Independent Statistics & Analysis
U.S. Energy Information Administration

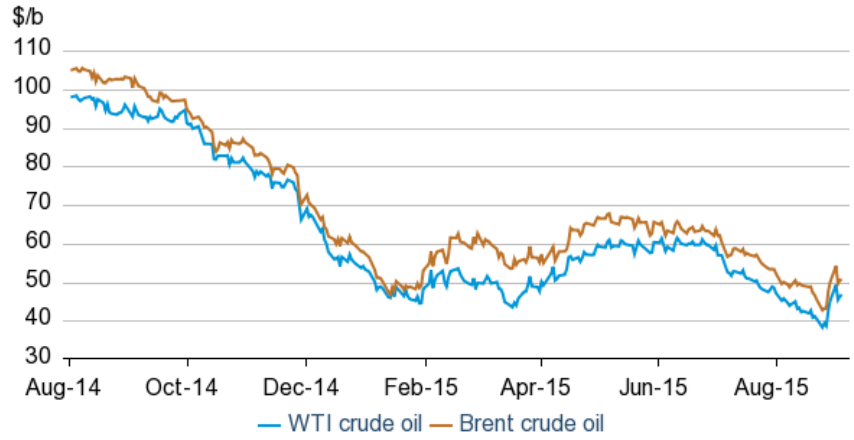
September 2015

Short-Term Energy Outlook
Market Prices and Uncertainty Report

Crude Oil

Prices: Crude oil prices declined through most of August before rising at the end of the month and in the first week of September. The North Sea Brent front month futures price rose $1.16 per barrel (b) since August 3 to settle at $50.68/b on September 3 **(Figure 1)**. The West Texas Intermediate (WTI) front month futures price increased $1.58/b over the same period to settle at $46.75/b.

Figure 1. Historical crude oil front month futures prices



In contrast to July, when crude oil prices may have responded to the potential for increased future crude oil supply from Iran, much of the decline in the first three weeks of August appears to be driven by demand-side factors. Recent actions by the People's Bank of China (PBoC) and worse-than-expected economic data from China and Japan have increased uncertainty about global economic growth, particularly in emerging markets. The sharp rise in crude oil prices at the end of August and into September was partly a result of gains in some equity markets around the world, but also demonstrates high market volatility and uncertainty.

This is a regular monthly companion to the EIA *Short-Term Energy Outlook* (http://www.eia.gov/forecasts/steo/)
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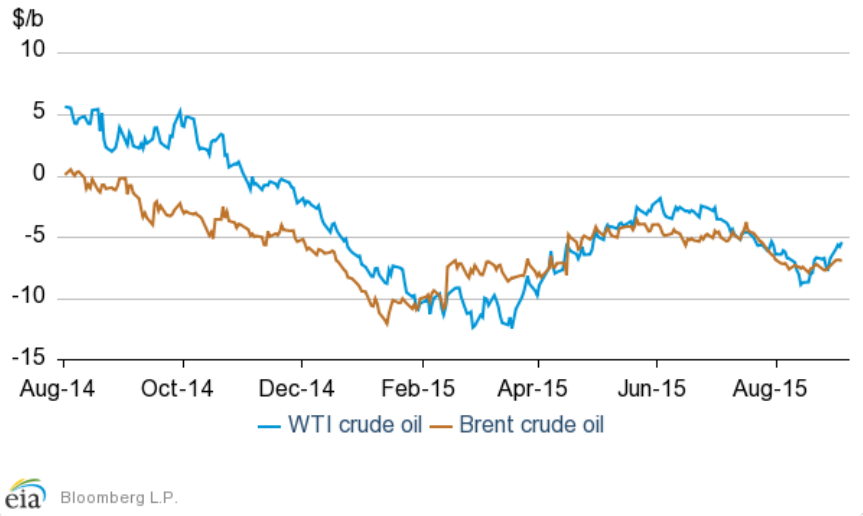
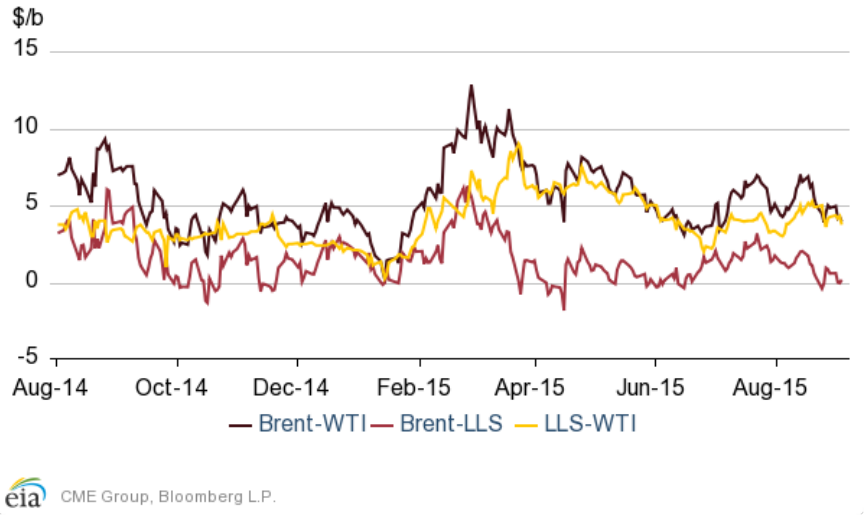
The price discount for the near-term futures contract compared with further-dated ones (contango) decreased slightly for both Brent and WTI since August 3. The 1st-13th spread for Brent and WTI settled at -$6.93/b and -$5.38/b on September 3 **(Figure 2)**. Even though crude oil prices in August declined beyond the six-year lows set in early 2015, the contango in the Brent and WTI futures curves did not increase to the levels seen in the first quarter of this year. This indicates that demand-side issues factored into the crude oil price declines in August, putting downward pressure on the entire futures curve rather than only the front month contract.

Figure 2. Crude oil front month - 13th month futures price spread



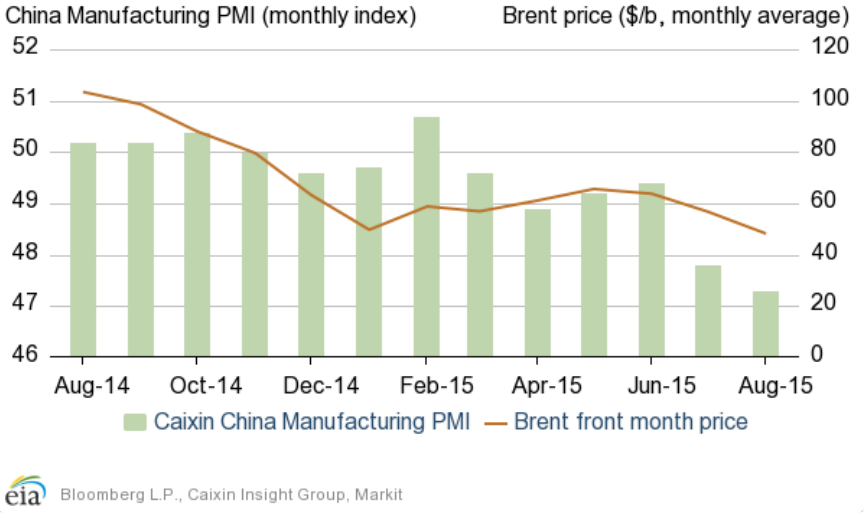
Consistently high refinery runs and crude oil stock declines in PADD 3 helped to strengthen Light Louisiana Sweet (LLS) prices against Brent and WTI prices. The Brent-LLS spread declined $1.12/b since August 3 and settled at 18 cents/b on September 3 **(Figure 3)**. The LLS-WTI spread increased 70 cents/b over the same period to settle at $3.75/b. PADD 3 gross inputs to refineries were 8.8 million barrels per day (b/d) in August, similar to runs in July. Crude oil stocks in PADD 3 declined 2.4 million barrels over that period, as have crude oil imports, which declined 0.2 million b/d. Globally, the build in crude oil stocks continues to pressure Brent crude oil prices. Parity in the Brent-LLS spread may reflect the rising storage availability on the U.S. Gulf Coast and could encourage more crude oil to be imported into PADD 3.

Figure 3. Historical crude oil differentials



China purchasing managers' index: A widely tracked indicator of economic activity in China is the manufacturing Purchasing Managers' Index (PMI), which surveys manufacturers in a country about changes in output, new orders, employment, and other manufacturing indicators. The Caixin China General Manufacturing PMI, a privately produced index that surveys a sample of about 400 small to medium sized manufacturers in China, declined to a six-year low of 47.3 in August **(Figure 4)** (where any reading lower than 50 indicates contraction in manufacturing activity). The Caixin PMI sub-indexes show that manufacturers experienced sharp declines in new orders and new export orders in August, which is an indicator of lower demand for their products in both domestic and international markets. The official China manufacturing PMI produced by the China Federation of Logistics and Purchases surveys large, state-owned enterprises and also showed a contraction in the manufacturing sector in August.

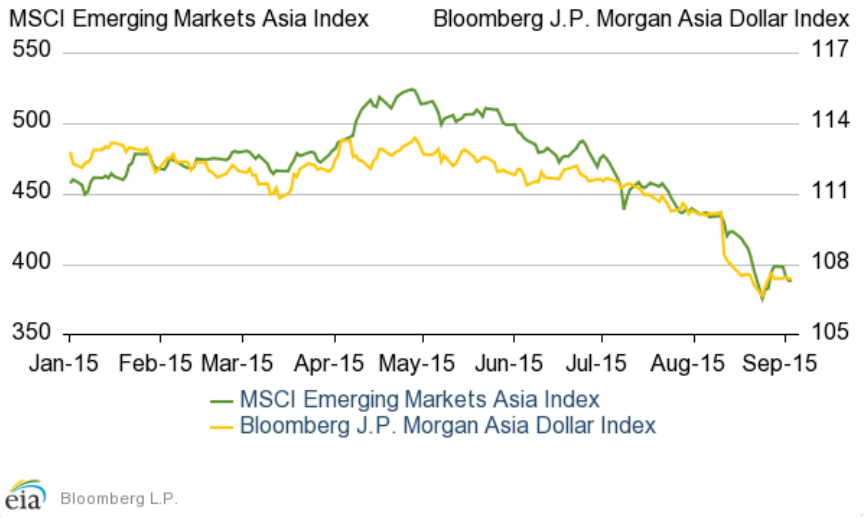
Figure 4. China monthly PMI and Brent price



Emerging markets in Asia: Crude oil prices are influenced by expectations of demand growth in emerging market economies. Recent volatility in equity and foreign exchange markets in Asia have increased uncertainty about the economic growth prospects of many developing nations in Asia, affecting the price of crude oil. In early August, the PBoC allowed for more market-based movements in the Chinese yuan. This action resulted in an immediate devaluation of the yuan and subsequently triggered the depreciation of a number of other emerging market currencies in Asia because of their significant trade exposure to China and any effects a cheaper yuan would have on the competitiveness of other Asian countries' exports. The Bloomberg J.P. Morgan Asia Dollar Index **(Figure 5)**, which tracks 10 of the most actively traded currencies in Asia, declined 2.4% from the monthly average of July to August, the largest monthly decline since 2008.

Declines in the yuan and weak manufacturing indicators contributed to decreases in Chinese stock indexes in August. Equity markets around the world, particularly those in other Asian countries, also declined, reflecting market sentiment that China's economic growth may slow and affect producers of energy and nonenergy commodities who are reliant on demand growth in China. The Morgan Stanley Capital International (MSCI) Emerging Markets Asia Index, which tracks stock indexes in Asian emerging markets, declined 8.7% from the monthly average of July to August, the largest monthly decline since 2011. Volatility in these financial markets along with market expectations for weaker growth in emerging markets could encourage further capital outflows from markets in these countries. Capital outflows could additionally lower growth prospects by affecting currency valuations, commodity prices, and domestic demand.

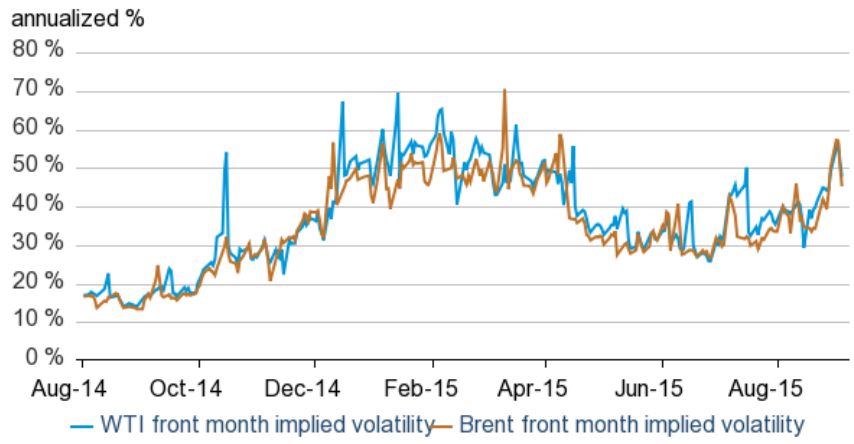
Figure 5. Asian equity and foreign exchange markets



Volatility: Crude oil implied volatility rose in August and in the beginning of September because of increased uncertainty about future emerging market demand

growth. The front month implied volatility for Brent and WTI futures contracts settled at 45.2% and 47.7%, respectively, on September 3, an increase of 5.2 percentage points and 7.7 percentage points, respectively, since August 3 **(Figure 6)**. Implied volatility for both Brent and WTI are near the highest levels of the year, matching levels from when crude oil prices were at previous lows in January.

Figure 6. Crude oil implied volatility



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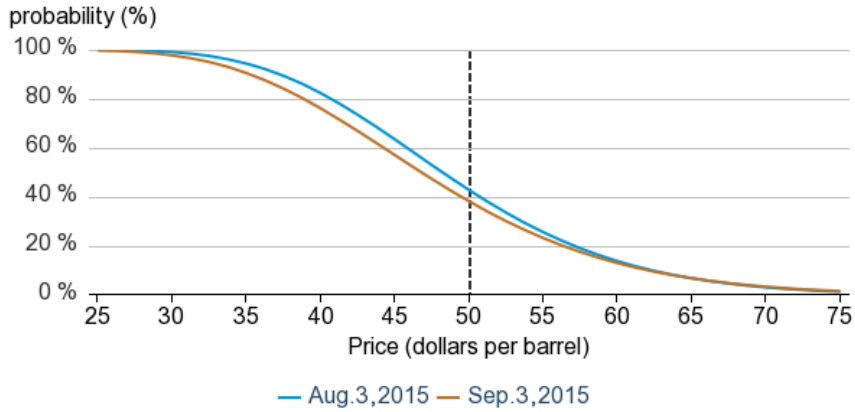
Market-Derived Probabilities: The December 2015 WTI futures contract averaged $47.95/b for the five trading days ending September 3 and has a 38% probability of exceeding $50/b at expiration. The same contract for the five trading days ending August 3 had a 43% probability of exceeding $50/b **(Figure 7)**. Because Brent prices are higher than WTI prices, the probability of Brent futures contracts expiring above the same dollar thresholds is higher.

Figure 7. Probability of the December 2015 WTI contract expiring above price levels



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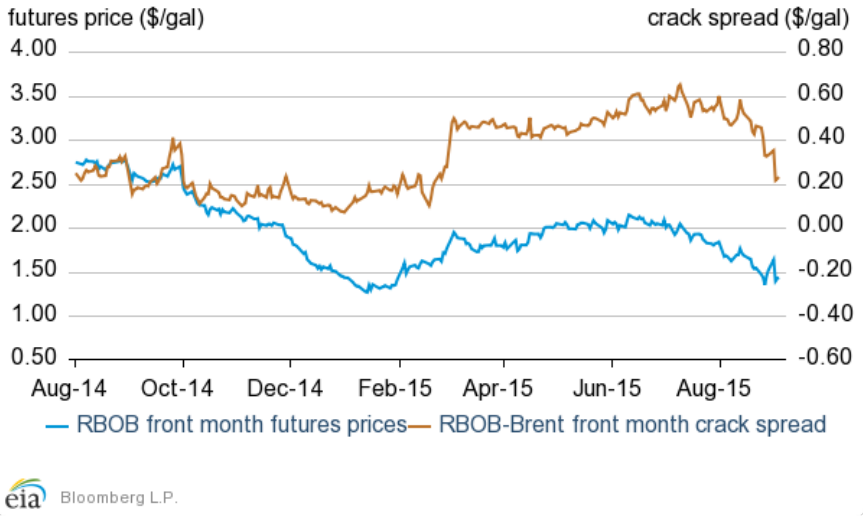
Petroleum Products

Gasoline prices: The reformulated blendstock for oxygenate blending (RBOB, the petroleum component of gasoline) front month futures price declined 24 cents per gallon (gal) from August 3 to September 3, settling at $1.44/gal **(Figure 8)**. The RBOB-Brent crack spread decreased by 27 cents/gal over the same period and settled at 23 cents/gal.

Part of the decrease in prices for the RBOB front month futures contract was caused by the roll from September to October delivery, which reflects winter grade gasoline that is cheaper for refineries to produce. However, gasoline prices were already showing weakness before the September contract expired. Although U.S. gasoline consumption plus exports for the four-weeks ending August 28 were 9.94 million b/d, relatively unchanged from the four weeks ending July 31, the end of the U.S. summer driving season as well as market concerns over global economic growth affecting future gasoline demand could be applying downward pressure on prices.

Figure 8. Historical RBOB futures prices and crack spread



An effect of slowing gasoline demand growth could be larger-than-expected builds in gasoline inventories and this may be influencing the shape of the RBOB futures curve. Over the previous month, the RBOB futures curve switched from backwardation to contango, meaning that near-term prices are now at a discount to further-dated ones. The RBOB 1st-13th futures spread settled at –5 cents/gallon on September 3, with front month prices decreasing by 11 cents/gal more than prices for one year out **(Figure 9)**. For the entire summer driving season, RBOB was in backwardation while the Brent, WTI, and ULSD futures curves were all in contango. Strong gasoline demand this summer was likely supporting near-term gasoline prices and in its absence, the RBOB futures curve shape should more closely resemble other petroleum markets.

Figure 9. RBOB front month - 13th month futures price spread

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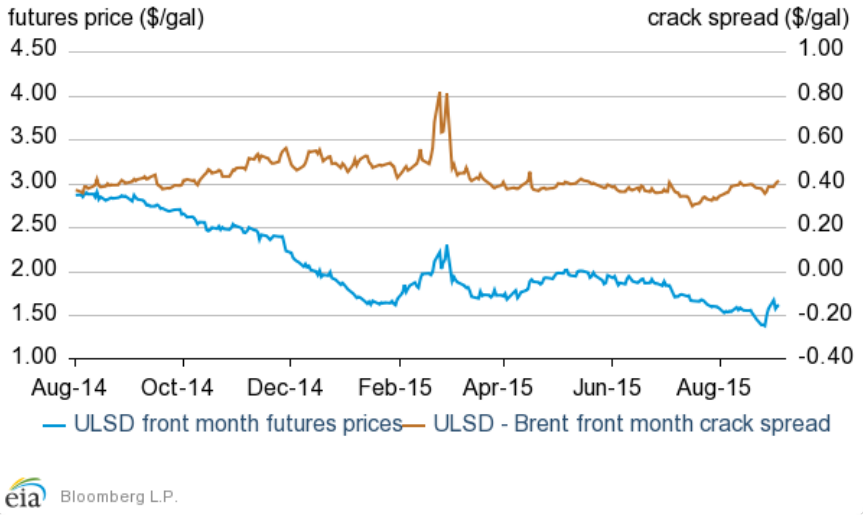
Ultra-Low Sulfur Diesel prices: The front month futures price for the New York Harbor Ultra-Low Sulfur Diesel (ULSD) contract increased 9 cents/gal from August 3 to settle at $1.62/gal on September 3 **(Figure 10)**. The ULSD-Brent crack spread increased by 6 cents/gal over the same period to settle at 41 cents/gal.

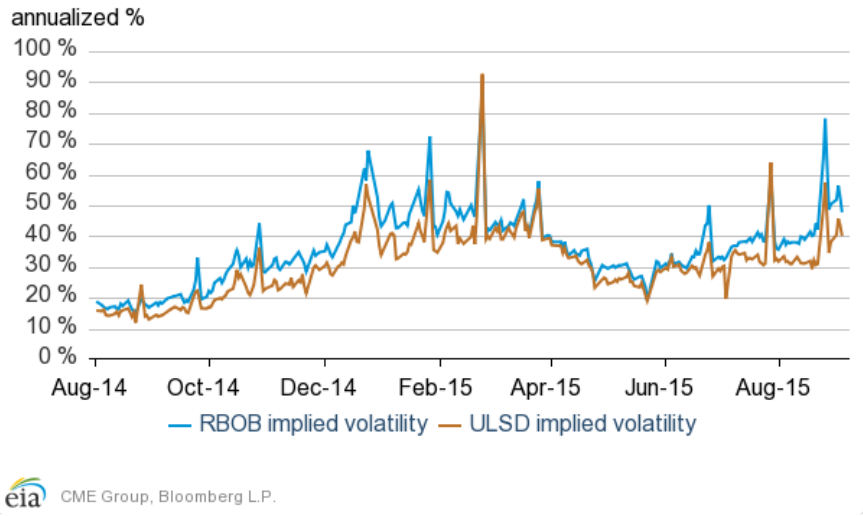
The increase in distillate crack spread is a little unusual in that it comes at a time when U.S. inventories have increased for 15 consecutive weeks, with some of the strongest builds occurring in the Mid-Atlantic region (the delivery point for the ULSD futures contract). Total U.S. distillate inventories were 150 million barrels for the week ending August 28, 22 million barrels higher than this time last year. Additionally, U.S. consumption plus exports for the four weeks ending August 28 were relatively unchanged compared to the previous month and this time last year. If the comparative looseness of the U.S. distillate market continues, high inventories and tempered demand could mean lower prices during the upcoming winter heating season.

Figure 10. Historical ULSD futures price and crack spread



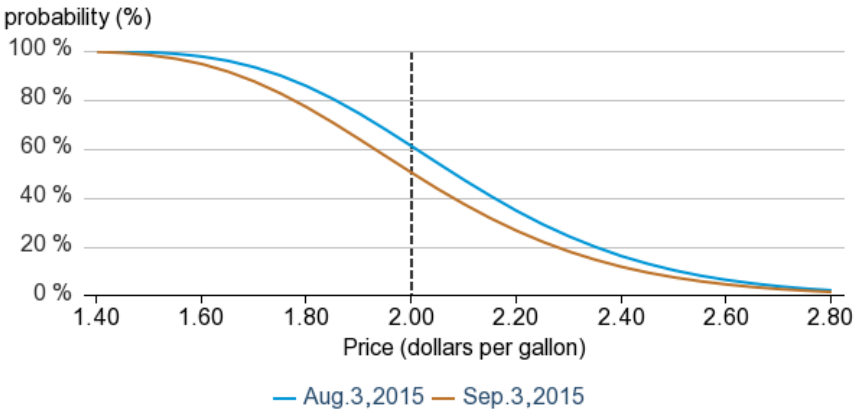
Volatility: Implied volatility for the RBOB and ULSD front month futures contracts rose 8.7 and 6.6 percentage points from August 3 to settle on September 3 at 47.8% and 40.1%, respectively **(Figure 11)**. Much like crude oil and other asset markets, petroleum product volatility is near its highest point of the year, excluding spikes that can occur near expiration.

Figure 11. RBOB and ULSD implied volatility



Market-Derived Probabilities: The December 2015 RBOB futures contract averaged $1.38/gal for the five trading days ending September 3 and has a 50% probability of exceeding $1.35/gal (typically leading to a retail price of $2.00/gal) at expiration. The same contract for the five trading days ending August 3 had a 61% probability of exceeding $1.35/gal **(Figure 12)**.

Figure 12. Probability of December 2015 retail gasoline exceeding different price levels at expiration



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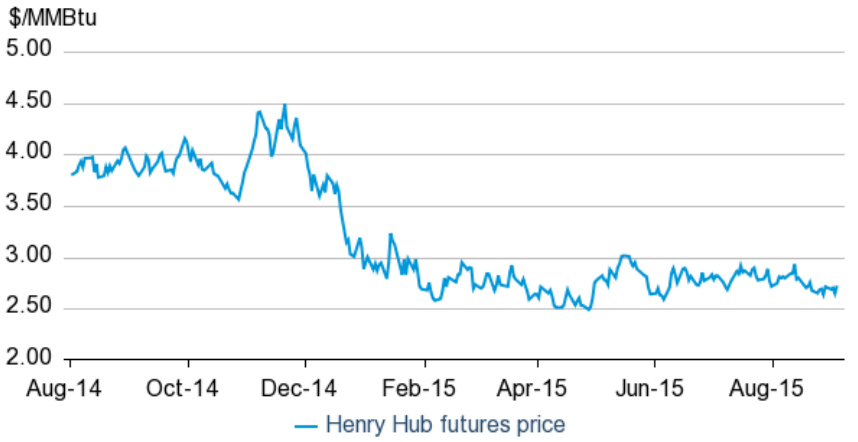
Natural Gas

Prices: Futures prices for natural gas at Henry Hub continued trading in a narrow range in August. The front month price declined 2 cents/MMBtu since August 3, settling at $2.73/MMBtu on September 3 **(Figure 13)**. Consumption from the electric power sector this summer has been at an all-time high, according to data from Bentek Energy. However, with U.S. working storage standing at a 122 billion cubic feet surplus to the five-year average as of August 28, high natural gas inventories seem to have kept prices from rising.

Figure 13. Historical front month U.S. natural gas prices



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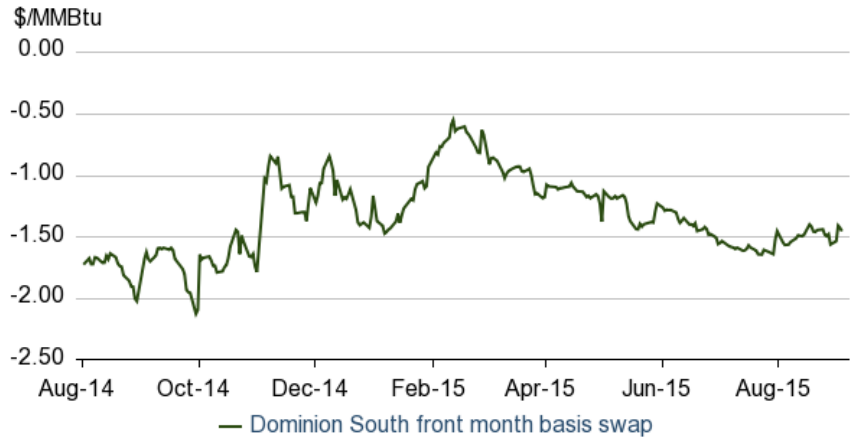
Several pricing points in the northeastern United States, where much of the growth in natural gas production has taken place from the Marcellus and Utica shales, are below

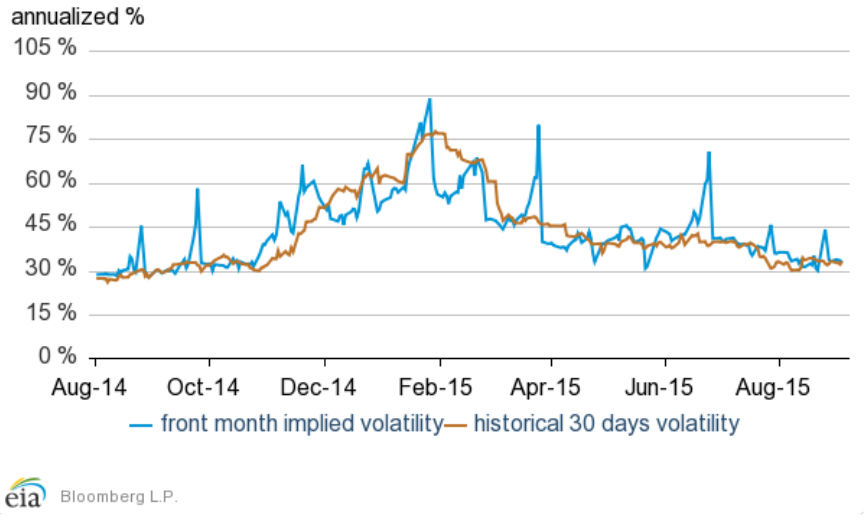
the benchmark Henry Hub price. The front month basis swap for Dominion South in southeast Pennsylvania settled at -$1.46/MMBtu on September 3 **(Figure 14)**, reflecting a lack of pipeline capacity, which forces producers to discount their gas. Compared to the same period last year, the average price for basis swaps in August increased by 26 cents/MMBtu compared to August of last year. Increased takeaway capacity in the region, such as the Texas Eastern Appalachia to Market expansion which began service in November 2014, has likely contributed to a narrowing of the basis swap. Approximately 2 billion cubic feet per day of pipeline expansions or reversals are expected to begin service by the end of the year in the Northeast, which could narrow basis swaps with Henry Hub further.

Figure 14. Dominion South front month basis swap



Volatility: Robust production and demand combined to help maintain price stability and reduce volatility, which averaged at the lowest levels for 2015 in August and is now very close to the levels of the same time in 2014. Implied and historical volatility declined 3.6 and 1.1 percentage points, respectively, since August 3, settling at 32.8% and 33.3%, respectively, on September 3 **(Figure 15)**. Natural gas prices continue to be relatively insulated from volatility in other markets such as crude oil, equities, and foreign exchange, which are all at or near the highest levels of volatility this year.

Figure 15. Natural gas historical and implied volatility



Market-Derived Probabilities: The December 2015 Henry Hub futures contract averaged $2.91/MMBtu for the five trading days ending September 3 and has a 40% probability of exceeding $3.00/MMBtu at expiration. The same contract for the five trading days ending August 3 had a 52% probability of exceeding $3.00/MMBtu **(Figure 16)**.

Figure 16. Probability of the December 2015 Henry Hub contract expiring above price levels