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US Natural Gas Prices: "The Fix is Underway"

Posted by Gail the Actuary on April 22, 2009 - 10:26am
Topic: Supply/Production
Tags: drilling rigs, jon freise, natural gas [list all tags]

This is a guest post by Jon Freise. Jon has written several previous guest posts related to natural gas.

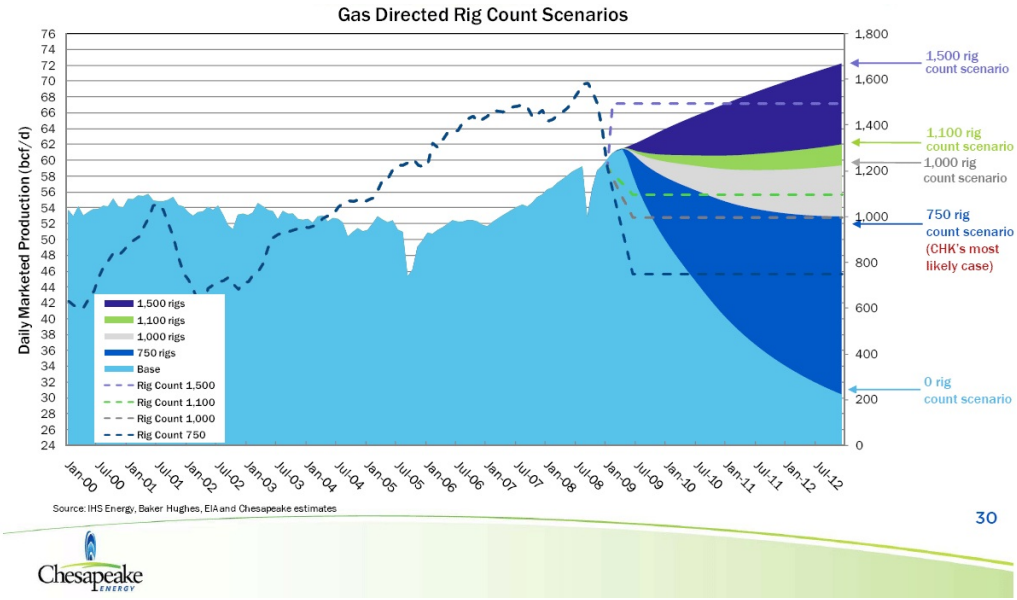

Figure 1: Future gas production based on final rig count drop
Source: Chesapeake Energy
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"The fix is underway" says Chesapeake Energy in their April Investor Presentation. What they mean is that natural gas prices are going back up this winter. The number of rigs drilling for natural gas is going down. Fewer rigs means fewer new wells and eventually less natural gas and higher prices for consumers.

This is the third article investigating the possibility of a spike in natural gas prices during early 2010. In this article we look at the scenarios Chesapeake has created based on the how low the drilling rig count goes (shown in Figure 1). And we dig a bit into the other factors that could increase or decrease demand for natural gas.

Quick Summary

As a kindness to those who are busy planting tomatoes and just want to know if they should order

wood pellets for next winter, here is the quick version: The number of rigs has already fallen enough to cause natural gas prices to rise next winter:

"CHK sees U.S. natural gas prices at Henry Hub averaging $4-6/mmcf in 2009 and $7-9 in 2010 and beyond"

We don't yet know if drilling will be cut back enough to cause a spike into a higher $12-$13 mmcf range (like prices did in 2005 after Hurricanes Katrina and Rita).

The Spike-Dip-Spike Pattern

The last 10 years have shown a repeating pattern of natural gas price spikes and dips (covered in more detail in Anatomy of a Natural Gas Price Spike).

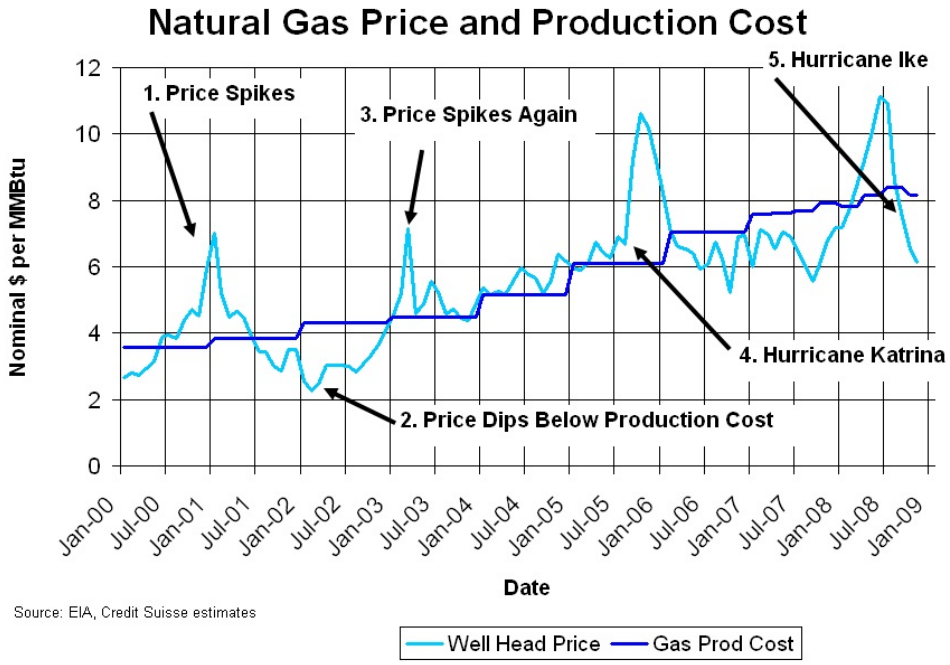

Figure 2: Natural Gas Wellhead Price and Production Cost
Source: EIA and Credit Suiss
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The reason for this repeating cycle is that price dips cause reductions in the number of wells drilled. Those reductions cut the flow of natural gas until a shortage develops. Prices then spike as consumers compete for too little natural gas.

High prices cause users to cut back on natural gas purchases and encourage more wells to be drilled. Eventually these cause an excess of natural gas and prices fall into another dip, setting up the next spike and repeating the pattern.

We are currently experiencing a dip after the 2008 price spike. (Just past arrow 5 in Figure 2). The current well head price for natural gas is far below the average producing cost, meaning that most natural gas producers cannot make a profit at these natural gas prices, and for this reason they are drastically cutting back the number of drilling rigs.

Balancing the Market

The question is how many rigs must be cut back to balance the market? And what further cut in rig numbers would cause a price spike?

Chesapeake put together some scenarios and published them in their March and April 2009 Investor Presentations. They lay out their logic for calculating the balance point:

2008 U.S. gas production YOY increase of ~7%, or ~4 bcf/day

2008 natural gas rig count averaged ~1,500 rigs - this overcame first year depletion of ~25% and generated growth of ~7%, for a combined ~32% addition rate

If natural gas rig count went to zero, then all would agree this ~32% number would also become zero

So, if natural gas rig count goes down by 50% in 2009, CHK believes industry will lose nearly 40% of this ~32% production capacity increase, through which ~7% growth disappears and ~7% production declines appear by 2010.

So, YOY growth of ~4 bcf/day in 2008 will soon give way to a decrease of ~4 bcf/day, setting up a big price rebound in 2010 and 2011 if U.S. economy does not materially weaken from here

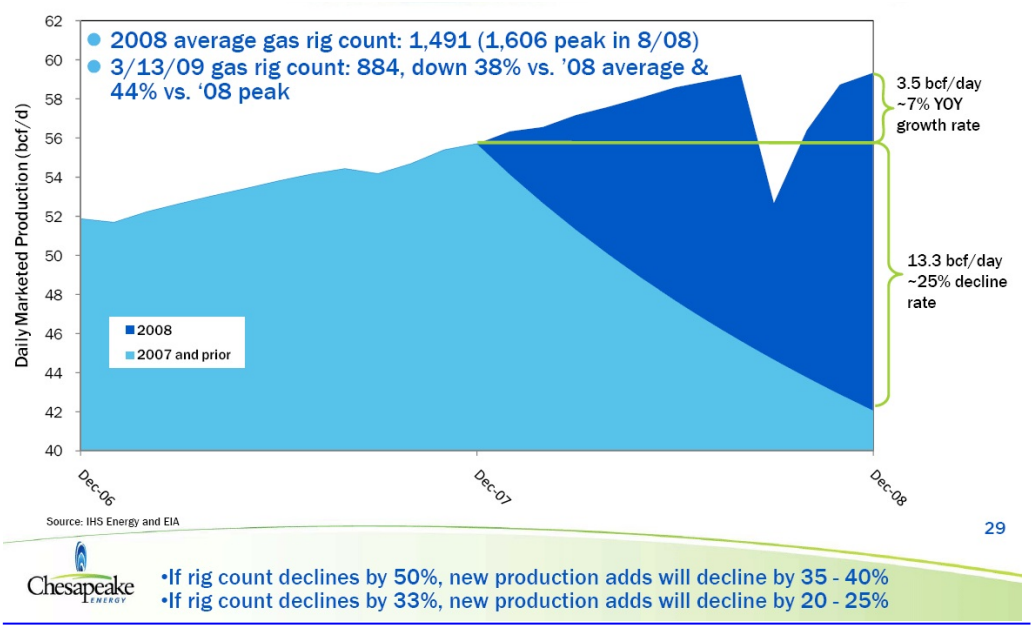

Figure 3: Decline Rate and Production Increases
Source: Chesapeake Energy
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A 50% decline in rigs only causes a 40% decline in new adds. So they are factoring in that the most productive wells survive the price dip and the least economic wells do not.

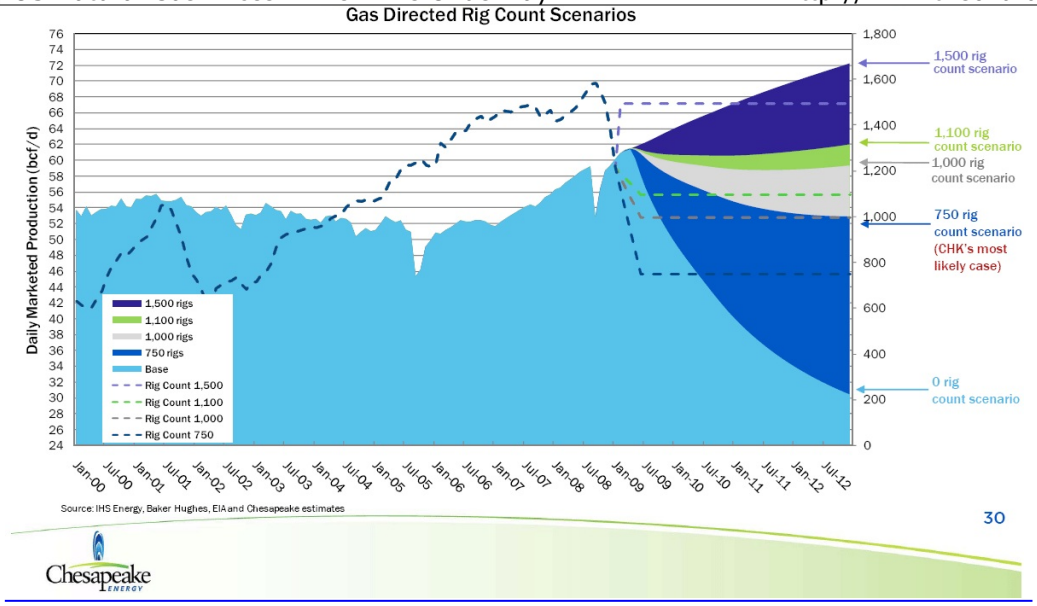

Figure 4: Future gas production based on final rig count drop
Source: Chesapeake Energy
-Click to Enlarge

Figure 4 shows that if the rig count drops to 750 (CHK's most likely case) that Chesapeake estimates that production will fall to 53 bcf/d.

Here I have added a red bar that allows easy comparison of when supply has fallen to or below 53 bcf/d in the last 8 years.

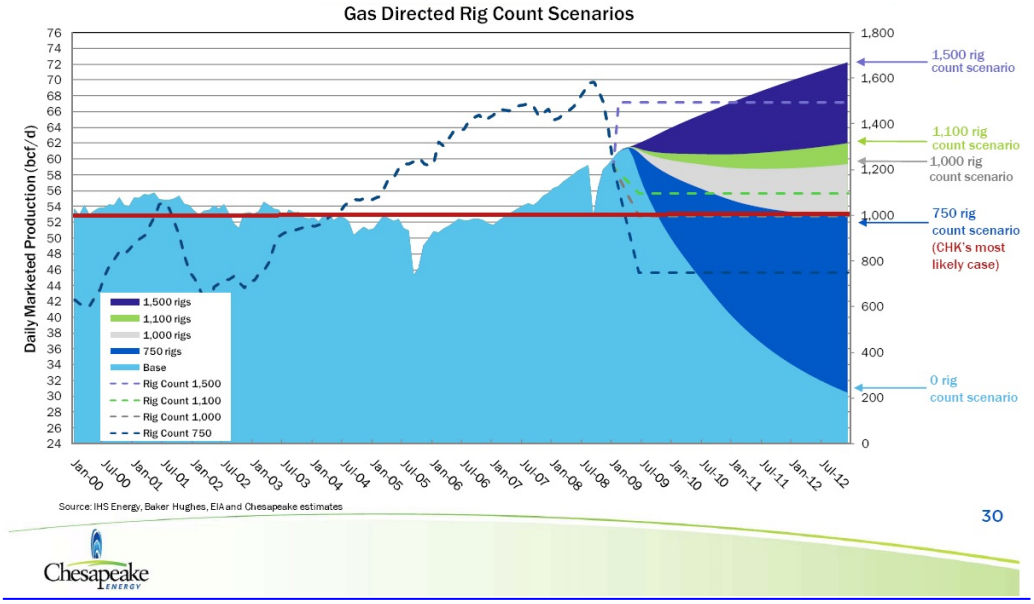

Figure 5: Past periods of low production
Source: Chesapeake Energy
-Click to Enlarge

A chart of price spikes has been provided as Figure 2. The dip below the red bar in 2002 caused the price spike in 2003. But the dip in 2004 did not cause a spike, but the deep fall in 2005 did (that was Hurricanes Katrina and Rita).

Current US Rig Count

Baker Hughes reported the gas directed rig count was 760 on April 17, down 30 from the prior week.

Johnson and Rice Co pointed out that the most productive rigs are shale gas rigs (discussed in Natural Gas Supply and Demand Balance). Those are mostly horizontal rigs, and Baker Hughes reports that the number of horizontals dropped by 11.

Where will the rig count end up? The last week showed a drop of 30 gas intent rigs. Does this mean that we are no where near bottom yet?

Smith Bits also keeps rig counts and they track how many rigs are setting up or tearing down. The totals for this week were 38 gas rigs setting up and 56 tearing down. We can expect the rig count to continue falling.

If those rigs do come down next week then we will have passed the 750 rig balancing point for the market and prices should recover early 2010, assuming Chesapeake's assumptions are correct. There are contributing factors, and we look at several of them next.

Contributing Factors

Johnson and Rice Co provided a list of additional factors that will adjust the supply/demand balance:
Avg. LNG Import Increase: 0.5 Bcf/d
Avg. U.S. to Mexico Export Drop: 0.5 Bcf/d
Remaining Industrial Demand Drop: 1.0 Bcf/d
Canadian Import Drop -0.9 Bcf/d
GOM Production Return 0.9 Bcf/d
Steepened Decline Curve Effect: -1.3 Bcf/d

We are going to take a look at the steepened decline curve, the industrial demand drop, and add to this list: curtailments of current production.

US Decline Rate

Chesapeake provided Figure 6 on US Natural Gas Decline Rates using data from IHS Energy. It shows that the current underlying decline rate in 2008 was ~24.5% and the first year decline rate was 44.1%.

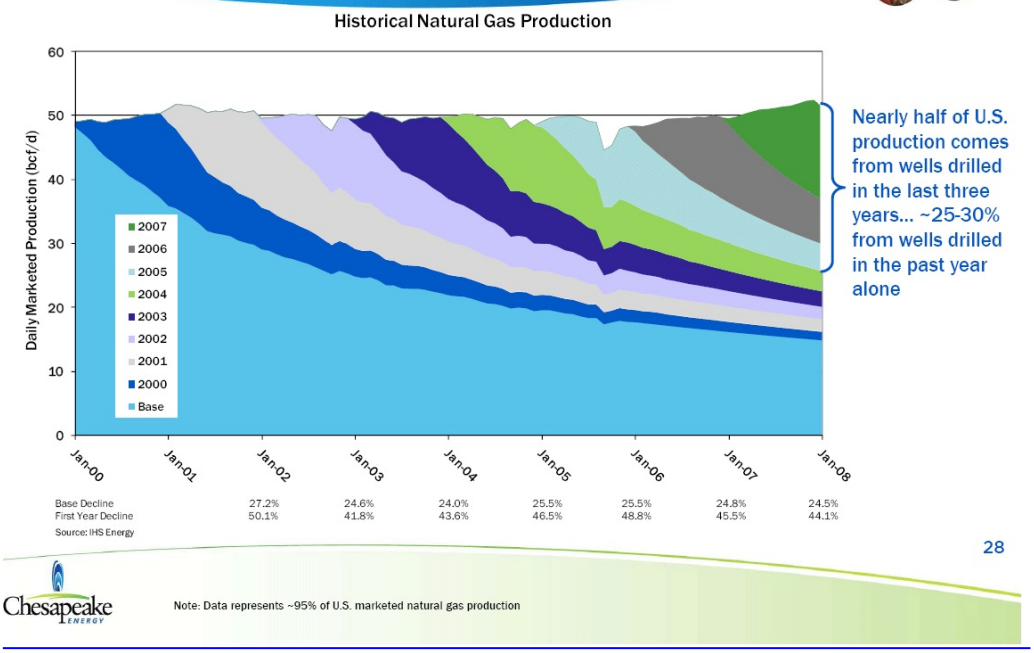

Figure 6: US Decline Rate vs Year
Source: Chesapeake Energy
-Click to Enlarge

What is fascinating about this chart is that while both base decline and first year decline tend to bounce around, they both trend slightly down in value. Is this the data that CERA is using as the basis of their claim that unconventional gas lowers decline rates?

From the CERA Press Release: "Technology Drives North American Gas Renaissance:"

"Given the increased productivity of unconventional wells, the study concludes that it is not necessary to increase drilling activity to maintain - or increase - production. After years of developing unconventional gas with its long-lived production, in the aggregate, the average decline rate will fall. This means, the study says, that a smaller quantity of new production is required to offset natural production declines."

This is in direct contradiction of JRCO which has said "We believe that the aggregate U.S. decline rate has increased from 28% in 2006 to 31% in 2009."

I must admit it is very hard to understand how unconventional wells with a first year decline rate of 60% or greater can push the national decline rate lower.

Figure 7 shows an earlier analysis by EOG Energy using IHS data. That analysis agrees with JRCO and projected a slowly increasing US decline rate.

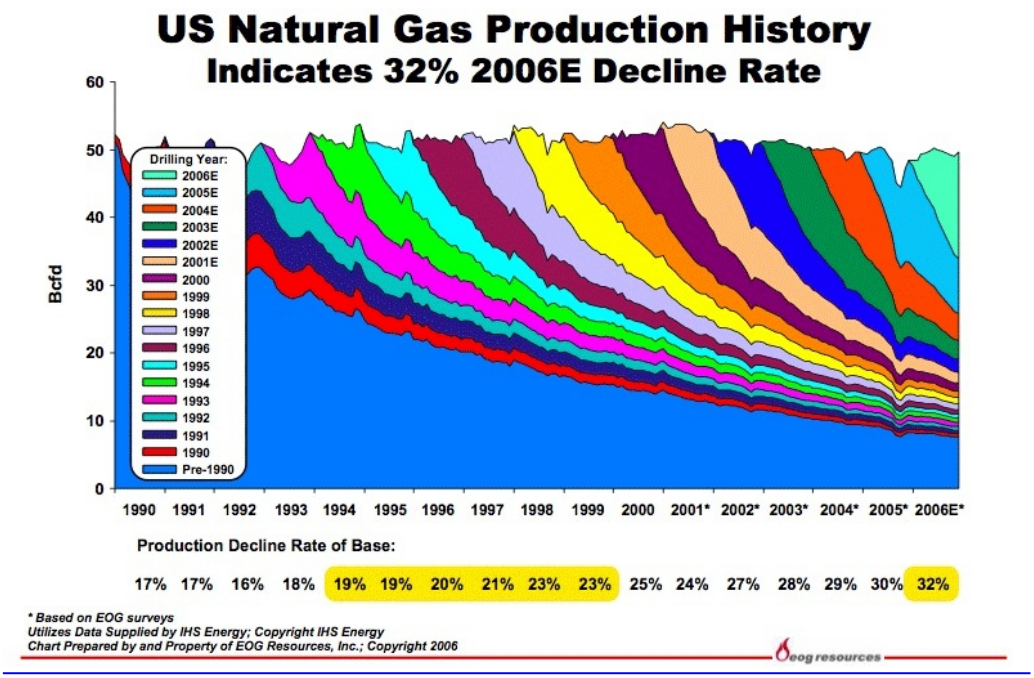

Figure 7: EOG Energy US Decline Rate vs Year
Source: EOG Energy
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Thank you to Seeking Alpha for Figure 7.

One possible explanation is that the sheer number of new wells drilled has created a low decline rate cushion. You can see from Figure 8 that wells begin with a high decline level and slowly fall to a lower and lower rate over time (producing less and less gas however).

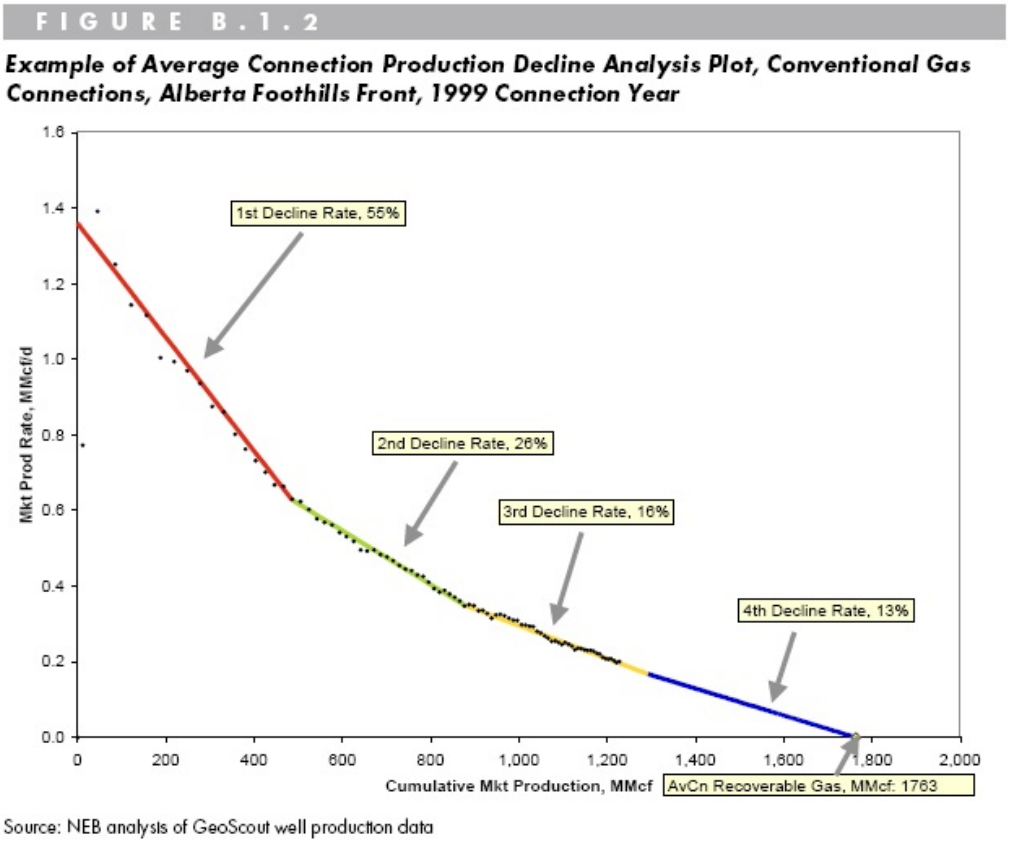

Figure 8: Typical Natural Gas Well Decline Plot
Source: Canadian National Energy Board
-Click to Enlarge

The national decline rate should end up somewhere between the first and last decline rate values. Unfortunately, I don't have the IHS database and we cannot investigate the basis of CERA's claim further.

In any case, if these more pessimistic estimates of the base decline rate are correct, then a drop to 750 drilling rigs will over correct the market into a supply shortage.

Industrial Demand

With GM declaring bankruptcy and many other manufacturers shutting down, it is critical to include some estimate of the falling demand for natural gas in the industrial sector.

JRCO found that industrial utilization and natural gas usage were tightly correlated and that historically a 1% drop in industrial utilization caused a 1% drop in industrial natural gas demand.

JRCO provided Figure 9 showing GDP and Industrial Utilization. I updated the chart with the April 15th Federal Reserve Statistical Release on Industrial Production and Capacity.

Industrial Capacity has fallen to 69.3%, which is a new historical low since data collection began in 1948 and 11.7 percent since first quarter 2008.

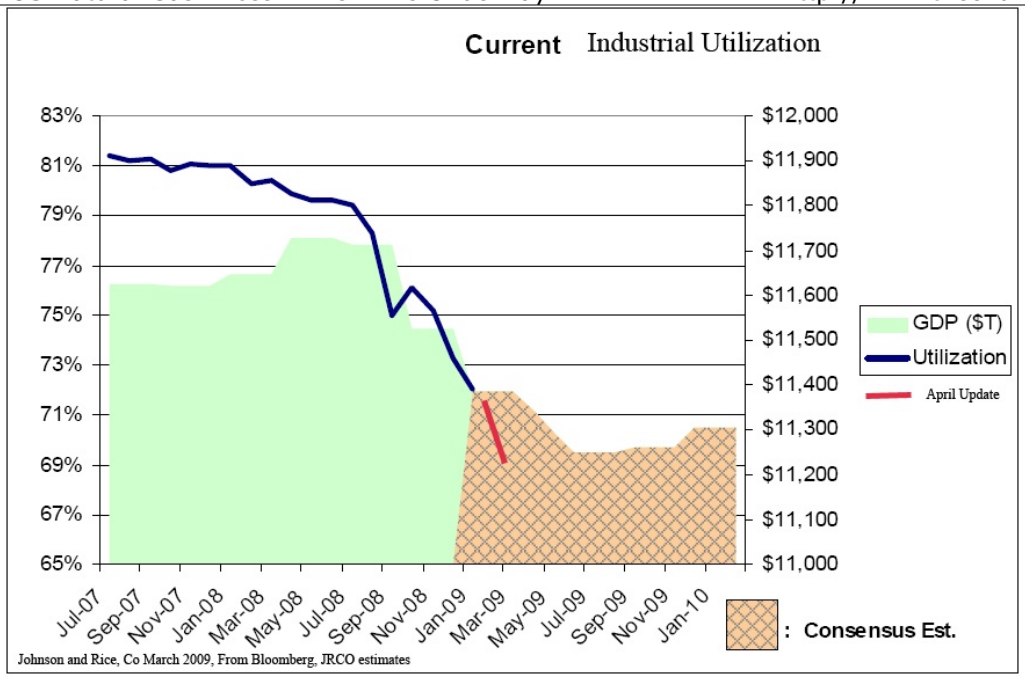

Figure 9: Industrial Capacity Utilization
Source: Johnson & Rice Co
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JRCO provided 18.2 bdf/d as the Industrial natural gas demand at the start of the recession. They project a total 15% drop in industrial utilization during this recession for a total natural gas demand reduction of 18.2 * 0.15 = 2.7 bcf/d

JRCO also offered the very interesting Figure 10 on the history of Industrial Utilization.

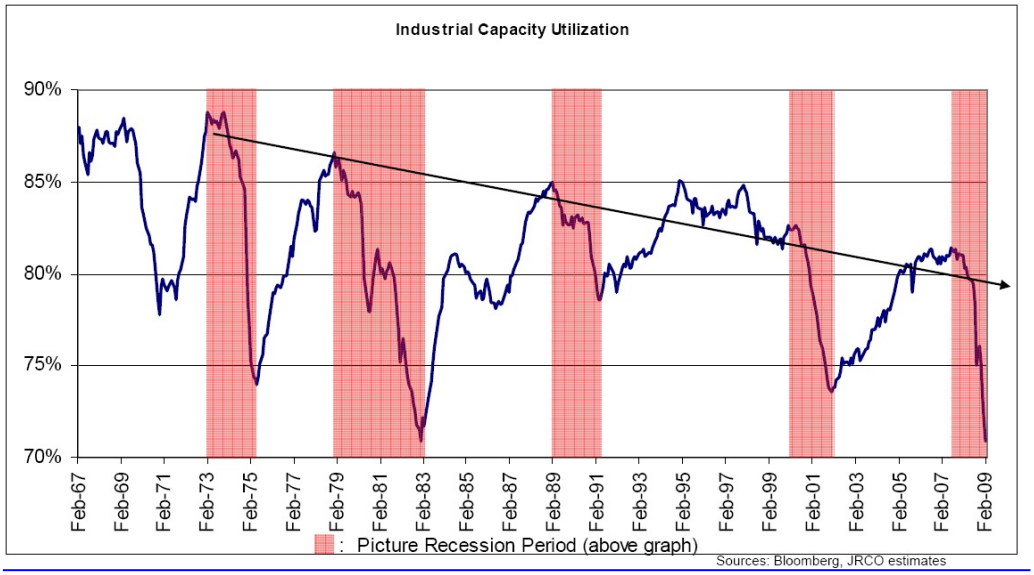

Figure 10: History of Industrial Capacity Utilization
Source: Johnson & Rice Co
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JRCO makes the point that some lost industrial capacity (and thus natural gas demand) will be gone forever. What I find interesting is how long it takes for industrial capacity to climb back after a recession. It took the whole decade of the 80's to recover from the Iranian Revolution and Iran-

Iraq war.

James Hamilton made the argument that the 2008 oil price spike was enough to cause the current recession. Counter arguments have been stated that if the oil prices caused the recession, why didn't demand spring back after prices fell? I think it is clear from this Industrial Capacity History chart that it takes a long time for demand to recover.

Curtailed Production

Another factor which could cut short a price spike is that gas companies may have wells they have shut in and are not producing. They will turns these wells on as prices rise allowing a rapid flood of natural gas to enter the market much faster than an increase in drilling could respond.

Here is a statement from a Chesapeake Energy press release:

> OKLAHOMA CITY--(BUSINESS WIRE)--Apr. 16, 2009-- Chesapeake Energy Corporation (NYSE:CHK) today announced it has elected to curtail approximately 400 million cubic feet (mmcf) per day of its gross natural gas production due to continued low wellhead prices. The reduction includes the 200 mmcf per day curtailment of natural gas production previously announced on March 2, 2009.

Oil Drum posters have been skeptical about how much production has really been shut in, given the cash flow needs of these companies. However, assuming the production has been shut in and other natural gas companies have followed suite, then there could be a bcf/d or more of natural gas production waiting to turn back on for high oil prices.

It is also likely that if storage reaches capacity there will be no choice but to shut in some production.

Such a development would be welcomed by consumers, as it would moderate any chance of a price spike even if the fall in rig count over corrects the market.

EIA Short Term Outlook

The EIA short term outlook predicts a modest price recovery in 2010. They do not see a large shortfall developing due to a drop in drilling.

> Total consumption of natural gas is projected to fall by nearly 2 percent in 2009, leading to lower natural gas prices. Industrial natural gas consumption is expected to decline by more than 7 percent, as industrial production declines during the current economic downturn. However, natural gas consumption in the electric power sector is projected to increase by almost 1 percent, since the lower natural gas prices will back out some coal consumption in this sector. The Henry Hub natural gas spot price is projected to decline from an average of $9.13 per thousand cubic feet (Mcf) in 2008 to $4.24 per Mcf in 2009, then increase in 2010 to an average of more than $5.80 per Mcf.

The 1% increase in electrical generation demand for gas is about 0.17 bcf/d, which is not tiny but

should be small compared to the other larger factors.

More importantly, the EIA expects the U.S. to enter the winter will storage at maximum capacity. This will help smooth out any production shortfalls.

Conclusion

The drilling rig count has fallen to the point where the market should balance in early 2010, if Chesapeake's assumptions are correct.

If a further drop in the rig count happens or if the decline rate is faster than assumed, then production will fall well below demand.

Shortfalls in supply will be moderated because of a continuing decline in the industrial sector that will be slow to recover and because storage is currently high (and possible shut in production coming back into production as prices rise).