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## MUSINGS FROM THE OIL PATCH

February 21, 2017

Allen Brooks  
Managing Director

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*Note: Musings from the Oil Patch reflects an eclectic collection of stories and analyses dealing with issues and developments within the energy industry that I feel have potentially significant implications for executives operating and planning for the future. The newsletter is published every two weeks, but periodically events and travel may alter that schedule. As always, I welcome your comments and observations. Allen Brooks*

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### Can We Grow Production As Much As The Optimists Say?

**The key issue seems to be the rate at which United States oil production will grow versus what OPEC member countries are prepared to do with their output**

In the debate over where crude oil prices are heading, the key issue, besides demand growth, seems to be the rate at which United States oil production will grow versus what OPEC member countries are prepared to do with their output. A recent article by Tom Whipple, editor of *Peak Oil Review*, pointed out that “A spokesman for Libya’s National Oil Company says that the security situation has improved so much that production is expected to reach 1.2 million b/d in August and 1.8 million b/d by March 2018. If these numbers can be reached, a problematic supposition, the increase in Libyan production during the next year coupled with whatever increases happen in the US could largely offset the OPEC/NOPEC (non-OPEC) production cut.”

**Few people could have dreamed that the shale revolution would become the oil industry game-changer it has become**

As Mr. Whipple noted, Libya’s ability to increase its production by the magnitude suggested by the national oil company’s spokesman is “problematic” given the country’s recent history of civil war and political violence. However, we have witnessed many past periods where “problematic” outcomes actually happened – witness the November 2014 and November 2016 OPEC meetings and resulting actions, as examples. Few people could have dreamed that the shale revolution would become the oil industry game-changer it has become following the limited success Mitchell Energy experienced by tapping shale gas resources in the Barnett Shale formations in the Ft. Worth, Texas, basin, another problematic success.

**The oil shale revolution is largely responsible for more than doubling U.S. oil production between 2005 and 2015**

What is important, but unquantified in Mr. Whipple’s statement, is the potential magnitude of the increase in U.S. crude oil output. What we know is that the oil shale revolution is largely responsible for more than doubling U.S. oil production between 2005 and 2015. During that span, U.S. crude oil output soared from 4.2 million barrels a day in September 2005 to 9.6 million barrels by April 2015.

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**From that point until February 10, 2017, the industry has put to work 275 more rigs targeting crude oil, or an 87% increase in oil-drilling activity**

Production subsequently fell to 8.6 million barrels a day in September 2016 in direct response to the decline in drilling caused by the drop in global oil prices from \$75 a barrel in November 2014 to \$26 in February 2016. Since then, oil prices have more than doubled to \$53-\$54 a barrel in response to OPEC's decision to cut its collective output by 1.2 million barrels a day and then securing agreements from leading non-OPEC countries for an additional cut of 600,000 barrels a day.

In concert with the revival in oil prices following the February 2016 low, the U.S. oil drilling rig count has climbed. The oil drilling rig count didn't hit bottom until three months after the February 2016 oil price low was set. In the last week of May 2016, there were only 316 oil drilling rigs working, representing nearly 80% of all active rigs. From that point until February 10, 2017, the industry has put to work 275 more rigs targeting crude oil, or an 87% increase in oil-drilling activity. At the same time, the Energy Information Administration (EIA), in its weekly oil market supply report for the week ending February 10, 2017, estimates domestic crude oil production has climbed back to just shy of 9 million barrels a day.

The key question now is where will oil production be a year from now? Or maybe, more importantly, where will oil production be in two to three years' time? Depending on how that question is answered, we can begin speculating on what might happen to future oil prices if OPEC holds to its production cuts for the balance of 2017, as opposed to the current agreement's six month time span.

**Both of these trends are leading to a rapid recovery in domestic crude oil and natural gas output,**

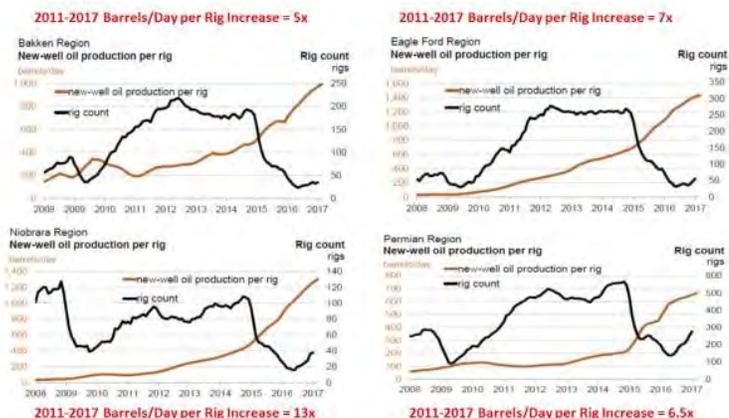
In a presentation at the Center for Strategic & International Studies (CSIS), Rusty Braziel, the head of RBN Energy, showed charts of improving crude oil and natural gas output per active drilling rig for the major shale plays in the United States along with a flattening production decline curve for shale wells as compared to the traditional sharply falling curves. In his view, both of these trends are leading to a rapid recovery in domestic crude oil and natural gas output, something he believes will last for years into the future.

To demonstrate the point Mr. Braziel was making about drilling productivity gains, we selected EIA graphs from its most recent monthly *Drilling Productivity Report* for four of the main oil producing basins in the United States. Between the start of 2011 and 2017, these four basins have seen their crude oil output per drilling rig climb by between five-fold on the low end to 13-fold at the high end. (See Exhibit 1, next page.)

**Mr. Braziel highlighted four factors explaining this dramatic improvement in crude oil output**

In his presentation, Mr. Braziel highlighted four factors explaining this dramatic improvement in crude oil output and why he remains optimistic that the industry is in for further sustained production growth. The four factors are: larger leaseholds; longer laterals; extra sand; and more chocking. All four of these factors are inter-related.

**Exhibit 1. Drilling Productivity Per Oil Rig Is Up Sharply**



Source: EIA, PPHB

**Through larger leaseholds, companies can gain greater efficiency in their operations**

The larger leaseholds in basins reflects the need for companies to exercise greater focus and intensity in the development of their resource base. This can best be accomplished with more assets in fewer locations. Through larger leaseholds, companies can gain greater efficiency in their operations extending all the way from geological and geophysical work in understanding the resource potential to better drilling and completion work and even on to administrative tasks of operating the business. But an extremely important point about larger leaseholds is that with more acreage aligned companies have an easier time drilling longer lateral sections in wells. For this reason we are seeing lateral well lengths extending from one mile in length to as much as two miles or possibly longer.

**Higher EURs translate into lower finding and development costs**

Those longer well laterals then allow for more fracturing locations (stages) and larger fracturing jobs that help boost initial well output and their economic ultimate recovery (EUR) volumes. Larger fracture jobs require larger volumes of sand to prop open the well fissures enabling hydrocarbons to escape, but more sand is proving to be directly correlated with greater well output. Higher EURs translate into lower finding and development costs and longer well-lives even though the initial cost of the well may be greater. Another aspect of higher EURs and greater well productivity is the ability to choke back the high initial flow rates, which can also help improve well economics.

A recent example of some of these forces at work were evident in a presentation to the Houston chapter of IPAA/TIPRO by Barton Brookman, Jr., president and CEO of Denver-based exploration and production company PDC Energy (PDCE-Nasdaq). The presentation began with a discussion about how the corporate strategy of PDC Energy had changed over the past five years.

**The size of the acreage position gives the company critical mass**

During 2015, PDC Energy executed an acreage swap in the Wattenberg basin that enabled the company to consolidate and expand its lease holdings. While PDC Energy's Wattenberg holdings were a core operation, the asset swap helped further boost the importance of its position for the future success of the company.

PDC Energy also entered the Delaware Basin in late 2016 through a large concentrated acreage purchase and then a bolt acreage transaction. While this offers a new geographic region, the size of the acreage position gives the company critical mass to begin exploiting opportunities in probably the hottest exploration play in North America at the moment.

**An important step was the shift to drilling monobore wells in the Wattenberg field**

Beginning in 2014 and continuing up to now, the company has sold off its holdings in the Bakken, Barnett and Piceance basins while also shedding acreage and production in New York State, Tennessee and the shallow Devonian shale formations of West Virginia and Pennsylvania, which were the original assets of PDC Energy when it started using drilling funds in 1969 to exploit these shallow gas wells. Now, PDC Energy management is focused on two core areas – the Wattenberg and Delaware basins – and is assessing what further strategic moves are necessary with its Utica and Marcellus holdings to make this another core area or a source of funds for its current drilling opportunities.

As part of the presentation, Mr. Brookman focused on the technology his company has brought to its core holdings to improve their economics. An important step was the shift to drilling monobore wells in the Wattenberg field. These large diameter pipes extending from the top to the bottom of the wells reduce the drilling

**Exhibit 2. How To Improve The Economics Of New Oil Wells  
Core Wattenberg – Monobore Drilling Gains**



Source: PDC Energy

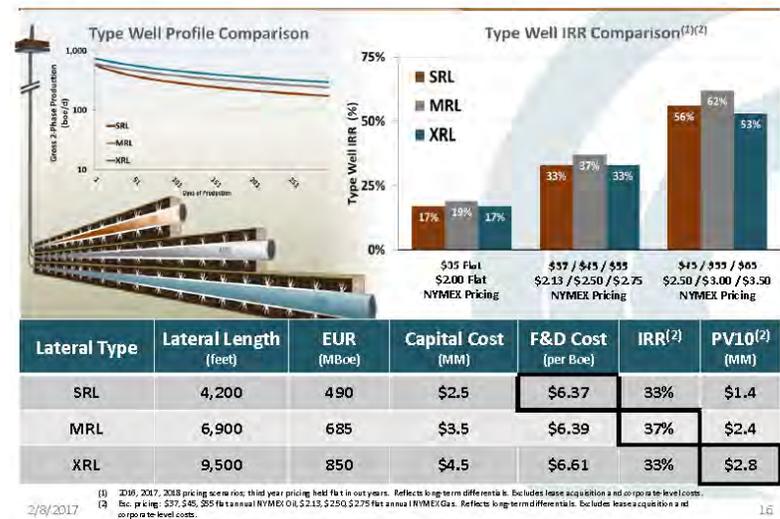
**The greater financial payoff comes from the ability to employ larger fracture treatments producing greater well flow rates through the larger diameter pipe**

**The cost of these longer laterals boosts the initial well cost**

time by a day, thus saving the company money initially. The greater financial payoff comes from the ability to employ larger fracture treatments producing greater well flow rates through the larger diameter pipe. This expanded pipe also facilitates PDC Energy re-entering wells to perform re-fracture treatments to help increase the reservoir drainage and improve the well's EUR.

PDC Energy has also begun drilling longer lateral well sections, which, along with the increased number of and larger fracture treatments and re-fractures, is enabling the company to improve financial returns through greater EURs. Although the cost of these longer laterals boosts the initial well cost, the higher EURs have led to only marginal per barrel finding and development cost inflation but significant increases in the present value of the reserves when compared to the shortest laterals it has drilled.

**Exhibit 3. Improved Long Lateral Economics Help Returns  
Core Wattenberg – Resilient Returns**



Source: PDC Energy  
Note: SRL: Standard-reach Lateral; MRL: Mid-reach Lateral; XRL: Extended-reach Lateral

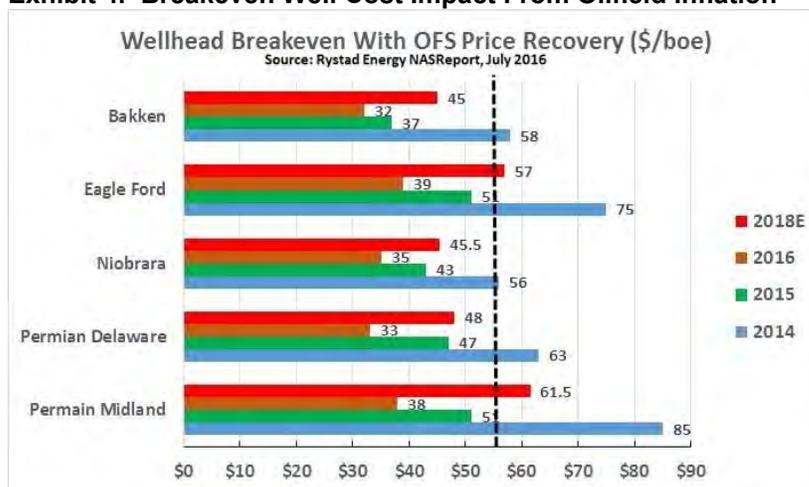
**We can see the concentration of leaseholds growing by the sheer number of very large acreage transactions ongoing in the Permian Basin**

Reducing drilling costs is the primary focus of all producers right now as they execute on the factors Mr. Braziel cited. We can see the concentration of leaseholds growing by the sheer number of very large acreage transactions ongoing in the Permian Basin. As we watch these deals happen, with the latest deal being more costly than the prior one, we are reminded of one of the operational truths expressed by Wall Street trader Nassim Taleb in his book *The Black Swan: The Impact of the Highly Improbable*. He wrote, "Missing a train is only painful if you run after it," by which he meant that chasing the latest trade/fad usually winds up in a painful experience because you overpay. We wonder if some of the recent Permian acreage transactions will wind up reinforcing Mr. Taleb's truth.

**There is a significant cost differential in using these two drilling systems, plus the company saves costs by avoiding having to switch out the different drilling fluid systems**

Efficiency of drilling operations is another area of acute focus for exploration and production (E&P) companies. A recent example is the use of smaller, highly mobile rigs on larger multi-well pads used to drill the upper (vertical) sections of wells. Once all those wells are drilled, the company then brings in a larger drilling rig to drill the long lateral well sections. There is usually a significant day rate differential between the two sized rigs plus the smaller rigs generally use water-based drilling fluids rather than the oil-based fluids needed for the lateral sections. There is a significant cost differential in using these two drilling systems, plus the company saves costs by avoiding having to switch out the different drilling fluid systems.

**Exhibit 4. Breakeven Well Cost Impact From Oilfield Inflation**



Source: Rystad Energy, PPHB

**Reduced well breakeven costs comes from a combination of improved drilling technology and reduced oilfield service prices**

Breakeven costs for wells have declined significantly over the past three years. Data from consultant Rystad Energy shows what has happened to these well breakeven costs in various basins between 2014 and 2016. What we know is that the reduced well breakeven costs comes from a combination of improved drilling technology, such as those examples cited above, and reduced oilfield service prices due to the highly competitive market and low activity caused by the industry downturn. What no one truly knows is how to weigh the relative contributions of technology and service costs. Is that ratio 60%-70% from technology and 30%-40% from lower service costs, or is something different?

**This oilfield pricing increase has the impact of raising basin breakeven prices**

We prepared a chart showing the reduced basin breakeven costs as compiled by Rystad Energy consultants and compared them against a \$55 a barrel oil price. The analysis examines what happens if 40% of the breakeven cost improvement between 2014 and 2016 is due to reduced service costs and those savings return to the service industry through higher prices by 2018. As can be seen, this oilfield pricing increase has the impact of raising basin breakeven prices and, in some cases, making certain basins such as the

**Many E&P companies are preparing their 2017 capital spending plans based on expectations for 15%-20% oilfield service cost inflation**

Permian Midland and Eagle Ford unprofitable. While they are marginally unprofitable, these basins could become swing activity centers reflecting whether oil prices rise above or fall below well breakeven levels.

While higher well breakeven prices should have a meaningful impact on drilling activity, as we saw in recent years, besides low oil prices, producers believed their weak profitability was due to poor drilling program execution or the result of drilling marginal acreage. This time probably won't be much different as producers justify maintaining their activity expecting greater profitability in the future given projections of rising oil prices. Recent discussions with several producers and commodity hedge traders suggest that many E&P companies are preparing their 2017 capital spending plans based on expectations for 15%-20% oilfield service cost inflation. At the same time, many of these same E&P companies are saying that the operational efficiencies they have developed still allow them to drill more wells with fewer rigs, and despite higher oilfield service costs, they expect to earn higher returns. Only time will tell whether those assumptions prove correct, and whether it is company specific rather than an industry-wide phenomenon. Once again we worry about people chasing that train.

## Driving Longer And Going Farther Can Actually Save Gas

**In 2004, UPS announced it would begin a policy of planning its delivery routes in such a way as to avoid making left-hand turns**

While it is hard to believe that you can drive longer and go farther and actually save gasoline, United Parcel Services Inc. (UPS), the ubiquitous package delivery service famous for its brown trucks and drivers' uniforms, has proven this scenario to be true. In 2004, UPS announced it would begin a policy of planning its delivery routes in such a way as to avoid making left-hand turns. This decision came after the logistics company developed better tracking devices for its trucks and began studying how to improve their efficiency. As a nationwide delivery service, UPS operates over 96,000 trucks and several hundred airplanes in the competitive package delivery business. Improving efficiency was a top goal for improving profitability.

UPS always understood that its performance required a series of optimization decisions about saving time, using less fuel and maximizing space utilization. With the advent of improved vehicle tracking devices in 2001, UPS was able to identify areas where it was less efficient in the use of its equipment and employees, and where operations might be improved by changing procedures.

**Turning against traffic resulted in long waits in left-hand turn lanes that wasted time and fuel**

UPS engineers found while studying the performance of its truck fleet that left-hand turns were a major drag on efficiency. Turning against traffic resulted in long waits in left-hand turn lanes that wasted time and fuel, and it also led to a disproportionate number of accidents. Thus, the company undertook a significant operational

**This no-left-hand-turn policy, coupled with some other minor operational improvements, led to an estimated savings of 10 million gallons of fuel for UPS in 2012**

**“I mean, we really, really hate left turns at UPS.”**

**We often wonder how long they have to sit there before getting that opportunity to turn left**

shift by instituting a policy for trucks to avoid making left-hand turns even if it meant a truck had to make multiple right-hand turns and driver farther in order to complete a loop and reach a location.

Most drivers would say that the shortest distance between two points is what should govern route-setting even if it means making a left-hand turn. Amazingly, even if a UPS delivery truck traveled farther and took more time, the entire process proved to be more efficient and profitable for UPS. In fact, this no-left-hand-turn policy, coupled with some other minor operational improvements, led to an estimated savings of 10 million gallons of fuel for UPS in 2012. At \$2 per gallon, that meant a cost savings of \$20 million.

In describing the policy during a speech, the CEO of UPS told the audience, "I can see a few of you smiling out there, and I know what you may be thinking. But it really works." So skeptical were people that Discovery channel's acclaimed science show Mythbusters decided to test the UPS claim. The program sent a truck out to deliver packages following a normal route and one employing the left-turn hating UPS route. They found the UPS approach saved gas but took a bit longer. It is possible that Mythbusters failed to save time on the route by following the UPS rule even more stringently than its drivers do. We, and we're sure you, too, have seen UPS drivers making left turns occasionally. It is usually in residential neighborhoods without much oncoming traffic. Asked by one of the Mythbusters hosts how often UPS drivers turn right, a driver said, "A guesstimate, I would probably say 90%. I mean, we really, really hate left turns at UPS."

UPS uses computer software to map its drivers' routes, which tend to be heavily right-hand turn oriented. In some situations, it will call for left-hand turns when they are easier and faster than the alternative. Those turns are generally in areas where traffic is light. But as one senior VP of UPS put it, "That's why I love the engineers, they just love to continue to figure out how to make it better."

In our commuting, we often see vehicles sitting in left-hand turning lanes waiting for a clear path across four lanes of traffic in order to turn into a shopping center parking lot. We often wonder how long they have to sit there before getting that opportunity to turn left. We also wonder why they don't consider driving on to an intersection with a traffic light that enables them to make a legal U-turn to go back and make a right-hand turn at the point where they were sitting waiting for clearance to make a left-hand turn. We believe, based on the flow of the traffic that our strategy would likely save time, even if they have to drive farther.

According to the Department of Transportation's fueleconomy.gov website, "Idling can use a quarter to a half gallon of fuel per hour, depending on engine size and air conditioner (AC) use. Turn off your engine when your vehicle is parked. It only takes about 10

seconds worth of fuel to restart your vehicle.” That seems like good advice, as does avoiding left-hand turns – just like UPS drivers.

## Understanding The Factors Influencing Crude Oil Prices

**We are more interested in where oil prices will be at some date in the future**

As we all struggle to forecast where crude oil prices are heading, understanding the forces impacting that trajectory is important. Everyone knows that an oil price is in theory a point at which supply and demand exactly balance, based on the condition that crude oil buyers and sellers can freely agree to a deal. Most of us looking at oil prices understand the meaning of the spot price – today’s market equilibrium point between supply and demand. However, we are more interested in where oil prices will be at some date in the future – either fairly near-term or possibly years in the future. These views of future prices are what guides the decision about whether an investment in the oil industry is worthwhile.

**The one factor essentially outside the dynamics of the oil industry is financial markets**

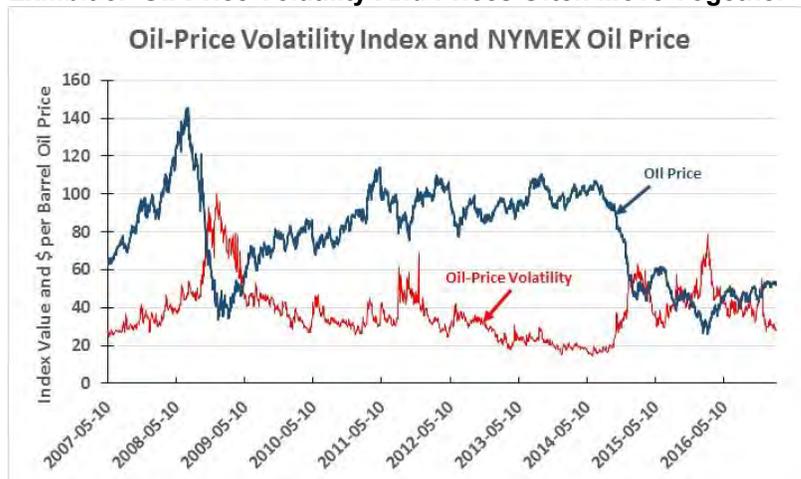
The Energy Information Administration (EIA) has a section discussing the seven factors influencing crude oil prices. Those seven factors they identified are: spot oil prices; supply from Non-OPEC countries; supply from OPEC countries; balance/inventories; financial markets; demand from Non-OPEC countries; and demand from OPEC countries. If you focus on these seven factors, four of them – the two supply and two demand factors – shape the balance/inventory and spot oil price factors. The one factor essentially outside the dynamics of the oil industry is financial markets.

Many of us are familiar with the discussion about how oil price futures curves are a good guide as to where buyers and sellers believe future oil prices are headed. Those curves evolve from the multitude of transactions between crude oil buyers (traders/speculators/consumers) and crude oil sellers (producers/refiners/speculators). When the two sides agree to a transaction for a quantity of oil at a negotiated price at a specified date, we have a data point that helps fill out the futures curve. The slope of these curves reflects the collective wisdom about future economic and industry conditions and, therefore, whether oil prices will be higher or lower than they currently are.

**Another financial factor impacting oil prices is their implied volatility**

Another financial factor impacting oil prices is their implied volatility. This implied volatility is a measurement developed in 2007 by the Chicago Board of Options Exchange (CBOE) that measures the market’s expectation of 30-day volatility of crude oil prices by applying the CBOE Volatility Index methodology to options on the United States Oil Fund, LP, (USO-NYSE) spanning a wide range of strike prices. The United States Oil Fund is an exchange-traded security designed to track changes in crude oil prices. These options have developed into one of the more actively traded options contracts.

**Exhibit 5. Oil-Price Volatility And Prices Often Move Together**

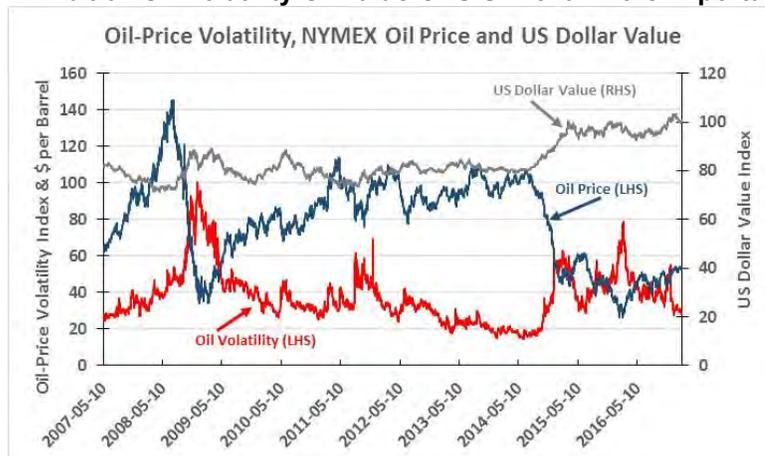


Source: CBOE, EIA, PPHB

**They attribute the increased volatility to the impact that the oil industry is undergoing extreme change, which is tied to global oil demand encountering a limit to global oil supply, known as peak oil**

The chart in Exhibit 5 shows the history of the oil-price volatility index compared to the West Texas Intermediate (WTI) oil price. Each time the volatility index shoots up, it is when oil prices are falling and then rebounding, or in essence being volatile, especially in relation to the movement of prices during their most recent period of time. There are some analysts who have concluded that the volatility index has a cycle of about three years (900-1000 days in length). They attribute the increased volatility to the impact that the oil industry is undergoing extreme change, which is tied to global oil demand encountering a limit to global oil supply, known as peak oil.

**Exhibit 6. Oil Volatility Or Value Of U.S. Dollar More Important?**



Source: CBOE, EIA, St Louis Fed, PPHB

We thought it would be interesting to introduce another financial variable to the oil price equation, with that being the value of the U.S. dollar. What can be seen from Exhibit 6 is that while oil-price

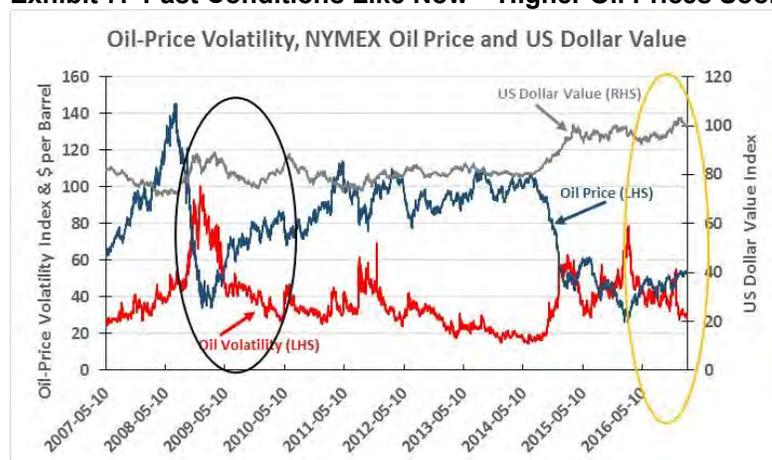
**When the value of the dollar began rising sharply in 2014, oil prices fell**

**What we find particularly interesting is to compare the current conditions versus those that were evident in the 2009-2010 period**

volatility appears every time the oil price moves sharply either up or down, we had a long time (2009-2014) during which there was a slow decline in the dollar's value as oil prices steadily climbed from the \$40s a barrel to over \$100. On the other hand, when the value of the dollar began rising sharply in 2014, oil prices fell. Oil prices have remained low compared to the levels during 2010-2014, while the dollar's value rose and remained stable, until recently.

What we find particularly interesting is to compare the current conditions (orange circle) versus those that were evident in the 2009-2010 (black circle) period. Just as now, the value of the U.S. dollar was rising but it then began to decline. At the same time, the oil-price volatility index was declining after having been quite high. Lastly, oil prices started to rise just as they are now. While the correlation of these three variables does not indicate causation, we do know that the value of the U.S. dollar is highly correlated with commodity price movements, either up or down.

#### Exhibit 7. Past Conditions Like Now – Higher Oil Prices Soon?



Source: CBOE, EIA, St. Louis Fed, PPHB

**The fact that the performance of the three factors is so similar between now and in 2009-2010, we should pay attention to what is happening**

There is no guarantee that the coincidence of the movement of factors in 2009-2010 will be the same now, or ever. On the other hand, the fact that the performance of the three factors is so similar between now and in 2009-2010, we should pay attention to what is happening. Will the dollar keep rising as expected or fall? What about volatility – rise or fall? Even if oil prices do continue to climb, there is no reason to expect that they will or have to go back to the \$80 to \$100 a barrel level. The strength of the similarities between the two periods merits watching closely.

## Are Commodity Speculators Becoming Less Bullish?

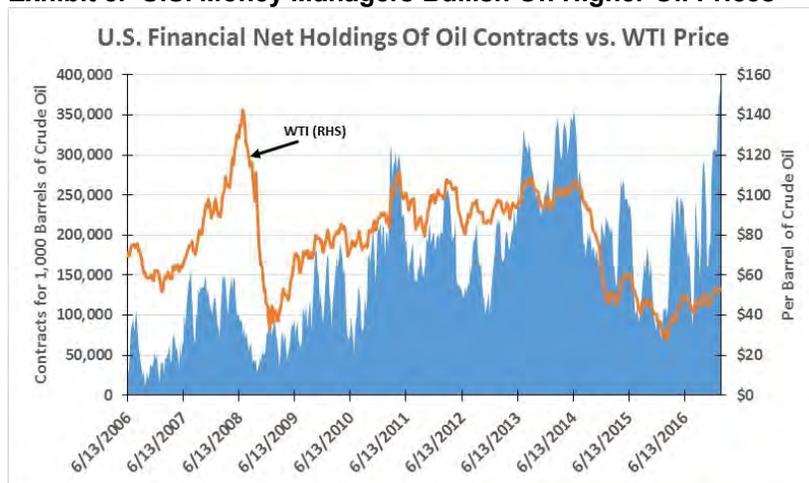
In the last *Musings* we wrote about how financial speculators had built their most bullish position (owning contracts and options to buy contracts for 1,000 barrels of crude oil) for higher crude oil prices in

**Traders appear to have a history of establishing record bullish bets just when oil prices are set to decline**

history, as of January 24th, based on the Commitments of Traders weekly report from the Commodity Financial Trading Commission (CFTC). We suggested, based on the history of these reports, traders appear to have a history of establishing record bullish bets just when oil prices are set to decline. Our conclusion was based on comparing the chart of commodity futures holdings of money managers as prepared by the *Wall Street Journal* along with a chart of weekly crude oil prices we prepared for the same time period. At the time of our article, we had not had time to secure all the CFTC weekly data and analyze it. After two additional weeks of data, we have prepared a series of charts demonstrating that it appears traders' bullishness is just starting to wane.

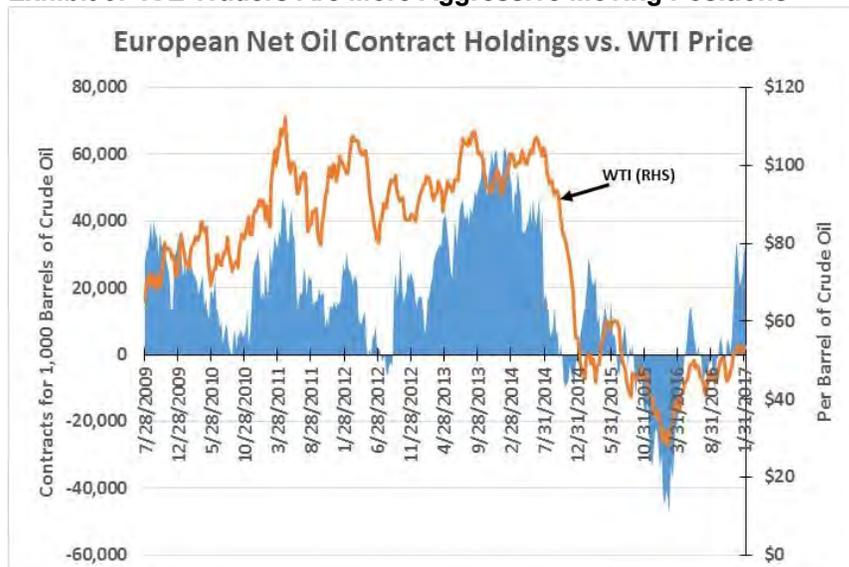
One of the issues we wished to understand was the trading pattern of all speculators. Therefore, we created charts showing the net long holdings (number of long positions minus the number of short positions) of U.S. managed money traders active on the New York Mercantile Exchange (NYMEX) and those managed money traders active on the International Exchange (ICE) in Europe. In Exhibits 8 and 9 (next page), we show the history available from the CFTC for the respective NYMEX and ICE managed money traders over the period from mid-June 2006 thru February 7, 2017.

**Exhibit 8. U.S. Money Managers Bullish On Higher Oil Prices**



Source: CFTC, EIA, PPHB

The chart above was similar to the chart the *Wall Street Journal* printed with two exceptions: it did not contain the oil price; and it ended with data as of January 24, 2017, two weeks shorter than this chart. What we found very interesting was the chart we prepared showing the net holdings of European speculators. It should be noted that the data is only available from the end of July 2009, or three fewer years than the data for U.S. traders. Since the ICE market is considerably smaller than the U.S. market, it becomes easier to measure shifts in traders' sentiment.

**Exhibit 9. ICE Traders Are More Aggressive Moving Positions**

Source: CFTC, EIA, PPHB

**It is also interesting that the traders were continuing to reduce their net long position in the run up to the November OPEC meeting and while oil prices were sliding from \$107 a barrel to \$75**

**As 2015 opened, ICE traders were building their net long position in anticipation that the oil price drop would soon rebound, a pattern similar to what happened in 2009 as the 2008 financial crisis wound down**

What Exhibit 9 shows is that almost immediately following the November 2014 OPEC decision to abandon support of global oil prices, European traders unwound their bullish commodity bet and quickly went into a net short position expecting crude oil prices to continue to fall. But more interesting was how these traders traded the oil market during 2014. Initially, they had gone long crude oil contracts in late 2013, reaching an all-time high by the start of 2014, just as oil prices began climbing toward their June 2014 peak. As oil prices traded up during the first six months of 2014, traders started cutting their net long holdings. As crude oil prices peaked in June 2014, these traders had reduced their net long position by nearly a third. It is also interesting that the traders were continuing to reduce their net long position in the run up to the November OPEC meeting and while oil prices were sliding from \$107 a barrel to \$75. By the time OPEC officials gathered in Vienna in late November 2014, ICE traders were at almost a neutral (zero) net long position.

The ICE trading pattern in early 2015 is also interesting as it confirmed the consensus at the time that OPEC's decision would produce only a short-lived oil price correction. From the chart, one can see that as 2015 opened, ICE traders were building their net long position in anticipation that the oil price drop would soon rebound, a pattern similar to what happened in 2009 as the 2008 financial crisis wound down. In early 2009, the oil price rebound reflect the reality that the 2008 price decline was associated more with global financial liquidity concerns rather than weak oil market dynamics. In reality, oil demand in 2009 rebounded by one of the largest yearly gains ever. It was only as the impact of the 2009 recession and the subsequent slow-growth economic outlook that people realized that oil market demand was deteriorating, at the

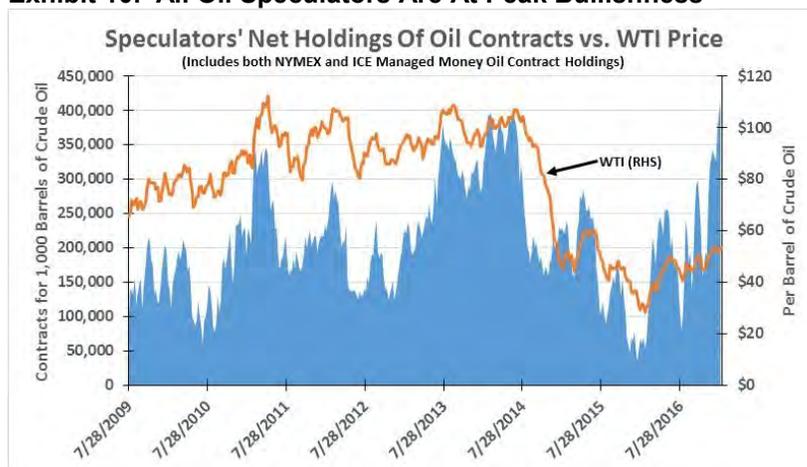
**European traders, while bullish about future oil prices, are only half as bullish as they were in early 2014**

same time the push for the shale oil revolution was accelerating. The increased shale oil output with only moderate oil consumption growth contributed to the global oil supply glut that became evident in late 2013 and grew in 2014, ultimately leading to OPEC's action.

European oil traders shifted their long and short positions in sync with the volatile oil market. They built a peak net short position just as oil prices bottomed in 2016. While it appears these European traders did reasonably well in timing the building and unwinding of net long positions, they were not perfect. What we find interesting now is that European traders, while bullish about future oil prices, are only half as bullish as they were in early 2014.

While the Europeans may have traded the oil price moves in recent years better than the Americans, we thought it would be interesting to see what the impact on positions was when all the positions were combined. As shown in Exhibit 10, the swing in the combined positions was greater than just in the U.S. holdings, but the patterns were similar and the bullishness of recent trading remains robust. What is important now is to look at the most recent trading activity.

**Exhibit 10. All Oil Speculators Are At Peak Bullishness**



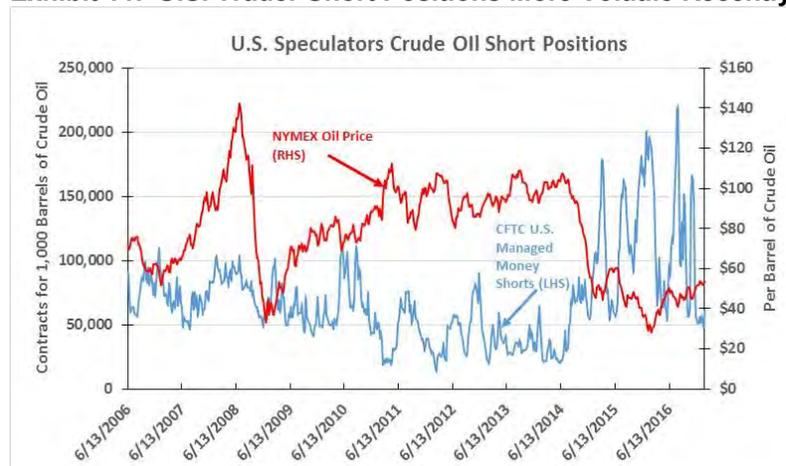
Source: CFTC, EIA, PPHB

**Oil prices have been rallying in recent weeks as the various surveys are reporting increasing higher OPEC compliance figure**

Last year marked the presumptive end to the oil industry downturn as crude oil prices hit bottom in February and then rose steadily throughout the balance of the year, culminating in OPEC's decision at the end of last November to agree to a production cut. Importantly, OPEC's agreement involved commitments from large non-OPEC oil exporters to trim their output, also. While oil markets are awaiting confirmation that the OPEC/NOPEC (non-OPEC) production cuts are, in fact, being complied with, oil prices are reflecting every nuance from media reports of survey results for January's output. Oil prices have been rallying in recent weeks as the various surveys are reporting increasing higher OPEC compliance figure. At the same time, the recent weekly U.S. crude

oil and petroleum product inventory builds suggest that OPEC and NOPEC countries boosted their exports in December prior to the start of the output reduction in order to capture additional revenues before having their output cut backed.

#### Exhibit 11. U.S. Trader Short Positions More Volatile Recently



Source: CFTC, EIA, PPHB

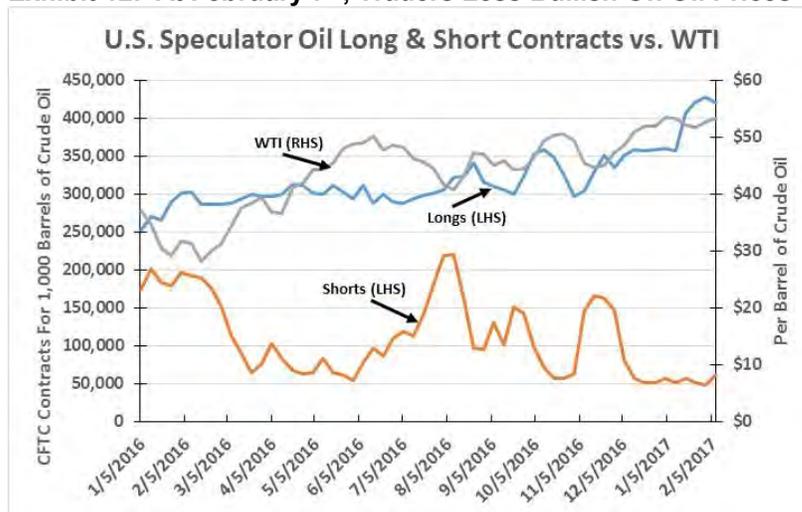
**As oil price volatility has increased so have crude oil short positions**

We thought it would be interesting to examine how U.S. traders had handled their short positions over time, so we plotted that data versus oil prices. The overall pattern is interesting. From mid-2006 until mid-2014, with the exception of a few spikes, the trend in short positions had been downward. That is not surprising as this was a period marked by steadily rising crude oil prices. In June 2014, as the crude oil price peaked, traders began building their short positions. Since then, as oil price volatility has increased so have crude oil short positions.

**In the first week of February, traders' bullish bets were reduced and they added to their shorts, significantly modifying their bullishness**

Turning to activity since the start of 2016, we see how U.S. trader long and short positions magnify their current bullishness. Long positions have steadily grown, reaching record high levels recently. In 2017, the shorts are at the lowest levels they have been since a brief time in June 2016. The most important point in examining this chart (Exhibit 12, next page) is what it shows about the past few weeks. As the *Wall Street Journal* pointed out in its article, the traders had established a record bullish position as of January 24. As subsequent data showed, the traders added to their bullish holdings the following week. However, in the first week of February, traders' bullish bets were reduced and they added to their shorts, significantly modifying their bullishness.

While U.S. traders increased their short positions and reduced their long ones, in Europe the same net shift was evident but it was almost completely due to traders there adding to their short positions. In fact, they barely cut their long positions (from 50,059 to 50,030 contracts), but their short position increased by 16%, or an

**Exhibit 12. At February 7<sup>th</sup>, Traders Less Bullish On Oil Prices**

Source: CFTC, EIA, PPHB

**While one week does not make a trend, it is possible we are seeing a repeat of the historical pattern of record net long positions coinciding with oil price direction changes**

increase of 2,828 contracts. While reflecting a more bearish view of near-term oil prices, the shifts by U.S. traders may be more meaningful as a bearish reflection. U.S. trader long positions fell in the February 7 weekly report by 2% from the prior week, while their short positions rose 26.5%, an increase of 12,710 contracts. While one week does not make a trend, it is possible we are seeing a repeat of the historical pattern of record net long positions coinciding with oil price direction changes. Time will tell, and we will be watching.

## Crude Oil Prices Supported By High OPEC Cut Compliance

**Over the past three decades, research has shown that OPEC generally only meets about two-thirds of its agreed-to production cuts**

The question about the direction for crude oil prices during the first half of 2017 likely rests on how successful will the members of the Organization of Petroleum Exporting Countries (OPEC) be in adhering to the reduced production targets they agreed to last November. Historically, over the past three decades, research has shown that OPEC generally only meets about two-thirds of its agreed-to production cuts. This time, at least so far, the compliance has been much higher, probably reflecting the more dire straits many of the member countries are in due to low oil prices.

**OPEC's compliance is estimated to have ranged between 75% to as high as 92%**

Based on various third-party surveys and estimates, including the latest report from the International Energy Agency (IEA), OPEC's compliance is estimated to have ranged between 75% to as high as 92%. The high estimate came from the IEA's survey of January volumes produced and translates into an output cut of a slightly over one million barrels a day, largely driven by Saudi Arabia's greater than agreed-to cut of 480,000 barrels a day for 2017's first six months, the initial time frame of the production cut agreement. According to the oil minister of Saudi Arabia, Khalid al-Falih,

**Production figures for January show that Saudi Arabia's oil production was some 625,000 barrels a day below its output volume in October 2016**

**Russia has already cut output by 100,000 barrels a day, or one-third of its target reduction**

**The IEA is now projecting 2017's oil demand growth to be 100,000 barrels a day higher than its last month's forecast, reaching 1.4 million barrels day**

**These forecasts raise the fundamental question of what if the U.S. turns out to be able to produce more crude oil in 2017, and in future years, than the consensus is forecasting**

speaking at the Atlantic Council Global Energy Forum in Abu Dhabi, the Kingdom is producing below 10 million barrels a day for the first time since April 2015. Production figures for January show that Saudi Arabia's oil production was some 625,000 barrels a day below its output volume in October 2016, the baseline month from which OPEC established production reduction targets. That would put its output somewhere in the 9.7 million barrels a day range.

The overall success of the OPEC/NOPEC (non-OPEC oil exporting countries who are supporting the output cut) agreement depends a lot on Russia's compliance as it accounts for over half the NOPEC production cut target of 558,000 barrels a day. Russia stated, at the time it agreed to cut output in cooperation with OPEC, its reduction would come over time. It has now announced that it has already cut output by 100,000 barrels a day, or one-third of its target reduction.

The IEA, in its February monthly oil report, has also raised its global oil consumption growth estimates. It boosted its 2016 demand growth for the third month in a row. Growth is projected to have increased by 1.6 million barrels a day due to colder weather in the fourth quarter and the long-term growth of China, India and non-OECD countries. The IEA is now projecting 2017's oil demand growth to be 100,000 barrels a day higher than its last month's forecast, reaching 1.4 million barrels day, and now coming off a higher base. The combination of increased demand growth and greater adherence to the OPEC/NOPEC production cut agreement should result in crude oil inventories falling sharply in the third and fourth quarters of 2017 leading to higher crude oil prices during the second half of the year, and certainly by year-end.

The big issue for the IEA, as well as all other forecasters, is estimating the volume of new oil output coming from non-OPEC countries. The IEA says it expects the combined oil production increases of Brazil, Canada and the United States will climb by 750,000 barrels a day in 2017. That growth would be offset by 11 other countries having reduced output, bringing total non-OPEC production growth this year to an increase of only 400,000 barrels a day. For the U.S., the IEA sees its oil production averaging an increase of 175,000 barrels a day, with a December 2017 to December 2016 growth of 520,000 barrels a day. There are other more optimistic estimates of production growth in the United States now that the industry is going back to work more earnestly. These forecasts raise the fundamental question of what if the U.S. turns out to be able to produce more crude oil in 2017, and in future years, than the consensus is forecasting.

At the present time there is a wide range of output projections for 2017 based on forecasters' assumptions about the trajectory for crude oil prices and how quickly drilling activity ramps up. There is also a wide range of expectations about drilling rig productivity – crude oil output per well drilled – that is somewhat dependent on

**We have seen forecasts for U.S. output ranging from a conservative 8.75 million barrels a day projection from oil consultant Wood Mackenzie to a much more optimistic 9.37 million barrels a day estimate from investment firm Macquarie Capital (USA)**

**It is also important to think about the trajectory of oil prices over the forecast period**

**It is hard to find any past period when oil prices moved in such a limited annual range of changes as suggested by their forecast**

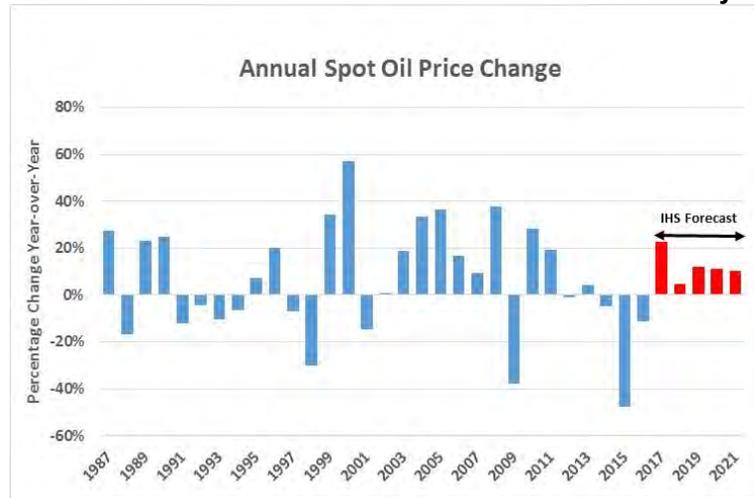
labor force availability, oilfield service costs and prospect economics. To some degree it also depends on exploration and development company cash flows and their ability and desire to access capital markets to augment their cash flows. Unfortunately, these considerations largely ignore the issue of global economic growth and oil demand.

Many of the forecasts never spell out the assumptions underlying their oil output projections. We have seen forecasts for U.S. output ranging from a conservative 8.75 million barrels a day projection from oil consultant Wood Mackenzie to a much more optimistic 9.37 million barrels a day estimate from investment firm Macquarie Capital (USA). Recently, we sat through a webinar hosted by the energy teams of IHS Markit focused on the outlook for U.S. oil markets over the next five years. The presenters delved into the economics of oil plays, the impact of technology and geologic knowledge on drilling, and corporate strategies. To present their best (most reasonable) case scenario, they felt compelled to also present two alternative oil output forecasts to highlight what might be or had to be different for them to materialize.

In the base case, which IHS calls their \$53 a barrel oil price case, domestic oil production begins 2017 at 8.8 million barrels a day and by the end of 2021 reaches 10.3 million barrels a day of output. In the final year of this forecast, crude oil prices would average \$76.59 a barrel, providing the incentive for the additional drilling and output. That would be considerably below what some forecasters expect oil prices to average for the next year or two. For the oilfield service industry, the number of wells drilled will increase by nearly 80% over the 2016-2021 span. For this increase to occur, not only does technology and improved completion techniques need to contribute, but continued high-grading of exploration prospects needs to happen. But it is also important to think about the trajectory of oil prices over the forecast period. The annual oil price increases for 2018-2021 are: 4.5%; 12%; 11.3%; and 10.5%, respectively. These follow a 23% increase projected for 2017's oil price. In today's environment, especially following the environment of the past two years, conjuring up a nearly \$77 a barrel oil price in 2021 is tough to do. Do these projected annual price increases reflect reasonable assumptions?

The chart (Exhibit 13, next page) of historical annual spot oil price increases leaves one debating whether the IHS folks are too conservative, or possibly delusional. It is hard to find any past period when oil prices moved in such a limited annual range of changes as suggested by their forecast. That is not to say it couldn't happen, but if we were to occur, we would suggest that there will be a year or two in the forecast period when the price change is much greater or possibly negative. Unfortunately, we can't guess which year or years it might be.

**Exhibit 13. IHS Oil Price Forecast Reflects Little Volatility**

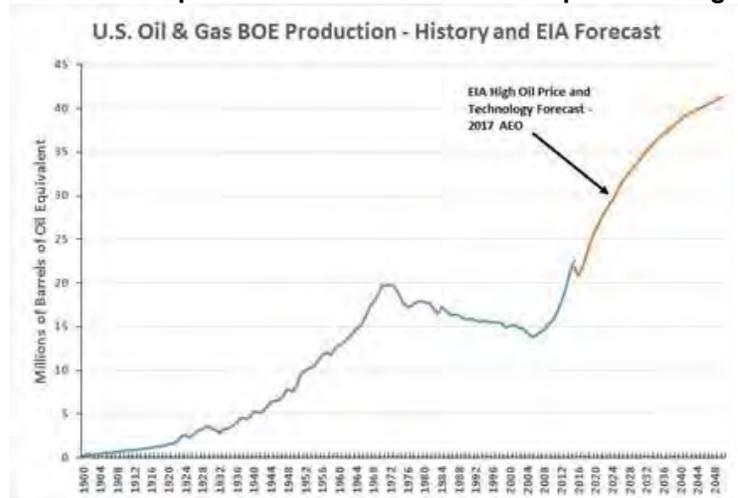


Source: EIA, IHS, PPHB

**The \$60 a barrel price case – oil output in 2021 would reach 11.1 million barrels a day, a level never seen in the United States**

IHS' answer to our concern was reflected in the alternative scenarios they presented - an upside oil price case and a downside case, too. Importantly, you get significantly different outcomes under the two alternative scenarios. On the optimistic side – the \$60 a barrel price case – oil output in 2021 would reach 11.1 million barrels a day, a level never seen in the United States, even in the industry's heyday. But it is not beyond the realm of speculation as suggested in the following chart that shows what the most optimistic case for oil and gas output, converted to barrels of oil-equivalent (Boe), projected by the Energy Information Administration (EIA) in its 2017 Annual Energy Outlook might look like. While natural gas plays a meaningful role in that forecast, between 2015 and 2050, the EIA sees the possibility of the industry doubling oil and gas output.

**Exhibit 14. Optimistic EIA Sees US Boe Output Doubling**



Source: EIA, PPHB

**The optimistic future depends importantly on better rocks (geology) and/or improved drilling and completion technology**

To reach IHS' optimistic output target, in 2021, the oil industry will be drilling 10% more wells than under the base case scenario. To achieve the output growth, the industry must also either find larger formation sweet spots or coax much greater volumes out of the types of wells they are drilling now. Either way, the optimistic future depends importantly on better rocks (geology) and/or improved drilling and completion technology.

**Surprisingly, at the end of 2021, under this downside case, the industry would still be producing 9.7 million barrels per day of crude oil**

To humor those in the audience, IHS also gave us their downside scenario – the \$46 a barrel price case – that surprisingly doesn't put the industry too far behind the base case. Surprisingly, at the end of 2021, under this downside case, the industry would still be producing 9.7 million barrels per day of crude oil, or about what the base case targets the industry's output to be at the start of 2021, or essentially only one year behind the base case 2021 year-end output target. Again, surprisingly, to reach that production target, the industry will be drilling only 1,465 fewer wells in 2021 than under the base case, or nearly what the industry is estimated to have drilled in 2020 under the base case forecast.

**Depending on events around the world, the risk for the domestic oil industry is that its success could undercut the global oil industry's recovery and knock down the prospect for a slow steady rise in oil prices and future domestic oil output**

All of the forecasts for domestic oil production appear feasible. The U.S. is home to some of the best oil and gas geology in the world with the largest number of independent explorers testing new theories about where to find and how to produce more hydrocarbons cheaper. These hundreds of independent operators are supported by the largest, most technically sophisticated oilfield service industry. Combine these elements with the deep capital markets existing in the United States that ensures that the petroleum industry has access to adequate capital for creating value for investors, and you have the makings of a vibrant and healthy industry. Depending on events around the world, the risk for the domestic oil industry is that its success could undercut the global oil industry's recovery and knock down the prospect for a slow steady rise in oil prices and future domestic oil output. We don't know what the odds of that happening are, but it is a scenario that everyone should keep in the back of their minds as they cheer on the nascent oil industry and oil production recoveries. However, too much U.S. oil success could actually be a bad thing for the industry, but probably a good thing for consumers.

## **A Lighter Moment, And A Serious Issue To Contemplate**

**A native of a small town in West Virginia, Mr. Stirewalt has an entertaining way of explaining the sometimes surreal political world we live in**

FOX News Politics editor Chris Stirewalt writes an email commentary every day about politics and life. A native of a small town in West Virginia, Mr. Stirewalt has an entertaining way of explaining the sometimes surreal political world we live in, while offering offbeat insights into some of life's more complex issues. We found an item he published recently about airbags and the dummies being used to test them both amusing, and somewhat terrifying.

**We have watched with some amusement the various attempts by political leaders to alter America's eating habits through government restrictions and taxation, with little success**

Given the safety concerns due to the massive deception by Takata, the manufacturer of defective inflator and propellant devices used globally in 42 million automobile airbags, we have paid attention to the growing list of vehicles being recalled due to their potential failure risk. We are always reading the recall lists to make sure that our vehicles are not among those listed as having these defective devices than can kill or maim you if they discharge. So far so good.

While the airbag episode has been playing out, we have watched with some amusement the various attempts by political leaders to alter America's eating habits through government restrictions and taxation, with little success. What has been successful has been the legal challenges and pushback against these politically-motivated actions. Efforts to tax sugary soft drinks and ban super-size drinks and refills at eating establishments have been pushed by mayors and governors in coastal cities and states as a way to force people to eat healthier, reduce obesity and improve medical conditions. The article Mr. Stirewalt published highlights how airbags have intersected with healthy eating habits.

#### **DOES THIS AIRBAG MAKE ME LOOK FAT?**

[Sacramento Bee](#): "It's come to this: America's crash-test dummies are getting older and fatter. In an effort to more accurately reflect the U.S. car-driving population, at least one manufacturer is making crash-test dummies – the pretend people used to test automobile safety features – bigger and older. 'The typical patient today is overweight or obese – they're the rule rather than the exception,' said Dr. **Stewart Wang**, director of the University of Michigan International Center for Automotive Medicine, in a statement... The new crash-test models include a 273-pound dummy, more than 100 pounds heavier than normal, as well as a prototype based on an overweight 70-year-old woman. 'The condition, size and shape of an individual is hugely important in how severe their injuries are in any given crash,' said Wang, who has studied crash injuries and works with automotive engineers on safety research."

Within a day, some readers emailed Mr. Stirewalt about his airbag article. They questioned whether the characterizations of the "heavier than normal" dummy or the one based on an "overweight 70-year old woman" were his views or those of the *Sacramento Bee*? Mr. Stirewalt commented about the truth of the observation, never disclosing whether the language was his. While we doubt it, we must admit to Mr. Stirewalt's cherubic face on television.

**This might actually be a more important consideration than cheap gasoline in why Americans select their vehicles**

We did wonder, however, what impact this trend to larger Americans is having on vehicles being purchased. In fact, we wondered whether this might actually be a more important consideration than cheap gasoline in why Americans select their vehicles, opting for more roomy pickups and sport utility vehicles (SUVs) in great

numbers lately over small cars. If people shrink in size through better diet, exercise and lifestyle programs, might that translate into more small car purchases in the future? Could that be an important opening for electric vehicles that tend to be smaller vehicles increasing their penetration into our nation's vehicle fleet?

**Contact PPHB:**  
**1900 St. James Place, Suite 125**  
**Houston, Texas 77056**  
**Main Tel: (713) 621-8100**  
**Main Fax: (713) 621-8166**  
**[www.pphb.com](http://www.pphb.com)**

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