PPHB

ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

September 6, 2016

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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

Debt And Interest Rates Will Impact Industry Restructuring

Crude oil prices fluctuate. Capital expenditures are strangled. New discoveries fall to their lowest levels in 70 years. Oil and natural gas production is falling. Hope for an industry rebound is growing. What's the blind spot in that scenario? Debt and interest rates.

Just over a week ago, the Chair of the Federal Reserve Board, Janet Yellen, spoke to a Federal Reserve sponsored conference in Jackson Hole, Wyoming. In her comments, she stated that "the case for an increase in the federal-funds rate has strengthened in recent months." This was a strong warning that an interest rate hike is coming. For financial reporters and stock market observers, her statement was considered about as strong a warning as a central banker could deliver, but the balance of her talk seemed to indicate that there was no urgency to raise rates despite the labor market performing well because other economic statistics suggested only modest improvement. Not surprisingly, for a couple of hours following her speech, the stock market traded higher as market participants interpreted Ms. Yellen's comments as being less hawkish than they had anticipated. Note how the stock market traded after Ms. Yellen's speech in the left-hand panel of Exhibit 1.

For financial reporters and stock market observers, her statement was considered about as strong a warning as a central banker could deliver, but the balance of her talk seemed to indicate that there was no urgency to raise rates

Exhibit 1. Yellen Speech Created Fear On Wall Street

Source: S&P

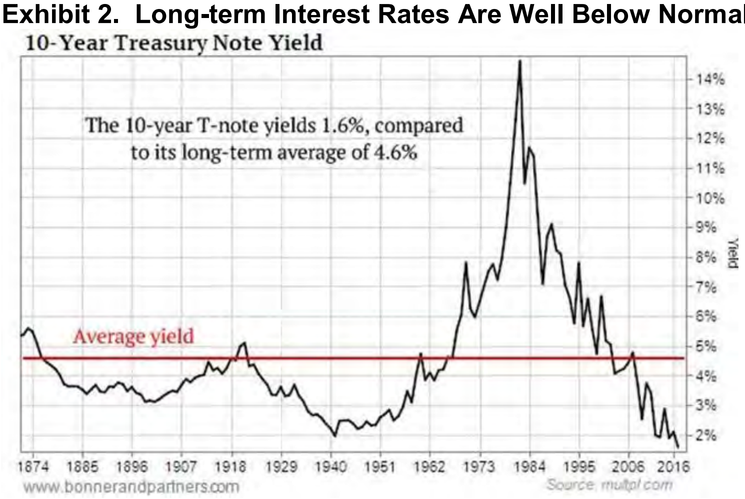
Following Ms. Yellen's speech and Mr. Fischer's comments, investors increased their odds for a September rate hike to 35% and the odds for a December rate hike to 60%

It was only later that morning when Federal Reserve Vice Chairman Stanley Fischer spoke to the economics reporter for CNBC that the market became scared. Mr. Fischer commented that the strengthening of the U.S. economy, despite the release of the second estimate of gross domestic product growth for the second quarter showing a 0.1% reduction from the initial estimate of a 1.2% increase, had the Federal Reserve on track for a potential rate hike at its upcoming September 20-21 meeting and that the Fed might possibly institute two rate hikes in 2016. This was not a scenario anticipated by the market, which at the time of Ms. Yellen's speech had estimated the odds for a September rate hike at 21% and was looking for only one rate hike in 2016. Following Ms. Yellen's speech and Mr. Fischer's comments, investors increased their odds for a September rate hike to 35% and the odds for a December rate hike to 60%. The idea of two rate hikes this fall, as the last rate hike occurred in mid-December 2015, was clearly not anticipated.

The chart shows that the current rate is 1.6%, which is well below the long-term average rate of 4.6%

A look at a long-term chart of the yields for the 10-year Treasury bond shows both where we are today and what history shows us has been the norm for rates. The chart shows that the current rate is 1.6%, which is well below the long-term average rate of 4.6%. It is interesting to note that the current rate is well below the all-time low rate that was established in 1940 at the end of the Great Depression. No one is suggesting that our economy is that bad off, although many people don't believe that the economy's health is anywhere near as good as President Barack Obama and his economic team are claiming.

Exhibit 2. Long-term Interest Rates Are Well Below Normal



Source: *Agora Financial*

What impact might interest rate hikes have on the oil and gas industry? There are two impacts that come immediately to mind – one which most crude oil traders pay attention to and a second that is often overlooked. The easiest impact to measure is the impact on the value of the U.S. dollar when we raise interest rates, especially

A higher-valued U.S. dollar depresses demand for oil as it becomes more expensive in local currencies, which therefore pressures oil prices

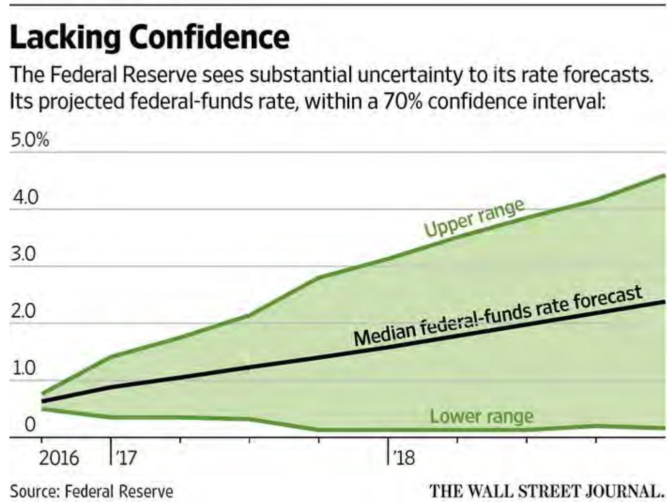
while the rest of the world is pumping liquidity into their markets in order to pump up their economic growth. Global investors seeking greater investment returns will find higher rates in the United States as the entire interest rate curve rises as the Fed Funds rate is increased. For foreign investors to invest in the U.S., they need to sell their currency and buy U.S. dollars driving its value up. A higher-valued dollar hurts the competitive price for oil, which is priced in dollars. As a result, a higher-valued U.S. dollar depresses demand for oil as it becomes more expensive in local currencies, which therefore pressures oil prices. People often forget that during the years following the 2008 financial crisis and the Federal Reserve's quantitative easing moves, the value of the U.S. dollar fell and oil prices soared. We recognize that this was not the only factor contributing to $100 a barrel oil prices, but it certainly helped. Now, we could be facing a period of a rising U.S. dollar value with its corresponding drag on the oil price recovery.

Raise the threshold interest rate cost for heavily-indebted energy companies struggling to recapitalize, and/or survive in the valley of the oil price downturn

The second impact on the oil and gas business likely to come from higher interest rates could actually do two things to the industry: first, draw money away from energy investments as higher yielding investments are available elsewhere; and secondly, raise the threshold interest rate cost for heavily-indebted energy companies struggling to recapitalize, and/or survive in the valley of the oil price downturn. In other words, higher government interest rates will boost the risk-free rate of return and thus raise the base level for pricing new loans to energy companies.

The Federal Reserve has been criticized lately for the failure of its economic models to forecast the outcome of its zero interest rate policy. A chart from a *Wall Street Journal* article shows a very wide confidence range assigned to the Fed's interest rate forecast. According to this chart, we could actually see interest rates lower in

Exhibit 3. Higher Interest Rates An Oil Industry Problem



Source: *WSJ*

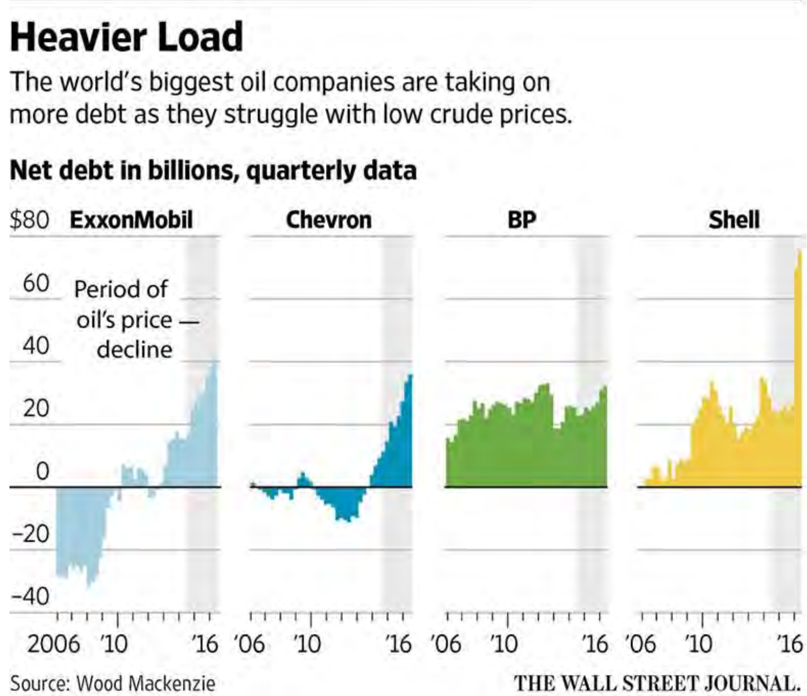
They could soar into the 3%+ and 4% range over the next two years

Fortunately, these companies operated with quite modest financial leverage during the recent industry boom so they have balance sheet strength to support additional debt to help them manage through the industry downturn

2017 and 2018 than they are currently, if the low end of the forecast range is achieved. On the other hand, they could soar into the 3%+ and 4% range over the next two years, which would certainly weigh on the energy business both from potentially reduced energy use as consumers find their budgets squeezed by higher interest payments on their consumer, housing and auto debt, and secondly from energy lenders demanding higher interest rates on corporate debt.

The potential significance from higher interest rates can be seen by another *Wall Street Journal* chart showing what has happened to the debt loads of four of the world's largest oil companies in recent years as they have had to borrow to offset their weak cash flows due to low oil prices and committed long-cycle capital projects and healthy dividend payments. Each of the companies has been forced to increase their borrowings recently, with Royal Dutch Shell's (RDS.A-NYSE) debt soaring due to its purchase of BG Group that closed earlier this year. These companies are also in a mode of rationalizing their asset bases – mostly selling non-essential assets – to improve long-term investment returns. Fortunately, these companies operated with quite modest financial leverage during the recent industry boom so they have balance sheet strength to support additional debt to help them manage through the industry downturn. That has not been the case, nor is it now the case, for most of the exploration and production (E&P) companies that have been the prime drivers of the American shale revolution.

Exhibit 4. Debt Ratios Climbing For Large Oil Companies



Source: ***WSJ***

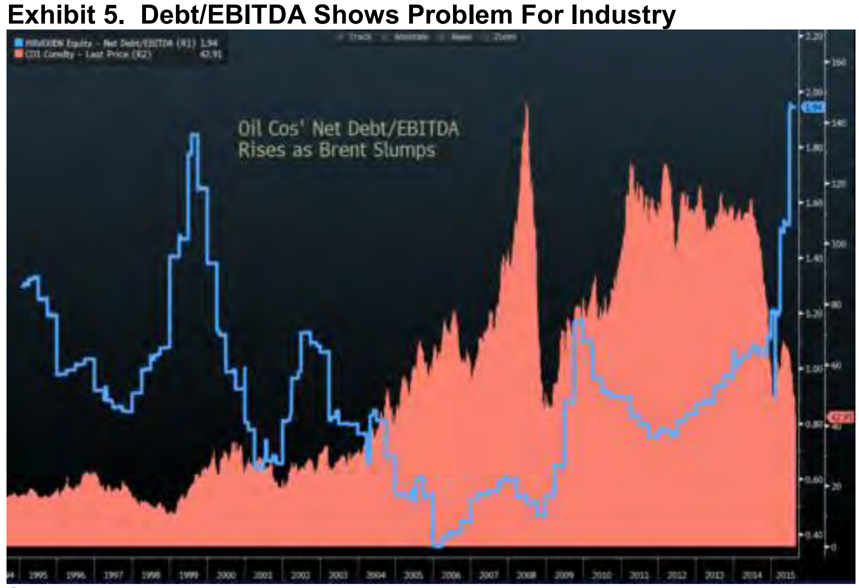
The ratio was higher than at any time since 1994

The financial leverage issue for oil companies is shown in Exhibit 5. It plots the ratio of net debt to earnings before interest, depreciation and amortization (EBITDA), or a broad measure of a company's cash flow from operations for the oil and gas industry. As shown, the debt/EBIDA ratio soared as we neared the end of 2015. At that point, the ratio was higher than at any time since 1994, including the last time the industry experienced a multi-year oil price downturn, 1998-1999.

The rise in the debt/EBITDA ratio during 2010-2014 was driven by the assumption of greater debt by oil and gas companies needed to fund their shale drilling efforts driven by the attractiveness of high oil prices

It is instructive to look at what happened to the debt/EBITDA ratio immediately following the 2008 financial crisis and resulting recession during which oil prices collapsed from over $100 a barrel to the low $30s. The debt ratio spiked during 2009, but then fell during 2010 and 2011. After that, the ratio started climbing slowly to match the 2009 peak by the end of 2014. The ratio's 2014 peak is significant because crude oil prices were still historically high – in the range of $70-$80 a barrel at the end of that year after having traded over $100 a barrel as late as June 2014. The rise in the debt/EBITDA ratio during 2010-2014 was driven by the assumption of greater debt by oil and gas companies needed to fund their shale drilling efforts driven by the attractiveness of high oil prices. In hindsight, one can question whether that was the appropriate business strategy of pursuing increased production and reserve growth at the expense of profitability. Hindsight would suggest it was the wrong strategy.

Exhibit 5. Debt/EBITDA Shows Problem For Industry



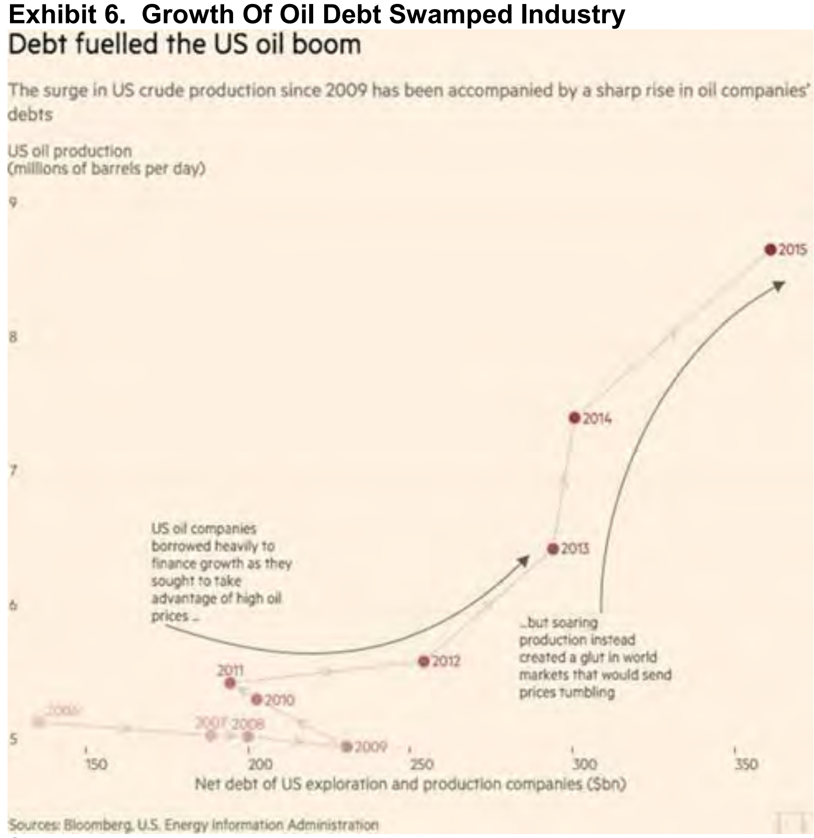
Source: ***Bloomberg***

Another view of the industry's use of debt to fund its activity is shown in Exhibit 6. What is shown is that during 2006-2009, debt grew but U.S. oil production remained essentially flat. Production did begin growing in 2010 and 2011, but balance sheet leverage

From 2011 onward, debt use exploded higher, but so did U.S. oil output

was reduced as oil and gas companies, smacked down by the 2008 financial crisis, decided to exercise greater financial discipline. The energy companies were also aided by a receptive equity market as excitement about the shale boom drove investors to chase the shares of new and existing shale E&P companies. From 2011 onward, debt use exploded higher, but so did U.S. oil output. The production increase was taken at face-value of proving the success of the shale revolution. The increased financial leverage and lack of profitability was dismissed as a necessary step in enabling E&P companies to build up future production growth.

Exhibit 6. Growth Of Oil Debt Swamped Industry

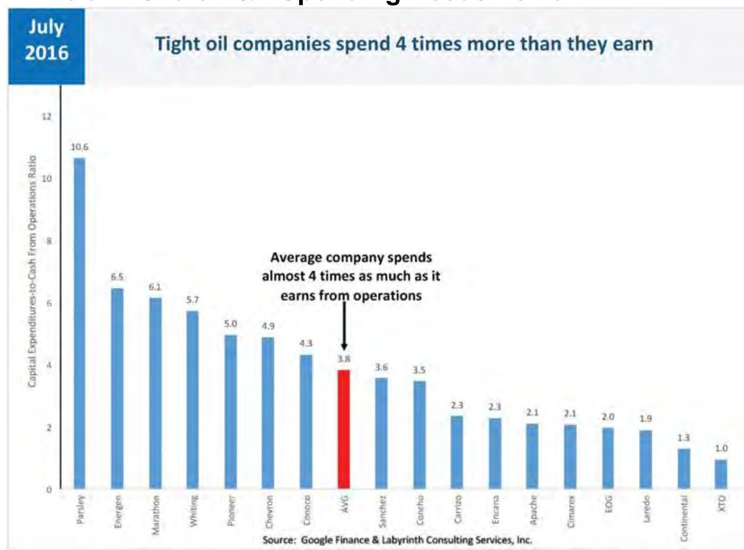


Source: *Financial Times*

The average E&P shale producer spends nearly four-times what it earns from its operations

The issue of E&P company profitability and the resulting problems visited on the oil and gas industry is explained in two charts prepared by our friend Art Berman. These charts show the spending patterns of shale producers and what those imply for their futures. The first chart (Exhibit 7) shows that the average E&P shale producer spends nearly four-times what it earns from its operations. The range in spending for companies, excluding the extremes at each end, is between six-times to under twice their incomes. Unless something changes, such as higher commodity prices or sharply reduced company spending, the situation is unsustainable.

Exhibit 7. Shale E&P Spending Needs To Fall

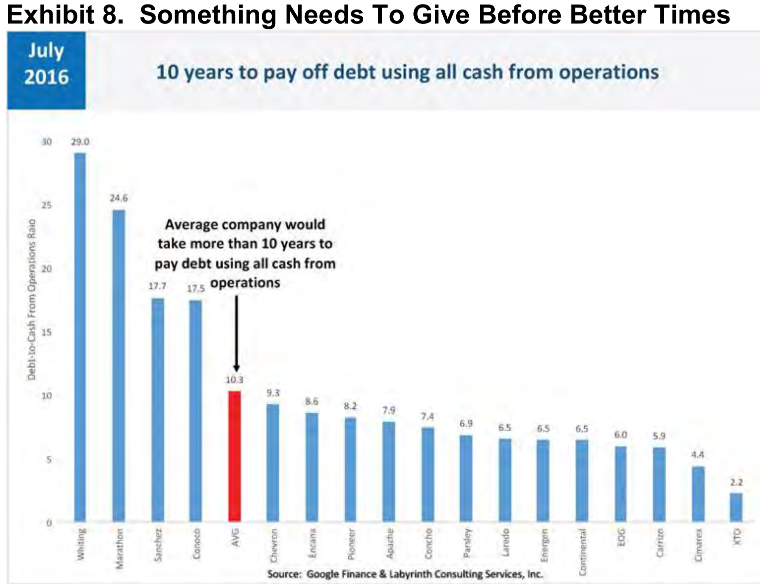


Source: Google Finance, Labyrinth Consulting Services, Inc.

This leaves little room for oil and gas companies to address their financial leverage without further spending reductions and massive balance sheet restructurings

The second chart (Exhibit 8) shows that the average E&P shale producer would need more than 10 years to pay off its debts when using all its cash generated from operations. Again, that timeframe would change significantly if oil prices return to $100 a barrel and natural gas prices to $5.00 per thousand cubic feet. Neither of those price scenarios looks likely in the foreseeable future. This leaves little room for oil and gas companies to address their financial leverage without further spending reductions and massive balance sheet restructurings.

Exhibit 8. Something Needs To Give Before Better Times

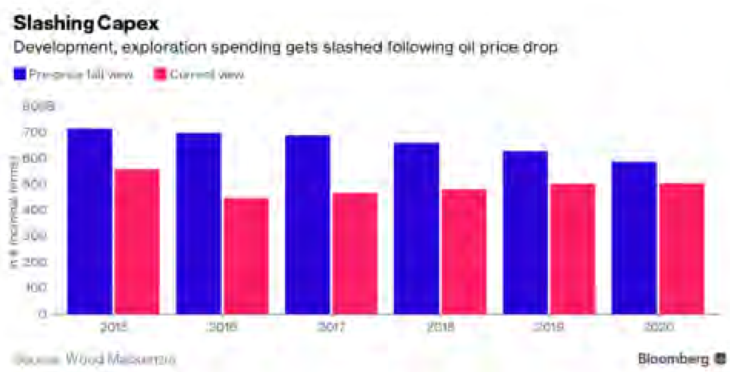


Source: Google Finance, Labyrinth Consulting Services, Inc.

Wood Mackenzie has estimated that the decline in capital spending by the largest 56 oil and gas firms during 2015 and 2016 will be a 49% reduction, or a cut of $230 billion

The need to cut spending means further reductions in industry capital spending. After having grown dramatically after 2009 during an era of $100 a barrel oil price, oil consulting firm Wood Mackenzie has estimated that the decline in capital spending by the largest 56 oil and gas firms during 2015 and 2016 will be a 49% reduction, or a cut of $230 billion. That spending reduction represents a large number of drilling rigs and well completions. It has also meant severe industry layoffs, most particularly among the oilfield service industry. An earlier study by Wood Mackenzie projected that the oil and gas industry would spend $1 trillion less over 2015-2020 on exploration and development activities than it planned to spend based on views before oil price fell in 2014. The impact of the estimated spending reductions is shown in Exhibit 9.

Exhibit 9. Future Capital Spending Will Be Much Lower



Source: ***Bloomberg***

A study prepared by the Bank for International Settlements (BIS) examined the debt situation of the energy sector in recent years, suggesting this could prove to be a greater challenge for the world's economy than merely an issue for the industry. In the study's preface, the authors wrote:

"The recent fall in the oil price represents a significant decline in the value of assets backing this debt, introducing a new element to price developments"

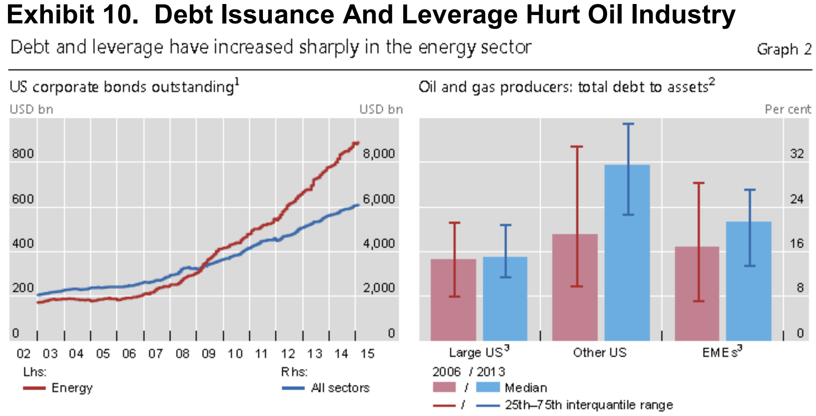
"The recent fall in the oil price represents a significant decline in the value of assets backing this debt, introducing a new element to price developments. In common with other episodes of retrenchment induced by rapid declines in asset values, greater leverage may have amplified the dynamics of the oil price decline. The high debt burden of the oil sector also complicates the assessment of the macroeconomic effects of the oil price decline because of its impact on capital expenditure and government budgets, and due to the interaction with a stronger dollar."

While this study was published in spring 2015, as the preface comment suggests, understanding the impact of the significant debt load on companies in the energy sector requires trying to learn what the broader ramifications will be as we have seen over the past year. We continue to see the unanticipated economic repercussions from the oil industry downturn and the adjustments forced on the energy companies, and we are likely not done with dealing with these challenges.

Total debt for the sector grew from $1.1 trillion in 2006 to $3.0 trillion in 2014

The issuance of debt by oil and gas and other energy companies far outpaced the overall issuance by other sectors starting in 2009 and continuing through 2014. (Left-hand chart, Exhibit 10.) The magnitude of oil and gas company bond issuance grew from $455 billion in 2006 to $1.4 trillion in 2014, a growth rate of 15% per annum. Energy companies have also borrowed heavily from commercial banks. Syndicated loans to the oil and gas sector in 2014 amounted to an estimated $1.6 trillion, having increased at an annual rate of 13% from $600 billion in 2006. Total debt for the sector grew from $1.1 trillion in 2006 to $3.0 trillion in 2014. Debt increased further in 2015, although that year marked the start of the restructuring of the industry in which some debt was forgiven and/or repaid, offsetting some of the increased borrowings by the industry. The right hand chart in Exhibit 10 shows the total debt to assets ratio for large oil and gas producers, other E&P companies and foreign oil and gas companies for 2006 and 2013. As shown, the increase in borrowings between 2006 and 2013 were most pronounced in the E&P sector, followed by the international oil and gas sector. The large U.S. oil and gas producers' debt to assets ratio barely increased during this time period, although as we showed earlier, it has jumped in the past year for the four largest oil and gas companies.

Exhibit 10. Debt Issuance And Leverage Hurt Oil Industry



[1] Face value of Merrill Lynch high-yield and investment grade corporate bond indices. [2] Integrated oil, gas and exploration/production companies. [3] Companies with total assets in 2013 exceeding $25 billion.

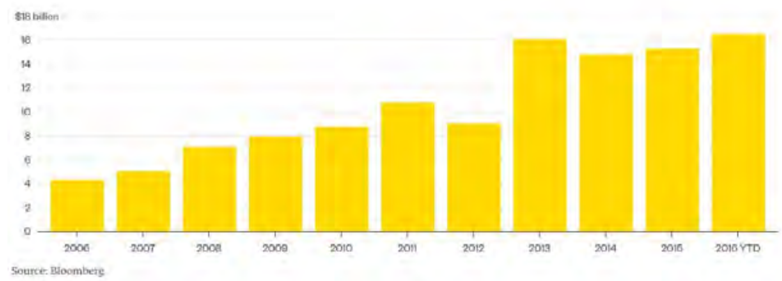
Sources: Bloomberg; Thomson Reuters Worldscope; BIS calculations.

Source: BIS

The E&P industry has sold more stock than it sold in the prior three years, including the record year of 2013

To help manage their balance sheets, E&P companies have been larger issuers of equity as shown in Exhibit 11 (next page) from Art Berman. As the graph highlights, so far this year the E&P industry has sold more stock than it sold in the prior three years, including the record year of 2013.

Exhibit 11. Equity Raising Easing Oil Company Pain

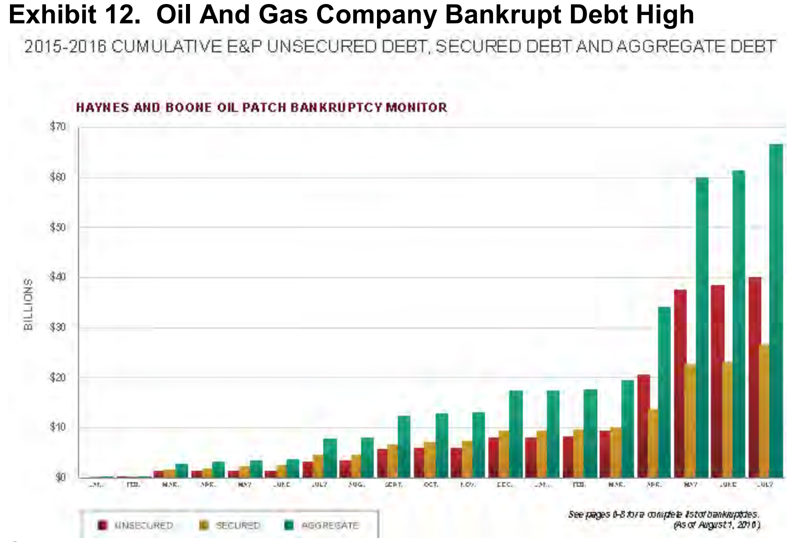


Source: Art Berman

90 oil and gas producers in North America have filed some form of bankruptcy involving $66.5 billion in cumulative secured and unsecured debt

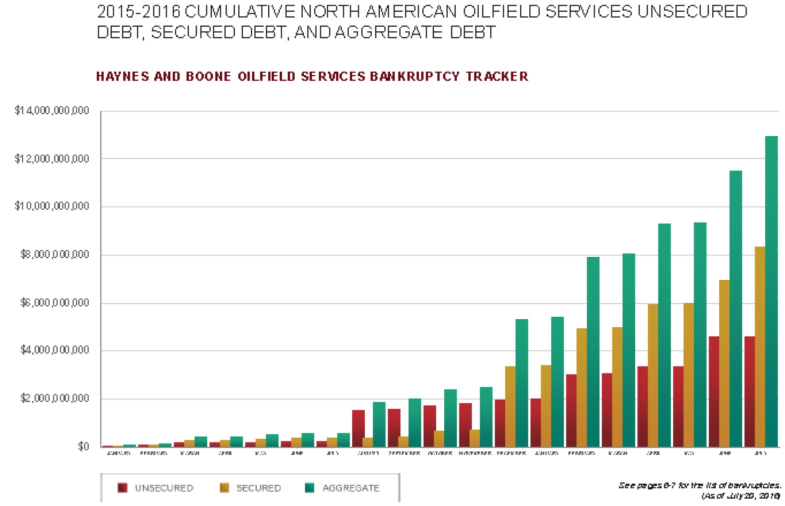
While equity raises have eased the pain for some E&P companies, the industry's continuing financial distress is shown by the fact that bankruptcies, defaults and deteriorating credits continue growing as the anticipated commodity price recovery has yet to materialize. The law firm of Haynes and Boone maintains a data base of bankruptcies among oil and gas and oilfield service companies. Their most recent updates show the magnitude of the cumulative amounts of debt that are associated with bankrupt companies and subject to restructuring and cancellation through debt/equity exchanges. According to their data, 90 oil and gas producers in North America have filed some form of bankruptcy involving $66.5 billion in cumulative secured and unsecured debt. This year alone, 48 producers with $49.3 billion of debt have filed for bankruptcy protection. Surprisingly, the oilfield service industry has been almost as active – 83 companies – but have not involved as much debt - $13 billion. The two sector charts are shown below.

Exhibit 12. Oil And Gas Company Bankrupt Debt High



Source: Haynes and Boone

Exhibit 13. Oilfield Company Bankrupt Debt Is Modest



Source: Haynes and Boone

This sector has the highest share of high yield bonds, 31%, trading at distressed levels

According to a recent Standard & Poor's Global report, 65 oil and gas companies missed debt payments, some 56% of overall year-to-date defaults. At the same time, this sector has the highest share of high yield bonds, 31%, trading at distressed levels. Specifically, of the bonds rated by S&P that are B- or lower with either a negative rating outlook or ratings on CreditWatch with negative implications hit a historical high in June with 245 companies. Of that total, 59, or 24.1%, were oil and gas companies. This condition is examined in Exhibit 14 (next page), which shows how oil and gas company bond yields and defaults have been growing since the middle of 2015 as industry conditions deteriorated and a quick industry rebound now seems unlikely.

Oil and gas investors have lost more than $150 billion in the value of their bonds and over $2 trillion in the value of their equities

The *Financial Times* prepared an analysis earlier this year that tracked the performance of mutual funds with greater than $50 million in assets and 5% or greater weighting in energy high-yield bonds over the time period from the summer of 2014 to the spring of 2016. The performance of these funds has resulted in oil and gas investors losing more than $150 billion in the value of their bonds and over $2 trillion in the value of their equities. Ouch!

Exhibit 14. Distress About Energy Bonds Remains High

Source: ***Financial Times***

Hiking interest rates, while an attempt to get the overall economy back to a more normal interest rate environment, may actually create further stresses for the oil and gas sector that people haven't thought about yet

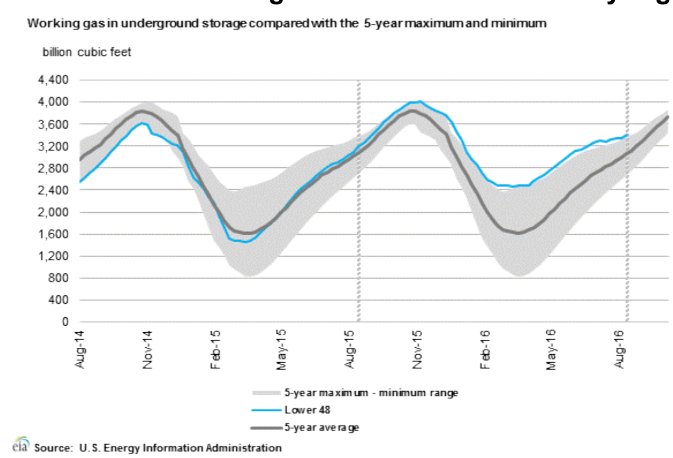
We started this article by discussing the equity markets' reaction to the signals about the future course of Federal Funds rates and the speed in which they may rise. Recent history has shown that every time our monetary gurus have tried to shut down their easy money policies, the stock market has swooned. Those market drops have scared the Feds into re-starting their monetary easing policies. So far, easy money has failed to jump-start U.S. economic growth since the 2008-2009 Great Recession ended, and a series of rate hikes will create headwinds for any oil and gas industry recovery. What the BIS report suggested was that the excess leverage in the oil and gas sector may have contributed to the greater oil price decline in 2014-2015 as producers were forced to keep drilling and producing in an effort to deal with their debt loads. Since we have yet to resolve the industry's debt overhang, it may continue to act as an anchor on the industry recovery. Hiking interest rates, while an attempt to get the overall economy back to a more normal interest rate environment, may actually create further stresses for the oil and gas sector that people haven't considered yet. We believe current and future interest rates, along with producer debt levels, are dynamics that need to be monitored as we attempt to scope out what an oil and gas industry recovery trajectory may look like.

Is There Hope For Natural Gas This Winter?

Injections so far this year (as of August 19) have been 933 Bcf, down 46% from the 1,722 Bcf injected during the same period last year

Natural gas futures prices have been strengthening in recent days as weekly storage injection volumes remain well below those of the comparable weeks in recent years. The smaller injection volumes are slowly closing the gap between current inventory volumes and the five-year average, even though the volume of natural gas in storage remains at a high. Injections so far this year (as of August 19) have been 933 billion cubic feet (Bcf), down 46% from the 1,722 Bcf injected during the same period last year. The smaller gas injections this summer reflects the impact of hotter temperatures that boosted electricity demand and as natural gas gains a larger share of the power generation market due to coal-fired power plants being shut down.

Exhibit 15. Gas Storage Volumes Are Historically High



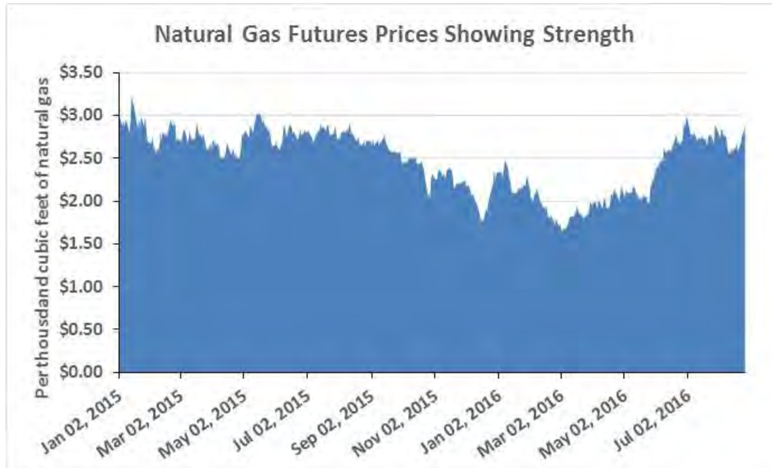
Source: EIA

The improvement in natural gas prices – currently sitting in the upper $2.80s per thousand cubic feet (Mcf) price range – reflects optimism that following a hotter summer we will not have a second warm winter, therefore gas consumption will be higher. An increase in demand would come just as natural gas production is falling as drilling for gas and gas-rich liquids declines.

As we approached the start of summer, gas prices climbed in anticipation of increased demand coupled with falling output

Higher natural gas prices are coming with the ending of the El Niño climate phenomenon that delivered an abnormally warm 2015-2016 winter, and generally warmer spring temperatures, too. Natural gas prices were generally steady from the start of 2015 until the end of the winter in 2016. As shown in Exhibit 16 (next page), after natural gas prices hit a low in February 2016, there was a swift rebound to the $2/Mcf level. As we approached the start of summer, gas prices climbed in anticipation of increased demand coupled with falling output. Unfortunately, the gas output decline reported by the Energy Information Administration's (EIA) between February 2016 and April stopped with the May report. Last week's June production report showed a 1.7% month-to-month decline from May as well as a negative 1.4% output compared to June 2015.

Exhibit 16. Natural Gas Prices Reflect Normal Winter

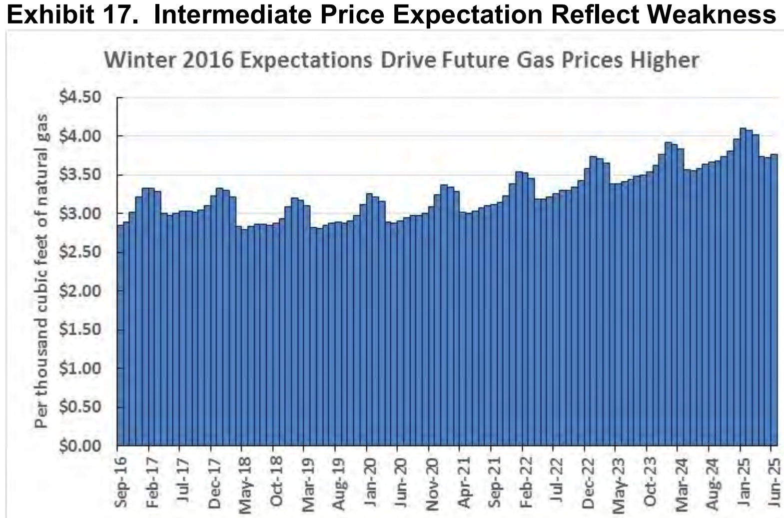


Source: EIA, PPHB

The natural gas futures price curve shows that prices are higher next year than this year, but then are lower in 2019 and 2020

As of a week ago, natural gas futures showed that traders expect gas demand to rise this winter driving gas prices into the $3.30 - $3.40/Mcf, prices that would drive producers to increase drilling and production of natural gas. What we find interesting when considering the natural gas futures price curve is that prices are higher next year than this year, but then are lower in 2019 and 2020 before rising above current price expectations. It is possible that traders are not active in the 2019 and 2020 monthly futures so those prices really are not reflective of true market sentiment, or it could signal that traders anticipate rising output in those years with less demand growth.

Exhibit 17. Intermediate Price Expectation Reflect Weakness



Source: CME, PPHB

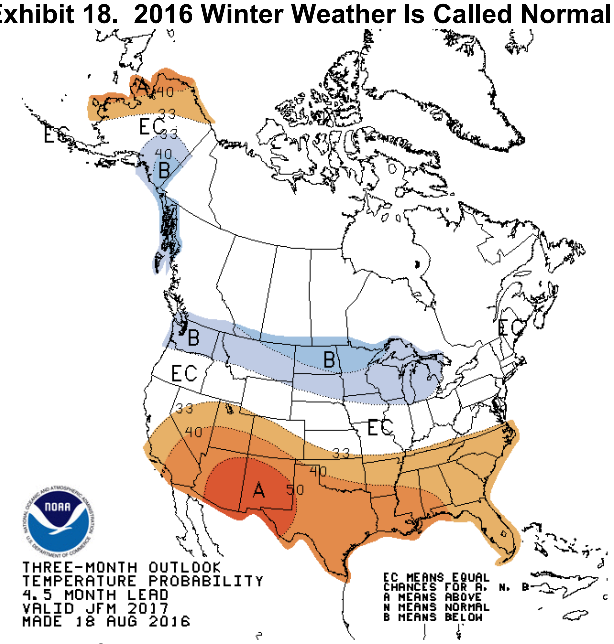
What is most important now in assessing future natural gas prices is estimating gas demand during the upcoming winter. That means we must attempt to assess if the upcoming winter will be similar to, warmer than, or colder than a normal winter. We are not predicting the winter weather, but rather assessing what various winter weather scenarios might mean for natural gas demand and therefore for natural gas prices. In order to make an assessment, we turned to the Climate Prediction Center (CPC) of the National Oceanic and Atmospheric Administration (NOAA). The CPC prepares long-range weather forecasts spanning three-month moving periods: November-December-January; December-January-February; and January-February-March. The CPC prepares these three-month moving forecasts for September 2016 through September 2017.

CPC relies on probabilities of whether temperatures and/or precipitation during the forecast period will be greater than, equal to or less than the average of the 30 observations from 1981-2010

For its predictions, CPC relies on probabilities of whether temperatures and/or precipitation during the forecast period will be greater than, equal to or less than the average of the 30 observations from 1981-2010. The CPC prepares a map of North America showing the probabilities. The coldest or driest one-third of the years (10 of the 30 years) define the B category, the warmest or wettest one-third of the years define the A category, with the middle 10 years defining the N category. So how does this analysis translate onto the map visual that comprises is the CPC prediction?

According to the CPC's explanation of their methodology, they state that "When the forecasters decide that one of the extreme categories, say above (A), is the most likely one, they assign probabilities which exceed 33.33% to that category, and label the

Exhibit 18. 2016 Winter Weather Is Called Normal



Source: NOAA

map with an "A" in the center of the region of enhanced probabilities." The challenge then becomes how to display three categories on one map. The CPC assumes that the middle category remains at 33.3%, which means the third category must be the remainder of 100% minus the "A" percentage and the 33.3% for the "N" category. Where the CPC doesn't have forecast tools that favor the probability of either "A" or "B," then each is assessed a 33.3% probability and the remaining region is labeled "EC," which stands for equal chances.

With EC dominating the upper half of the U.S. this winter, we are most likely to have a normal winter, and one that is unlikely to impact gas demand significantly

As can be seen in Exhibit 18 (prior page), which shows the CPC's January-February-March 2017 temperature prediction, the upper half the United States has either an equal chance (EC) of matching the middle range of winter temperatures during 1981-2010, i.e., a normal winter. A swath of territory across the Northern Plains extending from the West Coast to the Great Lakes is projected to have the coldest temperatures. The B color gradations reflect cold temperature gradations. With EC dominating the upper half of the U.S. this winter, we are most likely to have a normal winter, and one that is unlikely to impact gas demand significantly.

Factors influencing meteorological conditions for the upcoming winter weather remain are transition

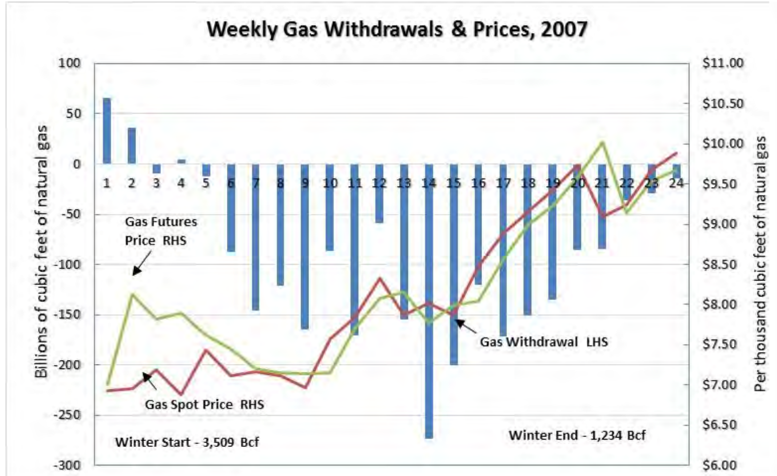
We are not sure how much faith to place in the CPC predictions, especially this far from the heart of winter, since factors influencing meteorological conditions for the upcoming winter weather remain are transition. Therefore, we decided to examine the winter gas demand from another perspective by examining the winters of the analog years selected by tropical storm forecasters at StormGeo to help them forecast the number and the severity of tropical storms during this year's hurricane season. We have weekly natural gas withdrawal data for 1994-2015, which provided us with six analog-year comparisons out of the seven years used by the forecasters.

Of the analog winters, two were among the 10 coldest, while three were among the warmest winters, including 2011, the warmest of the period

We divided the 1994-2015 winters into the ten coldest, ranked by the volume of natural gas consumed, and the ten warmest. Of the analog winters, two were among the 10 coldest, while three were among the warmest winters, including 2011, the warmest of the period. The sixth analog year of our historical era was the 11th warmest winter, but was excluded from our analysis as we focused on the coldest and warmest 10 winters. Other than 2011, the other two warm winters were the seventh (1998) and tenth (1999) warmest. The two coldest winters ranked third (2007) and fifth (1995). For each winter, we plotted the weekly withdrawal volumes along with natural gas spot and futures prices. The purpose of the plots was to see how natural gas prices reacted to weekly withdrawals, as well as how gas prices trended from the start of winter to its end. In each chart, we also list the beginning natural gas storage volume along with the ending volume, enabling the reader to see the magnitude of the decline.

The two coldest winter analyses of weekly natural gas withdrawals compared to gas prices are presented in Exhibits 19 and 20.

Exhibit 19. Third Coldest Winter In Recent Years

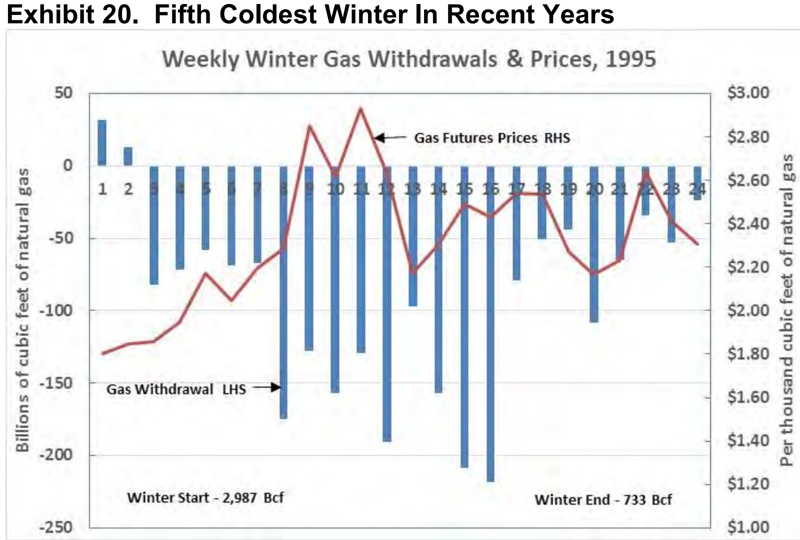


Source: EIA, PPHB

Gas futures prices reflected greater optimism about a cold winter at the start of the withdrawal season

Observing natural gas prices during the third coldest winter, 2007, we see that they soared by nearly 50%. Gas futures prices reflected greater optimism about a cold winter at the start of the withdrawal season, while spot gas prices were not in sync, suggesting consumers were comforted by the large gas supply available. Gas prices began rising in response to sharp withdrawal increases, but then fell after two of three weekly injections were well below earlier weekly withdrawals. Once demand increased, prices began climbing as producers anticipated low storage volumes at the end of the season.

Exhibit 20. Fifth Coldest Winter In Recent Years



Source: EIA, PPHB

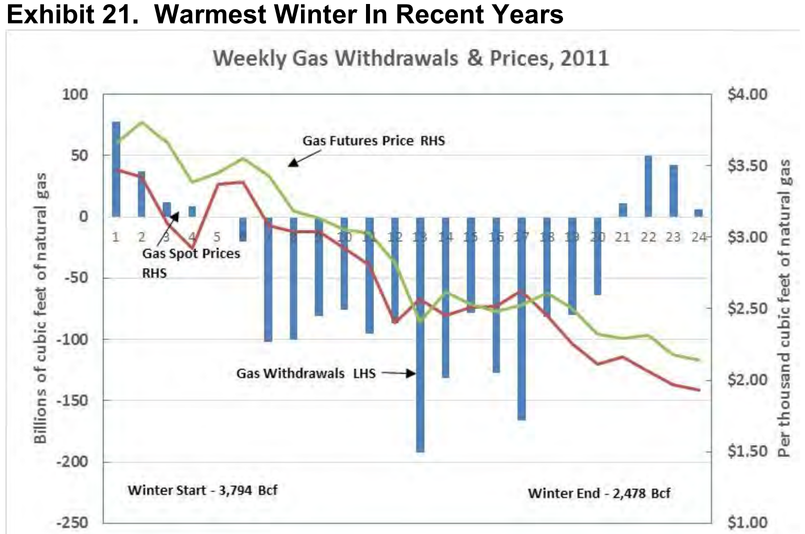
Gas futures prices (no spot prices were available) began rising during the early weeks of the 1995 winter season but then jumped

In the mid-1990s, natural gas prices in the mid-$2/Mcf range were considered good as the domestic industry has been struggling with gas prices closer to $1/Mcf

sharply when weekly withdrawal volumes soared. Gas prices during the first half of winter climbed from $1.80/Mcf to $2.80/Mcf, a significant jump. As weekly withdrawal volumes declined, so too did gas prices. They then rebounded when gas withdrawals increased. For the last third of the winter season, gas prices fluctuated in sync with weekly gas withdrawals. In the mid-1990s, natural gas prices in the mid-$2/Mcf range were considered good as the domestic industry has been struggling with gas prices closer to $1/Mcf, but one is surprised by the fact that gas prices were not much higher at the end of the season given the extremely low volume of gas in storage.

The three winters ranked from warmest to least warm are shown in Exhibits 21–23.

Exhibit 21. Warmest Winter In Recent Years

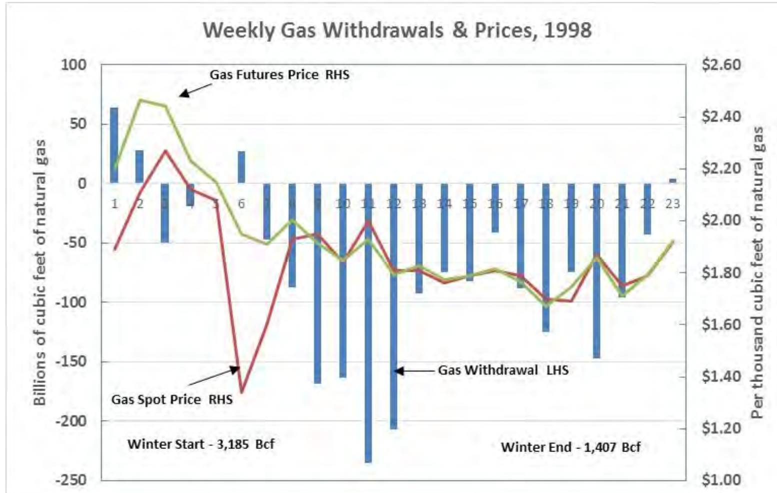


Source: EIA, PPHB

Even after weekly natural gas withdrawals reached 80-100 Bcf volumes, it became clear that without another dramatic increase in demand, i.e., much colder temperatures, shale gas output growth was overwhelming storage

During the warmest winter in recent years, 2011, natural gas prices fell by nearly 45% as the winter began with gas injections rather than withdrawals. Even after weekly natural gas withdrawals reached 80-100 Bcf volumes, it became clear that without another dramatic increase in demand, i.e., much colder temperatures, shale gas output growth was overwhelming storage and putting downward pressure on prices. Further downward price pressure was felt in the natural gas market as the length of the winter season was cut short and gas storage injections began in March rather than April 2012.

Exhibit 22. Seventh Warmest Winter In Recent Years

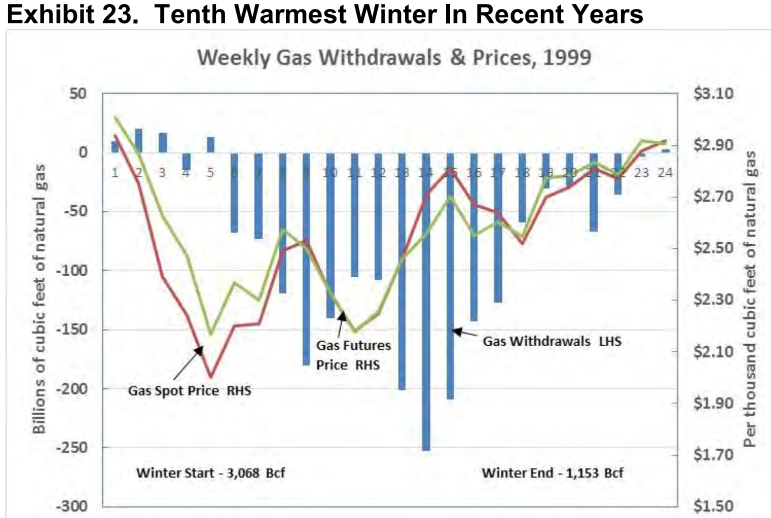


Source: EIA, PPHB

The impact of the absence of demand is seen in the movement of spot gas prices that fell from $2.20/Mcf to $1.30/Mcf in a two-week span

Once again, it was obvious from the action of natural gas prices in the early winter weeks of 1998 that there was a lack of demand. Weak seasonal demand early in the winter season was viewed as the kiss of death for the natural gas business. The impact of the absence of demand is seen in the movement of spot gas prices that fell from $2.20/Mcf to $1.30/Mcf in a two-week span. Prices rebounded sharply once gas withdrawals commenced and withdrawals showed signs of increasing on a weekly basis. However, the damage had already been done to gas price expectations as they sank to the $1.70/Mcf range. Gas prices traded between $1.70/Mcf and $1.90/Mcf for most of the remainder of the winter season as consumers were comfortable about adequate gas supplies being available at low prices.

Exhibit 23. Tenth Warmest Winter In Recent Years



Source: EIA, PPHB

With gas storage volumes trending toward 1,000 Bcf, a level thought crucial for natural gas supply, prices rose into the $2.90/Mcf range

After natural gas prices had recovered during the summer of 1999 following the warm winter of 1998-1999, they collapsed once storage injections continued in the early weeks of winter. Gas prices reacted to the first serious weekly withdrawal. Prices continued rising, but once it seemed that withdrawals were weakening, gas prices fell again. Prices finally soared once gas withdrawals jumped. With gas storage volumes trending toward 1,000 Bcf, a level thought crucial for natural gas supply, prices rose into the $2.90/Mcf range, a level the market thought appropriate for attracting future gas supplies.

What is also instructive is how impactful early season demand or lack thereof is on gas prices throughout the balance of winter

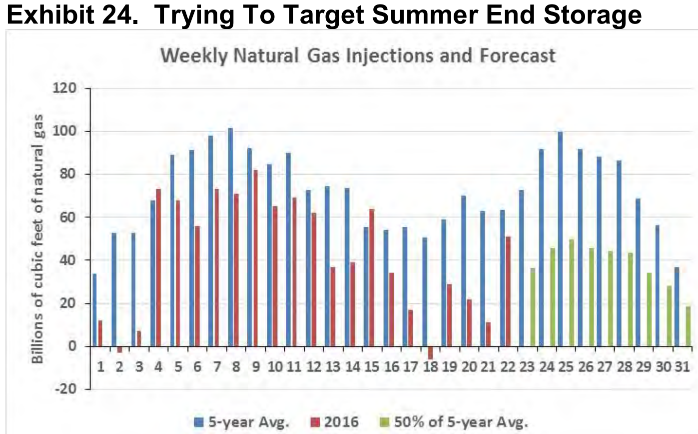
The analysis of these five winter withdrawal seasons shows how responsive natural gas prices are to demand shifts and withdrawal volumes. What is also instructive is how impactful early season demand or lack thereof is on gas prices throughout the balance of winter. Cold temperatures are very important, as are the starting levels of gas storage. It is too early to know what those variables are likely to be for this winter season.

If we assume that the 2016-2017 winter compares similarly to those of the five analog winters, then what could it mean for future gas prices? While natural gas prices will fluctuate throughout the period of analysis, the key price perspective we are seeking is to assess where gas prices are likely be by the end of the 2016-2017 winter as this will be the price that will drive natural gas drilling in 2017.

To start our analysis, we must assume a terminal value for natural gas storage at the end of the injection season

To start our analysis, we must assume a terminal value for natural gas storage at the end of the injection season. We have used two scenarios for this analysis, while recognizing multiple scenarios are possible. First, we have assumed that for the balance of the summer injection season weekly volumes match the current 5-year weekly averages. The second scenario assumes that the industry only injects half the 5-year weekly average volumes. Those weekly averages are shown in Exhibit 24 along with the 2016 weekly storage injections through the September 1st report from the Energy Information Administration.

Exhibit 24. Trying To Target Summer End Storage



Source: EIA, PPHB

The low volume would match the 11th lowest-ending inventory during the 1994-2015 seasons, while the high-end inventory would rank as the 3rd highest after 2011 and 2015

When we compare the natural gas volumes used during the respective analog years to the starting volumes based on the 5-year weekly average and 50% of the 5-year weekly average, we can see where storage volumes might end up in April 2017. The range of forecasts is from as little as 1,473 Bcf of natural gas remaining in storage to as much as 2,778 Bcf. If we focus only on the 50% scenario, the low would be 1,493 Bcf of gas remaining to a high of 2,432 Bcf. The low volume would match the 11th lowest-ending inventory during the 1994-2015 seasons, while the high-end inventory would rank as the 3rd highest after 2011 and 2015.

Exhibit 25. Using Past Winters To Forecast This Winter

(All volumes in Bcf)					2016 Winter @ 5-year Avg.		2016 Winter @ 50% of 5-year Avg.	
Winter	Rank	Start	End	Used	Start	End	Start	End
Coldest								
2007	#3	3,509	1,234	2,275	4,094	1,819	3,748	1,473
1995	#5	2,987	733	2,254	4,094	1,840	3,748	1,494
Warmest								
2011	#1	3,794	2,478	1,316	4,094	2,778	3,748	2,432
1998	#7	3,185	1,407	1,778	4,094	2,316	3,748	1,970
1999	#10	3,068	1,153	1,915	4,094	2,179	3,748	1,833

Source: EIA, PPHB

The 5-year average is 12.4% higher than the 20-year average

To further help define the significance of the above analysis, we calculated the 5-year average of starting natural gas inventories. That calculation showed 3,793 Bcf, or slightly higher than our starting point assuming the balance of the summer weekly gas injections only average 50% of the 5-year average. Just for curiosity sake, we also calculated the 20-year average (1996-2015) inventory starting point, which was 3,375 Bcf. The 5-year average is 12.4% higher than the 20-year average, which is not surprising given the increased use of natural gas for electricity generation and home heating, along with increased gas storage facilities.

For most of this summer the weekly gas storage injections have been low relative to the 5-year weekly averages

All forecasts are little more than educated guesses. On the supply side, for most of this summer the weekly gas storage injections have been low relative to the 5-year weekly averages. That is a combination of lower gas output and greater consumption for generating electricity. It is likely that both of these trends remain at work and will continue to limit gas storage injections, keeping them below the 5-year weekly average. The question that remains is just how far below. That was why we developed a scenario using half the 5-year weekly injection average. The volume difference between the 5-year weekly average injection rate and half the 5-year weekly average injection rate yields 346 Bcf less gas in storage.

Our analysis of analog tropical storm years doesn't produce a clear direction in winter temperature scenarios either

CPC doesn't appear to have sufficient information at this point to make a solid winter weather forecast that would suggest a colder than average winter. Our analysis of analog tropical storm years doesn't produce a clear direction in winter temperature scenarios either. This lack of clarity of forecasts, or evidence of prospects for a warmer than normal winter, especially since we ended the El Niño weather event that contributed to last year's unusually warm winter,

There are multiple variables at work in the gas market – lower output, higher consumption, possible hurricane disruptions, and a drilling rig rebound

may be why natural gas futures markets are projecting that gas prices will remain elevated for the remainder of this year and throughout most of 2017. Those prices are likely reflecting a continuation of the macro trends of falling output and rising demand. However, just as those trends have evolved slower than expected in the crude oil market, it is possible that could also happen in the natural gas segment. There are multiple variables at work in the gas market – lower output, higher consumption, possible hurricane disruptions, and a drilling rig rebound. Additionally, increased pipeline and liquefied natural gas exports will impact gas volumes. All that said, our analog year analysis suggests that if we have another warm winter and ending storage volumes range between 1,833–2,432 Bcf, natural gas prices will likely be capped, and possibly might be pushed lower. On the other hand, if we end the season at low storage volumes such as during previous cold winters, gas prices might be higher. Stay tuned as the future of the natural gas industry becomes clearer in the coming weeks.

Creating Legacies Often Means Re-writing History

The problem is that some of the articles take liberties with history to enhance the legacy claims

We are now in the waning months of the Obama administration, so we are being inundated by numerous actions by President Barack Obama and his bureaucratic officials to further his legacy, but we are also being treated to media articles cheering on these legacy actions. The problem is that some of the articles take liberties with history to enhance the legacy claims. The most recent example is the media's praise for the recent completion of the Block Island Wind Farm, a five-turbine, 30-megawatt, $300+ million project located offshore Rhode Island. Yes, this is the very first offshore wind farm to be built in the United States. However, we struggle to understand how its development was a result of the Obama administration's efforts, without rewriting much of the history of this wind farm project.

One would think the achievement was the equal of Neil Armstrong's first walk on the moon 47 years ago

When the Block Island wind farm begins generating electricity this fall, it will mark a significant event in the 134-year history of the U.S. power industry. As the wind farm's construction neared completion, the owner, Deepwater Wind, hosted a media day. From the tone of some of the articles we read following that event, one would think the achievement was the equal of Neil Armstrong's first walk on the moon 47 years ago.

Many of the reporters also don't understand or appreciate the history of the U.S. oil and gas industry's offshore history and its technological achievements

Many of the reporters who visited the wind farm site are obviously not familiar with offshore structures used in the oil and gas industry, so they are amazed to see 586-foot tall wind turbines rising out of the water. Many of the reporters have seen pictures of offshore wind farms in Europe, but we suspect few have actually seen them in person. Many of the reporters also don't understand or appreciate the history of the U.S. oil and gas industry's offshore history and its technological achievements. The industry constructed the first offshore platform in 1937, 79 years ago. Pure Oil Company (now part of Chevron (CVX-NYSE)) and Superior Oil Company (now part

Although the platform was designed to withstand 150-mile storm winds, it was wiped off of its piles by a hurricane in 1940

of ExxonMobil (XOM-NYSE)) contracted Brown & Root Marine Operators (now a part of KBR (KBR-NYSE)) to build a 320-foot by 180-foot wooden platform for installation in 14-feet of water, 1.6 miles offshore Creole, Louisiana. The platform sat 15-feet above the surface of the water on 300 wooden piles that were driven 14-feet into the ocean floor. Although the platform was designed to withstand 150-mile storm winds, it was wiped off of its piles by a hurricane in 1940. The platform was rebuilt and the companies continued to produce oil from the four-million barrel field.

The Block Island Wind Farm structures are sitting in 90-feet of water depth and including the wind turbines and their blades, they rise 586-feet above the water's surface

Today, the industry has producing platforms anchored to the ocean floor in 5,000-feet to 7,000-feet of water depth. The deepest water platform actually directly positioned on the ocean floor is the Petronius compliant tower, which is owned by Chevron and Marathon Oil Company (MRO-NYSE), and stands 2,001-feet tall in 1,755-feet of water depth. The Block Island Wind Farm structures are sitting in 90-feet of water depth and including the wind turbines and their blades, they rise 586-feet above the water's surface. So the Block Island project is noteworthy for its location, but certainly not pushing the frontier of offshore structure development.

If people want to see the capability of the offshore industry to put large steel structures in the water, they should come to the Gulf of Mexico

For an article by *The Hill*, a Washington, D.C.-based political news reporting service, Abigail Ross Hopper, director of the Bureau of Ocean Energy Management (BOEM), was interviewed. She is quoted in the article saying, "We like to see things, feel things and touch things. And the ability to go to Block Island and see an offshore wind farm in the United States, I think, will have an impact far greater than the size of the wind farm." Generally, it is true that people appreciate something more when they see it with their own eyes, although people may find the impact of seeing these wind turbines on the horizon less appealing than the politicians expect. If people want to see the capability of the offshore industry to put large steel structures in the water, they should come to the Gulf of Mexico.

Exhibit 26. Finishing The Fifth Wind Turbine

Source: Sierra Club

Every proposed offshore wind project to date has faced local opposition from residents

It was only in the third-to-the-last paragraph of the article that the writer brought up the fact that every proposed offshore wind project to date has faced local opposition from residents concerned about these wind turbines ruining ocean views. The writer mentioned that states and the federal government try to minimize this opposition when pushing for project approvals.

The Obama initiative had nothing to do with the Block Island project

With respect to the Obama legacy, the writer points out that Obama used his speech on his first Earth Day in office in 2009 to launch an initiative to get the ball rolling on offshore wind by overhauling the permitting and leasing process. But the Obama initiative had nothing to do with the Block Island project. That project was launched in 2006 by then-Rhode Island Governor Donald Carcieri (Rep). Additionally, the Block Island wind farm is located in state waters and did not require federal approval. This was also the case with the Cape Wind project planned for Nantucket Sound offshore Massachusetts, which was destined to be the first U.S. offshore wind farm. The U.S. government did have to assess whether the wind turbines would interfere with offshore radar and flight activities for Coast Guard and Navy facilities in the area.

BOEM did overhaul the offshore wind leasing program and has held several offshore wind lease sales, but it has done nothing to improve the economics of offshore wind

BOEM did overhaul the offshore wind leasing program and has held several offshore wind lease sales, but it has done nothing to improve the economics of offshore wind, which remains very expensive and is only gaining a foothold due to state mandates. We wrote last week about the Rhode Island Legislature rewriting its public utility law in 2011 to mandate the Public Utility Commission (PUC) to approve the Block Island project by recognizing that it had some social benefits, although a cost/benefit analysis was not allowed. A previous analysis led the PUC to turn down the project as "uneconomic" for ratepayers who will pay around $ 500 million in overcharges over the 20-year life of the power purchase agreement compared to what they would have paid for their electricity otherwise. The overcharges arise from the 24.4-cent per kilowatt-hour price, with a guaranteed 3.5% inflation adjustment that utilities have to pay for Block Island wind power, compared to the 8.9-cent per kilowatt-hour energy charge that Rhode Island ratepayers currently pay due to cheap natural gas that has been evident during President Obama's presidency, although without any help from the administration. Saddling consumers with much higher electricity costs will be the real legacy of President Obama and offshore wind.

Colorado Ballot Win Offsets Infrastructure Battles

Colorado voters will not be able to vote on two measures to allow local communities to ban hydraulic fracturing

Colorado voters will not be able to vote on two measures to allow local communities to ban hydraulic fracturing – one granting local officials more regulatory authority to limit or ban oil and gas development in their community and the other to require at least a 2,500-foot setback from any occupied structure for any oil and gas development. The first measure would have enabled communities to ban hydraulic fracturing, a practice the environmental movement

A measure, however, that will be on the ballot is initiative 71 that would make it harder to amend the state's constitution

in Colorado has been fighting for years. The second mandate would have, according to the Colorado Oil and Gas Conservation Commission, prohibited oil and gas development in most of the state. A measure, however, that will be on the ballot is initiative 71 that would make it harder to amend the state's constitution. That measure, if enacted, would help the oil and gas industry fight further attacks on its operations.

We are seeing a repeat of this Keystone game plan in the battle being waged over the construction of the Dakota Access Pipeline

While these ballot battles received much attention, the trench warfare is really being waged over infrastructure projects. These wars reflect a realization by environmentalists that by blocking new pipelines and other fossil fuel projects, they may be more successful in stymying future oil and gas development than fighting fossil fuel use or development directly. That realization was proven by the battle to block the issuance of a construction permit for the Keystone XL pipeline planned to bring oil sands output from Western Canada to U.S. Gulf Coast refineries, regardless of the fact that much of the oil was actually owned by U.S. producers. In addition, the pipeline would have brought domestic Bakken oil south, also. The Keystone success involved applying political pressure on President Barack Obama, who had the final approval authority over the issuance of the pipeline construction permit. Today, we are seeing a repeat of this Keystone game plan in the battle being waged over the construction of the Dakota Access Pipeline (DAPL) designed to haul oil from North Dakota to Illinois.

They ask in their letter for Mr. Obama to halt the pipeline's construction and cancel the construction permits issued by the Corps

A group of 31 environmental organizations, including the Sierra Club, 350.org, Oil Change International and Food and Water Watch, to name a few, sent a joint letter to the White House asking President Obama to halt construction of the pipeline. The groups make numerous claims including allegations the pipeline's owners used a Corps of Engineers approval process that enabled them to evade an open and transparency process. They ask in their letter for Mr. Obama to halt the pipeline's construction and cancel the construction permits issued by the Corps. We have not investigated the group's claims, or the approval process of the Corps, but the fact that it issued the permits means that the companies complied with the Corps' legal and regulatory process. While citing the fact that the pipeline will transport 425,000 barrels a day of "fracked oil" from the Bakken in North Dakota to Illinois where it would join with another pipeline that would then move the oil to Gulf Coast refineries, the use of the magic word "fracked" tells you all that is needed to be known about the motivation of the protesting groups.

The tag line of this group is "Because the earth needs a good lawyer," which gives one a flavor of its agenda

This motivation becomes clearer when you look at the web site of EARTHJUSTICE, the group that has filed suit against the Corps over its granting of the pipeline construction permits. The tag line of this group is "Because the earth needs a good lawyer," which gives one a flavor of its agenda. In fact, the web site highlights that the group's lawyers, legislative representatives and communications staff spent 18,000 hours on oil and gas drilling work in a year, from

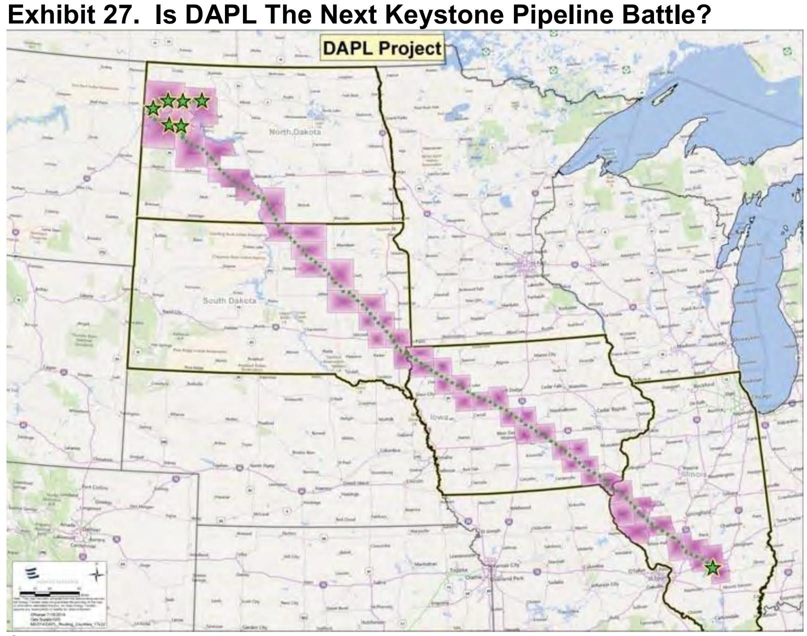
PPHB

July 2012 to June 2013. To put that into perspective, those hours equate to nine people working 8-hour days for 50 weeks straight.

"We are working with affected communities to fight pipelines, export terminals and other major infrastructure projects that will spur more gas drilling and burning for decades to come"

The more telling point about the EARTHJUSTICE group was one of the listings of how it was fighting the oil and gas industry. It said it was "Stopping infrastructure investments that will commit us to fossil fuel-fired future. We are working with affected communities to fight pipelines, export terminals and other major infrastructure projects that will spur more gas drilling and burning for decades to come." Based on this language, one can conclude that the root issue is "dirty fossil fuels," so doing anything that can block the movement or use of these fossil fuels will lead to them being left in the ground, their goal. The goal, unfortunately, ignores all the social and economic good that comes from the use of fossil fuels, especially for those in developing countries.

Exhibit 27. Is DAPL The Next Keystone Pipeline Battle?



Source: Dakota Access Pipeline

If the fight is really about stopping oil and gas drilling, the text of the second paragraph of the environmental groups' letter reinforces that position. The environmental groups wrote:

"Over the past several weeks, the mounting opposition to the pipeline has grown exponentially, captivating both activists around the country and the media"

"This pipeline would travel through the Standing Rock Sioux Tribe's ancestral lands and pass within half a mile of its current reservation. Over the past several weeks, the mounting opposition to the pipeline has grown exponentially, **captivating both activists around the country and the media**, while uniting and mobilizing Native American tribes across the country in an unprecedented manner." (Emphasis added.)

This protest will be used to energize the environmental supporters in the upcoming election – boosting donations and voter turnout

The DAPL protest has become a rallying cry for the environmental movement that has lacked such a motivating issue following their 2015 Keystone XL and Paris climate change treaty wins. This protest will be used to energize the environmental supporters in the upcoming election – boosting donations and voter turnout. Therefore, watch to see if, and when, Democratic presidential candidate Hillary Clinton comments on the stand-off. If so, she will be following the mantra of the former chief-of-staff to President Obama and current Chicago Mayor Rahm Emanuel, who said in 2009, "You never want a serious crisis to go to waste. And what I mean by that is an opportunity to do things you think you could not do before." Keeping oil and gas in the ground is good; motivating protesters to become political supporters is better; convincing them to vote for you is best!

Two of the state's electricity utilities that had supported the pipeline expansion, had also planned to build liquefied natural gas storage tanks to enable them to better manage increased winter gas demand

We wrote in our last issue about the anti-infrastructure battle going on in New England, a region woefully short of natural gas pipeline capacity that translates into power price spikes during winters. In Massachusetts, following the state's Supreme Court ruling that the Access Northeast natural gas pipeline expansion project could not be financed by charging electricity ratepayers' accounts, regardless of the fact that the pipeline would increase supplies that would hold down winter gas price hikes, the first fallout was announced. Two of the state's electricity utilities that had supported the pipeline expansion, had also planned to build liquefied natural gas storage tanks to enable them to better manage increased winter gas demand. Following the court's ruling, these utilities announced they were abandoning the gas storage project. Likewise, in Rhode Island, the Conservation Law Foundation, the victorious plaintiff in the Massachusetts case, has filed suit to invalidate the proposed financing plan, similar to the plan in Massachusetts, by the local utilities to fund their share of the expansion of the Access Northeast pipeline. We had predicted this outcome as the Rhode Island law needed the support of the other New England states.

Of those with legal standing, virtually none impact areas where oil and gas development activity is being undertaken

To better appreciate why fighting infrastructure projects has become a better strategy for environmentalists than fighting over actual oil and gas drilling, one only needs to consider the data presented in a *Wall Street Journal* article. Since 2011, government entities throughout the United States have passed 600 measures expressing opposition to fracking, with just under a half of them being legally binding. Of those with legal standing, virtually none impact areas where oil and gas development activity is being undertaken. For example, Vermont banned fracking in 2012, but it has no commercial oil or natural gas resources. New York State has banned fracking, but while the state does have some natural gas resources and existing drilling, fracking was not being used. Various studies of the state's natural gas resources questioned whether any of these efforts would be economic in today's gas pricing environment even if the producers had used fracking technology. Maryland is another state that has banned fracking, but only for a three-year period through 2017. But fracking wasn't being used there, either.

Commenting on the success of their efforts, Alex Beauchamp, an organizer for Food and Water Watch, said, "You stop it in New York, you stop it in Maryland, you stop it in a few more states, and then eventually you stop it nationally." Some might suggest this is wishful thinking, especially given the lack of success elsewhere. However, blocking exit routes for oil and gas may have an impact on future levels of hydrocarbon development and production activity, but it won't stop it altogether. This will be true for DAPL. One of the pipeline's owners ramped up his support for this project to transport Bakken crude oil after having had another pipeline project, Sandpiper, that would have gone east through Minnesota before turning south into Wisconsin rather than south through South Dakota, Iowa and into Illinois as DAPL does, stopped by litigation. Opponents filed a lawsuit to block the pipeline claiming insufficient analysis of the environmental impact had been conducted, which resulted in the project being returned to the state's public utility commission for further review and analysis despite the previous commission 5-0 vote in favor of the project going ahead. This project has now been abandoned. Given the 2015 Keystone experience and the current DAPL protest, one cannot assume that Bakken oil will flow readily or as profitably in the future. DAPL protesters fail to understand that there are numerous idle railroad tank cars that could be employed to ship the Bakken oil from North Dakota to Gulf Coast refineries. Of course, this transportation option is less greenhouse gas-friendly, potentially more dangerous due to train derailment risk, and more expensive than shipping by pipeline. For oil producers, they will get the oil to market. We suggest readers pay closer attention to key infrastructure projects under construction or being proposed as they will become the future battlegrounds in the war over fossil fuels.

DAPL protesters fail to understand that there are numerous idle railroad tank cars that could be employed to ship the Bakken oil from North Dakota to Gulf Coast refineries

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