Musings from the Oil Patch
August 27, 2019

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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.

Summary:

Energy Market Woes May Require Investment Thesis Rethink

The turmoil in the commodity and stock markets, driven by the trade tariffs and fears of slowing economic growth, reflect the world entering a low interest rate environment. What does this mean for energy?

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Does The U.S. Have An Oil Demand Problem?

An analyst has focused on refinery inputs falling as a signal the U.S. demand is falling, caused, in his opinion, by electric cars. VMT growth has slowed, signaling a possible demand decline, but other factors are at work.

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Forecasts for EVs continue to grow, but growth continues to be driven by government subsidies and policies, and little by economics. The hidden risk is that battery material may not be sufficient for EV forecasts.

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Energy Market Woes May Require Investment Thesis Rethink

For longer than we care to think, or admit, we have been wrestling with how to project the future of the energy market. Yes, this focus reflects the reality that our working life has largely been tied to the fortunes of the energy business. As a director of an oilfield service company, an advisor to others involved in energy markets, and the author of energy columns in industry magazines, we find we spend virtually all our waking hours thinking about the shape of the future world of energy. That is why this publication is titled: “Musings From the Oil Patch.”

Since well before Saudi Arabia undercut the established operating philosophy of the global oil market in late 2014, it was becoming evident that the future of the energy business would not resemble the past; at least the recent past. That expectation is what has us constantly re-examining the 1975–2000 history of the oil industry. That era was marked by an explosive oil price environment, which was followed by its collapse, engineered by a dramatic change in Saudi Arabia’s oil production strategy in response to the country losing significant market share and income to its OPEC partners who ignored the cartel’s weakening market clout. What happened in that earlier period is similar to the years immediately before the November 2014 OPEC meeting. Since that fateful Thanksgiving Day, oil industry players and market observers have offered theses about how the industry’s future will unfold, but often the outcomes failed to support them.

Starting with the belief that oil prices would repeat the “V-shaped” track of 2008–2010, 2015’s view morphed into embracing the comment of BP plc (BP-NYSE) CEO Bob Dudley that his company was planning its future based on oil prices being “lower for longer” than generally assumed. Those three words became the driving force for restructuring the global oil industry. It meant rebuilding business strategies from the bottom up, ending previous ventures and projects, and even reversing strategic directions. Sadly, it meant the end of thousands of energy careers, as they were too costly to retain, especially as companies struggled to pay their debts.

Since 2014, we, along with others, have struggled to explain why the industry recovery, even though oil prices doubled from the bottom, hasn’t been more substantial. Why hasn’t oil industry activity returned to prior highs, let alone global crude oil prices return to $100 a barrel? The disconnect between the improvement in oil industry fundamentals and energy share prices/values has been earthshattering, as well as wealth-destroying for investors. Trying to explain this disconnect has people groping for theories – but most are based on geopolitical events and their impact on economic activity and, in turn, on oil supply and demand, as well as shifts among investment philosophies that disfavor energy. Virtually all
Mr. Herbert offered the view that “the complexity factor for Energy remains exceptionally high and macro threats continue to coalesce.”

Recently, Bill Herbert of Simmons Energy, a division of Piper Jaffray, authored a piece titled “Energy Ruminations - 2019 Anchor-Leg Considerations, Coalescing Macro Threats.” His article was a set-up for the firm’s upcoming energy conference that kicks off the fall energy conference schedule. In his opening paragraphs, Mr. Herbert offered the view that “the complexity factor for Energy remains exceptionally high and macro threats continue to coalesce.” While that view may not be surprising, he went on to suggest that “[E]nergy continues to be confronted by a combination of secular and cyclical challenges” that he summarized in a list of ten topics. The following were the ten challenges he highlighted:

1. Continued Marginalization of Energy as an Asset Class
2. ESG – Growing Secular Wave
3. When Does One Make Money in Energy?
4. The Growing Allure of Sustainable and Competitive Dividends
5. Prominent Externalities Continue to Exert Disproportionate Influence on Oil Prices and Broader Energy
6. US/China Trade Friction and Global Economic Deceleration
7. Global Oil Demand – Weak and Weakening.
8. US Oil Production – Continued Cathartic Growth but Decelerating:
9. OPEC Spare Production Capacity Continuing to Expand.
10. The Importance of Recessions, or Avoiding One, in Presidential Politics

Crude oil remains a commodity whose price is subject to the vagaries of global supply and demand dynamics explanations are focused on short-term trends, with the thought that these trends will revert to conditions more favorable for energy company profitability and thereby higher stock prices at some point. What if the current environment represents a seismic change in the outlook for the global economy, which will never need to rely on energy to drive its future?
Economic weakness in Europe has pushed interest rates in that region into negative territory, sending money flowing into the U.S. bond market where interest rates are positive. That money flow drove bond prices up, thereby pushing American interest rates lower. In fact, the movement in U.S. interest rates led to a temporary rate inversion, where short-term rates were higher than long-term rates, a condition that historically has predicted future recessions. According to a report from Hoisington Investment Management, “The current inversion is the eighteenth cyclical flattening since 1921, with all of the prior seventeen preceding recessions...”

As these events unfolded and fear gripped the market, the stock market’s volatility spiked adding to the unsettled environment for investors.

Exhibit 1. Stock Market Volatility Alarms Investors

Dealing with an 801-point decline seven trading days later, equal to a 3% drop

Investors who had been shaken by August 5th’s 767-point drop in the Dow Jones Industrial Average (DJIA), found themselves dealing with an 801-point decline seven trading days later, equal to a 3% drop. Throw in the 380-point drop on August 12th, two days before, and investors were seriously questioning whether the world was on the brink of a global recession.

Helping drive that fear was weak economic data from China and Germany – surprising to both economists and stock market investors. The continued decline in global interest rates has been relentless since the start of 2019, unsettling bond investors who...
Only three out of 14 countries possess positive yields for all investment time horizons.

There are few investment markets where positive yields are available for bond investors.

were suddenly staring at $17 trillion of government debt sporting negative yields – you pay the government for the privilege of owning its bonds! Those bonds with negative yields represent 25% of all sovereign debt in the world!

A series of three charts about negative yields around the world and where the United States stands among countries is highly informative. The first (Exhibit 2) shows the current yield for government bonds of a number of leading governments. The red background reflects negative yields, while green designates positive returns. Only three out of 14 countries possess positive yields for all investment time horizons.

**Exhibit 2. Where To Find Positive Income From Bonds**

<table>
<thead>
<tr>
<th>Country</th>
<th>1-3 Years</th>
<th>3-5 Years</th>
<th>5-7 Years</th>
<th>7-10 Years</th>
<th>10-15 Years</th>
<th>15+ Years</th>
</tr>
</thead>
<tbody>
<tr>
<td>Denmark</td>
<td>0.919</td>
<td>0.910</td>
<td>-0.866</td>
<td>-0.789</td>
<td>-0.666</td>
<td>-0.480</td>
</tr>
<tr>
<td>Germany</td>
<td>-0.826</td>
<td>-0.949</td>
<td>-0.907</td>
<td>-0.810</td>
<td>-0.644</td>
<td>-0.366</td>
</tr>
<tr>
<td>Netherlands</td>
<td>-0.899</td>
<td>-0.877</td>
<td>-0.763</td>
<td>-0.656</td>
<td>-0.471</td>
<td>-0.306</td>
</tr>
<tr>
<td>Finland</td>
<td>-0.832</td>
<td>-0.813</td>
<td>-0.701</td>
<td>-0.540</td>
<td>-0.345</td>
<td>-0.084</td>
</tr>
<tr>
<td>Sweden</td>
<td>-0.725</td>
<td>-0.738</td>
<td>-0.664</td>
<td>-0.552</td>
<td>-0.339</td>
<td>0.020</td>
</tr>
<tr>
<td>France</td>
<td>-0.828</td>
<td>-0.832</td>
<td>-0.704</td>
<td>-0.519</td>
<td>-0.284</td>
<td>0.218</td>
</tr>
<tr>
<td>Austria</td>
<td>-0.816</td>
<td>-0.811</td>
<td>-0.712</td>
<td>-0.573</td>
<td>-0.198</td>
<td>0.304</td>
</tr>
<tr>
<td>Belgium</td>
<td>-0.802</td>
<td>-0.788</td>
<td>-0.641</td>
<td>-0.468</td>
<td>-0.197</td>
<td>0.269</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.279</td>
<td>-0.317</td>
<td>-0.353</td>
<td>-0.298</td>
<td>-0.149</td>
<td>0.092</td>
</tr>
<tr>
<td>Ireland</td>
<td>-0.671</td>
<td>-0.628</td>
<td>-0.438</td>
<td>-0.211</td>
<td>0.003</td>
<td>0.490</td>
</tr>
<tr>
<td>Spain</td>
<td>-0.562</td>
<td>-0.463</td>
<td>-0.292</td>
<td>-0.099</td>
<td>0.163</td>
<td>0.749</td>
</tr>
<tr>
<td>UK</td>
<td>0.379</td>
<td>0.323</td>
<td>0.314</td>
<td>0.358</td>
<td>0.520</td>
<td>0.890</td>
</tr>
<tr>
<td>US</td>
<td>1.567</td>
<td>1.439</td>
<td>1.457</td>
<td>1.498</td>
<td>1.526</td>
<td>1.912</td>
</tr>
<tr>
<td>Italy</td>
<td>0.147</td>
<td>0.556</td>
<td>0.883</td>
<td>1.115</td>
<td>1.570</td>
<td>2.149</td>
</tr>
</tbody>
</table>

Source: J.P. Morgan

The second chart (Exhibit 3, next page) shows the proportion of bonds trading with negative yields that are part of the JP Morgan GBI Broad Index. Once again, this chart reinforces the reality that there are few investment markets where positive yields are available for bond investors, forcing investors needing income to seek out the U.S. market.
With more global interest rates falling into negative territory, the U.S. is becoming the last bastion of positive returns, reaching 94% on a projected path to 100%

The third chart (Exhibit 4) demonstrates why the health of the U.S. bond market is drawing so much global capital, pushing down current interest rates. Since 2013, U.S. investment grade yields accounted for only about 40% of global bonds. From that point, the U.S. share has climbed steadily to around 80% for the past several years. Now, with more global interest rates falling into negative territory, the U.S. is becoming the last bastion of positive returns, reaching 94% on a projected path to 100%, according to Bank of America analysts.

Global investors, needing positive long-term interest rates to help fund their long-term liabilities, have been rushing into the U.S. bond market driving up bond prices, which drives down interest rates. In fact, Treasury yields have been cut in half in the past nine months.
The interest rate inversion is considered a flashing red light signaling a recession down the road.

For a brief time, short-term interest rates (2-year government bonds) sported a current yield greater than the rate for 10-year government bonds. Traditionally, long-term interest rates are higher than short-term rates to compensate investors for investing their money for a longer time period, exposing them to greater risks. The interest rate inversion is considered a flashing red light signaling a recession down the road. The only problem is that there is no timetable associated with the subsequent recession following an interest rate inversion. An examination of previous interest rate inversions since the early 1970s shows they can be associated with recessions commencing anywhere from four months to up to 22 months later. The general consensus has settled on an 8-9-month time lag for the start of a recession following an interest rate inversion. What we don’t know is how long rates need to stay inverted to drive a future recession. In the past, these interest rate inversions have lasted for months, not days.

Exhibit 5. How U.S. Interest Rates Have Fallen In 2019

The panic on Wall Street and in the bond trading pits showed up in commodity markets, as the prices for industrial metals fell, and gold, a perceived safe haven for investors, climbed higher. For the week of August 12, crude oil also experienced increased volatility. From the absolute low price to the absolute high price that week, the crude oil futures trading spread was 7%. For the four daily crude oil price changes, only one day experienced a change of under 1%. Two daily changes exceeded 3%.

Exhibit 6. Recent Oil Price Volatility Spiking Higher
To appreciate the volatility in crude oil prices in recent weeks, Exhibit 6 (prior page) shows the trend of the CBOE Crude Oil Volatility Index, which reflects the volatility in crude oil futures prices, for the past month. Since the end of July, the volatility index has been consistently above its level during the last half of July.

Exhibit 7. Crude Oil Volatility Under 2014-15

![Crude Oil Volatility Index](image)

Source: Yahoo Finance

While volatility hasn’t reached the levels experienced during the fall of 2014 and in 2015, it neared those highs during the oil price rout of 2018.

Many investors are questioning whether gold is evolving into a currency alternative. Another commodity, which carries greater weight in monetary circles, is gold. After years of being static, gold prices have soared by roughly 20% in the past 90 days. Traditionally, gold is viewed as a safe haven for risk-adverse investors. Today, however, many investors are questioning whether gold is evolving into a currency alternative. If so, it raises questions about the relationship of monetary policy and economic ties to the U.S. dollar, the established world currency standard.

Exhibit 8. Gold Price Soars As Interest Rates Fall

![Gold Price Chart](image)

Source: Money Metals Exchange, LLC
The shale revolution, born out of the era of super-high oil prices this century, has become a major global economic and political disruptor, offering the prospect for many additional unintended and unknown consequences.

For the past two months, we have been following a debate between two legendary financial thinkers/practitioners – Ray Dalio, the founder of one of the world’s most successful hedge funds, Bridgewater Associates, and John Mauldin, the publisher of “Thoughts From The Frontline,” one of the world’s most widely read financial newsletters.

On May 2nd, Mr. Dalio published an article entitled, “It’s Time to Look More Carefully at ‘Monetary Policy 3 (MP3)’ and ‘Modern Monetary Theory (MMT).’” In it, he wrote that in the next economic downturn central banks would be forced into MP3, which will be fiscal and monetary policy working together – with fiscal policy producing government deficits that are monetized by the central bank. He added that he believes MP3 is inevitable and it will be the best policy option available under the circumstances.

Mr. Mauldin thought differently, and on June 7th he published the first of a 6-part series called: “Ray Dalio Is Kinda, Sorta, Really Wrong.” There he wrote, “Ray Dalio is really, really wrong” for endorsing MP3. The next five weeks saw additional articles discussing the issues raised by Mr. Dalio. On June 24th, Mr. Dalio responded in an article in Forbes, reiterating his view of MP3 being the best option.

In one article, Mr. Mauldin forecasted the U.S. economy to 2029, along with government deficit projections assuming a recession in either 2020 or 2022. He used the economic and government spending forecasts from the Congressional Budget Office (prior to last week’s release). In the recession forecasts, he used changes in government spending and tax revenues similar to those experienced in the 2009-2010 recession. His conclusion was that total U.S. debt will rise to $44 trillion, essentially twice our current level. That debt load will overwhelm the U.S. economy, squeezing out discretionary spending and forcing entitlement spending changes, too. Mr. Mauldin questions if Congress will be able, let alone willing, to act on entitlement spending. His preferred solution for this pending debt crisis appeared in his last response to Mr. Dalio on July 13th. It is a Value Added Tax to reduce the federal government’s budget deficit in a manner Mr. Mauldin believes is better (less disruptive for the global economy) than Mr. Dalio’s MP3 solution.
Exhibit 9. Mauldin Forecast With Recession Drives Deficits

Federal Spending vs Revenue, 2000-2029
(Adjusted to assume 2022 Recession)

Source: Mauldin Economics
Growth is also being impacted by social and economic policy choices that governments around the world are making, but also by ageing populations and shrinking workforces across the world.

If Mr. Mauldin’s government spending and deficit projections, as well as the resulting increase in total federal debt, are close to being accurate, there are significant changes on the horizon for the U.S. economy. These changes, whatever they are, will be important, as the U.S. economy is the driver for global growth, which is currently slowing under the weight of the trade tariffs. Growth is also being impacted by social and economic policy choices that governments around the world are making, but also by ageing populations and shrinking workforces across the world.
This power struggle also is playing out in the seas of Southeast Asia and the sands of the Middle East

Will risky assets prove to be successful investments, or disasters, as the unintended economic consequences of this low interest rate environment undercut business models?

Mr. Mauldin’s most recent newsletter issue discusses his impressions from an exclusive, high-powered gathering of financial, economic and investment professionals he attended earlier that week. “Camp Kotok,” a gathering of about 50 professionals at a fishing lodge in Maine, at which as much time is devoted to free-wheeling discussions of economics, politics and investments as to fishing, is named for David Kotok, the get-together’s founder and the head of hedge fund Cumberland Advisors. This year, the gathering was to discuss three questions selected by Mr. Kotok:

1. A future where global interest rates remain permanently near zero
2. Modern Monetary Theory (MMT) and US fiscal strategy
3. A fundamental change in the US/China relationship

Of the three questions, the second relates to the long exchange between Mr. Dalio and Mr. Mauldin. The third question highlights the economic and political struggle underway between China and the United States, something that seems to be totally consumed by the trade and tariff issues, but which has much greater significance for the future of the less developed economies around the world. This power struggle also is playing out in the seas of Southeast Asia and the sands of the Middle East.

For us, the first question poses the most important challenge for the energy industry. We seem to have slipped into a “beggar thy neighbor” battle among central bankers and governments willing to do almost anything to inflate their local economies and keep their populaces satisfied. That has been done by dropping interest rates into negative territory as part of economic stimulus efforts.

The world has little experience with negative interest rates, which upend all measures of value. If we are destined to remain in a world of low interest rates, people needing income, especially those in retirement or nearing retirement, will be forced to invest in riskier assets. This comes at the wrong time for these investors. Will risky assets prove to be successful investments, or disasters, as the unintended economic consequences of this low-interest rate environment undercut business models? So far, we haven’t seen rapid deterioration in the credit rating of low-quality bonds issued by these riskier companies, but if so, it could easily become a rout.

As governments debase their currencies and drive up inflation, their citizens will struggle to earn a living and to be able to provide for themselves in retirement. This pressure will force them to step further out on the risk curve with everything they do with their lives, or they may resort to revolution to overturn their governments in an attempt to install more sympathetic leaders. The net result may be a world in which political turmoil explodes and economic growth grinds to a halt.
We have a world with relentless hydrocarbon supply growth due to producers being driven to seek greater profits from selling more oil and gas.

The data shows that for 1800-1999 compared to 2000-2018, the growth rates of real per capita GDP and yields have been cut by roughly a third.

Typically, E&P companies seek investment returns of 15-20%.

Is this the outlook that current oil and gas market fundamentals and energy equities’ pricing are telegraphing? We have a world with relentless hydrocarbon supply growth due to producers being driven to seek greater profits from selling more oil and gas. At the same time, hydrocarbon demand growth is slowing, or may even turn negative, as global economic activity slows. Additionally, hydrocarbon demand is being hurt by government policies in developed economies that require the increased use of renewables to displace hydrocarbons in an attempt to mitigate climate change.

The Hoisington report touched on the issue of global growth throughout our history. The data shows that for 1800-1999 compared to 2000-2018, the growth rates of real per capita GDP and yields have been cut by roughly a third. The report projects that the U.S. is heading toward joining the club of nations with zero or negative interest rates. That eventuality, which has been forecast by several prominent investment strategists, has implications for global growth and productivity, signaling that we may be looking at a much slower economic activity outlook.

Exhibit 11. Growth Slowing Relative To History

A low-interest rate world complicates the challenge for energy. If the risk-free interest rate is 2% or below, rather than the historical 5% rate, what returns energy companies, as well as other businesses, must earn on their investments shifts. Typically, E&P companies seek investment returns of 15-20%, which is why they are not keen on renewables investments, which only produce 5-8% returns. If investment metrics remain at a 3-4x the risk-free rate of return for oil and gas projects compared to 1x returns for renewables, the drop in the interest-free rate from 5% to 2% changes the pricing necessary for oil and gas returns to sustain their return metric.
Deflation is what has been occurring in Japan since its economic boom ended in the early 1990s. In effect, the reason for low interest rates is due to the lack of inflation, which is a key component in establishing the risk-free interest rate. Deflation is what has been occurring in Japan since its economic boom ended in the early 1990s, and has forced the government to continually pump stimulus into the economy with little success. Monetary easing there has involved not only buying up virtually all the government bonds issued, but now involves purchasing stocks. The Bank of Japan owns upwards of 75% of all the shares of ETFs trading in Japan.

The absence of the China bid, which dominated commodity markets for the first dozen years of this century, is potentially the more significant change. When China was booming, it sucked up commodity output around the world, causing investment to soar, as well as prices. As China’s economic growth moderates (second quarter marked the slowest growth in nearly three decades), it will need less of everything, making it hard for commodity producers to push up prices, and importantly, to justify new investments. That becomes a weight on global economic activity.

Geopolitical events remain a potential market disruptor, but as global demand weakens, the impact of these events has less potency in moving oil prices. One only needs to consider the magnitude of the oil price move (about $5/barrel, or less than 10%) during the Iranian tanker dispute in the Strait of Hormuz.

In the energy patch, companies unable to lift oil and gas prices will relentlessly focus on driving down costs. Reducing costs is behind the technology investment push being undertaken by petroleum companies, and which will be a focus of business strategy. At the same time, history has shown oil prices spike in response to shortages, which were driven by political events throughout time, as well as the China bid that existed during 2000-2010. Geopolitical events are always a wildcard, but not something a company can build a strategy around. The China bid, however, is disappearing due to the country’s population dynamics and its economic struggles due to trade.

The absence of the China bid, which dominated commodity markets for the first dozen years of this century, is potentially the more significant change. When China was booming, it sucked up commodity output around the world, causing investment to soar, as well as prices. As China’s economic growth moderates (second quarter marked the slowest growth in nearly three decades), it will need less of everything, making it hard for commodity producers to push up prices, and importantly, to justify new investments. That becomes a weight on global economic activity.

These dynamics suggest that producers can still meet their investment return thresholds in an environment of lower oil prices. It’s all about cost-control. Of course, the same argument will be true for renewables, but their costs do not seem to be falling as quickly as they did earlier.

A last consideration is that a permanent reduction in oil demand will reduce the pressure on oil producers to spend as much on new exploration. That will free up more cash flow for deleveraging, share repurchases and/or increased dividends — actions that could attract investors back into energy stocks.
Navigating into and in a permanent low-interest rate environment will create challenges. For energy companies, lower capital spending, although not a total cessation, will occur, as the world will continue to need oil and gas to meet global energy demand, even if it stops growing and begins to decline. Petroleum capital spending is likely to fall faster than oil and gas prices, but not cause a rebound in prices, as in the past, since demand will also be weakening. Such a scenario will force a reassessment of investment strategies and energy equity valuations. How long will this transition require? We are reluctant to offer a timetable because we really have no idea.

The low-interest rate environment will extend the decade-long battle between hydrocarbons and renewables. While we have debated the pace at which renewables will displace hydrocarbons as the world’s primary power source, we wonder what low-interest rates mean for renewables investment? Since these investments are driven by government policies rather than straight economic (return on investment) considerations, maybe renewables growth will not slow as much as one would expect, meaning the transition date for oil consumption in the global energy market moves closer. If so, then we may be entering a world where government actions combined with low interest rates ensure low hydrocarbon prices forever. That is not an outcome conducive to higher energy asset valuations.

Exhibit 12. Are We Destined For “Lower For Longer”? An outlook such as we have spelled out means we need a significantly smaller energy industry. We experienced such an outcome following the boom of the 1970s and the mid-1980s oil price crash. It took nearly 16 years for oil prices to recover from the 1986 crash and for the industry downsizing to be completed, after which higher oil prices translated directly into increased oilfield activity, lifting day rates and pricing for service companies. The December 1, 1998, Exxon and Mobil merger announcement, which was completed a year later, may have marked the end of the industry restructuring period.
Since we enjoyed twice as many months in that rarefied (real) oil pricing environment as we did in the late 1970s and early 1980s, maybe we are destined to spend the next three decades in a low oil price environment.

For the next 15 years, with the exception of the global financial crisis and recession years, the petroleum industry and its service company suppliers enjoyed healthy environments. That all changed in late 2014, but the seeds of the current industry depression were sown in the halcyon years of $100-plus per barrel oil prices. Since we enjoyed twice as many months in that rarefied (real) oil pricing environment as we did in the late 1970s and early 1980s, maybe we are destined to spend the next three decades in a low oil price environment until the Petroleum Age shrinks to a much smaller business, or even zero if the world switches to new fuel sources.

Putting odds on such a scenario is difficult, but thinking about the implications of a low-interest rate environment forever is needed.

Does The U.S. Have An Oil Demand Problem?

Weak and falling crude oil prices have prompted a search for the cause. While most people attribute the weakness to concerns over the trade war and a slowing in global economic activity, including in the United States, a few are pointing to this marking a more fundamental problem – the start of the post-peak oil world, at least for America.

One analyst writing in articles on the investment web site Seeking Alpha highlighted the U.S. Energy Information Administration’s (EIA) U.S. Petroleum Balance Sheet report for the week ending August 9th. The report showed that total oil inventory increased that week by 2.4 million barrels, primarily due to a 1.6-million-barrel increase in crude oil inventories. Total petroleum inventories were 69 million barrels higher than at the same time a year ago. To this analyst, the U.S. is in a relatively balanced crude oil market.

Oddly, the primary beneficiaries of Saudi’s decision to cut back exporting its heavy oil to the U.S. have been Canada and Russia.

At the same time, he pointed out that for the month of July, U.S. oil inventory draws were the largest going back to 1983, which he attributed to the sharply reduced inputs from Saudi Arabia, as it targets Asian markets for its exports. Oddly, the primary beneficiaries of Saudi’s decision to cut back exporting its heavy oil to the U.S. have been Canada and Russia, the same nation we are targeting with sanctions.

This analyst also highlighted the EIA’s recent report on petroleum input to refineries. It showed that the current week’s input was below the prior week’s and the year-ago input, as well as the 4-week averages for both measures. He takes this as a sign the U.S. has an oil demand problem.
His explanation for the demand problem is the growth in electric vehicle (EV) sales, and the possibility that the people buying these cars are ones who drive significant distances. As a result, the EV fleet is having a disproportionate impact on gasoline consumption.

To support his thesis, he posted a chart containing the latest EV sales data from InsideEVs.com.

Exhibit 13. Refinery Inputs Show Declines For All Periods

<table>
<thead>
<tr>
<th>Petroleum Supply (Thousand Barrels per Day)</th>
<th>Current Week</th>
<th>Week Ago</th>
<th>Year Ago</th>
<th>Four-Week Averages</th>
<th>Cumulative Daily Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8/2019</td>
<td>8/12/19</td>
<td>8/5/19</td>
<td>8/25/19</td>
<td>8/20/19</td>
</tr>
<tr>
<td>Crude Oil Supply</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) Domestic Production†</td>
<td>12,345</td>
<td>12,350</td>
<td>12,360</td>
<td>12,370</td>
<td>12,380</td>
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<tr>
<td>(2) Imports</td>
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<td>9,485</td>
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</tr>
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<td>(3) Net Imports (including API)</td>
<td>7,400</td>
<td>7,410</td>
<td>7,420</td>
<td>7,430</td>
<td>7,440</td>
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<tr>
<td>(4) Exports</td>
<td>5,000</td>
<td>5,010</td>
<td>5,020</td>
<td>5,030</td>
<td>5,040</td>
</tr>
<tr>
<td>(5) Other Imports (including API)</td>
<td>2,500</td>
<td>2,510</td>
<td>2,520</td>
<td>2,530</td>
<td>2,540</td>
</tr>
<tr>
<td>(6) Refinery Inputs</td>
<td>7,345</td>
<td>7,355</td>
<td>7,365</td>
<td>7,375</td>
<td>7,385</td>
</tr>
<tr>
<td>(7) Imports to Refineries by Others</td>
<td>5,345</td>
<td>5,355</td>
<td>5,365</td>
<td>5,375</td>
<td>5,385</td>
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<tr>
<td>(8) Exports</td>
<td>2,500</td>
<td>2,510</td>
<td>2,520</td>
<td>2,530</td>
<td>2,540</td>
</tr>
<tr>
<td>(9) Other Imports</td>
<td>1,000</td>
<td>1,010</td>
<td>1,020</td>
<td>1,030</td>
<td>1,040</td>
</tr>
</tbody>
</table>

Source: EIA

Exhibit 14. U.S. EV Sales Continue To Grow

The EV sales data shows that for the first half of 2019, each month’s sales exceeded those of the same month in 2018 and all prior years. However, for July, the data showed a decline in sales from a year ago. That is the first month reflecting another cut in EV tax subsidies for sales by Tesla, Inc. (TSLA-NYSE) and General Motors, Inc. (GM-NYSE). As the chart also makes clear, the monthly sales in the second half of 2018 show significant year-over-year increases, which may become a hurdle for the industry in 2019.

Although EVs will have an impact on gasoline consumption at some point, we don’t think that time is now.
We noticed there was a similar decline from the summer of 2015 to the summer of 2016. A year ago, the trend has been down. However, we noticed there was a similar decline from the summer of 2015 to the summer of 2016. While the analyst didn’t look at a longer period to see if there were other similar patterns, its existence doesn’t negate the question of whether the recent decline is symbolic of a demand problem. But it does raise a question about the significance of the current decline.

Exhibit 15. What Does Refinery Input Decline Mean?

Source: EIA, PPHB

It appears that VMT growth has flattened, which has coincided with a decline in monthly gasoline consumption.

What may be more important in addressing the question is to examine what is happening with gasoline consumption and vehicle miles traveled (VMT). When we examine the most recent data, it appears that VMT growth has flattened, which has coincided with a decline in monthly gasoline consumption.

Exhibit 16. Gasoline Use Follows Flattening VMT

Source: EIA

Looking at a longer time period and comparing VMT with the change in gasoline consumption from its 5-year average, we see a similar, but maybe more significant trend evolving. VMT appears to be
While it appears a peak in VMT may be developing, it is dangerous to forecast a future decline that will drive down gasoline consumption.

Exhibit 17. VMT Trend May Signal Downturn Coming

While it seems like this is a repeat of 2007 and immediately thereafter, VMT also showed brief periods of flattening in 2000, as well as in 2002, but neither developed into a decline that caused gasoline consumption growth to turn negative relative to its 5-year average. The point is that while it appears a peak in VMT may be developing, it is dangerous to forecast a future decline that will drive down gasoline consumption. If such a pattern develops, it bodes ill for oil prices.

Exhibit 18. Refinery Inputs Down For 1st Time In Years

For the first time since 2009, the U.S. refining industry will likely experience a decline in production runs. A recent analysis by the EIA points out that for the first time since 2009, the U.S. refining industry will likely experience a decline in production runs. This would mark the first time since the 2009 recession that such a decline has occurred. The issue is not as much demand related as it is that the refining industry has not expanded meaningfully in 2019. Rather, national refining capacity has shrunk due to the fire and closure of the 335,000-barrels-per-day Philadelphia Energy Solutions in South Philadelphia, the largest refinery among East Coast refineries.
Wee...
China cut EV subsidies sharply in late June, contributing to the sales decline. If achieved, EV’s share of the Chinese auto market will be 7.4%, with expectations it may increase to 10% in 2020.

Exhibit 20. The China Auto Sales Downturn

For New Energy Vehicles (NEV), China’s version of EVs, sales declined in July by 4.7% from a year ago, to 80,000 units, despite government pressure on auto manufacturers to promote the technology. This surprising drop was the first monthly decline since January 2017, when EV sales contracted by 74.4% as Chinese subsidies were in flux. China cut EV subsidies sharply in late June, contributing to the sales decline. Subsidies are projected to end next year, further pressuring the EV business, but the government is countering with a credit trading system that forces the manufacture of NEVs or auto companies will have to buy credits. While theoretically creating pressure on car companies to build better EVs, will that drive sales when buyers used to get cash?

Year-to-date, EV sales are up 40.9% from a year ago to 699,000 units. CAAM is projecting NEV sales of 1.6 million units this year. If achieved, EV’s share of the Chinese auto market will be 7.4%, with expectations it may increase to 10% in 2020. The 2019 growth rate and expectations for EV market share gains may suffer due to customer reactions to the subsidies elimination.

Exhibit 21. China EV Sales Are Down In July

Source: Quartz
The PUC is recommending Vermont create incentives for EV purchases or leases

To reach the near-term goal, the PUC estimates it will take adding about 50,000 to 60,000 EVs to replace vehicles with internal combustion engines (ICE) by 2025, a compound annual growth rate of about 54%.

We have seen forecasts for EV sales continuing to rise with every iteration.

Governments of all stripes continue to push EVs as the optimal solution for dealing with climate change caused by greenhouse gas emissions from the transportation sector. A June report from the Vermont Public Utility Commission (PUC) was titled “Promoting the Ownership and Use of Electric Vehicles in the State of Vermont.” The PUC is recommending Vermont create incentives for EV purchases or leases, either in the form of time-of-sale rebates or tax credits. It also recommends the state buy EVs for its vehicle fleet, and encourage the development of an EV charging infrastructure through zoning or building code modifications.

A proposed area of regulatory reform involves changing utility rate structures in Vermont that impose demand charges on most commercial electricity accounts, but not on residential accounts. This makes public direct-current, fast-charging options more expensive than at-home charging. Continuing such a pricing structure is an impediment to the development of a public EV charging network in the state. That becomes a hurdle in Vermont’s meeting its Comprehensive Energy Plan, passed in 2016, that calls for powering 10% of transportation with renewable energy by 2025, and 80% by 2050, while reducing greenhouse gas emissions from the sector by 30% by 2025. To reach the near-term goal, the PUC estimates it will take adding about 50,000 to 60,000 EVs to replace vehicles with internal combustion engines (ICE) by 2025, a compound annual growth rate of about 54%.

While Vermont is merely the latest government to push for policies to encourage the purchase of EVs, the embrace of this technology around the world is driving EV fleet growth. We have seen forecasts for EV sales continuing to rise with every iteration. That is demonstrated in Exhibit 22 showing the 2016 and 2018 EV forecasts for 2040 issued by Bloomberg New Energy Finance (BNEF). The difference in 2040 sales is about 10 million units, which we would not be surprised to increase when BNEF issues its 2019 forecast.

Exhibit 22. How EV Forecasts Have Grown Over Time

Source: Bloomberg NEF, PPHB
The key to success for EVs is the continual decline in battery costs, which allows the installation of larger batteries in vehicles while remaining price competitive with ICE vehicles. Larger batteries provide greater vehicle range before needing a recharge, which addresses consumer concern over range limitations for EVs.

According to consultant McKinsey, battery costs fell from $1,000 per kilowatt-hour (kWh) to $227 by 2016. In its report, the company wrote that battery costs continue to make EVs more costly than comparable ICE vehicles. Current projections put EV battery pack prices below $190/kWh by 2020, with the potential for pack prices to fall below $100/kWh by 2030. On that trajectory, price parity between EVs and ICE vehicles could occur in 2023-2025. General Motors (GM-NYSE) said last year that its cells cost $145/kWh and that it expected by late 2021, they could be in the $100/kWh range, which is key to the company’s EV strategy.

What if either the cost curve doesn’t continue down, or the price for the minerals necessary to make EV batteries rise due to supply shortages? Exhibit 23 shows BNEF’s projection as to the battery cost component in future EVs. It sees the battery’s share falling from over 50% in 2015 to only 20% in 2025.

Exhibit 23. Battery Share Of EV Cost Projected To Fall

Source: Bloomberg

Note: Includes profit margins and costs other than direct manufacturing costs.

Source: Bloomberg
Not all EV batteries are the same. A battery is composed of an anode, an electrolyte and a cathode. The anode is made of graphite, while the electrolyte is made from organic carbonate solvents with dissolved lithium salts.

**Exhibit 24. How Lithium-ion Batteries Work**

![Exhibit 24. How Lithium-ion Batteries Work](image)

All of the various cathode chemistries contain lithium, but each contains a different mix of metals.

The cathode has various compositions, each of which are favored by different EV manufacturers due to costs and performance. As Exhibit 25 shows, all of the various cathode chemistries contain lithium, but each contains a different mix of metals. While not all of the metals are rare, they often are byproducts of the mining of copper and nickel and often are not found in desirable locations.

**Exhibit 25. EV Battery Chemistry Is Not Standardized**

<table>
<thead>
<tr>
<th>Table 2: Cathode component of battery cells in various electric vehicles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cathode type</td>
</tr>
<tr>
<td>Lithium-nickel-cobalt-aluminum oxide (NCA)</td>
</tr>
<tr>
<td>Lithium-manganese oxide (LMO)</td>
</tr>
<tr>
<td>Lithium-nickel-manganese-cobalt oxide (NMC)</td>
</tr>
</tbody>
</table>


Because lithium is the primary metal, it receives the most attention, especially its price. When the EV boom initially began, projections suggested there needed to be a capacity expansion of the required minerals. As a result, lithium prices spiked as a way to induce the supply expansion. What was not anticipated was how rapidly Australia’s spodumene (hard rock lithium) sector responded to bring new production on stream. The new capacity contributed to the decline in lithium prices, although lithium at the end of the first half of 2019 is still 50% higher than it was in 2015.
While the 2018-2019 supply response has addressed the relatively minor growth of today, it is far from meeting the needs of anticipated EV growth.

By the middle of 2018, four new hard rock mines were beginning operation, helping push spodumene output beyond lithium brine as the leading source of feedstock production. The number of active spodumene mines climbed from 1 in 2016 to 9 by the end of 2018, contributing to a belief in early 2019 that the industry was swimming in battery-grade lithium chemicals, sufficient to support rapid EV growth over the coming years. According to Benchmark Minerals, who tracks the lithium market, while the 2018-2019 supply response has addressed the relatively minor growth of today, it is far from meeting the needs of anticipated EV growth.

Benchmark points out that lithium chemical production is projected to grow from about 285 thousand tons (kt) to 350kt at the end of 2019. The industry was only producing 160kt in 2015. Since 2016, five new lithium chemical plants have come into production, while another three have expanded their output capacity. However, as with many mining and chemical projects, they do not always arrive on time and on budget.

A listing of all lithium projects suggests that had all arrived on time and at capacity, there would have been an additional 500,000 tons of lithium chemical capacity on stream in 2020. Benchmark says the reality is that the expansion will add less than 40% of this number. A greater challenge is that the cathode chemistry desired may be changing, impacting the outlook for carbonate vs. hydroxide and the competitiveness of supply chains supporting chemical expansions.

For years, the low-cost benefits of brine extraction, along with the dominance of lithium carbonate, positioned South American projects at the bottom of the lithium industry cost curve. The possible shift away from lithium carbonate as the primary chemical in battery cathodes, along with changes to the royalty structure in Chile, has begun to challenge this dominance. The ability to produce lithium hydroxide directly from spodumene, rather than from lithium carbonate, which is the brine process, means the cost curve for lithium hydroxide production can take a distinctly different shape.
Lithium supply needs to increase at a 19% annual average growth rate over 2019-2025

Based on current EV battery demand forecasts, Benchmark projects that lithium supply needs to increase at a 19% annual average growth rate over 2019-2025. They point out that from 2015-2018, a period of rapid lithium capacity expansion, the industry was only able to grow output by 11% per year on average.

The point of this discussion is that there are many issues undecided within the EV battery market that will impact the supply expansion of lithium. As with all these projects, and those that will be needed in the future, timing and quality will prove critical. Remember, it takes time for the quality of new mining and chemical operations output to be tested and approved for use in batteries. Then there are the logistical challenges of delivering the output to where the batteries are manufactured.

Benchmark said in a recent article: "As of June 2019, the Benchmark Minerals Lithium ion Battery Megafactory Assessment stood just shy of 2 TWh capacity by 2028. To put that in context, it would equate to 1.5m tons lithium demand just from these operations if they were to reach full capacity, compared to total lithium ion battery demand of 150,000 tons LCE in 2018.” A tenfold increase in lithium mining capacity over a ten-year span represents a potentially significant hurdle for the EV industry to deliver on their growth projections. Is it possible that the EV growth assumed by the optimists planning an early end for fossil fuels may prove too optimistic due to battery mineral capacity limitations?

Pictures Reflecting The Reality Of Our Green Energy World

In New Zealand, electric vehicle chargers are powered by diesel generators. As one wag pointed out, the diesel generators are either close to the vehicle when charging or more remote when making the power, but they still do the work.

Exhibit 27. Batteries Charged By Diesel Generators

Source: Thedriven.io
If you are worried about getting stranded in your electric car, why not take along your personal range extender.

Exhibit 28. The Electric Car Range Extender


After two years, the French have determined its solar road experiment was a disaster – cost too much, wouldn’t stand up to road traffic, parts of it had to be removed when they broke, and it failed to generate sufficient electricity to power highway lights due to cars shading the solar panels. Maybe they should have located the road in the south of France where the sun is stronger and not in Normandy where there is little sun. A solar bike path in the Netherlands seems to be working, probably due to less weight on the road and shade from bike riders. Two other solar-topped road experiments in the Netherlands continue to be tested.

Exhibit 29. Solar Road Future Fails In Big Way

Source: Benoit Tessier/Reuters
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