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Administration

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Short-Term Energy Outlook
Market Prices and Uncertainty Report[1]

April 9, 2012 Release

Crude Oil

Prices: After moving higher in the first two months of this year, crude oil prices have traded in a narrow range during the month of March. Front month futures prices for Brent and WTI settled at $123.43 and $103.31 per barrel, respectively, on April 5 **(Figure 1)**. These prices are at the lower end of the $4 and $6 per barrel trading ranges observed for these two benchmarks over the last month. The average price for Brent in March was $124.46 per barrel, the highest since July 2008.

Figure 1. Historical crude oil front month futures prices
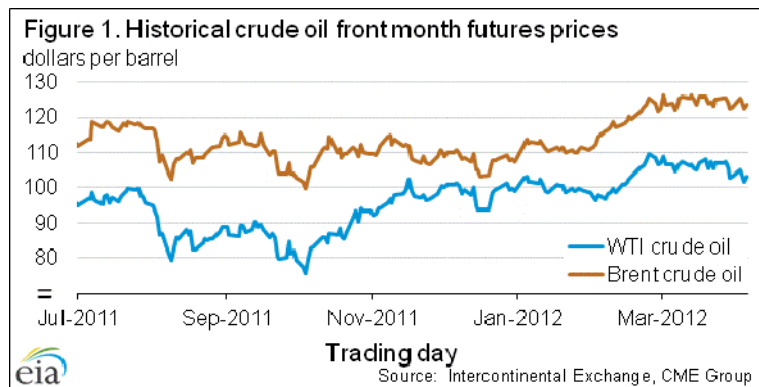
The recent price stability suggests that little has changed with regard to the market's expectations for future supply and demand of crude oil. Continued supply disruptions in South Sudan, Syria and Yemen have been offset by higher OPEC production as well as reduced crude oil consumption due to refinery maintenance. EIA estimates that global crude oil and petroleum product inventories are currently building, a bearish sign for prices, while tightness in spare production capacity provides support to current price levels.
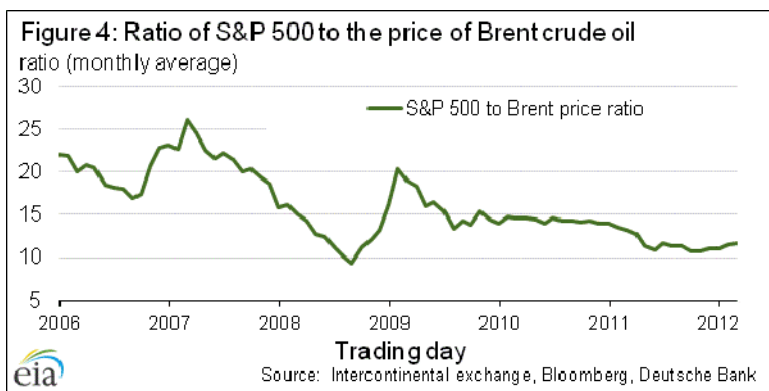

Time spreads across crude oil futures contracts are a measure of current market conditions relative to future expectations and can provide incentive to either store oil now or draw down inventories. The difference between the front month contract and the third month contract focuses more on market expectations over the next few months, as opposed to using a longer term spread such as front month and 12th month. The Brent time spread increased in February, reaching about $1.75 per barrel for the five day period ending March 1, but then decreasing by $.60 per barrel for the five day period ending April 5, reducing incentive to sell oil out of inventories now, and supporting estimates that world petroleum inventories may build more than previously anticipated during the refinery maintenance period **(Figure 2)**.

Figure 2: Crude oil front month - 3rd month futures price spread
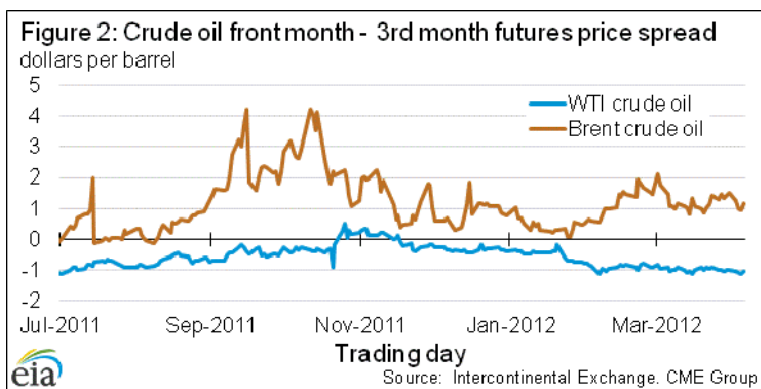
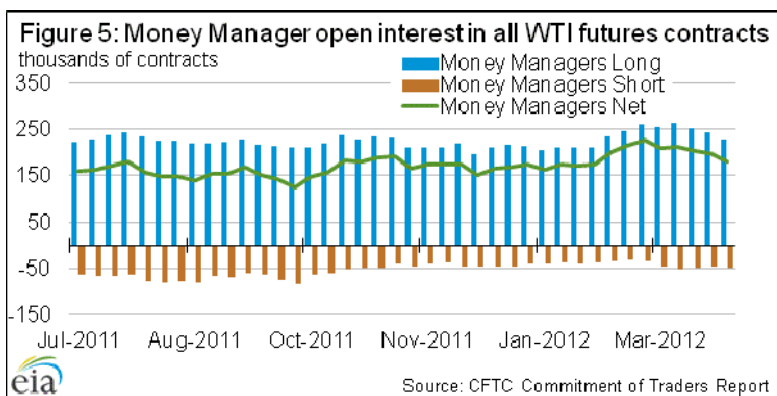The discount of WTI to Brent widened during the month of March from an average of $13 per barrel for the 5 day period ending March 1 to $19 per barrel for the five day period ending April 5 **(Figure 3)**. The upward trend of the price spread suggests that the transportation cost for moving the marginal barrel of WTI from Cushing Oklahoma to U.S. Gulf Coast refineries has risen. Increased oil production from the Bakken formation in North Dakota may also be causing the Brent – WTI spread to widen. Much of the increased production from the tight oil play, partly due to a relatively mild winter having less of an impact on production compared to last year, is making its way to Cushing. The discount of Bakken oil to WTI represents a second transportation constraint forming in PADD 2, as this spread has widened from under $5 per barrel in early January to $11 per barrel for the five days ending April 5.

Figure 3: Historical crude oil price spreads
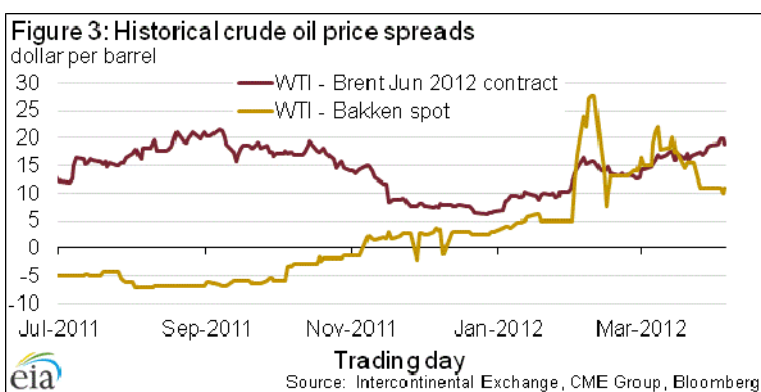
Crude oil and equities: The S&P 500 is an index of stock prices of the 500 largest companies in the United States, measured by market capitalization, and tends to rise with expectations for future economic growth. Crude oil is an important part of the U.S. economy as petroleum products make up a large component of the energy necessary to transport goods and provide services. As the economy started growing following the financial crisis in 2008 and early 2009, the price of crude oil relative to the value of U.S. equities remained nearly constant, with the ratio of the S&P 500 divided by the price of Brent hovering just under 14 **(Figure 4)**. In 2011 and 2012, the price of oil moved higher compared to other asset classes, including stocks, in large part due to actual or anticipated supply disruptions. The average for the ratio in the month of March was 11.1, only slightly above the low set in July of 2008 of 9.3.


Figure 4: Ratio of S&P 500 to the price of Brent crude oil
ratio (monthly average)
S&P 500 to Brent price ratio
Trading day
Source: Intercontinental exchange, Bloomberg, Deutsche Bank

Open Interest: After increasing to begin the year 2012 to a high of 228 thousand contracts on February 28, the net open interest for money managers has been decreasing over the last five weeks. Initially, the decline in net positions was due to an increase of short positions held by traders classified as money managers according to the CFTC. Subsequently, long positions were also reduced and contributed to the decline in net open interest. As of April 2, money managers held 180 thousand WTI futures contracts traded on NYMEX **(Figure 5)**.

Figure 5: Money Manager open interest in all WTI futures contracts
thousands of contracts
Money Managers Long
Money Managers Short
Money Managers Net
Source: CFTC Commitment of Traders Report

Volatility: The VIX, a measure of implied volatility for the S&P 500 calculated from options expiring within the next 30 days, and the OVX, a similar measure for WTI crude oil, both moved lower in the month of March. The OVX index settled at 28 percent on April 5, 4 percentage points below its value on February 1, and remains highly correlated with the VIX

(Figure 6). Improving economic data from the U.S. over the last few months has pushed down the market's expectations for price volatility in the near future as continued economic growth can provide support for potential future returns for U.S. companies as well as demand for crude oil.

Figure 6: Equity and crude oil volatility indices
annualized percent
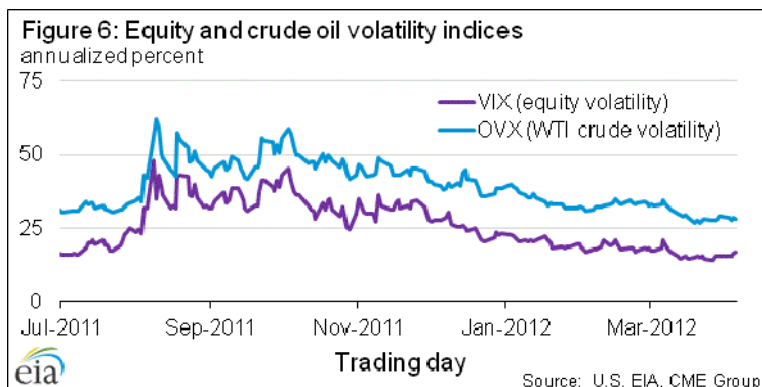
Another way to look at implied volatility for crude oil futures is the volatility skew, which is constructed by graphing implied volatility for out-of-the-money call and put option contracts by their strike price. Implied volatility for puts, as well as for most out-of-the-money calls, dropped over the last two months by a similar amount to what was seen in the broader OVX index **(Figure 7)**. However, call options with strike greater than $135 for June 2012, which will only have value if the price of crude oil increases to over $135 per barrel by expiration of the June contracts, have had increasing implied volatility. This suggests that the market's perception of risks surrounding events that could lead to large upward price movements have not abated over the last two months.


Figure 7: Volatility skew for the June 2012 WTI futures contract
annualized percent
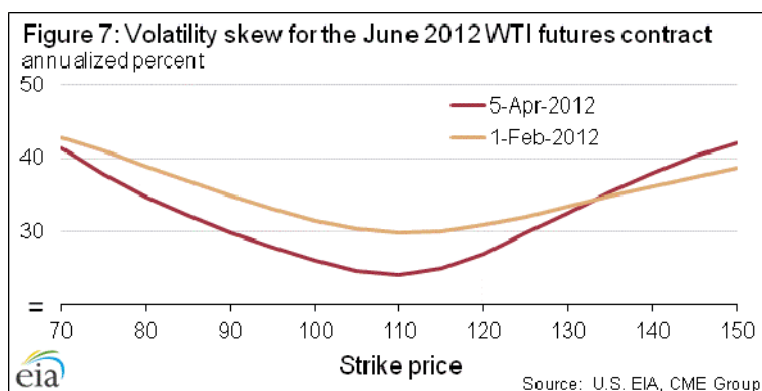
Market Derived Probabilities: The average price of WTI crude oil for June delivery for the five days ending April 5 has increased by $4 per barrel since February 1 and implied volatility for that futures contract has moved lower by 6 percentage points over the same time period. Even though there was an increase in price, the less time until the contract expires resulted in a decreased probability for prices to settle higher compared to market conditions on February 1. The probability of the June 2012 futures contract expiring above $120 per barrel is now 6 percent, a 7 percentage point decrease from the five day period ending February 1 (**Figure 8**). It

should be noted that these probabilities do not reflect the future price distribution of world waterborne crude oil. These probabilities are based on the cumulative normal densities derived from market expectations using futures and options prices. (See Appendices I and II of EIA's October 2009 *Energy Price Volatility and Forecast Uncertainty* article for discussion on how these probabilities are derived.)

Figure 8: Probability of the June 2012 WTI contract expiring above different price levels
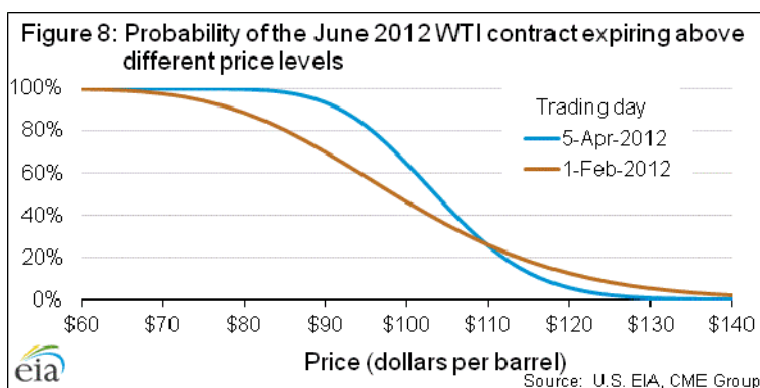
Gasoline

Prices: New York Harbor Reformulated Blendstock for Oxygenate Blending (RBOB) prices increased during the month of March but at a slower pace compared to January and February **(Figure 9)**. The average front month price from March 30 through April 5 was $3.36 per gallon, up from an average of $2.88 per gallon for the five days ending February 1. The $0.48 increase in monthly RBOB prices between February and April came from a combination of crude oil price increases, the changeover to summer grade gasoline as of the April contract (the front month contract during March), and increases in the gasoline crack spread. Crude oil price changes contributed the most to the increase in gasoline prices, with Brent increasing by about $12.50 per barrel, or $0.30 per gallon.


Figure 9: Historical RBOB futures prices
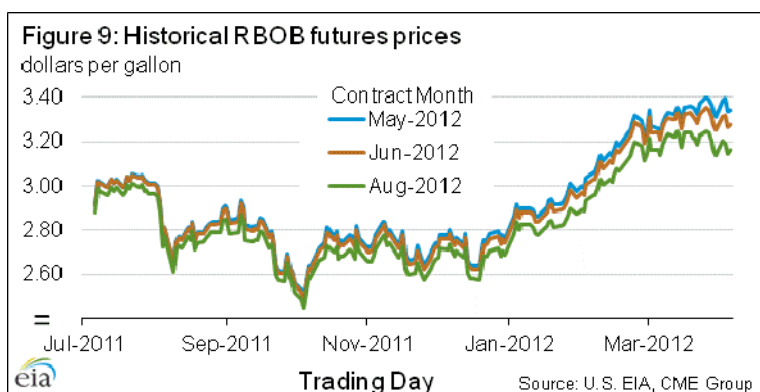
The average price differential between the winter-grade March contract and the summer-grade April contract for the month of February was $0.16 per gallon, which is indicative of the higher cost of producing, and higher demand for, summer grade gasoline. The gasoline crack spread increased by an additional 7 cents per gallon between January and March beyond the contract specification changes **(Figure 10)**. The historical crack spread futures curve shows the seasonal

backwardation in the RBOB curve, which has become increasingly steep as of April 5 **(Figure 11)**. Prices for the May contract are considerably higher than the August contract, which indicates tightness in the current market.

Figure 10: RBOB - Brent front month price spread

Figure 11: Historical RBOB - Brent crack spread futures curves
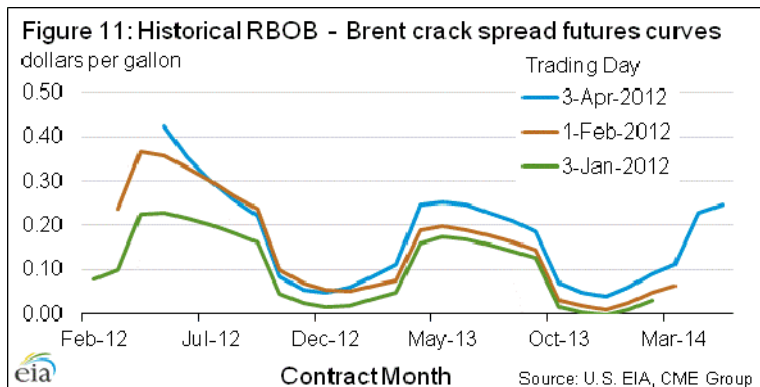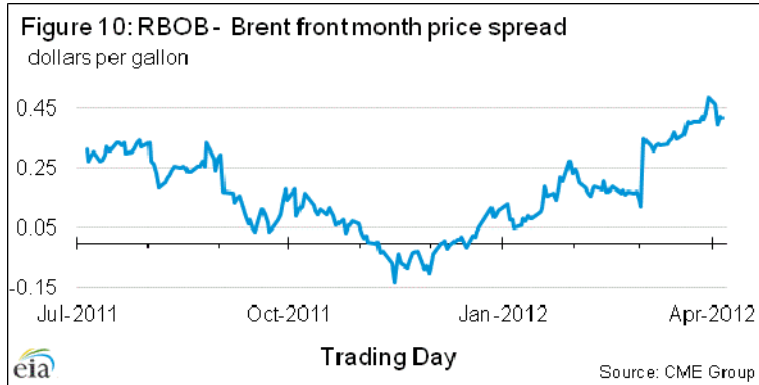
Market Derived Probabilities: The June 2012 RBOB futures contract averaged $3.28 for the five trading days ending April 5 and has a probability of exceeding $3.35 per gallon ($4.00 retail) at expiration of approximately 40 percent, and a probability of exceeding $3.85 per gallon ($4.50 retail) of about 5 percent. The same contract as of the five trading days ending February 1 had a probability of exceeding $4.00 retail of 23 percent, and a probability of exceeding $4.50 retail of 6 percent. A combination of higher crude oil prices, increased crack spreads, and relatively unchanged implied volatility contributed to a higher probability of the June contract exceeding $3.35 per gallon, while the less time to expiration was responsible for keeping the probability of exceeding $3.85 per gallon constant (**Figure 12**).
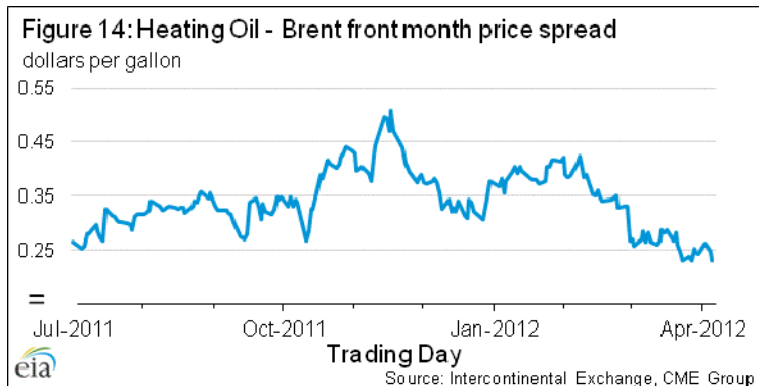
Figure 12: Probability of June 2012 retail gasoline exceeding different price levels at expiration
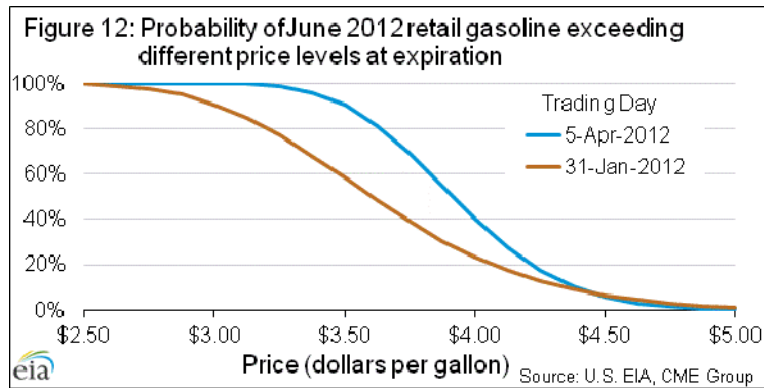
Heating Oil

Prices: Heating oil prices fluctuated slightly over the month of March, after increasing through February. The average prompt month price for March 1 through April 5 was $3.22, up from $3.19 in February and $3.05 in January (**Figure 13**). The price differential between contracts with different maturities has disappeared with the approach of the end of the heating season. On April 5, the prices for heating oil delivery in May, June and August were $3.17, $3.18 and $3.20, respectively, indicating a flat futures curve.

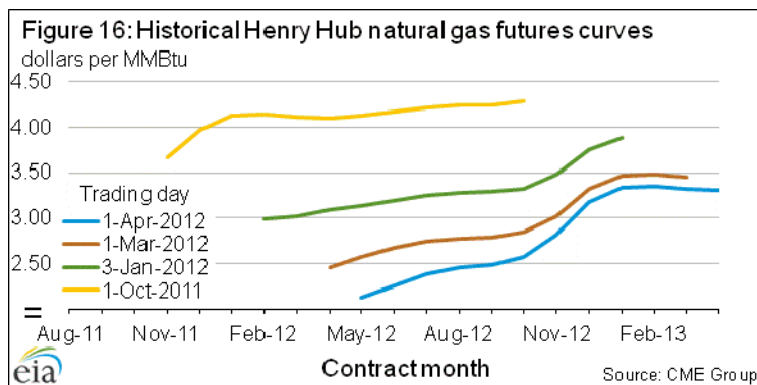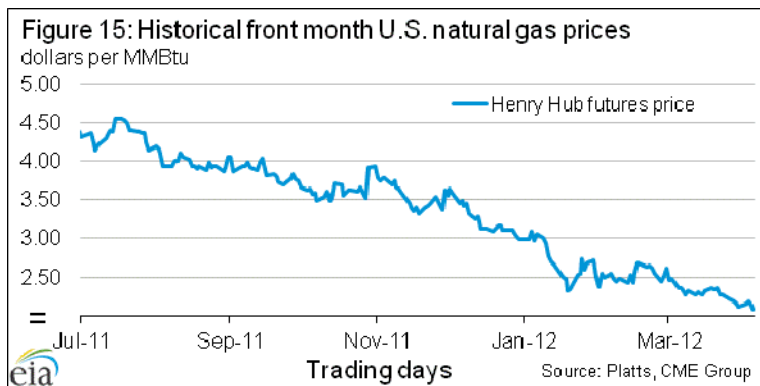Figure 13: Historical Heating Oil futures prices
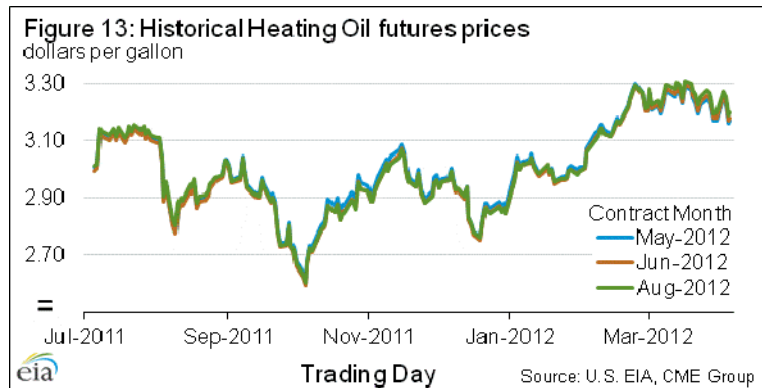
According to the EIA *Weekly Product Supplied* data, the 4-week average of heating oil and diesel fuel implied consumption in U.S. markets was down 5 percent in March from the comparable weekly average one year ago. This, combined with generally warmer weather, led to a decreasing crack spread (prompt heating oil minus prompt Brent) over the month of March (**Figure 14**). The average crack spread for March was $0.26 cents per gallon, down from $0.36 in February.

Figure 14: Heating Oil - Brent front month price spread

dollars per gallon

Source: Intercontinental Exchange, CME Group

Natural Gas

Prices: Natural gas stocks saw their first build of 2012 on the week ending March 16 when 57 bcf was added to U.S. inventories. Typically, the injection season for natural gas does not start until the first week in April and with inventories already being nearly 1000 bcf higher than their five year averages, natural gas prices have moved lower in response to ample supplies. The front month contract for delivery of natural gas to Henry Hub was $2.08 per mmBtu on April 5, a drop of $0.38 per mmBtu since March 1 **(Figures 15 and 16)**. Adjusted for inflation, the average price for the month of March was the lowest since September 2001.

Figure 15: Historical front month U.S. natural gas prices

dollars per MMBtu

Source: Platts, CME Group

Figure 16: Historical Henry Hub natural gas futures curves

dollars per MMBtu

Source: CME Group

Volatility: Warmer than usual temperatures during the winter heating season were largely responsible for increases in price volatility during the months of January and February as the

market priced in new information affecting expectations for natural gas demand. Coming to the end of the heating season in March, with demand typically being less volatile and a clearer picture of the amount of natural gas in U.S. inventories, volatility, along with prices, declined. Historical 30 day realized volatility is now 35 percent, a return to levels seen at the beginning of this year, and front month implied volatility is now 44 percent **(Figure 17)**.

Figure 17: Natural gas historical and implied volatility
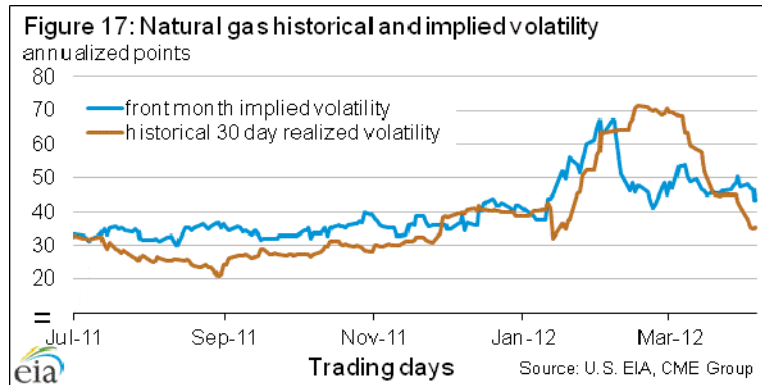
Market Derived Probabilities: The average price over the five trading days ending on April 5 for the June 2012 natural gas futures contract has fallen by $0.66 per MMBtu since February 1. Even though there was an increase in implied volatility of 5 percentage points for that contract, the lower prices were responsible for a large decrease in the probability of natural gas prices exceeding different price levels compared to market conditions a couple months ago. The probability that the June contract will settle higher than $3.00 per MMBtu fell by 37 percentage points from 43 to 6 percent when compared to market conditions on the five trading days ending February 1 **(Figure 18)**. These natural gas probabilities are cumulative normal densities generated using market-based inputs provided by futures and options markets, i.e., futures prices and implied volatilities. (See Appendices I and II of EIA's October 2009 *Energy Price Volatility and Forecast Uncertainty* article for additional discussion).

Figure 18: Probability of the June 2012 Henry Hub contract expiring above price levels