U.S. Energy Information Administration

September 2010

Short-Term Energy Outlook
Energy Price Volatility and Forecast Uncertainty[1]

September 8, 2010 Release

Crude Oil Prices. West Texas Intermediate (WTI) crude oil spot prices averaged about $77 per barrel in August 2010, very close to the July average, but $3 per barrel lower than projected in last month's *Outlook*. WTI spot prices averaged almost $82 per barrel over the first 10 days of August but then fell by $9 per barrel over the next 2 weeks as the market reacted to a series of reports of a stumbling economic recovery. EIA has lowered its average fourth quarter 2010 WTI spot price forecast to $77 per barrel, compared with $81 in last month's *Outlook*. WTI spot prices are projected to rise to $84 by the end of next year (West Texas Intermediate Crude Oil Price Chart).

WTI futures have been range bound for most of the year, with brief excursions above $85 per barrel and below $75 per barrel. As August drew to a close, the trend was downward, in response to macro-economic indicators suggesting the U.S. economy was stalling. The prompt October 2010 contract ranged from the mid-$80s at the start of the month to below $72 by the end of August (Figure 1).

Energy price forecasts are highly uncertain, as history has shown. WTI futures for November 2010 delivery for the 5-day period ending September 2 averaged $75 per barrel, and implied volatility averaged 32 percent. This made the lower and upper limits of the 95-percent confidence interval $61 and $94 per barrel, respectively (Figure 2). Last year at this time, WTI for November 2009 delivery averaged $70 per barrel, and implied volatility averaged 47 percent, with the limits of the 95-percent confidence interval at $51 and $96 per barrel.

[1] This is a regular monthly supplement to the EIA *Short-Term Energy Outlook.* (http://www.eia.doe.gov/emeu/steo/pub/contents.html)
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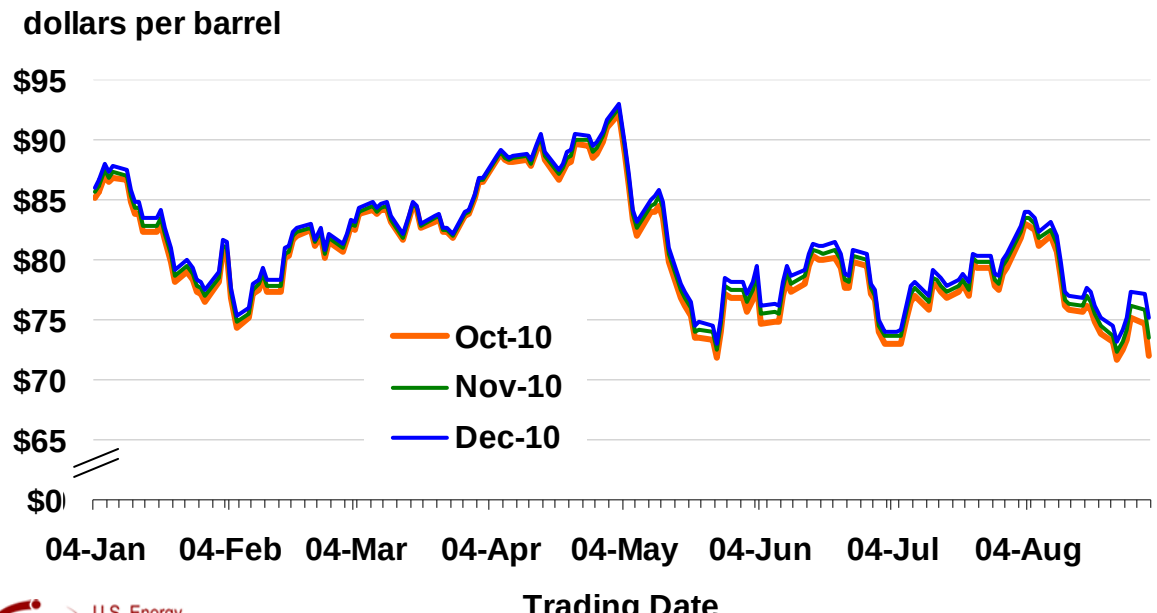
Figure 1. 4Q 2010 WTI futures contracts



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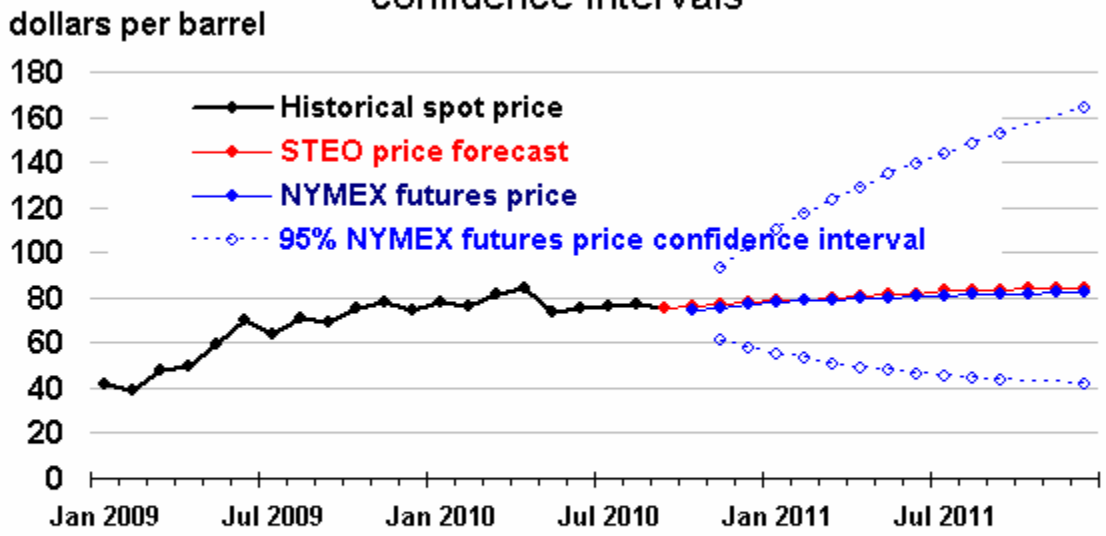
Source: U.S. EIA, CME Group

Figure 2. West Texas Intermediate (WTI) crude oil price and confidence intervals



Note: Confidence interval derived from options market information for the 5 trading days ending September 2, 2010

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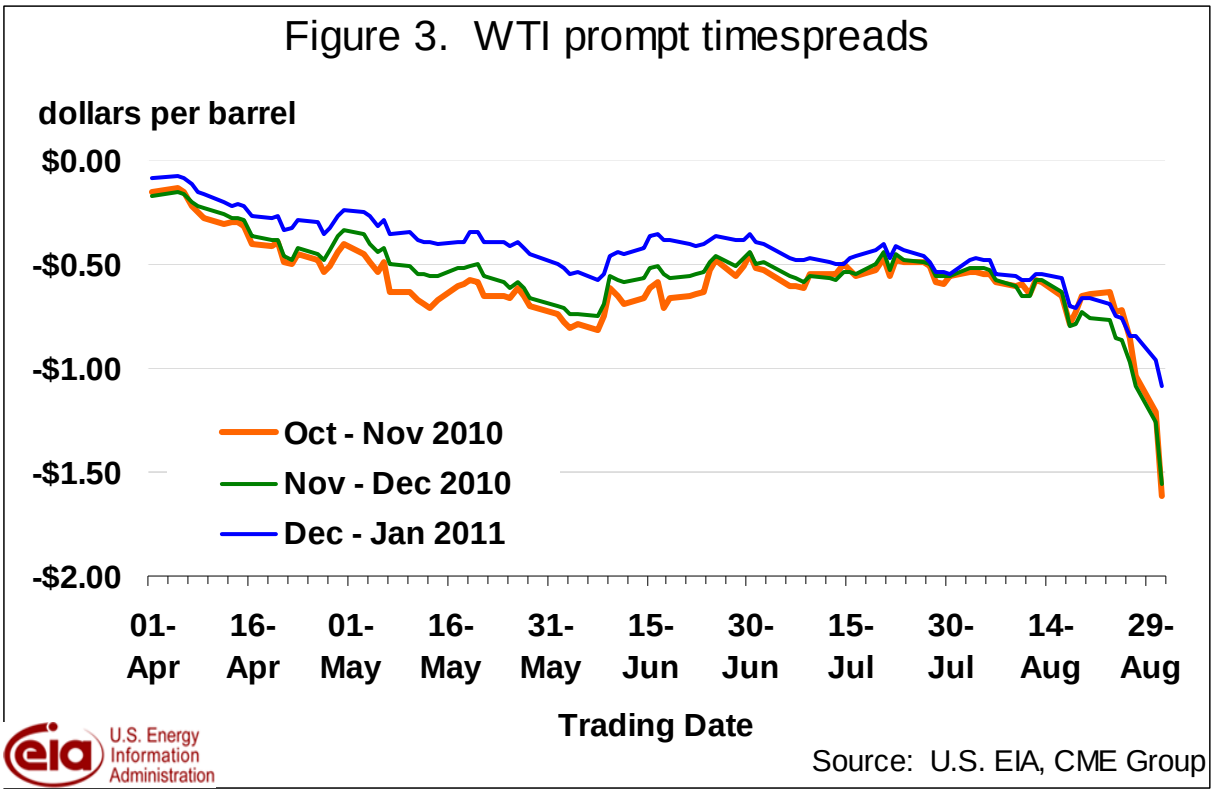
Source: Short-Term Energy Outlook, September 2010; Reuters News Service; and CME Group

The lower prices toward the end of the month were accompanied by expectations of an increase in crude oil inventories generally. While stock levels at Cushing declined during the week ended August 27, according to EIA's Weekly Petroleum Status Report, inventories overall built by 3.4 million barrels, with the largest increase occurring in Petroleum Administration for Defense District (PADD) III. The presence of higher inventories could also be seen in the behavior of WTI timespreads, i.e., the difference between prompt-delivered crude oil and future delivery. Timespreads widened during the course of the month, which is consistent with market building of inventories to capture increasing future prices relative present prices (Figure 3). This would be consistent with reduced refinery runs during the upcoming maintenance season, expected after the summer driving season draws to a close with the Labor Day holiday.

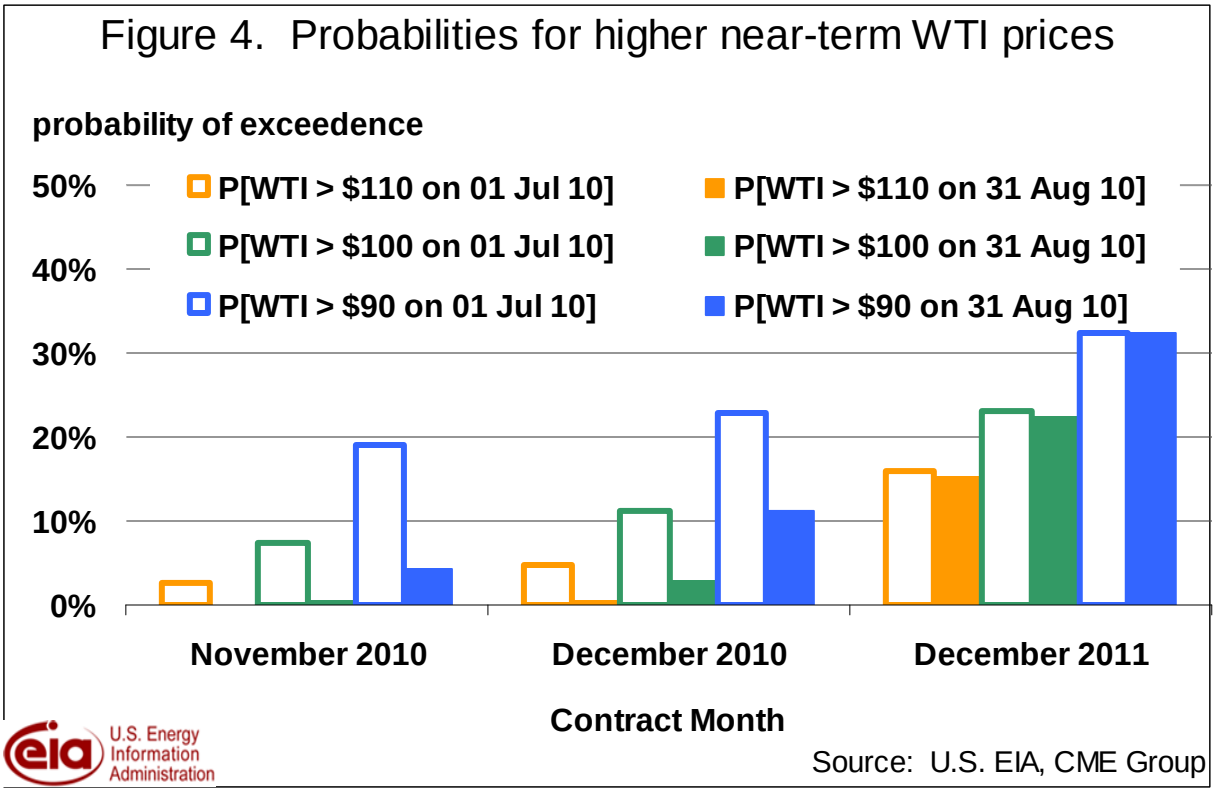


Timespreads are closely related to storage levels. This is because buyers of crude oil lacking an immediate need for the commodity typically factor in the cost of storing crude by bidding at a level that allows them to cover the cost of carrying oil in storage from one month to the next. For example, if the cost to store oil is 50 cents per barrel per month (i.e., the time-value of money plus the cost of getting crude to and from storage facilities) then a refiner would bid prompt-delivered barrels at least 50 cents

below where she could sell those barrels one month forward in the futures or forward markets.

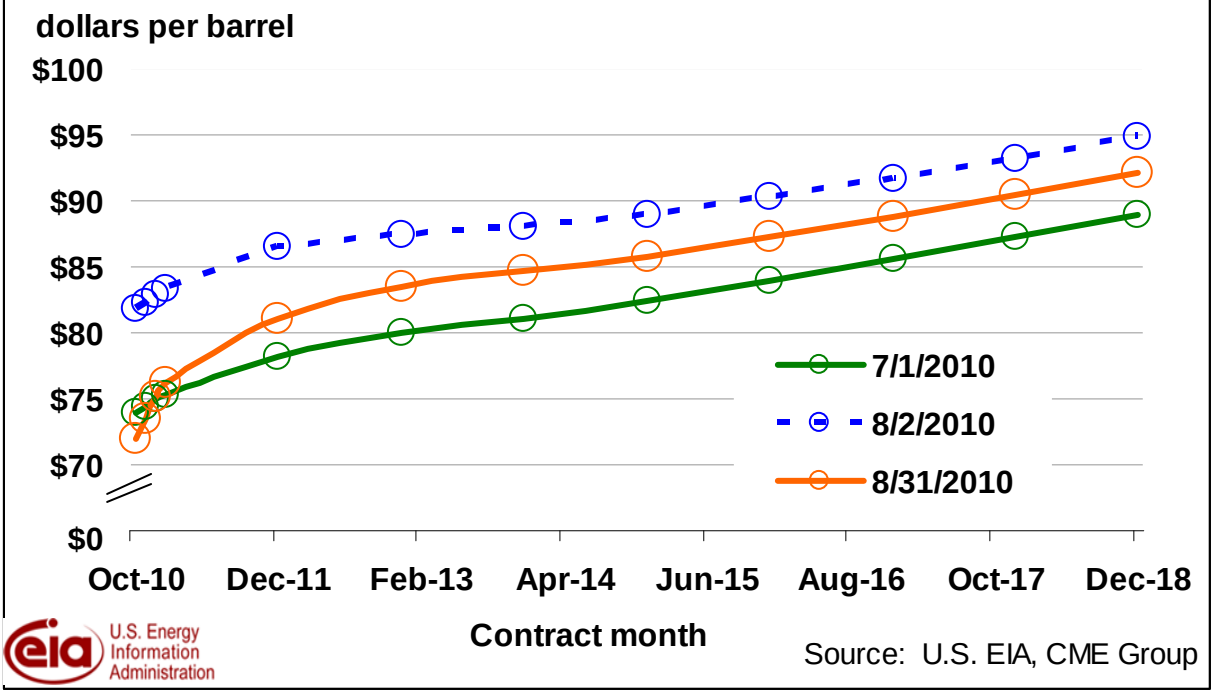
Taken together, lower prices and stable volatilities meant market participants significantly reduced the likelihood of seeing much higher prices by year-end 2010 (Figure 4). Relative to expectations in the market at the beginning of July, the probability of seeing WTI futures above $100 per barrel for December 2010 delivery was reduced to a little over 2.5 percent from approximately 11 percent at the beginning of July. The expectation of prices exceeding $100 per barrel at the end of next year, however, held fairly steady at slightly less than 25 percent as August came to a close.

Figure 4. Probabilities for higher near-term WTI prices



The relative stability of longer-term price expectations also can be seen in the evolution of the forward curve, where the prices at which buyers and sellers were contracting for crude oil delivered out as far as December 2018 fell by less than prompt-delivered futures (Figure 5).

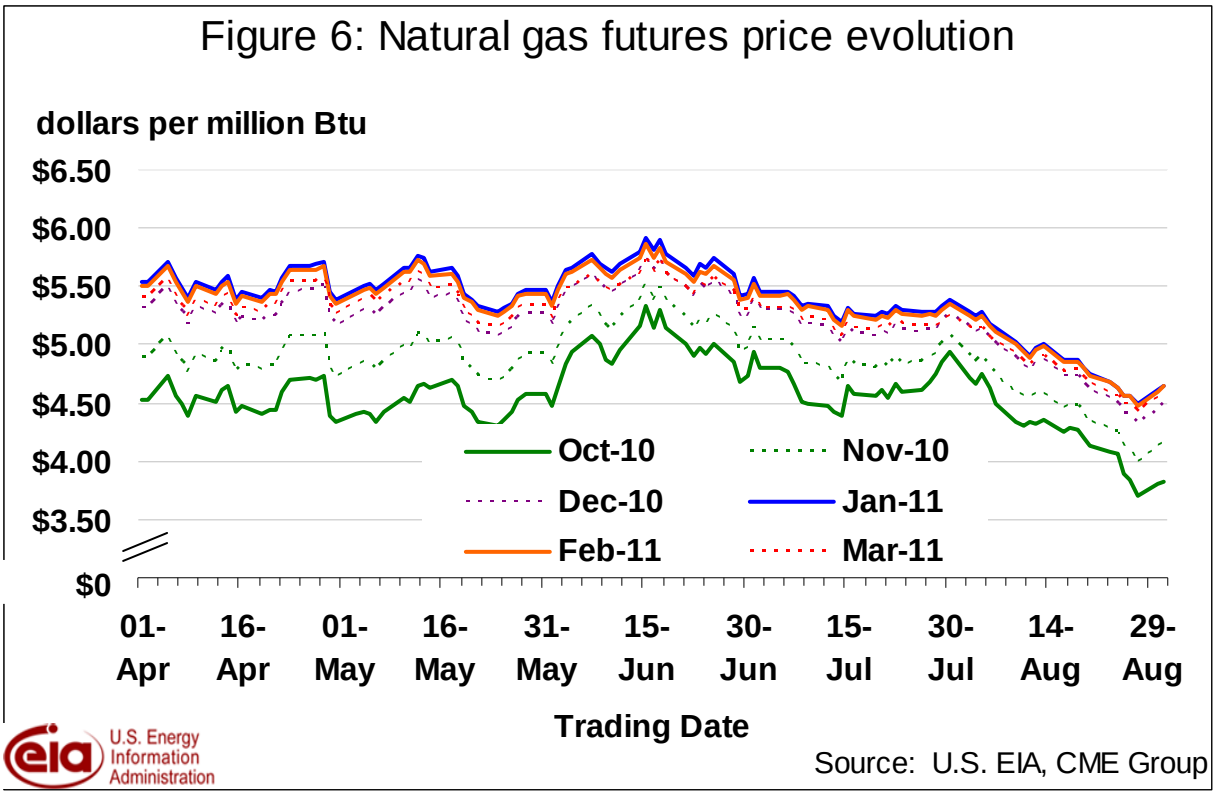
Figure 5. WTI futures term structure



U.S. Natural Gas Prices. The Henry Hub spot price averaged $4.32 per MMBtu in August, $0.31 per MMBtu lower than the average spot price in July (Henry Hub Natural Gas Price Chart). EIA expects prices will fall below $4 per MMBtu in September and October before rebounding at the onset of colder weather. EIA now expects prices will average $4.76 per MMBtu in 2011; this is a downward revision from the $4.98 per MMBtu forecast in last month's *Outlook*.

Uncertainty over future natural gas prices is lower this year compared with last year at this time. Natural gas futures for November 2010 delivery for the 5-day period ending September 2 averaged $4.07 per MMBtu, and the average implied volatility over the same period was 48 percent. This produced lower and upper bounds for the 95-percent confidence interval of $2.84 and $5.83 per MMBtu, respectively. At this time last year the natural gas November 2009 futures contract averaged $3.89 per MMBtu and implied volatility averaged 75 percent. The corresponding lower and upper limits of the 95-percent confidence interval were $2.22 and $6.81 per MMBtu.

Natural gas prices were under pressure during the entire month of August, despite increased demand from electric generators meeting higher air-conditioning loads (Figure 6).

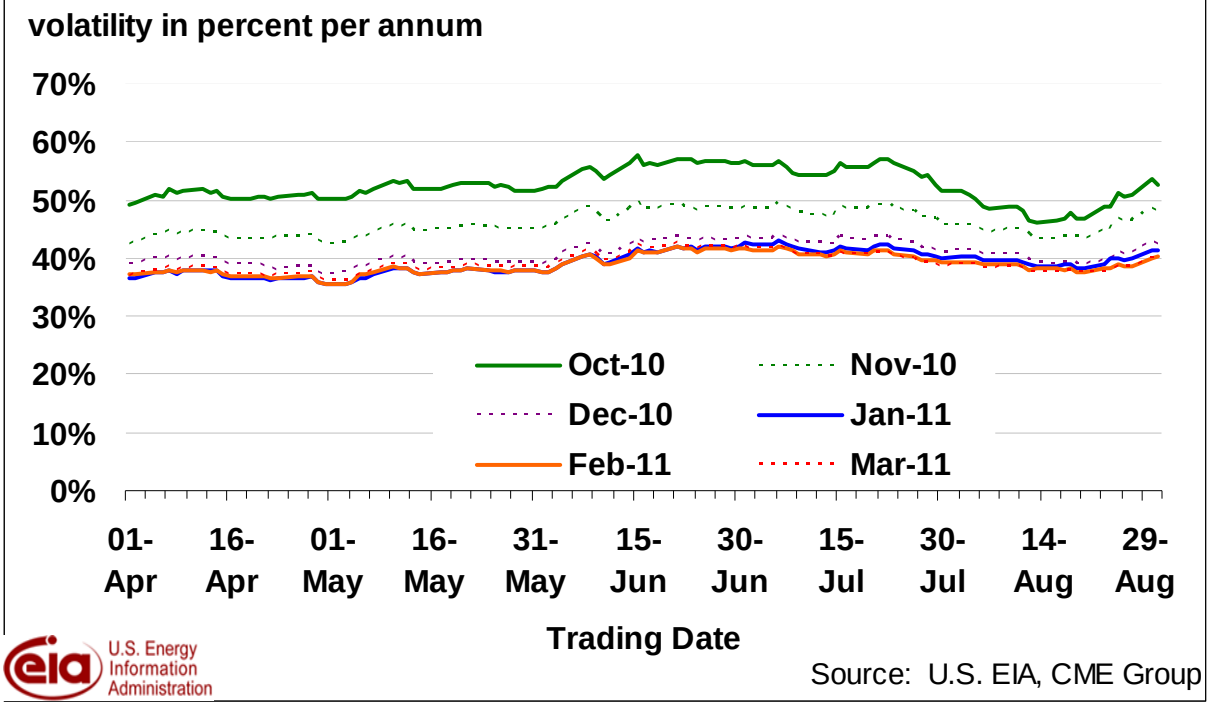


Implied volatility for the October 2010 contract – the last month of the injection season – trended steadily lower for the first half of August, but then reversed course as prices continued to deteriorate (Figure 7). Implied volatilities for natural gas futures delivering during the winter months, however, were fairly constant in August.

The sharp drop in prices – with winter volatilities relatively stable – translated into a significant drop in the market's expectation of higher prices for natural gas delivered to Henry Hub in the November – March period (Figure 8). By the end of August, for example, market participants reduced the probability of the December price exceeding $5.50 per MMBtu to slightly more than 1 in 10 (11.6 percent), versus an earlier expectation of more than 1 in 3 (35.2 percent) at the end of July.

As with the crude oil probabilities, the natural gas probabilities are cumulative normal densities, which are generated using market-based inputs provided by futures and options markets – i.e., futures prices and implied volatilities. (See Appendix I and II of EIA's October 2009 *Energy Price Volatility and Forecast Uncertainty* article for additional discussion).

Figure 7: Natural gas futures implied volatility evolution



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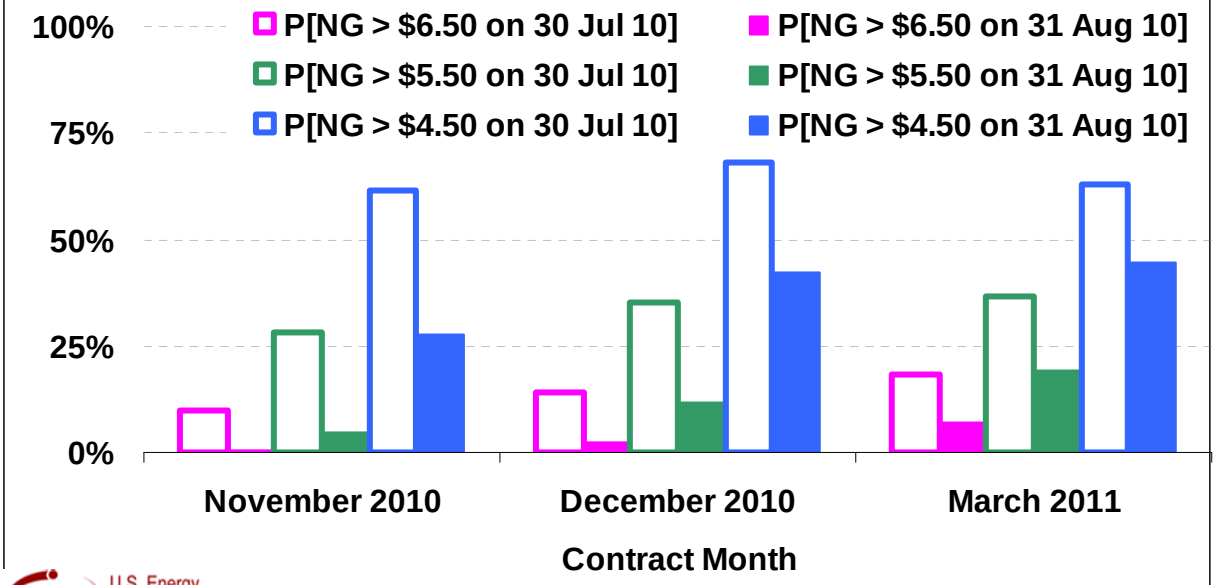
Source: U.S. EIA, CME Group

Figure 8: Probabilities for higher near-term NG prices



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Source: U.S. EIA, CME Group