Wednesday, February 25, 2009

Petroleum Club • 800 Bell (downtown)
Social 11:15 AM, Luncheon 11:30 AM

Cost: $30 pre-registered members; $35 for non-members & walk-ups; Emeritus/Life/Honorary: $15; Students: FREE

To guarantee a seat, you must pre-register on the HGS website (www.hgs.org) and pre-pay with a credit card.
Pre-registration without payment will not be accepted.
You may still walk up and pay at the door, if extra seats are available.

HGS General Luncheon Meeting

J. Michael Bodell
Aperio Energy Research

The Dynamics of Natural Gas Price Formation: Implications for Gas Producers

The United States reference cash or spot gas price is set at the Henry Hub (HH) in Sabine, Louisiana. The immediate weekly average value of HH spot natural gas is dependent on: 1) weather-related, near-term supply-consumption fundamentals; 2) the marginal cost of supply; and, to a minor degree, 3) the utility value of alternate fuels (e.g., low-sulfur No. 6 fuel oil and steaming coal) on a British Thermal Unit (BTU) parity basis. Yet the dominant factor in the systematic variability in spot gas price resides in the dynamics of supply and consumption. The tension between these fundamentals is reflected in weekly underground natural gas storage inventories as reported by the Energy Information Administration (EIA).

The weather — always unpredictable and never normal — is the major short-term supply-consumption driver in the evolution of storage inventories. Typically, moderate weather allows inventories to build as production advances over consumption and extreme weather depletes inventories. Of course, this explanation is a simplification because price over the long term has an impact on future gas supply, whether the supply comes from domestic resources or from imports such as liquefied natural gas or Canadian pipeline exports. Furthermore, long-term increases in use-efficiency lower consumption per heating or cooling degree-day even though a growing United States population — increasingly dependent on natural gas — boosts demand. However, weather, with its impact on storage inventory, is the primary short-term driver to changes in the spot price of natural gas.

When comparative inventories are net long, spot prices decline to a somewhat stable local minimum or plateau. Conversely, when inventories are short, spot prices rise.

The United States gas supply includes all existing and expected production (including imports), productive capacity (from wells that, for whatever reason, are not currently producing), and storage volumes. Domestic gas production is relatively flat or stable during the course of the year. In North America, during the spring, summer, and fall, production typically exceeds demand thereby permitting gas to be stored for use during the winter heating season. For supply to grow, favorable price levels need to be maintained over the long term. Lower prices force producers to lower investment, thereby threatening supply security, while elevated prices can induce "irrational exuberance" in investment. Price, therefore, becomes the de facto long-term market arbiter influencing supply in the face of uncertain and variable demand.

The market gauges the strength of the gas supply within the context of consumption through changes in storage inventories. More important, the weekly release of the EIA storage inventory data provides a regular measure of the readily accessible gas supply. Storage volumes become critical in the short term because they are the only reliable source of gas to balance a stressed market. In essence, the market understands whether prevailing storage levels are net long or net short relative to recent history (e.g., the most recent five years). Conceptually, the market expects a certain storage inventory or "cushion," and it prices natural gas accordingly.

Based on our research, the spot price for gas is highly correlated to the size of the storage cushion. We track this cushion, which we term "comparative inventory," meaning we evaluate prevailing volumes relative to a specific moving benchmark inventory. Analysis of this metric allows for a nearly real-time evaluation of the dynamic between supply and consumption, and the attendant price response. Exhibit 1 is an economic price-versus-quantity diagram that shows price variability in 2007 and 2008 as a function of change in net volumes. This price-quantity relationship is called a "yield curve" because of important non-linear dynamics in the value of gas as correlated to comparative inventory position.

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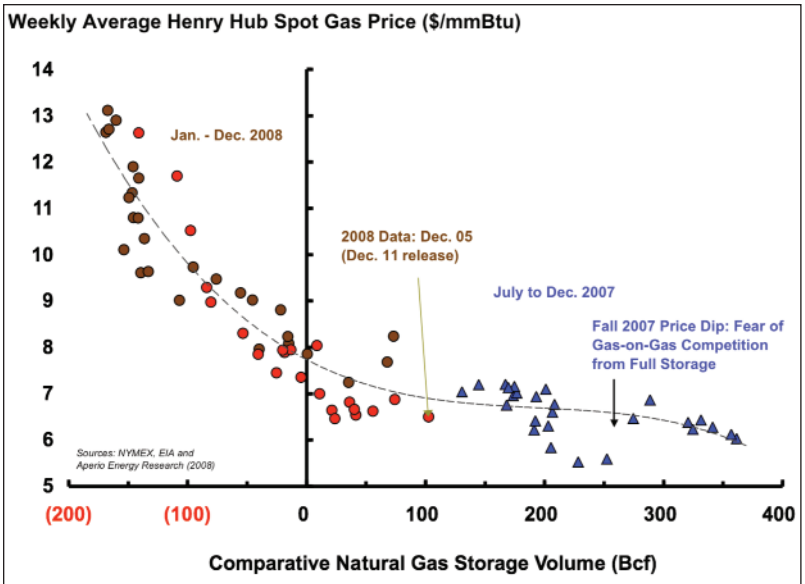

Exhibit 1 Yield curve showing the relationship between the weekly average Henry Hub spot natural gas price in US dollars per million BTU (y-axis) versus the national gas storage inventories relative to a benchmark inventory in billions of cubic feet (x-axis).

During early 2008, comparative storage inventories for natural gas moved into a deficit (brown data points) relative to a benchmark inventory and the weekly average Henry Hub spot gas price increased sharply as illustrated in this plot. However, after June 2008, the return of the Independence Hub to service in the Gulf of Mexico added to supply, allowing inventories to quickly rebuild a surplus (red data points) through late November despite a more than 400 billion cubic feet of storage drawdown due to hurricane-related losses. Sources: EIA, NYMEX, and Aperio Energy Research.

supplies are very short, prices rise very quickly (occasionally leading to high volatility, as seen in larger daily price changes) in an attempt to ration remaining physical inventory. Viewed in this way, it is clear that over the long term, the market uses rational price signals to encourage the development of stable sustainable supplies and to discourage the maintenance of surplus supplies. And when storage inventories are in severe stress (i.e., a deficit position), the market uses price to ration consumption, sometimes destroying demand and frequently creating an economic incentive to switch to an alternate fuel. Alternate fuel values, notably low sulfur No. 6 residual fuel oil and steaming coal, have several impacts on natural gas price. First, alternative fuel values create price breakpoints related to fuel switching economics. For example, oil price increases can pull up the value of natural gas toward parity with No. 6 fuel oil. The converse is also true, as seen in late 2008, as crude oil prices plummeted. Also, when the price for coal used in power generation increases, as it did in the first half of 2008 in response to global supply concerns, the effective floor value of natural gas rises.

In addition to its direct effect on the price of gas, a change in the price of oil can cause an up or down shift in the yield curve. In part, this effect may be seen as variability with respect to the trend in the data (refer to Exhibit 1). For example, if the crude oil price decreases by $1.00 per barrel, the value of No. 6 fuel oil typically declines. To maintain some semblance of BTU parity, the price of natural gas may respond likewise (changing about 10 to 13 cents per million BTU), although not always on a one-to-one basis. This relationship is complex and requires a detailed understanding of respective crude and natural gas inventories, supply, and demand seasonality. Moreover, natural gas price dynamics are separate from those of alternate fuels. In fact, an argument can be made that in 2007 and 2008, the value of crude oil had essentially no impact on the value of natural gas until December 2008, when No. 6 fuel oil declined below natural gas on a BTU-parity basis. In this case, because natural gas was net long, the declining value of crude essentially drove natural gas prices lower.

An evaluation of the historical price structure with respect to comparative inventory reveals a longer term "mid-cycle" price level or platform around which spot prices oscillate over a period of a year or longer. [Note in Exhibit 1, the mid-cycle price level at zero on the x-axis and the storage-related price variability about this point]. Theoretically, a change in the long-term price platform is the mechanism the market employs to secure adequate supply. Therefore, we postulate that the mid-cycle price is the effective cost of marginal supply required to maintain long-term supply consumption balance and to ensure some semblance of supply security.

This specific price level must be sufficient for at least 90 percent of producers to earn at least their weighted-average cost of capital of six to eight percent on the exploration and development of new resources. The market will not normally reward over-investment or mal-investment (mal-investment refers to development of resources with a very high cost structure such that the play fails to earn target returns at prevailing market-clearing prices) which is why we call this theoretical price level the "effective" cost of marginal supply. Therefore, a much higher cost structure attendant with the development of unconventional gas resources underpins the significant increase in natural gas prices from 2004 to 2007. Simply, the market increased spot prices until it secured an industry response that promised to balance supply and demand. As a consequence, the entire yield curve shifted to a new mid-cycle price point whereby the price-inventory trend was reestablished.

From 2007 to mid-2008, the marginal cost of supply appeared to be

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near $8.00 per million BTU, as noted in Exhibit 1 (0 on the x-axis). Higher gas prices drove record level drilling rig counts and permitted monthly gas production to increase at a faster pace though 2008. During the first half of 2008, a temporary deficit in comparative storage briefly elevated weekly average spot prices above $13.00 per per million BTU, which undoubtedly overstimulated producer investment in some cases. However, by late 2008, in the face of burgeoning domestic production and by then adequate storage inventories into the heating season, the market began to adjust that price level toward $7.00 per million BTU , if not a bit below, on the established and somewhat stable yield curve.

Meanwhile, producers have scrambled to improve cost structure among emerging unconventional plays in an attempt to build material reserves and improve cash margins. As a consequence, sharper project selection, greater drilling efficiency, and enhanced reserve recovery from sophisticated formation fracturing technologies have, in concert, lowered cost structure in important plays. Yet market efficiency is operating in a veritable Dutch auction to discover a lower mid-cycle price while constantly gauging producer behavior for signals that the new price level threatens future supply. To be sure, new, more prolific unconventional resources now in development will change the shape of the supply cost curve and justify the market's recent pricing behavior. ■

Biographical Sketch

J. Michael Bodell is a consultant who writes on market fundamentals for Strategic Energy Research, an energy investment advisory firm, and for Cambridge Energy Research Associates (CERA). He has over 30 years experience in the energy industry with particular concentration is the evaluation of resources, midstream opportunities, and risk management. He also has expertise in gas storage, gas trading, gas-fired power plant development, and natural resource exploration and exploitation. He was Director of Strategic Planning & Market Analysis at Unocal Midstream & Trade, where he was responsible for fundamental analysis and price modeling of gas for the North American market. Mr. Bodell has also been an industry advisor to the Independent Petroleum Association of America's Supply and Demand Committee; to the Western Interstate Energy Board (via the California Energy Commission, 2004 – 2005), to the National Petroleum Council on the 2003 North American Natural Gas Study; and to the Gas Research Institute 2000 Baseline study. He also advised the Federal Energy Regulatory Commission and the United States Department of Energy on natural gas market fundamentals pertaining to price formation. After a 25-year career with Unocal, Mr. Bodell joined CERA as a Director where he developed and managed a team that evaluated the industry-wide, full-cycle cost structure of natural gas resource plays in the United States and Canada. He holds a BS in geology and an MS in geophysics from the University of Utah and an MBA from the University of Ateneo de Manila.