Has Anyone Done the Math?

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I have read many articles on Natural Gas prices, presenting the likelihood of a pending natural gas bull market. Surprisingly, I have yet to see any editorial committed to predicting the impact of the falling rig count in North America. Bearish natural gas price forecasts are driven by the high productivity of shale plays, industrial demand destruction and LNG imports, with bullish price forecasts based on the precipitous drop in drilling activity. After doing the analysis, the evidence points to a very alarming supply shortage about to hit North American natural gas markets.

Let's start with some very simple facts:

- Base Production in the US is 56 bcf per day
- Average production declines amount to 35% per annum.
- In 2008, there were 1,491 active rigs focused on natural gas drilling.
- Of the total rig count, 30% were drilling horizontal wells of which 80% were natural gas wells with the balance oil wells.
- There were approximately 32,000 natural gas wells drilled in 2008

Here is the math:

Base Production bcf/d	56.0
Decline Rate	35%
Production Decline bcf/d	19.6
Natural Gas Wells Drilled in 2008	32,623
Average First Year Production Rate per Well Drilled in 2008 mcf/d	**601**

In order to maintain US production from 2007 to 2008, each well drilled during that period produced an average 601 mcf/d. We will use this assumption for forecasting the impact of lower drilling activity.

The natural gas-directed rig count has fallen from its peak of 1,600 in September 2008 to 700 in June 2009. Since we know the average production rate of a well placed on stream in its first year, we can calculate the replacement production derived from the drilling activity of 700 gas-directed rigs over the course of a year. We can also estimate the number of wells each rig drills in a year and the average number of days it takes to drill a well.

	Jun-09	**2008**
Number of Active Gas Rigs	700	1,491
Days per Well	17	17
Wells per Year per Rig	22	22
Wells Drilled per Year	15,316	32,623
Average First Year Production Rate per Well mcf/d	601	601
Incremental Production bcf/d	9.2	19.6
Deficit bcf/d	**10.4**	

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Based on these assumptions, our calculations indicate that drilling replaced 9.2 bcf/d out of the 19.6 bcf/d necessary to maintain US production **– a 10.4 bcf/d shortfall.**

But what about all the high-productivity shale gas wells that are being put on stream? The following approach is a bit simplistic, but with a few educated guesses, we can predict the impact of shale gas production on US supply.

A few more assumptions:

- Current horizontal drilling activity in the US is 381 rigs, targeting both oil and natural gas
- In 2008, there were 599 horizontal rigs operating of which 80% were focused on gas targets.
- We will assume that all of the horizontal gas rigs drilled highly productive shale wells.

If we assume a horizontal well takes 40 days on average to drill, and average production in the first year is 3,100 mcf/d, then we can calculate the following:

	2008		
	Total	**Conventional Gas**	**Horizontal Gas Wells**
Number of Rigs	1,491	1,012	479
Days per Well	17	13	40
Wells per Year per Rig	22	28	9
Wells Drilled per Year	32,623	28,408	4,373
Average First Year Production Rate mcf/d	601	225	3,100
First Year Production bcf/d	19.6	6.4	13.6

If a horizontal, shale-gas well declines at 60% per annum, then its initial production ("IP") must be approximately 4,750 mcf/d for a well to average 3.1mmcf/d over its first year. Many would say assuming all horizontal wells drilled in the US are gas wells and that each well had an average IP of 4,750 mcf/overestimates likely US natural gas production.

Now let's apply these findings to the lower rig counts we are currently experiencing.

	Current		
	Total	**Conventional**	**Horizontal Shale**
Number of Rigs	700	402	298
Days per Well	18	13	40
Wells per Year per Rig	20	28	9
Wells Drilled per Year	14,014	11,298	2,716
Average First Year Production Rate mcf/d	782	225	3,100
Incremental Production bcf/d	11.0	2.5	8.4

Adjusting for the highly productive nature of shale we only obtain 11.0 bcf/d of incremental production – a **resulting short fall in U.S. production of 8.6 bcf/d.**

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If we use slightly less optimistic production rates using an IP rate of 3,100 mcf/d, with an average first year production rate of 2,000 mcf/d for each horizontal gas well, then the results are as follows:

	Current		
	Total	**Conventional**	**Horizontal Shale**
Number of Rigs	700	402	298
Days per Well	18	13	40
Wells per Year per Rig	20	28	9
Wells Drilled per Year	14,014	11,298	2,716
Average First Year Production Rate mcf/d	569	225	2,000
Incremental Production bcf/d	8.0	2.5	5.4

This more conservative analysis results in a supply deficit of 11.6 bcf/d.

In summary, the looming supply deficit calculates to be as follows:

		Supply Deficit bcf/d
	Simple 700 Rig Analysis	10.4
Optimistic	HZ Break Out IP of 4.7 mmcf/d	8.6
Realistic	HZ Break Out IP of 3.1 mmcf/d	11.6

Without question some dramatic supply issues are mounting. If rig counts remain at 700 for any length of time, and North American producers continue to focus on drilling shale wells, those wells' robust initial production rates are clearly insufficient to offset declines from their overall drilling activities. Even more concerning is the fact that shale gas is likely to represent 70% of all new gas added in the next year. The initial decline rates of shale gas are estimated to be 60%, compounding the industry's challenge to replace production.

This analysis raises several questions:

1. How much of a surplus existed with US production at 56 bcf/d?
2. How much demand destruction has resulted from the current economic conditions?
3. Can LNG and Canadian gas imports make up the supply deficit that is created by lower drilling activity?
4. How quickly will drilling activity pick up?

Only time will tell.

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