

 **Short-Term Energy Outlook****Energy Price Volatility and Forecast Uncertainty<sup>1</sup>**

January 11, 2011 Release

**Crude Oil Prices.** West Texas Intermediate (WTI) crude oil spot prices averaged over \$89 per barrel in December, about \$5 per barrel higher than the November average. Expectations of higher oil demand, combined with unusually cold weather in both Europe and the U.S. Northeast, contributed to prices. EIA has raised the first quarter 2011 WTI spot price forecast by \$8 per barrel from last month's Outlook to \$92 per barrel with a continuing rise to an average \$99 per barrel in the fourth quarter of 2012. The projected annual average WTI price is \$93 per barrel in 2011 and \$98 per barrel in 2012.

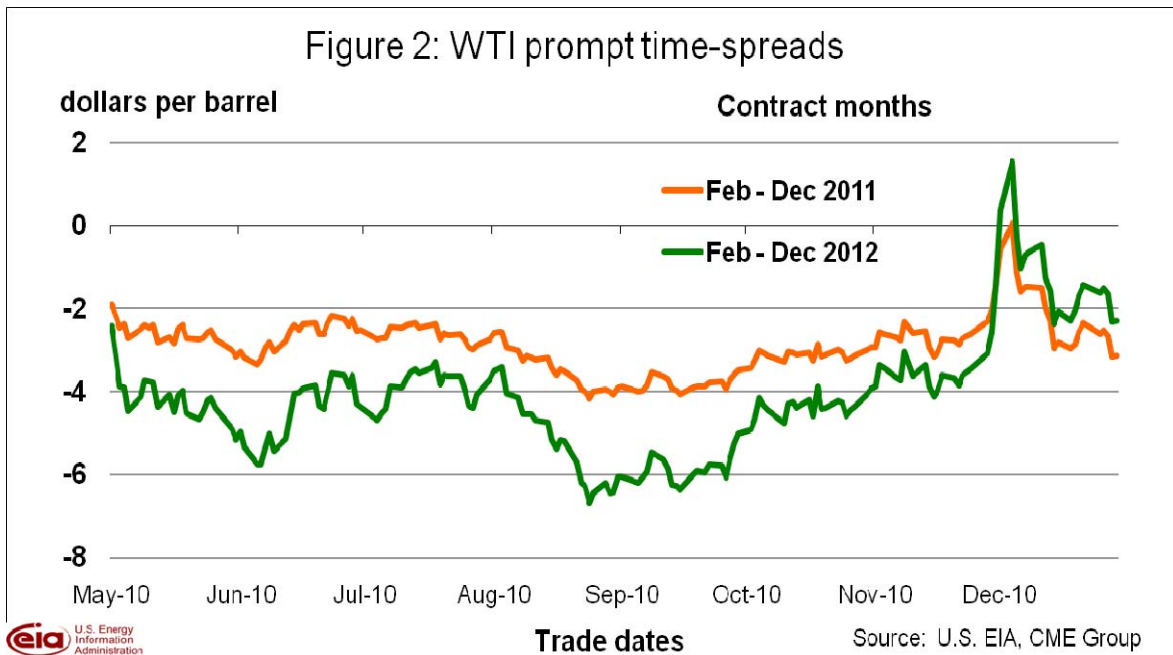
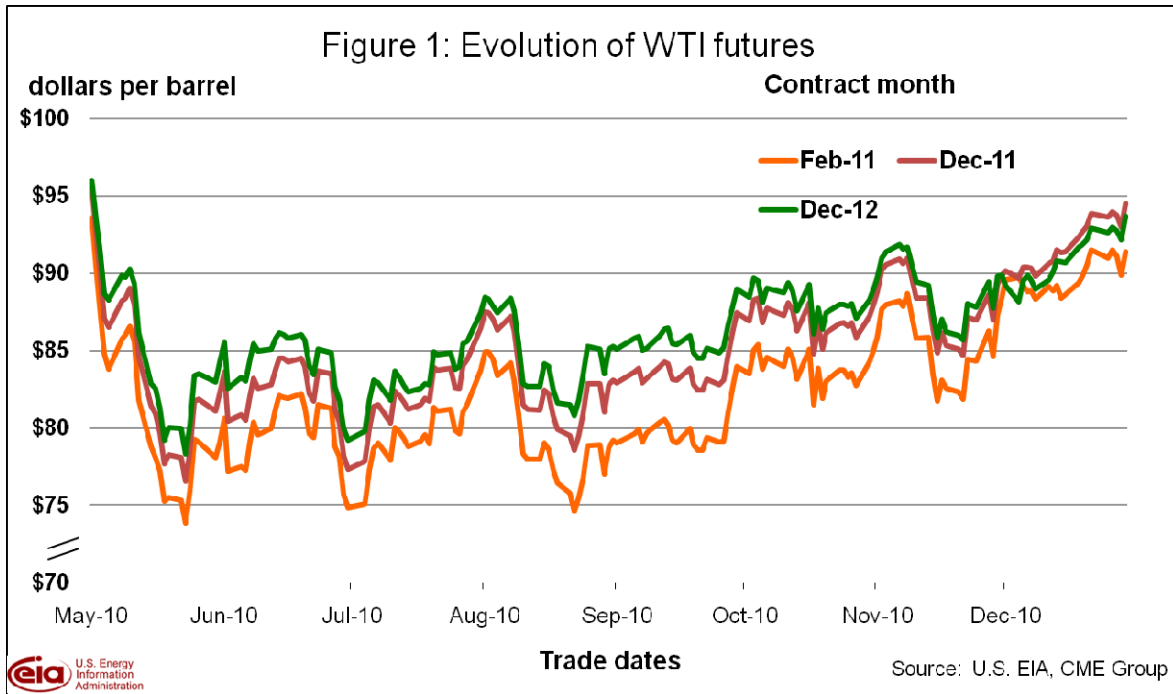
WTI futures for March 2011 delivery for the 5-day period ending January 6 averaged \$92 per barrel, and implied volatility averaged 27 percent. This made the lower and upper limits of the 95-percent confidence interval \$76 per barrel and \$110 per barrel, respectively, for WTI delivered in March 2011. Last year at this time, WTI for March 2010 delivery averaged \$82 per barrel and implied volatility averaged 40 percent, with the limits of the 95-percent confidence interval at \$66 per barrel and \$102 per barrel. The probability that the price of WTI crude oil will exceed \$100 per barrel in December 2011 is about 36 percent. Conversely, the probability that the December 2011 WTI price will fall below \$80 per barrel is about 31 percent.

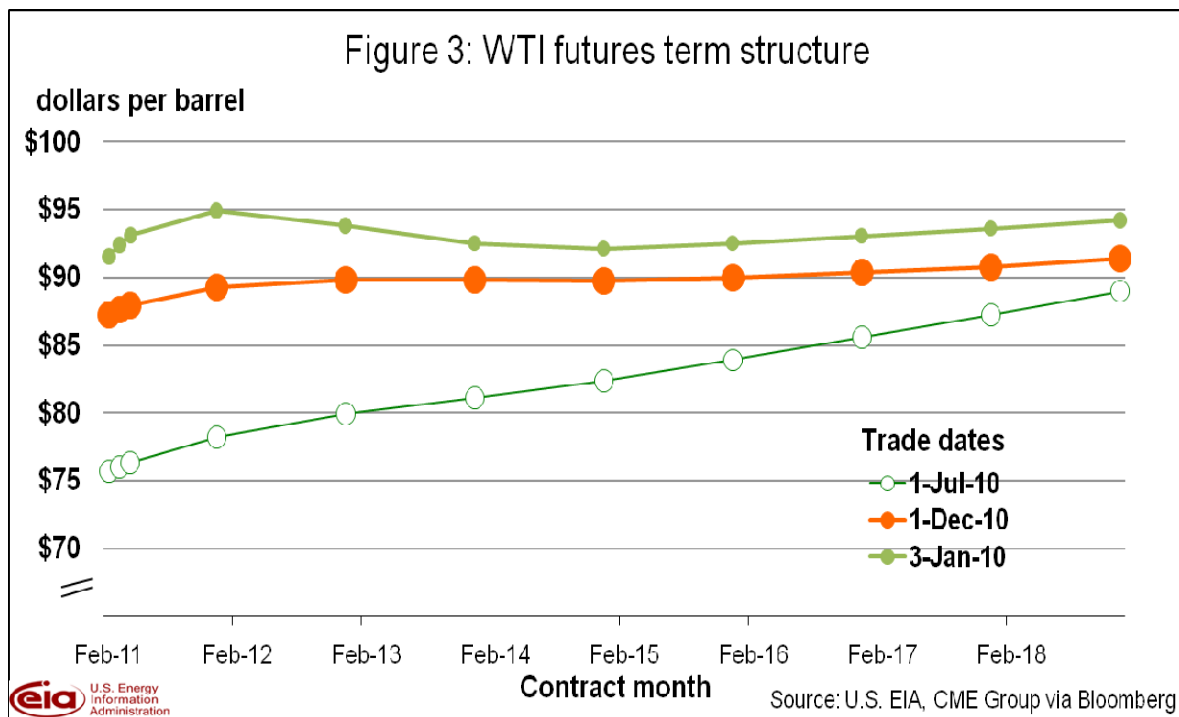
Crude oil prices continued to strengthen during the month of December (Figure 1), with the current front-month futures contract trading above \$90 for the first time since 2008. December was also the first occurrence since 2008 of the front-month price trading at a premium to the December 2011 and December 2012 contracts (Figure 2). Contract spreads traditionally move with changes in crude inventory levels; these levels have decreased in recent months due to strengthening demand. As a result, the trend of forward curve flattening continued during the prior month, with recent trading leading to minor curve backwardation after one year expiration (Figure 3).

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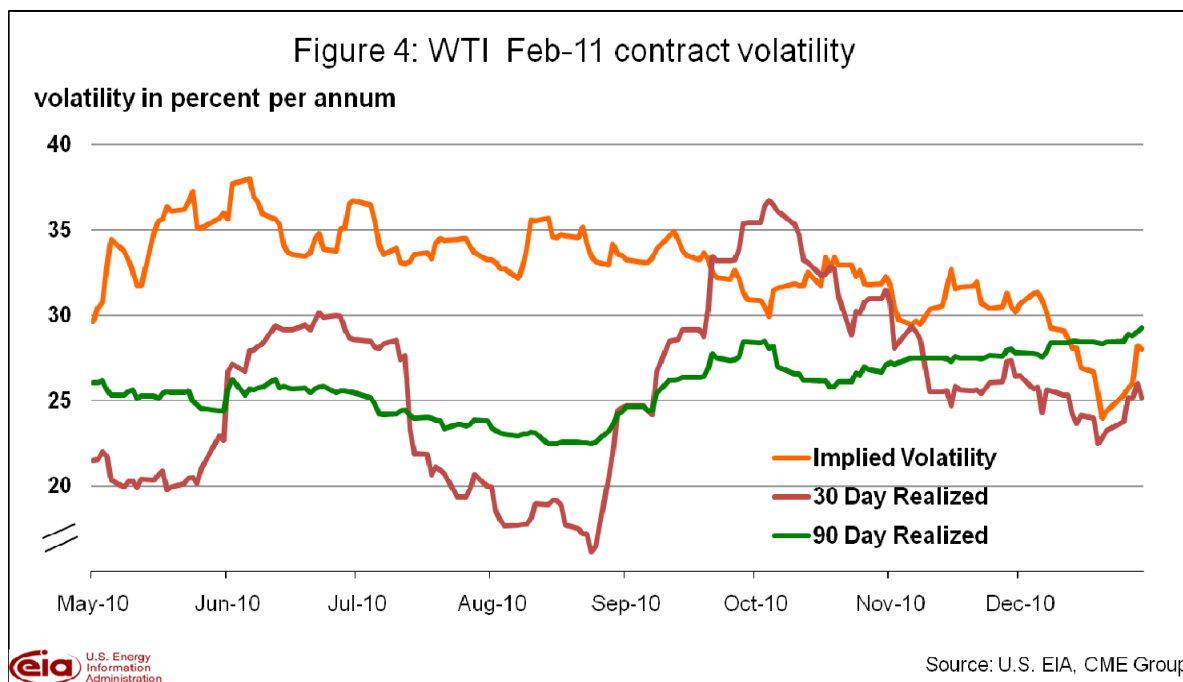
<sup>1</sup> This is a regular monthly supplement to the EIA *Short-Term Energy Outlook*.  
(<http://www.eia.doe.gov/emeu/steo/pub/contents.html>)

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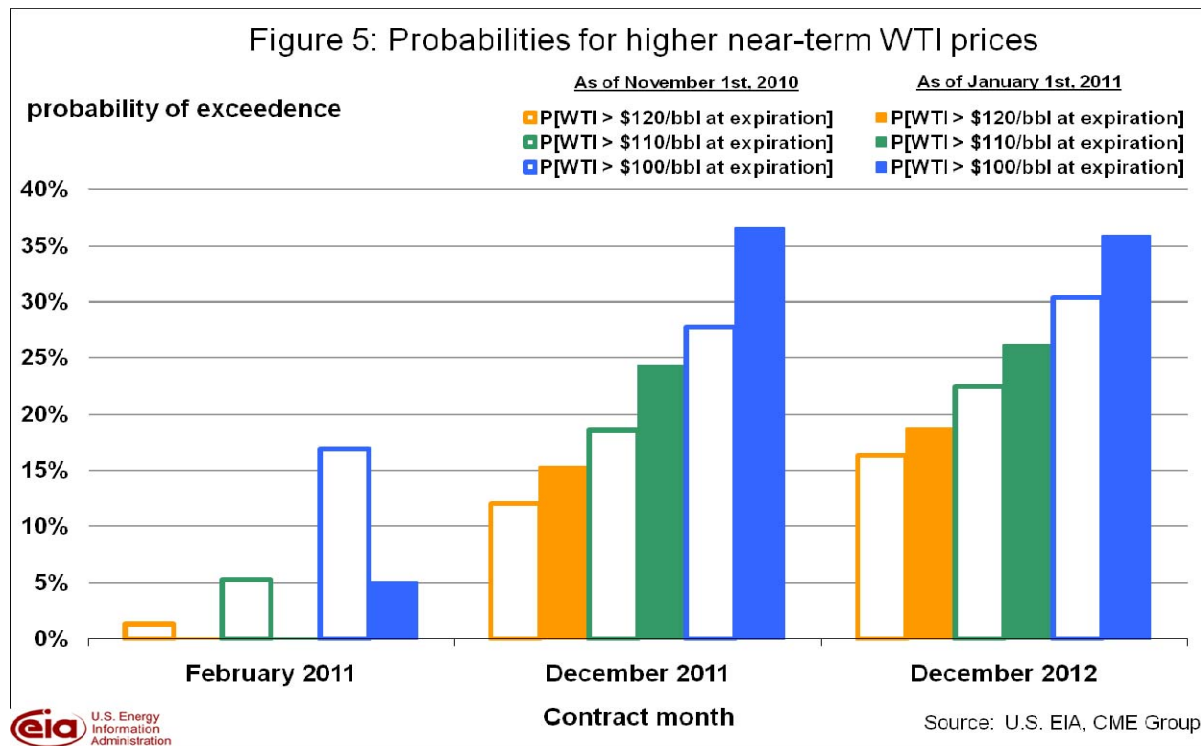


With higher prices and a strengthening economy have come decreased implied volatilities (Figure 4). During the month, the market saw front month implied volatilities drop from above 30 percent annualized levels to a low of 24. This reduction reversed in the final days of December, in what is traditionally a low volume holiday market.

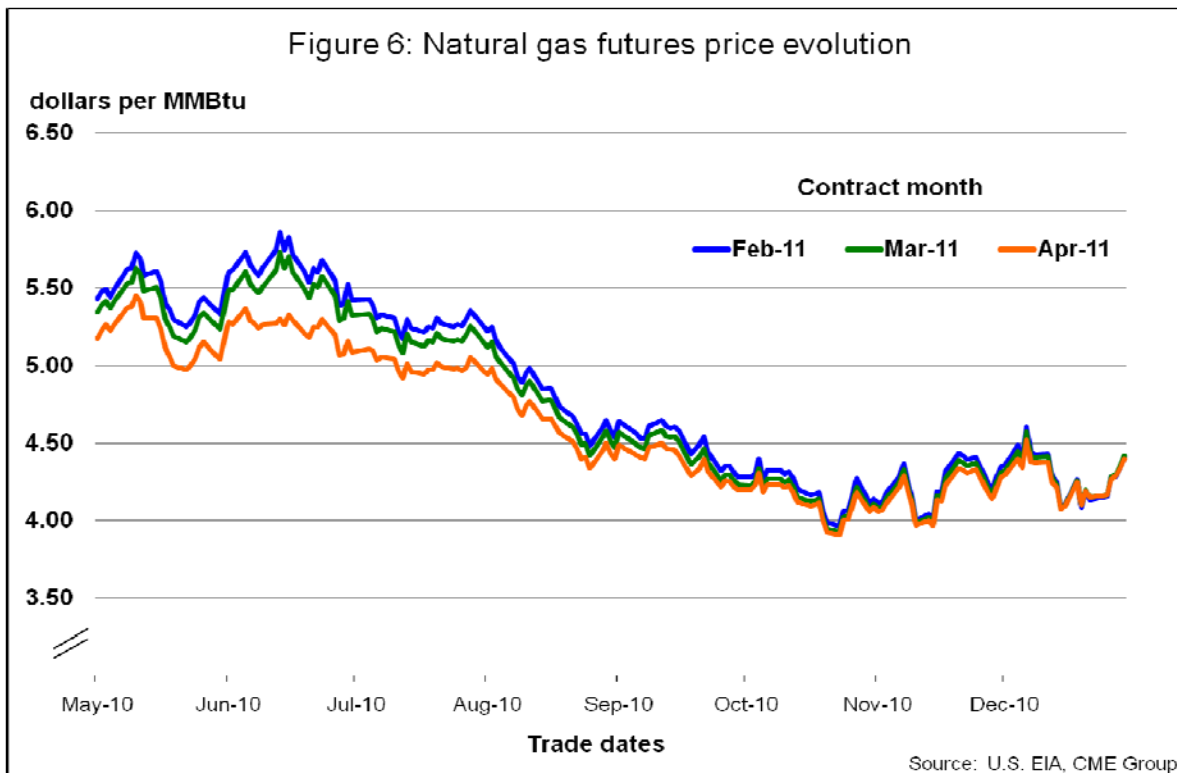


With WTI prices higher and volatility lower, EIA’s probability assessments for higher prices by the end of 2011 and 2012 generally moved up from levels calculated two months prior (Figure 5). Though the probability of reaching \$100/bbl by the expiration

of the Feb-11 contract is minimal (5 percent), this rises to over 35 percent by the end of both 2011 and 2012. If implied volatility returns to levels seen earlier in 2010, we are likely to see these chances further increase. 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 of how these probabilities are derived.)

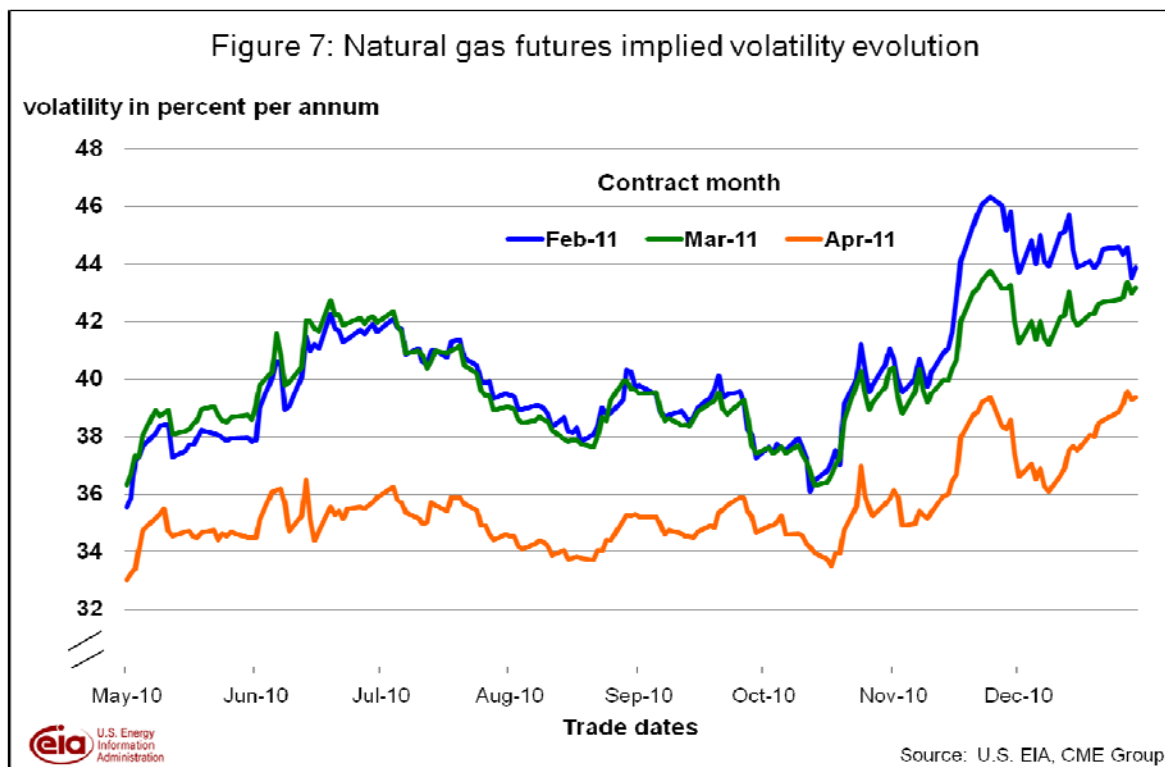


**U.S. Natural Gas Prices.** The Henry Hub spot price averaged \$4.25 per MMBtu during December, an increase of about 54 cents from November's price of \$3.71 per MMBtu; the February 2011 futures contract similarly increased to a monthly average of \$4.30 (Figure 6). EIA expects that the higher forecast production during the first half of 2011 compared with the same period last year combined with a decline in consumption will keep natural gas spot prices depressed for most of the year. The projected spot price falls to a low of \$3.75 per MMBtu in June then rises to \$4.64 in December, averaging \$4.04 per MMBtu for all of 2011, which is \$0.35 per MMBtu lower than the 2010 average and \$0.30 per MMBtu lower than in last month's *Outlook*. In 2012, the spot price rises to an average of \$4.53 per MMBtu.



Uncertainty over future natural gas prices is slightly lower this year compared with last year at this time. Natural gas futures for March 2011 delivery (for the 5-day period ending January 6) averaged \$4.39 per MMBtu, and the average implied volatility over the same period was 43 percent. This produced lower and upper bounds for the 95-percent confidence interval for March 2011 contracts of \$3.21 per MMBtu and \$6.02 per MMBtu, respectively. At this time last year, the natural gas March 2010 futures contract averaged \$5.73 per MMBtu and implied volatility averaged 57 percent. The corresponding lower and upper limits of the 95-percent confidence interval were \$3.88 per MMBtu and \$8.47 per MMBtu.

After moving higher in November, natural gas implied volatility eased downwards slightly as prices increased. For the February 2011 futures contract, implied volatility is 1.9 percent lower when compared to its level on December 1 (Figure 7). Natural gas implied volatility has a seasonal component which can be seen in the month of April, the month following the end of the winter heating season (October to March). With lowered demand, the risk of unexpected consumption falls and the market anticipates this with lower implied volatility on the April futures contract.



For the month of February, the chance that prices will rise above certain price points has continued to decrease (Figure 8); however, the market is now yielding greater probabilities of natural gas prices breaching higher levels by April 2011. Currently, there is just above a 22 percent chance of prices being above \$5 per MMBtu and a 4.4 percent chance of prices exceeding \$6 per MMBtu in April 2011. 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 8: Probabilities for higher NYMEX Henry Hub prices

