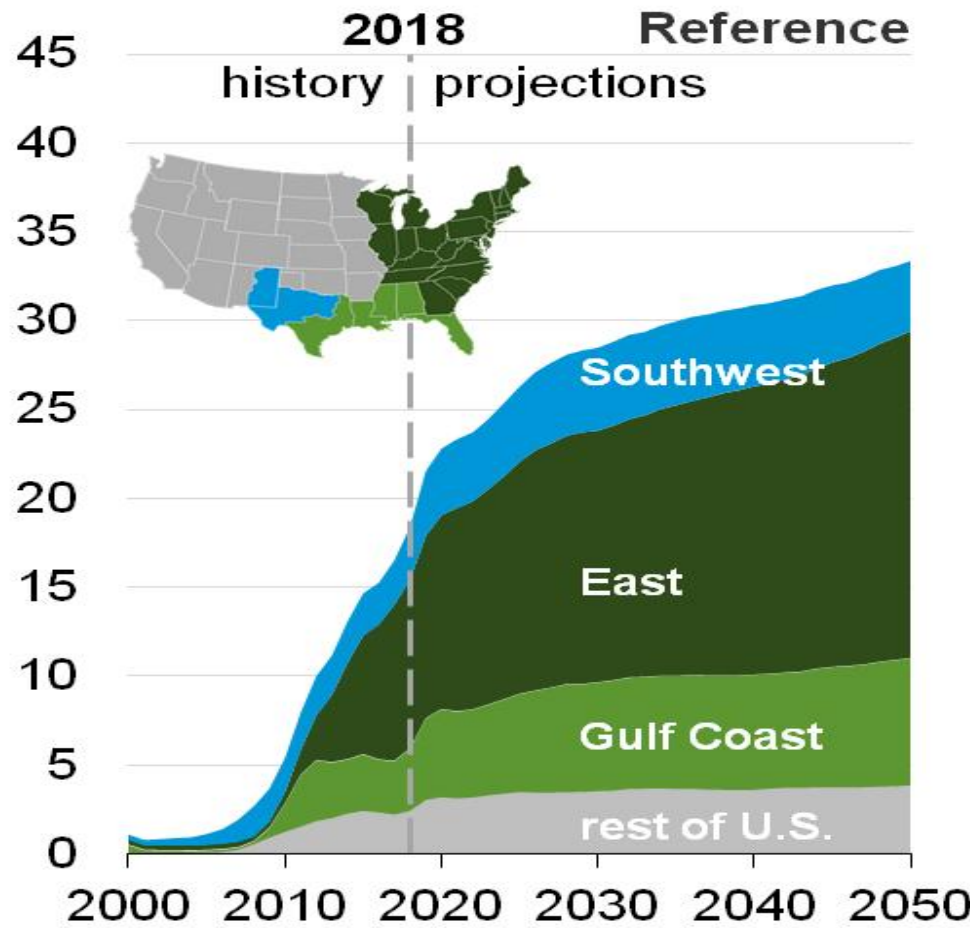
U.S. dry natural gas production increases as a result of continued development of tight and shale resources which account for nearly 90% of dry natural gas production in 2050.

Dry natural gas production by type
trillion cubic feet



Eastern U.S. production of natural gas from shale resources leads growth followed by growth in Gulf Coast onshore production.

Dry shale gas production by region
trillion cubic feet



2018: A Busy
YEAR
for the Federal Energy Regulatory
Commission

Here is a breakdown of some of the accomplishments - from January 2018 to mid-December - as listed by chairman Neil Chatterjee in the Dec. 20 "Open Access" podcast.

48 Natural gas
Pipeline projects
Approved in 2018

Combined for.....

703 miles of pipelines

Amounting to....

9,131 million
cubic feet
per day

FERC also approved

4 natural gas storage
projects totaling:

3,600
billion cubic feet of
storage

Extended Range Forecast of Hurricane Activity
Continued from page 1.

slightly below the 1981-2010 average. We estimate that 2019 will have about 5 hurricanes (average is 6.4), 13 named storms (average is 12.1), 50 named storm days (average is 59.4), 16 hurricane days (average is 24.2), 2 major (Category 3-4-5) hurricanes (average is 2.7), and 4 major hurricane days (average is 6.2). The probability of U.S. major hurricane landfall is estimated to be about 90 percent of the long-period average. We expect Atlantic basin Accumulated Cyclone Energy (ACE) and Net Tropical Cyclone (NTC) activity in 2019 to be approximately 75 percent of their long-term averages. This forecast is based on an extended-range early April statistical prediction scheme that was developed using 29 years of past data. Analog predictors are also utilized. For the first time, we are also using a statistical/dynamical model based off of data from the ECMWF System 5 as an additional forecast guidance tool.

The current weak El Niño event appears likely to maintain intensity or perhaps even strengthen during the summer/fall. The tropical Atlantic is slightly cooler than normal, while the subtropical Atlantic is quite warm, and the far North Atlantic is anomalously cool. The anomalously cold sea surface temperatures in the far North Atlantic lead us to believe that the Atlantic Multi-decadal Oscillation is in its negative phase. There is considerable uncertainty as to what the configuration of Atlantic sea surface temperatures will look like for the peak of the Atlantic hurricane season.

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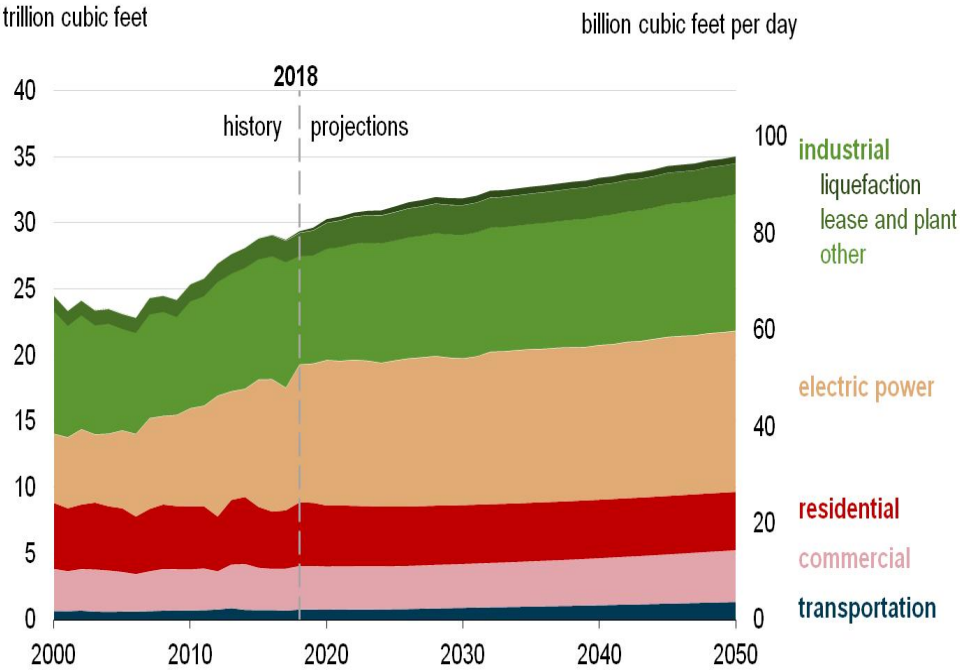
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Natural Gas Long Term Projections

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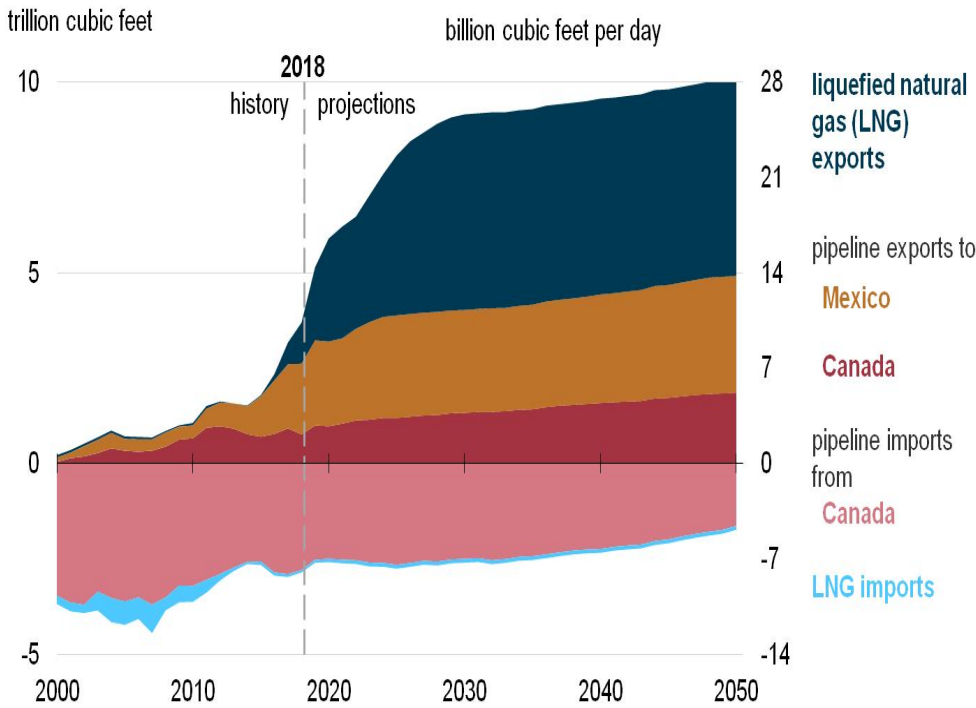
Industrial and electric power demand drives natural gas consumption growth while consumption in the residential and commercial sectors remains relatively flat across the projection period.

Natural gas consumption by sector (Reference case)



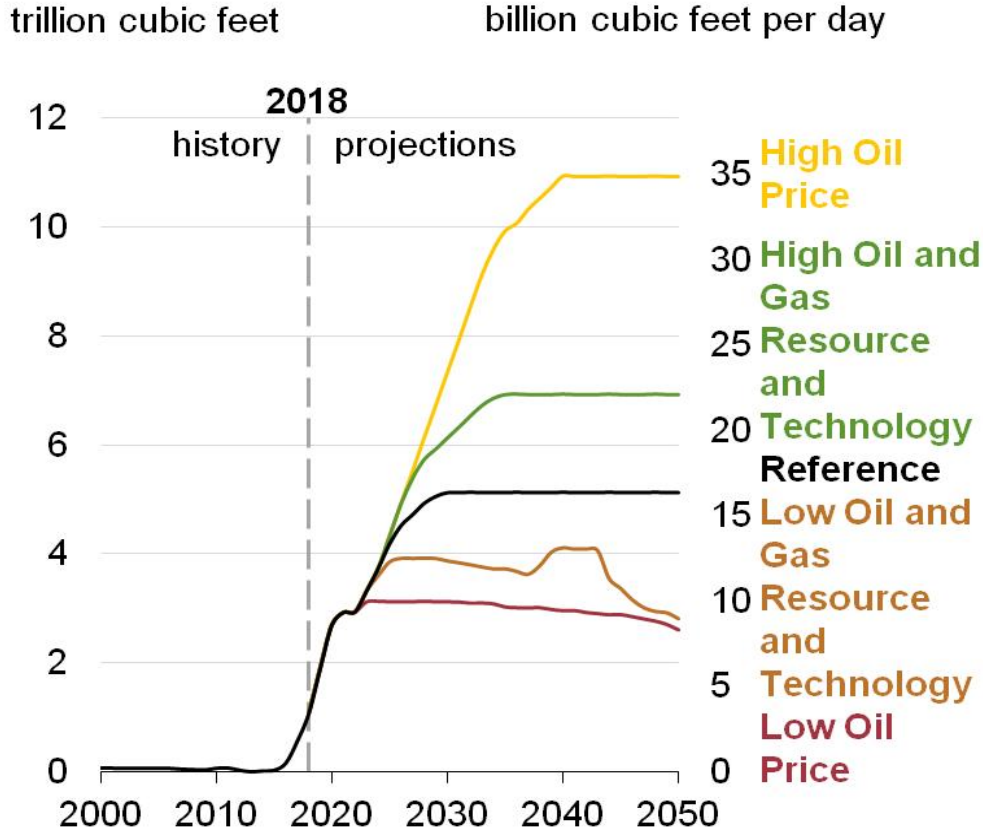
Net exports of natural gas from the United States continue to grow because of near-term export growth and LNG export facilities delivering domestic production to global markets.

Natural gas trade (Reference case)

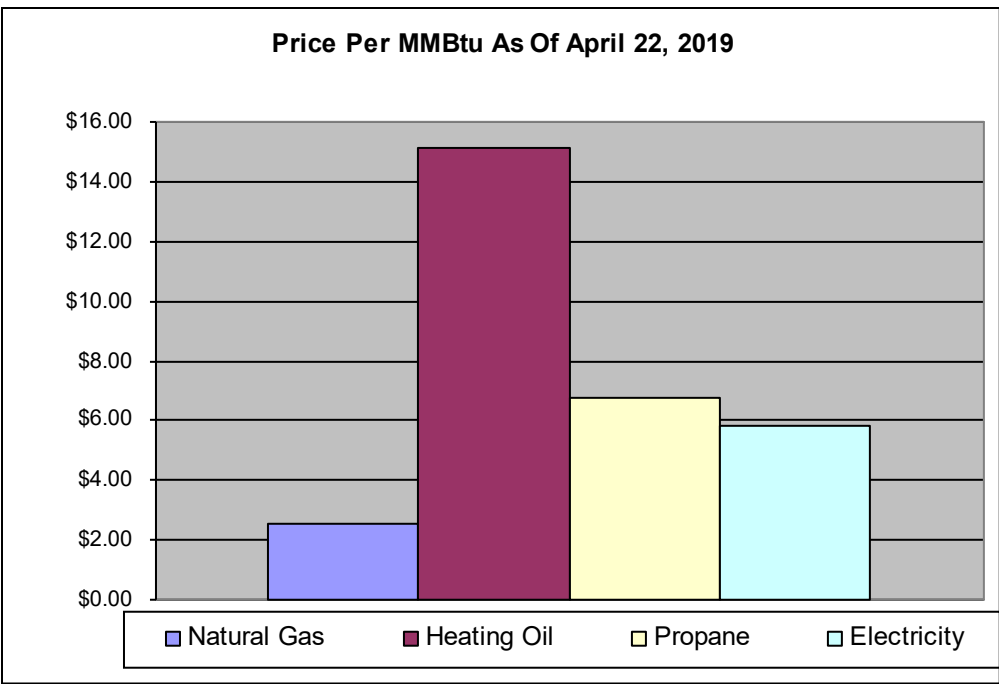
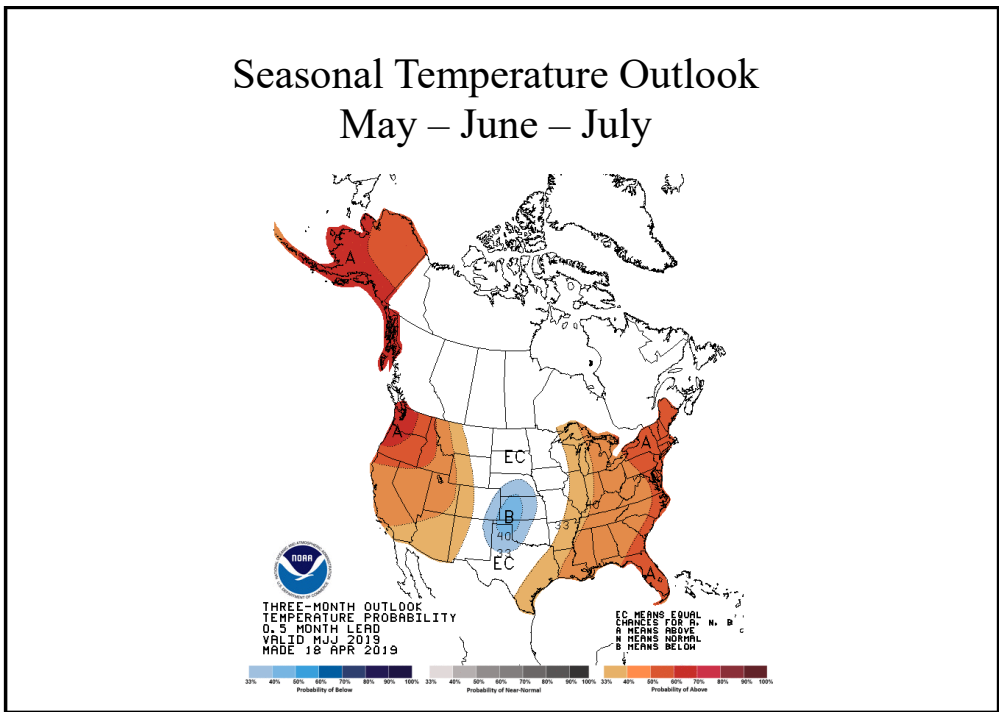
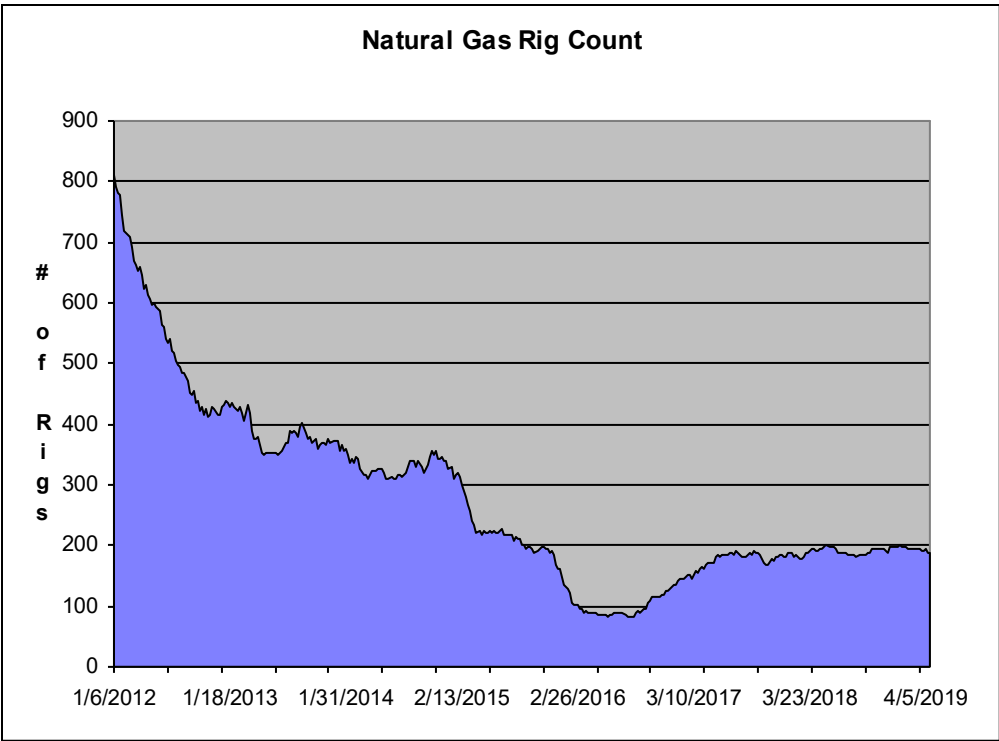
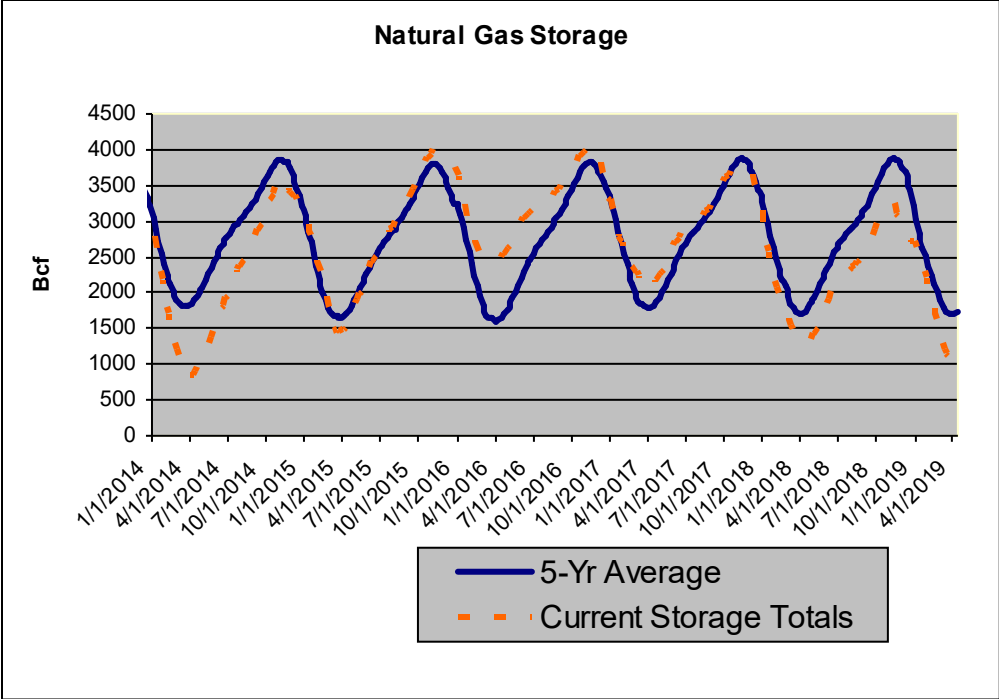


U.S. LNG exports are sensitive to both oil and natural gas prices resulting in a wide range of U.S. LNG export levels across cases.

Liquefied natural gas exports



Snapshots



INCREASING CAPACITY

Gathering Pipelines Needed to Bolster U.S. Production

Oil and gas production is booming in the United States, but pipeline capacity is falling short. New gathering lines and takeaway capacity is needed to get energy products from the well to processing facilities to the market. While these lines tend to be smaller in size, they have a big impact on how oil and gas products reach the end-user.

Recently, both ExxonMobil and Chevron announced plans to increase activity in the Permian Basin of West Texas and southeastern New Mexico.

On March 5, ExxonMobil announced it had revised its Permian Basin growth plans to produce more than 1 million barrels per day (bpd) of oil-equivalent by as early as 2024 — an increase of nearly 80 percent. The anticipated increase in production will be supported by further evaluation of the company’s activities in the Delaware Basin, infrastructure development plans and secured capacity to transport oil and gas to ExxonMobil’s Gulf Coast refineries and petrochemical operations through the Wink-to-Webster, Permian Highway and Double E pipelines.

Chevron’s outlook is supported by strong performance in the Permian, where the company has added almost 7 billion barrels of resource and doubled its portfolio value over the past two years. Permian unconventional net oil-equivalent production is now expected to reach 600,000 bpd by 2020 and 900,000 bpd by 2023.

Other companies, including BP PLC, Royal Dutch Shell PLC and Occidental Petroleum Corp., have also considered increasing activity in the Permian.

Last fall, Enable Midstream announced plans to expand its gathering pipeline business in the Anadarko and Williston basins. The company announced on Oct. 23, 2018, the acquisition of Velocity Holdings LLC, an integrated crude oil and condensate gathering and transportation company in the SCOOP and Merge plays in Oklahoma, for \$442 million. In the Williston Basin, Enable announced it

would add up to 72,000 bpd of crude gathering capacity to up to approximately 130,00 bpd.

Likewise, production in Appalachia with the Marcellus-Utica play continues to climb rapidly. However, as oil and gas production throughout the United States increases, gathering and takeaway pipeline capacity remain a challenge, according to David Murk, pipelines manager for the American Petroleum Institute (API).

API represents the entire oil and gas industry, including upstream, midstream and downstream pipelines. Gathering pipelines cross both upstream and midstream segments.

The need for new gathering pipelines in the United States is driven by plays in place, the main ones being the Utica, Marcellus, Bakken and Permian, Murk says. With the major increase in activity in the Permian Basin, there’s a big push to move the oil and gas to the Gulf Coast for fractionating and then for the most part to export to the international market.

With major companies entering or increasing their existing presence in the region, the Permian Basin represents the largest area of activity for building new gathering pipelines, Murk says. That activity is centered in Texas and New Mexico.

While there is demand to build more gathering pipelines, Murk adds that getting permitting through the states and the Bureau of Land Management (BLM) has been “a bit of a challenge.”

“The main challenge that companies are running into is the permitting process,” Murk says. “There are challenges with BLM on some of the federal lands. That’s more on the connection of actual wells. Permitting presents challenges, and that’s across the board. With gathering, and transmission lines as well, there are concerns about the length of time it takes to get a permit. There’s a lot of interest from the industry in getting that process streamlined to get infrastructure built.”

The U.S. Department of Transportation’s Pipeline and Hazardous Materials Safety Administration (PHMSA) currently regulates some gathering

pipelines, such as those in high consequence areas (HCAs), but not all gathering lines are included. However, that could change later this year. PHMSA is in the process of revising natural gas safety regulations with what has been called the “Gas Mega Rule.”

“Some gathering pipelines are currently regulated by PHMSA, those deemed to be in HCAs, such as populated areas and so forth,” Murk says. “PHMSA went through the mega rule and separated out the gathering rule on its own, updating the rules on gathering lines that are already regulated and drawing in rural gathering lines that are larger diameter from unconventional plays that look more like transmission lines or operate at a higher pressure and present a higher risk. We don’t feel that all gathering lines in rural areas should be regulated. We would like them to look more at a risk-based approach.”

According to a report from corrosion protection provider Matcor Inc., PHMSA’s proposed rulemaking will be broken up into three parts. The first section will address the expansion of risk assessment and maximum allowable operating pressure (MAOP) requirements to include areas in non-HCAs and moderate consequence areas (MCAs). Another part of the rulemaking will focus on the expansion of integrity management program regulations, including corrosion control to gathering lines and other previously non-regulated lines. And finally, the rule making is expected to focus on reporting requirements, safety regulations and definitions to include expanding into related gas facilities associated with pipeline systems.

Building new gathering pipelines and takeaway capacity is crucial to the U.S. energy industry. “What happens is, on the production side, once the oil and gas is out of ground, it goes through a gathering line to a processing facility,” Murk explains. “Then, once it’s processed, the product is moved into a transmission line. That middle point is especially important, because if producers can’t get that infrastructure built, they can’t get the product to market.”

There’s a strong desire on the part of oil and gas producers to export, as energy needs are being met in the

United States, Murk says. The desire is to move liquefied natural gas (LNG) and natural gas to other markets, primarily through the Gulf of Mexico.

Gathering pipelines tend to be smaller diameter projects. However, Murk says that in unconventional production areas, such as the major shale plays like the Marcellus and Utica, gathering lines tend to be larger diameter, since more wells can be placed on a single pad. Larger diameter pipelines are needed to move the additional product from these multiple well pads.

“That’s the dynamic as an industry that we face,” Murk says. “From a size standpoint, they look more like transmission lines. What is happening now with PHMSA is that they are trying to establish the framework for regulating higher risk gathering pipelines.”

Rulemakings go through PHMSA’s pipeline advisory committees, one for liquid (LPAC) and one for gas (GPAC). The gas gathering rule is scheduled to go through discussion with the GPAC at the end of June, Murk says. That will give the committee the opportunity to discuss the rule and come to an agreement, and then PHMSA will make any additional changes.

“We expect the rule will be moving internally in the fall timeframe,” he says. “It will likely be the end of year before we might see something go to the Office of Management and Budget for White House approval.” Depending on the final outcome of the rule, if the scope gets down to where the risk becomes too great of a cost to bear, it could drive some of the smaller operators out of business. However, Murk says he doesn’t see the final rule swaying the industry from building new gathering pipelines.

Despite the coming rule changes from PHMSA, Murk says there isn’t a rush to get projects approved and built.

“From an industry standpoint, it doesn’t matter when the rule is approved,” he says. “Safety is our core value, and we want to make sure whatever rule is in place is done in a risk-based way.”

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