



Short-Term Energy Outlook

Energy Price Volatility and Forecast Uncertainty¹

February 12, 2010 Release

Crude Oil Prices. WTI crude oil spot prices averaged \$78.33 per barrel in January 2010, almost \$4 per barrel higher than the prior month's average and matching the \$78-per-barrel forecast in last month's *Outlook*. The WTI spot price peaked at \$83.12 on January 6 and then fell to \$72.85 on January 29 as the weather turned warm and concerns about the strength of world economic recovery increased. EIA forecasts that WTI spot prices will remain near current levels over the next few months, averaging \$76 per barrel in February and March, before rising to about \$82 per barrel in the late spring and to \$85 by late next year ([West Texas Intermediate Crude Oil Price Chart](#)).

Expected WTI price volatility was fairly steady over the month. April 2010 implied volatility (based on options prices) averaged 35 percent per annum during January, and, over the 5 days ending February 4, 2010, it was slightly over 34 percent. April 2010 WTI futures averaged \$75 per barrel over that same 5-day window, yielding a lower and upper limit for the 95-percent confidence interval of \$60 and \$94 per barrel, respectively (see [Energy Price Volatility and Forecast Uncertainty](#)).

One year ago, April-delivered WTI into Cushing, Oklahoma, was priced at \$45 per barrel, and implied volatility, at 74 percent, was more than twice the rate now trading in the options markets. Thus, the 95-percent confidence interval for April WTI futures had lower and upper limits of \$28 and \$72 per barrel, respectively.

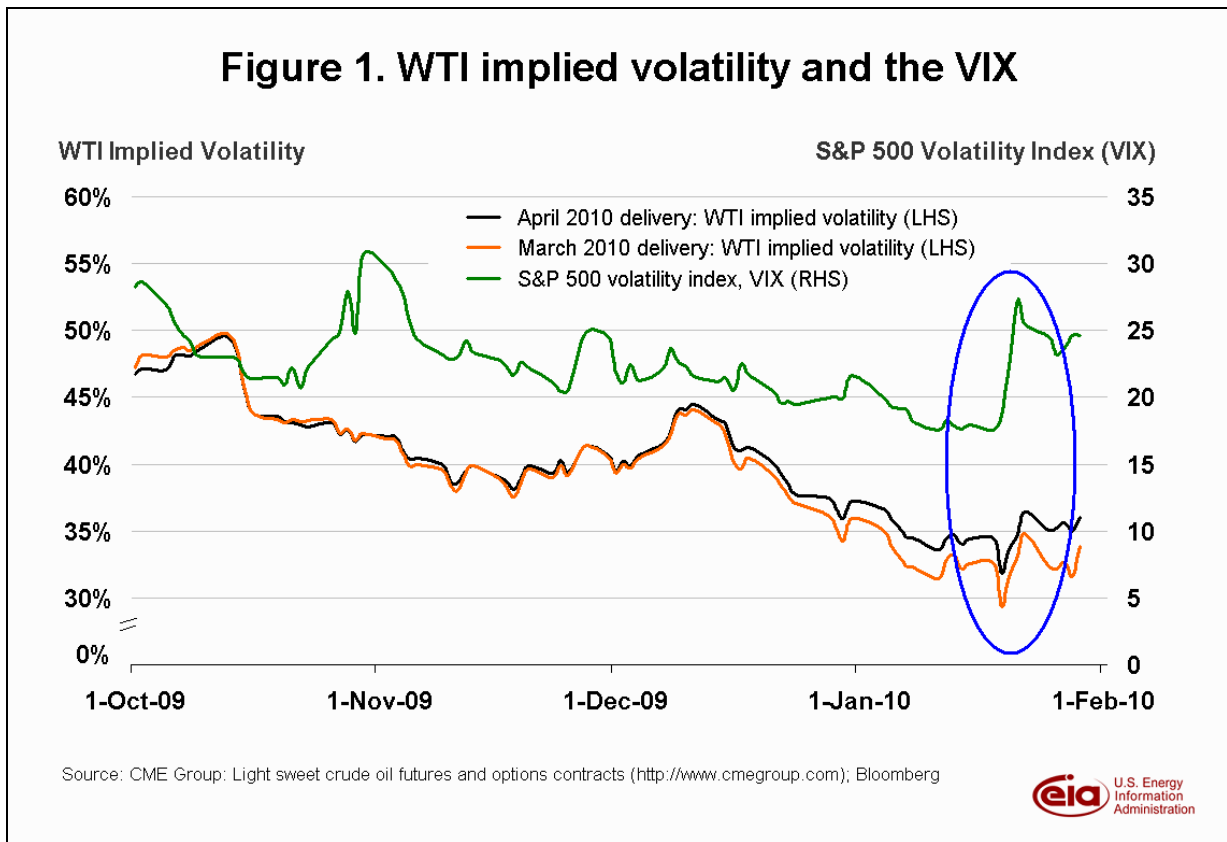
Prompt-month WTI implied volatility in the low- to mid-30-percent range still is below recent highs seen in October 2009, when implied volatilities were in the mid- to upper-40-percent range. But mid- to late-January saw the reversal of a downtrend in volatility in oil and financial markets that began in the fourth quarter of 2009.

¹ This is a regular monthly supplement to the EIA *Short-Term Energy Outlook*.

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

Contact: Bob Ryan (Robert.Ryan@eia.doe.gov)

Market participants' volatility expectations across trading markets generally picked up during the week of January 18. In the oil markets, implied volatility for options on the March 2010 WTI futures contract went from trading just over 29 percent Tuesday (January 19) to almost 35 percent by Friday (January 22).



Financial markets, particularly equities, saw much greater increases in expected volatility. The Chicago Board Options Exchange (CBOE) volatility index – known as the “VIX” – registered a sharp increase in mid-January, as is seen in the green curve in Figure 1, going to a level of more than 27 from less than 18 during the week of January 18 (Figure 1). That is an approximately 45-percent increase in a 4-day period. The VIX is short-hand for the CBOE’s VIX index, which is based on the S&P 500® Index, and reflects market participants’ expected volatility for equities.²

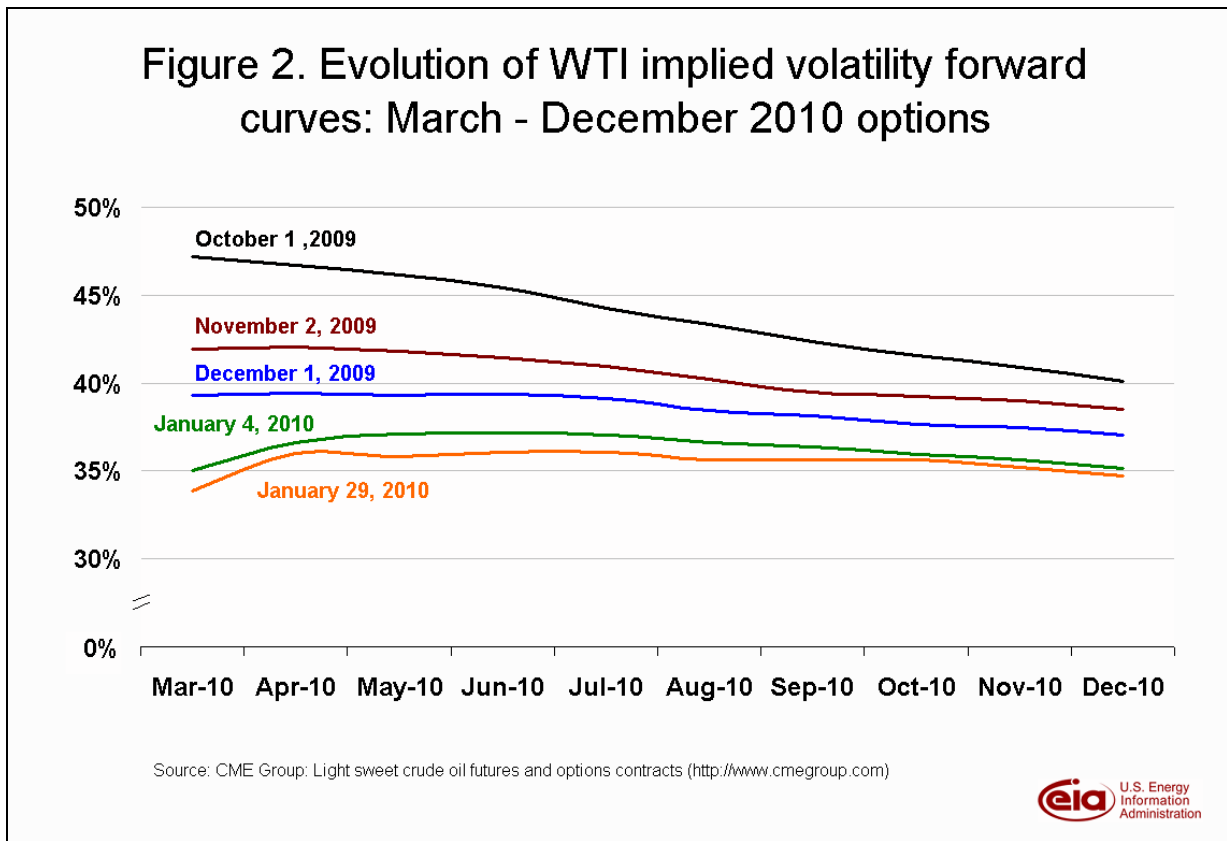
Chief among the factors cited by news services to be driving market uncertainty in mid-January were reports the Obama Administration would seek to separate some

² The VIX measures 30-day expected volatility of the S&P 500 Index. See “The CBOE Volatility Index – VIX,” at <http://www.cboe.com/micro/VIX/vixwhite.pdf> for a description of the index and its calculation. Essentially, the VIX is a weighted average of implied volatilities recovered from S&P 500 index options, which is multiplied by 100 to express it as an index.

risk-taking activities of U.S. banks from deposit-taking and loan-making functions under the so-called “Volcker Rule” (named after the former Federal Reserve Board Chairman Paul Volcker). News services reported market participants were surprised by the news, and expressed concern over the uncertainty such action could have on market liquidity.

Additional uncertainty was introduced in financial markets by numerous reports casting doubt on the re-appointment of Federal Reserve Board Chairman Ben Bernanke, who was ultimately reappointed on January 28 by the U.S. Senate.

Lastly, reports from the prior week that China’s central bank might impose higher reserve requirements on banks, in an effort to reduce the pace of lending, continued to add to demand-side uncertainty in petroleum markets and markets generally.



Despite the financial markets’ heightened uncertainty, by the end of January, expected volatility in the oil markets still remained below highs registered in the fourth quarter of 2009 (Figure 2). March 2010 implied volatility at the end of January went out trading under April 2010, continuing the inversion of the backwardated volatility term structure typically seen in oil markets. In the "normal" term structure for WTI

implied volatility, prompt implied volatilities are higher than longer-dated implied volatilities. Prompt implied volatility usually is higher than deferred implied volatility because supply of and demand for most energy commodities are price-inelastic as the commodities' delivery period approaches or is underway. (See the [January 12, 2010, Energy Price Volatility and Forecast Uncertainty](#) article describing these mechanics of the WTI implied volatility forward curve.) Market participants' expectations of higher volatility were extended into the second quarter of 2010, as April's implied volatility exceeded March's.

U.S. Natural Gas Prices. The Henry Hub spot price averaged \$5.83 per MMBtu in January 2009, \$0.49 per MMBtu higher than the average spot price in December and \$0.36 per MMBtu higher than the forecast for January in last month's *Outlook* ([Henry Hub Natural Gas Price Chart](#)). The Henry Hub spot price peaked at \$7.51 per MMBtu on January 7, as colder-than-normal weather tightened its grip on much of the country. Temperatures eased and the Henry Hub spot price fell to about \$5.30 per MMBtu by the end of the month. While the early cold spell contributed to a substantial withdrawal from working natural gas inventories, prices are projected to reflect an end-of-winter storage level that is still above the 5-year average. The relatively high inventory level combined with the increased supply potential from domestic resources should keep prices from rising dramatically this year. However, in addition to anomalous weather, unforeseen consumption increases in the electric power and industrial sectors could elevate prices above the current forecast. The Henry Hub spot price forecast averages \$5.37 per MMBtu in 2010 and \$5.86 per MMBtu in 2011.

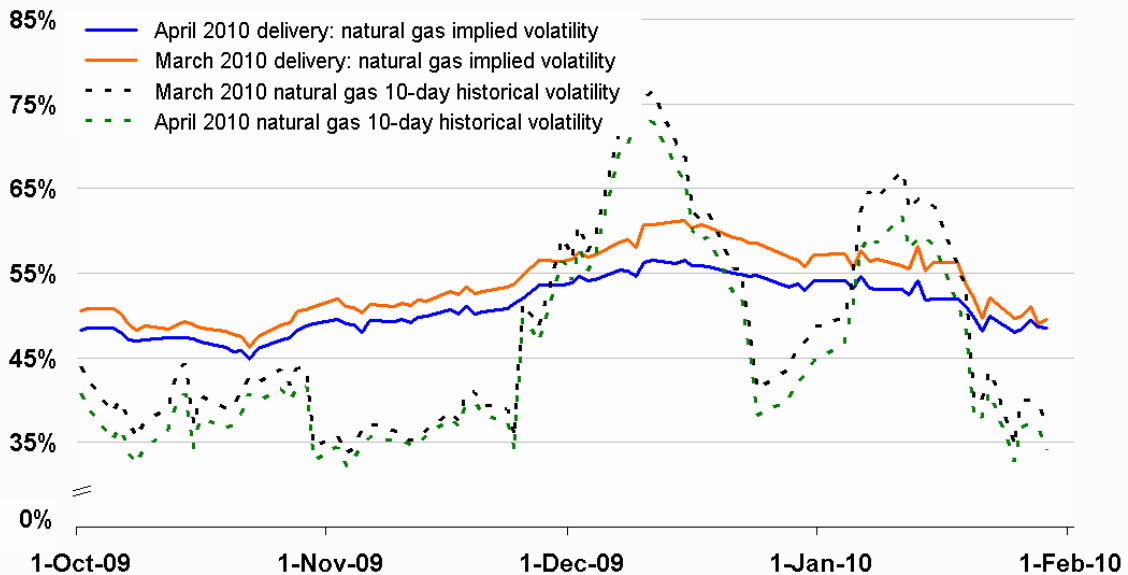
Both March and April implied volatilities based on natural gas futures market options contracts started the month in the 55-to-60 percent range and finished the month slightly below 50 percent. Implied volatility for April natural gas options averaged 46 percent per annum for the 5 days ending February 4, 2010. With the average April delivery price at \$5.35 per MMBtu for the 5 days ending February 4, the lower and upper limits of the 95 percent confidence interval were \$3.80 and \$7.50 per MMBtu, respectively.

Natural gas delivered to the Henry Hub during April 2009 was trading at \$4.60 per MMBtu at this time last year. Options market participants were pricing the April 2009 implied volatility at 60 percent, producing a lower and upper limit for the 95-percent confidence interval of \$3 and \$7 per MMBtu, respectively.

Contrary to the oil and financial markets, implied volatility in the natural gas markets trended steadily lower during January (Figure 3). Natural gas prices are driven

primarily by weather during the winter months, and expectations for the coming injection season beginning in April in any given year. Ample inventories allowed the markets to weather the unusually cold weather in the early part of January by drawing down storage. Furthermore, the prospect of an orderly refill beginning in April indicated no extreme events were being discounted by market participants as they look toward the coming injection season. Realized volatility, depicted as the 10-day historical volatility in Fig. 3, moderated as January came to a close, indicating price movement in the underlying futures contract was subdued as well.

Figure 3. Natural gas implied and historical volatility



Note: Historical, or realized, volatility is calculated as a rolling 10-day annualized standard deviation of daily log returns for a particular futures contract.
 Source: CME Group: Natural gas futures and options contracts (<http://www.cmegroup.com/>)

