PPHB
ENERGY INVESTMENT BANKING

MUSINGS FROM THE OIL PATCH

January 23, 2018

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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

Nobody Cares About Oil Anymore – But Is That Smart?

"I get no respect"

Among comedian Rodney Dangerfield's most noted quotes was "I get no respect. The way my luck is running, if I was a politician I would be honest." Clearly, politicians were aghast! But, for energy investors, and, more importantly, those in the energy business, they can identify with "getting no respect." Why is that? The annual sector performance chart (page 2) for the past decade shows that energy only topped the market in 2007 and 2016.

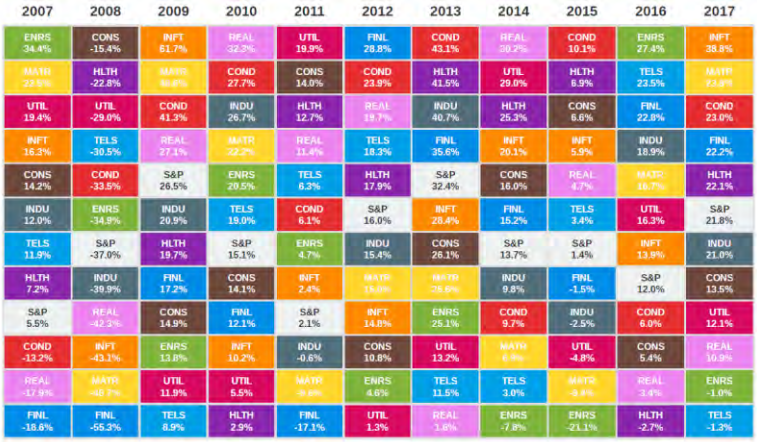
The performance of energy stocks in 2007 was not surprising given that oil prices were on their way to $140+ per barrel, which quickly fell off the cliff as the 2008 financial crisis hit, and the 2009 recession cut demand for crude oil and created liquidity problems for producers. The latter issue was significant as it forced producers to cut back on activity to conserve balance sheet liquidity, and for firms with too much leverage, it took them down.

As the early months of 2017 demonstrated, it was going to take longer than most people expected for the oil market to rebalance

The performance of energy stocks in 2016 was buoyed by the strong year-end rally as the news of the forthcoming OPEC production cut, supported by Russia, was viewed as the ticket to a balanced oil market and higher oil prices, lifting the fortunes of energy companies. As the stock market is prone to do, share prices rose in anticipation of the expected financial outlook improvement for 2017. However, as the early months of 2017 demonstrated, it was going to take longer than most people anticipated for the oil market to rebalance. Yes, the production cut did result in the drawing down of global crude oil inventories, but not until the market had digested the impact of inventory stuffing by exporters in anticipation of having their output restricted, and thus their income. The improved energy stock market did show up, but it came late in the year. The delayed rebalancing, following numerous rallies based on unfulfilled expectations of improvement over the prior three years, kept many

energy investors on the sideline. That was not surprising, as energy investors, who had previously been embarrassed by buying into the earlier fictitious recoveries, elected to embrace the mantra, "Fool me once, shame on you. Fool me twice, shame on me."

Exhibit 1. How S&P Sectors Have Performed In Last Decade



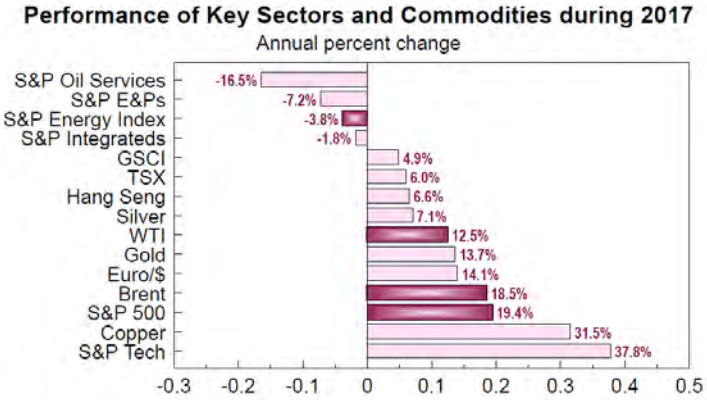
Source: ***NovelInvestor.com***

For energy, its cumulative return over the decade was 3.81%, ranking it 11th

As the Standard & Poor's 500 stock index annual sector performance chart shows, energy finished in the top half of the 12-sector rankings only three times – 2007, 2008 and 2016 – during the decade of 2007-2017. A table accompanying the chart showed how each sector performed overall for the period, as well as each sector's best and worst annual performance. For energy, its cumulative return over the decade was 3.81%, ranking it 11th, only beating the 1.51% cumulative performance for the financial sector. Interestingly, energy's best and worst annual performances were essentially identical (+34.4% versus -34.9%).

To gain a better appreciation of energy's poor investment performance, a chart from Cornerstone Analytics, an investment

Exhibit 2. Energy Stocks Trailed Oil Prices Last Year



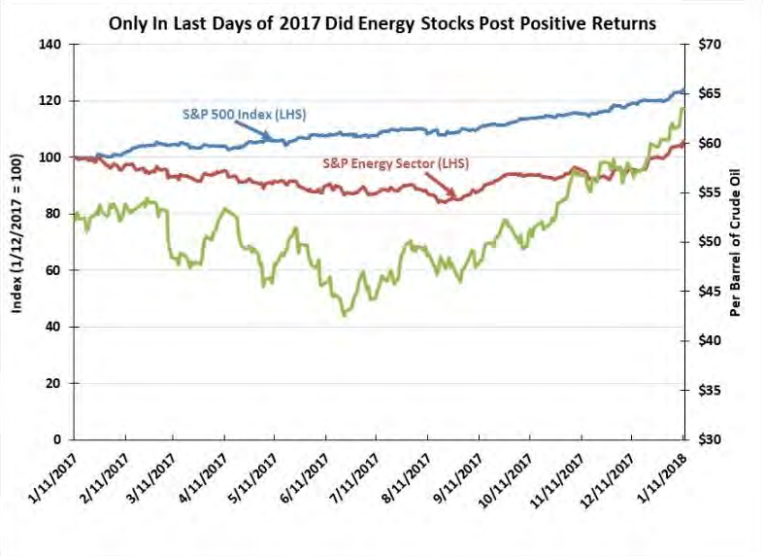
Source: Cornerstone Analytics

firm, shows how key industry sectors saw their share prices fall, while WTI and Brent oil prices rose by 12.5% and 18.5%, respectively. The killing number for energy equity investors is the fact that the S&P Energy Index fell 3.8% while the S&P 500 Index climbed 19.4% during 2017.

The performance disconnect between the price of crude oil and oil shares has been remarkable

With the rebalancing of the global oil market well under way, energy stocks are beginning to perform better. Their performance, however, still lags that of the price of oil, which is the driving force behind producer earnings and cash flow. Given the improvement in oil prices during the second half of last year, one would have assumed that energy stocks would have performed better before now. The performance disconnect between the price of crude oil and oil shares has been remarkable. To better appreciate the disconnect, we have prepared a series of charts covering three distinct time periods – the last 10 years, three years and one year.

Exhibit 3. 2017 Was Year Of Sea Change For Energy



Source: EIA, Yahoo Finance, PPHB

Energy stocks remained flat until mid-December, at which point they seemed to come to life

As the 1-year chart shows, oil prices bottomed in June 2017 and have risen steadily into this year. Following a bounce in August, energy stocks remained flat until mid-December, at which point they seemed to come to life, reflecting the improving 2018 outlook. The better energy stock performance has been a long time in coming as the three-year performance chart shows. But the energy stock performance continues to struggle to shake the belief that producers will merely use higher oil prices to spend even more money on growing reserves and production, rather than beginning to restore their balance sheets to more healthy profiles, and even return some of the money to their shareholders. Until investors believe producers' spots have changed about spending, the energy stocks will continue to struggle to perform better.

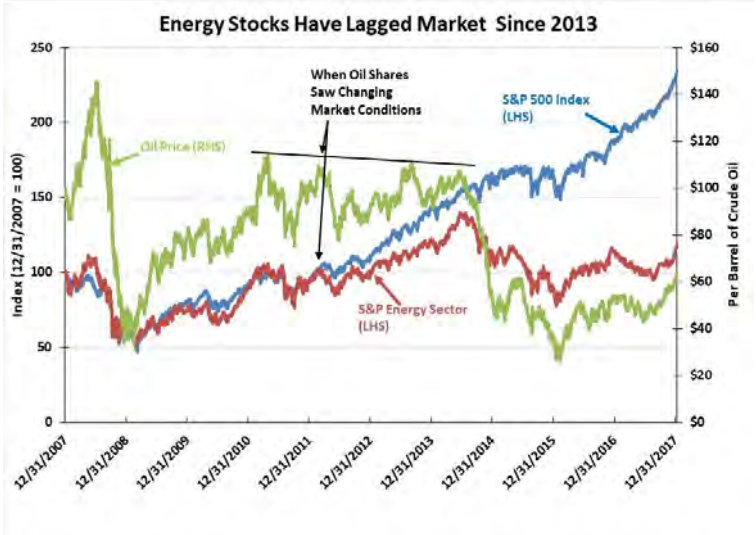
Exhibit 4. Energy Stocks Recovering With Oil Prices

Source: EIA, Yahoo Finance, PPHB

The stock market correctly sensed that any oil price rebound would be temporary, and that the industry's economics had changed with damaging results for participants

In the early months of 2015, energy shares outperformed the overall stock market. This was in response to the strong belief that the market would respond to OPEC's decision of November 2014 with a quick rebound, similar to the V-shaped recovery oil prices posted following the 2008-2009 economic crisis. Once it became clear that oil prices would not rebound as rapidly as in that earlier period, energy shares began falling despite oil prices performing better. The stock market correctly sensed that any oil price rebound would be temporary, and that the industry's economics had changed with damaging results for participants. This is exactly what happened. The stock market got it right!

Exhibit 5. Understanding Energy Market Change In 2011



Source: EIA, Yahoo Finance, PPHB

It shows how closely energy stocks, and the overall stock market tracked oil prices in the early years of the decade

To us, the most interesting chart of energy's history is the 10-year one (prior page). It shows how closely energy stocks, and the overall stock market tracked oil prices in the early years of the decade. It was not surprising, as those years marked the tail-end of the great commodity boom that drove up the prices of all commodities and the share prices of companies involved with them.

This stock price pattern is a signal of deteriorating fundamental strength for an industry sector

As the chart shows, the booming oil price of 2007 was derailed by the 2008-2009 global economic crisis. As that crisis eased, crude oil prices began to march higher, eventually reaching $114 a barrel in April 2011. After subsequently falling back into the low $80s a barrel by late summer, oil prices reversed and began climbing again. This time, however, the high-water mark was only $108 a barrel, reached in March 2012. Note how closely energy stocks tracked oil prices during that span. As often is the case with the stock market, energy investors sensed a change in the industry's fundamentals as we moved into the second quarter of 2012. By not matching or surpassing the previous high oil price, the market recognized the start of a trend of lower high prices, which is traditionally accompanied by lower low prices. This stock price pattern is a signal of deteriorating fundamental strength for an industry sector.

To show oil's price action, we have drawn a black line connecting the high price in 2011 with subsequent high prices, ending with the 2014 peak price. Yes, the 2013 peak oil price reached $110 a barrel, but only fleetingly. That brief high was considered more of an aberration than a change in industry fundamentals, such that it would change the technical pattern of "lower highs and lower lows."

From that point forward, regardless of the action of oil prices, energy shares began underperforming the overall stock market.

When the 2012 oil price peak failed to exceed 2011's high, it raised questions for investors about the health of the energy business (and commodity businesses, in general) prompting them to shun investing in the sector. From that point forward, regardless of the action of oil prices, energy shares began underperforming the overall stock market. That pattern appears to be changing, now, but admittedly energy stocks are coming from a low base, and their low valuations are attracting bargain-hunting investors.

Legendary oilman Boone Pickens was closing his energy hedge fund, BP Capital Fund Advisors

A little over a week ago, there was, in our opinion, a significant announcement. It involved a high-profile energy investor. The announcement matched a previous event that occurred last August. The 2017 announcement seemed to signal a potential change in energy's outlook. The recent announcement, in the form of a *LinkedIn* post on Friday, January 12th, was that legendary oilman Boone Pickens was closing his energy hedge fund, BP Capital Fund Advisors. The 89-year old Mr. Pickens wrote that he wants to concentrate on "personal passions like promoting unbridled entrepreneurship and philanthropic and political endeavors." He also referenced health issues as another reason behind closing the fund, as he suffered from a series of small strokes late last year, as well as a major fall last summer.

Another reason for the fund's closure, but not mentioned by Mr. Pickens, was its recent poor performance

Another reason for the fund's closure, but not mentioned by Mr. Pickens, was its recent poor performance. That's not surprising given the charts we have shown above demonstrating energy's dramatic underperformance versus the broader stock market over the past five years, despite energy's positive performance in 2016. According to media reports, during the 2008 financial crisis, one of Mr. Pickens' funds was nearly totally wiped out, and another lost 64%. In the nine years beginning with 2008, BP Capital's over $4 billion in assets under management shrank to $335.1 million at the end of 2016. Ouch!

Astenbeck Commodities Fund II, managed by oil trader Andy Hall, known as "God" to his fellow oil traders, shut down after losing almost 30% in the first six months

We put the significance of Mr. Pickens' announcement alongside what happened in the energy commodity trading sector last summer. At the beginning of August, Astenbeck Commodities Fund II, managed by oil trader Andy Hall, known as "God" to his fellow oil traders, shut down after losing almost 30% in the first six months of the year. According to media reports, the management company overseeing Mr. Hall's funds had $1.4 billion under management at the end of 2016. "God's" capitulation marked another, although an extremely high-profile fund, added to the pile of at least 10 commodity managers shutting down since 2012.

For all of 2016, Mr. Hall had been pushing back on the bearish oil price sentiment, arguing in letters to his investors that he questioned the data showing a rising tide of crude oil supplies, and arguing that a sustained rally was coming. In July 2016, Mr. Hall shifted, arguing that the global crude oil market had "materially worsened" and that oil prices were stuck around $50 a barrel or below.

One sees a leading oil trader shutting down literally just after the bottom in oil prices was set in 2016, and now an influential and successful oil industry player, who helped shape industry trends for decades, is throwing in the towel on trading energy equities

Looking at these two events from a 30,000-foot perspective, one sees a leading oil trader shutting down literally just after the bottom in oil prices was set in 2016, and now an influential and successful oil industry player, who helped shape industry trends for decades, is throwing in the towel on trading energy equities. Based on the history of the stock market, market bottoms, whether for the overall market or specific stock sectors, are generally marked by a high level of disinterest among investors (often reflected in low weightings in the market sector), long-term bullish investors capitulating and selling their shares, while expressing the opinion that "this market is different, and not likely to improve anytime soon."

A common refrain among institutional investors currently shunning energy investments, is that they have been burned by the predictions of recoveries that turned out to be wrong. Since energy's weighting in the S&P 500 index is so small, they plan to overcome any outperformance by placing bigger bets on the outperforming information technology sector, the top performing sector in 2017. Who can argue with investing in the FANG (Facebook, Amazon, Netflix and Google) stocks, given their industry dominance and favorable outlooks? The question is whether their valuations excessively reward their future earnings prospects?

Next New Year's Eve we will be interested to see institutional investor energy holdings

We are being careful to not confuse coincidence with causation, when we highlight the timing of the shutting down of these two high-profile energy funds by high-profile personalities. On the other hand, next New Year's Eve we will be interested to see institutional investor energy holdings, as well as the explanations about their 2018 performance, and their forecasts for the most outstanding investments for 2019. Will energy be topping those lists?

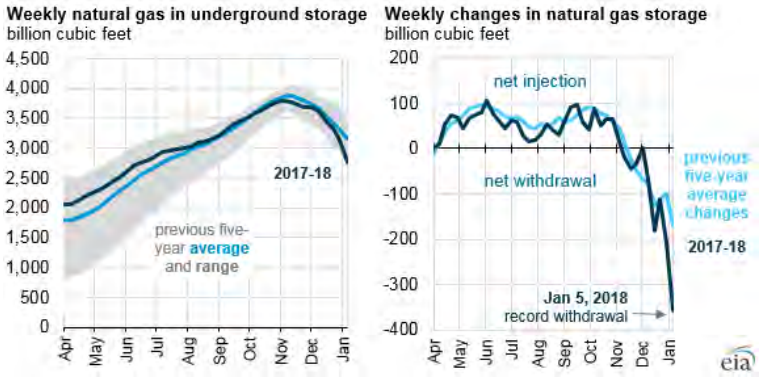
Winter Weather Highlights Natural Gas Market Challenges

"Baby it's cold outside," was the title of a song written in 1944 by Frank Loesser. The song is performed as a duet, which Mr. Loesser did with his wife, Lynn Garland, at their Navarro Hotel in New York City. After years of informally performing the song at various parties, Mr. Loesser sold the rights to MGM in 1948, which used it twice in the 1949 motion picture, Neptune's Daughter. The duets were sung by Ricardo Montalbán and Esther Williams, and also by Red Skelton and Betty Garrett, names that may ring a bell with our older readers.

Spot natural gas prices in the Northeast soared into the upper $30s per thousand cubic feet (Mcf), compared to Henry Hub prices that hovered around $3/Mcf

Venturing outside when it's extremely cold is not a smart move unless it is necessary. Early this year, bitter cold weather descended from the Arctic into a large portion of the U.S., and made for extremely challenging conditions. The Energy Information Administration (EIA) published winter energy alerts for the Northeastern portion of the country. The releases were on January 5th and January 8th, the latter as the bitter cold weather began to ease. What happened in energy markets during those days, especially in the Northeast region was amazing. *Nationwide, we experienced the largest weekly withdrawal of natural gas from storage in history. Spot natural g*as prices in the Northeast soared into the upper $30s per thousand cubic feet (Mcf), compared to Henry Hub prices that hovered around $3/Mcf.

Exhibit 6. How Record Cold Helps Empty Gas Storage



Source: EIA

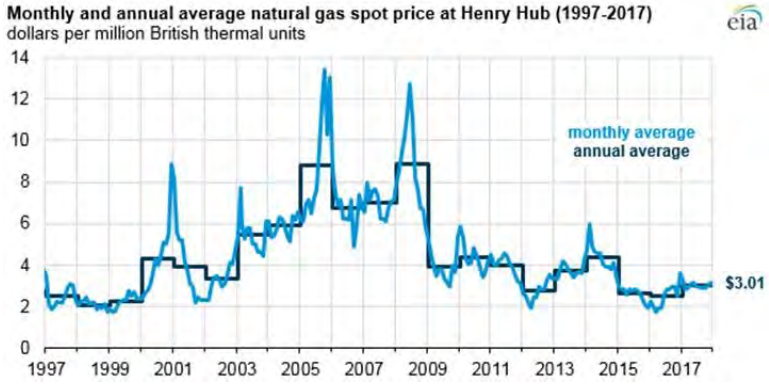
For the week ending January 5th, the nation had the largest weekly withdrawal from natural gas storage on record - 359 billion cubic feet

(Bcf). That week's record easily blew past the prior withdrawal record of 288 Bcf of natural gas taken out in mid-January 2014. That withdrawal record had barely beaten the earlier record weekly withdraw of 285 Bcf extracted in mid-December 2013, barely a month earlier.

So far, we have withdrawn the equivalent of 41% of the total amount of gas withdrawn during the record winter of 2013-2014

The new record withdrawal has some analysts concerned since it represented 11.5% of the volume of gas in storage at the beginning of the withdrawal week, and 9.4% of the total amount of natural gas in storage at the start of this withdrawal season. At the current time, we are 12 weeks into the withdrawal season, or just about half way through it. So far, we have withdrawn the equivalent of 41% of the total amount of gas withdrawn during the record winter of 2013-2014, which was the last time we experienced two severe Polar Vortex episodes. We are 49% through the volume of gas used in the previous record winter of 2002-2003. Compared to last year's relatively warm winter, we have used the equivalent of nearly 63% of the total volume consumed last winter.

Exhibit 7. 20 Years of Natural Gas Price Movements



Source: EIA

The high gas prices of 2003-2008 appear to have been an aberration

The EIA recently published a chart showing monthly and annual average natural gas prices spanning the past 20 years. What the chart conveys graphically is how the high gas prices of 2003-2008 appear to have been an aberration. It appears that gas prices in the $2-$4/Mcf range are more the norm for the United States. Of course, one needs to understand that the price we see quoted from the Henry Hub trading point may bear no relationship to actual local prices being paid for gas supply. The same is true for gas producers who may find Henry Hub prices are a lofty target because of transportation differentials and other price suppressing hurdles.

To gain a greater appreciation for just how wild natural gas markets may become at times, one needs only to consider the data in the EIA's two winter energy alerts. We have pulled the data for the two reports into one table, so we can see the six-day impact. In addition, we added the available Henry Hub spot and futures prices for those days. As seen, the Henry Hub prices, especially the futures prices,

bear little relationship to the "real" market for natural gas in New York City and New England during that cold spell.

From January 4th to the 5th, spot gas prices in New England more than doubled

As the table documents, when the arctic cold weather arrived in the Northeast on Friday, January 5th, gas and electric markets experienced significantly challenging market conditions. From January 4th to the 5th, spot gas prices in New England more than doubled. At the same time, in New York City, the spot price nearly tripled. When you compare the spot price on the Jan. 5th with that for Jan. 3rd, in New York City, it jumped nearly eight-fold, but only increased four-times in Boston. Amazingly, spot prices plummeted on Saturday and Sunday in both New England and New York City, with the latter experiencing a much greater price retreat. That is because demand disappears on weekends, but probably more so in New York City because of its large business community, which is shut down during the weekend.

Exhibit 8. How Cold Temps Drove Energy Market Crazy

	Wed. 1/3	Thurs. 1/4	Fri. 1/5	Sat. 1/6	Sun. 1/7	Mon. 1/8
Avg. Temp.						
Boston	23 F	26 F	7 F	9F	11 F	26 F
New York City	23 F	26 F	11 F	10 F	12 F	32 F
Natural Gas Demand Bcf/day						
New England	3.9	3.9	3.8	4.0	3.9	3.8
New York City	4.8	5.1	5.3	5.4	5.3	4.5
Spot Nat Gas Price per MMBtu						
New England	$ 21.50	$ 36.32	$ 82.75	$ 20.25	$ 20.25	$ 20.25
New York City	$ 17.71	$ 51.42	$ 140.25	$ 12.65	$ 12.65	$ 12.65
Henry Hub - Spot	$ 6.24	$ 4.65	NA	NA	NA	$ 2.89
Henry Hub - Futures	$ 3.01	$ 2.88	$ 2.80	NA	NA	$ 2.84
On-peak Electricity Price per MWh						
New England	$ 170.00	$ 198.50	$ 305.50	NA	NA	$ 150.75
New York City	$ 178.75	$ 185.50	$ 247.75	NA	NA	$ 120.75
Oil Use in New England ISO			>30%			>30%

Source: EIA

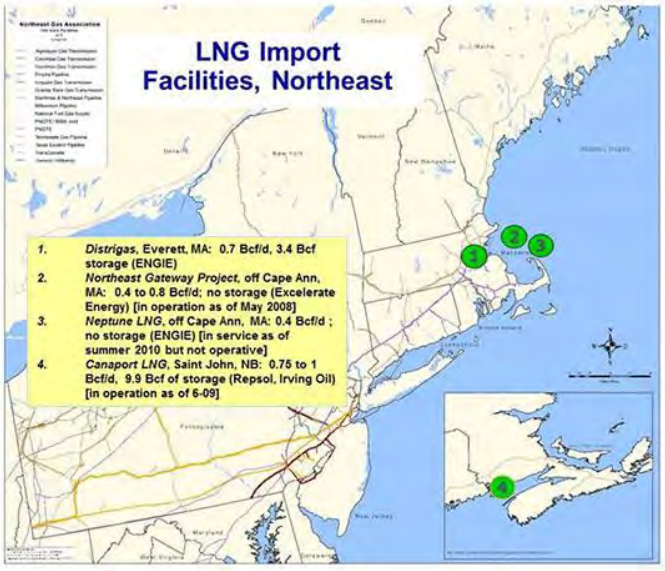
It is not often that the New England Independent System Operator, the non-profit group that manages the region's electricity grid, reports more than 30% of its power being generated by oil-fired power plants

We would point out another interesting data point from Exhibit 8, which is the amount of oil-fired power generation capacity used during the cold weather. It is not often that the New England Independent System Operator, the non-profit group that manages the region's electricity grid, reports more than 30% of its power being generated by oil-fired power plants. In some situations, New England has been known to restart coal-fired power plants to meet electricity demand during cold spells. The need to use oil-fired and coal-fired power plants comes from the lack of natural gas supply. During bitter cold spells, incremental natural gas goes to home heating rather than electric generation. The New England power grid does get electricity generated by plants burning liquefied natural gas (LNG). There is a large LNG import terminal located in Boston harbor that has been operating for 40 years. There is gas storage at that Everett, Massachusetts facility. A similarly-sized import facility with storage is located in Saint John, New Brunswick, Canada, that

There is also an LNG storage facility in Providence, Rhode Island, but the supply is trucked from New York or Boston

injects gas into the Maritimes and Northeast Pipeline that transports it to New England. There are also two small subsea LNG receiving terminals located off Cape Ann, Massachusetts, but due to the nature of their operation do not have any storage capacity. There is also an LNG storage facility in Providence, Rhode Island, but the supply is trucked from New York or Boston. We are not aware of any other LNG storage facilities in the region.

Exhibit 9. Terminals For Receiving LNG For Northeast



Source: ISO New England

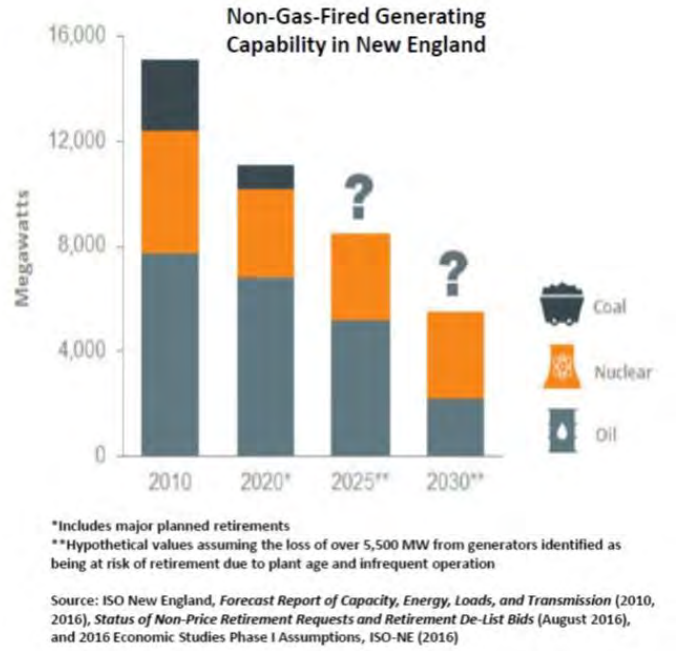
The Northeast depends on natural gas to power a substantial amount (approximately 40%) of its electricity generation capacity

The response of natural gas spot prices to the cold weather is consistent with the challenges the New England has faced and will continue to face given the limited pipeline capacity in the region. The Northeast depends on natural gas to power a substantial amount (approximately 40%) of its electricity generation capacity. Based on the push for cleaner energy in the region and aging power plants, it is estimated that 66% of the incremental power generation capacity to be built in New England will be fired by natural gas. Between 2012 and 2020, New England will see 4,200 megawatts (MW) of power capacity fueled by coal, oil and nuclear closed. That is equal to about 15% of starting capacity. An additional 4,500 MW of oil- and coal-fired generating capacity is at risk of being shut down during this period, also. The potential capacity at risk of closing exceeds the scheduled closures, meaning the Northeast potentially faces a serious power supply situation.

From an environmental position, in 2015, after Vermont Yankee closed, the region's carbon emissions increased by 2.5%

With respect to nuclear power in New England, the region has already seen the Vermont Yankee plant shut down in late 2014. The Pilgrim plant is targeted to close by May 2019. These two plants provided 30% of the region's power. Interestingly, from an environmental position, in 2015, after Vermont Yankee closed, the region's carbon emissions increased by 2.5%. To counteract this

Exhibit 10. Shrinking Fossil Fuel Capacity Will Push Up Prices

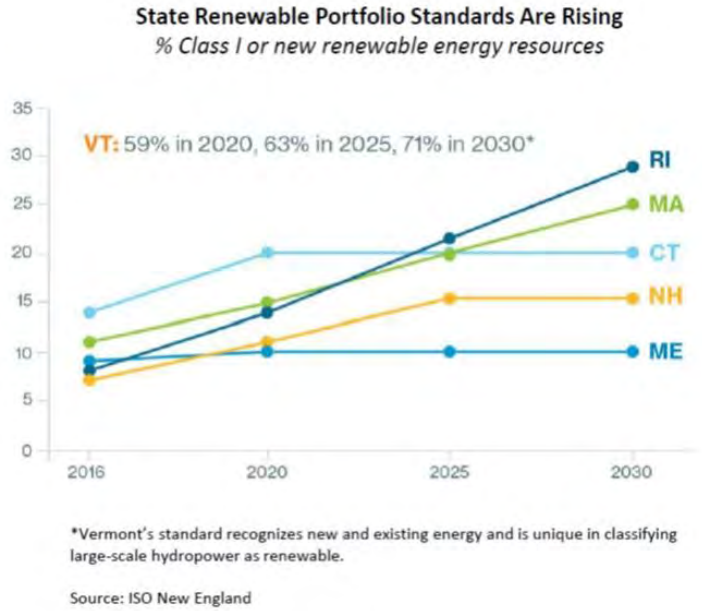


Source: ISO New England

Most of the New England states have instituted, and are now raising, renewable energy portfolio standards

challenge, most of the New England states have instituted, and are now raising, renewable energy portfolio standards. That will put increased pressure on local utilities to have to find more clean energy power supplies, which will likely mean greater grid instability.

Exhibit 11. State Clean Energy Targets Drive Renewables



Source: ISO New England

We would remind readers that capacity does not equate with actual output, as wind and solar are intermittent power sources

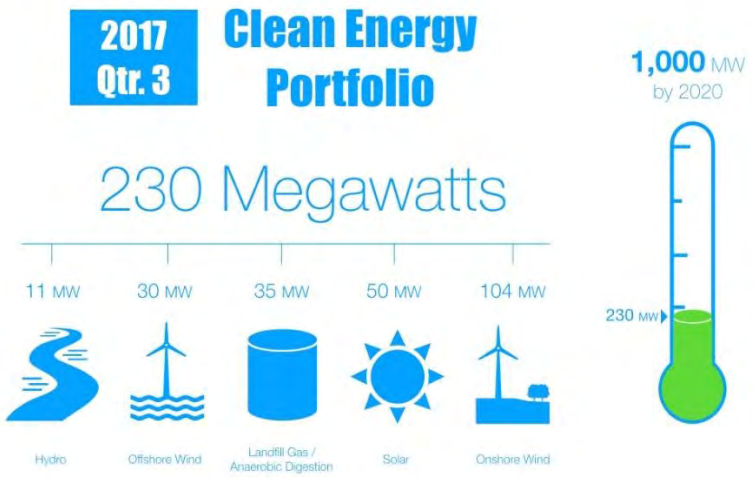
As shown in Exhibit 11 (prior page), Vermont's renewable standard is off the chart, but the state does classify large-scale hydropower energy as renewable in satisfying its goal. Of the remaining New England states, our summer-home state of Rhode Island now has the most aggressive renewable energy standard. In fact, the governor wants the state to have 1,000 MW of renewable energy capacity installed by 2020, a tenfold increase over the amount existing in 2016. We would remind readers that capacity does not equate with actual output, as wind and solar are intermittent power sources. To meet Rhode Island's target, utilities are being pushed to offer attractive renewable energy programs with the help of the state. In fact, these programs can become so attractive it is smart to take advantage of them.

Under National Grid's program, now in its third year, it is buying the solar generated power at 34.75-cents per kilowatt-hour (kWh) for 15 years, with a guaranteed renewal

The town where our summer home is located sponsored a program with a solar power firm last summer to install solar panels on the roof of homes. National Grid (NGG-NYSE), the local utility, offered 15-year contract to purchase the power, as it will not allow net metering, where the homeowner uses the power to offset buying power, but can sell any excess power to the utility. Under National Grid's program, now in its third year, it is buying the solar generated power at 34.75-cents per kilowatt-hour (kWh) for 15 years, with a guaranteed renewal. Our electricity currently costs 16-cents/kWh. When National Grid began the program, it purchased power for 41-cents/kWh, and the second year the price dropped to 37-cents/kWh. We expect next year the price will be lower than this year's price.

The town's deal with the solar panel installer was that if it secured certain numbers of installations, all customers in the program would have their installation cost reduced. The top tier number of installations resulted in a 20% cost reduction for installation. The town did achieve that goal. This cost reduction, coupled with the

Exhibit 12. Grand Clean Energy Strategy For RI



Source: Rhode Island Energy Office

An estimated 5.5-year, after-tax, cash payback of our investment

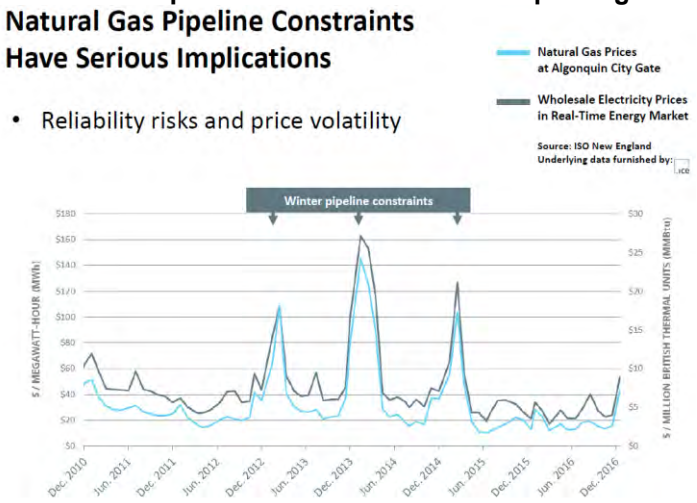
investment tax credit and the performance (location) of the panels, resulted in an estimated 5.5-year, after-tax, cash payback of our investment. That means we will still have 9.5 years of our power supply contract in place.

While our solar project is likely included in the 50 MW total of solar listed as a goal for Rhode Island in Exhibit 12 (prior page), we know our panels are only generating power for about nine hours a day, now that it is winter. During the summer, the generating day will be considerably longer, but still not 24 hours. The 30 MW of offshore wind power comes from the Block Island offshore wind farm, which is generating about 30% of the time, or 9 MW of actual power. National Grid is paying 27-cents/kWh, with an annual 3.5% inflation escalator, for any excess power Block Island doesn't consume.

The capacity shortfall shows up during winter cold snaps, which sends power prices sky-high due to expensive natural gas bought on the spot market or high-cost LNG

The biggest problem for New England is the lack of adequate pipeline capacity to bring more gas into the region. The capacity shortfall shows up during winter cold snaps, which sends power prices sky-high due to expensive natural gas bought on the spot market or high-cost LNG. Exhibit 13 shows wholesale electricity prices and natural gas prices for 2010-2016. During that time, there were three winter price spikes due to cold temperatures.

Exhibit 13. Pipelines And Cold Weather Equal High Prices



Source: ISO New England

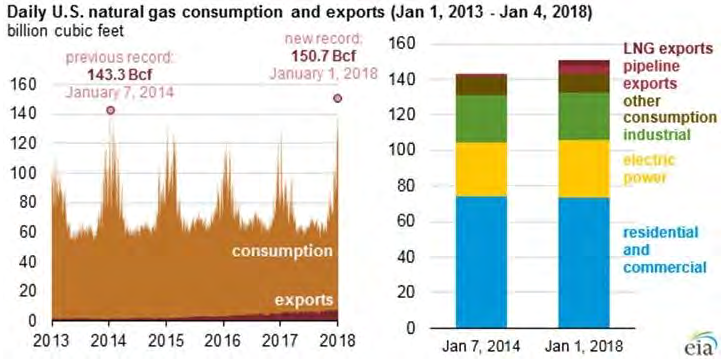
The true danger is the growing number of New England residents being pushed into energy poverty by these anti-pipeline and renewable energy policies

The data in Exhibit 8 (page 9) signals that another spike will be added to the graph in Exhibit 13. It is disappointing that the environmental movement has convinced New England residents that building more or enlarging existing natural gas pipelines is dangerous. The true danger is the growing number of New England residents being pushed into energy poverty by these anti-pipeline and renewable energy policies. Do not be surprised if we see another Polar Vortex this winter or in coming winters and that natural gas and wholesale electricity prices spike to unimaginable levels.

According to the EIA, January 1, 2018, set a new United States record for natural gas consumption, surpassing the prior record demand of January 7, 2014

The disparity in natural gas pricing between local/regional spot prices and Henry Hub futures prices reflects overall conditions in the market. According to the EIA, January 1, 2018, set a new United States record for natural gas consumption, surpassing the prior record demand of January 7, 2014. Along with the chart showing daily gas consumption are two bar charts showing which markets used how much gas on the two dates. Almost all the increase in 2018 was due to increases in pipeline exports and now LNG shipments, as residential and consumer, electric power and industrial gas usages were virtually unchanged. This is both a positive, as the U.S. can now become a player in the world natural gas market, but also troublesome, as natural gas should be the preferred environmental fuel compared to coal in generating electricity. If gas consumption fails to grow, then producers are at risk of facing a static, and low, gas price for the future. What impact on futures supplies will low gas prices have?

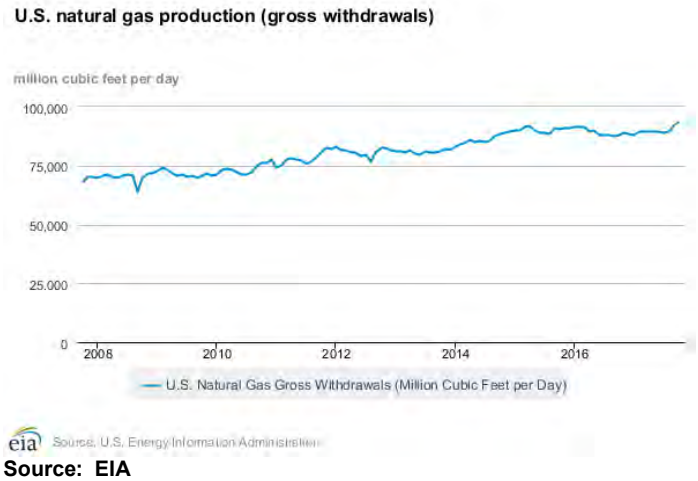
Exhibit 14. Gas Production At A High Due To LNG



Source: EIA

After peaking in 2015, natural gas production essentially remained flat until recently (October 2017) when it rose to a new record of

Exhibit 15. Natural Gas Production Is Starting To Grow Again



Source: EIA

93/Bcf per day. The uptick in tight oil drilling should add to our natural gas output, given the volumes of associated gas produced with the oil. More natural gas supplies should help support increased exports both via pipeline to Mexico and in the form of LNG. The increase in gas supply will hold gas prices down, contributing to stable or lower electricity prices, and further competitive advantages for the growing U.S. petrochemical industry.

These regional issues will continue to highlight the infrastructure problems that continue to limit increased use of natural gas for the betterment of local economies and their residents

More Polar Vortex moments, or additional named winter storms this year will create issues for natural gas and electricity prices in the various regions impacted by the weather. These regional issues will continue to highlight the infrastructure problems that continue to limit increased use of natural gas for the betterment of local economies and their residents. If we experience more blasts of super cold weather, we will see high gas withdrawals from storage. At the moment, the wager being made by natural gas traders is that spring weather will come sooner than many believe, which is why natural gas futures prices trade around $3/Mcf. We will be watching gas demand over the next month as it will likely tell us where gas storage volumes end the withdrawal season, and how difficult it may be to refill storage this summer.

Are Electric Vehicles Old News Now Or Merely Mainstream?

Given the recent focus on EV strategies, the lack vehicles being showcased was "striking"

A columnist for *Automotive News* pointed out that it was very difficult to find displays of electric vehicles (EV) at the Detroit Auto Show recently. It seems some EV models were not shown, or they were squished between other cars, and particularly new truck models. Autonomous vehicles (AVs) were more visible, begging the question of whether EVs are passé, or are now considered mainstream. Quite possibly, auto manufacturers abandoned showcasing new EVs because they spent much of the second half of last year announcing their future EV models and dates when they will arrive so there was no new news to report. As a result, they returned to the normal mode of showing new vehicles that will hit showrooms within the next four months. But, as the columnist suggested, given the recent focus on EV strategies, the lack vehicles being showcased was "striking."

The issue for EVs is less about car makers' strategies and more about the economics of batteries

The issue for EVs is less about car makers' strategies, as those are being dictated by government policies, and more about the economics of batteries. The big fear that the U.S. government tax overhaul might result in the death of EV tax subsidies, was eliminated when Congress passed, and the president signed, legislation extending the $7,500 per vehicle credit.

The two leading U.S. providers of EVs are facing a challenge as 2018 unfolds, which is that the 200,000-unit cap for the EV tax credit remains in place. For Tesla (TSLA-Nasdaq) and General Motors (GM-NYSE), their early successes in selling EVs will see the companies reaching their tax-credit caps this year. That means

buyers of their cars – Tesla's S, X and 3 models and GM's Bolt – will soon no longer be able to enjoy the $7,500 tax credit. Given the disparity in vehicle prices - $50,000-$100,000+ for Tesla and $37,500 for GM – the cap may prove more of a marketing hurdle for GM. The impact of the tax credit on an EV's final purchase price may determine how large a hit its sales may take.

Jim Hackett, Ford's CEO, spelled out how his company will boost its investment in EVs from $4.5 billion a year by 2020 to $11 billion by 2022

For those auto companies that have lagged in announcing EV strategies, such as Ford Motor Co. (F-NYSE), the auto show was a chance to highlight them. In an interview with *CNBC* reporter Phil LeBeau, Jim Hackett, Ford's CEO, spelled out how his company will boost its investment in EVs from $4.5 billion a year by 2020 to $11 billion by 2022. He also announced that Ford would expand its line-up of gas-electric hybrid vehicles as well as fully-electric models. Together, Ford will be producing 40 new electric cars by 2022.

The more interesting aspect of the automobile industry's future, and Ford's response, was Mr. Hackett's comment that "We believe the market for autonomous in the future is for both moving people and moving goods. It is not clear which one is going to be the biggest. So, Ford's strategy here is to have a platform that can do both really well." He did caution investors that making money on autonomous vehicles and mobility services will require patience. "The revenue is going to be de minimis early." This is probably an accurate assessment of how the market for "mobility as a service" will evolve, despite the excitement over ride-hailing companies like Uber and Lyft who are managing a few million trips a day.

Ford competitor GM also announced plans to launch a public ride-hailing service using AVs that won't have manual controls such as steering wheels and pedals

Ford competitor GM also announced plans to launch a public ride-hailing service using AVs that won't have manual controls such as steering wheels and pedals. The target start date is next year, assuming the company gains permission from the National Highway Transportation Safety Administration, who regulates vehicle safety. To demonstrate just how far ahead of other auto companies GM is, its service will use the "Cruise AV" self-driving vehicle, developed by GM subsidiary Cruise Automation, employing a Chevrolet Bolt EV and could be summoned with a smartphone app. This plan touches all the new mobility era bases - connected, autonomous, shared and electric. The announcement came shortly before U.S. Transportation Secretary Elaine Chao spoke at the Detroit auto show forum. She said that the Trump administration plans to publish revised self-driving car guidelines this summer. These voluntary guidelines would address not only self-driving automobiles, but "barriers to the safe integration of autonomous technology for motor carriers, transit, trucks, infrastructure and other modes."

Importantly, Sec. Chao said that "The technology is there, the question is how do we regulate it, how do we continue to promote innovation but also safeguard safety." She also highlighted the philosophy of the NHTSA in drafting these revised guidelines by eliminating "unnecessary obstacles to the development and

The philosophy implies, as the secretary stated, that the government would "not be in the business of picking winners or losers, or favoring one form of technology over another"

integration of new technology. Our approach will be tech-neutral and flexible – not top-down, or command and control." The philosophy implies, as the secretary stated, that the government would "not be in the business of picking winners or losers, or favoring one form of technology over another." This approach is much wider than has been the case so far, and will enable development of guidelines and the elimination of barriers for autonomous buses and trucks.

GM had filed its petition with NHTSA only days before the secretary's remarks. In commenting on the filing, Sec. Chao said the "department will review this petition, and give it responsible and careful consideration." But one of her key messages to auto executives was that they needed to do more to reassure skeptical Americans about autonomous technology. Her point was that "consumer acceptance will be a constraint to growth in this industry."

78% said they are afraid of riding in a self-driving vehicle, and 54% fear sharing highways with autonomous vehicles

Sec. Chao's admonishment seems to reflect attitudes of American drivers surveyed by the motor club AAA. Its most recent survey showed that while nearly 60% of drivers desire some form of autonomous driving technology in their next vehicle, 78% said they are afraid of riding in a self-driving vehicle, and 54% fear sharing highways with autonomous vehicles. After reading GM's 33-page self-driving car safety report, one is left with the impression that self-driving cars will not engage in the idiotic moves human drivers often do. For example, the report explained how GM's driving technology will force the vehicle to go around the block rather than to block a traffic lane waiting for an opening to move into the adjacent lane.

It claimed that almost a quarter of a million of its passengers (one-tenth of one percent) dropped owning a personal vehicle due to the availability of ridesharing services

Countering the AAA survey results, which are similar to the results from other broad-based consumer surveys about attitudes toward self-driving vehicles, a new report on the 2017 results of ride-hailing company Lyft reaches dramatically different conclusions. Lyft claims it handled 375.5 million rides last year, up 130% over 2016's total, or slightly more than one million rides a day. The company serviced 23 million different customers, a 92% increase. In its commentary, Lyft made strong claims about its impact on car ownership trends in this country. It claimed that almost a quarter of a million of its passengers (one-tenth of one percent) dropped owning a personal vehicle due to the availability of ridesharing services. *The New York Times* reporter assigned to cover Uber and Lyft wrote an article about how he survives without owning a car, but with a 70-pound dog that often accompanies him on trips. The begging of friends or the renting of cars highlights the efforts he has to engage in by not possessing transportation independence. For him, the cost/benefit relationship favors non-ownership of a car.

Lyft also made the point that 83% of its passengers said they'd be open to hailing a self-driving vehicle when they are available. This result is not a total surprise given that Lyft was surveying its riders, which represents a portion of society that is already pre-disposed to

using ridesharing services, so if the car was self-driving, it probably doesn't make that much of a difference to them. That is quite different from the survey results of a broad swath of society's drivers.

In a presentation to auto analysts at the start of the year, GM CEO Mary Barra outlined the company's strategy for earning profits from its EVs. The company is famous for having stated that it was losing $9,000 per EV car sold, but that it was working on changing that in the future. The key to improvement will be reducing the cost of batteries. GM's new EMC 1.0 battery system will slash the amount of cobalt, the most expensive component, in current lithium-ion battery cells. The reduced cobalt will be replaced by more nickel. GM engineers are working on other design and technological advances, including more efficient packaging of battery cells, and improved systems for managing energy flow and cooling cells. These are the areas for improvement that should enable GM to cut the cost of its batteries from $145 per kilowatt-hour to less than $100 by 2021. Battery experts believe the full cost of a GM battery pack, such as the one used in the Chevy Bolt, costs between $10,000 and $12,000, or nearly a third of the car's total sales price. According to battery technology consultants, by 2021, the battery cost could drop to $6,000. By improving battery chemistry and packaging, GM may gain the flexibility to deliver a 45% increase in vehicle range at the same battery cost, or similar range at 45% less for the battery pack.

By improving battery chemistry and packaging, GM may gain the flexibility to deliver a 45% increase in vehicle range at the same battery cost, or similar range at 45% less for the battery pack

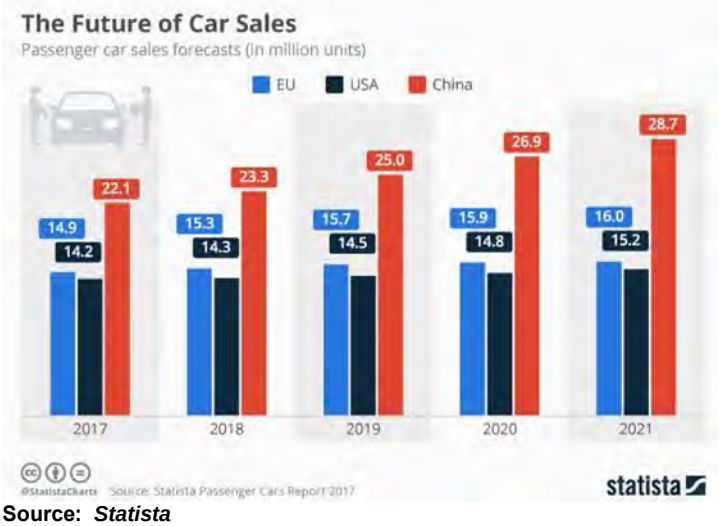
The improvements are being driven by GM's 1,700 engineers, designers and researchers working on battery technology and EV design and assembly. GM's battery and EV group is one of the largest in the world, rivaled only by Toyota Motor Corp. (TM-NYSE) and Daimler AG (DDAIF-OTC) in Germany. GM was issued 661 U.S. patents on battery technology between 2010 and 2015, trailing only Toyota's 762 battery patents among global auto manufacturers. GM's head of global product development, Mark Reuss, made the point that the company's strategy to reduce battery cost is not tied to a single development, but rather a series of continuous enhancements. He stated, "There are no silver bullets here." Moreover, he acknowledged that GM had not solved all the issues needed to achieve its cost reduction goal, but he said, "It's called 'product development' for a reason." But, Mr. Reuss also admitted, there is a lot of technology GM has chosen not to patent because it doesn't want to make it visible before it goes into production.

He acknowledged that GM had not solved all the issues needed to achieve its cost reduction goal, but he said, "It's called 'product development' for a reason"

All of these developments within the EV and AV sectors of the automobile industry are occurring despite and industry backdrop of lower auto sales in the United States in 2017. In fact, 2017's sales marked the first annual decline since 2007 and the Great Recession. A projection for global auto sales shows that four years hence, the U.S. market will grow by the least amount, up only 7%. At the same time, Europe is forecast to grow by 7.5%. The auto sales market opportunities are focused in China, which is projected to grow by

2017's sales marked the first annual decline since 2007 and the Great Recession

Exhibit 16. China Car Market Will Drive Global Auto Business



Source: ***Statista***

The China passenger car market is 50% larger than either the U.S. or European markets

30%. (The figures in Exhibit 16 represent only cars, SUVs and crossovers, not pickups.) The fact that the China passenger car market is 50% larger than either the U.S. or European markets, and is projected to grow four times faster, helps explain why auto companies are marching to the Chinese EV drum.

Globally, transportation accounts for about 60% of the oil used in the world. Changes in how the transportation sector is powered will have significant ramifications on both the automobile and petroleum industries. Changes are coming rapidly, but there are technical hurdles that need resolution. The world knows that predicting the timing of technological breakthroughs is a fool's game. What we do know is that breakthroughs will come and they will reshape these two huge global businesses. We just don't know when it will happen.

Germany's Renewable Energy Revolution Faces Challenges

Last Christmas Eve, German consumers were treated to a rare gift – negative electricity prices

Last Christmas Eve, German consumers were treated to a rare gift – negative electricity prices. In fact, during that Sunday, manufacturers and other major electricity customers were at times paid more than 50 euros ($60) per wholesale megawatt-hour to use power. While electricity demand is often lowest on weekends, that day marked merely another in the more than 100 times that power prices were negative during 2017.

Germany isn't the only European country to experience negative power prices. Belgium, Britain, France, the Netherlands and Switzerland have all had negative power prices in recent times. Germany, however, has experienced it more frequently, and for longer periods of time and with deeper negative prices than the

This inverse compensation arrangement arises when power supply exceeds demand, largely at night during windy times, or on weekends when overall power consumption is at its lowest

other countries. In fact, at the end of October, Germany's power prices were negative for 31 consecutive hours, and the price paid to wholesale power users climbed to €83 ($98) per megawatt-hour. In the United States, negative power prices have been experienced most frequently in Texas, but now California is seeing such episodes. This inverse compensation arrangement arises when power supply exceeds demand, largely at night during windy times, or on weekends when overall power consumption is at its lowest. Negative power prices in the U.S. are helped by the renewable energy credits that pay renewable power suppliers when they are generating electricity. The negative price here never goes above the credit amount.

We thought about this experience when we saw a chart detailing how much money an electricity customer can save annually by using an LED (light emitting diode) lightbulb in various European countries. German and Danish customers could save the most, or roughly 25% of their cost, compared to Irish customers, who have the next highest power cost. One of the reasons Germans and Danes can save so much money is because these two countries have the most expensive electricity for homeowners in all of Europe.

Reportedly, outside of a few island nations and Australia, Denmark and Germany have the highest-cost of residential electricity in the world. For them to show the greatest cost-savings from using LED lightbulbs is, therefore, not a surprise.

Wholesale power costs account for barely over a fifth of the total hourly cost of power in Germany

German electricity customers should benefit from the negative price for electricity, right? Well, yes and no. Wholesale power costs account for barely over a fifth of the total hourly cost of power in Germany. The rest of the bill represents electricity distribution costs, as well as taxes and fees related to renewable energy costs. Thus, low and negative power costs help homeowner bills some, the savings are muted by the other expenses and fees.

Exhibit 17. LED Lightbulbs Save Energy And Money

Source: ***Statista***

This guarantee encourages developers to build high-cost renewable power facilities as they are assured of earning a return regardless of the competitive electricity landscape

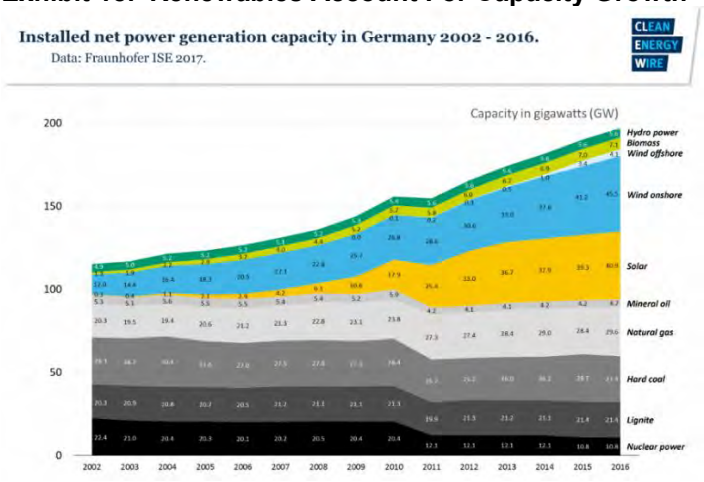
The reason German electricity customers pay so much for their power is a function of the workings of the government's "Energiewende" program. The term means "energy transition" in German. This is the popular name adopted for the German government's effort to shift its economy from generating electricity from fossil fuels to renewable energy. While the name for the transition wasn't adopted until a few years ago, the feed-in tariff mechanism was begun in 1991. That is the mechanism that provides a payment above the market rate for power, guaranteeing a profit for renewable energy. This guarantee encourages developers to build high-cost renewable power facilities as they are assured of earning a return regardless of the competitive electricity landscape.

For a nation of about 80 million people, it means each one has paid an additional $2,500 in taxes to pay for these energy subsidy programs

Estimates are that over the past 20 years, German electricity consumers have paid over $200 billion in above-market power rates. For a nation of about 80 million people, it means each one has paid an additional $2,500 in taxes to pay for these energy subsidy programs. This cost is especially hard on the country's low-income families as attested to by multiple studies spanning 2005 to 2015, and conducted by the economics journal Public Choice, the European bank, and the European Commission's energy think tank. The growing number of Germany families in energy poverty (20% or more of income is needed to pay for energy) has forced the government to make changes to the tilt of the energy tax sharing scheme, which had favored industrial electricity customers.

Part of the energy cost problem Germany is experiencing comes from the quick and aggressive push to transition electricity generation from traditional fossil fuels and nuclear, to renewable energy sources. Encouraged by the feed-in tariff and other favorable treatments for renewable energy, Germany has been aggressively building generating capacity employing these technologies.

Exhibit 18. Renewables Account For Capacity Growth

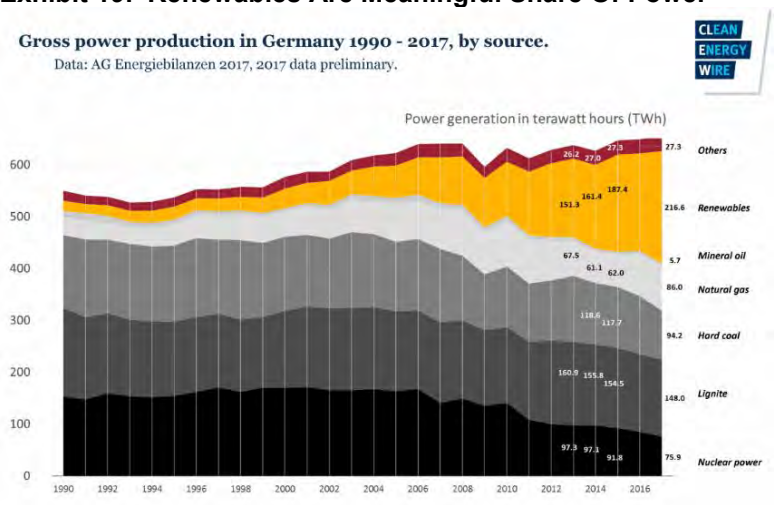


Source: ***Clean Energy Wire***

Since 2002, virtually all the new electricity generation capacity added in Germany has been renewable, in particular, wind and solar

As shown in Exhibit 18 (prior page), since 2002, virtually all the new electricity generation capacity added in Germany has been renewable, in particular, wind and solar. According to the data, in 2016, Germany had 197.1 gigawatts (GW) of power generating capacity, of which 49.5% was solar, offshore and onshore wind, and biomass. That renewable generating capacity equated to 70.5 GW, which just happens to be the total amount of additional generating capacity added in Germany over the prior decade. This growth reflects the power of financial incentives, combined with the government's mandate to accelerate the shutting down of the nation's nuclear generating capacity.

Exhibit 19. Renewables Are Meaningful Share Of Power

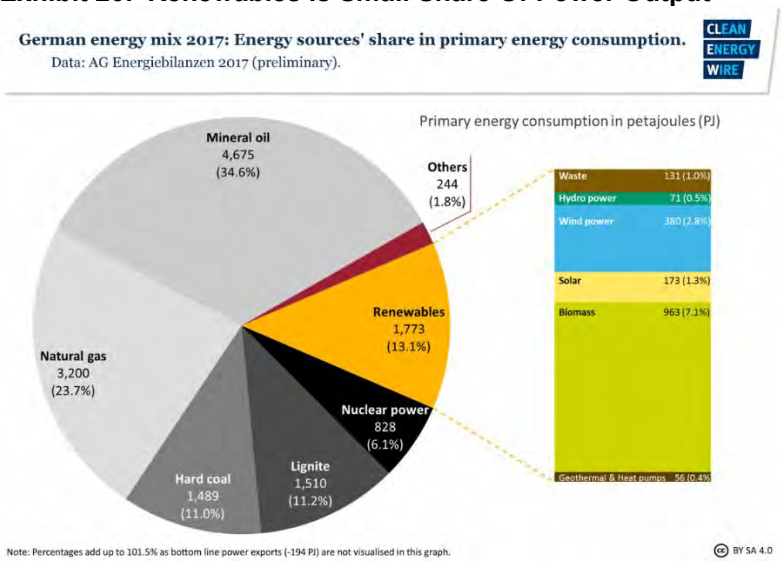


Source: ***Clean Energy Wire***

"We now have technology that cannot produce according to demand, but is producing according to the weather"

Equally telling is the fact that renewables provided only 33.1% of Germany's gross power production in 2017, compared to the nearly 50% they represented of total electricity generating capacity. However, when we look at the share of primary energy consumption in 2017 represented by renewable power, it is barely over 13%. Interestingly, the largest component of renewable power output comes from biomass, or burning wood. The disparity between gross electricity generated by renewables versus actual consumption of renewable power reflects the large amount of power sold or shipped to energy users outside of Germany, in some cases to help keep Germany's power grid stable, and at low prices. Like most traditional power systems, Germany's was designed to match output to demand. However, as Tobias Kurth, the managing director of Energy Brainpool, a Berlin-based consulting firm told *The New York Times*, "we now have technology that cannot produce according to demand, but is producing according to the weather." This inefficiency is being paid for by German consumers, primarily households.

Exhibit 20. Renewables Is Small Share Of Power Output

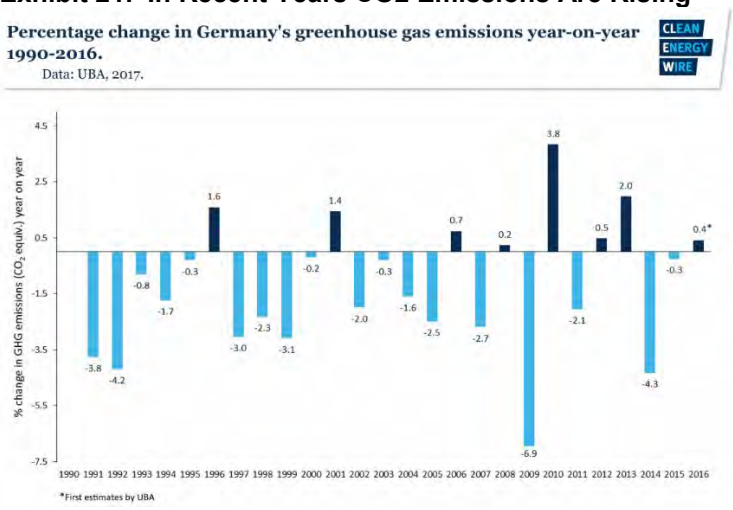


Source: ***Clean Energy Wire***

Numerous studies have indicated that Germany will miss its 2020 emissions reduction target by a wide margin

The inability of Germany's power system to meet demand by relying on intermittent sources of power forces utility companies to keep fossil fuel-powered plants operating as backup energy suppliers. This is upsetting the nation's environmental goal of cutting carbon emissions 40% by 2020 from the amount emitted in 1990. Numerous studies have indicated that Germany will miss its 2020 emissions reduction target by a wide margin. What the country needs to do with respect to its energy program and carbon emissions target has become a significant political issue. Along with the question of Germany's immigration policy, energy and the environment have become flash points in the negotiations

Exhibit 21. In Recent Years CO2 Emissions Are Rising



Source: ***Clean Energy Wire***

Germany has now gone four months without a formal government

Chancellor Angela Merkle is conducting to form a new coalition government following her party's losses in last fall's election. Germany has now gone four months without a formal government, which is creating leadership vacuum within both the country and Europe. While negotiations are ongoing, their stalemate may soon force another national election, which may not be favorable for Chancellor Merkle's political future.

The great German renewable energy saga is showing many signs of structural problems

The great German renewable energy saga is showing many signs of structural problems. Other governments contemplating modeling the German approach to an energy transition would be wise to examine its challenges and pitfalls, especially the cost for the country's citizens. Renewables have their place, but as Germany is demonstrating, possibly more thought should be given as to how they will work in the real world and how they should be integrated into the existing power structure.

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