PPHB
ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

May 30, 2017

Allen Brooks
Managing Director

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

The Oil Drums Are Beating – Higher Prices Coming?

Higher prices! Higher prices! That's what everyone is hearing

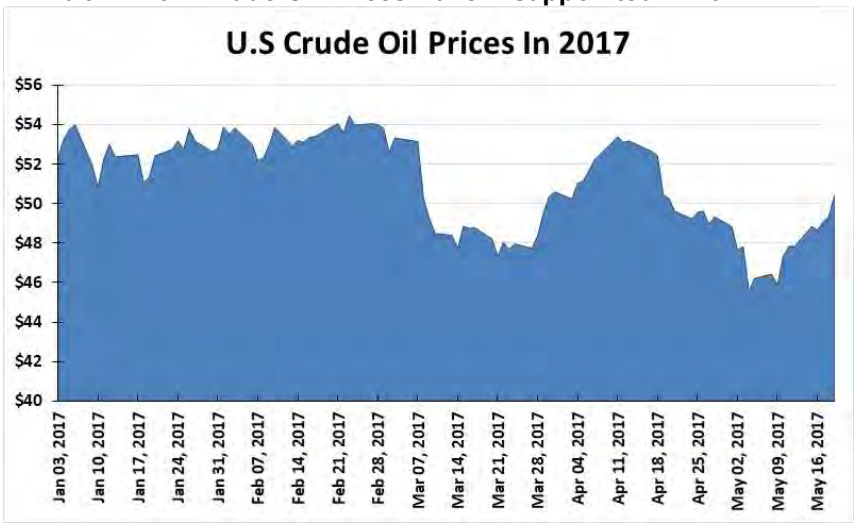
In the oil patch, the price drums are being banged. Everyone has their hand cupped to their ear trying to decipher the message. Higher prices! Higher prices! That's what everyone is hearing. Those drums started beating that message rapidly more than a week ago when global oil prices fell to a five-month low. As oil prices started crashing, the price action was explained by traders, speculators and hedgers who were increasingly doubting the resolve of oil exporters, principally OPEC and its non-OPEC supporters, who had agreed to cut their output by a combined 1.8 million barrels a day. As this lack of conviction grew that exporters, by cutting their output, would be able to drive down global oil inventories thus allowing world oil prices to climb, crude oil prices fell.

Recently, when it appeared oil prices might fall to $40 a barrel or possibly even lower, the fear factor drove the OPEC producers most impacted by lower global oil prices to react. The key players in the world oil market – OPEC, Saudi Arabia and Russia began beating the drum to send the message that they would do what was necessary in order to drive oil prices higher.

Even as oil prices crossed above the $50 a barrel mark, they still remained nearly $2 a barrel below where they started the year

The need for this drum beat became so important that it required two of the world's three largest oil producers, whose economies are significantly dependent on oil prices, to appear together in an effort to talk up the oil price. Before the rebound in oil prices that followed the joint presentation, concern was that the oil production cut agreement was failing to rebalance the global oil market. In fact, even as oil prices crossed above the $50 a barrel mark, they still remained nearly $2 a barrel below where they started the year. That was certainly not what OPEC, Saudi Arabia, Russia or the other non-OPEC exporters were counting on when they agreed to limiting or reducing their oil output last November.

Exhibit 1. How Crude Oil Prices Have Disappointed In 2017



Source: EIA, PPHB

What oil exporters wanted to see was a return to where oil prices traded during the first two months of 2017

The low oil price in early May, as shown in Exhibit 1, was below the prior low established in March when market concerns focused on whether OPEC members were complying with the production cut agreement. What oil exporters wanted to see was a return to where oil prices traded during the first two months of 2017, closer to the mid-$50s a barrel.

"Much work remains to be done in the second half of 2017"

What is impacting oil prices this year is more than just expectations about the pace of the market rebalancing. On that point, the May Monthly Oil Report (MOR) from the International Energy Agency (IEA) concluded, "It has taken some time for stocks to reflect lower supply when volumes produced before output cuts by OPEC and eleven non-OPEC countries took effect are still being absorbed by the market." It further pointed out that while the oil market rebalancing is "accelerating," and inventory volumes are being drawn down, in order to reach the five-year average inventory levels that OPEC is targeting, "much work remains to be done in the second half of 2017." That observation, consistent with the view of OPEC in its May monthly oil market report, put great pressure on Saudi Arabia and Russia to lead the OPEC/non-OPEC combine in getting to an agreement to extend the production cuts if they wished global oil prices to rise to the $60 a barrel target.

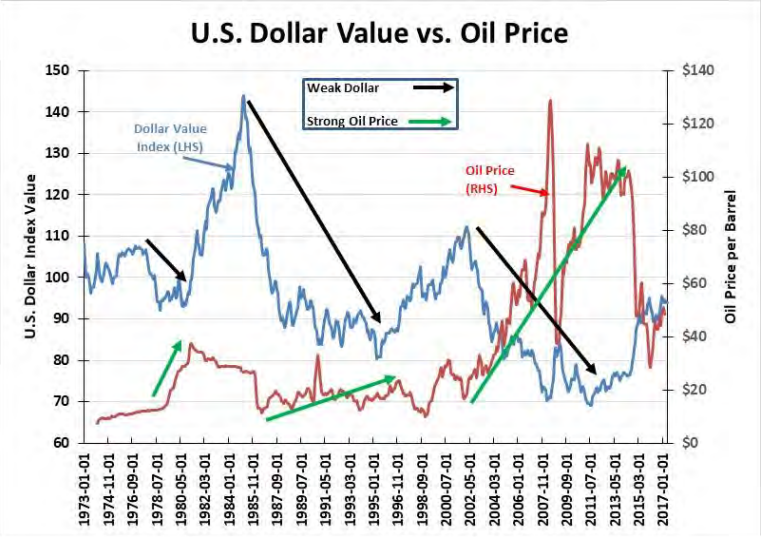
Part of the challenge for OPEC and its partners is overcoming the other market forces that are influencing oil prices

Part of the challenge for OPEC and its partners is overcoming the other market forces that are influencing oil prices, both positively and negatively. For example, what is happening with the value of the U.S. dollar has an impact on the price of commodities, especially oil. There is also the pressure on oil prices that comes from the actions of speculators who trade options on future oil prices. Those pressures can either help boost oil prices or act to depress the efforts to raise them.

Movements in the value of the U.S. dollar against other currencies impact the prices of commodities

Traditionally, movements in the value of the U.S. dollar against other currencies impact the prices of commodities that are traded globally. When the value of the dollar falls, it makes crude oil, which is traded worldwide in U.S. dollars, cheaper in foreign currencies and stimulates global oil demand. Likewise, when the dollar's value increases, foreign buyers find oil more expensive, limiting demand. That pattern has been observed over long periods of oil history.

Exhibit 2. History Of Inverse Dollar Value And Oil Prices



Source: EIA, St Louis Fed, PPHB

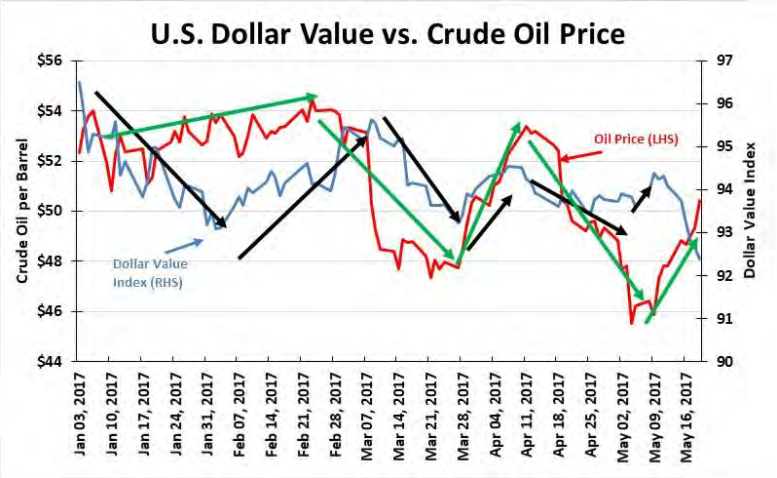
A reason why oil prices didn't increase more during that time is largely explained by the huge expansion of oil output globally

As shown in Exhibit 2, since 1973, it is easy to see extended periods when the U.S. dollar was weak and correspondingly, oil prices rose. In particular, note what happened to the value of the dollar during the 1980s and first half of the 1990s. As the dollar's value fell during that period, oil prices rose slightly. A reason why oil prices didn't increase more during that time is largely explained by the huge expansion of oil output globally in response to the explosion in oil prices during the 1970s following the Arab oil embargo of 1973/74 and the loss of oil supplies due to the Iranian revolution in 1979. The resulting global economic recession and increase in world oil supplies combined to limit the magnitude of improvement in oil prices.

Those years coincided with the commodity super-cycle when global demand for all commodities seemed to explode

If we look at the weakness in the dollar value during 2002-2011, we see that oil prices exploded, rising well above $100 a barrel for a significant portion of that time. Those years coincided with the commodity super-cycle when global demand for all commodities seemed to explode, driven by the rapid economic growth of China and India, along with concerns about the ability of the industries to bring sufficient new supplies to market to meet projected future demand. Now, however, it seems that this strong correlation between changes in the value of the U.S. dollar and oil prices has weakened.

Exhibit 3. Dollar Value And Oil Prices Not Correlated In 2017

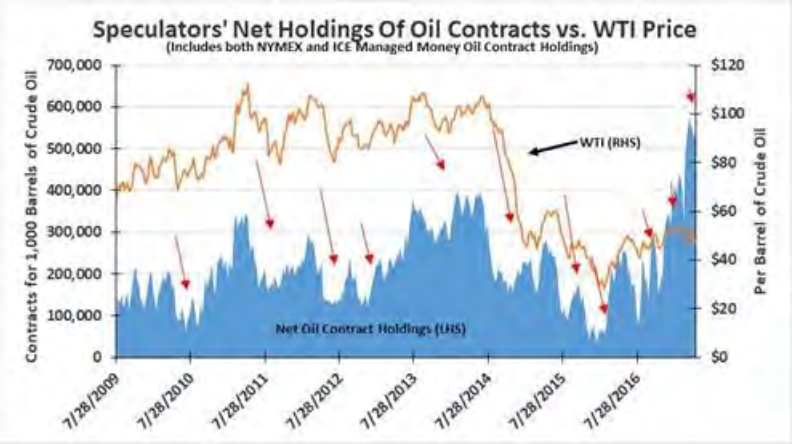


Source: EIA, St Louis Fed, PPHB

Does it mean this relationship is no longer working?

Exhibit 3 shows the oil price and the value of the U.S. dollar so far this year. During the first two months of 2017, oil prices rose while the dollar's value fell initially, but then rose. During March, the oil price fell as did the value of the dollar, the opposite of what would have been expected. This new relationship has continued through April and May. Does it mean this relationship is no longer working? Theoretically, it should still work, but the breakdown of the correlation suggests other factors are having a more powerful impact on oil prices than just changes in the value of the U.S. dollar.

Exhibit 4. Traders' History Of Peak Holdings As Oil Prices Fall



Source: CFTC, EIA, PPHB

One of the more powerful forces impacting crude oil prices this year has been speculators and oil traders. These are people who are trading futures contracts in expectation of changes in future oil prices, either up or down. One of the patterns that has proven quite accurate over the past seven years has been the tendency for

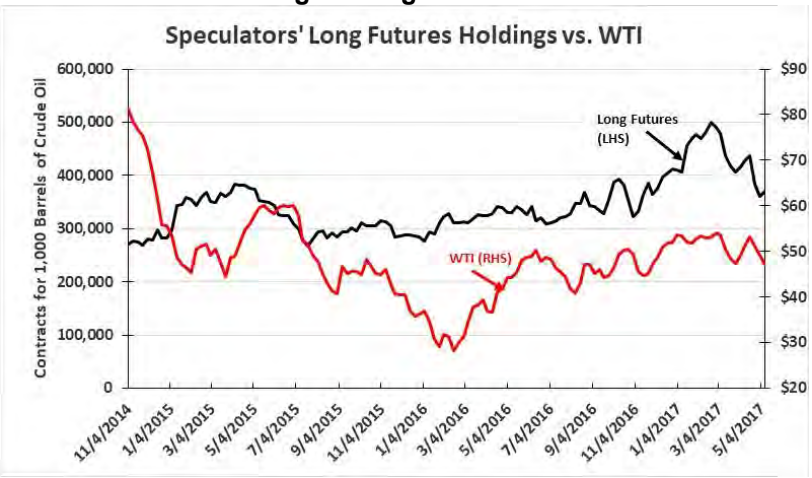
What may be missed to some degree is what influence the traders and speculators had on oil prices, as they built their positions

speculators to build peak oil holdings just as oil prices reach a peak before declining. Examining Exhibit 4 (prior page) and the chart's red arrows showing when oil prices fell compared to the level of oil futures holdings demonstrates this correlation. One would suggest that these traders and speculators have done a very good job in maximizing their trading activity – selling their holdings just as oil prices fell. What may be missed to some degree is what influence the traders and speculators had on oil prices, as they built their positions.

Early in 2017, speculators began aggressively adding to their futures holdings, but the oil price increase stopped and then prices went sideways before falling

So far in 2017, these traders and speculators have built the largest holdings ever seen. That phenomenon reflects both the high level of optimism traders and speculators had/have for higher oil prices. So far, that bet has not been as successful as the amount of capital they have wagered would imply. When we look at what has happened with speculators' long oil futures holdings and oil prices since the Saudi Arabia decision to abandon supporting OPEC oil prices in late 2014, we see how, early in 2015, speculators anticipated an oil price recovery and built their long futures holdings. Oil prices did rebound, but couldn't sustain the higher level and began falling almost steadily until the February 2016 oil price low was established. During that decline, speculators slowly built their long holdings, thus benefitting from the February to May 2016 oil price rise. From then until November 2016, the changes in speculator long holdings mirrored the pattern of oil prices. Starting in November and continuing through December, holdings grew as oil prices rose. Early in 2017, speculators began aggressively adding to their futures holdings, but the oil price increase stopped and then prices went sideways before falling, which came immediately after the speculators started unwinding their positions.

Exhibit 5. Traders' Long Holdings Don't Match Oil Price Action

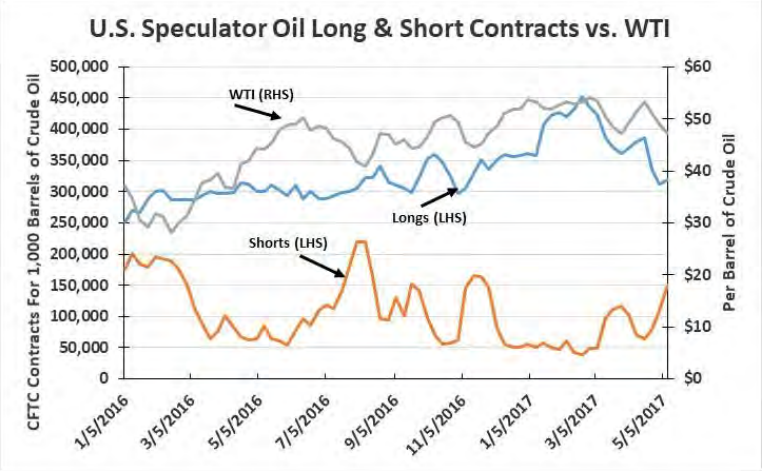


Source: CFTC, PPHB

The recent decline in the oil price along with the unwinding of speculator long positions coincided with a sharp increase in

speculators' short holdings as shown in Exhibit 6. It was partially in response to this shift in sentiment among speculators and traders that motivated Saudi Arabia and Russia to jointly announce their pledge to work for a nine-month extension of the current oil production cut agreement when OPEC met May 25th. A decision that was the outcome of the meeting.

Exhibit 6. Traders Are Positioning Against Higher Oil Prices



Source: CFTC, PPHB

For Saudi Arabia, getting oil prices to $60 a barrel by early 2018 is important for the success of their planned IPO of Saudi Aramco

It has taken an incredible amount of effort by OPEC and non-OPEC exporters to push oil prices from the $47 a barrel range back above $50. These exporters have talked about working to get all the exporters to agree to the nine-month extension and possibly to increase the size of the oil production cut from what they have been undertaking. The IEA's comments about the rebalancing of the oil market in the first quarter of 2017, despite the need for additional work, combined with the sixth weekly draw in closely-watched U.S. crude oil inventories and the first decline in estimated U.S. oil production also helped improve oil pricing sentiment. What is important to contemplate is that it took all of these efforts to stop the erosion in oil prices and boost them back above $50, still quite a ways below where Saudi Arabia, Russia and OPEC want them to be. For Saudi Arabia, getting oil prices to $60 a barrel by early 2018 is important for the success of their planned IPO of Saudi Aramco. Does the current oil price action suggest there are structural issues at work within the global oil market that people are not either paying attention to, or do not comprehend? Time will tell.

Peak Oil Demand Is A Risk – Why Nobody Knows If Or When

The lead story in a recent *The Wall Street Journal* Report on Innovations In Energy was titled "Get Ready for Peak Oil Demand." We have been getting ready for the past couple of years. However, in dealing with such a critical issue overhanging the future of this

important global industry, the unanswered question is when will oil demand peak and begin to decline. To answer the question one needs to know when those forces reducing oil consumption will become meaningful. Then, one has to know how much the demand will be reduced.

The assumptions underlying some of the most pessimistic forecasts for oil consumption treat demand-altering forces as switch-like – once thrown, oil use goes from light to dark, hot to cold, or rising to collapsing

The assumptions underlying some of the most pessimistic forecasts for oil consumption treat demand-altering forces as switch-like – once thrown, oil use goes from light to dark, hot to cold, or rising to collapsing. It has a nearly immediate impact. However, it may be more appropriate to view the transition from expanding energy use to shrinking consumption as the equivalent to turning an ocean liner: it takes a long time and lots of distance, even when the ship is equipped with bow and stern thrusters. But as the *WSJ* article highlighted, there are a number of considerations that require unique judgement calls, and then all these individual calls must be rationalized before arriving at the final forecast.

Everyone assumes the adoption of these new technologies will match that of smart phones (five years to reach 60% penetration), but what if it is more like the pace of adoption of electricity (50 years)?

The *WSJ* wrote: "New technologies that improve fuel efficiency are starting to push down the amount of gasoline and diesel that's needed for transportation, and a consensus is growing that fuel demand for passenger cars could fall as carbon rules go into effect, electric vehicles grain traction and the internal combustion engine gets re-engineered to be dramatically more efficient. Western countries' growth used to move in lockstep with their energy consumption, but that phenomenon is starting to decouple in advanced economies." Based on their view, as these forces play out, energy consumption in meeting the global economy's needs will stop rising and, over time, will most likely decline. Several questions come to mind: Is it possible that technology improvements will make fossil fuels significantly cleaner and more efficient, while keeping them cheaper than renewable power; If autonomous technology and artificial intelligence overcomes the historical decline in energy use by aging populations, might that offset some of the other energy-reducing trends; and while everyone assumes the adoption of these new technologies will match that of smart phones (five years to reach 60% penetration), but what if it is more like the pace of adoption of electricity (50 years)?

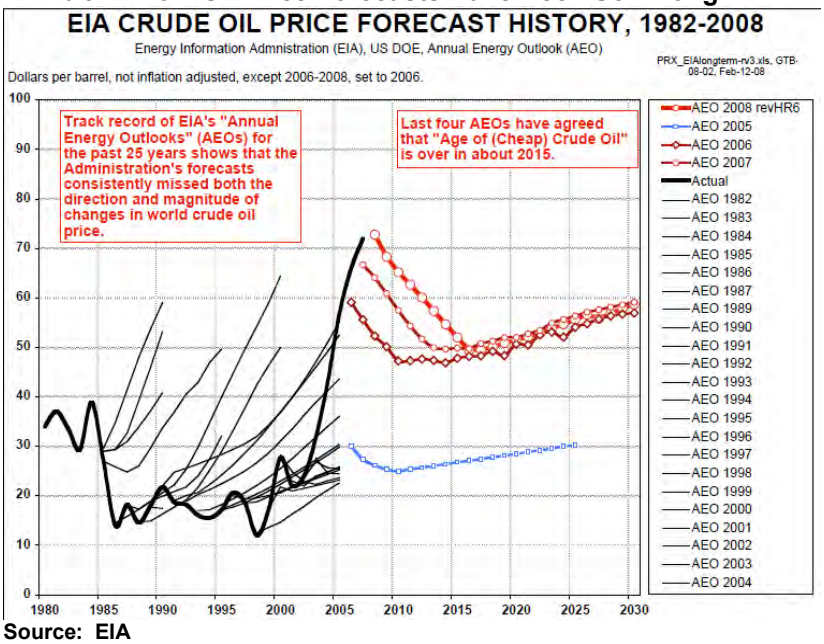
"What did you say about 2000 in 1980?"

The role of long-term energy market forecasts was touched on in Steve Coll's book, Private Empire – ExxonMobil and American Power. ExxonMobil's (XOM-NYSE) forecasting changed in 2000 under CEO Lee Raymond. The company had been preparing 20-year energy forecasts starting in the 1940s. In 2000, Mr. Raymond, who was overseeing the first forecasts from the combined Exxon and Mobil staffs, asked them, "What did you say about 2000 in 1980?" The question was taken as criticism, but what Mr. Raymond was really asking was to assess what the forecasts had gotten right and what they had missed.

Where Exxon was way off was in its crude oil price forecast

In this case, Exxon forecasters in 1980 had been half right and half wrong. They forecasted total global energy consumption in 2000 within 1% of actual use. Where Exxon was way off was in its crude oil price forecast. It had underestimated the pace of technological improvements that made finding and developing new oil supplies that pulled down oil prices, while also failing to anticipate geopolitical events that had a significant impact on oil prices. The conclusion reached by Mr. Raymond from this lookback was to stop forecasting oil prices. Had he spent time looking at numerous studies and reviews of past forecasts such as those conducted by the EIA, he would have seen how wildly wrong oil prices forecasts have been in the past, almost all being based on extrapolations of recent price trends. This is an excellent reason to not forecast oil prices, or at least make the forecasts as a broad range.

Exhibit 7. How Oil Price Forecasts Have Been So Wrong



Source: EIA

Oil consultant Wood Mackenzie expects EVs will shave 2%, or two million barrels a day off oil's use

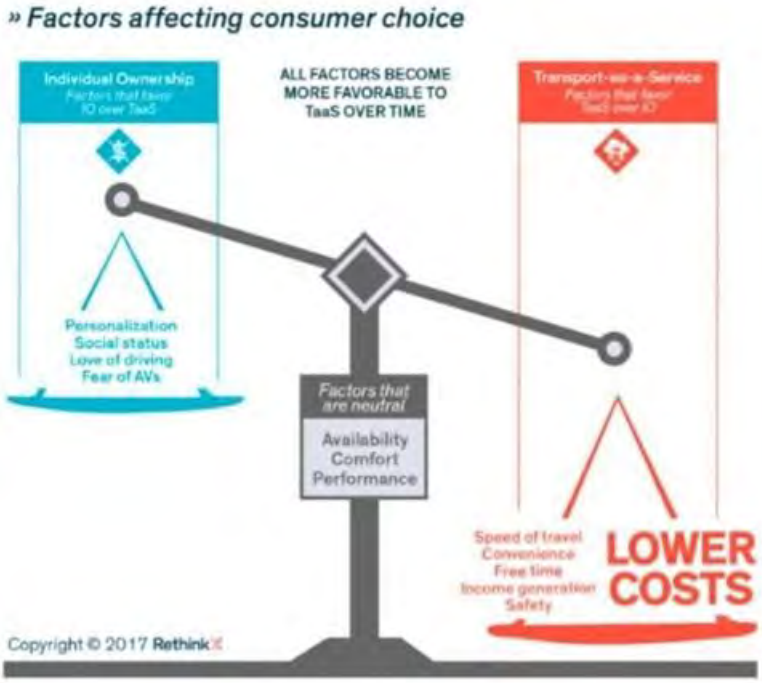
When it comes to forecasting oil demand, probably the most critical ingredient is the assumption about the pace of potential change in the transportation sector, principally the personal automobile. Every forecast must address when, and by what share of the automobile market, electric vehicles (EVs) will capture. Among oil companies, BP plc (BP-NYSE) expects that EVs will represent 100 million units by 2035, up from one million on the roads today. However, they believe the growth in EVs will only trim global oil consumption by 1.0-1.5 million barrels a day. On the other hand, oil consultant Wood Mackenzie expects EVs will shave 2%, or two million barrels a day off oil's use. Norway's Statoil is more pessimistic about oil demand due to the greater penetration of EVs into the global transportation fleet, likely driven by their experience of the rapid rate

by which EVs have grown in the Scandinavian country. Of course, Norway has provided hefty EV subsidies that have helped stimulate sales, plus the country enjoys cheap power from its huge hydropower supplies.

Its report says that the transition will be driven entirely by economics and will overcome the current desire for individual car ownership

The diversity in forecasts about how quickly EVs and self-driving vehicles will impact fuel consumption is significant. Not only do the energy companies hold widely different views, but so do think-tanks and technology companies who are very active in developing autonomous vehicle technology. Potentially the most radical EV forecast we have seen is that of RethinkX, an independent think tank that focuses on technology-driven disruption and its implications across society. Its report says that the transition will be driven entirely by economics and will overcome the current desire for individual car ownership. This shift will begin in the largest metropolises on the West Coast and in the urban corridor extending from Boston to New York City and the immediately surrounding areas. The spread of this technology will then follow into the suburbs and eventually into the rest of the country.

Exhibit 8. Attributes Favoring On-demand Ride Services



Source: RethinkX

The disruption caused by EVs and autonomous vehicles will have enormous implications across the transportation and oil industries

According to the report, the disruption caused by EVs and autonomous vehicles will have enormous implications across the transportation and oil industries, decimating entire portions of their value chains, causing oil demand and prices to plummet, and destroying trillions of dollars in investor value, not to mention the

value of used cars. One can also point to the impact collapsing used car values will have on auto financing and the financial health of individual car owners, especially low income families.

By 2030, 40% of the fleet will still be owned by people, but they will only account for 5% of passenger miles

How quickly will this transition occur? Tony Seba, an economist at Stanford University and a co-author of the report, says, "By 2030, within 10 years of regulatory approval of autonomous vehicles, 95 percent of US passenger miles traveled will be served by on-demand autonomous electric vehicles owned by fleets, not individuals, in a new business model we call 'transport-as-a-service.'" He says that by 2030, 40% of the fleet will still be owned by people, but they will only account for 5% of passenger miles, as they opt for the on-demand autonomous EVs (AEVs).

"Every time we have had a ten x change in technology, we had a disruption"

Mr. Seba suggests autonomous cars will be used 10 times more than internal combustion vehicles were, and that they will last longer, possibly as much as one million miles. Importantly, this transition will provide U.S. consumers with upwards of $1 trillion of benefits by 2030. His forecast, he admits, is difficult to accept, but it is consistent with other major transitions that produced a 10x opportunity cost advantage. He says it happened with the printing press and with the first Model T car produced by Henry Ford. The Model T cost the same as a carriage and two horses, but offered 10x the horsepower. According to Mr. Seba, "Every time we have had a ten x change in technology, we had a disruption. This is going to be no different." The reason it will be no different this time is that everything becomes cheaper.

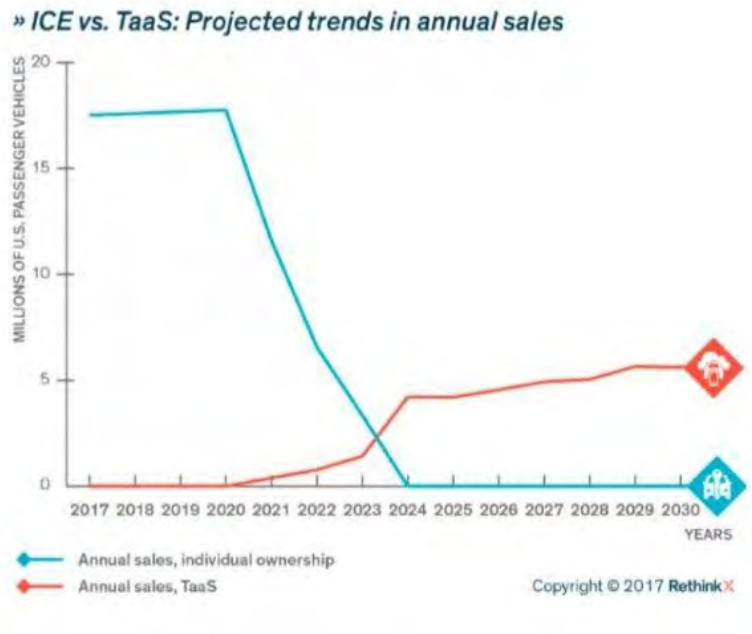
"Cars powered by fossil fuels will no longer be made after 2024 as self-driving electric vehicles become vastly cheaper to use"

Mr. Seba's view is that in a few years the upfront costs of AEVs will be equal to those of internal combustion engine (ICE) cars, plus they will be owned by fleets and will "last a lifetime." Maintenance costs will be significantly lower because these EVs will have only 20 moving parts in their powertrains compared to 2,000 for ICE vehicles. These factors will contribute to a much greater use of AEVs in on-demand services compared to their use of ICE cars. For on-demand service fleets, the longer vehicle life for AEVs means much lower depreciation expense, lower maintenance costs and significantly reduced insurance costs. This is why the report concludes that the cost for driving a paid-off car will cost 34-cents per mile compared to using an on-demand AEV service at an estimated 16-cents per mile. For Mr. Seba, what this means is that "cars powered by fossil fuels will no longer be made after 2024, as self-driving electric vehicles become vastly cheaper to use."

Auto sales will collapse starting in 2020, reaching zero for ICE vehicles in 2024, but only five million AEVs will be needed that year

Mr. Seba's conclusion is shown by the report's forecast for how U.S. auto sales will collapse starting in 2020, reaching zero for ICE vehicles in 2024, but only five million AEVs will be needed that year. Think of the impact this scenario has for automobile companies seeking to plan their future vehicle models and the necessary assembly plants. To some degree, this issue is being debated as it relates to the CEO change at Ford Motor Company (F-NYSE) last

Exhibit 9. A Questionable Forecast Of U.S. Vehicle Sales



Source: RethinkX

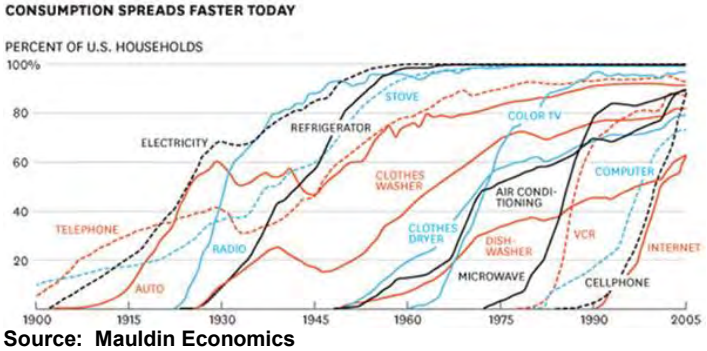
week. One auto industry consultant, commenting on the chaos in the auto business from autonomous vehicles, EVs and on-demand car sharing services, pointed to the difference in business strategies between Ford and General Motors (GM-NYSE). Ford is talking about building a new assembly plant in Mexico, as it replaces its CEO, while GM is reducing its U.S. assembly capacity while also selling its car businesses in Europe, Russia, South Africa and Singapore.

It was barely a dozen years ago that Matt Simmons published his book, Twilight In The Dessert, discussing the failing oil reservoirs of Saudi Arabia that would propel the world into a peak oil supply scenario

As quoted by the *WSJ*, "The peak-demand discussion is only at most a couple of years old," according to Daniel Yergin, vice chairman of IHS Markit Ltd., an energy research firm and the sponsor of the CERAWeek energy conference. According to Mr. Yergin, as this debate has progressed and gained greater credence, American oil companies have pushed back on the idea. It is important to remember that it was barely a dozen years ago that Matt Simmons published his book, Twilight In The Dessert, discussing the failing oil reservoirs of Saudi Arabia that would propel the world into a peak oil supply scenario resulting in extremely high oil prices and global economic and energy deprivation. Average oil prices of $79 a barrel in 2010, however, were well below Mr. Simmons' projection that they would average at least $200. For oil companies that pushed back against the peak oil supply scenario and won that battle, one can understand why they might push back equally hard against a peak demand scenario. Does history repeat or even rhyme?

At the heart of the peak oil demand argument is the question of how quickly new energy-reducing technologies will be adopted.

Exhibit 10. The History Of Technology Product Acceptance



Source: Mauldin Economics

The telephone needed nearly 50 years, while electricity needed only about 25 years, to reach the 60% penetration level

When the pace of adoption of technologies is examined, there are a number of interesting questions that bear on the projections of how quickly EVs and AEVs, as well as on-demand ride services, will be accepted. Are they going to be adopted as consumer technology items or truly revolutionary technologies and labor-saving devices? As shown in Exhibit 10, proponents of rapid technology adoption point to the cellphone, which took about a decade to go from zero to 60% penetration. That was about the same time span as the internet, but maybe only slightly longer than the VCR. On the other hand, the telephone needed nearly 50 years, while electricity needed only about 25 years, to reach the 60% penetration level. However, maybe we should look at these vehicle technologies as akin to those that brought significant lifestyle changes such as the stove, the clothes washer and the dishwasher, which needed between 35 and 50 years to reach 60% of American homes.

It is important to remember that automobiles remain the second largest purchase after homes for families

Our best guess is that the adoption rate will be somewhere between the cellphone and electricity, 10 to 25 years, but with a bias toward the longer timeframe. Why do we say that? It is important to understand that vehicles play an important role in family evolutions, something that hasn't changed over generations. The hyped concern about millennials not getting married, starting families and buying homes, which was very popular during the years immediately following the global financial crisis of 2008, is disappearing. We now see millennials coming out of their parents' basements, getting married, starting families and buying homes – although maybe not of the same size or in the same locations as their parents. These millennials are, however, continuing the generational pattern of societal evolution, although they are taking longer than previous generations to take some of the steps down that road. Given the pace of this phenomenon's development, it is important to remember that automobiles remain the second largest purchase after homes for families. These purchases are not made frequently, they usually require significant research and time to reach a decision, and the decisions are often based on economic considerations involving all

aspects of families' lives and not just social concerns, such as climate change.

Their lives will become more complex until electric charging stations are as ubiquitous as gasoline stations, since they may not be able to afford the wait for battery recharges

Given the factors involved in new car purchases, those forecasting the demise of petroleum must explain how those with limited incomes and wealth will voluntarily give up their perfectly functioning fossil fuel vehicle for an expensive EV, which because of battery technology may not get anywhere close to the advertised performance due to the climate where they reside. Their lives will become more complex until electric charging stations are as ubiquitous as gasoline stations, since they may not be able to afford the wait for battery recharges nor the cost of an installed charger in their home, if that option even exists for them.

There is also the question of what happens to the economics of EVs versus ICE cars when the values of used ICE cars go essentially to zero? In that case, unless gasoline and diesel fuels are banned, which may be the next target of environmental activists, it will be much cheaper to own and operate ICE cars than EVs.

Despite the high number of EVs in the fleet, it still leaves 104 million ICE vehicles on the roads burning fossil fuels

There is also the question of how quickly the fleet of American vehicles can be converted to EVs or AEVs. For the past several years, Americans have purchased 17 million or slightly more new vehicles each year. At that pace, it will take 15 1/3 years to completely replace the approximately 260 million vehicles currently on America's roads. To reach the magic 60% penetration rate, Americans must buy 17 million new EVs every year for more than nine years. Despite the high number of EVs in the fleet, it still leaves 104 million ICE vehicles on the roads burning fossil fuels.

EVs do become a viable solution for high urban density areas, but are probably less viable in lower population density regions

Without some critical technology breakthroughs, principally in battery and fast charging technology, that improve the time commitment related to traveling in EVs, the distance they can travel and their cost, EVs are likely to remain a niche market. EVs do become a viable solution for high urban density areas, but are probably less viable in lower population density regions. Just as ExxonMobil's Mr. Raymond questioned what his forecasters got right and wrong in their forecasts, EVs, consumer attitudes toward car ownership and on-demand ride service developments are forces that need to be monitored to assess their possible impact on petroleum consumption. Energy company managements need to develop alternative scenarios of the pace of these trends impacting their businesses, but claiming that the Age of Petroleum is facing a near-term demise is premature.

Will Higher Oil Prices Finally Revive The Offshore Sector?

Half a dozen years ago, the offshore industry was not only booming, but its future prospects looked extremely bright. Offshore was the last great frontier for oil and gas companies seeking those elephant hydrocarbon deposits that are deemed critical to ensure the world

possessed sufficient hydrocarbon resources to meet its future energy needs. The concept of the world reaching peak oil supplies was driving oil prices to new, all-time highs. The bright offshore outlook prompted oil and gas companies to aggressively secure drilling rights around the world, but especially in the more promising deepwater regions of the planet – West Africa, Brazil, the Gulf of Mexico and various cold water areas, such as the North Sea and the Arctic. With visions of extensive drilling campaigns combined with the expectation that most of that drilling would occur in extremely deep waters, the industry's future was colored by the prospect of all new fields being developed utilizing subsea equipment and technology. Subsea fields translate into greater floating drilling rig demand, as all exploration and delineation wells, in addition to all development wells, need to be drilled from these floating platforms.

Subsea fields translate into greater floating drilling rig demand, as all exploration and delineation wells, in addition to all development wells, need to be drilled from these floating platforms

This very optimistic view for offshore drilling's outlook, especially the deepwater drilling component, helped drive the second greatest mobile drilling rig building boom in the industry's history. The first offshore drilling rig construction boom came in the late 1970s, propelled when oil prices exploded following the 1973 Arab oil embargo. The subsequent 1979 Iranian revolution, which caused Iran's oil exports to be stopped, equal to 4% of global oil supply, drove a doubling of global oil prices in 1980. What is interesting is that during the 1980s and 1990s, when people were asked about the trend in oil prices during the 1970s, most would answer that prices rose consistently throughout the period. In reality, oil prices went up in steps – 1973/74 and again in 1978/79 - with the years between those periods marked by either stable or lower oil prices.

In reality, oil prices went up in steps – 1973/74 and again in 1978/79 - with the years between those periods marked by either stable or lower oil prices

Between 1970 and 1979, the offshore drilling rig fleet represented by all types of mobile offshore rigs increased by 220%, with 324 new rigs added while 70 were retired during the decade. The net rig fleet grew during this period from 204 active rigs to 449 by the end of 1979. Over the next six years, while the percentage increase for the rig fleet was much smaller – only 174% - there were 350 new drilling rigs delivered but only 19 were retired. The pace of expansion of the offshore rig fleet was much faster in the early 1980s, as an average of 59 rigs a year were added to the active rolls compared to an average of only 32 rigs a year during the 1970s.

The pace of expansion of the offshore rig fleet was much faster in the early 1980s, as an average of 59 rigs a year were added to the active rolls compared to an average of only 32 rigs a year during the 1970s

The net rig fleet between the end of 1979 and 1985 grew from 449 drilling rigs to 780, a gain of 331 new units in operation at the end of the period. Following 1985, the fall in oil prices that had begun in 1981 and which culminated in the crash in 1986, when oil dropped to $10 a barrel, stopped the offshore rig fleet's growth entirely for the remainder of the decade. For the offshore drilling rig industry, the second half of the 1980s and early 1990s was a period of extreme financial distress punctuated with numerous offshore company bankruptcies.

The fall in oil prices that had begun in 1981 and which culminated in the crash in 1986, when oil dropped to $10 a barrel, stopped the offshore rig fleet's growth entirely for the remainder of the decade

The magnitude of the financial pain absorbed by the offshore drilling industry in this downturn has been much greater than experienced during the 1980s' depression

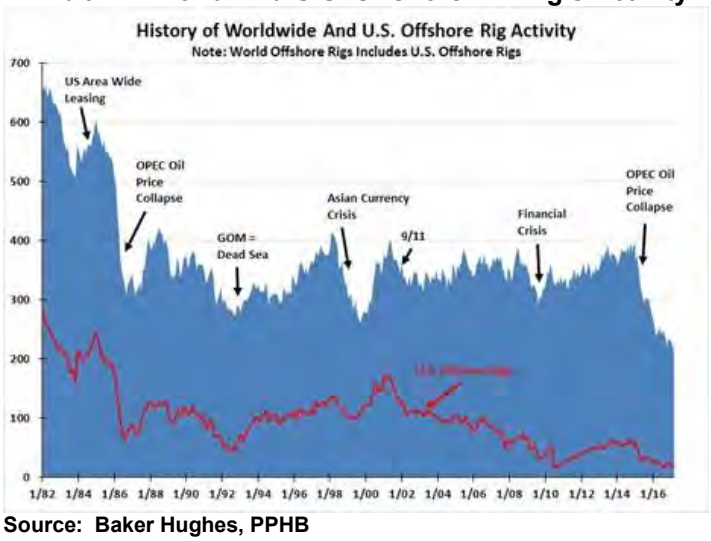
This current offshore rig fleet expansion, occasioned by the anticipated activity boom started in the early 2000s, saw a smaller absolute number of new drilling rigs added than during the earlier boom, but the dollar amount invested in new rigs in recent years has dwarfed the amount committed earlier. This is not surprising given that these new drilling rigs are larger, more capable and more rugged than the earlier generations of rigs. Today's rigs cost in the hundreds of millions of dollars, often five to six times the cost of the largest floating drilling rigs built in the 1970s and 1980s. The cost of new jackup drilling rigs also is a multiple of the cost of earlier jackup versions. As a result, the magnitude of the financial pain absorbed by the offshore drilling industry in this downturn has been much greater than experienced during the 1980s' depression.

To put the rig fleet growth numbers into perspective, for 1970-1979 there were 324 of all types of rigs delivered with an additional 350 arriving during the 1979-1985 years, for a total of 674 new rigs over that 15-year span. During 2006-2016, 385 new rigs were built and another 136 either delivered or are scheduled for delivery during 2017-2021, for a total of 521 rigs, some 153 fewer than earlier.

It shows how total offshore drilling activity stepped down after the mid-1980s industry bust and may be showing another step down now

To better understand the current offshore industry depression, one must appreciate the history of offshore drilling. Exhibit 11 shows the number of worldwide offshore drilling rigs working (in blue) with the red line showing the U.S. active offshore rig fleet. The world fleet total also includes the U.S. fleet, but it is interesting to be able to see the similarity in activity between the U.S. market and the rest of the world. As the data spans from 1982 to now, it shows how total offshore drilling activity stepped down after the mid-1980s industry bust and may be showing another step down now. That is the unanswered question confronting offshore drilling contractors, and the rest of the offshore support businesses.

Exhibit 11. World And U.S. Offshore Drilling's Activity History

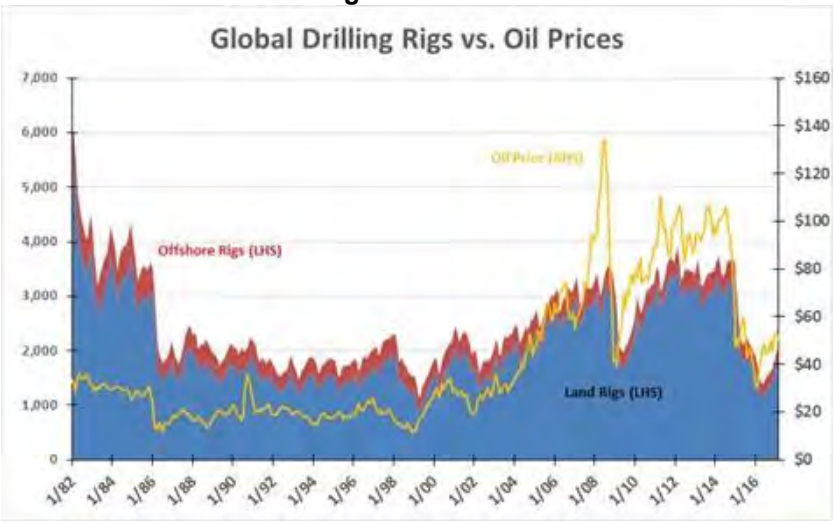


Source: Baker Hughes, PPHB

Today, offshore drilling is only a fraction of what it has been for decades

To begin to address that question, we need to examine how offshore drilling activity performed during 1982-2017 with respect to global drilling activity. Exhibit 12 shows active global offshore and onshore drilling rigs. What can be seen is that the offshore rig component has been relatively stable over the time period until the start of the 2014 downturn. Although offshore rig activity had been curtailed somewhat with the 2008-2009 global financial crisis and recession, followed in 2010 by the Gulf of Mexico moratorium following the Macondo well blowout, the offshore rig component of total drilling did recover. Today, offshore drilling is only a fraction of what it has been for decades.

Exhibit 12. Offshore Drilling Is Now At A Fraction Of Its Past



Source: EIA, Baker Hughes, PPHB

Does today's low offshore drilling activity reflect a new permanent phase for the industry?

With global offshore drilling down substantially during the past two-plus years in response to the fall in oil prices, one must question what role the success of U.S. onshore shale drilling has had on that decline? Does today's low offshore drilling activity reflect a new permanent phase for the industry? The answer is tied to the structural nature of the offshore oil and gas industry versus that of onshore drilling, especially for unconventional resources. The manufacturing-like approach being employed when drilling onshore oil and gas shale formations, coupled with the prospect of avoiding dry holes, has allowed operators to significantly improve drilling efficiency, meaning they are producing more oil and gas with fewer drilling rigs needed to drill the wells. Add to the drilling efficiency the use of improved drilling and completion technologies, and onshore shale well breakeven prices have fallen sharply in recent times and are now below current oil prices.

Because the offshore arena has not been able to develop a comparable manufacturing-type drilling process, plus offshore bears the additional cost necessary for constructing offshore production and transportation infrastructure to produce the hydrocarbon output,

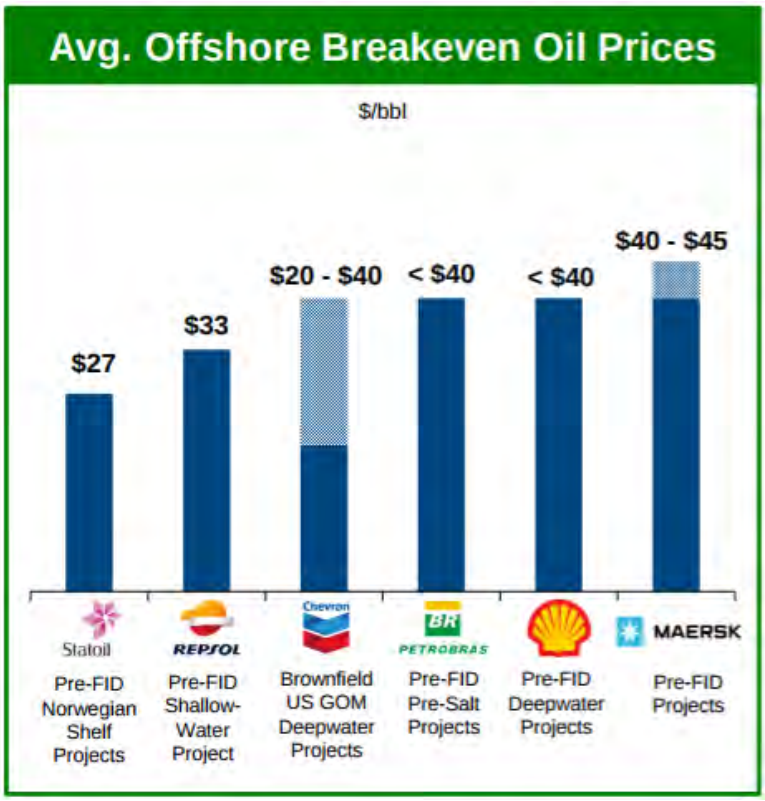
offshore well breakeven costs have remained quite high. That is beginning to change. Oil consultant Wood Mackenzie estimates that changes to drilling strategies and technology have allowed operators to cut the average cost of projects by about 20%, making many projects that previously required $70 a barrel oil prices in order to be profitable, now achieving profitability at $50 per barrel or lower. This improvement has also been helped by operators high-grading their prospects as well as reduced oilfield service costs, benefits from standardized equipment design and reduced drilling rig day rates.

Oil consultant Wood Mackenzie estimates that changes to drilling strategies and technology have allowed operators to cut the average cost of projects by about 20%

A Royal Dutch Shell (RDS.A-NYSE) manager, speaking at CERAWeek in March stated that his company had cut well, logistics and staff costs to such an extent that some project developments in the Gulf of Mexico and Nigeria would turn in profits at oil prices below $40 per barrel. This offshore cost reduction momentum was further echoed by Jarand Rystad, managing partner of Rystad Energy, speaking at the Offshore Marine Forum at Sea Asia 2017 in Singapore in April, who noted that overall breakeven for offshore projects would fall from $70 per barrel to around $50 a barrel globally with many achieving profitability at significantly lower levels. He specifically cited a Barents Sea field, which had a breakeven of $65 per barrel a year ago that is now profitable at $35 a barrel.

He specifically cited a Barents Sea field, which had a breakeven of $65 per barrel a year ago that is now profitable at $35 a barrel

Exhibit 13. Offshore Well Breakeven Prices Have Come Down



Source: Ensco

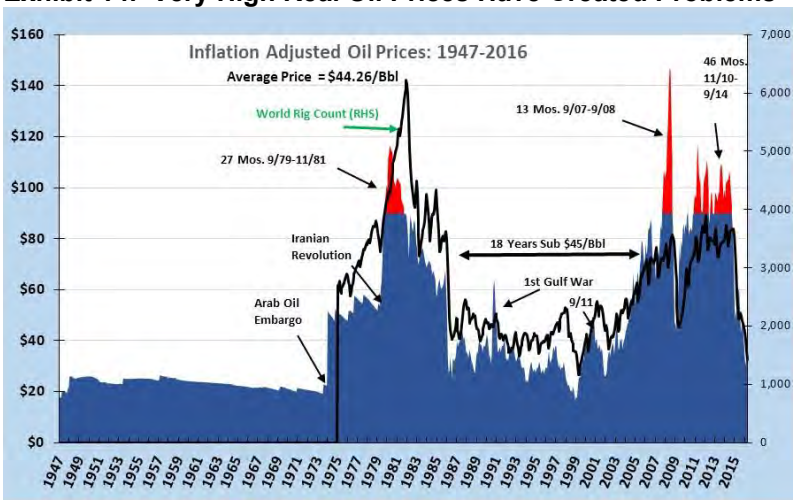
The determination of well breakeven costs can easily be manipulated by excluding certain legacy costs

The offshore industry's well breakeven improvement was captured in a recent presentation slide (Exhibit 13, prior page) from Ensco International Inc. (ESV-NYSE). It must be noted, however, that the determination of well breakeven costs can easily be manipulated by excluding certain legacy costs such as acreage lease acquisition expense and seismic data collection and interpretation costs, as well as by providing overly optimistic well completion cost estimates and production volumes. But, if producers are citing these reduced cost estimates, their belief in improved well breakeven economics may influence future spending decisions.

This 18-year span seems to have been the result of the extremely high real oil prices of the 1970s and early 1980s

The significance of reduced well breakeven costs for the offshore market may prove extremely important should the oil industry be about to experience a repeat of the mid-1980s to 2004 period when real oil prices never traded above $45 a barrel with the brief exceptions during the 1st Gulf War and immediately after 9/11. This 18-year span seems to have been the result of the extremely high real oil prices of the 1970s and early 1980s. Exhibit 14 shows that the world drilling rig count peaked at a much higher level in 1981 than in 2011, despite experiencing a longer period of extremely high oil real prices during the recent boom compared to the 1970s.

Exhibit 14. Very High Real Oil Prices Have Created Problems



Source: *WSJ*, BEA, Baker Hughes, PPHB

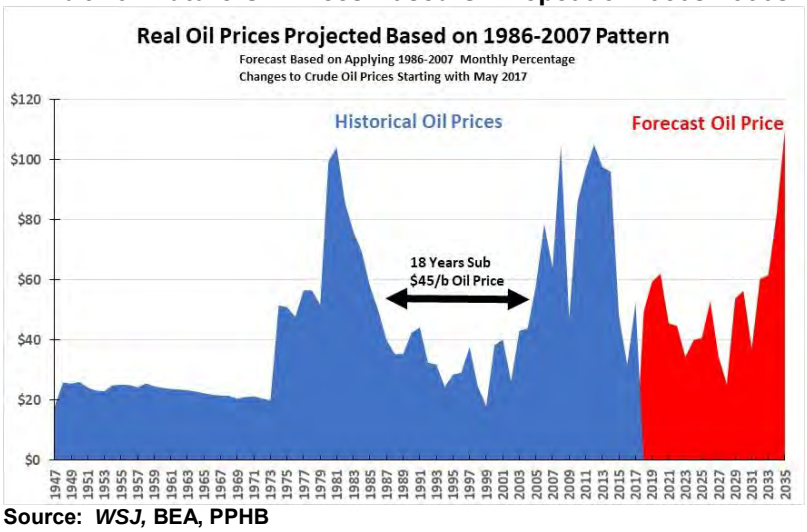
We will see higher oil prices in the near-future, but also lower prices

As we have written in the past, our fear is that the industry may experience another extended period of relatively low oil prices compared to those experienced in the last boom years. As an exercise to see what this might mean for future oil prices, we used monthly percentage change figures for 1986-2004 to project future oil prices. Because there has already been over a two-year downturn, we applied the 1988 April to May price change to the April 2017 average monthly price and then projected future oil prices. The result of this exercise is shown in Exhibit 15 (next page). We will see higher oil prices in the near-future, but also lower prices

Our projection shows a $60 a barrel price by the start of 2019

eventually, too. The next boom will take oil prices to higher levels than experienced in either of the prior booms. Our projection shows a $60 a barrel price by the start of 2019, but it also shows lower oil prices during the rest of 2017 before prices head toward $60 during 2018.

Exhibit 16. Future Oil Prices Based On Repeat of 1980s-1990s



Source: ***WSJ,*** **BEA, PPHB**

That improvement may even allow producers to let oilfield service companies increase their prices and day rates

While this projection may appear wrong nearly right out the box due to the outcome of the OPEC meeting in Vienna, the price projection might be realistic absent the political maneuvering of OPEC and its oil exporting country supporters. Even with a long low oil price environment, since we are starting from a higher oil price base, the average price during the low-price period will be higher than the $45 a barrel average experienced the last time. Given reduced well breakeven prices, producing company profitability should improve quickly. That improvement may even allow producers to let oilfield service companies increase their prices and day rates.

Even the offshore sector will participate, although the magnitude of its recovery may be muted by the sheer oversupply of offshore drillings and supply vessels

The conditions we have described above reflect the first stage of an industry recovery. Even the offshore sector will participate, although the magnitude of its recovery may be muted by the sheer oversupply of offshore drillings and supply vessels. While a recovery from the currently depressed state will take the offshore sector a while to experience, those companies at the forefront of the restructuring parade will be the best-positioned to capitalize on the shuffling of high-quality assets that inevitably occurs during the recovery phase of an industry. There will be better days ahead for the offshore industry, but its future may not be what people expected as recently as five years ago.

British Columbia's Elections Upset Canada's Energy Future

On May 9th, voters in British Columbia went to the polls to elect a new provincial government. That night, when the initial votes were counted, the current right-of-center Liberal government was rejected. Although the Liberals retained the largest number of legislature seats, it appears that the new government to be formed will be a minority government. On election eve, the Liberals were leading in 43 elections for legislature seats, but not enough to control the majority of the 87 seats. The New Democratic Party (NDP) was leading in 41 seats, while the Green Party secured three seats, putting it in control over the governing philosophy of the next government. Before the election can be finally determined, there remains to be counted 180,000 absentee ballots, which was completed on May 22-24, two weeks after election day, in addition to any vote recounts mandated by the closeness of the vote. The final vote tally confirmed the election night outcome.

On election eve, the Liberals were leading in 43 elections for legislature seats, but not enough to control the majority of the 87 seats

The May 9th vote results threw into doubt the future of British Columbia's energy policy and how it may or may not upset national energy policies. With a 49-seat majority, Liberals comfortably governed the province since 2013. The NDP, with 35 seats, was the loyal opposition and the Green party held only one seat. On May 8th, CBC, the nation's broadcasting service, posted the following charts showing the then-latest polling data for the election's outcome the next day. It predicted a very close popular vote, with the NDP slightly ahead of the Liberals, but the latter securing 45 seats and remaining in control of the next government.

It predicted a very close popular vote, with the NDP slightly ahead of the Liberals, but the latter securing 45 seats and remaining in control of the next government

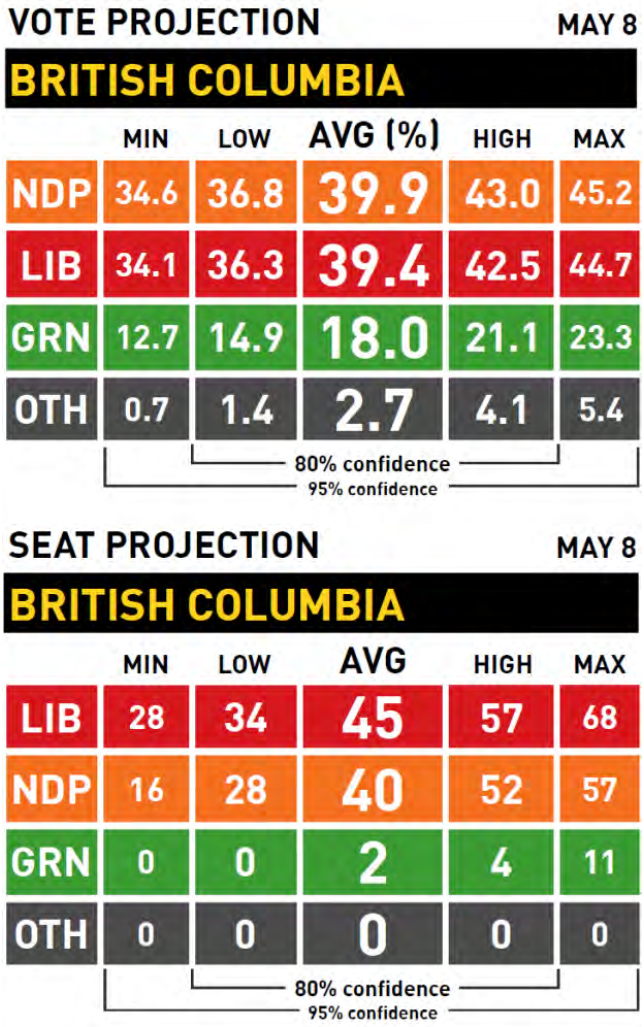
Based on the May 9th vote totals, the NDP's share of the popular vote was on target with the poll average, while the Liberals outpaced the poll's projection, and the Green party falling short. One riding (comparable to a district in the U.S.) on Vancouver Island was initially decided in NDP favor by a nine-vote majority – 10,058-10,049. With the absentee ballots, the Liberals were hoping to win their 44th seat providing them a majority, but the NDP widened its victory margin instead. The last time British Columbia had a minority government was in 1952, which lasted for one year before another election returned a majority party to power.

The last time British Columbia had a minority government was in 1952, which lasted for one year before another election returned a majority party to power

With the Green party gaining three seats and potentially becoming the power broker in the formation of a coalition government, the negotiations began immediately the day after the election. The Green party is headed by Andrew Weaver, an environmental scientist who, prior to his election to the BC Legislature in 2013 was the Canada Research Chair in climate modelling and analysis in the School of Earth and Ocean Sciences at the University of Victoria, where he worked for 25 years. He has authored or coauthored over 200 peer-reviewed papers in climate, meteorology, oceanography, earth science, policy, education and anthropology journals, and was a lead author in the United Nations Intergovernmental Panel on

The Green party is headed by Andrew Weaver, an environmental scientist

Exhibit 17. How The B.C. Election Was Projected To End



Source: ***CBC***

Climate Change's (IPCC) 2nd, 3rd, 4th and 5th scientific assessments.

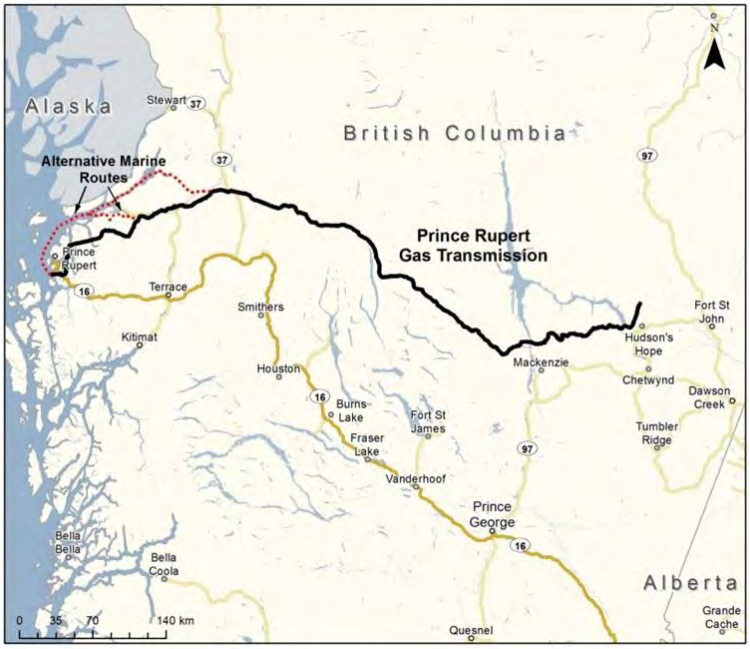
The Green party has a strong anti-fossil fuel agenda, including strict opposition to any liquefied natural gas (LNG) terminals in the province and opposition to the construction of Kinder Morgan Inc.'s (KMI-NYSE) Trans Mountain oil pipeline

As one would expect, the Green party has a strong anti-fossil fuel agenda, including strict opposition to any liquefied natural gas (LNG) terminals in the province and opposition to the construction of Kinder Morgan Inc.'s (KMI-NYSE) Trans Mountain oil pipeline, that has already received Canadian federal government approval. The Green party agenda happens to be in sync with the anti-energy policies of the NDP party, which wants to re-examine all oil and gas company subsidies, is opposed to the use of fracking technology, and rejects the construction of both the Trans Mountain oil export pipeline and Malaysia's Petroliam Nasional Bhd's (Petronas) $27-billion LNG export terminal to be built at Rupert Sound.

Exhibit 18. Proposed Route For Trans Mountain Pipeline

Source: National Energy Board

Exhibit 19. Proposed Gas Pipeline To LNG Export Terminal



Source: *Vancouver Observer*

Uncertainty exists over whether the energy agenda of the Liberals, at least its support of oil and gas export projects that would help the energy businesses of both British Columbia and neighboring Alberta province will prevail, or a new political leadership will disrupt that positive policy landscape. Based on assessments of the issue of

provincial versus federal energy policy, the view is the latter will trump the former. George Hoberg, professor of environmental and natural resource policy at the University of British Columbia, told a reporter for the *The Vancouver Observer*, "Constitutionally, the federal government might have the upper hand ... but the B.C. government could force significant delays," he said.

The lack of certainty about Canada's energy export policies has already cost the nation one window of opportunity to construct new oil and gas export facilities several years ago

The prospect of further energy policy uncertainty or legal delays for significant energy export projects is not what Canada's energy industry needs or wants, especially now as it recovers from the past two-year industry recession. The lack of certainty about Canada's energy export policies has already cost the nation one window of opportunity to construct new oil and gas export facilities several years ago. The prospect of another extended period of energy policy uncertainty could cost Canada's oil and gas industry future growth opportunities, especially in helping to meet Asia's growing energy needs. This is important since most of these energy projects will rely on foreign capital.

With the final tally completed, Christy Clark, the Liberal leader, will continue to head a minority government

With the final tally completed, Christy Clark, the Liberal leader, will continue to head a minority government. Without a majority, any actions the new government wishes to undertake will require the support of some NDP or Green representatives, not likely in the area of energy policy. Energy executives will be forced to watch and wait to see what happens with B.C. energy policy, something they have gotten used to after years of political infighting, but the outcome is not particularly good news for Canada's energy business.

The next Musings will be in three weeks' time due to the author's travel.

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

PPHB is an independent investment banking firm providing financial advisory services, including merger and acquisition and capital raising assistance, exclusively to clients in the energy service industry.