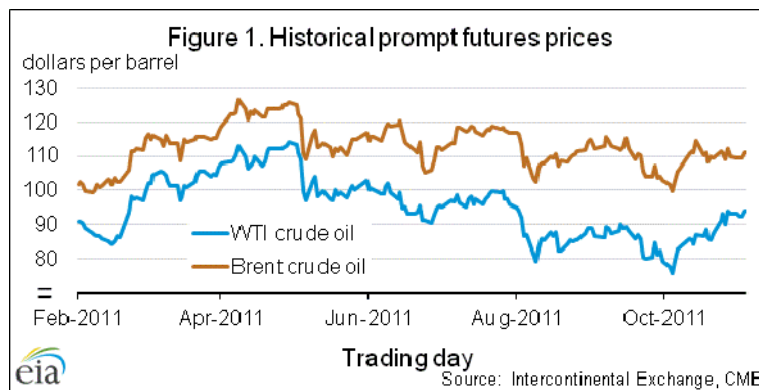




## Short-Term Energy Outlook Market Prices and Uncertainty Report<sup>1</sup>

November 8, 2011 Release

**Crude Oil Prices.** On October 4, prices for both world waterborne (Brent) and U.S. domestic (West Texas Intermediate) crude oil reached their lowest levels since February 2011 and August 2010, respectively, as uncertainty surrounding European debt and fears of slower economic growth weighed heavily on markets. Since that time, renewed hopes for a solution to stabilize the Eurobond market and several positive economic reports from the U.S. have put upward price pressure on both oil benchmarks (**Figure 1**). As of market close on November 3, Brent had increased by \$11 per barrel from its early October low while WTI had shown even more strength, moving higher by \$18 per barrel over the same time period.



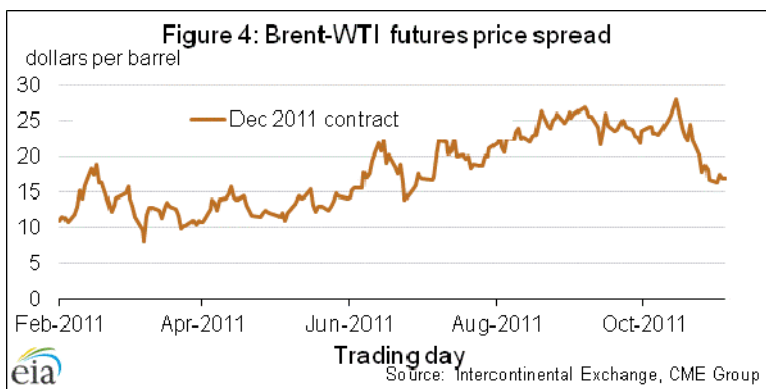
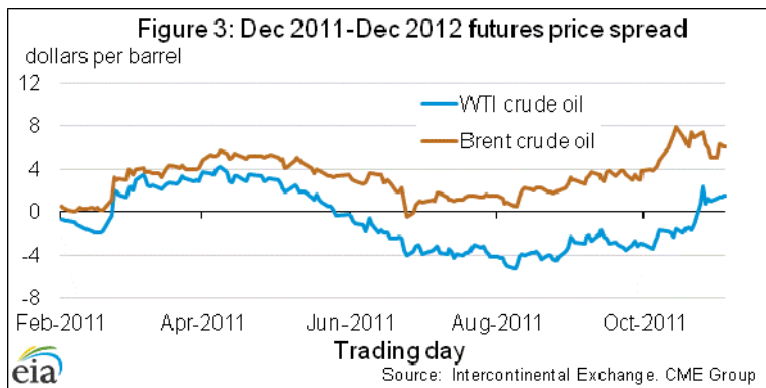
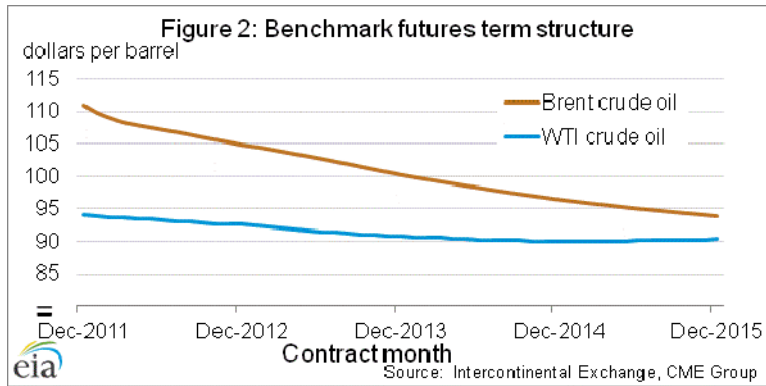
During October, the shape of the WTI futures curve also changed, from a modest contango to being slightly backwardated (**Figure 2**). On October 3, the December 2011 WTI futures contract was trading at a \$3.25 per barrel discount to the December 2012 contract; but as of the beginning of November, that differential had risen to a \$1.46 premium (**Figure 3**). A combination of factors, including the U.S. economy growing at 2.5 percent in the third quarter, U.S. worker productivity increasing by 3.1 percent in the third quarter, lower crude oil inventories at the

<sup>1</sup> This is a regular monthly companion to the EIA *Short-Term Energy Outlook*.

(<http://www.eia.doe.gov/emeu/steo/pub/contents.html>)

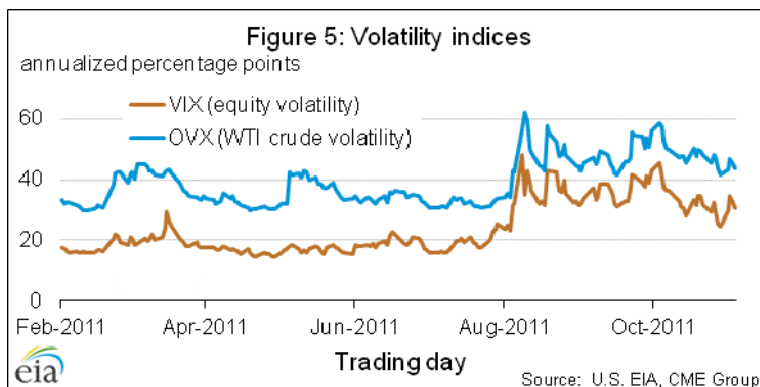
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delivery point in Cushing, Oklahoma, and reports of increased rail activity moving oil out of PADD 2, have contributed to the perception of a tighter market for crude oil in the U.S midcontinent. Meanwhile, Brent backwardation has decreased by \$1.35 per barrel from its October peak after the delivery window for crude oil was lengthened to 25 days after the Brent futures contract settles. Positive reports surrounding Libyan crude oil production and exports have also helped reduce the premium market participants are paying for front month Brent contracts. All of these changing dynamics have led to a narrowing of the Brent – WTI spread from the \$28 seen on October 14 (Figure 4).

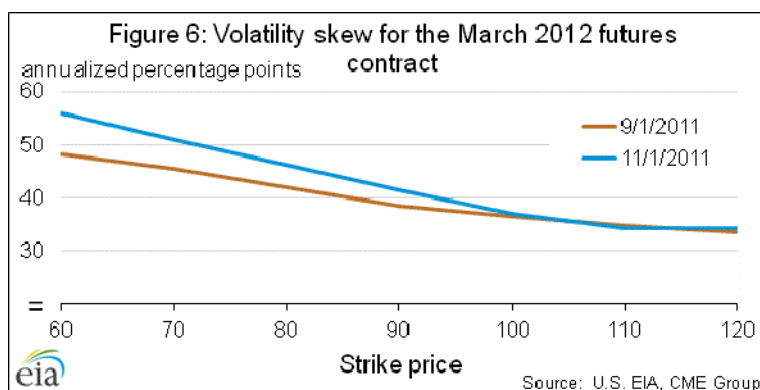


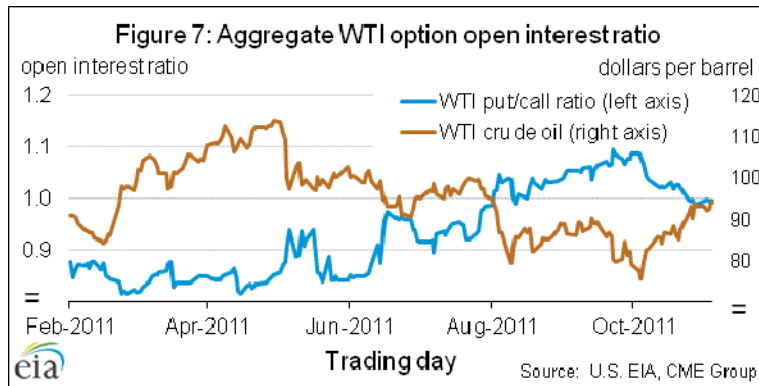
Uncertainty in the crude oil market continues to be largely affected by the market’s changing sentiment over future economic growth. The OVX index, a measure of uncertainty for WTI

crude oil, and the VIX index, a measure of implied volatility for the 500 largest companies traded on U.S. exchanges, have continued to move closely together (**Figure 5**). Over the last three months, the daily percent movements of these two indices have exhibited a positive correlation of 0.80; both indices have moved lower in the latter half of the month of October.

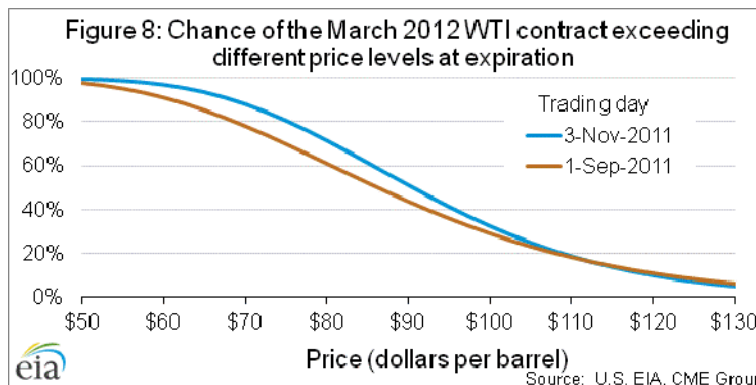


Concerns about downward price movements currently seem to be stronger than those for potential price increases. The volatility skew is constructed by graphing the implied volatility of specific WTI options contracts against their strike prices. Implied volatility can be used as a measure of how cheap or expensive an option is while controlling for other factors such as the price of the underlying, time to expiration, and interest rates. As of the market close on November 1, out-of-the-money put options on the March 2012 WTI contract are more expensive compared to two months ago, as the implied volatility has risen by 4 to 7 percentage points, depending on the strike price (**Figure 6**). Implied volatility for out-of-the-money call option contracts was nearly unchanged, which suggests the market is willing to pay comparatively higher prices for purchasing insurance against downward price movements than in September. Over the same time period, the ratio of open interest of put options to call options on all WTI futures contracts has actually dropped by 4 percent since September (**Figure 7**). Market participants are holding fewer put options for downside protection but they are paying higher premiums for those contracts.

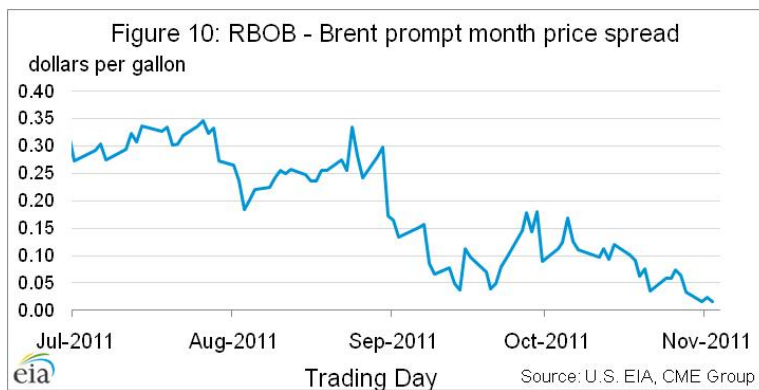
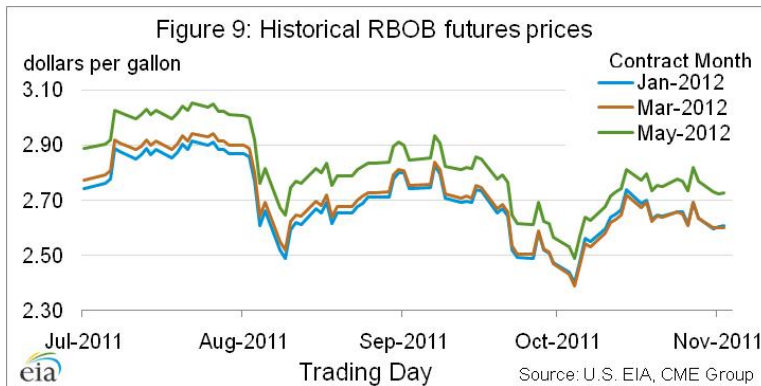




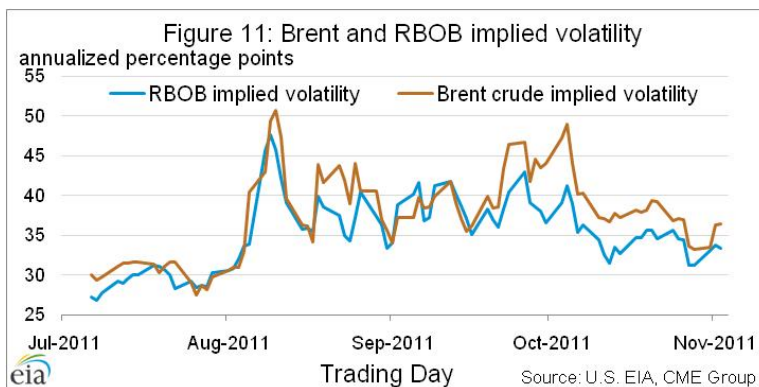
After moving higher during the beginning and middle of October and retreating later in the month, implied volatility for the March 2012 WTI futures contract is now only slightly higher than levels seen at the beginning of September. During that same time period, prices also increased by \$3 per barrel which has resulted in a small rise in the probability of exceeding price levels by expiration. The probability of the March 2012 futures contract expiring above \$100 per barrel is now 32 percent, a 3 percentage point increase from September 1 (**Figure 8**). 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.)

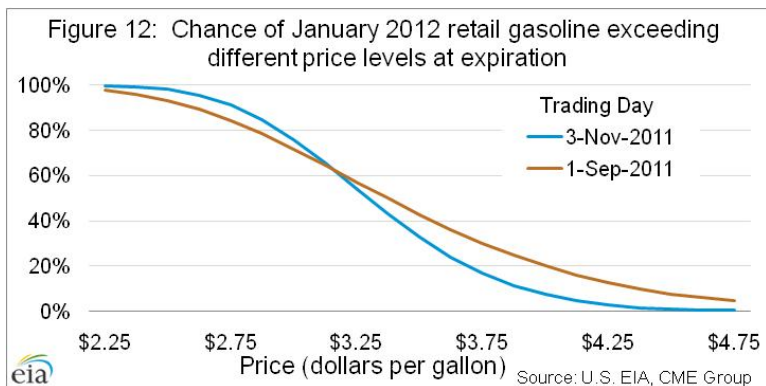


**Gasoline.** New York Harbor Reformulated Blendstock for Oxygenate Blending (RBOB) prices remained steady in the second half of October (**Figure 9**), after falling to \$2.50 or lower early in the month. The average prompt month prices declined \$0.05 per gallon from September to \$2.68 per gallon in October. Brent crude averaged just under \$109 per barrel for October, approximately the same as September. The crack spread (the gasoline prompt month price minus the crude benchmark prompt month price) has continued to fall substantially from summer levels, averaging \$0.09 per gallon in October compared to \$0.25 per gallon in August and \$0.31 per gallon in July (**Figure 10**). This drop in the crack spread stems from lower gasoline prices rather than an increase in crude benchmark price levels. The 4-week average U.S. finished gasoline product supplied (a measure of consumption) is 7 percent below its high point in June and the monthly average prompt month price of \$2.68 is 14 percent lower than the July average of \$3.10 and 7 percent below the August average of \$2.87.

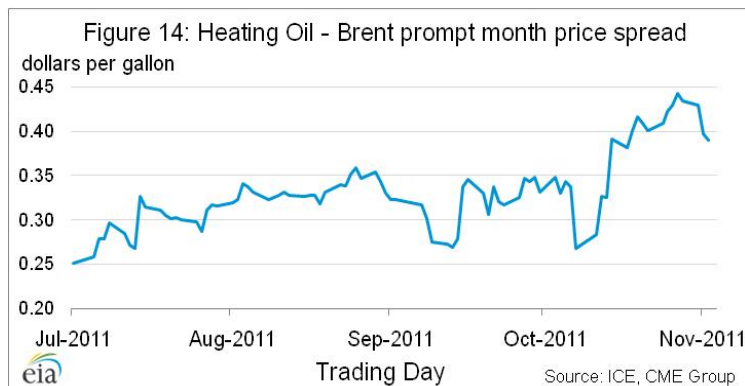
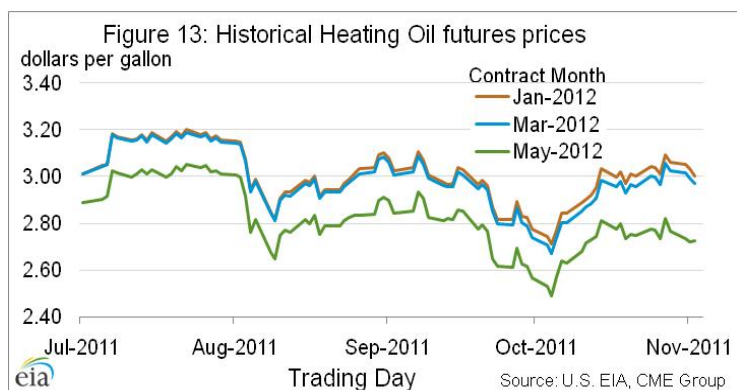


Market expectations of uncertainty in monthly average RBOB prices are reflected in the pricing and related implied volatility of futures options contracts. RBOB implied volatility for the month of October tracked Brent implied volatility, although at a slightly lower level during the middle of the month (**Figure 11**). RBOB futures contracts for January 2012 delivery closed on November 3 at \$2.63 per gallon. The probability the January 2012 RBOB futures price will exceed \$2.80 per gallon (consistent with a U.S. average regular gasoline retail price above \$3.50 per gallon) at expiration is approximately 28 percent, down from approximately 42 percent on September 1 (**Figure 12**). Moving further out on the curve, the March 2012 RBOB futures contract price also closed at \$2.63 on November 3 and has a probability of exceeding \$2.80 per gallon (\$3.50 retail) at expiration of approximately 33 percent due to increased time to expiration.

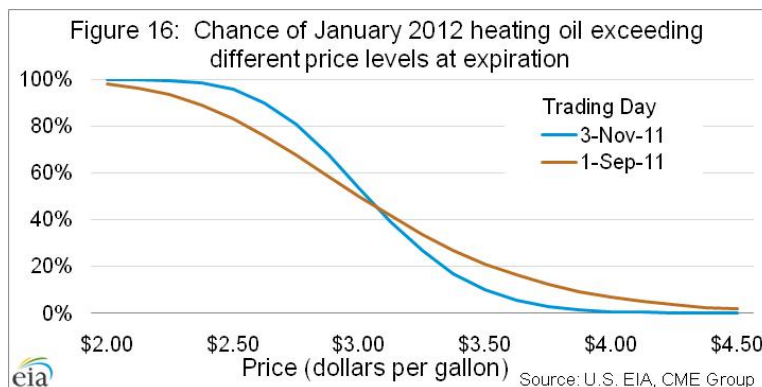
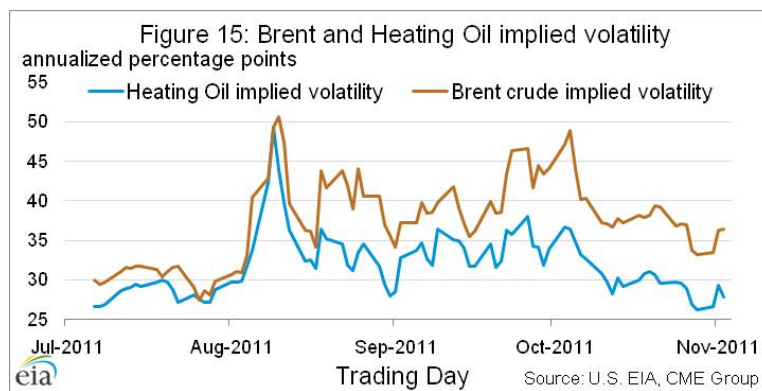




**Heating Oil.** Unlike gasoline, heating oil prices have increased through the month of October as demand increased with colder weather (**Figure 13**). The 4-week average consumption for distillate fuel oil was up 9 percent at the end of October compared to the end of September. Increasing heating oil prices relative to the Brent crude benchmark resulted in higher heating oil crack spreads (prompt heating oil minus prompt Brent) in October, averaging \$0.37, up \$0.05 per gallon from September (**Figure 14**). The current tightness in the heating oil market has pushed prices in the January contract somewhat above those in the March contract.

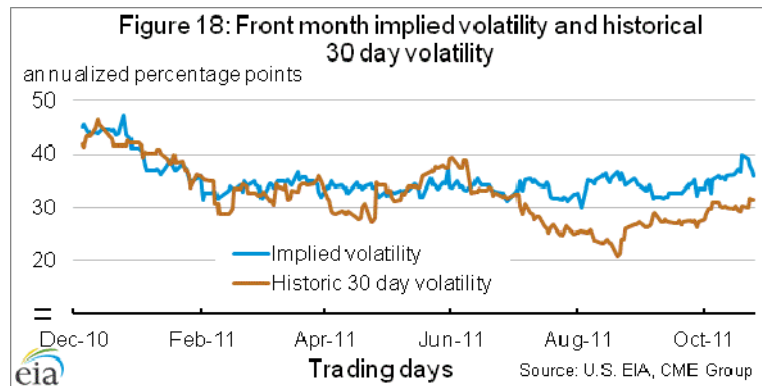
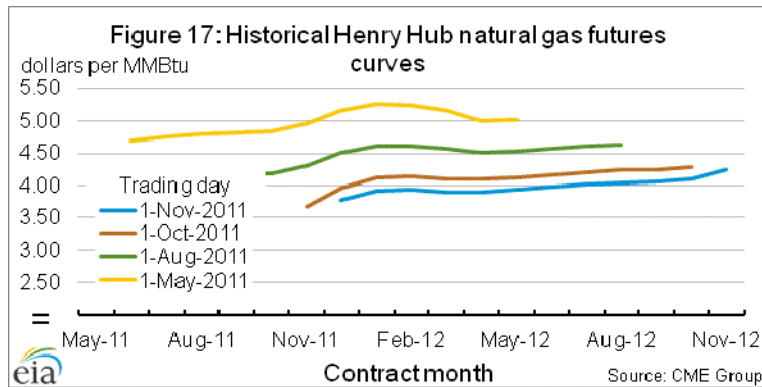


Market expectations of uncertainty in monthly average heating oil prices are reflected in the pricing and related implied volatility of futures options contracts. Heating oil implied volatility has decreased over the month of October (**Figure 15**). Even though heating oil futures contracts for January 2012 delivery settled on November 3 at \$3.04 per gallon, up from \$2.84 on October 6, the probability the futures price will exceed \$3.50 per gallon at expiration is approximately 10 percent, down from 21 percent on September 1 (**Figure 16**). The most likely explanation of an increasing contract price and a decreasing probability of reaching \$3.50 per gallon at expiration is that we are now much nearer the contract expiration date. Looking further out on the curve to the end of the heating oil season, the heating oil futures contract price on November 3 for March 2012 settled at \$3.01 and has a probability of exceeding \$3.50 per gallon at expiration of approximately 17 percent.



**Natural Gas.** The daily price for natural gas that is most often quoted is the settlement price of the NYMEX futures contract that is closest to expiration. On days when contracts expire and the quoted front month price rolls forward to the next contract, price changes may be dominated by seasonal factors affecting the value of deliveries in the next month rather than new information regarding the market balance. At any time of the year, the December contract usually carries about a 10 to 15 percent premium to the November contract, as this marks the beginning of higher natural gas demand for winter heating purposes (**Figure 17**). When the

November contract expired on October 28, the quoted price for the next day was for the December contract, leading to an apparent increase of \$0.39 per MMBtu, or about 11 percent, for that day. The same seasonality effect can be seen in implied volatility since unexpected events during the winter months, such as extreme weather or a supply disruption, will have a larger effect on natural gas prices compared to other times of the year. On October 28, the switch to the December contract yielded a jump of 3.2 percentage points in implied volatility (Figure 18).



The price of the futures contract for March 2012 delivery of natural gas fell by \$0.19 per MMBtu during the month of October while the implied volatility rose by 4 percentage points. Although the uncertainty band did widen due to the increase in implied volatility, the probability of exceeding certain price levels fell because of the price drop and the contract being closer to expiration. The probability that the March contract will settle higher than \$4.50 per MMBtu fell by 19 percentage points from 39 to 20 percent when compared to market conditions in August (Figure 19). 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).



