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With Gas So Cheap and Well Drilling Down, Why Is Gas Production So High?

Posted by Euan Mearns on January 26, 2012 - 5:20am
Topic: Supply/Production
Tags: fracking, natural gas prices, natural gas production, shale gas plays [list all tags]

This is a guest post by David Hughes, a geoscientist, president of a consultancy dedicated to research on energy and sustainability issues, and a fellow of Post Carbon Institute, on whose website this article first appeared.

Natural gas prices have declined to below $3.00/mcf, levels not seen for years, yet the EIA posted the highest gas production ever in October, 2011. U.S. gas production is growing despite annual well completion rates that are half that at the peak of the drilling boom in 2008, when gas price topped $12.00/mcf. Proponents of shale gas as a "game changer" suggest that, despite the well-known high decline rates of shale gas wells, their productivity is sufficient to grow production with far fewer wells at historically low prices. Others, such as Arthur Berman, claim that shale gas plays require much higher prices to be economic. The answer may lie in the gas produced in association with oil drilling, which is near all time historical highs.

Figure 1 illustrates the annual number of gas wells and gas production documented by the EIA. Although drilling is still well above 1990's levels, it is only half that of the all time record drilling levels reached in 2008.

Natural Gas Production versus Annual Drilling Rates, 1990-2011

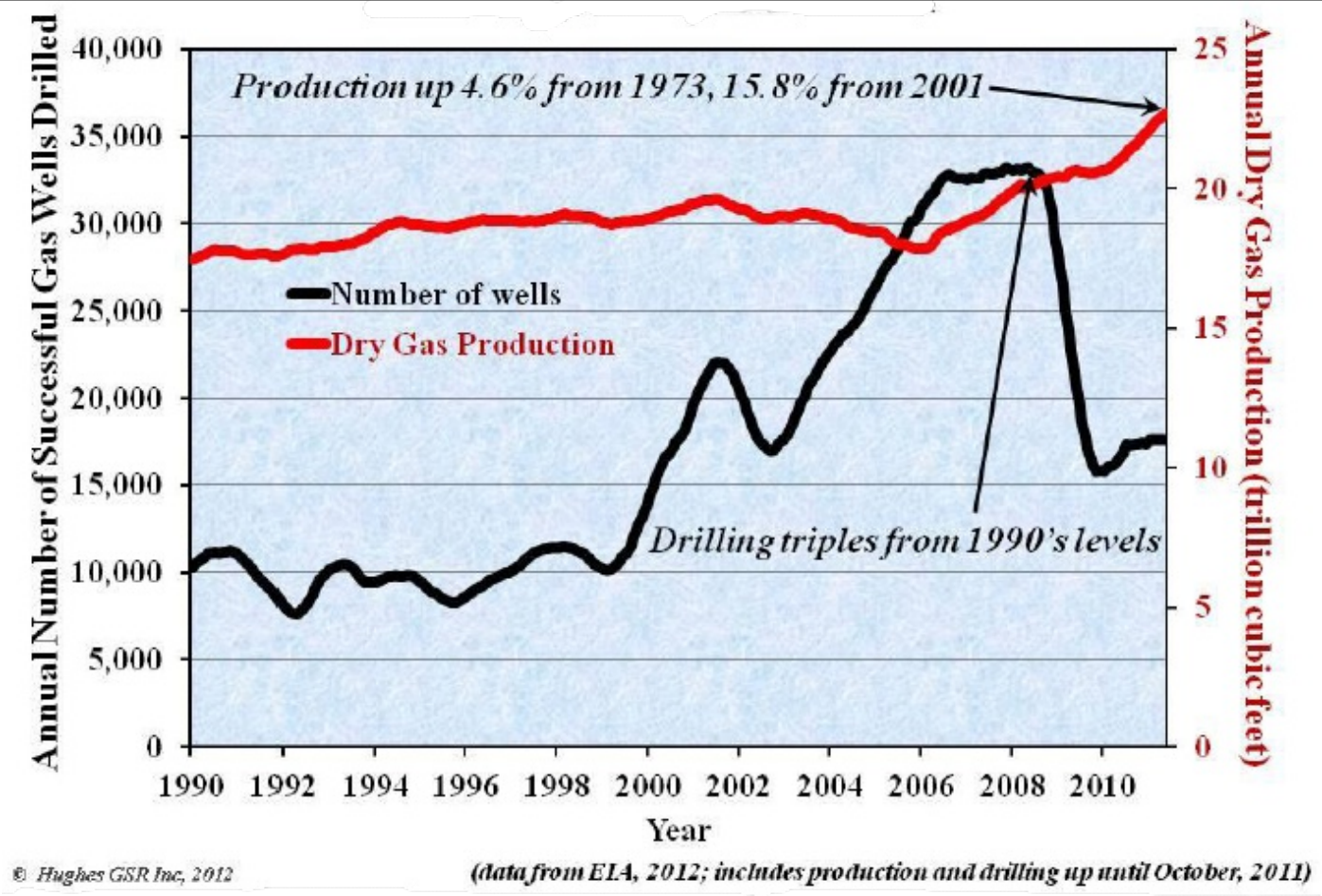

Figure 1 – Annualized U.S. natural gas production and drilling rates, 1990-2011.

U.S. natural gas production has reached production levels of 4.6 percent above the previous 1973 peak, and nearly 16% above the recent 2001 peak. While some of this increase is likely due to delayed tie-ins from the 2008 drilling boom, and some due to the high initial productivities of shale gas wells, these are not likely the whole story.

Hydraulic fracturing has certainly changed the game with respect to gas production from shales and tight rocks, albeit with widely reported collateral damage including methane leakage into groundwater, pollution from produced frackwater disposal on the surface, induced earthquakes from frackwater injection into disposal wells and the environmental footprint of industrialized landscapes. Equally important is the game changing nature of applying hydraulic fracturing to producing oil from shales.

Figure 2 illustrates annualized crude oil production versus well drilling rates. Drilling rates are near all time highs, more than double the rates of the 1990's, and have succeeded in increasing production to levels not seen since late 2003 (yet down 42% from 1971). Production has grown by 0.65 million barrels per day above the all time low in U.S. oil production in May, 2008, causing some pundits to declare a new era of "American energy independence".

Crude Oil Production versus Annual Drilling Rates, 1990-2011

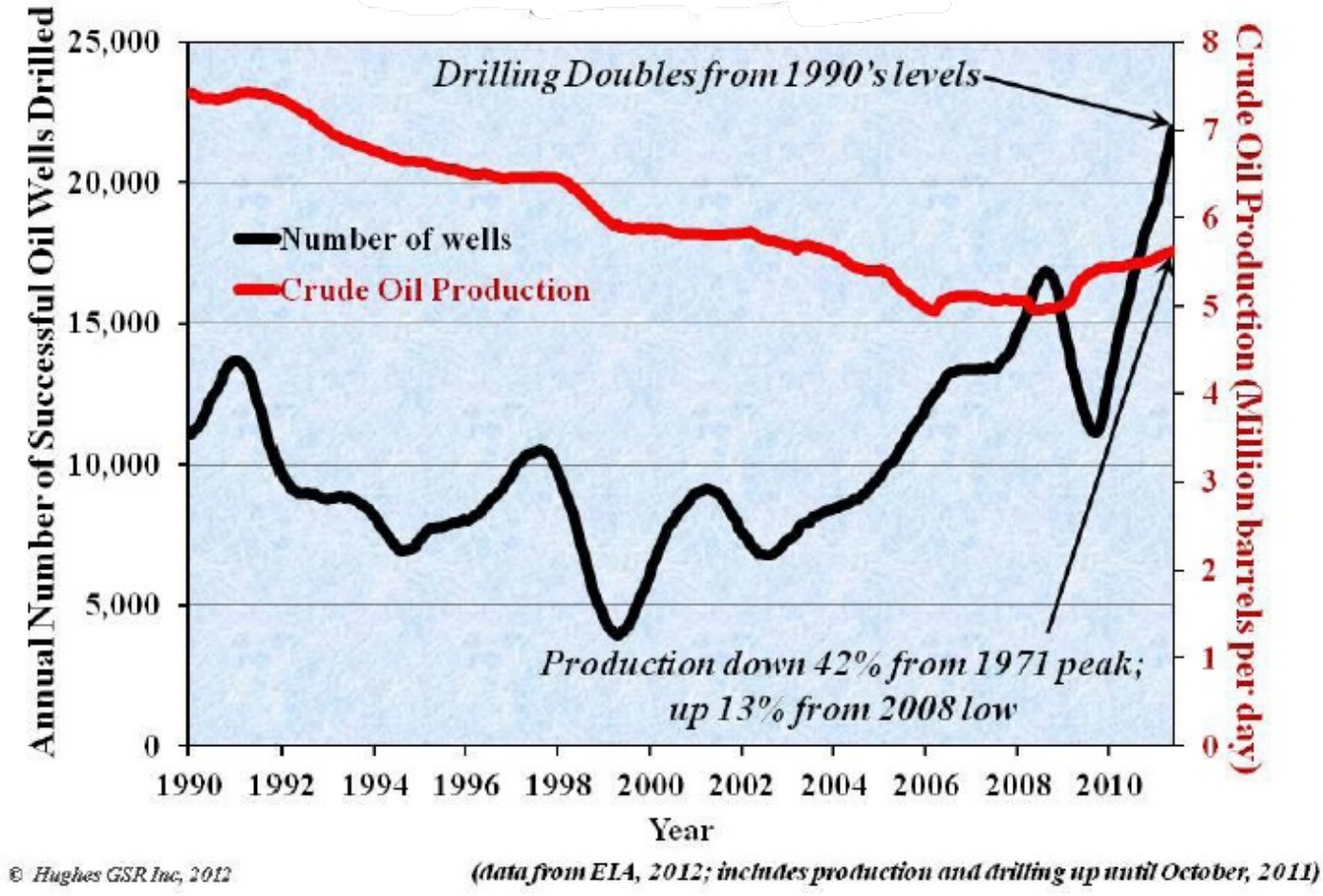

Figure 2 - Annualized U.S. crude oil production and drilling rates, 1990-2011.

Large amounts of natural gas are produced in conjunction with the production of hydraulically fractured shale oil and in association with conventional oil drilling. Given the price differential between oil and gas at present many companies have changed their focus to shale oil or liquids rich shale gas to enhance economic returns. Although much associated gas in the production of shale oil is simply flared, as in the Bakken play in North Dakota, much is also produced into the market even at current low prices. Thus the apparent "too- good-to-be-true" statistics showing growing gas production with declining drilling are simply that – too- good-to-be-true. The record drilling for oil, and its contribution to gas production, is masking the high drilling rates required to grow gas production in the EIA statistics (which classify a well as either "oil" or "gas" depending on its principal product).

Drill baby drill – Recent drilling rates are near all time highs

Production decline rates in both shale gas and shale oil wells are very high – first year declines in Barnett shale gas wells are in the order of 65% and are higher in Haynesville wells. Similar decline rates are observed in shale oil plays. Thus new wells must continually be drilled to offset depletion in existing wells. Figure 3 illustrates the aggregate footage drilled for oil and gas in the U.S. and the average depth of the wells.

Annual Footage Drilled versus Average Well Depth 1990-2011

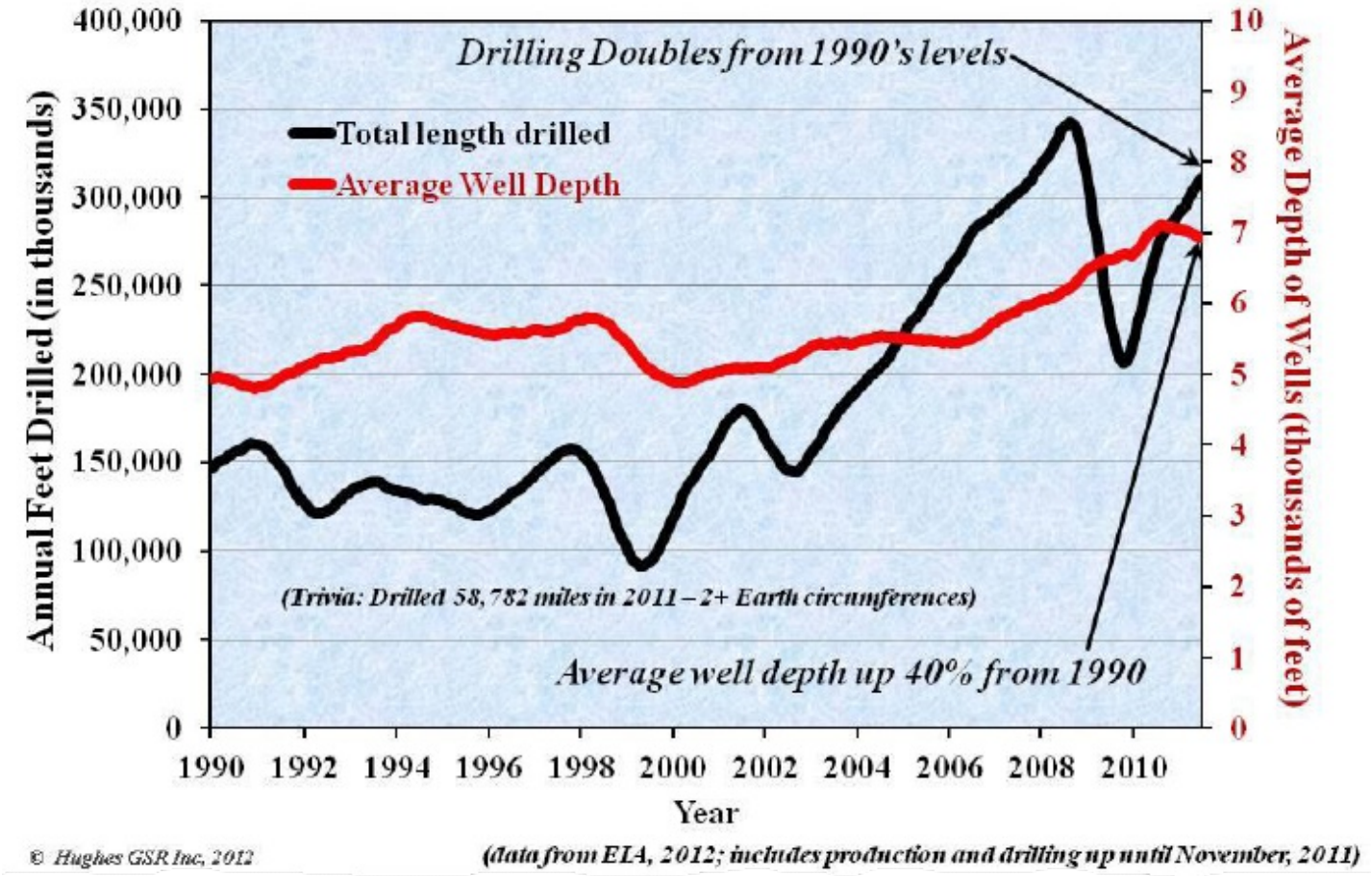

Figure 3 - Annualized U.S. aggregate footage drilled and average well depth, 1990-2011.

It can be seen that the footage drilled is near all time historical highs. And it can be argued that a hydraulically fractured foot, drilled in 2012, required much higher inputs of energy and capital investment than a foot drilled in 1980, as the deposits targeted are so much more challenging (or marginal, depending on your perspective). In addition, the average depth of a well is 40 percent deeper than it was in 1990. This reflects the declining EROEI associated with domestic U.S. oil and gas production, which can only be expected to decline further going forward.

So, despite vocal industry proponents to the contrary, there is no such thing as a free lunch. Growing, or even maintaining, U.S. oil and gas production will require an increasing level of inputs in terms of the number of wells drilled, the footage drilled, the capital investments required, and likely, the large amounts of collateral environmental damage incurred.

Editor's note: This post spawned a vigorous debate among the editors that has delayed publication by about a week. This debate revolved around the contribution made by shale gas and shale oil plays to overall US gas production, the impact of delayed hook ups to production figures and the veracity of EIA data. These issues are open for debate in the comments.