

NATURAL GAS WEEK®

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ENERGY TRANSITION

Accelerating Grid Transformation Complicates Winter Gas Burn Outlook

Higher natural gas prices could lead to lower US power-sector gas burns this winter, but an accelerating grid transformation occurring amid global upheaval clouds that outlook.

The Natural Gas Supply Association (NGSA) said in its 2022-23 Winter Outlook that it expects generators will burn an average of 26.8 billion cubic feet per day of gas this winter, down 1.9 Bcf/d from a year ago.

But as the US power grid's transition toward renewable fuels accelerates, "natural gas and natural gas infrastructure are becoming ever more important ... to balance out variations in the grid," NGSA Chairman David Atwood said last week.

According to consulting group Energy Ventures Analysis (EVA), more than 176 gigawatts of net renewable capacity, including almost 22 GW of battery storage, will be added to the grid from 2018 to 2023. At the same time more than 53 GW of net thermal capacity, including coal-fired and nuclear generation, will exit the market. A large portion of that shift — nearly 53% for renewables and just over 44% for thermal resources — will take place this year and next.

Despite the accelerating shift toward renewables, gas-fired generators will account for more than 26% of the nearly 123 GW of net capacity additions during 2018-23, with a 32 GW increase in gas-fired generation helping offset 73 GW of coal capacity retirements.

But EVA said the timing and magnitude of the shift in the power supply stack could yet change, citing pandemic-driven supply-chain constraints, the Russia-Ukraine conflict, and a potential ban on Chinese solar panels due to their production from alleged forced labor.

"With the delays in renewable installation, rapid retirement in coal capacity, and restricted hydropower availability, gas-fired generators will remain the primary swing resource to ensure grid reliability," EVA said.

Fuel Switching 'Difficult to Predict'

That an exceptional increase in natural gas prices last summer failed to curb power-sector gas demand stunned some observers.

In July, when gas prices averaged \$7.28 per million Btu, gas-fired generation set three new daily records, according to the US Energy Information Administration. The previous daily record was set in July 2020 when natural gas prices averaged only

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KEY WEEKLY SPOT PRICES*

Flow Dates: 10/11-10/17

| | \$/MMBtu | Chg. | High | Low |
|-------------------|----------|-------|------|------|
| Henry Hub | 6.18 | -0.06 | 6.60 | 6.02 |
| Transco Z6 - NY | 5.28 | -0.14 | 5.45 | 5.05 |
| Algonquin | 5.68 | 0.03 | 6.25 | 5.24 |
| Eastern Gas South | 5.04 | -0.21 | 5.45 | 4.81 |
| Chicago Citygate | 5.56 | -0.18 | 5.90 | 5.30 |
| NNG Ventura | 5.42 | -0.19 | 5.85 | 5.20 |
| Waha Hub | 3.72 | 0.23 | 4.40 | 3.40 |
| Katy Hub | 5.38 | -0.04 | 5.70 | 5.05 |
| SoCal Border | 5.99 | -0.04 | 7.65 | 5.25 |
| NW Rockies | 5.32 | 0.04 | 5.70 | 5.05 |
| NW Sumas | 5.25 | -0.30 | 5.71 | 4.80 |
| AECO | 2.09 | -1.30 | 3.09 | 0.36 |

>> *Full table on page 2

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NATURAL GAS WEEKLY SPOT PRICES

Flow Dates: 10/11-10/17

| Price Point | \$/MMBtu | Chg. | High | Low | Avg. Daily Vol. | Avg. Daily Deals | Oct Bid Week |
|---------------------------|----------|-------|------|------|-----------------|------------------|--------------|
| GULF COAST | | | | | | | |
| ANR SE | 6.22 | 0.18 | 6.52 | 5.90 | 24,786 | 5 | 6.87 |
| Col. Gulf - Erath | 6.01 | 0.05 | 6.24 | 5.92 | 12,829 | 2 | -- |
| Col. Gulf - Rayne | 5.32 | -0.30 | 5.68 | 5.10 | 79,957 | 13 | 5.24 |
| Florida Zone 1 | 5.91 | 0.36 | 6.26 | 5.40 | 8,286 | 1 | 6.23 |
| Florida Zone 2 | 6.24 | 0.04 | 6.60 | 6.01 | 14,423 | 3 | -- |
| Florida Zone 3 | 6.38 | 0.05 | 6.76 | 5.85 | 134,535 | 24 | 7.25 |
| Henry Hub | 6.18 | -0.06 | 6.60 | 6.02 | 32,714 | 5 | 6.88 |
| NGPL-LA | -- | -- | -- | -- | -- | -- | -- |
| Pine Prairie Hub | 6.06 | -0.10 | 6.52 | 5.90 | 46,171 | 9 | -- |
| Sonat | 6.20 | 0.23 | 6.80 | 5.75 | 279,757 | 42 | 7.02 |
| Tenn 500 So LA Z1 | 5.91 | 0.11 | 6.35 | 5.42 | 63,734 | 9 | 6.72 |
| Tenn 800 So LA Z1 | 6.09 | 0.18 | 6.40 | 5.86 | 12,800 | 2 | -- |
| Tetco ELA | 5.65 | 0.15 | 6.05 | 5.30 | 12,186 | 2 | 5.40 |
| Tetco WLA | 6.06 | 0.22 | 6.45 | 5.90 | 39,871 | 5 | 6.68 |
| TGT Zone SL | -- | -- | -- | -- | -- | -- | -- |
| Transco Station 45 | 6.20 | 0.32 | 6.60 | 5.76 | 16,306 | 3 | 6.93 |
| Transco Station 65 | 6.20 | 0.27 | 6.69 | 5.78 | 162,730 | 18 | 6.80 |
| Trunkline ELA | -- | -- | -- | -- | -- | -- | -- |
| Trunkline WLA | -- | -- | -- | -- | -- | -- | -- |
| Trunkline Zone 1A | 5.37 | -0.55 | 5.72 | 5.27 | 17,571 | 3 | 5.26 |
| Regional Average | 6.09 | 0.09 | | | | | 6.56 |
| TEXAS (SOUTH/EAST) | | | | | | | |
| Carthage Hub | 5.14 | -0.56 | 5.65 | 4.95 | 24,686 | 4 | -- |
| Houston Ship Channel | 5.40 | -0.13 | 5.66 | 5.18 | 12,643 | 1 | 5.27 |
| Katy Hub | 5.38 | -0.04 | 5.70 | 5.05 | 70,871 | 8 | 5.33 |
| NGPL-South Texas | 5.38 | 0.06 | 5.70 | 5.10 | 72,386 | 8 | -- |
| NGPL-TexOk | 5.39 | 0.00 | 5.90 | 5.00 | 287,714 | 38 | 5.24 |
| Tenn Zone 0 | 5.11 | -0.03 | 5.60 | 4.85 | 85,514 | 15 | 5.08 |
| Tetco-East Texas | 5.65 | 0.21 | 5.65 | 5.65 | 257 | 1 | -- |
| Tetco-South Texas | 5.84 | 0.08 | 6.27 | 5.45 | 8,100 | 2 | 5.85 |
| TGT Zone 1 | 5.40 | 0.06 | 5.80 | 4.90 | 104,644 | 16 | 5.15 |
| Transco Station 30 | 5.18 | -0.59 | 5.61 | 5.00 | 23,371 | 5 | 5.55 |
| Tres Palacios Hub | 5.46 | -0.18 | 6.01 | 5.02 | 25,686 | 5 | -- |
| Regional Average | 5.35 | -0.04 | | | | | 5.26 |
| TEXAS (WEST) | | | | | | | |
| El Paso Permian | 3.75 | 0.30 | 4.60 | 3.40 | 76,071 | 14 | 4.22 |
| NNG Custer | -- | -- | -- | -- | -- | -- | -- |
| Transwex E of Thoreau | 3.73 | 0.58 | 4.05 | 3.37 | 24,800 | 5 | 3.45 |
| Waha Hub | 3.72 | 0.23 | 4.40 | 3.40 | 78,700 | 16 | 3.48 |
| Regional Average | 3.74 | 0.29 | | | | | 3.82 |
| MIDCONTINENT | | | | | | | |
| ANR SW | 5.32 | -0.11 | 5.75 | 5.10 | 9,929 | 2 | -- |
| CenterPoint East | 5.30 | 0.15 | 5.55 | 4.80 | 39,457 | 4 | 4.91 |
| CenterPoint West | -- | -- | -- | -- | -- | -- | -- |
| NGPL-MC | 5.27 | -0.05 | 5.62 | 5.07 | 89,221 | 15 | 5.03 |
| Oneok | 5.13 | -0.47 | 5.35 | 4.90 | 8,457 | 1 | -- |
| Panhandle | 5.28 | -0.06 | 5.55 | 5.05 | 87,400 | 15 | 5.00 |
| Southern Star | 5.31 | -0.10 | 5.59 | 5.15 | 9,014 | 1 | 5.35 |
| Regional Average | 5.28 | -0.08 | | | | | 4.99 |
| GREAT PLAINS | | | | | | | |
| Emerson | 5.17 | 0.32 | 5.63 | 4.90 | 28,529 | 12 | 5.22 |
| NB Ventura TP | 5.45 | 0.04 | 5.85 | 5.27 | 22,200 | 3 | -- |
| NGPL Amarillo | 5.36 | -0.44 | 5.68 | 5.25 | 13,686 | 1 | -- |
| NNG Demarc | 5.40 | -0.42 | 5.75 | 5.25 | 27,557 | 4 | -- |
| NNG Ventura | 5.42 | -0.19 | 5.85 | 5.20 | 146,114 | 16 | 5.47 |
| Regional Average | 5.39 | -0.10 | | | | | 5.25 |
| UPPER MIDWEST | | | | | | | |
| Alliance | 5.51 | 0.04 | 5.85 | 5.30 | 190,614 | 24 | -- |
| ANR ML7 | -- | -- | -- | -- | -- | -- | -- |
| Chicago Citygate | 5.56 | -0.18 | 5.90 | 5.30 | 101,024 | 15 | 5.79 |
| Consumers | 5.50 | -0.05 | 5.82 | 5.36 | 96,186 | 16 | 5.54 |
| MichCon | 5.46 | -0.01 | 5.75 | 5.30 | 69,657 | 8 | 5.49 |
| REX Zone 3 Delivered | 5.41 | -0.02 | 5.75 | 5.25 | 287,310 | 38 | 5.39 |
| Regional Average | 5.47 | -0.02 | | | | | 5.43 |

| Price Point | \$/MMBtu | Chg. | High | Low | Avg. Daily Vol. | Avg. Daily Deals | Oct Bid Week |
|---|----------|-------|------|-------|-----------------|------------------|--------------|
| SOUTHEAST | | | | | | | |
| Tetco M1 | -- | -- | -- | -- | -- | -- | -- |
| Transco Zone 4 | 6.25 | 0.16 | 6.75 | 5.77 | 401,200 | 55 | 6.96 |
| Transco Zone 5 | 6.41 | 0.35 | 6.95 | 5.80 | 53,814 | 10 | 7.17 |
| Regional Average | 6.27 | 0.19 | | | | | 7.01 |
| APPALACHIA | | | | | | | |
| Col. Gas App. Pool | 5.20 | -0.14 | 5.36 | 4.97 | 33,775 | 9 | 4.88 |
| Eastern Gas North | 5.25 | 0.14 | 5.25 | 5.23 | 4,477 | 1 | 4.64 |
| Eastern Gas South | 5.04 | -0.21 | 5.45 | 4.81 | 97,743 | 15 | 4.54 |
| Lebanon Hub | 5.44 | -0.72 | 5.77 | 5.25 | 4,571 | 1 | -- |
| Millennium, East Receipts | 5.10 | -0.54 | 5.38 | 4.75 | 33,137 | 4 | 4.45 |
| TENN Z4 200-leg | 5.19 | -0.20 | 5.48 | 4.95 | 68,913 | 11 | 4.83 |
| TENN Z4 300 leg, receipts | 5.07 | 0.06 | 5.25 | 4.90 | 8,157 | 1 | 4.36 |
| TENN Z4 313 pool | 5.25 | 0.02 | 5.48 | 4.90 | 19,724 | 6 | 4.89 |
| Tetco M2 | 5.01 | -0.21 | 5.27 | 4.86 | 70,571 | 8 | 4.38 |
| Transco Leidy Line | 5.12 | -0.42 | 5.36 | 4.92 | 31,759 | 6 | 4.50 |
| Regional Average | 5.11 | -0.21 | | | | | 4.58 |
| EASTERN CANADA | | | | | | | |
| Dawn | 5.50 | -0.03 | 6.12 | 5.30 | 161,571 | 32 | 5.49 |
| Iroquois | 5.69 | 0.02 | 6.53 | 5.40 | 8,057 | 2 | 5.44 |
| Niagara | -- | -- | -- | -- | -- | -- | 4.92 |
| Regional Average | 5.51 | -0.03 | | | | | 5.49 |
| NORTHEAST / MIDATLANTIC | | | | | | | |
| Algonquin | 5.68 | 0.03 | 6.25 | 5.24 | 35,532 | 9 | 5.63 |
| Dracut | -- | -- | -- | -- | -- | -- | -- |
| Iroquois Zone 2 | 5.61 | -0.24 | 6.00 | 5.40 | 68,954 | 11 | 5.48 |
| Tenn Gas Zone 6 | 5.67 | -0.08 | 6.25 | 5.30 | 69,351 | 9 | 5.37 |
| Tetco M3 | 5.15 | -0.21 | 5.35 | 5.00 | 49,471 | 8 | 4.60 |
| Transco Z6 - Non-NY | 5.12 | -0.30 | 5.36 | 4.96 | 41,629 | 8 | 4.51 |
| Transco Z6 - NY | 5.28 | -0.14 | 5.45 | 5.05 | 17,895 | 3 | 4.62 |
| Regional Average | 5.46 | -0.17 | | | | | 4.65 |
| ROCKIES | | | | | | | |
| Cheyenne Hub | 5.28 | -0.07 | 5.67 | 5.13 | 94,371 | 15 | 5.33 |
| CIG | 5.38 | 0.06 | 5.62 | 5.17 | 14,257 | 2 | 5.35 |
| Kern River / Opal | 5.35 | -0.09 | 5.70 | 5.15 | 120,114 | 21 | 5.56 |
| NW Rockies | 5.32 | 0.04 | 5.70 | 5.05 | 77,157 | 16 | 5.50 |
| Questar | -- | -- | -- | -- | -- | -- | 5.40 |
| White River Hub | 5.23 | -0.19 | 5.64 | 5.10 | 69,757 | 12 | 5.34 |
| Regional Average | 5.30 | -0.07 | | | | | 5.48 |
| SAN JUAN BASIN | | | | | | | |
| El Paso Bondad | 5.30 | -0.01 | 5.65 | 5.00 | 53,829 | 10 | -- |
| El Paso San Juan | 5.21 | 0.00 | 5.75 | 4.93 | 99,786 | 15 | 5.33 |
| Transwestern, San Juan | 5.48 | -0.12 | 6.00 | 5.00 | 62,786 | 8 | 5.61 |
| Regional Average | 5.31 | -0.04 | | | | | 5.40 |
| PACIFIC NORTHWEST/WESTERN CANADA | | | | | | | |
| AECO | 2.09 | -1.30 | 3.09 | 0.36 | 291,738 | 53 | 3.23 |
| Kingsgate | 3.99 | -0.09 | 4.85 | 2.79 | 7,471 | 2 | -- |
| Malin | 4.99 | -0.40 | 5.61 | 4.75 | 18,714 | 5 | 5.80 |
| NW Sumas | 5.25 | -0.30 | 5.71 | 4.80 | 51,171 | 10 | 5.55 |
| Stanfield | 4.95 | -0.30 | 5.63 | 4.55 | 63,871 | 11 | -- |
| Westcoast Station 2 | -1.15 | -2.27 | 0.72 | -2.71 | 41,433 | 11 | 2.17 |
| Regional Average | 2.68 | -1.01 | | | | | 4.52 |
| CALIFORNIA | | | | | | | |
| El Paso - South Mainline | 6.31 | -0.29 | 7.80 | 5.25 | 64,243 | 12 | -- |
| Kern - Wheeler Ridge | -- | -- | -- | -- | -- | -- | -- |
| Kern River Delivered | 5.90 | -0.29 | 6.25 | 5.48 | 62,914 | 13 | -- |
| PG&E Citygate | 7.97 | 0.34 | 8.35 | 7.70 | 57,071 | 10 | 7.54 |
| PG&E South | 5.69 | -0.42 | 6.10 | 5.35 | 15,429 | 5 | -- |
| SoCal Border | 5.99 | -0.04 | 7.65 | 5.25 | 131,307 | 26 | 6.55 |
| SoCal Citygate | 7.64 | 0.77 | 8.40 | 5.82 | 55,586 | 11 | 6.79 |
| Regional Average | 6.55 | 0.02 | | | | | 6.96 |
| WEEKLY COMPOSITE SPOT PRICES | | | | | | | |
| Delivered | 5.88 | 0.00 | | | | | |
| Wellhead | 4.48 | -0.43 | | | | | |

MARKET VIEW

Are US Henry Hub Futures Unmoored From Bearish Fundamentals

Caught between the looming risk of a cold winter and a near-term loosening of supply/demand fundamentals, November gas futures ended a volatile but rangebound week by falling 28.8¢ to \$6.453 per million Btu, down 29.5¢ from a week ago. But judging from market action this week, it could as well have finished higher.

Trading could be as corralled in the week to come as upside risk could continue to counterbalance bearish fundamentals.

On Monday, the November contract fell 31.3¢ to \$6.435/MMBtu before offsetting sessions on Tuesday and Wednesday left the price unchanged by Wednesday's close. On Thursday, a 125 billion cubic foot storage build shaved the five-year deficit to 221 Bcf, ensuring domestic gas stocks will enter the winter close to 3.5 trillion cubic feet, if not higher. The November contract promptly rallied 30.6¢ to close at \$6.741/MMBtu.

However, while Thursday's rally would appear counterintuitive, it indicates that the market's focus is more on future upside risk than near-term fundamentals, no matter how bearish they may be.

For example, bulls would argue that even with continuing robust storage builds, working gas inventories are expected to enter the winter heating season at the second lowest level in the last decade at a time of diminishing fuel switching capability in the power sector.

"We expect natural gas generation to remain near record levels this winter despite the higher natural gas prices, because coal-fired power plants, which have traditionally acted as alternatives to natural gas, are facing fuel supply constraints," The US Energy Information Administration (EIA) said in its Winter Fuels Outlook.

Analysts with consultancy East Daley Capital said that back-to-back triple-digit weekly storage injections have bolstered their view that the market will be structurally long supply by the first quarter of 2023 if current mild forecasts pan out and domestic production remains above 99 Bcf/d.

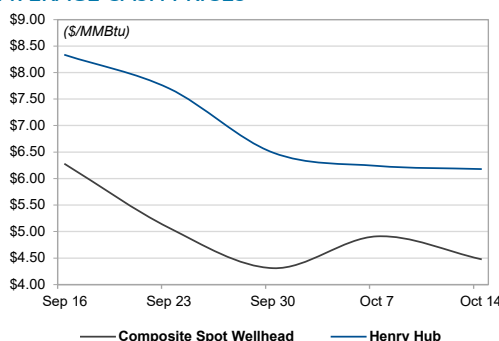
The consultancy sees storage filling to 3,447 Bcf by end-October, exiting the refill season just 189 Bcf short of the five-year average. "Much depends on when winter weather arrives, but our model shows storage continues to build into early November and returns to seasonal averages

by mid-December," the East Daley analysts said. By spring they see inventories in surplus.

It's possible that Thursday's price action was anticipating what winter might bring, or it was a response to an early-season cold spell set to blanket the east coast next week, Gelber & Associates (G&A) analysts observed. But this weather pattern will be short-lived, and dry gas production is wavering between 99 Bcf/d and 101 Bcf/d. The EIA estimates production this week at 99.9 Bcf/d

"Once the bout of chilly weather passes next week, temperatures across the bulk of the nation will revert to extensively mild, low-demand conditions. In addition, wind generation is expected to see bolstered numbers," they said, adding that before injections trickle to a close in mid-November inventories could reach between 3.5 trillion and 3.6 trillion cubic feet. Storage now stands at 3,231 Bcf.

AVERAGE CASH PRICES



But the impact that might have on prices is hard to say. "Other than the looming winter, there are few bullish drivers in the US gas market to support such lofty prices," G&A said.

Nonetheless, one could argue that the market has already sold off, having dropped nearly \$2.65 since mid-September. The prompt month also remains in a \$6.40-\$6.90/MMBtu trading range in large part because storage optics are trending bearish.

Post-Winter Storage Recovery?

Longer term, a reversal in fundamentals could undermine price supports. "The 12-month rolling average of natural gas demand has exceeded supply since February 2021," the EIA said in its latest *Short-Term Energy Outlook*. That trend is one of the pillars underpinning the increase in prices seen this year, according to the agency. "We expect the Henry Hub spot price to remain elevated until the second quarter of 2023 when we forecast the 12-month rolling average of supply to rise closer to average demand and inventories to rise above the five-year average."

As dry gas production reaches 99.63 Bcf/d, a 2.1% year-over-year increase, the EIA expects Henry Hub spot prices will average \$5.77/MMBtu in 2023, down 3.9% from the prior outlook, for a 16.1% year over year decline.

Everett Wheeler, Washington

Gas Burns >> continued from page 1

\$1.77/MMBtu. Even as gas prices hit 14-year highs in August, gas-fired generation climbed 2.5% year over year to 173.9 million megawatt hours, it's third-highest level on record.

Diminished fuel-switching capability from the ongoing shift in the capacity mix — EVA estimates US fuel-switching capability has diminished from about 6 billion cubic feet per day five years ago to between 2.5 Bcf/d and 3 Bcf/d now — and a tighter-than-usual coal market were the main factors driving the trend, and it is difficult to pinpoint how those factors will influence the market this winter.

"Switching between coal and gas is an evolving dynamic because the stack of today has less coal and more renewables," Atwood said. "This winter, both natural gas and coal prices have been affected by the ongoing war in Ukraine, making the amount of switching exceptionally difficult to predict."

According to EVA, power-sector gas demand is most sensitive to coal and gas price swings in the South Central and Eastern US.

"Higher prices for replacement coal due to spikes in international coal markets will keep the competition between coal and gas tight for the winter, especially in the eastern part of the country," EVA said. "Coal stockpile levels have not recovered despite the strong utilization of gas-fired generation displacing coal-fired generation."

With coal prices for eastern markets nearly five times higher year over year, "coal plant dispatch is likely to be limited throughout 2023," EVA concluded.

Because of coal supply constraints, the EIA predicted in its Winter Fuels Outlook that gas-fired generators will run "near record levels this winter despite ... higher natural gas prices." Although the agency expects domestic gas supplies

to be "adequate" to meet winter demand, it warned that severe winter temperatures could bring localized wholesale price spikes that could "ripple" through the energy distribution system.

"Higher wholesale prices or curtailments to electric power generators can cause electric generators to turn to other fuels during cold periods, which we have seen most typically in New England," the EIA said.

Everett Wheeler, Washington

ENERGY TRANSITION

Offshore Wind to Challenge New England Gas Dominance

Within five years, New England natural gas-fired generation could be significantly undermined by offshore wind power much as onshore wind has challenged gas-fired generation in Texas.

But while onshore wind capacity in Texas has soared to around 38 gigawatts, the most of any state in the US — factors will initially limit offshore wind inroads in New England to around 5.8 GW — or about 1 billion cubic feet per day in gas burns.

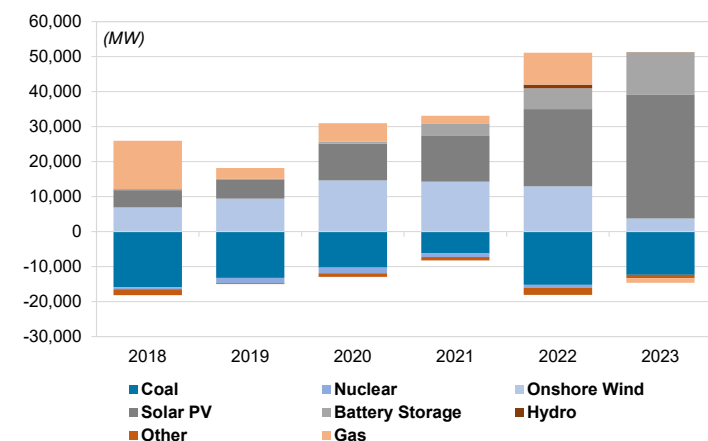
Why? The power transmission system as it exists on New England's coast will accommodate that initial 5.8 GW slug of wind by 2028. But legislative goals in Massachusetts and Connecticut to bring an additional 10 GW more into the region will require significant upgrades to the power grid, possibly including high voltage transmission to carry power from the coast.

And that will require planning and cooperation among a variety of stakeholders, Julie Cohn, a nonresident scholar at Rice University's Baker Institute, told Energy Intelligence.

When Texas was faced with a similar dilemma of needing to build a high voltage transmission system that would carry wind power hundreds of miles from rural West Texas and the Panhandle to urban markets in central and east Texas, the Legislature adopted the \$7 billion Texas Competitive Renewable Energy Zone (CREZ) initiative in 2005.

The seven CREZ transmission systems were competed in 2014, which she said "illustrates both the array of difficulties that new power lines face and the policy choices that can facilitate development of this necessary infrastructure."

NET CHANGE IN US GENERATING CAPACITY



Source: Energy Ventures Analysis, Energy Information Administration

But as a result, wind capacity has soared to 29% of generation capacity in the Electric Reliability Council of Texas, the grid operator for 90% of the state. Gas still has a 44% share, though new generation added to the grid is mostly renewables. Renewables, mainly wind, can displace up to 6.5 Bcf/d of gas demand if run at full capacity. The lesson here is Texas would not be the wind giant it has become if not for heavy investment in transmission.

However, New England does have advantages, Cohn said. "One thing that would be easier about linking offshore wind to an on-land grid is that there won't be very many property owners between the wind turbines and the first point of contact onshore, which is a challenge for most transmission development projects across the country," she said. BTU Analytics analyst Trevor Fugita would agree.

"Compared to the development of wind energy in Texas, the Northeast should have an easier time connecting offshore wind to the grid thanks to the ability to re-use existing infrastructure," he told Energy Intelligence.

The New England Independent System Operator (ISO-NE) is in the process of identifying what critical upgrades need to be made to connect the first group of projects to the grid. The offshore projects bear the cost so they "submit multiple interconnection requests for one project, so that they can find the cheapest option ..., which will typically be sites where less upgrades will be needed," Fugita explained.

"One example of this is Mayflower Wind, which is interconnecting at Brayton Point in Massachusetts, where a 1.5 GW coal plant retired in 2017, allowing for the substation and all existing transmission to be used for offshore wind generation," he said. The hard part will come once this low hanging fruit is picked and new transmission has to be sited in a densely populated region.

"In a situation like New England where there are so many states involved in any part of the interconnected transmission network, it will be more difficult, I suspect, to establish something like CREZ because you would have to gain the concurrence of every legislature that's involved on top of whatever the technical challenges are," Cohn observed. Also challenging will be allocating costs for building and upgrading NE-ISO transmission systems, which could fall to both ratepayers and investors.

"So, if that were to be the way the New England states chose to develop the transmission network, I think it would be harder to pull off than it was in Texas 20 years ago," Cohn said. Nonetheless, Fugita sees more cooperation than confrontation ahead.

"Although New England is made up of different states, the alignment of all the states' climate goals in the Northeast

should provide incentive to work together to help with upgrading the transmission system to ensure offshore wind generation makes its way onto the grid," he said. "This cooperation can be seen by the states' request for information for a multistate Modular Offshore Wind Integration Plan."

Renewable Desert

ISO-NE has lagged in adding renewable capacity, due its lack of wind and solar resources, as well as open land to site projects. This has led to a heavy reliance on natural gas, which comprises a third of ISO-NE generation capacity but provides more than half of its dispatched power.

"While the market has seen little impact from large-scale renewables generation, that dynamic will likely change as proposed offshore wind farms begin to come to market," BTU Analytics analyst Matthew Hoza said a recent blog.

The first megawatts of offshore wind power will immediately begin undermining gas dominance in the generation stack, Hoza says, because offshore wind's chief disruption will be to the ISO-NE's thermal dispatch curve, which prioritizes power based on cost. And since wind power has no fuel costs it will be dispatched first and push gas-fired plants down the line.

Hoza estimates just under 20% of total power burn in the region is at risk, rising to 30% when offshore wind surges in February.

Tom Haywood, Houston

POLICY

New Premier Backs 'Made in Alberta' Carbon Tax Policy

Alberta's new premier this week unveiled plans to develop a new carbon tax structure within the natural gas- and oil-rich Canadian province, adding stress to an already-tense relationship with Ottawa.

Danielle Smith, who was chosen by the ruling United Conservative Party (UCP) last week to the leadership post, told reporters this week she planned to confer with the province's new energy and environment ministers on a path for Alberta to map out its own carbon tax structure.

Canada's Supreme Court last year ruled in favor of Prime Minister Justin Trudeau, upholding the legality of the federal government's price on carbon. Alberta had been among the provinces to challenge the law.

“The lesson out of the carbon tax ruling is that we need to fully occupy the legislative space,” Smith said this week. “Otherwise, the federal government is going to step in and be able to make the case that we’re not answering the question.”

Smith told reporters her government will aim to have a position going into COP27 later this fall, so details have yet to be finalized; however, she said that she had asked Trudeau about Alberta’s potential participation in the Paris Agreement’s emissions trading mechanism.

“I think that’s going to be central in us exporting LNG and displacing higher polluting fuels like coal and wood,” she said. “And so if we can work with our federal counterparts to be able to get that kind of credit here, and accelerate some of the expansion of our LNG, I think that those are the kinds of global wins and local wins that we’re looking for. So we will have a full strategy that we map out ... and I would hope that we would be able to have a fully made-in-Alberta solution on addressing issues of carbon neutrality.”

Still, one longtime Western Canadian energy expert told Energy Intelligence that it’s hard to say how Smith’s energy policies will unfold until she’s formed a cabinet and chosen an energy minister who can execute her energy policy.

Until then, how her rhetoric will translate to action isn’t clear one way or another, he said.

Alberta Sovereignty

Former Alberta Premier Jason Kenney often sparred with Ottawa over the federal government’s increasing focus on decarbonization, and unsuccessfully attempted to revive the Keystone XL pipeline with provincial support. But he lost support during the Covid-19 pandemic as his government’s health policies angered the more extreme members of the UCP. He narrowly won a leadership review vote in May and promised to step down after the results were announced.

Smith, the former leader of the right-wing Wildrose Party that merged with the Progressive Conservative Association of Alberta to form the UCP in 2017, is likely to continue to be at odds with Ottawa over energy and other issues; the hallmark of Smith’s campaign was a promise to put forth the Alberta Sovereignty Act, which would allow the province to refuse enforcement of some federal laws.

Trudeau’s Liberal Party government has “effectively imposed economic sanctions against Alberta (and parts of Saskatchewan and British Columbia) that have resulted in economic chaos,” according to Smith’s website. “Hundreds of billions [of dollars] in investment and tax revenues, and hundreds of thousands of jobs, have been lost to these sanctions as investors around the world find it too risky to do business in Alberta’s energy industry.”

Alberta sovereignty was also on Smith’s mind when she was asked about what message she hopes to take to COP27.

“Natural resources, its development, its conservation policy, and its export, are the exclusive jurisdiction of the provinces under our constitution,” she told reporters. “So if there are any issues or questions about how those policies should be enacted, they need to come and talk to our level of government.”

Looming General Election

In a statement after Smith’s election, Trudeau said he looked forward to working with the new Alberta government on key issues. “We will remain focused on delivering concrete results for Albertans, including making life more affordable, growing the economy for everyone, creating jobs and fighting climate change while positioning Canada’s energy sector and its workers to succeed in new global markets,” he said.

But Smith took a more aggressive tone.

“Today marks a new beginning in the Alberta story,” she told UCP members after winning the leadership race, according to Reuters. “No longer will Alberta ask permission from Ottawa to be prosperous and free ... we will not have our resources landlocked or our energy phased out of existence by a virtue-signaling prime minister.”

Still, it’s unclear how long Smith’s tenure will last. She won 53% of the party vote and may face a bigger contest in a general election scheduled for next spring.

Caroline Evans, Houston, and Tom Haywood, Houston

ENERGY TRANSITION

Hydrogen Pipes Needed for ‘Deep Decarbonization’

Blending hydrogen with natural gas will be an important step toward decarbonization, utility executives said this week. But pure hydrogen pipelines will be needed in the future to transport the amounts needed for deeper decarbonization.

“In order to decarbonize heavy duty manufacturing, trucks, you need to move larger and larger volumes,” Neil Navin, vice president of Clean Energy Innovations for Southern California Gas (SoCalGas) said at the Reuters Hydrogen North America conference in Houston. “And there is value in moving pure hydrogen, rather than blending it. You don’t want to have to unscramble the egg every time you want to get your hydrogen. So we firmly believe that some amount of hydrogen backbone will start to emerge in the United States.”

SoCalGas, a Sempra subsidiary which claims to be the nation's largest natural gas distribution utility, has been an early mover in the still nascent effort to use hydrogen as a tool for decarbonization. The company's proposed Angeles Link project would use California's renewable resources to produce green hydrogen and deliver it to the Los Angeles Basin for use in heavy transportation, industrial processes and dispatchable electricity generation.

The proposal is still in early stages, but SoCalGas has said Angeles Link could displace up to 3 million gallons of diesel fuel per day and convert up to four natural gas-power plants to green hydrogen.

Scaling Up

Hydrogen projects like Angeles Link are huge affairs, requiring massive amounts of renewable electricity. Siemens Gamesa said recently that to make 1 million tons of hydrogen takes 10 GW of offshore wind capacity, or 15 GW of onshore wind capacity.

SoCalGas' proposal calls for 25–35 GW of renewable power, which it plans to source from curtailed or new solar and wind operations. But as electrification becomes more widespread, hydrogen is likely to face stiff competition from other sectors.

California's ban on internal combustion engines, which goes into effect in 2035, could create an opportunity for hydrogen to fuel heavy-duty vehicles, Navin said. Meanwhile, a proposal to end the sale of diesel trucks in California early next decade adds urgency to the need to bring hydrogen to market.

"We actually don't believe the electric system is capable of supporting all those vehicles," he said. "So at some point larger vehicles, heavy duty vehicles, especially trucks, we believe firmly are going to be hydrogen. They will need hydrogen that is not trucked in on other trucks. And so we believe there will be a need for pipelines." But California is a different story from the rest of the US, much of which is still building out its renewable resources, said Mark Webb, Chief Innovation Officer at Dominion Energy.

"It's very difficult to imagine that you're going to dedicate a renewable resource solely to create green hydrogen, you're

just taking it away from the grid," Webb said at the conference. "So I think we're a ways away from having excess zero carbon, whether it's from offshore wind, nuclear, solar, whichever generates zero carbon."

In the interim, blue hydrogen from natural gas could make for an affordable option, he added.

"I think we'd love to electrify as much as possible," he said. "But we're also realistic about the costs consumers can bear, and what can realistically be done in terms of building transmission and the pace that we can build it, and the availability of materials to build that."

Dominion's portfolio of natural gas and electric facilities serves 7 million customers across 15 states. It also operates the second-largest solar portfolio in the US, according to its website.

Pipeline Hurdles

Hydrogen pipelines are likely to face a slew of regulatory and legal challenges, as well as intense public hostility, that has held up natural gas pipeline development for years, especially in the US Northeast. So it's incumbent on hydrogen pipeline developers to prepare for similar battles, Webb said.

"I think you're going to end up with much more concentrated production and delivery in the hub-type concept, or localized areas where you could permit and a delivery system that is local and avoids as many permits as possible," Webb told conference attendees.

Navin noted that Angeles Link is likely to include "hundreds of miles" of pipelines; one solution could be to use existing natural gas pipeline rights-of-way to build new systems.

"A lot of those right-of-way agreements today either specify natural gas, or they specify gas without designation," he said. "And so you're going to have to work through all of the complexity to make it happen. And communities are not necessarily going to want to permit, especially in urban communities, new pipeline routes. So we firmly believe, as a society, we need to figure out how to reuse the existing infrastructure corridors today and use hydrogen in them."

Caroline Evans, Houston

IN BRIEF

Ontario Adding Gas Power

When Ontario Energy Minister Todd Smith asked its Independent Electricity System Operator to explore a moratorium on new natural gas plants to reduce emissions, the IESO concluded it would cause future blackouts and brownouts.

Instead, Ontario will need to secure up to 1,500 megawatts of new natural gas capacity between 2025 and 2027, which if run at capacity could add up to 250 million cubic feet per day of gas demand. In its interim report, the IESO added that while a moratorium on adding gas capacity wouldn't be feasible in the near term, one could be possible after 2027.

"As of yet, there is no like-for-like replacement [for gas-fired power]," the IESO said in its report.

Smith has signed off on IESO's plan citing rapid economic growth that could not only bring on "brownouts and blackouts" but keep green advances in check.

"If we don't have the electricity that we need, we're not going to see the uptake in electrification and electric vehicles, which will reduce emissions in other parts of the economy," he said.

DTM Expanding Capacity

DT Midstream (DTM) is preparing for Gulf Coast LNG demand growth with a two-year project expanding capacity on two Haynesville-Gulf Coast pipeline systems.

DTM will gradually add 0.5 Bcf/d of capacity on its Blue Union dry gas gathering system in the Haynesville, with the capacity to be fully on line by the end of the year. The 343 mile system in northwest Louisiana feeds up to

2 Bcf/d of supply into DTM's LEAP lateral and other pipelines delivering gas to the Louisiana Gulf Coast.

Southwestern Energy is the major producer on Blue Union, which also counts Rockcliff Energy, Comstock Resources and Tellurian among its shippers.

In addition, DTM has sanctioned Leap's Phase II expansion adding 1.7 Bcf/d of takeaway capacity. The Leap Gathering Lateral Pipeline is a 155 mile high-pressure pipeline that gathers gas along a spine-like system that supplies gas to interstate pipelines that access petrochemical and refining facilities, power plants and LNG export facilities. It terminates at an interconnection with the Transco Mainline in southwest Louisiana.

Permian States Sign MOU

New Mexico's Oil Conservation Division (OCD) and the Texas Railroad Commission signed an agreement last month to regulate interstate oil and gas facilities in tandem.

The memorandum of understanding (MOU) requires the two regulators to get adequate reporting and compliance from oil and gas operators that cross the state's border. The move arose from a 2021 case where an operator sought to permit a cross-border well the OCD said required collaboration between the two agencies. The MOU was intended to clarify how production from such wells would be allocated, along with permitting and reporting requirements across the two jurisdictions.

Oil and gas operations in the Permian Basin — shared by southeast New Mexico and West Texas — boomed in recent years with wells sprouting up along the border between the two

states. As most wells are now drilled horizontally from origin points in either New Mexico or Texas, wells can access supply up to 10 miles across the border.

The Permian Basin daily produces more than 20.5 billion cubic feet of associated gas and more than 1 million barrels of crude.

EQT Joins LNG Coalition

Shale player EQT and midstream giant TC Energy have joined in a coalition to advance North American gas and LNG.

The coalition is called the Partnership to Address Global Emissions (PAGE) and is targeting a quadrupling of US LNG capacity by 2030.

"We have the potential for 50 billion cubic feet per day of US LNG exports," EQT CEO Toby Rice told an Axios event this week. The US currently exports around 12 Bcf/d.

However, "by the time I see the price signals, and the time I can add rigs ... it's about 18 months," he said.

In a 56-page presentation on PAGE, EQT cited international coal-fired power as "The Elephant in the Room" and noted the difficulties in relying entirely on renewables to displace coal.

Engineering company Williams is also a founding member of PAGE with Baker Hughes and the United Association of Union Plumbers and Pipefitters as supporting members.

Paul Bledsoe of the left-leaning Progressive Policy Institute is a member of the PAGE advisory council, which suggests a bipartisan bent to the organization.

NATURAL GAS WEEK DATA ROUNDUP

NATURAL GAS FUTURES - Trading Dates: Oct 10 - Oct 14

New York Mercantile Exchange (NYMEX) Henry Hub

| | Monday | | Tuesday | | Wednesday | | Thursday | | Friday | | Week's | Open |
|----------------|--------|---------|---------|---------|-----------|---------|----------|---------|--------|------|-------------|----------|
| | Oct 10 | Vol. | Oct 11 | Vol. | Oct 12 | Vol. | Oct 13 | Vol. | Oct 14 | Vol. | Low-High | Interest |
| Nov '22 | 6.435 | 114,235 | 6.596 | 106,885 | 6.435 | 112,382 | 6.741 | 131,392 | 6.453 | -- | 6.337-6.901 | 90,592 |
| Dec '22 | 6.784 | 51,331 | 6.928 | 44,662 | 6.766 | 50,199 | 7.053 | 61,875 | 6.827 | -- | 6.672-7.205 | 80,452 |
| Jan '23 | 6.974 | 49,023 | 7.114 | 45,924 | 6.953 | 50,001 | 7.242 | 55,906 | 7.043 | -- | 6.859-7.360 | 120,767 |
| Feb '23 | 6.743 | 16,413 | 6.876 | 16,773 | 6.723 | 14,512 | 7.006 | 17,227 | 6.793 | -- | 6.637-7.084 | 51,665 |
| Mar '23 | 6.081 | 24,397 | 6.239 | 22,988 | 6.110 | 23,799 | 6.350 | 26,636 | 6.144 | -- | 6.005-6.364 | 88,115 |
| Apr '23 | 5.022 | 17,881 | 5.136 | 15,085 | 5.096 | 16,422 | 5.173 | 21,928 | 5.088 | -- | 4.938-5.199 | 77,498 |
| May '23 | 4.932 | 15,187 | 5.040 | 13,884 | 5.004 | 13,626 | 5.072 | 15,160 | 4.999 | -- | 4.839-5.087 | 83,519 |
| Jun '23 | 5.005 | 4,400 | 5.109 | 5,397 | 5.076 | 3,466 | 5.142 | 5,270 | 5.070 | -- | 4.936-5.154 | 24,792 |
| Jul '23 | 5.077 | 4,509 | 5.179 | 5,557 | 5.150 | 4,640 | 5.215 | 5,695 | 5.145 | -- | 4.993-5.223 | 29,388 |
| Aug '23 | 5.083 | 1,863 | 5.184 | 2,629 | 5.158 | 2,812 | 5.221 | 3,697 | 5.155 | -- | 4.998-5.227 | 21,071 |
| Sep '23 | 5.048 | 2,581 | 5.149 | 3,771 | 5.126 | 4,353 | 5.186 | 3,305 | 5.122 | -- | 4.960-5.193 | 27,580 |
| Oct '23 | 5.120 | 10,412 | 5.221 | 10,987 | 5.201 | 15,544 | 5.255 | 13,463 | 5.196 | -- | 5.034-5.261 | 53,744 |
| Nov '23 | 5.476 | 4,299 | 5.581 | 4,361 | 5.566 | 7,204 | 5.598 | 4,102 | 5.570 | -- | 5.386-5.646 | 22,448 |
| 12 Month Strip | 5.692 | | 5.814 | | 5.733 | | 5.888 | | 5.753 | | | |
| 2022 Strip | 6.754 | | 6.779 | | 6.752 | | 6.802 | | 6.759 | | | |
| Total Volume | | 321,771 | | 303,896 | | 325,527 | | 369,756 | | -- | | |

GAS PRICE REPORT

| (\$/MMBtu) The Week of | 10/10/2022 | APPA- LACHIA | CALIFORNIA | | LOUISIANA | | | MID- CONT | MID- WEST | NEW ENG- LAND | NEW MEXICO | ROCKIES | SOUTH- EAST | TEXAS | | |
|---------------------------|------------|-----------------|------------|-------|------------------------|-----------------------|-------|--------------|--------------|---------------------|---------------|---------|----------------|--------------------|------------------------|------|
| | | | North | South | Gulf Coast Offshore | Gulf Coast Onshore | North | | | | | | | Central Onshore | Gulf Coast Offshore | West |
| Delivered to Pipeline | This Week | 5.13 | 5.31 | 5.99 | 5.57 | 6.13 | 5.40 | 5.34 | 5.51 | 5.18 | 5.21 | 5.31 | 6.28 | 5.37 | 5.37 | 3.74 |
| | Bid Week | 4.62 | 5.80 | 6.55 | 5.43 | 6.49 | 5.15 | 5.06 | 5.79 | 4.57 | 5.33 | 5.49 | 7.16 | 5.59 | 5.79 | 3.82 |
| Delivered to Utility | This Week | 5.21 | 7.97 | 7.64 | -- | 6.24 | 5.54 | 5.59 | 5.56 | 5.62 | 5.36 | 5.64 | 6.67 | 5.52 | -- | 3.82 |
| | Bid Week | 4.71 | 7.54 | 6.79 | -- | 6.64 | 5.29 | 5.17 | 5.79 | 5.08 | 5.48 | 5.82 | 7.51 | 5.74 | -- | 3.90 |
| Interstate Wellhead | This Week | 5.02 | -- | -- | 5.50 | 6.06 | 5.33 | 5.24 | -- | -- | 5.04 | 5.19 | 6.13 | 5.29 | 5.30 | 3.67 |
| | Bid Week | 4.51 | -- | -- | 5.36 | 6.42 | 5.08 | 4.96 | -- | -- | 5.16 | 5.37 | 7.01 | 5.51 | 5.72 | 3.75 |
| Intrastate Wellhead | This Week | -- | -- | 5.97 | 5.50 | 6.06 | 5.32 | 5.22 | -- | -- | -- | 5.16 | -- | 5.31 | 5.31 | 3.67 |
| | Bid Week | -- | -- | 6.53 | 5.36 | 6.42 | 5.07 | 4.94 | -- | -- | -- | 5.34 | -- | 5.53 | 5.73 | 3.75 |

INTRASTATE WEEKLY SPOT PRICES - Trade Dates 10/10-10/14

| Price Point | \$/MMBtu | Chg. | High | Low | Avg. Daily Vol. | Avg. Daily Deals | Oct Bid Week |
|-------------------|----------|-------|------|------|-----------------|------------------|--------------|
| Oklahoma Intras | 5.13 | -0.47 | 5.35 | 4.90 | 8,457 | 1 | -- |
| West Texas Intras | -- | -- | -- | -- | -- | -- | 3.65 |

PRICE OUTLOOK

| | Composite Wellhead | Delivered to Pipeline | 12-Month Strip Nymex |
|--------------|--------------------|-----------------------|----------------------|
| Oct 17, 2022 | 4.48 | 5.88 | 5.75 |
| 2022 Outlook | 5.69 | 7.18 | -- |

CANADIAN PRICE REPORT

| (\$US/MMBtu and \$Can/MMBtu) | ALBERTA | | BRITISH COLUMBIA | | MANITOBA | | ONTARIO | |
|------------------------------|----------|----------------|------------------|------------------|-----------------|----------------|----------|---------|
| | AECO Hub | Empress Border | Total Province | Kingsgate Border | NW Sumas Border | Emerson Border | Dawn Hub | Niagara |
| October 14, 2022 | | | | | | | | |
| Delivered to Pipeline (US\$) | 2.09 | 4.24 | 5.09 | 3.99 | 5.25 | 5.17 | 5.50 | -- |
| Delivered to Pipeline (C\$) | 2.88 | 5.85 | 7.04 | 5.50 | 7.26 | 7.14 | 7.60 | -- |
| Wellhead (US\$) | -- | -- | 4.95 | -- | -- | -- | -- | -- |
| Wellhead (C\$) | -- | -- | 6.85 | -- | -- | -- | -- | -- |
| Sep 2022 Avg. | | | | | | | | |
| Delivered to Pipeline (US\$) | 3.32 | 4.59 | 6.18 | 3.61 | 7.24 | 5.68 | 6.84 | -- |
| Delivered to Pipeline (C\$) | 4.42 | 6.11 | 8.21 | 4.86 | 9.60 | 7.53 | 9.10 | -- |
| Wellhead (US\$) | -- | -- | 6.04 | -- | -- | -- | -- | -- |
| Wellhead (C\$) | -- | -- | 8.02 | -- | -- | -- | -- | -- |
| 2021 Avg. | | | | | | | | |
| Delivered to Pipeline (US\$) | 2.78 | 2.95 | 3.96 | 3.12 | 4.05 | 3.50 | 3.64 | 3.40 |
| Delivered to Pipeline (C\$) | 3.48 | 3.71 | 4.98 | 3.91 | 5.09 | 4.40 | 4.56 | 4.27 |
| Wellhead (US\$) | -- | -- | 3.82 | -- | -- | -- | -- | -- |
| Wellhead (C\$) | -- | -- | 4.81 | -- | -- | -- | -- | -- |

Note: Monetary conversions are done weekly. All prices represent volume-weighted averages for the most recent Monday-Sunday trading week.

NATURAL GAS WEEK DATA ROUNDUP

NORTH AMERICAN WEEKLY GAS STORAGE

(Billion Cubic Feet)

| Region | Week Ending Oct 7 | Week Ending Sep 30 | % Full | 1 Week Chg. | Year Ago | 1 Yr Chg. | 5 Yr Avg. | 5 Yr Chg. |
|------------------------------|-------------------|--------------------|-------------|-------------|--------------|--------------|--------------|--------------|
| US | | | | | | | | |
| East | 782 | 756 | 71.2 | 26 | 831 | (49) | 856 | (74) |
| Midwest | 952 | 916 | 77.8 | 36 | 993 | (41) | 1,001 | (49) |
| Mountain | 190 | 184 | 40.3 | 6 | 209 | (19) | 211 | (21) |
| Pacific | 249 | 247 | 67.6 | 2 | 251 | (2) | 289 | (40) |
| South Central | 1,058 | 1,003 | 67.7 | 55 | 1,075 | (17) | 1,096 | (38) |
| Total Lower 48 | 3,231 | 3,106 | 68.3 | 125 | 3,357 | (126) | 3,452 | (221) |
| Canada | | | | | | | | |
| East | 266 | 262 | 94.6 | 5 | 268 | (2) | 263 | 3 |
| West | 426 | 419 | 87.2 | 7 | 456 | (29) | 422 | 5 |
| Total Canada | 693 | 681 | 89.9 | 12 | 724 | (31) | 685 | 8 |
| Lower 48 & Canada | | | | | | | | |
| Total North America | 3,924 | 3,787 | 71.4 | 137 | 4,082 | (158) | 4,137 | (213) |

Sources: US-EIA, Canada-RBN Energy. Values in Bcf unless otherwise noted.

COMPARATIVE FUEL PRICES

(Cash Market) Oct 14, 2022

| Natural Gas | \$/MMBtu | Comparative Fuel | Fuel Price | MMBtu equivalent |
|-----------------------|----------|--------------------|--------------|------------------|
| Appalachia | | | | |
| App Pool Dvld (util) | 5.09 | McCloskey CSX Coal | \$177.20/ton | 7.37 |
| East Coast | | | | |
| New York City Gate | 5.40 | Heating Oil No. 2* | 428.85¢/gal | 30.92 |
| | -- | Residual 0.30% | \$98.13/bbl | 15.61 |
| | -- | Residual 1.00% | \$86.99/bbl | 13.84 |
| Gulf Coast | | | | |
| TX Central Onshore | 5.37 | Heating Oil No. 2* | 382.57¢/gal | 27.58 |
| | -- | Residual 0.70% | \$83.13/bbl | 13.22 |
| LA Gulf Coast Onshore | 6.13 | Residual 3.00% | \$56.25/bbl | 8.95 |
| | -- | WTI Cushing | \$88.97/bbl | 15.34 |

Notes: (1) Residual=Residual Fuel Oil, priced exclusive of taxes; (2) WTI=West Texas Intermediate crude oil; (3) % = % of sulfur content. *Average sulfur content = 0.2%-0.5%. Sources: Gas: Natural Gas Week; all prices volume-weighted. Oil: The weekly average of The Oil Daily's cash price postings.

SPOT ELECTRICITY TRADING

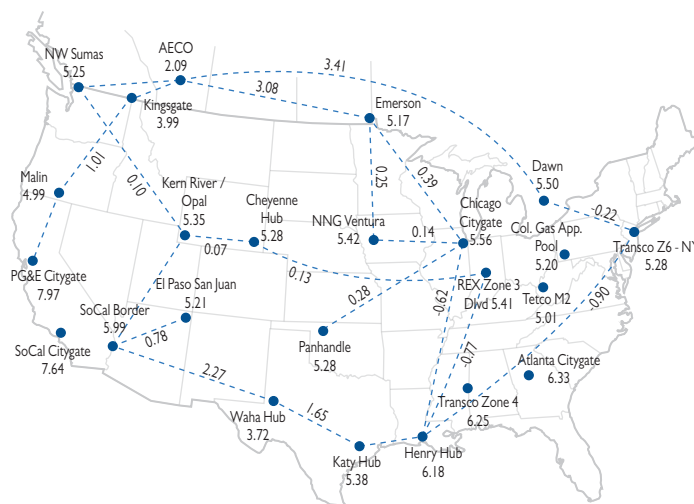
Trading Dates: 10/10-10/13, 2022

| POINT | Avg. Price This Week | Avg. Price Last Week | Change | Year Ago | Month Ago |
|--------------|----------------------|----------------------|---------|----------|-----------|
| COB | \$83.13 | \$86.35 | -\$3.22 | \$73.33 | \$107.10 |
| ERCOT | \$82.45 | \$68.45 | \$14.01 | \$72.73 | \$75.23 |
| Mid-Columbia | \$76.19 | \$77.69 | -\$1.50 | \$72.44 | \$95.30 |
| NEPOOL | \$65.25 | \$62.88 | \$2.38 | \$76.55 | \$74.18 |
| Palo Verde | \$63.94 | \$71.20 | -\$7.26 | \$43.25 | \$72.00 |
| PJM-West | \$74.00 | \$70.60 | \$3.40 | \$57.45 | \$108.28 |

Notes: (1) Prices in \$/MWh. (2) Prices are for next day peak delivery. Sources: Energy Intelligence and wire reports.

PRICES AND DIFFERENTIALS FOR MAJOR HUBS AND SELECTED CITY GATES

Oct 14, 2022 — (US\$/MMBtu, Volume-Weighted)



Selected Daily Differentials

| Differential | Oct 10 | Oct 11 | Oct 12 | Oct 13 | Oct 14 |
|--------------|--------|--------|--------|--------|--------|
| NY-HH | -0.82 | -1.18 | -1.11 | -0.86 | -0.93 |
| Chicago-HH | -0.71 | -0.95 | -0.66 | -0.67 | -0.54 |
| CHIC-AECO | 3.61 | 3.92 | 4.76 | 2.59 | 3.04 |
| PG&E-AECO | 6.23 | 6.73 | 6.96 | 4.79 | 5.23 |

BAKER HUGHES RIG COUNT

Week Ended Oct 14, 2022

| Region | Current Week | Previous Week | Year Ago |
|----------------|--------------|---------------|----------|
| Total US | 769 | 762 | 543 |
| Land | 755 | 749 | 531 |
| Inland Waters | 0 | 0 | 0 |
| Offshore | 14 | 13 | 12 |
| Gulf of Mexico | 13 | 12 | 12 |
| Total Canada | 216 | 215 | 168 |

US Rigs Exploring for

| | | | |
|-------------|-----|-----|-----|
| Oil | 610 | 602 | 445 |
| Gas | 157 | 158 | 98 |
| Unspecified | 2 | 2 | 0 |

US Gas Rig Count

