#5 - Gas Boom Goes Bust

Posted by Jonathan Callahan on December 29, 2012 - 6:40pm

The Oil Drum staff wishes Happy Holidays to all in our readership community. We are on a brief hiatus during this period, and will be back with our regular publications early in the new year. In the meantime, we present the top ten of best read Oil Drum posts in 2012. The sixth in this series is a post by Jonathan Callahan on the US gas market and its unsustainable price level.

The current boom in drilling for 'unconventional' gas has helped raise US production to levels not seen since the early 1970's. This has been an incredible boon to consumers and has kept spot prices contained below $5 per million BTU for the past year, recently dropping below $3/mmbtu. Unfortunately, this price is below the cost of production for many of these new wells. When the flood of investment currently pouring into natural gas drilling operations dries up, the inevitable bust will be as scary as the boom was exciting.

The Problem

A well written and realistic overview of the situation appeared in a Dec. 6, 2011 article in Rigzone: Musings: Imagining The Future for The Natural Gas Industry. In this article, author G. Allen Brooks focuses on the damaging impact low natural gas prices have on the industry. The following excerpt captures the main message of the article:

> Gas shale wells are expensive to drill and complete as well are the cost of the leases on which they are drilled. Even though initial gas production from shale wells is huge, the low price has depressed the amount of cash companies are receiving. As a result, producers are spending well in excess of their cash flows. To supplement cash flow, producers have engaged in every known trick in the finance book to boost available funds. These tactics include hedging forward future production whenever high prices are available, tapping Wall Street to raise equity and debt, and seeking out relationships such as joint ventures with larger, and often foreign, oil and gas companies.
> In order to access Wall Street capital, producers have needed to demonstrate that they are being successful in exercising a strategy for aggressive wealth creation. That means aggressively buying acreage and drilling wells. Exercising a successful strategy often creates a vicious cycle – more acreage and wells equals increased production and depressed prices. This cycle will continue as long as the music (Wall Street's money) continues to flow. Once that stops, we will see how many producers can find a chair in the room. In the meantime, the fun continues!

Let's review the pertinent facts and big trends to try to understand the situation and get a sense of the most likely outcomes.

The Backstory

In recent years, the news media have contained lot of hype and misinformation about energy issues. Energy reporting is plagued with incorrect/inconsistent use of units, misleading charts and a general lack of critical thinking. In order to put the current natural gas crisis in context we need to understand the role of natural gas in the United States economy. A review of publicly available

data can help provide unbiased answers to several key questions.

Question 1) How does natural gas figure into our overall energy consumption?

Figure 1) from the Energy Export databrowser shows US energy consumption of the five primary sources of energy: nuclear, coal, oil, gas and hydro-electric. Data are in consistent units of "million tonnes of oil equivalent" (mtoe) as provided in the British Petroleum Statistical Review. [1] The general trend toward increased energy consumption is obvious as are dips due to the 1973 and 1980 oil crises as well as the economic crash in 2008. Initial data for 2010 show a return to increased consumption following the massive injection of Federal stimulus money. We can also see that oil is the primary source of energy in the United States and that natural gas has recently outpaced coal in importance. In 2010, natural gas accounted for 30% of total energy use.

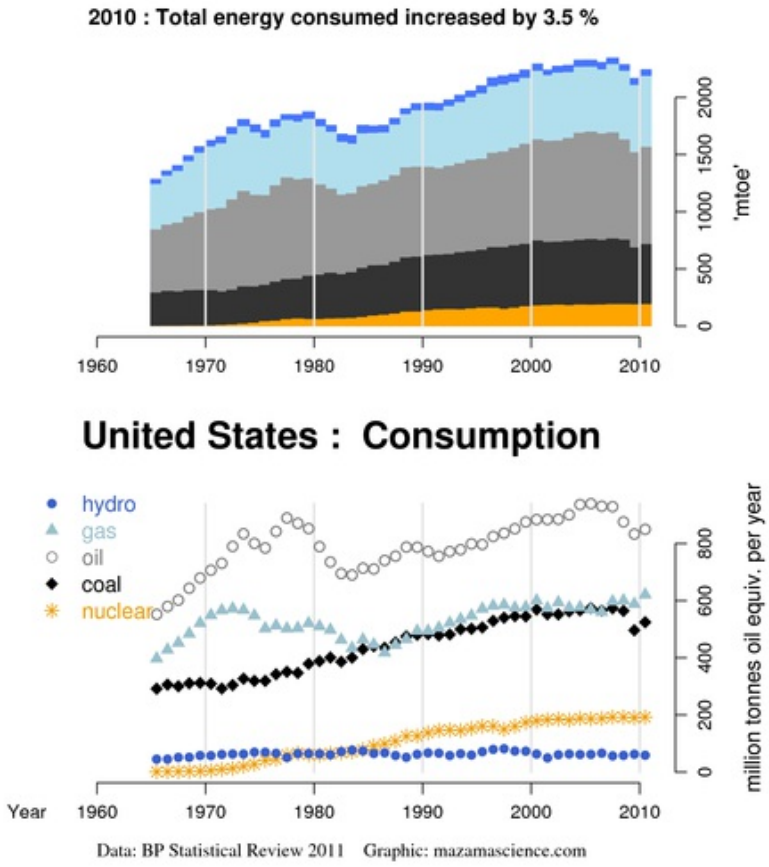

Figure 1) US consumption of energy from primary sources.

Question 2) What is the balance of production and consumption for natural gas?

Figure 2) uses the difference between production and consumption data to estimate net imports/exports of natural gas. Production matched consumption throughout the 70's and 80's. Since 1990, the US has had a pretty steady import habit with almost all of the imports coming from Canada. [2] Production has been increasing quite steadily since 2006 but we have also seen increased consumption some years resulting in only a small decrease in imports. Nevertheless, it would only take a modest conservation effort for the US to become "energy independent" with respect to natural gas. Unless, that is, more consumption switches from using oil as a fuel to using natural gas. As we saw in Figure 1), replacing even a fraction of our oil use with natural gas would quickly overwhelm US natural gas supply.

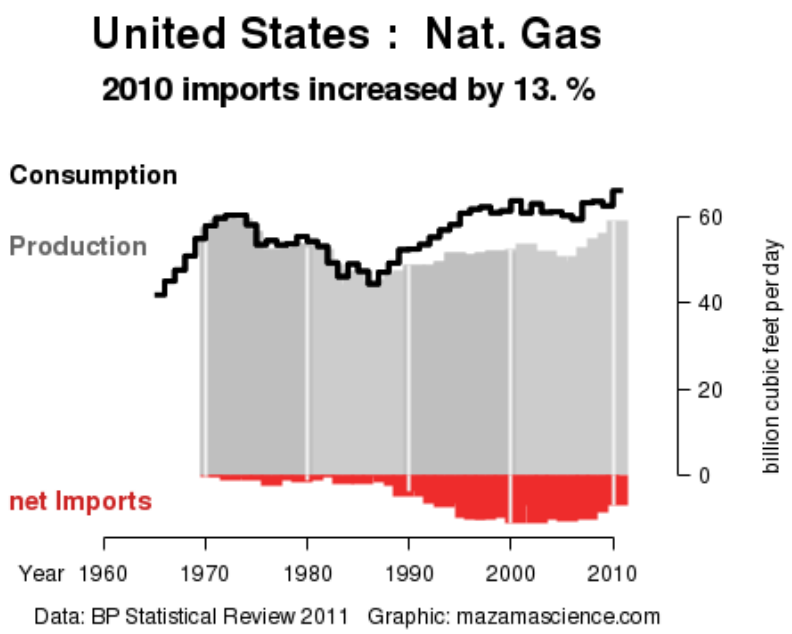

Figure 2) Production (gray), consumption (black line) and imports (red) of natural gas.

Question 3) How is natural gas used in the United States?
The US Energy Information Administration has data on Natural Gas Consumption by End Use. Figure 3) shows the categories tracked by the EIA along with one more that appears to be planning for the future. Natural gas vehicles currently account for only 0.14% of total consumption.

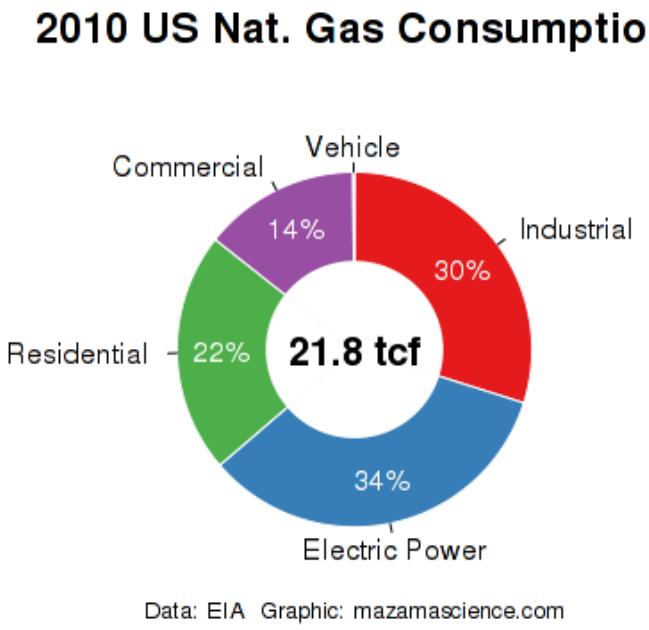

Figure 3) US Natural Gas consumption by sector.

Question 4) How have natural gas prices evolved?
Figure 4) brings together data from three different EIA datasets [3] It is clear that prices before the year 2000 were relatively stable compared with prices after 2000. The increase in drilling rig activity after 2000 is also evident along with a significant increase in marketed production of natural gas beginning in about 2006.

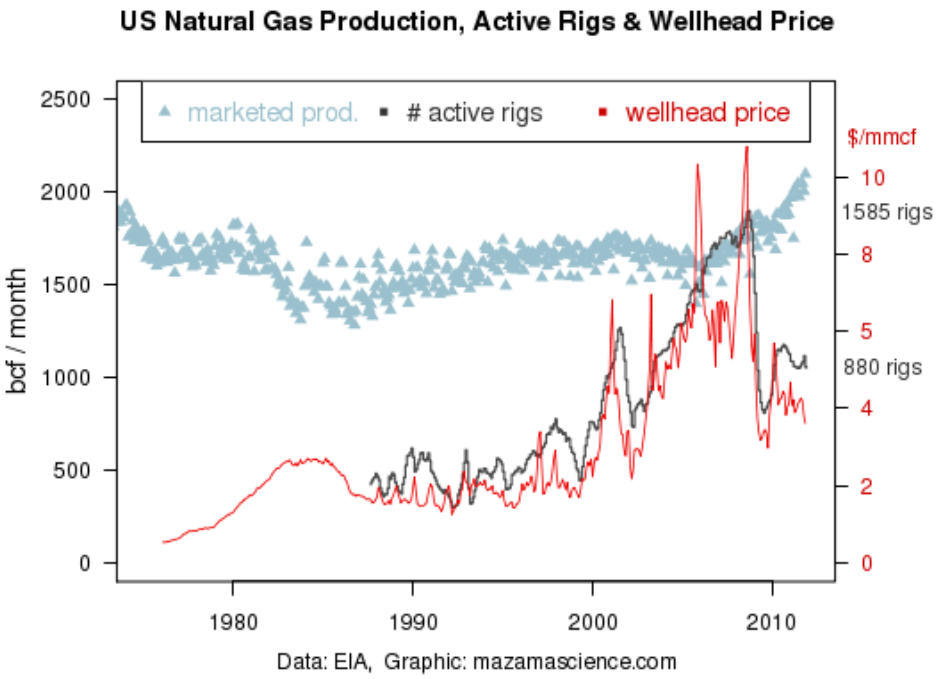

Figure 4) US Natural Gas Production, Active Rigs and Wellhead Price

It's worth having a closer look at the period since 2000 as seen in Figure 5). Here we can see how the number of active rigs often closely follows the price with a 6-12 month delay. The connection between number of rigs and production is less obvious but it seems clear that the sustained rise in active rigs after about 2002 has been responsible for the steady increase in production since 2006. Surprisingly, the rapid drop-off in drilling activity since 2009 has yet to result in any decrease in production.
A detailed explanation of the four price spikes seen in the chart is given in a March 6, 2009 Oil Drum post: The Anatomy of a Natural Gas Price Spike – Past and Future.

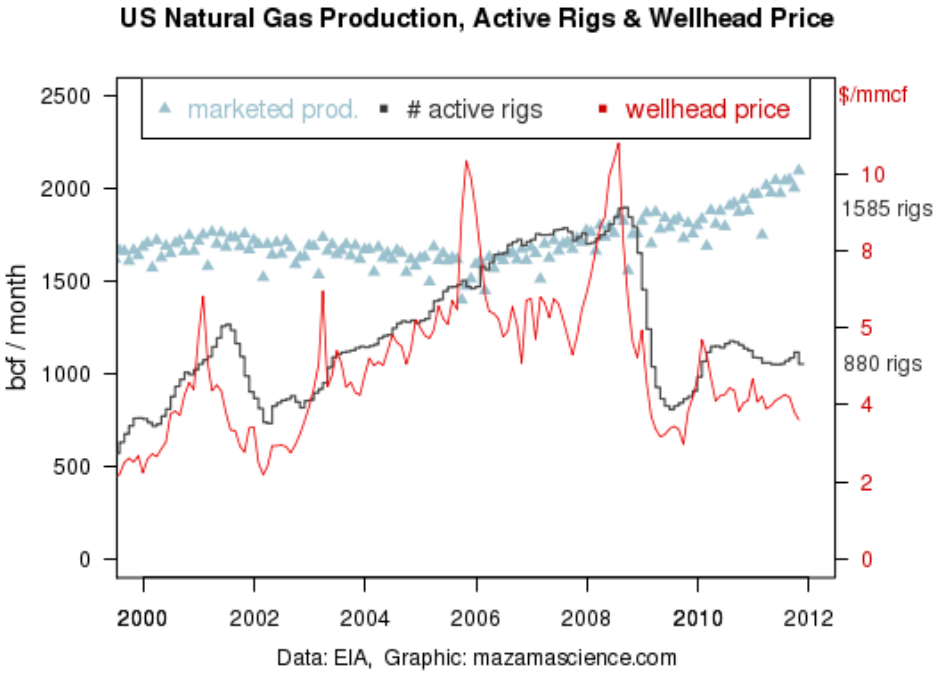

Figure 5) Natural gas production, rigs and price since 2000.

Question 5) How much natural gas is in storage?

According to the EIA Short Term Energy Outlook, a warm winter has left the use US with record amounts of natural gas in storage for this time of year. Figure 6) shows that the US is currently

above the upper range of historical levels and are projected to stay there. Nothing is certain, of course. A disruptive hurricane, a bitterly cold and extended winter, or a punishing summer heat wave could bring storage back down. But without any of these extreme-weather events the EIA is projecting that the natural gas glut will continue for at least the next two years.

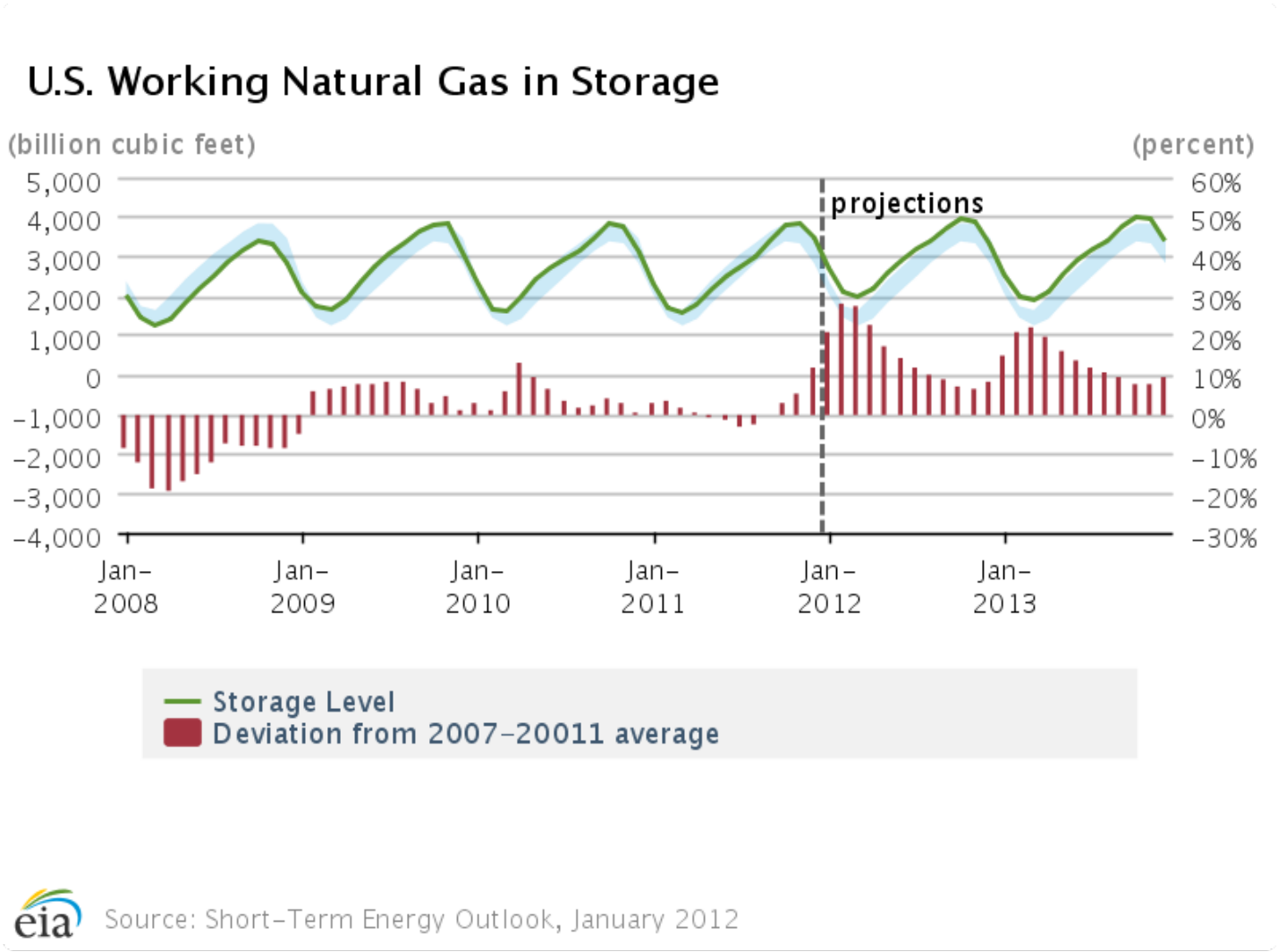

Figure 6) Natural gas storage levels.

The Finance Story

As is evident in the graphs above, a recent increase in natural gas production, combined with decreased consumption due to a warm winter, is leading to a supply demand imbalance and very low prices in the United States. The question that now arises is: To what extent can current prices support additional drilling? To answer this question, we need to understand how energy companies use the markets to *hedge* — to sell product forward to lock in a price.

Question 6) How does 'hedging' work?

Drilling a natural gas well takes time, typically from 3-6 months from spudding until completion. When drilling begins, companies have an estimate of what it will cost to complete a well. If they hire talented geologists, they will have a reasonable guess as to the amount of natural gas they hope to find. What they don't know is what price that natural gas will command 6 months – 2 years down the road. For this they have two options: 1) gamble that the price in a year will be high enough to generate a profit; or 2) 'hedge' by selling production forward on the futures market.

There is always a market today for natural gas that is to be delivered in the future. (Henry Hub natural gas futures). The sellers of these *futures* contracts are the natural gas producers who want to guarantee a price minimum. The buyers of these futures contracts are typically large consumers of natural gas like power plants who want lock in a price maximum. It's basically the same thing as buying a season's worth of heating oil at a fixed price the summer before the winter heating season.

We can do a little time traveling by looking at what the futures contracts for natural gas were two years ago when the now 1-year-old producing wells were first penciled out on corporate balance sheets. A *futures chain* simply connects the futures contracts for one month out, two months out, *etc*. to form a continuous chain when plotted. Figure 7) shows futures chains for natural gas leading up to January 23, 2010. On that date, the futures chain had a seasonal cycle which shows that natural gas prices are generally expected to go up for the winter heating season and then down in the spring. Figure 7) also shows what was expected at that time to be a generally increasing price trend.

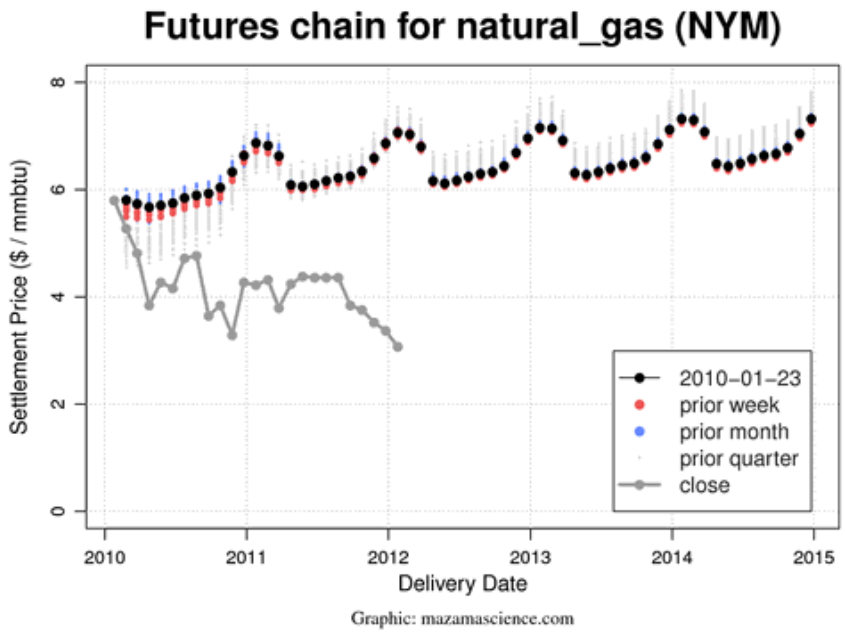

Figure 7) Natural Gas futures chain from Jan 23, 2010.

On January 23, 2010, natural gas for delivery in February of 2012 could have been hedged (sold forward) at ~ $7/mmbtu and would have generated a tidy profit if well completion costs ended up in the $4/mmbtu range. (Please note that futures prices are given per million BTU while production is given in units of thousand cubic feet. The conversion factor depends upon the gas stream but is typically somewhere between 1020-1100 BTU/standard cubic feet. A **very** rough conversion is 1 thousand cubic feet (kcf) ≈ 1 million BTU (mmbtu).)

Things looked a little different in late January, 2012 as seen in figure 8). On January 22, 2012, if companies hedged 100% of their production 6-24 months out they would have gotten less than $4/mmbtu in February 2014.

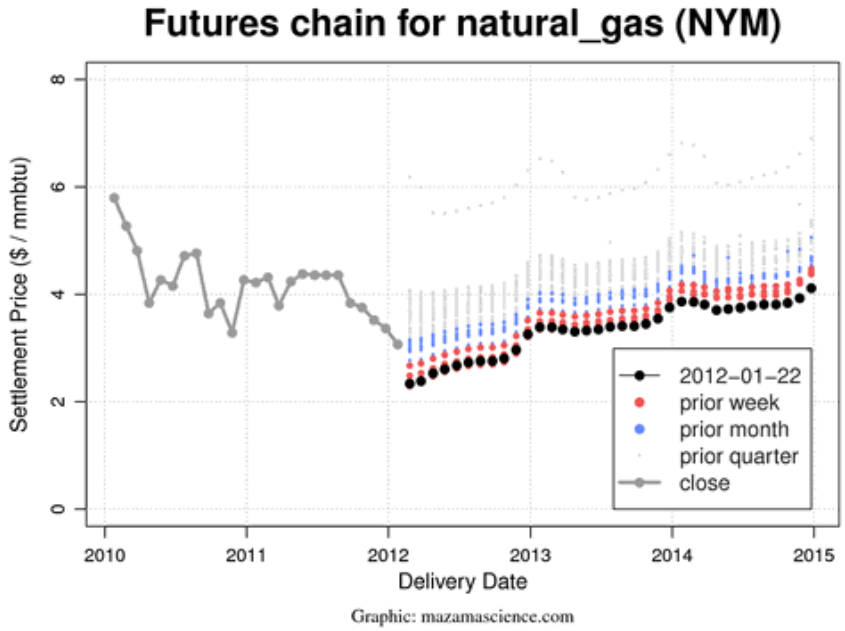

Figure 8) Natural gas futures chain from January 22, 2012

To make things clearer, lets take a look at the evolution of a single futures contract — the four-month futures contract. If you started drilling a well today you might hope to have significant production in four months and could lock in a price with the four-month futures contract. Figure 9) shows how the price of that contract has evolved over the last two years, briefly touching $4/mmbtu on a few occasions before moving decidedly lower on October 15, 2011.

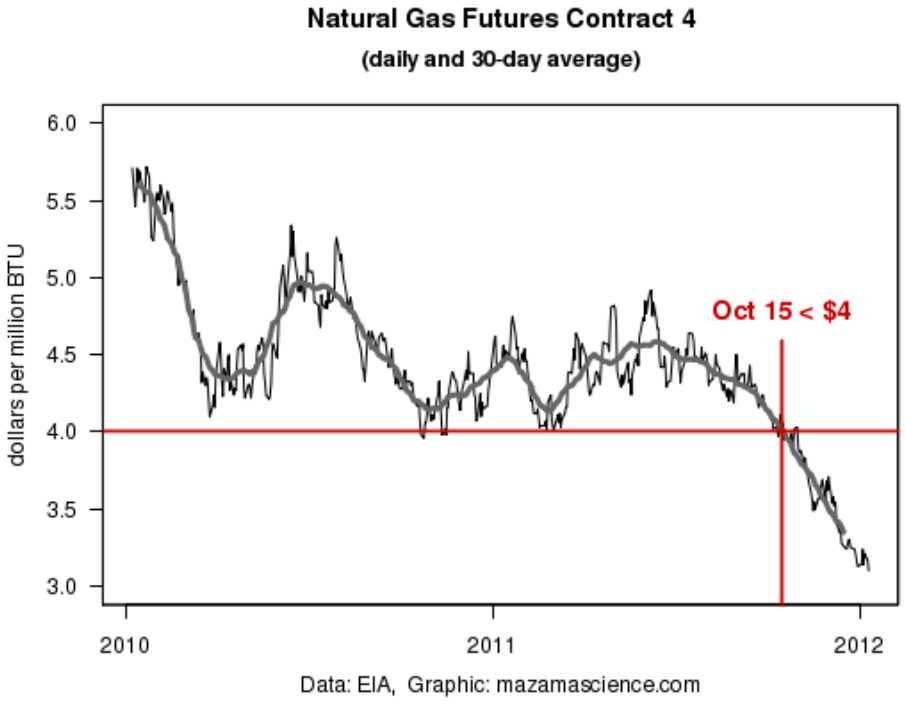

Figure 9) Evolution of natural gas four month futures contract.

Question 7) Who can make money at these prices?

From figure 4) we know that prices below $4/mmbtu were typical before 2000 but very rare since then. Given our lead off quote's contention that "gas shale wells are expensive to drill and complete" we need an assessment of which shale gas plays can turn a profit when prices are below $4/mmbtu.

Luckily, Goldman Sachs already did this analysis as reported in a recent presentation by Range Resources. (I would encourage anyone interested in shale gas production and finance to look at this report. While I am often skeptical of corporate reports, this presentation answered a number of questions with detailed information and charts.) Slide 11 from this report contains information from the Goldman Sachs report on the NYMEX price required to produce a 12% Internal Rate of Return — the threshold for a project to receive financing. Transcribing the information from the Range Resource presentation and adding on $3/mmbtu and $4/mmbtu thresholds paints a rather ugly picture for the shale gas industry today as seen in figure 10).

A detailed and even less optimistic study of well performance and potential profitability in various shale gas plays also appeared in an August 5, 2011 Oil Drum post: U.S. Shale Gas: Less Abundance, Higher Cost.

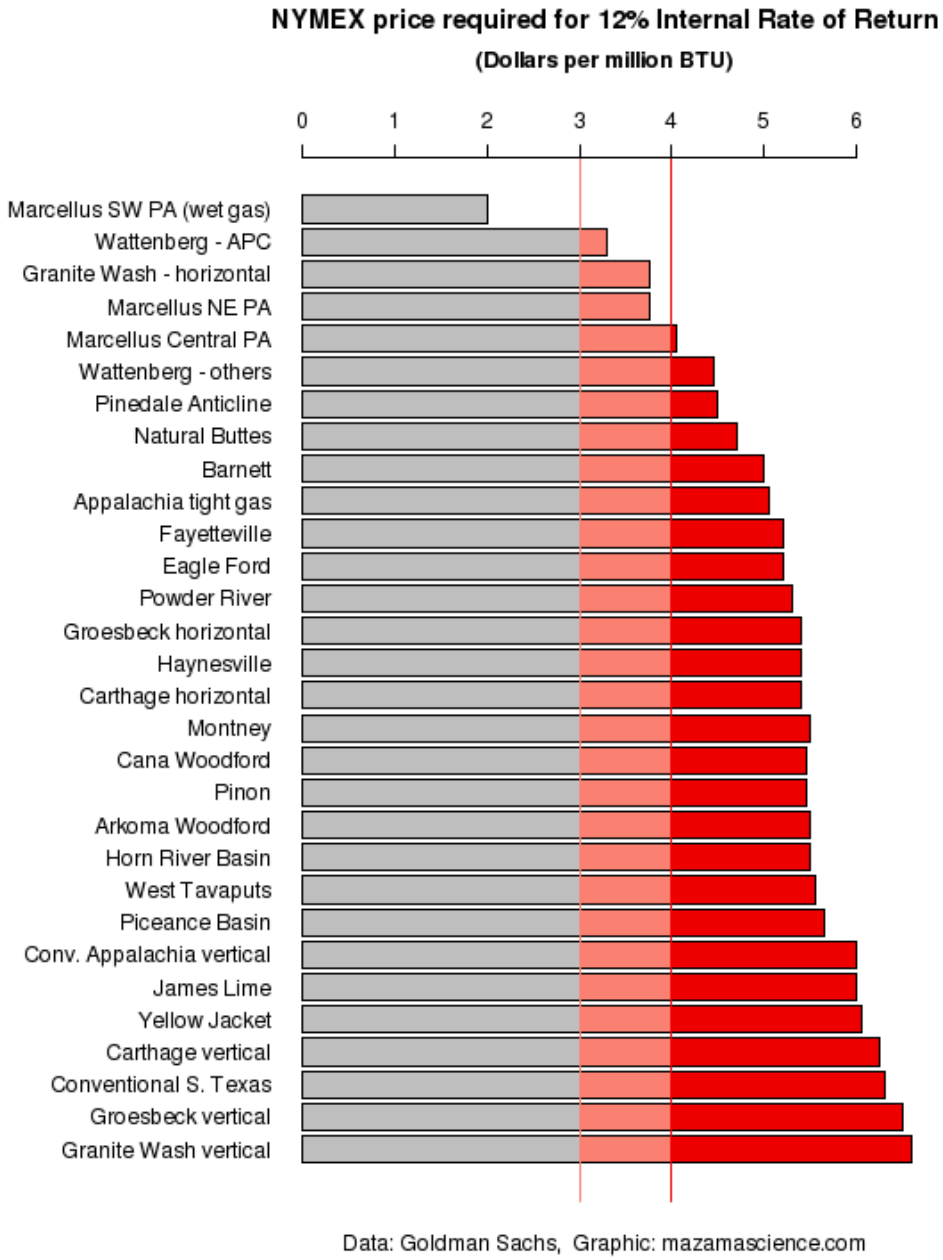

Figure 10) Relative profitability of various shale gas plays

The Bust

The situation depicted in figure 10) is not just theoretical.With current spot and future prices

below the cost of production, some companies are in trouble. Here are some newsworthy items to convince you that the jig is up — whatever the President said in the State of the Union speech.

Jan 20: Form 8-K for EQT CORP

> In light of lower natural gas prices, the resultant reduction in projected cash flow, and consistent with its determination to live within its means financially, EQT Corporation has decided to suspend development in the Huron indefinitely.

Jan 23: Natural gas glut, low prices, prompt Chesapeake to cut exploration and production

> Faced with decade-low natural gas prices that have made some drilling operations unprofitable, Chesapeake Energy Corp. says it will drastically cut drilling and production of the fuel in the U.S.

Jan 24: Prices continue to slide on gushers of natural gas

> "It would not surprise me to see gas prices below $2," Schenker said. "If supply continues to outstrip demand in a massive way throughout the year, it's going to be hard to find a bottom for the market."

Jan 26: Carbo Ceramics down almost 20% following disappointing earnings report

> Noting "challenges beyond typical seasonality," the company said the severe decline in natural gas prices during the quarter led E&Ps to reduce capital spending, leading to a sequential reduction of about 70% in its Haynesville proppant sales volumes.

Jan 30: Comstock to focus drilling on oil plays

> US producer Comstock Resources has become the latest gas-focused player to shift its investment away from natural gas amid low prices.

Jan 30: Natural gas price drops after Energy Dept. report shows supplies well above 5-year average

> Barring any unseasonable swings in the weather, natural gas companies likely will trim production by another 2 billion cubic feet per day this year, independent energy analyst Stephen Smith said.

The Consequences

Clearly, low prices are going to affect many in the industry. But that is not all. Low gas prices put pressure on other sources of energy used to produce electricity. Natural gas competes against coal and wind and solar photovoltaics and is now the lowest cost provider. We should expect 2012 to

be a year in which we see a variety of knock-on effects:

- Natural gas producers and investors with poor hedge books and too much debt will end up in bankruptcy court.
- Drilling operations will focus on liquids-rich plays only.
- Jobs creation in the natural gas drilling industry will fall well short of expectations.
- Several older coal-fired plants will close.
- New wind power generation will fall — especially if the production tax credit is not extended.
- Natural gas fueled fleet vehicles should become more popular.

Low gas prices will have positive and negative ripple effects throughout the economy. The final question one has to ask is: "How long will prices stay this low?" And that is one for which there is simply not enough public information available. It would take a serious accounting effort, using the production stats from all producing gas wells to make some decent estimates about decline rates.

The bottom line is that natural gas is a cyclical industry which recently enjoyed a very large boom. As night follows day, a bust is sure to come. Based on the information presented above, I would humbly submit that it has just arrived.

Footnotes:

1. In Figure 1) the primary energy values of both nuclear and hydroelectric power generation have been derived by calculating the equivalent amount of fossil fuel required to generate the same volume of electricity in a thermal power station, assuming a conversion efficiency of 38% (the average for OECD thermal power generation). [↩]
2. EIA — US Natural Gas Imports by Country [↩]
3. Data for Figure 4) include EIA datasets: Gross Withdrawals and Production, Crude Oil and Natural Gas Drilling Rig Activity, and Prices. [↩]