

## FROM THE OIL PATCH

*Has oil and gas production peaked?*



We are well into 2016 and being bombarded with presidential campaign news. The current front runner for the Republican presidential nomination is “The Donald” and for a while it was a statistical dead heat for the Democrats between Hillary Clinton and Bernie Sanders. Stocks took a downturn and crude oil prices dipped below \$30/bbl in mid-February. Russia, Saudi Arabia, Qatar and Venezuela have proposed an oil production freeze in an attempt to move prices upward. And 2015 has gone on record as the warmest year in the 136 years of record keeping, however, 2016 will probably be warmer due to the aforementioned political campaign.

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Borrowing song lyrics from R.E.M., does all this mean “it’s the end of the world as we know it?” Probably. Change is inevitable, therefore, some of our world will always be disrupted and different from what we are used to. The unknown is whether the change will be positive or negative in the final outcome.

One driver of change is technology. We are living in an age when technology allows us to instantly connect with anyone in the world. We can get news and information from thousands of sources on a 2 inch by 3 ½ inch screen that is also a phone, camera and just about anything else. Technology has certainly impacted the oil and gas industry as well.

On the second day of IHS CERAWeek, the Minister of Petroleum and Mineral Resources of Saudi Arabia mentioned cycles of rising and falling production, demand and price. He also noted, in jest, that he had survived peak oil and had the t-shirt.

### What is peak oil?

What was the Saudi minister referring to when he mentioned peak oil? Peak oil was discussed in the paper that M. King Hubbert, a geologist with Shell Development Company, presented to the American Petroleum Institute in 1956. I began my career in the oil and gas industry after the time Hubbert predicted that U. S. oil and natural gas production would both reach their peak!

Hubbert predicted that oil and gas production would follow a bell curve, with peak oil production occurring between 1965 and 1975, and natural gas production peaking around 1970.

### Was Hubbert right?

Based on information from the U.S. Energy Information Administration, it turns out that U.S. oil production peaked in 1970. (So, those of us around in 1970 should also have the t-shirt.) The annual production in 1970 was 3.5 billion barrels compared to the maximum of 3 billion barrels Hubbert had estimated. As mentioned above, production was predicted to be a bell curve and the decline would be at a rate similar to the incline.

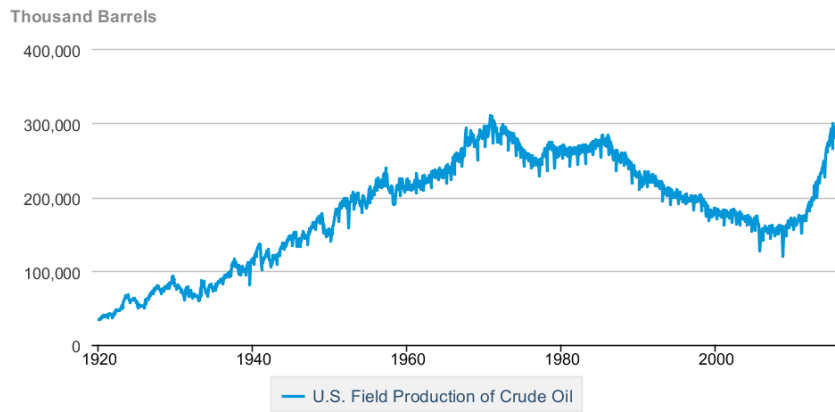
Looking at the graph below, titled *U.S. Field Production of Crude Oil*, there are a couple of anomalies from the prediction. After initially dropping in the manner Hubbert predicted, production slightly increased and continued this upward trend until 1985. This was the result of the Arab oil embargo in 1974 and the Iranian

Revolution in 1979, both of which helped stimulate the U.S. oil and gas industry. Following these events there was a glut of oil due to a weakening economy and conservation efforts, and production returned to its downward trajectory.

Looking ahead on the graph to 2005, a transition from declining production to inclining begins. In 2011 the oil production rate increase is substantial and continues into 2015. Annual U.S. production went from under 2 billion barrels to over 3 billion barrels in 6 years, again over the peak rate Hubbert had predicted. This latest increase was due to improved technology fostering the development of shale plays.

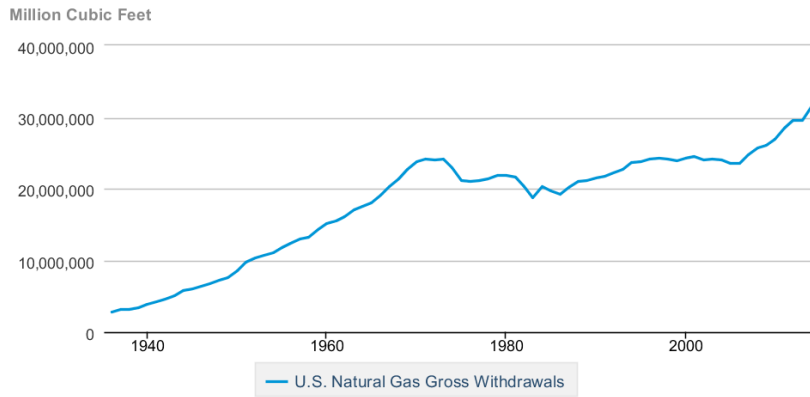
Focusing briefly on natural gas, Hubbert predicted a similar production bell curve, with peak production of 14 trillion cubic feet around 1970. In the graph titled *U. S. Natural Gas Gross Withdrawals*, production reached a peak in 1971 at 24 trillion cubic feet. This rate stays essentially flat for 2 years before going on a decline. Production starts to increase in 1985, following the deregulation of gas prices in 1978 and several changes in the gas transmission industry. Natural gas production peaks again in 2001 at 24.5 trillion cubic feet before starting a slight decline. In 2006 gas production begins to increase at a rate greater than pre-1970 production and continues to increase into 2015. This time the rate tops out over 31 trillion cubic feet. As with oil, this production increase is due to shale plays being developed.

#### U.S. Field Production of Crude Oil



 Source: U.S. Energy Information Administration

### U.S. Natural Gas Gross Withdrawals

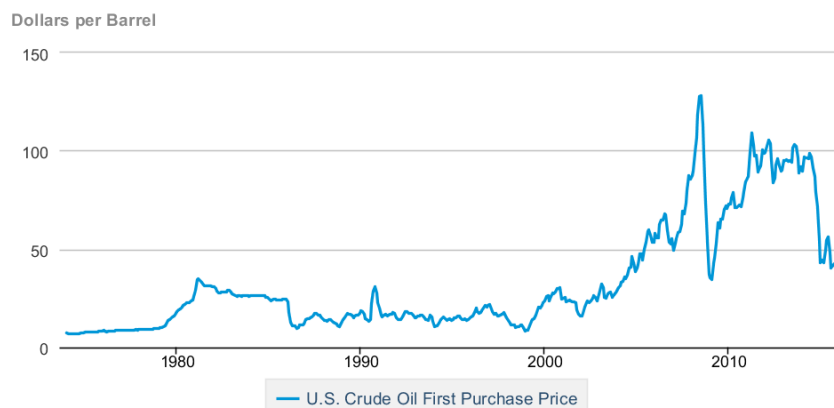


Source: U.S. Energy Information Administration

While the numbers initially look like Hubbert was generally right in his predictions, things fall apart after his predicted peaks were reached. Economic and political issues were not considered, however, as Hubbert stated in his paper, “The reserve figures cited are for oil capable of being extracted by present techniques.” This implies that he understood there could be technology advances which would change the reality. This has been the case with horizontal drilling and multistage high volume hydraulic fracturing of both oil and gas-producing shale wells.

Looking at oil price history, there is a correlation between higher prices and production increases both in 1979 and in 2005. This was the result of the increased product price allowing for more dollars to be spent on innovation by the exploration and production companies.

### U.S. Crude Oil First Purchase Price



Source: U.S. Energy Information Administration

In his paper Hubbert continued that as fossil fuels (including coal) production declines, nuclear energy would increase at an exponential rate. He had no way of conceiving the likes of Chernobyl, Three Mile Island and,

more recently, the Fukushima Daiichi nuclear disasters and the detrimental effect these accidents have had on the nuclear industry. Needless to say, his prediction for this energy source does not match with the energy industry in the U.S.

### **Technology and production**

Recapping the predictions and actual production, U.S. production reached the predicted peak for both oil and gas in the 1970's as forecast by Hubbert. Oil production did decline after a short leveling out but then started to change in 2005. At this point, production began to increase and oil almost reached the production peak of 1970. Natural gas production also peaked as predicted, but then declined at a much slower rate before beginning a gradual increase. Like oil in the early 2000's, the rate of increase was greater and production has surpassed the peak of 1971. Both product increases were the result of technology developments resulting in production from shale.

Will there be more technology developments in the oil and gas industry and will these have as great an impact on production? What price must be sustained to launch a technology change? Will technology develop an alternate source of energy that will surpass oil and gas usage? These are questions that will be answered over time. When they are answered, once again, "it's the end of the world as we know it".

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