PPHB
ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

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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

Unlikely Investor Touts Energy Investments As Good Value

A new white paper from GMO LLC, a Boston-based money management firm, makes the case for natural resource equities

A new white paper from GMO LLC, a Boston-based money management firm, makes the case for natural resource equities. The paper was written by Lucas White, a member of the firm's focused equity group, and Jeremy Grantham, a founder of the firm. Mr. Grantham has had a long history of value investing starting in the late 1960s after leaving his position as an economist with Royal Dutch Shell (RDS.A-NYSE). He has written about and invested extensively in commodity equities over his career. This investment focus led to Mr. Grantham and his wife creating the Grantham Foundation for the Protection of the Environment in 1997. In 2007, the couple funded the Grantham Institute for Climate Change at London's Imperial College, and the following year they endowed the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science. Mr. Grantham even became an environmental activist when he and his daughter joined the Sierra Club outside of the White House in protesting the Keystone XL pipeline in February 2013.

For a man clearly committed to fighting climate change, how does he find natural resource equities an attractive investment?

For a man clearly committed to fighting climate change, how does he find natural resource equities an attractive investment? It probably lies in Mr. Grantham's heavy focus on statistics and his long history with value investing. In exercising his and his firm's value investing approach to managing institutional funds, Mr. Grantham and GMO believe in reversion to the mean as an investment philosophy. This means that one should buy lagging or out-of-favor market sectors and then wait for the industry's underlying fundamentals to create attraction for other investors who then bid up the company share prices to their fair value.

"Prices of many commodities will rise in the decades to come due to growing demand and the finite supply of cheap resources"

In the white paper, the authors lay out their premise that "prices of many commodities will rise in the decades to come due to growing demand and the finite supply of cheap resources." During the last commodity boom, referred to as the Great Commodity Cycle that lasted from 2000 to 2014, commodity prices were driven higher by the same belief of an unending surge in demand from the emerging BRIC (Brazil, Russia, India and China) countries combined with concern about adequate supplies. In effect, the current GMO investment thesis was what drove the Great Commodity Cycle. Will it work this time?

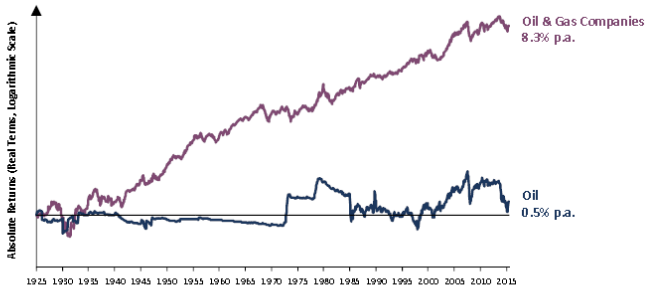
GMO also believes that public equities are the best way to invest in commodities

Based on GMO's research, the firm finds that commodity producers tend to trade at a discount, but that "they have outperformed the broad market historically." This outperformance has come despite commodity producer equities being highly volatile. GMO also believes that public equities are the best way to invest in commodities for three reasons: 1) to "gain commodity exposure in a cheap, liquid manner:" 2) to "harvest the equity risk premium," and 3) to "avoid negative yields associated with rolling some futures contracts" forward. On the latter point, the GMO paper shows that by investing in commodity futures and then rolling them forward when the contracts mature, a substantial amount of the gain earned by early investing in the market is lost.

Between 1925 and 2015, oil earned a 0.5% per year return while oil and gas stocks generated an 8.3% return

To show the value of harvesting the equity premium, the white paper presented a chart showing absolute real returns from investing in crude oil compared to investing in oil and gas companies. The result was that between 1925 and 2015, oil earned a 0.5% per year return while oil and gas stocks generated an 8.3% return, roughly a 16-fold performance gap.

Exhibit 1. Energy Stocks Are Best Way To Play Crude Oil



As of 6/30/16
Source: CRSP, Global Financial Data, GMO

Source: GMO

Another important criteria in GMO's argument for a natural resource equity investment strategy is how little money investors have committed to these stocks. They point out that the exposure of the Standard & Poor's 500 stock index to energy and metals companies has dropped by more than 50% over the past few years. They also

state that this same phenomenon has happened with the MSCI All Country World Index, another popular broad stock market index.

Pushback from investors over the cyclicality of energy prices

During my career as a Wall Street energy analyst, analysts were always confronted with pushback from investors over the cyclicality of energy prices. The argument was that this volatility forced investors, and analysts, to become very short-term focused, meaning you needed to become an active trader, which is a difficult task to master. This argument was most often thrown up during sector downturns when investors in other market sectors were doing well. One can see the volatility in the performance of the oil and gas companies shown in Exhibit 1 (prior page), especially during 1980-1983, 1997-2001, 2007-2009 and 2014 to the present. On the other hand, if one had purchased the sector and held throughout the period from 1980 to now, one would still have performed well.

Professional money managers are comfortable being in the mainstream of investing even if they are losing money

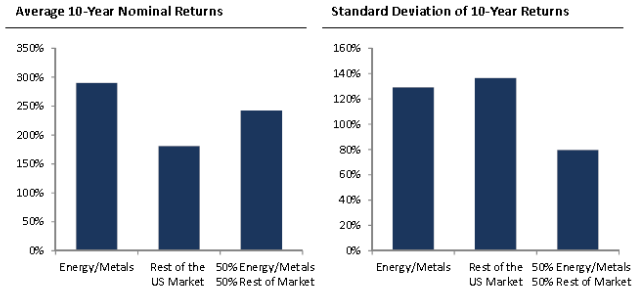
Withstanding volatile periods can be extremely difficult. It is particularly challenging for professional money managers, a key tenet of GMO's investment philosophy. Their research has shown that over the years, professional money managers are comfortable being in the mainstream of investing even if they are losing money for their investors. It's ok, as long as everyone else is losing money. The hard part is losing money with a value investment strategy when others are making money. That is a career-risking strategy.

The GMO white paper listed other attributes of investing in natural resource equities – they provide diversification relative to the broad equity market and that benefit increases over long investment timeframes, and they can provide protection against inflation. The paper contained charts that supported both of those beliefs.

Energy/metals out-performed the other two portfolios

With respect to diversification, GMO measured the average 10-year nominal returns for a monthly rebalanced portfolio of energy/metals companies, the rest of the stock market, and a portfolio of 50% energy/metals and 50% for the rest of the stock market. The left-hand chart in Exhibit 2 shows that energy/metals out-performed the other two portfolios. But the key point is in the right-hand chart that

Exhibit 2. Adding Energy Stocks Can Boost Returns



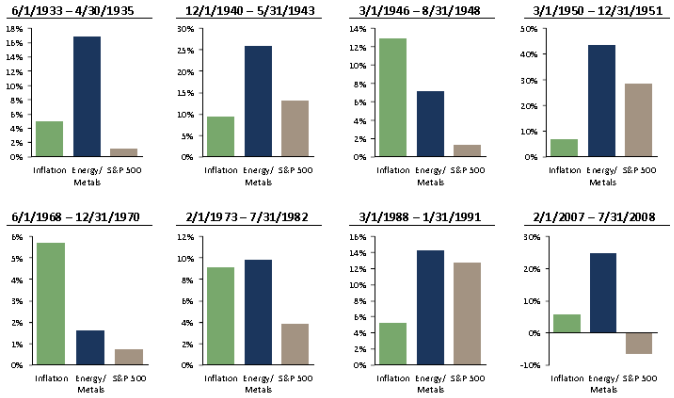
As of 6/30/16
Source: S&P, MSCI, CRSP, GMO
Source: GMO

By investing in natural resource equities, an investor could gain better performance with reduced risk

shows the results of the three portfolios when considering the standard deviation of 10-year returns. It shows that the blended portfolio had a lower standard deviation of return than either of the other two portfolios, meaning it had a lower risk. That result supports the view that by investing in natural resource equities, an investor could gain better performance with reduced risk – the outcome normally expected from a diversification strategy.

As for inflation protection, Exhibit 3 shows how energy/metals performed compared to the S&P 500 during those periods when inflation, measured by the Consumer Price Index, is greater than 5% per year for a period longer than one year.

Exhibit 3. Commodities Have Gained From Inflation



Annualized data.
Inflationary periods have been identified as periods where inflation, as measured by CPI, was greater than 5% per annum for a period longer than one year.

Source: GMO

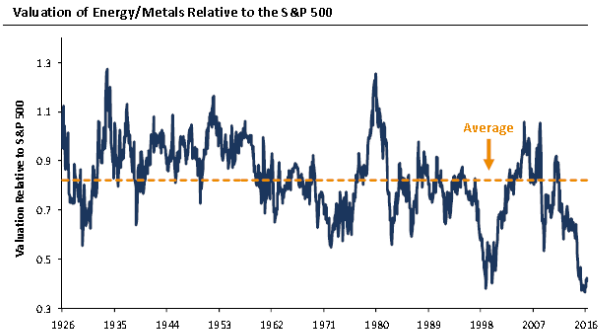
Valuation has now begun recovering some, but is still about at the lowest point it has been since the late 1990s

After listing all the positives that justify investing in natural resource equities, GMO also pointed out that current market valuations are around all-time lows relative to the S&P 500. To measure valuation, GMO constructed a measure that included price-to-earnings ratios normalized for historical earnings, price-to-book value ratios and dividend yields. As shown in Exhibit 4 (next page), that valuation has now begun recovering some, but it is still about at the lowest point it has been since the late 1990s.

Since 1920 an energy/metals portfolio has outperformed the S&P 500 index by 2.2% per year

This low relative valuation provides a possible entry point for investors who understand that short-term volatility doesn't necessarily mean continued long-term volatility or long-term underperformance. In fact, GMO calculated that since 1920 an energy/metals portfolio has outperformed the S&P 500 index by 2.2% per year. That history includes the recent underperformance since the early 2000s, and the long period of weak performance during the 1980s and 1990s, when commodity prices were especially weak.

Exhibit 4. Energy Stocks Cheap; Value Trap?

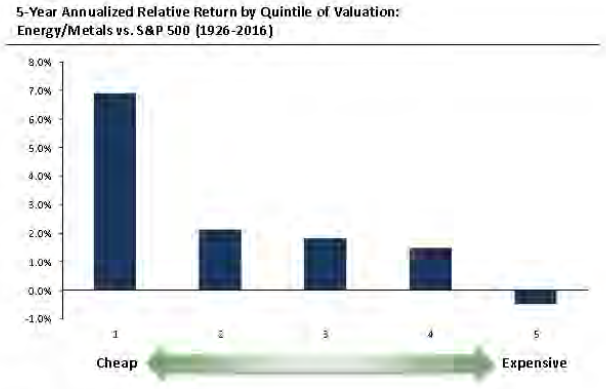


As of 6/30/16
Source: S&P, MSCI, Moody's, GMO
Valuation metric is a combination of P/E (Normalized Historical Earnings), Price to Book Value, and Dividend Yield.
Source: GMO

The data showed that the cheapest valuation translated into at least a 3.5-times outperformance compared to the next cheapest valuation quintile

The final argument why value investors should be targeting natural resource equities is their relative performance, measured by the 5-year annualized relative return by quintile of valuation compared to the S&P 500 during 1926-2016. History has shown that if you can buy at the cheapest valuation, your returns are likely to be outsized. The data showed that the cheapest valuation translated into at least a 3.5-times outperformance compared to the next cheapest valuation quintile. Usually, when stocks are cheap, their forward price/earnings ratios are quite expensive – the opposite of the investment thesis that greater returns come from buying stocks with the lowest price/earnings ratio stocks. This is why GMO calculated a valuation methodology that overcomes this natural price/earnings disparity. By considering price to book value and dividend yield, a more realistic valuation current metric was developed.

Exhibit 5. Cheap Stocks Usually Offer Good Returns



As of 6/30/16
Source: S&P, MSCI, Moody's, GMO
Note: Due to the need for five years of forward-looking returns, the last five years of returns are not equally represented in this data.
Source: GMO

GMO's consideration of climate change has not become a measure of valuation within the firm's research effort

As pointed out at the start of this article, Mr. Grantham, who helped author GMO's white paper arguing that value investors should be buying natural resource equities, is a leader in the climate change fear community. In an interview in *Institutional Investor* magazine in 2014, one of Mr. Grantham's co-workers pointed out that GMO's consideration of climate change has not become a measure of valuation within the firm's research effort. We find it strange that Mr. Grantham has not been able to convince his own firm of the value of his concerns. Maybe that is due to the fact his co-workers understand that stock investing tends to have a shorter time horizon than issues of climate change.

We have also learned that Norway's investment fund has announced it will no longer invest in U.S. power company Duke Energy (DUK-NYSE) because of its record for handling coal ash at its coal-fired power plants. Norway's investment fund has become an outspoken leader in targeting its investment process to avoid investing in companies aiding global warming. This is an interesting tactic given that the investment funds come from a share of Norway's income from its North Sea oil and gas output.

Climate change is an issue (risk) that companies and investors need to consider when investing

Climate change is an issue (risk) that companies and investors need to consider when investing. The importance of that consideration was highlighted by the recent announcement by BlackRock, the world's largest investment fund with over $4.9 trillion of assets under management, that it will now consider climate change risk in all its investments. The firm has issued a detailed report about climate change and why they have adopted this policy, but it is summarized on its web site. BlackRock sees both risks and opportunities from climate change. They cite four aspects to the issue. First, through the physical aspect, the firm sees climate change bringing more frequent and severe weather events. Second, they see both opportunities and challenges from technology – advances in batteries, electric vehicles, energy, and efficiency gains. Third, there are the regulatory impacts from energy subsidies, and their potential removal, along with increased energy-related taxes and mandated energy-efficiency rules. Lastly, there are the social impacts that can alter consumer and corporate consumption patterns. As BlackRock correctly points out, all of these issues can create risks for companies (and their profit performance), but also opportunities to enhance profit margins and/or to open new markets. But the real key is that the longer an asset-owner's time horizon, the greater the possibility for climate-related risks to compound. However, even in the short-term, many of the issues identified above can impact business operations, and if not prepared, companies could find their strategies disrupted. BlackRock states that regardless of what you think about the climate change science, it is driving politicians and regulators to act, and significant weather events are creating challenges, even if they are not out of the historical norm. These are issues investors are starting to pay attention to, and business leaders must also.

Do You Think You Know Where Oil Prices Are Heading?

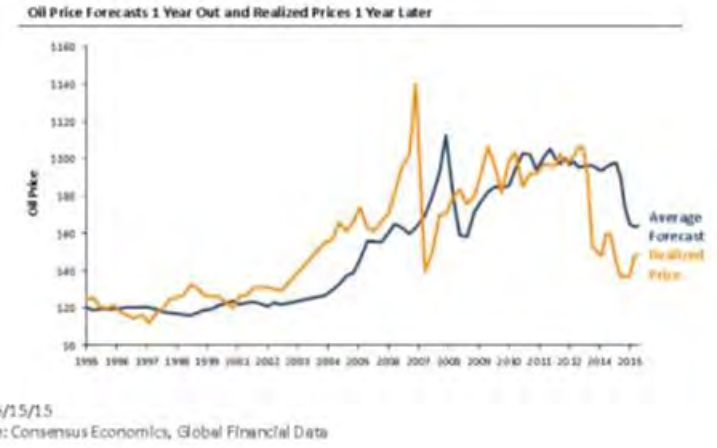
Given how important future oil prices are, how come forecasts are so poor?

If your answer to the question is yes, then welcome to a very small minority. Forecasting oil prices is important for the oil industry as it provides a road map for company managers to plan their business strategy. Future oil prices are, importantly, a signal to capital markets about the future profitability of companies and the opportunities for putting capital to work with attractive return potential. Given how important future oil prices are, how come forecasts are so poor?

it is imperative to "think about how much insight people really have regarding the future of commodity prices"

In a GMO white paper authored by Lucas White and Jeremy Grantham about why investors should be considering investing in natural resource equities, they examined the forecasting record of professionals and how that record may relate to current energy stock valuations. The paper's authors offer the opinion that there is a lot of bearishness in the market about natural resource equities. They also point out that if the bearishness is correct, then these stocks are not as cheap as the GMO managers believe. Therefore, the authors believe it is imperative to "think about how much insight people really have regarding the future of commodity prices."

Exhibit 6. Expert Oil Price Forecasters Are Not Good



Source: GMO

They found that forecasters got the direction correct only slightly more than 50% of the time

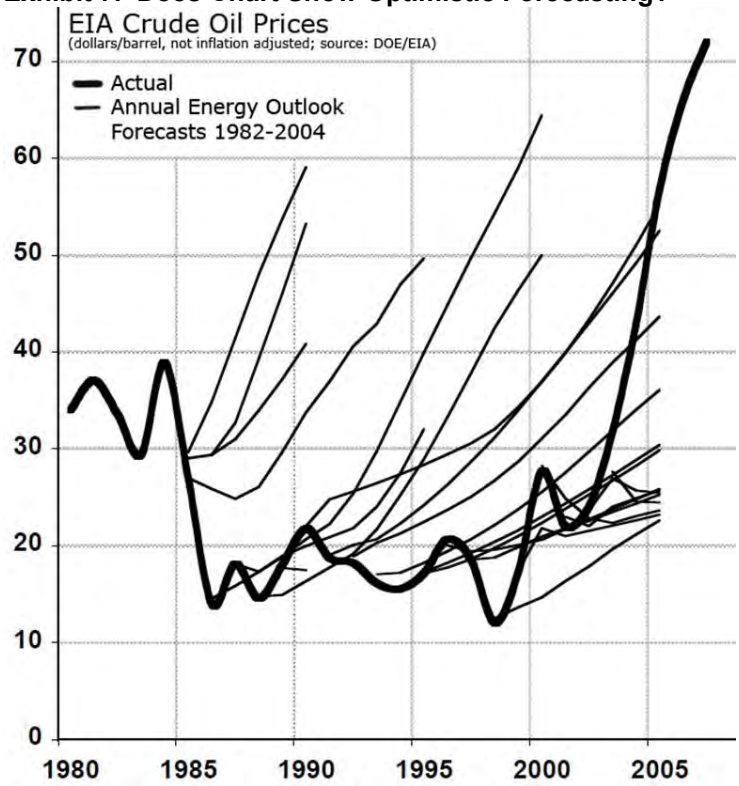
To better understand if forecasters actually possess insight into future oil prices, the authors examined the average one-year oil price forecast from leading commodity analysts compared to the actual oil price one year later. GMO found, on average, that the forecasts were more than 30% off from the actual oil price. Interestingly, they found that forecasters got the direction correct only slightly more than 50% of the time. These results led the GMO managers to rank the forecasters in an attempt to see if some were better than others at forecasting future oil prices. Their belief was that if better forecasters did exist, their existence would be proven by a positive correlation. GMO calculated that the average rank

correlation of the expert forecasters was effectively zero (0.025). Just because you are an "expert" doesn't mean your forecasts are better than everyone else's, or maybe even worthwhile.

He showed how forecasters were always predicting a gradual increase in prices, regardless of what happened subsequently

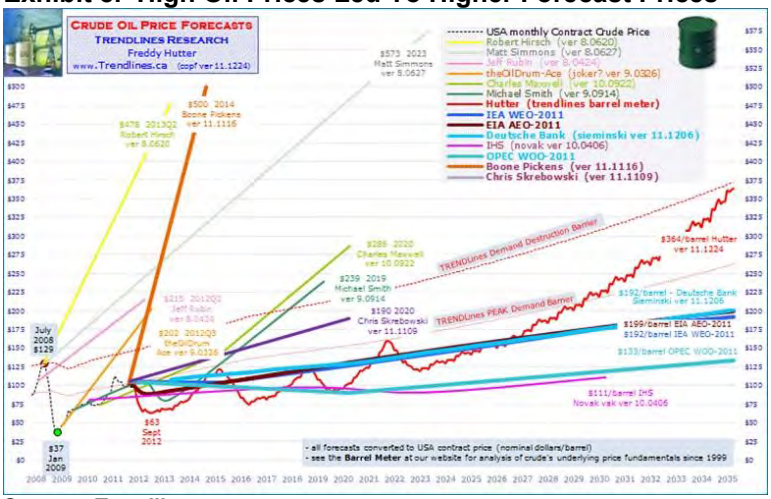
After reading the GMO white paper, we wondered why the authors bothered to focus on oil price forecasting, other than to question whether the bearishness was warranted for natural resource equities valuations. All they needed to do was consult Michael Lynch, president of Strategic Energy and Economic Research, Inc. and formerly a researcher at the Energy Laboratory and Center for International Studies. He published a working paper in 1992 at MIT called "The Fog of Commerce: The Failure of Long-Term Oil Market Forecasting." His point was that bad theories and bad models produce bad forecasts. At that time, he was challenging the belief of resource economists that fossil fuel prices had to rise exponentially. He showed how forecasters were always predicting a gradual increase in prices, regardless of what happened subsequently. As he showed, forecasters usually just changed the starting price for their forecast, but kept predicting near-identical rates of change in the long-term future. There are a number of charts showing this phenomenon, and we have prepared similar ones in the past. We present two such charts below.

Exhibit 7. Does Chart Show Optimistic Forecasting?



Source: blog.enrichconsulting.com

Exhibit 8. High Oil Prices Led To Higher Forecast Prices



Source: Trendlines.ca

The models assumed that all variables impacting oil prices could be quantified

After the 1973 oil embargo experience, and its shock to U.S. and Western European economies, the federal government and universities decided to devote extensive resources to building oil forecasting models. Universities such as MIT and Stanford built computer models for predicting energy markets and prices. Of course, they were helped by the vast amount of data about energy available, but the models assumed that all variables impacting oil prices could be quantified. That was not the case as they found out then, and it continues not to be the case today. Geopolitical considerations play a huge role in setting global oil prices and they seldom lend themselves to quantification.

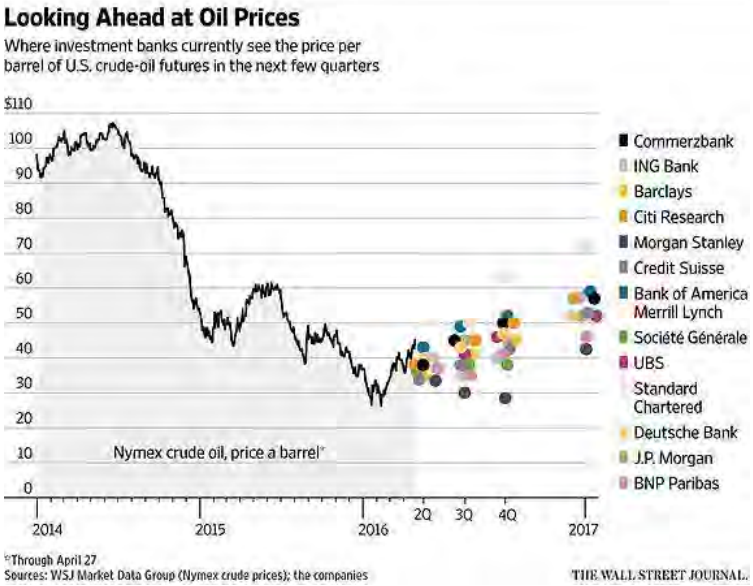
The IEA was charged with helping its members develop policies to protect their economies from sky-rocketing oil prices and potential supply shortages

The amount of data about the industry's operations, especially internationally, turned out to not be as great as initially assumed. This was one justification for creating the International Energy Agency (IEA), representing the interests of developed countries composing the Organization for Economic Co-operation and Development (OECD). The IEA was charged with helping its members develop policies to protect their economies from sky-rocketing oil prices and potential supply shortages. Gathering data and understanding its implications was at the heart of the organization's mandate.

So how should we consider all the oil price forecasts, such as those shown in the chart in Exhibit 9 (next page)? Are these forecasts valid? The third quarter price estimate ranges from $30 to $50 a barrel, as oil prices sit in the low-$40s a barrel range.

As we move into the fourth quarter, the central tendency of the investment bank forecasts contained in the *Wall Street Journal* chart is for a more tightly concentrated range of $40-$50 a barrel. The 2017 forecast range centers on $50-$60 a barrel. Will these

Exhibit 9. All Forecasters Expect Higher Oil Prices In 2017



Source: WSJ

forecasts prove any more accurate than past forecasts? A recent *WSJ* article discussed the reduced volatility of oil prices and how that was forcing commodity traders to settle for smaller gains on less dramatic price moves compared to those gains they realized when oil prices fell from $100 a barrel in June 2014 to $27 in early 2015.

"At Harvard, they call it judgmental forecasting, at MIT we said guessing"

We take all commodity price forecasts with a grain of salt. Rather, we spend more time identifying the forces shaping the environment in which oil prices are established than trying to pick a price. Given our focus, we embrace a comment from Mr. Lynch in which he drew the distinction between two university forecasting approaches – "At Harvard, they call it judgmental forecasting, at MIT we said guessing."

Is Our Energy Future At Risk Following Oil Price Downturn?

"Global oil demand growth is slowing at a faster pace than initially predicted"

The September Oil Market Report issued last week by the International Energy Agency (IEA) delivered a sour outlook for the oil industry. The IEA lowered its oil demand forecast and as a result expects the global oil market rebalancing to take longer than before. In its summary comments, the IEA wrote: "Global oil demand growth is slowing at a faster pace than initially predicted." That was not a message the oil industry wanted to hear, or oil traders who drove oil future prices lower. The IEA reduced its estimate of global demand for 2016 by 100,000 barrels a day to 96.1 million barrels a day (mmb/d), a gain of 1.2 mmb/d for the year. Of greater concern was the IEA's reduction of its 2017 demand growth by 200,000 barrels a day, or only a 1.2 mmb/d annual increase, to 97.3 mmb/d. It was

only recently that we were applauding the 1.6 mmb/d increase in demand between 2014 and 2015. If growth is slowing, despite the serious monetary stimulus around the world, one must become concerned about the dynamism of the global economy.

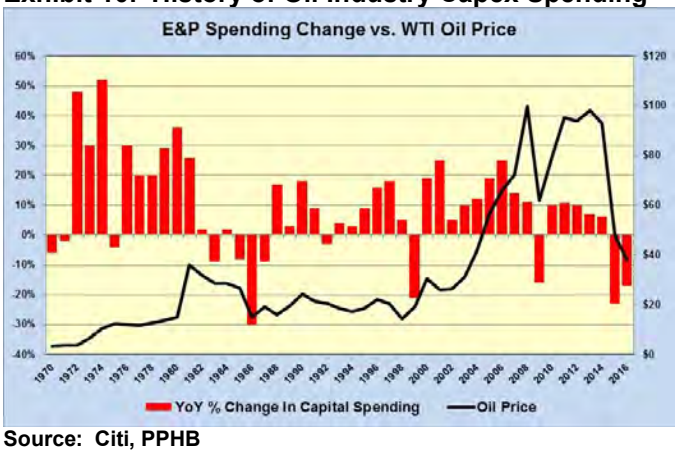
Those cuts wiped out $300 billion in spending over the two years, bringing estimated industry spending down to $450 billion

The other message the industry didn't want to hear was the IEA's projection that capital spending would be down in 2017 for the third straight year. According to the agency, industry capital expenditures fell 25% in 2015 and declined a further 24% this year. Those cuts wiped out $300 billion in spending over the two years, bringing estimated industry spending down to $450 billion. The expected reduction in 2017 will reflect the lower costs for drilling and completing wells as well as the continued weak finances due to crude oil's slump. If the IEA forecast is accurate, the industry will have cut capital spending for three consecutive years, which would be the first time since the mid-1980s, or nearly 30 years ago.

They see industry spending increasing by 3%-8% after falling 26% in 2015 and 22% this year

A recent mid-year capital spending survey conducted by investment bank Barclays prior to its energy conference two weeks ago reported a more optimistic outlook for industry spending in 2017. They see industry spending increasing by 3%-8% after falling 26% in 2015 and 22% this year. The Barclays survey has different totals than the IEA report, but the magnitude of the declines are similar. Barclays estimates that capital spending in 2016 will be $383 billion, down $287 billion from the $670 billion spent in 2014.

Exhibit 10. History of Oil Industry Capex Spending



Source: Citi, PPHB

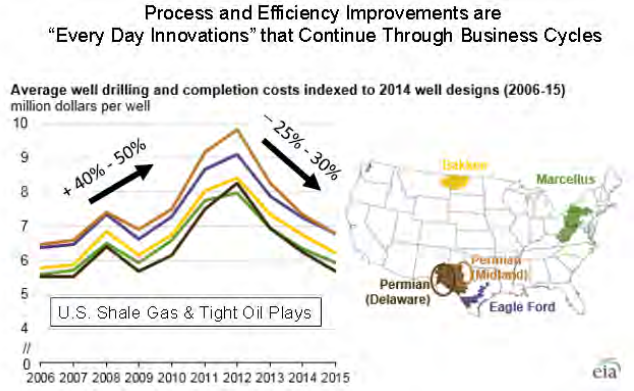
The industry has benefited from lower well drilling and completion costs

One of the more interesting questions is how much the industry has benefited from lower well drilling and completion costs and whether those savings will be retained when the industry recovery becomes more sustained. An interesting set of presentations at a recent New York Energy Forum meeting pointed out where and how these cost savings are being realized and what might happen in a recovery. Robert Kleinberg, a Fellow at Schlumberger (SLB-NYSE), showed how the industry typically responds to a downturn and how that flows through to companies.

The EIA concluded was that costs increased by 40%-50% to a peak at the start of 2012 before declining 25%-30% by 2015

He showed a chart from the Energy Information Administration (EIA) showing what has happened to average U.S. shale gas and tight oil well drilling and completion costs indexed to 2014 well designs starting in 2006. What the EIA concluded was that costs increased by 40%-50% to a peak at the start of 2012 before declining 25%-30% by 2015.

Exhibit 11. How Well Costs Have Changed



Source: EIA

The question becomes why do costs rise and then how might they decline? Mr. Kleinberg presented a chart answering the question. What drives well costs higher are efforts in trying to define a play, and then the surprises encountered while developing the optimal well design and the fallout from the chaos associated with the rush to capitalize on the developing industry boom.

Exhibit 12. How Industry Benefits and Suffers In Cycle

Process & Efficiency Improvements

Increasing Costs	Decreasing Costs
Play margin delineation	Derisked geology
Drilling/completion/ stimulation surprises	More efficient drilling/ completion/stimulation
Competition for leases	Consolidation of leases
Supply chain bottlenecks	Supply chain optimization
Infrastructure bottlenecks	Infrastructure buildout
Service cost increases ○ Equipment shortages ○ Personnel shortages	Service cost discounts ○ Amortization of CAPEX ○ Service efficiencies ○ Increased competition

Early in development cycle

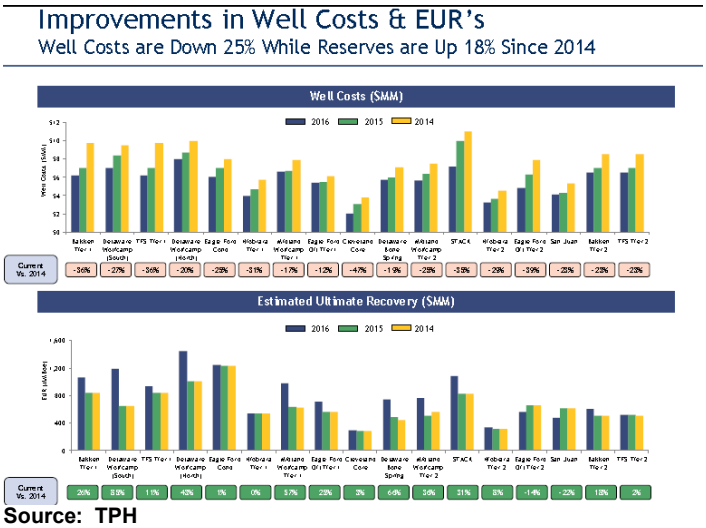
Late in development cycle

Source: Schlumberger

As knowledge is gained and the pace of activity slows, the industry becomes increasingly more efficient along with learning how to drill better wells

In a downturn, many of the factors that drove well drilling and completion costs higher are reversed. As knowledge is gained and the pace of activity slows, the industry becomes increasingly more efficient along with learning how to drill better wells. At the same time, the surplus of equipment built up during the boom weighs on service providers who aggressively compete on service prices to generate cash flows, further reducing well costs.

Exhibit 13. Downturn Has Boosted Economic Returns



Source: TPH

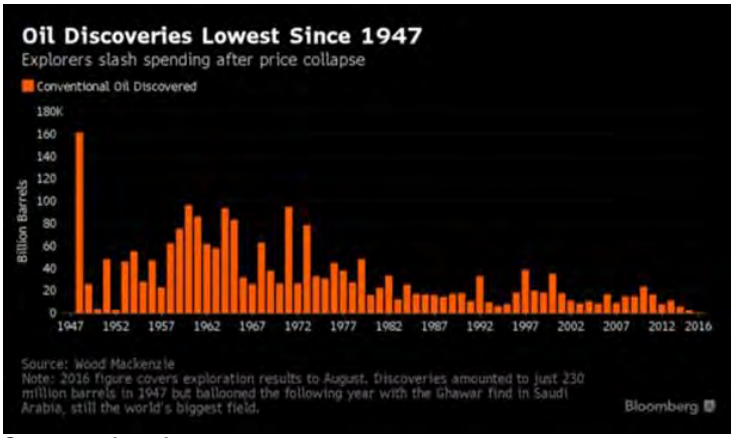
How improved efficiencies, increased geologic information and reduced service costs have enabled the industry to both lower well costs and improve estimated ultimate recovery from the wells

Bobby Tudor, Chairman and CEO of investment bank, Tudor, Pickering & Holt, also presented data that shed light on how the industry's economics change during a downturn. His focus was on how improved efficiencies, increased geologic information and reduced service costs have enabled the industry to both lower well costs and improve estimated ultimate recovery from the wells. Mr. Tudor acknowledged that shale wells are not huge cash flow generators in their early years due to their high cost. On the other hand, Mr. Kleinberg pointed out that shale wells produce the majority of their output in their early years, generating maximum cash flows.

How quickly will oilfield service costs rise in support of the industry's rebuilding needs following the destruction of the past two years?

There are two big questions for the industry. Will commodity prices climb high enough and stay up long enough to generate sufficient cash flows to support increased activity levels while also addressing the industry's debt problems? Also, how quickly will oilfield service costs rise in support of the industry's rebuilding needs following the destruction of the past two years? The answer to these questions may be signaled by the announcement by oil consultant Wood Mackenzie that oil industry discovered just 2.7 billion barrels of new supply in 2015, the smallest amount since 1947 when Saudi Arabia's Ghawar field, the world's largest oilfield, was found. So far this year, the industry has discovered only 736 million barrels of conventional crude as of the end of August. This situation should ensure higher oil prices in the future.

Exhibit 14. 2015 New Oil Discoveries Lowest Since 1947

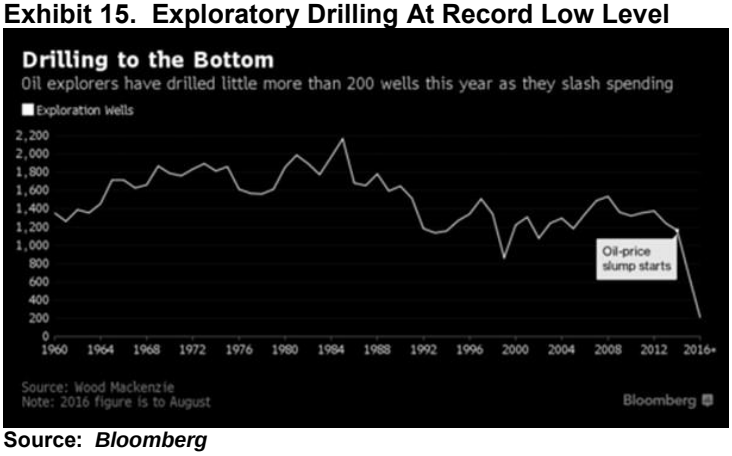


Source: ***Bloomberg***

No one can afford a dry hole, so only no-risk development wells and/or drilled but uncompleted wells (DUCs) are targeted

In Mr. Kleinberg's presentation, he pointed out that in downturns the industry responds quickly to high-grade its prospect inventory and stops exploration drilling. No one can afford a dry hole, so only no-risk development wells and/or drilled-but-uncompleted wells (DUCs) are targeted. That rule is demonstrated by Wood Mackenzie's data showing only 200 exploratory wells drilled through the first eight months of this year. Even with a herculean drilling effort by the industry, 2016 will be a record low year for exploratory wells.

Exhibit 15. Exploratory Drilling At Record Low Level



Source: ***Bloomberg***

This scenario suggests the oil industry may be facing another 12 months of difficult times

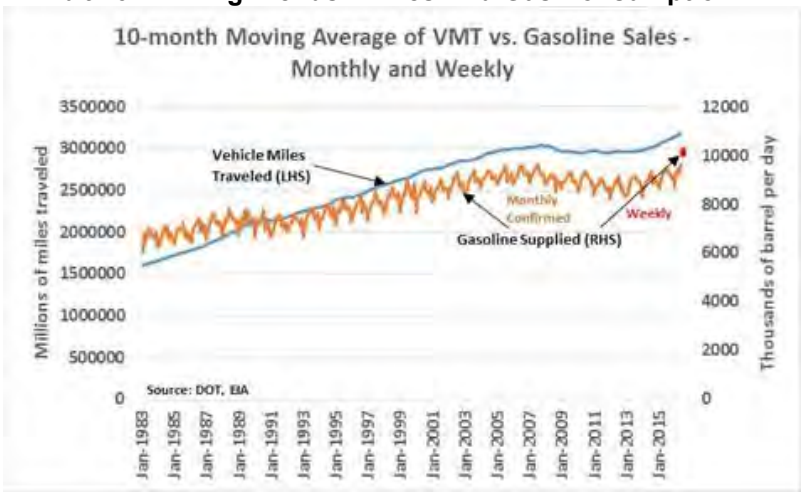
If the IEA's projections for a third year of capital spending cuts and slowing demand growth prove correct, then their forecast suggesting that the global oil market will not rebalance before the end of 2017is highly likely. This means oil prices will be lower than many are forecasting, limiting industry cash flow growth and making fewer prospects economic. This scenario suggests the oil industry may be facing another 12 months of difficult times. That seems to be what the price action of energy stocks is signaling. We hope we are wrong, but people should be preparing for more of the "Lower for Longer" scenario.

Can Gasoline Survive Economic, Enviro and Tech Attacks?

The growth in VMT and gasoline consumption marked a sharp change from the conditions that had existed in prior years

The rally in crude oil prices this spring and summer was driven by traders focusing on trends underlying demand in the gasoline market. The key dynamic was the acceleration in the 12-month moving average for vehicle miles traveled (VMT) to above 3% monthly starting in February and continuing through the balance of springtime. Gasoline consumption, after being essentially flat year over year in January, surged to a 6.4% year-over-year gain for February, which was followed by a 3.8% gain in March. Growing VMT and surging gasoline consumption encouraged commodity traders to believe that oil prices would rise after hitting bottom in February in the $27 a barrel range, as they anticipated refiners would be buying more oil to make gasoline to meet the growing demand. It takes refiners two barrels of oil to produce one barrel of gasoline. The strong growth in gasoline demand, helped by the swing in Americans' purchasing of low-mileage vehicles – pickup trucks and sport utility and crossovers – was helping gasoline use. The growth in VMT and gasoline consumption marked a sharp change from the conditions that had existed in prior years.

Exhibit 16. Driving Trends – Miles And Gas Consumption

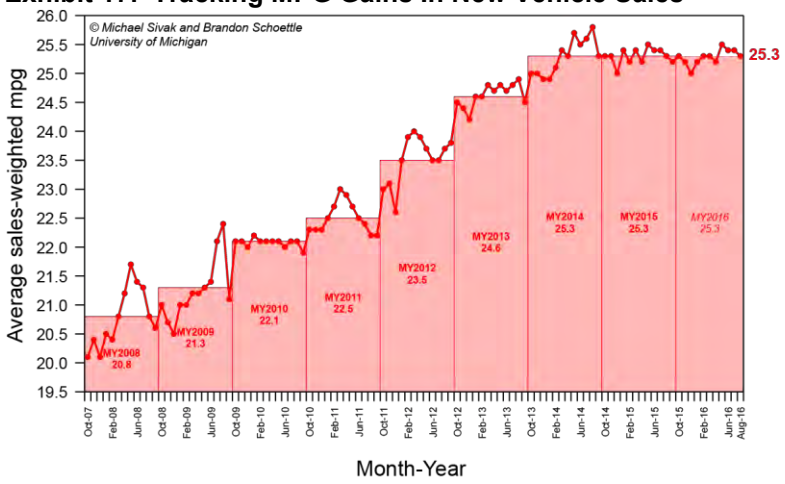


Source: DOT, EIA, PPHB

On the other hand, gasoline use started rising as fuel prices began falling and consumers accelerated their purchases of the less-fuel efficient vehicles they could now afford to drive

As shown in Exhibit 16, the 12-month moving average of VMT slumped from 2007 until 2014 when the growth rate accelerated. Gasoline consumption began falling in 2006, before the VMT started declining, and only started to recover in 2013-2014. The earlier decline in consumption was related to both the high price for gasoline at the pump and the improved fuel-efficiency of newer vehicles entering the fleet. On the other hand, gasoline use started rising as fuel prices began falling and consumers accelerated their purchases of the less-fuel efficient vehicles they could now afford to drive.

Exhibit 17. Tracking MPG Gains In New Vehicle Sales



Source: UMTRI

This data, since it is done consistently, represents a fair representation of what has been occurring in the vehicle market

The University of Michigan Transportation Research Institute (UMTRI) has been tracking the fuel-efficiency rating of the vehicles being sold monthly along with their emissions. UMTRI calculates the sales-weighted fuel economy based on the monthly sales of individual models of light-duty vehicles (cars, SUVs, vans, and pickup trucks) and the combined city/highway fuel-economy ratings published in the EPA Fuel Economy Guide (i.e., the window sticker ratings) for the respective models. There is no guarantee that the arithmetic average calculated actually matches the fuel performance of the vehicles, but this data, since it is done consistently, represents a fair representation of what has been occurring in the vehicle market.

Since then, the monthly averages have been essentially flat at 25.3/mpg

As shown in Exhibit 17, there was steady improvement in the model-year vehicle fuel-efficiency ratings from 2008 through 2014, but has remained flat for the 2015 and 2016 model years, so far. When examining the ratings for the individual months, the high was achieved in August 2014 at 25.8 miles per gallon (mpg). Since then, the monthly averages have been essentially flat at 25.3 mpg.

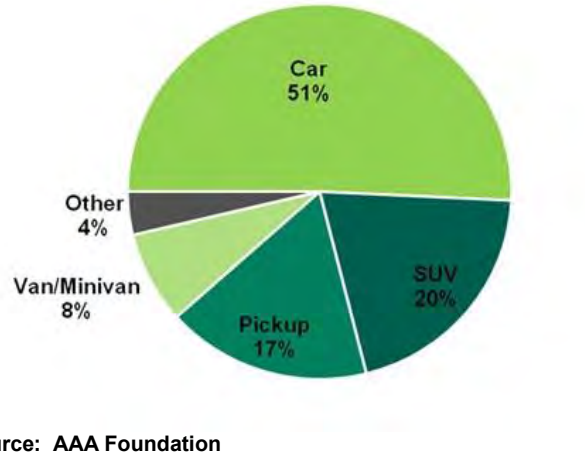
As SUVs, pickups and vans/minivans grow as a percentage of the overall fleet, then gasoline consumption will rise faster than the growth in VMT

Information from a recently released survey done for the American Automobile Association (AAA) Foundation for Traffic Safety of driving market trends in 2014-2015 further supports the data showing a faster growth rate in gasoline consumption compared to the growth rate in VMT. One of the charts showed the percentage of miles driven in for the survey period by type of vehicle. The data confirmed that 51% of the miles were driven by cars, while the balance was driven by SUVs, pickups, vans/minivans and others. SUVs, pickups and vans/minivans have lower fuel-efficiency ratings than cars. Therefore, as SUVs, pickups and vans/minivans grow as a percentage of the overall fleet, then gasoline consumption will rise faster than the growth in VMT.

The aging of the American population along with the government's push for much greater vehicle fuel-efficiency standards will hurt VMT and fuel consumption trends

In assessing the role that gasoline demand will play in driving crude oil prices in the future, we need to consider the many variables at work in the domestic transportation sector now and in the future. Issues such as the improving economy and a growing workforce will positively impact vehicle use and gasoline consumption. On the other hand, where these jobs are located will impact driving use and distances traveled. The aging of the American population along with the government's push for much greater vehicle fuel-efficiency standards will hurt VMT and fuel consumption trends. There is also the issue of disruptive forces in the vehicle and personal transportation markets including electric vehicles and hybrid cars, low-cost shared rider services, expanded public transportation options, on-line shopping and remote working, and eventually the penetration of autonomous vehicles.

Exhibit 18. Who Drives The Miles Impacts Gas Used



Source: AAA Foundation

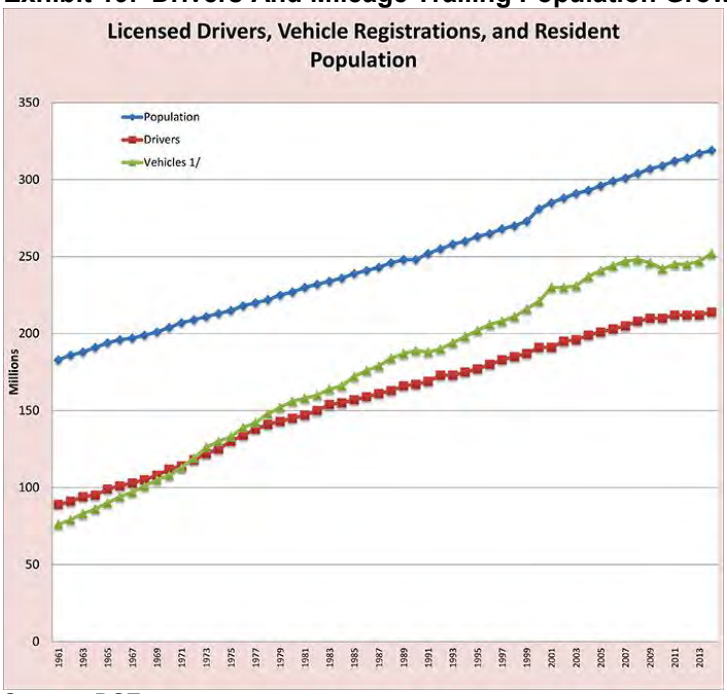
The AAA survey showed that there are 1.8 drivers per household and 2.1 vehicles

The long-term trends for driving and gasoline consumption, as shown in Exhibit 19 (next page), have shown that the number of drivers has declined in recent years as millennials have not embraced the American love-affair with the automobile as did earlier generations. Interestingly, the AAA survey showed that there are 1.8 drivers per household and 2.1 vehicles.

The slower growth in drivers probably reflected the impact of the recession on employment

As shown by long-term charts, the number of drivers in the U.S. grew steadily along with the growth in overall population until the late 1970s. As we entered the 1980s, the growth rate in drivers was slower than the population growth, but the driver growth rate was steady until the Great Recession of 2008. The slower growth in drivers probably reflected the impact of the recession on employment, reducing the need for some potential drivers to secure their driver's license. The most recent data (2014) shows the first uptick in drivers at a rate of increase greater than for the overall population (+0.09% versus +0.06%). Again, this improvement is probably explained by the improving economy and employment.

Exhibit 19. Drivers And Mileage Trailing Population Growth

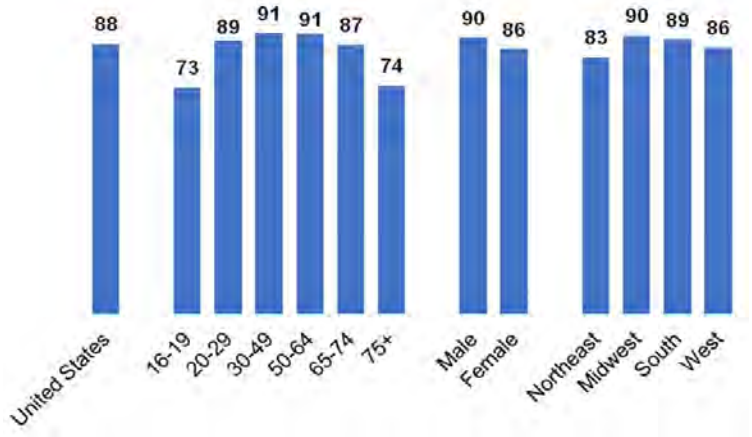


Source: DOT

The national data reported by the Department of Transportation shows only 67% of our total population are drivers

This issue of participation in the driving market was further detailed by the AAA report. Their data showed that the overall percentage of the population that drives was 88%, with the lowest percentages registered by the youngest and the oldest age groupings. One must be careful in looking at this data as it reflects the proportion drivers represent of those age groups. The national data reported by the Department of Transportation shows only 67% of our total population are drivers, which reflects the inclusion of all the youngsters not old enough and those too old to drive.

Exhibit 20. Percentage Of Populations Who Are Driving

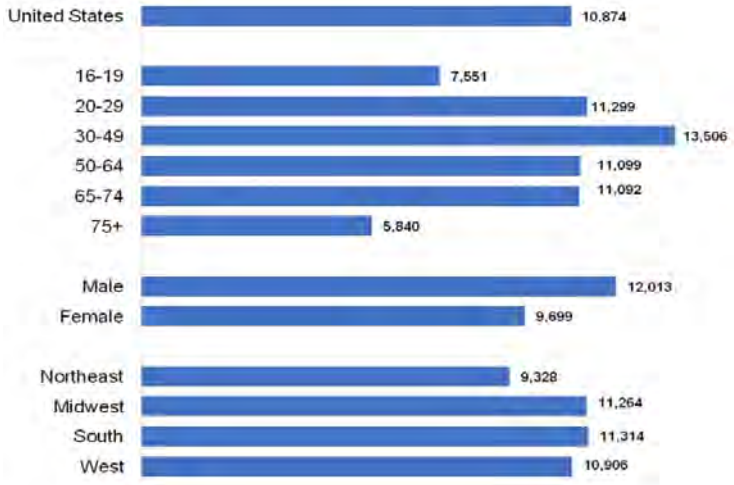


Source: AAA Foundation

Drivers in the Northeast travel only 86% of the national average, and it represents the only region below the national average

Interestingly, when looking at the proportion of drivers by geographic region, those below the national average reflect the heavily populated East Coast (Northeast) and West Coast (West). These fewer drivers reflect higher urban density, which typically means shorter distances traveled and a greater number of transportation options. That assumption was confirmed by the survey's data on miles driven by age group and region. Drivers in the Northeast travel only 86% of the national average, and it was the only region below the national average, confirming the urban density argument.

Exhibit 21. Annual Mileage Driven By Populations



Source: AAA Foundation

This suggests that average miles driven may not grow as meaningfully over the next 5-10 years as they have in recent months

What becomes interesting for its implications on future driving trends is the mileage by age group. The least annual miles driven are for those of the 75+ age group – not surprising given reduced physical skills and transportation needs. The second lowest mileage is reported by the 16-19 age group, which reflects that most are still in school and have less need to drive. The highest mileage group is those aged 30-49, which represents the prime employment sector and the heads of households. Looking forward, the population projections show that the 50-74 age category will be the fastest growing segment. They consistently drive only 2% more miles than the overall national average. This suggests that average miles driven may not grow as meaningfully over the next 5-10 years as they have in recent months. That will not be good for the oil market, especially if gasoline prices begin rising in concert with a recovery in crude oil prices. Higher pump prices might force new car buyers to shift their buying from larger, less fuel-efficient vehicles in favor of more thrifty gasoline consumers. (Throw that trend shift into the equation for what happens to auto manufacturer profits, the stock market and overall economic vitality, and the picture isn't pretty.)

So looking forward in a world of slow economic activity as experienced for the past decade, we can see VMT growth slowing

and potentially a shift toward more fuel-efficient vehicle purchases – both not positive for gasoline demand. We then have the question of the impact of greater millennials in the population and the impact of the disruptive factors we enumerated earlier.

Self-driving vehicle technology seems to be moving toward the mainstream faster than many anticipated

A Ford Motor Company (F-NYSE) senior executive told an analyst meeting recently that the company expected autonomous vehicles to represent 5% of the auto fleet sales in 2025, or potentially a million cars per year. Self-driving vehicle technology seems to be moving toward the mainstream faster than many anticipated. The City of Pittsburgh, Pennsylvania is now allowing Uber to test an autonomous vehicle taxi service. The cars are equipped with 20 cameras and seven sensors to help them navigate the city's streets. The taxis will be required to have a human driver behind the wheel in case control of the vehicle needs to shift, along with an engineer in the front seat. Right now the service is free, and it has attracted many reporters who will publicize it. Will it attract many customers? Unless a taxi causes significant traffic disruptions or a life-threatening accident, we suspect the test will be declared a success. The industry, however, is still awaiting the federal government's issuance of guidelines about how self-driving vehicle regulations should be constructed. Traffic laws are primarily under local control, but basic national standards are important for the regulatory process and the vehicle manufacturing process, including vehicle safety and emissions standards. Steering wheels and pedals, or not?

This represented 10.2 deaths per 100,000 people and 1.08 deaths per 100 million vehicle miles traveled

Self-driving technology's primary benefit is to reduce and/or eliminate accidents and especially deaths. In 2014, according to data from the U.S. Department of Transportation, which is responsible for the Fatality Analysis Reporting System, there were 29,989 fatal motor vehicle crashes in which 32,675 deaths occurred. This represented 10.2 deaths per 100,000 people and 1.08 deaths per 100 million vehicle miles traveled. Some 38% of the deaths involved car accidents, while 25% related to pickup and SUV vehicle accidents. Only 2% of the deaths involved large trucks while the balance was accounted by motorcyclists, pedestrians and bicyclists. All deaths from large truck crashes were 12% of total vehicle deaths.

Reducing vehicle weight will make vehicles much more fuel-efficient and thus reduce future fuel consumption

There remain a number of legal issues about self-driving cars that need to be resolved. Who is given a ticket for a self-driving car failing to heed traffic rules or becoming involved in an accident: the passenger, a driver in the vehicle, the owner of the vehicle, or the engineer who wrote the software? These issues will be overcome with time, but the impact on energy markets will likely come in dramatic fashion. Once auto companies feel comfortable that their self-driving cars will not be involved in accidents, they can begin designing vehicles for greater passenger comfort and entertainment, while using lighter materials since the heavy steel cages required now to protect passengers in accidents will no longer be needed. Reducing vehicle weight will make vehicles much more fuel-efficient and thus reduce future fuel consumption.

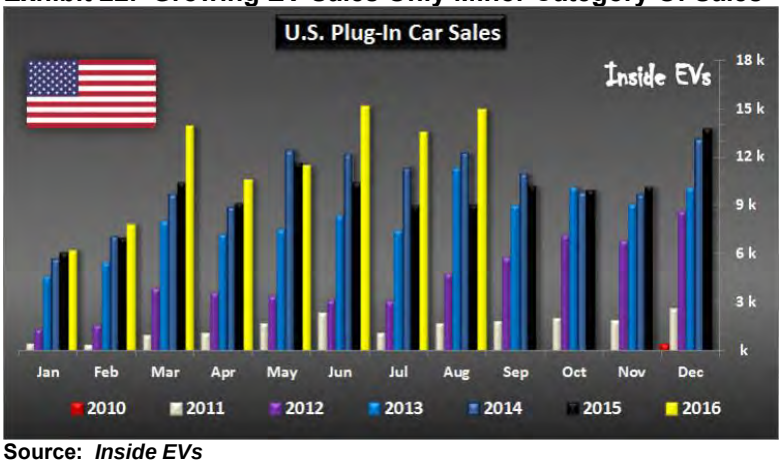
For many of these alternative powered vehicles, the lack of refueling options is merely compounding the already existing range-anxiety fear of potential owners

While there are many estimates about when self-driving vehicles will become mainstream due to the lack of clarity on the legal and regulatory situation, expectations are that acceptance will be quick. In association with self-driving vehicles is the push into alternative powered vehicles. Natural gas powered vehicles have yet to gain significant market penetration, largely due to the lack of fueling facilities. That has also been an impediment for electric and plug-in hybrid car sales. For many of these alternative powered vehicles, the lack of refueling options is merely compounding the already existing range-anxiety fear of potential owners. Last week, Chevrolet announced that its Bolt electric car will have a range of 238 miles on a single charge. That distance exceeds the promise of Tesla's (TSLA-Nasdaq) Model 3's estimated 215 mile range. The Bolt is due to begin deliveries this fall, considerably ahead of Tesla, but it will cost slightly more ($37,500 vs. $35,000, before the $7,500 federal tax credit). The Bolt has a maximum speed of 91 miles per hour, less than Tesla's maximum, which may be an objection for some buyers. However, in urban areas, exceeding 91 miles per hour is not a real option, so one wonders how limiting that will be.

The record sales year in 2016 would still represent only nine-tenths of one percent of estimated full-year light-duty vehicle sales

Electric vehicles, along with plug-in hybrid cars, have been touted as the future of the automobile industry because they release no emissions. That claim isn't totally correct when full-cycle emissions are considered. So far through August, 2016 sales of electric vehicles, 93,197 units, are 29% higher than for the similar period in 2015. If that margin of outperformance is maintained for the rest of 2016, the year's estimated sales of 149,768 units would exceed the prior peak in 2014 when the industry sold 122,438 units. The fall-off in electric vehicle sales in 2015 is partially explained by the sharp drop in gasoline prices that made conventional cars cheaper alternatives, while avoiding any range-anxiety. While the record of monthly electric vehicle sales in Exhibit 22 looks impressive, the record sales year in 2016 would still represent only nine-tenths of one percent of estimated full-year light-duty vehicle sales.

Exhibit 22. Growing EV Sales Only Minor Category Of Sales



Source: ***Inside EVs***

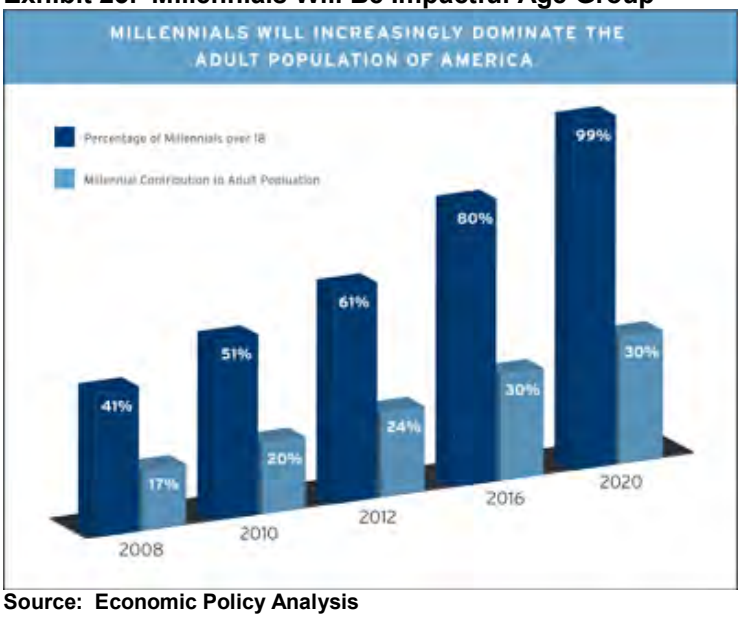
During this entire time, a popular topic was how our youth – the millennials – were not interested in learning to drive and own cars

The most difficult auto market dynamic to get one's arms around is the impact of millennials and their relationship with cars. When VMT growth was stagnant during the early years of the 2000s, the thought was that our aging population was impacting driving. Later, VMT growth was negative as the impact of the financial crisis and recession hurt employment and consumer budgets were squeezed by very high gasoline prices. During this entire time, a popular topic was how our youth – the millennials – were not interested in learning to drive and own cars. The rationale was that the socialization associated with automobiles was being replaced by the Internet. Besides, we found that people had discovered shopping on the Internet, meaning they had less need to visit the mall. We struggled to understand how firm or transitory these forces were.

By 2020, when millennials represent 30% of our population, any attitudinal shifts in their use of personal transportation services will significantly impact the automobile market and gasoline demand, either positively or negatively

There is little doubt that millennials – those born in 1982-2003 – have and will continue to reshape much about how our society, politics and economy will function in the future compared to the past. The chart in Exhibit 23 shows how millennials in total, and those over 18 years old, have impacted the adult population for the past eight years and how they will impact it over the next four years. By 2020, when millennials represent 30% of our population, any attitudinal shifts in their use of personal transportation services will significantly impact the automobile market and gasoline demand, either positively or negatively.

Exhibit 23. Millennials Will Be Impactful Age Group



Source: Economic Policy Analysis

In researching millennial views toward autos, we found two conflicting surveys taken at about the same time in 2014. One survey was conducted by Zipcars, a vehicle short-term rental company that has been tracking the attitudes of millennials toward

"53 percent of millennials said the cost of owning a car, including insurance, gas, parking as well as payments, is out of reach for them."

automobiles since 2010. A media article made the point that based on the annual survey, "53 percent of millennials said the cost of owning a car, including insurance, gas, parking as well as payments, is out of reach for them." That compares with only 35 percent of older generations that took part in the survey." The survey also said that "nearly 40 percent of millennials believe that losing their phone would be a bigger hardship than losing their automobile." That compares with 16% of those over 35 who responded to the same question about losing their cell phones versus losing their cars.

The survey also showed "that 8 in 10 Millennials get around most often by car as opposed to any other form of transportation – a stark contrast to studies in recent years that show driving on the decline among young people."

Results of a survey done in 2014 by MTV uncovered "an increase in young people's passion for cars and car ownership with 3 in 4 young people agreeing they would rather give up social media for a day than their car and 72 percent agreeing they would rather give up texting for a week than their car." The survey also showed "that 8 in 10 Millennials get around most often by car as opposed to any other form of transportation – a stark contrast to studies in recent years that show driving on the decline among young people." Finally, "young people claim to drive more miles per month than any other generation with a self-reported 72 percent increase in the average number of miles driven versus Boomers (934 miles vs. 544 miles) and an 18 percent increase versus Gen X (934 miles vs. 790 miles)"

The implications of each survey will take you in almost diametrically opposing directions

So which survey do you believe? The implications of each survey will take you in almost diametrically opposite directions. After reading the survey data and methodologies, we aren't sure about the quality of either survey. However, these surveys seem to be the only way to begin making sense out of the current data about millennial attitudes toward transportation and living styles. As a result, in one case you will conclude that there is a boom underway for the automobile business and gasoline demand. On the other hand, you might conclude that the age of the automobile, as most of us have lived it, is over and gasoline demand will be falling continually until we scrap the last of the conventionally-powered cars. One environmental group says that date should be 2035!

We lean in the direction of the millennials having less interest in cars and more willing to use alternative transportation modes

What we know is that neither of these conclusions is absolute – the challenge is knowing which dynamic will have the greatest influence. If we have to hazard a guess, we lean in the direction of the millennials having less interest in cars and more willing to use alternative transportation modes, while also electing to live in more urban areas with greater personal transportation options.

That doesn't mean a top in gasoline demand will happen in months, but possibly within a reasonable time frame – two to three years

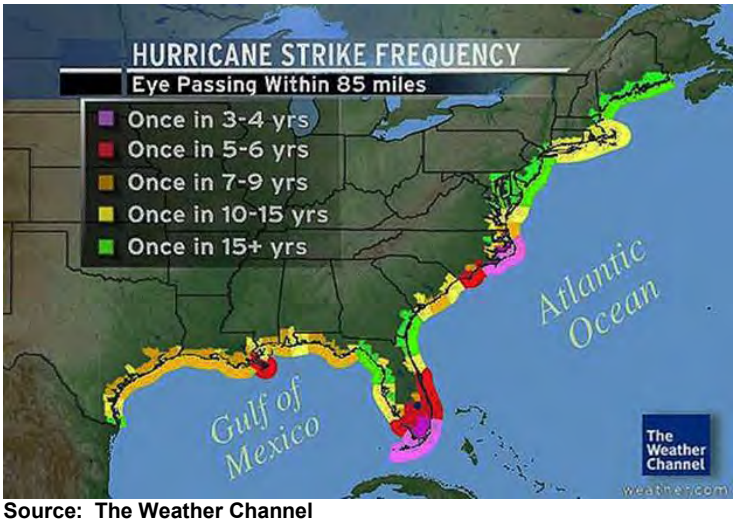
If gasoline prices begin to rise with a recovery in crude oil prices, we believe we are much closer to a top in gasoline demand than not. That doesn't mean a top in gasoline demand will happen in months, but possibly within a reasonable time frame – two to three years. What we do believe is that by identifying the leading factors influencing driving and gasoline consumption, we can more effectively monitor the factors and comment on their current status in future *Musings*.

Will Hurricane Hermine Be Only Test For Offshore Industry?

Hurricane Wilma in 2005 was the last hurricane to hit Florida

Hurricane Hermine made landfall on the Florida Panhandle early on the morning of September 2nd as a Category 1 storm with winds of 80 miles per hour, becoming the first hurricane to make landfall in Florida in over a decade. Hurricane Wilma in 2005 was the last hurricane to hit Florida. While Hermine was a marginal hurricane, it did dump substantial rain on the area where Florida's panhandle bends around and turns into the peninsula for which Florida is known. Tens of thousands of residents in the area lost their electricity and many experienced flooding due to the rains, a high tide and the storm surge that pushed water onshore. This area of the state seldom experiences tropical storms as the green coastal marking in Exhibit 24 reflects a 15+ year frequency between tropical storm landfalls. Note also on the map the green stretch of Georgia along the East Coast that seldom experiences storm landfalls, as this was where Hermine transited on her way up the East Coast.

Exhibit 24. Hermine Landed Where Few Storms Have



Source: The Weather Channel

There were no deaths attributed to flooding or electrocution due to falling power lines

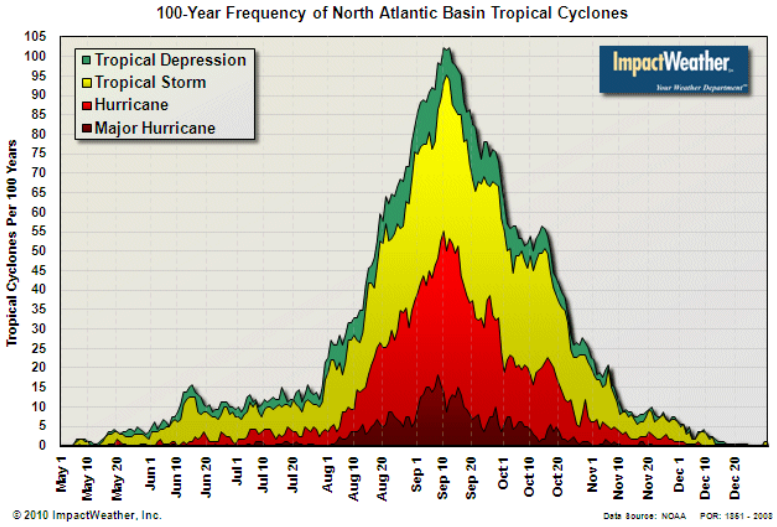
As Hurricane Hermine crossed Florida on its way to the East Coast, the storm weakened to tropical storm status, creating less damage as wind speeds dropped and rainfalls eased. Sadly, three deaths were attributed to the storm as a homeless man was hit by a falling tree in Florida, a South Carolina man attempting to remove a tree on a road was hit by a car, and a truck driver lost his life in North Carolina when the wind blew his 18-wheel vehicle off a bridge. Surprisingly, there were no deaths attributed to flooding or electrocution due to falling power lines.

For the Gulf of Mexico oil and gas industry, Hurricane Hermine caused it to evacuate some of its easternmost platforms, forcing production to be shut in. The shutdown was short as the storm made a quick U-turn from its westerly course as it entered the Gulf

The historical peak in tropical storm activity occurs around September 10th

of Mexico to a Northeastern track taking it to the Florida Panhandle. So while the oil and gas industry dodged its first tropical storm experience, the question now is whether there are likely to be more episodes in the industry's future. Remember that the historical peak in tropical storm activity occurs around September 10th.

Exhibit 25. September 10th Is Peak Of Tropical Storm Season



Source: StormGeo

Normally, we experience 70 tropical disturbances in a season, and at the time of the webinar, disturbances 30, 32 and 33 were being tracked on their journey from the West African coast to North America

Two weeks ago, StormGeo presented one of their periodic hurricane season webinars. As of September 7th, the season has experienced eight named tropical storms with four becoming hurricanes including one that grew to be a major hurricane (Hurricane Gaston, which was only in the Atlantic Ocean). Hurricane Hermine evolved from the 26th tropical disturbance of the season. Normally, we experience 70 tropical disturbances in a season, and at the time of the webinar, disturbances 30, 32 and 33 were being tracked on their journey from the West African coast to North America. At that time, disturbance 33 was given the best chance to evolve into a tropical storm, based on the then-meteorological conditions. Forecasting models also acknowledge the potential for a storm to develop. Meteorological reasons given for the greater possibility of this disturbance becoming a tropical storm include that it is dealing with reduced African desert dust and more humid air offshore Africa where the storm came from. It is also tracking into an ocean area of low atmospheric pressure that is favorable for storm formation and intensification. As well, ocean temperatures in the South Atlantic are warmer and there is less wind shear – conditions that are favorable for storm formation. (That disturbance became Tropical Storm Julia.)

As Chris Hebert, StormGeo's tropical storm forecaster, pointed out, over the next two weeks (about now) the strong Bermuda high pressure mass would shift to lower pressure, which could increase the possibility of tropical storms crossing the Atlantic Ocean to

That will have the impact of taking Texas out of the picture of exposure to storms making landfall

veer northward and go out to sea rather than making their way to the U.S. Gulf of Mexico or up the East Coast. What Mr. Hebert foresees is the potential for the central and western areas of the Caribbean Sea (the area below Cuba) becoming more active and pushing tropical storms into the Gulf of Mexico. He pointed out that this was the region where Superstorm Sandy formed before moving up the East Coast in 2012. Any storms that form in the region will be influenced by the cooling anticipated to start in Texas in the next couple of weeks. That will have the impact of taking Texas out of the picture of exposure to storms making landfall. That will not be the case with Louisiana and Gulf Coast states eastward.

One change StormGeo has made is eliminating all the High Risk areas for landfall and listed all of the Caribbean and U.S. coast lines at Normal Risk

Based on the history of 1950-2015, the average number of storms forming in September indicate there will be about four (3.8) tropical storms with two becoming (1.9) hurricanes and one (1.2) becoming a major hurricane. If this number of storms is reached in September, it would bring the season's activity close to StormGeo's original forecast of 15 named storms, eight hurricanes and four major hurricanes. One change StormGeo has made to its forecast is to eliminate all the High Risk areas for landfall and now posting all of the Caribbean and U.S. coast lines as being at Normal Risk.

If StormGeo's tropical storm outlook proves correct, then the Gulf of Mexico oil and gas industry has dodged another bullet

The bottom line from the webinar discussion was that while we are always at risk of tropical storm formation, they thought the risk of storms impacting the region was diminishing, leading them to comment that this webinar might be the last dealing with tropical weather as the next webinar would deal with the winter weather outlook. If StormGeo's tropical storm outlook proves correct, then the Gulf of Mexico oil and gas industry has dodged another bullet. The lack of storm disruptions in Gulf of Mexico oil and gas output isn't helping to speed the recovery in the energy market's imbalance, so other dynamics will have to play a greater role.

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